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STOCK SUMMARY REPORTS for COLUMBIA RIVER ANADROMOUS SALMONIDS

Volume II Oregon Subbasins above Bonneville Dam for the coordinated information system

Annual Report 1992

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STOCK SUMMARY REPORTS
for
COLUMBIA RIVER ANADROMOUS SALMONIDS

Volume II: Oregon Subbasins above Bonneville Dam

for
THE COORDINATED INFORMATION SYSTEM

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VOLUME II

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PREFACE

An essential component of the effort to rebuild the Columbia Basin's anadromous fish resources is that available information and experience be organized and shard among numerous organizations and individuals. Past experience and knowledge must form the basis for actions into the future. Much of this knowledge exists only in unpublished form in agency and individual files. Even that information which is published in the form of technical and contract reports receives only limited distribution and is often out of print and unavailable after a few years. Only a small fraction of the basin's collective knowledge is captured in permanent and readily available databases (such as the Northwest Environmental Database) or in recognized journals.

State, tribal, and federal fishery managers have recognized these information management problems and have committed to a program, the Coordinated Information System Project, to capture and share more easily the core data and other information upon which management decisions are based. That project has completed scoping and identification of key information needs and development of a project plan. Work performed under the CIS project will be coordinated with and extend information contained in the Northwest Environmental Database. Construction of prototype systems will begin in Phase 3.

This report is one in a series of seven describing the results of the Coordinated Information System scoping and needs identification phase. A brief description of each of these reports follows.

CIS Phase II Products

Phase II Summary Report

This report (Roger 1992) summarizes and integrates the results of the next five reports and relates them to deliverables identified in the Phase II cooperative agreement. Broader issues of organization and operation which are not appropriate for the more focused reports are also discussed. This report should be viewed as an executive summary for the CIS project to date. If one wants a quick overview of the CIS project, this report and the project plan will provide that perspective.

Report on Information Needs

This report (Weber et al. 1992) identifies the core information needed to plan, implement, monitor, and evaluate projects to manage and restore anadromous fish. This information has been organized into various categories and missing items are identified. Prototype testing in Phase 3 will focus on this core information.

Data Catalog Report

This report (O'Connor et al. 1992) might be thought of as a "yellow pages" directory describing relevant numeric data available throughout the basin. An easily searched electronic version will be developed during prototype development and the catalog will be maintained and expanded.

Technical and Administrative options Report

This report (Allen et al. 1992) describes a process for implementing the CIS and feasible hardware, software, and operational options. Recommendations are made for the prototype and implementation phases of the project.

Library Resource Options Report

This report (Roseberry 1992) describes options for the size and operational features for the non-numeric portion of the CIS. Recommendations are made for the prototype and implementation phases.

Stock Summary Reports

These reports (Olsen et al. 1992; Hymer et al. 1992; Kiefer et al. 1992) are available in five separate volumes for Oregon (2), Washington (2), and Idaho (l). The reports contain basic biologic information on anadromous fish populations in the Columbia Basin. This information will be incorporated into computerized data bases during prototyping and implementation and will be updated annually.

project Plan

The Project Plan (Roger et al. 1992) is derived directly from recommendations from the above reports. It describes anticipated activities, staff needs, and cost of the project for the testing and implementation phases.

INTRODUCTION

Purpose of the Report.

These volumes update the Stock Assessment Report (SAR) published in 1985 (Howell et al.). They have been enlarged partially in response to Northwest Power Planning Council comments concerning the 1985 report. The volumes are new in their format and an annual updating and refining of their information is anticipated. The volumes include both genetic information such as electrophoretic profiles, and non-genetic information. Non-genetic items include the abundance of populations, number of smolts released or outmigrating, and number of adults caught in the subbasin, etc.

The reports are divided into subbasin chapters composed of sections reporting the species of salmon and steelhead present, and their production type (natural ardor hatchery). Within each subbasin, the species are listed in the following order, if present:

spring chinook
summer chinook
fall chinook
coho
chum
sockeye
summer steelhead
winter steelhead

Within each species, naturally produced fish are listed before hatchery produced fish and early run types before late run types.

It should not be presumed that the geographical scale of these units is of biological significance. The subbasins used were the same as those units defined in the Columbia Basin Subbasin Planning Process. Some agencies chose to summarize data in freer geographic sub-divisions. The use of the word "stock" in the title "Stock Summary Report" refers to these geographic subbasin units, and does not presuppose any evolutionary significance. As in the 1985 SAR, the information varies from specific conclusions based on substantial data, to general statements which have not been verified. The standards established and agreed upon by the contributors may have not yet been met in all categories by the authors.

Desired Qualities in Stock Assessment Data.

These data should be used with caution if used to compare subbasin populations. A description of how the data was collected and summarized follows in the methods section, and the reader is urged to contact the primary authors for further clarification.

The methods of comparing stock data may vary, but there are certain qualities such data should have. A calibration of the effects the environment has on the traits described would also give analyses more meaning. For example, the environmental influences of temperature, size and timing of release or outmigration, and harvest may all influence the observed age composition of a brood.

Life history differences between stocks should not be artifacts of year-to-year variations in abundance. This is one reason information was reported in the brood year format. Multiple year class data were reported so the magnitude of a trait's temporal variation might be assessed.

Brood Year Format

The brood year format was used in the majority of the standard tables as a way of tracking the progeny of a season's spawners (a cohort). For instance, 1987 brood coho salmon came from adults that spawned in the fall of 1987. As juveniles, these coho might not have migrated until the spring of 1989. The 1987 brood jacks (two year olds) returned and were accounted for in the fall of 1989. The remaining adults returned and were accounted for in 1990. Thus, a 1987 brood year entry in a coho table is in fact current through 1990 returns. Similarly, a complete accounting of a chinook salmon brood may take six years." In such a case, the 1984 brood would be the latest brood fully reportable with 1990 return year data (reporting up to the 1990 run year was *urn goal for these reports).

Authorship

The views represented in this volume are those of the Oregon Department of Fish and Wildlife (ODFW), and do not necessarily represent the views of other CIS participants. Portions of the information in this report are reported in standard formats developed by the CIS participants. The Columbia River Inter-Tribal Fish Commission provided coordinating services to provide consistency among the five Stock Summary Report volumes. This report includes all data received from the agencies by September 30, 1992.

METHODS

Following Howell et al.'s methodology (1985), published and unpublished anadromous fish data derived from both a literature review and contacts with biologists and hatchery personnel were summarized by subbasin. This report includes all of that information which could be located and fit into a set of standardized tables. The agencies were free to introduce these tables in the order they found appropriate to the following major text headings:

Geographic Location
(A brief description of the subbasin)
origin
(Source of broodstock or eggs for hatchery stocks, history of hatchery stock introductions)
Distribution
('The distribution of the species in the subbasin)
Production
Adult Life History
Juvenile Life History
Biochemical-Genetic Characteristics
Diseases
References

Ten categories of information based on the Northwest Power Planning Council comments on the 1985 SAR were addressed. A list of the standard tables developed to address these categories, and a key to the two letter codes used to identify them throughout the document, follows at the end of this section.

1. Species and Strain

Maps were used to depict spawning, rearing, and hatchery locations for at least one anadromous species per subbasin. A complete set of these maps maybe found in the 1990 Subbasin Production Plans.

2. Timing of Runs

Charts also developed for the 1990 Subbasin Production Plans were used to depict the freshwater life history of the salmon and steelhead. Peak dates were added when available. Available information that related to adult migration timing (such as jaw tags, radio telemetry, pit tags, freeze brands) was summarized. These timing charts also addressed incubation, rearing, and emergence times.

3. Disease Status and Tolerance

Diseases with management importance, as defined by the Model Comprehensive Fish Health Protection Program for the Pacific Northwest (Weld et al. 198'7), were listed in the standard table coded "TD". These diseases are generally those that restrict stock transfers. In some cases agencies reported more comprehensive lists. Any known subbasin specific information on resistance or treatment response was cited in the text.

4. Stock Size, Stock Recruitment

Accounting for the number of recruits per spawner first requires an estimate of the total number of spawners. Age-specific return data for a series of years is then needed to track the recruits. Standard age composition table code "RN" reports a breakdown of spawner escapement by total age. Age specific estimates of sport catch (code RS), hatchery rack (code RH), and subbasin totals (code RB), were also generated when possible.

In the special case of summer steelhead, the total age assigned may have been the eventual total age of the fish at maturity in the spring. Steelhead needing such a projected total age might include steelhead non-lethally sampled in August at a weir or ladder during the first calendar year of their two year run span. These fish would not be spawning until the following spring. Such data was only reported if it was considered an adequate sample for describing the age composition of the run at maturity.

Estimates of the total number of smolts were included in standard table (code JM) that reports outmigration totals by season and brood year.

5. Freshwater and Ocean Migration Characteristics

Residualism was described in tables of age composition (code AC) that included freshwater age. Anything known about non-anadromous populations existing in sympatry with anadromous forms was discussed in the text.

Ocean and river distribution data are with few exceptions only available from coded wire tags recovered during fisheries not designed to scientifically sample distribution. This report focused on providing a subbasin specific guide to the available coded wire tag groups, including their number and size at release (table code TR). Numerous reports available from the Pacific States Marine Fisheries Commission and the Pacific Salmon Commission detail aspects of time and place of recovery for any coded wire tag code of interest.

6. Survival and Fecundity

Actual measurements of survival by life stage are extremely rare and most subbasin specific data are described in a text format.

Fecundity data are also rare, and infrequently measured even in hatcheries. When such data was available, it was reported in standard table "AF." Fecundity data are usually a measure of total egg take divided by the number of females spawned. Sometimes the total egg take figure itself is based on old fecundity estimates multiplied by the number of females.

The proportion of females in a brood's various age classes are reported in a table coded "AS". The "Total % Female" value in this table is based on the age composition of a brood, weighted by the "% Female" in each age class (unless otherwise stated). For example, if 10% of a coho brood returned at two years of age, the rest as three year olds, all of the jacks were male, and fifty percent of the adults were female, then:

$$(.10 \times .00) + (.90 \times .50) = .45$$

Forty-five percent of the accounted for brood was female.

The "N" reported in this table is the sum of the fish belonging to the brood that were actually aged and sexed.

7. Age and Size **Composition, Life Stage Timing**

The timing of early life stages was reported in charts developed for the Subbasin Production Plans. These charts (coded TT) depict the freshwater life history of the salmon and steelhead.

Length was the most universally measured parameter of smelt size. Mean length, range, and sample size basis were displayed for outmigrating smelts (table code SL). Such data may reflect rearing conditions or the timing of outmigration sampling, therefore a reference was included directly in these tables.

The life history trait of freshwater/ocean age combinations was displayed in standard table "AC". In this and other tables, the number of years of freshwater residence is denoted by the number displayed before a decimal point. The balance of the total age in years (usually equivalent to the number of years of saltwater residence) follows the decimal point. Thus a coho jack salmon would be described as a "2.0", a three year adult a "2.1".

The "N" column in the table reports the sum of fish belonging to a brood that were aged. This was a crude measure of confidence, because each of the run years summed could have had a different sampling rate. Note the size of entire brood was reported elsewhere.

Adult length data was displayed utilizing the above freshwater-ocean age specific format. Methods, sample size and standard deviations are also included in standard table code "AL". Because the availability of weight data is ram, no standard tables were developed to report this data.

8. Current **Rearing and Release Methods (Hatcheries)**

Standard table code "TR", based on a Washington Department of Fisheries format reports most of the information concerning hatchery releases. The use of a uniform set of definitions for the 'Life Stage' at release column proved impossible, both between, and within some states. Each of the states therefore defined the terms they used for this table.

Outplanting was described in the hatchery release table. The reporting of all hatchery releases in the Columbia Basin in a common format. on 8.5 x 11 inch paper led to less detail than is available **in the assorted** source databases. **Further CIS** development will likely allow additional detail for this table. For instance in the 'Release Site' field, where presently only the common name of the creek or river of release is listed.

9. Anatomical and **Biochemical Traits**

A collection of electrophoretic tables from major published works in the Columbia Basin were collected and appear as appendices. These tables were reproduced verbatim, and reflect the nomenclature used by researchers to report allele frequencies at their time of publishing. Efforts have subsequently been made by the American Fisheries Society to standardize the reporting of this type of information. The availability of meristic data was noted for the applicable subbasins.

10. Genetic Variability, Straying

Emigration and immigration were described in a standard table format proposed by Idaho (standard

table codes AE and AI). These tables report the number of amasses examined for coded wire tags at hatcheries and during spawning ground surveys, the number of tags recovered, and an expanded "total number estimated" based on the numbers reported by PSMFC. Approximately 4,600 individual coded wire tag codes have been released to date in the Columbia River Basin, the bulk of these into Washington and Oregon waters. Harvest recoveries were not listed in the standard form of the these tables.

Standard, and Non-standard Table Codes.

A collection of standardized tables conveyed the above information. An upper case, two letter code identifies the category of these tables. The standard table codes are as follows:

- (HB) NPPC habitat quality
- (RN) Returns back as Natural spawner%
- (RH) Returns back to a Hatchery. 99% of the time these are rack returns, but a few places with 100% marking have made splits between marked and unmarked fish.
- (RT) Tribal catch in the subbasin
- (RS) Sport catch in the subbasin.
- (RB) Subbasin grand total, (subbasin catches, natural and hatchery escapement).
- (JM) Number of juvenile migrants
- (SL) Length of smelts
- (AC) Age composition (freshwater.ocean)
- (As) Percent finales by brood year and age class
- (AL) Mean fork length by broody= and age class
- (AF) Mean fecundity by brood year and age class
- (TR) Hatchery releases by brood year
- (AE) Emigration of tagged fish
- (AI) Immigration of tagged fish
- (TD) Parasites and diseases
- (AD) Distribution, present/potential and absence figure
- (TT) Subbasin plan bar chart of life stage timing

Deviations from the standard formats, (i.e. run years instead of brood years), are identified with a third lowercase letter such as: RS-a or RS-b.

Tables for categories of information without standardized formats also have a third lowercase letter, and were coded as follows:

TS-a, etc.	Survival tables, any life stage
ST-a, etc.	Non-standard Smelt Timing information
AT-a, etc.	Non-standard Adult Timing information
AH-a, etc.	Adult Harvest information, i.e. Ocean or mainstem
ET-a, etc.	Egg Take data
AW-a, etc.	Mean weight by brood year and age class
JC-a, etc.	Juvenile age Composition

REFERENCES

Howell, P. J., K. Jones, D. Scarnecchia, L. LaVoy, W. Kendra, and D. Ortmann. 1985. Stock assessment of Columbia River anadromous salmonids, volumes I & II. Final report of Oregon Department of Fish and Wildlife, Washington Department of Fisheries, Washington Department of Game, and Idaho Department of Fish and Game (Project 83-335, Contract DE-AI79-84BP12737) to Bonneville Power Administration, Portland, Oregon.

Weld, E., J. Gearheard, and J. Warren. Model Comprehensive Fish Health Protection program, Part I. Pacific Northwest Fish Health Protection Committee. January 1, 1987.

RESULTS

The results of this project are contained in five volumes.

Volume I includes the following Oregon subbasins below Bonneville Dam:

Lower Columbia
Mid-Willamette
Clackamas
Molalla
Tualatin
Coast Range
Santiam
Mckenzie
Coast Fork
Long Tom
Middle Fork
Sandy
Hood River

Volume II includes the following Oregon subbasins above Bonneville Dam:

15 Mile
Deschutes
John Day
Umatilla
Grande Ronde (including data for Washingt
Imnaha

Volume III includes the following Washington subbasins below McNary Dam:

Lower Columbia
Grays
Elochoman
Cowlitz
Kalama
Lewis
Washogal
Wind
White Salmon
Klickitat

Volume IV includes the following Washing subbasins above McNary Dam:

Walla Walla (including data for Oregon)
Snake
Tucannon
Yakima
Upper Columbia
Wenatchee
Entiat
Wells
Methow
Okanoagan

Volume V includes the following Idaho subbasins:

Clearwater
- Mainstem
- South Fork
- Mid Fork
- Locksa
- Selway

Salmon River
- Lower Mainstem
- Little Salmon
- Mid-Mainstem
- Upper Mainstem
- Lemhi
- Headwaters
- South Fork
- Pahsimeroi

The following Tables 1 through 5 summarize, by species, the presence or absence of the standardize (and some non-standardized) tabular data for the Oregon subbasins below Bonnevill Dam. Tables 6 through 10 cover the region above Bonneville Dam.

Table 1. Summary of tabular information on spring chinook salmon in eleven Oregon subbasins below Bonneville Dam.

	lcol	mwill	clak	mola	tual	crng	sant	mcke	cfrk ltom	mid fk	sand
HABITAT	✓	✓	✓	✓			✓	✓		✓	✓
SUBBASIN DISTRIBUTION											
PRODUCTION											
HATCHERY RELEASES	✓	✓	✓	✓			✓	✓	✓	✓	✓
HATCHERY RETURNS							✓				
SUBBASIN HARVEST											
SPORT											
TRIBAL											
ADULT LIFE HISTORY											
# SPAWNERS											
TOTAL SUBBASIN RETURNS											
LENGTH											
AGE COMP.							✓			✓	
SEX RATlo											
FECUNDITY											
IMMIGRATION	✓	✓	✓				✓	✓		✓	✓
EMIGRATION		✓	✓				✓	✓		✓	
JUVENILE LIFE HISTORY											
TIMING		✓	✓	✓			✓			✓	✓
SMOLT LENGTH											
# SMOLTS											
BIOCHEMICAL			✓				✓	✓		✓	
DISEASE			✓				✓				

Table 2. Summary of tabular information on fall chinook in eleven Oregon subbasins below Bonneville Dam.

	lcol	InWin	clak	mola	tual	crng	Suit	mcke	cfrk ltom	mid fk	sand
HABITAT	✓	✓	✓	✓			✓	✓			✓
SUBBASIN DISTRIBUTION											
PRODUCTION											
HATCHERY RELEASES	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓
HATCHERY RETURNS	✓										
SUBBASIN HARVEST											
SPORT											
TRIBAL											
ADULT LIFE HISTORY											
# SPAWNERS											
TOTAL SUBBASIN RETURNS	✓										
LENGTH	✓										
AGE COMP.	✓										
SEX RATIO	✓										
FECUNDITY	✓										
IMMIGRATION	✓	✓	✓				✓				✓
EMIGRATION	✓	✓		✓				✓	✓		
JUVENILE LIFE HISTORY											
TIMING			✓	✓			✓				✓
SMOLT LENGTH											
# SMOLTS											
BIOCHEMICAL											
DISEASE		✓									

Table 3. **Summary** of tabular information on coho in **eleven** Oregon subbasins below Bonneville Dam.

	lcol	mwill	clak	mola	tual	crng	sant	mcke	cfrk ltom	mid fk	sand
HABITAT	✓	✓	✓	✓	✓	✓	✓	✓			✓
SUBBASIN DISTRIBUTION											
PRODUCTION											
HATCHERY RELEASES		✓	✓	✓	✓	✓	✓		✓	✓	✓
HATCHERY RETURNS			✓								
SUBBASIN HARVEST											
SPORT											
TRIBAL											
ADULT LIFE HISTORY											
# SPAWNERS											
TOTAL SUBBASIN RETURNS											
LENGTH											
AGE COMP.			✓								✓
SEX RATIO			✓								✓
FECUNDITY			✓								✓
IMMIGRATION	✓	✓	✓								✓
EMIGRATION			✓								✓
JUVENILE LIFE HISTORY											
TIMING			✓	✓	✓	✓	✓				✓
SMOLT LENGTH	✓										
# SMOLTS	✓		✓								
BIOCHEMICAL											
DISEASE											✓

Table 4. Summary of tabular information on summer steelhead in eleven Columiba River subbasins below Bonneville Dam.

	lcol	mwill	clak	mola	tual	crng	sant	mcke	cfrk ltom	mid fk	sand
HABITAT	✓	✓	✓	✓			✓	✓		✓	✓
SUBBASIN DISTRIBUTION											
PRODUCTION											
HATCHERY RELEASES	✓	✓	✓	✓			✓	✓		✓	✓
HATCHERY RETURNS											
SUBBASIN HARVEST											
SPORT											
TRIBAL											
ADULT LIFE HISTORY											
# SPAWNERS											
TOTAL SUBBASIN RETURNS											
LENGTH							✓				
AGE COMP.							✓			✓	
SEX RATIO											
FECUNDITY											
IMMIGRATION											
EMIGRATION											
JUVENILE LIFE HISTORY											
TIMING			✓				✓				
SMOLT LENGTH											
# SMOLTS											
BIOCHEMICAL							✓				
DISEASE							✓				

Table 5. Summary of tabular information on winter steelhead in eleven Oregon subbasins below Bonneville Dam.

	lcol	mwill	clak	mola	tual	crng	sant	mcke	cfrk ltom	mid fk	sand
HABITAT	✓	✓	✓	✓		✓	✓	✓		✓	✓
SUBBASIN DISTRIBUTION		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
PRODUCTION											
HATCHERY RELEASES	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓
HATCHERY RETURNS			✓								
SUBBASIN HARVEST											
SPORT											
TRIBAL											
ADULT LIFE HISTORY											
# SPAWNERS											
TOTAL SUBBASIN RETURNS											
LENGTH											
AGE COMP.	✓		✓								
SEX RATIO			✓								
FECUNDITY											
IMMIGRATION	✓										
EMIGRATION											
JUVENILE LIFE HISTORY											
TIMING		✓	✓	✓	✓	✓				✓	✓
SMOLT LENGTH											
# SMOLTS											
BIOCHEMICAL							✓				✓
DISEASE	✓		✓	✓			✓				

Table 6. Summary of tabular information on spring chinook salmon in seven Oregon subbasins above Bonneville Dam.

	HOOD RIVER	15 MILE	DESCHUTES	JOHN DAY	UMATILLA	GRANDE RONDE	IMNAHA
HABITAT	✓		✓	✓	✓	✓	✓
SUBBASIN DISTRIBUTION			✓	✓		✓	
PRODUCTION							
HATCHERY RELEASES	✓		✓	✓	✓	✓	✓
HATCHERY RETURNS			✓			✓	✓
SUBBASIN HARVEST							
SPORT							
TRIBAL							
ADULT LIFE HISTORY							
# SPAWNERS			✓				
TOTAL SUBBASIN RETURNS			✓				
LENGTH			✓	✓		✓	✓
AGE COMP.			✓	✓		✓	✓
SEX RATIO			✓	✓		✓	✓
FECUNDITY			✓			✓	✓
IMMIGRATION			✓	✓		✓	✓
EMIGRATION			✓		✓	✓	✓
JUVENILE LIFE HISTORY							
TIMING			✓	✓	✓	✓	✓
SMOLT LENGTH			✓	✓			
# SMOLTS			✓	✓		✓	
BIOCHEMICAL			✓				
DISEASE			✓	✓		✓	✓

Table 7. Summary of tabular information on fall chinook salmon in seven Oregon subbasins above Bonneville Darn.

	HOOD RIVER	15 MILE	DESCHUTES	JOHN DAY	UMATILLA	GRANDE RONDE	IMNAHA
HABITAT	✓		✓		✓		✓
SUBBASIN DISTRIBUTION					✓		
PRODUCTION							
HATCHERY RELEASES	✓		✓		✓		
HATCHERY RETURNS							
SUBBASIN HARVEST							
SPORT							
TRIBAL							
ADULT LIFE HISTORY							
# SPAWNERS							
TOTAL SUBBASIN RETURNS							
LENGTH			✓				
AGE COMP.			✓				
SEX RATIO							
FECUNDITY							
IMMIGRATION			✓		✓		
EMIGRATION			✓		✓		
JUVENILE LIFE HISTORY							
TIMING			✓		✓		✓
SMOLT LENGTH							
# SMOLTS							
BIOCHEMICAL			✓				
DISEASE			✓				

Table 8. Summary of tabular information on coho salmon in seven Oregon subbasins above Bonneville Dam.

	HOOD RIVER	M MILE	DESCHUTES	JOHN DAY	UMATILLA	GRANDE RONDE	IMNAHA
HABITAT	✓		✓				
SUBBASIN DISTRIBUTION							
PRODUCTION							
HATCHERY RELEASES	✓				✓	✓	
HATCHERY RETURNS							
SUBBASIN HARVEST							
SPORT							
TRIBAL							
ADUET LIFE HISTORY							
# SPAWNERS							
TOTAL SUBBASIN RETURNS							
LENGTH							
AGE COMP.							
SEX RATIO							
FECUNDITY							
IMMIGRATION			✓		✓		
EMIGRATION					✓		
JUVENILE LIFE HISTORY							
TIMING					✓		
SMOLT LENGTH							
# SMOLTS							
BIOCHEMICAL							
DISEASE							

Table 9. Summary of tabular information on summer steelhead in seven Oregon subbasins above Bonneville Darn.

	HOOD RIVER	15 MILE	DESCHUTES	JOHN DAY	UMATILLA	GRANDE RONDE	IMNAHA
HABITAT			✓	✓	✓	✓	
SUBBASIN DISTRIBUTION	✓	✓					✓
PRODUCTION							
HATCHERY RELEASES	✓		✓	✓	✓	✓	✓
HATCHERY RETURNS			✓			✓	✓
SUBBASIN HARVEST							
SPORT							
TRIBAL			✓				
ADULT LIFE HISTORY							
# SPAWNERS			✓				
TOTAL SUBBASIN RETURNS			✓				
LENGTH						✓	✓
AGE COMP.			✓			✓	✓
SEX RATIO			✓			✓	✓
FECUNDITY			✓		✓	✓	✓
IMMIGRATION			✓		✓	✓	✓
EMIGRATION						✓	
JUVENILE LIFE HISTORY							
TIMING			✓	✓	✓	✓	✓
SMOLT LENGTH							
# SMOLTS							
BIOCHEMICAL							
DISEASE			✓		✓	✓	✓

Table 10. Summary of tabular information on winter steelhead in seven Oregon subbasins above Bonneville Dam.

	HOOD RIVER	15 MILE	DESCHUTES	JOHN DAY	UMATILLA	GRANDE RONDE	IMNAHA
HABITAT		✓					
SUBBASIN DISTRIBUTION	✓	✓					
PRODUCTION							
HATCHERY RELEASES	✓		✓	✓			
HATCHERY RETURNS							
SUBBASIN HARVEST							
SPORT							
TRIBAL							
ADULT LIFE HISTORY							
# SPAWNERS							
TOTAL SUEBASIN RETURNS							
LENGTH							
AGE COMP.							
SEX RATIO							
FECUNDITY							
IMMIGRATION							
EMIGRATION							
JUVENILE LIFE HISTORY							
TIMING							
SMOLT LENGTH							
# SMOLTS							
BIOCHEMICAL							
DISEASE							

HOOD RIVER SUBBASIN

Naturally Produced Spring Chinook Salmon

GEOGRAPHIC LOCATION

The Hood River, located in north central Oregon, flows in a northeasterly direction to enter the Columbia River at approximately RM 169. The subbasin covers approximately 352 square miles. The Hood River is located above Bonneville Dam.

ORIGIN

Spring chinook are indigenous to the Hood River subbasin. Non-indigenous stocks introduced into the subbasin include the Carson and Lookingglass Creek stocks (see HOOD RIVER SUBBASIN, Hatchery Produced Spring Chinook Salmon, PRODUCTION).

DISTRIBUTION

Subbasin

Limited information is available on the spatial distribution of spring chinook in the Hood River subbasin. It is believed that the population is primarily located in the mainstem of the Hood River, in the West Fork Hood River, and in several streams that are tributary to the West Fork (Figure 1). It is believed that little if any spawning or rearing of spring chinook occurs in the Middle and East fork drainages of the Hood River (Oregon Department of Fish and Wildlife and Confederated Tribes of the Warm Springs Reservation of Oregon 1990). The quality of the spawning and rearing habitat varies throughout the subbasin (Tables 1 and 2).

PRODUCTION

Harvest

sport

Subbasin: Spring chinook are currently harvested incidentally in the winter steelhead fishery. The sport fishery primarily occurs in the mainstem of the Hood River below the confluence of the West Fork of the Hood River. There are no records of a season closure in the subbasin. No brood year specific estimates of harvest are available. Run year specific estimates of harvest (punch card) are available from Oregon Department of Fish and Wildlife (unpublished data).

Treaty

Subbasin: The entire Hood River subbasin is located on lands ceded to the United States by the Confederated Tribes of the Warm Springs Reservation. The tribal harvest of naturally produced spring chinook is unknown but it is believed that the numbers harvested each year are low.

ADULT LIFE HISTORY

Escapement

Subbasin

Numbers: No brood year specific estimates of escapement are available. Run year specific estimates of escapement past Powerdale Dam are available for the 1963-71 run years in Oregon Department of Fish and Wildlife and Confederated Tribes of the Warm Springs Reservation of Oregon (1990).

Figure 1. Spring chinook distribution in the Hood River subbasin, based on the NPPC presence\absence data base (solid and dashed lines respectively) and the BPA Geographic Information System.

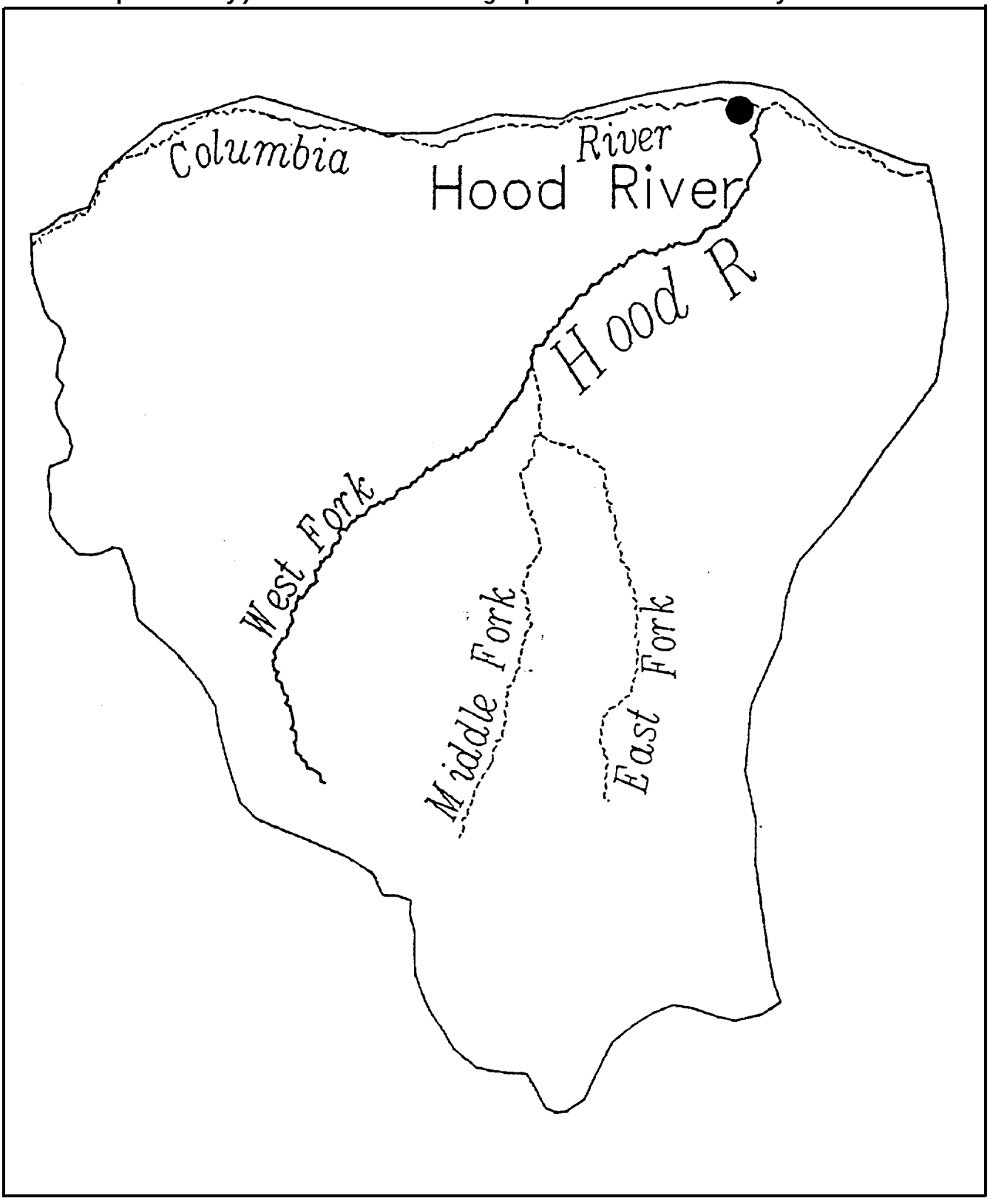

Table 1 (HB-1). Estimated amount of spawning and rearing habitat by quality of Hood River subbasin spring chinook production area[a].

Distance/ Area	Excellent	Good	Fair[b]	Poor[b]	Unknown	Total	Confi-dence
Miles (%)	--	--	--	100.0	--	25.4	--
Acres (%)	--	--	--	--	--	--	--

[a] Estimates are modified from the Northwest Power Planning Council's presence/absence database.
[b] Ratings of fair and poor habitat quality may reflect natural physical features such as waterfall barriers, as well as degradation caused by man.

Table 2 (HB-2). Estimated amount of rearing only habitat by quality of Hood River subbasin spring chinook production area[a].

Distance/ Area	Excellent	Good	Fair[b]	Poor[b]	Unknown	Total	Confi-dence
Miles (%)	--	--	--	100.0	--	5.5	--
Acres (%)	--	--	--	--	--	--	--

[a] Estimates are modified from the Northwest Power Planning Council's presence/absence database.
[b] Ratings of fair and poor habitat quality may reflect natural physical features such as waterfall barriers, as well as degradation caused by man.

REFERENCES

Oregon Department of Fish and Wildlife and Confederated Tribes of the Warm Springs Reservation of Oregon. 1990. Hood River subbasin salmon and steelhead production plan. Columbia Basin System Planning Report to Northwest Power Planning Council, Portland, Oregon.

HOOD RIVER SUBBASIN

Hatchery Produced Spring Chinook Salmon

ORIGIN

The first recorded release of juvenile hatchery fish into the subbasin is the 1984 brood release of the Eagle Creek stock (Table 1). The Hood River subbasin was supplemented with juvenile hatchery fish from 1984-90 (Table 1). Stocks introduced into the subbasin include the Eagle Creek, Carson, and Lookingglass Creek stocks (Table 1).

A hatchery program is currently being developed to utilize the native Hood River stock as hatchery broodstock. Hatchery broodstock will be collected at Powerdale Dam, located at RM 4.5 on the mainstem of the Hood River; spawned at Round Butte Hatchery (DesChutes River subbasin); and reared in Pelton Ladder (Deschutes River subbasin).

DISTRIBUTION

Subbasin

Hatchery releases in the Hood River subbasin are entirely in the West Fork of the Hood River (Table 1).

PRODUCTION

Releases

Egg

There are no records of releases in the subbasin.

Fry

Hatchery facilities in which fry were reared or acclimated prior to release in the subbasin are unknown (Table 1). Annual numbers released ranged from 19,708 to 218,116 (Table 1). Size at release is unknown.

Fingerling

There are no records of releases in the subbasin.

Smelt

Hatchery facilities in which smelts were reared or acclimated prior to release in the subbasin include Oxbow Hatchery (T'able 1). Annual numbers released ranged from 134,317 to 198,002 (Table 1). Size at release ranged from 11.6 to 9.4 fish per pound (Table 1).

Jack and Adult

There are no records of releases in the subbasin.

Harvest

Sport

Subbasin: Spring chinook are currently harvested incidentally in the winter steelhead fishery. The sport fishery primarily occurs in the **mainstem** of the Hood River below the confluence of the West Fork of the Hood River. There are no records of a season closure in the **subbasin.** No brood year specific estimates of harvest are available for **subbasin** hatchery production.

Treaty

Subbasin: The entire Hood River **subbasin** is located on lands ceded to the United States by the **Confederated** Tribes of the Warm Springs Reservation. The tribal harvest of hatchery produced spring chinook is unknown but it is believed that the numbers harvested each year are low.

DISEASES

There are no hatchery facilities in the Hood River subbasin that currently hold or rear hatchery spring chinook prior to release in the subbasin. For information on parasites and disease agents of subbasin hatchery production that is held or reared at hatchery **facilities** located outside of the subbasin see SANDY RIVER SUBBASIN, Hatchery Produced Spring Chinook Salmon, DISEASES.

Table 1 (IR). Hatchery releases of spring chinook salmon into the Hood River subbasin by brood year and if marked, by coded wire tag code[s].

Brood Year	Stock	Hatchery	Life Stage	Release Date (1)	Release Date (2)	Fish/ lb	Number Released	Release LoCat i on	CUT/ Fin clip
1984	Eagle Creak	--	fry	01/09/85	--	..	100	Neal Creek	--
1984	Eagle Creak	--	fry	01/14/85	--	--	15,112	Hood River, WFk	..
1984	Eagle Creek	..	fry	02/08/85	--	..	39,474	Hood River, WFk	..
1984	Eagle Creek	..	fry	12/28/84	--	--	19,708	Lake Branch Creek	..
1984	Eagle Creek	..	fry	01/15/85	--	..	19,000	Lake Branch Creek	.-
1985	Carson	..	fry	12/11/85	--	--	13,761	Hood River, WFk	..
1985	Carson	.-	fry	12/19/85	--	..	13,865	Hood River, WFk	..
1985	Carson	..	fry	01/27/86	--	..	63,037	Hood River, WFk	..
1985	Carson	--	fry	12/11/85	--	..	13,761	Lake Branch Creek	..
1985	Carson	..	fry	12/19/85	--	..	13,864	Lake Branch Creek	..
1986	Carson	..	fry	12/22/86	--	--	23,666	Hood River, WFk	..
1986	Carson	..	fry	12/22/86	--	..	24,561	Hood River, WFk	--
1986	Carson	..	fry	12/22/86	--	..	23,463	Hood River, WFk	..
1986	Carson	..	fry	01/14/87	--	..	14,767	Hood River, WFk	..
1986	Carson	..	fry	01/ 14/87	--	--	7,754	Hood River, WFk	..
1986	Carson	--	fry	01/14/87	--	--	29,688	Hood River, WFk	..
1986	Carson	..	fry	02/09/87	--	..	59,277	Hod River, WFk	..
1986	Carson	..	fry	12/22/86	--	--	47,331	Lake Branch Creek	..
1986	Carson	oxbow	Smelt	03/14/88	--	9.4	11,734	Hood River, WFk	No mark
1986	Carson	Oxbow	smolt	03/14/88	--	9.7	30,910	Hood River, WFk	No mark
1986	Carson	bow	smolt	03/14188	--	10.1	11,650	Hood River, WFk	No mark
1986	Carson	bow	molt	03/14/88	--	10.2	12,288	Hood River, WFk	No mark
1986	Carson	bow	molt	03/14/88	--	10.5	4,992	Hood River, WFk	No mark
1986	Carson	bo	smolt	03/14/88	--	10.8	9,155	Hood River, WFk	No mark
1986	Carson	bow	smolt	03/14/88	--	11.1	14,580	Hood River, WFk	No mark
1986	Carson	bo	molt	03/14188	--	11.2	34,588	Hood River, WFk	07-42-57
1986	Carson	bo	smolt	03/14/88	--	11.4	14,453	Hood River, WFk	07-42-57
1986	Carson	Oxbow	smolt	03/14/88	--	11.6	5,689	Hood River, WFk	07-42-57
1987	Lookingglass	..	fry	12/10/87	--	..	28,418	Hood River, WFk	--
1987	Lookingglass	..	fry	12/10/87	--	..	22,206	Hood River, WFk	..
1987	Lookingglass	..	fry	12/10/87	--	..	29,801	Hood River, WFk	..
1987	Lookingglass	..	fry	12/10/87	--	--	4,000	Hood River, WFk	..
1987	Lookingglass	..	fry	01/08/88	--	..	29,544	Hood River, WFk	..
1987	Lookingglass	..	fry	01/30/88	--	..	77,615	Hood River, WFk	..
1987	Lookingglass	..	fry	12/10/87	--	..	22,205	Lake Branch Creek	..
1987	Lookingglass	bow	molt	03109/89	--	10.0	33,033	Hood River, WFk	No mark
1987	Lookingglass	Oxbow	smolt	03/09/89	--	10.8	31,928	Hood River, WFk	No mark
1987	Lookingglass	bo	molt	03/09/89	--	11.0	32,117	Hood River, WFk	07-42-58
1987	Lookingglass	bow	smolt	03/09/89	--	11.1	37,239	Hood River, WFk	07-42-58
1988	Lookingglass	--	fry	12/04/88	--	..	19,135	Hood River, WFk	..
1988	Lookingglass	..	fry	12/04/88	--	--	19,424	Hood River, WFk	..
1988	Lookingglass	..	fry	12/04/88	--	--	19,131	Hood River, WFk	..

Table 1 (TR). (cent.) Hatchery releases of spring chinook salmon into the Hood River subbasin by brood year and if marked, by coded wire tag Codes.

Brood Year	Stock	Hatchery	Life Stage	Release Date (1)	Release Date (2)	Fish/ lb	Number Released	Release Location	CUT/ Fin clip
1988	Lookingglass	..	fry	12/0 /88	- "	..	1,132	Hood River, WFk	..
1988	Lookingglass	.-	fry	01/2 /89	- -	..	19,934	Ledd Creek	--
1988	Lookingglass	..	fry	12/0 /88	- "	..	19,838	Lake Branch Creak	--
1988	Look ingglass	Oxbow	Smelt	03/1 /90	- -	9.9	10,890	Hood River, WFk	No mark
1988	Lookingglass	bow	smolt	03/1 /90	- "	10.1	11,211	Hood River, WFk	No mark
1988	Lookingglass	Oxbow	molt	03/1 /90	- "	10.2	13,974	Hood River, WFk	No mark
1988	Lookingglass	bow	Smelt	03/1 /90	- -	10.3	11,330	Nood River, WFk	No mark
1988	Lookingglass	bo	Smelt	03/1 /90	- -	10.5	7,770	Hood River, WFk	No mark
1988	Lookingglass	bo	smelt	03/1 /90	- -	10.8	11,664	Nood River, WFk	No mark
1988	Lookingglass	bow	smolt	03/1 /90	- -	9.4	23,970	Nood River, WFk	07-52-23
1988	Lookingglass	bo	smolt	03/1 /90	- -	9.9	31,680	Hood River, WFk	No mark
1988	Look ingglass	Oxbow	Smelt	03/1 /90	- -	10.0	10,650	Hood River, WFk	07-52-23
1988	Lookingglass	Oxbow	smolt	03/1 /90	- -	10.0	20,800	Hood River, WFk	No mark
1988	Lookingglass	Oxbow	smolt	03/1 /90	- "	10.3	19,158	Hood River, WFk	No mark
1988	Lookingglass	Oxbow	smolt	03/1 /90	- "	10.2	10,761	Hood River, WFk	07-52-23
1988	Look ingglass	Oxbow	Smelt	03/1 /90	- -	10.4	14,144	Hood River, WFk	07-52-23
1989	Look ingglass	..	fry	12/2 /89	. .	--	4,992	Hood River, WFk	--
1989	Look ingglass	..	fry	12/2 /89	. .	--		Hood River, WFk	--
1989	Lookingglass	..	fry	12/2 '/89	--	--	2 5 , %	Hood River, WFk	--
1989	Look ingglass	..	fry	12/2 '/89	. .	--	12,762	Hood River, WFk	--
1989	Looki ngglass	..	fry	02/2 1/90	--	.>.	2,116	Hood River, WFk	..
1989	Look ingglass	..	fry	02/2 1/90	--	..	8,749	Hood River, WFk	--
1989	Lookingglass	--	fry	02/2 /90	- -	..	10,864	Hood River, WFk	..

*Estimates ara f rom Oregon Department of Fish and Wildlife (unpubl i shed data).

HOOD RIVER SUBBASIN

Naturally Produced Fall Chinook Salmon

GEOGRAPHIC LOCATION

The Hood River, located in north central Oregon, flows in a northeasterly direction to enter the Columbia River at approximately RM 169. The subbasin covers approximately 352 square miles. The Hood River is located above Bonneville Dam.

ORIGIN

Fall chinook are indigenous to the Hood River subbasin. There are no records of the subbasin having ever been supplemented with hatchery fish.

DISTRIBUTION

Subbasin

Limited information is available on the spatial distribution of fall chinook in the Hood River subbasin. It is believed that the population is primarily restricted to the mainstem of the Hood River. Punchbowl Falls (RM 0.4 on the West Fork Hood River) either impedes or restricts upstream migrants into the West Fork Hood River and little, if any, spawning or rearing of fall chinook occurs in the Middle and East fork drainages of the Hood River (Oregon Department of Fish and Wildlife and Confederated Tribes of the Warm Springs Reservation of Oregon 1990). The quality of the spawning and rearing habitat varies throughout the subbasin (Tables 1 and 2).

PRODUCTION

Harvest

sport

Subbasin: Fall chinook are currently harvested incidentally in the summer steelhead fishery. The sport fishery primarily occurs in the mainstem of the Hood River below the confluence of the West Fork of the Hood River. There are no records of a season closure in the subbasin. No brood year specific estimates of harvest are available. Run year specific estimates of harvest (punch card) are available from Oregon Department of Fish and Wildlife (unpublished data).

Treaty

Subbasin: The entire Hood River subbasin is located on lands ceded to the United States by the Confederated Tribes of the Warm Springs Reservation. The tribal harvest of naturally produced fall chinook is unknown but it is believed that the numbers harvested each year are low.

ADULT LIFE HISTORY

Escapement

Subbasin

Numbers: No brood year specific estimates of escapement are available. Run year specific estimates of escapement past Powerdale Dam are available for the 1963-71 run years in Oregon Department of Fish and Wildlife and Confederated Tribes of the Warm Springs Reservation of Oregon (1990).

Table 1 (HB-1). Estimated amount of spawning and rearing habitat by quality of Hood River subbasin fall chinook production area[a].

Distance/ Area	Excellent	Good	Fair[b]	Poor[b]	Unknown	Total	Confi-dence
Miles (%)	100.0	--	--	--	--	19.7	--
Acres (%)	--	--	--	--	--	--	--

[a] Estimates are modified from the Northwest Power Planning Council's presence/absence database.
[b] Ratings of fair and poor habitat quality may reflect natural physical features such as waterfall barriers, as well as degradation caused by man.

Table 2 (HB-2). Estimated amount of rearing only habitat by quality of Hood River subbasin fall chinook production area[a].

Distance/ Area	Excellent	Good	Fair[b]	Poor[b]	Unknown	Total	Confi-dence
Miles (%)	0.0	0.0	0.0	0.0	--	0.0	--
Acres (%)	--	--	--	--	--	--	--

[a] Estimates are modified from the Northwest Power Planning Council's presence/absence database.
[b] Ratings of fair and poor habitat quality may reflect natural physical features such as waterfall barriers, as well as degradation caused by man.

REFERENCES

Oregon Department of Fish and Wildlife and Confederated Tribes of the Warm Springs Resection of Oregon. 1990. Hood River subbasin salmon and steelhead production plan. Columbia Basin System Planning Report to Northwest Power Planning Council, Portland, Oregon.

HOOD RIVER SUBBASIN

Naturally Produced Coho Salmon

GEOGRAPHIC LOCATION

The Hood River, located in north central Oregon, flows in a northeasterly direction to enter the Columbia River at approximately river mile RM 169. The subbasin covers approximately 352 square miles. The Hood River is located above Bonneville Dam.

ORIGIN

Coho are indigenous to the Hood River subbasin. Non-indigenous stocks released into the subbasin include the Little White Salmon, Washougal, and Cascade stocks and an unknown stock obtained from Bonneville Hatchery (see HOOD RIVER SUBBASIN, Hatchery Produced Coho Salmon, PRODUCTION). Subbasin production has been entirely from the native stock since the last recorded release of hatchery fish in 1977.

DISTRIBUTION

Subbasin

Limited information is available on the spatial distribution of coho in the Hood River subbasin. It is believed that the population is distributed throughout most of the mainstem of the Hood River and its tributaries (excluding the West Fork Hood River). It is believed that Punchbowl Falls (RM 0.4 on the West Fork Hood River) may impede or block upstream migrants into the West Fork drainage of the Hood River (Oregon Department of Fish and Wildlife and Confederated Tribes of the Warm Springs Reservation of Oregon 1990). The quality of the spawning and rearing habitat varies throughout the subbasin (Tables 1 and 2).

PRODUCTION

Harvest

sport

Subbasin: There is currently no sport fishery in the Hood River subbasin that targets coho. Coho are currently harvested incidentally in the summer steelhead fishery. There are no records of a season closure in the subbasin. No brood year specific estimates of harvest are available. Run year specific estimates of harvest (punch card) are available from Oregon Department of Fish and Wildlife (unpublished data).

Treaty

Subbasin: The entire Hood River subbasin is located on lands ceded to the United States by the Confederated Tribes of the Warm Springs Reservation. The tribal harvest of naturally produced coho is unknown but it is believed that the numbers harvested each year are very low.

ADULT LIFE HISTORY

Escapement

Subbasin

Timing: Peak migration in Hood River past Powerdale Dam occurred in September and October (Howell et al. 1985).

Numbers: No brood year specific estimates of escapement are available. Run year specific estimates of escapement past Powerdaie Dam are available for the 1963-71 run years in Oregon Department of Fish and Wildlife and Confederated Tribes of the Warm Springs Reservation of Oregon (1990).

spawner Area

Timing: Spawning recurs during October and November (Oregon State Game Commission 1963, cited by Howell et al. 1985).

Table 1 (HB-1). Estimated amount of spawning and rearing habitat by quality of Hood River subbasin coho production area[a].

Distance/ Area	Excellent	Good	Fair[b]	Poor[b]	Unknown	Total	Confi-dence
Miles (%)	12.5	0.0	7.9	79.6	--	61.7	--
Acres (%)	--	--	--	--	--	--	--

[a] Estimates are modified from the Northwest Power Planning Council's presence/absence database.
[b] Ratings of fair and poor habitat quality may reflect natural physical features such as waterfall barriers, as well as degradation caused by man.

Table 2 (HB-2). Estimated amount of rearing only habitat by quality of Hood River subbasin coho production area[a].

Distance/ Area	Excellent	Good	Fair[b]	Poor[b]	Unknown	Total	Confi-dence
Miles (%)	0.0	0.0	0.0	0.0	--	0.0	--
Acres (%)	--	--	--	--	--	--	--

[a] Estimates are modified from the Northwest Power Planning Council's presence/absence database.
[b] Ratings of fair and poor habitat quality may reflect natural physical features such as waterfall barriers, as well as degradation caused by man.

REFERENCES

Oregon Department of Fish and Wildlife and Confederated Tribes of the Warm Springs Reservation of Oregon. 1990. Hood River subbasin salmon and steelhead production plan. Columbia Basin System Planning Report to Northwest Power Planning Council, Portland, Oregon.

Oregon State Game Commission. 1963. The fish and wildlife resources of the Hood Basin, Oregon, and their water use requirements. Federal aid to fish restoration progress report of the Oregon State Game Commission. (As reported in Howell et al. 1985.)

Howell, P., K. Jones, D. Scarnecchia, L. Lavoy, W. Kendra, D. Ortmann. 1985. Stock assessment of Columbia River anadromous salmonids, volume I: chinook, coho, chum and sockeye salmon stock summaries. Final Report of Oregon Department of Fish and Wildlife, Washington Department of Fisheries, Washington Department of Game, and Idaho Department of Fish and Game (Contract No. DE-A179-84BP12737, Project Number 83-335) to Bonneville Power Administration, Portland, Oregon.

HOOD RIVER SUBBASIN

Hatchery Produced Coho Salmon

ORIGIN

The first recorded release of juvenile hatchery fish into the subbasin is the 1967 brood release from the Little White Salmon stock (Table 1). The Hood River subbasin was supplemented with juvenile hatchery fish in 1967, 1971, and 1977 (Table 1). Adults were outplanted into the subbasin in 1966 and 1968 (Table 1). Stocks introduced into the subbasin include the Little White Salmon, Sandy, Washougal, and Cascade stocks and an unknown stock obtained from Bonneville Hatchery (Table 1). There is currently no coho hatchery supplementation program in the subbasin.

DISTRIBUTION

Subbasin

Hatchery fry were released into the Middle and East forks of the Hood River and adult fish were released into the Middle and East forks of the Hood River and into Neal and Clear Branch creeks (Table 1). Neal Creek is a tributary to the mainstem of the Hood River and Clear Branch Creek is a tributary to the Middle Fork of the Hood River.

PRODUCTION

Releases

Egg

There are no records of releases in the subbasin.

Fry

Hatchery facilities in which fry were reared or acclimated prior to release in the subbasin include Little White Salmon NFH and Washougal and Cascade hatcheries (Table 1). Annual numbers released ranged from 239,400 to 969,323 (Table 1). Size at release ranged from 1,235 to 550 fish per pound (Table 1).

Fingerling

There are no records of releases in the subbasin.

Smelt

There are no records of releases in the subbasin.

Jack and Adult

Hatchery facilities in which jacks and adults were held prior to release in the subbasin include Sandy and Bonneville hatcheries (Table 1). Annual numbers released ranged from 225 to 1,480 (Table 1).

DISEASES

There are no hatchery facilities in the Hood River subbasin that currently hold or rear hatchery coho salmon prior to release in the subbasin. For information on parasites and disease agents of subbasin hatchery production that is held or reared at hatchery facilities located outside of the subbasin see SANDY RIVER SUBBASIN, Hatchery Produced Coho Salmon, DISEASES and see LOWER COLUMBIA RIVER SUBBASIN, Hatchery Produced Coho Salmon, DISEASES.

Table 1 (TR). Hatchery releases of coho salmon into the Hood River subbasin by brood year and if marked, by coded wire tag code[a].

Brood Year	Stock	Hatchery	Life Stage	Release Data (1)	Release Date (2)	Fiah/ lb	Number Released	Release Location	CUT/ Fin clip
1966	Unknown	Bonneville	adult	09/05/66	..	--	225	Clear Branch Creek	.-
1967	L White Salmon	L White Salmon	fry	02/14/67	..	1,050.0	186,900	Hood River, East Fork	..
1967	L White Salmon	L White Salmon	fry	02/14/67	..	1,050.0	52,500	Hood River, Middle Fork	..
196s	Unknown	Bonneville	adult	09/1 7/68	--	..	1 4 0	Neal Creek	--
1960	Unknown	Bonneville	adult	09/15/6s	..	..	990	Hood River, East Fork	.-
196s	Unknown	Bonneville	adult	09/1 5/6s	..	..	150	Hood River, Middle Fork	..
196s	Unknown	Bonneville	adult	09/1 7/6s	..	--	200	Hood River, Middle Fork	--
1970	Sandy River	Sandy	adult	11/10/70	--	.-	320	Hood River, East Fork	--
1971	Washougal	Washougal	fry	04/16/71	..	550.0	302,500	Hood River, East Fork	--
1977	Cascade	Cascade	fry	03/21/77	03/22/77	1,235.0	969,323	Hood River, East Fork	..

[a]Estimates are from Oregon Department of Fish and Wildl ife (unpublished data).

HOOD RIVER SUBBASIN

Naturally Produced Summer Steelhead

GEOGRAPHIC LOCATION

The Hood River, located in north central Oregon, flows in a northeasterly direction to enter the Columbia River at approximately RM 169. The subbasin covers approximately 352 square miles. The Hood River is located above Bonneville Dam.

ORIGIN

Summer steelhead are indigenous to the Hood River subbasin. Non-indigenous hatchery stocks that have been introduced into the subbasin include the Skamania, Washougal, Big Creek, and Cascade stocks and one unknown stock of hatchery fish obtained from Oxbow Hatchery. Natural production is believed to occur as the result of hatchery supplementation in the Hood River subbasin.

DISTRIBUTION

Subbasin

Limited information is available on the spatial distribution of summer steelhead in the Hood River subbasin. It is believed that the population is generally distributed throughout the entire subbasin but that spawning and rearing primarily occurs in the mainstem of the Hood River and its tributaries (excluding the East and Middle forks of the Hood River) and in the West Fork drainage of the Hood River (Oregon Department of Fish and Wildlife and Confederated Tribes of the Warm Springs Reservation of Oregon 1990; Figure 1). The quality of the spawning and rearing habitat varies throughout the subbasin (Tables 1 and 2).

ocean

"Ocean distribution is largely unknown; however, one tagged adult which was released in the West Fork, Hood River was recovered in the north Pacific Ocean, south of the Aleutian Islands, approximately 180° longitude and 45°N latitude" (International North Pacific Fisheries Commission 1981, cited by Howell et al 1985).

PRODUCTION

Harvest

sport

Subbasin: The Hood River subbasin currently sustains a popular summer steelhead fishery. The sport fishery primarily occurs in the mainstem of the Hood River below the confluence of the West Fork of the Hood River. There are no records of a season closure in the subbasin. No brood year specific estimates of harvest are available. Run year specific estimates for the combined harvest (punch card) of naturally and hatchery produced fish are available from Oregon Department of Fish and Wildlife (unpublished data).

Treaty

Subbasin: The entire Hood River subbasin is located on lands ceded to the United States by the Confederated Tribes of the Warm Springs Reservation. The tribal harvest of naturally produced summer steelhead is unknown but it is believed that the numbers harvested each year are low.

ADULT LIFE HISTORY

Escapement

Subbasin

Timing: Adult steelhead can be found in the Hood River subbasin throughout the year. The peak of the steelhead run passes Powerdale Dam from mid-March through mid-May (Lichens and Haxton undated, cited by Howell et al. 1985). The steelhead run peaked at the Punch Bowl ladder from mid-May through mid-July (Haxton 1965, cited by Howell et al. 1985).

Spawner Area

Timing: Summer steelhead primarily spawn in the Hood River subbasin from May-July (Howell et al. 1985).

JUVENILE LIFE HISTORY

Age Structure

In 1965 90% of 20 wild steelhead smelts sampled in the Hood River were age 2 + (Lichens and Haxton undated, cited by Howell et al. 1985). In 1966 the age composition of steelhead smelts "sampled (n =40) was 45% age 1+, 27.5% age 2+, and 27.5% age 3+. Differences between the two years may have been due to size selectivity of the different types of traps used each year and mortalities during the 1964 flood" (Lichens and Haxton undated, cited by Howell et al. 1985).

Migration Timing

In 1964 and 1965 the downstream migration of wild juvenile steelhead in Hood River peaked in late May (Howell et al. 1985). Outmigration in the fall has also been reported but has not been verified or measured (Haxton 1965, cited by Howell et al. 1985).

Figure 1. Summer Steelhead distribution in the Hood River subbasin, based on the NPPC presence\absence data base (solid and dashed lines respectively) and the BPA Geographic Information System.

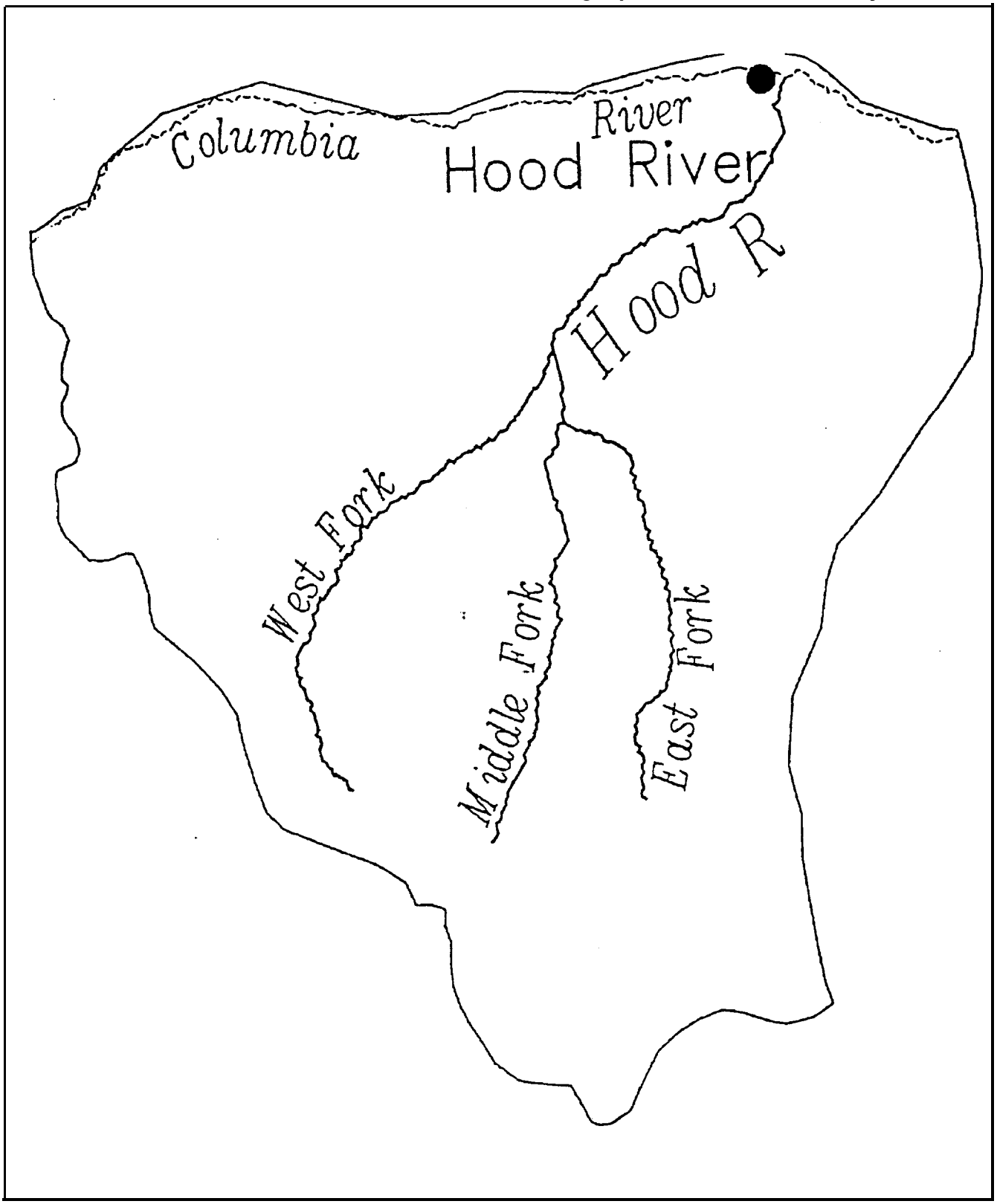

Table 1 (HB-1). Estimated amount of spawning and rearing habitat by quality of Hood River subbasin summer steelhead production area[a].

Distance/ Area	Excellent	Good	Fair[b]	Poor[b]	Unknown	Total	Confi-dence
Miles (%)	1.6	6.3	30.6	61.6		114.7	
Acres (%)	--	--	--	--	--	--	--

[a] Estimates are modified from the Northwest Power Planning Council's presence/absence database.
[b] Ratings of fair and poor habitat quality may reflect natural physical features such as waterfall barriers, as well as degradation caused by man.

Table 2 (HB-2). Estimated amount of rearing only habitat by quality of Hood River subbasin summer steelhead production area[a].

Distance/ Area	Excellent	Good	Fair[b]	Poor[b]	Unknown	Total	Confi-dence
Miles (%)	0.0	0.0	0.0	0.0	--	0.0	--
Acres (%)	--	--	--	--	--	--	--

[a] Estimates are modified from the Northwest Power Planning Council's presence/absence database.
[b] Ratings of fair and poor habitat quality may reflect natural physical features such as waterfall barriers, as well as degradation caused by man.

REFERENCES

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HOOD RIVER SUBBASIN

Hatchery Produced Summer Steelhead

ORIGIN

The first recorded release of juvenile hatchery fish into the subbasin is the 1958 release from the Hatchery Hood River stock (Table 1). The Hood River subbasin was supplemented with juvenile hatchery fish from 1958-90 and adults were outplanted into the subbasin in 1968 and 1969 (Table 1). Stocks introduced into the subbasin include the Washougal, Big Creek, Cascade, and Skamania stocks and an unknown stock obtained from Oxbow Hatchery (Table 1). The Hatchery Hood River stock was developed from summer steelhead collected at Powerdale Dam; located at RM 4.5 on the mainstem of the Hood River. The Skamania stock is the only hatchery stock that is currently released into the subbasin.

DISTRIBUTION

Subbasin

Juvenile hatchery fish have been released into the mainstem and West Forks of the Hood River and into Lake Branch Creek, a tributary to the West Fork of the Hood River (Table 1). Adult fish were released into the East and West forks of the Hood River (Table 1). Juvenile hatchery fish are currently released into the mainstem and West Forks of the Hood River (Table 1).

PRODUCTION

Releases

Egg

There are no records of releases in the subbasin.

Fry

There are no records of releases in the subbasin.

Fingerling

Hatchery facilities in which fingerlings were reared or acclimated prior to release in the subbasin include Oak Springs Hatchery (Table 1). Only one recorded release of 114,000 fry was made in 1984 (Table 1). Size at release ranged from 55 to 50 fish per pound (Table 1).

Smelt

Hatchery facilities in which smelts were reared or acclimated prior to release in the subbasin include Hood River, Gnat Creek, and Oak Springs hatcheries (Table 1). Annual numbers released ranged from 1,800 to 185,510 (Table 1). Size at release ranged from 22.0 to 3.5 fish per pound (Table 1).

Adult

Hatchery facilities in which adults were held prior to release in the subbasin include Big

Creek, Cascade, Hood River, and Oxbow hatcheries (Table 1). Annual numbers released ranged from 262 to 550 (Table 1).

Harvest

sport

Subbasin: The Hood River subbasin currently sustains a popular summer steelhead fishery. The sport fishery primarily occurs in the mainstem of the Hood River below the confluence of the West Fork of the Hood River. There are no records of a season closure in the subbasin. No brood year specific estimates of harvest are available. Run year specific estimates for the combined harvest (punch card) of naturally and hatchery produced fish are available from Oregon Department of Fish and Wildlife (unpublished data).

Treaty

Subbasin: The entire Hood River subbasin is located on lands ceded to the United States by the Confederated Tribes of the Warms Springs Reservation. The tribal harvest of hatchery summer steelhead is unknown but it is believed that the numbers harvested each year are very low.

DISEASES

There are no hatchery facilities in the Hood River subbasin that currently hold or rear hatchery summer steelhead prior to release in the subbasin. For information on parasites and disease agents of subbasin hatchery production that is held or reared at hatchery facilities located outside of the subbasin see DESCHUTES RIVER SUBBASIN, Hatchery Produced Summer Steelhead, DISEASES.

Table 1 (TR). Hatchery releases of summer steel head into the Hood River subbasin by brood year and if marked, by coded wire tag Codes.

Brood Year	Stock	Hatchery	Life Stage	Release Date (1)	Release Date (2)	Fish/ lb	Number Released	Release Location	CUT/ Fin clip[b]
1956	Hoed River	Hood River	smolt	04/16/58	--	9.0	1,800	Hoed River	AD-RM
1957	Hood River	Hood River	-Smelt	04/01/59	--	8.1	2,454	Hood River, Eaat Fork	RP-RM
1958	Hood River	Hood River	molt	04/13/60	--	11.0	7,920	Hood River	RP
1958	Hood River	Hood River	molt	04/14/60	--	11.0	9,460	Hood River	RP
1959	Hood River	Oak Springs	smolt	04/13/60	--	12.0	7,680	Hood River	RP
1959	Hood River	Oak Springa	molt	04/14/60	--	12.4	7,746	Hood River	RP
1960	Hood River	Hood River	molt	11/12/61	--	9.0	2,727	Hood River, West Fork	LP-RM
1960	Hood River	Hood River	molt	11/13/61	--	9.0	20,349	Hood River, West Fork	LP-RM
1960	Hood River	Gnat Creek	smolt	05/25/61	--	8.7	18,242	Hood River, West Fork	LP
1960	Hood River	Gnat Creek	molt	06/02/61	--	10.0	12,000	Hood River, West Fork	LP
1960	Hood River	Gnat Creek	molt	06/05/61	--	10.0	9,730	Hood River, West Fork	LP
1961	Hood River	Hood River	smolt	05/07/63	--	9.5	5,225	Lake Branch Creek	LV-RP-RM
1961	Hood River	Gnat Creek	molt	05/08/62	--	12.0	11,460	Lake Branch Creek	RP-RM
1961	Hood River	Gnat Creek	molt	05/04/62	--	12.0	15,972	Hood River, Uest Fork	RP-RM
1961	Hood River	Gnat Creek	molt	06/08/62	--	22.0	13,200	Lake Branch Creek	RP-RM
1961	Hoed River	Gnat Creek	molt	06/11/62	--	22.0	16,038	Hood River, Uest Fork	RP-RM
1962	Hood River	Hood River	molt	08/28/63	--	11.0	4,103	Hood River, Uest Fork	RV-LP-LM
1962	Hood River	Hood River	molt	08/30/63	--	11.0	7,051	Hood River, Uest Fork	RV-LP-LM
1962	Hoed River	Hood River	smolt	09/05/63	--	11.0	3,740	Hood River, Uest Fork	RV-LP-LM
1962	Hood River	Hood River	molt	09/05/63	--	11.0	3,355	Lake Branch Creek	RV-LP-LM
1962	Hood River	Hood River	smolt	09/06/63	--	11.0	3,861	Hood River, Uest Fork	RV-LP-LM
1962	Hood River	Hood River	smolt	09/07/63	--	11.0	2,640	Lake Branch Creek	RV-LP-LM
1962	Hood River	Hood River	molt	09/09/63	--	11.0	3,432	Lake Branch Creek	RV-LP-LM
1962	Hood River	Hood River	molt	09/10/63	--	11.0	6,578	Hood River, Uest Fork	RV-LP-LM
1962	Hood River	Hood River	smolt	06/08/64	--	9.0	28,377	Hoed River, West Fork	LV-RP
1962	Hoed River	Gnat Creek	molt	06/03/63	--	9..5	10,500	Hood River, West Fork	LP-LM
1962	Hood River	Gnat Creek	smolt	06/04/63	--	10.5	10,500	Lake Branch Creek	LP-LM
1962	Hoed River	Gnat Creek	molt	06/05/63	--	10.5	9,355	Lake Branch Creek	LP-LM
1%3	Hood River	Hood River	smolt	04/12/65	--	7.0	2,100	Lake Branch Creek	RP-LM
1963	Hood River	Hood River	molt	04/12/65	--	7.0	9,450	Hood River, West Fork	RP-LM
1963	Hood River	Hood River	-smelt	04/13/65	--	7.0	2,100	Hood River, Uest Fork	RP-LM
1963	Hood River	Gnat Creek	molt	05/22/64	--	10.0	10,000	Hood River, West Fork	RP-RM
1963	Hood River	Gnat Creek	smolt	05/25/64	--	10.0	10,000	Lake Branch Creek	RP-RM
1963	Hood River	Gnat Creek	molt	05/25/64	--	10.2	10,934	Lake Branch Creek	RP-RM
1963	Hood River	Gnat Creek	molt	05/26/64	--	10.2	10,240	Hood River, West Fork	RP-RM
1963	Hood River	Gnet Creek	molt	05/28/64	--	11.2	11,346	Hood River, Uest Fork	RP-RM
1963	Hood River	Gnat Creek	smolt	05/29/64	--	11.4	12,004	Hood River, Uest Fork	RP-RM
1963	Mood River	Gnat Creek	smolt	06/01/64	--	11.4	12,574	Lake Branch Creek	RP-RM
1963	Hood River	Gnat Creek	molt	06/02/64	--	11.8	12,000	Hood River, West Fork	RP-RM
1964	Hood River	Gnat Creek	smolt	07/14/65	--	10.8	10,260	Hood River, West Fork	LP-LM
1964	Hood River	Gnat Creek	smolt	07/15/65	--	10.6	10,600	Hood River, bleat Fork	LP-LM
1964	Hood River	Gnat Creek	-smelt	07116165	--	10.3	10,815	Lake Branch Creek	LP-LM

Table 1 (IR). (cent.) Hatchery releases of summer steelheed into the Hood River subbasin by brood year end if marked, by coded wire tag code[a].

Brood Year	Stock	Hatchery	Life Stage	Release Date (1)	Release Date (2)	Fish/ lb	Number Released	Release Location	CUT/ Fin clip[b]
1964	Hood River	Gmt Creek	smolt	07/20/65	--	10.5	11,025	Hood River, West Fork	LP-LM
1964	Hood River	Gnat Creek	smelt	07/21/65	--	10.5	11,235	Hood River, West Fork	LP-LM
1964	Hood River	Gnat Creek	smolt	05/02/66	--	7.0	17,941	Hood River, Weat Fork	AD-RP-RM
1964	Hood River	Gnat Creek	smolt	05/03/66	--	6.8	8,704	Hood River, West Fork	AD-RP-RM
1964	Hood River	Gnat Creak	smolt	05/03/66	--	7.0	8,981	Hood River, West Fork	AD-RP-RM
1964	Hood River	Gnat Creak	smolt	05/04/66	--	6.8	9,044	Lake Branch Creek	AD-RP-RM
1964	Hood River	Gnat Creak	smolt	05/05/66	--	6.8	8,228	Hood River, West Fork	AD-RP-RM
1965	Hood River	Gnat Creek	smolt	06/01166	--	7.4	8,140	Lake Branch Creek	RP-RM
1%5	Hood River	Gnat Creek	molt	06/01/66	--	7.4	9,620	Hood River, West Fork	RP-RM
1966	Washougal	Gnat Creek	smolt	06/06/ 67	--	12.3	11,070	Lake Branch Creek	LV-LM
1966	Washougal	Gnat Creek	molt	06/06/67	--	12.3	11,070	Hood River, West Fork	LV-LM
1966	Washougal	Gnat Creek	smolt	06/07/67	--	10.3	11,433	Hood River, West Fork	LV-LM
1%7	Washougal	Gnat Creek	molt	05/13/6s	--	9.6	20,553	Hood River, Weat Fork	RV
1%7	Washougal	Gnat Creek	smolt	05/14/68	--	7.8	9,625	Hood River, West Fork	RV
1%7	Washougal	Gnat Creek	-Smelt	05/14/68	--	9.6	11,520	Hood River, West Fork	RV
1%7	Washougal	Gnat Creek	"Smelt	05/15/68	--	7.7	20,867	Hood River, West Fork	RV
1%7	Washougal	Gnat Creek	smolt	05/16/68	--	8.1	11,137	Hood River, West Fork	RV
1967	Washougal	Gnat Creek	molt	05/16/68	--	8.6	11,266	Hood River, West Fork	RV
1%7	Washougal	Gnat Creek	smolt	05/17/68	--	8.6	11,610	Hood River, West Fork	RV
1968	Washougal	Gnat Creek	molt	06/02/69	--	8.5	14,321	Hood River, Weat Fork	LV-RV
1968	Washougal	Gnet Creek	molt	06/03/69	--	9.0	25,908	Hood River, West Fork	LV-RV
1968	Washougal	Gnat Creek	smolt	06/04/69	--	9.0	26,990	Hood River, West Fork	LV-RV
1968	Washougal	Gnat Creek	molt	06/05/69	--	8.0	9,440	Hood River, West Fork	LV-RV
1968	Washougal	Gnat Creak	molt	06/05/69	--	8.5	14,448	Hood River, West Fork	LV-RV
1968	Washougal	Gnat Creek	-smelt	06/06/69	--	8.5	12,871	Hood River, West Fork	LV-RV
1968	Big Creek	Big Creek	adult	02/20/68	--	..	300	Hood River, East Fork	--
1968	Big Creek	Big Creek	adult	02/21/68	--	..	250	Hood River, East Fork	..
1%9	Washougal	Gnat Creek	molt	06/01/70	--	6.9	11,730	Hoed River, West Fork	LP-LM
1969	Washougal	Gnat Creek	smolt	06/01/70	--	7.4	12,570	Hood River, West Fork	LP-LM
1969	Washougal	Gnat Creek	molt	06/02/70	--	7.1	12,448	Hood River, Uest Fork	LP-LM
1969	Washougal	Gnat Creak	molt	06/02/70	--	7.3	8,760	Hood River, West Fork	LP-LM
1969	Washougal	Gnat Creek	smolt	06/02/70	--	7.4	8,954	Hood River, Wast Fork	LP-LM
1969	Washougal	Gnat Creek	molt	06/03/70	--	7.2	8,640	Hood River, Uest Fork	LP-LM
1969	Washougal	Gnat Creek	smolt	06/03/70	--	7.4	34,744	Hood River, West Fork	LP-LM
1969	Cascade	Cascade	adult	09/30/69	--	..		Hood River, West Fork	..
1%9	Hood River	Hood River	adult	03/10/69	--	..	1::	Hood River, West Fork	..
1969	Hood River	Hood River	adult	10/01/69	--	..	96	Hood River, West Fork	..
1%9	Unknown	oxbow	adult	10/13/69	--	.-	26	Hood River, West Fork	..
1970	Washougal	Gmt Creek	molt	04/26/71	--	8.8	10,560	Hood River	RP-LM
1970	Washougal	Gnat Creek	smolt	04/27/71	--	8.8	10,560	Hood River	RP-LM
1970	Washougal	Gnat Creek	smolt	04/27/71	--	9.0	10,800	Hood River	RP-LM
1970	Washougal	Gnat Creek	-Smelt	04/30/71	--	8.8	10,560	Hood River	RP-LM
1970	Washougal	Gnat Creek	smolt	04/28/71	--	8.0	9,680	Hood River, West Fork	RP-LM

Table 1 (TR). (cent.) Hatchery releases of summer steel head into the Hood River subbasin by brood year and if marked, by coded wire tag code[a].

Brood Year	Stock	Hatchery	Life Stage	Release Date (1)	Release Date (2)	Fish/ lb	Number Released	Release Location	CWT/ Fin clip[b]
1970	Washougal	Gnat Creek	molt	04/28/71	--	8.8	10,648	Hood River, Uest Fork	RP-LM
1970	Washougal	Gnat Creek	smolt	04/29/71	--	8.7	10,440	Hood River, West Fork	RP-LM
1970	Washougal	Gnat Creek	molt	04/29/71	--	8.8	10,736	Hood River, Uest Fork	RP-LM
1970	Washougal	Gnat Creek	-Smelt	04/30/71	-"	8.8	12,056	Hood River, Uest Fork	RP-LM
1970	Washougal	Gnat Creek	molt	05/03/71	--	15.0	14,400	Hood River	RP-LM
1971	Washougal	Gnat Creek	molt	04/18/72	--	7.1	9,301	Lake Branch Creek	AN-RV
1971	Washougal	Gnat Creek	molt	04/19/72	--	7.1	9,301	Hood River, Uest Fork	AN-RV
1971	_	Gnat Creek	molt	04/20/72	-"	7.1	9,230	Hood River	AN-RV
1971	Washougal	Gnat Creek	molt	04/21/72	--	7.1	9,301	Hood River, Uest Fork	AN-RV
1971	Washougal	Gnat Creek	molt	04/24/72	--	7.1	13,062	Hood River, Uest Fork	AN-RV
1971	Washougal	Gnat Creek	molt	04/25/72	--	7.4	13,902	Hoed River, Uest Fork	AN-RV
1971	Washougal	Gnat Creek	smolt	04/26/72	--	7.4	13,762	Hood River	AN-RV
1971	Washougal	Gnat Creek	molt	04/26/72	--	7.4	10,064	Lake Branch Creek	AN-RV
1971	Washougal	Gnat Creek	molt	04/27/72	--	7.3	14,079	Hood River, Uest Fork	AN-RV
1972	Washougal	Gnat Creek	smolt	04/17/73	--	6.5	21,125	Hood River, Uest Fork	RP-RM
1972	Washougal	Gnat Creek	molt	04/17/73	--	11.2	21,350	Hood River	RP-RM
1972	Washougal	Gnat Creek	s-molt	04/18/73	--	6.5	13,228	Lake Branch Creek	RP-RM
1972	Washougal	Gnat Creek	smolt	04/19/73	--	6.5	34,548	Hood River, Ueat Fork	RP-RM
1972	Washougal	Gnat Creek	smolt	04/20/73	--	6.8	21,246	Hood River	RP-RM
1973	Washougal	Gnat Creek	-smelt	05/08/74	--	7.3	8,758	Hood River	RP-LM
1973	Washougal	Gnat Creek	smolt	05/09/74	--	7.3	27,740	Hood River	RP-LM
1973	Washougal	Gnat Creek	molt	05/09/74	--	7.3	9,490	Lake Branch Creek	RP-LM
1973	Washougal	Gmt Creek	-Smelt	05/10/74	"-	7.3	9,125	Hood River, Ueat Fork	RP-LM
1973	Washougal	Gnat Creek	molt	05/13/74	--	6.5	11,700	Hood River	RP-LM
1973	Washougal	Gnat Creek	molt	05/13/74	--	6.8	12,235	Hood River	RP-LM
1973	Washougal	Gnat Creek	molt	05/13/74	--	7.1	9,372	Hood River	RP-LM
1973	ug	Gnat Creek	smolt	05/13/74	--	6.5	8,580	Lake Branch Creek	RP-LM
1973	Washougal	Gnat Creek	molt	05/13/74	--	7.1	9,372	Hood River, Uest Fork	RP-LM
1973	Washougal	Gnat Creek	molt	05/14/74	--	5.0	5,000	Hood River	RP-LM
1973	Washougal	Gnat Creek	molt	05/15/74	-"	3.5	5,600	Hood River, Uest Fork	RP-LM
1974	Skamania	Gnat Creek	molt	04/04/75	--	6.5	10,724	Lake Branch Creek	AD-LV
1974	Skamania	Gnat Creek	-smelt	04/16/73	--	6.7	9,111	Hood River	AD-LV
1974	Skamania	Gnat Creek	smolt	04/16/75	--	6.7	9,489	Hood River, Uest Fork	AD-LV
1974	Skamania	Gnat Creek	-Smelt	04/17/75	--	6.7	18,023	Hood River	AD-LV
1974	Skamania	Gnat Creek	smolt	04/21/75	--	6.5	10,725	Hood River, Uest Fork	AD-LV
1974	Skamania	Gnat Creek	molt	04/22/75	--	6.5	10,205	Hood River, Uest Fork	AD-LV
1974	Skamania	Gnat Creek	molt	04/22/75	--	6.7	11,926	Hood River, Uest Fork	AD-LV
1974	Skamania	Gnat Creek	molt	04/23/75	--	6.0	9,238	Hood River	AD-LV
1974	Skamania	Gnat Creek	molt	04/24/75	--	7.4	5,809	Hood River, Uest Fork	AD-LV
1974	Skamania	Gnat Creek	smolt	04/25/75	--	6.0	10,500	Hood River	AD-LV
1975	Skamania	Oak Springs	smolt	04/05/76	--	4.8	10,846	Hood River	--
1975	Skamania	Oak Springs	molt	04/05/76	--	4.8	5,992	Hood River, Uest Fork	--
1975	Skamania	Oak Springs	molt	04/05/76	--	4.9	4,981	Hood River, Uest Fork	--

Table 1 (TR). (cant.) Hatchery releases of summer steelhead into the Hood River subbasin by brood year end if marked, by coded wire tag code[a].

Brood Year	stock	Hatchery	Life Stage	Release Date (1)	Release Dete (2)	Fish/ lb	Number Released	Release LoCat ion	CWT/ Fin clip[b]
1975	Skamania	Oak Springs	smolt	04/06/76	--	4.0	10,314	Hood River, West Fork	--
1975	Skamania	Oak Springs	smolt	04/06/76	--	4.8	5,400	Hood River	--
1975	Skamania	Oak Springs	smolt	04/07/76	--	4.0	10,100	Hood River, West Fork	--
1975	Skamania	Oak Springs	smolt	04/07/76	--	4.0	10,280	Lake Branch Creek	--
1975	Skamania	Oak Springs	smolt	04/08/76	--	3.9	10,277	Hood River	--
1975	Skamania	Oak Springs	smolt	04/08/76	--	4.0	10,940	Hoed River	..
1973	Skamania	Oak Springs	smolt	04/09/76	--	3.9	10,803	Hood River	--
1975	Skamania	Oak Springs	smolt	04/09/76	--	3.9	4,871	Hood River, West Fork	..
1975	Skamania	Oak Springs	smolt	04/09/76	--	3.9	6,123	Lake Branch Creek	..
1975	Skamania	Oak Springs	smolt	04/12/76	--	3.9	3,276	Hood River	..
1975	Skamania	Oak Springs	smolt	04/12/76	--	4.4	6,600	Hood River	--
1976	Skamania	Oak Springs	-Smelt	04/11/77	--	5.5	6,186	Hood River, West Fork	--
1976	Skamania	Oak Springs	-Smelt	04/11/77	--	5.7	6,305	Hood River	..
1976	Skamania	Oak Springs	smolt	04/11/77	--	6.0	6,240	Hood River	--
1976	Skamania	oak Springs	smolt	04/12/77	--	6.0	16,260	Hood River	.-
1976	Skamania	Oak Springs	smolt	04/12/77	--	6.0	6,660	Lake Branch Creek	..
1976	Skamania	Oak Springs	smolt	04/13/77	--	6.0	30,510	Hood River, West Fork	.-
1976	Skamania	Oak Springs	smolt	04/14/77	--	5.2	7,436	Hood River, West Fork	..
1976	Skamania	Oak Springs	smolt	04/14/77	--	5.5	14,465	Hood River, bleat Fork	..
1976	Skamania	Oak Springs	Smelt	04/14/77	--	5.6	6,384	Hood River, West Fork	..
1976	Skamania	Oak Springs	smolt	04/15/77	--	5.4	14,769	Hood River, West Fork	..
1977	Washougal	Oak Springs	Smelt	04/11/78	--	5.2	24,362	Hoed River	..
1977	Washougal	Oak Springs	smolt	04/12/78	--	5.3	6,678	Hood River	..
1977	Washougal	Oak Springs	smolt	04/12/78	--	5.5	6,875	Hood River	..
1977	Washougal	Oak Springs	smolt	04/13/78	--	5.3	6,678	Hood River	..
1977	Washougal	Oak Springs	smolt	04/13/78	--	5.5	12,763	Hood River	--
1977	Washougal	Oak Springs	smolt	04/14/78	--	5.5	20,942	Hood River	--
1977	Washougal	Oak Springs	-smelt	04/12/78	--	5.2	7,059	Hood River, blest Fork	--
1977	Washougal	Oak Springs	-smelt	04/12/78	--	5.3	6,890	Hood River, Uest Fork	--
1978	Skamania	Oak Springs	smolt	04/09/79	--	6.5	7,178	Hood River	..
1978	Skamania	Oak Springs	smelt	04/16/79	--	5.0	13,375	Hood River	..
1978	Skamania	Oak Springs	smolt	04/10/79	--	5.4	5,993	Hood River, West Fork	..
1978	Skamania	Oak Springs	smolt	04/11/79	--	5.4	6,210	Hood River, West Fork	..
1978	Skamania	Oak Springs	-Smelt	04/12/79	--	5.0	12,000	Hood River, West Fork	.-
1978	Skamania	Oak Springs	smolt	04/13/79	--	5.2	13,572	Hood River, West Fork	..
1978	Skamania	Oak Springs	-Smelt	04/17/79	--	4.3	4,795	Hood River	..
1978	Skamania	Oak Springs	-Smelt	04/17/79	--	4.7	5,875	Hood River	--
1978	Skamania	Oak Springs	smolt	04/20/79	--	5.0	13,000	Hood River	..
1978	Skamania	Oak Springs	smolt	04/20/79	--	5.0	6,850	Hood River, West Fork	..
1978	Skamania	Oak Springs	smolt	04/24/79	--	4.4	11,660	Hood River, West Fork	--
1978	Skamania	Oak Springs	smolt	04/26/79	--	4.4	4,004	Hood River, West Fork	..
1979	Skamania	Oak Springs	smolt	04/09/80	--	4.2	5,040	Hood River, West Fork	..
1979	Skamania	Oak Springs	molt	04/10/80	--	4.2	5,460	Hood River, West Fork	--

Table 1 (TR). (cent.) Hatchery releases of summer steelhead into the Hoed River subbasin by brood year and if marked, by coded wire tag Codes.

Brood Year	Stock	Hatchery	Life Stage	Release Date (1)	Release Date (2)	Fish/ lb	Number Released	Release Location	CWT/ Fin clip[b]
1979	Skamania	Oak Springs	Smelt	04/10/80	--	4.2	5,628	Hood River	--
1979	Skamania	Oak Springs	Smelt	04/11/80	--	4.3	6,235	Hood River	--
1979	Skamania	Oak Springs	smolt	04/11/80	--	4.2	5,565	Hood River, West Fork	--
1979	Skamania	Oak Springs	smolt	04/14/80	--	4.2	6,090	Hood River, West Fork	--
1979	Skamania	oak Springs	smolt	04/14/80	--	4.0	5,300	Hood River	--
1979	Skamania	Oak Springs	smolt	04/ 15/80	--	3.8	5,510	Hood River	..
1979	Skamania	Oek Springs	smolt	04/15/80	--	4.2	6,300	Lake Branch Creek	..
1979	Skamania	Oak Springs	Smelt	04/16/80	--	3.8	5,320	Lake Branch Creek	--
1979	Skamania	Oak Springs	smolt	04/16/80	--	4.0	5,800	Hood River	--
1979	Skamania	Oak Springs	Smelt	04/ 17/80	--	4.0	6,200	Hood River	--
1979	Skamania	Oak Springs	smolt	04/17/80	--	4.3	6,020	Hood River	--
1979	Skamania	Oak Springa	smolt	04/18/80	--	3.8	4,648	Hood River, West Fork	--
1979	Skamania	Oak Springs	smolt	05/14/80	--	4.0	2,899	Hood River	..
1980	Skamania	Oak Springs	smolt	04/07/81	--	5.0	6,250	Hood River	..
1980	Skamania	Oak Springs	smolt	04/07/81	--	5.1	5,508	Hood River	..
1980	Skamania	Oak Springs	Smelt	04/07/81	--	5.7	13,462	Hood River	..
1980	Skamania	Oak Springs	smelt	04/08/81	--	5.0	13,248	Hood River, West Fork	..
1980	Skamania	Oak Springs	smolt	04/08/81	--	5.6	14,540	Hood River, Uest Fork	--
1980	Skamania	Oak Springs	smolt	04/09/81	--	5.6	6,440	Lake Branch Creek	.-
1980	Skamania	Oak Springs	Smelt	04/09/81	--	6.0	6,000	Lake Branch Creek	..
1980	Skamania	Oak Springs	smolt	04/09/81	--	5.0	12,800	Hood River, West Fork	..
1980	Skamania	Oak Springs	Smelt	04/10/81	--	4.7	10,927	Hood River, West Fork	..
1980	Skamania	Oak Springs	smolt	05/01/81	--	4.3	10,369	Hood River	--
1981	Skamania	Oak Springs	smolt	04/05/82	--	4.3	13,650	Hood River	..
1981	Skamania	Oak Springs	smolt	04/06/82	--	4.3	14,566	Hood River, Uest Fork	.-
1981	Skamania	Oak Springs	smolt	04/07182	--	4.3	10,105	Hood River, Uest Fork	..
1981	Skamania	Oak Springs	Smelt	04107/82	--	4.3	10,019	Hood River	..
1981	Skamania	Oak Springs	smolt	04/08/82	--	5.6	13,300	Lake Branch Creek	..
1981	Skamania	Oak Springs	smolt	04/09/82	--	5.6	13,720	Hood River	.-
1981	Skamania	Oak Springs	smolt	04/12/82	--	5.6	14,270	Hood River, blest Fork	..
1982	Skamania	Oak Springs	Smelt	04/06/83	--	5.1	11,730	Hood River	..
1982	Skamania	Oak Springs	Smelt	04/07/83	--	5.1	35,589	Hoed River	--
1982	Skamania	Oak Springs	smolt	04/07/83	- "	5.0	12,125	Hood River, West Fork	.-
1982	Skamania	Oak Springs	smolt	04/08183	--	5.0	11,975	Lake Branch Creek	..
1982	Skamania	Oak Springs	smolt	04/09/83	--	5.0	12,440	Lake Branch Creek	..
1982	Skamania	Oak Springs	smolt	04/10/83	--	5.0	51,515	Hood River, Uest Fork	..
1982	Skamania	Oak Springs	smolt	04/11/83	--	4.5	11,475	Hood River, West Fork	..
1982	Skamania	Oak Springs	Smelt	04/11/83	--	5.0	6,900	Hood River, West Fork	..
1982	Skamania	Oak Springs	Smelt	04/11/83	-"	5.1	6,120	Hood River, blest Fork	..
1982	Skamania	Oak Springs	smolt	04/12/83	-"	5.0	19,075	Hood River	..
1982	Skamania	Oak Springs	smolt	04/13/83	-"	4.9	6,566	Hood River	--
1983	Skamania	Oak Springs	smolt	04/05/84	--	4.0	9,960	Hood River	AD
1983	Skamania	Oak Springs	Smelt	04/04/84	" -	4.0	4,400	Hood River, Nest Fork	AD

Table 1 (TR). (cent.) Hatchery releases of summer steelhead into the Hood River subbasin by brood year and if marked, by coded wire tag code[a].

Brood Year	Stock	Hatchery	Life Stage	Release Date (1)	Release Date (2)	Fish/ lb	Number Released	Release Location	CUT/ Fin clip[b]
1983	Stamania	Oak Springs	smolt	04/04/84	--	4.5	5,400	Hood River, West Fork	AD
1983	Stamania	Oak Springs	smolt	04/06/84	--	4.0	4,600	Hood River	AD
1983	Stamania	Oak Springs	Smelt	04/09/84	--	3.9	9,516	Hood River	AD
1983	Stamania	Oak Springs	Smelt	04/09/84	--	5.5	6,325	Hood River	AD
1983	Stamania	Oak Springs	smolt	04/10/84	--	3.9	4,485	Hood River	Ao
1983	Stamania	Oak Springs	smolt	04/11/84	--	3.9	9,653	Lake Branch Creek	AD
1983	Stamania	Oak Springs	smolt	04/13/84	--	4.9	12,985	Hood River	AD
1983	Stamania	Oak Springs	smolt	04/13/84	--	3.8	5,320	Hood River, West Fork	AD
1983	Stamania	Oak Springs	Smelt	04/13/84	--	5.0	6,125	Hood River, West Fork	AD
1983	Stamania	Oak Springs	smolt	04/16/84	--	4.5	4,725	Hood River, Uest Fork	AD
1984	Stamania	Oak Springs	fins.	09/10/84	--	55.0	57,750	Hood River, West Fork	--
1984	Stamania	Oak springs	fing.	09/11/84	--	50.0	56,250	Hood River, West Fork	..
1984	Stamania	Oak Springs	smolt	04/04/85	--	4.5	10,710	Lake Branch Creek	AD
1984	Stamania	Oak Springs	Smelt	04/03/85	--	4.7	11,506	Hood River, West Fork	Ao
1984	Stamania	Oak Springs	smolt	04/05/85	--	4.4	4,743	Hood River, Uaat Fork	AD
19s4	Stamania	Oak Springs	smolt	04/09/85	--	4.2	10,920	Hood River	AD
1984	Stamania	Oak Springs	smolt	04/09/8S	--	5.5	7,095	Hood River	AD
1984	Stamania	Oak Springs	Smelt	04/10/85	--	4.3	16,542	Hood River	Ao
1984	Stamania	Oak Springs	Smelt	04/11/85	--	4.3	4,300	Hood River	AD
1984	Stamania	Oak Springs	Smelt	04/11/85	--	4.5	5,963	Hood River, Uest Fork	AD
1984	Stamania	Oak Springs	Smelt	04/12/85	--	4.5	5,850	Hood River, Uest Fork	Ao
1984	Stamania	Osk Springs	smolt	04/16/85	--	4.0	10,100	Hood River	AD
1984	Stamania	Oak Springs	Smelt	04/16/85	--	4.1	5,433	Hood River	AD
1985	Stamania	Oak Springs	smolt	04/07/86	--	4.1	4,920	Hood River	AO
1985	Stamania	Oak Springs	molt	04107/86	--	4.1	9,143	Hood River, Uest Fork	AD
1985	Stamania	Oak Springs	smolt	04/08/86	--	4.1	14,494	Hood River, Uest Fork	Ao
1985	Stamania	Oak Springs	molt	04/08/86	--	4.1	4,100	Hood River	Ao
1985	Stamania	Oak Springs	molt	04/09/86	--	4.1	9,430	Hood River, Uest Fork	AD
1985	Stamania	Oak Springs	smolt	04/09/86	--	4.1	9,656	Hood River	Ao
1985	Stamania	Oak Springs	smolt	04/10/86	--	4.5	21,173	Hood River	Ao
1985	Stamania	Oak Springs	smolt	04/11/86	--	4.5	9,900	Hood River	AD
1986	Stamania	Oak Springs	smolt	04/06/87	--	4.0	4,900	Hood River, Uest Fork	AD
1986	Stamania	Oak Springs	Smelt	04/07/87	--	4.0	9,900	Hood River, Uest Fork	AD
1986	Stamania	Oak Springs	smolt	04/07/87	--	4.0	4,700	Hood River	Ao
1986	Stamania	Oak Springs	molt	04/08/87	--	4.5	5,738	Hood River	AD
1986	Stamania	Oak Springs	Smelt	04/08/87	--	4.6	5,635	Hood River, Uest Fork	AD
1986	Stamania	Oak Springs	smolt	04/09/87	--	4.2	10,206	Hood River, Uest Fork	AD
1986	Stamania	Oak Springs	smolt	04/09/87	--	4.8	11,424	Hood River	AD
1986	Stamania	Oak Springs	Smelt	04/10/87	--	4.7	5,358	Hood River	AD
1986	Stamania	Oak Springs	smolt	04/10/87	--	4.8	5,760	Hood River	AD
1986	Skamania	Oak Springs	smolt	04/10/87	--	4.4	5,170	Hood River, Uest Fork	AD
1986	Skamania	Oak Springs	smolt	04/10/87	--	5.2	6,422	Hood River, West Fork	Ao
1986	Skamania	Oak Spri rigs	molt	04/13/87	--	4.4	4,840	Hoed River, Uest Fork	Ao

Table 1 (IR). (cont.) Hatchery releases of summer steelhead into the Hood River subbasin by brood year and if marked, by coded wire tag Codes.

Brood Year	Stock	Hatchery	Life Stage	Release Date (1)	Release Date (2)	Fish/ lb	Number Released	Re 1 ease Location	CUT/ Fin clip[b]
1987	Skamania	Oak Springs	Smelt	04/04/88	..	4.5	5,400	Hood River, WFk	AD
1987	Skamania	Oak Springs	smolt	04/04/88	..	4.7	5,358	Hood River, WFk	AO
1987	Skamania	Oak Springs	Smelt	04/04/88	..	4.7	6,110	Hood River	AD
1987	Skamania	Oak Springs	smolt	04/05/811	..	4.7	11,844	Hood River, WFk	AO
1987	Skamania	Oak Springs	smelt	04/05/88	--	4.7	11,139	Hood River	AO
1987	Skamania	Oak Springs	smolt	04/06/88	..	4.6	10,327	Hood River, WFk	AO
1987	Skamania	Oak Springs	smolt	04/07/8a	--	5.0	12,350	Hood River, Wfk	AO
1987	Skamania	Oak Springs	smolt	04/08/88	--	4.4	5,500	Hood River, WFk	AO
1987	Skamania	Oak Springs	Smelt	04108/88	..	4.4	5,830	Hood River	Ao
1987	Skamania	Oak Springs	smoit	04/11/88	--	4.6	6,026	Hood River	AD
1988	Skamania	Oak Springs	Smelt	04/06/89	..	5.5	6,215	Hood River, WFk	AO
1988	Skamania	Oak Springs	smoit	04/07/89	--	5.3	12,826	Hoed River	AO
1988	Skamania	Oak Springs	smoit	04/10/89	..	5.3	19,504	Hood River, WFk	Ao
1988	Skamania	Oak Springs	Smelt	04/11/89	..	5.5	13,640	Hood River	AO
1988	Skamania	Oak Springs	smoit	04/1 1/89	..	5.5	13,585	Hood River, WFk	AO
1988	Skamania	Oak Springs	smoit	04/1 2/89	..	5.5	13,063	Hood River, WFk	AD
1988	Skamania	Oak Springs	Smelt	05/02/89	--	4.3	5,160	Hood River, WFk	AD
1988	Skamania	Oak Springs	Smelt	05/03/89	..	4.3	5,053	Hood River, WFk	AD
1989	Skamania	Oak Springs	smoit	04/03/90	--	5.4	5,940	Hood River, WFk	Ao
1989	Skamania	Oak Springs	smoit	04/03/90	--	5.5	6,325	Hood River, WFk	AD
1989	Skamania	Oak Springs	Smelt	04/04/90	..	5.3	4,876	Hood River	AO
1989	Skamania	Oak Springs	smoit	04/04/90	.-	5.3	12,906	Hoed River, WFk	AO
1989	Skamania	Oak Springs	smoit	04/05/90	..	5.3	12,561	Hood River, WFk	AO
1989	Skamania	Oak Springs	Smelt	04/06/90	..	5.5	6,463	Hood River, WFk	AO
1989	Skamania	Oak Springs	smoit	04/06/90	..	5.7	14,592	Hood River, WFk	Ao
1989	Skamania	Oak Springs	Smelt	04/09/90	..	5.5	7,535	Hood River, WFk	AD
1989	Skamania	Oak Springs	smoit	04/1 1/90	--	6.5	10,660	Hood River	AD

[a] Estimates are from Oregon Department of Fish and Wildlifa (unpublished data).
[b] AO = Adipose, LV = Left ventral, RV = Right ventral, LP = Left pectoral, RP = Right pectoral, LM = Left maxillary, RM = Right maxillary.

HOOD RIVER SUBBASIN

Naturally Produced Winter Steelhead

GEOGRAPHIC LOCATION

The Hood River, located in north central Oregon, flows in a northeasterly direction to enter the Columbia River at approximately RM 169. The subbasin covers approximately 352 square miles. The Hood River is located above Bonneville Dam.

ORIGIN

Winter steelhead are indigenous to the Hood River subbasin. Non-indigenous hatchery stocks introduced into the subbasin include the Alsea River, Big Creek, Foster Reservoir, and Klaskanine River stocks and unknown stocks of hatchery fish obtained from Carson and Eagle Creek national fish hatcheries and Gnat Creek and Little White Salmon hatcheries (see HOOD RIVER SUBBASIN, Hatchery Produced Winter Steelhead, PRODUCTION). Natural production is believed to occur as the result of hatchery supplementation in the Hood River subbasin.

DISTRIBUTION

Subbasin

Limited information is available on the spatial distribution of winter steelhead in the Hood River subbasin. It is believed that the population is generally distributed throughout the entire subbasin but that spawning and rearing primarily occurs in the mainstem of the Hood River and its tributaries (excluding the West Fork of the Hood River) and in the Middle and East fork drainages of the Hood River (Oregon Department of Fish and Wildlife and Confederated Tribes of the Warm Springs Reservation of Oregon 1990; Figure 1). The quality of the spawning and rearing habitat varies throughout the subbasin (Tables 1 and 2).

PRODUCTION

Harvest

sport

Subbasin: The Hood River subbasin currently sustains a small but popular winter steelhead fishery. The sport fishery primarily occurs in the mainstem of the Hood River below the confluence of the West Fork of the Hood River. There are no records of a season closure in the subbasin. No brood year specific estimates of harvest are available. Run year specific estimates for the combined harvest (punch card) of naturally and hatchery produced

ADULT LIFE HISTORY

Escapemen

Subbasin

Timing: Adult steelhead can be found in the Hood River subbasin throughout the year. The peak of the steelhead run passes Powerdale Dam from mid-March through mid-May (Lichens and Haxton undated, cited by Howell et al. 1985). The steelhead run peaked at the Punch Bowl ladder from mid-May through mid-July (Haxton 1965, cited by Howell et al. 1985).

JUVENILE LIFE HISTORY

Age Structure

In 196S 90% of 20 wild steelhead smelts sampled in the Hood River were age 2+ (Lichens and Haxton, undated, cited by Howell et al. 1985). In 1966 the age composition of steelhead smelts "sampled (n =40) was 45% age 1+, 27.5% age 2+, and 27.5% age 3+. Differences between the two years may have been due to size selectivity of the different types of traps used each year and mortalities during the 1964 flood" (Lichens and Haxton undated, cited by Howell et al. 1985).

Migrati'on Timing

In 1964 and 1965 the downstream migration of wild juvenile steelhead in Hood River peaked in late May (Howell et al. 1985). Outmigration in the fall has also been reported but has not been verified or measured (Haxton 1965, cited by Howell et al. 1985).

BIOCHEMICAL-GENETIC CHARACTERISTICS

Juvenile wild winter steelhead were collected from the Hood River subbasin, and analyzed electrophoretically at selected protein-coding loci (Schreck et al. 1986). Relative allele nobilities and allele frequencies were determined for 20 enzyme systems (Appendix Table 4). No rare alleles were detected.

Schreck et al. (1986) classified Columbia River Basin steelhead into several clusters of similar stocks based on biochemical, morphological and life history characters. Columbia River Basin steelhead stocks segregate into two primary groups, those from west of the Cascade Mountains and those from east of the Cascades. Wild steelhead from the Hood River cluster with other stocks from west of the Cascades. This primary group is composed of 3 subgroups. At the subgroup level, wild winter steelhead from the Hood River were found to be most similar to six other stocks of wild winter steelhead from the Columbia River Basin, 2 hatchery winter steelhead stocks, and 2 wild summer steelhead stocks. This subgroup is characterized by the greatest head width, highest number of anal fin rays and branchiostegal rays, and the lowest average frequencies of the common malate dehydrogenase and glucose phosphate isomerase alleles.

Figure 1. Winter Steelhead distribution in the Hood River subbasin, based on the NPPC presence\absence data base (solid and dashed lines respectively) 'and the BPA Geographic Information System.

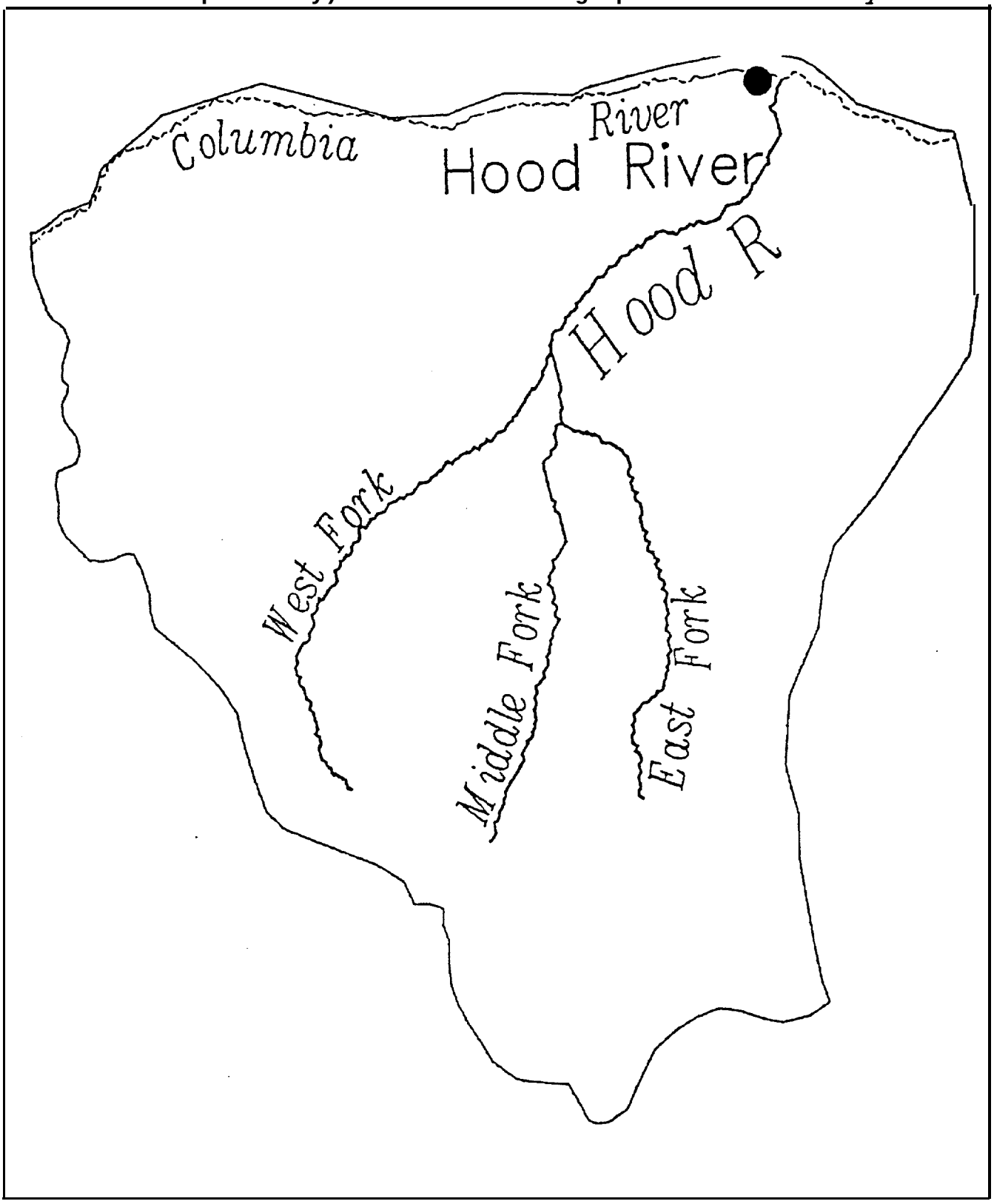

Table 1 (HE-1). Estimated amount of spawning and rearing habitat by quality of Hood River subbasin winter steelhead production area[a].

Distance/ Area	Excellent	Good	Fair[b]	Poor[b]	Unknown	Total	Confi-dence
Miles (%)	1.6	6.3	30.8	61.4	--	114.1	--
Acres (%)	--	--	--	--	--	--	--

[a] Estimates are modified from the Northwest Power Planning Council's presence/absence database.
[b] Ratings of fair and poor habitat quality may reflect natural physical features such as waterfall barriers, as well as degradation caused by man.

Table 2 (HB-2). Estimated amount of spawning habitat by quality of Hood River subbasin winter steelhead production area[a].

Distance/ Area	Excellent	Good	Fair[b]	POOP	Unknown	Total	Confi-dence
Miles (%)	0.0	0.0	0.0	0.0	--	0.0	--
Acres (%)	--	--	--	--	--	--	--

[a] Estimates are modified from the Northwest Power Planning Council's presence/absence database.
[b] Ratings of fair and poor habitat quality may reflect natural physical features such as waterfall barriers, as well as degradation caused by man.

REFERENCES

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Lichens, A., and J. Haxton. Undated. Resume of Hood River summer steelhead program. Oregon State Game Commission, Portland, Oregon. (unpublished manuscript.; As reported in Howell et al. 1985.)

Oregon Department of Fish and Wildlife and Confederated Tribes of the Warm Springs Reservation of Oregon. 1990. Hood River subbasin salmon and steelhead production plan. Columbia Basin System Planning Report to Northwest Power Planning Council, Portland, Oregon.

Schreck, C.B., H.W. Li, R.C. Hjort, and C.S. Sharpe. 1986. Stock identification of Columbia River chinook salmon and steelhead trout. Final Report of Oregon Cooperative Fisheries Unit, Oregon State University (Project 83-451, Agreement DE-A179-83 BP 13499) to Bonneville Power Administration, Portland, Oregon.

HOOD RIVER SUBBASIN

Hatchery Produced Winter Steelhead

ORIGIN

The first recorded release of juvenile hatchery fish into the subbasin is the 1962 brood release of an unknown stock of fish obtained from Carson National Fish Hatchery (Table 1). The Hood River subbasin was supplemented with juvenile hatchery fish in 1962-63, 1966, 1969-70, 1972, 1974, 1976, 1978, and 1985-90 (Table 1). Adults were outplanted into the subbasin from 1966-67 (Table 1). Stocks introduced into the subbasin include the Big Creek, Alsea River, Foster Reservoir, and Klaskanine River stocks and unknown stocks of hatchery fish obtained from Carson and Eagle Creek national fish hatcheries and from Little White Salmon and Gnat Creek hatcheries (Table 1). The Klaskanine River and Big Creek stocks are the only hatchery stocks that are currently released into the subbasin (Table 1).

DISTRIBUTION

Subbasin

Winter steelhead fry are primarily released into streams that are tributaries to the mainstem of the Hood River (excluding the West Fork of the Hood River) and the Middle and East forks of the Hood River (Table 1). Winter steelhead fingerlings although not currently released into the subbasin were historically released into the subbasin in all three forks of the Hood River and in tributary streams located throughout the subbasin. Winter steelhead smelts are primarily released into the mainstem of the Hood River and the Middle and East forks of the Hood River.

PRODUCTION

Releases

Egg

There are no records of releases in the subbasin.

Fry

Hatchery facilities in which fry were reared or acclimated prior to release in the subbasin include Little White Salmon Hatchery (Table 1). Annual numbers released ranged from 26,250 to 229,674 (Table 1). Size at release is unknown (Table 1).

Fingerling

Hatchery facilities in which fingerlings were reared or acclimated prior to release in the subbasin include Carson and Eagle Creek national fish hatcheries and Oak Springs, Gnat Creek, and Little White Salmon hatcheries (Table 1). Annual numbers released ranged from 37,100 to 400,365 (Table 1). Size at release ranged from 114 to 27 fish per pound (Table 1).

Smelt

Hatchery facilities in which smelts were reared or acclimated prior to release in the subbasin include Lookingglass Hatchery (Table 1). Annual numbers released ranged from 5,040 to 99,235 (Table 1). Size at release ranged from 5.8 to 4.0 fish per pound (Table 1).

Adult

Hatchery facilities in which adults were held prior to release in the subbasin include Big Creek Hatchery (Table 1). Annual numbers released ranged from 43 to 384 fish (Table 1).

Harvest

sport

Subbasin: The Hood River subbasin currently sustains a small but popular winter steelhead fishery. The sport fishery primarily occurs in the mainstem of the Hood River below the confluence of the West Fork of the Hood River. There are no records of a season closure in the subbasin. No brood year specific estimates of harvest are available. Run year specific estimates of total harvest (punch card) of naturally and hatchery produced fish are available from Oregon Department of Fish and Wildlife (unpublished data).

Treaty

Subbasin: The entire Hood River subbasin is located on lands ceded to the United States by the Confederated Tribes of the Warm Springs Reservation. The tribal harvest of hatchery winter steelhead is unknown but it is believed that the numbers harvested each year are very low.

DISEASES

There are no hatchery facilities in the Hood River subbasin that currently hold or rear hatchery winter steelhead prior to release in the subbasin. For information on parasites and disease agents of subbasin hatchery production that is held or reared at hatchery facilities located outside of the subbasin see LOWER COLUMBIA RIVER SUBBASIN, Hatchery Produced Winter Steelhead, DISEASES.

Table 1 (TR). Hatchery releases of winter steelhead into the Hood River subbasin by brood year and if marked, by coded wi re

Brood Year	Stock	Hatchery	Life Stage	Release Date (1)	Release Date (2)	Fish/ lb	Number Released	Release LoCat ion	CWT/ Fin clip[b]
1962	Unknown	Carson NFH	fins.	02/14/62	--	45.0	56,340	Tony Creek	--
1962	Unknown	Carson NFH	fing.	02/13/62	--	45.0	50,040	Lake Branch Creek	--
1962	Unknown	Carson NFH	fing.	02/26/62	--	45.0	120,150	Hood River, East Fork	--
1962	Unknown	Carson NFH	fing.	02/19/62	--	45.0	117,450	Hood River, Middle Fork	--
1962	Unknown	Carson NFH	fing.	02/14/62	--	45.0	56,385	Hood River, West Fork	--
1963	Unknown	Eagle Cr NFH	fing.	06/07/63	--	42.6	34,165	Clear Branch Creek	--
1963	Unknown	Eagle Cr NFH	fing.	06/06/63	--	35.4	36,850	Hood River, East Fork	--
1963	Unknown	Eagle Cr NFH	fing.	06/04/63	--	32.0	29,024	Hood River, Middle Fork	--
1966	Unknown	L White Salmon	fry	02/14/66	--	1,050.0	26,250	Bear Creek	--
1966	Big Creak	Big Creek	adult	01/14/66	--	--	43	Bear Creek	--
1%7	Big Creek	Big Creek	adult	01/14/67	--	--	172	Hood River, East Fork	--
1%7	Big Creek	Big Creak	adult	01/16/67	--	--	212	Hoed River, East Fork	--
1969	Unknown	Gnat Creek	fing.	09/14/69	--	53.0	37,100	Laurance Lake	--
1970	Unknown	Gnat Creek	fing.	10/06/70	--	68.0	47,580	Laurance Lake	--
1970	Alsea River	Oak Springs	fing.	10/06/70	--	35.0	34,965	Laurance Lake	--
1970	AlSea River	Oak Springs	fing.	10/08/70	--	36.0	21,564	Laurance Laka	--
1972	Foster Res.	Oak Springs	fing.	09/12/72	--	47.8	49,983	Laurance Lake	--
1974	Foster Res.	Oak Springs	fing.	08/21/74	--	114.0	52,435	Laurance Lake	--
1974	Foster Res.	Oak Springa	fing.	08/22/74	--	107.0	48,150	Laurance Lake	--
1976	Big Creek	Gnat Creek	fing.	11/18/76	--	27.0	101,658	Laurance Laka	--
1977	Big Creek	Gnat Creek	smolt	09/18/78	--	4.0	33,8%	Hood River, East Fork	--
1977	Big Creek	Gnat Creek	smolt	09/19/78	--	4.0	33,450	Hood River, Eaat Fork	--
1977	Big Creek	Gnat Creek	smolt	09/20/78	--	4.0	31,889	Hood River, East Fork	--
1984	Big Creek	Trojan ponds	smolt	04/30/85	--	4.3	13,379	Hood River, Middle Fork	--
1984	Big Creek	Trojan ponds	-smelt	05/01/85	--	4.8	13,397	Hoed River, Middle Fork	--
1984	Big Creek	Trojan ponds	smolt	05/02/85	--	4.4	13,125	Hood River, Middle Fork	--
1985	Klaskanine R	--	fry	04/06/85	--	--	22,607	Neal Creek	--
1985	Klaskanine R	--	fry	07/31/85	--	--	3,926	Dog River	--
1985	Klaskanine R	....	fry	05/06/85	--	--	10,990	MFk Hood River	--
1985	Klaskanine R	--	fry	04/06/85	--	--	22,647	Tony Creek	--
1985	Klaskanine R	--	fry	06/25/85	--	--	23,129	clear Branch Cr	--
1985	Big Creek	Trojan ponds	smolt	03/17/86	--	5.2	4,577	Hood River, Middle Fork	--
1985	Big Creek	Trojan ponds	smolt	03/17/86	--	5.3	4,710	Hood River	--
1985	Big Creek	Trojan ponds	-smelt	03/18/86	--	4.7	4,368	Hood River, Middle Fork	--
1985	Big Creek	Trojan ponds	smolt	03/18/86	--	4.7	4,269	Hood River	--
1985	Big Creek	Trojan ponds	smolt	03/19/86	--	5.8	4,628	Hood River	--
1985	Big Creek	Trojan prods	smolt	03/19/86	-"	5.8	4,398	Neal Creek	--
1985	Big Creak	Trojan ponds	smolt	03/20/86	--	5.2	4,370	Hood River, Middle Fork	--
1985	Big Creek	Trojan ponds	-smelt	03/20/86	--	5.3	4,448	Hood River	--
1985	Big Creek	Trojan ponds	-smelt	03/21/86	--	5.6	4,138	Hood River	--
1986	Big Creek	--	fry	03/23/86	--	--	19,638	Neal Creek	--
1986	Big Creek	--	fry	03/23/86	--	--	15,179	WFk Neal Creek	--

Table 1 (TR). (cont.) Hatchery releases of winter steelhead into the Hood River subbasin by brood year and if marked, by coded wire tag code[a].

Brood Year	Stock	Hatchery	Life Stage	Release Data (1)	Release Date (2)	Fish/ lb	Number Released	Release location	CWT/ Fin clip[b]
1986	Klaskanine R	..	fry	03/ 9/86	..	--	28,955	Odell Creek	.-
1986	Klaskanine R	..	fry	04/ 3/86	..	--	9,700	Neal Creek	..
1986	Klaskanine R	..	fry	03/ 3/86	..	..	4,448	WFk Neal Creek	..
1986	Klaskanine R	..	fry	05/ 4/86	..	--	14,711	Evans Creek	..
1986	Klaskanine R	..	fry	03/ 9/86	..	..	28,966	Dog River	..
1986	Klaskanine R	..	fry	03/ 8/86	..	--	19,255	Tony Creek	..
1986	Klaskanine R	..	fry	05/ 4/s6	..	..	1,814	Rogers Springs Creek	..
1986	Klaskanine R	..	fry	05/ 4/s6	..	..	19,410	Bear Crack	..
1986	Klaskanine R	..	fry	04/ 13/86	..	--	29,279	Clear Branch Cr	..
1986	Big Creek	Trojan ponds	smolt	05/ 4/87	..	4.5	7,419	Hood River, East Fork	No mark
1986	Big Creek	Trojan ponds	Smelt	05/ 4/87	..	4.5	13,115	Hood River, Middle Fork	No mark
1986	Big Creek	Trojan ponds	smolt	05/ 9/87	..	4.0	3,318	Hood River, Eaat Fork	No mark
1987	Big Creek	..	fry	04/ 7/S7	..	..	9,870	Evans Creek	..
1987	Big Creek	..	fry	04/ 5/87	..	--	9,811	Tony Creek	--
1987	Big Creak	..	fry	04/ 5/87	..	..	9,015	Tony Creek	.-
1987	Big Creek	--	fry	04/ 7/87	..	..	15,111	Clear Branch Cr	..
1987	Big Creek	..	fry	04/ 7/87	..	..	9,788	Clear Branch Cr	..
1987	Big Creek	Gnat Creek	smolt	04/ 2/88	..	5.6	28,010	Hood River, MFk	No mark
1988	Big Creek	..	fry	04/ 6/88	..	--	35,011	Odell Crack	..
1988	Big Creek	..	fry	04/ 6/88	..	..	10,000	Neal Creek	..
198s	Big Creek	..	fry	04/ 6/88	--	..	2,999	Neal Creek	..
1988	Big Creek	.-	fry	04/ 9/88	..	--	7,559	Dog River	..
19ss	Big Creek	..	fry	04/ 9/8s	..	--	15.078	MFk Hood River	..
1988	Big Creek	...	fry	04/ 4/88	..	..	33; 119	Clear Branch Cr	--
198s	Klaskanine R	..	fry	04/ 9/8s	..	--	10,416	Neal Creek	..
1988	Klaskanine R	..	fry	06/ 0/88	..	--	32,900	Evens Creek	..
198s	Klaskanine R	..	fry	04/ 9/88		--	49,474	MFk Hood River	..
1988	Klaskanine R	..	fry	06/ 0/88	..	.-	16,414	Tony Creek	..
198s	Klaskanine R	..	fry	06/ 0/88	..	..	16,414	Bear Creak	..
1988	Big Creek	Trojan ponds	Smelt	04/ 7/89	..	4.2	5,000	Hood River, EFk	No mark
1989	Big Creek	Gnat Creek	Smelt	05/ 19/90	..	5.4	24,000	Hood River, EFk	AD
1989	Big Creek	Trojan ponds	smolt	04/ 2/90	..	4.7	4,214	Hood River, MFk	AD
1989	Big Creek	Trojan ponds	smolt	04/ 2/90	..	4.7	7,715	Hood River, EFk	AD

[a] Estimates are from Oregon Department of Fish and Wildlife (unpublished data).
[b] AD = Adipose.

REFERENCES

Oregon Department of Fish and Wildlife and Confederated Tribes of the Warm Springs Reservation of Oregon. 1990. Hood River subbasin salmon and steelhead production plan. Columbia Basin System Planning Report to Northwest Power Planning Council, Portland, Oregon.

FIFTEENMILE CREEK SUBBASIN

Naturally Produced Winter Steelhead

GEOGRAPHIC LOCATION

The Fifteenmile Creek subbasin, located in north central Oregon, heads in the Mount Hood National Forest just east of Mount Hood. Fifteenmile Creek flows in a northeasterly direction to enter the Columbia River at approximately River Mile (RM) 192 (Figure 1). The Fifteenmile Creek subbasin encompasses approximately 373 square miles. The mouth of Fifteenmile Creek is located above Bonneville Dam.

ORIGIN

Winter steelhead are indigenous to the Fifteenmile Creek subbasin. The subbasin represents the eastern most distribution of winter steelhead in the Columbia River Basin. The subbasin has never been supplemented with hatchery fish.

DISTRIBUTION

Subbasin

Winter steelhead are believed to be distributed throughout most of the Fifteenmile, Eightmile, Fivemile, and Ramsey creeks (Oregon Department of Fish and Wildlife and Confederated Tribes of the Warm Springs Reservation of Oregon 1990; Figure 1). The quality of the spawning and rearing habitat varies throughout the subbasin (Tables 1 and 2).

PRODUCTION

Harvest

sport

Subbasin: The Fifteenmile Creek subbasin currently sustains a small fishery. While there are no records of any season closures, current regulations restrict the sport fishery to the catch and release of kelts. No brood year specific estimates of harvest are available. Run year specific estimates of harvest (punch card) are available from Oregon Department of Fish and Wildlife (unpublished data).

Treaty

Subbasin: The entire Fifteenmile Creek subbasin is located on lands ceded to the United States by the Warms Springs Tribes. The tribal harvest of winter steelhead is unknown but it is believed that the numbers harvested each year are very low.

BIOCHEMICAL-GENETIC CHARACTERISTICS

Juvenile wild winter steelhead were collected from the Fifteenmile Creek subbasin in 1983 and 1985, and analyzed electrophoretically at selected protein-coding loci (Schreck et al.

1986). Relative allele nobilities and allele frequencies were determined for 17 enzyme systems in the 1983 sample, and for 21 enzyme systems in the 1985 sample (Appendix Table 4). No rare alleles were detected.

Schreck et al. (1986) classified Columbia River Basin steelhead into several clusters of similar stocks based on biochemical, morphological and life history characters (Appendix Table 3). Columbia River Basin steelhead stocks segregate into two primary-groups, those from west of the Cascade Mountains and those from east of the Cascades. Wild winter steelhead from Fifteenmile Creek cluster with other stocks from east of the Cascades. This primary group is composed of 3 subgroups. Wild winter steelhead from Fifteenmile Creek do not cluster tightly with any of these three subgroups, but fit between subgroup 1 and 2. Subgroup 1 consists of stocks of wild summer steelhead from tributaries of the Columbia between Fifteenmile Creek and the Entiat River, the lower Snake River and the Salmon River. This subgroup is characterized by the greatest average head length, maxillary length, head depth, and interorbital width. This subgroup also has the lowest average caudal peduncle length. Subgroup 2 contains primarily hatchery summer steelhead stocks from various tributaries of the Columbia and lower Snake River. This subgroup is characterized by the earliest average time of entry into freshwater, the greatest average frequency of the common glycerol-3-phosphate dehydrogenase allele, and the lowest average head depth.

Figure 1. The **Fifteenmile** Creek subbasin.

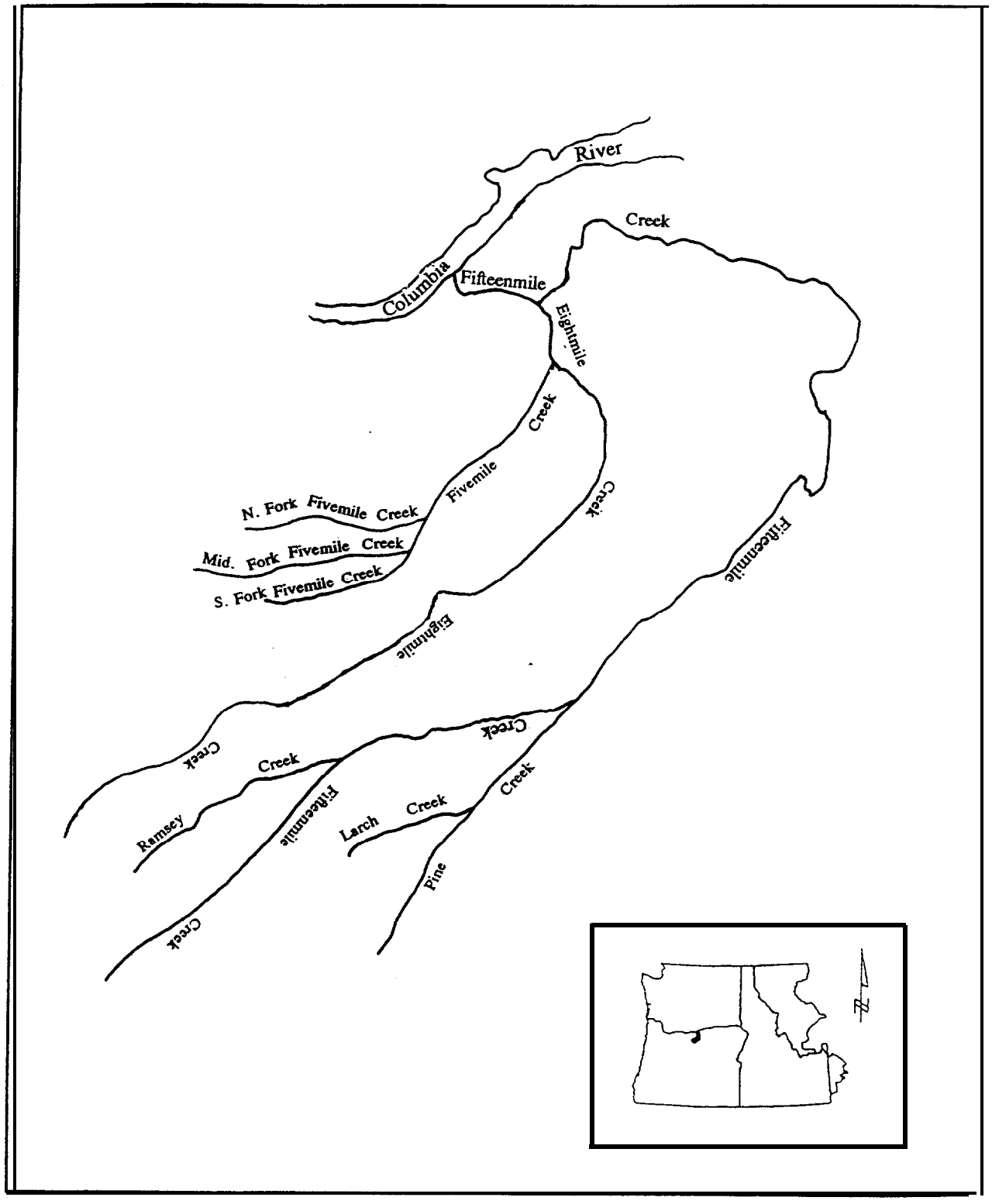


Table 1 (HB-1). Estimated amount of spawning and rearing habitat by quality of Fifteenmile Creek subbasin winter steelhead production area[a].

Distance/ Area	Excellent	Good	Fair[b]	Poor[b]	Unknown	Total	Confi- dence
Miles (%)	6.9	9.9	12.2	71.0	--	152.7	'--
Acres (%)	--	. .	--	--	--	--	--

[a] Modified from the Northwest Power Planning Council's presence/absence database.
[b] Ratings of fair and poor habitat quality may reflect natural physical features such as waterfall barriers, as well as degradation caused by man.

Table 2 (HB-2). Estimated amount of rearing only habitat by quality of Fifteenmile Creek subbasin winter steelhead production area[a].

Distance/ Area	Excellent	Good	Fair[b]	Poor[b]	Unknown	Total	Confi- dence
Miles (%)	0.0	0.0	0.0	100.0	--	25.5	--
Acres (%)	--	...	--	--	--	--	--

[a] Modified from the Northwest Power Planning Council's presence/absence database.
[b] Ratings of fair and poor habitat quality may reflect natural physical features such as waterfall barriers, as well as degradation caused by man.

REFERENCES

Oregon Department of Fish and Wildlife and Confederated Tribes of the Warm Springs Reservation of Oregon. 1990. Fifteenmile Creek subbasin salmon and steelhead production plan. Columbia Basin System Planning Report to Northwest Power Planning Council, Portland, Oregon.

Schreck, C. B., H.W. Li, R.C. Hjort, and C.S. Sharpe. 1986. Stock identification of Columbia River chinook salmon and steelhead trout. Final Report of Oregon Cooperative Fisheries Unit, Oregon State University (Project 83-451, Agreement DE-A179-83 BP 13499) to Bonneville Power Administration, Portland, Oregon.

DESCHUTES RIVER SUBBASIN

Naturally Produced Spring Chinook Salmon

GEOGRAPHIC LOCATION

The DesChutes River subbasin covers 10,500 square miles of central Oregon and is the second largest subbasin in the state. From its source in the Cascade Mountains, it flows north to where it enters the Columbia River 205 miles from the ocean. The Deschutes River is located above Bonneville and The Dalles dams.

ORIGIN

Spring chinook are indigenous to the Deschutes River subbasin. Non-indigenous stocks introduced into the subbasin include the Santiam stock and unknown stocks of fish obtained from Carson and Eagle Creek national fish hatcheries and McKenzie, Oak Springs, Wizard Falls, Marion Forks, and Fall River hatcheries (see DESCHUTES RIVER SUBBASIN, Hatchery Produced Spring Chinook Salmon, PRODUCTION). Stray hatchery spring chinook originating from various Columbia River Basin and coastal stocks are also recovered in the subbasin (see ADULT LIFE HISTORY, Strays).

DISTRIBUTION

Subbasin

Prior to completion of the Pelton-Round Butte hydroelectric complex wild spring chinook spawned in the mainstem Deschutes River up to Steelhead Falls (km 206), Squaw Creek, the Metolius River, the Warm Springs River drainage, and the Shitike Creek drainage. After completion of the complex, in 1964, spawning has primarily been limited to the Warm Springs River drainage with only limited spawning occurring in the Shitike Creek drainage (Figure 1). Juvenile spring chinook rear in the Warm Springs River and Shitike Creek drainages and throughout the mainstem of the DesChutes River below the mouth of the Warm Springs River (Figure 1). The quality of the spawning and rearing habitat varies throughout the subbasin (Tables 1 and 2).

PRODUCTION

Juvenile

Egg

Estimates of egg deposition for the Warm Springs River are available in Lindsay et al. (1989).

Smelt

Estimates of smelt production (spring migrants) were made at a humphreys scoop trap located in the Warm Springs River approximately 1 mile above its confluence with the DesChutes River. Annual estimates of smelt production ranged from 14,647 to 57,216 smelts per year (Table 3). Annual estimates of the number downstream migrants ranged

from 35,235 to 131,943 (Table 3).

Mark Information

Naturally produced juvenile spring chinook were coded wire tagged from 1978-80 at various sites located in the DesChutes River subbasin. Several of the coded wire tag groups used to tag spring chinook were also used to tag juvenile chinook classified as naturally produced fall chinook (see DESCHUTES RIVER SUBBASIN, Naturally Produced Fall Chinook Salmon, PRODUCTION, Juvenile, Mark Information). Annual estimates of the number of juveniles tagged and released ranged from 2,540 to 8,346 (Table 4).

No naturally produced spring chinook, tagged and released as juvenile fish in the DesChutes River subbasin, were recovered at hatchery facilities or on spawning ground surveys outside of the subbasin. Coded wire tags were recovered from naturally produced spring chinook harvested in fisheries located in the mainstem of the Columbia River and in the Deschutes River subbasin (Pacific States Marine Fisheries Commission coded wire tag database).

Harvest

sport

Subbasin: No brood year specific estimates of harvest are available. Run year specific estimates of harvest are available from Oregon Department of Fish and Wildlife (unpublished data) and in Lindsay et al. (1989).

Treaty

Subbasin: No brood year specific estimates of harvest are available. Run year specific estimates of harvest are available from Oregon Department of Fish and Wildlife (unpublished data) and in Lindsay et al. (1989).

ADULT LIFE HISTORY

Escapement

Subbasin

Timing: Data collected at a steeppass fish trap located at Sherars Falls (km 69 on the mainstem Deschutes River) provides the only estimates of run timing through the Deschutes River subbasin. The trap was generaUy operated 5 days per week beginning in mid- to late April. Estimates are available for the 1977-80 and 1982 run years. To distinguish between spring and fall runs, chinook salmon sampled from 1 April through 15 June were classified as spring run fish and chinook salmon sampled from 16 June through 31 December were classified as fall run fish.

Naturally produced jack and adult spring chinook retur" to the DesChutes River subbasin around the beginning of April (Figure 2). Data obtained at the steeppass trap indicates that naturally produced spring chinook arrive at Sherars Falls around mid-April; that the run peaks during May; and that most fish have passed the falls by mid-June (Lindsay et al. 1989).

Numbers: Subbasin escapement is estimated as the sum of escapement to the Warm Springs River, escapement to Pelton Trap, and estimates of harvest at Sherars Falls. This

method of estimating escapement is believed to account for most of the naturally produced spring chinook returning to the Deschutes River subbasin. It does not account for spring chinook that are known to spawn in Shitike Creek. Escapement of naturally and hatchery produced spring chinook to Shitike Creek is believed to be low (i.e. less than 50 fish) in most years.

Spring chinook fisheries in the DesChutes River subbasin are located at Sherars Falls. Statistical creels conducted at Sherars Falls are used to estimate harvest in both sport and tribal fisheries. Creels were used to estimate the harvest of jack and adult fish. Jacks were differentiated by size and age composition of adult fish harvested in both sport and tribal fisheries was based on adult age composition at Warm Springs National Fish Hatchery (WSNFH).

Escapement to the Warm Springs drainage is estimated at a weir located at km 14.4 on the mainstem of the Warm Springs River. The weir is used to divert fish through the WSNFH where they are counted and then passed above the weir. Estimates at WSNFH are believed to account for most of the fish escaping to the Warm Springs River drainage. The number of naturally and hatchery produced fish that remain below the weir are believed to be low (i.e. less than 20 fish) in most years. Estimates of total subbasin production are made for run years in which estimates are available at each of the primary recovery sites.

Annual estimates of the number of naturally produced spring chinook escaping to the subbasin, by brood year, ranged from 51 to 293 jacks and 1,210 to 2,546 adult fish (Table 5).

Spawning Area

Timing: Beginning in 1969, surveys have been conducted to count the number of redds in selected reaches of stream located in the Warm Springs River drainage. Data collected from the surveys indicate that spawning begins in mid- to late August and peaks by the second week in September (Lindsay et al. 1989; Figure 2). Spawning is completed by the last week in September (Lindsay et al. 1989).

Numbers: Subbasin spawner escapement is estimated as the number of spring chinook passed above a weir located at km 14.4 in the mainstem of the Warm Springs River (see ADULT LIFE HISTORY, Escapement, Subbasin). Escapement past the weir is used to estimate spawner escapement to the drainage because it is believed that in most years minimal spawning occurs below the weir and in Shitike Creek (see ADULT LIFE HISTORY, Escapement, Subbasin).

Prior to the 1981 run year only naturally produced spring chinook were allowed above the weir. During the 1981-84 run years the WSNFH passed both naturally and hatchery produced spring chinook above the weir. In 1985 the WSNFH discontinued passing hatchery fish above the weir and that policy continues to date.

Annual estimates of naturally produced spring chinook spawner escapement, by brood year, ranged from 18 to 139 jacks and 711 to 2,634 adult fish (Table 6). Annual estimates of Hatchery DesChutes stock spring chinook spawner escapement, by brood year, ranged from O to 31 jacks and O to 628 adult fish (Table 7).

Spawning ground counts in the Deschutes River subbasin are available from Oregon Department of Fish and Wildlife (unpublished data) and in Lindsay et al. (1989), Fritsch (1989), and Heinith (1987).

Survival: Estimates of pre-spawning survival in the Warm Springs River drainage are available in Lindsay et al. (1989).

Strays

Limited information is available on the immigration of naturally produced spring chinook into the DesChutes River subbasin. The only data available on stray wild spring chinook are coded wire tag returns from six wild spring chinook tagged and released as juvenile fish in the John Day River subbasin (Pacific States Marine Fisheries Commission coded wire tag database). Tags were recovered from the fishery. Naturally produced spring chinook tagged and released as juvenile fish in the DesChutes River subbasin were recovered on spawning ground surveys and at trapping facilities located in the subbasin ('Table 8).

Few stray hatchery spring chinook are recovered annually in the subbasin but they include jacks and adults coded wire tagged and released as juvenile fish at sites located over a wide geographical area (Table 9). Coded wire tags were recovered from spring chinook released as juvenile fish in subbasins located in Washington and Idaho as well as coastal subbasins that include the Rogue River in Oregon and the Trinity River in California (Table 9).

Age Structure

Age structure was estimated for naturally produced spring chinook returning to WSNFH. Age structure was determined based on a combination of tagcode and scale analysis.

Annual estimates of age structure, by brood year, ranged from 2% to 8% age 3 fish, 65% to 86% age 4 fish, and 12% to 28% age 5 fish (Table 10).

Annual estimates of age structure, by run year, ranged from 1% to 8% age 3 fish, 72% to 89% age 4 fish, and 7% to 34% age 5 fish (Table 11).

Sex Ratio

Sex ratios (percent females) were estimated for naturally produced spring chinook returning to the WSNFH. Age structure was determined based on a combination of tagcode and scale analysis.

Annual estimates of sex ratio ranged from 53% to 65 % for age 4 fish and from 46% to 80% for age 5 fish (Table 12).

JUVENILE LIFE HISTORY

Fork Length

Downstream migrant spring chinook were collected at various locations with humphreys floating scoop traps and by seine (see JUVENILE LIFE HISTORY, Migration Timing). Estimates of mean fork length were made for samples obtained from selected time periods, locations, and years.

Annual estimates of mean fork length ranged from 102 mm to 132 mm for age 1+ spring chinook smelts (Table 13).

Weight

Mean weight of age O spring chinook from the 1982 brood was estimated for samples obtained from selected time periods in the Warm Springs River and in Shitike Creek (Lindsay et al. 1989). Mean weight was 6.3 g in the Warm Springs River and 7.3 g in Shitike Creek.

Age Structure

Adult scale analysis indicates that naturally produced spring chinook in the Deschutes River subbasin enter the ocean primarily as age 1+ smelts (Tables 10 and 11; see ADULT LIFE HISTORY, Age Structure) although some returning adults (i.e. approximately 1%) had migrated as sub-yearling smelts (Lindsay et al. 1989).

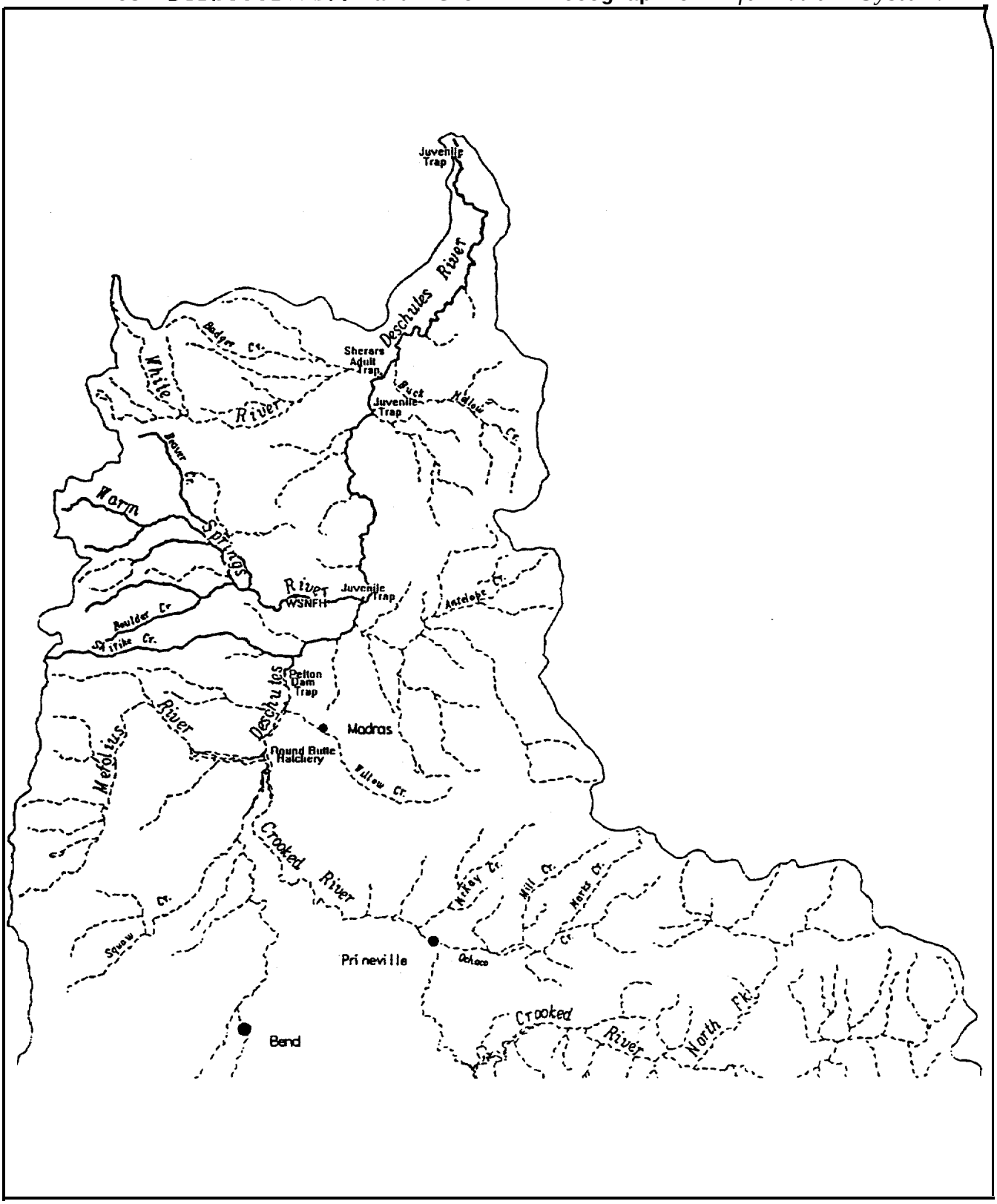
Migration Timing

Humphreys floating scoop traps were fished at two locations in the Warm Springs River in order to monitor the temporal distribution of migration from the drainage. One trap, located at the mouth of the Warm Springs River, was fished in 1976, 1977, and 1979 and one trap, located in the Warm Springs River approximately 1 mile above its confluence with the Deschutes River, has been fished annually since 1976.

Data obtained at the trapping facilities indicate that naturally produced juvenile spring chinook migrate from the Warm Springs River throughout the year (Lindsay et al. 1989). Peak migration for age O spring chinook occurs from September through October (Lindsay et al. 1989). The smelt migration begins in late January or early to mid-February, peaks during March through May (Figure 2), and is completed in mid-June (Lindsay et al. 1989).

In addition to studies conducted in the Deschutes River subbasin there have also been studies in the mainstem Columbia River designed to monitor the temporal distribution of migration past the dams. Tag recoveries at the ice-trash sluiceway at The Dalles Dam (km 308 in the mainstem of the Columbia River) indicate that naturally produced yearling spring chinook, originating from the Deschutes River subbasin, migrate through the Columbia River in April and May (Howell et al. 1985).

Figure 1. Spring Chinook distribution in the Deschutes River subbasin, based on the NPPC presence\absence data base (solid and dashed lines respectively) and the BPA Geographic *Information System.*



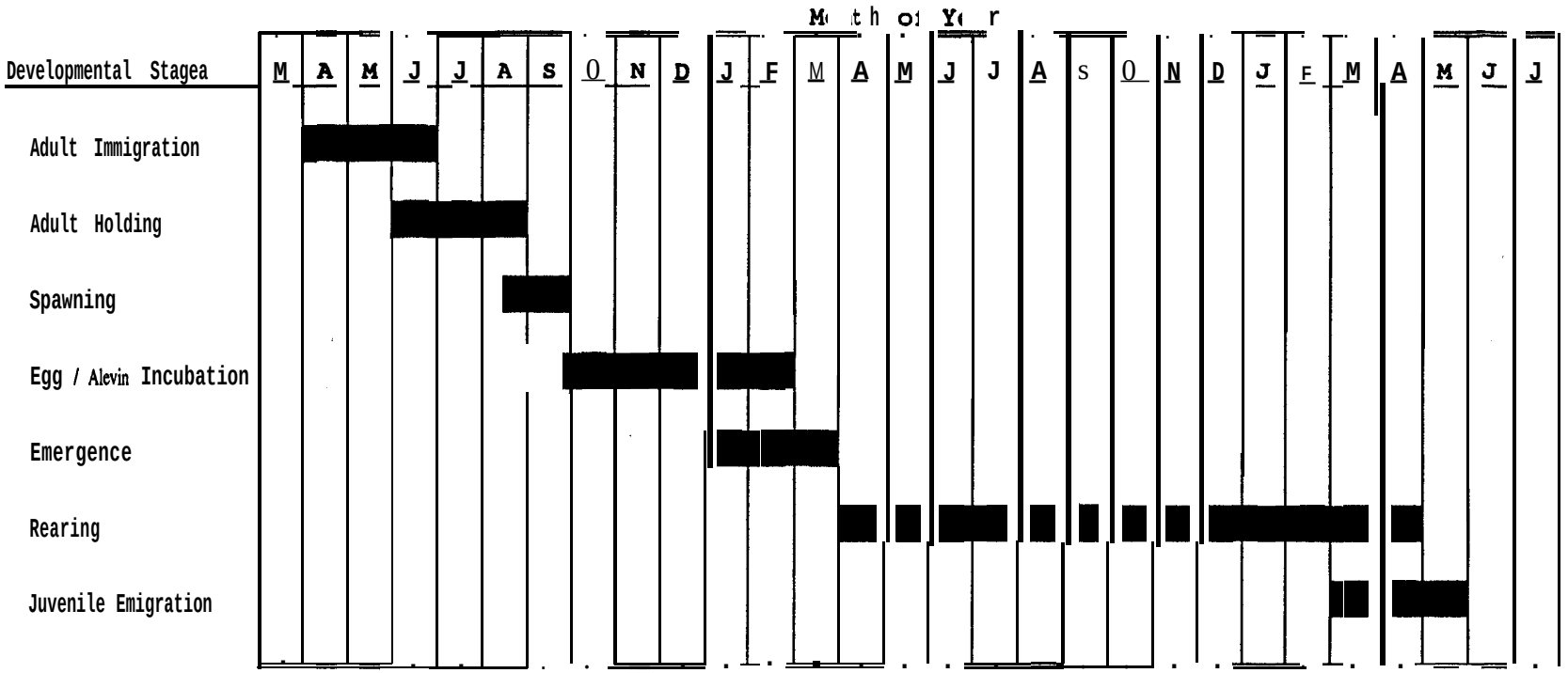


Figure 2 (TT). Spring chinook freshwater life history in the Deschutes River subbasin (Oregon Department of Fish and Wildlife and Confederated Tribes of the Warm Springs Reservation of Oregon 1990).

Table 1 (HB-1). Estimated amount of spawning and rearing habitat by quality of Deschutes River subbasin spring chinook production area[a].

Distance/ Area	Excellent	Good	Fair[b]	Poor[b]	Unknown	Total[c]	Confi-dence
Miles (%)	0.0	11.7	74.0	14.3	--	88.4	--
Acres (%)	--	--	--	--	--	--	--

[a] Estimates are modified from the Northwest Power Planning Council's presence/absence database.
[b] Ratings of fair and poor habitat quality may reflect natural physical features such as waterfall barriers, as well as degradation caused by humans.
[c] Does not include habitat in the White River drainage above White River Falls. Area was included in the Northwest Power Planning Council's database to account for habitat that would be utilized by spring chinook when BPA implements a project to release jack and adult spring chinook above White River Falls.

Table 2 (HB-2). Estimated amount of rearing only habitat by quality of Deschutes River subbasin spring chinook production area[a].

Distance/ Area	Excellent	Good	Fair[b]	Poor[b]	Unknown	Total[c]	Confi-dence
Miles (%)	23.7	0.0	35.3	41.0	--	35.4	--
Acres (%)	--	--	--	--	--	--	--

[a] Estimates are modified from the Northwest Power Planning Council's presence/absence database.
[b] Ratings of fair and poor habitat quality may reflect natural physical features such as waterfall barriers, as well as degradation caused by humans.
[c] Does not include habitat in the White River drainage above White River Falls. Area was included in the Northwest Power Planning Council's database to account for habitat that would be utilized by spring chinook when BPA implements a project to release jack and adult spring chinook above White River Falls.

Table 3 (JM). Number of natural juvenile spring chinook salmon that migrated from the Warm Springs River in the Deschutes River subbasin[a], 1975-1989.

Brood Year	Time of Miaration		Total
	Fall (subyearling)	Spring	
1975	25,795	43,250	69,045
1976	47,041	26,043	73,084
1977	25,125	25,304	50,429
1978	74,727	57,216	131,943
1979	24,930	25,628	50,558
1980	20,579	14,656	35,235
1981	29,238	14,647	43,885
1982	67,719	30,594	98,313
1983	89,396	31,101	120,497
1984	61,970	34,827	96,797
1985	35,991	38,335	74,326
1986	47,125	35,651	82,776
1987	59,195	27,508	86,703
1988	56,007	40,365	96,372
1989	42,720	33,154	75,874

[a] Estimates of fall and spring migrants for the 1975-81 broods are from Lindsay et al. (1989); for the 1982-86 broods from Heinith (1987); and for the 1987-89 broods from personal communication (28 October 1991, Mark Fritsch, Warm Springs Tribes, Warm Springs, Oregon).

Table 4(TR-a). Releases of coded wire tagged wild spring chinook salmon into the Deschutes River subbasin[a], by brood year.

Brood Year	Stock	Hatchery	Life Stage	Release Date (1)	Release Date (2)	Fork[b] length	Number Released	Release[c] Location	CWT/ Fin clip
1976	Deschutes	..	..	04/01/78[d]	06/30/78[d]	130.0	140	USR to Sherars Falls	H7-02-01
1976	Deschutes	..	..	04/01/78[d]	06/30/78[d]	110.0	8	Pelton Trap to WSR	H7-02-04
1976	Deschutes	..	..	04/01/78[d]	06/30/78[d]	120.0	301	Sherars Falls to mouth	117-02-05
1976	Deschutes	..	..	04/01/78[d]	06/30/78[d]	107.8	835	WSR	07-16-05
1977	Deschutes	..	..	02/01/79[d]	05/31/79[d]	120.5	280	Sherars Fal 1s to mouth	07-18-31
1977	Deschutes	..	..	02/01/79[d]	06/30/79[d]	131.5	1,099	WSR to Sherars Fal 1s	07-18-33
1977	Deschutes	..	..	03/01/79[d]	06/30/79[d]	128.0	96	Deschutes River (RM 50)	07-18-38
1977	Deschutes	..	..	03/01/79[d]	06/30/79[d]	125.0	41	Deschutes River (RM 1)	07-18-40
1977	Deschutes	..	..	05/01/78[d]	06/30/78[d]	84.3	335	USR	07-16-05
1977	Deschutes	..	..	09/01/78[d]	12/31/78[d]	96.1	921	WSR	07-16-07
1977	Deschutes	..	..	02/01/79[d]	06/30/79[d]	107.0	1,599	WSR	07-18-39
1978	Deschutes	..	..	02/01/80[d]	05/31/80[d]	116.7	384	Deschutes River (RM 50)	07-21-51
1978	Deschutes	..	..	02/01/80[d]	03/31/80[d]	101.9	2,672	WSR to Sherars Fal 1s	07-21-52
1978	Deschutes	..	..	04/01/80[d]	06/30/80[d]	112.6	1,347	WSR to Sherars Fal 1s	07-18-47
1978	Deschutes	..	..	05/01/79[d]	06/30/79[d]	83.1	118	WSR	07-18-29
1978	Deschutes	--	..	09/01/79[d]	12/31/79[d]	87.5	4,655	USR	07-18-30
1978	Deschutes	..	..	12/15/79:	--	88.6	1,514	WSR	07-18-32
1978	Deschutes	..	..	07/01/79[d]	08/31/79[d]	59.2	2,775	Beaver Creek	07-20-29
1978	Deschutes	..	..	09/01/79[d]	11/30/79[d]	94.0	636	WSR (RM 2-7)	07-20-30
1978	Deschutes	..	..	02/01/80[d]	06/30/80[d]	102.4	3,827	USR	07-21-49
1979	Deschutes	..	..	05/01/80[d]	06/30/80[d]	86.9	116	USR	07-21-48

a Est i metes for the 1976-79 brood releases are from Lindsay et al. (1989) .
b Fork length is measured in mi llimeters.
c WSR = Uarm Springs River.
d Release dates unknown (only the months of release known). Standardized to the first and last days of the months released.
e Release dates unknown (only the month of release known). Standardized to the middle of the month for the month of rel ease.

Table 5 (RB) . Total returns of wild spring chinook salmon to the Deschutes River subbasin[a], by brood year.

Brood Year	Total Age 2	3	4	5	6	Total	Adult Total
1974	--	293	2,121	425	--	2,839	2,546
1975	--	85	1,424	322	--	1,831	1,746
1976	--	115	1,075	329	--	1,519	1,404
1977	--	74	1,240	415	--	1,729	1,655
1978	--	51	1,659	266	--	1,976	1,925
1979	--	108	1,757	259	--	2,124	2,016
1980	--	72	952	258	--	1,282	1,210
1981	--	100	1,784	--	--	--	--
1982	--	119	--	--	--	--	--
1983	--	--	--	--	--	--	--
1984	--	141	1,811	450	--	2,402	2,261
1985	--	147	1,679	493	--	2,319	2,172
1986	--	114	2,386	--	--	--	--
1987	--	103	--	--	--	--	--

[a] Estimates of adult production for the 1974-82 brood years are a synthesis of data from Lindsay et al. (1989), U.S. Fish and Wildlife Service (unpublished data), and Oregon Department of Fish and Wildlife (unpublished data) and for the 1984-87 broods are a synthesis of data from U.S. Fish and Wildlife Service (unpublished data) and Oregon Department of Fish and Wildlife (unpublished data).

Table 6 (RN-1). Total spawning escapement of wild spring chinook salmon to the Deschutes River subbasin[a,b], by brood year.

Brood rear	Total Age 2	3	4	5	6	Total	Adult Total
1972	--	--	--	144[c]	--	--	--
1973	--	--	1,926[c]	708	--	--	2,634
1974	--	139[c]	1,307	208	--	1,654	1,515
1975	--	59	698	150	--	907	848
1976	--	73	501	210	--	784	711
1977	--	34	794	260	--	1,088	1,054
1978	--	50	1,040	137	--	1,227	1,177
1979	--	46	919	177	--	1,142	1,096
1980	--	18	689	98	--	805	787
1981	--	98	679	100	--	877	779
1982	--	56	1,086	300	--	1,442	1,386
1983	--	55	1,250	318	--	1,623	1,568
1984	--	86	941	265	--	1,292	1,206
1985	--	69	989	291	--	1,349	1,280
1986	--	65	1,430	--	--	--	--
1987	--	46	--	--	--	--	--

[a] Estimates are for fish that were released above Warm Springs National Fish Hatchery (WSNFH). Numbers are used to represent spawner escapement based on the assumption that spring chinook salmon primarily spawn in the Warm Springs River above the WSNFH.

[b] Estimates of spawner returns for the 1972-74 broods are a synthesis of data from Lindsay et al. (1989) and U.S. Fish and Wildlife Service (unpublished data) and estimates for returns from the 1975-87 broods are from the U.S. Fish and Wildlife Service (unpublished data).

[c] Includes and estimated 603 fish spawning below WSNFH (Lindsay et al. 1989); including 38 jacks, 526 age 4 fish, and 39 age 5 fish. Brood returns below WSNFH were estimated based on age structure at WSNFH.

Table 7 (RN-2) . Total spawning escapement of Hatchery Deschutes stock spring chinook salmon to the Deschutes River subbasin[a, b], by brood year.

Brood Year	Total Age 2	3	4	5	6	Total	Adult Total
1978	--	13	287	5	--	305	292
1979	--	0	206	23	--	229	229
1980	--	0	468	160	--	628	628
1981	--	31	327	1	--	359	328
1982	--	0	24	0	--	0	24
1983	--	0	0	0	--	0	0
1984	--	0	0	0	--	0	0
1985	--	0	0	0	--	0	0
1986	--	0	0	0	--	0	0
1987	--	0	0	0	--	0	0

[a] Estimates are for jack and adult fish released above Warm Springs National Fish Hatchery. Estimates are used to represent spawner escapement based on the assumption that spring chinook salmon primarily spawn in the Warm Springs River above the WSNFH.

[b] Estimates of spawner returns for the 1978-87 broods are from the U.S. Fish and Wildlife Service (unpublished data).

Table 8 (AI-l). Non-harvest recoveries of coded wire tagged wild spring chinook salmon in the Deschutes River subbasin[a,b].

Hatchery/Release Site	Recovery Site, Run Year(s)	Recovery Method	Number Recovered	Total Number Estimated, (PSMFC)
Deschutes River	Deschutes River 1982	Spawner Surveys --	4	4
Deschutes River	Deschutes River 1984	Trap returns --	2	2

[a] Based on the following tag codes: 07-18-38, 07-21-52, 07-21-54.
[b] Estimates are modified from the Pacific States Marine Fisheries Commission coded wire tag database.

Table 9 (AI-2). Non-harvest recoveries of coded wire tagged hatchery spring chinook salmon in the Deschutes River subbasin[a,b].

Hatchery/Release Site	Recovery Site, Run Year(s)	Recovery Method	Number Recovered	Total Number Estimated, (PSMFC)
Deschutes River	Deschutes River	Spawner Surveys		
	1981	--	1	1
	1982	--	--	--
	1983	--	1	1
	1984	--	1	1
Deschutes River	Deschutes River	Trap returns		
	1978	--	6	8
	1979	--	28	32
	1980	--	62	68
	1981	--	323	330
	1982	--	402	414
	1983	--	557	584
	1984	--	528	528
	1985	--	1,239	1,239
	1986	--	1,544	1,544
	1987	--	998	998
	1988	--	705	705
Clearwater River	Deschutes River	Trap Returns		
	1987	--	1	1
Coquille River	Deschutes River	Trap Returns		
	1988	--	1	1
Grande Ronde	Deschutes River	Trap Returns		
	1986	--	1	1
	1987	--	5	5
	1988	--	1	1
Imnaha River	Deschutes River	Trap Returns		
	1987	--	4	4

Table 9 (AI-2). (cont.) Non-harvest recoveries of coded wire tagged hatchery spring chinook salmon in the Deschutes River subbasin[a,b].

Hatchery/Release Site	Recovery Site, Run Year(s)	Recovery Method	Number Recovered	Total Number Estimated, (PSMFC)
Rapid River	Deschutes River	Trap Returns		
	1980	--	1	1
	1981	--	3	3
	1987	--	1	1
	1988	--	4	4
Rogue River	Deschutes River	Trap Returns		
	1980	--	2	2
	1981	--	2	2
	1982	--	1	1
	1983	--	2	2
	1984	--	--	--
	1985	--	2	2
	1986	--	2	2
	1987	--	8	8
Trinity River	Deschutes River	Trap Returns		
	1980	--	1	1
	1985	--	1	1
	1987	--	2	2
Umpqua River	Deschutes River	Trap Returns		
	1980	--	1	1
	1981	--	1	1
Yakima River	Deschutes River	Trap Returns		
	1987	--	1	1
Rapid R. Hatchery	Deschutes River	Trap Returns		
	1982	--	2	2
	1983	--	1	1
Kooskia NFH	Deschutes River	Trap Returns		
	1981	--	2	2

Table 9 (AI-2). (cont.) Non-harvest recoveries of coded wire tagged hatchery spring chinook salmon in the Deschutes River subbasin[a,b].

Hatchery/Release Site	Recovery Site, Run Year(s)	Recovery Method	Number Recovered	Total Number Estimated, (PSMFC)
Sawtooth Hatchery	Deschutes River	Trap Returns		
	1986	--	1	1
	1987	--	1 0	1 0
	1988	--	1	1
MacKay Hatchery	Deschutes River	Trap Returns		
	1981	--	1	1
Columbia River[c]	Deschutes River	Trap Returns		
	1979	--	2	2
	1980	--	2	2
Columbia River[d]	Deschutes River	Trap Returns		
	1978	--	1	2
	1979	--	5	6
	1980	--	5	5
	1981	--	1	1
	1982	--	1	1
	1983	--	1	1
	1984	--	--	--
	1985	--	1	1
	1986	--	5	5
	1987	--	4	4
	1988	--	5	5
Columbia River[e]	Deschutes River	Trap Returns		
	1987	--	1	1
Deschutes River	Deschutes River	Hatchery Returns		
	1983	--	18	18
	1984	--	--	--
	1985	--	3	3
	1986	--	7	7

Table 9 (AI-2). (cont.) Non-harvest recoveries of coded wire tagged hatchery spring chinook salmon in the Deschutes River subbasin[a,b].

Hatchery/Release Site	Recovery Site, Run Year(s)	Recovery Method	Number Recovered	Total Number Estimated, (PSMFC)
Deschutes River	Deschutes River	Hatchery Returns (continued)		
	1987	--	8	8
	1988	--	23	23
	1989	--	3	3
Trinity River	Deschutes River	Hatchery Returns		
	1980	--	1	1
Grande Ronde	Deschutes River	Hatchery Returns		
	1988	--	1	1

[a] Based on the following tag codes from hatchery reared fish: 03-45-02, 05-06-27, 05-08-20, 05-08-23, 05-08-25, 05-12-23, 05-20-07, 06-61-06, 06-61-37, 06-61-43, 07-16-11, 07-16-12, 07-16-15, 07-16-50, 07-16-53, 07-16-54, 07-16-55, 07-18-24, 07-19-49, 07-19-50, 07-19-51, 07-21-53, 07-22-09, 07-22-35, 07-23-09, 07-23-10, 07-23-11, 07-23-47, 07-23-48, 07-23-49, 07-23-50, 07-25-12, 07-25-20, 07-26-50, 07-27-05, 07-27-14, 07-27-15, 07-27-16, 07-27-17, 07-27-52, 07-28-20, 07-28-36, 07-28-37, 07-28-39, 07-28-40, 07-28-41, 07-28-42, 07-28-43, 07-28-48, 07-28-61, 07-30-03, 07-30-16, 07-30-17, 07-31-11, 07-31-13, 07-31-14, 07-31-18, 07-31-28, 07-31-29, 07-31-30, 07-31-31, 07-31-32, 07-31-34, 07-31-35, 07-31-52, 07-31-53, 07-31-55, 07-31-60, 07-33-20, 07-33-21, 07-33-62, 07-34-01, 07-39-18, 07-39-25, 07-39-28, 07-39-29, 07-46-24, 09-04-06, 09-04-07, 09-16-01, 09-16-04, 09-16-19, 09-16-33, 10-28-43, 23-16-60, 23-17-05, 23-17-07, 23-17-10, 23-17-12, 23-17-14, LBYWYW, RDYW*2, YWWH, YWYWGM, YWYWOR. Based on the following tag codes from fish of unknown rearing type (assumed to be hatchery): 05-04-27, 10-03-48, 10-04-15, 10-04-24, 10-21-15, 10-26-35, 10-27-08, 10-27-09, 10-30-13, 10-30-15, 23-16-22, 23-16-47, 23-16-48, 23-16-49, 23-16-50, 23-17-22, 23-18-08, ORBL, PULBPK, RDGN*1, RDRDOR*1, RDYWOR*1, YWRD, YWYWLG* 1.

[b] Estimates are modified from the Pacific States Marine Fisheries Commission coded wire tag database.

[c] Release site in the mainstem Columbia River in the estuary.

[d] Release site in the mainstem Columbia River below Bonneville Dam.

[e] Release site in the mainstem Columbia River between McNary and Priest Rapids dams.

Table 10 (AC). Age composition (freshwater.ocean) by brood year for wild spring chinook salmon returning to the Warm Springs National Fish Hatchery in the Deschutes River subbasin[a].

Brood Year	N	Age Composition (%) 1.1	1.2	1.3	2.1	2.2	2.3	3.1	3.2	3.3
1974	--	--	--	--	5	81	15	--	--	--
1975	--	--	--	--	6	77	17	--	--	--
1976	--	--	--	--	6	65	28	--	--	--
1977	--	--	--	--	2	79	19	--	--	--
1978	--	--	--	--	4	82	15	--	--	--
1979	--	--	--	--	3	81	16	--	--	--
1980	--	--	--	--	2	86	13	--	--	--
1981	--	--	--	--	8	80	12	--	--	--
1982	--	--	--	--	3	80	17	--	--	--
1983	--	--	--	--	3	75	22	--	--	--
1984	--	--	--	--	6	76	18	--	--	--
1985	--	--	--	--	5	74	22	--	--	--

[a] Estimates for the 1974-85 broods are from the U.S. Fish and Wildlife Service (unpublished data).

Table 11 (AC-a). Age composition (freshwater.ocean) by run year for wild spring chinook salmon returning to the Warm Springs National Fish Hatchery in the Deschutes River subbasin[a].

Run Year	N	Age Composition (%) 1.1	1.2	1.3	2.1	2.2	2.3	3.1	3.2	3.3
1977	--	--	--	--	6	87	7	--	--	--
1978	--	--	--	--	3	63	34	--	--	--
1979	--	--	--	--	5	73	22	--	--	--
1980	--	--	--	--	3	74	22	--	--	--
1981	--	--	--	--	3	77	20	--	--	--
1982	--	--	--	--	3	77	19	--	--	--
1983	--	--	--	--	1	86	13	--	--	--
1984	--	--	--	--	8	73	20	--	--	--
1985	--	--	--	--	5	83	12	--	--	--
1986	--	--	--	--	3	89	8	--	--	--
1987	--	--	--	--	5	77	18	--	--	--
1988	--	--	--	--	4	72	24	--	--	--
1989	--	--	--	--	5	75	20	--	--	--
1990	--	--	--	--	2	81	17	--	--	--

[a] Estimates for the 1977-90 run years are from the U.S. Fish and Wildlife Service (unpublished data).

Table 12 (AS) . Percent females by brood year and age class (freshwater.ocean) for wild spring chinook salmon returning to the Warm Springs National Fish Hatchery in the Deschutes River subbasin[a].

Brood Year	N	1.1	1.2	1.3	2.1	2.2	2.3	3.1	3.2	3.3
						Females (%)				
1979	--	--	--	--	--	--	80	--	--	--
1980	--	--	--	--	--	59	62	--	--	--
1981	--	--	--	--	--	65	46	--	--	--
1982	--	--	--	--	--	53	71	--	--	--
1983	--	--	--	--	--	62	46	--	--	--
1984	--	--	--	--	--	55	71	--	--	--
1985	--	--	--	--	--	58	60	--	--	--
1986	--	--	--	--	--	64	--	--	--	--

[a] Estimates for the 1979-86 brood years are from the U.S. Fish and Wildlife Service (unpublished data) .

Table 13 (SL) . Lengths of wild spring chinook salmon smelts from the Deschutes River subbasin, 1978-1980.

Location and Year	No. Fish	Length (mm) ave.	range	Reference
mainstem 1978	--	123	--	Modified from Lindsay et al. (1989)
mainstem 1979	--	120	--	Modified from Lindsay et al. (1989)
mainstem 1979	--	132	--	Modified from Lindsay et al. (1989)
mainstem 1979	--	127	--	Modified from Lindsay et al. (1989)
mainstem 1980	--	102	--	Modified from Lindsay et al. (1989)
mainstem 1980	--	117	--	Modified from Lindsay et al. (1989)
mainstem 1980	--	113	--	Modified from Lindsay et al. (1989)
Warm Springs River 1978	--	108	--	Modified from Lindsay et al. (1989)
Warm Springs River 1979	--	107	--	Modified from Lindsay et al. (1989)
Warm Springs River 1980	--	102	--	Modified from Lindsay et al. (1989)

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DESCHUTES RIVER SUBBASIN

Hatchery Produced Spring Chinook Salmon

ORIGIN

The first recorded release of juvenile hatchery fish into the subbasin is the 1961 release of an unknown stock of fish obtained from Carson National Fish Hatchery (Table 1). The subbasin was supplemented with juvenile hatchery fish in 1961 and 1962 and from 1964-90 (Table 1). Hatchery jacks were outplanted into the subbasin in 1970 and adults were outplanted into the subbasin in 1968 and 1970 (Table 1). Non-indigenous stocks introduced into the subbasin include the Santiam stock and unknown stocks of fish obtained from Carson and Eagle Creek national fish hatcheries and McKenzie, Oak Springs, Wizard Falls, and Fall River hatcheries (Table 1). The hatchery program currently restricts the use of non-indigenous stocks as hatchery broodstock. The Hatchery Deschutes stock is currently utilized as hatchery broodstock for the subbasin.

The Hatchery DesChutes stock was developed from broodstock collected at Warm Springs National Fish Hatchery (WSNFH), located at km 14.4 on the mainstem of the Warm Springs River; Sherars Falls, located at km 69 on the mainstem of the Deschutes River; and Pelton Trap, located at km 178 on the mainstem of the DesChutes River (Lindsay et al. 1989).

DISTRIBUTION

Subbasin

Juvenile and adult spring chinook have been released at several sites in the DesChutes River subbasin but are primarily released in the Warm Springs River and in the mainstem DesChutes River at Pelton Deregulating Dam (Table 1).

PRODUCTION

Releases

Egg

There are no records of releases in the subbasin.

Fry

Hatchery facilities in which fry were reared or acclimated prior to release in the subbasin include McKenzie Hatchery and Eagle Creek and Carson national fish hatcheries (Table 1). Annual numbers released ranged from 24,685 to 697,000 (Table 1). Size at release ranged from 1,700 to 1,000 fish per pound for releases in which estimates are available (Table 1).

Fingerling

Hatchery facilities in which fingerlings were reared or acclimated rior to release in the subbasin include Round Butte, Marion Forks, Oak Springs, and J izard Falls hatcheries and Warm Springs, Eagle Creek, and Carson national fish hatcheries (Table 1). Annual numbers released ranged from 38,865 to 514,672 (Table 1). Size at release ranged from 200 to 4.2 fish per pound (Table 1).

Smelt

Hatchery facilities in which smelts were reared or acclimated prior to release in the subbasin

include Round Butte, Fall River, Oak Springs, and Wizard Falls hatcheries and WSNFH (Table 1). Annual numbers released ranged from 10,163 to 1,094,318 (Table 1). Size at release ranged from 21.4 to 2.8 fish per pound (Table 1).

Jack and Adult

Hatchery facilities in which jack and adult fish were held prior to release in the subbasin include Round Butte and one unknown hatchery of origin (Table 1). Annual numbers released ranged from 121 to 272 fish (Table 1).

Harvest

sport

Subbasin: No brood year specific information is available. Run year specific information is available from Oregon Department of Fish and Wildlife (unpublished data) and in Lindsay et al. (1989).

Treaty

Subbasin: No brood year specific information is available. Run year specific information is available from Oregon Department of Fish and Wildlife (unpublished data) and m Lindsay et al. (1989).

ADULT LIFE HISTORY

Escapement

Subbasin

Timing: Data collected at a steeppass fish trap located at Sherars Falls provides the only estimates of run timing to the subbasin. The trap was generally operated 5 days per week beginning in mid-to late April. The only estimate of run timing currently available for the Hatchery DesChutes stock is for the 1982 run year.

Hatchery DesChutes stock spring chinook return to the DesChutes River subbasin in early April. In 1982, the Hatchery DesChutes stock arrived at Sherars Falls on 25 April; the run peaked during May; and had passed Sherars Falls by 13 June (Lindsay et al. 1989).

Numbers: Subbasin escapement is estimated as the sum of escapement to the Warm Springs River, escapement to Pelton Trap, and estimates of harvest at Sherars Falls, This method of estimating escapement is believed to account for most of the Hatchery DesChutes stock spring chinook returning to the DesChutes River subbasin. It does not account for spring chinook that are known to spawn in Shitike Creek. Escapement of naturally and hatchery produced spring chinook to Shitike Creek is believed to be low (i.e. less than 50 fish) in most years.

Spring chinook fisheries in the DesChutes River subbasin are located at Sherars Falls. Statistical creels conducted at Sherars Falls are used to estimate harvest in both sport and tribal fisheries. Creels were used to estimate the harvest of jack and adult fish. Jacks were differentiated by size and age composition of adult fish harvested in both sport and tribal fisheries was based on adult age composition at WSNFH.

Escapement to the Warm Springs drainage is estimated at a weir located at km 14.4 on the mainstem of the Warm Springs River. The weir is used to divert fish through the WSNFH where they are counted and then passed above the weir. Estimates at WSNFH are believed

to account for most of the fish escaping to the Warm Springs River drainage. The number of naturally and hatchery produced fish that remain below the weir are believed to be low (i.e. less than 20 fish) in most years. Estimates of escapement to the subbasin are made for run years in which estimates are available at each of the primary recovery sites.

Annual estimates of Hatchery DesChutes stocks spring chinook escapement to the subbasin, by brood year, ranged from 111 to 1,395 jacks and 1,394 to 6,576 adult fish (Table 2).

Hatchery Facilities

Timing: Hatchery spring chinook arrive at Pelton Trap and WSNFH in May, June, and July. Jack salmon return to WSNFH from late May through July, and a few return m September (Howell et al. 1985).

Numbers: Estimates of the number of naturally and hatchery produced spring chinook escaping to hatchery facilities located in the Deschutes River subbasin are available at Pelton Trap and at a weir located in the Warm Springs River and operated by the WSNFH.

Annual estimates of naturally produced spring chinook escapement to WSNFH, by brood year, ranged from 18 to 139 jacks and 1,065 to 2,834 adult fish (Table 3). Annual estimates of naturally produced spring chinook escapement to Pelton Trap, by brood year, ranged from 1 to 8 jacks and 11 to 133 adult fish (Table 4).

Annual estimates of Hatchery DesChutes stock spring chinook escapement to WSNFH, by brood year, ranged from 16 to 341 jacks and 294 to 2,459 adult fish (Table 5). Annual estimates of Hatchery Deschutes stocks spring chinook escapement to Pelton Trap, by brood year, ranged from 25 to 968 jacks and 462 to 2,243 adult fish (Table 6).

Survival: Estimates of pre-spawning survival at hatchery facilities located in the subbasin are available from Oregon Department of Fish and Wildlife (unpublished data) and U.S. Fish and Wildlife Service (unpublished data).

Age Structure

Age structure was estimated for Hatchery Deschutes stock spring chinook returning to WSNFH. Age structure was determined based on tagcode and scale analysis.

Annual estimates of age structure, by brood year, ranged from 2% to 33% age 3 fish, 58% to 92% age 4 fish, and 4% to 14% age 5 fish (Table 7).

Annual estimates of age structure, by run year, ranged from 2% to 54% age 3 fish, 31% to 93% age 4 fish, and 2% to 22% age 5 fish (Table 8).

Sex Ratio

Sex ratios (percent females) were estimated for Hatchery Deschutes stock spring chinook returning to WSNFH. Age was determined based on tagcode and scale analysis.

Annual estimates of sex ratio ranged from O% to 3% for age 3 fish, 51% to 66% for age 4 fish, and 33% to 78 % for age 5 fish (Table 9).

Fecundity

Estimates of fecundity are available for spring chinook spawned at WSNFH and RBH. Estimates were derived by dividing hatchery egg take by the number of females spawned.

Annual estimates of fecundity at WSNFH, by run year, ranged from 2,850 to 3,647 eggs per

female (Table 10). Annual estimates of fecundity at RBH, by run year, ranged from 2,672 to 4,852 eggs per female (Table 11).

Mark Recoveries

Few freshwater recoveries of coded wire tagged Hatchery DesChutes stock spring chinook are available but they include recoveries over a wide geographical range (Table 12). Coded wire tagged Hatchery DesChutes stock jack and adult spring chinook, released as juveniles in the DesChutes River subbasin, were recovered in the Cowlitz and Klickitat river subbasins and in the Rogue, Trask, and Coos river subbasins located on the Oregon coast (Table 12).

JUVENILE LIFE HISTORY

Survival Rate

Post-release survival rates are available in Lindsay et al. (1989) and from Oregon Department of Fish and Wildlife (unpublished data).

BIOCHEMICAL-GENETIC CHARACTERISTICS

Juvenile hatchery spring chinook salmon were sampled from RBH, in 1983 and 1985, and from WSNFH in 1985 (Schreck et al. 1986). Relative allele nobilities and allele frequencies were determined for 18 enzyme systems from the 1983 RBH sample and 17 enzyme systems for the 1985 samples from RBH and WSNFH (Appendix Table 3). In the 1983 RBH sample, a rare allele was detected at the isocitrate dehydrogenase (sIDH- 1,2) locus.

Columbia River Basin stocks of spring chinook were compared based on a cluster analysis of selected electrophoretic, meristic, morphometric, and life history characteristics. The analysis grouped hatchery spring chinook from WSNFH with other spring chinook stocks, both wild and hatchery, that are widely distributed east of the Cascade Mountains (Schreck et al. 1986). This group exhibited the greatest average head depth, head width and pectoral ray counts, and the lowest average number of gill rakers. The streams of the wild stocks are located at higher elevations, in the upper reaches of the Columbia River, and have colder climates compared to the other stream systems included in the analysis. The cluster analysis grouped hatchery spring chinook from RBH with wild spring chinook found in the lower Snake and upper Columbia rivers (Schreck et al. 1986). This group is characterized by the highest average length of the anal fin base and interorbital width, the greatest frequency of the common tripeptide aminopeptidase allele, the lowest average number of branchiostegal rays, and the earliest average time of spawning. The spawning areas of the wild stocks have a steeper slope than the averages of the other groups.

A cluster analysis of various stocks of spring, summer, and fall races of chinook salmon in the Columbia River Basin indicate that RBH and WSNFH stocks of spring chinook are more similar to other stocks of spring chinook from east of the Cascade Mountains and with summer chinook from Idaho than with spring chinook from west of the Cascades, summer chinook from the upper Columbia, and all stocks of fall chinook (Schreck et al. 1986).

DISEASES

Various parasites and infectious disease agents have been identified at hatchery facilities that rear or hold juvenile spring chinook for subbasin hatchery production (Table 13). Parasites include *Ceratomyxa shasta* and *Glochidia* sp. Bacterial diseases include furunculosis, bacterial kidney disease, and cold water disease. Viral diseases include infectious hematopoietic necrosis and viral erythrocytic necrosis. For information on parasites and

disease agents of subbasin hatchery production that is held or reared at hatchery facilities located outside of the subbasin see CLACKAMAS RIVER SUBBASIN, Hatchery Produced Spring Chinook Salmon, DISEASES; see MCKENZIE RIVER SUBBASIN, Hatchery Produced Spring Chinook Salmon, DISEASES; and see SANTIAM RIVER SUBBASIN, Hatchery Produced Spring Chinook Salmon, DISEASES.

Table 1 (TR). Hatchery releases of spring chinook salmon into the Deschutes River subbasin by brood year and i f marked, by co

Brood Year	Stock	Hatchery	Life Stage	Release Date (1)	Release Date (2)	F i ah/ lb	Number Released	Release Location	CUT/ Fin clip[b]
··	Unknown	Carson NFH	fing.	01/01/61[c]	12/31/61[c]	--	75,313	Warm Springs R.	··
··	Unknown	Carson NFH	fry	01/01/62[c]	12/31/62[c]	1 ,000	150,000	Quartz Creek	··
--	Unknown	McKenzie	fry	01/01/64[c]	12/31/64[c]	··	399,000	Warm Springs R.	··
··	Unknown	McKenzie	fry	01/01/64[c]	12/31/64[c]	--	232,000	Mill Creek	··
··	Unknown	McKenzie	fry	01/01/64[c]	12/31/64[c]	--	66,000	Beever Creek	··
··	Unknown	Eagle Creek NFH	fing.	01/01/65[c]	12/31/65[c]	196.0	500,044	Warm Springa R.	··
--	Unknown	Eagle Creek NFH	fing.	01/01/66[c]	12/31/66[c]	200.0	200,000	Warm Springs R.	··
··	Unknown	Eagle Creek NFH	fry	01/01/66[c]	12/31/66[c]	1700	500,000	Warm Springs R.	··
··	Unknown	Eagle Creek NFH	fing.	01/01/6?	12/31/67[c]	34.0	211,500	Warm Springa R.	--
1966	Unknown	Oak Springs	fing.	06/15/6$	··	11.0	9,900	Pelton Rereg. Oem	AD-LM
1966	Unknown	Wizard Falls	fing.	10/01/67	11/30/67		71,150	Pelton Rereg. Dam	AD-RM
1967	Santiam	Marion Forks	fry	01/15/68[d]	--	1 , X	24,685	Pelton tedder	No mark
1967	Unknown	Wizard Falls	fing.	10/15/68[d]	··	5.2	66,557	Pelton Rereg. Res.	AD-LV
1967	Unknown	Oak Springs	fing.	07/15/68[d]	··	9.3	40,103	Pelton Rereg. Res.	AD-RV
1968	Unknown	Wizard falls	fing.	02/15/69[d]	--	133.4	150,168	Lake Simtustus	No mark
1968	Unknown	Wizard Falls	fing.	02/15/69[d]	··	107.5	100,036	Pelton ladder	No mark
1968	Unknown	Wizard Falls	fing.	02/01/69	03/31/69	90.8	103,935	Pel ton Rereg. Res.	No mark
1968	Unknown	Wizard Falls	fing.	11/15/69[d]	--	6.2	56,557	Pel ton Rereg. Dam	AD-RM
1968	Unknown	Oak Springs	fing.	05/15/69[d]	··	38.0	40,470	Pelton Rereg. Res.	No mark
1968	Unknown	Oak Springa	fing.	07/15/69[d]	··	8.5	54,230	Pelton Rereg. Oam	RV-RM
1968	Unknown	Wizard Falls	Smelt	07/15/70[d]	--	2.8	220	Pel ton Rereg. Res.	AD-RM
--	Unknown	Unknown	adult	01/01/68:	12/31/68[c]	··	121	Shit i ke Creek	··
1969	Unknown	Wizard Falls	fing.	03/15/70	··	91.0	149,588	Lake Simtustus	No mark
1969	Unknown	Wizard Falls	fing.	03/01/70	04/30/70	95.0	104,107	Pelton ladder	No mark
1969	Unknown	Wizard Falls	fing.	06/15/70[d]	--	100.0	22,600	Pelton Rereg. Res.	No mark
1969	Unknown	oak Springs	fing.	05/15/70[d]	··	36.8	8,905	Pelton Rereg. Res.	No mark
1969	Unknown	Oak Springs	fing.	11/15/70[d]	--	4.2	51,792	Pelton Rereg. Dam	LV-LM
1969	Unknown	Wizard Fal 1s	Smelt	12/01/70	01/31/71	4.8	36,797	Pelton Rereg. Dam	LP-LM
1969	Unknown	Wizard Fal 1s	Smelt	01/15/71[d]	··	4.5	10,163	Pelton Rereg. Dam	LP-RM
1970	Unknown	Wizard Fal 1s	fing.	03/15/71[d]	··	100.0	150,000	Lake Simtustus	No mark
1970	Unknown	Wizard Falls	fing.	03/15/71[d]	··	97.0	90,206	Pelton Rereg. Res.	No mark
1970	Unknown	Wizard Fal la	fing.	03/15/71[d]	--	120.0	8,472	Pelton Rereg. Res.	No mark
1970	Unknown	Oak Springs	fing.	06/15/71[d]	··	70.0	20,510	Pelton Rereg. Dam	No merk
1970	Unknown	Wizard Fal 1s	Smelt	03/15/72:	··	5.9	61,013	Pelton Rereg. Dam	LV-RP
1970	Unknown	Oak Springs	Smelt	03/15/72	··	5.9	52,730	Pelton Rereg. Dam	RV-LP
··	Deschutes	Round Butte	jack	01/01/70[c]	12/31 /70[c]	··	207	Beaver Creek	--
··	Deschutes	Round Butte	adult	01/01/70:	12/31/70[c]	--	65	Beaver Creek	··
1971	Unknown	Wizard Fal 1s	fing.	04/15/72[d]	··	79.0	165, 229	Lake Simtustus	No mark
1971	Unknown	Oak Springs	fing.	04/15/72[d]	··	117.0	71,258	Pelton ladder	No mark
1971	Unknown	Fall River	smolt	04/15/73[d]	··	6.7	117,853	Pelton Rereg. Dem	LV-RV
1972	Deschutes	Round Butte	fing.	04/27/73	--	76.6	50,122	Pelton ladder	D-LP

Table 1 (TR). (cent.) Hatchery releases of spring chinook salmon into the Deschutes River subbasi n by brood yaar and if marked, by coded wi re tag code[a].

Brood Year	Stock	Hatchery	Life Stage	Release Date (1)	Release Date (2)	Fish/ lb	Number Released	Release Location	CWT/ Fin clip[b]
1972	Deschutes	Round Butte	fing.	04/27/73	--	63.7	182,283	Lake Simtustus	LP
1972	Deschutes	Round Butte	fing.	06/05/73	--	50.6	65,678	Pelton Rereg. Res.	LP
1972	Deschutes	Round Butte	smolt	03104/74	03/05/74	7.0	145,214	Pelton Rereg. Dam	AD-LP
1973	Deschutes	Round Butte	fing.	04/10/74	04/16/74	65.0	81,110	Lake Simtustus	LV
1973	Deschutes	Round Butte	fing.	04/19/74	--	61.0	65,635	Lake Simtustus	No mark
1973	Deschutes	Round Butte	fing.	04/23/74	··	61.1	81,704	Pelton Rereg. Res.	No mark
1973	Deschutes	Round Butte	fing.	04/23/74	--	65.0	86,775	Pel ton Rereg. Res.	No mark
1973	Deschutes	Round Butte	fing.	04/23/74	··	60.0	1,320	Pel ton Rereg. Res.	AN
1973	Deschutes	Round Butte	fing.	05/10/74	··	55.0	23,964	Pel ton ladder	AN
1973	Deschutes	Round Butte	fing.	06/03/74	··	26.2	61,560	Pelton Rereg. Dam	D-RP
1973	Deschutes	Round Butte	fing.	06/11/74	--	75.0	15,000	Lake Billy Chinook	No mark
1973	Deschutes	Round Butte	Smelt	02/ 14/75	02/18/75	5.5	103,629	Pelton Rereg. Dam	LV-LM
1974	Deschutes	Round Butte	fing.	06/03/75	··	30.0	20,150	Pel ton Rereg. Dam	D-1P
1974	Deschutes	Round Butte	fing.	10/20/75	··	5.6	4,267	Pel ton Rereg. Oam	D-LV
1974	Deschutes	Round Butte	fing.	12/19/75	··	13.0	14,448	Pelton Rereg. Dam	D-LV
1975	Deschutes	Round Butte	fing.	10/05/76	--	9.3	27,579	Pelton Rereg. Rea.	09-04-06
1975	Deschutes	Round Butte	fing.	10/05/76	··	9.3	12,051	Pelton Rereg. Res.	09-04-07
1976	Deschutes	Round Butte	fing.	05/02/77	··	40.0	62,040	Pelton Rereg. Dam	09-16-01
									09-16-02
1976	Deschutes	Round Butte	fing.	06/03/77	--	25.0	36.675	Pelton Rereg. Dam	09-16-03
1976	Deschutes	Round Butte	fing.	06/03/77	··	25.0	35; 625	Pelton Rereg. Dam	09-16-04
1977	Deschutes	Round Butte	fing.	05/31/78	··	28.4	47,802	Pelton Rereg. Dam	07-16-11
1977	Deschutes	Round Butte	fing.	05/31/78	--	32.3	47,598	Pelton Rereg. Dam	07-16-12
1977	Deschutes	Round Butte	fing.	05/31/78	··	23.7	26,394	Pelton Rereg. Dam	07-16-15
1977	Deschutes	Round Butte	fing.	10/04/78	··	13.0	26,640	Pelton Rereg. Dsm	07-16-54
1977	Deschutes	Round Butte	fing.	10/04/78	··	13.2	25,908	Pelton Rereg. Dam	07-16-55
1977	Deschutes	Round Butte	smolt	04/09179	--	9.1	42,000	Pelton Rereg. Dam	07-16-53
1978	Deschutes	Round Butte	fing.	05/10/79	--	19.7	14,579	Pelton ladder	07-18-24
1978	Deschutes	Round Butta	fing.	05/30/79	··	22.0	54,300	Pelton Rereg. Dam	07-18-25
1978	Deschutes	Warm Springs NFH	smolt	04/07/80	04/1 4/80	19.0	168,000	Warm Springs R.	05-06-27
1978	Deschutes	Warm Springs NFH	smolt	04/01/80	04/14/80	19.0	10,890	Warm Springs R.	05-06-28
1978	Deschutes	Round Butte	smelt	04/14/80	--	8.0	32,865	Pelton Rereg. Dam	07-19-49
1978	Deschutes	Round Butte	smolt	04/14/80	··	8.8	30,758	Pelton Rereg. Dsm	07-19-50
1978	Deschutes	Round But te	smolt	04/14/80	··	8.0	29,993	Pelton Rereg. Dem	07-19-51
1979	Deschutes	Warm Springs NFH	fing.	1 1106/80	··	9.0	26,852	Warm Springs R.	05-08-20
1979	Deschutes	Warm Springs NFH	fing.	1 1/06/80	··	9.0	27,816	Warm Springs R.	05-08-21
1979	Deschutes	Round Butte	fing.	05/1 2/80	--	20.0	22,245	Pelton ladder	07-21-53
1979	Deschutes	Round Butte	fing.	10/06/80	··	5.9	29,264	Pelton Rereg. Dam	07-21-54
1979	Deschutes	Warm Springs NFH	smolt	04/02/81	··	8.0	66,700	Warm Springs R.	05-08-22
1979	Deschutes	Warm Springs NFH	smolt	04/09/81	04/ 16/81	18.0	170,167	Warm Springs R.	05-08-23
1979	Deschutes	Warm Springs NFH	smolt	04/02/81	--	8.0	32,300	Warm Springs R.	05-08-24
1979	Deschutes	Warm Springs NFH	smolt	04/09/81	--	20.0	88,970	Warm Springs R.	05-08-25

Table 1 (TR). (cent.) Hatchery releases of spring chinook salmon into the Deschutes River subbasin by brood year and if marked, by coded wire tag code[a].

Brood Year	Stock	Hatchery	Life Stage	Release Date (1)	Release Date (2)	Fish/ lb	Number Released	Release Location	CUT/ Fin clip[b]
1979	Deschutes	Round Butte	smo t	0 i/10/81	··	7.3	30,450	Pelton Rereg. Dam	07-23-10
1979	Deschutes	Round Butte	smo t	0 I/24/81	··	4.9	29,200	Pelton Rereg. Dam	07-23-09
1979	Deschutes	Round Butte	Smo t	0 i/02/81	--	8.8	25,446	Pelton ladder	07-23-11
1980	Deschutes	Warm Springs NFH	fin 1.	1 /16/81	12/18/81	12.0	65,303	Uarm Springs R.	No mark
1980	Deschutes	Round Butte	fin].	1 1/05/81	··	5.7	48,472	Pelton Rereg. Dam	07-23-47
1980	Deschutes	Round Butte	fin].	1 1/05/81	··	11.4	29,430	Pelton Rereg. Dam	07-23-49
1980	Deschutes	Warm Springs NFH	smo t	0 i/29/82	··	12.0	142,884	Uarm Springs R.	No mark
1980	Deschutes	Round Butte	smo t	0 i/02/82	··	5.9	28,656	Pelton ladder	07-23-48
1980	Deschutes	Round Butte	smo t	0 i/23/82	·-	4.8	25,010	Pelton Rereg. Oam	07-23-50
1981	Deschutes	Uarm Springs NFH	fin 1.	1 I/05/82	··	10.0	68,557	Uarm Springs R.	OTC
1981	Deschutes	Uarm Springs NFH	fin 1.	1 }/05/82	··	10.0	13,965	Uarm Springs R.	RV, OTC
1981	Deschutes	Uerm Springs NFH	fin 1.	1)/05/82	··	6.0	25,950	Uarm Springs R.	LV, OTC
1981	Deschutes	Round Butte	fin 1.	1 I/11/82	··	6.4	28,538	Pelton Rereg. Dam	07-25-20
1981	Deschutes	Round Butta	fin 1.	1 1/11/82	--	23.6	59,118	Pelton Rereg. Dam	07-27-15
1981	Deschutes	Warm Springs NFH	smo t	0 ,/1 2/83	··	15.0	154,954	Uarm Springs R.	2-OTC
1981	Deschutes	Uarm Springs NFH	smo t	0 ,/1 2/83	··	15.0	27,645	Uarm Springs R.	LV,2-OTC
1981	Deschutes	Uarm Springs NFH	smo t	0 ,/ 12/83	··	15.0	27,257	Uarm Springs R.	RV,2-OTC
1981	Deschutes	Round Butte	Sma t	0 ;/21/83	··	9.3	57,340	Pelt'on Rereg. Dam	07-27-14
1981	Deschutes	Round Butte	smo t	0 i/02/83	··	12.2	48,495	Pelton ladder	07-27-16
1981	Deschutes	Round Butte	smo t	0 ;/21 /83	··	12.2	24,847	Pelton ladder	07-27-17
1982	Deschutes	Warm Springs NFH	fin 1.	1 }/24/83	··	9.0	61,864	Uarm Springs R.	LV, OTC
1982	Deschutes	Round Butte	fin 1.	0 ;/24/83	·-	19.2	28,979	Pelton Rereg. Dam	07-28-36
1982	Deschutes	Round Butte	fin 1.	1 I/05/83	··	16.3	53,550	Pelton Rereg. Dam	07-28-43
1982	Deschutes	Round Butte	fin 1.	1 }/06/83	··	5.6	28,200	Pelton Rereg. Dam	07-28-37
1982	Deschutes	Uarm Springs NFH	mo t	0)/13/84	--	18.0	625,995	Uarm Springs R.	LV
1982	Deschutes	Round Butte	mo t	0 ,/16/84	··	5.2	28,790	Pelton Rereg. Dam	07-28-39
1982	Deschutes	Round Butte	mo t	0 }/16/84	··	5.2	28,991	Pelton Rereg. Dam	07-28-40
1982	Deschutes	Round Butte	mo t	0 i/05/84	--	9.5	54,000	Pelton ladder	07-28-42
1982	Deschutes	Round Butte	Sma t	a 1/15/84	··	8.4	51,000	Pelton ladder	07-28-41
1983	Deschutes	Uarm Springs NFH	fin].	1)/16/84	··	9.0	345,544	Uarm Springs R.	RV, OTC
1983	Deschutes	Uarm Springs NFH	fin].	1 I/16/84	··	10.0	77,937	Warm Springs R.	LV, OTC
1983	Deschutes	Round Butte	fin 1.	1 }/08/84	··	12.4	60,797	Pel ton Rereg. Dam	07-31-31
1983	Deschutes	Round Butte	fin 1.	1 }/09/84	··	6.5	30,394	Pelton Rereg. Dam	07-31-32
1983	Deschutes	Uarm Springs NFH	Sma t	0 }/09/85	··	19.0	321,194	Uarm Springs R.	RV
1983	Deschutes	Uarm Springs NFH	mo t	a 1/09/85	··	17.0	61,650	Warm Springs R.	LV
1983	Deschutes	Round Butte	mo t	a }/02/85	··	5.8	57,749	Pel ton Rereg. Dam	07-31-28
1983	Deschutes	Round Butte	mo t	o ;/09/85	··	7.6	60,725	Pelton ladder	07-31-29
1983	Deschutes	Round Butte	mo t	a ,/01/85	··	7.6	60,770	Pel ton ladder	07-31-30
1984	Deschutes	Uarm Springs NFH	fin].	1 }/01/85	··	9.0	46,822	Warm Spri nga R.	RV
1984	Deschutes	Uarm Springs NFH	fin 1.	1 I/01/85	··	9.0	279,001	Warm Springs R.	LV
1984	Deschutes	Uarm Springs NFH	smo t	0 ,/09/86	··	17.0	62,011	Uarm Springs R.	RV, OTC
1984	Deschutes	Uarm Springs NFH	smo t	a ,/09/86	--	17.0	358,353	Warm Springs R.	LV, OTC

Table 1 (TR). (cent.) Hatchery releases of spring chinook salmon into the Deschutes River subbasin by brood year and if marked, by coded wire tag code[a].

Brood Year	Stock	Hatchery	Life Stage	Rel eaae Date (1)	Release Date (2)	F i ah/ lb	Number Released	Release Location	CWT/ Fin clip[b]
1984	Deschutes	Round Butte	molt	03/1 2/86	··	5.7	62,952	Pelton Rereg. Dam	07-33-20
1984	Deschutes	Round Butte	smolt	03/1 1/86	··	7.7	65,931	Pelton ladder	07-33-21
1984	Deschutes	Round Butte	smolt	03/1 1/86	··	7.7	75,349	Pelton ladder	LV-LM
1984	Deschutes	Round Butte	smolt	03/1 1/86	·-	7.7	73,529	Pelton tedder	LP
1985	Deschutes	Warm Springs NFH	fing.	10/01/86	··	9.1	79,490	Warm Springs River	LV
1985	Deschutes	Warm Springs NFH	fing.	10/01/86	··	8.0	80,698	Warm Springs River	RV
1985	Deschutes	Round Butte	Smelt	04/13/87	··	5.0	22,625	Pelton Rereg. Dam	07-39-28
1985	Deschutes	Round Butte	Smelt	04/13/87	--	6.1	32,238	Pelton Rereg. Oam	07-39-28
1985	Deschutes	Round Butte	Smelt	05/27/87	··	7.5	62,000	Pelton ladder	07-39-29
1985	Deschutes	Round Butte	smolt	05/27/87	--	7.5	74,000	Pelton ladder	RV-RM
1985	Deschutes	Round Butte	Smelt	05/27/87	··	7.5	75,000	Pel ton ladder	RP
1985	Deschut es	Warm Springs NFH	smolt	04/09/87	··	16.9	340,832	Warm Springs River	RV,OTC
1985	Deschutes	Warm Springs NFH	smolt	04/09/87	··	16.9	219,308	Warm Springs River	LV,OTC
1986	Deschut es	Warm Springs NFH	fing.	10/01/87	··	8.8	35,237	Warm Springs River	LV
1986	Deschutes	Warm Springs NFH	fing.	10/01/87	··	9.3	307,556	Warm Springs River	RV
1986	Deschutes	Round Butte	Smelt	04/12/88	··	6.9	54,221	Pelton Rereg. Dam	07-44-61
1986	Deschut es	Round But te	smolt	05/25/88	·-	8.3	61,269	Pel ton Ladder	07-44-62
1986	Deschutes	Round Butte	Smelt	05/25/88	··	8.3	74,365	Pel ton Ladder	LP
1986	Deschutes	Round Butte	smolt	05/25/88	··	8.3	74,364	Pelton Ladder	LV-LM
1986	Deschutes	Warm Springs NFH	smolt	04/08/88	--	15.8	326,044	Warm Springs River	RV
1986	Deschutes	Warm Springs NFH	smolt	04/08/88	··	15.8	31,418	Warm Springs River	LV
1987	Deschutes	Warm Springs NFH	fing.	05/06/88	··	66.0	5,762	Warm Springs River	LV
1987	Deschutes	Warm Springs NFH	fing.	05/06/88	··	66.0	3,493	Warm Springs River	Ao
1987	Deschutes	Warm Springs NFH	fing.	05/06/88	--	66.0	5,319	Warm Springs River	05-16-63
1987	Deschutes	Warm Springs NFH	fing.	05/06/88	··	66.0	37,036	Warm Springs River	05-20-10
1987	Deschutes	Uarm Springs NFH	fing.	09/30/88	··	10.2	1,847	Warm Springs River	Ao
1987	Deschutes	Warm Springs NFH	fing.	09/30/88	--	10.5	1,689	Warm Springs River	Ao
1987	Deschutes	Warm Springs NFH	fing.	09/30/88	··	11.6	12,130	Warm Springs River	LV
1987	Deschutes	Uarm Springs NFH	fing.	09/30/88	··	10.6	5,595	Warm Springs River	AD
1987	Deschutes	Warm Springs NFH	fing.	09/30/88	··	11.4	2,093	Warm Springs River	AO
1987	Deschutes	Warm Springs NFH	fing.	09/30/88	--	10.9	11,338	Warm Springs River	RV
1987	Deschutes	Warm Springs NFH	fing.	09/30/ 88	·-	9.0	575	Warm Springs River	AD
1987	Deschutes	Warm Springs NFH	fing.	09/30/88	··	11.4	13,339	Warm Springs River	RV
1987	Deschutes	Warm Springs NFH	fing.	09/30/88	··	9.0	7,492	Warm Springa River	LV
1987	Deschutes	Warm Springs NFH	fing.	09/30/88	··	11.6	1,287	Warm Springs River	AD
1987	Deschutes	Warm Springs NFH	fing.	09/30/88	··	10.9	553	Warm Springs River	AD
1987	Deschutes	Warm Springa NFH	fing.	09/30/88	--	10.9	10,682	Warm Springs River	05-16-07
1987	Deschut es	Warm Springs NFH	fing.	09/30/88	·-	11.4	12,071	Warm Springs River	05-16-58

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Brood Year	Stock	Hatchery	Life Stage	Release Date (1)	Release Date (2)	Fish/ lb	Number Released	Release Location	CWT/ Fin clip[b]
1987	Deschutes	Warm Springs NFH	fing.	09/30/8s	··	9.0	6,898	Warm Springs River	05-16-63
1987	Deschutes	Warm Springs NFH	fing.	09/30/88	··	10.5	19,213	Warm Springs River	05-20-05
1987	Deschutes	Warm Springs NFH	fing.	09/30/8s	··	10.6	19,906	Warm Springs River	05-20-06
1987	Deschutes	Warm Springs NFH	fing.	09/30/8s	··	11.4	15,709	Warm Springs River	05-20-07
1987	Deschutes	Warm Springs NFH	fing.	09/30/88	··	10.2	14,638	Warm Springs River	05-20-08
1987	Deschutes	Warm Springs NFH	fing.	09/30/88	··	10.6	4,994	Warm Springs River	05-20-10
1987	Deschutes	Warm Springs NFH	fing.	09/30/88	··	10.6	16,988	Warm Springs River	05-20-11
1987	Deschutes	Warm Springs NFH	fing.	09/30/8s	··	10.6	13,642	Warm Springs Rivar	05-20-12
1987	Deschutes	Warm Springs NFH	fing.	09/30/88	··	11.6	10,808	Warm Springs River	05-20-22
1987	Deschutes	Warm Springs NFH	fing.	09/30/88	··	10.6	803	Warm Springs River	14-07-W
1987	Deschutes	Warm Springs NFH	fing.	09/30/88	··	10.6	805	Warm Springs River	14-08-09
1987	Deschutes	Warm Springs NFH	fing.	09/30/88	··	10.6	219	Warm Springs River	14-W-09
1987	Deschutes	Round Sutte	Smelt	04/1 7/89	·-	6.4	29,528	Pelton Rereg. Dam	07-46-23
1987	Deschutes	Round But te	Smelt	04/1 7/89	··	7.3	28,186	Pelton Rereg. Oem	07-46-22
1987	Deschutes	Round Butte	Smelt	04/18/89	··	9.3	20,408	Pelton Ladder	07-46-25
1987	Deschutes	Round But te	Smelt	04/18/89	··	9.5	20,473	Pelton Ladder	07-46-24
1987	Deschutes	Round Butts	smolt	04/18/89	··	9.8	153,865	Pelton LadeJar	RM
1987	Deschutes	Round Butte	smolt	04/18/89	··	10.6	20,458	Pelton Ladder	07-46-26
1987	Deschutes	Warm Springs NFH	smolt	04/05/89	··	15.8	1,436	Warm Springs River	AD, OTC
1987	Deschutes	Warm Springs NFH	Smelt	04/05/89	··	15.6	2,445	Warm Springs River	AD, OTC
1987	Deschutes	Warm Springs NFH	Smelt	04/05/89	··	8.5	850	Warm Springs River	AD, OTC
1987	Deschutes	Warm Springs NFH	Smelt	04/05/89	··	15.4	1,887	Warm Springs River	AD, OTC
1987	Deschutes	Warm Springs NFH	Smelt	04/05/89	··	15.2	7,036	Warm Springs River	AD, OTC
1987	Deschutes	Warm Springs NFH	Smelt	04/05/89	··	15.4	27,074	Warm Springs River	RV,OTC
1987	Deschutes	Warm Springs NFH	Smelt	04/05/89	··	15.8	13,542	Warm Springs River	LV,OTC
1987	Deschutes	Warm Springs NFH	smolt	04/05/89	··	8.8	1,111	Warm Springs Rivar	AD, OTC
1987	Deschutes	Warm Springs NFH	smolt	04/05/89	··	15.0	1,538	Warm Springs River	AD
1987	Deschutes	Warm Springs NFH	Smelt	04/05/89	--	13.6	1,767	Warm Springs River	AD ,OTC
1987	Deschutes	Warm Springs NFH	Smelt	04/05/89	··	15.0	957	Warm Springs River	AD ,OTC
1987	Deschutes	Warm Springs NFH	Smelt	04/05/89	··	17.0	1,622	Warm Springs River	AD
1987	Deschutes	Warm Springs NFH	Smelt	04/05/89	··	15.0	12,482	Warm Springs River	LV,OTC
1987	Deschutes	Warm Springs NFH	Smelt	04/05/89	··	14.4	5,446	Warm Springs River	AD, OTC
1987	Deschutes	Warm Springs NFH	Smelt	04/05/89	··	15.4	13,757	Warm Springs River	05-16-07
1987	Deschutes	Warm Springs NFH	Smelt	04/05/89	··	15.4	11,285	Warm Springs River	05-16-58
1987	Deschutes	Warm Springs NFH	Smelt	04/05/89	··	15.0	11,479	Warm Springs River	05-16-63
1987	Deschutas	Warm Springs NFH	Smelt	04/05/89	··	15.6	27,808	Warm Springs River	05-20-05
1987	Deschutes	Warm Springs NFH	Smelt	04/05/89	··	15.2	25,009	Warm Springs River	05-20-06
1987	Deschutes	Warm Springs NFH	Smelt	04/05/89	··	13.6	33,229	Warm Springs River	05-20-07
1987	Deschutes	Warm Springs NFH	Smelt	04/05/89	··	15.2	30,743	Warm Springs River	05-20-08
1987	Deschutes	Warm Springs NFH	Smelt	04/05/89	··	8.5	16,631	Warm Springs River	05-20-W
1987	Deschutes	Warm Springs NFH	Smelt	04/05/89	··	15.0	30,086	Warm Springs River	05-20- W
1987	Deschutes	Warm Springs NFH	Smelt	04/05/89	··	14.4	5,968	Warm Springs River	05-20-10

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Brood Year	Stock	Hatchery	Life Stage	Release Date (1)	Release Date (2)	Fish/ lb	Number Released	Release Location	CUT/ Fin clip[b]
1987	Deschutes	Warm Springs NFH	Smelt	04/05/89	··	14.4	20,300	Warm Springs River	05-20-11
1987	Deschutes	Warm Springs NFH	Smelt	04/05/89	--	14.4	35,150	Warm Springs River	05-20-12
1987	Deschutes	Warm Springs NFH	smolt	04/05/89	··	8.8	18,978	Warm Springs River	05-20-14
1987	Deschutes	Warm Springa NFH	Smelt	04/05/89	··	17.0	27,703	Warm Springs River	05-20-14
1987	Deschutes	Warm Springs NFH	Smelt	04/05/89	··	15.8	12.067	Warm Springs River	05-20-22
1987	Deschutes	Warm Springs NFH	smolt	04/05/89	··	14.4	2; 068	Warm Springs River	14-07-W
1987	Deschutes	Warm Springs NFH	Smelt	04/05/89	··	14.4	2,075	Warm Springs River	14-08-09
1987	Deschutes	Warm Springs NFH	Smelt	04/05/89	··	14.4	566	Warm Springs River	14-09-09
1988	Deschutes	Round Butte	Smelt	04/20/90	--	4.2	9,234	Pelton Rereg. Dam	07-50-61
1988	Deschutes	Round Butte	Smelt	04/19/90	··	6.0	28,608	Pelton Rereg. Dam	07-50-62
1988	Deschutes	Round Butte	smolt	05/17/90	--	8.8	21,328	Pelton Ladder	07-50-60
1988	Deschutes	Round Butte	smolt	05/ 1 7/90	··	8.8	45,323	Pelton Ladder	LM
1988	Deschutea	Round Butte	Smelt	04/20/90	··	8.8	20,356	Pelton Rereg. Dam	07-50-61
1988	Deschutes	Round Butte	Smelt	05/ 17/90	··	9.7	20,967	Pelton Ladder	07-50-59
1988	Deschut es	Round Butte	Smelt	05/1 7/90	--	9.7	46,667	Pelton Ladder	LM
1988	Deschutes	Round Butte	Smelt	05/ 17/90	··	10.7	24,107	Pelton Ladder	07-50-58
1988	Deschutes	Round Butte	Smelt	05/ 1 7/90	··	10.7	42,857	Pelton Ladder	LM
1988	Deschutes	Warm Springs NFH	fing.	09/27/89	··	8.3	6,270	Uarm Springs River	RV
1 9 =	Deschutes	Warm Springs NFH	fing.	09/27/89	--	9.6	694	Uarm Springs River	AD
1988	Deschut es	Uarm Springs NFH	fing.	09/27/89	··	9.5	4,371	Uarm Springs River	AD
1988	Deschutes	Warm Springs NFH	fing.	09/27/89	··	9.5	7,650	Uarm Springs River	RV
1988	Deschutes	Warm Springs NFH	fing.	09/27/89	··	8.3	4,191	Uarm Springs River	AD
1988	Deschutes	Uarm Springs NFH	fing.	09/27/89	··	9.2	1,920	Warm Springs River	AD
1988	Deschutes	Warm Springs NFH	fing.	09/27/89	··	7.8	7,070	Warm Springs River	LV
1988	Deschutes	Warm Springs NFH	fing.	09/27/89	··	8.5	366	Warm Springs River	AD
1988	Deschutes	Warm Springs NFH	fing.	09/27/89	--	7.8	459	Warm Springs River	AD
1988	Deschutes	Warm Springs NFH	fing.	09/27/89	--	10.1	2,025	Warm Springs River	AD
1 988	Deschutes	Warm Springs NFH	fing.	09/27/89	··	8.5	10,302	Warm Springs River	LV
1988	Deschutes	Uarm Springs NFH	fing.	09/27/89	··	8.4	770	Uarm Springs River	AD
1988	Deschutes	Warm Springs NFH	fing.	09127/89	--	9.2	12,029	Uarm Springs River	05-20-26
1988	Deschutes	Warm Springs NFH	fing.	09/27/89	--	9.5	19,516	Warm Springs River	05-20-27
1988	Deschutes	Warm Springa NFH	fins.	09/27/89	··	10.1	17.042	Warm Springa River	05-20-28
1988	Deschutes	Warm Springs NFH	fing.	09/27/89	··	9.6	18,046	Warm Springs River	05-20-29
1988	Deschutes	Warm Springs NFH	fing.	09/27/89	··	8.5	9,874	Uarm Springs River	05-20-61
1988	Deschutes	Warm Springa NFH	fing.	09/27/89	··	8.3	5,891	Uarm Springs River	05-20-62
1988	Deschutes	Warm Springs NFH	fing.	09/27/89	··	9.5	6,096	Warm Springs River	05-20-63
1988	Deschutes	Warm springs NFH	fing.	09/27/89	··	7.8	6.576	Warm Springs River	05-21-05
1988	Deschutes	Warm Springs NFH	fing.	09/27/89	··	8.4	2; 060	Warm Springs River	05-21-40
1988	Deschutes	Warm Springs NFH	fing.	09/27/89	--	8.4	2,127	Warm Springs River	05-21-41
1988	Deschutes	Warm Springs NFH	fing.	09/27189	--	8.3	9,358	Warm Springs River	05-40-20
1988	Deschutes	Warm Springs NFH	fing.	09/27189	--	8.3	8,275	Uarm Springs River	05-40-21
1988	Deschutes	Warm Springs NFH	fing.	11/15/89	··	9.0	296	Warm Springs River	--

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Brood Year	Stock	Hatchery	Life Stage	Release Date (1)	Release Date (2)	Fish/ lb	Number Released	Release Location	CWT/ Fin clip[b]
1988	Deschutes	Uarm Springs NFH	fing.	11/15/89	··	9.0	4,704	Warm Springs River	05-20-30
1988	Deschutes	Warm Springs NFH	smelt	04/1 1/90	··	20.1	6,459	Warm Springs River	AD, OTC
1988	Deschutes	Warm Springs NFH	smolt	04/11/90	··	21.1	1,028	Warm Springs River	AD, OTC
1988	Deschutes	Warm Springs NFH	smelt	04/1 1/90	··	10.5	2,437	Warm Springs River	AD,OTC
1988	Deschutes	Warm Springs NFH	smolt	04/1 1/90	··	17.9	4,095	Uarm Springs River	AD, OTC
1988	Deschutes	Warm Springs NFH	smolt	04/11/90	··	18.9	2,674	Warm Springs River	AD
1988	Deschutes	Uarm Springs NFH	Smelt	04/1 1/90	··	20.4	3,709	Warm Springs River	AD
1988	Deschutes	Uarm Springs NFH	smelt	04/1 1/90	··	21.2	400	Warm Springs River	··
1988	Deschutes	Uarm Springs NFH	smelt	04/11/90	··	19.3	801	Warm Springs River	AD, OTC
1988	Deschutes	Warm Springa NFH	molt	04/1 1/90	··	9.1	3,471	Warm Springs River	AD, OTC
1988	Deschutes	Uarm Springs NFH	smolt	04/1 1/90	··	21.3	4,687	Warm Springs River	AD, OTC
1988	Deschutes	Uarm Springa NFH	Smelt	04/1 1/90	··	21.4	10,889	Warm Springa River	AD, OTC
1988	Deschutes	Uarm Springs NFH	molt	04/1 1/90	··	18.2	6,860	Warm Springs River	AD, OTC
1988	Deschutes	Warm Spri nga NFH	molt	04/1 1 /90	··	21.2	812	Warm Springs River	LV, OTC
1988	Deschutes	Uarm Springs NFH	smelt	04/1 1/90	··	21.4	29,756	Warm Springs River	05-20-26
1988	Deschutes	Warm Springa NFH	Smelt	04/1 1/90	··	21.4	23,699	Warm Springa River	05-20-27
1988	Deschutes	Warm Springs NFH	Smelt	04/1 1/90	··	17.9	27,939	Warm Springa River	05-20-28
1988	Deschutes	Uarm Springa NFH	smelt	04/1 1/90	··	19.3	32,821	Uarm Springs River	05-20-29
1988	Deschutes	Warm Springa NFH	smol t	04/1 1/90	··	9.1	21,815	Uarm Springa River	05-20-36
1988	Deschutes	Warm Springs NFH	smelt	04/11/90	--	20.4	23,315	Uarm Springs River	05-20-36
1988	Deschutes	Warm Springs NFH	smolt	04/1 1/90	··	21.2	28,855	Uarm Springs River	05-20-61
1988	Deschutes	Warm Springa NFH	smolt	04/1 1 /90	··	21.3	37,411	Uarm Springs River	05-20-62
1988	Deschutes	Uarm Springs NFH	molt	04/1 1 /90	··	21.3	32,503	Uarm Springa River	05-20-63
1988	Deschutes	Uarm Springs NFH	smelt	04/11/90	··	21.1	37,734	Uarm Springs River	05-21-05
1988	Deschutes	Warm Springs NFH	smolt	04/11/90	··	18.2	6,613	Warm Springs River	05-21-40
1988	Deschutes	Warm Springa NFH	smelt	04/11/90	··	18.2	6,828	Warm Springs River	05-21-41
1988	Deschutes	Warm Springs NFH	Smelt	04/1 1/90	··	18.9	24,641	Uarm Springs River	05-40-19
1988	Deschutes	Warm Springs NFH	smolt	04/1 1/90	··	10.5	22,455	Warm Springs River	05-40-19
1988	Deschutes	Warm Springs NFH	smolt	04/1 1/90	··	20.1	34,138	Uarm Springs River	05-40-20
1988	Deschutes	Uarm Springs NFH	smelt	04/1 1/90	··	18.2	26,110	Uarm Springs River	05-40-21
1988	Deschutes	Uarm Springs NFH	Smelt	04/16/90	··	14.5	7,541	Warm Springs River	AO
1988	Deschutes	Uarm Springs NFH	smolt	04/16/90	··	14.5	44,163	Warm Springs River	05-20-30
1988	Deschutes	Uarm Springa NFH	smelt	04/16/90	··	14.5	47,302	Uarm Springs River	05-20-31
1989	Deschutes	Round Butte	smolt	05/17/90	··	5.7	14,253	Pelton Rereg. Dam	07-53-61
1989	Deschutes	Round Butte	smolt	05/17/90	·-	5.7	14,253	Pelton Rereg. Dam	07-53-62
1989	Deschutes	Round Butte	molt	05/17/90	··	6.5	15,705	Pelton Rereg. Dam	07-53-61
1989	Deschutes	Round Butte	smelt	05/17/90	··	6.5	15,705	Pelton Rereg. Dam	07-53-62
1989	Deschutes	Round Butte	smolt	05/1 7/90	··	9.5	21,236	Pelton Ladder	07-53-63
1989	Deschutes	Round Butte	smelt	05/17/90	--	9.5	21,232	Pelton Ladder	07-54-01
1989	Deschutes	Round Butte	smelt	05/17/90	··	9.5	%, 769	Pelton Ladder	RM
1989	Deschutes	Round Butte	Smelt	05/17/90	··	10.5	21,521	Pelton Ladder	07-54-02
1989	Deschutes	Round Butte	smolt	05/1 7/90	··	10.5	50,216	Pelton Ladder	RM

Table 1 (TR). (cent.) Hatchery releases of spring chinook salmon into the Deschutes River subbasin by brood year and if marked, by coded wire tag code[a].

Brood Year	Stock	Hatchery	Life Staga	Release Date (1)	Release Data (2)	Fish/ lb	Number Released	Release Location	CWT/ Fin clip[b]
1989	Deschutes	Warm Springs NFH	fing.	09/26/90	..	9.4	660	Warm Springs River	AD
1989	Deschutes	Warm Springs NFH	fing.	09/26/90	--	9.3	300	Warm Springs River	AD
1989	Deschutes	Warm Springs NFH	fing.	09/26/90	..	8.0	639	Warm Springs River	AD
1989	Deschutes	Warm Springs NFH	fing.	09/26/90	--	11.9	2 8 4	Warm Springs River	AD
1989	Deschutes	Warm Springs NFH	fing.	09/26/90	..	11.5	854	Warm Springs River	AD
1989	Deschutes	Warm Springs NFH	fing.	09/26/90	--	8.6	214	Warm Springa River	AD
1989	Deschutes	Warm Springs NFH	fing.	09/26/90	--	10.0	330	Warm Springs River	AD
1989	Deschutes	Warm Springs NFH	fing.	09/26/90	--	10.7	340	Warm Springs River	AD
1989	Deschutes	Warm Springs NFH	fing.	09/26/90	--	11.0	83	Warm Springs River	AD
1989	Deschutes	Warm Springs NFH	fing.	09/26/90	--	8.2	402	Warm Springs River	AD
1989	Deschutes	Warm Springs NFH	fing.	09/26/90	--	8.7	444	Warm Springs River	AD
1989	Deschutes	Warm Springs NFH	fing.	09/26/90	.-	11.6	256	Warm Springs River	AD
1989	Deschutes	L/arm Springs NFH	fing.	09/26/90	..	10.7	17,923	Warm Springs River	05-19-48
1989	Deschutes	Warm Springs NFH	fing.	09/26/90	..	8.6	11,278	Warm Springs River	05-19-48
1989	Deschutes	Warm Springs NFH	fing.	09/26/90	..	12.2	7,259	Warm Springs River	05-22-41
1989	Deschutes	Warm springs NFH	fing.	09/26/90	..	9.3	15,891	Warm Springs River	05-22-42
1989	Deschutes	Warm Springs NFH	fing.	09/26/90	..	9.4	24,297	Warm Springs River	05-22-43
1989	Deschutes	Warm Springs NFH	fing.	09/26/90	..	8.7	14,367	Warm Springs River	05-22-44
1989	Deschutes	Warm Springs NFH	fing.	09/26/90	--	8.2	7,645	Warm Springs River	05-23-39
1989	Deschutes	Warm springs NFH	fing.	09/26/90	--	8.2	8,097	Warm Springs River	05-23-39
1989	Deschutes	Warm Springs NFH	fing.	09/26/90	..	8.0	9,792	Warm Springs River	05-23-40
1989	Deschutes	Warm Springs NFH	fing.	09/26/90	--	8.0	9,103	Warm Springa River	05-23-40
1989	Deschutes	Warm Springs NFH	fing.	09/26/90	--	10.0	12,873	Warm Springs River	05-23-41
1989	Deschutes	Warm Springs NFH	fing.	09/26/90	--	11.0	8,649	Harm Springs River	05-23-42
1989	Deschutes	Warm Springs NFH	fing.	09/26/90	..	9.4	7,142	Warm Springs River	05-23-43
1989	Deschutes	Warm Springs NFH	fing.	09/26/90	--	11.9	7,725	Uarm Springs River	05-23-44
1989	Deschutes	Warm Springs NFH	fing.	09/26/90	--	11.5	9,449	Uarm Springs River	05-23-45
1989	Deschutes	Warm Springs NFH	fing.	09/26/90	--	11.5	9,507	Warm Springs River	05-23-46
1989	Deschutes	Warm Springs NFH	fing.	09/26/90	--	11.6	8,375	Warm Springs River	05-23-50
1989	Deschutes	Warm Springs NFH	fing.	11/01/90	--	12.0	1,345	Warm Springs River	AD
1989	Deschutes	Warm Springs NFH	fing.	11/01/90	--	13.5	2,354	Warm Springs River	AD
1989	Deschutes	Warm Springs NFH	fing.	11/01/90	.-	12.0	24,986	Uarm Springs River	05-22-39
1989	Deschutes	Warm Springs NFH	fing.	11/01/90	..	13.5	31,650	Uarm Springs River	05-22-40
1989	Deschutes	Warm Springs NFH	smolt	04/ 1 7/91	..	16.5	1,435	Uarm Springs River	AD, OTC
1989	Deschutes	Warm Springs NFH	smolt	04/ 1 7/91	--	12.4	173	Warm Springs River	AD
1989	Deschutes	Warm Springs NFH	smolt	04/17/91	..	16.1	565	Uarm Springs River	AD,OTC
1989	Deschutes	Warm Springs NFH	Smelt	04/17/91	..	16.0	619	Warm Springs River	AD, OTC
1989	Deschutes	Warm Springs NFH	smolt	04/ 1 7/91	..	15.5	398	Warm Springs River	AD,OTC
1989	Deschutes	Warm Springs NFH	Smelt	04/ 1 7/91	..	15.4	870	Warm Springs River	AD,OTC
1989	Deschutes	Warm Springs NFH	Smelt	04/ 1 7/91	..	15.5	21,362	Uarm Springs River	RV,OTC
1989	Deschutes	Warm Springs NFH	smolt	04/ 1 7/91	--	7.3	177	Warm Springa River	AD,OTC

Table 1 (TR). (cent.) Hatchery releases of spring chinook salmon into the Deschutes River subbasin by brood year and if marked, by coded wire tag code[a].

Brood Year	Stock	Hatchery	Life Stage	Release Data (1)	Release Date (2)	Fish/ lb	Number Released	Release LoCation	CWT/ Fin clip[b]
1989	Deschutes	Warm Springs NFH	smolt	04/17/91	··	12.8	170	Warm Springs River	AD
1989	Deschutes	Warm Springa NFH	Smelt	04/17/91	··	15.4	18,454	Warm Springs River	RV,OTC
1989	Deschutes	Warm Springs NFH	smolt	04/17/91	--	12.9	266	Warm Spri nga River	AD
1989	Deschutes	Warm Springa NFH	smolt	04/17/91	··	16.5	17,123	Warm Springs River	LV,OTC
1989	Deschutes	Warm Springs NFH	smolt	04/17/91	--	13.3	197	Warm Springs River	AD
1989	Deschutes	Warm Springs NFH	smolt	04/17/91	··	17.6	470	Warm Springs River	AD, OTC
1989	Deschutes	Warm Springs NFH	Smelt	04/17/91	··	16.3	1,460	Warm Springa River	AD,OTC
1989	Deschutes	Warm Springs NFH	Smelt	04/17/91	··	7.9	22	Warm Springs River	AD,OTC
1989	Deschutes	Warm Springs NFH	Smelt	04/17/91	··	14.4	512	Warm Springs River	AD
1989	Deschutes	Warm Springs NFH	Smelt	04/17/91	··	17.6	15,420	Warm Springs River	LV,OTC
1989	Deschutes	Warm Springs NFH	smolt	04/17/91	··	18.2	96	Warm Springs River	AD
1989	Deschutes	Warm Springs NFH	smolt	0.4/17/91	··	17.4	225	Warm Springs River	AD,OTC
1989	Deschutes	Warm Springs NFH	Smelt	04/17/91	··	18.1	1,457	Warm Springs River	AD,OTC
1989	Deschutes	Warm Springs NFH	smolt	04/17/91	··	10.1	1,:;:	Warm Springs River	AD
1989	Deschutes	Warm Springs NFH	Smelt	04/17/91	··	19.4		Warm Springs River	AD
1989	Deschutes	Warm Springs NFH	Smelt	04/17/91	··	16.3	69,845	Warm Springs River	05-19-48
1989	Deschutes	Warm Springs NFH	smolt	04/17/91	··	18.2	20,292	Warm Springs River	05-22-23
1989	Deschutes	Warm Springs NFH	smolt	04/17/91	··	7.9	4,770	Warm Springs River	05-22-23
1989	Deschutes	Warm Springs NFH	smolt	04/17/91	··	18.2	20,301	Warm Springa River	05-22-24
1989	Deschutes	Warm Springs NFH	smolt	04/17/91	··	7.9	4,770	Warm Springs River	05-22-24
1989	Deschutes	Warm Springs NFH	Smelt	04/17/91	··	10.1	8,869	Warm Springs River	05-22-27
1989	Deschutes	Warm Springa NFH	smolt	04/17/91	··	10.1	7,228	Warm Springs River	05-22-28
1989	Deschutes	Warm Springs NFH	Smelt	04/17/91	··	10.1	8,384	Warm Springs R i var	05-22-31
1989	Deschutes	Warm Springs NFH	Smelt	04/17/91	··	19.4	39,515	Warm Springs River	05-22-38
1989	Deschutes	Warm Springs NFH	Smelt	04/17/91	--	7.3	10,705	Warm Springs River	05-22-38
1989	Deschutes	Warm Springs NFH	smol t	04/17/91	··	16.0	42,693	Warm Springs River	05-22-41
1989	Deschutes	Warm Springs NFH	Smelt	04/17/91	··	16.1	34.793	Warm Springs River	05-22-42
1989	Deschutes	Warm Springs NFH	smolt	04/17/91	··	18.1	26; 182	Uerm Springs River	05-22-43
1989	Deschutes	Warm Springs NFH	smolt	04/17/91	--	18.1	35,516	Warm Springs River	05-22-44
1989	Deschutes	Warm Springs NFH	smolt	04/17/91	··	12.9	9,235	Uarm Springa River	05-22-45
1989	Deschutes	Warm Springs NFH	molt	04/17/91	··	12.8	39,884	Uarm Springs River	05-22-45
1989	Deschutes	Warm Springs NFH	smolt	04/17/91	··	12.4	40,133	Warm Springs River	05-22-46
1989	Deschutes	Warm Springs NFH	Smelt	04/17/91	··	12.9	8,073	Uarm Springs River	05-22-46
1989	Deschutes	Warm Springs NFH	smolt	04/17/91	··	14.4	39,613	Warm Springs River	05-22-47
1989	Deschutes	Warm Springs NFH	molt	04/17/91	··	12.9	9,879	Warm Springa River	05-22-47
1989	Deschutes	Warm Springa NFH	molt	04/1 7/91	--	12.9	12,886	Uarm Springs River	05-22-48
1989	Deschutes	Warm Springs NFH	smolt	04/17/91	··	13.3	39,717	Warm Springs River	05-22-48
1989	Deschutes	Warm Springs NFH	smolt	04/17/91	··	16.5	15,543	Uarm Springs River	05-23-39
1989	Deschutes	Warm Springs NFH	smolt	04/17/91	--	17.6	14,780	Uarm Springs River	05-23-40
1989	Deschutes	Warm Springa NFH	Smelt	04/17/91	··	15.4	17,390	Warm Springa River	05-23-41
1989	Deschutes	Warm Springa NFH	Smelt	04/17/91	··	15.5	20.320	Warm Springs River	05-23-42

Table 1 (TR). (cent.) Hatchery releases of spring chinook salmon into the Deschutes River subbssin by brood year and if marked, by coded wire tag code[a].

Brood Year	Stock	Hatchery	Life Stage	Release Date (1)	Release Date (2)	Fish/ lb	Number Released	Release LoCat ion	CUT/ Fin clip[b]
1989	Deschutes	Warm Springs NFH	Smelt	04/17/91	--	17.3	18,138	Warm Springs River	05-23-43
1989	Deschutes	Warm Springs NFH	Smelt	04/17/91	--	17.4	17,006	Warm Springs River	05-23-44
1989	Deschutes	Warm Springs NFH	Smelt	04/17/91	--	16.1	15,670	Warm Springs River	05-23-45
1989	Deschutes	Warm Springa NFH	Smelt	04/17/91	--	16.1	15,764	Warm Springs River	05-23-46
1989	Deschutes	Warm Springs NFH	Smelt	04/17/91	--	16.1	15,967	Warm Springs River	05-23-50
1989	Deschutes	Warm Springs NFH	smol t	04/22/91	--	12.0	1,157	Warm Springs River	AD
1989	Deachutes	Warm Springs NFH	smolt	04/22/91	--	12.0	28,031	Warm Springs River	05-22-39
1989	Deschutes	Warm Springs NFH	smol t	04/22/91	--	12.0	19,716	Warm Springs River	05-22-40

[a] Est imates through the 1984 brood releases are from Lindsay et al. (1989) and for the 1985-90 brood releases from the Oregon Department of Fish and Wildlife (unpublished data) and U.S. Fish and Wildlife Service (unpublished data).

[b] D = Dorsal, AD = Adipose, AN = Anal, LV = Left ventral, RV = Right ventral, LP = Left pectoral, RP = Right pectoral, LM = Left maxillary, RM = Right maxillary.

[c] Release dates unknown (onl y the year of release known). Standardized to the first and last day of the year.

[d] Release dates unknown (only the month of release known). Standardi zad to the middle of the month for the month of release.

Table 2 (RB). Total returns of Hatchery Deschutes stock spring chinook salmon to the Deschutes River subbasin[a], by brood year.

	Total Age						
Brood Year	2	3	4	5	6	Total	Adult Total
1980	--	111	1,216	178	--	1,505	1,394
1981	--	321	3,545	--	--	--	--
1982	--	306	--	--	--	--	--
1983	--	--	--	--	--	--	--
1984	--	903	2,266	172	--	3,341	2,438
1985	--	1,395	6,111	465	--	7,971	6,576
1986	--	622	4,437	--	--	--	--
1987	--	319	--	--	--	--	--

[a] Estimates of brood returns for the 1980-82 and 1984-85 brood years are a synthesis of data from Lindsay et al. (1989), U.S. Fish and Wildlife Service (unpublished data), and Oregon Department of Fish and Wildlife (unpublished data) and estimates for the 1986-87 brood years are a synthesis of data from the U.S. Fish and Wildlife Service (unpublished data) and Oregon Department of Fish and Wildlife (unpublished data).

Table 3 (w-1). Total returns of wild spring chinook salmon to the Warm Springs National Fish Hatchery[a], by brood year.

Brood Year	Total Age 2	3	4	5	6	Total	Adult Total
1972	--	--	--	144[b]	--	--	--
1973	--	--	1,926[b]	908	--	--	2,834
1974	--	139[b]	1,676	304	--	2,119	1,980
1975	--	76	1,018	223	--	1,317	1,241
1976	--	73	745	320	--	1,138	1,065
1977	--	34	1,205	282	--	1,521	1,487
1978	--	50	1,126	200	--	1,376	1,326
1979	--	46	1,323	255	--	1,624	1,578
1980	--	18	937	139	--	1,094	1,076
1981	--	98	960	140	--	1,198	1,100
1982	--	56	1,516	329	--	1,901	1,845
1983	--	55	1,368	399	--	1,822	1,767
1984	--	86	1,179	284	--	1,549	1,463
1985	--	69	1,060	312	--	1,441	1,372
1986	--	65	1,509	--	--	--	--
1987	--	46	--	--	--	--	--

[a] Estimates of escapement to Warm Springs National Fish Hatchery (WSNFH) for the 1972-87 broods are from the U.S. Fish and Wildlife Service (unpublished data).

[b] Includes and estimated 603 fish spawning below WSNFH (Lindsay et al. 1989); including 38 jacks, 526 age 4 fish, and 39 age 5 fish. Brood returns below WSNFH were estimated based on age structure at WSNFH.

Table 4 (RH-2). Total returns of wild spring chinook salmon to Pelton Trap[a,b], by brood year.

Brood Year	Total Age 2	3	4	5	6	Total	Adult Total
1972	--	--	--	1	--	--	--
1973	--	--	17	3	--	--	20
1974	--	1	6	5	--	12	11
1975	--	1	18	4	--	23	22
1976	--	1	13	9	--	23	22
1977	--	1	35	5	--	41	40
1978	--	1	19	1	--	21	20
1979	--	1	8	4	--	13	12
1980	--	1	15	13	--	29	28
1981	--	2	89	4	--	95	93
1982	--	5	39	29	--	73	68
1983	--	1	120	13	--	134	133
1984	--	8	39	10	--	57	49
1985	--	2	38	8	--	48	46
1986	--	2	36	--	--	--	--
1987	--	1	--	--	--	--	--

[a] Brood year reconstruction at Pelton Trap is based on age composition at Warm Springs National Fish Hatchery.
[b] Estimates for the 1972-87 broods are modified from Oregon Department of Fish and Wildlife (unpublished data).

Table 5 (RH-3). Total returns of Hatchery Deschutes stock spring chinook salmon to the Warm Springs National Fish Hatchery[a], by brood year.

	Total Age						
Brood Year	2	3	4	5	6	Total	Adult Total
1978	--	85	894	80	--	1,059	974
1979	--	20	274	20	--	314	294
1980	--	16	769	52	--	837	821
1981	--	203	1,037	53	--	1,293	1,090
1982	--	18	108	21	--	147	129
1983	--	187	491	69	--	747	560
1984	--	229	411	66	--	706	477
1985	--	341	2,341	118	--	2,800	2,459
1986	--	131	1,127	--	--	--	--
1987	--	64	--	--	--	--	--

[a] Estimates of escapement to the Warm Springs National Fish Hatchery for the 1978-87 broods are from the U.S. Fish and Wildlife Service (unpublished data).

Table 6 (RH-4). Total returns of Hatchery Deschutes stock spring chinook salmon to Pelton Trap[a,b] by brood year.

Brood Year	Total Age 2	3	4	5	6	Total	Adult Total
1978	--	--	--	131	--	--	--
1979	--	--	450	12	--	--	462
1980	--	26	447	72	--	545	519
1981	--	118	1,430	274	--	1,822	1,704
1982	--	25	559	38	--	622	597
1983	--	968	885	123	--	1,976	1,008
1984	--	413	732	58	--	1,203	790
1985	--	608	2,046	197	--	2,851	2,243
1986	--	114	1,885	--	--	--	--
1987	--	107	--	--	--	--	--

[a] Estimates are based on age composition at Warm Springs National Fish Hatchery.

[b] Estimates for the 1978-87 broods are from the U.S. Fish and Wildlife Service (unpublished data) and Oregon Department of Fish and Wildlife (unpublished data).

Table 7 (AC). Age composition (freshwater.ocean) by brood year for Hatchery Deschutes stock spring chinook salmon returning to the Warm Springs National Fish Hatchery in the Deschutes River subbasin[a].

Brood Year	N	Age Composition (%) 1.1	1.2	1.3	2.1	2.2	2.3	3.1	3.2	3.3
1978	--	--	--	--	8	84	8	--	--	--
1979	--	--	--	--	6	87	6	--	--	--
1980	--	--	--	--	2	92	6	--	--	--
1981	--	--	--	--	16	80	4	--	--	--
1982	--	--	--	--	12	74	14	--	--	--
1983	--	--	--	--	25	66	9	--	--	--
1984	--	--	--	--	33	58	9	--	--	--
1985	--	--	--	--	12	84	4	--	--	--

[a] Estimates for the 1978-85 broods are from the U.S. Fish and Wildlife Service (unpublished data).

Table 8 (AC-a). Age composition (freshwater.ocean) by run year for Hatchery Deschutes stock spring chinook salmon returning to the Warm Springs National Fish Hatchery in the Deschutes River subbasin[a].

Run Year	N	Age Composition (%) 1.1	1.2	1.3	2.1	2.2	2.3	3.1	3.2	3.3
1983	--	--	--	--	4	74	22	--	--	--
1984	--	--	--	--	20	78	2	--	--	--
1985	--	--	--	--	2	93	5	--	--	--
1986	--	--	--	--	54	31	15	--	--	--
1987	--	--	--	--	31	66	3	--	--	--
1988	--	--	--	--	42	50	8	--	--	--
1989	--	--	--	--	5	92	3	--	--	--
1990	--	--	--	--	5	86	9	--	--	--

[a] Estimates for the 1983-90 run years are from the U.S. Fish and Wildlife Service (unpublished data).

Table 9 (AS). Percent females by brood year and age class (freshwater.ocean) for Hatchery Deschutes stock spring chinook salmon returning to Warm Springs National Fish Hatchery in the Deschutes River subbasin[a].

		Females (%)								
Brood Year	N	1.1	1.2	1.3	2.1	2.2	2.3	3.1	3.2	3.3
1978	--	--	--	--	0	65	46	--	--	--
1979	--	--	--	--	0	66	59	--	--	--
1980	--	--	--	--	0	59	62	--	--	--
1981	--	--	--	--	1	59	60	--	--	--
1982	--	--	--	--	0	51	78	--	--	--
1983	--	--	--	--	--	59	50	--	--	--
1984	--	--	--	--	--	56	33	--	--	--
1985	--	--	--	--	3	62	53	--	--	--
1986	--	--	--	--	0	59	--	--	--	--
1987	--	--	--	--	0	--	--	--	--	--

[a]Estimates for the 1978-87 brood years are from the U.S. Fish and Wildlife Service (unpublished data).

Table 10 (AF-a). Mean fecundity by run year for spring chinook returning to the Warm Springs National Fish Hatchery[a].

Run Year	N	Mean Fecundity	st. dev.
1978	206	3,355	--
1979	187	3,647	--
1980	112	3,443	--
1981	162	3,435	--
1982	--	--	--
1983	301	3,089	--
1984	339	3,124	--
1985	430	3,028	--
1986	282	2,850	--

[a] Estimates of mean fecundity for the 1978-86 run years at Warm Springs National Fish Hatchery are from Lindsay et al. (1989).

Table 11 (AF-b). Mean fecundity by run year for spring chinook salmon collected at Pelton Trap[a].

Run Year	N	Mean Fecundity	st. dev.
1972	168	4,395	--
1973	183	4,852	--
1974	32	3,694	--
1975	40	3,445	--
1976	53	3,121	--
1977	85	2,889	--
1978	56	3,400	--
1979	58	2,839	--
1980	51	3,023	--
1981	161	2,975	--
1982	202	2,819	--
1983	266	3,095	--
1984	104	3,528	--
1985	134	3,482	--
1986	136	3,158	--
1987	132	3,764	--
1988	150	3,224	--
1989	120	2,672	--
1990	162	2,829	--

[a] Estimates of mean fecundity for the 1972-90 run years are from the Oregon Department of Fish and Wildlife (unpublished data).

Table 12 (AE). Emigration of coded wire tagged hatchery spring chinook salmon released as juveniles in the Deschutes River subbasin[a,b].

Hatchery/Release Site	Recovery Site, Run Year(s)	Recovery Method	Number Recovered	Total Number Estimated, (PSMFC)
Deschutes River	Coos Bay	Hatchery returns		
	1986	--	6	6
	1987	--	8	8
Deschutes River	Rogue River	Hatchery returns		
	1986	--	1	1
Deschutes River	Cowlitz River	Hatchery returns		
	1986	--	1	1
Deschutes River	Klickitat River	Hatchery returns		
	1986	--	2	2
Deschutes River	Trask River	Hatchery returns		
	1987	--	1	1
Deschutes River	Columbia River[c]	Hatchery returns		
	1981	--	1	1

[a] Based on the following tag codes: 05-06-27, 07-31-28, 07-33-20, 07-33-21, 07-39-28, 07-39-29
[b] Estimates are modified from the Pacific States Marine Fisheries Commission coded wire tag database.
[c] Recovery site in the mainstem Columbia River between Bonneville and McNary dams.

Table 13 (TD). Parasites and diseases of spring chinook at hatcheries located in the Deschutes River subbasin[a].

Disease type	Hatchery	Specific Pathogen
Parasite	Round Butte	*Ceratomyxa shasta*
Parasite	Round Butte	*Myxidium minteri*
Parasite	Warm Springs NFH	*Glochidia Sp.*
Parasite	Warm Springs NFH	*Sanguinicola spp.*
Parasite	Warm Springs NFH	*Nanophyetus spp.*
Parasite	Warm Springs NFH	*Hexamita Spp.*
Parasite	Warm Springs NFH	*Ichthyobodo spp.*
Parasite	Warm Springs NFH	*Scyphidia spp.*
Parasite	Warm Springs NFH	*Epistylis spp.*
Parasite	Warm Springs NFH	*Neascus sp.* (Black spot)
Parasite	Warm Springs NFH	*Salminicola wardi*
Parasite	Warm Springs NFH	*Miracidia spp.*
Bacteria	Round Butte	*Renibacterium salmoninarum* (Bacterial kidney disease)
Bacteria	Round Butte	*Aeromonas salmonicida* (Furunculosis)
Bacteria	Round Butte	*Cytophaga psychrophila* (Cold water disease)
Bacteria	Warm Springs NFH	*Renibacterium salmoninarum* (Bacterial kidney disease)
Bacteria	Warm Springs NFH	*Aeromonas salmonicida* (Furunculosis)
Bacteria	Warm Springs NFH	*Flexibacter columnaris* (Columnaris)
Bacteria	Warm Springs NFH	*Cytophaga psychrophila* (Cold water disease)
Bacteria	Warm Springs NFH	*Pseudomonas spp.*
Bacteria	Warm Springs NFH	Gill disease
Virus	Round Butte	Infectious Hematopoietic Necrosis (IHN)
Virus	Round Butte	Viral erythrocytic necrosis
Virus	Warm Springs NFH	Infectious Hematopoietic Necrosis (IPN)
Virus	Warm Springs NFH	Viral erythrocytic necrosis

[a] Data are from Lindsay et al. (1989).

REFERENCES

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DESCHUTES RIVER SUBBASIN

Naturally Produced Summer Chinook Salmon

GEOGRAPHIC LOCATION

The DesChutes River subbasin covers 10,500 square miles of central Oregon and is the second largest subbasin in the state. From its source in the Cascade Mountains, it flows north to where it enters the Columbia River 205 miles from the ocean. The DesChutes River is located above Bonneville and The Dalles dams.

ORIGIN

Resource managers believe that the lower Deschutes River subbasin may sustain populations of both summer and fall run chinook or a single population of fall run chinook that has a protracted time of entry into the subbasin (see DESCHUTES RIVER SUBBASIN, Naturally Produced Fall Chinook Salmon, ORIGIN). The summer and fall races are believed to enter the subbasin from late June through October. Evidence for the existence of summer and fall runs is that there appears to be two peaks in the run at Sherars Falls; an "early peak occurring in July and a late peak in September. Evidence for the existence of one run is that there does not appear to be reproductive isolation between the early and late segments of the run. Both segments spawn in the same areas with considerable overlap in time of spawning. " (Oregon Department of Fish and Wildlife and Confederated Tribes of the Warm Springs Reservation of Oregon, 1990)

The chinook run returning from late June through late October is currently managed as one distinct race. Chinook salmon harvested in the fisheries and counted on spawning ground surveys are recorded as fall chinook. Returns to Pelton Trap, however, are divided into summer and fall races based on time of entry into the trap. Chinook salmon returning from July through August are classified as summer run chinook and fish returning from September through December are classified as fall run chinook (Jonasson and Lindsay 1988). No non-indigenous stocks have been introduced into the subbasin (see DESCHUTES RIVER SUBBASIN, Hatchery Produced Summer Chinook Salmon, PRODUCTION) and few stray fish are recovered in the subbasin (see ADULT LIFE HISTORY, Strays).

ADULT LIFE HISTORY

Strays

Several stocks of hatchery summer chinook, released as juvenile fish in subbasins located in Washington and Idaho, have been recovered at hatchery facilities located in the Deschutes River subbasin (Table 1). Coded wire tags were recovered from jack and adult fish that were released as juvenile fish in the South Fork Salmon River in Idaho and the Klickitat River in Washington (Table 1).

Fecundity

Estimates of fecundity are available for native stock summer chinook spawned at hatchery facilities located in the subbasin. Estimates were derived by dividing hatchery egg take by the number of females spawned.

Annual estimates of fecundity at Round Butte Hatchery ranged from 4,322 to 4,911 eggs per female (Table 2).

Table 1 (AI). Non-harvest recoveries of coded wire tagged hatchery summer chinook salmon
River subbasin[a,b].

Hatchery/Release Site	Recovery Site, Run Year(s)	Recovery Method	Number Recovered	Total I Estim (
Deschutes River	Deschutes River	Trap Returns		
	1979	--	4	
	1980	--	3	
SFk Salmon River	Deschutes River	Trap Returns		
	1981	--	3	
	1982	--	--	
	1983	--	1	
	1984	--	2	
	1985	--	--	
	1986	--	--	
	1987	--	14	
	1988	--	3	
Klickitat River	Deschutes River	Trap Returns		
	1979	--	2	
Columbia River[c]	Deschutes River	Trap Returns		
	1981	--	1	

[a] Based on the following tag codes from hatchery reared fish: 07-16-09, 07-16-10, 07-18-27,
on the following tag codes from fish of unknown rearing type (assumed to be hatchery): 1
10-21-18, 10-24-58, 10-25-18, 10-26-33, 10-27-38, 10-28-04, 10-30-10.
[b] Estimates are modified from the Pacific States Marine Fisheries Commission coded wire tag
[c] Release site in the mainstem Columbia River below Bonneville Dam.

Table 2 (AF-a). Mean fecundity by run year for summer chinook salmon collected at Pelton Trap[a].

Run Year	N	Mean Fecundity	st. dev.
1974	63	4,911	--
1975	23	4,823	--
‘1976	37	4,322	--
1977	37	4,620	--
1978	32	4,365	--

[a] Estimates for the 1974-78 run years are from Jonasson and Lindsay (1988).

REFERENCES

Jonasson, B.C. and R.B. Lindsay. 1988. Fall chinook salmon in the Deschutes River, Oregon. Information Reports (Fish) 88-6 of Oregon Department of Fish and Wildlife, Research and Development Section, Portland, Oregon.

Oregon Department of Fish and Wildlife and Confederated Tribes of the Warm Springs Reservation of Oregon. 1990. Deschutes River subbasin salmon and steelhead preduction plan. Columbia Basin System Planning Report to Northwest Power Planning Council, Portland, Oregon.

DESCHUTES RIVER SUBBASIN

Hatchery Produced Summer Chinook Salmon

ORIGIN

The first recorded release of hatchery fish into the subbasin is the 1974 brood release of the Hatchery Deschutes stock (Table 1). The subbasin was supplemented with juvenile hatchery fish from 1975-79. No non-indigenous stocks have been introduced into the subbasin.

The Hatchery Deschutes stock was developed from native fish returning to Pelton Trap. Chinook salmon were classified as summer run fish based on time of entry into Pelton Trap (see DESCHUTES RIVER SUBBASIN, Naturyl Produced Summer Chinook Salmon, ORIGIN). The program was discontinued after th 1978 brood release (Table 1). There is currently no hatchery supplementation program in the subbasin.

DISTRIBUTION

Subbasin

Summer chinook were released in the mainstem Deschutes River (RM 100), Lake Simtustus, Pelton Deregulating Reservoir, and the Columbia River below Bonneville Dam.

PRODUCTION

Releases

Egg

There are no records of releases in the subbasin.

Fry

There are no records of releases in the subbasin.

Fingerling

Round Butte Hatchery is the only facility in which fingerlings were reared or acclimated prior to release in the subbasin (Table 1). Annual numbers released ranged from 59,040 to 143,040 fish (Table 1). Size at release ranged from 52.0 to 22.4 fish per pound.

Smelt

There are no records of releases in the subbasin.

Jack and Adult

There are no records of releases in the subbasin.

ADULT LIFE HISTORY

Escapem

Hatchery Facilities

Numbers: No brood year specific estimates of escapement are available at hatchery facilities located in the subbasin. Run year specific estimates for native stock summer chinook returning to Pelton Trap in the 1957-90 run years are available in Jonasson and Lindsay (1988) and from Oregon Department of Fish and Wildlife (unpublished data).

Mark Recoveries

No coded wire tagged adult fish have been recovered at trapping facilities or on spawning ground surveys. Coded wire tagged Hatchery DesChutes stock summer chinook were recovered in fisheries located in the DesChutes River subbasin (Pacific States Marine Fisheries Commission coded wire tag database).

Table 1 (TR). Hatchery releases of summer chinook salmon into the Deschutes River subbasin by brood year and if marked, by

Brood Year	Stock	Hatchery	Life Stage	Release Date (1)	Re 1•ase Date (2)	Fish/ lb	Number Released	Release Location	CLIT/ Fin cli
1974	Deschutes	Round Butte	fing.	04/21/75	--	52.0	40,768	Lake Simtustus	RP
1974	Deschutes	Round Butte	fing.	05/20/75	--	38.0	12,144	Pelton Reregulating Res.	LP
1974	Deschutes	Round Butte	fing.	06/03/75	--	30.0	6,128	Deschutes (RM 100)	LP
1975	Deschutes	Round Butte	fing.	06/14/76	--	28.0	60,234	Pelton Deregulating Res.	09-04-0
197S	Deschutes	Round Butte	fing.	06/14/76	--	28.0	'1 ,450	Pelton Deregulating Res.	AD
1976	Deschutes	Round Butte	fing.	06/13/77	--	22.6	53,704	Deschutes (RM 100)	09-16-1
1976	Deschutes	Round Butte	fing.	06/13/77	--	22.6	1,304	Deschutes (RM 100)	AD
1976	Deschutes	Round Butte	fing.	06/13/77	--	25.9	57,769	Deschutes (RM 100)	09-16-1
1976	Deschutes	Round Butte	fing.	06/13/77	--	25.9	5,580	Deschutes (RM 100)	AD
1977	Deschutes	Round Butte	fing.	05/22/?8	--	35.6	66,523	Deschutes (RM 100)	07-16-0
1977	Oeschutes	Round Butte	fing.	05/22/78	--	35.6	2,736	Deschutes (RM 100)	AD
1977	Deschutes	Round Butte	fing.	05/22/78	--	35.6	689	Deschutes (RM 100)	No mark
1977	Deschutes	Round Butte	f ing.	05/30/78	--	32.5	71,512	Col. R. below Bonn. Dam	07-16-1
1977	Deschutes	Round Butte	fing.	05/30/78	--	32.5	718	Col. R. below Bonn. Dam	Ao
1977	Deschutes	Round Butte	fing.	05/30/78	--	32.5	862	Col. R. below Bonn. Dam	No mark
1978	Deschutes	Round Butte	fing.	05/23/79	--	24.8	48,878	Deschutes (RM 100)	07-18-2
1978	Deschutes	Round Butte	fing.	05/23/79	--	24.8	3,231	Deschutes (RM 100)	No mark
1978	Deschutes	Round Butte	fing.	05/30/79	--	22.4	49,666	Col. R. below Bonn. Oam	07-18-2
1978	Deschutes	Round Butte	fing.	05/30/79	--	22.4	3,170	Col. R. below Bonn. Dam	No mark

[a] Estimates for the 1974-78 brood year releases are from Jonasson and Lindsay (1988).
[b] D = Dorsal, AO = Adipose, AN = Anal, LV = Left ventral, RV = Right ventral, LP = Left pectoral, RP = Right pectoral, LM
Right maxillary.

REFERENCES

Jonasson, B.C. and R.B. Lindsay. 1988. Fall chinook salmon in the Deschutes River, Oregon. Information Reports (Fish) 88-6 of Oregon Department of Fish and Wildlife, Research and Development Section, Portland, Oregon.

DESCHUTES RIVER SUBBASIN

Naturally Produced Fall Chinook Salmon

GEOGRAPHIC LOCATION

The Deschutes River subbasin covers 10,500 square miles of central Oregon and is the second largest subbasin in the state. From its source in the Cascade Mountains, it flows north to where it enters the Columbia River 205 miles from the ocean. The DesChutes River is located above Bonneville and The Dalles dams.

ORIGIN

Fall chinook are indigenous to the Deschutes River subbasin. Non-indigenous stocks introduced into the subbasin include the Little White Salmon stock and one unknown stock of fish obtained from Spring Creek Hatchery (see DESCHUTES RIVER SUBBASIN, Hatchery Produced Fall Chinook Salmon, PRODUCTION). Stray hatchery fall chinook originating from various Columbia River Basin and coastal stocks are also recovered in the subbasin (see ADULT LIFE HISTORY, Strays).

DISTRIBUTION

Subbasin

Fall chinook currently spawn and rear in the Deschutes River subbasin from the mouth of the DesChutes River to Pelton Deregulating Dam, located at km 178 on the mainstem of the Deschutes River. Prior to completion of a fish ladder at Sherars Falls (located at km 69 on the mainstem of the DesChutes River), in the 1940's, it is believed that summer and fall flows probably limited historical spawning and rearing habitat to the 44 mile reach of stream below the falls (Jonasson and Lindsay 1988). The quality of the spawning and rearing habitat varies throughout the subbasin (Tables 1 and 2).

PRODUCTION

Juvenile

Mark Information

Naturally produced juvenile fall chinook from the 1977-79 broods were coded wire tagged and released in the subbasin (Table 3). Several coded wire tag groups that were used to tag fall chinook were also used to tag juvenile chinook classified as naturally produced spring chinook (see DESCHUTES RIVER SUBBASIN, Naturally Produced Spring Chinook Salmon, PRODUCTION, Juvenile, Mark Information). Annual numbers marked and released ranged from 39,694 to 42,045 (Table 3).

Coded wire tagged fall chinook, marked and released as juvenile fish in the Deschutes River subbasin, were recovered in the mainstem Columbia River below Bonneville Dam and in the DesChutes River subbasin (Tables 4 and 5).

Harvest

sport

Subbasin: No brood year specific estimates of harvest are available. Run year specific

estimates of harvest are available in Jonasson and Lindsay (1988) and from Oregon Department of Fish and Wildlife (unpublished data).

Treaty

Subbasin: No brood year specific estimates of harvest are available. Run year specific estimates of harvest are available in Jonasson and Lindsay (1988) and from Oregon Department of Fish and Wildlife (unpublished data).

ADULT LIFE HISTORY

Escapement

Subbasin

Timing: Data collected at a steeppass fish trap located at Sherars Falls provides the only long term data set on run timing in the DesChutes River subbasin. The trap was generally operated 5 days per week from mid- to late April through early to mid-November. Estimates are available for the 1977-86 run years. To distinguish between fall and spring runs, chinook salmon sampled from 1 April through 15 June were classified as spring run fish and chinook salmon sampled from 16 June through 31 December were classified as fall run fish.

Naturally produced chinook salmon are found in the DesChutes River subbasin from early April through late December. Peak movement of fall chinook past Sherars Falls primarily occurs from early September to late October (Jonasson and Lindsay 1988; Figure 1).

Numbers: No brood year specific estimates of escapement are available to the DesChutes River subbasin. Run year specific estimates at Sherars Falls are available for the 1977-90 run years in Jonasson and Lindsay (1988) and from Oregon Department of Fish and Wildlife (Unpublished).

spawning Area

Timing: Temporal distribution of spawning was estimated in the DesChutes River subbasin based on carcass recoveries during spawning ground surveys. Spawning in the mainstem Deschutes River was estimated to occur from late September to mid-December (Jonasson and Lindsay 1988; Figure 1).

Numbers: No brood year specific estimates of spawrier escapement are available. Run year specific estimates are available for the 1977-90 run years in Jonasson and Lindsay (1988) and from Oregon Department of Fish and Wildlife (Unpublished). Spawning ground counts are available from Oregon Department of Fish and Wildlife (unpublished data).

Strays

There is no information available on the number of stray naturally produced fall chinook that enter the DesChutes River subbasin.

Few stray hatchery fall chinook are recovered annually in the subbasin but recoveries include hatchery fish that were released as juvenile fish at sites located over a wide geographical area. Stray hatchery fall chinook originated from the Klickitat and Lower Columbia river subbasins; the Klamath and Rogue river subbasins, located on the Oregon coast; and the Trinity River subbasin, located on the California coast (Table 6).

Fork Length

Fork length was estimated for coded wire tagged naturally produced fall chinook collected at various sites in the DesChutes River subbasin. Fork lengths were taken on coded wire tagged adult fish returning from the 1975-78 brood releases of juvenile fish marked as summer chinook (see DESCHUTES RIVER SUBBASIN, Hatchery Produced Summer Chinook Salmon, PRODUCTION) and the 1977-79 brood releases of juvenile fish marked as fall chinook. The groups were combined because of the inability to accurately distinguish between summer and fall races. Age was determined based on tagcode and scale analysis.

Mean fork length was greater for returning jack and adult fish that had migrated to the ocean as age 1+ fish (freshwater age 2) than for those that migrated to the ocean as age O+ (freshwater age 1) fish (Table 7). Annual estimates of mean fork length, by age category, ranged from 43 cm to 60 cm for ocean age 1 fish, 60 cm to 76 cm for ocean age 2 fish, and 84 cm to 102 cm for ocean age 3 fish (Table 7).

Age Structure

Age structure was estimated for naturally produced fall chinook sampled at the Sherars Falls steeppass trap (see ADULT LIFE HISTORY, Escapement, Subbasin), from carcass surveys, and from fisheries located at Sherars Falls. Age was determined based on scale analysis.

Annual estimates of age structure, by brood year, ranged from 26% to 45% ocean age 1 fish, 21% to 46% ocean age 2% fish, 22% to 42% ocean age 3 fish, 3% to 4% ocean age 4 fish, and O% to <1% ocean age 5 fish (Table 8).

Annual estimates of age structure, by run year, ranged from 5% to 46% ocean age 1 fish, 16% to 34% ocean age 2 fish, 23% to 57% ocean age 3 fish, 4% to 11% ocean age 4 fish, and O% to <1% ocean age 5 fish (Table 9).

JUVENILE LIFE HISTORY

Fork Length

Mean fork length was estimated for age O naturally produced fall chinook collected by seine in the mainstem DesChutes River. Estimates were made for selected time periods and reaches of stream. Mean fork length ranged from 54.6 mm to 92.2 mm for the 1978-79 broods (Jonasson and Lindsay 1988).

Age Structure

Adult scale analysis indicates that the native stock of fall chinook primarily migrates as sub-yearling smelts (i.e. age O+ fish; Tables 8 and 9; see ADULT LIFE HISTORY, Age Structure).

BIOCHEMICAL-GENETIC CHARACTERISTICS

Juvenile wild fall chinook were collected from the Deschutes River in 1984 and 1985 for electrophoretic analysis. An analysis of selected protein-coding loci resolved seventeen enzyme systems for the 1984 sample, and 18 enzyme systems for the 1985 sample (Appendix Table 3). In the 1984 sample one rare allele was detected at the isocitrate dehydrogenase (sIDH-1,2) locus.

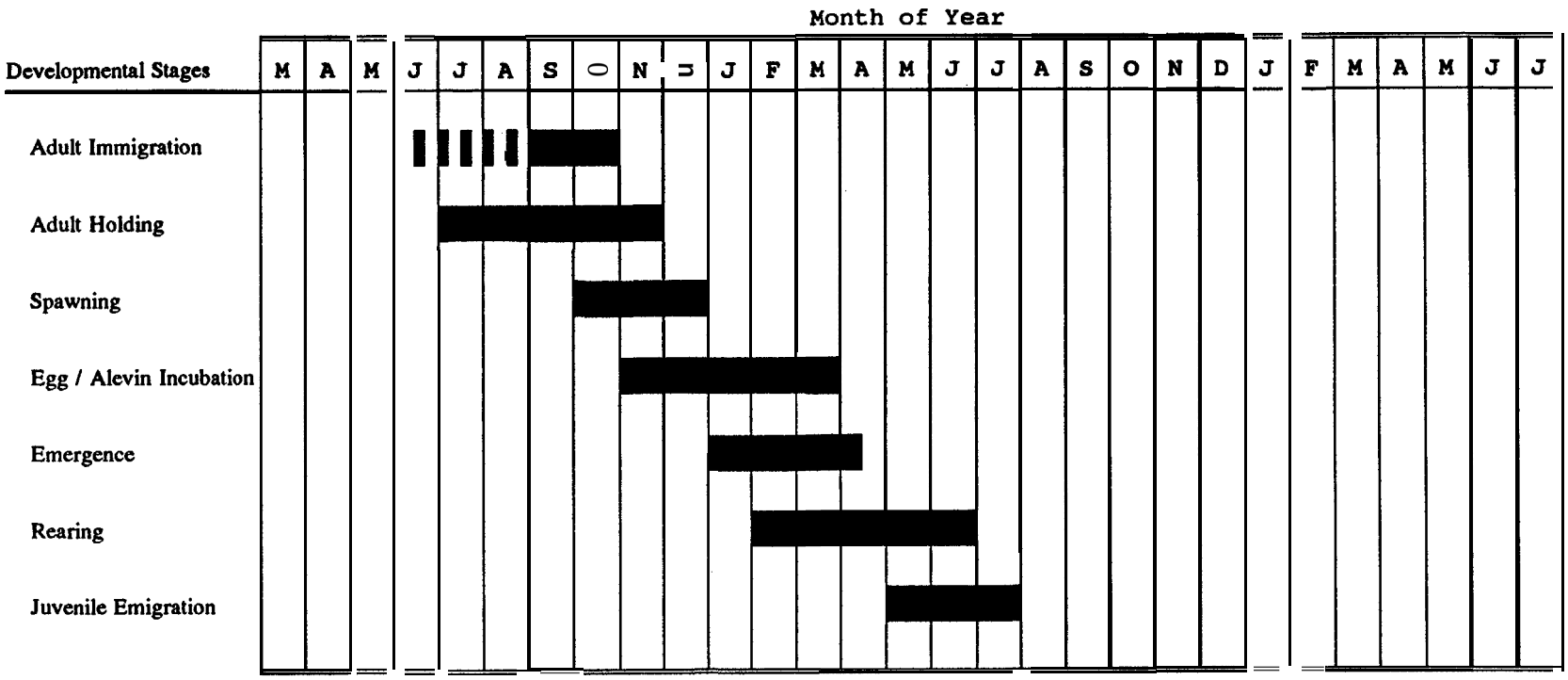
Columbia River Basin stocks of fall chinook were compared based on a cluster analysis of selected electrophoretic, meristic, morphometric, and life history characteristics (Schreck et

al. 1986). The analysis grouped fall chinook from the DesChutes River subbasin with stocks of hatchery and wild fall chinook from the Cowlitz River up to Hanford Reach, and two hatchery spring chinook stocks from the lower Columbia. This group is characterized by the latest average time of freshwater entry, the lowest average number of scales in the lateral series, scales above the lateral line and vertebrae, and the lowest frequency of the common dipeptidase allele. In general, the streams of the wild stocks are located in areas that experience mild, moist climates, and are at low elevations, near the mouth of the Columbia River, with gentle stream gradients.

A cluster analysis of various stocks of spring, fall, and summer races of chinook salmon in the Columbia River Basin indicate that wild fall chinook in the DesChutes River subbasin are more similar to wild and hatchery components of stocks of fall chinook, spring chinook from west of the Cascade Mountains, and summer chinook from the upper Columbia River than with spring chinook from east of the Cascades and summer chinook from Idaho.

DISEASES

Ceratomyxa shasta is the only parasite or infectious disease agent of wild fall chinook that has been detected in the DesChutes River subbasin (Table 10).



1. Solid bars indicate periods of heaviest adult immigration, spawning, and juvenile emigration.

Figure 1 (TT). Fall chinook freshwater life history in the Deschutes River subbasin (Oregon Department of Fish and Wildlife and Confederated Tribes of the Warm Springs Reservation of Oregon 1990).

Table 1 (HB-1). Estimated amount of spawning and rearing habitat by quality of Deschutes River subbasin fall chinook production area[a].

Distance/ Area	Excellent	Good	Fair[b]	Poor[b]	Unknown	Total	Confi-dence
Miles (%)	0.0	18.0	82.0	0.0	--	71.1	--
Acres (%)	--	--	--	--	--	--	--

[a] Estimates are modified from the Northwest Power Planning Council's presence/absence database.
[b] Ratings of fair and poor habitat quality may reflect natural physical features such as waterfall barriers, as well as degradation caused by humans.

Table 2 (HB-2). Estimated amount of rearing only habitat by quality of Deschutes River subbasin fall chinook production area[a].

Distance/ Area	Excellent	Good	Fair[b]	Poor[b]	Unknown	Total	Confi-dence
Miles (%)	0.0	0.0	60.1	39.9	--	24.8	--
Acres (%)	--	--	--	--	--	--	--

[a] Estimates are modified from the Northwest Power Planning Council's presence/absence database.
[b] Ratings of fair and poor habitat quality may reflect natural physical features such as waterfall barriers, as well as degradation caused by humans.

Table 3 (IR-a). Releases of coded wire tagged wild fall chinook salmon into the Deschutes River subbasin[a], by brood year.

Brood Year	Stock	Hatchery	Life stage	Release Data (1)	Release Data (2)	Fork[b] length	Number Released	Release[c] Location	CUT/ Fin clip
1977	Deschutes	--	--	04/01/78:	07/31/78:	72.2	2,357	WSR to Sherars Falls	H7-02-01
1977	Deschutes	--	--	09/01/78[d]	11/30/78[d]	104.0	315	USR to Sherars Falls	H7-02-02
1977	Deschutes	--	--	07/01/78[d]	08/31/78[d]	95.2	1,069	Pelton to USR	H7-02-03
1977	Deschutes	--	--	04/01/78[d]	07/31/78[d]	69.8	33,330	Pelton to WSR	H7-02-04
1977	Deschutes	--	--	04/01/78[d]	07/31/78[d]	75.0	3,712	Sherars Falls to mouth	H7-02-05
1977	Deschutes	--	--	06/15/78[e]	--	74.5	129	Deschutes River (RM 50)	07-16-06
1978	Deschutes	--	--	03/01/79[d]	07/31/79[d]	73.8	229	Deschutes River (RH 50)	07-18-28
1978	Deschutes	--	--	10/15/79[e]	--	110.0	270	Pelton to WSR	07-18-34
1978	Deschutes	--	--	03/01/79:	07/31/79[d]	73.5	13,670	WSR to Sherars Falls	07-18-35
1978	Deschutes	--	--	03/01/79[d]	07/31/79[d]	49.5	4,901	Sherars Falls to mouth	07-18-36
1978	Deschutes	--	--	04/01/79[d]	07/30/79[d]	68.0	20,119	Pelton to USR	07-18-37
1978	Deschutes	--	--	03/01/79[d]	06/31/79[d]	53.2	505	Deschutes River (RM 1)	07-16-62
1978	Deschutes	--	--	04/01/80[d]	06/30/80[d]	120.1	56	Pelton to WSR	07-21-45
1979	Deschutes	--	--	04/01/80[d]	07/30/80[d]	67.1	23,193	Petton to USR	07-21-45
1979	Deschutes	--	--	04/01/80[d]	07/30/80[d]	68.9	11,871	USR to Sherars Falls	07-21-46
1979	Deschutes	--	--	04/01/80[d]	07/30/80[d]	58.3	5,248	Sherars Falls to mouth	07-21-47
1979	Deschutes	--	--	05/01/80[d]	07/31/80[d]	99.2	1,677	Deschutes River (RM 50)	07-21-50
1979	Deschutes	--	--	08/15/79[e]	--	95.4	451	Pelton to USR	07-18-48

a Estimates for the 1977-79 brood releases are from Jonasson and Lindsay (1988).
b Fork length is measured in millimeters.
c USR = Uarm Springs River.
d Release dates unknown. Standardized to the first and last days of the months released.
e Release dates unknown. Standardized to the middle of the month for the month of release.

Table 4 (AE). Emigration of coded wire tagged wild fall chinook salmon released as juveniles in the Deschutes River subbasin[a,b].

Hatchery/Release Site	Recovery Site, Run Year(s)	Recovery Method	Number Recovered	Total Number Estimated, (PSMFC)
Deschutes River	Columbia River[c]	Trap Returns		
	1983	--	6	6
	1984	--	4	4

[a] Based on the following tag codes: 07-18-35, 07-18-37, 07-21-45, 07-21-46.
[b] Estimates are modified from the Pacific States Marine Fisheries Commission coded wire tag database.
[c] Recovery site in the mainstem Columbia River below Bonneville Dam.

Table 5 (AI-l). Non-harvest recoveries of coded wire tagged wild fall chinook salmon in the Deschutes River subbasin[a, b].

Hatchery/Release Site	Recovery Site, Run Year(s)	Recovery Method	Number Recovered	Total Number Estimated, (PSMFC)
Deschutes River	Deschutes River	Spawner Surveys		
	1979	--	2	2
	1980	--	2	2
	1981	--	30	30
	1982	--	20	20
	1983	--	18	18
Deschutes River	Deschutes River	Trap returns		
	1979	--	36	42
	1980	--	12	13
	1981	--	4	4
	1982	--	2	2

[a] Based on the following tag codes: 07-18-35, 07-18-37, 07-18-48, 07-21-45, 07-21-46, H7-02-03, H7-02-04.
[b] Estimates are modified from the Pacific States Marine Fisheries Commission coded wire tag database.

Table 6 (AI-2). Non-harvest recoveries of coded wire tagged hatchery fall chinook salmon in the Deschutes River subbasin[a,b].

Hatchery/Release Site	Recovery Site, Run Year(s)	Recovery Method	Number Recovered	Total Number Estimated, (PSMFC)
Columbia River[c]	Deschutes River	Spawner Surveys		
	1984	--	1	1
Klamath River	Deschutes River	Spawner Surveys		
	1985	--	1	1
Rogue River	Deschutes River	Spawner Surveys		
	1982	--	1	1
Klamath River	Deschutes River	Trap Returns		
	1982	--	1	1
Klickitat River	Deschutes River	Trap Returns		
	1979	--	2	2
	1980	--	1	1
Trinity River	Deschutes River	Trap Returns		
	1978	--	1	1
	1979	--	--	--
	1980	--	--	--
	1981	--	--	--
	1982	--	--	--
	1983	--	1	1

[a] Based on the following tag codes from hatchery reared fish: 06-59-02, 06-59-19, 06-61-01, 06-61-21, 07-18-53, 63-16-05, 63-16-63. Based on the following tag codes from fish of unknown rearing type (assumed to be hatchery): 03-17-33.
[b] Estimates are modified from the Pacific States Marine Fisheries Commission coded wire tag database.
[c] Release site in the mainstem Columbia River below Bonneville Dam.

Table 7 (AL). Mean fork length by brood year and age class (freshwater.ocean) for wild fall chinook originating in the Deschutes River subbasin[a].

Brood Year	Mean Fork Length (cm)									
	1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3
1973	--	--	--	96	--	--	96	--	--	--
N	--	--	--	--	--	--	--	--	--	--
st. dev.	--	--	--	--	--	--	--	--	--	--
1974	--	--	86	92	--	77	102	--	--	--
N	--	--	--	--	--	--	--	--	--	--
st. dev.	--	--	--	--	--	--	--	--	--	--
1975	--	61	84	93	54	78	--	--	--	--
N	--	--	--	--	--	--	--	--	--	--
st. dev.	--	--	--	--	--	--	--	--	--	--
1976	43	62	86	91	57	78	91	--	--	--
N	--	--	--	--	--	--	--	--	--	--
st. dev.	--	--	--	--	--		--	--	--	--
1977	45	64	85	96	52	76	--	--	--	--
N	--	--	--	--	--	--	--	--	--	--
st. dev.	--	.-	--	--	--	--	--	--	--	--
1978	43	60	87	96	53	--	90	--	--	--
N	--	--	--	--	--	--	--	--	--	--
st. dev.	--	--	--	--	--	--	--	--		--

Table 7 (AL). (cent.) Mean fork length by brood year and age class (freshwater.ocean) for wild fall chinook originating in the Deschutes River subbasin[a].

Mean Fork Length (cm)

Brood Year		1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3
1979	44	70	86	97	--	82	--	--	[illegible]	[illegible]	
N	--	--	--	--	--	--	--	--	--	--	--
st. dev.	--	--	--	--	--	--	--	--	--	--	--
1980	45	66	89	--	60	89	--	--	[illegible]	[illegible]	
N	--	--	--	--	--	--	--	--	--	--	--
st. dev.	--	--	--	--	--	--	--	--	--	--	--
1981	46	70	--	--	--	--	--	--	--	--	--
N	--	--	--	--	--	--	--	--	--	--	--
st. dev.	--	--	--	--	--	--	--	--	--	--	--
1982	53	--	--	--	--	--	--	--	--	--	--
N	--	--	--	--	--	--	--	--	--	--	--
st. dev.	--	--	--	--	--	--	--	--	--	--	--

[a]Estimates for the 1973-82 broods are from the Oregon Department of Fish and Wildlife (unpublished data).

Table 8 (AC). Age composition (freshwater.ocean) by brood year for wild fall chinook originating in the Deschutes River subbasin[a].

Brood Year	N	Age Composition (%) 1.1	1.2	1.3	1.4	1.5	2.1	2.2	2.3	3.1	3.2	393
1975	--	29	28	34	4	<1	1	3	0	--	--	--
1976	--	38	28	27	4	0	2	<1	<1	--	--	--
1977	--	40	27	27	4	0	<1	1	<1	--	--	--
1978	--	24	27	40	4	<1	2	<1	2	--	--	--
1979	--	29	43	22	3	<1	<1	3	<1	--	--	--
1980	--	44	20	28	4	<1	1	1	2	--	--	--

[a] Estimates for the 1975-80 brood years are modified from Jonasson and Lindsay (1988).

Table 9 (AC-a). Age composition (freshwater.ocean) by run year for wild fall chinook originating in the Deschutes River subbasin[a].

Run Year	N	Age Composition (%) 1.1	1.2	1.3	1.4	1.5	2.1	2.2	2.3	3.1	3.2	3.3
1978	--	30	17	40	7	0	1	1	4	--	--	--
1979	--	44	14	26	9	<1	2	2	2	--	--	--
1980	--	41	30	23	4	<1	1	<1	0	--	--	--
1981	--	25	29	37	4	<1	3	1	1	--	--	--
1982	--	26	33	34	5	0	<1	<1	<1	--	--	--
1983	--	13	26	41	9	0	2	5	4	--	--	--
1984	--	--	--	--	--	--	--	--	--	--	--	--
1985	--	4	23	56	11	0	1	4	1	--	--	--

[a]Estimates for the 1978-85 run years are from the Oregon Department of Fish and Wildlife (unpublished data).

Table 10 (TD). Parasites and diseases of wild fall chinook salmon located in the Deschutes River subbasin.

Disease type	Hatchery	Specific Pathogen
Parasite	--	*Ceratomyxa shasta*

[a] Data are from Jonasson and Lindsay (1988).

REFERENCES

Jonasson B.C. and R.B. Lindsay. 1988. Fall chinook salmon in the Deschutes River, Oregon. Information Reports (Fish) 88-6 of Oregon Department of Fish and Wildlife, Research and Development Section, Portland, Oregon.

Oregon Department of Fish and Wildlife and Confederated Tribes of the Warm Springs Reservation of Oregon. 1990. Deschutes River subbasin salmon and steelhead production plan. Columbia Basin System Planning Report to Northwest Power Planning Council, Portland, Oregon.

Schreck, C. B., H.W. Li, R.C. Hjort, C.S. Sharpe. 1986. Stock identification of Columbia River chinook salmon and steelhead trout. Final Report of Oregon Cooperative Fisheries Unit, Oregon State University (Project 83-451, Agreement DE-A179-83 BP 13499), to Bonneville Power Administration, Portland, Oregon.

DESCHUTES RIVER SUBBASIN

Hatchery Produced Fall Chinook Salmon

ORIGIN

The first recorded release of juvenile hatchery fish into the subbasin is the 1967 brood release of fry from the Little White Salmon stock ('Table 1). The subbasin was supplemented with juvenile hatchery fish in 1967 and 1968 (Table 1). In 1958 eggs were incubated in matchboxes located in the subbasin (Lindsay et al. 1989). Non-indigenous stocks introduced into the subbasin include the Little White Salmon stock (Table 1) and an unknown stock of eggs obtained from Spring Creek Hatchry (Lindsay et al. 1989). There is currently no hatchery supplementation program in the Deschutes River subbasin.

DISTRIBUTION

Subbasin

Juvenile hatchery fall chinook were released into the Warm Springs River drainage (Table 1).

PRODUCTION

Releases

Egg

The DesChutes River subbasin was supplemented with eggs in 1958 (Lindsay et al. 1989).

Fry

There are no records of releases in the subbasin.

Fingerling

Hatchery facilities in which fingerlings were reared or acclimated prior to release in the subbasin include Little White Salmon Hatchery (Table 1). Annual numbers released ranged from 502,500 to 1,000,000 fish (Table 1). Size at release ranged from 1,139.0 to 856.0 fish per pound (Table 1).

Smelt

There are no records of releases in the subbasin.

Jack and Adult

There are no records of releases in the subbasin.

ADULT LIFE HISTORY

Escapement

Hatchery Facilities

Numbers: No brood year specific estimates of escapement are available at hatchery

facilities located in the subbasin. Run year specific estimates of naturally and hatchery produced fall chinook escapement, to hatchery facilities located in the subbasin, are available in Jonasson and Lindsay (1988) and from Oregon Department of Fish and Wildlife (unpublished data).

Table 1 (IR). Hatchery releases of fall chinook salmon into the Deschutes River subbasin by brood yeer and if marked, by co

Brood Year	Stock	Hatchery	Life Stage	Release Date (1)	Release Date (2)	Fish/ lb	Number Released	Re 1•ase Location	CUT/ Fin clip
1967	L White Salmon	Unknown	fins.	01/01/67[b]	12/31/6$	1 139.0	502,500	Warm Springs River	·-
1968	L Whi te Salmon	Unknown	fins.	01/01/68[b]	12/31/68	'856.0	1,000,000	Warm Springs River	··

[a] Estimates are from Lindsay et al. (1989).
[b] Release dates unknown (only the year of release known). Standardi zed to the first and last day of the year.

REFERENCES

Lindsay, R.B., B.C. Jonasson, and R.K. Schroeder. 1989. Spring chinook salmon in the Deschutes River, Oregon. Information Reports (Fish) 89-4 of Oregon Department of Fish and Wildlife, Research and Development Section, Portland, Oregon.

DESCHUTES RIVER SUBBASIN

Naturally Produced Coho Salmon

GEOGRAPHIC LOCATION

The Deschutes River subbasin covers 10,500 square miles of central Oregon and is the second largest subbasin in the state. From its source in the Cascade Mountains, it flows north to where it enters the Columbia River 205 miles from the ocean. The Deschutes River is located above Bonneville and The Dalles dams.

ORIGIN

Coho are indigenous to the Deschutes River subbasin. Non-indigenous stocks introduced into the subbasin include unknown stocks of fish obtained from Carson National Fish Hatchery and an unknown hatchery of origin (see DESCHUTES RIVER SUBBASIN, Hatchery Produced Coho Salmon, PRODUCTION).

DISTRIBUTION

Subbasin

Spawning and rearing habitat is considered to be the primary limiting factor in the subbasin. An estimated 2.8 miles of spawning and rearing habitat is believed to be available in the mainstem of the Deschutes River. The habitat is rated as good (Tables 1 and 2).

ADULT LIFE HISTORY

Strays

The only information on stray coho in the subbasin is the recovery of one coded wire tagged hatchery adult coho released as a juvenile fish in Tanner Creek (Table 3).

Table 1 (HB-1). Estimated amount of spawning and rearing habitat by quality of Deschutes River subbasin coho production area[a].

Distance/ Area	Excellent	Good	Fair[b]	Poor[b]	Unknown	Total	Confi-dence
Miles (%)	0.0	100	0.0	0.0	--	2.8	--
Acres (%)	--	--	--	--	--	--	--

[a] Estimates are modified from the Northwest Power Planning Council's presence/absence database.
[b] Ratings of fair and poor habitat quality may reflect natural physical features such as waterfall barriers, as well as degradation caused by humans.

Table 2 (HB-2). Estimated amount of rearing only habitat by quality of Deschutes River subbasin coho production area[a].

Distance/ Area	Excellent	Good	Fair[b]	Poor[b]	Unknown	Total	Confi-dence
Miles (%)	0.0	0.0	0.0	0.0	--	0.0	--
Acres (%)	--	--	--	--	--	--	--

[a] Estimates are modified from the Northwest Power Planning Council's presence/absence database.
[b] Ratings of fair and poor habitat quality may reflect natural physical features such as waterfall barriers, as well as degradation caused by humans.

Table 3 (AI). Non-harvest recoveries of coded wire tagged hatchery coho salmon in the Deschutes River subbasin[a, b].

Hatchery/Release Site	Recovery Site, Run Year(s)	Recovery Method	Number Recovered	Total Number Estimated, (PSMFC)
Tanner Creek	Deschutes River 1983	Trap returns --	1	1

[a] Based on the following tag codes: 07-27-47.
[b] Estimates are modified from the Pacific States Marine Fisheries Commission coded wire tag database.

DESCHUTES RIVER SUBBASIN

Hatchery Produced Coho Salmon

ORIGIN

The first recorded release of juvenile hatchery fish into the subbasin is the 1965 release of an unknown stock of hatchery fish obtained from Carson National Fish hatchery (Table 1). The subbasin was supplemented with juvenile hatchery fish in 1965 and adult fish were outplanted into the subbasin from 1966-68 and in 1970 (T'able 1). Eggs obtained from the 1958, 1963-64 and 1966 broods were incubated in matchboxes located in the Warm Springs River drainage (Lindsay et al. 1989). Non-indigenous stocks introduced into the subbasin include unknown stocks of eggs obtained from Eagle Creek and Carson national fish hatcheries and unknown stocks of juvenile fish obtained from Oxbow and Little White Salmon hatcheries (Table 1). There is currently no hatchery supplementation program in the DesChutes River subbasin.

DISTRIBUTION

Subbasin

Fingerling and adult coho were released into the Warm Springs River drainage (Table 1).

PRODUCTION

Releases

Egg

The Deschutes River subbasin was supplemented with coho eggs in 1958, 1963-64, and 1966 (Lindsay et al. 1989).

Fry

There are no records of releases in the subbasin.

Fingerling

Hatchery facilities in which fingerlings were reared or acclimated prior to release in the subbasin include Carson National Fish Hatchery and one unknown hatchery of origin (Table 1). One release of 683,750 fingerlings was made in 1965 (Table 1). Size at release ranged from 60.0 to 25.0 fish per pound.

Smelt

Table 1 (IR). Hatchery releases of coho salmon into the Deschutes River subbasin by brood year end if marked, by coded wire tag Codes.

Brood Year	Stock	Hatchery	Life Stage	Release Date (1)	Release Date (2)	Fish/ lb	Number Released	Release Location	CWT/ Fin clip
..	Unknown	Carson	fing.	01/01/65;	12/31/65:	60.0	515,000	Warm Springs River	--
..	Unknown	Carson	fing.	01/01/65[b]	12/31/65[b]	25.0	34,425	Badger Creek	--
..	Unknown	Carson	fing.	01/01/65[b]	12/31/65[b]	- -	100,000	Beaver Creek	..
..	Unknown	Carson	fing.	01/01/65[b]	12/31/65[b]	25.0	34,325	Warm Springs River	..
..	Unknown	Unknown	adult	01/01/66[b]	[illegible]	--	417	Shitike Creek	..
..	Unknown	Unknown	adult	01/01/6$	12/31/67[b]	--	450	Shit i ke Creek	--
..	Unknown	Unknown	adult	01/0 1/68[b]	12/31/68[b]	--	717	Shit ike Creak	..
..	Unknown	Unknown	adult	01/01/70	12/31/70	--	1	Beavar Creek	--

[a] Estimates are from Lindsay et al. (1989).
[b] Release dates unknown (only the yaar of release known). Standardi zed to the first and last day of the year.

REFERENCES

Lindsay, R.B., B.C. Jonasson, and R.K. Schroeder. 1989. Spring chinook salmon in the Deschutes River, Oregon. Information Reports (Fish) 89-4 of Oregon Department of Fish and Wildlife, Research and Development Section, Portland, Oregon.

DESCHUTES RIVER SUBBASIN

Naturally Produced Sockeye Salmon

GEOGRAPHIC LOCATION

The DesChutes River subbasin covers 10,500 square miles of central Oregon and is the second largest subbasin in the state. From its source in the Cascade Mountains, it flows north to where it enters the Columbia River 205 miles from the ocean. The DesChutes River is located above Bonneville and The Dalles dams.

ORIGIN

Sockeye are indigenous to the Deschutes River subbasin. The native stock "was most likely the parent stock that developed into the landlocked population in Lake Billy Chinook. This population may have been influenced by the kokanee stocking programs in the upper lakes and reservoirs. " (Oregon Department of Fish and Wildlife and Confederated Tribes of the Warm Springs Reservation of Oregon 1990). Stocks introduced into the subbasin include unknown stocks of fish obtained from Leavenworth National Fish Hatchery and Round Butte Hatchery (see DESCHUTES RIVER SUBBASIN, Hatchery Produced Sockeye Salmon, PRODUCTION).

DISTRIBUTION

Subbasin

Sockeye (Oncorhynchus nerka) historically occurred in the DesChutes River Subbasin (Nielsen 1950, cited by Oregon Department of Fish and Wildlife and Confederated Tribes of the Warm Springs Reservation of Oregon 1990) and (Haas and Warren 1961, cited by Oregon Department of Fish and Wildlife and Confederated Tribes of the Warm Springs Reservation of Oregon 1990) and (Fulton 1970, cited by Oregon Department of Fish and Wildlife and Confederated Tribes of the Warm Springs Reservation of Oregon 1990). "The run originated in Suttle Lake. Construction of a small power dam and installation of screens at the outlet of Suttle Lake in the 1930s reduced passage of sockeye salmon to and from the lake" (Nielsen 1950, cited by Oregon Department of Fish and Wildlife and Confederated Tribes of the Warm Springs Reservation of Oregon 1990) and (Fulton 1970, cited by Oregon Department of Fish and Wildlife and Confederated Tribes of the Warm Springs Reservation of Oregon 1990), but did not eliminate the run in the Deschutes River (Oregon Department of Fish and Wildlife and Confederated Tribes of the Warm Springs Reservation of Oregon 1990). "Access to the upper DesChutes Basin was impeded to anadromous salmonids with the completion of Pelton and Round Butte dams in 1958 and 1964, respectively. Adult passage past the dams continued until 1968 when downstream passage facilities at the dams proved insufficient to sustain natural runs above the dams. Poor passage of downstream migrants at Round Butte Dam was attributed to early stratification of the reservoir and surface currents that attracted downstream migrants away from the dam" (Kern et al. 1967, cited by Oregon Department of Fish and Wildlife and Confederated Tribes of the Warm Springs Reservation of Oregon 1990). "Lake Billy Chinook now has a large population of kokanee (landlocked sockeye salmon). Currently, a small run of sockeye salmon is maintained by incidental passage of smelts thorough the dam turbines. " (Oregon Department of Fish and Wildlife and Confederated Tribes of the Warm Springs Reservation of Oregon 1990).

Approximations of the temporal distribution of adult immigration, adult holding, spawning, incubation, emergence, rearing, and juvenile outmigration were reported in Oregon Department of Fish and Wildlife and Confederated Tribes of the Warm Springs Reservation

of Oregon (1990) and are presented in Figure 1. The methodology used to generate these approximations is unknown.

PRODUCTION

Harvest

sport

Subbasin: No brood year specific estimates are available. Run year specific estimates are available in Oregon Department of Fish and Wildlife and Confederated Tribes of the Warm Springs Reservation of Oregon (1990).

Treaty

Subbasin: No brood year specific estimates are available. Run year specific estimates are available in Oregon Department of Fish and Wildlife and Confederated Tribes of the Warm Springs Reservation of Oregon (1990).

ADULT LIFE HISTORY

Escapement

Subbasin

Numbers: No brood year specific estimates are available. Run year specific estimates are available in Oregon Department of Fish and Wildlife and Confederated Tribes of the Warm Springs Reservation of Oregon (1990).

Spawning Area

Timing: Prior to completion of the Pelton-Round Butte hydroelectric complex in 1964 spawning was documented as occurring from mid-September through November in the upper subbasin (Oregon Department of Fish and Wildlife and Confederated Tribes of the Warm Springs Reservation of Oregon 1990).

Strays

One coded wire tagged sockeye was recovered at a trapping facility in the DesChutes River subbasin. The adult sockeye was marked and released as a juvenile fish in the mainstem Columbia River below Bonneville (Table 1).

Fork Length

"Adult sockeye salmon capured at the Sherars Falls trap averaged 21 inches fork length with a range of 16.5 inches to 22.2 inches. " (Oregon Department of Fish and Wildlife and Confederated Tribes of the Warm Springs Reservation of Oregon 1990).

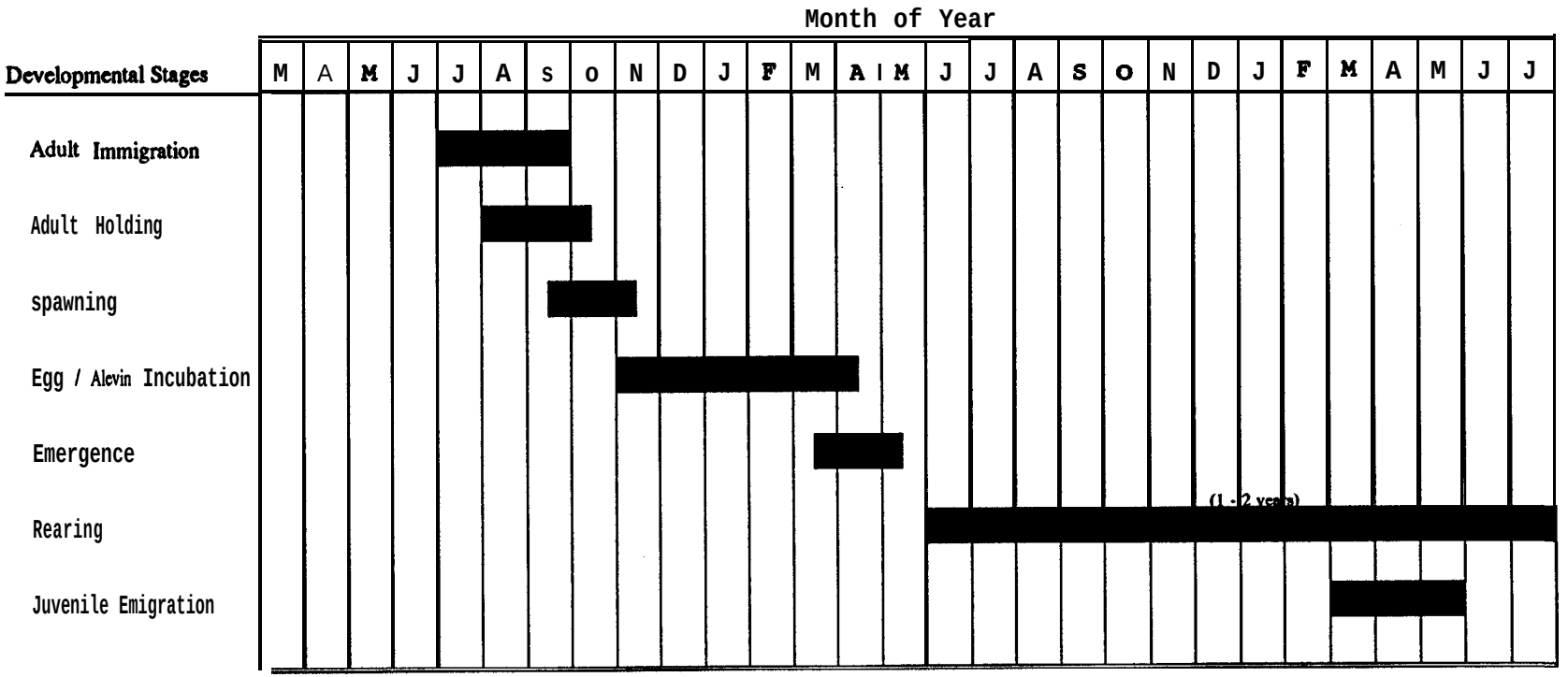


Figure 1 (TT). Sockeye salmon freshwater life history in the Deschutes River subbasin (Oregon Department of Fish and Wildlife and Confederated Tribes of the Warm Springs Reservation of Oregon 1990).

Table 1 (AI). Non-harvest recoveries of coded wire tagged hatchery sockeye salmon in the Deschutes River subbasin[a,b].

Hatchery/Release Site	Recovery Site, Run Year(s)	Recovery Method	Number Recovered	Total Number Estimated, (PSMFC)
Columbia River[c]	Deschutes River 1987	Trap returns --	1	1

[a] Based on the following tag codes: 23-17-52.
[b] Estimates are modified from the Pacific States Marine Fisheries Commission coded wire tag database.
[c] Release site in the mainstem Columbia River below Bonneville Dam.

REFERENCES

Fulton, L.A. 1970. Spawning areas and abundance of steelhead trout and coho, sockeye, and chum salmon in the columbia River Basin - past and present. National Marine Fisheries Service Scientific Report (Fisheries) 618. (As reported in Oregon Department of Fish and Wildlife and Confederated Tribes of the Warm Springs Reservation of Oregon 1990.)

Haas, J. B., and H.C. Warren. 1961. Environmental survey report pertaining to salmon and steelhead in certain rivers of Eastern Oregon and Willamette River and its tributaries Part III, Survey Reports of the Deschutes and John Day Rivers and Fifteenmile Creek. Fish Commission of Oregon, Research Division, Processed Report. (As reported in Oregon Department of Fish and Wildlife and Confederated Tribes of the Warm Springs Reservation of Oregon 1990.)

Kom, L., L.H. Hreha, R.G. Montagne, W.G. Mullarkey, and E.J. Wagner. 1967. The effect of small impoundments on the behavior of juvenile anadromous salmonids. Fish Commission of Oregon, Research Division. (As reported in Oregon Department of Fish and Wildlife and Confederated Tribes of the Warm Springs Reservation of Oregon 1990.)

Nielson, R.S. 1950. Survey of the Columbia River and its tributaries. Part 5, Area IV. U.S. Fish and Wildlife Service, Special Scientific Report (Fisheries) 38. (As reported in Oregon Department of Fish and Wildlife and Confederated Tribes of the Warm Springs Reservation of Oregon 1990.)

Oregon Department of Fish and Wildlife and Confederated Tribes of the Warm Springs Reservation of Oregon. 1990. Deschutes *River* subbasin salmon and steelhead production plan. Columbia Basin System Planning Report to Northwest Power Planning Council, Portland, Oregon.

DESCHUTES RIVER SUBBASIN

Hatchery Produced Sockeye Salmon

ORIGIN

The first recorded release of juvenile hatchery fish into the subbasin is the 1957 release of an unknown stock of fingerlings obtained from Leavenworth National Fish Hatchery (Table 1). The subbasin was supplemented with juvenile hatchery fish in 1957 and adult fish were outplanted into the subbasin in 1970. Stocks introduced into the subbasin include unknown stocks of juvenile hatchery fish obtained from Leavenworth Hatchery and adult fish obtained from Round Butte Hatchery (Table 1). There is currently no hatchery supplementation program in the DesChutes River subbasin.

DISTRIBUTION

Subbasin

Fingerlings were released into Long Lake in 1957 and adult fish were released into Beaver Creek in 1970.

PRODUCTION

Releases

Egg

There are no records of releases in the subbasin.

Fry

There are no records of releases in the subbasin.

Fingerling

Hatchery facilities in which fingerlings were reared or acclimated prior to release in the subbasin include Leavenworth National Fish Hatchery (Table 1). One release of 30,000 fish was made in 1957 (Table 1). Size at release is unknown (Table 1).

Smelt

There are no records of releases in the subbasin.

Jack and Adult

Hatchery facilities in which adult fish were held prior to release in the subbasin include Round Butte Hatchery (Table 1). One release of 19 adult fish was made in 1970 (Table 1).

ADULT LIFE HISTORY

Escapement

Hatchery Facilities

Numbers: No **brood year specific** estimates of escapement are available at hatchery facilities located in the **subbasin.** Run year specific estimates are available in Oregon **Departm**ent of Fish and Wildlife and Confederated Tribes of the Warm Springs **Reservation** of **Oregon (1990).**

Table 1 (IR). Hatchery releases of sockeye salmon into the Deschutes River subbasin by brood year and if marked, by coded wire tag code[a].

Brood Year	Stock	Hatchery	Life Stage	Release Date (1)	Release Date (2)	Fish/ lb	Number Released	Release Location	CWT/ Fin clip
..	unknown	LeavenNorth NFH	fing.	01/01/57[b]	12/31/57[b]	-	30,000	Long Laka	..
--	Unknown	Round Butta	adult	01/01/70[b]	12/31/70[b]	--	19	Beaver Creek	..

[a] Eat imates are from the Oregon Department of Fish and Wildl if e and Confederated Tribes of the Warm Springs Reservation of Oregon (1990).
[b] Release dates unknown (onl y the year of release known). Standardi zad to the first and last day of the year.

REFERENCES

Oregon Department of Fish and Wildlife and Confederated Tribes of the Warm Springs Reservation of Oregon. 1990. Deschutes River subbasin salmon and steelhead production plan. Columbia Basin System Planning Report to Northwest Power Planning Countil, Portland, Oregon.

DESCHUTES RIVER SUBBASIN

Naturally Produced Summer Steelhead

GEOGRAPHIC LOCATION

The Deschutes River subbasin covers 10,500 square miles of central Oregon and is the second largest subbasin in the state. From its source in the Cascade Mountains, it flows north to where it enters the Columbia River 205 miles from the ocean. The DesChutes River subbasin is located above Bonneville and The Dalles dams.

ORIGIN

Summer steelhead are indigenous to the DesChutes River subbasin. Non-indigenous stocks introduced into the subbasin include the Skamania and Siletz stocks (see DESCHUTES RIVER SUBBASIN, Hatchery Produced Summer Steelhead, PRODUCTION). Stray hatchery summer steelhead originating from various Columbia River Basin stocks are also recovered in the subbasin (see ADULTS LIFE HISTORY, Strays). Natural production is believed to occur as the result of hatchery supplementation in the subbasin.

DISTRIBUTION

Subbasin

Wild summer steelhead historically spawned in the mainstem Deschutes River and most tributaries, including the Metolius River, Crooked River, and Squaw Creek. Following completion of the Pelton-Round Butte hydroelectric complex in 1964 the distribution of summer steelhead has been restricted to areas below Pelton Deregulating Dam, located at RM 111 on the mainstem of the Deschutes River. Tributaries currently used for spawning include the Warm Springs and White rivers and Shitike, Trout, Bakeoven, Buck Hollow, Wapinitia, Eagle, and Nena creeks (Olsen et al. Undated; Figure 1). Spawning distribution in White River is limited to the area below White River Falls which is located at RM 2.0 in the mainstem of White River. Approximately 97% of the spawning in the mainstem of the DesChutes River is estimated to occur between RM 40 and Pelton Deregulating Dam (Olsen et al. Undated). Summer steelhead rear in the spawning tributaries and throughout the mainstem of the Deschutes River. The quality of the spawning and rearing habitat varies throughout the subbasin (Tables 1 and 2).

PRODUCTION

Harvest

sport

Subbasin: No brood year specific estimates of harvest are available. Run year specific estimates of harvest are available in Olsen et al. (Undated) and from Oregon Department of Fish and Wildlife (unpublished data).

Treaty

Subbasin: No brood year specific estimates of harvest are available. Run year specific estimates of harvest are available in Olsen et al. (Undated) and from Oregon Department of Fish and Wildlife (unpublished data).

ADULT LIFE HISTORY

Escapement

Subbasin

Timing: Data collected at a steeppass trap operated at Sherars Falls (RM 40 in the mainstem of the DesChutes River) provides the only long term estimates of run timing for unmarked summer steelhead in the DesChutes River subbasin. Sampling dates varied at the steeppass trap which was put into operation as early as mid-April and left in operation until as late as mid-November. The trap was installed in 1977 and a continuous data set is available for the 1977-78 through 1989-90 run years.

Unmarked summer steelhead can be found in the DesChutes River subbasin throughout the year. Unmarked summer steelhead were sampled at Sherars Falls as early as April 12 and as late as November 16 (Olsen et al. Undated). Median date of migration at Sherars Falls ranged from 29 August to 8 October (Olsen et al. Undated). Annual estimates of the temporal distribution of returns at Sherars Falls are available in Olsen et al. (Undated).

An approximation of the temporal distribution of adult returns was also reported in Oregon Department of Fish and Wildlife and Confederated Tribes of the Warm Springs Reservation of Oregon (1990) and is presented in Figure 2. The methodology used to generate this approximation is unknown.

Numbers: There are no brood year specific estimates of escapement to the subbasin. Run year specific estimates are available in Olsen et al. (Undated).

spawning Area

Timing: Spawning occurs from January through mid-April. Data collected on spawning ground surveys in Bakeoven Creek indicates that peak spawning occurs from mid-February through the end of March (Olsen et al. Undated; Figure 2).

Numbers: Spawning in the DesChutes River subbasin primarily occurs above Sherars Falls (personal communication., Jim Newton, Oregon Department of Fish and Wildlife, The Dalles, Oregon). For this reason it is believed that estimates of escapement past Sherars Falls approximate spawner escapement to the subbasin. Annual estimates of escapement past Sherars Falls were made beginning with the 1977-78 run year.

Annual estimates of escapement past Sherars Falls were made using Chapman's modification of the Petersen mark and recapture method. Summer steelhead are marked at Sherars Falls and recovered at WSNFH and at Pelton Trap. Factors that affect the accuracy of this estimate include harvest above the falls and the number of stray wild and hatchery fish that move out of the subbasin. It is believed, however, that harvest above the falls is negligible in relation to total escapement past Sherars Falls and that tagged and untagged fish migrate out of the subbasin at the same rate, therefore, reducing the bias associated With Straying.

No brood year specific estimates of spawner escapement are available for naturally produced summer steelhead or stray hatchery summer steelhead. Run year specific estimates of spawner escapement for these components of the run are available in Olsen et al. (Undated).

The number of Hatchery DesChutes stock summer steelhead that spawn in the wild is estimated as escapement passed Sherars Falls minus counts at Pelton Trap (RM 111 in the mainstem Deschutes River) and WSNFH (RM 9 in the mainstem Warm Springs River). Counts at Pelton Trap and WSNFH are subtracted from the estimate at Sherars Falls because most hatchery fish returning to each facility are either retained as hatchery broodstock or are killed (personal communication, Don Ratliff, Portland General Electric, Madras, Oregon;

personal communication, Doug Olsen, U.S. Fish and Wildlife Service, Vancouver, Washington). Few hatchery fish are recycled through the fishery.

Annual estimates of Hatchery Deschutes stock spawner escapement to the subbasin, by brood year, ranged from 556 to 8,164 adult fish (Table 3).

Spawning ground counts are available in Olsen et al. (Undated).

Strays

No stray wild summer steelhead have been recovered on spawning ground surveys or at hatchery facilities located in the Deschutes River subbasin. One stray coded wire tagged wild adult summer steelhead was recovered in the fishery located in the Deschutes River subbasin. The adult fish was marked and released in the Yakima River subbasin (Pacific States Marine Fisheries Commission coded wire tag database).

Coded wire tags were recovered from hatchery summer steelhead relined as juvenile fish in various subbasins located in the Columbia River Basin (Table 4). Stray hatchery summer steelhead originated in the Tucannon River subbasin in Washington and the Snake, Pahsimeroi, and Little Salmon river subbasins in Idaho (Table 4). There are no records of any summer steelhead recovered in the DesChutes River subbasin that originated in a coastal subbasin.

Fork Length

Fork length was estimated for unmarked summer steelhead collected at the Sherars Falls steeppass trap (see ADULT LIFE HISTORY, Escapement) and at WSNFH. No age specific information is available at either site.

Annual estimates of mean fork length ranged from 61 cm to 68 cm at the Sherars Falls steeppass trap (Table 5) and from 61 cm to 67 cm at WSNFH (Table 6).

Weight

No age specific estimates are available. Sample mean weights are available in Olsen et al. (Undated).

Sex Ratio

Sex ratios (percent females) were estimated for unmarked summer steelhead returning to Pelton Trap and the WSNFH. No age specific information is available at either site.

Annual estimates of sex ratio ranged from 60% to 78% at WSNFH (Table 7) and from 51% to 75 % at Pelton Trap (Table 8).

Repeat Spawners

Repeat spawners have been documented at Sherars Falls (Olsen et al. Undated) but the percentage of a given brood that return as repeat spawners is currently unknown.

BIOCHEMICAL-GENETIC CHARACTERISTICS

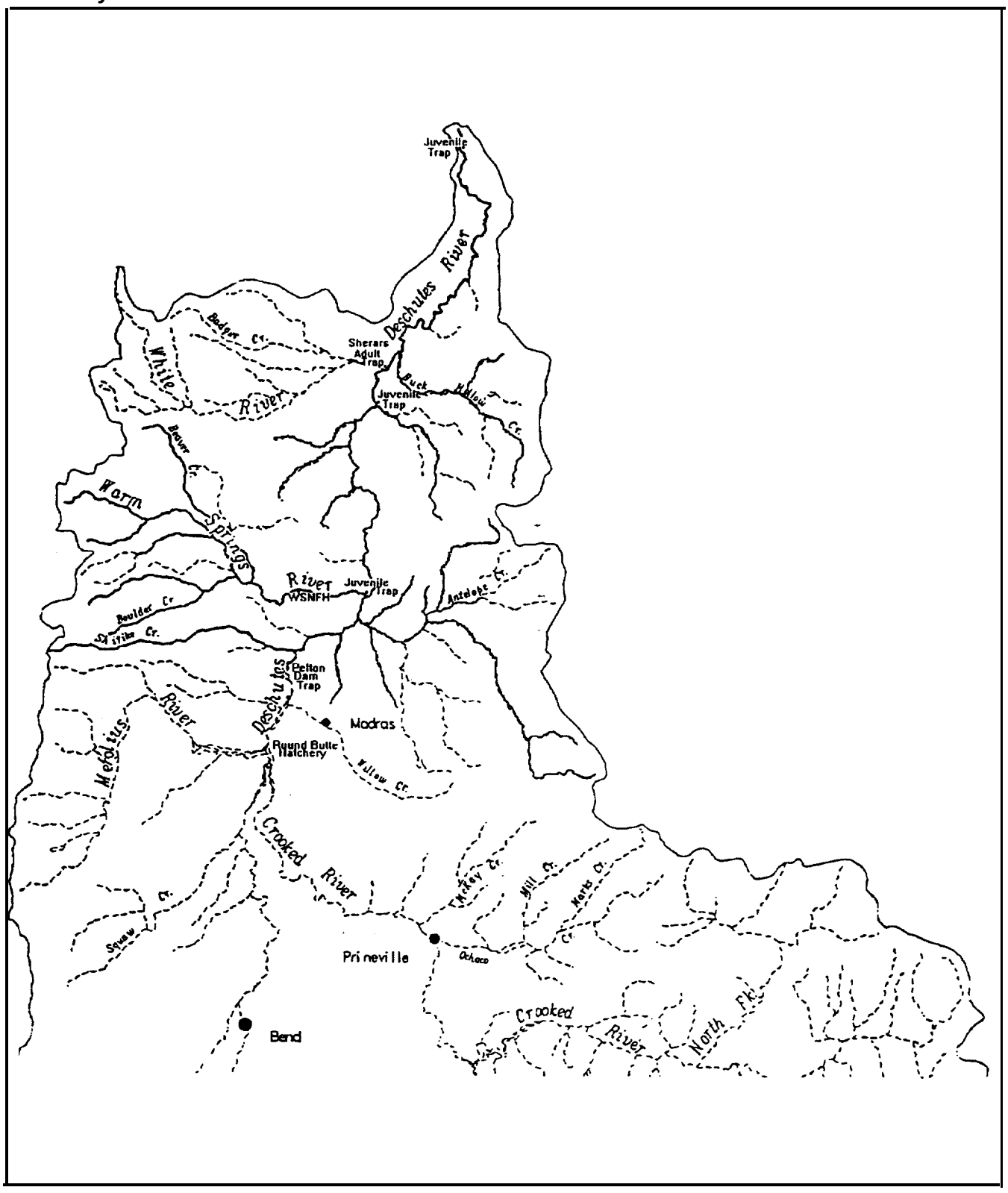
Naturally produced juvenile summer steelhead were sampled from the DesChutes River subbasin in 1984 (Schreck et al. 1986). Relative allele nobilities and allele frequencies were determined for 18 enzyme systems (Appendix Table 4). Seven rare alleles were detected in the sample; one each at the alcohol dehydrogenase (ADH), isocitrate dehydrogenase

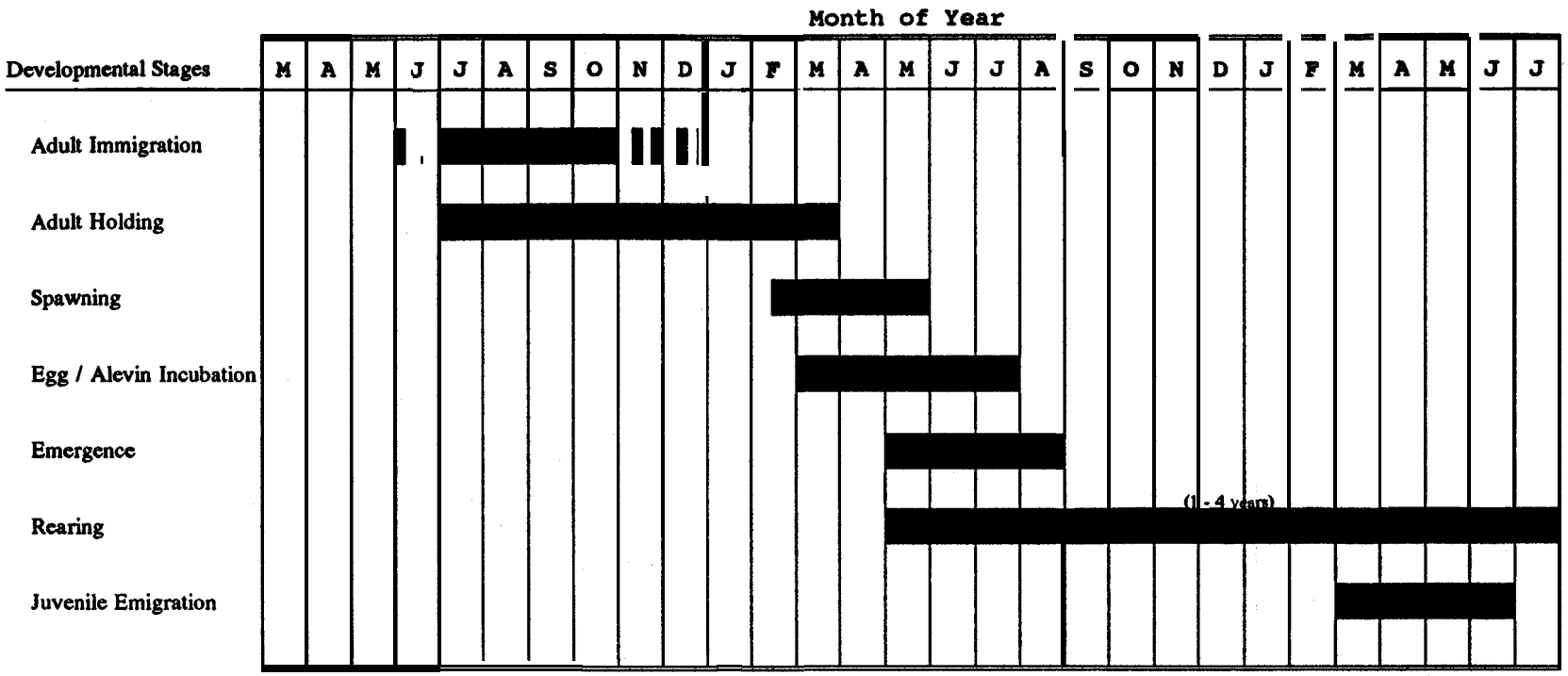
(sIDH-1,2), malate dehydrogenase (sMDH-A1,2), tripeptide aminopeptidase (PEPB-1) and phosphoglucomutase (PGM-1) loci, and two at the malate dehydrogenase (sMDH-B3,4) loci.

Columbia River Basin stocks of summer steelhead were compared based on a cluster analysis of selected electrophoretic, meristic, morphometric, and life history characteristics. The analysis grouped naturally produced summer steelhead in the Deschutes River subbasin with wild summer steelhead located in tributaries of the Columbia River, between Fifteenmile Creek and the Entiat River; the lower Snake River; and the Salmon River, tributary to the Snake River (Schreck et al. 1986). This group is characterized by the greatest average head length, head depth, and interorbital width, and the lowest average caudal peduncle length.

A cluster analysis of various stocks of summer and winter races of steelhead in the Columbia River Basin indicate that naturally produced summer steelhead in the Deschutes River subbasin are more similar to the wild and hatchery components of stocks of steelhead (primarily summer, but also including one winter steelhead stock) from east of the Cascade Mountains than With either wild or hatchery summer and winter steelhead stocks from west of the Cascades (Schreck et al. 1986).

Figure 1. Summer Steelhead distribution in the Deschutes River subbasin, based on the NPPC presence\absence data base (solid and dashed lines respectively) and the BPA Geographic Information System.





Notes:

1. Solid bars indicate periods of heaviest adult immigration, spawning, and juvenile emigration.

Figure 2 (TT). Summer steelhead freshwater life history in the Deschutes River subbasin (Oregon Department of Fish and Wildlife and Confederated Tribes of the Warm Springs Reservation of Oregon 1990).

Table 1 (HB-1). Estimated amount of spawning and rearing habitat by quality of Deschutes River subbasin summer steelhead production area[a].

Distance/ Area	Excellent	Good	Fair[b]	Poor[b]	Unknown	Total[c]	Confi- dence
Miles (%)	0.0	26.6	40.1	33.3	--	284.7	--
Acres (%)	--	--	--	--	--	--	--

[a] Estimates are modified from the Northwest Power Planning Council's presence/absence database.
[b] Ratings of fair and poor habitat quality may reflect natural physical features such as waterfall barriers, as well as degradation caused by humans .
[c] Does not include habitat in the White River drainage above White River Falls. Area was included in the Northwest Power Planning Council's database to account for habitat that would be utilized by summer steelhead when BPA implements a project to release adult summer steelhead above White River Falls.

Table 2 (HB-2). Estimated amount of rearing only habitat by quality of Deschutes River subbasin summer steelhead production area[a].

Distance/ Area	Excellent	Good	Fair[b]	Poor[b]	Unknown	Total[c]	Confi- dence
Miles (%)	0.0	12.0	29.3	58.7	--	112.7	--
Acres (%)	--	--	--	--	--	--	--

[a] Estimates are modified from the Northwest Power Planning Council's presence/absence database.
[b] Ratings of fair and poor habitat quality may reflect natural physical features such as waterfall barriers, as well as degradation caused by humans.
[c] Does not include habitat in the White River drainage above White River Falls. Area was included in the Northwest Power Planning Council's database to account for habitat that would be utilized by summer steelhead when BPA implements a project to release adult summer steelhead above White River Falls.

Table 3 (RN). Total spawning escapement of Hatchery Deschutes stock summer steelhead to the Deschutes River subbasin by brood year[a,b,c].

Brood Year	Total Age 2	3	4	5	6	Total	Adult Total
1975	2,689	1,010	--	--	--	3,699	3,699
1976	456	507	--	--	--	963	963
1977	2,259	1,650	--	--	--	3,909	3,909
1978	1,619	1,092	--	--	--	2,711	2,711
1979	826	1,400	--	--	--	2,226	2,226
1980	171	385	--	--	--	556	556
1981	4,336	3,315	--	--	--	7,651	7,651
1982	985	1,555	--	--	--	2,540	2,540
1983	2,677	3,708	--	--	--	6,385	6,385
1984	2,692	5,472	--	--	--	8,164	8,164
1985	2,240	1,699	--	--	--	3,939	3,939
1986	829	1,102	--	--	--	1,931	1,931

[a] Estimates are based on the assumption that spawning primarily occurs above Sherars Falls.

[b] Brood year reconstruction is based on the assumption that hatchery fish migrate as age 1+ smelts and that they return primarily as 1 and 2 salt adult fish.

[c] Estimates for the 1975-86 brood years are modified from Olsen et al. (Undated).

Table 4 (AI). Non-harvest recoveries of coded wire tagged hatchery summer steelhead in subbasin[a,b].

Hatchery/Release Site	Recovery Site, Run Year(s)	Recovery Method	Number Recovered	Total Est
Deschutes River	Deschutes River	Trap Returns		
	1981	--	17	
	1982	--	25	
EFk Salmon River	Deschutes River	Trap Returns		
	1987	--	1	
Grande Ronde	Deschutes River	Trap Returns		
	1981	--	1	
	1982	--	5	
	1983	--	4	
	1984	--	22	
	1985	--	16	
	1986	--	--	
	1987	--	23	
L Salmon River, ID	Deschutes River	Trap Returns		
	1985	--	6	
	1986	--	2	
	1987	--	2	
Pahsimeroi River	Deschutes River	Trap Returns		
	1981	--	2	
	1982	--	3	
	1983	--	35	
	1984	--	5	
	1985	--	4	
	1986	--	2	
	1987	--	1	
Snake River	Deschutes River	Trap Returns		
	1983	--	2	

Table 4 (AI). (cont.) Non-harvest recoveries of coded wire tagged hatchery summer steelhea
Deschutes River subbasin[a,b].

Hatchery/Release Site	Recovery Site, Run Year(s)	Recovery Method	Number Recovered	Total N Estim (
	1984	--	--	
	1985	--	1	
Tucannon River	Deschutes River	Trap Returns		
	1983	--	2	
Niagara Spr. Hat.	Deschutes River	Trap Returns		
	1986	--	2	
Hagerman NFH	Deschutes River	Trap Returns		
	1983	--	10	
	1984	--	3	
	1985	--	2	
	1986	--	3	
	1987	--	1	
Columbia River[c]	Deschutes River	Trap Returns		
	1981	--	4	
	1982	--	--	
	1983	--	--	
	1984	--	--	
	1985	--	1	
Columbia River[d]	Deschutes River	Trap Returns		
	1978	--	2	
Deschutes River	Deschutes River	Hatchery Returns		
	1983	--	6	
	1984	--	3	
	1985	--	7	
Snake River	Deschutes River	Hatchery Returns		
	1980	--	1	
Pahsimeroi River	Deschutes River	Hatchery Returns		
	1983	--	4	

Table 4 (AI). (cont.) Non-harvest recoveries of coded wire tagged hatchery summer steelhead in the Deschutes River subbasin[a,b].

Hatchery/Release Site	Recovery Site, Run Year(s)	Recovery Method	Number Recovered	Total Number Estimated, (PSMFC)
L Salmon R., ID	Deschutes River	Hatchery Returns		
	1987	--	1	1
Grande Ronde	Deschutes River	Hatchery Returns		
	1979	--	1	1
	1980	--	7	7
	1981	--	8	8
	1982	--	1	1
	1983	--	11	11
	1984	--	--	--
	1985	--	3	3
	1986	--	--	--
	1987	--	9	9
	1988	--	16	16
	1989	--	3	3
Columbia River[c]	Deschutes River	Hatchery Returns		
	1987	--	1	1
Hagerman NFH	Deschutes River	Hatchery Returns		
	1983	--	1	1

[a] Based on the following tag codes: 05-04-22, 05-04-23, 05-04-39*1, 05-06-35, 05-07-29, 05-13-36, 07-16-14, 07-16-27, 07-22-01, 07-22-02, 07-37-62, 07-37-63, 07-38-01, 07-38-02, 07-40-25, 07-40-26, 07-41-25, 07-41-26, 09-06-13, 09-16-36, 10-28-42, 23-16-05, 62-16-08, 62-16-27, 62-16-50*1, 63-28-39, 63-28-40, 63-33-06, LBPKLB, LNSM, ORYWYW*1. Based on the following tag codes from fish of unknown rearing type (assumed to be hatchery): $$YW*2, 05-10-20, 05-10-21, 10-22-39, 10-24-04, 10-24-50, 10-25-19, 10-26-32, 10-27-44, 10-27-45, 10-27-46, 10-28-06, 10-28-07, 10-28-52, 10-28-54, 23-18-11, BL*2, ORYW*1. Based on the following tag codes from fish of unknown race and rearing type (assumed to be hatchery summer steelhead): 10-22-41.

(cent.)

Table 4 (AI). (cont.) Non-harvest recoveries of coded wire tagged hatchery summer steelhead in the Deschutes River subbasin[a,b].

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b Estimates are modified *from* the Pacific States Marine Fisheries Commission coded wire tag database.
[c]Release site in the mainstem Columbia River below Bonneville Dam.
d Release site in the mainstem Columbia River between Bonneville and McNary dams.

Table 5 (AL-a). Mean fork length by run year for unmarked summer steelhead returning to Sherars Falls in the Deschutes River subbasin[a].

Run Year	N	Mean Fork Length (cm)	st. dev.
1977-78	--	64	--
1978-79	--	67	--
1979-80	--	62	--
1980-81	--	61	--
1981-82	--	63	--
1982-83	--	67	--
1983-84	--	61	--
1984-85	--	63	--
1985-86	--	63	--
1986-87	--	68	--
1987-88	--	66	--
1988-89	--	63	--
1989-90	--	65	--

[a] Estimates for the 1977-78 through 1989-90 run years are from the Oregon Department of Fish and Wildlife (unpublished data).

Table 6 (AL-b). Mean fork length by run year for unmarked summer steelhead returning to the Warm Springs National Fish Hatchery in the Deschutes River subbasin[a].

Run Year	N	Mean Fork Length (cm)	st. dev.
1976-77	--	61	--
1977-78	--	64	--
1978-79	--	66	--
1979-80	--	63	--
1980-81	--	62	--
1981-82	--	65	--
1982-83	--	67	--
1983-84	--	62	--
1984-85	--	66	--
1985-86	--	63	--

[a] Estimates for the 1976-77 through 1985-86 run years are from the U.S. Fish and Wildlife Service (unpublished data).

Table 7 (AS-a). Percent females by run year for unmarked summer steelhead returning to the Warm Springs National Fish Hatchery in the Deschutes River subbasin[a].

Run Year	N	Percent Females	st. dev.
1977-78	--	65	--
1978-79	--	77	--
1979-80	--	62	--
1980-81	--	68	--
1981-82	--	66	--
1982-83	--	78	--
1983-84	--	60	--
1984-85	--	65	--
1985-86	--	64	--
1986-87	--	72	--
1987-88	--	75	--
1988-89	--	68	--
1989-90	--	62	--

[a] Estimates for the 1977-78 through 1989-90 run years are modified from Olsen et al. (Undated).

Table 8 (AS-b). Percent females by run year for unmarked summer steelhead returning to Pelton Trap in the Deschutes River subbasin[a].

Run Year	N	Percent Females	st. dev.
1972-73	- -	63	- -
1973-74	- -	75	- -
1974-75	- -	70	- -
1975-76	- -	68	- -
1976-77	- -	51	- -
1977-78	- -	66	- -
1978-79	- -	69	- -
1979-80	- -	68	- -
1980-81	- -	69	- -
1981-82	- -	65	- -
1982-83	- -	73	- -
1983-84	- -	63	- -
1984-85	- -	66	- -
1985-86	- -	56	- -
1986-87	- -	74	- -
1987-88	- -	69	- -
1988-89	- -	58	- -
1989-90	- -	59	- -

[a] Estimates for the 1972-73 through 1989-90 run years are modified from Olsen et al. (Undated).

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DESCHUTES RIVER SUBBASIN

Hatchery Produced Summer Steelhead

ORIGIN

The frost recorded release of juvenile hatchery fish into the subbasin is the 1951 brood release of fingerlings and smelts from the Squaw Creek stock (Table 1). The subbasin has been supplemented with juvenile hatchery fish from 1952-57 and 1965-90. Non-indigenous stocks introduced into the subbasin include the Siletz and Skamania stocks (Table 1). Hatchery practices currently restrict the use of non-indigenous stocks as hatchery broodstock. The Hatchery DesChutes stock is currently utilized as hatchery broodstock for the subbasin.

The Squaw Creek stock was developed from adult summer steelhead collected in Squaw Creek, a tributary to the Deschutes River. Hatchery broodstock was collected from Squaw Creek in the 1950-51 through 1955-56 run years and the 1965-66 run year. The Hatchery Deschutes stock was developed from the native stock of summer steelhead collected at Warm Springs National Fish Hatchery (WSNFH), located at RM 9 on the Warm Springs River, and from both the native and hatchery components of the run to Pelton Trap, located at the base of Pelton Dam (RM 111) on the mainstem of the Deschutes River.

DISTRIBUTION

Subbasin

Hatchery summer steelhead have been released at various locations throughout the subbasin (Table 1) in response to a variety of management and hatchery related programs implemented in the subbasin. The two primary locations of release include a site located approximately 200 feet below Pelton Trap and various sites located several miles above and below Sherars Falls; located at RM 40 on the mainstem of the Deschutes River. Prior to the 1989 brood releases, hatchery summer steelhead were released at the sites located below Sherars Falls in order to home returning adult fish to the lower river; the primary location of the summer steelhead fishe . The program was discontinued after the 1988 brood releases when data became available which indicated that a much higher percentage of the adult fish returning from these releases failed to return to the hatchery and remained in the subbasin as potential spawners.

PRODUCTION

Releases

Egg

There are no records of releases in the subbasin.

Fry

Hatchery facilities in which fry were reared or acclimated prior to release in the subbasin include Cedar Creek, Gnat Creek, and Round Butte hatcheries; Warm Springs National Fish Hatchery; and one unknown hatchery of origin (Table 1). Annual numbers released ranged from 2,715 to 149,416 (Table 1). Size at release ranged from 1,680 to 413 fish per pound for releases in which estimates are available (Table 1).

Fingerling

Hatchery facilities in which fingerlings were reared or acclimated prior to release in the subbasin include Cedar Creek, Oak Springs, Round Butte, and Wizard Falls hatcheries; Warm Springs National Fish Hatchery; and one unknown hatchery of origin (Table 1). Annual numbers released ranged from 16,888 to 602,215 (Table 1). Size at release ranged from 145 to 10.0 fish per pound (l'able 1).

Smelt

Hatchery facilities in which smelts were reared or acclimated prior to release in the subbasin include Cedar Creek, Gnat Creek, Oak Springs, Round Butte, Wizard Falls hatcheries and Warm Springs National Fish Hatchery (Table 1). Annual numbers released ranged from 4,410 to 241,115 (Table 1). Size at release ranged from 9.5 to 3.6 fish per pound (Table 1).

Adult

There are no records of releases in the subbasin.

Harvest

sport

Subbasin: Statistical creels were conducted in selected years, beginning with the 1973-74 run year, to estimate sport harvest of hatchery summer steelhead returning to the DesChutes River subbasin. Estimates of harvest were made for fisheries located at the mouth of the DesChutes River, at an access road to Macks Canyon (km 69), and at Sherars (km 69). Complete surveys were conducted for the 1973-74 through 1975-76, 1977-78, 1980-81 through 1983-84, 1987-88, and 1989-90 run years. In addition to creels conducted in these primary sampling areas a creel was also conducted at Kloan (km 7) for the 1973-74 through 1975-76, 1977-78, and 1980-81 run years. The creel was discontinued in subsequent years but it is believed that most of the harvest at Kloan is accounted for at the mouth of the DesChutes River. This assumption is based on the increased use of jet boats that are put in at the mouth of the DesChutes River to fish the lower DesChutes River; which includes the Kloan area.

Creels conducted at the mouth, the Macks Canyon access road, and at Sherars Falls are believed to account for the majority of hatchery summer steelhead harvested in the DesChutes River. A small fishery is known to occur above Sherars Falls but the numbers harvested are believed to represent only a small percentage of the total harvest (personal communication, Jim Newton, Oregon Department of Fish and Wildlife, The Dalles, Oregon).

Annual estimates of sport harvest for Hatchery DesChutes stock summer steelhead ranged from 258 to 2,980 adult fish (Table 2).

Run year specific estimates of sport harvest for stray hatchery fish and exploitation rates for Hatchery DesChutes stock summer steelhead are available in Olsen et al. (Undated).

Treaty

Subbasin: Statistical creels were conducted in selected years, beginning with the 1973-74 run year, to estimate tribal harvest of hatchery summer steelhead returning to the DesChutes River subbasin. The creel was conducted at Sherars Falls; the location in which the majority of the tribal ceremonial and subsistence harvest occurs in the subbasin.

Annual estimates of tribal harvest of Hatchery DesChutes stock summer steelhead ranged from 154 to 1,951 adult fish (Table 3).

Run year specific estimates of tribal harvest for stray hatchery fish and exploitation rates for Deschutes stock summer steelhead are available in Olsen et al. (Undated).

ADULT LIFE HISTORY

Escapement

Subbasin

Timing: Data collected at a steeppass trap operated at Sherars Falls provides the only long term estimates of run timing for hatchery summer steelhead returning to the DesChutes River subbasin. Sampling dates varied at the steeppass trap which was put into operation as early as mid-April and left in operation until as late as mid-November. The trap was installed in 1977 and a continuous data set is available for the 1977-78 through 1989-90 run years.

Hatchery summer steelhead can be found in the Deschutes River subbasin throughout the year. Hatchery Deschutes stock summer steelhead were collected as early as 8 June and as late as 4 November at the Sherars Falls steeppass trap (Olsen et al. Undated). Median date of migration at Sherars Falls ranged from 6 September to 26 September for Hatchery Deschutes stock summer steelhead released as juvenile fish at Pelton trap (Olsen et al. Undated). Annual estimates of the temporal distribution of returns at the steeppass trap are in Olsen et al. (Undated).

Numbers: Data collected at a steeppass trap operated at Sherars Falls provides the only estimate of escapement for Hatchery Deschutes stock summer steelhead returning to the subbasin. Annual estimates of escapement past Sherars Falls were made using Chapman's modification of the Petersen mark and recapture method. Hatchery Deschutes stock summer steelhead are marked at Sherars Falls and recovered at WSNFH and at Pelton Trap. Estimates of escapement to the subbasin were made by adding harvest below Sherars Falls and escapement past Sherars Falls; most spawning is believed to occur above the falls (see DESCHUTES RIVER SUBBASIN, Naturally Produced Summer Steelhead, DISTRIBUTION, Subbasin). Estimates of subbasin escapement were made for only those years when complete creels were conducted in the subbasin (see PRODUCTION, Harvest) and an estimate was made of escapement past Sherars Falls. Estimates are available for the 1978-79 broods. Summer steelhead were aged based on unique fin clip combinations and the assumption that juvenile hatchery fish migrate as age 1 + smelts.

Annual estimates of subbasin escapement for Hatchery DesChutes stock summer steelhead, by brood year, ranged from 1,474 to 6,864 adult fish (Table 4).

Hatchery Facilities

Timing: Summer steelhead return to Pelton Trap throughout the year and begin to enter the Warm Springs River in February and March (Olsen et al. Undated). Annual estimates of run timing are available from Oregon Department of Fish and Wildlife (unpublished data) and U.S. Fish and Wildlife (unpublished data) and in Olsen et al. (Undated).

Numbers: Estimates of the number of summer steelhead escaping to hatchery facilities located in the subbasin are available at Pelton Trap and the WSNFH. Summer steelhead were aged based on unique fin clip combinations and the assumption that juvenile hatchery fish migrate as age 1+ smelts.

Annual estimates of Hatchery Deschutes stock summer steelhead escapement to WSNFH, by brood year, ranged from 6 to 124 adult fish (Table 5). Annual estimates of Hatchery DesChutes stock summer steelhead escapement to Pelton Trap, by brood year, ranged from 491 to 5,870 adult fish (Table 6).

Run year specific estimates of escapement for naturally produced summer steelhead returning to WSNFH and RBH are available in Olsen et al. (Undated).

Survival: Information on pre-spawning survival at WSNFH and RBH is available from U.S. Fish and Wildlife Service (unpublished data) and in Olsen et al. (Undated).

Fork Length

Fork length was estimated for Hatchery DesChutes stock summer steelhead collected at the Sherars Falls steeppass trap (see ADULT LIFE HISTORY, Escapement). Summer steelhead were aged based on unique fin clip combinations and the assumption that juvenile hatchery fish migrate as age 1+ smelts.

Annual estimates of mean fork length ranged from 58 cm to 60 cm for 1 salt fish and 67 cm to 70 cm for 2 salt fish (Table 7).

Age Structure

Age structure was estimated for Hatchery DesChutes stock summer steelhead collected at Pelton Trap and the Sherars Falls steeppass trap (see ADULT LIFE HISTORY, Escapement) Summer steelhead were aged based on unique fin clip combinations and the assumption that juvenile hatchery fish migrate as age 1+ smelts.

Annual estimates of age structure for Hatchery Deschutes stock summer steelhead returning to Pelton Trap, by brood year, ranged from 28.7% to 74.0% and 26.0% to 71.3% for 1 and 2 salt fish, respectively (Table 8). Annual estimates of age structure for Hatchery DesChutes stock summer steelhead returning to Sherars Falls, by brood year, ranged from 37.3% to 64.5% and 35.5 % to 62.7% for 1 and 2 salt fish, respectively (Table 9).

Annual estimates of age structure for Hatchery DesChutes stock summer steelhead returning to Pelton Trap, by run year, ranged from 15% to 89% and 11% to 89% for 1 and 2 salt fish, respectively (Table 10). Annual estimates of age structure for Hatchery DesChutes stock summer steelhead returning to Sherars Falls, by run year, ranged from 13% to 91% and 9% to 87% for 1 and 2 salt fish, respectively (Table 11).

Sex Ratio

Sex ratios (percent females) were estimated for Hatchery Deschutes stock summer steelhead collected at Pelton Trap. Summer steelhead were aged based on unique fin clip combinations and the assumption that juvenile hatchery fish migrate as age 1 + smelts.

Annual estimates of sex ratio for Hatchery DesChutes stock summer steelhead returning to Pelton Trap ranged from 31% to 54% and 57% to 82% for 1 and 2 salt fish, respectively (Table 12).

Fecundity

Estimates of fecundity are available for summer steelhead returning to Pelton Trap and spawned at RBH. Estimates were derived by dividing hatchery egg take by the number of females spawned.

Annual estimates of fecundity, for Hatchery Deschutes stock summer steelhead spawned at RBH, ranged from 3,530 to 5,511 eggs per female (Table 13).

Repeat Spawners

Repeat spawners have been documented at Sherars Falls (Olsen et al. Undated) but the

percentage of a given brood that return as repeat spawners is currently unknown.

Mark Recoveries

No coded wire tagged summer steelhead, released as juveniles in the DesChutes River subbasin, have been recovered on spawning ground surveys or at hatchery facilities located outside of the subbasin.

Coded wire tagg Hatchery DesChutes stock summer steelhead, released as juvenile fish in the DesChutes River subbasin, were recovered in fisheries located in the mainstem Columbia River and in the DesChutes River subbasin (Pacific States Marine Fisheries Commission coded wire tag database).

JUVENILE LIFE HISTORY

Age Structure

Juvenile hatchery summer steelhead are currently released as age 1 + smelts and are believed to migrate to the ocean in the year of release. No information is available on what percentage of the production releases residualize.

Survival Rate

Smelt to returning adult survival rates are available in Olsen et al. (Undated).

BIOCHEMICAL-GENETIC CHARACTERISTICS

In 1983 and 1985 juvenile hatchery summer steelhead were collected at Round Butte Hatchery for electrophoretic analysis. An analysis of selected protein-coding loci resolved nineteen enz yme sytems for samples collected in 1983 and 21 enzyme s sy.ems from samples collected in 1985 (Appendix Table 4). The 1983 sample had one rare al ele detected at the malate dehydrogenase (sMDH-l ,2) locus.

Columbia River Basin stocks of summer steelhead were compared based on a cluster analysis of selected electrophoretic, meristic, morphometric, and life history characteristics. The analysis grouped RBH summer steelhead with stocks of hatchery summer steelhead located in tributaries of the Columbia and lower Snake rivers (Schreck et al. 1986). This group is characterized by the earliest time of freshwater entry, the greatest average frequency of the common glycerol-3-phosphate dehydrogenase (GAPDH) allele, and the lowest average head depth.

A cluster analysis of various stocks of summer and winter races of steelhead in the Columbia River Basin indicate that Round Butte Hatchery summer steelhead are more similar to wild and hatchery components of stocks of summer and winter steelhead from east of the Cascade Mountains than with wild and hatchery com ponts of stocks of summer and winter steelhead from west of the Cascades (Schreck et al. 1986).

DISEASES

Various parasites and infectious disease agents have been identified at hatchery facilities that rear or hold juvenile summer steelhead for subbasin hatchery production (Tab bl 14). Parasites linc ude *Ceratomyxa shasta* and *Myxidium minteri*. Bacterial diseases include furunculoses (*Aeromonas salmonicida*), bacterial kidney disease (*Renibacterium salmoninarum*), and cold water disease (*Cytophaga psychrophila*). Viral diseases include

Infectious Hematopoietic Necrosis **(IHN).** For information on parasites and diseas agents of subbasin **hatchry pro**uction that is held **or** reared at hatchery facilities located **outsi**de of the subbasin see LOWER COLUMBIA RIVER SUBBASIN, Hatchery Produced Summer **Steelhead,** DISEASES.

Table 1 (TR). Hatchery releases of summer steelhead into the Deschutes River subbasin by brood year and if marked, by coded

Brood Year	Stock	Hatchery	Life Stage	Release Date (1)	Release Date (2)	Fish/ lb	Number Released	Release Location	CUT/ Fin clip
1951	Squaw Cr	Wizard Falls	fing.	06/01/52;	07/31 /52[c]	14.6	16,888	Squaw Creek	LV-RV
1951	Squaw Cr	Wizard Falls	smolt	11/15/52[d]	--	5.5	10,929	Squaw Creek	LV-RV
1951	Squaw Cr	Wizard Fal 1s	smolt	04/15/52[d]	--	9.5	6,445	Metolius R.	AD-LV-RV
1952	Squaw Cr	Wizard Falls	fing.	10/15/53[d]	--	10.9	3,434	Deschutes @ lower bridge	D-AD
1952	Squaw Cr	Wizard Fal 1s	fing.	10/15/53[d]	--	16.3	325	Metolius R.	O-AO
1952	Squaw Cr	Wizard Fal 1s	fing.	04/01/53;	05/31/53[c]	11.2	32,432	Squaw Creek	O-AD
1953	Squaw Cr	Wizard Fal 1s	smolt	08/15/54[d]	--	8.8	4,293	Deschutes @ lower bridge	AD-RP-RM
1953	Squaw Cr	Wizard Fal 1s	smolt	06/ 15/54[d]	--	8.3	8,874	Metolius R.	AD-RP-RM
1953	Squaw Cr	Wizard Falls	smolt	08/ 15/54[d]	--	9.2	27,654	Squaw Creek	AD-RP
1954	Squaw Cr	Wizard Falls	fing.	04/15/55[d]	--	10.5	26,162	Squaw Creek	AD- LV
1954	Squaw Cr	Wizard Fal 1s	fing.	06/15/55[d]	--	23.6	13,924	Suttle lake	AD-LV
1954	Squaw Cr	Wizard Fal 1s	smolt	09/15/55[d]	--	8.7	5,414	Metolius R.	AD-LV
1955	Squaw Cr	Wizard Fal 1s	fing.	05/01/56:	08/31 /56[c]	10.6	17,101	Deschutes @ Warm Spr R.	D-AD
1955	Squaw Cr	Wizard Fal 1s	fing.	08/15/56[d]	--	16.0	15,967	Deschutes @ Warm Spr R.	D-AD
1955	Squaw Cr	Wizard Falls	fing.	10/15/56[d]	--	12.3	10,093	Metolius R.	D-AD-RM
1955	Squaw Cr	Wizard Falls	fing.	05/15/56[d]	--	48.3	14,994	Suttle Lake	D-AD-RM
1955	Squaw Cr	Wizard Fal 1s	Smelt	08/1. 5/56[d]	--	7.4	4,410	Deschutes @ Uarm Spr R.	D-AD
1956	Squaw Cr	Wizard Falls	fing.	09/15/57[d]	--	10.4	10,468	Deschutes @ Uarm Spr R.	LV-RV
1956	Squaw Cr	Wizard Falls	fing.	09/15/57[d]	--	15.8	30,716	Deschutes @ Warm Spr R.	LV-RV
1956	Squaw Cr	Wizard Falls	fing.	09/15/57[d]	--	12.1	7,072	Lower bridge	LV-RV
1965	Siletz	Oak Springs	fing.	01/18/66	--	31.6	19,592	North Junction - mouth	--
1965	Skamania	Oak Springs	fing.	01/01/65[e]	12/31/65[e]	85.0	4,505	Deschutes R.	--
1965	Deschutes	Wizard Fal la	fing.	01/01/65[e]	12/31/65[e]	145.0	38,615	Deschutes R.	--
1965	Deschutes	Wizard Falls	smolt	04/01 /66[c]	06/30/66[c]	6.4	68,685	Below Pelton Rereg. Dam	AD-LP
1965	Deschutes	Wizard Fal 1s	smolt	04/01/66[c]	05/31/66[c]	7.8	1,519	Lake Simtustus	AD-LP
1966	Deschutes	Oak Springs	fing.	01/04/67	--	56.0	10,640	North Junction - mouth	--
1966	Deschutes	Oak Springs	fing.	04/13/67	--	78.0	9,906	North Junction - mouth	--
1966	Deschutes	Oak Springs	fing.	10/06/66	--	126.4	25,276	North Junction - mouth	--
1966	--	Oak Springs	fing.	01/01/67[e]	12/31/67[e]	21.6	26,435	Deschutes R.	--
1966	Squaw Cr	Wizard Fal 1s	fing.	06/22/67	06/23/67	11.7	23,008	Deschutes R. @ Rereg. Rea.	LV-RV
1966	Deschutes	Wizard Fal ls	smolt	05/16/67	05/1 7/67	8.8	21,376	Below Pelton Rereg. Dam	LV-RV
1966	Deschutes	Wizard Fal 1s	smolt	06/20/67	--	9.2	15,621	Below Pelton Rereg. Dam	LV-RV
1966	Deschutes	Wizard Falls	smolt	04/10/67	04/1 1/67	6.8	15,145	Below Pelton Rereg. Dam	LV-RV
1966	Deschutes	Wizard Falls	smelt	06/18/68	--	4.1	893	Pelton Rereg. Rea.	AN- LV
1966	Deschutes	Oak Springs	Smelt	06/02/67	--	6.5	5,889	Below Pelton Rereg. Dam	LV-RP
1967	Deschutes	Wizard Falls	Smelt	03/18168	03121/68	6.3	45,620	Pelton Rereg. Res.	AN-LV
1967	Deschutes	Wizard Fal 1s	smolt	06/03/68	06/05/68	6.5	40,570	Pelton Rereg. Res.	AN- LV
1967	Deschutes	Oak Springs	smolt	04/10/68	04/11/68	6.0	12,948	Pelton Rereg. Res.	AN -RV
1967	Deschutes	Oak Springs	Smelt	05/27/68	05/29/68	6.9	22,652	Pelton Rereg. Res.	AN-RV
1968	Deschutes	Unknown	fing.	--	--	37.0	117,211	Pelton Rereg. Res.	--
1968	Deschutes	Wizard Fal ls	smolt	04/11/69	04/15/69	5.2	34,058	Pelton Rereg. Res.	AN-RP

Table 1 (IR). (cent.) Hatchery releases of summer steelhead into the Deschutes River subbasin by brood year and if marked, by coded wire tag Codes.

Brood Year	Stock	Hatchery	Lif ● Stage	Release Data (1)	Release Date (2)	Fish/ lb	Number Released	Release Location	CUT/ Fin clip[b]
1968	Deschutes	Wi zard Fal 1s	Smelt	03/10/69	03/13/69	6.3	50,665	Pelton Rereg. Res.	AD-LV
1968	Deschutes	Oak Springs	Smelt	03/1 1/69	03/12/69	5.2	21,428	Pelton Rereg. Res.	AO-RV
1968	Deschutes	Oak Springs	Smelt	05/05/69	05/07/69	5.5	62,676	Pelton Rereg. Res.	AD-RV
1969	Deschutes	Cedar Creek	fry	..	--	..	122,018	Pelton Rereg. Res.	..
1969	Deschutes	Ceder Creek	fing.	02/15/70[d]	--	40.0	15,398	Deschutes mouth	..
1969	Deschutes	Cedar Creak	fing.	--	..	53.0	120,600	Pelton Rereg. Res.	..
1969	Deschutes	Wizard Fal ls	Smelt	03/20/70	03/25/70	5.0	37,842	Below Pelton Rereg. Dam	LP-RM
1969	Deschutes	Wizard Fal 1s	smolt	03/01/70[c]	04/30/70[c]	5.6	38,358	Below Pelton Rereg. Dam	LV-LM
1969	Deschutes	Oak Springs	Smelt	03/12/70	03/13/70	5.6	24,640	Below Pelton Rereg. Dam	LP-RM
1969	Deschutes	oak Springs	smolt	04/13/70	04/14/ 70	6.6	23,650	Pelton Rereg. Rea.	LP-RM
1969	Deschutes	Oak Springs	Smelt	04/27170	04/28/70	6.8	32,880	Pelton Rereg. Res.	LP-RM
1969	Deschutes	Gnat Creek	smolt	04/05/71	04/08/71	6.2	37,916	Below Pelton Rereg. Dam	AO-LV
1969	Deschutes	Gnat Creek	Smelt	04/15/71[d]	--	6.2	500	Trout Creek	AD-LV
1969	Deschutes	Cedar Creek	Smelt	05/07/70	--	6.8	24,406	Below Pelton Rereg. Dam	LV-RM
1970	Deschutes	Unknown	fry	..	..	..	52,150	North Junction - mouth	..
1970	Deschutes	Unknown	fry	04/01/71[c]	11/30/71[c]	..	83,943	Pelton Rereg. Res.	..
1970	Deschutes	Oak Springs	fing.	04/23/7$	--	10.0	17,300	Below pelton Rereg. Dam	..
1970	Deschutes	Wizard Falls	Smelt	04/05/71	04/07/71	4.8	38,810	Bel on Pel ton Rereg. Dam	AO-LV-RV
1970	Deschutes	Wizard Fal 1s	Smelt	04/08/71	04/09/71	5.5	40,533	Below Pel ton Rereg. Dam	AO-RP
1970	Deschutes	Oak Springs	Smelt	04/05/71	04/07/71	5.6	60,075	Below Pel ton Rereg. Osm	AD-RP
1970	Deschutes	Gnat Creek	smolt	04/03/72	04/07/72	7.1	33,668	Below Pelton Rereg. Oem	LV
1970	Deschut es	Gnat Creek	Smelt	04/15/72[d]	..	7.1	500	Trout Creek	LV
1970	Deschut es	Cedar Creek	Smelt	04/07/71	04/08/71	6.8	47,650	Bel on Pelton Rereg. Dam	AD-RV
1971	Deschutes	Gnat Creek	fry	06/15/72[d]	--	--	20,764	North Junction - mouth	..
1971	Deschut es	Wizard Fal ls	Smelt	03/03/72	04/04/72	4.6	78,442	Below Pel ton Rereg. Dam	AD- LM
1971	Deschut es	Wizard Fal ls	smolt	04/04/72	04/06/72	5.7	42,206	Be lon Pelton Rereg. Oam	RV
1971	Deschut es	Oak Springs	Smelt	04/04/72	04/07/72	5.3	40,190	Be 1 on Pelton Rereg. Dam	AD-LM
1971	Deschutes	Oak Springs	Smelt	04/15/72[d]	--	..	1,000	Trout Creek	..
1971	Deschut es	Gnat Creek	smolt	04/02/73	04/06/73	3.6	24,965	Below Pelton Rereg. Dam	AO-LV
1971	Deschutes	Gnat Creek	Smelt	04/15/73[d]	--	3.6	500	Trout Creek	AD-LV
1971	Deschutes	Cedar Creek	Smelt	04/05/72	--	7.4	44,609	Below Pelton Rereg. Oam	LV-RV
1971	Deschutes	Ceder Creek	Smelt	04/15/72[d]	--	7.4	500	Trout Creek	LV-RV
1972	Deschutes	Unknown	fry	01/01/73[c]	08/31/73[c]	--	17,322	North Junction - mouth	..
1972	Deschut es	Unknown	fry	08/08/72	09/09/72	..	94,178	Pelton Rereg. Res.	..
1972	Deschut es	Wizard Fal 1s	Smelt	04/02/73	04/06/73	4.9	123,938	Below Pelton Rereg. Dam	AO-RP
1972	Deschut es	Wizard Fal 1s	Smelt	04/15/73[d]	--	4.9	500	Trout Creek	AO-RP
1972	Deschut es	Wizard Fal 1s	Smelt	04/15/73[d]	--	5.5	500	Trout Creek	AO-LV-RV
1972	Deschut es	Wizard Fal 1s	smelt	04/02/73	04/05/73	5.5	40,634	Macks Canyon	AO-LV-RV
1972	Deschutes	Ceder Creek	Smelt	04/02/73	04/04/73	5.7	38,357	Below Pelton Rereg. Dam	AO-RV
1972	Deschutes	Ceder Creek	Smelt	04/15/73[d]	--	5.7	500	Trout Creek	AO-RV
1973	Deschutes	Round Butte	fry	06/08/73	--	1680.0	13,800	Laka Billy Chinook	..
1973	Deschutes	Round Butte	fry	W / o l / n[c]	10/31/73[c]	..	3,850	Oak Spr Creek	..

Table 1 (TR). (cont.) Hatchery releases of sinner steelhead into the Deschutes River subbasin by brood Year and if marked, by coded wire tag codes.

Brood Year	Stock	Hatchery	Life Stage	Release Date (1)	Release Date (2)	Fish/ lb	Number Released	Release Location	CUT/ Fin clip[b]
1973	Deschutes	Round Butte	fins.	11/10/73	..	103.0	65,714	Lake Billy Chinook	..
1973	Deschutes	Round Butte	fing.	10/02/73	..	105.0	58,800	Lake Simtustus	RP
1973	Deschutes	Round Butte	fing.	10/03/73	10/10/73	119.0	146,574	Lake Simtustus	RP
1973	Deschutes	Round Butte	fing.	09/28/73	lo/02/n	123.0	107, 994	Lake Simtustus	RP
1973	Deschutes	Round Butte	fing.	09/27/73	10/02/73	136.0	133,076	Lake Simtustus	RP
1973	Deschutes	Round Butte	smolt	05/15/74	05/17/74	8.5	71,316	Beavertail campground	AD-LV-RM
1973	Deschutes	Round Butte	Smelt	05/14174	..	8.7	12,833	Beavertail campground	AD-LV-RM
1973	Deschutes	Round Butte	smolt	05/01/74	..	5.8	26,680	Below Pelton Rereg. Dam	LV-RP
1973	Deschutes	Round Butte	Smelt	05 /01/74	05/02/74	6.2	61,318	Below Pelton Rereg. Dam	LV-RP
1973	Deschutes	Round Butte	Smelt	05/02/74	..	7.0	12,250	Below Pelton Rereg. Dam	LV-RP
1974	Deschutes	Round Butte	fing.	08/08/74	--	142.0	116,106	Deschutes mouth	--
1974	Deschutes	Round Butte	fing.	08/20/74	..	84.0	217,702	Lake Simtustus	LP
1974	Deschutes	Round Butte	fing.	01/13/75	.-	10.0	100	Pelton ladder	RV
1974	Deschutes	Round Butte	fing.	02112/75	..	11.0	100	Pelton ladder	AD-LV
1974	Deschutes	Round Butte	fing.	03/04/75	--	11.0	100	Pelton ladder	LV-RV
1974	Deschutes	Round Butte	fing.	01/13/75	..	12.0	100	Pelton ladder	LV
1974	Deschutes	Round Butte	fing.	01/13/75	--	12.0	100	Pelton ladder	LV-RV
1974	Deschutes	Round Butte	fing.	05/12/75	--	12.0	100	Pelton ladder	AD-LV-RV
1974	Deschutes	Round Butte	Smelt	03/04/75	--	7.2	100	Pelton ladder	RV
1974	Deschutes	Round Butte	Smelt	03/04/75	..	7.5	100	Pelton ladder	LV
1974	Deschutes	Round Butte	smolt	04/10/75	--	7.5	100	Pelton tackler	LV
1974	Deschutes	Round Butte	smolt	04/01/75	--	8.1	100	Pelton ladder	LV-RV
1974	Deschutes	Round Butte	smolt	02/12/75	--	9.0	100	Pelton ladder	AD-RV
1974	Deschutes	Round Butte	Smelt	05/05/75	05/08/7S	5.7	53,964	Beavertail campground	AD-RM
1974	Deschutes	Round Butte	smolt	05/05/75	05/08/75	4.5	33,510	Below Pelton Rereg. Oam	RV
1974	Deschutes	Round Butte	smolt	05/05/75	05/08/75	5.6	34,776	Below Pelton Rereg. Dam	LV
1974	Deschutes	Round Butte	smolt	05/05/75	05/08/75	6.0	35,004	Below Pelton Rereg. Dam	LV-RV
1974	Deschutes	Round Butte	Smelt	05/06/75	.-	5.5	10, m	Maupin park	AD-RM
1974	Deschutes	Round Butte	Smelt	05/01/75	..	4.9	100	Pelton ladder	RV
1974	Deschutes	Round Butte	smolt	05/01/75	--	5.2	100	Pelton ladder	LV
1974	Deschutes	Round Butte	smolt	05/01/75	--	6.1	100	Pelton ladder	LV-RV
1974	Deschutes	Round Butte	smolt	04/10/75	..	6.6	100	Pelton ladder	RV
1975	Deschutes	Round Butte	fry	07/08/75	..	600.0	82,319	Lake Simtustus	..
1975	Deschutes	Round Butte	fing.	09/09/75	09/ 16/75	57.0	110,442	Lake Simtustus	RP
1975	Deschutes	Round Butte	fing.	01/05/76	..	14.0	100	Pelton ladder	RP-RM
1975	Deschutes	Round Butte	smolt	03/04/76	--	7.0	1,997	Lake Simtustus	RP
1975	Deschutes	Round Butte	smolt	02/09/76	--	7.0	100	Pelton ladder	LP-LM
1975	Deschutes	Round Butte	Smelt	03/04176	..	7.3	99	Pelton ladder	RP-RM
1975	Deschutes	Round Butte	Smelt	02/09/76	..	8.0	100	Pelton ladder	RP-RM
1975	Deschutes	Round Butte	Smelt	01/05/76	..	9.0	100	Pelton ladder	LP-LM
1975	Deschutes	Round Butte	smolt	01/05/76	--	9.0	100	Pelton ladder	LP-RM
1975	Deschutes	Round Butte	smolt	05/03/76	05/04/76	4.2	26,610	Beavertail campground	RP-RM

Table 1 (TR). (cent.) Hatchery releases of summer steelhead into the Deschutes River subbasin by brood year and if marked, by coded wire tag code[a].

Brood Year	Stock	Hatchery	Life Stage	Release Date (1)	Release Date (2)	Fish/ lb	Number Released	Release Location	CUT/ Fin clip[b]
1975	Deschutes	Round Butte	smolt	03/02/76	03/04/76	5.4	25,752	Beavertail campground	LP-RM
1975	Deschutes	Round Butte	smolt	03/02/76	03/04/76	6.1	25,769	Beavertail campground	LP-LM
1975	Deschutes	Round Butta	Smelt	05/05/76	--	4.3	26,483	Below Pelton Rereg. Oam	LV-RM
1975	Deschutes	Round Butte	molt	05/06/76	..	4.4	26,972	Below Pel ton Rereg. Dam	RV-LM
1975	Deschutes	Round Butte	smolt	05/05/76	05/06/76	4.5	27,000	Bel ow P l ton Rereg. Dam	RV-RM
1975	Deschutes	Round Butte	molt	04/30/76	..	4.3	100	Pelton adder	RV-LM
1975	Deschutes	Round Butte	smolt	04/30/76	..	4.3	100	Petton adder	RP-RM
1975	Deschutes	Round Butta	molt	04/30/76	..	4.5	100	Pelton adder	LV-LM
1975	Deschutes	Round Butte	molt	04/30/76	--	4.7	100	Pel ton adder	RV-RM
1975	Deschutes	Round Butte	smolt	02/09/76	..	5.0	100	Pelton adder	LP-RM
1975	Deschutes	Round Butte	Smelt	03/04/76	--	5.4	100	Patton adder	LP-RM
1975	Deschutes	Round Butte	Smelt	03/04/76	.-	6.1	100	Pelton ladder	LP-LM
1976	Deschutes	Round Butte	fing.	09/09/76	..	96.0	138,650	Deschutes mouth	..
1976	Deschutes	Round Butte	fing.	09/08/76	..	67.0	190,769	Lake Simtustus	RP
1976	Deschutes	Round Butte	fing.	01/17/77	..	11.0	99	Pelton ladder	AO-LV-RV
1976	Deschutes	Round Butte	Smelt	03/07/77	..	7.2	100	Pel ton ladder	AD- LV-RV
1976	Deschutes	Round Butte	Smelt	01/17/77	..	7.4	90	Pelton ladder	AD-LV
1976	Deschutes	Round Butte	Smelt	01/17/77	..	7.4	96	Pelton ladder	AO-RV
1976	Deschutes	Round Butte	Smelt	02/15/77	..	8.2	99	Pelton ladder	AO-LV-RV
1976	Deschutes	Round Butte	Smelt	04/07/77	..	5.0	82, 906	Below Pelton Rereg. Dam	LV-RP
1976	Deschutes	Round Butte	Smelt	03/01/77	03/02/77	4.9	27,440	Buck Hollow Creek	AD-RV
1976	Deschutes	Round Butte	Smelt	04/1 1/77	04/1 2/77	5.0	27,515	Buck Hollow Creek	AD- LV-RV
1976	Deschutes	Round Butte	smolt	03/02/77	..	5.1	27,030	Buck Hollow Creak	AD - LV
1976	Deschutes	Round Butts	Smelt	03/01/77	..	5.0	97	Pel ton l adder	AO-LV
1976	Deschutes	Round Butts	smelt	02/15/77	..	5.0	100	Pal ton ladder	AD-RV
1976	Deschutes	Round Butte	Smelt	03/01/77	..	5.0	100	Pel ton ladder	AO-RV
1976	Deschutes	Round Butte	Smelt	02/15/77	--	5.5	97	Pel ton ladder	AO-LV
1976	Deschutes	Round Butte	Smelt	03/31/77	..	5.8	100	Pel ton ladder	AD-LV-RV
1977	Deschutes	Round But te	fing.	12/15/77	..	32.2	11,761	Laka Simtustus	RV
1977	Deschutes	Round Butte	fing.	12/15/77	--	32.2	679	Lake Simtustus	LP-LM
1977	Deschutes	Round Butts	fing.	12/15/77	--	32.2	9,462	Lake Simtustus	RP-RM
1977	Deschutes	Round Butte	fing.	08/23/77	..	95.0	318,250	Leke Simtustus	..
1977	Deschutes	Round Butte	Smelt	04/03/78	..	4.2	27,195	Below Pelton Rereg. Dam	LV
1977	Deschutes	Round Butte	smolt	04/03/78	04/04/78	4.2	26,565	Below Pelton Rereg. Dam	RV
1977	Deschutes	Round Butte	smolt	04/03/78	..	4.3	27,627	Below Pelton Rereg. Osm	LV-RV
1977	Deschutes	Round Butte	Smelt	04/06/78	04/07/78	4.1	25,542	Buck Hollow Creek	LP-RM
1977	Deschutes	Round Butte	Smelt	04/05/78	04/06/78	4.2	27,489	Buck Hollow Creek	LP-LM
1977	Deschutes	Round Butte	Smelt	04/04/78	04/05/78	4.4	28,050	Buck Hollow Crack	RP-RM
1977	Deschutes	Round Butte	smolt	05/22/78	..	4.5	4,122	Lake Simtustus	LV
1977	Deschutes	Round Butte	smolt	05/22/78	.-	4.5	8,291	Lake Simtustus	LV-RV
1977	Deschutes	Round Butte	Smelt	05/22/78	..	4.5	6,357	Laka Simtustus	LP-LM
1977	Deschutes	Round Butte	Smelt	05/22/78	..	4.5	4,261	Laka Simtustus	LP-RM

Table 1 (IR). (cont.) Hatchery releases of summer steelhead into the Deschutes River subbasin by brood year and if marked, by coded wire tag codes.

Brood Year	Stock	Hatchery	Life Stage	Release Date (1)	Release Date (2)	Fish/ lb	Number Released	Release Location	CUT/ Fin clip[b]
1977	Deschutes	Round Butte	smolt	05/03/78	..	5.6	1,002	Lake Simtustus	LV
1977	Deschutes	Round Butte	smolt	05/03/78	..	5.6	2,016	Lake Simtustus	LV-RV
1977	Deschutes	Round Butte	molt	05/03/78	..	5.6	1,546	Lake Simtustus	LP-LM
1977	Deschutes	Round Butte	smolt	05/03/78	--	5.6	1,036	Lake Simtustus	LP-RM
1978	Deschutes	Round Butte	fing.	03114/79	--	20.3	3,508	Lake Simtustus	LV-LM
1978	Deschutes	Round Butte	fing.	03/ 14/79	--	20.3	7,421	Lake Simtustus	RV-LM
1978	Deschutes	Round Butte	fing.	03/14/79	--	20.3	6,380	Lake Simtustus	RV-RM
1978	Deschutes	Round Butte	fing.	09/ 12/78	..	88.0	26,400	Lake Simtustus	--
1978	Deschutes	Round Butte	fing.	10/05/78	..	90.0	4,320	Lake Simtustus	--
1978	Deschutes	Warm Springs NFH	fing.	05/11/79	..	35.0	75,000	Lake Simtustus	..
1978	Deschutes	Warm Springs NFH	fing.	05/10/79	--	15.0	89,380	Warm Spr R.	..
1978	Deschutes	Round Butte	smolt	0s/01/79	..	3.8	27,207	Below Pelton Rereg. Dam	LV-RM
1978	Deschutes	Round Butte	smolt	05/01/79	..	4.6	21,334	Below Pelton Rereg. Dam	RV-RM
1978	Deschutes	Round Butte	smolt	04/08/79	04/09/79	4.7	27,572	Pine tree	LV-RV-LM
1978	Deschutes	Round Butte	smolt	04/06/79	04/08/79	5.2	49,105	Pine tree	RV-LM
1979	Deschutes	Round Butte	fing.	12/21/79	..	26.0	4,550	Lake Simtustus	LP-LM
1979	Deschutes	Round Butte	fing.	12/21/79	--	26.0	4,472	Lake Simtustus	RP-LM
1979	Deschutes	Round Butte	fing.	12/21/79	..	27.9	6,277	Lake Simtustus	RP
1979	Deschutes	Round Butte	fing.	12/21/79	--	29.0	8,148	Lake Simtustus	LP-RM
1979	Deschutes	Round Butte	fing.	12/21/79	..	30.8	8,316	Lake Simtustus	RP-RM
1979	Deschutes	Round Butte	fing.	12/21/79	--	32.0	5,120	Lake Simtustus	LP
1979	Deschutes	Round Butte	fing.	08/08/79	--	78.0	248,508	Lake Simtustus	..
1979	Deschutes	Round Butte	fing.	08/15/79	..	117.0	135,135	Lake Simtustus	..
1979	Deschutes	Round Butte	smolt	04/29780	04/30/80	4.0	28,744	Below Pelton Rereg. Dam	LP-LM
1979	Deschutes	Round Butte	Smelt	04/30/80	--	4.2	28,056	Below Pelton Rereg. Dam	LP
1979	Deschutes	Round Butte	smolt	04/29/80	..	4.2	24,759	Below Pelton Rereg. Dam	LP-RM
1979	Deschutes	Round Butte	smolt	04/ 16/80	..	4.4	28,837	Pine tree	RP-LM
1979	Deschutes	Round Butte	smolt	04/ 17/80	..	4.6	25,001	Pine tree	RP-RM
1980	Deschutes	Round Butte	fing.	04/10/81	--	10.0	40,790	Lake Simtustus	--
1980	Deschutes	Round Butte	fing.	12/ 17/80	..	28.8	3,542	Lake Simtustus	LV
1980	Deschutes	Round Butte	fing.	12/17180	..	28.8	3,916	Lake Simtustus	LV-RP
1980	Deschutes	Round Butte	fing.	12/17/80	..	33.6	3,394	Lake Simtustus	LV-RV
1980	Deschutes	Round Butte	fing.	12/17/80	--	36.2	6,118	Lake Simtustus	RV-LP
1980	Deschutes	Round Butte	fing.	12/17/80	..	38.5	5,929	Lake Simtustus	LV-RV-RM
1980	Deschutes	Round Butte	fing.	12/ 17/80	..	40.0	4,960	Lake Simtustus	RV
1980	Deschutes	Warm Springs NFH	fing.	04/02/81	..	54.4	15,000	Badger Creek	--
1980	Deschutes	Warm Springs NFH	fing.	04/01/81	..	54.4	20,000	Beaver Creek	--
1980	Deschutes	Warm Springs NFH	fing.	04/02/81	..	54.4	28,000	Mill Creek	..
1980	Deschutes	Warm Springs NFH	fing.	04/22/81	..	13.0	4,486	Warm Spr R.	--
1980	Deschutes	Warm Springs NFH	fing.	04/01/81	..	54.4	35,000	Warm Spr R.	..
1980	Deschutes	Round Butte	smolt	04/20/81	04/29/81	3.9	26,813	Below Pelton Rereg. Dam	LV
1980	Deschutes	Round Butte	smolt	04/20/81	04/29/81	3.9	27,516	Below Pelton Rereg. Dam	LV-RV

Table 1 (TR). (cent.) Hatchery releases of summer steelhead into the Deschutes River subbasin by brood year and i f marked, by ceded wire tag Codes.

Brood Year	Stock	Hatchery	Life Stage	Release Date (1)	Release Date (2)	Fish/ lb	Number Released	Release Location	CUT/ Fin clip[b]
1980	Deschutes	Round Butte	molt	04120/81	04/29/81	4.3	25,263	Below Pelton Rereg. Dam	LV-RV-RM
1980	Deschutes	Round Butte	Smelt	04/20/81	04/29/81	4.5	25,403	Below Pelton Rereg. Dam	RV
1980	Deschutes	Round Butte	smolt	04/20/81	04/29/81	3.9	25,897	Macks Canyon	LV-RP
1980	Deschutes	Round Butte	Smelt	04/20/81	04/29/81	4 .7	25,615	Pine tree	RV-LP
1981	Deschutes	Warm Springs NFH	fry	06/24/81	..	781 .0	27,332	Shitike Creek	..
1981	Deschutes	Round Butte	fing.	12/18/81	..	31.7	9,007	Lake Simtustus	RV-RM
1981	Deschutes	Round Butte	fing.	12/17/81	..	41.3	10,420	Lske Simtustus	RV-LM
1981	Deschutes	Round Butte	Smelt	04/15/82	..	3.8	26,885	Below Pelton Rereg. Dam	RV-RM
1981	Deschutes	Round Butte	Smelt	04/15/82	..	4.8	27,144	Below Pelton Rereg. Dam	RV-LM
1981	Deschutes	Round Butte	Smelt	04/21/82	..	6.6	24,994	Lake Simtustus	--
1981	Deschutes	Round Butte	Smelt	04/17/82	04/18/82	4.0	27,292	Maupin park	RV-RM
1981	Deschutes	Round Butte	Smelt	04/16/82	..	4.9	26,975	Maupin park	RV-LM
1981	Deschutes	Round Butte	smolt	04/19/82	--	4.1	27,553	Pins tree	RV-RM
1981	Deschutes	Round Butte	Smelt	04120/82	..	4.6	26,312	Pine trae	RV-LM
1982	Deschutes	Warm Springs NFH	fry	06/30/82	..	753.0	79,748	Shit i ke Creek	..
1982	Deschutes	Warm Springs NFH	fry	06/29/82	..	981.0	35,000	Badger Creek	..
1982	Deschutes	Warm Springs NFH	fry	06/29/82	.-	981.0	16,668	Beaver Creek	..
1982	Deschutes	Warm Springs NFH	fry	06/29/82	..	981.0	15,000	Mill Creek	..
1982	Deschutes	Warm Springs NFH	fry	06/29/82	..	981.0	3,000	Wilson Creek	..
1982	Deschutes	Round Butte	Smelt	04/20/83	..	5.0	23,450	Below Pelton Rereg. Dam	LP
1982	Deschutes	Round Butte	Smelt	04/20/83	04/21/83	5.4	57,888	Below Pel ton Rereg. Oam	RP
1982	Deschutes	Round Butte	Smelt	04120/83	--	5.5	27,144	Below Pel ton Rereg. Dam	LP
1982	Deschutes	Round Butte	Smelt	05/25/83	..	7.9	16,037	Maupin park	LP
1982	Deschutes	Round Butte	Smelt	05/24/83	05/25/83	7.9	13,067	Maupin park	RP
1982	Deschutes	Round Butte	Smelt	05/24/83	..	8.2	20,623	Maupin park	LP
1982	Deschutes	Round Butte	Smelt	06/01/83	06/14/83	6.0	8,178	White R.	LP
1982	Deschutes	Round Butta	smolt	05/10/83	..	6.2	353	White R.	RP
1982	Deschutes	Round Butte	Smelt	05/1 of 83	--	6.2	353	White R.	LP
1982	Deschutes	Round Butte	smolt	05/1 7/83	..	6.8	1,006	White R.	RP
1982	Oeschutes	Round Butte	Smelt	05/1 7/83	..	6.8	1,006	White R.	LP
1983	Deschutes	Warm Springs NFH	fry	06/09/83	--	413.0	31,718	Shitike Creek	..
1983	Deschutes	Warm Springs NFH	fry	06/07/83	..	440 .0	54,400	Badger Creek	--
1983	Deschutes	Warm Springs NFH	fry	06/07/83	..	440.0	5,000	Beaver Creek	..
1983	Deschutes	Warm Springs NFH	fry	06/07/83	..	440.0	5,000	Swamp Creek	--
1983	Deschutes	Harm Springs NFH	fry	06107/83	.-	440.0	5,000	Wilson Creek	--
1983	Deschutes	Round Butte	fing.	12/28/83	..	23.5	14,335	Lake Simtustus	AD-RV
1983	Deschutes	Round Butte	fing.	10/14/83	10/ 19/83	23.0	54,625	Pine tree	AD-RM
1983	Oeschutes	Round Butte	fing.	10/20/83	10/24/83	28.6	95,381	Pine tree	AD-RM
1983	Deschutes	Round Butte	Smelt	04/23/84	..	3.8	20,178	Below Pelton Rereg. Dam	AD-RV
1983	Deschutes	Round Butte	Smelt	04/19/84	04/23/84	4.2	17,304	Below Pelton Rereg. Dam	AD-RV
1983	Deschutes	Round Butte	Smelt	04/16/84	..	4.3	11,412	Below Pelton Rereg. Dam	AD-RV
1983	Deschutes	Round Butte	Smelt	04/18/84	..	4.4	5,720	Below Pelton Rereg. Dam	AD-RV

Table 1 (TR). (cent.) Hatchery releases of summer steelhead into the Deschutes River subbasin by brood year and if marked, by coded wire tag code[a].

Brood Year	Stock	Hatchery	Life Stage	Release Date (1)	Release Date (2)	Fish/ lb	Number Released	Release Location	CUT/ Fin clip[b]
1983	Deschutes	Round Butte	smolt	04/24/84	04126/84	3.8	21,622	Maupin park	AD-RV
1983	Deschutes	Round Butte	smolt	04/ 18/84	04/19/84	4.2	16,506	Maupin park	AD-RV
1983	Deschutes	Round Butte	smolt	04/1 7/84	--	4.3	6,343	Maupin park	AD-RV
1983	Deschutes	Round Butte	smolt	04/ 1 7/84	04/18/84	4.4	11,880	Maupin park	AD-RV
1983	Deschutes	Round Butte	Smelt	04/24/84	04/25/84	3.8	15,447	Pine tree	AD-RV
1983	Deschutes	Round Butte	smolt	04/19/84	04/23/84	4.2	22,134	Pine tree	AD-RV
1983	Deschutes	Round Butte	smolt	04/17/84	--	4.3	11,056	Pine tree	AD-RV
1983	Deschutes	Round Butte	smolt	04/ 18/84	..	4.4	5,821	Pine tree	AD-RV
1983	Deschutes	Round Butte	smolt	04/26/84	..	4.0	1,208	White R.	AD-RV
1983	Deschutes	Round Butte	smolt	04/20/84	05/01/84	4.2	4,134	White R.	AD-RV
1984	Deschutes	Warm Springs NFH	fry	07/03/84	..	993.0	80,481	Shitike Creek	..
1984	Deschutes	Round Butte	fing.	09/1 7/84	..	51.2	37,478	Beavertail campground	AD-LM
1984	Deschutes	Round Butte	fing.	12/10/84	..	24.5	24,255	Lake Simtustus	AD-LM
1984	Deschutes	Round Butte	fing.	09/19/84	..	51.2	37,478	Macks Canyon	AD-LM
1984	Deschutes	Round Butte	fing.	09/ 18/84	09/20/84	51.2	75,059	Pine tree	AD-LM
1984	Deschutes	Round Butte	smolt	05/01/85	..	3.6	4,766	Below Pelton Rereg. Dam	AD-RP
1984	Deschutes	Round Butte	smolt	05/01/85	05/02/85	3.8	29,887	Below Pel ton Rereg. Dam	AD-RP
1984	Deschutes	Round Butte	smolt	04/22/85	05/01/85	4.0	21,148	Below Pelton Rereg. Dam	AD-RP
1984	Deschutes	Round Butte	smolt	04/22/85	--	4.2	10,710	Below Pelton Rereg. Dam	AD-RP
1984	Deschutes	Round Butte	smolt	04/24/85	..	3.9	8,970	Maupin park	AD-RP
1984	Deschutes	Round Butte	smolt	04/25/85	04/30/85	4.0	14,944	Maupin park	AD-RP
1984	Deschutes	Round Butte	Smelt	04/23/85	04/26/85	4.1	15,580	Maupin park	AD-RP
1984	Deschutes	Round But te	smolt	04126185	--	4.3	15,390	Maupin park	AD-RP
1984	Deschutes	Round Butte	smolt	04/22/85	..	3.8	4,765	Pine tree	AD-RP
1984	Deschutes	Round Butte	smolt	04/23/85	..	3.9	4,742	Pine tree	AD-RP
1984	Deschutes	Round Butte	smolt	04/30/85	--	4.0	4,756	Pine tree	AD-RP
1984	Deschutes	Round Butte	smolt	04/23/85	04/30/85	4.1	24,535	Pine tree	AD-RP
1984	Deschutes	Round Butte	smolt	04/22/85	04/29/85	4.2	15,813	Pine tree	AD-RP
1985	Deschutes	Round Butte	fing.	12/26/85	..	25.0	4,625	Lake Simtustus	AD-LP-RM
1985	Deschutes	Round But te	fing.	12/26/85	..	28.0	12,488	Lake Simtustus	AD-LP-LM
1985	Deschutes	..	fry	06/14/85	..	..	2,715	Wilson Cr, Trout Cr	..
1985	Deschutes	Round Butte	smolt	04/14/86	..	4.1	18,171	Below Pelton Rereg. Dam	AD-LP-RM
1985	Deschutes	Round Butte	smolt	04114/86	..	4.2	10,823	Below Pel ton Rereg. Dam	AD-LP-RM
1985	Deschutes	Round Butte	smolt	04/14/86	--	4.6	24,955	Below Pel ton Rereg. Dam	AD-LP-RM
1985	Deschutes	Round Butte	smolt	04/07/86	..	4.4	10,789	Maupin park	AD-LP-LM
1985	Deschutes	Round Butte	smolt	04/08/86	04/09/86	4.5	10,427	Maupi n park	AD-LP-LM
1985	Deschutes	Round Butte	smolt	04/08/86	..	4.6	5,382	Maupin park	AD-LP-LM
1985	Deschutes	Round Butte	smolt	04/09/86	..	5.3	5,963	Maupin park	AD-LP-LM
1985	Deschutes	Round Butte	smolt	04/ 1 0/86	..	5.4	31,185	Maupin park	AD-LP-LM
1985	Deschutes	Round Butte	smolt	04 /07/86	--	4.4	10,873	Pine tree	AD-LP-LM
1985	Deschutes	Round Butte	smolt	04/08/86	04/w/86	4.5	11,750	Pine tree	AD-LP-LM
1985	Deschutes	Round Butte	Smelt	04/08186	..	4.6	5,368	Pine tree	AD-LP-LM
1985	Deschutes	Round Butte	smolt	04/1 1/86	..	4.8	22,623	Pine tree	AD-LP-LM

Table 1 (TR). (cent.) Hatchery releases of summer steelhead into the Deschutes River subbasin by brood year and if marked, by coded wi re tag code[a].

Brood Year	Stock	Hatchery	Lifa Stage	Release Date (1)	Release Data (2)	Fish/ lb	Number Released	Release Location	CWT/ Fin clip[b]
1985	Deschutes	Round Butte	molt	0 /0 /86	..	5.3	6,185	Pine tree	AD-LP-LM
1986	Deschutes	..	fry	0 i/O /86	--	..	5,572	Wilson Cr, Trout Cr	--
1986	Deschutes	Round Butte	fing.	1 !/2 /86	..	12.0	600	Lake Simtuatus	AD-1P
1986	Deschutes	Round Butte	fing.	1 !/2 /86	..	24.9	6,051	Leke Simtustus	AD-1P
1986	Deschutes	Round Butte	fing.	1 !/2 /86	..	27.2	5,277	Lake Simtustus	AD-RP
1986	Deschutes	Round Butte	fins.	1 !/2 /86	..	37.2	12,164	Lake Simtustus	AD-RP
1986	Deschutes	Round Butte	smolt	0 /2 /87	.-	4.3	25,062	Below Pelton Rereg. Dam	AD-LP
1986	Deschutes	Round Butte	smolt	0 /2 /87	..	4.6	25,369	Below Pelton Rereg. Dam	AD-LP
1986	Deschutes	Round Butte	smolt	a /1 /87	.-	4.5	2,245	Maupin	AD-RP
1986	Deschutes	Round Butte	Smelt	o /1 /87	04/15/87	4.5	24,921	Maupin park	AD-RP
1986	Deschutes	Round Butte	Smelt	0 /2 1/87	04/21/87	4.7	25,245	Maupin park	AD-RP
1986	Deschutes	Round Butte	Smelt	a /1 /87	04/16/87	4.8	30,169	Maupin park	AD-RP
1986	Deschutes	Round Butte	Smelt	a /1 I/87	04/1 7/87	5.1	26,470	Maupin park	AD-RP
1987	Deschutes	..	fry	a i/2 I/87	..	..	13,000	Wilson Cr, Trout Cr	..
1987	Deschutes	Round Butte	Smelt	a /2 /88	..	4.0	17,492	Be Lou Pelton Rereg. Dam	AD-RV-RM
1987	Deschutes	Round Butte	smolt	a /2 /88	--	4.0	7,124	Below Pelton Rereg. Dam	AD-RV-RM
1987	Deschutes	Round Butte	Smelt	o /2 /88	..	4.3	28,786	Below Pelton Rereg. Dam	AD-RV-RM
1987	Deschutes	Round Butte	Smelt	0 /1 /88	..	4.0	16,775	Maupin Park	AD-RV-LM
1987	Deschutes	Round Butte	smolt	0 /2 /88	..	4.0	10,844	Maupin Park	AD-RV-LM
1987	Deschutes	Round Butte	smolt	a /2 /88	..	4.1	5,560	Maupin Park	AD-RV-LM
1987	Deschutes	Round Butte	Smelt	a /2 /88	--	4.1	21,408	Maupin Park	AD-RV-LM
1987	Deschutes	Round Butte	Smelt	o /1 /88	--	4.3	21,326	Maupin Park	AD-RV-LM
1987	Deschutes	Round Butte	Smelt	a /1 /88	..	4.3	5,348	Maupin Park	AD-RV-LM
1987	Deschutes	Round Butte	Smelt	a /2 /88	..	4.4	6,300	Maupin Park	AD-RV-LM
1987	Deschutes	Round Butte	Smelt	a /2 /88	..	4.4	21,556	Maupin Park	AD-RV-LM
1988	Deschutes	Round Butte	Smelt	o /1 /89	..	4.2	18,512	Below Pel ton Rereg. Dam	AD-LP-LM
1988	Deschutes	Round Butte	Smelt	a /1 I/89	..	4.2	7,909	Below Pelton Rereg. Dam	AD-LP-LM
1988	Deschutes	Round Butte	Smelt	o /1 /89	..	4.2	28,510	Below Pel ton Rereg. Dam	AD-LP-LM
1988	Deschutes	Round Butte	Smelt	0 /1 I/89	.-	4.2	28,987	Below Pelton Rereg. Dam	AD-RP-RM
1988	Deschutes	Round Butte	Smelt	0 /1 /89	..	5.4	7,980	Below Pel ton Rereg. Dam	AD-LP-LM
1988	Deschutes	Round Butte	smolt	0 /1 /89	..	5.4	14,201	Below Pelton Rereg. Dam	AD-RP-RM
1988	Deschutes	Round Butte	Smelt	0 /1 /89	..	4.1	10,452	Maupin Park	AD-RP-LM
1988	Deschutes	Round Butte	Smelt	a /1 /89	.-	4.1	16,872	Maupin Park	AD-RP-LM
1988	Deschutes	Round Butte	Smelt	a /1 /89	..	4.2	24,704	Maupin Park	AD-RP-LM
1989	Deschutes	Round Butte	Smelt	o /1 /90	..	4.0	24,321	Below Pelton Rereg. Dam	AD-RM
1989	Deschutes	Round Butte	Smelt	a /1 /90	..	4.3	30,224	Below Pelton Rereg. Dam	AD-RM
1989	Deschutes	Round Butte	smolt	a /1 i/90	..	4.4	26,051	Below Pelton Rereg. Dam	AD-RM
1989	Deschutes	Round Butte	Smelt	a /1 /90	..	4.5	28,087	Below Pelton Rereg. Dam	AD-RM

Table 1 (TR). (cent.) Hatchery releases of summer steelhead into the Deschutes River subbasin by brood Year and if marked, by coded wire tag code[a].

Brood Year	Stock	Hatchery	Life Stage	Release Date (1)	Release Date (2)	Fish/ lb	Number Released	Release Location	CUT/ Fin clip[b]
1989	Deschutes	Round Butte	smolt	04/16/90	--	4.7	24,365	Below Pelton Rereg. Dam	AD-LM
1989	Deschutes	Round Butte	smolt	04/16/90	--	4.8	28,560	Below Pelton Rereg. Dam	AD-LM

a Estimates through the 1989 brood are from Olsen et al. (Undated).
b D = Dorsal, AO = Adipose, AN = Anal, LV = Left ventral, RV = Right ventral, LP = Left pectoral, RP = Right pectoral, LM = Left maxillary, RM = Right maxillary.
c Release dates unknown. Standardized to the first and last days of the months released.
d Release dates unknown (only the month of release known). Standardized to the middle of the month for the month of release.
e Release dates unknown (only the year of release known). Standardized to the first and last day of the year.

Table 2 (RS). Total sport catches of Hatchery Deschutes stock summer steelhead returning to the Deschutes River subbasin by brood year[a,b].

Brood Year	Total Age 2	3	4	5	6	Total	Adult Total
1971	1,337	996	--	--	--	2,333	2,333
1972	2,170	810	--	--	--	2,980	2,980
1973	324	--	--	--	--	--	--
1974	.-	342	--	--	--	--	--
1975	719	--	--	--	--	--	--
1976	--	--	--	--	--	--	--
1977		936	--	--	--	--	--
1978	1,029	575	--	--	--	1,604	1,604
1979	715	997	--	--	--	1,712	1,712
1980	124	134	--	--	--	258	258
1981	1,068	--	--	--	--	--	--
1982	--	--	--	--	--	--	--
1983		--	--	--	--	--	--
1984	--	683	--	--	--	--	--
1985	170	--	--	--	--	--	--
1986	--	247	--	--	--	--	--
1987	172	--	--	--	--	--	--

[a] Brood year reconstruction is based on the assumption that hatchery fish migrate as age 1+ smelts and that they return primarily as 1 and 2 salt adult fish.

[b] Estimates for the 1971-75, 1977-81, and 1984-87 brood years are from Olsen et al. (Undated).

Table 3 (RT). Tribal harvest of Hatchery Deschutes stock summer steelhead returning to the Deschutes River subbasin by brood year[a,b].

Brood Year	Total Age 2	3	4	5	6	Total	Adult Total
1970	--	445	--	--	--	--	--
1971	498	686	--	--	--	1,184	1,184
1972	1,085	440	--	--	--	1,525	1,525
1973	115	132	--	--	--	247	247
1974	89	380	--	--	--	469	469
1975	671	311	--	--	--	982	982
1976	133	122	--	--	--	255	255
1977	388	767	--	--	--	1,155	1,155
1978	388	394	--	--	--	782	782
1979	219	482	--	--	--	701	701
1980	51	103	--	--	--	154	154
1981	777	1,174	--	--	--	1,951	1,951
1982	496	549	--	--	--	1,045	1,045
1983	745	854	--	--	--	1,599	1,599
1984	565	861	--	--	--	1,426	1,426
1985	121	418	--	--	--	539	539
1986	179	238	--	--	--	417	417
1987	90	--	--	--	--	--	--

[a] Brood year reconstruction is based on the assumption that hatchery fish migrate as age 1+ smelts and that they return primarily as 1 and 2 salt adult fish.

[b] Estimates for the 1970-87 brood years are from Olsen et al. (Undated).

Table 4 (RB) . Total returns of Hatchery Deschutes stock summer steelhead to the Deschutes River subbasin[a,b], by brood year.

Brood Year	Total Age 2	3	4	5	6	Total	Adult Total
1978	3,972	3,107	--	--	--	7,079	7,079
1979	2,596	4,268	--	--	--	6,864	6,864
1980	586	888	--	--	--	1,474	1,474

[a] Brood year reconstruction is based on the assumption that hatchery fish migrate as age 1+ smelts and that they return primarily as 1 and 2 salt adult fish.

[b] Estimates for the 1978-80 brood years are modified from Olsen et al. (Undated).

Table 5 (RH-1). Total escapement of Hatchery Deschutes stock summer steelhead to the Warm Springs National Fish Hatchery by brood year[a,b,c].

	Total Age						
Brood Year	2	3	4	5	6	Total	Adult Total
1976	2	4	--	--	--	6	6
1977	18	19	--	--	--	37	37
1978	17	69	--	--	--	86	86
1979	53	71	--	--	--	124	124
1980	11	4	--	--	--	15	15
1981	36	15	--	--	--	51	51
1982	7	6	--	--	--	13	13
1983	9	34	--	--	--	43	43
1984	26	3	--	--	--	29	29
1985	1	20	--	--	--	21	21
1986	8	5	--	--	--	13	13
1987	5	--	--	--	--	--	--

[a] Estimates were derived based on age composition at Sherars Falls.
[b] Brood year reconstruction is based on the assumption that hatchery fish migrate as age 1+ smelts and that they return primarily as 1 and 2 salt adult fish.
[c] Estimates for the 1976-87 brood years are modified from Olsen et al. (Undated).

Table 6 (RH-2). Total escapement of Hatchery Deschutes stock summer steelhead to Pelton trap by brood year[a,b].

Brood Year	Total Age 2	3	4	5	6	Total	Adult Total
1969	2,225	1,257	--	--	--	3,482	3,482
1970	1,132	1,740	--	--	--	2,872	2,872
1971	3,501	2,369	--	--	--	5,870	5,870
1972	3,859	1,353	--	--	--	5,212	5,212
1973	348	718	--	--	--	1,066	1,066
1974	365	798	--	--	--	1,163	1,163
1975	1,322	1,196	--	--	--	2,518	2,518
1976	536	417	--	--	--	953	953
1977	2,195	1,276	--	--	--	3,471	3,471
1978	919	978	--	--	--	1,897	1,897
1979	782	1,318	--	--	--	2,100	2,100
1980	229	262	--	--	--	491	491
1981	2,177	1,746	--	--	--	3,923	3,923
1982	1,532	1,452	--	--	--	2,984	2,984
1983	1,701	1,413	--	--	--	3,114	3,114
1984	1,227	1,106	--	--	--	2,333	2,333
1985	378	938	--	--	--	1,316	1,316
1986	306	382	--	--	--	688	688
1987	447	--	--	--	--	--	--

[a] Brood year reconstruction is based on the assumption that hatchery fish migrate as age 1+ smelts and that they return primarily as 1 and 2 salt adult fish.
[b] Estimates for the 1969-87 brood years are from Olsen et al. (Undated).

Table 7 (AL) . Mean fork length by brood year and age class (freshwater.ocean) for Hatchery Deschutes stock summer steelhead returning to Pelton Trap in the Deschutes River subbasin[a,b].

Mean Fork Length (cm)

Brood Year	1.1	1.2	1.3	2.1	2.2	2.3	3.1	3.2	3.3
1974	--	68	--	--	--	--	--		--
N	--	--	--	--	--	--	--	--	--
St. dev.	--	--	--	--	--	--	--	--	--
1975	60	70	--	--	--	--	--	--	--
N	--	--	--	--	--	--	--	--	--
St. dev.	--	--	--	--	--	--	--	--	--
1976	58	69	--	--	--	--	--	--	--
N		--	--	--	--	--	--	--	--
St. dev.	--	--	--	--	--	--	--	--	--
1977	60	67	--	--	--	--	--	--	--
N	--	--	--	--	--	--	--	--	--
St. dev.	--	--	--	--		--	--	--	--
1978	58	68	--	--	--	--	--	--	--
N	--		--	--	--	--	--	--	--
St. dev.	--	--	--	--	--	--	--	--	--
1979	58	67	--	--	--	--	--	--	--
N	--	--	--	--	--	--	--	--	--
St. dev.	--	--	--	--	--	--	--	--	--
1980	60	67	--	--	--	--	--	--	--
N	--	--	--	--	--	--	--	--	--
St. dev.	--	--	--	--	--	--	--	--	--
1981	60	69	--	--	--	--	--	--	--
N	--	--	--	--	--	--	--		--
St . dev.	--	--	--	--	--	--	--	--	--
1982	59	69	--	--	--	--	--	--	--
N	--	--	--	--	--	--	--	--	--
St. dev.	--	--	--	--	--	--	--	--	--
1983	59	70	--	--	--	--	--	--	--
N	--	--	--	--	--	--	--	--	--
St . dev.	--	--	--	--	--	--	--	--	--

Table 7 (AL) . (cont.) Mean fork length by brood year and age class (freshwater.ocean) for Hatchery Deschutes stock summer steelhead returning to Pelton Trap in the Deschutes River subbasin[b].

Mean Fork Length (cm)

Brood Year	1.1	1.2	1.3	2.1	2.2	2.3	3.1	3.2	3.3
1984	59	67	--	--		--	--	--	--
N	--	--	--	--		--	--	--	--
st. dev.	--	--	--	--		--	--	--	--
1985	58	69	--	--	--	--	--	--	--
N	--	--	--	--	--	--	--	--	--
st. dev.	--	--	--	--	--	--	--	--	--
1986	60	67	--	--	--	--	--	--	--
N	--	--	--	--	--	--	--	--	--
st. dev.	--	--	--	--	--	--	--	--	--
1987	59	--	--	--	--	--	--	--	--
N	--	--	--	--	--	--	--	--	--
st. dev.	--	--	--	--	--	--	--	--	--

[a] Brood year reconstruction is based on the assumption that hatchery fish migrate as smelts in the year of release.
[b] Estimates for the 1974-87 brood years are from Olsen et al. (Undated).

Table 8 (AC-l). Age composition (freshwater.ocean) by brood year for Hatchery Deschutes st steelhead returning to Pelton Trap in the Deschutes River subbasin[a].

Brood Year	N	Age Composition (%)								
		1.1	1.2	1.3	2.1	2.2	2.3	3.1	3.2	3.3
1972	5,212	74.0	26.0	--	--	--	--	--	--	--
1973	1,066	32.7	67.3	--	--	--	--	--	--	--
1974	1,163	31.4	68.6	--	--	--	--	--	--	--
1975	2,518	52.5	47.5	--	--	--	--	--	--	--
1976	953	56.2	43.8	--	--	--	--	--	--	--
1977	3,471	63.2	36.8	--	--	--	--	--	--	--
1978	1,897	48.4	51.6	--	--	--	--	--	--	--
1979	2,100	37.2	62.8	--	--	--	--	--	--	--
1980	491	46.6	53.4	--	--	--	--	--	--	--
1981	3,923	55.5	44.5	--	--	--	--	--	--	--
1982	2,984	51.3	48.7	--	--	--	--	--	--	--
1983	3,114	54.6	45.4	--	--	--	--	--	--	--
1984	2,333	52.6	47.4	--	--	--	--	--	--	--
1985	1,316	28.7	71.3	--	--	--	--	--	--	
1986	688	44.5	55.5	--	--	--	--	--	--	--

[a] Estimates for the 1972-86 brood years are modified from Olsen et al. (Undated).

Table 9 (AC-2). Age composition (freshwater.ocean) by brood year for Hatchery Deschutes stock summer steelhead returning to Sherars Falls in the Deschutes River subbasin[a].

		Age Composition (%)								
Brood Year	N	1.1	1.2	1.3	2.1	2.2	2.3	3.1	3.2	3.3
1975	--	64.5	35.5	--	--	--	--	--	--	--
1976	--	51.7	48.3	--	--	--	--	--	--	--
1977	--	60.3	39.7	--	--	--	--	--	--	--
1978	--	54.4	45.6	--	--	--	--	--	--	--
1979	--	37.3	62.7	--	--	--	--	--	--	--
1980	--	38.7	61.3	--	--	--	--	--	--	--
1981	--	56.3	43.7	--	--	--	--	--	--	--
1982	--	45.6	54.4	--	--	--	--	--	--	--
1983	--	46.0	54.0	--	--	--	--	--	--	--
1984	--	37.5	62.5	--	--	--	--	--	--	--
1985	--	49.6	50.4	--	--	--	--	--	--	--
1986	--	43.4	56.6	--	--	--	--	--	--	--

[a] Estimates for the 1975-86 broods are modified from Olsen et al. (Undated).

Table 10 (AC-a). Age composition (freshwater.ocean) by run year for Hatchery Deschutes stock summer steelhead returning to Pelton Trap in the Deschutes River subbasin[a].

Run Year	N	Age Composition (%) 1.1	1.2	1.3	2.1	2.2	2.3	3.1	3.2	3.3
1975-76	--	20	80	--	--	--	--	--	--	--
1976-77	--	34	66	--	--	--	--	--	--	--
1977-78	--	62	38	--	--	--	--	--	--	--
1978-79	--	31	69	--	--	--	--	--	--	--
1979-80	--	84	16	--	--	--	--	--	--	--
1980-81	--	42	58	--	--	--	--	--	--	--
1981-82	--	44	56	--	--	--	--	--	--	--
1982-83	--	15	85	--	--	--	--	--	--	--
1983-84	--	89	11	--	--	--	--	--	--	--
1984-85	--	47	53	--	--	--	--	--	--	--
1985-86	--	54	46	--	--	--	--	--	--	--
1986-87	--	46	54	--	--	--	--	--	--	--
1987-88	--	25	75	--	--	--	--	--	--	--
1988-89	--	25	75	--	--	--	--	--	--	--
1989-90	--	54	46	--	--	--	--	--	--	--

[a]Estimates for the 1975-76 through 1989-90 run years are modified from Olsen et al. (Undated).

Table 11 (AC-b). Age composition (freshwater.ocean) by run year for Hatchery Deschutes stock summer steelhead returning to Sherars Falls in the Deschutes River subbasin[a].

Run Year	N	Age Composition (%) 1.1	1.2	1.3	2.1	2.2	2.3	3.1	3.2	3.3
1977-78	--	66	34	--	--	--	--	--	--	--
1978-79	--	31	69	--	--	--	--	--	--	--
1979-80	--	83	17	--	--	--	--	--	--	--
1980-81	--	46	54	--	--	--	--	--	--	--
1981-82		44	56	--	--	--	--	--	--	--
1982-83	--	13	87	--	--	--	--	--	--	--
1983-84	--	91	9	--	--	--	--	--	--	--
1984-85	--	33	67	--	--	--	--	--	--	--
1985-86	--	59	41	--	--	--	--	--	--	--
1986-87	--	43	57	--	--	--	--	--	--	--
1987-88	--	28	72	--	--	--	--	--	--	--
1988-89	--	30	70	--	--	--	--	--	--	--
1989-90		47	53	--	--	--	--	--	--	--

[a] Estimates for the 1977-78 through 1989-90 run years are modified from Olsen et al. (Undated).

Table 12 (AS). Percent females by brood year and age class (freshwater.ocean) for Hatchery Deschutes stock summer steelhead returning to Pelton Trap in the Deschutes River subbasin[a,b].

Brood Year	N	Females (%) 1.1	1.2	1.3	2.1	2.2	2.3	3.1	3.2	3.3
1969	--	--	76	--	--	--	--	--	--	--
1970	--	42	79	--	--	--	--	--	--	--
1971	--	47	79	--	--	--	--	--	--	--
1972	--	54	82	--	--	--	--	--	--	--
1973	--	38	70	--	--	--	--	--	--	--
1974	--	47	72	--	--	--	--	--	--	--
1975	--	52	78	--	--	--	--	--	--	--
1976	--	38	72	--	--	--	--	--	--	--
1977	--	47	72	--	--	--	--	--	--	--
1978	--	48	71	--	--	--	--	--	--	--
1979	--	33	68	--	--	--	--	--	--	--
1980	--	34	68	--	--	--	--	--	--	--
1981	--	42	57	--	--	--	--	--	--	--
1982	--	35	71	--	--	--	--	--	--	--
1983	--	41	69	--	--	--	--	--	--	--
1984	--	35	69	--	--	--	--	--	--	--
1985	--	31	66	--	--	--	--	--	--	--
1986	--	33	63	--	--	--	--	--	--	--
1987	--	37	--	--	--	--	--	--	--	--

[a] Brood year reconstruction is based on the assumption that hatchery fish migrate as smelts in the year of release.
[b] Estimates for the 1969-87 broods are modified from Olsen et al. (Undated).

Table 13 (AF-a). Mean fecundity by run year for summer steelhead collected at Pelton Trap in the Deschutes River subbasin[a].

Run Year	N	Mean Fecundity	st. dev.
1973-74	252	3,530	--
1974-75	248	4,024	--
1975-76	495	3,827	--
1976-77	308	4,851	--
1977-78	199	4,355	--
1978-79	189	4,297	--
1979-80	178	5,148	--
1980-81	165	4,798	--
1981-82	162	4,550	--
1982-83	144	5,488	--
1983-84	150	5,511	--
1984-85	275	4,177	--
1985-86	233	5,502	--
1986-87	297	5,052	--
1987-88	144	5,147	--
1988-89	193	5,398	--
1989-90	167	5,407	--

[a] Estimates for the 1973-74 through 1989-90 run years are from Olsen et al. (Undated).

Table 14 (TD). Parasites and diseases of summer steelhead at hatcheries located in the Deschutes River subbasin[a].

Disease type	Hatchery	Specific Pathogen
Parasite	Round Butte	*Ceratomyxa shasta*
Parasite	Round Butte	*Myxidium minteri*
Parasite	Oak Springs	Costia (*Ichthyobodo sp.*)
Parasite	Oak Springs	*Gyrodactylus*
Parasite	Oak Springs	*Epistylis sp.*
Parasite	Oak Springs	*Scyphidia*
Parasite	Oak Springs	*Tetrahymena*
Bacteria	Round Butte	*Renibacterium salmoninarum* (Bacterial kidney disease)
Bacteria	Round Butte	*Aeromonas salmonicida* (Furunculosis)
Bacteria	Round Butte	*Cytophaga psychrophila* (Cold water disease)
Bacteria	Oak Springs	*Cytophaga psychrophila* (Cold water disease)
Bacteria	Oak Springs	*Renibacterium salmoninarum* (Bacterial kidney disease)
Bacteria	Oak Springs	*Yersinia ruckeri* (Enteric redmouth)
Bacteria	Oak Springs	*Aeromonas spp.*
Bacteria	Oak Springs	*Pseudomonas spp.*
Virus	Round Butte	Infectious Hematopoietic Necrosis (IHN)
Fungi	Oak Springs	External fungi

[a]Data for Round Butte Hatchery are from Olsen et al. (Undated) and for Oak Springs Hatchery from Oregon Department of Fish and Wildlife (unpublished data).

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DESCHUTES RIVER SUBBASIN

Hatchery Produced Winter Steelhead

ORIGIN

The only recorded release of juvenile hatchery fish into the subbasin is the 1960 brood releases of the Big Creek and Willamette stocks (Table 1). There is currently no hatchery supplementation program in the Deschutes River subbasin.

DISTRIBUTION

Subbasin

Winter steelhead were released into the Metolius River and the mainstem of the DesChutes River above Pelton Dam (Table 1).

PRODUCTION

Releases

Egg

There are no records of releases in the subbasin.

Fry

There are no records of releases in the subbasin.

Fingerling

Hatchery facilities in which fingerlings were reared or acclimated prior to release in the subbasin include Big Creek and Marion Forks hatcheries (Table 1). One release of 35,981 fingerlings was made in 1960 (Table 1). Size at release ranged from 18.0 to 11.0 fish per pound (Table 1).

Smelt

There are no records of releases in the subbasin.

Adult

There are no records of releases in the subbasin.

DISEASES

For information on parasites and disease agents of subbasin hatchery production that is held or reared at hatchery facilities located outside of the subbasin see LOWER COLUMBIA RIVER SUBBASIN, Hatchery Produced Winter Steelhead, DISEASES and see SANTIAM RIVER SUBBASIN, Hatchery Produced Winter Steelhead, DISEASES.

Table 1 (TR). Hatchery releases of winter steelhead into the Deschutes River subbasin by brood year and if marked, by coded wire tag Codes.

Brood Year	Stock	Hatchery	Lifa Stage	Release Date (1)	Release Date (2)	Fish/ lb	Number Released	Releese Location	CUT/ Fin Clip[b]
1958	Willamette	Marion Forks	fing.	04/29/60	--	18.0	16,976	Deschutes above Pelton Dam	AD
1959	Big Cr.	Big Creek	fing.	03/31/60	--	11.0	19,005	Metolius River	AN

[a] Est i metes are f rom Olsen et al. (Undated).
[b] AD = Adipose, AN = Anal fin.

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JOHN DAY RIVER SUBBASIN

Naturally Produced Spring Chinook Salmon

GEOGRAPHIC LOCATION

The John Day River drains 8,100 square miles in east central Oregon and is the third largest drainage area in the state. From its source in the Strawberry Mountains at an elevation near 5,906 ft, the mainstem John Day River flows 284 mi to its mouth at RM 218 on the Columbia River. The John Day River is located above Bonneville, The Dalles, and John Day dams.

ORIGIN

The John Day stock of spring chinook is indigenous to the John Day River subbasin and is the largest remaining native wild spring chinook stock in eastern Oregon. Subbasin production is entirely from the native stock.

DISTRIBUTION

Subbasin

Spring chinook are found in the mainstem John Day, the North and Middle forks, and in their tributaries (Lindsay et al. 1986; Figure 1). Spring chinook currently spawn in a total of 244 km (152 miles) of the John Day system. Spawning areas are located in the upper main stem between Hall Hill (RK 418) and Roberts Creek (RK 443), in the Middle Fork between Armstrong Creek (RK 68) and Summit Creek (RK 116), in the North Fork between Cabin Creek (RK 29) and Baldy Creek (RK 171), and in 29 km of the Granite Creek system, which includes Bull Run and Clear creeks (personal communication with Errol Claire, District Fish Biologist, Oregon Department of Fish and Wildlife, John Day, Oregon, on 10/ 15/92). Camas and Desolation creeks sustain remnant spring chinook spawning populations and depending on water conditions spring chinook sporadically spawn in Canyon Creek (personal communication with Errol Claire, District Fish Biologist, Oregon Department of Fish and Wildlife, John Day, Oregon, on 10/15/92). The spring chinook spawning areas in the mainstem below John Day are no longer being utilized (personal communication with Errol Claire, District Fish Biologist, Oregon Department of Fish and Wildlife, John Day, Oregon, on 10/15/92). There are no major man-made barriers that block spring chinook from historical spawning and rearing areas. Reduced spatial distribution is primarily the result of habitat degradation. The quality of spawning and rearing habitat varies throughout the subbasin (Tables 1 and 2).

Ocean

Only one ocean recovery of an adipose coded wire tagged spring chinook from the John Day River subbasin has been reported. The 1978 brood spring chinook was caught near Sitka, Alaska on 24 June 1982 (Lindsay et al. 1986).

PRODUCTION

Juvenile

Smelt

Smelt production from the 1978-82 broods was estimated in the John Day River subbasin using a mark and recapture program. Smelts were tagged in the North Fork John Day River at Desolation Creek, in the Middle Fork John Day River at Slide Creek, and in the mainstem John Day River at the town of John Day. Smelts were recaptured in the mainstem John Day River between Spray and Kimberly. Estimates of smolt production were made using a pooled Petersen estimate (Lindsay et al. 1986).

Annual estimates of smelt production ranged from 64,000 to 169,000 (Table 3).

Mark Information

Wild juvenile spring chinook from the 1976-80 broods were coded wire tagged and released in the John Day River subbasin (Table 4). Annual numbers of juveniles marked and released ranged from 1,336 to 32,051 (Table 4).

Coded wire tags were recovered from stray John Day River spring chinook sampled at hatchery facilities located in the Alsea and Rogue river subbasins (Table 5); located on the southern Oregon Coast. Freshwater recoveries of coded wire tagged spring chinook originating in the John Day River were limited to fisheries located in the mainstem Columbia River (Pacific States Marine Fisheries Commission unpublished data) and to the John Day River subbasin (Table 6).

Harvest

sport

Subbasin: The John Day River subbasin historically sustained a sport fishery for spring chinook. The sport fishery was closed in 1978 and remained closed through the 1991 run year (Oregon Department of Fish and Wildlife et al. 1990). No brood year specific estimates of harvest are available prior to the 1978 season closure. Run year specific estimates of harvest (punch card) are available in Howell et al. (1985), Lindsay et al. (1986), and from Oregon Department of Fish and Wildlife (unpublished data).

Treaty

Subbasin: The Umatilla and Warm Springs confederated tribes have reserved usual and accustomed fishing sites located in the John Day River subbasin. No information is available on tribal harvest but effort has decreased in the last decade and has been negligible in recent years due to depressed runs (James 1984, cited by Howell et al. 1985).

ADULT LIFE HISTORY

Escapement

Columbia River

Timing: Temporal distribution of return to the Columbia River was estimated based on

recoveries of coded wire tagged John Day River wild spring chinook sampled in the Corbett and Woody Island test fisheries and recovered in the ceremonial fishery located in the Bonneville Pool. Data indicates that adult fish migrate through the mainstem Columbia River *in* March, April, and May (Lindsay et al. 1986; Pacific States Marine Fisheries Commission unpublished data).

Subbasin

Timing: Adult spring chinook begin entering the John Day River in mid-April (James 1984, cited by Howell et al. 1985).

Spawner Area

Timing: Spawning in the John Day River subbasin begins in late. August and continues through September (Lindsay et al. 1986; Figure 2). Temporal distribution of spawning varied in the subbasin. Peak spawning activity occurred earliest in the mainstem and Granite Creek and latest in the Middle Fork and lower North Fork (Lindsay et al. 1986). Estimates are based on observations of redds and live fish counted during spawning ground surveys conducted from 1978-84.

Temporal distribution of@ emergence was estimated by seining selected sites in spawning areas of the John Day River subbasin. Sites were sampled once each week from February through June, 1979-84.

Fry emerge in the John Day River subbasin as early as 25 February and as late as 7 July but in most years fry emergence occurs from mid-March until mid-June (Lindsay et al. 1986; Figure 2). Temporal distribution of fry emergence varied throughout the subbasin. Fry emergence occurred earliest in the mainstem and Middle Fork and latest in the North Fork and Granite Creek (Lindsay et al. 1986).

Numbers: No brood year specific estimates of spawner escapement are available. Spawning ground counts are available in Lindsay et al. (1986) and Howell et al. (1985) and from Oregon Department of Fish and Wildlife (unpublished data).

Strays

Coded wire tag recoveries in the subbasin are almost entirely from wild John Day River spring chinook (Tables 6 and 7). Only one recovery of a coded wire tagged stray spring chinook has been reported for the subbasin. The fish was released from Kooskia National Fish Hatchery (Table 7).

Fork Length

Spring chinook were collected on spawning ground surveys conducted in the John Day River subbasin and measured to the nearest 0.5 centimeter fork length. Estimates of mean fork length were made for spring chinook sampled in the mainstem, Middle Fork, and North Fork of the John Day River and in the Granite Creek system. Age was determined based on scale analysis.

Annual estimates of mean fork length ranged from 42 cm to 48 cm for age 3 fish, 68 cm to 71 cm for age 4 fish, and 80 cm to 88 cm for age 5 fish (Tables 8-11).

Age Structure

Age structure was estimated for spring chinook collected on spawning ground surveys conducted in the John Day River subbasin. Estimates of age structure were made for spring chinook sampled in the mainstem, Middle Fork, and North Fork of the John Day River and in the Granite Creek system. Age was determined based on scale analysis.

Annual estimates of age structure, by brood year, ranged from O% to 27% age 3 fish, 36% to 96% age 4 fish, and 1% to 64% age 5 fish (Tables 12-15).

Annual estimates of age structure, by run year, ranged from O% to 22% age 3 fish, 29% to 100% age 4 fish, and O% to 65% age 5 fish (Tables 16-19).

Sex Ratio

Sex ratios (percent females) were estimated for spring chinook collected on spawning ground surveys conducted in the John Day River subbasin. Estimates of sex ratio were made for spring chinook sampled in the mainstem, Middle Fork, and North Fork of the John Day River and in the Granite Creek system. Age was determined based on scale analysis.

Annual estimates of sex ratio were O% for age 3 fish and ranged from 53% to 90% for age 4 fish and 65% to 86% for age 5 fish (Tables 20-23).

JUVENILE LIFE HISTORY

Fork Length

Age 1+ spring chinook smelts were sampled by seine in the mainstem of the John Day River at two sites; one located near Rock Creek and one at Spray. Humphreys scoop traps were used to sample age 1+ smelts at sites located in the mainstem of the John Day River at the town of John Day, in the Middle Fork of the John Day at Slide Creek, and in the North Fork of the John Day at Desolation Creek. Smelts were measured to the nearest one millimeter fork length. Samples were collected throughout the entire migration period. The sampling sites located at Rock Creek and Spray are below the primary rearing areas in the mainstem, Middle Fork, and North Forks of the John Day River and are used to estimate mean fork length for smelts migrating from the John Day River subbasin.

Annual estimates of mean fork length ranged from 98 mm to 114 mm at Spray and 110 mm to 126 mm at Rock Creek (Table 24). Smolts were generally huger in the mainstem of the John Day River and smallest in the North Fork of the John Day River (Table 24).

Age Structure

An analysis of scales taken from adult spring chinook collected on spawning ground surveys indicates that wild spring chinook primarily migrate as age 1+ smelts (see ADULT LIFE HISTORY, Age Structure) although some returning adults (i.e. <0.5%) had migrated as sub-yearling smelts (Knox et al. 1984, cited by Howell et al. 1985).

Migration Timing

Temporal distribution of the smelt migration was monitored at Humphreys scoop traps located in the mainstem, Middle Fork, and North Fork of the John Day River and by seine in the mainstem of the John Day River from Spray to Kimberly. The Humphreys scoop

traps were operated from February through May and seining in the lower river was conducted from February through early June (Lindsay et al. 1986). Smelts were cold branded at each site in order to monitor temporal distribution of migration past mainstem Columbia River Dams.

Because of variable stream flows and problems associated with ice and debris it was difficult to estimate peak migration past the traps. Catch rates were generally highest at the traps from late February through mid-April (Lindsay et al. 1986; Figure 2). Catch rates from Spray to Kimberly generally peaked during the first 2 weeks of April (Lindsay et al. 1986). Smelts were collected at mainstem dams and Jones Beach from early April through mid-August (Lindsay et al. 1986). Estimated peak migration timing past mainstem dams and Jones beach occurred from late April through early June (Lindsay et al. 1986).

BIOCHEMICAL-GENETIC CHARACTERISTICS

Juvenile spring chinook were collected from the John Day River subbasin in 1984 and 1985, and analyzed electrophoretically at selected protein-coding loci (Schreck et al. 1986). Relative allele nobilities and allele frequencies were determined for 18 enzyme systems in each sample year (Appendix Table 3). One rare allele was detected, at the isocitrate dehydrogenase locus in the 1985 sample.

Schreck et al. (1986) classified Columbia River Basin chinook salmon into several clusters of similar stocks based on biochemical, morphological and life history characters. Columbia River Basin chinook stocks segregate into two primary groups. The first group contains spring chinook from east of the Cascade Mountains and summer chinook from Idaho. The second group contains spring chinook from west of the Cascades, summer chinook from the upper Columbia, and all fall chinook stocks. The first primary group is composed of 4 subgroups. At the subgroup level, wild spring chinook from the John Day River were found to be most similar to other stocks of wild and hatchery spring chinook that are widely distributed east of the Cascades. This subgroup is characterized by the greatest average head depth, head width and pectoral ray count, and the lowest average number of gill rakers. The streams of the wild stocks in this subgroup are at higher elevations, in the upper reaches of the Columbia River, and have colder climates than streams of stocks in the other subgroups.

DISEASES

In 1984, 51 smelt mortalities were collected from traps and tested for bacterial kidney disease. Only 1 juvenile fish was found to have a moderate level of the infectious disease agent (Table 25).

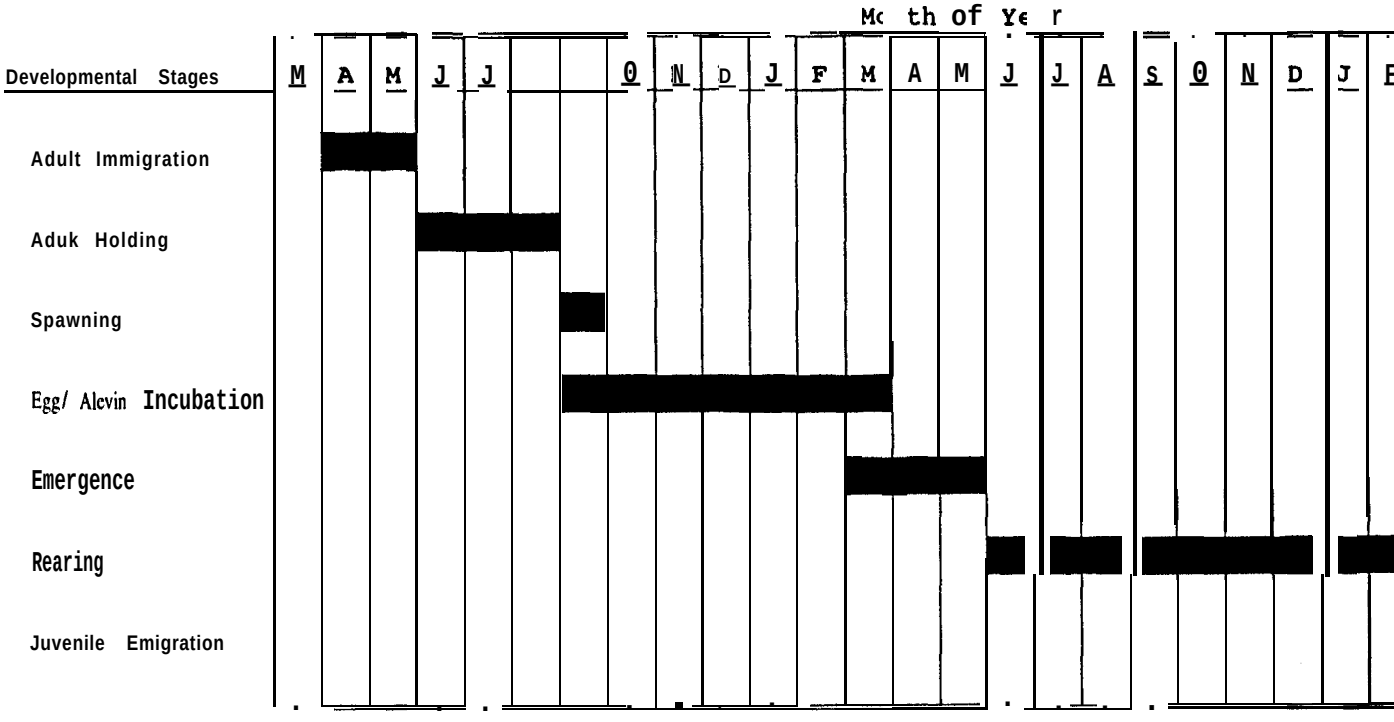

Figure 2 (TT) . Spring chinook freshwater life history in the John Day River subbasin (O
Fish and Wildlife et al. 1990).

Table 1 (HB-1). Estimated amount of spawning and rearing habitat by quality of John Day River subbasin spring chinook production area[a].

Distance/ Area	Excellent	Good	Fair[b]	Poor[b]	Unknown	Total	Confi- dence
Miles (%)	0.0	27.5	66.0	6.5	--	192.2	--
-Acres (%)	--	--	--	--	--	--	--

[a] Estimates are modified from the Northwest Power Planning Council's presence/absence database.
[b] Ratings of fair and poor habitat quality may reflect natural physical features such as waterfall barriers, as well as degradation caused by man.

Table 2 (HB-2). Estimated amount of rearing only habitat by quality of John Day River subbasin spring chinook production area[a].

Distance/ Area	Excellent	Good	Fair[b]	Poor[b]	Unknown	Total	Confi- dence
Miles (%)	0.0	7.8	28.9	9.4	--	151.1	--
Acres (%)	--	--	--	--	--	--	--

[a] Estimates are modified from the Northwest Power Planning Council's presence/absence database.
[b] Ratings of fair and poor habitat quality may reflect natural physical features such as waterfall barriers, as well as degradation caused by man.

Table 3 (JM). Number of natural juvenile spring chinook that migrated from the John Day River subbasin[a], 1978-1982 brood years.

Brood Year	Time of Migration		Total
	Fall (subyearling)	Spring	
1978	--	169,000	--
1979	--	83,000	--
1980	.-	94,000	--
1981	--	64,000	--
1982	--	78,000	--

[a] Lindsay et al. (1986).

Table 4 (TR-a). Releases of coded wire tagged wild spring chinook salmon into the John Day subbssin by brood year[a].

Brood Year	BroodStock	Hatchery	Life Stage	Re 1 ease Date (1)	Release Date (2)	Fork length	Number Released	Release Location	CWT/ Fin clip
1976	John Day R.	--	smolt	04/01/78[b]	06/30/78[b]	--	407	Mainstem (km 253-298)	07-17-01
1977	John Day R.	..	fing.	06/01/78[b]	10/31/78[b]	--	9,351	..	H7-01-06
1977	John Day R.	..	Smelt	02101/79[b]	05/31/79[b]	--	740	Mainstem (km 253-298)	07-17-02
1978	John Day R.	--	fing.	06/15/79[c]	--	--	9	Mainstem (km 418-643)	07-19-42
1978	John Day R.	--	fing.	06/01/79[b]	08/31/79[b]	--	3,546	Middle Fork	07-19-39
1978	John Day R.	.-	fing.	06/01/79[b]	08/31/79[b]	--	5,042	North Fork	07-19-41
1978	John Day R.	..	fing.	06/01/79[b]	07/31/79[b]	--	8,029	Granite Creek	07-19-40
1978	John Day R.	--	fing.	07/01/79[b]	08/31/79[b]	--	5 # 888	Granite Creek	07-20-24
1978	John Day R.	--	fing.	08/01/79[b]	10/31/79[b]	--	8,797	Granite Creek	07-20-25
1978	John Day R.	..	smelt	02/01/80[b]	05/31/80[b]	--	1,548	Mainstem (km 282)	07-20-26
1978	John Day R.	..	Smelt	03/01/80[b]	06/30/80[b]	.-	608	Middle Fork (km 51)	07-20-27
1978	John Day R.	..	smolt	02/01/80[b]	05/31/80[b]	..	923	North Fork (km 97)	07-20-28
1979	John Day R.	--	fing.	09/15/80:	..	--	98	Mainstem (km 418-443)	07-20-56
1979	John Day R.	..	fing.	06/01/80[b]	09/30/80[b]	--	4, 056	Middle Fork	07-20-57
1979	John Day R.	..	fing.	06/01/80[b]	09/30/80[b]	--	7,397	North Fork	07-20-58
f 979	John Day R.	..	fing.	07/01/80[b]	09/30/80[b]	--	8,447	Granite Creek	07-20-59
1979	John Day R.	..	fing.	09/15/80[c]	--	--	517	Granite Creek	07-20-60
1979	John Day R.	--	smolt	02/01/81[b]	05/31/81[b]	..	1,608	Mainstem (km 282)	07-20-61
1979	John Day R.	--	Smelt	02/01/81[b]	04/30/81[b]	--	232	Mainstem (km 394)	07-20-62
1979	John Day R.	..	Smelt	03/01/81[b]	04/30/81[b]	--	333	Middle Fork (km 51)	07-20-63
1979	John Day R.	--	Smelt	02/01/81[b]	04/30/81[b]	--	270	North Fork (km 97)	07-21-01
1980	John Day R.	--	fing.	05/01/81[b]	06/30/81[b]	--	3,863	Middle Fork	07-21-02
1980	John Day R.	--	fing.	06/01/81[b]	09/30/81[b]	--	1,575	Middle Fork	07-23-55
1980	John Day R.	--	fing.	06/01/81[b]	09/30/81[b]	..	4,731	North Fork	07-23-52
1980	John Day R.	--	fing.	09/15/81[c]	--	..	557	North Fork	07-23-56
1980	John Day R.	--	fing.	09/15/81;	--	--	236	Granite Creek	07-23-51
1980	John Day R.	--	fing.	06/01/81[b]	09/30/81[b]	--	7,518	Granite Creek	07-23-54
1980	John Day R.	--	smolt	03/01/82[b]	05/31/82[b]	..	612	Mainstem (km 282)	07-23-53
1980	John Day R.	--	smolt	03/01/82[b]	05/31/82[b]	--	71	Mainstem (km 35)	07-26-58
1980	John Day R.	--	smolt	03/01/82[b]	05/31/82[b]	..	243	Mainstem (km 394)	07-26-59
1980	John Day R.	--	Smelt	03/01/82[b]	05/31/82[b]	--	46	Middle Fork (km 51)	07-26-60
1980	John Day R.	--	Smelt	03/01/82[b]	04/30/82[b]	--	364	North Fork (km 97)	07-26-61

[a] Estimates are from Lindsay et al. (1986).
[b] Release dates unknown. Standardized to the first and last days of the ninths released.
[c] Release dates unknown (only the month of release known). Standardized to the middle of the month for the month of release.

Table 5 (AE). Emigration of coded wire tagged wild *spring* chinook salmon released as juveniles in the John Day River subbasin[a,b].

Hatchery/Release Site	Recovery Site, Run Year(s)	Recovery Method	Number Recovered	Total Number Estimated, (PSMFC)
John Day River	Alsea River 1979	Hatchery Returns	1	1
John Day River	Rogue River 1986	Hatchery Returns	1	1

[a] Based on the following tag codes: 07-20-62, 07-26-59.
[b] Estimates are a synthesis of data from the Pacific States Marine Fisheries Commission coded wire tag database.

Table 6 (AI-l). Non-harvest recoveries of coded wire tagged wild spring chinook salmon in the John Day River subbasin[a,b].

Hatchery/Release Site	Recovery Site, Run Year(s)	Recovery Method	Number Recovered	Total Number Estimated, (PSMFC)
John Day River	John Day River	Spawner Surveys		
	1981	--	8	8
	1982	--	68	68
	1983	--	22	22
	1984	--	39	39
	1985	--	4	4
Columbia River[c]	John Day River	Spawner Surveys		
	1985	--	1	1

[a] Based on the following tag codes: 07-17-02, 07-19-39, 07-19-40, 07-19-41, 07-20-24, 07-20-25, 07-20-26, 07-20-27, 07-20-28, 07-20-57, 07-20-58, 07-20-59, 07-20-61, 07-20-63, 07-21-02, 07-23-51, 07-23-52, 07-23-53, 07-23-54, 07-23-55, 07-26-61, 23-16-22, H7-01-06.

[b] Estimates are a synthesis of data from the Pacific States Marine Fisheries Commission coded wire tag database.

[c] Mark and release site was in the mainstem Columbia River below Bonneville Dam. The fish is assumed to have originated in the John Day River subbasin.

Table 7 (AI-2). Non-harvest recoveries of coded wire tagged hatchery spring chinook salmon in the John Day River subbasin[a,b].

Hatchery/Release Site	Recovery Site, Run Year(s)	Recovery Method	Number Recovered	Total Number Estimated, (PSMFC)
Kooskia NFH	John Day River 1982	Spawner Surveys	1	1

[a] Based on the following tag codes from fish of unknown rearing type (assumed to be hatchery): 05-04-27.
[b] Estimates are a synthesis of data from the Pacific States Marine Fisheries Commission coded wire tag database.

Table 8 (AL-l). Mean fork length by brood year and age class (freshwater.ocean) for wild spring chinook salmon collected on spawning ground surveys conducted above Prairie City *in* the mainstem John Day River subbasin[a].

Brood Year	N	Mean Fork length (cm) 1.1	1.2	1.3	2.1	2.2	2.3	3.1	3.2	3.3
1982	--	--	--	--	--	--	88	--	--	--
1983	--	--	--	--	--	70	85	--	--	--
1984	--	--	--	--	--	69	--	--	--	--

[a] Estimates are from Oregon Department of Fish and Wildlife (unpublished data).

Table 9 (AL-2). Mean fork length by brood year and age class (freshwater.ocean) for wild spring chinook salmon collected *on* spawning ground surveys conducted above Galena in the Middle Fork John Day River subbasin[a].

Brood Year	N	Mean Fork length (cm) 1.1	1.2	1.3	2.1	2.2	2.3	3.1	3.2	3.3
1982	--	--	--	--	--	--	80	--	--	--
1983	--	--	--	--	--	69	81	--	--	--
1984	--	--	--	--	42	68	--	--	--	--

[a] Estimates are from Oregon Department of Fish and Wildlife (unpublished data).

Table 10 (AL-3). Mean fork length by brood year and age class (freshwater.ocean) for wild spring chinook salmon collected on spawning ground surveys conducted above Desolation Creek in the North Fork John Day River[a].

		Mean Fork length (cm)								
Brood Year	N	1.1	1.2	1.3	2.1	2.2	2.3	3.1	3.2	3.3
1982	--	--	--	--	--	--	84	--	--	--
1983	--	--	--	--	--	71	85	--	--	--
1984	--	--	--	--	48	71	--	--	--	--
1985	--	--	--	--	48	--	--	--	--	--

[a] Estimates are from Oregon Department of Fish and Wildlife (unpublished data).

Table 11 (AL-4). Mean fork length by brood year and age class (freshwater.ocean) for wild spring chinook salmon collected on spawning ground surveys conducted in the Granite Creek system; a tributary to the North Fork John Day River[a].

		Mean Fork length (cm)								
Brood Year	N	1.1	1.2	1.3	2.1	2.2	2.3	3.1	3.2	3.3
1982	--	--	--	--	--	--	--	87	--	--
1983	--	--	--	--	--	70	82	--	--	--
1984	--	--	--	--	--	68	--	--	--	--

[a] Estimates are from Oregon Department of Fish and Wildlife (unpublished data).

Table 12 (AC-l). Age Composition (freshwater.ocean) by brood year for wild spring chinook salmon collected on spawning ground surveys conducted above Prairie City in the mainstem John Day River[a].

Brood Year	N	Age Composition (%)								
		1.1	1.2	1.3	2.1	2.2	2.3	3.1	3.2	3.3
1975	24	--	--	--	0	92	8	--	--	--
1976	5	--	--	--	0	40	60	--	--	--
1977	6	--	--	--	0	83	17	--	--	--
1978	5	--	--	--	0	80	20	--	--	--
1979	25	--	--	--	0	84	16	--	--	--
1980	42	--	--	--	0	90	10	--	--	--
1981	50	--	--	--	2	96	2	--	--	--
1982	22	--	--	--	27	59	14	--	--	--
1983	40	--	--	--	10	65	25	--	--	--

[a] Estimates for the 1975-83 brood years are from Oregon Department of Fish and Wildlife (unpublished data).

Table 13 (AC-2). Age Composition (freshwater.ocean) by brood year for wild spring chinook salmon collected on spawning ground surveys conducted above Galena in the Middle Fork John Day River[a].

Brood Year	N	Age Composition (%)								
		1.1	1.2	1.3	2.1	2.2	2.3	3.1	3.2	3.3
1975	55	--	--	--	4	76	20	--	--	--
1976	8	--	--	--	0	63	37	--	--	--
1977	13	--	--	--	8	85	7	--	--	--
1978	35	--	--	--	0	91	9	--	--	--
1979	45	--	--	--	0	91	9	--	--	--
1980	60	--	--	--	2	82	17	--	--	--

[a]Estimates for the 1975-80 brood years are from Oregon Department of Fish and Wildlife (unpublished data).

Table 14 (AC-3). Age Composition (freshwater.ocean) by brood year for wild spring chinook salmon collected on spawning ground surveys conducted above Desolation Creek in the North Fork John Day River[a].

Brood Year	N	Age Composition (%) 1.1	1.2	1.3	2.1	2.2	2.3	3.1	3.2	3.3
1975	39	--	--	--	0	69	31	--	--	--
1976	47	--	--	--	0	36	64	--	--	--
1977	97	--	--	--	0	93	7	--	--	--
1978	89	--	--	--	6	76	18	--	--	--
1979	57	--	--	--	4	89	7	--	--	--
1980	48	--	--	--	0	75	25	--	--	--
1981	70	--	--	--	3	96	1	--	--	--
1982	106	--	--	--	8	59	33	--	--	--
1983	135	--	--	--	1	73	26	--	--	--

[a]Estimates for the 1975-83 brood years are from Oregon Department of Fish and Wildlife (unpublished data).

Table 15 (AC-4). Age Composition (freshwater.ocean) by brood year for wild spring chinook salmon collected on spawning ground surveys conducted in the Granite Creek system; a tributary to the North Fork John Day River.

		Age Composition (%)								
Brood Year	N	1.1	1.2	1.3	2.1	2.2	2.3	3.1	3.2	3.3
1975	--	--	--	--	4	70	26	--	--	--
1976	--	--	--	--	3	75	22	--	--	--
1977	--	--	--	--	0	88	12	--	--	--
1978	--	--	--	--	1	85	14	--	--	--
1979	--	--	--	--	11	77	11	--	--	--
1980	--	--	--	--	2	82	16	--	--	--
1981	--	--	--	--	5	94	1	--	--	--
1982	--	--	--	--	6	86	9	--	--	--
1983	--	--	--	--	9	72	19	--	--	--

*Estimates for the 1975-83 brood years are from Oregon Department of Fish and Wildlife (unpublished data).

Table 16 (AC-a). Age Composition (freshwater.ocean) by run year for wild spring chinook salmon collected on spawning ground surveys conducted above Prairie City in the mainstem John Day River[a].

Run Year	N	Age Composition (%)								
		1.1	1.2	1.3	2.1	2.2	2.3	3.1	3.2	3.3
1978	3	--	--	--	0	100	0	--	--	--
1979	22	--	--	--	0	100	0	--	--	--
1980	4	--	--	--	0	50	50	--	--	--
1981	8	--	--	--	0	62	38	--	--	--
1982	5	--	--	--	0	80	20	--	--	--
1983	22	--	--	--	0	96	4	--	--	--
1984	43	--	--	--	3	88	9	--	--	--
1985	58	--	--	--	10	83	7	--	--	--
1986	18	--	--	--	22	72	6	--	--	--
1987	29	-	--	-	0	90	10		--	
1988	20	--	--	--	0	50	50	--	--	--

[a] Estimates for the 1978-85 run years are from Lindsay et al. (1986) and for the 1986-88 run years from Oregon Department of Fish and Wildlife unpublished data).

Table 17 (AC-b). Age Composition (freshwater.ocean) by run year for wild spring chinook s
spawning ground surveys conducted above Galena in the Middle Fork John Day River[a].

Run Year	N	Age Composition (%) 1.1	1.2	1.3	2.1	2.2	2.3	3.1	3.2	3.3
1978	56	--	--	--	4	94	2	--	--	--
1979	44	--	--	--	0	96	4	--	--	--
1980	17	--	--	--	6	29	65	--	--	--
1981	14	--	--	--	0	79	21	--	--	--
1982	33	--	--	--	0	97	3	--	--	--
1983	45	--	--	--	2	91	7	--	--	--
1984	56	--	--	--	5	88	7	--	--	--
1985	27	--	--	--	4	59	37	--	--	--
1986	4	--	--	--	--	--	--	--	--	--
1987	103	--	--	--	1	83	16	--	--	--
1988	49	--	--	--	0	71	29	--	--	--

[a] Estimates for the 1978-85 run years are modified from Lindsay et al. (1986) and for the
from Oregon Department of Fish and Wildlife (unpublished data).

Table 18 (AC-c). Age Composition (freshwater.ocean) by run year for wild spring chinook salmon collected on spawning ground surveys conducted above Desolation Creek in the North Fork John Day River[a].

		Age Composition (%)								
Run Year	N	1.1	1.2	1.3	2.1	2.2	2.3	3.1	3.2	3.3
1978	36	--	--	--	0	39	61	--	--	--
1979	32	--	--	--	0	84	16	--	. .	--
1980	29	--	--	--	0	59	41	--	--	--
1981	125	--	--	--	4	72	24	--	--	--
1982	77	--	--	--	3	88	9	--	--	--
1983	67	--	--	--	0	76	24	--	--	--
1984	42	--	--	--	5	86	9	--	--	--
1985	87	--	--	--	9	77	14	--	--	--
1986	66	--	--	--	3	95	2	--	--	--
1987	134	--	--	--	1	73	26	--	--	--
1988	92	--	--	--	2	60	38	--	--	--

[a] Estimates for the 1978-85 run years are modified from Lindsay et al. (1986) and for the 1986-88 run years from Oregon Department of Fish and Wildlife (unpublished data).

Table 19 (AC-d). Age Composition (freshwater.ocean) by run year for wild spring chinook salmon collected on spawning ground surveys conducted in the Granite Creek system; a tributary to the North Fork John Day River[a].

		Age Composition (%)								
Run Year	N	1.1	1.2	1.3	2.1	2.2	2.3	3.1	3.2	3.3
1978	85	--	--	--	2	38	60	--	--	--
1979	46	--	--	--	2	72	26	--	--	--
1980	36	--	--	--	0	67	33	--	--	--
1981	67	--	--	--	2	88	10	--	--	--
1982	98	--	--	--	4	88	8	--	--	--
1983	42	--	--	--	3	64	33	--	--	--
1984	50	--	--	--	10	82	8	--	--	--
1985	110	--	--	--	4	88	7	--	--	--
1986	86	--	--	--	9	90	1	--	--	--
1987	71	--	--	--	0	89	11	--	--	--
1988	33	--	--	--	0	48	52	--	--	--

[a] Estimates for the 1978-85 run years are modified from Lindsay et al. (1986) and for the 1986-88 run years from Oregon Department of Fish and Wildlife (unpublished data).

Table 20 (AS-l). Percent females by brood year and age class (freshwater.ocean) for wild spring chinook salmon collected on spawning ground surveys conducted above Prairie City in the mainstem John Day River[a].

		Females (%)								
Brood Year	N	1.1	1.2	1.3	2.1	2.2	2.3	3.1	3.2	3.3
1982	--	--	--	--	--	--	67	--	--	--
1983	--	--	--	--	--	62	70	--	--	--
1984	--	--	--	--	--	90	--	--	--	--

[a] Estimates for the 1982-84 brood years are from Oregon Department of Fish and Wildlife (unpublished data).

Table 21 (AS-2). Percent females by brood year and age class (freshwater.ocean) for wild spring chinook salmon collected on spawning ground surveys conducted above Galena in the Middle Fork John Day River[a].

		Females (%)								
Brood Year	N	1.1	1.2	1.3	2.1	2.2	2.3	3.1	3.2	3.3
1982	--	--	--	--	--	--	69	--	--	--
1983	--	--	--	--	--	71	86	--	--	--
1984	--	--	--	--	0	74	--	--	--	--

[a] Estimates for the 1982-84 brood years are from Oregon Department of Fish and Wildlife (unpublished data).

Table 22 (AS-3). Percent females by brood year and age class (freshwater.ocean) for wild spring chinook salmon collected on spawning ground surveys conducted above Desolation Creek in the North Fork John Day River[a].

		Females (%)								
Brood Year	N	1.1	1.2	1.3	2.1	2.2	2.3	3.1	3.2	3.3
1982	--	--	--	--	--	--	65	--	--	--
1983	--	--	--	--	--	53	71	--	--	--
1984	--	--	--	--	0	62	--	--	--	--
1985	--	--	--	--	0	--	--	--	--	--

[a] Estimates for the 1982-85 brood years are from Oregon Department of Fish and Wildlife (unpublished data).

Table 23 (AS-4). Percent females by brood year and age class (freshwater.ocean) for wild spring chinook salmon collected on spawning ground surveys conducted in the Granite Creek system; a tributary to the North Fork John Day River[a].

		Females (%)								
Brood Year	N	1.1	1.2	1.3	2.1	2.2	2.3	3.1	3.2	3.3
1982	--	--	--	--	--	--	75	--	--	'-
1983	--	--	--	--	--	57	71	--	--	--
1984	--	--	--	--	--	71	--	--	--	--

[a] Estimates for the 1982-84 brood years are from Oregon Department of Fish and Wildlife (unpublished data).

Table 24 (sL). Lengths of wild spring chinook smelts from the John Day River subbasin.

Location and Year	No. Fish	Lenath (mm) ave.	range	Reference
mainstem(@ Spray)				
1978	224	109	--	Lindsay et al. (1986)
1979	164	98	--	Lindsay et al. (1986)
1980	718	104	--	Lindsay et al. (1986
1981	525	108	--	Lindsay et al. (1986
1982	244	106	--	Lindsay et al. (1986
1983	405	113	--	Lindsay et al. (1986
1984	542	110	--	Lindsay et al. (1986
mainstem(@ Rock Cr)				
1982	77	110	--	Lindsay et al. (1986
1983	18	126	--	Lindsay et al. (1986
mainstem(@ John Day)				
1980	9	107	--	Lindsay et al. (1986
1981	309	108	--	Lindsay et al. (1986
1982	234	113	--	Lindsay et al. (1986)
1983	255	108	--	Lindsay et al. (1986)
1984	206	99	--	Lindsay et al. (1986)
Middle Fork(@ Slide Creek)				
1980	441	105	--	Lindsay et al. (1986)
1981	374	98	--	Lindsay et al. (1986)
1982	51	91	--	Lindsay et al. (1986)
1983	14	108	--	Lindsay et al. (1986)
1984	151	104	--	Lindsay et al. (1986)
North Fork(@ Desolation Creek)				
1980	502	94	--	Lindsay et al. (1986)
1981	301	96	--	Lindsay et al. (1986)
1982	192	93	--	Lindsay et al. (1986)
1983	477	92	--	Lindsay et al. (1986)
1984	386	96	--	Lindsay et al. (1986)

Table 25 (TD). Parasites and diseases of wild spring chinook collected in the John Day River subbasin[a].

Disease Type	Location	Specific Pathogen
Bacteria	John Day River	*Renibacterium salmoninarum* (Bacterial kidney disease)

[a]Data are from (personal communication, Bill Knox, Oregon Department of Fish and Wildlife, as cited by Howell et al. 1985).

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JOHN DAY RIVER SUBBASIN

Naturally Produced Fall Chinook Salmon

GEOGRAPHIC LOCATION

The John Day River drains 8,100 square miles in east central Oregon and is the third largest drainage area in the state. From its source in the Strawberry Mountains at an elevation near 5,906 ft, the John Day River flows 284 mi to its mouth at rm 218 on the Columbia River. The John Day River is located above Bonneville, The Dalles, and John Day dams.

ORIGIN

Fall chinook are indigenous to the John Day River subbasin. Subbasin production is entirely from the native stock.

DISTRIBUTION

Subbasin

Spawning distribution is believed to have extended up to RM 184 below the confluence of the North Fork of the John Day River (USFWS and NMFS 1981, cited by Howell et al. 1985) and (ODFW 1980, cited by Howell et al. 1985).

ADULT LIFE HISTORY

Escapement

Subbasin

Numbers: Present escapement is currently estimated at fewer than 100 adult fish (personal communication with Errol Claire, District Fish Biologist, Oregon Department of Fish and Wildlife, John Day, Oregon, on 10/15/92).

REFERENCES

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JOHN DAY RIVER SUBBASIN

Naturally Produced Summer Steelhead

GEOGRAPHIC LOCATION

The John Day River drains 8,100 square miles in east central Oregon and is the third largest drainage area in the state. From its source in the Strawberry Mountains at an elevation near 5,906 ft, the John Day River flows 284 mi to its mouth at rm 218 on the Columbia River. The John Day River is located above Bonneville, The Dalles, and John Day dams.

ORIGIN

Summer steelhead are indigenous to the John Day River subbasin. The subbasin currently sustains the largest remaining native wild summer steelhead run in eastern Oregon. Non-indigenous stocks were released into the subbasin in 1966, 1967, and 1969 (see JOHN DAY RIVER SUBBASIN, Hatchery Produced Summer Steelhead, PRODUCTION). With the except of these releases, subbasin production has entirely been from the native stock. Strays are believed to account for 4% to 8% of the run (Oregon Department of Fish and Wildlife et al. 1990)

DISTRIBUTION

Subbasin

Summer steelhead are distributed throughout most of the John Day River subbasin (Figure 1). There is currently only one major man-made barrier that block summer steelhead from historical spawning and rearing areas; a dam located at RM 0.5 in Bridge Creek (Grant County). . Irrigation dams have historically blocked passage at several locations in Rock Creek (Gilliam County), however, fishways were constructed to improve passage. The fishways were put into operation beginning with the 1992-93 run year (personal communication with Errol Claire, District Fish Biologist, Oregon Department of Fish and Wildlife, John Day, Oregon, on 10/15/92). During low flow years passage may also be blocked or impeded in various tributary streams. The quality of the spawning and rearing habitat varies throughout the subbasin (Tables 1 and 2).

Approximations of the temporal distribution of adult holding, incubation, emergence, and rearing were reported in Oregon Department of Fish and Wildlife et al. (1990) and are presented in Figure 2. The methodology used to generate these approximations is unknown.

PRODUCTION

Harvest

sport

Subbasin: The John Day subbasin currently supports a popular sport fishery. There are no records of a season closure in the subbasin. No brood year specific estimates of harvest are available. Run year specific estimates of harvest (punch card) for the 1975-76 through 1987-88 run years are available in Oregon Department of Fish and Wildlife et al. (1990), and for the 1988-89 through 1990-91 run years in Oregon Department of Fish and Wildlife (unpublished data).

Treaty

Subbasin: The Umatilla and Warm Springs confederated tribes have reserved usual and accustomed fishing sites located in the John Day River subbasin. No information is available on tribal harvest of wild summer steelhead.

ADULT LIFE HISTORY

Escapement

Columbia River

Timing: "Adults pass Bonneville Dam July 15-August 15 and pass John Day Dam July-March" (W. Bowers, ODFW, personal communication, cited by Howell et al. 1985).

Subbasin

Timing: "Fish begin migrating up the John Day River in September when water temperatures cool and flow increases" (Howell et al. 1985; Figure 2).

Spawner Area

Timing: "The earliest spawning begins in lower tributaries in mid-March. Spawning progresses upstream and continues through mid-June in the upper tributaries" (personal communication, Errol Claire, ODFW, cited by Howell et al. 1985; Figure 2). Temporal distribution of migration was monitored in Tex Creek, a tributary of Murderers Creek, which flows into the South Fork of the John Day. In most years temporal distribution of migration into Tex Creek extended through May (West et al. 1965, cited by Howell et al. 1985).

Fry emerge in Tex Creek in early July (West et al. 1965, cited by Howell et al. 1985).

Numbers: No brood year specific estimates of spawner escapement are available. Spawning ground counts are available from Oregon Department of Fish and Wildlife (unpublished data).

Age Structure

The native stock of summer steelhead primarily migrate as age 2+ and 3+ juvenile fish and return as 1 and 2 salt fish (Howell et al. 1985).

Sex Ratio

No brood year specific information is available for the native stock of summer steelhead returning to the John Day River subbasin. The estimated sex ratio (percent females) for returns to Tex Creek was 50% (West et al. 1965, cited by Howell et al. 1985).

JUVENILE LIFE HISTORY

Migration Timing

"The most extensive set of data documenting juvenile migration patterns are records of rotary screen bypass traps on irrigation diversions. Interpretation of those data is complicated by varying trap efficiencies, numbers of traps, and timing of installation, which are dependent upon precipitation, flows, and irrigation demands. It is also not possible to readily distinguish juvenile steelhead from resident rainbow trout, both of which are present in the

streams.

Peak downstream movement of smelts generally occurs from April through June (Personal communication with Errol Claire, District Fish Biologist, Oregon Department of Fish and Wildlife, John Day, Oregon, on 10/15/92; Figure 2). Fry and fingerlings also migrate during the fall with peak migration occurring from October through November (Personal communication with Errol Claire, District Fish Biologist, Oregon Department of Fish and Wildlife, John Day, Oregon, on 10/15/92). "In Tex Creek peak spring migration occurred in mid-May and early June" (West et al. 1965, cited by Howell et al. 1985).

Peak spring movement of juvenile fish is generally associated with smelt migration, however, downstream migrants sampled in Camp Creek in the spring of 1984 were primarily age 1+ fish (Howell et al. 1985). "Similarly, none of the downstream migrants sampled in Tex Creek during the spring were classified as "smelts"" (Howell et al. 1985).

Juvenile summer steelhead periodically migrate during the summer and fall. These later migrations may be related to increases in precipitation and flow (Howell et al. 1985). Movement into the larger tributaries and the mainstem indicate that these areas may be providing important rearing habitat prior to migration as smelts.

BIOCHEMICAL-GENETIC CHARACTERISTICS

Juvenile summer steelhead were collected from the John Day River subbasin, and analyzed electrophoretically at selected protein-coding loci (Schreck et al. 1986). Relative allele nobilities and allele frequencies were determined for 19 enzyme systems in the 1984 sample, and for 21 enzyme systems in the 1985 sample (Appendix Table 4). Six rare alleles were detected, at the creatine kinase, glucose phosphate isomerase, and malate dehydrogenase loci in the 1984 sample.

Schreck et al. (1986) classified Columbia River Basin steel head into several clusters of similar stocks based on biochemical, morphological and life history characters (Appendix Table 4). Columbia River Basin steel head stocks segregate into two primary groups, those from west of the Cascade Mountains and those from east of the Cascades. As expected, wild summer steelhead from the John Day River cluster with other stocks from east of the Cascades. This primary group is composed of 3 subgroups. At the subgroup level, wild summer steelhead from the John Day River were found to be most similar to other wild summer steelhead stocks from tributaries of the Columbia between Fifteenmile Creek and the Entiat River, the lower Snake River and the Salmon River. This subgroup is characterized by the greatest average head length, maxillary length, head depth, and interorbital width. This subgroup also has the lowest average caudal peduncle length.

DISEASES

"Tissue samples from eight adult steelhead and 50 rainbow trout spawners were tested for viral hemorrhagic septicemia, infectious pancreatic necrosis (IPN), and infectious hematopoietic necrosis (IHN). No evidence of these viruses was found" (Knox et al. 1984, cited by Howell et al. 1985).

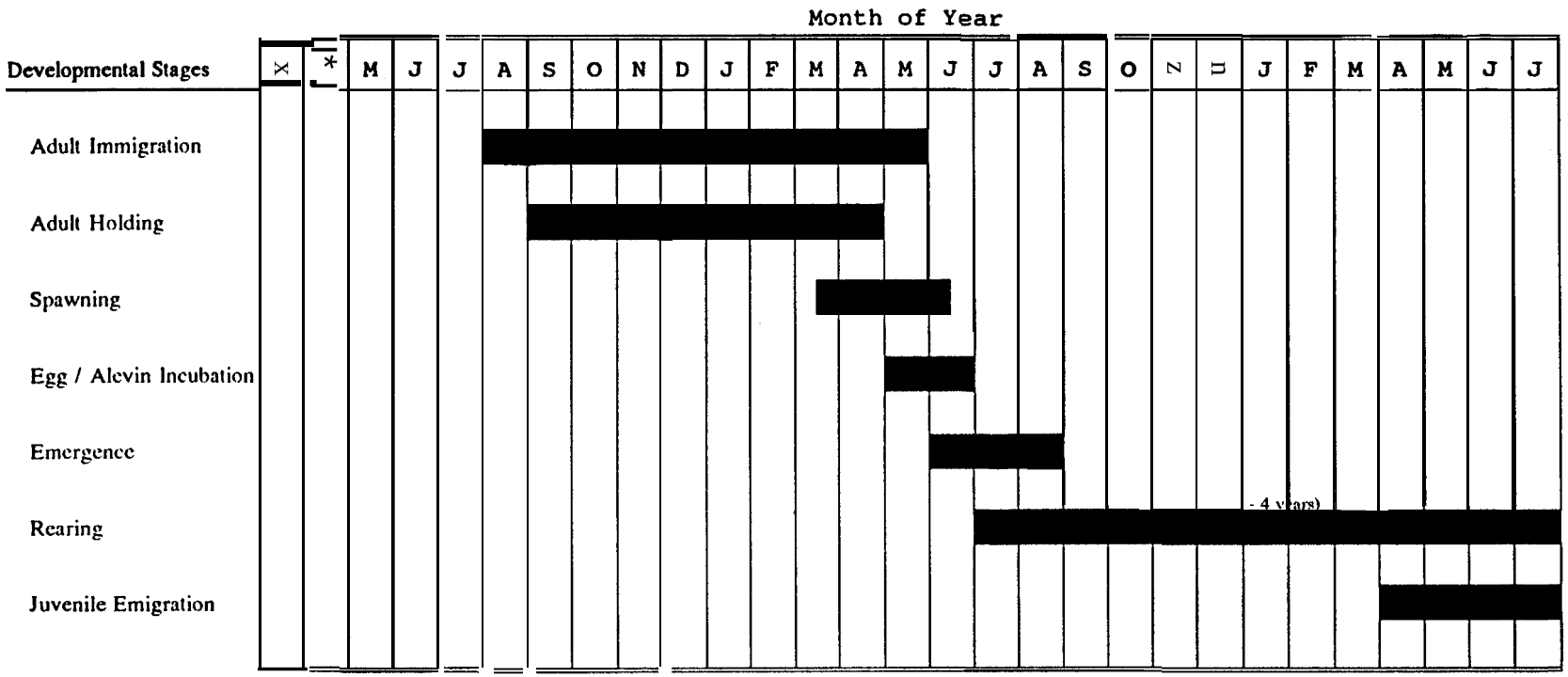

Figure 2 (TT). Summer steelhead freshwater l fe history in the ay River subbasin (Oregon Department of Fish and Wildlife et al. 1990).

Table 1 (HB-1). Estimated amount of spawning and rearing habitat by quality of John Day River subbasin summer steelhead production area[a].

Distance/ Area	Excellent	Good	Fair[b]	Poor[b]	Unknown	Total	Confi-dence
Miles (%)	0.0	12.9	74.4	12.7	--	1555.1	--
Acres (%)	--	--	--	--	--	--	--

[a] Estimates are modified from the Northwest Power Planning Council's presence/absence database.
[b] Ratings of fair and poor habitat quality may reflect natural physical features such as waterfall barriers, as well as degradation caused by man.

Table 2 (HB-2). Estimated amount of rearing habitat by quality of John Day River subbasin summer steelhead production area[a].

Distance/ Area	Excellent	Good	Fair[b]	Poor[b]	Unknown	Total	Confi-dence
Miles (%)	0.0	7.2	77.7	15.1	--	322.5	--
Acres (%)	--	--	--	--	--	--	--

[a] Estimates are modified from the Northwest Power Planning Council's presence/absence database.
[b] Ratings of fair and poor habitat quality may reflect natural physical features such as waterfall barriers, as well as degradation caused by man.

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JOHN DAY RIVER SUBBASIN

Hatchery Produced Summer Steelhead

ORIGIN

The first recorded release of juvenile hatchery fish into the subbasin is the 1966 release of Skamania stock fingerlings (Table 1). Juvenile hatchery fish were released into the subbasin in 1966, 1967, and 1969 (Table 1). Stocks introduced into the subbasin include the Skamania and Oxbow (Idaho) stocks and one release of an unknown stock (Table 1). These releases were test releases for special studies only and not for production purposes as there is currently no hatchery supplementation program in the subbasin (Personal communication with Errol Claire, District Fish Biologist, Oregon Department of Fish and Wildlife, John Day, Oregon, on 10/15/92).

DISTRIBUTION

Subbasin

Juvenile hatchery summer steelhead were released into the Middle Fork of the John Day River in 1966, the mainstem John Day River and Camas Creek in 1967, and Bridge Creek in 1969 (Table 1).

PRODUCTION

Releases

Egg

There are no records of releases in the subbasin.

Fry

There are no records of releases in the subbasin.

Fingerling

Hatchery facilities in which fingerlings were reared or acclimated prior to release in the subbasin are unknown (Table 1). Annual numbers released ranged from 22,400 to 170,500 fish (Table 1). Size at release is unknown.

Smelt

There are no records of releases in the subbasin.

Adult

There are no records of releases in the subbasin.

Table 1 (TR). Hatchery releases of summer steel head into the John Day River subbasin by brood year and i f marked, by coded wi re tag Codes.

Brood Year	Broodstock	Hatchery	Life Stage	Release Date (1)	Release Date (2)	Fish/ lb	Number Released	Release Location	CWT/ Fin clip
..	Skameni a	--	Fing.	01/01/66[b]	12/31/66[b]	- -	55.568	Mfk John Day River	--
..	Idaho (Oxbow)	--	Fing.	01/01/67[b]	12/31/67[b]	- -	99,000	John Day River	..
--	Idaho (Oxbow)	- -	Fing.	01/01/67[b]	12/31/67[b]	- -	71,500	Camas Creek	--
- - - -	-[c]	..	Fing.	01/01/69[b]	12/31/69[b]	- -	22,400	Bridge Creek	..

[a] Estimates are from Howell et al. (1985).
[b] Release dates unknown (only the year of release known). Standardized to the f i rst and last day of the year.
[c] Race and broodstock unknown. Assumed to be summer steelhead based on the fact that releases from 1966-67 were summer steelhead.

REFERENCES

Howell, P., K. Jones, D. Scarnecchia, L. Lavoy, W. Kendra, D. Ortmann. 1985. Stock assessment of Columbia River anadromous salmonids, volume II: steelhead stock summaries-Stock Transfer Guidelines-Information Needs. Final Report of Oregon Department of Fish and Wildlife, Washington Department of Fisheries, Washington Department of Game, and Idaho Department of Fish and Game (Contract No. DE-A179-84BP12737, Project Number 83-335) to Bonneville Power Administration, Portland, Oregon, USA.

JOHN DAY RIVER SUBBASIN

Hatchery Produced Winter Steelhead

ORIGIN

The first recorded release of juvenile hatchery fish into the subbasin is the 1962 release of Eagle Creek stock fingerlings and fingerlings from an unknown stock (Table 1). Juvenile hatchery fish were released into the subbasin in 1962, 1964, and 1965 (Table 1). Stocks introduced into the subbasin include the Eagle Creek, Sandy, and Alsea stocks and one release of an unknown stock (Table 1). All of the fish released were for special project evaluation and not for production (Personal communication with Errol Claire, District Fish Biologist, Oregon Department of Fish and Wildlife, John Day, Oregon, on 10/15/92). The one release of fry into the subbasin (Table 1) were swimups at the time of release and most died immediately after release due to hauling stress (Personal communication with Errol Claire, District Fish Biologist, Oregon Department of Fish and Wildlife, John Day, Oregon, on 10/15/92). There is currently no hatchery supplementation program in the subbasin.

DISTRIBUTION

Subbasin

Hatchery winter steelhead were released into Camas, Cable, Bowman, and Granite creeks in 1962, the mainstem John Day River in 1964, and the South Fork of the John Day River in 1965 (Table 1).

PRODUCTION

Releases

Egg

There are no records of releases in the subbasin.

Fry

Hatchery facilities in which fry were reared or acclimated prior to release in the subbasin are unknown (Table 1). One release of 375,000 fry was made in 1962. Size at release is unknown.

Fingerling

Hatchery facilities in which fingerlings were reared or acclimated prior to release in the subbasin are unknown (Table 1). Annual numbers released ranged from 10,200 to 200,000 fish (Table 1). Size at release is unknown.

Smelt

There are no records of releases in the subbasin.

Adult

There are no records of releases in the subbasin.

Table 1 (TR). Hatchery releases of winter steelhead into the John Day River subbasin by brood year and if marked, by coded w

Brood Year	Broodstock	Hatchery	Life Stage	Release Date (1)	Release Date (2)	Fish/ lb	Number Released	Release Location	CUT/ Fin clip
. [b] . .		..	..[c]	01/01/62[d]	12/31/62;	45.0	200,000	Camas, Cable, and Bowman cr.	--
--	Eagle Creek	--	Fry	01/01/62[d]	12/31/62[d]	- -	375,000	Granite Creek	--
--	Sandy	--	Fing.	01/01/64[d]	12/31/64[d]	--	10,200	John Day River	.-
..	Al sea	..	Fing.	01/01/65[d]	12/31/65[d]	--	27,900	Sfk John Day River	..

[a] Estimates are from Howell et al. (1985).
[b] Race unknown. Assumed to be winter steelhead based on the fact that one other group of steelhead released into the drainag as winter steelhead.
[c] Life stage unknown. Assumed to be fingerlings based on size at release.
[d] Release dates unknown (only the year of release known). Standardized to the first and last day of the year.

REFERENCES

Howell, P., K. Jones, D. Scarnecchia, L. Lavoy, W. Kendra, D. Ortmann. 1985. Stock assessment of Columbia River anadromous salmonids, volume II: steelhead stock summaries-Stock Transfer Guidelines-Information Needs. Final Report of Oregon Department of Fish and Wildlife, Washington Department of Fisheries, Washington Department of Game, and Idaho Department of Fish and Game (Contract No. DE-A179-84BP12737, Project Number 83-335) to Bonneville Power Administration, Portland, Oregon, USA.

UMATILLA RIVER SUBBASIN

Naturally Produced Spring Chinook Salmon

GEOGRAPHIC LOCATION

The Umatilla subbasin covers 2,290 square miles in Northeast Oregon (Confederated Tribes of the Umatilla Indian Reservation and Oregon Department of Fish and Wildlife 1990). With the headwaters originating in the Blue Mountains, the river flows northwesterly across the Umatilla plateau 115 miles to its confluence with the Columbia River at RM 289. The mouth of the Umatilla River is located above Bonneville, The Dalles, and John Day dams in the mainstem Columbia.

ORIGIN

Wild spring chinook were once abundant in the Umatilla River subbasin, but upon completion of the Hermiston Power and Light and Three Mile dams in 1910 and 1914, respectively, the run went extinct. Problems which contributed to the runs extinction include dewatering of the mainstem Umatilla River, degradation of headwater habitat, and mortalities at Columbia River dams (Confederated Tribes of the Umatilla Indian Reservation and Oregon Department of Fish and Wildlife 1990). The subbasin is currently being supplemented with hatchery fish tore-establish a naturally producing run (see UMATILLA RIVER SUBBASIN, Hatchery Produced Spring Chinook Salmon)

DISTRIBUTION

Subbasin

The historical spawning and rearing distribution of spring chinook salmon is not documented for the Umatilla River subbasin. Habitat considered suitable for spawning and rearing includes the rnainstem Umatilla River and Meacham Creek (Figure 1). The quality of habitat considered suitable for spawning and rearing varies throughout the subbasin (Tables 1 and 2).

Figure 1. Spring chinook distribution in the Umatilla River subbasin, based on the NPPC presence\absence data base (solid and dashed lines respectively) 'and the "BPA Geographic Information System.

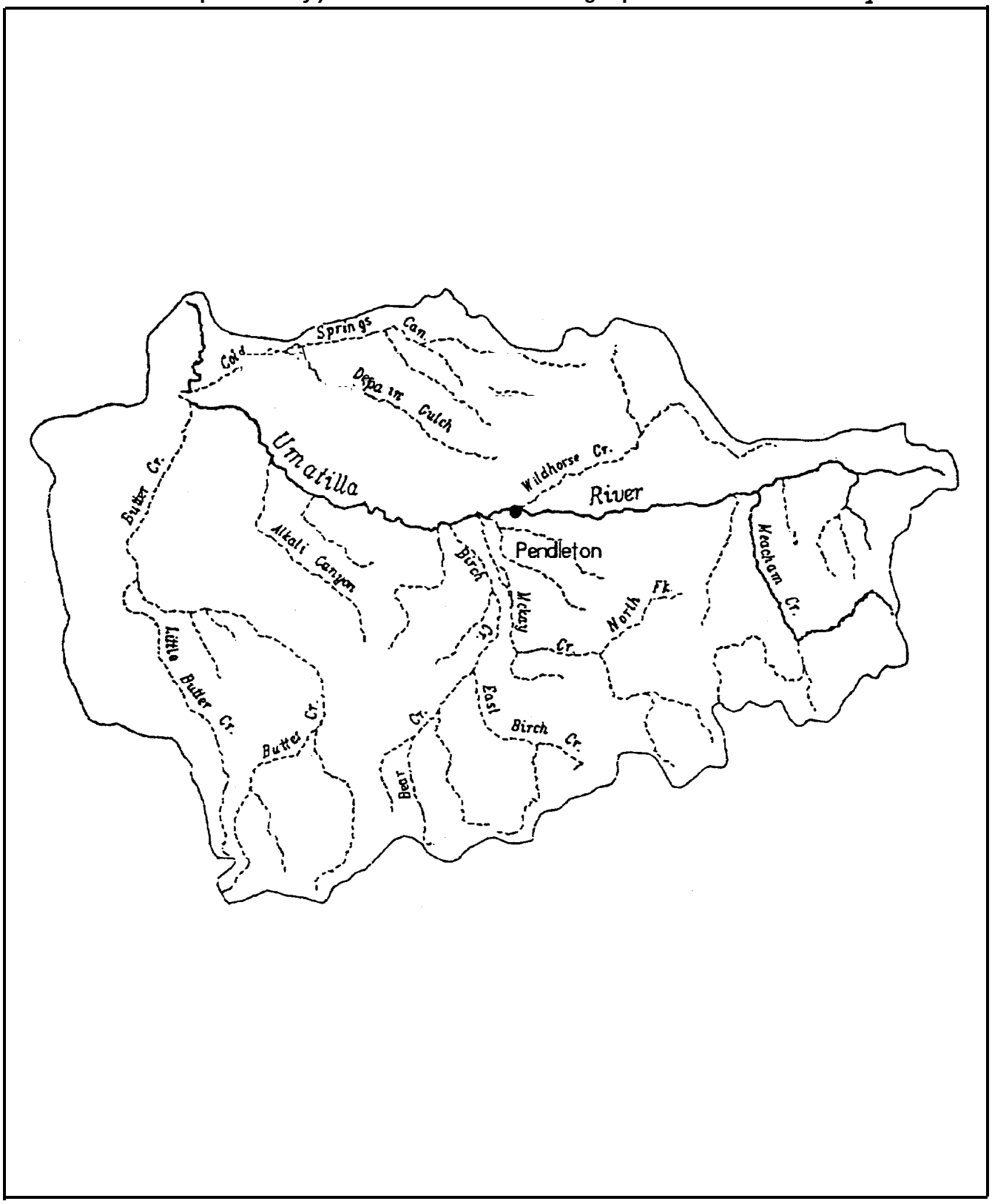


Table 1 (HB-1). Estimated amount of spawning and rearing habitat by quality of Umatilla River subbasin spring chinook production area.

Distance/ Area	Excellent	Good	Fair[b]	Poor[b]	Unknown	Total	Confi-dence
Miles (%)	0.0	31.0	36.9	32.1	--	41.7	--
Acres (%)	--	--	--	--	--	--	--

[a] Estimates are modified from the Northwest Power Planning Council's presence/absence database.
[b] Ratings of fair and poor habitat quality may reflect natural physical features such as waterfall barriers, as well as degradation caused by man.

Table 2 (HB-2). Estimated amount of rearing only habitat by quality of Umatilla River subbasin spring chinook production area.

Distance/ Area	Excellent	Good	Fair[b]	Poor[b]	Unknown	Total	Confi-dence
Miles (%)	0.0	29.4	21.0	49.6	--	11.9	--
Acres (%)	--	--	--	--	--	--	--

[a] Estimates are modified from the Northwest Power Planning Council's presence/absence database.
[b] Ratings of fair and poor habitat quality may reflect natural physical features such as waterfall barriers, as well as degradation caused by man.

REFERENCES

Confederated Tribes of the Umatilla Indian Reservation and Oregon Department of Fish and Wildlife. 1990. Umatilla River subbasin salmon and steelhead production plan. Columbia Basin System Planning Report to Northwest Power Planning Council, Portland, Oregon.

UMATILLA RIVER SUBBASIN

Hatchery Produced Spring Chinook Salmon

ORIGIN

Hatchery spring chinook were released into the subbasin beginning in 1986 to re-establish a naturally producing run, provide broodstock for an ongoing hatchery program in the subbasin, sustain sport and tribal fisheries, and assist in meeting Columbia River Basin fish production goals (Confederated Tribes of the Umatilla Indian Reservation and Oregon Department of Fish and Wildlife 1990). Stocks used for hatchery supplementation include the Carson and Lookingglass Creek stocks of spring chinook. Long range plans for the hatchery program are to have broodstock collected from naturally and hatchery produced fish returning to Threemile Dam and the Bonifer and Minthorn facilities.

DISTRIBUTION

Subbasin

Hatchery spring chinook are released into the mainstem Umatilla River, Meacham Creek, and at Bonifer Pond (Table 1).

Approximations of the temporal distribution of adult immigration, adult holding, spawning, incubation, emergence, rearing, and juvenile outmigration 'were reported in Confederated Tribes of the Umatilla Indian Reservation and Oregon Department of Fish and Wildlife (1990) and are presented in Figure 1. The methodology used to generate these approximations is unknown.

PRODUCTION

Releases

Egg

There are no records of releases into the subbasin.

Fry

Hatchery facilities in which fry were reared or acclimated prior to release in the subbasin include Irrigon, Oxbow, and Bonneville hatcheries (Table 1). Annual numbers released ranged from 76,714 to 397,775 (Table 1). Size at release ranged from 199.0 to 11.1 fish per pound (Table 1).

Fingerling

There are no records of releases into the subbasin.

Smelt

Hatchery facilities in which smelts were reared or acclimated prior to release in the subbasin include Carson National Fish Hatchery and Bonneville Hatchery (Table 1). Annual numbers

released ranged from 99,897 to 393,277 (Table 1). Size at release ranged from 22.8 to 8.0 fish per pound ('Table 1).

Jack and Adult

There are no records of adult releases into the subbasin.

ADULT LIFE HISTORY

Escapement

Subbasin

Numbers: No brood year specific estimates of escapement are available. Run year specific estimates of escapement are available in Confederated Tribes of the Umatilla Indian Reservation and Oregon Department of Fish and Wildlife (1990) and Olson et al. (1990) and from Confederated Tribes of the Umatilla Indian Reservation (unpublished data).

Fork Length

No brood year specific estimates are available. Run year specific estimates are available in Confederated Tribes of the Umatilla Indian Reservation and Oregon Department of Fish and Wildlife (1990).

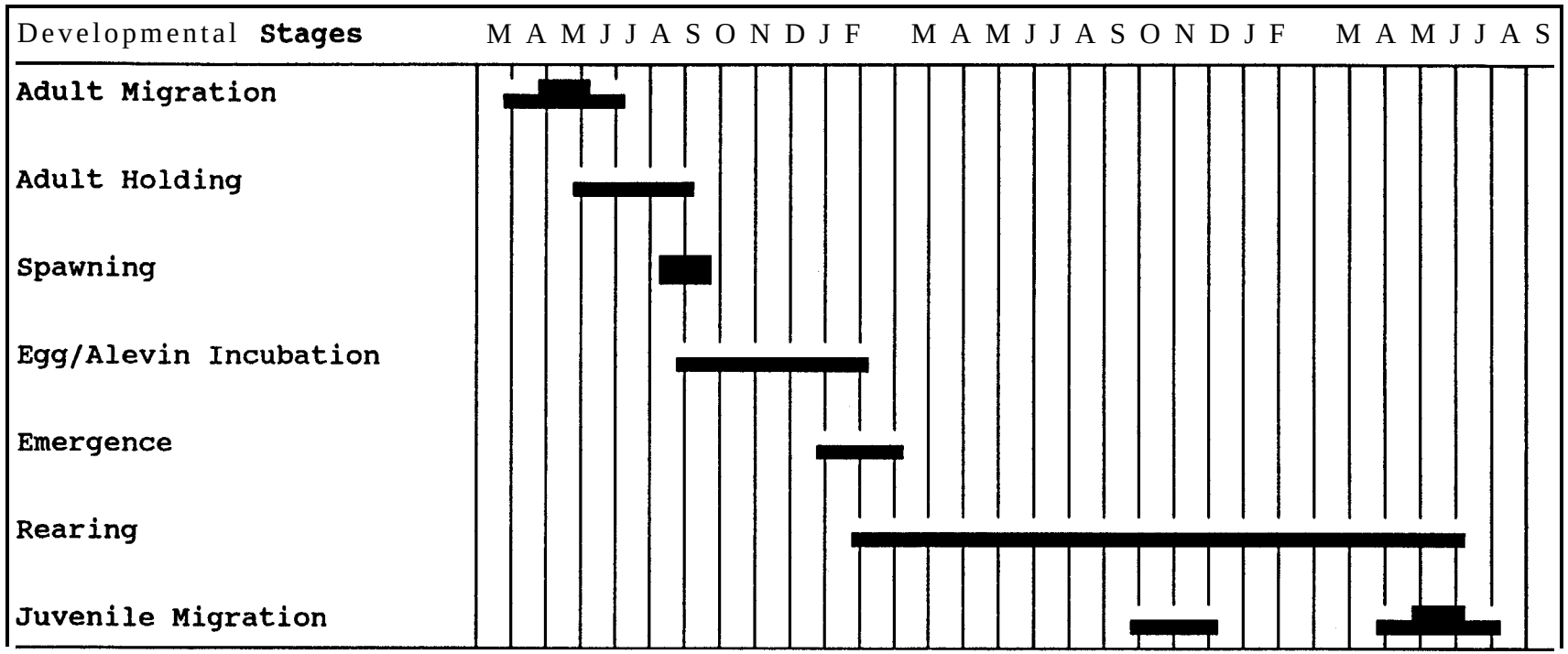
Mark Recoverie

Coded wire tagged stray hatchery spring chinook salmon, released as juveniles into the Umatilla River subbasin, were recovered in the mainstem Columbia below Bonneville Dam and in the Cowlitz River (Table 2).

DISEASES

There are no hatchery facilities in the Umatilla River subbasin that have historically held or reared hatchery spring chinook prior to release in the subbasin. For information on parasites and disease agents of subbasin hatchery production that is held or reared at hatchery facilities located outside of the subbasin see LOWER COLUMBIA RIVER SUBBASIN, Hatchery Produced Spring Chinook Salmon, DISEASES and see SANDY RIVER SUBBASIN, Hatchery Produced Spring Chinook Salmon, DISEASES.

Figure 1 (TT). Freshwater **life** history for hatchery reared **spring** chinook, Carson **Hatchery stock, in the Umatilla River subbasin (Confederated Tribes of the Umatilla Indian Reservation** and Oregon Department of **Fish** and **Wildlife** 1990).



Notes:

1. The developmental stage timing represents **basin-wide** averages, local conditions may cause some **variability.**
2. Double thick bars **indicate** periods of **heaviest** adult migration, spawning and juvenile outmigration.
3. Adult migration based on counts over McNary Dam. **First** returns **to Umatilla River in** 1988.
4. Adult holding through rearing stages based on Carson Hatchery data (Howell **et** al. 1985).
5. Juvenile **migration** based on **Umatilla River counts** at Westland **trap;** sub-yearlings released **in** the fall, yearling released **in** the spring.

Table 1 (IR). Hatchery releases of spring chinook salmon into the Umati 1 la River subbasin by brood year end i f marked, by coded wire tag code[a].

Brood Year	Stock	Hatchery	Life Stage	Release Date (1)	Release Date (2)	Fish/ lb	Number Released	Release Location	CUT/ Fin clip
1984	Carson	Carson	smolt	03/ 27/86	--	22.8	99,970	Boni fer pond	No mark
1985	Carson,	Irrigon	fry	04/07/86	--	89.0	300,438	Umatilla River	No mark
1985	Carson	Irrigon	fry	10/21/86	--	15.0	97,337	Boni fer pond	No mark
1985	Carson	Carson	smolt	04/21/87	04/24/87	10.4	99,897	Bonifer pond	No mark
1986	Carson	Oxbow	fry	04/09/87	--	199.0	169,100	Umatilla River	No mark
1986	Carson	Bonnevil e	smolt	03/29/88	04/20/88	10.1	26,640	Meacham Creek	07-43-25
1986	Carson	Bonnevil e	smolt	03/29/88	04/20/88	10.1	25,863	Meacham Creek	07-43-26
1986	Carson	Bonnevil e	smolt	03/29/88	04/20/88	10.1	25,853	Meacham Creek	07-43-27
1986	Carson	Bonnevil e	smolt	03/29/88	04/20/88	10.1	25,972	Meacham Creek	No mark
1986	Carson	Bonneville	smolt	04/18/88	04/20/88	8.7	26,319	Umatilla River	07-43-28
1986	Carson	Bonnevil la	smolt	04/18/S8	04/20/88	8.7	25,722	Umatilla River	07-43-29
1986	Carson	Bonneville	smelt	04/18/88	04/22/88	8.7	26,252	Umatilla River	07-43-30
1986	Carson	Bonneville	smolt	04/18/88	04/22/88	8.7	21,388	Umatilla River	No mark
1986	Carson	Carson	smolt	04/11/88	--	10.4	89,268	Umatilla River	No mark
1986	Carson	Carson	smolt	04/11/88	04/12/88	8-10	100,000	Umatilla River	No mark
1987	Lookingglass	Bonnevi1le	fry	11/08/88	--	11.1	25,987	Umatilla River	07-44-27
1987	Lookingglass	Bonnevilla	fry	11/08/88	--	11.1	24,070	Umatilla River	07-44-29
1987	Lookingglass	Bonneville	fry	11/08/88	--	11.1	25,356	Umatilla River	07-44-30
1987	Lookingglass	Bonneville	fry	11/08/88	--	11.1	119	Umatilla River	No mark
1987	Looki nggl ass	Bonneville	fry	11/10/88	--	21.4	410	Umatilla River	07-44-20
1987	Looki nggl ass	Bonneville	fry	11/10/88	--	21.4	393	Umatilla River	07-44-23
1987	Lookingglass	Bonnevi1le	fry	11/10/88	--	21.4	376	Umatilla River	07-44-24
1987	Lookingglass	Bonneville	fry	11/10/88	--	21.4	3	Umatilla River	No mark
1987	Look i nggl ass	Bonnevil la	smolt	03/1 0/89	05/23/89	10.5	25,427	Meacham Creek	07-44-33
1987	Looki nggl ass	Bonnevi1le	smolt	03/10/89	05/23/89	10.5	27,004	Meacham Creek	07-44-34
1987	Lookingglass	Bonneville	smolt	03/10/89	05/23/89	10.5	25,386	Meacham Crack	07-44-36
1987	Lookingglass	Bonneville	smolt	03/10/89	05/23189	10.5	1,793	Meacham Crack	No mark
1987	Looki ngg 1 asa	Bonneville	smolt	03/27/89	03/28/89	10.6	27,585	Meacham Creek	07-44-39
1987	Looki ngglass	Bonneville	smolt	03/27/89	03/28/89	10.6	27,550	Meacham Creak	07-44-40
1987	Looki nggl ass	Bonneville	smolt	03/27/89	03/28/89	10.6	24,165	Meacham Creek	07-44-43
1987	Looki nggl ass	Bonnevi1le	smolt	03/27/89	03/28/89	10.6	790	Meacham Creek	No mark
1988	Lookingglass	Bonnevi1le	fry	10/13/89	--	12.0	24 ,801	Meacham Creek	07-50-63
1988	Lookingglass	Bonnevi1le	fry	10/13/89	--	12.0	28,109	Meacham Creek	07-51-01
1988	Looki nggl ass	Bonnevi lle	fry	10/13/89	--	12.0	27,299	Meacham Creek	07-51-02
1988	Looki ngglass	Bonnevil la	fry	10/13/89	--	12.0	27,137	Meacham Creek	07-51-03
1988	Lookingglass	Bonneville	fry	10/13/89	--	12.0	28,560	Meacham Creek	07-51-04
1988	Lookingglass	Bonneville	fry	10/13/89	--	12.0	27,695	Meacham Creek	07-51-05
1988	Lookingglass	Bonneville	fry	10/13/89	--	12.0	540	Meacham Creek	No mark
198S	Lookingglass	Bonneville	smolt	03/22/90	--	9.0	26,638	Boni fer pond	07-51-06
1988	Lookingglass	Bonneville	smolt	03/22/90	--	9.0	26,160	Bonifer pond	07-51-07
198S	Lookingglass	Bonneville	smolt	03/22/90	--	9.0	26,8SS	Boni fer pond	07-51-0s

Table 1 (IR). (cont.) Hatchery releases of spring chinook salmon into the Umatilla River subbasin by brood year and if marked, by coded wire tag codes.

Brood Year	Stock	Hatchery	Life Stage	Release Date (1)	Release Date (2)	Fish/ lb	Number Released	Re 1 ease Location	CUT/ Fin clip
19BB	Lookingglass	Bonneville	smolt	03/22/90	--	9.0	33,824	Bonifer pond	No mark
198B	Lookingglass	Bonneville	smolt	03 /22/90	03/23/90	9.6	25,611	Meacham Creek	07-51-09
1988	Lookingglass	Bonneville	smolt	03/22/90	03/23/90	9.6	26,307	Meacham Creek	07-51-10
198S	Lookingglass	Bonneville	smelt	03/22/90	03/23/90	9.6	25,172	Meacham Creek	07-51-11
1988	Lookingglass	Bonnevil1e	smelt	03/22/90	03/23/90	9.6	39,232	Meacham Creek	No mark

[a]Estimates are from Oregon Department of Fish and Wildlife (unpublished data).

Table 2 (AE). Emigration of coded wire tagged hatchery spring chinook salmon released in the Umatilla River subbasin[a,b].

Hatchery/Release Site	Recovery Site, Run Year(s)	Recovery Method	Number Recovered	Total Number Estimated, (PSMFC)
Umatilla River	Columbia River[c] 1988	Hatchery Returns --	5	5
Umatilla River	Cowlitz River 1988	Hatchery Returns --	1	1

[a] Based on the following tag codes: 07-43-25, 07-43-28, 07-43-29.
[b] Estimates are modified from the Pacific States Marine Fisheries Commission coded wire tag database.
[c] Recovery site in the mainstem Columbia River below Bonneville Dam.

REFERENCES

Olson, D.E., G.A. James, B. Duke, and J. Phelps. 1990. Trapping and transportation of adult and juvenile salmon in the lower Umatilla River in northeast Oregon, 1989-1990. Annual Progress Report of Department of Natural Resources Confederated Tribes of the Umatilla Indian Reservation and Oregon Department of Fish and Wildlife (Contract DE-B179-89BP98636, Project No. 88-022) to Bonneville Power Administration, Portland, Oregon.

Confederated Tribes of the Umatilla Indian Reservation and Oregon Department of Fish and Wildlife. 1990. Umatilla River subbasin salmon and steelhead production plan. Columbia Basin System Planning Report to Northwest Power Planning Council, Portland, Oregon.

UMATILLA RIVER SUBBASIN

Naturally Produced Fall Chinook Salmon

GEOGRAPHIC LOCATION

The Umatilla subbasin covers 2,290 square miles in Northeast Oregon (Confederated Tribes of the Umatilla Indian Reservation and Oregon Department of Fish and Wildlife 1990). With the headwaters originating in the Blue Mountains, the river flows northwesterly across the Umatilla plateau 115 miles to its confluence with the Columbia River at RM 289. The mouth of the Umatilla River is located above Bonneville, The Dalles, and John Day dams in the mainstem Columbia.

ORIGIN

Wild fall chinook were once abundant in the Umatilla River subbasin, but upon completion of the Hermiston Power and Light and Three Mile dams in 1910 and 1914, respectively, the run went extinct. Problems which contributed to the runs extinction include dewatering of the mainstem Umatilla River, degradation of headwater habitat, and mortalities at Columbia River dams (Confederated Tribes of the Umatilla Indian Reservation and Oregon Department of Fish and Wildlife 1990). The subbasin is currently being supplemented with hatchery fish to re-establish a naturally producing run (see UMATILLA RIVER SUBBASIN, Hatchery Produced Fall Chinook Salmon).

DISTRIBUTION

Subbasin

Historical spawning and rearing distribution of fall chinook salmon is not documented for the Umatilla River subbasin. Habitat considered suitable for spawning and rearing is located throughout most of the mainstem Umatilla River and in Meacham Creek (Figure 1). The quality of habitat considered suitable for spawning and rearing varies throughout the subbasin (Tables 1 and 2).

ADULT LIFE HISTORY

Strays

Coded wire tagged stray hatchery fall chinook recovered in the Umatilla River subbasin include fish that were released as juveniles in the Trinity River in California and Rock Creek in Washington (Table 3). Coded wire tags were primarily recovered from fish returning from subbasin hatchery production releases (Table 3).

Figure 1. Fall Chinook distribution in the Umatilla River subbasin, based on the NPPC presence\absence data base (solid and dashed lines respectively) 'and the BPA Geographic Information System.

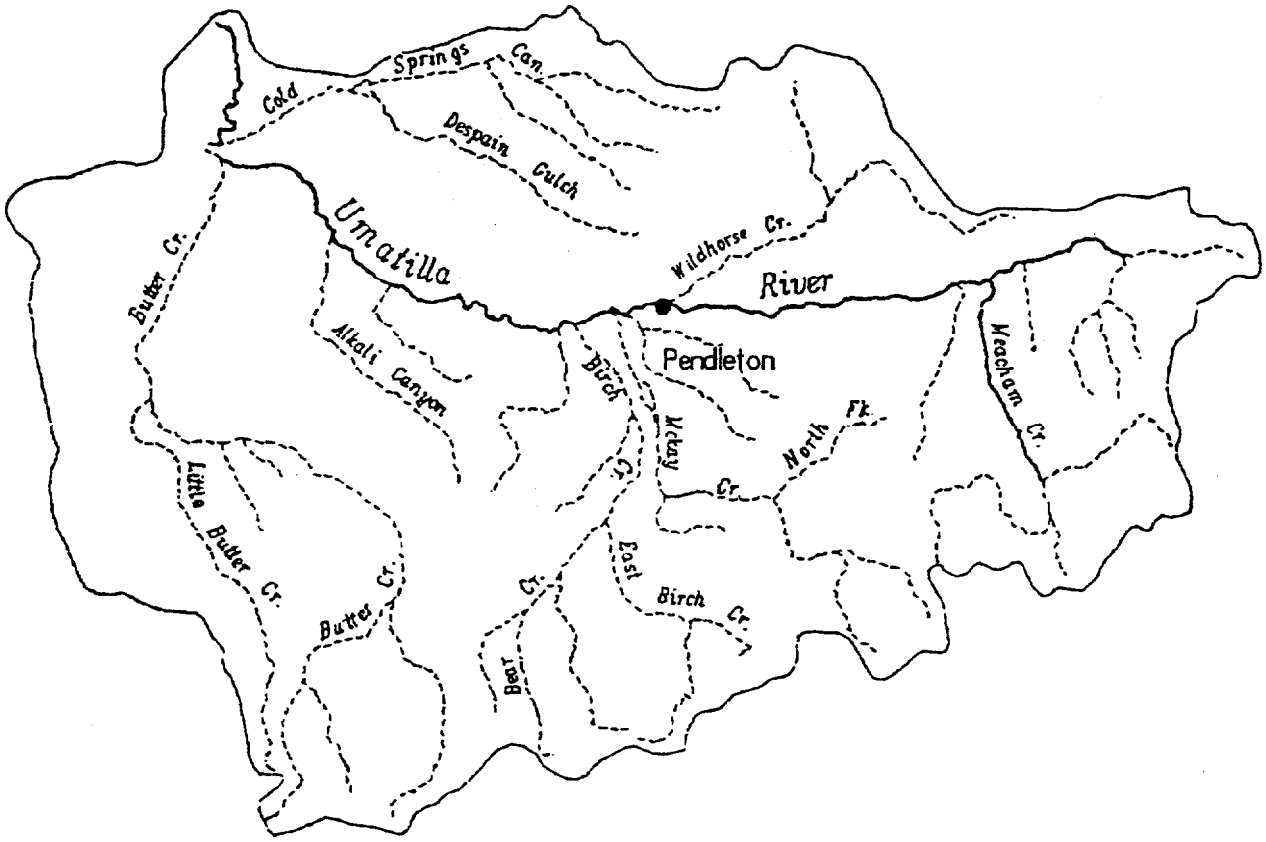


Table 1 (HB-1). Estimated amount of spawning and rearing habitat by quality of Umatilla River subbasin fall chinook production area.

Distance/ Area	Excellent	Good	Fair[b]	Poor[b]	Unknown	Total	Confi-dence
Miles (%)	77.0	23.0	0.0	0.0	--	102.4	--
Acres (%)	--	--	--	--	--	--	--

[a] Estimates are modified from the Northwest Power Planning Council's presence/absence database.
[b] Ratings of fair and poor habitat quality may reflect natural physical features such as waterfall barriers, as well as degradation caused by man.

Table 2 (HB-2). Estimated amount of rearing only habitat by quality of Umatilla River subbasin fall chinook production area.

Distance/ Area	Excellent	Good	Fair[b]	Poor[b]	Unknown	Total	Confi-dence
Miles (%)	0.0	0.0	0.0	0.0	--	0.0	--
Acres (%)	--	--	--	--	--	--	--

[a] Estimates are modified from the Northwest Power Planning Council's presence/absence database.
[b] Ratings of fair and poor habitat quality may reflect natural physical features such as waterfall barriers, as well as degradation caused by man.

Table 3 (AI). Non-harvest recoveries of coded wire tagged hatchery fall chinook salmon in the
subbasin[a, b]

Hatchery/Release Site	Recovery Site, Run Year(s)	Recovery Method	Number Recovered	Total Numb Estimate (PSMFC
Umatilla River	Umatilla River	Trap Returns		
	1986	--	73	
	1988	--	600	8
Trinity River	Umatilla River	Trap Returns		
	1988	--	1	
Rock Creek, WA	Umatilla River	Trap Returns		
	1988	--	1	

[a] Based on the following tag codes: 06-56-28, 07-27-41, 07-31-24, 07-31-27, 07-33-26, 07-33-27
07-38-24, 07-38-25, 07-38-26, 07-38-27, 07-38-28, 07-38-29, 07-38-30, 07-38-31, 07-38-32, 07
07-40-36, 07-40-37, 07-40-38, 07-40-39, H5-07-04

[b] Estimates are modified from the Pacific States Marine Fisheries Commission coded wire tag da

REFERENCES

Confederated Tribes of the Umatilla Indian Reservation and Oregon Department of Fish and Wildlife. 1990. Umatilla River subbasin salmon and steelhead production plan. Columbia Basin System Planning Report to Northwest Power Planning Council, Portland, Oregon.

UMATILLA RIVER SUBBASIN

Hatchery Produced Fall Chinook Salmon

ORIGIN

Hatchery fall chinook were released into the subbasin beginning in 1982 tore-establish a naturally producing run, provide broodstock for an ongoing hatchery program in the subbasin, sustain sport and tribal fisheries, and assist in meeting Columbia River Basin fish production goals (Confederated Tribes of the Umatilla Indian Reservation and Oregon Department of Fish and Wildlife 1990). Stocks used for hatchery supplementation include the Spring and Tanner creek stocks and the Washington and Columbia River substocks of the Upriver Bright stock. Long range plans for the hatchery program are to have broodstock collected from naturally and hatchery produced fish returning to Threemile Dam and the Minthom facility. In addition, subbasin hatchery production will also be obtained from the upriver bright stock of fall chinook at Bonneville Hatchery (Confederated Tribes of the Umatilla Indian Reservation and Oregon Department of Fish and Wildlife 1990).

DISTRIBUTION

Subbasin

Juvenile hatchery fall chinook are primarily released into the mainstem Umatilla River and Meacham Creek with occasional releases at Bonifer Pond. Historically, fall chinook were released into the lower river, at less than an optimum time, in order to reduce mortalities at irrigation diversions (Confederated Tribes of the Umatilla Indian Reservation and Oregon Department of Fish and Wildlife 1990). Closer regulation of irrigation diversions have reduced potential losses, thereby, making it more feasible to release smelts in the upper subbasin. Hatchery releases in the upper subbasin are designed to provide smelts more time to imprint on potential spawning and rearing areas and to the outflow at hatchery facilities (Confederated Tribes of the Umatilla Indian Reservation and Oregon Department of Fish and Wildlife 1990).

Approximations of the temporal distribution of adult immigration, adult holding, spawning, incubation, emergence, rearing, and juvenile outmigration were reported in Confederated Tribes of the Umatilla Indian Reservation and Oregon Department of Fish and Wildlife (1990) and are presented in Figure 1. The methodology used to generate these approximations is unknown.

PRODUCTION

Releases

Egg

There are no records of releases into the subbasin.

Fry

There are no records of releases into the subbasin.

Fingerling

There are **no** records of releases into the subbasin.

Smelt

Hatchery facilities in which smelts were reared or acclimated prior to release in the subbasin include Bonneville, **Irrigon,** Bonifer Pond, and Spring Creek (Table 1). Annual numbers released ranged **from 99,769** to 3,805,193 (Table 1). Size, at release ranged from 109.0 to 4.7 fish per pound **(Table 1).**

Jack and Adult

There are **no records** of releases into the subbasin.

ADULT LIFE HISTORY

Escapement

Subbasin

Numbers: No brood year specific estimates of escapement are available. Run year specific estimates of escapement are available in Confederated Tribes of the **Umatilla** Indian Reservation and Oregon Department of Fish and Wildlife (1990) and Olson et al. (1990) and from Confederated Tribes of the **Umatilla** Indian Reservation (unpublished data).

Fork Length

No brood year specific estimates are available. Run year specific estimates are available in **Confederated** Tribes of the **Umatilla** Indian Reservation and Oregon Department of Fish and Wildlife (1990).

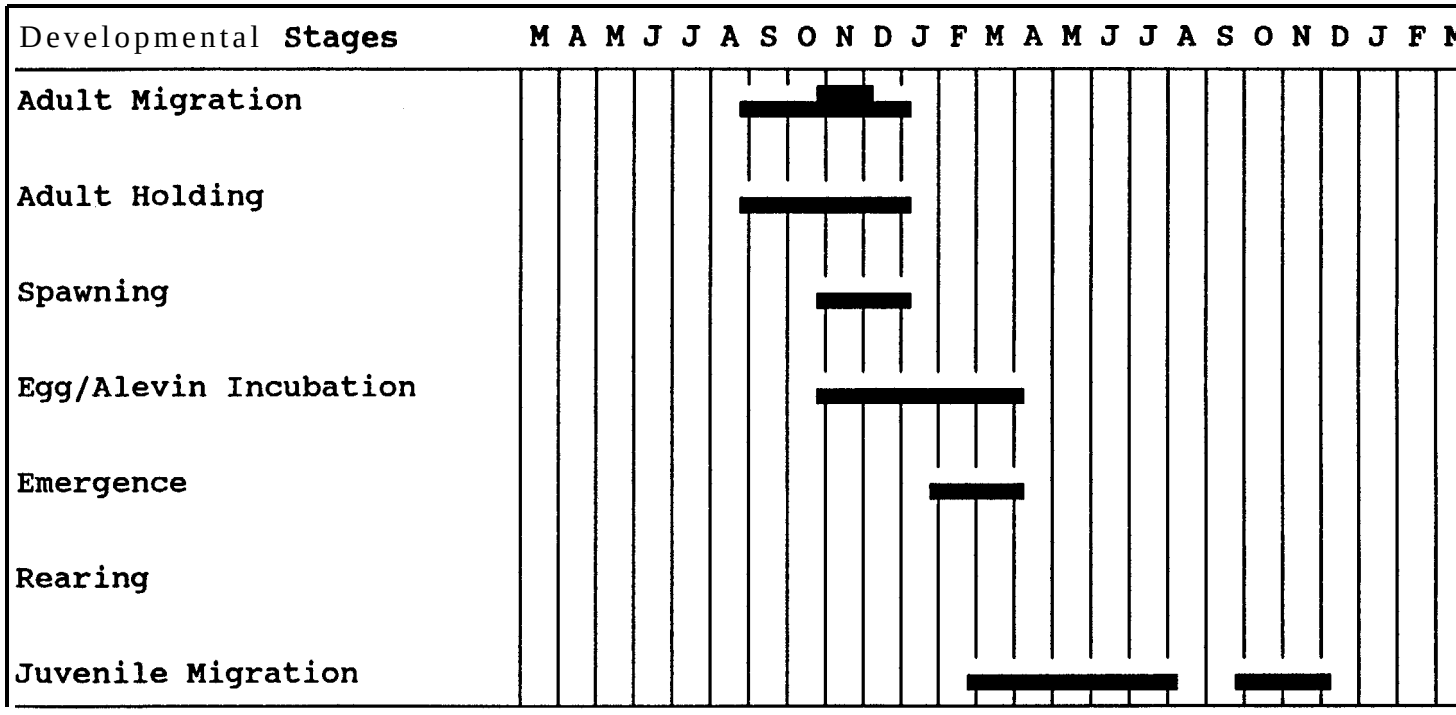
Mark Recoveries

Coded wire tagged hatchery fall chinook, released as juveniles in the **Umatilla** River subbasin, were recovered in the mainstem Columbia River from the estuary to Priest Rapids Dam and in the Snake River and Little White Salmon River subbasins (Table 2).

DISEASES

There are no hatchery facilities in the **Umatilla** River subbasin that have historically held or reared hatchery fall chinook prior to release in the subbasin. For information on parasites and disease agents of subbasin hatchery production that is held or reared at hatchery facilities located outside of the subbasin see LOWER COLUMBIA RIVER SUBBASIN, Hatchery Produced Fall Chinook Salmon, DISEASES.

Figure 1 (TT). Freshwater **life** history for Upriver **River Bright (URB)** fall ch
Bonneville **Hatchery,** released **in the Umatilla River subbasin** (Confederate
Umatilla Indian Reservation and Oregon Department of **Fish and Wildlife** 19



Notes:

1. The developmental stage **timing** represents basin-wide averages, local cond
some **variability.**
2. Double **thick bars indicate** periods of heaviest adult **migration.**
3. **Adult** migration based on **Umatilla** River returns, 1986-88. Returns **to** Bo
are **in late** August-early November.
4. **Adult** holding through emergence **times** based on Bonneville Hatchery data
Pers. **comm**.)
5. Juvenile migration **times** based on **Umatilla River** counts **at** Westland **trap**
at Brownell Diversion; yearling releases, sub-yearling **spring** and fall r

Table 1 (TR). Hatchery releases of fall chinook salmon into the Umatilla River subbasin by brood year end if marked, by coded wire tag code[a].

Brood Year	Stock[b]	Hatchery	Life Stage	Release Date (1)	Release Date (2)	Fish/ lb	Number Released	Release Location	CWT/ Fin clip
1981	Spring Cr	Spring Cr NFH	Smelt	04/12/82	04/13/82	79.0	47,905	Umatilla River	05-08-51
1981	Spring Cr	Spring Cr NFH	smolt	04/12/82	04/13/82	79.0	104,955	Umatilla River	05"10-57
1981	Spring Cr	Spring Cr NFH	smolt	04/12/82	04/13/82	79.0	825,476	Umatilla River	No mark
1981	Tanner Cr[c]	Bonneville	smolt	04/14/82	04/20/82	92.0	102,386	Umatilla River	07-26-63
1981	Tanner Cr[c]	Bonneville	Smelt	04/14/82	04/20/82	92.0	2,724,471	Umatilla River	No mark
1981	Col. R. (UB)	Bonneville	Smelt	03/24/83	04/18/83	5.9	99,570	Meacham Creek	07-27-41
1981	Col. R. (UB)	Bonneville	smolt	03/24/83	04/18/83	5.9	199	Meacham Creek	No mark
1982	Col. R. (UB)	Bonneville	smolt	03/16/84	03/23/84	8.6	96,448	Meacham Creek	0?-28-29
1982	Col. R. (UB)	Bonneville	Smelt	03/16/84	03/23/84	8.6	129,803	Meacham Creek	No mark
1983	Col. R. (UB)	Bonneville	smolt	06/18184	06/29/84	85.1	210,441	Umatilla River	07-31-24
1983	Col. R. (UB)	Bonneville	smolt	06/18/84	06/29/84	85.1	753,227	Umatilla River	No mark
1983	Col . R. (UB)	Bonneville	Smelt	03/12/85	03/29/85	7.8	88,306	Umatilla River	07-31-27
1983	Col. R. (UB)	Bonneville	smolt	03/12/85	03/29/85	7.8	109,000	Umatilla River	No mark
1984	Col. R. (UB)	Bonifer pond	smolt	10/23/85	--	16.2	30,838	Umatilla River	07-31-62
1984	Col. R. (UB)	Bonifer pond	Smelt	10/23/85	--	16.2	19,982	Umatilla River	No mark
1984	Col. R. (UB)	Bonneville	smolt	06/17/85	06/20/85	92.3	206,756	Umatilla River	07-33-26
1984	Col. R. (UB)	Bonneville	smolt	06/17/85	06/20/85	92.3	3,010,657	Umatilla River	No merk
1984	Col. R. (UB)	Irrigon	Smelt	03/03/86	--	4.7	75,355	Bonifer pond	No mark
1984	Col. R. (UB)	Irrigon	Smelt	03/10/86	--	4.7	40,424	Bonifer pond	No mark
1984	Col. R. (UB)	Irrigon	smolt	03/21/86	03/25/86	4.8	88,396	Umatilla River	07-33-27
1984	Col. R. (UB)	Irrigon	smolt	03/21/86	03/25/86	4.8	116,205	Umatilla River	No mark
1985	Col. R. (UB)	Bonneville	Smelt	03/23/87	--	8.6	10,253	Umatilla River	07-38-28
1985	Col. R. (UB)	Bonneville	Smelt	03/23/87	--	8.6	9,970	Umatilla River	07-38-29
1985	Col. R. (UB)	Bonneville	smolt	03/23/87	--	8.6	10,135	Umatilla River	07-38-30
1985	Col. R. (UB)	Bonneville	smolt	03/23/87	--	8.6	10,053	Umatilla River	07-38-31
1985	Col. R. (UB)	Bonneville	smolt	03/23/87	--	8.6	10,081	Umatilla River	07-38-32
1985	Col. R. (UB)	Bonneville	smolt	03/23/87	--	8.6	51,182	Umatilla River	No mark
1985	Col. R. (UB)	Bonneville	smolt	03/29/87	--	8.1	10,103	Umatilla River	07-38-23
1985	Col. R. (UB)	Bonneville	smolt	03/29/87	--	8.1	10,243	Umatilla River	07-38-24
1985	Col. R. (UB)	Bonneville	smolt	03/29/87	--	8.1	9,917	Umatilla River	07-38-25
1985	Cot. R. (UB)	Bonneville	smolt	03/29/87	--	8.1	9,496	Umatilla River	07-38-26
1985	Col. R. (UB)	Bonneville	smolt	03/29/87	--	8.1	9,876	Umatilla River	07-38-27
1985	Col. R. (UB)	Bonneville	smolt	03/29/87	--	8.1	58,937	Umatilla River	No mark
1985	Col. R. (UB)	Irrigon	smolt	06/09/86	06/11/86	86.0	20,636	Umatilla River	07-38-33
1985	Col. R. (UB)	Irrigon	smolt	06/09/86	06/11/86	86.0	21,335	Umatilla River	07-38-34
1985	Col. R. (UB)	Irrigon	smolt	06/09/86	06/11/86	86.0	20,690	Umatilla River	07-38-35
1985	Cot. R. (UB)	Irrigon	smolt	06/09/86	06/11/86	86.0	20,170	Umatilla River	07-38-36
1985	Col. R. (UB)	Irrigon	smolt	06/09/86	06/11/86	86.0	20,982	Umatilla River	07-38-37
1985	Col. R. (UB)	Irrigon	Smelt	06/09/86	06/11/86	86.0	20,815	Umatilla River	07-38"38
1985	Col. R. (UB)	Irrigon	smolt	06/09/86	06/11/86	86.0	21,659	Umatilla River	07-38-39
1985	Cot. R. (UB)	Irrigon	smolt	06/09/86	06/11/86	86.0	20,269	Umatilla River	07-38-40
1985	Col. R. (UB)	Irrigon	smolt	06/09/86	06/11/86	86.0	20,8%	Umatilla River	07-38-41

Table 1 (IR). (cont.) Hatchery releases of fall chinook salmon into the Umatil la River subbasin by brood year and if marked, by coded wire tag Codes.

Brood Year	Stock[b]	Hatchery	Life Stage	Release Date (1)	Release Date (2)	Fish/ lb	Number Released	Release Location	CUT/ Fin clip
1985	CO(. R. (UB)	Irrigon	Smelt	06/09/86	06/1 1/86	86.0	21,694	Umatilla River	07-38-42
1985	Col. R. (UB)	Irrigon	Smelt	06/09/86	06/1 1/86	86.0	1,815,799	Umatilla River	No mark
1986	Wash. Brights	Irrigon	Smelt	05/05/87	05/08/87	60.4	40,793	Umatilla River	07-39-12
1986	Wash. Brights	Irrigon	smolt	05/05/87	05/08/87	60.4	41, 096	Umatilla River	07-39-13
1986	Wash. Brights	Irrigon	smolt	05/05/87	05/08/87	60.4	39,187	Umatilla River	07-39-14
1986	Wash. Brights	Irrigon	smolt	05/05/87	05/08/87	60.4	1,351,245	Umatilla River	No mark
1986	Wash. Brights	Irrigon	Smelt	07/14/87	--	20.0	643	Umatilla River	07-39-15
1986	Wash. Brights	Irrigon	smolt	07/14/87	--	20.0	645	Umatilla River	07-39-16
1986	Wash. Brights	Irrigon	smolt	07/14/87	--	20.0	632	Umatilla River	07-40-35
1986	Cot. R. (UB)	Bonnevi1le	smolt	03/24/88	03/25/88	8.8	42,068	Umatilla River	07-40-38
1986	Col. R. (UB)	Bonneville	Smelt	03/24/88	03/25/88	8.8	38,978	Umatilla River	07-40-39
1986	Col. R. (UB)	Bonnevi1le	smolt	03/24/88	03/25/88	8.8	19,159	Umatilla River	No mark
1986	Col. R. (UB)	Bonneville	Smelt	03/27/88	03/28/88	10.2	39,509	Meacham Creek	07-40-36
1986	Col. R. (UB)	Bonneville	smolt	03/27/88	03/28/88	10.2	38,405	Meacham Creek	07-40-37
1986	Col. R. (UB)	Bonneville	Smelt	03/27/88	03/28/88	10.2	21,076	Meacham Creek	No mark
1987	Wash. Brights	Bonneville	smolt	11/03/88	11/04/88	8.6	24,656	Umatilla River	07-45-36
1987	Wash. Brights	Bonnevi11e	smolt	1 1/03/88	1 1/04/88	8.6	23,403	Umatilla River	07-45-37
1987	Wash. Brights	Bonneville	Smelt	1 1/03/88	1 1/04/88	8.6	25,089	Umatilla River	07-45-38
1987	Wash. Brights	Bonneville	Smelt	1 1/03/88	1 1/04/88	8.6	2,840	Umatilla River	No mark
1987	Wash. Brights	Bonnevi1le	Smelt	1 1/03/88	1 7/04/88	9.8	4,438	Umatilla River	07-45-39
1987	Wash. Brights	Bonneville	Smelt	1 1/03/88	1 1/04/88	9.8	4,289	Umatilla River	07-45-40
1987	Wash. Brights	Bonnevi1le	Smelt	1 1/03/88	1 1/04/88	9.8	4,533	Umatilla River	07-45-41
1987	Wash. Brights	Bonnevi1le	Smelt	1 1/03/88	1 1/04/88	9.8	560	Umatilla River	No mark
1987	Wash. Brights	Irrigon	Smelt	05/04/88	05/06/88	68.3	198,285	Umatilla River	07-50-07
1987	Wash. Brights	Irrigon	Smelt	05/04/88	05/06/88	68.3	1,688,472	Umatilla River	No mark
1987	Col . R. (UB)	Bonneville	smolt	03/01/89	--	7.8	32,665	Umatilla River	No mark
1987	Col. R. (UB)	Bonnevi1le	Smelt	03/01/89	--	8.6	93,291	Umatilla River	No merk
1987	Col . R. (UB)	Bonneville	Smelt	03/02/89	--	9.0	91,487	Umatilla River	No mark
1987	Col . R. (UB)	Irrigon	smolt	06/01/88	--	92.0	273,695	Umatilla River	No mark
1987	Col . R. (UB)	Irrigon	smolt	06/01/88	--	86.4	744,320	Umatilla River	No mark
1987	Col. R. (UB)	Irrigon	smolt	06/01/88	--	109.0	410,900	Umatilla River	No mark
1988	Wash. Brights	Irrigon	smolt	05116/89	--	75.0	52,228	Umatilla River	07-46-46
1988	Wash. Brights	Irrigon	smolt	05/16/89	--	75.0	49,771	Umatilla River	07-46-47
1988	Wash. Brights	Irrigon	smolt	05/16/89	--	75.0	52,244	Umatilla River	07-46-48
1988	Wash. Brights	Irrigon	smolt	10/18/89	--	10.9	26,358	Umatilla River	07-47-53
1988	Wash. Brights	Irrigon	Smelt	10/18/89	--	10.9	25,028	Umatilla River	07-47-54
1988	Wash. Brighta	Irrigon	smolt	10/18/89	--	10.9	25,438	Umatilla River	07-47-57
1988	Wash. Brights	Irrigon	smolt	10/18/89	--	11.0	26,790	Umatilla River	07-47-58
1988	Wash. Brights	Irrigon	Smelt	10118/89	--	11.0	24,285	Umatilla River	07-47-60
1988	Wash. Brights	Irrigon	Smelt	10/18/89	--	11.0	25,350	Umatilla River	07-47-63
1988	Wash. Brights	Irrigon	Smelt	10/18/89	--	10.9	137	Umatilla River	No mark
1988	Wash. Brights	Irrigon	Smelt	05/15189	05/17/89	61.0	863,150	Umatilla River	No mark
1988	Wash. Brights	Irrigon	Smelt	05/15/89	05/16/89	67.0	653,585	Umatilla River	No mark

Table 1 (IR). (cont.) Hatchery releases of fall chinook salmon into the Umatil la River subbasin by brood year and if marked, by coded wire tag Codes.

Brood Year	Stock[b]	Hatchery	Life Stage	Release Date (1)	Release Date (2)	Fish/lb	Number Released	Release LoCat ion	CWT/ Fin clip
1988	Wash. Brights	Irrigon	Smelt	05/15/89	··	72.0	342,000	Umatilla River	No mark
19SS	Mash. Brights	Irrigon	molt	05/16/89	··	80.0	158,000	Umatilla River	No mark
1988	Wash. Brights	Irrigon	smolt	05/16/89	··	68.0	217,600	Umatilla River	No mark
1988	Col. R. (UB)	Bonneville	smolt	03/19/90	--	8.3	39,840	Umatilla River	No mark
1988	Col. R. (UB)	Bonnevi1le	smolt	03/20/90	03/21/90	7.9	59,250	Umatilla River	No mark
1988	Col. R. (UB)	Bonnevi1le	Smelt	03/20/90	··	8.7	41,760	Umatilla River	No mark
1988	Col. R. (UB)	Bonneville	Smelt	03/21 /90	··	8.0	44,000	Umatilla River	No mark
1988	Col . R. (UB)	Bonnevi11e	smelt	03/21/90	03/26/90	8.1	70,875	Umatilla River	No mark
1988	Col. R. (UB)	Irrigon	smolt	05/1 7/89	··	73.0	297,475	Umatilla River	No mark
1988	Col . R. (UB)	Irrigon	smolt	05/1 7/89	··	79.0	361,030	Umatilla River	No mark

[a] Estimates ara from Oregon Department of Fish snd Wildl ife (unpubl i shed data).
[b] UB = Upriver brights.
[c] Tule fall chinook.

Table 2 (AE). Emigration of coded wire tagged hatchery fall chinook salmon released in the Umatilla River subbasin[a,b].

Hatchery/Release Site	Recovery Site, Run Year(s)	Recovery Method	Number Recovered	Total Number Estimated, (PSMFC)
Umatilla River	Columbia River[c]	Spawner Surveys		
	1985	--	2	44
	1986	--	3	86
	1987	--	10	208
	1988	--	6	127
Umatilla River	Columbia River[d]	Trap Returns		
	1985	--	1	1
	1986	--	1	1
	1987	--	2	2
Umatilla River	Snake River	Trap Returns		
	1986	--	6	6
Umatilla River	Columbia River[c]	Trap Returns		
	1987	--	2	2
Umatilla River	L White Salmon R.	Hatchery Returns		
	1989	--	1	1
Umatilla River	Columbia River[d]	Hatchery Returns		
	1983	--	3	3
	1985	--	2	2
	1987	--	3	3
Umatilla River	Columbia River[e]	Hatchery Returns		
	1984	--	1	1
	1985	--	--	--
	1986	--	--	--
	1987	--	--	--
	1988	--	1	1

Table 2 (AE). (cont.) Emigration of coded wire tagged hatchery fall chinook salmon released in the Umatilla River subbasin[a,b].

Hatchery/Release Site	Recovery Site, Run Year(s)	Recovery Method	Number Recovered	Total Number Estimated, (PSMFC)
Umatilla River	Columbia River[c]	Hatchery Returns		
	1984	--	2	2
	1985	--	25	27
	1986	--	11	12
	1987	--	49	49
	1988	--	60	60

[a] Based on the following tag codes: 07-26-63, 07-27-41, 07-28-29, 07-31-24, 07-31-27, 07-31-62, 07-33-26, 07-33-27, 07-38-23, 07-38-24, 07-38-25, 07-38-26, 07-38-29, 07-38-33, 07-38-34, 07-38-35, 07-38-37, 07-38-38, 07-38-39, 07-38-40, 07-38-41, 07-39-12, 07-39-13, 07-39-14, 07-40-36, 07-40-39.
[b] Estimates are modified from the Pacific States Marine Fisheries Commission coded wire tag database.
[c] Recovery site in the mainstem Columbia River between McNary and Priest Rapids dams.
[d] Recovery site in the mainstem Columbia River below Bonneville Dam.
[e] Recovery site in the mainstem Columbia River between Bonneville and McNary dams.

REFERENCES

Olson, D. E., G.A. James, B. Duke, and J. Phelps. 1990. Trapping and transportation of adult and juvenile salmon in the lower Umatilla River in northeast Oregon, 1989-1990. Annual Progress Report of Department of Natural Resources Confederated Tribes of the Umatilla Indian Reservation and Oregon Department of Fish and Wildlife (Contract DE-B179-89BP98636, Project No. 88-022) to Bonneville Power Administration, Portland, Oregon.

Confederated Tribes of the Umatilla Indian Reservation and Oregon Department of Fish and Wildlife. 1990. Umatilla River subbasin salmon and steelhead production plan. Columbia Basin System Planning Report to Northwest Power Planning Council, Portland, Oregon.

UMATILLA RIVER SUBBASIN

Naturally Produced Coho Salmon

GEOGRAPHIC LOCATION

The Umatilla subbasin covers 2,290 square miles in Northeast Oregon. With the headwaters originating in the Blue Mountains, the river flows northwesterly across the Umatilla plateau 115 miles to its confluence with the Columbia River (RM 289). The mouth of the Umatilla River is located above Bonneville, The Dalles, and John Day dams in the mainstem Columbia.

ORIGIN

Wild coho were once abundant in the Umatilla River subbasin, but upon completion of the Hermiston Power and Light and Three Mile dams in 1910 and 1914, respectively, the run went extinct. Problems which contributed to the runs extinction include dewatering of the mainstem Umatilla River, degradation of headwater habitat, and mortalities at Columbia River dams (Confederated Tribes of the Umatilla Indian Reservation and Oregon Department of Fish and Wildlife 1990). The subbasin is currently being supplemented with hatchery fish to re-establish a naturally producing run (see UMATILLA RIVER SUBBASIN, Hatchery Produced Coho Salmon).

DISTRIBUTION

Historical spawning and rearing distribution of coho salmon is not documented for the Umatilla River subbasin. Potential spawning and rearing habitat is located in the mainstem Umatilla River and in Meacham Creek (Figure 1).

ADULT LIFE HISTORY

Strays

No coho from subbasin hatchery production releases have been recovered at hatchery facilities or on spawning ground surveys outside of the subbasin. All coded wire tag recoveries were from subbasin hatchery production releases recovered in the Umatilla River subbasin (Table 1).

Figure 1. Coho distribution in the Umatilla River subbasin, based on the NPPC presence\absence data base (solid and dashed lines respectively) and **the** BPA Geographic Information System.

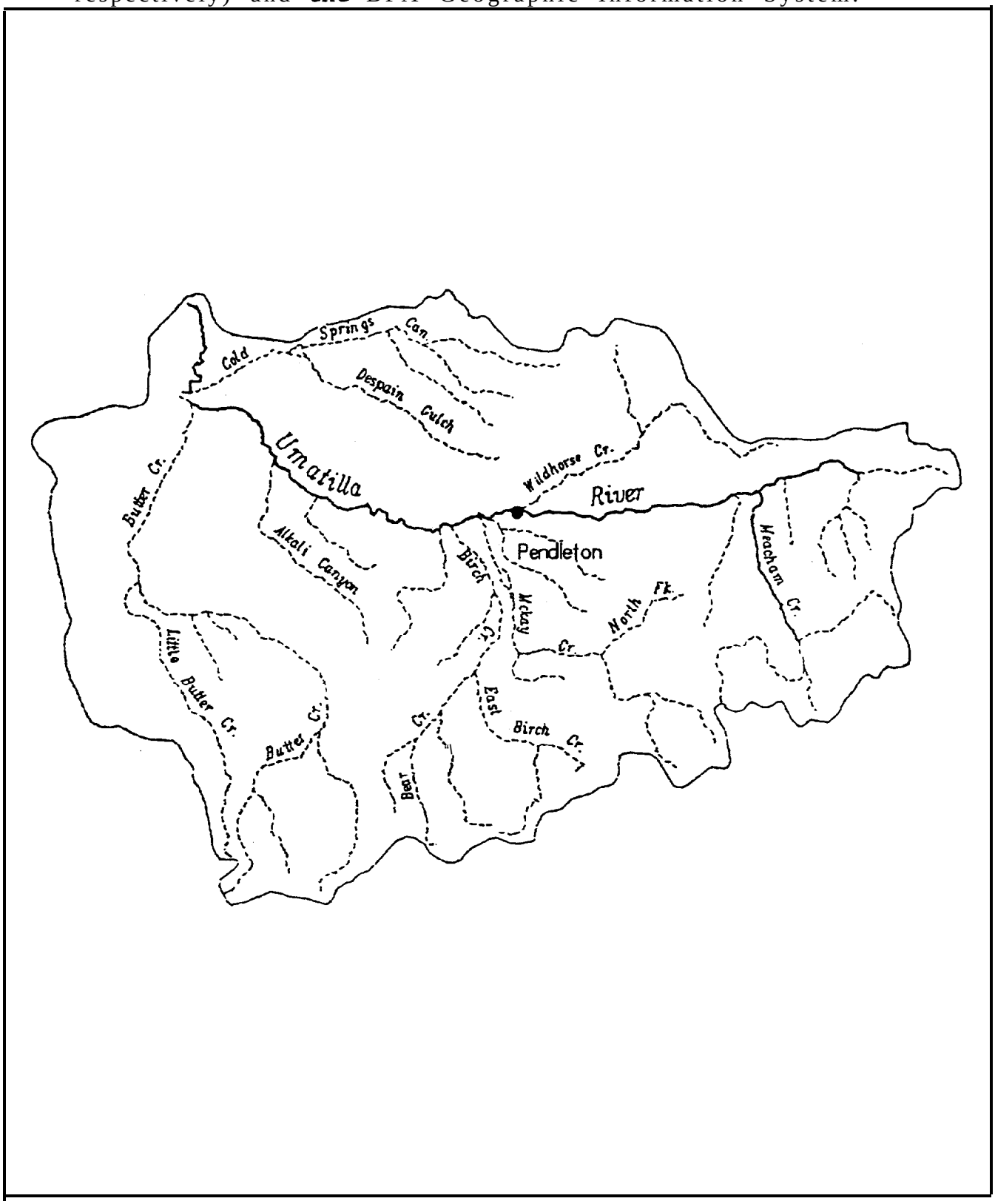


Table 1 (AI). Non-harvest recoveries of coded wire tagged hatchery coho salmon in the Umati

Hatchery/Release Site	Recovery Site, Run Year(s)	Recovery Method	Number Recovered	Total Nu Estima (PS
Umatilla River	Umatilla River 1988	Trap returns --	69	

[a] Based on the following tag codes: 07-36-17, 07-36-24, 07-36-25, 07-43-56, 07-43-57, 07-43-
[b] Estimates are modified from the Pacific States Marine Fisheries Commission coded wire tag

REFERENCES

Confederated Tribes of the Umatilla Indian Reservation and Oregon Department of Fish and Wildlife. 1990. Umatilla River subbasin salmon and steelhead production plan. Columbia Basin System Planning Report to Northwest Power Planning Council, Portland, Oregon.

UMATILLA RIVER SUBBASIN

Hatchery Produced Coho Salmon

ORIGIN

Hatchery coho salmon were released into the subbasin beginning in 1966 tore-establish a naturally producing run, sustain sport and tribal fisheries, and improve harvest in mainstem Columbia River fisheries (Confederated Tribes of the Umatilla Indian Reservation and Oregon Department of Fish and Wildlife 1990). The hatchery program was discontinued from 1970-86 and was again implemented with the 1985 brood release of hatchery smelts in 1987 (Table 1). Non-indigenous stocks introduced into the subbasin include the Little White Salmon and Toutle River stocks. Long range plans for the hatchery program are to have broodstock collected from returning hatchery fish; once a self sustaining run has been established in the subbasin.

DISTRIBUTION

Subbasin

Juvenile hatchery coho are released into the mainstem of the Umatilla River (Table 1).

Approximations of the temporal distribution of adult immigration, adult holding, spawning, incubation, emergence, rearing, and juvenile outmigration were reported in Confederated Tribes of the Umatilla Indian Reservation and Oregon Department of Fish and Wildlife (1990) and are presented in Figure 1. The methodology used to generate these approximations is unknown.

PRODUCTION

Releases

Egg

Matchboxes were used in 1967 and 1968 to incubate eggs for release as fry into the Umatilla River subbasin (Confederated Tribes of the Umatilla Indian Reservation and Oregon Department of Fish and Wildlife, 1990). Matchboxes were used in 1967 to incubate 500,000 eggs collected from Cascade Hatchery and in 1968 to incubate 750,000 eggs collected from Little White Salmon Hatchery.

Fry

Little White Salmon Hatchery released 500,000 and 200,000 fry into the subbasin in 1966 and 1967, respectively (Table 1). Size at release ranged from 1,312 to 1,087 fish per pound (Table 1).

Fingerling

Carson National Fish Hatchery released 200,040 fingerlings into the subbasin in 1969 (Table 1). Size at release was 23 fish per pound (Table 1).

Smelt

Hatchery facilities in which smelts were reared or acclimated prior to release in the subbasin include

Cascade Hatchery (Table 1). Annual numbers released ranged from 945,670 to 991,271 (Table 1). Size at release ranged from 19.1 to 11.2 fish per pound (Table 1).

Jack and Adult

There are no records of releases into the subbasin.

ADULT LIFE HISTORY

Escapement

Subbasin

Numbers: No brood year specific estimates of escapement are available. Run year specific estimates of escapement are available in Confederated Tribes of the Umatilla Indian Reservation and Oregon Department of Fish and Wildlife (1990) and Olson et al. (1990) and from Confederated Tribes of the Umatilla Indian Reservation (unpublished data).

Fork Length

No brood year specific estimates are available. Run year specific estimates of fork length are available in Confederated Tribes of the Umatilla Indian Reservation and Oregon Department of Fish and Wildlife (1990).

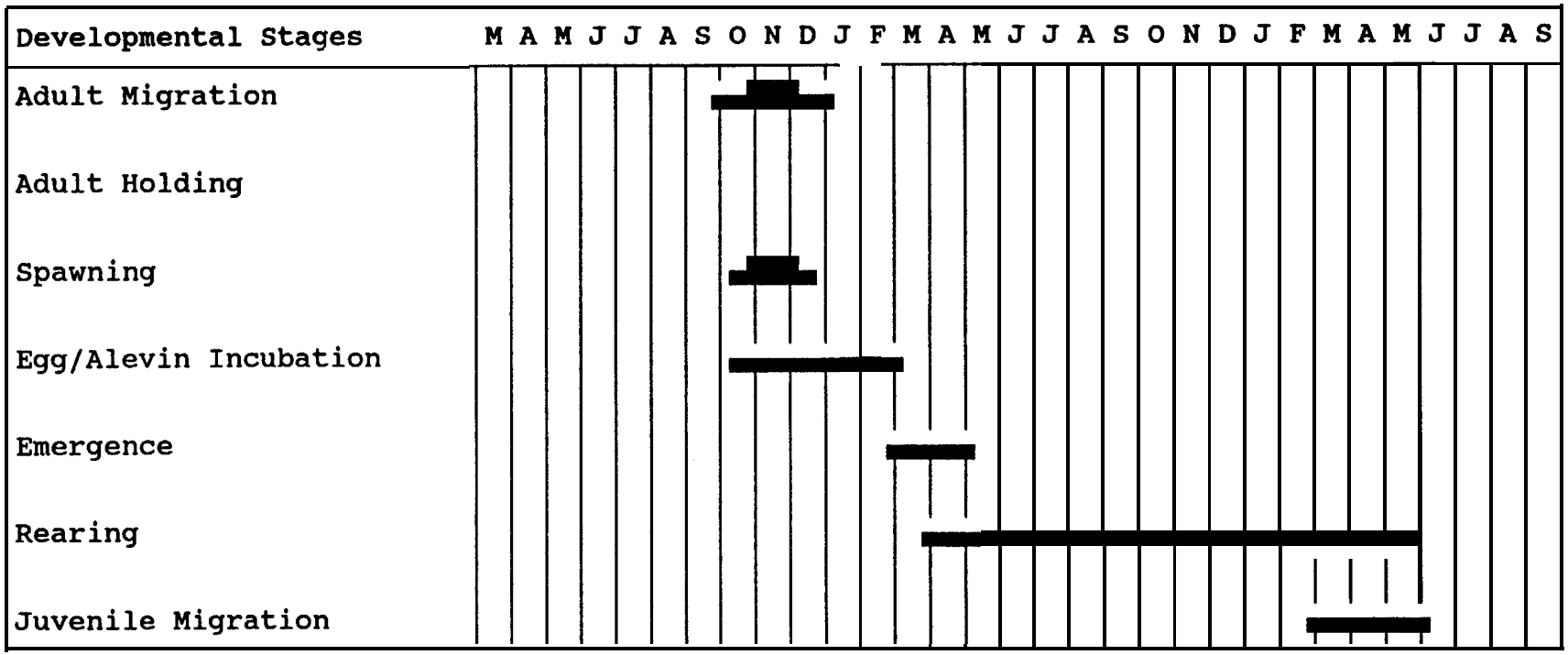
Mark Recoveries

Coded wire tagged stray hatchery coho, released as juveniles in the Umatilla River subbasin, were recovered in the mainstem Columbia River from the estuary to Priest Rapids Dam and in the Little White Salmon River subbasin (Table 2).

DISEASES

There are no hatchery facilities in the Umat.ills River subbasin that have historically held or reared hatchery coho salmon prior to release in the subbasin. For information on parasites and disease agents of subbasin hatchery production that is held or reared at hatchery facilities located outside of the subbasin see SANDY RIVER SUBBASIN, Hatchery Produced Coho Salmon, DISEASES.

Figure 1 (TT). Freshwater life history for Toutle stock coho salmon from the Cascade Hatchery, released in the Umatilla subbasin (Confederated Tribes of the Umatilla Indian Reservation and Oregon Department of Fish and Wildlife 1990).



Notes:
1. The developmental stage timing represents basin-wide averages, local conditions may cause some variability.
2. Double thick bars indicate periods of heaviest adult migration and spawning.
3. Adult migration based on jack returns to the Umatilla River in 1987; adults and jacks in 1988.
4. Adult spawning through emergence times based on Cascade Hatchery data (Wayne Stedronsky, ODFW, Pers. comm.)
5. Juvenile migration times based on release as yearlings in the spring.

Table 1 (TR). Hatchery releases of coho salmon into the Umatilla River subbasin by brood yaar end if marked, by coded wire tag code[a].

Brood Year	stock	Hatchery	Lifa Stage	Release Data (1)	Release Date (2)	Fish/ lb	Number Released	Release Location	CWT/ Fin clip
--	L White Salmon	L White Salmon	fry	0 /01/66[b]	12/31/66[b]	1,312	500,000	Umatilla River	No mark
..	L White Salmon	L White Salmon	fry	0 /01/67[b]	12/31/67[b]	1,087	200,000	Umatilla River	No mark
..	L White Salmon	Carson	fing.	0 /01/69[b]	12/31/69[b]	23.0	200,040	Umatilla River	No mark
1985	Toutle River	Cascade	Smelt	0 /14/87	--	14.3	568,677	Umatilla River	No mark
1985	Toutle River	Cascade	Smelt	0 /20/87	--	13.9	217,983	Umatilla River	No mark
1985	Toutle River	Cascade	smolt	0 /24/87	--	13.5	13,440	Umatilla River	07-36-17
1985	Toutle River	Cascade	Smelt	0 /24/87	--	13.5	22,765	Umatilla River	No mark
1985	Toutle River	Cascade	smolt	0 /29/87	--	13.5	26,740	Umatilla River	07-36-25
1985	Toutle River	Cascade	smolt	0 /29/87	--	13.5	43,330	Umatilla River	No mark
1985	Toutle River	Cascade	smolt	0 /04/87	--	13.s	19,879	Umatilla River	07-36-24
1985	Toutle River	Cascade	Smelt	0 /04/87	--	13.5	32,856	Umatilla River	No mark
1986	Toutle River	Cascade	smolt	0 /28/88	--	16.8	20,592	Umatilla River	07-43-56
1986	Toutle River	Cascade	smolt	0 /28/88	--	16.8	46,357	Umatilla River	No mark
1986	Toutle River	Cascade	Smelt	0 /28/88	--	17.3	18,963	Umatilla River	07-43-57
1986	Toutle River	Cascade	smolt	0 /28/88	--	17.3	52,850	Umatilla River	No mark
1986	Toutle River	Cascade	smolt	0 /28/88	--	15.7	18,513	Umatilla River	07-43-58
1986	Toutle River	cascade	smolt	0 ,/28/88	--	15.7	40,944	Umatilla River	No mark
1986	Toutle River	Cascade	Smelt	0 /28/88	04/ 11 /88	16.4	793,052	Umatilla River	No mark
1987	Toutle River	Cascade	Smelt	0 /14/89	--	17.1	20,520	Umatilla River	No mark
1987	Toutle River	Cascade	smolt	0 /14/89	--	17.7	187,488	Umatilla River	No mark
1987	Toutle River	Cascade	smolt	0 /14/89	--	19.1	248,854	Umatilla River	No mark
1987	Toutle River	Cascade	smolt	0 /17/89	--	17.1	88,687	Umatilla River	No mark
1987	Toutle River	Cascade	Smelt	0 /1 7/89	--	17.6	91,560	Umatilla River	No mark
1987	Toutle River	Cascade	smolt	0 /20/89	--	16.7	109,667	Umatilla River	No mark
1987	Toutle River	Cascade	Smelt	0 /21/89	--	17.6	6,861	Umatilla River	No mark
1987	Toutle River	Cascade	smolt	0 /31/89	--	17.2	27,062	Umatilla River	07-46-09
1987	Toutle River	Cascade	smolt	0 /31/89	--	17.2	48,305	Umatilla River	No mark
1987	Toutle River	Cascade	smolt	0 /31/89	--	17.3	26,416	Umatilla River	07-46-10
1987	Toutle River	Cascade	Smelt	0 /31 /89	--	17.3	44,934	Umatilla River	No mark
1987	Toutle River	Cascade	smolt	0 /3 1 /89	--	19.1	26,739	Umatilla River	07-46-11
1987	Toutle River	Cascade	Smelt	0 I/31/89	--	19.1	57,141	Umatilla River	No mark
1988	Toutle River	Cascade	smolt	0 /28/90	--	13.5	28,033	Umatilla River	07-48-14
1988	Toutle River	Cascade	smolt	0 I/28/90	--	13.5	39,039	Umatilla River	No mark
1988	Toutle River	Cascade	Smelt	0 /29/90	--	13.3	26,881	Umatilla River	07-48-13
1988	Toutle River	Cascade	smolt	0 I/29/90	--	13.3	32,109	Umatilla River	No mark
"1988	Toutle River	Cascade	smolt	0 /12/90	--	11.2	27,226	Umatilla River	07-48-15
1988	Toutle River	Cascade	smolt	0 /12/90	--	11.2	37,495	Umatilla River	No mark
1988	Toutle River	Cascade	smolt	0 /28/90	03/29/90	13.7	61,513	Umatilla River	No mark
1988	Toutle River	Cascade	Smelt	0 /27/90	--	13.8	70,104	Umatilla River	No stark
1988	Toutle River	Cascade	smolt	0 /27/90	--	14.4	66,456	Umatilla River	No stark
1988	Toutle River	Cascade	smolt	0 /28/90	--	14.6	68,620	Umatilla River	No stark
1988	Toutle River	Cascade	smolt	0 /26/90	03/27/90	14.7	173,388	Umatilla River	No mark

Table 1 (IR). (cont.) Hatchery releases of coho salmon into the Umatilla River subbasin by brood Yeer and if marked, by coded wire tag codes"

Brood Stock Year	Hatchery	Life Stage	Release Date (1)	Release Date (2)	Fish/ lb	Number Released	Release Location	CUT/ Fin clip
1988 Toutle River	cascade	smolt	03/27/90	03/29/90	14.8	140,008	Umatilla River	No mark
1988 Toutle River	Cascade	smolt	03/26/90	--	15.0	68,250	Umatilla River	No mark
1988 Toutle River	Cascade	smolt	03/26/90	03/27/90	15.2	70,224	Umatilla River	No mark
1988 Toutle River	Cascade	smolt	04/02/90	--	15.9	78,705	Umatilla River	No mark

a Estimates are from Oregon Department of Fish and Wildlife (unpublished data).
b Release dates unknown (only the year of release known). Standardized to the first and last day of the year.

Table 2 (AE). Emigration of coded wire tagged hatchery coho salmon released in the Umatilla River subbasin[a,b].

Hatchery/Release Site	Recovery Site, Run Year(s)	Recovery Method	Number Recovered	Total Number Estimated, (PSMFC)
Umatilla River	L White Salmon R. 1988	Hatchery Returns .-	1	1
Umatilla River	Columbia River[c] 1988	Hatchery Returns --	1	1
Umatilla River	Columbia River[d] 1987	Hatchery Returns --	1	1
	1988	.-	12	12
Umatilla River	Columbia River[e] 1988	Hatchery Returns --	1	1

a Based on the following tag codes: 07-36-17, 07-36-24, 07-36-25.
[b] Estimates are modified from the Pacific States Marine Fisheries Commission coded wire tag database.
[c] Recovery site in the mainstem Columbia River below Bonneville Dam.
[d] Recovery site in the mainstem Columbia River between Bonneville and McNary dams.
[e] Recovery site in the mainstem Columbia River between McNary and Priest Rapids dams.

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Olson, D.E., G.A. James, B. Duke, and J. Phelps. 1990. Trapping and transportation of adult and juvenile salmon in the lower Umatilla River in northeast Oregon, 1989-90. Annual Progress Report of Department of Natural Resources Confederated Tribes of the Umatilla Indian Reservation and Oregon Department of Fish and Wildlife Contract DE-B179-89BP98636, Project No. 88-022) to Bonneville Power Administration, Portland, Oregon.

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UMATILLA RIVER SUBBASIN

Naturally Produced Summer Steelhead

GEOGRAPHIC LOCATION

The Umatilla subbasin covers 2,290 square miles in Northeast Oregon. With the headwaters originating in the Blue Mountains, the river flows northwesterly across the Umatilla plateau 115 miles to its confluence with the Columbia River (RM 289). The mouth of the Umatilla River is located above Bonneville, The Dalles, and John Day dams in the mainstem Columbia.

ORIGIN

Wild summer steelhead were once abundant in the Umatilla River subbasin, but upon completion of the Hermiston Power And Light and Three Mile dams in 1914 and 1910, respectively, their numbers have been greatly reduced. Problems which have contributed to reduced run sizes to the subbasin include dewatering of the mainstem Umatilla River by irrigation diversions, degradation of headwater habitat, and mortalities at Columbia River dams (Confederated Tribes of the Umatilla Indian Reservation and Oregon Department of Fish and Wildlife 1990). The subbasin is supplemented with hatchery fish to increase spawner returns and improve harvest opportunities (see UMATILLA RIVER SUBBASIN, Hatchery Produced Summer Steelhead).

DISTRIBUTION

Subbasin

Habitat considered suitable for spawning and rearing is primarily located in the upper mainstem of the Umatilla River, Meacham Creek drainage, North and South fork drainages of the Umatilla River, Birch and West Birch creek drainages, Squaw Creek, and several other smaller tributaries to the mainstem of the Umatilla River (Figure 1). The quality of the spawning and rearing habitat varies throughout the subbasin (Tables 1 and 2).

Approximations of the temporal distribution of adult immigration, adult holding, spawning, incubation, emergence, rearing, and juvenile outmigration were reported in Confederated Tribes of the Umatilla Indian Reservation and Oregon Department of Fish and Wildlife (1990) and are presented in Figure 2. The methodology used to generate these approximations is unknown.

PRODUCTION

Harvest

sport

Subbasin: No brood year specific estimates of harvest are available. Run year specific estimates for the combined sport harvest of naturally and hatchery produced fish are available in Confederated Tribes of the Umatilla Indian Reservation and Oregon Department of Fish and Wildlife (1990).

Treaty

Subbasin: No brood year specific estimates of harvest are available. Run year specific estimates

for the combined tribal harvest of naturally and hatchery produced fish are available in Confederated Tribes of the Umatilla Indian Reservation and Oregon Department of Fish and Wildlife (1990).

ADULT LIFE HISTORY

Escapement

Subbasin

Numbers: No brood year specific estimates of escapement are available. Run year specific estimates of escapement are available in Confederated Tribes of the Umatilla Indian Reservation and Oregon Department of Fish and Wildlife (1990).

spawning Area

Numbers: No brood year specific estimates of spawner escapement are available. Run year specific estimates of spawner escapement are available in Confederated Tribes of the Umatilla Indian Reservation and Oregon Department of Fish and Wildlife (1990).

Strays

Coded wire tags were recovered from stray hatchery fish originating from Hagerman National Fish Hatchery and the Grande Ronde River subbasin (Table 3).

Fork Length

No brood year specific estimates are available. Run year specific estimates are available in Confederated Tribes of the Umatilla Indian Reservation and Oregon Department of Fish and Wildlife (1990).

Sex Ratio

No brood year specific estimates are available. Run year specific estimates are available in Confederated Tribes of the Umatilla Indian Reservation and Oregon Department of Fish and Wildlife (1990).

Fecundity

See UMATILLA RIVER SUBBASIN, Hatchery Produced Summer Steelhead, ADULT LIFE HISTORY, Fecundity.

DISEASES

Several parasites and infectious disease agents of naturally produced summer steelhead have been identified in the Umatilla River subbasin (Table 5). Parasites include *Ceratomyxa shasta* and whirling disease (*Myxosoma cerebralis*). *Bacterial* diseases include bacterial kidney disease (BKD). Viral diseases include Infectious Hematopoietic Necrosis (IHN) and Infectious Pancreatic Necrosis (IPN). An unknown percentage of summer steelhead classified as naturally produced and sampled for pathogens may have been unmarked hatchery fish. However, the numbers are considered to be low.

Figure 1. Summer Steelhead distribution in the Umatilla River subbasin, based on the NPPC presence\absence data base (solid and dashed lines respectively) and the BPA Geographic Information System.

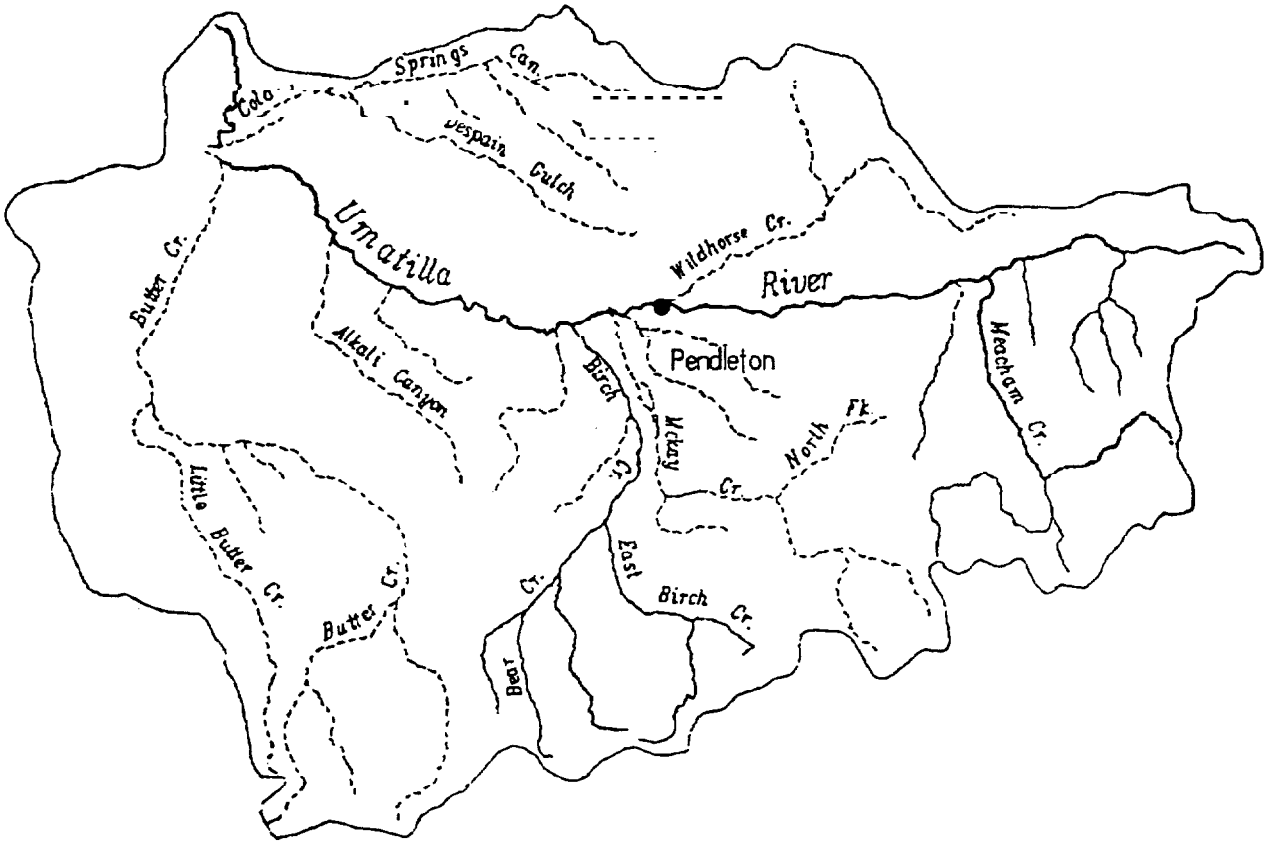
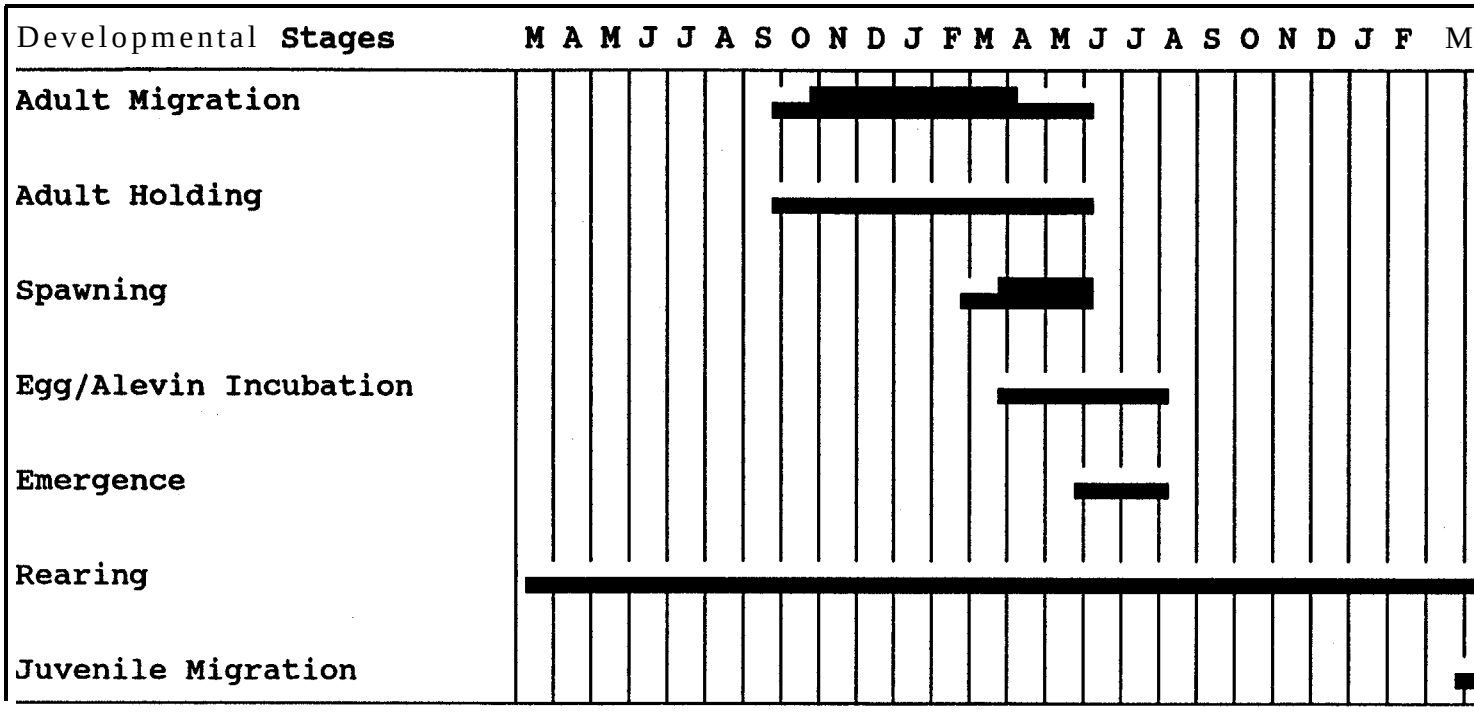


Figure 2 **(TT).** Freshwater **life** history for naturally produced summer steelhea
subbasin ∫Confederated **Tribes** of the **Umatilla Indian** Reservation and **Oregon**
Fish and **Wildlife** 1990).



Notes:

1. **The developmental stage timing represents basin-wide averages, local cond some variability.**
2. Double **thick** bars **indicate** periods of **heaviest** adult migration, spawning a outmigration.
3. **Adult** migration based on adults **to** Three Mile Dam, 1972-73 to 1987-88.
4. Spawning-through emergence **timing** based on spawning ground surveys and ave environmental conditions.
5. **Juveniles** rear one **to** three years; most migrate as 2-year olds (Howell **et**

Table 1 (HB-1). Estimated amount of spawning and rearing habitat by quality of Umatilla River subbasin summer steelhead production area.

Distance/ Area	Excellent	Good	Fair[b]	Poor[b]	Unknown	Total	Confi- dence
Miles (%)	1.2	29.6	45.5	23.7	--	223.5	--
Acres (%)	--	--	--	--	--	--	--

[a] Estimates are modified from the Northwest Power Planning Council's presence/absence database.
[b] Ratings of fair and poor habitat quality may reflect natural physical features such as waterfall barriers, as well as degradation caused by man.

Table 2 (HB-2). Estimated amount of rearing only habitat by quality of Umatilla River subbasin summer steelhead production area.

Distance/ Area	Excellent	Good	Fair[b]	Poor[b]	Unknown	Total	Confi- dence
Miles (0)	0.0	0.0	0.0	100.0	--	23.6	--
Acres (%)	--	--	--	--	--	--	--

[a] Estimates are modified from the Northwest Power Planning Council's presence/absence database.
[b] Ratings of fair and poor habitat quality may reflect natural physical features such as waterfall barriers, as well as degradation caused by man.

Table 3 (AI). Non-harvest recoveries of coded wire tagged hatchery summer steelhead *in* the Um
subbasin[a,b].

Hatchery/Release Site	Recovery Site, Run Year(s)	Recovery Method	Number Recovered	Total Numb Estimate (PSMF
Hagerman NFH	Umatilla River 1989	Trap returns --	1	
Grande Ronde	Umatilla River 1989	Trap returns --	3	

[a] Based on the following tag codes: 07-40-26, 07-41-26, 63-38-43. Based on the following tag
unknown rearing type (assumed to be hatchery): 10-29-48.
[b] Estimates are modified from the Pacific States Marine Fisheries Commission coded wire tag da

Table 4 (AF-a). Mean fecundity by run year for unmarked summer steelhead returning to the Umatilla River subbasin[a,b].

Run Year	N	Mean Fecundity	st. dev.
1982-83	34	4,412	--
1983-84	23	4,869	--
1984-85	33	4,787	--
1985-86	30	5,534	--
1986-87	37	6 486	--
1987-88	31	5,695	--
1988-89	42	5,754	--
1989-90	25	5,870	--

[a] Estimates for the 1982-83 through 1986-87 run years are from Oregon Department of Fish and Wildlife (unpublished data), cited by James and Olson (1987); for the 1987-88 run year from Lofy (1989); for the 1988-89 run year from Lofy and Rowan (1990); and for the 1989-90 run year from Rowan (1991).

[b] Estimates are for adults returning to Threemile Dam.

Table 5 (TD). Parasites and diseases of unmarked summer steelhead collected in the Umatilla River subbasin[a,b].

Disease Type	Location	Specific Pathogen
Parasite	Umatilla River	*Ceratomyxa shasta*
Parasite	Umatilla River	*Myxosomacerebralis* (Whirling disease)
Bacteria	Umatilla River	*Renibacterium salmoninarum* (Bacterial kidney disease)
Bacteria	Umatilla River	*Aeromonas salmonicida* (Furunculosis)
Bacteria	Umatilla River	*Pseudomonas spp.*
Virus	Umatilla River	Infectious Hematopoietic Necrosis (IHN)
Virus	Umatilla River	Infectious Pancreatic Necrosis (IPN)

[a] Data are from Rowan (1991), Lofy and Rowan (1990), Lofy (1989), and Lofy and James (1988).
[b] Summer steelhead sampled for pathogens may have been hatchery fish, however, numbers are considered to be low.

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UMATILLA RIVER SUBBASIN

Hatchery Produced Summer Steelhead

ORIGIN

Hatchery summer steelhead were released into the subbasin beginning in 1967 to increase escapement to the subbasin and improve harvest opportunities. Stocks introduced into the subbasin include the Idaho, Skamania, and Umatilla River stocks. Hatchery broodstock is currently obtained primarily from unmarked summer steelhead returning to the Umatilla River subbasin. A small percentage of unmarked steelhead used as hatchery broodstock, however, are believed to be unmarked hatchery fish. This is based on an analysis of scale which indicates that some unmarked summer steelhead are hatchery fish (Confederated Tribes of the Umatilla Indian Reservation and Oregon Department of Fish and Wildlife, 1990). The hatchery program is currently designed to be in compliance with Oregon's Wild Fish Policy.

DISTRIBUTION

Subbasin

Hatchery releases of summer steelhead have been made into the upper and lower mainstem Umatilla River, and Meacham Creek, with occasional releases at the Bonifer Pond holding facility (Table 1).

Approximations of the temporal distribution of adult immigration, adult holding, spawning, incubation, emergence, rearing, and juvenile outmigration for hatchery fish were reported in Confederated Tribes of the Umatilla Indian Reservation and Oregon Department of Fish and Wildlife 1990(1990) and are presented in Figure 1. The methodology used to generate these approximations is unknown.

PRODUCTION

Releases

Egg

Matchboxes were used in 1968 to incubate eggs for release as fry into the Umatilla River subbasin (Oregon Department of Fish and Wildlife unpublished data). Matchboxes were used in 1968 to incubate 150,000 eggs collected from Gnat Creek Hatchery.

Fry

Hatchery facilities in which fry were reared or acclimated prior to release in the subbasin include Oak Springs, Wallowa, Gnat Creek, and Irrigon hatcheries (Table 1). Annual numbers released ranged from 3,774 to 490,065 (Table 1). Size at release ranged from 3,200 to 57.5 fish per pound (Table 1).

Fingerling

There are no records of releases into the subbasin.

Smelt

Hatchery facilities in which smelts were reared or acclimated prior to release in the subbasin include Carson National Fish Hatchery and Oak Springs, Bonneville, and Wizard Falls hatcheries (Table 1). Annual numbers released ranged from 1,485 to 117,877 (Table 1). Size at release ranged from 11.0 to 4.2 fish per pound (Table 1).

Adult

There are no records of releases into the subbasin.

Harvest

Sport

Subbasin: No brood year specific estimates of harvest are available. Run year specific estimates are available for the combined sport harvest of naturally and hatchery produced fish in Confederated Tribes of the Umatilla Indian Reservation and Oregon Department of Fish and Wildlife (1990).

Treaty

Subbasin: No brood year specific estimates of harvest are available. Run year specific estimates are available for the combined tribal harvest of naturally and hatchery produced fish in Confederated Tribes of the Umatilla Indian Reservation and Oregon Department of Fish and Wildlife (1990).

ADULT LIFE HISTORY

Escapement

Subbasin

Numbers: No brood year specific estimates of escapement are available. Run year specific estimates of escapement are available in Confederated Tribes of the Umatilla Indian Reservation and Oregon Department of Fish and Wildlife (1990).

Fork Length

No brood year specific estimates of fork length are available. Run year specific estimates are available in Confederated Tribes of the Umatilla Indian Reservation and Oregon Department of Fish and Wildlife (1990).

Fecundity

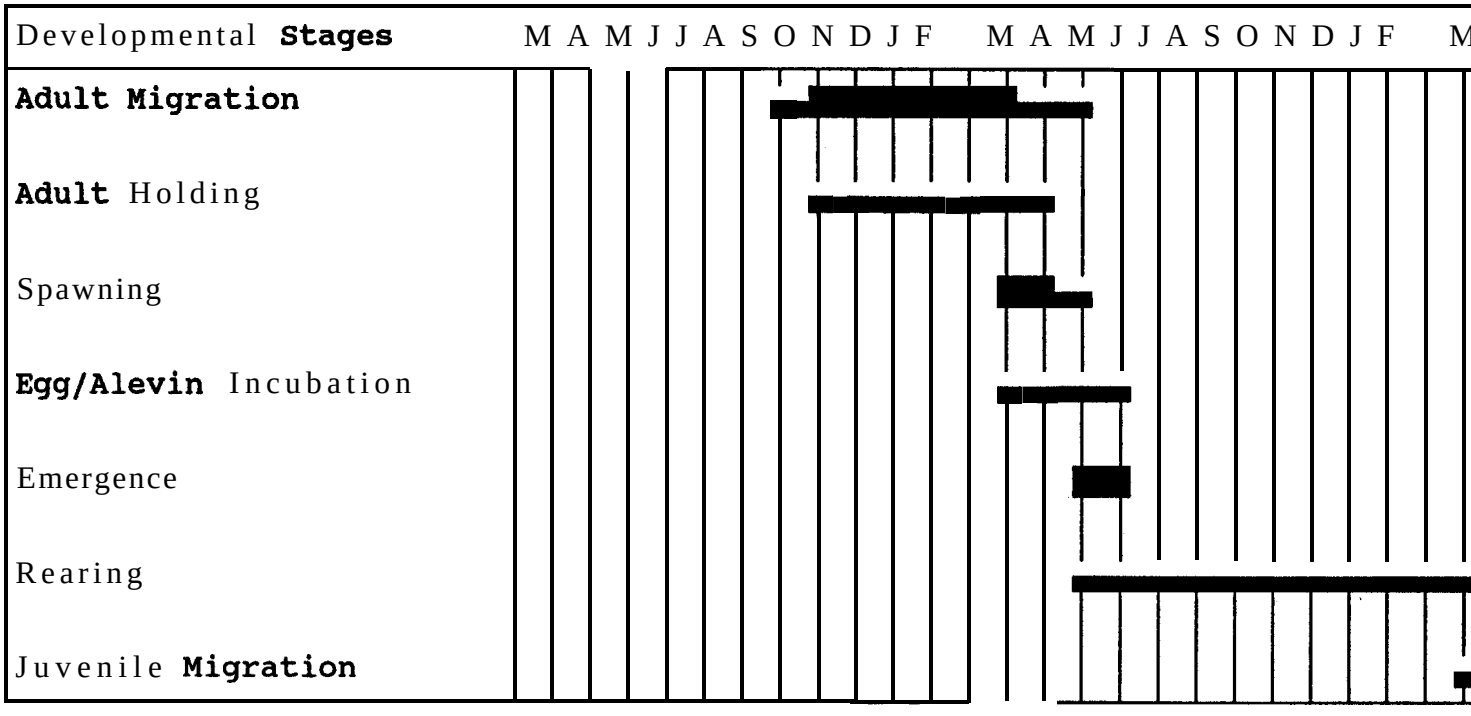
Mean fecundity was estimated for unmarked summer steelhead returning to the Umatilla River subbasin. Estimates of fecundity were made by dividing hatchery egg take by the number of females spawned. The majority of summer steelhead collected for hatchery broodstock were unmarked summer steelhead. In some years, however, a few marked hatchery fish were utilized as hatchery broodstock (personal communication, Gary James, Confederated Tribes of the Umatilla Indian Reservation, Pendleton, Oregon). All unmarked summer steelhead were classified as wild or naturally produced. - Scale analysis, however, has shown that some unmarked summer steelhead may be hatchery fish (Confederated Tribes of the Umatilla Indian Reservation and Oregon Department of Fish and Wildlife, 1990).

Annual estimates of mean fecundity for unmarked summer steelhead returning to the Umatilla River subbasin ranged from 4,412 to 5,870 eggs per female (Table 2).

DISEASES

There are no hatchery facilities in the Umatilla River subbasin that historically held or reared hatchery summer steelhead prior to release in the subbasin. Several parasites and disease agents have been detected in the Umatilla stock of summer steelhead held at Irrigon Hatchery (Table 2). For information on parasites and disease agents of subbasin hatchery production that is held or reared at hatchery facilities located outside of the subbasin see GRANDE RONDE RIVER SUBBASIN, Hatchery Produced Summer Steelhead, DISEASES; see IMNAHA RIVER SUBBASIN, Hatchery Produced Summer Steelhead, DISEASES; see LOWER COLUMBIA RIVER SUBBASIN, Hatchery Produced Summer Steelhead, DISEASES; and see DESCHUTES RIVER SUBBASIN, Hatchery Produced Summer Steelhead, DISEASES.

Figure 1 **(TT).** Freshwater **life** history for **Umatilla** stock hatchery Produced su
Umatilla River subbasin (Confederated **Tribes** of the **Umatilla Indian** Reserva
Department of **Fish** and **Wildlife** 1990).



Notes:

1. **The developmental stage** timing represents basin-wide averages, local condi
some variability.
2. **Double thick bars indicate periods of heaviest adult migration,** spawning a
outmigration.
3. **Egg/alevin incubation based on Irrigon Hatchery data, (Ray Hill** pers. **comm**
4. **Juvenile migration shown is primarily for yearlings.**

Table 1 (TR). Hatchery releases of sinner steelhead into the Umatil la River subbasin by brood year and if marked, by coded wire

Brood Stock Year	Hatchery	Life Stage	Release Date (1)	Release Date (2)	Fish/ lb	Number Released	Release Location	CUT/ Fin clip
1%7 Idaho (Oxbow)	Oak Springs	fry	01/01/67[b]	12/31/67[b]	117.0	238,020	Barnhart to South Cr. bridge	--
1967 Idaho (Oxbow)	Wallowa	fry	01/01/67[b]	12/31/67[b]	240.0	142,240	Barnhart to South Cr. bridge	--
1967 Skamania	Gnat Creek	fry	01/01/67[b]	12/31/67[b]	75.0	109,805	Barnhart to South Cr. bridge	--
1968 Skamania	Gnat Creak	fry	01/01/68[b]	12/31/68[b]	66.0	23,100	Upper Umatilla	..
1969 Skamenia	Oak Springs	fry	01/01/69[b]	12/31/69[b]	145.0	174,341	Upper Umatilla	--
1969 Skamania	Carson	Smelt	01/01/70[b]	12/31/70[b]	9.0	23,400	Upper Umatilla	..
1969 Skamania	Carson	smolt	01/01/70[b]	12/31/70[b]	8.0	16,089	Upper Umatilla	--
1974 Umatilla R	Wizard Falls	smolt	01/01/75;	12/31/75[b]	9.0	11,094	Umatilla River	..
1980 Umatilla R	Oak Springs	smolt	01/01/81	12/31/81[b]	6-9	17,600	Umatilla River	No mark
1981 Umatilla R	Oak Springs	fry	11/13/81	--	150.0	9,400	Umatilla River	No mark
1981 Umatilla R	Oak Springs	smolt	05/25/82	--	7.8	52,994	Umatilla River	No mark
1981 Umatilla R	Oak Springs	smolt	05/26/82	--	10.5	6,500	Umatilla River	No mark
1982 Umatilla R	Oak Springs	fry	11/08/82	--	123.6	67,910	Umatilla River	No mark
1982 Umatilla R	Oak Springs	Smelt	05106/83	--	11.0	60,400	Umatilla River	No mark
1983 Umatilla R	Oak Springs	fry	12/16/83	--	62.0	52,700	Umatilla River	No mark
1983 Umatilla R	Oak Springs	Smelt	05/08/84	05/10/84	6.9	57,947	Umatilla River	AD
1984 Umatilla R	Oak Springs	fry	11/16/84	--	135.0	22,000	Umatilla River	No merk
1984 Umatilla R	Oak Springs	smolt	05/07/84	05/08/85	8.5	59,930	Meacham Creek	AD
1985 Umatilla R	--	fry	08/12/85	--	..	2,500	Minehaha Springs Creek	..
1985 Umatilla R	..	fry	08/12/85	--	--	7,704	EFk Birch Creek	..
1985 Umatilla R	--	fry	08/12/85	--	..	3,852	Pearson Creek	--
1985 Umatilla R	Oek Springs	fry	09/25/85	--	206.0	39,134	Bonifer pond	No mark
1985 Umati lla R	Oak Springs	smolt	04/22/86	--	8.4	55,337	Bonifer pond	AD
1986 Umatilla R	Oak Springs	Smelt	05/13/87	--	5.5	1,485	Meacham Creek	No mark
1987 Umatilla R	--	fry	10/12/87	--	--	3,774	Umatilla River	..
1987 Umatilla R	Oak Springs	smolt	04/18/88	04/19/88	6.5	9,689	Umatilla River	07-38-56
1987 Umatilla R	Oak Springs	Smelt	04/18/88	04/19188	6.5	9,455	Umatilla River	07-38-57
1987 Umatilla R	Oak Springs	Smelt	04/18/88	04/19/88	6.5	9,448	Umatilla River	07-38-58
1987 Umatilla R	Oak Springs	Smelt	04/18/88	04/19/88	7.4	9,829	Umatilla River	07-38-59
1987 Umatilla R	Oak Springs	Smelt	04/18/88	04/19/88	7.4	9,721	Umatilla River	07-38-60
1987 Umatilla R	Oak Springs	smolt	04/18/88	04/19/88	7.4	9,925	Umatilla River	07-38-61
1987 Umatilla R	Oak Springs	Smelt	04/18/88	04/19/88	6.5	1,732	Umatilla River	AD-LV
1987 Umatilla R	Oak Springs	smolt	04/18/88	04/19/88	7.4	822	Umatilla River	AD-LV
1987 Umatilla R	Oak Springs	Smelt	05/05188	--	4.2	33,984	Umatilla River	No mark
1988 Umatilla R	Oak Springs	fry	12/21/88	--	57.5	10,063	Umatilla River	No mark
1988 Umatilla R	Irrigon	fry	01/01/88[b]	12/31/88[b]	3,200	24,618	Umatilla River	No mark
1988 Umatilla R	Bonneville	smolt	05/23/89	--	5.5	22,274	Meacham Creek	No mark
1988 Umatilla R	Oak Springs	Smelt	05/15/89[c]	--	6.6	8,784	Umatilla River	07-47-20
1988 Umatilla R	oak Springs	smolt	05/15/89[c]	--	6.6	8,789	Umatilla River	07-47-23
1988 Umatilla R	Oak Springs	Smelt	05/15/89[c]	--	6.6	8,784	Umatilla River	07-47-24
1988 Umatilla R	Oak Springs	Smelt	05/15/89[c]	--	6.6	3,495	Umatilla River	AD-LV
1988 Umatilla R	oak Springs	Smelt	05/17/89	"-	5.5	8,800	Umatilla River	07-47-15

Table 1 (TR). (cent.) Hatchery releases of summer steelhead into the Umatil la River subbasin by brood year and if marked, by coded wire tag code[a].

Brood Year	Stack	Hatchery	Life Stage	Release Date (1)	Release Date (2)	F i ah/ lb	Number Released	Release LoCat ion	CWT/ Fin clip
1988	Umatilla R	Oak Springs	smolt	05/17/89	··	5.5	8,791	Umatilla River	07-47-17
1988	Umatil La R	Oak Springs	smolt	05/1 7/89	··	5.5	8,778	Umatilla River	07-47-18
1988	Umatilla R	Oak Springs	*Smelt*	05/17/89	··	5.5	441	Umatilla River	AD-LV
1989	Umatilla R	Bonneville	Smelt	05/07/90	··	7.7	29,522	Meacham Creek	AD
1989	Umatilla R	Oak Spri ngs	Smelt	05/07/90	--	5.9	9,331	Meacham Creek	07-52-12
1989	Umatilla R	Oak Springs	Smelt	05/07/90	··	5.9	9,133	Meacham Creek	07-52-13
1989	Umatilla R	Oak Springs	Smelt	05/07/90	··	5.9	9,080	Meacham Creek	07-52-14
1989	Umatilla R	Oak Springs	Smelt	05/07/90	·-	5.9	1,462	Meacham Creek	AD-LV
1989	Umatilla R	Oak Springs	Smelt	05/11/90	··	5.5	9,511	Meacham Creek	07-52-15
1989	Umatilla R	Oak Springs	Smelt	05/11/90	--	5.5	9,525	Meacham Creek	07-52-16
1989	Umatilla R	Oak Spri ngs	Smelt	05/1 1/90	··	5.5	9,454	Meacham Creek	07-52-17
1989	Umatilla R	Oak Springs	Smelt	05/1 1/90	·-	5.5	191	Meacham Creek	AD-LV

[a] Estimates are from Oregon Department of Fish and Wildlife (unpubl i shad data).
[b] Release dates unknown (only the yaar of release known). Standardized to the first and last day of the year.
[c] Release dates unknown (only the month of release known). Standardi zad to the middle of the month.

Table 2 (TD). Parasites and diseases of Umatilla stock summer steelhead at hatchery facilities that rear or hold juveniles prior to release into the Umatilla River subbasin[a].

Disease Type	Hatchery	Specific Pathogen
Parasite	Irrigon	Costia (*Ichthyobodo sp.*)
Bacteria	Irrigon	Bacterial gill disease
Bacteria	Irrigon	*Aeromonas sp.*
Bacteria	Irrigon	*Pseudomonas sp.*
Bacteria	Irrigon	*Flexibacter psychrophilus*

[a]Data are from a letter dated 2/92 from Warren Groberg, Oregon Department of Fish and Wildlife, Fish Pathology, La Grande, Oregon.

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GRANDE RONDE RIVER SUBBASIN

Naturally Produced Spring Chinook Salmon

GEOGRAPHIC LOCATION

The Grande Ronde River subbasin covers 3,950 square miles in the northeast comer of Oregon. The lower 39 miles of the Grande Ronde River is located in the extreme southeast comer of Washington. From its source in the Blue Mountains, the Grande Ronde River flows north to northeast to where it enters the Snake River at RM 168.7; approximately 493 miles from the mouth of the Columbia River. The mouth of the Grande Ronde River is located above Bonneville, The Dalles, John Day, and McNary dams in the mainstem Columbia River and Ice Harbor, Lower Monumental, Little Goose, and Lower Granite dams in the mainstem Snake River.

ORIGIN

Spring chinook salmon are indigenous to the Grande Ronde River subbasin. Declining escapement to the subbasin has reduced the run to remnant populations located in selected geographic areas of the subbasin (personal communication, Rhine Messmer, Oregon Department of Fish and Wildlife, La Grande, Oregon). Non-indigenous stocks introduced into the subbasin include the Rapid River, Carson, Lookingglass Creek-Carson, and Imnaha stocks (see GRANDE RONDE RIVER SUBBASIN, Hatchery Produced Spring Chinook Salmon, PRODUCTION).

The Minam and Wenaha rivers are currently managed as wild stock streams.

DISTRIBUTION

Subbasin

Spring chinook salmon were historically distributed throughout the Grande Ronde River subbasin. While there are currently no man-made barriers that block spring chinook salmon from historical spawning and rearing areas, the combined effects of habitat degradation and a decline in escapement to the subbasin have contributed to reducing the spatial distribution in the subbasin. The primary spawning and rearing areas in the subbasin are located in the Wenaha, Miriam, Lostine, and the upper mainstem Grande Ronde rivers and in Catherine and Lookingglass creeks (Figure 1). The quality of the spawning and rearing habitat varies throughout the subbasin (Tables 1 and 2).

Approximations of the temporal distribution of adult immigration, adult holding, spawning, incubation, emergence, rearing, and juvenile outmigration are presented in Figure 2 (Oregon Department of Fish and Wildlife et al. 1990). The methodology that was used to generate these approximations is unknown.

PRODUCTION

Juvenile

Smelt

There is no information available on the number of smelts produced in the Grande Ronde River subbasin. The only available estimate of production for the subbasin is the number of fry, fingerlings, and smelts that migrate from Lookingglass Creek during the spring.

Annual estimates of the number of juvenile fish that migrate from Lookingglass Creek in the spring ranged from 40,950 to 97,750 (Table 3).

Harvest

sport

Subbasin: The sport fishery was closed in Oregon waters beginning in 1974 and in Washington waters beginning in 1977. The fisheries have remained closed through the 199 I run year.

No brood year specific information is available for the sport fishery. Run year specific information is available from Oregon Department of Fish and Wildlife (unpublished data).

Treaty

Subbasin: The Nez Perce Tribe of Idaho and the Confederated Tribes of the Umatilla Indian Reservation have reserved usual and accustomed fishing sites located in the Grande Ronde River subbasin.

Tribal ceremonial and subsistence fisheries are allowed to harvest spring chinook salmon at target levels jointly established by the Oregon Department of Fish and Wildlife, the Confederated Tribes of the Umatilla Indian Reservation, and the Nez Perce Tribe of Idaho. The maximum recorded harvest occurred in 1968 when 300 spring chinook were caught in the upper Grande Ronde River (West 1968, cited by Oregon Department of Fish and Wildlife et al. 1990). "The Umatilla Tribes closed the Grande Ronde to subsistence fishing in 1982 and 1983" (James 1984, cited by Howell et al. 1985) and the Nez Perce Tribe of Idaho closed the Snake River and its tributaries, including the Grande Ronde, to subsistence fishing in 1984 (Howell et al. 1985). No information is available on harvest but the numbers are believed to be low.

ADULT LIFE HISTORY

Escapement

Spawning Area

Timing: Data collected in Lookingglass Creek indicates that spawning begins around the end of July to early August and peaks around the last week of August (Burck 1974a, cited by Howell et al. 1985). Emergence of fry in Lookingglass Creek occurs in January and February (Burck 1974b, cited by Howell et al. 1985).

Numbers: There are no brood year specific estimates of spawner escapement to the

Grande Ronde River subbasin. Data obtained from spawning ground counts are available from Oregon Department of Fish and Wildlife (unpublished data).

Strays

No information is available on the immigration of naturally produced spring chinook salmon into the Grande Ronde River subbasin.

Few hatchery spring chinook salmon that were released from outside of the subbasin have been recovered on spawning ground surveys or at hatchery facilities located in the subbasin. Recoveries include stray fish that were released as juveniles in the Imnaha River and in the Rogue River on the southern Oregon coast (Table 4). Coded wire tag recoveries were primarily from fish returning from subbasin hatchery production releases in the Grande Ronde River subbasin (Table 4).

Age Structure

Age structure was estimated for spring chinook salmon collected on spawning ground surveys conducted in index areas located throughout the Grande Ronde River subbasin.

Spring chinook salmon return to the Grande Ronde River subbasin as three year old jacks and 4, 5, and 6 year old adult fish with the greatest percentage returning as four year old fish (Tables 5-8). Age structure was found to vary among the various drainages of the subbasin. Data indicates that the Lostine and Miriam rivers have a greater proportion of age 5 fish than Lookingglass and Catherine creeks.

JUVENILE LIFE HISTORY

Age Structure

Naturally produced spring chinook salmon migrate as age 1 + smelts (Tables 5-8). Estimates are based on scale analysis of returning jack and adult fish (see ADULT LIFE HISTORY, Age Structure).

Migration Timing

Data collected in Lookingglass Creek indicates that age 1 + smelts begin migrating as early as January and continue to migrate through mid- to late June (Burck 1974b, cited by Howell et al. 1985). Migration in Lookingglass Creek peaks in March and April (Burck 1974b, cited by Howell et al. 1985).

BIOCHEMICAL-GENETIC CHARACTERISTICS

Wild juvenile spring chinook from the Grande Ronde River were analyzed electrophoretically at selected protein-coding loci. Relative allele nobilities and allele frequencies were determined for 18 enzyme systems (Appendix Tables 1-3). No rare alleles were detected.

Schreck et al. (1986) classified Columbia River Basin chinook salmon into several clusters of similar stocks based on biochemical, morphological and life history characters (Appendix Table 3). Columbia River Basin chinook stocks segregate into two primary groups. The first group contains spring chinook from east of the Cascade Mountains and summer chinook from Idaho. The second group contains spring chinook from west of the Cascades, summer

chinook from the upper Columbia, and all fall chinook stocks. The first primary group is composed of 4 subgroups.

At the subgroup level, wild spring chinook from the Wallowa-Lostine and Grande Ronde rivers were found to be most similar to other stocks of wild spring chinook from the lower Snake and upper Columbia rivers, and Round Butte Hatchery spring chinook. This subgroup is characterized by the earliest average time of spawning, the highest average length of the anal fin base and interorbital width, and the lowest average number of branchiostegal rays. This subgroup also has the greatest average frequency of the common tripeptide aminopeptidase allele. The spawning areas of this subgroup of stocks have a steeper average slope than the other subgroups.

Figure 1. Spring chinook distribution in the Grande Ronde River subbasin, based on the NPPC presence\absence data base (solid and dashed lines respectively) and the BPA Geographic Information System.

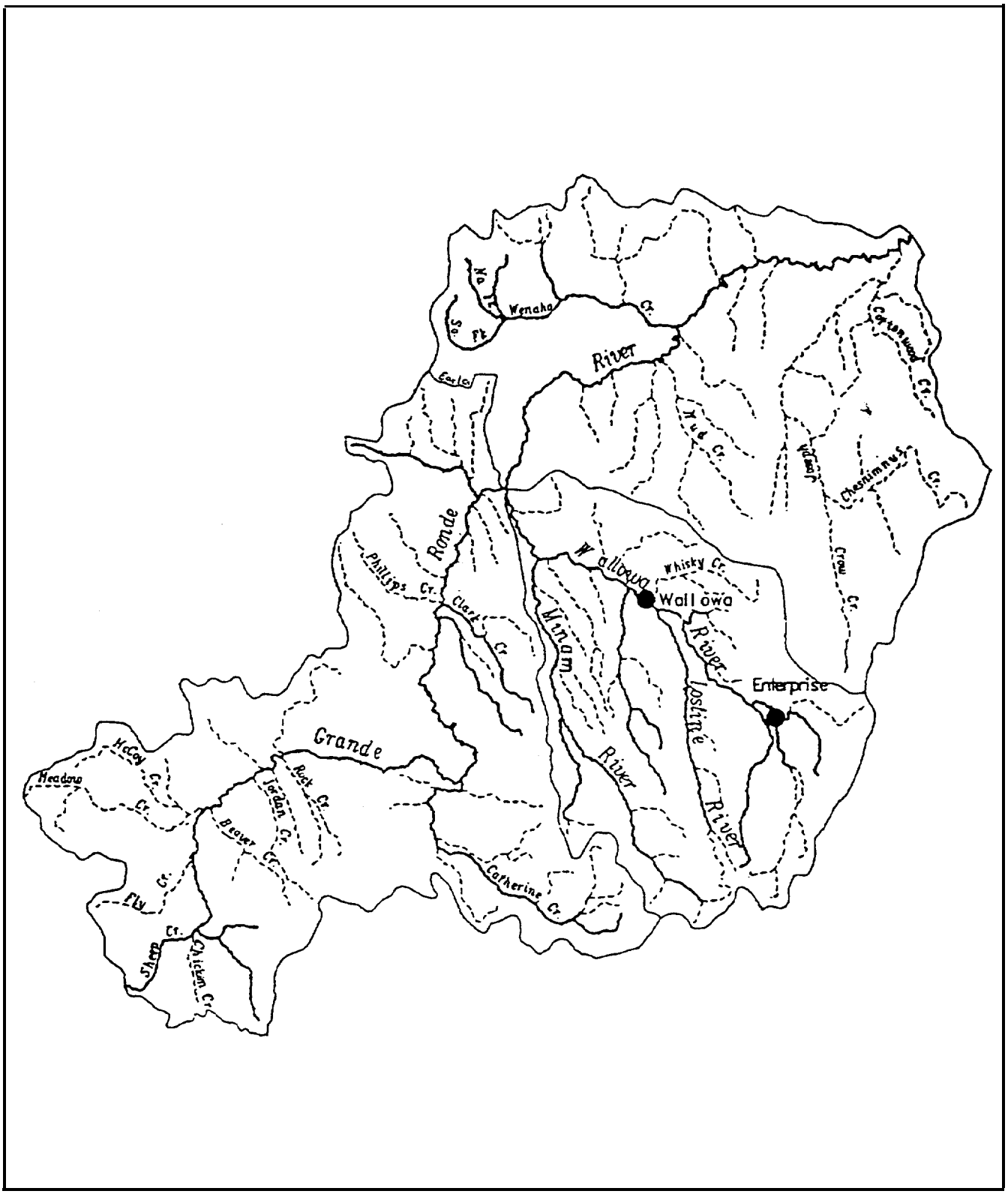
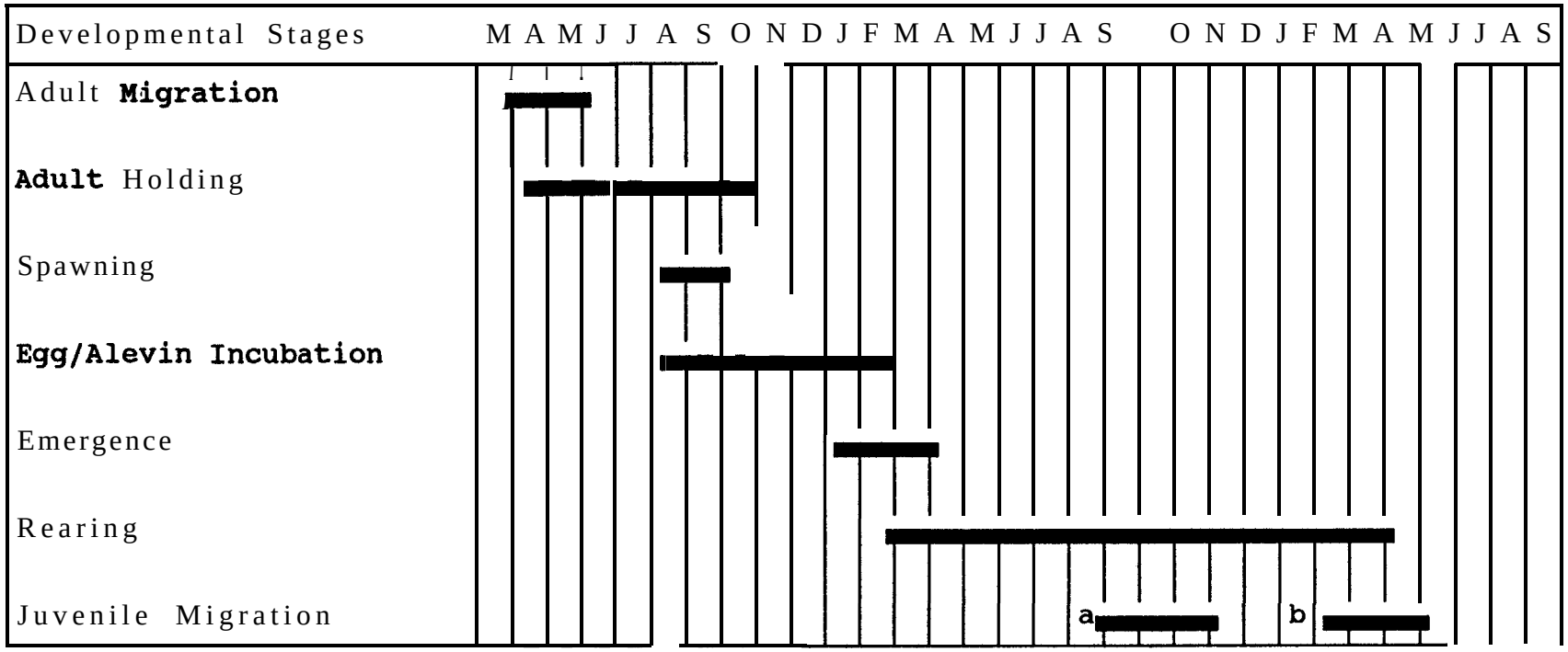


Figure 2 (TT). Freshwater **life** history for both hatchery and natural **spring** chinook **in** the **Grande** Ronde **River subbasin** (Oregon **Department** of **Fish** and **Wildlife et** al. 1990).



Notes:

a. Developmental **stage timing** represents **basinwide** averages.

b. Includes ?me-smelts that **emigrate** from rearing tributaries but may **overwinter** lower **in** the **system before** migrating out **of** basin **in** the spring.

c. **Spring** smelt **outmigration** includes **wild** juveniles that reared **overwinter** and all hatchery releases.

Table 1 (HB-1). Estimated amount of spawning and rearing habitat by quality of Grande Ronde River subbasin spring chinook production area[a].

Distance/ Area	Excellent	Good	Fair[b]	Poor[b]	Unknown	Total	Confi-dence
Miles (%)	29.5	43.8	23.7	3.0	--	230.7	--
Acres (%)	--	--	--	--	--	--	--

[a] Estimates are modified from the Northwest Power Planning Council's presence/absence database.
[b] Ratings of fair and poor habitat quality may reflect natural physical features such as waterfall barriers, as well as degradation caused by humans.

Table 2 (HB-2). Estimated amount of rearing only habitat by quality of Grande Ronde River subbasin spring chinook production area[a].

Distance/ Area	Excellent	Good	Fair[b]	Poor[b]	Unknown	Total	Confi-dence
Miles (%)	2.3	48.4	44.6	4.8	--	221.2	--
Acres (%)	--	--	--	--	--	--	--

[a] Estimates are modified from the Northwest Power Planning Council's presence/absence database.
[b] Ratings of fair and poor habitat quality may reflect natural physical features such as waterfall barriers, as well as degradation caused by humans.

Table 3 (JM). Number of natural juvenile spring chinook salmon that migrated from Lookingglass Creek, 1965-69a.

Brood Year	Time of Migration		Total
	Fall (subyearling)	Spring	
1965	--	48,800	--
1966	--	97,750	--
1967	--	40,950	--
1968	--	42,200	--
1969	--	63,400	--

[a] Estimates for the 1965-69 brood years are from Oregon Department of Fish and Wildlife et al. (1990).

Table 4 (AI). Non-harvest recoveries of coded wire tagged hatchery spring chinook salmon in River subbasin[a,b].

Hatchery/Release site	Recovery cite, Run Year(s)	Recovery Method	Number Recovered	Total Nu Estimat (PS
Columbia River[c,d]	Grande Ronde 1987	Spawner surveys --	1	
Snake River[d]	Grande Ronde 1988	Spawner Surveys --	1	
Grande Ronde	Grande Ronde 1986	Spawner Surveys --	3	
	1987	--	3	
	1988	--	16	
	1989	--	2	
Grande Ronde	Grande Ronde 1985	Hatchery Returns --	1	
	1986	--	44	
	1987	--	175	
	1988	--	328	
Imnaha River	Grande Ronde 1986	Hatchery Returns --	1	
Snake River[d]	Grande Ronde 1988	Hatchery Returns --	1	
Rogue River	Grande Ronde 1986	Hatchery Returns --	1	
	1987	--	1	
	1988	--	2	
Columbia River[c,d]	Grande Ronde 1985	Hatchery Returns --	3	
	1986	--	1	

Table 4 (AI). (cont.) Non-harvest recoveries of coded wire tagged hatchery spring chinook sal
Ronde River subbasin[a,b].

Hatchery/Release site	Recovery site, Run Year(s)	Recovery Method	Number Recovered	Total Numb Estimate (PSMF
Columbia River[c,d]	Grande Ronde	Hatchery Returns (continued)		
	1987	--	6	
	1988	--	5	

[a] Based on the following tag codes from hatchery reared fish: 07-28-20, 07-28-60, 07-28-61, 0
07-30-02, 07-30-03, 07-30-04, 07-31-11, 07-31-18, 07-31-37, 07-31-49, 07-31-50, 07-31-51, 07
07-31-54, 07-31-55, 07-31-56, 07-31-58, 07-33-13, 07-33-14, 07-33-15, 07-33-16, 07-33-57, 07
07-33-60, 07-33-61, 07-33 62, 07-34-01, 07-34-09, 07-38-05, 07-38-06, 07-38-07, 07-38-08, 07
07-38-11, 07-38-12. Based on the following tag codes from fish of unknown rearing type (ass
hatchery): 23-16-21, 23-16-22, 23-18-08, 23-18-14, 23-18-15, 23-18-63, 23-19-07, 23-19-15,
[b] Estimates are modified from the Pacific States Marine Fisheries Commission coded wire tag da
[c] Release site in the mainstem Columbia River below Bonneville Dam.
[d] These fish are assumed to have originated from the Grande Ronde River subbasin based on the
are recovered in the subbasin.

Table 5 (AC-a). Age composition (freshwater.ocean) by run year for wild spring chinook salmon collected in the Lostine River in the Grande Ronde River subbasin[a].

Run Year	N	Age Composition (%) 1.1	1.2	1.3	1.4	2.1	2.2	2.3	2.4	3.1	3.2	3.3
1961	--	--	--	--	--	13	63	25	0	--	--	--
1962	--	--	--	--	--	30	55	15	0	--	--	--
1963	--	--	--	--	--	10	53	37	0	--	--	--
1964	--	--	--	--	--	8	76	16	0	--	--	--
1965	--	--	--	--	--	9	64	27	0	--	--	--
1966	--	--	--	--	--	18	60	22	1	--	--	--
1967	--	--	--	--	--	11	46	42	1	--	--	--
1968	--	--	--	--	--	2	50	48	0	--	--	--
1969	--	--	--	--	--	3	61	36	0	--	--	--
1970	--	--	--	--	--	0	77	23	0	--	--	--
1971	--	--	--	--	--	18	64	18	0	--	--	--
1972	--	--	--	--	--	5	15	80	0	--	--	--
1973	--	--	--	--	--	0	46	54	0	--	--	--
1974	--	--	--	--	--	0	50	50	0	--	--	--
1975	--	--	--	--	--	0	36	64	0	--	--	--
1976	--	--	--	--	--	0	44	56	0	--	--	--

[a]Estimates for the 1961-76 run years are from Oregon Department of Fish and Wildlife et al. (1990).

Table 6 (AC-b). Age composition (freshwater.ocean) by run year for wild spring chinook salmon collected in the Minam River in the Grande Ronde River subbasin[a].

Run Year	N	Age Composition (%) 1.1	1.2	1.3	1.4	2.1	2.2	2.3	2.4	3.1	3.2	3.3
1961	--	--	--	--	--	33	50	17	--	--	--	--
1962	--	--	--	--	--	11	64	25	--	--	--	--
1963	--	--	--	--	--	0	60	40	--	--	--	--
1964	--	--	--	--	--	23	65	12	--	--	--	--
1965	--	--	--	--	--	0	83	17	--	--	--	--
1966	--	--	--	--	--	0	55	45	--	--	--	--
1967	--	--	--	--	--	8	67	25	--	--	--	--
1968	--	--	--	--	--	20	73	7	--	--	--	--
1969	--	--	--	--	--	7	82	11	--	--	--	--
1970	--	--	--	--	--	12	69	19	--	--	--	--
1971	--	--	--	--	--	13	60	27	--	--	--	--
1972	--	--	--	--	--	8	78	14	--	--	--	--
1973	--	--	--	--	--	7	47	47	--	--	--	--
1974	--	--	--	--	--	6	56	38	--	--	--	--
1975	--	--	--	--	--	0	50	50	--	--	--	--
1976	--	--	--	--	--	10	76	14	--	--	--	--

[a] Estimates for the 1961-76 run years are from Oregon Department of Fish and Wildlife et al. (1990).

Table 7 (AC-c). Age composition (freshwater.ocean) by run year for wild spring chinook salmon collected in Lookingglass Creek in the Grande Ronde River subbasin[a].

Run Year	N	1.1	1.2	1.3	1.4	2.1	2.2	2.3	2.4	3.1	3.2	3.3
						Age Composition (%)						
1961	--	--	--	--	--	0	100	0	--	--	--	.-
1962	--	--	--	--	--	0	90	10	--	--	--	--
1963	--	--	--	--	--	50	50	0	--	--	--	--
1964	--	--	--	--	--	17	77	6	--	--	--	--
1965	--	--	--	--	--	12	86	2	--	--	--	--
1966	--	--	--	--	--	6	93	1	--	--	--	--
1967	--	--	--	--	--	21	53	26	--	--	--	--
1968	--	--	--	--	--	47	51	2	--	--	--	--
1969	--	--	--	--	--	24	75	1	--	--	--	--
1970	--	--	--	--	--	9	89	3	--	--	--	--
1971	--	--	--	--	--	13	83	4	--	--	--	--
1972	--	--	--	--	--	16	76	8	--	--	--	--
1973	--	--	--	--	--	3	88	9	--	--	--	--
1974	--	--	--	--	--	8	85	7	--	--	--	--
1975	--	--	--	--	--	0	33	67	--	--	--	--
1976	--	--	--	--	--	36	50	14	--	--	--	--

[a] Estimates for the 1961-76 run years are from Oregon Department of Fish and Wildlife et al. (1990

Table 8 (AC-d). Age composition (freshwater.ocean) by run year for wild spring chinook salmon collected in Catherine Creek *in* the Grande Ronde River subbasin[a].

Run Year	N	Age Composition (%) 1.1	1.2	1.3	1.4	2.1	2.2	2.3	2.4	3.1	3.2	3.3
1962	--	--	--	--	--	0	100	0	--	--	--	--
1963	--	--	--	--	--	--	--	--	--	--	--	--
1964	--	--	--	--	--	--	--	--	--	--	--	--
1965	--	--	--	--	--	33	67	0	--	--	--	--
1966	--	--	--	--	--	0	75	25	--	--	--	--
1967	--	--	--	--	--	0	75	25	--	--	--	--
1968	--	--	--	--	--	0	100	0	--	--	--	--
1969	--	--	--	--	--	3	94	0	--	--	--	--
1970	--	--	--	--	--	0	89	11	--	--	--	--
1971	--	--	--	--	--	5	95	0	--	--	--	--
1972	--	--	--	--	--	3	75	22	--	--	--	--
1973	--	--	--	--	--	0	83	17	--	--	--	--
1974	--	--	--	--	--	0	74	26	--	--	--	--
1975	--	--	--	--	--	0	0	100	--	--	--	--
1976	--	--	--	--	--	2	95	2	--	--	--	--

[a] Estimates for the 1962-76 run years are from Oregon Department of Fish and Wildlife et al. (1990).

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GRANDE RONDE RIVER SUBBASIN

Hatchery Produced Spring Chinook Salmon

ORIGIN

The first recorded release of juvenile hatchery fish into the subbasin is the 1978 brood release from the Rapid River stock (Table 1). Juvenile hatchery fish were released into thesubbasinin 1980 and from 1982-91 (Table l). Non-indigenous stocks introduced into the subbasin include the Rapid River, Carson, and Imnaha stocks. The Imnaha stock was not introduced for broodstock purposes, the juveniles were differentially marked and returning adults were removed from the population.

The hatchery program in the Grande Ronde River subbasin was implemented with the Rapid River stock because it was believed that the life history characteristics and genetic traits would be similar to those of the native stock. The native Grande Ronde River stock was not used to develop the hatchery program because escapement was inadequate to achieve both the subbasin escapement goals and hatchery broodstock needs. The hatchery program discontinued using the Rapid River stock, after the first brood release, because of disease concerns and an inadequate supply of eggs.

The hatchery program began supplementing the subbasin with Carson stock juvenile fish in 1982 (Table 1). The Carson stock was used to develop a stock that was initially defined as the Lookingglass Creek-Carson stock but which is now defined as the Lookingglass Creek stock. The Lookingglass Creek stock was developed from hatchery broodstock collected at Lookingglass Hatchery (RM 2 on the mainstem of Lookingglass Creek).

The hatchery program discontinued using the Carson stock after the 1985 brood release and plans on phasing out the Lookingglass Creek stock in favor of the Rapid River stock. Rapid River stock juvenile fish were again released into the subbasin in 1987 and the stock has been released annually into the subbasin through 1991. One brood release of the Imnaha stock was made in 1987 because of disease concerns associated with releasing the fish into the Imnaha River subbasin.

A hatchery program is being considered to develop hatchery broodstock from native stocks returning to Lostine and Catherine creeks. Hatchery production would be used to supplement each creek with progeny of broodstock obtained from the creek.

DISTRIBUTION

Subbasin

Juvenile spring chinook salmon are released at various sites located throughout the Grande Ronde River subbasin. The greater percentage of hatchery releases have been in Lookingglass, Catherine, and Deer creeks and in the mainstem of the Grande Ronde River (Table 1). Current releases are made directly from Lookingglass Hatchery.

PRODUCTION

Releases

Egg

There are no records of releases in the subbasin.

Fry

There are no records of releases in the subbasin.

Fingerling

Hatchery facilities in which fingerlings were reared or acclimated prior to release in the subbasin include Lookingglass, Irrigon, and Oxbow hatcheries (Table 1). Annual numbers released ranged from 126,700 to 1,970,235 (Table 1). Size at release ranged from 187.5 to 8.5 fish per pound (Table 1).

Smelt

Hatchery facilities in which smelts were reared or acclimated prior to release in the subbasin include Bonneville, Lookingglass, Wallowa, and Oxbow hatcheries and Carson Nation Fish Hatchery (NFH; Table 1). Annual numbers released ranged from 101,870 to 1,020,865 (Table 1). Size at release ranged from 35.6 to 7.0 fish per pound (Table 1).

Jack and Adult

There are no records of releases in the subbasin. However, a program has been proposed to allow jack and adult spring chinook salmon to pass above Lookingglass Hatchery. There are approximately 11 miles of available habitat in Lookingglass Creek and 4 miles of available habitat in Little Lookingglass Creek (personal communication on 12/17/91 with Rhine Messmer, Oregon Department of Fish and Wildlife, Research Section, La Grande, Oregon). Spring chinook salmon are currently not allowed to pass above Lookingglass Hatchery in order to minimize the transmission of diseases to fish that are held and reared at the hatchery.

Harvest

sport

Subbasin: The sport fishery was closed in 1977 and has remained closed through the 1991 run year. Returns from the first release of hatchery fish would have occurred in 1985. There are no plans to re-open the fishery until both hatchery broodstock and subbasin escapement goals can be met.

Treaty

Subbasin: The Nez Perce Tribe of Idaho and the Confederated Tribes of the Umatilla Indian Reservation have reserved usual and accustomed fishing sites located in the Grande Ronde River subbasin.

"The Umatilla Tribes closed the Grande Ronde to subsistence fishing in 1982 and 1983" (James 1984, cited by Howell et al. 1985) and the Nez Perce Tribe closed the Snake River and its tributaries including the Grande Ronde to subsistence fishing in 1984 (Howell et al. 1985). No information is available on annual harvest but the numbers are believed to be low.

ADULT LIFE HISTORY

Escapement

Columbia River

Timing: Data from recoveries of coded wire tagged hatchery fish, returning from subbasin hatchery production releases in the Grande Ronde River subbasin, indicate that Carson stock spring chinook migrate through the mainstem of the Columbia River from mid-February through May, the Rapid River stock from mid-March through mid-May, the Lookingglass Creek stock from March through April, and the Imnaha stock from June through mid-July (Pacific States Marine Fisheries Commission unpublished data).

Subbasin

Timing: Data from recoveries of coded wire tagged hatchery fish, returning from subbasin hatchery production releases in the Grande Ronde River subbasin, indicate that the Carson stock returns around mid-May, the Rapid River stock in late May, and the Imnaha stock in mid-July (Pacific States Marine Fisheries Commission unpublished data).

Hatchery Facilities

Timing: Hatchery spring chinook salmon return to Lookingglass Hatchery from mid-May through early September (Howell et al. 1985). Data indicates that the Carson stock may return at an earlier date than either the Lookingglass Creek-Carson or Imnaha stocks. Spring chinook salmon are spawned at Lookingglass Hatchery from mid-August through mid-September.

Numbers: Estimates of escapement are available for spring chinook returning to Lookingglass Hatchery (see ADULT LIFE HISTORY, Fork Length). Spring chinook are diverted into Lookingglass Hatchery by way of a fish ladder located on Lookingglass Creek. The entrance to the fish ladder is located at approximately RM 2. A weir located above the fish ladder is used to prevent fish from migrating above the hatchery facility. Although estimates of escapement to Lookingglass Hatchery are believed to account for most of the fish escaping to Lookingglass Creek there have been redds observed above the hatchery facility; indicating that some fish escape above the weir. Spring chinook are aged based on a combination of scale analyses and tag code.

Annual estimates of escapement, by brood year, are available for the Lookingglass Creek-Carson, Rapid River, and Imnaha stocks (Tables 2-4). The Lookingglass Creek-Carson stock is the only stock in which complete brood returns are available. Annual estimates of Lookingglass Creek-Carson stock spring chinook escapement to Lookingglass Hatchery, by brood year, ranged from 9 to 84 jacks and 42 to 3,515 adult fish (Table 2).

Fork Length

Estimates of fork length are available for hatchery spring chinook salmon returning to Lookingglass Hatchery (see ADULT LIFE HISTORY, Escapement, Subbasin, Numbers) and collected at a weir located at RM 0.01 in Deer Creek (Big Canyon facility). Marked hatchery returns are differentiated by stock based on a combination of coded wire tag, fin clip, and analysis of scales. All unmarked fish returning to each facility are classified as hatchery fish based on the assumptions that 1) no wild fish return to the Big Canyon facility and 2) that because no fish are allowed to spawn above Lookingglass Hatchery few wild or naturally produced fish return to the hatchery. Stocks of unmarked hatchery spring chinook salmon are differentiated based on brood year of release; only one stock of spring chinook salmon is released unmarked from any given brood. Age was determined based on a combination of scale analyses and tag code.

Estimates of fork length are available for the Lookingglass Creek-Carson, Rapid River, and Imnaha stocks. Annual estimates of mean fork length ranged from 48 cm to 56 cm for age 3 fish, 70 cm to 77 cm for age 4 fish, and 89 cm to 94 cm for age 5 fish (Tables 5-8).

Weight

Estimates of weight are available for hatchery spring chinook salmon returning to Lookingglass Hatchery and collected at the Big Canyon facility (see ADULT LIFE HISTORY, Fork Length). Age was determined based on a combination of scale analyses and tag code.

Estimates of weight are available for the Lookingglass Creek-Carson, Carson, Rapid River, and Imnaha stocks. Annual estimates of mean weight ranged from 1.2 kg to 1.9 kg for age 3 fish, 3.7 kg to 7.4 kg for age 4 fish, and 6.5 kg to 7.7 kg for age 5 fish (Tables 9-13).

Age Structure

Estimates of age structure are available for hatchery spring chinook salmon returning to Lookingglass Hatchery and collected at the Big Canyon facility (see ADULT LIFE HISTORY, Fork Length). Estimates are available for the Lookingglass Creek-Carson stock. Age was determined based on a combination of scale analyses and tag code.

Annual estimates of age structure, by brood year, was 2% age 3 fish, and ranged from 46% to 60% age 4 fish, 15% to 50% age 5 fish, and O% to 2% age 6 fish (Table 14).

Annual estimates of age structure, by run year, ranged from 1% to 21% age 3 fish, 36% to 96% age 4 fish, O% to 62% age 5 fish, and O% to 1% age 6 fish (Tables 15 and 16).

Sex Ratio

Sex ratios (percent females) were estimated for hatchery spring chinook salmon returning to Lookingglass Hatchery and collected at the Big Canyon facility (see ADULT LIFE HISTORY, Fork Length). Estimates are available for the Lookingglass Creek-Carson, Rapid River, and Imnaha stocks. Age was determined based on a combination of scale analyses and tag code.

Annual estimates of sex ratio ranged from O% to 8% for age 3 fish, 47% to 62% for age 4 fish, 41% to 62% for age 5 fish, and 27% to 40% for age 6 fish (Tables 17-19).

Fecundity

Estimates of mean fecundity are available for spring chinook salmon spawned at hatchery facilities located in the Grande Ronde River subbasin. Estimates were made by dividing hatchery egg take by the number of females spawned. Annual estimates of mean fecundity ranged from 3,336 to 4,804 eggs per female (Tables 20-23).

Mark Recoveries

Coded wire tagged hatchery spring chinook, released as juveniles in the Grande Ronde River subbasin, were recovered over a wide geographical area in the Columbia River Basin (Table 24). Subbasins in which coded wire tagged fish were recovered include the Little White Salmon and Klickitat rivers in Washington and the Sandy, Deschutes, and Imnaha rivers in Oregon (Table 24).

The only freshwater recoveries reported at hatchery facilities or from spawning ground surveys outside of the Columbia River Basin are two adult spring chinook salmon that were sampled at Cole Rivers Hatchery; located in the Rogue River on the southern Oregon coast (Table 24).

DISEASES

Various parasites and infectious disease agents have been identified at hatchery facilities that rear or hold juvenile spring chinook for subbasin hatchery production (Table 25). Parasites include *Ichthyobodo sp.* (Costia) and *Trichodina spp. Bacterial* diseases include *Renibacterium salmoninarum* (bacterial kidney disease) and *Cytophaga psychrophila* (cold water disease). Viral diseases include Erythrocytic Inclusion Body Syndrome (EIBS). For information on parasites and disease agents of subbasin hatchery production that is held or reared at hatchery facilities located outside of the subbasin see SANDY RIVER SUBBASIN, Hatchery Produced Spring Chinook Salmon, DISEASES and see LOWER COLUMBIA RIVER SUBBASIN, Hatchery Produced Spring Chinook Salmon, DISEASES.

Losses associated with bacterial and viral disease agents detected at ODFW hatchery facilities are minimized by various methods. The ODFW has a policy of disinfecting eggs by water hardening them in iodophor. This procedure is designed to kill bacterial and viral agents on the eggs and to reduce counts in the egg sac. Juvenile fish are fed erythromycin to minimize the spread of infection at hatchery facilities and to reduce mortalities associated with bacterial kidney disease (personal communication on 1/17/92 with Rich Holt, Oregon Department of Fish and Wildlife, Fish Pathology, Clackamas, Oregon).

Table 1 (TR). Hatchery releases of spring chinook salmon into tha Grands Ronde River subbasin by brood year and if marked, by coded wire tag Codes.

Brood Year	Stock	Hatchery	Life Stage	Release Date (1)	Release Date (2)	Fish/ lb	Number Released	Release LoCat ion	CWT/ Fin clip[b]
197s	Rapid R	oxbow	molt	03/1 1/s0	..	8.4	418,488	Looki ngglass Creek	..
1980	Caraon,	Oxbow	Smelt	04/02/82	04/12/82	9.4	460,744	Lookingglass Creek	No mark
1980	Carson	Carson NFH	molt	04/08/82	--	20.0	100,000	Catherine Creek	No mark
1981	Carson	Lookingglass	Smelt	04/03/83	.-	20.0	434,640	Looki ngglass Creek	No mark
1982	Carson	Lookingglass	fing.	12/22/83	..	25.0	49,538	Lookingg l ass Creek	07-28-62
1982	Carson	Looki ngglass	fing.	12/22/83	..	25.0	2,035	Looki ngglass Creak	AD
1982	Carson	Lookingglass	fing.	12/22/83	..	25.0	17,367	Looki ngg lass Creek	No mark
1982	Carson	Lookingglass	fing.	12/22/83	..	32.0	2,073	Looki ngg lass Creek	AD
1982	Carson	Lookingglass	fing.	12/22/83	..	32.0	50,491	Looki ngg 1sss Creek	07-28-61
1982	Carson	Look ingglass	fing.	12/22/83	..	32.0	658,057	Look i ngg lass Creek	No mark
1982	Look ingglass	Look ingglass	Smelt	12/22/83	03/22/84	31.0	37,4s3	Looki ngg l ass Creek	07-28-60[c]
1982	Lookingg lass	Lookingglass	smelt	12/22/83	03/22/84	31.0	1,768	Lookingglass Creek	AD
1982	Lookingglass	Lookingglass	smolt	12/22/83	03/22/84	31.0	707	Looki ngg 1sss Creek	No mark
1982	Carson	Carson NFH	smolt	04/17/84	..	16.7	101,870	Catherine Creek	No mark
19s3	Carson	Lookingglass	fins.	07/13/84	..	78.2	50,742	Look i ngg lass Creek	07-30-01
1983	Carson	Lookingglass	fing.	07/13/84	..	78.2	50,395	Look i ngg lass Creek	07-30-02
1983	Carson	Lookingglass	fing.	07/13184	..	78.2	4,010	Looki ngg lass Creek	AD
1983	Carson	Look ingglass	fing.	07/13/84	--	78.2	138,388	Lookingglass Creek	No mark
1983	Carson	Looki ngglass	fing.	07/17/84	..	85.5	50,454	Upper Granola Rode	07-30-03
1983	Carson	Lookingglass	fing.	07/17/84	..	85.5	50,091	Uppar Grande Ronde	07-30-04
1983	Carson	Look ingglass	fing.	07/1 7/84	..	85.5	5,783	Upper Grande Ronde	AD
1983	Carson	Looki ngg lass	fing.	07/1 7184	--	85.5	85,604	Upper Grande Ronde	No mark
1983	Carson	Looki ngglass	fing.	09/1 1/84	..	16.3	35,087	Big Canyon	07-31-57
1983	Carson	Looki ngglass	fing.	09/1 1/84	--	16.3	34,386	Big Canyon	07-31-58
1983	Carson	Looki ngglass	fing.	09/1 1/84	..	16.3	3,556	Big Canyon	AD
1983	Carson	Lookingglass	fing.	09/1 1/84	..	16.3	10,878	Big Canyon	No mark
1983	Carson	Look ingglass	fing.	09/1 1/84	--	13.9	32,665	Deer Creek	No mark
1983	Carson	Look ingglass	fing.	09/1 1/84	--	15.5	19,375	Deer Creek	No mark
1983	Carson	Look i ngg l ass	fing.	09/ 12/84	..	15.1	33,915	Deer Creek	No mark
1983	Carson	Looki ngg l ass	fing.	09/1 5/84	--	32.8	37,977	Lookingglass Creek	07-31-51
1983	Carson	Look i ngg l ass	fing.	09/1 5/84	..	32.8	36,673	Lookingglass Creek	07-31-52
1983	Carson	Look i ngg l ass	fing.	09/15/84	..	32.8	244	Lookingglass Creek	AD
1983	Carson	Look i ngg l ass	fing.	09/15/84	..	32.8	37,150	Lookingglass Creek	No merk
1983	Carson	Looki ngglass	fing.	09/29/84	..	23.5	35,376	Lookingglass Creek	07-31-49
1983	Carson	Looki ngg l ass	fing.	09/29/84	..	23.5	34,837	Lookingglass Creek	07-31-50
1983	Carson	Looki ngglass	fing.	09/29/84	..	23.5	3,202	Lookingglass Creek	AD
1983	Carson	Look ingglass	fing.	09/29/84	..	23.5	75,129	Lookingglass Creek	No mark
1983	Carson	Lookingglass	fing.	11/01/84	..	28.3	33,559	Look i ngg l ass Creek	07-31-53
1983	Carson	Lookingglass	fing.	11/01/84	..	28.3	29,992	Lookingglass Creek	07-31-54
1983	Carson	Lookingglass	fing.	11/01/s4	..	28.3	8,940	Lookingglass Creek	Ao
1983	Carson	Lookingglass	fing.	11/01/84	..	28.3	39,606	Lookingglass Creek	No mark

Table 1 (TR). (cont.) Hatchery releases of spring chinook salmon into the Grande Ronde River subbasin by brood year and if marked, by coded wire tag codes.

Brood Year	Stock	Hatchery	Life Stage	Release Date (1)	Release Date (2)	Fish/ lb	Number Released	Release Location	CWT/ Fin clip[b]
1983	Carson	Lookingglass	fing.	06/13/84	06/14/84	187.5	382,500	Catherine Creek	No mark
1983	Carson	Lookingglass	fing.	06/18/84	..	141.0	105,750	Grands Rondo River	No mark
1983	Carson	Look ingglass	fing.	06118/84	..	108.0	54,000	Grands Ronde River	No mark
1983	Carson	Lookingglass	fing.	09/ 16/84	.-	21.5	49,837	Lookingglass Cr	No mark
1983	Carson	Look ingglass	fing.	09/ 16/84	..	23.3	100,050	Lookingglass Cr	No mark
1983	Carson	Lookingglass	fing.	11/01/84	..	17.0	149,124	Lookingglass Cr	No mark
1983	Carson	oxbow	fing.	05/16/84	--	148.0	150,960	Grande Ronde River	No mark
1983	Carson	Look ingglass	smolt	04/0.4/85	..	23.5	37,533	Lookingglass Creek	07-31-55
1983	Carson	Look ingglass	smolt	04104185	--	23.5	37,694	Lookingglass Creek	07-31-56
1983	Carson	Look ingglass	smolt	04/04/85	..	23.5	2,766	Lookingglass Creek	AD
1983	Carson	Looki nggl ass	smolt	04/04/85	.-	23.5	147,560	Lookingglass Creek	No mark
1983	Carson	Look i ngg l ass	smolt	04/04185	..	15.5	694,974	Lookingglass Cr	No mark
1983	Carson	Carson NFH	smolt	04/16/85	--	18.2	59,332	Catherine Cr	No mark
1983	Carson	Carson NFH	smolt	04/16/85	.-	20.2	41,006	Catherine Cr	No mark
1984	Carson	Look i ngg l ass	fing.	07/19/85	..	32.0	49,042	Lookingglass Creek	07-33-13
1984	Carson	Look ingglass	fing.	071 19/85	--	32.0	48,234	Lookingglass Creek	07-33-14
1984	Carson	Look ingglass	fing.	07/19/85	..	32.0	7,547	Lookingglass Creek	AD
1984	Carson	Looki nggl ass	fing.	09/ 18/85	..	19.2	52,683	Lookingglass Creek	07-33-57
1984	Carson	Look ingglass	fing.	09/18/85	--	19.2	50,722	Lookingglass Creek	07-33-58
1984	Carson	Lookingglass	fing.	09/18/85	..	19.2	2,381	Lookingglass Creek	AD
1984	Carson	Look ingglass	fing.	09/18/85	--	19.2	73,856	Lookingglass Creek	No mark
1984	Carson	Look ingglass	fing.	11/01/85	..	16.6	50,825	Lookingglass Creek	07-33-59
1984	Carson	Look ingglass	fing.	11/01/85	--	16.6	50,442	Lookingglass Creek	07-33-60
1984	Carson	Look i ngg 1 ass	fing.	11/01/85	.-	16.6	3,256	Lookingglass Creek	AD
1984	Carson	Looki ngglass	fing.	11/01/85	..	16.6	70,971	Lookingglass Creek	No mark
1984	Carson	Look ingglass	fing.	11/23/85	--	9.6	47,739	Lookingglass Creek	07-33-15
1984	Carson	Lookingglass	fing.	11/23/85	..	9.6	1,346	Lookingglass Creek	AD
1984	Carson	Looki nggl ass	fing.	11/23/85	--	8.5	41,143	Lookingglass Creek	No mark
1984	Carson	Look ingglass	fing.	09/18/85	..	29.5	102,424	Lookingglass Cr	No mark
1984	Carson	Looki nggl ass	fing.	09/18/85	..	19.7	91,388	Lookingglass Cr	No mark
1984	Carson	Lookingglass	fing.	11/01/85	..	23.3	102,520	Lookingglass Cr	No mark
1984	Lookingglass	Lookingglass	smolt	03128/86	04/01/86	15.6	41,512	Lookingglass Creek	07-34-01[c]
1984	Lookingglass	Look ingglass	smolt	03/28/86	04/01/86	15.6	107	Lookingglass Creek	AD
1984	Lookingglass	Look ingglass	smolt	03/28/86	04/01/86	15.6	5,604	Lookingglass Creek	No mark
1984	Carson	Look ingglass	smolt	04/02/86	..	8.8	47,955	Lookingglass Creek	07-33-16
1984	Carson	Lookingglass	smolt	04102/86	..	8.8	1,491	Lookingglass Crack	AD
1984	Carson	Look ingglass	smolt	04/02/86	--	8.8	248	Lookingglass Creek	No mark
1984	Carson	Look ingglass	smolt	04102/86	..	15.2	48,761	Lookingglass Creek	07-33-61
1984	Carson	Look ingglass	smolt	04/02/86	--	15.2	50,687	Lookingglass Creek	07-33-62
1984	Carson	Lookingglass	smolt	04/02/86	..	15.2	3,673	Lookingglass Crack	AD
1984	Carson	Lookingglass	smolt	04102/86	..	15.2	75,487	Lookingglass Crack	No mark
1984	Carson	Lookingglass	smolt	04/01/86	..	10.4	48,880	Deer Creek	No mark

Table 1 (IR). (cent.) Hatchery releases of spring chinook salmon into the Grande Ronde River subbasin by brood year and if marked, by coded wire tag code[a].

Brood Year	Stock	Hatchery	Life Stage	Release Date (1)	Release Date (2)	Fish/ lb	Number Released	Release Location	CWT/ Fin clip[b]
1984	Carson	Look ingglass	smolt	04/01/86	--	10.8	51,192	Deer Creek	No mark
1984	Carson,	Lookingg lass	smolt	04/01/86	--	10.4	16,058	Lookingglass Cr	No mark
1984	Carson	Lookingglass	smolt	04/02/86	--	10.9	56,909	Lookingglass Cr	No mark
1984	Carson	Looki ngglass	smolt	04/02/86	--	10.0	50,100	Catherine Cr	No mark
1984	Carson	Looki ngglass	smolt	04/02/86	04/03/86	11.0	50,050	Catherine Cr	No mark
1984	Carson	Look ingglass	Smelt	04/03/86	--	11.0	14,344	Lookingglass Cr	No mark
1984	Carson	Lookingglass	Smelt	05/01/86	--	9.8	61,544	Lookingglass Cr	No mark
1984	Carson	Lookingglass	smolt	05/01/86	--	16.4	1%,554	Lookingglass Cr	No mark
1985	Carson	Looki ngg lass	fing.	06/11/86	--	24.6	93,234	Grands Ronde River	No mark
1985	Carson	Lookingglass	fing.	06/12/86	--	25.0	148,375	Grands Ronde River	No mark
1985	Carson	Looki ngglass	fing.	06/16/86	--	24.0	87,840	Grande Ronde River	No mark
1985	Carson	Lookingglass	fing.	06/16/86	--	24.3	50,058	Grande Ronde River	No mark
1985	Lookingglass	Lookingglass	fing.	07/17/86	--	53.5	42,773	Lookingglass Creek	07-39-54
1985	Lookingglass	Look ingglass	fing.	07/17/86	--	53.5	43,258	Lookingglass Creek	07-39-55
1985	Looki nggl asa	Look ingglass	fing.	07/17/86	--	53.5	1,231	Lookingglass Creek	AD
1985	Lookingglass	Lookingglass	fing.	09/24/86	--	23.6	52,614	Lookingglass Creek	07-38-03
1985	Look ingglass	Lookingglass	fing.	09/24/86	"-	23.6	921	Lookingglass Creek	AD
1985	Lookingglass	Look ingglass	fing.	09/24186	--	23.6	28,097	Lookingglass Creek	No mark
1985	Lookingglass	Lookingglass	fing.	09/24/86	--	25.3	52,583	Lookingglass Creek	07-38-04
1985	Look ingglass	Lookingg lass	fing.	09/24/86	--	25.3	1,041	Lookingglass Creek	AD
1985	Lookingglass	Lookingglass	fing.	09/24/86	--	25.3	28,019	Lookingglass Creek	No mark
1985	Look ingglass	Look ingglass	fing.	11/01/86	--	23.8	52,377	Lookingglass Creek	07-38-07
1985	Lookinggl ass	Look ingglass	fing.	11/01/86	"-	23.8	52,915	Lookingglass Creek	07-38-08
1985	Looki ngglass	Lookingg lass	fing.	11/01/86	--	23.8	2,143	Lookingglass Creek	AD
1985	Looki ngg lass	Look ingglass	fing.	11/01/86	--	23.8	59,602	Lookingglass Creek	No mark
1985	Looki nggl ass	Looki ngglass	fing.	07/29/86	--	52.1	37,773	Catherine Cr	No mark
1985	Rapid R	Lookingglass	smolt	04/01187	--	9.1	50,018	Lookingglass Creek	07-38-12
1985	Rapid R	Looki ngg lass	smolt	04/01/87	--	9.1	374	Lookingglass Creek	AD
1985	Rapid R	Lookingglass	smolt	04/01/87	--	9.1	146,689	Lookingglass Creek	No mark
1985	Rapid R	Looki ngg lass	smolt	04/01/87	--	9.3	49,871	Lookingglass Creek	07-38-11
1985	Rapid R	Looki ngg lass	smolt	04/01/87	--	9.3	247	Lookingglass Creek	AD
1985	Rapid R	Lookingglass	smolt	04/01/87	--	9.3	146,440	Lookingglass Creek	No mark
1985	Look ingglass	Look ingglass	smolt	04/01/87	--	18.3	52,825	Lookingglass Creek	07-38-05
1985	Look ingglass	Lookingglass	smolt	04/01/87	--	18.3	52,360	Lookingglass Creek	07-38-06
1985	Look ingglass	Looki ngg lass	smolt	04/01/87	--	18.3	2,494	Lookingglass Creek	AD
1985	Look inggl ass	Looki ngglass	smolt	04/01/87	--	18.3	56,839	Lookingglass Creek	No mark
1985	Looki ngglass	Look ingglass	smolt	04/06/87	--	17.1	111,749	Grande Ronde River	No mark
1985	Imnaha	Look ingglass	Smelt	04/20/87	--	8.2	53,307	Lookingglass Crack	07-38-09
1985	Imnaha	Lookingglass	Smelt	04/20/87	--	8.2	1,050	Lookingglass Creek	AD
1985	Imnaha	Lookingglass	smolt	04/20/87	--	8.2	8,366	Lookingglass Creek	No mark
1985	Imnaha	Lookingglass	smolt	04/20/87	--	8.3	52,047	Lookingglass Creek	07-38-10
1985	Imnaha	Lookingglass	smolt	04/20/87	--	8.3	658	Lookingglass Creek	AD

Table 1 (TR). (cent.) Hatchery releases of spring chinook salmon into the Granola Ronde River subbasin by brood year and if marked, by coded wire tag codes.

Brood Year	Stock	Hatchery	Life Stage	Release Date (1)	Release Date (2)	Fish/ lb	Number Released	Release Location	CUT/ Fin clip[b]
1985	Imnaha	Lookingglass	Smelt	04/20/87	--	8.3	8,105	Lookingglass Creek	No mark
1985	Carson	Lookingglass	smolt	03/30/87	--	11.5	39,355	Big Canyon	07-39-56
1985	Carson	Lookingglass	smolt	03/3018?	--	11.5	39,502	Big Canyon	07-39-57
1985	Carson	Look ingglass	smolt	03/30/87	--	11.5	1,717	Big Canyon	AD
1985	Carson	Bonnevi1le	smolt	02/24/87	--	10.1	29,896	Catherine Cr	No mark
1985	Carson	Bonneville	smolt	02/24/87	--	10.3	7,107	Catherine Cr	No mark
1985	Carson	Bonneville	Smelt	02/24/87	02/26/87	11.7	29,192	Catherine Cr	No mark
1985	Carson	Bonneville	smolt	02/26/87		11.1	22,533	Catherine Cr	No mark
1986	Lookingglass	Lookingg lass	fing.	07/20/87	--	58.3	43,086	Looki nggl ass Creek	07-40-22
1986	Lookingglass	Looki ngg lass	fing.	07/20/87	--	58.3	43,127	Lookingglass Creek	07-40-23
1986	Lookingglass	Lookingglass	fing.	07/20/87	--	S8.3	870	Looki ngglass Creek	AD
1986	Lookingglass	Look ingglass	fing.	07/20/87	--	58.3	13,835	Lookingglass Creek	No mark
1986	Rapid R	Look ingglass	fing.	05/20/87	--	35.6	40,831	Look ingglass Creek	07-40-11
1986	Rapid R	Lookingglass	fing.	05/20/87	--	35.6	41,293	Looki ngglass Creek	07-40-12
1986	Rapid R	Lookingglass	fing.	05/20/87	--	35.6	40,782	Lookingglass Creek	07-40-13
1986	Rapid R	Lookingglass	fing.	05/20/87	--	35.6	1,770	Lookingglass Creek	Ao
1986	Rapid R	Lookingglass	fing.	05/20/87	--	35.6	49,298	Looki ngglass Creek	No mark
1986	Rapid R	Lookingglass	fing.	09/18/87	--	22.6	38,378	Lookingglass Creek	07-40-16
1986	Rapid R	Looki nggl ass	fing.	09/18/87	--	22.6	41,232	Lookingglass Creek	07-40-17
1986	Rapid R	Look ingglass	fing.	09/18/87	--	22.6	1,800	Lookingglass Creek	AD
1986	Rapid R	Lookingglass	fing.	09/18/87	--	22.6	492	Lookingglass Creek	No mark
1986	Rapid R	Lookingglass	fing.	11/03/87	--	22.8	38,501	Lookingglass Creek	07-40-18
1986	Rapid R	Look ingglass	fing.	11/03/87	--	22.8	39,188	Lookingglass Creek	07-40-19
1986	Rapid R	Lookingglass	fing.	11/03/87	--	22.8	3,963	Lookingglass Creek	AD
1986	Rapid R	Lookingglass	fing.	11/03/87	--	22.8	793	Lookingglass Creek	No mark
1986	Rapid R	Look ingglass	smolt	04101/88	--	13.1	42,339	Looki ngglass Creek	07-40-14
1986	Rapid R	Lookingglass	Smelt	04/01/88	--	13.1	958	Looki ngglass Creek	AD
1986	Rapid R	Lookingglass	smolt	04/01/88	--	13.1	261	Lookingglass Creek	No mark
1986	Rapid R	Look ingglass	smolt	04/01/88	--	13.2	42,057	Look inggl ass Creek	07-40-15
1986	Rapid R	Look ingglass	smolt	04/01/88	--	13.2	505	Look ingglass Creek	AD
1986	Rapid R	Look ingglass	Smelt	04/01/88	" -	13.2	1,262	Looki ngglass Creek	No mark
1986	Rapid R	Lookingglass	smolt	04/01/88	--	20.1	41,266	Lookingglass Creek	07-40-20
1986	Rapid R	Lookingglass	smelt	04/01/88	--	20.1	42,744	Lookingglass Creek	07-40-21
1986	Rapid R	Look ingglass	smolt	04/01/88	--	20.1	1,901	Lookingglass Creek	AD
1986	Repid R	Lookingglass	Smelt	04/01/88	--	20.1	519	Lookingglass Creek	No mark
1986	Rapid R	Lookingglass	smolt	04/01/88	--	15.2	65,786	Lookingglass Cr	RV
1986	Rapid R	Lookingglass	smolt	04/01/88	--	14.4	65,794	Lookingglass Cr	RV
1986	Rapid R	Look ingglass	smolt	04/01/88	--	7.0	40,551	Lookingglass Cr	RV
1986	Rapid R	Look ingglass	smolt	05/20/87	--	35.6	48,904	Looki ngglass Creek	No mark
1986	Lookingglass	Lookingglass	smolt	03/31/88	04/05/88	20.6	151,966	Catherine Cr	LV
1986	Lookingglass	Look ingglass	Smelt	03/30/88	--	17.6	136,675	Deer Creek	LV

Table 1 (TR). (cent.) Hatchery releases of spring chinook salmon into the Grands Ronde River subbasin by brood year and if marked, by coded wire tag code[a].

Brood Year	Stock	Hatchery	Life Stage	Release Date (1)	Release Date (2)	Fish/ lb	Number Released	Release Location	CWT/ Fin clip[b]
1986	Lookingglass	Lookingglass	smolt	04/08/88	--	20.6	49,634	Deer Creek	LV
1987	Rapid R	Lookingglass	fing.	05/13/8s	--	29.3	42,697	Lookingglass Creek	07-45-23
1987	Rapid R	Lookingglass	fing.	05/13/88	--	29.3	41,703	Lookingglass Creek	07-45-24
1987	Rapid R	Lookingglass	fing.	05/13/88	--	29.3	41,524	Lookingglass Creek	07-45-25
1987	Rapid R	Lookingglass	fing.	05/13/88	--	29.3	2,869	Lookingglass Creek	AD
1987	Rapid R	Lookingglass	fing.	05/13/88	--	29.3	12,289	Lookingglass Creek	No mark
1987	Rapid R	Lookingglass	fing.	09/23/88	--	21.7	43,220	Lookingglass Creek	07-46-30
1987	Rapid R	Lookingglass	fing.	09/23/88	--	21.7	40,399	Lookingglass Creek	07-46-31
1987	Rapid R	Lookingglass	fing.	09/23/88	--	21.7	1,591	Lookingglass Creek	AD
1987	Rapid R	Lookingglass	fing.	09/23/88	--	21.7	3s4	Lookingglass Creak	No mark
1987	Rapid R	Lookingglass	fing.	11/01/88	--	20.9	42,837	Lookingglass Crack	07-46-32
1987	Rapid R	Lookingglass	fing.	11/01/88	--	20.9	42,796	Lookingglass Crack	07-46-33
1987	Rapid R	Lookingglass	fing.	11/01/88	--	20.9	508	Lookingglass Creek	AD
1987	Rapid R	Lookingglass	fing.	11/01/88	--	20.9	169	Lookingglass Crack	No mark
1987	Rapid R	Lookingglass	smolt	04/03/89	--	13.4	43,287	Lookingglass Creek	07-45-33
1987	Rapid R	Lookingglass	smolt	04/03/89	--	13.4	1,064	Lookingglass Creek	AD
1987	Rapid R	Lookingglass	smolt	04/03/89	--	13.4	6,140	Lookingglass Creek	No mark
1987	Rapid R	Lookingglass	smolt	041 03/89	--	13.8	43,283	Lookingglass Creek	07-45-35
1987	Rapid R	Lookingglass	smolt	04/03/89	--	13.8	433	Lookingglass Creek	AD
1987	Rapid R	Lookingglass	smolt	04/03/89	--	13.8	6,875	Lookingglass Creak	No mark
1987	Rapid R	Lookingglass	smolt	0.4/03/89	--	19.5	43,390	Lookingglass Creek	07-45-31
1987	Rapid R	Lookingglass	smolt	04/03/89	--	19.5	42,987	Lookinggl ass Creek	07-45-32
1987	Rapid R	Lookingglass	smolt	04/03/89	--	19.5	341	Lookingglass Creek	AD
1987	Rapid R	Lookinggl aas	smolt	04/03/89	--	14.5	91,858	Lookingglass Cr	No mark
1987	Rapid R	Lookingglass	smolt	04/03/89	--	14.8	45,836	Lookingglass Cr	No mark
1987	Rapid R	Lookingglass	smelt	04/03/89	--	16.4	45,920	Lookingglass Cr	No mark
1987	Rapid R	Lookingglass	smolt	04/03/89	--	13.5	45,941	Lookingglass Cr	No mark
1987	Lookingglass	Wallowa	smolt	04/04/89	--	13.2	83,160	Catherine Cr	LV
1987	Lookingglass	Lookinggl ass	smolt	04/06/89	--	14.9	89,102	Oeer Creak	LV
1988	Rapid R	Irrigon NFH	fing.	05/15/89	--	36.2	40,234	Lookingglass Creek	07-47-36
1988	Rapid R	Irrigon NFH	fing.	05/15/89	--	36.2	41,267	Lookingglass Creek	07-46-34
1988	Rapid R	Irrigon NFH	fing.	05/15/89	--	36.2	41,667	Lookingglass Creek	07-45-34
1988	Rapid R	Irrigon NFH	fing.	05/15/89	--	36.2	3,427	Lookingglass Creek	AD
1988	Rapid R	Irrigon NFH	fing.	05/15/89	--	36.2	105	Lookinggl ass Creek	No mark
1988	Rapid R	Lookingglass	smolt	03/31/90	--	16.7	91,433	Deer Creek	No mark
1988	Rapid R	Lookingglass	smolt	04/02/90	--	12.2	43,788	Lookinggl ass Creek	07-47-43
1988	Rapid R	Lookingglass	smolt	04/02/90	--	12.2	660	Lookingglass Creek	AD
1988	Rapid R	Lookingglass	smolt	04/02/90	--	12.2	6,887	Lookingglass Creek	No mark
1988	Rapid R	Lookingglass	molt	04/02/90	--	13.0	43,479	Lookingglass Creek	07-47-45
1988	Rapid R	Lookingglass	smelt	04/02/90	--	13.0	172	Lookingglass Creek	AD
1988	Rapid R	Lookingglass	smolt	04/02/90	--	13.0	7,857	Lookingglass Creek	No mark
1988	Rapid R	Lookingglass	smolt	04102/90	--	20.0	42,187	Lookingglass Creek	07-47-39

Table 1 (IR). (cont.) Hatchery releases of spring chinook salmon into the Grande Ronde River subbasin by brood year and if marked, by coded wire tag code[a].

Brood Year	Stock	Hatchery	Life Stage	Release Date (1)	Release Date (2)	Fish/ lb	Number Released	Release Location	CWT/ Fin clip[b]
1988	Rapid R	Lookingglass	smolt	04/02/90	..	20.0	1,205	Looking glass Creek	AD
1988	Rapid R	Lookingglass	smolt	04/02/90	--	20.0	43,571	Lookingglass Creek	No mark
1988	Rapid R	Lookingglass	smolt	04/02/90	..	20.2	41,780	Lookingglass Creek	07-47-40
1988	Rapid R	Lookingglass	smolt	04/02/90	..	20.2	2,102	Lookingglass Creek	AD
1988	Rapid R	Lookingglass	smolt	04/02/90	--	20.2	44,233	Lookingglass Creek	No mark
1988	Rapid R	Lookingglass	smolt	04/02/90	--	18.3	341,716	Lookingglass Cr	No mark
1988	Rapid R	Lookingglass	smolt	04/09/90	--	19.5	80,073	Grande Ronde River	No mark
1988	Rapid R	Lookingglass	smolt	04/09/90	--	19.5	17,523	Catherine Cr	No mark
1988	Rapid R	Lookingglass	smolt	04/09/90	..	20.0	52,479	Catherine Cr	No mark
1988	Rapid R	Lookingglass	smolt	04/10/90	.-	20.7	26,445	Wallowa River	No mark
1988	Rapid R	Lookingglass	smolt	04/10/90	..	20.7	26,445	Hurricane Creek	No mark
1989	Rapid R	Lookingglass	Smelt	04/01/91	--	13.6	42,859	Lookingglass Creek	07-50-51
1989	Rapid R	Lookingglass	smolt	04/01/91	..	13.6	337	Lookingglass Creek	AD
1989	Rapid R	Lookingglass	Smelt	04/01/91	..	13.6	4,313	Looking lass Creek	No mark
1989	Rapid R	Lookingglass	Smelt	04/01/91	..	14.0	42,698	Lookingglass Creek	07-50-48
1989	Rapid R	Lookingglasa	Smelt	04/01/91	--	14.0	342	Lookingglass Creek	AD
1989	Rapid R	Lookingglass	Smelt	04/01/91	--	14.0	4,376	Looking glass Creek	No mark
1989	Rapid R	Lookingglass	smolt	04/01/91	..	20.4	43,450	Lookingglass Creek	07-50-54
1989	Rapid R	Lookingglass	smolt	04/01/91	--	20.4	87	Looking lass Creek	Ao
1989	Rapid R	Lookingglass	Smelt	04/01/91	--	20.4	75,027	Lookingglass Creek	No merk
1989	Rapid R	Lookingglass	Smelt	04/01/91	..	20.8	42,705	Looking lass Creek	07-50-53
1989	Rapid R	Lookingglass	Smelt	04/01/91	..	20.8	432	Lookingglass Creek	AD
1989	Rapid R	Lookingglass	Smelt	04/01/91	..	20.8	75,008	Lookingglass Creek	No mark
1989	Lookingglass	Lookingglass	smolt	04/02/91	..	18.6	504,668	Lookingglass Cr	LV

[a] Eatimetes are from Oregon Department of Fish and Wildlife (unpublished data).
[b] AD = Adipose, LV = Left ventral, RV = Right ventral.
[c] Estimated numbers released into Lookingglass Creek. Oue to problems at Lookingglass Hatchery a small percentage of this production group was released into the Imnaha River (personal communication, Rich Carmichael, Oregon Department of Fish and Wildlife).

Table 2 (RH-1). Total returns of Lookingglass-Carson stock[a] spring chinook salmon returning to Lookingglass Hatchery in the Grande Ronde River subbasin, by brood year. Estimates for each age category along the upward diagonal to the right of a given footnote were derived from the same reference.

	Total Age						
Brood Year	2	3	4	5	6	Total	Adult Total
1979	--	--	--	1	0	--	--
1980	--	--	33	9	0	--	42
1981	--	9[b]	433	81	0	523	514
1982	--	10[c]	231	252	12	505	495
1983	--	84[d]	2,154	1,354	8	3,600	3,516
1984	--	64[e]	995	453	--	--	--
1985	--	31[f]	265	--	--	--	--
1986	--	9[g]	--	--	--	--	--

[a] Lookingglass/Carson stock returns include jack and adult fish returning from Carson stock releases and fish that are progeny of hatchery broodstock developed from Carson stock returns and the wild Lookingglass Creek stock.
[b] Estimate is modified from Carmichael and Messmer (1985).
[c] Estimate is modified from Carmichael et al. (1986).
[d] Estimate is modified from Carmichael et al. (1987).
[e] Estimate is modified from Carmichael et al. (1988).
[f] Estimate is modified from Messmer et al. (1989).
[g] Estimate is modified from Messmer et al. (1990).

Table 3 (RH 2). Total returns of Rapid River stock spring chinook salmon returning to Lookingglass Hatchery in the Grande Ronde River subbasin, by brood year. Estimates for each age category along the upward diagonal to the right of a given footnote were derived from the same reference.

	Total Age						
Brood Year	2	3	4	5	6	Total	Adult Total
1985	--	0[a]	172	--	--	--	--
1986	--	44[b]	--	--	--	--	--

[a] Estimate is modified from Messmer et al. (1989).
[b] Estimate is modified from Messmer et al. (1990).

Table 4 (RH-3). Total returns of Imnaha stock spring chinook salmon returning to Lookingglass Hatchery in the Grande Ronde River subbasin, by brood year.

	Total Age						
Brood Year	2	3	4	5	6	Total	Adult Total
1985	--	48[a]	63[b]	--	--	--	--

[a] Estimate is modified from Messmer et al. (1989).
[b] Estimate is modified from Messmer et al. (1990).

Table 5 (AL-1) . Mean fork length by brood year and age class (freshwater.ocean) for Lookingglass/Carson stock hatchery spring chinook salmon returning to Lookingglass Hatchery in the Grande Ronde River subbasin. Estimates within each freshwater age group that are along the upward diagonal to-the right of a given footnote were derived from the same reference.

Mean Fork Length (cm)

Brood Year	1.1	1.2	1.3	1.4	2.1	2.2	2.3	2.4
1980	--	--	--	--	--	--	94	--
N	--	--	--	--	--	--	--	--
st. dev.	--	--	--	--	--	--		--
1981	--	--	--	--	--	74	89	--
N	--	--	--	--	--	--		--
st. dev.	--	--	--	--	--	--		--
1982	--	--	--	--	54[a]	77	91	102
N	--	--	--	--	--	--	--	--
st. dev.	--	--	--	--	--	--		--
1983	--	--	--	--	56[b]	76	90	101
N	--	--	--	--	--	--	--	--
st. dev.	--	--	--	--	--	--	--	--
1984	--	--	--	--	53[c]	74	92	
N	--	--	--	--	--	--	--	--
st. dev.	--	--	--	--	--	--	--	--
1985	--	--	--	--	56d	72	--	--
N	--	--	--	--	--	--	--	--
st. dev.	--	--	--	--	--	--	--	--
1986	--	--	--	--	56[e]	--	--	--
N	--	--	--	--	--	--	--	--
st. dev.	--	--	--	--	--	--	--	--

[a] Estimate is modified from Carmichael et al. (1986).
[b] Estimate is modified from Carmichael et al. (1987).
[c] Estimate is modified from Carmichael et al. (1988).
[d] Estimate is modified from Messmer et al. (1989).
[e] Estimate is modified from Messmer et al. (1990).

Table 6 (AL-2). Mean fork length by brood year and age class (freshwater .ocean) for Rapid River stock hatchery spring chinook salmon returning to Lookingglass Hatchery in the Grande Ronde River subbasin. Estimates within each freshwater age group that are along the upward diagonal to the right of a given footnote were derived from the same reference.

Mean Fork Length (cm)

Brood Year	1.1	1.2	1.3	1.4	2.1	2.2	2.3	2.4
1985	--	--	--	--	48 [a]	70	--	--
N	--	--	--	--	6	--	--	--
st. dev.	--	--	--	--	--	--	--	--
1986	--	--	--	--	48b	--	--	--
N	--	--	--	--	--	--	--	--
st. dev.	--	--	--	--	--	--	--	--

[b] Estimate is modified from Messmer et al. (1989).
[c] Estimate is modified from Messmer et al. (1990).

Table 7 (AL-3) . Mean fork length by brood year and age class (freshwater.ocean) for Imnaha stock hatchery spring chinook salmon returning to Lookingglass Hatchery in the Grande Ronde River subbasin.

	Mean Fork Length (cm)							
Brood Year	1.1	1.2	1.3	1.4	2.1	2.2	2.3	2.4
1985	--	--	--	--	55[a]	76[b]	--	--
N	--	--	--	--	36	--	--	--
et. dev.	--	--	--	--	--	--	--	--

[a] Estimate is modified from Messmer et al. (1989).
[b] Estimate is modified from Messmer et al. (1990).

Table 8 (AL-4). Mean fork length by brood year and age class (freshwater.ocean) for Lookingglass/Carson stock hatchery spring chinook salmon collected at the Big Canyon facility in the Grande Ronde River subbasin. Estimates within each freshwater age group that are along the upward diagonal to the right of a given footnote were derived from the same reference.

Mean Fork Length (cm)

Brood Year	1.1	1.2	1.3	1.4	2.1	2.2	2.3	2.4
1984	--	--	--	--	--	--	89	--
N	--	--	--	--	--	--	--	--
st. dev.	--	--	--	--	--	--	--	--
1985	--	--	--	--	--	77	--	--
N	--	--	--	--	--	--	--	--
st. dev.	--	--	--	--	--	--	--	--
1986	--	--	--	--	52 [a]	--	--	--
N	--	--	--	--	--	--	--	--
st. dev.	--	--	--	--	--	--	--	--

[a] Estimate is modified from Messmer et al. (1990).

Table 9 (AW-1). Mean weight by brood year and age class (freshwater.ocean) for Lookingglass/Carson stock hatchery spring chinook salmon returning to Lookingglass Hatchery in the Grande Ronde River subbasin.

	Mean weight (kg)							
Brood Year	1.1	1.2	1.3	1.4	2.1	2.2	2.3	2.4
1982	--	--	--	--	--	4.0[a]	--	--
N	--	--	--	--	--	--	--	--
St. dev.	--	--	--	--	--	--	--	--
1983	--	--	--	--	--	7.4[b]	--	--
N	--	--	--	--	--	--	--	--
St. dev.	--	--	--	--	--	--	--	--
1984	--	--	--	--	--	--	--	--
N	--	--	--	--	--	--	--	--
St. dev.	--	--	--	--	--	--	--	--
1985	--	--	--	--	1.9[c]	4.3[d]	--	--
N		--	--	--	--	--	--	--
St. dev.		--	--	--	--	--	--	--

[a] Estimate is modified from Carmichael et al. (1987).
[b] Estimate is modified from Carmichael et al. (1988).
[c] Estimate is modified from Messmer et al. (1989).
[d] Estimate is modified from Messmer et al. (1990).

Table 10 (AW-2). Mean weight by brood year and age class (freshwater.ocean) for Carson stock hatchery spring chinook salmon returning to Lookingglass Hatchery in the Grande Ronde River subbasin. Estimates within each freshwater age group that are along the upward diagonal to the right of a given footnote were derived from the same reference.

	Mean weight (kg)							
Brood Year	1.1	1.2	1.3	1.4	2.1	2.2	2.3	2.4
1982	--	--	--	--	--	4.7	7.7	--
N	--	--	--	--	--	--	--	--
st. dev.	--	--	--	--	--	--	--	--
1983	--	--	--	--	1.9[a]	4.7	7.4	--
N	--	--	--	--	--	--	--	--
st. dev.	--	--	--	--	--	--	--	--
1984	--	--	--	--	1.6[b]	4.2[c]	6.5	--
N	--		--	--	--	--	--	--
st. dev.	--		--	--	--	--	--	--
1985	--	--	--	--	--	3.7[d]	--	--
N	--	--	--	--	--	--	--	--
st. dev.	--	--	--	--	--	--	--	--

[a] Estimate is modified from Carmichael et al. (1987).
[b] Estimate is modified from Carmichael et al. (1988).
[c] Estimate is modified from Messmer et al. (1989).
[d] Estimate is modified from Messmer et al. (1990).

Table 11 (AW-3). Mean weight by brood year and age class (freshwater.ocean) for Rapid River stock hatchery spring chinook salmon returning to Lookingglass Hatchery in the Grande Ronde River subbasin. Estimates within each freshwater age group that are along the upward diagonal to the right of a given footnote were derived from the same reference.

	Mean weight (kg)							
Brood Year	1.1	1.2	1.3	1.4	2.1	2.2	2.3	2.4
1985	--	--	--	--	1.4	[a] 3.8	--	--
N	--	--	--	--	--	--	--	--
st. dev.	--	--	--	--	--	--	--	--
1986	--	--	--	--	1.2[b]	--	--	--
N	--	--	--	--	--	--	--	--
st. dev.	--	--	--	--	--	--	--	--

[a] Estimate is modified from Messmer et al. (1989).
[b] Estimate is modified from Messmer et al. (1990).

Table 12 (AW-4). Mean weight by brood year and age class (freshwater.ocean) for Imnaha River stock hatchery spring chinook salmon returning to Lookingglass Hatchery in the Grande Ronde River subbasin.

	Mean weight (kg)							
Brood Year	1.1	1.2	1.3	1.4	2.1	2.2	2.3	2.4
1982	--	--	--	--	--	5.2[a]	--	--
N	--		---	--	--	--	--	--
st. dev.	--	--	--	--	--	--	--	--
1983	--	--	--	--	--	--	--	--
N	--	--	--	--	--	--	--	--
st. dev.	--	--	--	--	--	--	--	--
1984	--	--	--	--	--	--	--	
N	--	--	--	--	--	--	--	--
st. dev.	--	--	--	--	--	--	--	--
1985	--	--		--	1.7[b]	4.7[c]	--	--
N	--	--	--	--	--	--	--	--
st. dev.	--	--	--	--	--	--	--	--

[a] Estimate is modified from Carmichael et al. (1987).
[b] Estimate is modified from Messmer et al. (1989).
[c] Estimate is modified from Messmer et al. (1990).

Table 13 (AW-5). Mean weight by brood year and age class (freshwater.ocean) for Lookingglass/Carson stock hatchery spring chinook salmon collected at the Big Canyon facility in the Grande Ronde River subbasin.

	Mean weight (kg)							
Brood Year	1.1	1.2	1.3	1.4	2.1	2.2	2.3	2.4
1985	--	--	--	--	--	4.1[a]	--	--
N	--	--	--	--	--	--	--	--
st. dev.	--	--	--	--	--	--	--	--

[b] Estimate is modified from Messmer et al. (1990).

Table 14 (AC). Age composition (freshwater.ocean) by brood year for Lookingglass/Carson stock chinook salmon returning to Lookingglass Hatchery in the Grande Ronde River subbasin. E freshwater age group that are along the upward diagonal to the right of a given footnote the same reference.

		Age Composition (%)										
Brood Year	N	1.1	1.2	1.3	1.4	2.1	2.2	2.3	2.4	3.1	3.2	3
1981	--	--	--	--	--	2 [a]	83	15	0	--	--	
1982	--	--	--	--	--	2[b]	46	50	2	--	--	
1983	--	--	--	--	--	2[c]	60[d]	38[e]	<1[f]	--	--	

[a] Sample size used to estimate age composition, by brood year, was derived from data in Carmi (1985).
[b] Sample size used to estimate age composition, by brood year, was derived from data in Carmi
[c] Sample size used to estimate age composition, by brood year, was derived from data in Carmi
[d] Sample size used to estimate age composition, by brood year, was derived from data in Carmi
[e] Sample size used to estimate age composition, by brood year, was derived from data in Messm
[f] Sample size used to estimate age composition, by brood year, was derived from data in Messm

Table 15 (AC-a). Age composition (freshwater.ocean) by run year for Lookingglass/Carson sto
chinook salmon returning to Lookingglass Hatchery in the Grande Ronde River subbasin[a].

Run Year	N	Age Composition (%) 1.1	1.2	1.3	1.4	2.1	2.2	2.3	2.4	3.1	3.2
1984	43	--	--	--	--	21	79	0	0	--	--
1985	452	--	--	--	--	2	96	2	0	--	--
1986	396	--	--	--	--	21	59	20	0	--	--
1987	2470	--	--	--	--	3	87	10	0	--	--
1988	2392	--	--	--	--	1	42	56	<1	--	--
1989	735	--	--	--	--	1	36	62	1	--	--

[a] Estimates are modified from Carmichael et al. (1987) for the 1984-86 run years, from Carmic
for the 1987 run year, from Messmer et al. (1989) for the 1988 run year, and from Messmer
1989 run year.

Table 16 (AC-b). Age composition (freshwater.ocean) by run year for Lookingglass/Carson sto
chinook salmon collected at the Big Canyon facility in the Grande Ronde River subbasin[a]

Run Year	N	Age Composition (%) 1.1	1.2	1.3	1.4	2.1	2.2	2.3	2.4	3.1	3.2
1989	73	--	--	--	--	15	62	23	0	--	--

[a] Estimates for the 1989 run year are modified from Messmer al. (1990).

Table 17 (AS-l). Percent females by brood year and age class (freshwater.ocean) for Lookingglass/Carson stock hatchery spring chinook salmon returning to Lookingglass Hatchery in the Grande Ronde River subbasin. Estimates within each freshwater age group that are along the upward diagonal to the right of a given footnote were derived from the same reference.

		Females (%)										
Brood Year	N	1.1	1.2	1.3	1.4	2.1	2.2	2.3	2.4	3.1	3.2	3.3
1980	--	--	--	--	--	--	--	55	--	--	--	--
1981	--	--	--	--	--	--	62	62	--	--	--	--
1982	--	--	--	--	--	0[a]	47	42	40	--	--	--
1983	--	--	--	--	--	1[b]	60	52	27	--	--	--
1984	--	--	--	--	--	4[c]	57	53	--	--	--	--
1985	--	--	--	--	--	8[d]	50	--	--	--	--	--
1986	--	--	--	--	--	0[e]	--	--	--	--	--	--

[a] Estimate is modified from Carmichael et al. (1986).
[b] Estimate is modified from Carmichael et al. (1987).
[c] Estimate is modified from Carmichael et al. (1988).
[d] Estimate is modified from Messmer et al. (1989).
[e] Estimate is modified from Messmer et al. (1990).

Table 18 (AS-2). Percent females by brood year and age class (freshwater.ocean) for Rapid River stock hatchery spring chinook salmon returning to Lookingglass Hatchery in the Grande Ronde River subbasin. Estimates within each freshwater age group that are along the upward diagonal to the right of a given footnote were derived from the same reference.

		Females (%)										
Brood Year	N	1.1	1.2	1.3	1.4	2.1	2.2	2.3	2.4	3.1	3.2	3.3
1985	--	--	--	--	--	0[a]	60	--	--	--	--	--
1986	--	--	--	--	--	0[b]	--	--	--	--	--	--

[a] Estimate is modified from Messmer et al. (1989).
[b] Estimate is modified from Messmer et al. (1990).

Table 19 (AS-3). Percent females by brood year and age class (freshwater.ocean) for Imnaha stock hatchery spring chinook salmon returning to Lookingglass Hatchery in the Grande Ronde River subbasin.

		Females (%)										
Brood Year	N	1.1	1.2	1.3	1.4	2.1	2.2	2.3	2.4	3.1	3.2	3.3
1985	--	--	--	--	--	0[a]	51[b]	--	--	--	--	--

[a] Estimate is modified from Messmer et al. (1989).
[b] Estimate is modified from Messmer et al. (1990).

Table 20 (AS-4). Percent females by brood year and age class (freshwater.ocean) for Lookingglass/Carson stock hatchery spring chinook salmon collected at the Big Canyon facility in the Grande Rondo River subbasin. Estimates within each freshwater age group that are along the upward diagonal to the right of a given footnote were derived from the same reference.

		Females (%)										
Brood Year	N	1.1	1.2	1.3	1.4	2.1	2.2	2.3	2.4	3.1	3.2	3.3
1984	--	--	--	--	--	--	--	41	--	--	--	--
1985	--	--	--	--	--	--	53	--	--	--	--	--
1986	--	--	--	--	--	0[a]	--	--	--	--	--	--

[a] Estimate is modified from Messmer et al. (1990).

Table 21 (AF-a). Mean fecundity by run year for Lookingglass/Carson stock hatchery spring chinook salmon returning to the Big Canyon Creek facility and Lookingglass Hatchery in the Grande Ronde River subbasin[a].

Run Year	N	Mean Fecundity	st. dev.
1989	234	4,458	--

[a] Estimates are from Messmer et al. (1990).

Table 22 (AF-b). Mean fecundity by run year for Lookingglass/Carson stock hatchery spring chinook salmon returning to Lookingglass Hatchery in the Grande Ronde River subbasin[a].

Run Year	N	Mean Fecundity	st. dev.
1983	4	3,716	--
1984	17	3,670	--
1985	252	3,896	--
1986	149	4,268	--
1987	294	4,160	--
1988	292	4,804	--

[a] Estimates are a synthesis of data from Messmer et al. (1990) and Oregon Department of Fish and Wildlife (unpublished data).

Table 23 (AF-c). Mean fecundity by run year for Rapid River stock hatchery spring chinook salmon returning to Lookingglass Hatchery in the Grande Ronde River subbasin[a].

Run Year	N	Mean Fecundity	st. dev.
1987[b]	--	4,655	--
1988	--	--	--
1989	100	3,336	--

[a] Estimates are from Messmer et al. (1990).
[b] Fecundity was estimated for spring chinook salmon spawned at Pahsimeroi Hatchery in Idaho.

Table 24 (AE). Emigration of coded wire tagged hatchery spring chinook salmon released as juveniles into the Grande Ronde River subbasin[a,b].

Hatchery/Release site	Recovery site, Run Year(s)	Recovery Method	Number Recovered	Total Number Estimated, (PSMFC)
Grande Ronde	Imnaha River	Trap Returns		
	1986	--	3	3
Grande Ronde	Deschutes River	Trap Returns		
	1986	--	1	1
	1987	--	5	5
	1988	--	1	1
Grande Ronde	Cowlitz River	Hatchery Returns		
	1987	--	1	1
	1988	--	1	1
Grande Ronde	Rogue River	Hatchery Returns		
	1986	--	2	2
Grande Ronde	Sandy River	Hatchery Returns		
	1986	--	1	1
Grande Ronde	Klickitat River	Hatchery Returns		
	1987	--	1	1
Grande Ronde	Deschutes River	Hatchery Returns		
	1988	--	1	1
Grande Ronde	L White Salmon R.	Hatchery Returns		
	1988	--	1	1
Grande Ronde	Columbia River[c]	Hatchery Returns		
	1988	--	1	1
Grande Ronde	Columbia River[d]	Hatchery Returns		
	1987	--	1	1

[a] Based on the following tag codes: 07-28-60, 07-28-61, 07-30-02, 07-30-03, 07-31-52, 07-31-53, 07-31-55, 07-33-13, 07-33-62, 07-34-01, 07-38-10, 07-38-11, 07-40-15.

(cent.)

Table 24 (AE). (cont.) Emigration of coded wire tagged hatchery spring chinook salmon released as juveniles into the Grande Ronde River subbasin[a,b].

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[b] Estimates are modified from the Pacific States Marine Fisheries commission coded wire tag database.
[c] Recovery site in the mainstem Columbia River below Bonneville Dam.
[d] Recovery site in the mainstem Columbia River between McNary and Priest Rapids dams.

Table 25 (TD). Parasites and diseases of spring chinook salmon at hatcheries releasing juveniles into the Grande Ronde River subbasin[a].

Disease type	Hatchery	Specific Pathogen
Parasite	Lookingglass	Costia (*Ichthyobodo*)
Parasite	Lookingglass	*Ceratomyxa shasta*
Parasite	Lookingglass	*Ichthyobodo sp.* (Costia)
Parasite	Lookingglass[b]	*Epistylis sp.*
Parasite	Lookingglass[b]	*Trichodina spp.*
Parasite	Wallows	*Ceratomyxa shasta*
Bacteria	Lookingglass	*Myxobolus cerebralis* (Whirling disease)
Bacteria	Lookingglass	Motile Gill Bacteria
Bacteria	Lookingglass	Furunculosis (*Aeromonas salmonicida*)
Bacteria	Lookingglass	Bacterial gill disease
Bacteria	Lookingglass	*Renibacterium salmoninarum* (Bacterial kidney disease)
Bacteria	Lookingglass	*Aeromonas spp.*
Bacteria	Lookingglass	*Pseudomonas spp.*
Bacteria	Lookingglass	*Flexibacter psychrophilus*
Bacteria	Lookingglass[b]	*Cytophaga psychrophila* (Cold water disease)
Bacteria	Lookingglass	*Yersinia ruckeri* (Enteric Red Mouth disease)
Bacteria	Lookingglass	*Ichthyophthirius sp.*
Bacteria	Irrigon	Motile Gill Bacteria
Bacteria	Irrigon	*Aeromonas spp.*
Bacteria	Irrigon	*Pseudomonas spp.*
Bacteria	Irrigon	Bacterial gill disease
Bacteria	Irrigon	*Renibacterium salmoninarum* (Bacterial kidney disease)
Bacteria	Irrigon	*Flexibacter psychrophilus*
Bacteria	Wallowa	*Aeromonas spp.*
Bacteria	Wallowa	*Pseudomonas spp.*
Bacteria	Wallows	*Renibacterium salmoninarum* (Bacterial kidney disease)
Bacteria	Wallowa	Furunculosis (*Aeromonas salmonicida*)
Virus	Lookingglass	Infectious Hematopoietic Necrosis (IHN)

(cent.)

Table 25 (TD). (cont.) Parasites and diseases of spring chinook salmon at hatcheries releasing juveniles into the Grande Ronde River subbasin[a].

Virus	Lookingglass	Erythrocytic Inclusion Body Syndrome (EIBS)
Fungi	Lookingglass	*Phoma herbarum* (Internal fungi)
Fungi	Lookingglass[b]	External fungi

[a] Except where footnoted, data are from a letter dated 2/92 from Warren Groberg, Oregon Department of Fish and Wildlife, Fish Pathology, La Grande, Oregon.
[b] Data are from Carmichael et al. (1986), Carmichael et al. (1987), Carmichael et al. (1988), and Messmer et al. (1989).

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GRANDE RONDE RIVER SUBBASIN

Naturally Produced Fall Chinook Salmon

GEOGRAPHIC LOCATION

The Grande Ronde River subbasin covers 3,950 square miles in the northeast corner of Oregon. The lower 39 miles of the Grande Ronde River is located in the extreme southeast comer of Washington. From its source in the Blue Mountains, the Grande Ronde River flows north to northeast to where it enters the Snake River at RM 168.7; approximately 493 miles from the mouth of the Columbia River. The mouth of the Grande Ronde River is located above Bonneville, The Dalles, John Day, and MeNary dams in the mainstem Columbia River and Ice Harbor, Lower Monumental, Little Goose, and Lower Granite dams in the mainstem Snake River.

ORIGIN

Historically, fall chinook salmon were indigenous to the Grande Ronde River subbasin. Spawning has been observed in the lower mainstem of the subbasin but these fish are believed to be Snake River fall chinook salmon that strayed into the subbasin (Oregon Department of Fish and Wildlife et al. 1990). The native Grande Ronde River stock is believed to be extinct.

DISTRIBUTION

Subbasin

Fall chinook salmon were historically distributed in the lower mainstem of the Grande Ronde River, the Wallowa, Lostine and Miriam rivers, and in Joseph Creek (Oregon Department of Fish and Wildlife et al. 1990; Howell et al. 1985; Figure 1). Spawning is currently limited to the lower mainstem of the subbasin. There are currently no man made-barriers that block fall chinook salmon from historical spawning and rearing areas.

PRODUCTION

Harvest

Treaty

Subbasin: The Nez Perce Tribe of Idaho and the Confederated Tribes of the Umatilla Indian Reservation have reserved usual and accustomed fishing sites located in the Grande Ronde River subbasin. No information is available on historical harvest.

ADULT LIFE HISTORY

Escapement

Subbasin

Timing: Fall chinook salmon enter the lower Grande Ronde River subbasin from late October through mid-November and entered the lower Miriam from early to mid-November Smith (1975,

cited by Howell et al. 1985).

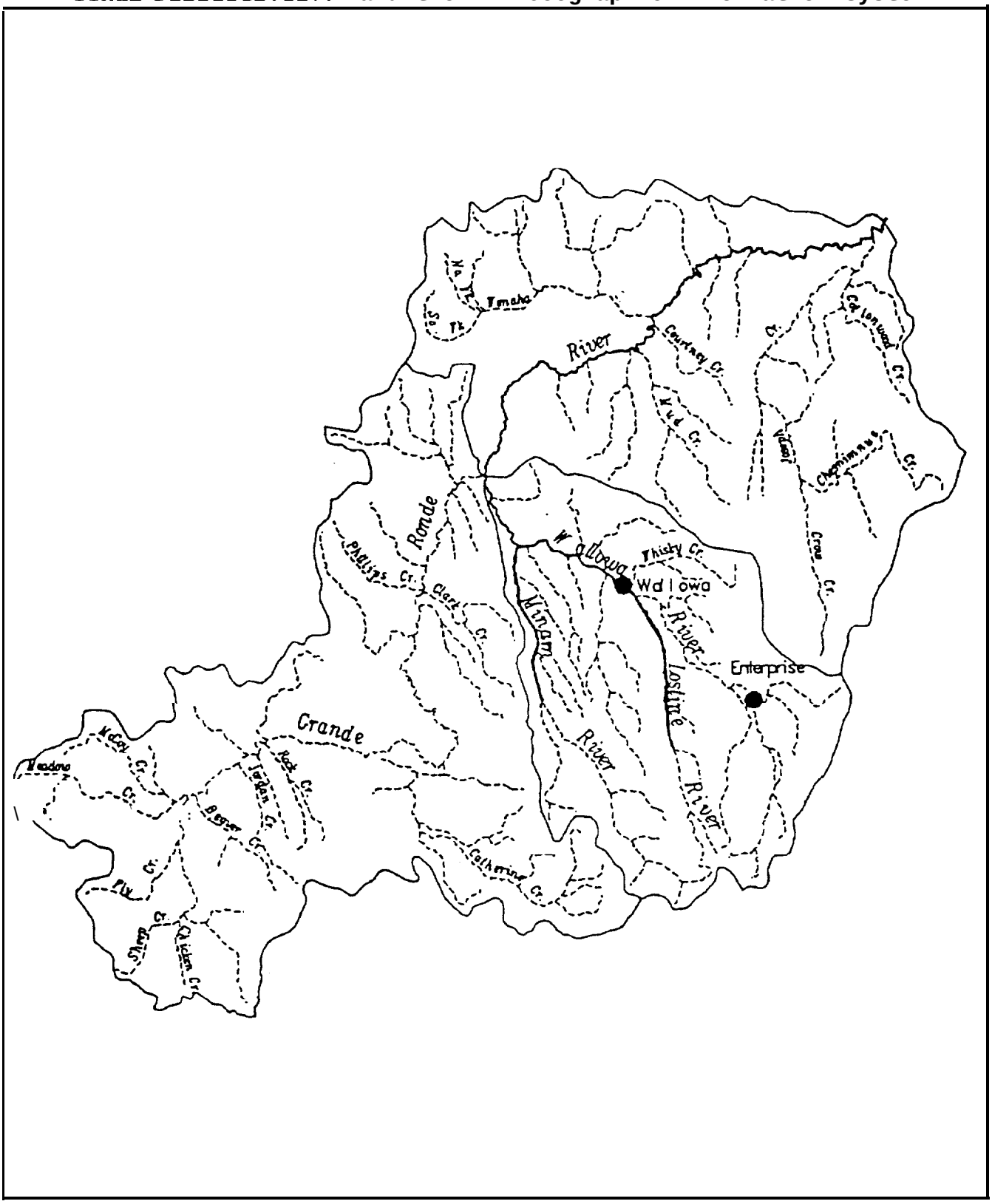
spawning Area

Timing: "Smith (1975) reported that spawning occurs from mid- to late November. However, early hatchery records indicated that chinook collected and spawned in the early 1900s attained sexual maturity between September 15 and late October (Thompson and Haas 1960). In 1957 freshly spawned carcasses were found on October 28 and November 1. Redds and carcasses were observed on the Miriam on September 22 and October 1, 1958 (Thompson and Haas 1960)" (Howell et al. 1985).

Fall chinook salmon collected for hatchery broodstock in the 1900s were spawned from mid-September to late-October with peak spawning in mid-October (Oregon Department of Fish and Wildlife et al. 1990). Based on time of spawning at the hatchery "it appears that the spawning timing of the Grande Ronde fall chinook was earlier than the present Snake River fall chinook" (Oregon Department of Fish and Wildlife et al. 1990).

Numbers: Suspected fall chinook spawning areas have been inventoried in the Grande Ronde River subbasin since 1965 (Howell et al. 1985). Prior to 1987, no fall chinook salmon spawning had been observed in the subbasin. In 1987, fall chinook were observed spawning in the Washington section of the Grande Ronde River (Oregon Department of Fish and Wildlife et al. 1990). These fish were believed to have been Snake River stock strays and not the native Grande Ronde River stock (Oregon Department of Fish and Wildlife et al. 1990).

Figure 1. Fall chinook distribution in the Grande Ronde River subbasin, based on the NPPC presence\absence data base (solid and dashed lines respectively) and the BPA Geographic Information System.



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GRANDE RONDE RIVER SUBBASIN

Hatchery Produced Fall Chinook Salmon

ORIGIN

A hatchery facility was operated below Miriam from 1903-07 to supplement the Grande Ronde River subbasin with hatchery fish (Howell et al. 1985). Hatchery broodstock was collected at hatchery racks located in the mainstem of the Grande Ronde and Wallowa rivers (Oregon Department of Fish and Wildlife et al 1990). No information is available on hatchery production releases. There is currently no hatchery supplementation program in the Grande Ronde River subbasin.

A hatchery supplementation program has been proposed to reintroduce fall chinook into the subbasin. The proposed program calls for collecting hatchery broodstock at Ice Harbor Dam; which is located in the Snake River. There are currently no plans to implement the proposed hatchery program (Oregon Department of Fish and Wildlife et al. 1990).

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GRANDE RONDE RIVER SUBBASIN

Naturally Produced Coho Salmon

GEOGRAPHIC LOCATION

The Grande Ronde River subbasin covers 3,950 square miles in the northeast comer of Oregon. The lower 39 miles of the Grande Ronde River is located in the extreme southeast comer of Washington. From its source in the Blue Mountains, THE Grande Ronde River flows north to northeast to where it enters the Snake River at RM 168.7; approximately 493 miles from the mouth of the Columbia River. The mouth of the Grande Ronde River is located above Bonneville, The Dalles, John Day, and McNary dams in the mainstem Columbia River and Ice Harbor, Lower Monumental, Little Goose, and Lower Granite dams in the mainstem Snake River.

ORIGIN

Historically, coho salmon were indigenous to the Grande Ronde River subbasin which was "the major production area for coho in the Snake River Basin, and was the farthest upstream river system used by coho in the Columbia Basin" (Fulton 1970, cited by Oregon Department of Fish and Wildlife et al. 1990) and (Thompson and Haas 1960, cited by Oregon Department of Fish and Wildlife et al. 1990). Counts at lower Snake River Dams, spawning ground counts, and counts of juvenile fish at rotary screen bypass traps in the subbasin have all documented the decline of coho salmon production in the Grande Ronde River subbasin (Oregon Department of Fish and Wildlife et al. 1990). It is believed that coho salmon are currently extinct in the subbasin based on data indicating that no adult fish have passed Snake River dams since 1986 (Oregon Department of Fish and Wildlife et al. 1990).

DISTRIBUTION

Subbasin

'Historical distribution of coho is known to include the lower Grande Ronde River, the Wenaha and Wallowa drainages, and Catherine Creek (Parkhurst 1950, Thompson and Haas 1960). Surveys in 1957 documented spawning in the Wallowa River from two to 4.5 miles downstream of Joseph, and the lower five miles of the Lostine River. Smith (1975) reported coho spawning in Hurricane, Prairie, Spring, and Bear creeks (Wallowa River), and Lostine River. In 1953, coho juveniles were collected in Catherine Creek" (Oregon Department of Fish and Wildlife et al. 1990).

Approximations of the temporal distribution of adult immigration, adult holding, incubation, emergence, and rearing are presented in Figure 1 (Oregon Department of Fish and Wildlife et al. 1990). The methodology that was used to generate these approximations is unknown.

PRODUCTION

Harvest

sport

Subbasin: The sport fishery was closed in Oregon waters beginning in 1975. No brood year specific estimates of harvest are available. Run year specific estimates are available from Oregon

Department of Fish and Wildlife (unpublished data).

Treaty

Subbasin: The **Nez** Perce Tribe of Idaho and the Confederated Tribes of the **Umatilla** Indian **Reservation** have reserved usual and accustomed fishing sites located in the **Grande** Ronde River subbasin. No information is available on harvest.

ADULT LIFE HISTORY

Escapemen

Subbasin

Numbers: The Grande Ronde River subbasin was historically an important producer of coho salmon. No information is available on historical escapements to the subbasin but the largest recorded egg take "in **early** records of the Oregon Fish Commission was 7.5 million eggs from 2,655 adults trapped in 1902 at a rack on the lower Grande Ronde near the mouth of the **Wenaha" (Parkhurst** 1950, cited by Howell et al. 1985).

spawning Area

Timing: Coho "enter the **Wallowa** River in late September and October and spawn in late November. Surveys conducted on the **Wallowa** River in 1957 indicated that spawning commenced sometime between October 7 and 18" (Smith 1975, cited by Howell et rd. 1985). "Spawning activity peaked in late October and early November. Spawning was believed to be completed by November 20 on the **Lostine** River" (Thompson and Haas 1960, cited by Howell et al. 1985).

An approximation of the temporal distribution of spawning is presented in Figure 1 (Oregon Department of Fish and Wildlife et al. 1990). The methodology that was used to generate this approximation is unknown.

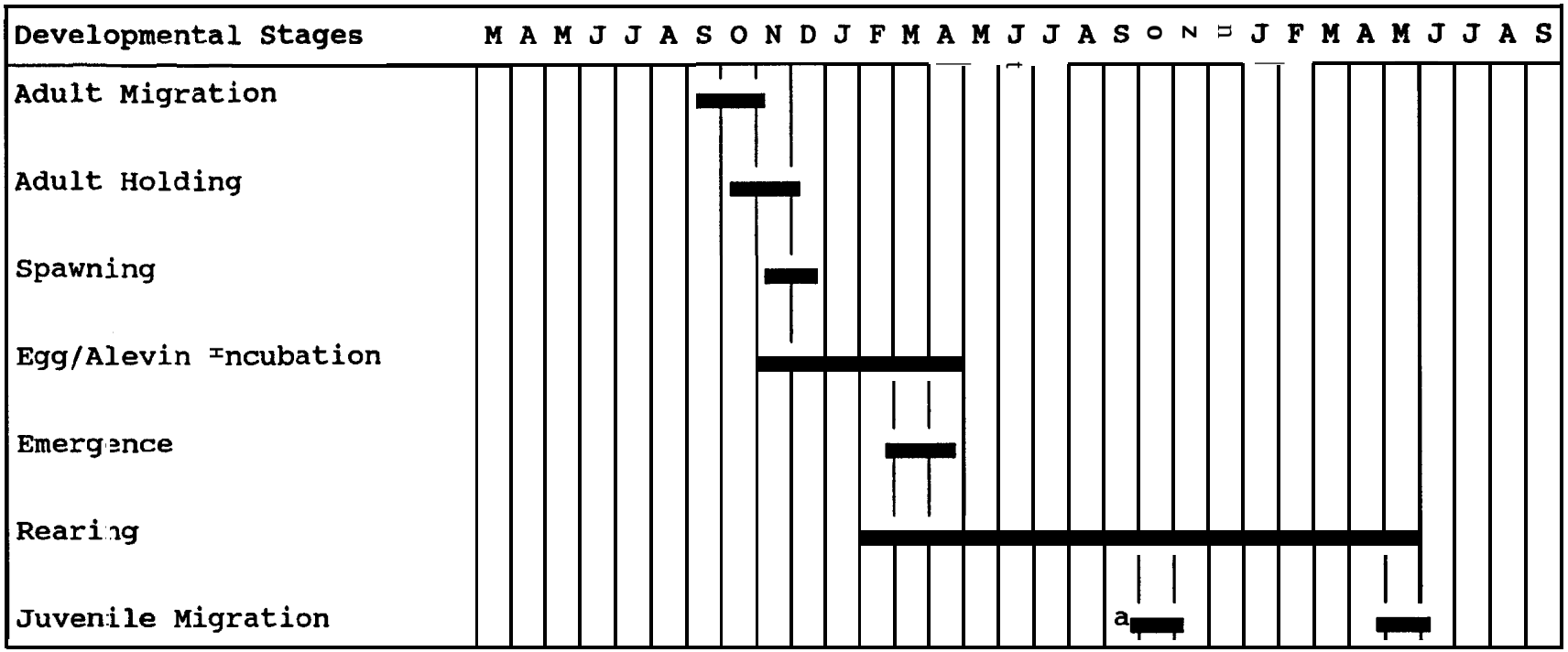
JUVENILE LIFE HISTORY

Migration Timing

"Juvenile coho were collected in traps at irrigation diversion screens along the Wallowa River from the time the screens were installed, usually in late April, until July. The peak movement occurred in May and June" (Thompson and Haas 1960, cited by Howell et al. 1985).

An approximation of the temporal distribution of juvenile **outmigration** is presented in Figure 1 (Oregon Department of Fish and Wildlife et al. 1990). The methodology that was used to generate this approximation is unknown.

Figure 1 (TT). Freshwater life history for natural coho in the Grande Ronde River subbasin (Oregon Department of Fish and Wildlife et al. 1990).



a Pre-smolt migration

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GRANDE RONDE RIVER SUBBASIN

Hatchery Produced Coho Salmon

ORIGIN

The only recorded release of coho into the Grande Ronde River subbasin was in 1964 (Table 1). The Wallowa River drainage and the upper Grande Ronde River were supplemented with adult fish obtained from Tanner Creek and Oxbow hatcheries. There is currently no hatchery supplementation program in the subbasin.

In 1983 an attempt was made to implement a hatchery program in the Grande Ronde River subbasin (Oregon Department of Fish and Wildlife et al. 1990). The Snake River and the early run hatchery stock in the lower Columbia River were proposed to develop the hatchery broodstock. The Snake River stock was chosen to develop the hatchery broodstock because the life history characteristics were believed to be more similar to those of the native stock and because it was believed that the early run stock in the lower Columbia River Basin would be less fit than the Snake River stock (Howell et al. 1985). An attempt was made to collect hatchery broodstock at Ice Harbor Dam in 1983 and 1984. Attempts at collecting hatchery broodstock at the dam proved to be unsuccessful and the program was discontinued in 1984 (Oregon Department of Fish and Wildlife et al. 1990).

Table 1 (IR). Hatchery releases of coho salmon into the Grande Ronde River subbasin by brood year and if marked, by coded wire tag

Brood Year	Stock	Hatchery	Life Stage	Release Date (1)	Release Date (2)	Fish/ lb	Number Released	Release Location	CWT/ Fin clip
--	--	Oxbow	adult	01/01/64[b]	12/31/64[b]	- -	900	Wallowa River	--
. . . .		Tanner Creek	adult	01/01/64[b]	12/31/64[b]	- -	1,130	Upper Grande Ronde	--

[a] Estimates are from Oregon Department of Fish and Wildlife et al. (1990).
[b] Release dates unknown (only the year of release known). Standardi zad to the first and last day of the year.

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GRANDE RONDE RIVER SUBBASIN

Naturally Produced Sockeye Salmon

GEOGRAPHIC LOCATION

The Grande Ronde River subbasin covers 3,950 square miles in the northeast comer of Oregon. The lower 39 miles of the Grande Ronde River is located in the extreme southeast comer of Washington. From its source in the Blue Mountains, the Grande Ronde River flows north to northeast to where it enters the Snake River at RM 168.7; approximately 493 miles from the mouth of the Columbia River. The mouth of the Grande Ronde River is located above Bonneville, The Dalles, John Day, and McNary dams in the mainstem Columbia River and Ice Harbor, Lower Monumental, Little Goose, and Lower Granite dams in the mainstem Snake River.

ORIGIN

Historically, sockeye salmon were indigenous to the Grande Ronde River subbasin. Early unsuccessful hatchery programs, overfishing and migrant losses at irrigation diversions reduced the run to low levels by the early 1900's (Personal communication with Brad Smith 10/1/92, District Fish Biologist, Oregon Department of Fish and Wildlife, Enterprise, Oregon). In 1916, a dam at Wallowa Lake was raised to a level that prevented passage to spawning areas located in the Wallowa River above Wallowa Lake (Oregon Department of Fish and Wildlife et al. 1990). The last recorded observation of sockeye salmon in the Grande Ronde River subbasin was in 1917 (Oregon Department of Fish and Wildlife et al. 1990). A natural population of kokanee salmon currently exists in Wallowa Lake (Oregon Department of Fish and Wildlife et al. 1990).

DISTRIBUTION

Subbasin

Sockeye salmon were historically distributed in the Wallowa River in and above Wallowa Lake (Oregon Department of Fish and Wildlife et al. 1990). The dam at Wallowa Lake prevents passage of adult sockeye salmon to historical spawning and rearing areas.

PRODUCTION

Harvest

sport

Subbasin: Historically, a commercial fishery was located at Wallowa Lake (Oregon Department of Fish and Wildlife et al. 1990). There are no estimates of harvest for the fishery.

Treaty

Subbasin: The Nez Perce Tribe of Idaho and the Confederated Tribes of the Umatilla Indian Reservation have reserved usual and accustomed fishing sites located in the Grande Ronde River subbasin.

Historically, a tribal ceremonial and subsistence fishery was located at Wallowa Lake (Oregon

Department of Fish and Wildlife et al. 1990). There are no estimates of harvest for the fishery.

ADULT LIFE HISTORY

Escapement

Subbasin

Timing: Sockeye salmon "migrated through the lower and middle Grande Ronde River from late June to late July and entered the Wallowa River from mid-October to mid-November" (Oregon Department of Fish and Wildlife et al. 1990).

Numbers: No information is available on historical sockeye salmon production. However, numbers are believed to be "large as indicated by the presence of sockeye canneries at Wallowa Lake in the 1890s. In 1902, at a rack near Troy on the Grande Ronde River, 2,511 female sockeye were collected and spawned" (Van Dusen 1903, cited by Oregon Department of Fish and Wildlife et al. 1990).

spawning Area

Timing: Sockeye salmon spawn from mid-October to mid-November (Oregon Department of Fish and Wildlife et al. 1990).

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GRANDE RONDE RIVER SUBBASIN

Naturally Produced Summer Steelhead

GEOGRAPHIC LOCATION

The Grande Ronde River subbasin covers 3,950 square miles in the northeast comer of Oregon. The lower 39 miles of the Grande Ronde River is located in the extreme southeast comer of Washington. From its source in the Blue Mountains, the Grande Ronde River flows north to northeast to where it enters the Snake River at RM 168.7; approximately 493 miles from the mouth of the Columbia River. The mouth of the Grande Ronde River is located above Bonneville, The Dalles, John Day, and McNary dams in the mainstem Columbia River and Ice Harbor, Lower Monumental, Little Goose, and Lower Granite dams in the mainstem Snake River.

ORIGIN

Summer steelhead are indigenous to the Grande Ronde River subbasin. Non-indigenous stocks introduced into the subbasin include the Idaho (Oxbow), Skamania, Idaho/Wallowa, Snake River, Pahsimeroi, and Imnaha stocks (see DESCHUTES RIVER SUBBASIN, Hatchery Produced Summer Steelhead, PRODUCTION).

The Miriam and Wenaha rivers and Joseph Creek are currently managed as wild stock streams.

DISTRIBUTION

Subbasin

Summer steelhead are distributed throughout most of the Grande Ronde River subbasin (Figure 1). The Wallowa River, Hurricane, Prairie, Deer, and Spring creeks all have barriers that preclude steelhead from former spawning and rearing areas. The quality of the spawning and rearing habitat varies throughout the subbasin (Tables 1 and 2).

Approximations of the temporal distribution of adult immigration, adult holding, incubation, emergence, and rearing are presented in Figure 2 (Oregon Department of Fish and Wildlife et al. 1990). The methodology that was used to generate these approximations is unknown.

PRODUCTION

Harvest

sport

Subbasin: The sport fishery was closed in 1974. A catch and release fishery was allowed in selected areas of the subbasin from 1983-85 and beginning in 1986 the subbasin was re-opened to the sport harvest of adipose clipped fish (see DESCHUTES RIVER SUBBASIN, Hatchery Produced Summer Steelhead, Harvest, Sport). In 1987, a special regulation was enacted in Oregon's segment of the Grande Ronde River and in the Wallowa River to allow the sport harvest of unmarked summer steelhead with a dorsal fin less than two inches. The rule was enacted to harvest surplus hatchery fish destined for Wallowa Hatchery. No published brood year specific estimates of sport harvest are available for the Grande Ronde River subbasin. Run year specific information is

available from Oregon Department of Fish and Wildlife (unpublished data).

Treaty

Subbasin: The Nez Perce Tribe of Idaho and the Confederated Tribes of the Umatilla Indian Reservation have reserved usual and accustomed fishing sites located in the Grande Ronde River subbasin.

Historically, the Umatilla and Nez Perce tribes harvested summer steelhead in the Grande Ronde River subbasin. Estimates of harvest are not available but it is believed that numbers are low. The Umatilla tribes closed the fishery in 1982 and 1983 (James 1984, cited by Howell et al. 1985).

ADULT LIFE HISTORY

Escapement

Columbia River

Timing: Grande Ronde River "summer steelhead migrate through the lower Snake River during two periods -- a fall movement that peaks mid to late September, and a spring movement that peaks during March and April" (Oregon Department of Fish and Wildlife et al. 1990).

Subbasin

Timing: Some adult summer steelhead return to the lower Grande Ronde River as early as July but primarily return from September through March (Oregon Department of Fish and Wildlife et al. 1990). Escapement to the larger tributaries occurs in early fall (Smith 1975, cited by Howell et al. 1985). Fish move into the smaller spawning tributaries in the spring. Peak migration into Lookingglass Creek occurs in May (Oregon Department of Fish and Wildlife et al. 1990).

spawning Area

Timing: Spawning occurs from March through early June (Williams 1975, cited by Howell et al. 1985 and James 1984, cited by Howell et al. 1985). Data collected in Lookingglass Creek indicates that fry are emerging in July and August (Mullarkey 1971, cited by Howell et al. (1985).

An approximation of the temporal distribution of spawning is presented in Figure 2 (Oregon Department of Fish and Wildlife et al. 1990). The methodology that was used to generate this approximation is unknown.

Numbers: There are no brood year specific estimates of spawner escapement to the Grande Ronde River subbasin. Spawning ground counts are available from Oregon Department of Fish and Wildlife (unpublished data).

Strays

No stray naturally or hatchery produced fish were recovered at broodstock collection facilities or on spawning ground surveys (Table 3). Coded wire tag recoveries were entirely from hatchery fish returning from subbasin hatchery production releases in the Grande Ronde River subbasin (Table 3).

Fork Length

Estimates of fork length, by age category, are available for unmarked summer steelhead collected at

a weir located at RM 0.01 in Deer Creek (Big Canyon facility). Brood returns in the 1988-89 through 1989-90 run years include unmarked hatchery fish and progeny of wild and hatchery stocks that were released above the Big Canyon facility to spawn in Deer Creek. Brood returns after the 1989-90 run year include only the progeny of natural and hatchery stocks that were released above the Big Canyon facility; all adults returning in these run years were 100% marked as juveniles. Age structure was determined based on scale analysis.

Annual estimates of mean fork length, by age category, ranged from 60 cm to 64 cm for 1 salt fish and was 67 cm for 2 salt fish (Table 4).

Age Structure

Estimates of age structure are available for unmarked summer steelhead collected at the Big Canyon facility (see ADULT LIFE HISTORY, Fork Length). Age structure was determined based on scale analysis.

Data indicates that naturally produced summer steelhead primarily return as 1 and 2 salt fish (Table 5). Annual estimates of age structure, by age category and run year, ranged from 47% to 69% 1 salt fish and from 31% to 53% 2 salt fish (Table 5).

Sex Ratio

Sex ratio (percent females) was estimated for unmarked summer steelhead collected at the Big Canyon facility (see ADULT LIFE HISTORY, Fork Length). Age structure was determined based on scale analysis.

Annual estimates of sex ratio, by age category, ranged from O% to 28% for 1 salt fish and were 63% for 2 salt fish (Table 6).

JUVENILE LIFE HISTORY

Migration Timing

Peak downstream migration of juvenile fish usually occurs in Lookingglass Creek in May with a much smaller pulse of fish migrating in the fall (Smith 1975, cited by Howell et al. 1985).

Data indicates that naturally produced summer steelhead primarily migrate as age 2+ smelts (Table 5). Estimates are based on scale analysis of returning adult fish (see ADULT LIFE HISTORY, Fork Length).

An approximation of the temporal distribution of juvenile outmigration is presented in Figure 2 (Oregon Department of Fish and Wildlife et al. 1990). The methodology that was used to generate this approximation is unknown.

BIOCHEMICAL-GENETIC CHARACTERISTICS

Wild juvenile summer steelhead from the Grande Ronde River were analyzed electrophoretically at selected protein-coding loci. Relative allele nobilities and allele frequencies were determined for 21 enzyme systems (Appendix Table 4). One rare allele was detected at the malate dehydrogenase-3,4 locus taken from a sample collected in a 1984.

Schreck et al. (1986) classified Columbia River Basin steelhead into several clusters of similar

stocks based on biochemical, morphological and life history characters. Columbia River Basin steelhead stocks segregate into two primary groups, those from west of the Cascade Mountains and those from east of the Cascades.

Wild summer steelhead from the Grande Ronde River cluster with other stocks from east of the Cascades. This primary group is composed of 3 subgroups. At the subgroup level, wild summer steelhead from the Grande Ronde River were found to be most similar to other wild summer steelhead stocks from tributaries of the Columbia between Fifteenmile Creek and the Entiat River, the lower Snake River and the Salmon River. This subgroup is characterized by the greatest average head length, maxillary length, head depth, and interorbital width. This subgroup also has the lowest average caudal peduncle length.

Wild steelhead from the Wallowa-Lostine River cluster with other stocks from east of the Cascades. This primary group is composed of 3 subgroups. At the subgroup level, wild summer steelhead from the Wallowa-Lostine River were found to be most similar to wild summer steelhead from the Methow River, and hatchery summer steelhead stocks from tributaries of the Columbia River and the lower Snake River. This subgroup is characterized by the earliest average time of entry into freshwater, the greatest average frequency of the common glycerol-3-phosphate dehydrogenase allele, and the lowest average head depth.

DISEASES

Neascus sp. is the only infectious disease agent of wild juvenile summer steelhead that has been detected in the Grande Ronde River subbasin (Table 7).

Figure 1. Summer steelhead distribution in the Grande Ronde River subbasin, based on the NPPC presence\absence data base (solid and dashed lines respectively) and the BPA Geographic Information

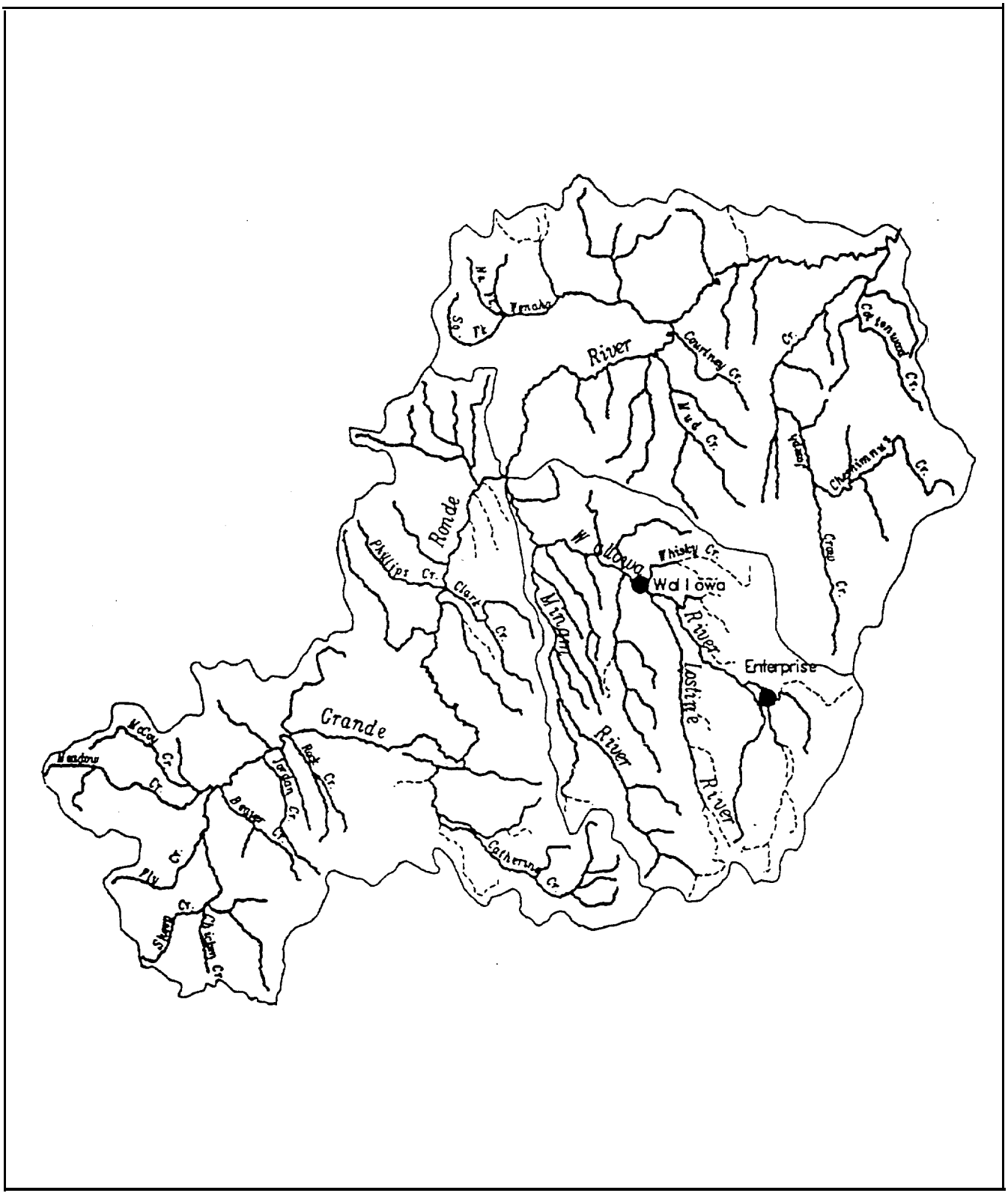
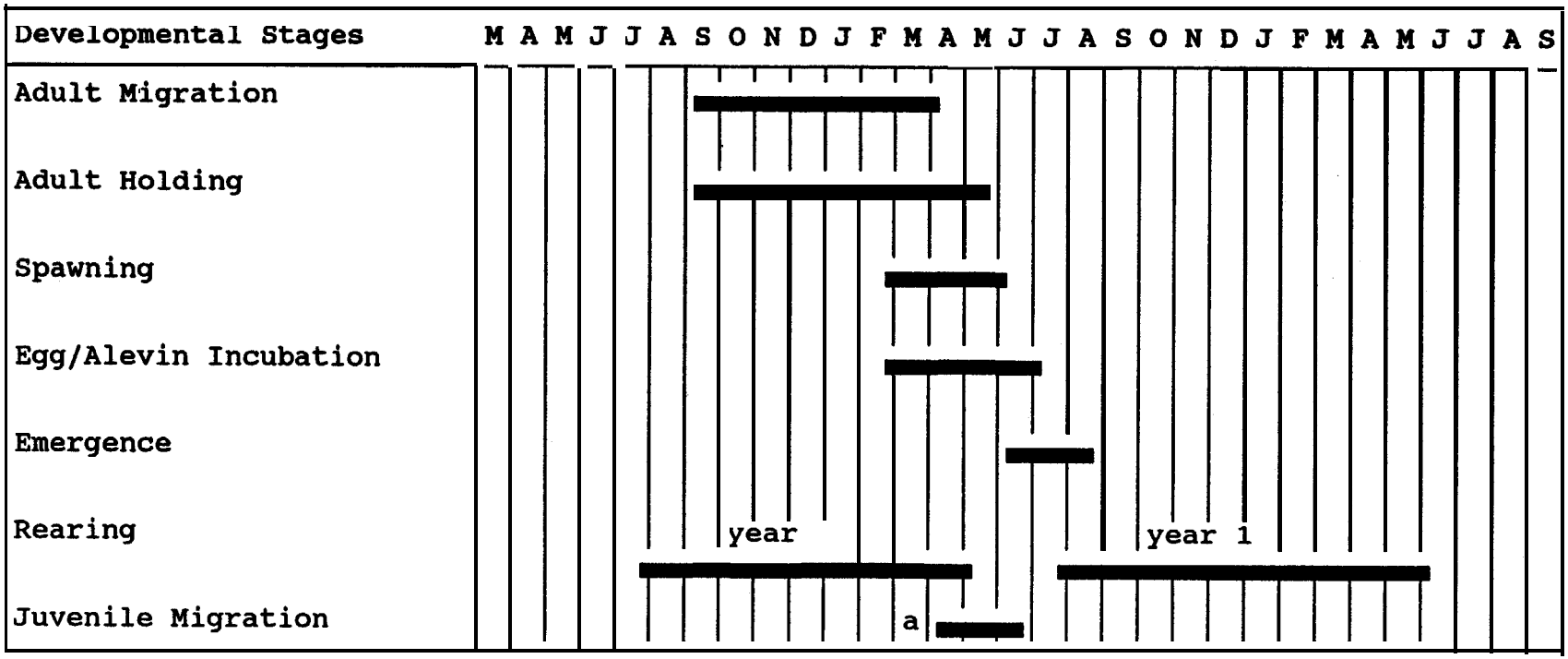


Figure 2 (TT). Freshwater life history for natural summer steelhead in the Grande Ronde River subbasin (Oregon Department of Fish and Wildlife et al. 1990).



a age 2+ smolts

Table 1 (HB-1). Estimated amount of spawning and rearing habitat by quality of Grande Ronde River subbasin summer steelhead production area[a].

Distance/ Area	Excellent	Good	Fair[b]	Poor[b]	Unknown	Total	Confi-dence
Miles (%)	9.6	49.8	31.5	9.1	--	1,088	--
Acres (%)	--	--	--	--	--	--	--

[a] Estimates are modified from the Northwest Power Planning Council's presence/absence database.
[b] Ratings of fair and poor habitat quality may reflect natural physical features such as waterfall barriers, as well as degradation caused by humans.

Table 2 (HB-2). Estimated amount of rearing only habitat by quality of Grande Ronde River subbasin summer steelhead production area[a].

Distance/ Area	Excellent	Good	Fair[b]	Poor[b]	Unknown	Total	Confi-dence
Miles (%)	4.7	47.2	41.0	7.1	--	312.1	--
Acres (%)	--	--	--	--	--	--	--

[a] Estimates are modified from the Northwest Power Planning Council's presence/absence database.
[b] Ratinge of fair and poor habitat quality may reflect natural physical features such as waterfall barriers, as well as degradation caused by humans.

Table 3 (AI). Non-harvest recoveries of coded wire tagged hatchery summer steelhead in the Grande Ronde River subbasin[a, b]

Hatchery/Release site	Recovery site, Run Year(s)	Recovery Method	Number Recovered	Total Number Estimated, (PSMFC)
Snake River[c]	Grande Ronde	Hatchery Returns		
	1982	--	1	1
Columbia River[c,d]	Grande Ronde	Hatchery Returns		
	1986	--	3	3
	1987	--	2	2
	1988	--	7	7
Grande Ronde	Grande Ronde	Hatchery Returns		
	1982	--	58	65
	1983	--	169	194
	1984	--	42	42
	1985	--	319	319
	1986	--	60	60
	1987	--	--	--
	1988	--	240	240

[a] Based on the following tag codes from hatchery reared fish: 07-16-14, 07-16-27, 07-22-01, 07-22-02, 07-37-62, 07-37-63, 07-38-01, 07-38-02, 09-16-36, 63-28-39, 63-28-40. Based on the following tag codes from fish of unknown rearing type (assumed to be hatchery): 23-16-51, 23-16-52, 23-18-11, 23-18-12, 23-18-13, RDYWLB*2.
[b] Estimates are modified from the Pacific States Marine Fisheries Commission coded wire tag database.
[c] These fish are assumed to have originated from the Grande Ronde River subbasin based on the fact that few strays are recovered in the subbasin.
[d] Release site in the mainstem Columbia River below Bonneville Dam.

Table 4 (AL) . Mean fork length by brood year and age class (freshwater.ocean) for naturally produced summer steelhead collected at the Big Canyon facility in the Grande Ronde River subbasin. Estimates within each freshwater age group that are along the upward diagonal to the right of a given footnote were derived from the same reference.

Mean Fork Length (cm)

Brood Year	1.1	1.2	1.3	2.1	2.2	2.3	3.1	3.2	393
1985	--	--	--	63	[a] 67	--	64[b]	--	--
N	--	--	--	--	--	--	--	--	--
st. dev.	--	--	--	--	--	--	--	--	--
1986	--	--	--	60[b]	--	--	--	--	--
N	--	--	--	--	--	--	--	--	--
st. dev.	--	--	--	--	--	--	--	--	--

[a] Estimate is modified from Messmer et al. (1989).
[b] Estimate is modified from Messmer et al. (1990).

Table 5 (AC-a). Age composition (freshwater.ocean) by run year for naturally produced summer steelhead collected at the Big Canyon facility in the Grande Ronde River subbasin[a].

Run Year	N	Age Composition (%)										
		1.1	1.2	1.3	1.4	2.1	2.2	2.3	2.4	3.1	3.2	3.3
1988-89	15	0	0	--	--	47	53	--	--	0	--	--
1989-90	26	0	0	--	--	65	31	--	--	4	--	--

[a] Estimates are modified from Messmer et al. (1989) for the 1988-89 run year and from Messmer et al. (1990) for the 1989-90 run year.

Table 6 (AS). Percent females by brood year and age class (freshwater.ocean) for naturally produced summer steelhead collected at the Big Canyon facility in the Grande Ronde River subbasin. Estimates within each freshwater age group that are along the upward diagonal to the right of a given footnote were derived from the seine reference.

		Females (%)										
Brood Year	N	1.1	1.2	1.3	1.4	2.1	2.2	2.3	2.4	3.1	3.2	3.3
1984	--	--	--	--	--	--	63	--	--	--	--	--
1985	--	--	--	--	--	28	[a] 63	--	--	0[b]	--	--
1986	--	--	--	--	--	18[b]	--	--	--	--	--	--

[a] Estimate is modified from Messmer et al. (1989).
[b] Estimate is modified from Messmer et al. (1990).

Table 7 (TD). Parasites and diseases of wild summer steelhead collected in the Grande Ronde River subbasin[a].

Disease type	Location	Specific Pathogen
Bacteria	Grande Ronde	*Neascus sp.* (Black spot disease)

[a] Data are *from* a telephone interview on 1/9/92 with Warren Groberg, Oregon Department of Fish and Wildlife, Fish Pathology, La Grande, Oregon.

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GRANDE RONDE RIVER SUBBASIN

Hatchery Produced Summer Steelhead

ORIGIN

The first recorded release of juvenile hatchery fish into the subbasin is the 1969 release from the Oxbow (Idaho) stock (Table 1). The subbasin was supplemented with juvenile hatchery fish from 1969-76 and from 1978-91 (Table 1). Non-indigenous stocks introduced into the subbasin include the Idaho (Oxbow), Skamania, Idaho/Wallowa, Snake River, Pahsimeroi, and Imnaha stocks.

Washington Department of Wildlife's (WDW) hatchery program in the Grande Ronde River subbasin was implemented beginning in 1970 (Table 1). WDW released Skamania stock summer steelhead in 1970, from 1973-76, and in 1978 and one release of Snake River stock summer steelhead in 1987. WDW first released the Hatchery Wallowa stock of summer steelhead into Washington's portion of the Grande Ronde River subbasin in 1981 and this stock has remained the primary source of hatchery broodstock used by WDW. The Hatchery Wallowa stock was developed from adult summer steelhead collected in the Snake River. Adult fish were collected at Ice Harbor Dam in 1976 and at Little Goose Dam from 1977-78 (Oregon Department of Fish and Wildlife et al. 1990). Adult fish were collected from the spring run and to minimize the number of B run fish incorporated into the hatchery broodstock no 2 salt fish were collected at either site.

The first recorded release of hatchery summer steelhead into Oregon's portion of the Grande Ronde River subbasin was the 1969 release of Oxbow stock (Idaho) juvenile fish (Table 1). Since 1969, various hatchery stocks have been released into Oregon's portion of the subbasin. They include the Hatchery Wallowa, Snake River, Pahsimeroi, and Imnaha stocks. Records indicate that a " Wallowa stock" of summer steelhead was introduced into Oregon's portion of the subbasin in 1972. Where the hatchery broodstock was initially obtained for the 1972 release is unknown. The first release of the Hatchery Wallowa stock was in 1981. This stock is the primary source of hatchery broodstock used to supplement Oregon's portion of the subbasin. Broodstock is collected at hatchery facilities located in the Grande Ronde River subbasin.

Oregon's hatchery program is currently being evaluated to develop methods for minimizing the programs impact on the native stock. Hatchery practices are primarily being evaluated in the upper Grande Ronde River and its tributaries and in Catherine Creek.

DISTRIBUTION

Subbasin

Juvenile summer steelhead are released at various sites located in the Grande Ronde River subbasin. Release sites in Oregon's portion of the Grande Ronde River subbasin are primarily located in the lower Grande Ronde River. Hatchery fish are released into Deer, Wildcat, Catherine, Spring, and Prairie creeks and in the mainstem of the Grande Ronde and Wallowa rivers (Table 1). The hatchery program in Oregon is designed to imprint hatchery smelts to the lower subbasin so that returning adult fish will home to the lower subbasin. The two main objectives of the hatchery program are: 1) improve sport harvest in areas where the sport fishery is concentrated and 2) minimize the hatchery programs impact on naturally produced summer steelhead in the upper Grande Ronde River subbasin.

Approximations of the temporal distribution of hatchery summer steelhead adult immigration, adult holding, spawning, incubation, and emergence are presented in Figure 1 (Oregon Department of

Fish and Wildlife et al. 1990). The methodology that was used to generate these approximations is unknown.

PRODUCTION

Releases

Egg

There are no records of releases in the subbasin.

Fry

Hatchery facilities in which fry were reared or acclimated prior to release in the subbasin include Irrigon Hatchery, Dworshak National Fish Hatchery (NFH), and one undocumented hatchery (Table 1). Annual numbers released ranged from 38,928 to 207,630 fish (Table 1). Size at release ranged from 3,070 to 918 fish per pound for releases in which estimates are available (Table 1).

Fingerling

Hatchery facilities in which fingerlings were reared or acclimated prior to release in the subbasin include Cottonwood Pond (Table 1). One release of 63,000 fish was made in 1986 (Table 1). Size at release was 4.6 fish per pound (Table 1).

Smelt

Hatchery facilities in which smelts were reared or acclimated prior to release in the subbasin include Irrigon, Wallowa, Cascade, Lyons Ferry, Ringgold, and Tucannon hatcheries, Cottonwood Pond, and Dworshak NFH (Table 1). Annual numbers released ranged from 264 to 1,777,270 (Table 1). Size at release ranged from 15.5 to 3.6 fish per pound (Table 1).

Adult

There are no records of releases in the subbasin.

Harvest

sport

Subbasin: The sport fishery in the Grande Ronde River subbasin was closed to sport harvest in 1974 in Oregon and in 1980 in Washington. The sport fishery located in Oregon's portion of the subbasin was opened to catch and release from 1983-85 and to the harvest of adipose clipped summer steelhead from 1986-91. In 1987 the sport fishery located in Oregon' portion of the subbasin was allowed to harvest unmarked summer steelhead with dorsal fins less than 2 inches in height; these fish are assumed to be unmarked hatchery fish destined for Wallowa Hatchery. Brood year specific estimates of harvest for the 1986-87 through 1990-91 run years are available from Oregon Department of Fish and Wildlife (unpublished data). Run year specific estimates (punchcard) are available from Oregon Department of Fish and Wildlife (unpublished data).

Treaty

Subbasin: The Nez Perce Tribe of Idaho and the Confederated Tribes of the Umatilla Indian Reservation have reserved usual and accustomed fishing sites located in the Grande Ronde River

subbasin.

Historically, the Umatilla and Nez Perce tribes harvested summer steelhead in the Grande Ronde River subbasin. Estimates of harvest are not available but it is believed that numbers are low. The Umatilla tribes closed the fishery in 1982 and 1983 (James 1984, cited by Howell et al. 1985).

ADULT LIFE HISTORY

Escapement

Columbia River

Timing: Data from recoveries of coded wire tagged hatchery fish, returning from subbasin hatchery production releases in the Grande Ronde River subbasin, indicate that the Hatchery Wallowa stock of summer steelhead migrates through the mainstem of the Columbia River from June through March, the Snake River and Skamania stocks from July through March, and the Pahsimeroi stock from July through October (Pacific States Marine Fisheries Commission unpublished data).

Subbasin

Timing: Data from recoveries of coded wire tagged hatchery fish, returning from subbasin hatchery production releases in the Grande Ronde River subbasin, indicate that the Hatchery Wallowa, Pahsimeroi, and Snake River stocks of summer steelhead can be found in the subbasin throughout the year (Pacific States Marine Fisheries Commission unpublished data). Adult fish return to Wallowa Hatchery from March through May and median date of return is in mid- to late April (Howell et al. 1985).

Hatchery Facilities

Timing: Adult fish are spawned at Wallowa Hatchery from March through May and median date of spawning is in late April (Howell et al. 1985).

Numbers: Estimates of escapement are available for summer steelhead returning to Wallowa Hatchery and collected at a weir located at RM 0.01 in Deer Creek (Big Canyon facility; see ADULT LIFE HISTORY, Fork Length). Wallowa Hatchery is located in the Spring Creek drainage. Summer steelhead are diverted into Wallowa Hatchery by way of a fish ladder located at the mouth of Spring Creek. A weir located above the entrance to the fish ladder is used to prevent fish from migrating above the hatchery facility. Both trapping facilities estimate all summer steelhead that escape to the trapping sites. Estimates are available for unmarked and Hatchery Wallowa stock summer steelhead returning to the Big Canyon facility and for returns of Hatchery Wallowa, Snake River, and Pahsimeroi stocks at Wallowa Hatchery (Tables 2-6). No complete brood returns are available at the Big Canyon facility. Summer steelhead are aged based on a combination of scale analyses and tag code.

Annual estimates of Hatchery Wallowa stock summer steelhead escapement to Wallowa Hatchery, by brood year, ranged from 346 to 3,642 adult fish (Table 3). Estimates for the Snake River and Pahsimeroi stocks include only one complete brood return for each stock. Estimates of summer steelhead escapement to Wallowa Hatchery was estimated at 235 adult fish for the 1979 brood returns of the Snake River stock (Table 5) and 191 adult fish for the 1978 brood returns of the Pahsimeroi stock (Table 6).

Survival: Estimates of pre-spawning survival rates are available from Carmichael et al. (1986,

1987, and 1988, and Messmer et al. 1989 and 1990).

Fork Length

Estimates of fork length are available for hatchery summer steelhead returning to Wallowa Hatchery and collected at a weir located at RM 0.01 in Deer Creek (Big Canyon facility). Marked hatchery returns are differentiated by stock based on a combination of coded wire tag, fin clip, and scale analysis. Unmarked summer steelhead returning to Wallowa Hatchery were all classified as hatchery fish based on the fact that there is no natural production above the hatchery and minimal natural production below the hatchery. Estimates are available for the Snake River, Pahsimeroi, and Hatchery Wallowa stocks of summer steelhead. Age was determined based on a combination of *scale* analyses and tag code.

Annual estimates of mean fork length, by age category, ranged from 47 cm to 65 cm for 1 salt fish, 68 cm to 74 cm for 2 salt fish, and 67 cm to 77 cm for 3 salt fish (Tables 7-10).

Age Structure

Estimates of age structure are available for hatchery summer steelhead returning to Wallowa Hatchery and collected at the Big Canyon facility (see ADULT LIFE HISTORY, Fork Length). Estimates are available for the Snake River, Pahsimeroi, and Hatchery Wallowa stocks of summer steelhead. Age was determined based on a combination of scale analyses and tag code.

Annual estimates of age structure, by age category and brood year, ranged from 25% to 93 % 1 salt fish, 6% to 72% 2 salt fish, and O% to 3% 3 salt fish (Tables 11-13).

Annual estimates of age structure, by age category and run year, ranged from 37% to 100% 1 salt fish, O% to 63% 2 salt fish, and O% to <1% 3 salt fish (Tables 14 and 15).

Sex Ratio

Sex ratios (percent females) were estimated for summer steelhead returning to Wallowa Hatchery and collected at the Big Canyon facility (see ADULT LIFE HISTORY, Fork Length). Estimates are available for the Pahsimeroi and Hatchery Wallowa stocks of summer steelhead. Age was determined based on a combination of scale analyses and tag code.

Annual estimates of sex ratio varied markedly among hatchery facilities and stocks (Tables 16-18).

Fecundity

Estimates of mean fecundity are available for hatchery summer steelhead spawned at hatchery facilities located in the Grande Ronde River subbasin. Estimates were made by dividing hatchery egg take by the number of females spawned. Annual estimates of mean fecundity ranged from 5,029 to 5,674 eggs per female (Table 19).

Mark Recoveries

Coded wire tagged hatchery fish, returning from subbasin hatchery production releases in the Grande Ronde River subbasin, were recovered in the Umatilla and Deschutes river subbasins.

There are no freshwater recoveries. of subbasin hatchery Production, reported at hatchery facilities or from spawning ground surveys outside of the Columbia River Basin.'

JUVENILE LIFE HISTORY

Age structure

Hatchery juvenile fish are primarily released as yearling smelts (Table 1).

Residualism

Data on age structure of returning hatchery adult fish (see ADULT LIFE HISTORY, Age structure) indicate that hatchery juvenile fish residualize and that the extent to which residualism occurs varies widely. The Hatchery Wallowa stock of juvenile fish from the 1981-84 brood releases from Wallowa Hatchery were released as age 1+ smelts. The percent of returning adults with a 2 or 3 year freshwater life history pattern ranged from 1% to 15% (Table 12).

BIOCHEMICAL-GENETIC CHARACTERISTICS

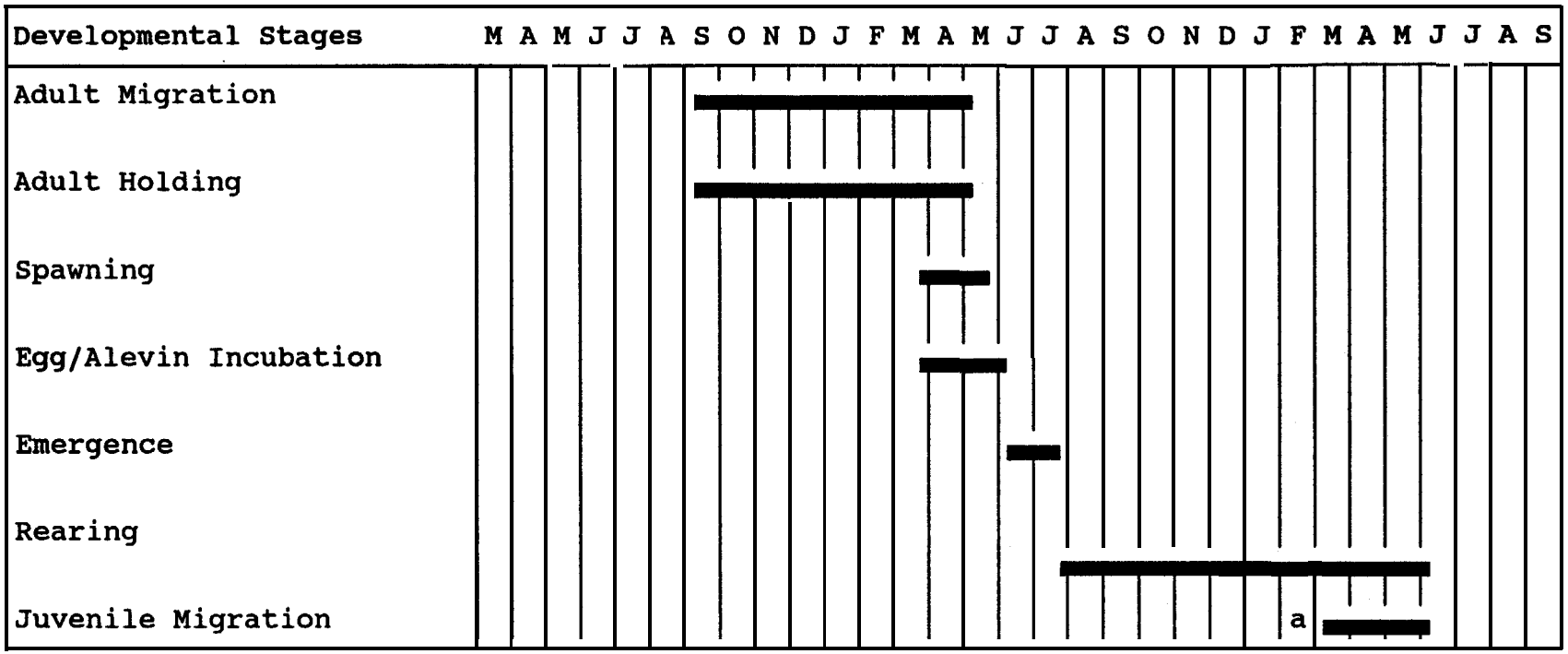
Juvenile hatchery summer steelhead were collected from the Grande Ronde River subbasin in 1984, and analyzed electrophoretically at selected protein-coding loci (Schreck et al. 1986). Relative allele nobilities and allele frequencies were determined for 21 enzyme systems (Appendix Table 4). No rare alleles were detected.

Schreck et al. (1986) classified Columbia River Basin steelhead into several clusters of similar stocks based on biochemical, morphological and life history characters. Columbia River Basin steelhead stocks segregate into two primary groups, those from west of the Cascade Mountains and those from east of the Cascades. Hatchery steelhead from the Wallowa River cluster with other stocks from east of the Cascades. This primary group is composed of 3 subgroups. At the subgroup level, hatchery summer steelhead from the Wallowa River were found to be most similar to other hatchery summer steelhead stocks from tributaries of the Columbia River and the lower Snake River, and 2 stocks of wild summer steelhead. This subgroup is characterized by the earliest average time of entry into freshwater, the greatest average frequency of the common glycerol-3-phosphate dehydrogenase allele, and the lowest average head depth.

DISEASES

Various parasites and infectious disease agents have been identified at hatchery facilities that rear or hold juvenile summer steelhead for subbasin hatchery production (Table 21). Parasites include *Ichthyobodo sp.* (Costia) and *Ichthyophthirius sp.* (Ich). Bacterial diseases include bacterial gill disease, *Aeromonas spp., Pseudomonas spp., Cytophaga psychrophila* (Cold water disease), and *Flexibacter columnaris* (Columnaris). Viral diseases include Infectious Hematopoietic Necrosis . (IHN) and Erythrocytic Inclusion Body Syndrome (EIBS). For information on parasites and disease agents of subbasin hatchery production that is held or reared at hatchery facilities located outside of the subbasin see LOWER COLUMBIA RIVER SUBBASIN, Hatchery Produced Summer Steelhead, DISEASES.

Figure 1 (TT). Freshwater life history for hatchery summer steelhead in the Grand Ronde subbasin (Oregon Department of Fish and Wildlife et al. 1990).



a Age 1+ smolts

Table 1 (IR). Hatchery releases of summer steelhead into the Grande Ronde River subbasin by brood year and if marked, by coded wire tag codes.

Brood Year	Stock	Hatchery	Life Stage	Release Date (1)	Release Date (2)	Fish/ lb	Number Released	Release Location	CUTI Fin clip[b]
..	Idaho(Oxbow)	Unknown	fry	01/01/69[c]	12/31/69[c]	3,070.0	70,600	Grande Ronde	..
..	Skamania	Ringgold	smolt	01/01/70[c]	12/31/70[c]	7 . 0	44,935	Grande Ronde	..
..	Skamania	Ringgold	smelt	01/01/70[c]	12/31/70[c]	7.0	30,075	Grande Ronde	AD
..	Idaho(Oxbow)	Unknown	smelt	01/01/71[c]	12/31/71[c]	6.0	264	Wallowa	..
..	Idaho/Wallowa	Unknown	molt	01/01/72[c]	12/31/72[c]	6.1	45,419	Wallowa	..
..	Skamania	Ringgold	smolt	01/01/73[c]	12/31/73[c]	5.1	57,235	Grande Ronde	..
..	Skamania	Unknown	smolt	01/01/73[c]	12/31/73[c]	8.0	73,375	Wallowa	..
..	Skamania	Ringgold	Smelt	01/01/74[c]	12/31/74[c]	6.0	50,046	Grande Ronde	..
--	Skamania	Tucannon	smolt	01/01/74[c]	12/31/74[c]	6.0	53,634	Grande Ronde	..
.-	Skamania	no	smolt	01/01/74[c]	12/31/74[c]	..	695	Wallowa	..
..	Skamania	Ringgold	smolt	01/01/75[c]	12/31/75[c]	6.5	30,000	Grands Ronde	No mark
..	Skamania	Tucannon	smolt	01/01/75[c]	12/31/75[c]	6.5	13,452	Grande Ronde	No mark
..	Skamania	Tucannon	smolt	01/01/75[c]	12/31/75[c]	6.5	74,522	Grande Ronde	Ad
..	Skamania	no	smolt	01/01/75[c]	12/31/75[c]	15.0	49,650	Wallowa	..
..	Skamania	Tucannon	smolt	01/01/76[c]	12/31/76[c]	7.$	79,721	Grande Ronde	..
..	Skamania	Tucannon	Smelt	01/01/78[c]	12/31/78[c]	7.4	55,557	Grande Ronde	AD
..	Skamania	Tucannon	smolt	01/01/78[c]	12/31/78[c]	7.4	4,125	Grande Ronde	No mark
..	Skamania	Dworshak	fry	01/01/78[c]	12/31/78[c]	918.0	207,630	Grande Ronde	..
1976	Snake R	Wallowa	Smelt	05/08/78	--	6.2	66,960	Spring Creek	09-06-13
1976	Snake R	Wallowa	smelt	05/08/78	--	6.2	13,960	Spring Creek	No mark
1977	Snake R	Wallowa	smolt	04/30/79	--	8.0	66,228	Spring Creek	09-16-36[d]
1977	Snake R	Wallowa	Smelt	04/30/79	--	8.0	8,228	Spring Creek	AD
1977	Snake R	Wallowa	smolt	04/30/79	--	8.0	803	Spring Creek	No mark
1977	Snake R	Wallowe	smolt	05/12/78	--	13.0	18,160	Spring Creek	09-16-36[d]
1977	Snake R	Wallowa	smolt	05/12/78	--	13.0	1,780	Spring Creek	AD
1977	Snake R	Wallowa	Smelt	05/12178	--	13.0	60	Spring Creek	No mark
1978	Snake R	Wallowa	smolt	04/05/80	--	5.0	30,733	Spring Creek	07-16-14[d]
1978	Snake R	Wallowa	smolt	04/05/80	--	5.0	2,702	Spring Creak	AD
1978	Snake R	Wallowa	smolt	04/05/80	--	5.0	1,466	Spring Creek	No mark
1978	Snake R	Wallowa	smolt	05/16/79	--	14.7	19,322	Spring Creek	07-16-14[d]
1978	Snake R	Wallowa	smolt	05/16/79	--	14.7	682	Spring Creek	AD
1978	Snake R	Wallowa	Smelt	05/16/79	--	14.7	1,091	Spring Creek	No mark
1979	Pahsimeroi	Wallowa	smolt	04/03/81	--	5.2	55,180	Spring Creek	07-22-02
1979	Pahsimeroi	Wallowa	smolt	04/03/81	--	5.2	5,890	Spring Creek	AD
1979	Pahsimeroi	Wallowa	smolt	04/03/81	--	5.2	930	Spring Creek	No mark
1979	Pahsimeroi	Wallowa	Smelt	04/21/80	--	10.6	25,283	Spring Creek	07-22-01
1979	Pahsimeroi	Wallowa	smolt	04121/80	--	10.6	2,692	Spring Creek	AD
1979	Pahsimeroi	Wallowa	Smelt	04/21/80	--	10.6	433	Spring Creek	No mark
..	Skamania	Tucannon	smolt	01/01/81	12/31/81	6.5	106,800	Grande Ronde	AD
..	Skamania	Tucannon	Smelt	01/01/81	12/31/81	6.5	6,900	Grande Ronde	No mark
1980	Wallowa	Wallowa	smolt	04/09182	--	5.0	14,275	Spring Creek	No msrk
1980	Wallowa	Wallowa	smolt	04/03/81	--	5.2	2,941	Spring Creek	07-16-27
1980	Wallowa	Wallowa	smolt	05/04/81	--	5.5	18,673	Spring Creek	07-16-27

Table 1 (TR). (cent.) Hatchery releases of summer steelhead into the Grands Ronde River subbasin by brood year end if marked, by coded wire tag code[a].

Brood Year	Stock	Hatchery	Life Stage	Release Dste (1)	Release Date (2)	Fish/ lb	Number Released	Release Location	M / Fin clip[b]
1980	Wallowa	Wallowa	smolt	04/15/81	--	6.0	15,804	spring Crack	07-16-27
1980	Wallowa	Wallowa	smolt	04/09/82	--	8.0	29,488	Spring Creek	No mark
1981	Wal lowa	Tucannon	smolt	05/18/82	--	9.7	7,760	Grande Ronde River	..
1981	Wal lowa	Tucannon	smolt	05/17/82	--	9.7	9,215	Grands Ronde River	..
1981	Wal lowa	Tucannon	smolt	05/13/82	--	9.7	9,409	Grands Ronde River	..
1981	Wal lowa	Tucannon	smolt	05/12/82	--	9.8	8,771	Grands Ronde River	--
1981	Wal lowa	Irrigon NFH	smolt	04/09/82	--	5.0	13,600	Spring Creek	No mark
1981	Wal lowa	Irrigon NFH	smolt	04/w/82	--	5.6	14,375	Spring Creek	No mark
1981	Wal lowa	Irrigon NFH	smolt	04/27/82	--	7.6	48,921	spring Creek	No mark
1981	Wal lowa	Wallowa	Smelt	05/10/82	--	10.0	37,500	spring Creek	No mark
1981	Wal lowa	Wallowa	smolt	05/10/82	--	15.0	27,450	Spring Creek	No mark
1981	Wallowa	Cascade	smolt	04/27/83	04/29/83	6.6	36,208	Deer Creek	No mark
1981	Wallowa	Cascade	smolt	04/25/83	--	6.9	21,362	Deer Creek	No mark
1982	Wallowa	Wallowa	Smelt	05/15/83	--	5.0	31,911	Spring Creek	63-28-39
1982	Wallowa	Wallowa	-Smelt	0s/15/83	--	4.4	31,167	Spring Creek	63-28-40
1982	Wal lowa	Wallowa	smolt	05/06/83	--	8.4	23,058	Spring Creek	No msrk
1982	Wallowa	Lyons Ferry NFH	smolt	05/03/83	-"	4.7	14,688	Spring Creek	AD
1982	Wallowa	Lyons Ferry NFH	smolt	05/02/83	--	5.1	14,790	spring Creek	AD
1982	Wal lowa	Lyons Ferry NFH	smolt	05/02/83	05/03/83	5.8	34,655	Spring Creek	AD
1982	Wal lowa	Lyons Ferry NFH	smolt	05/04/83	--	7.4	32,930	Spring Creek	No mark
1982	Wal lowa	Lyons Ferry NFH	smolt	05/05/83	--	8.3	22,991	Spring Creek	No mark
1982	Wal lowa	Lyons Ferry NFH	smolt	05/ 04/83	--	10.4	41,600	Spring Creek	AD
1982	Wa l lowa	Lyons Ferry NFH	smolt	05/05/83	--	15.5	18,600	Spring Creek	No mark
1983	Wallowa	Wallowa	smolt	04/24/84	--	7.1	11,928	Spring Creek	No mark
1983	Wal lowa	Wallowa	smolt	04/24/84	--	9.0	28,890	Spring Creek	No mark
1983	Wal lowa	Lyons Ferry NFH	smolt	04/23/84	--	5.0	20,750	Spring Creek	No mark
1983	Wal lowa	Lyons Ferry NFH	smolt	04/24/84	04/25/84	6.0	62,250	Spring Creek	No mark
1983	Wal lowa	Lyona Ferry NFH	smolt	04/26/84	--	6.4	25,800	Spring Creek	No mark
1983	Wal lows	Lyons Ferry NFH	smolt	04/25/84	--	6.5	22,750	Spring Creek	No mark
1983	Wallowa	Lyons Ferry NFH	smolt	04/27/84	--	6.6	25,410	Spring Creek	No mark
1983	Wallowa	Lyons Ferry NFH	smolt	04/23/84	04/26/84	6.8	82,280	Spring Creek	No mark
1983	Wal lows	Lyona Ferry NFH	smolt	04/27/84	04/30/84	7.1	75,970	Spring Creek	No mark
1983	Wal lowa	Lyons Ferry NFH	smolt	05/01/84	--	7.7	57,750	Spring Creek	No mark
1983	Wal lowa	Lyons Ferry NFH	smolt	05/02/84	--	9.3	70,215	Spring Creek	No mark
1983	Wallowa	Lyons Ferry NFH	smolt	04/27/84	--	6.8	14,280	Oeer Creek	No mark
1983	Wallowa	Lyons Ferry NFH	smolt	05/01/84	--	7.7	13,090	Oeer Creek	No mark
1983	Wallowa	Lyona Ferry NFH	smolt	04/03/84	--	8.5	10,200	Deer Creek	No mark
1983	Wallowa	Lyona Ferry NFH	smolt	04/02/84	--	9.3	19,530	Deer Creek	No mark
1984	Wallowa	cottonwood Pond	smolt	05/10/85	--	5.5	46,717	Grands Ronde River	--
1984	Wal lowa	Cottonwood Pond	smolt	05/04/85	--	5.5	41,028	Grands Ronde River	62-16-27
1984	Wal lows	cot tonwood Pond	smolt	05/15/85[e]	--	5.5	40,201	Grande Ronde River	62-16-28
1984	Wallowa	Wallows	-smelt	03/01/85	--	6.0	15,690	Spring Creek	No mark

Table 1 (TR). (cent.) Hatchery releases of sinner steel head into the Grande Ronde River subbasin by brood year and if marked, by coded wire tag codes.

Brood Year	Stock	Hatchery	Life Stage	Release Date (1)	Release Date (2)	Fish/ lb	Number Released	Release Location	CWT/ Fin clip[b]
1984	Wallowa	Wallowa	smolt	04/29/85	--	6.4	630,355	Spring Creek	AD
1984	Wallowa	Lyons Ferry NFH	smolt	04/25/85	--	7.8	50,115	Deer Creek	AD
1984	Wallowa	Lyons Ferry NFH	smolt	04/25/85	--	8.1	13,365	Deer Creek	AD
1984	Wallowa	Lyons Ferry NFH	smolt	04/26/85	--	8.8	32,560	Deer Creek	AD
1985	Wallowa	Lyons Ferry	-smelt	05/17/85	--	10.1	21,462	Grande Ronde River	--
1985	Wallowa	cottonwood Pond	smolt	04/15/86[e]	--	4.6	20,234	Grande Ronde River	63-33-49
1985	Wallowa	cottonwood Pond	smolt	04/15/86[e]	--	4.6	20,038	Grande Ronde River	63-33-06
1985	Wallowa	cottonwood Pond	smolt	04/15/86[e]	-"	4.7	20,205	Grande Ronde River	63-33-05
1985	Wallowa	Cottonwood Pond	fing.	04/15/86[e]	--	4.6	63,600	Grande Ronde River	--
1985	Wallowa	Wallowa	-smelt	04/29/86	05/05/86	3.9	26,908	Spring Creak	07-37-62
1985	Wallowa	Wallowa	smelt	04/29/86	05/05/86	4.1	28,094	Spring Creek	07-37-63
1985	Wallowa	Wallowa	smelt	04/29/86	05/05/86	5.4	26,316	Spring Creek	07-38-01
1985	Wallowa	Wallowa	smolt	04/29/86	05/05/86	5.4	26,117	Spring Creek	07-38-02
1985	Wallowa	Wallowa	smolt	04/29/86	05/05/86	3.9	2,512	Spring Creek	AD-LV
1985	Wallowa	Wallowa	smelt	04/29/86	05/05/86	4.1	1,910	Spring Creek	AD-LV
1985	Wallowa	Wallowa	Smelt	04/29/86	05/05/86	5.4	2,687	Spring Creek	AD-LV
1985	Wallowa	Wallowa	smolt	04/29/86	05/05/86	3.9	6,194	Spring Creek	No mark
1985	Wallowa	Wallowa	smelt	04/29/86	05/05/86	4.1	6,036	Spring Creek	No mark
1985	Wallowa	Wallowa	smolt	04/29/86	05/05/86	5.4	67,758	Spring Creek	No mark
1986	Unknown	Cottonwood Pond	smolt	04/20/87	--	5.4	120,384	Grande Ronde River	--
1986	Unknown	Cottonwood Pond	smolt	04/20/87	--	5.4	20,083	Grande Ronde River	63-38-41
1986	Unknown	cottonwood Pond	smolt	04/20/87	--	5.4	20,099	Granola Ronde River	63-38-40
1986	Unknown	Cottonwood Pond	smolt	04/20/87	--	5.4	20,115	Grande Rode River	63-38-42
1986	Unknown	Cottonwood Pond	smolt	04/20/87	--	5.4	20,164	Granola Ronde River	63-38-43
1986	Wallowa	Irrigon NFH	smolt	04/08/87	04 /23/87	4.8	167,520	Grande Ronde R	AD
1986	Wallowa	Irrigon NFH	smelt	04/15/87	04/24/87	4.9	51,029	Grande Ronde R	AD
1986	Wallowa	Irrigon NFH	smelt	04/23/87	--	5.0	25,350	Grande Ronde R	AD
1986	Wallowa	Irrigon NFH	smolt	04/27/87	--	4.4	1,205	Spring Creek	AD
1986	Wallowa	Irrigon NFH	smolt	04/13/87	--	4.5	10,215	Catherine Creek	AD
1986	Wallowa	Irrigon NFH	smolt	04/13/87	04/27/87	4.6	40,710	Catherine Creek	AD
1986	Wallowa	Irrigon NFH	smelt	04/23187	--	5.0	11,000	Catherine Creek	AD
1986	Wallowa	Irrigon NFH	-smelt	04/29/87	--	4.5	15,638	Prairie Creek	AD
1986	Wallowa	Irrigon NFH	-smelt	04/29/87	--	5.0	8,625	Prairie Creek	AD
1986	Wallowa	Irrigon NFH	smolt	04/29/87	--	4.5	18,000	Wallowa River	AD
1986	Wallowa	Irrigon NFH	-smelt	04/21/87	--	4.8	37,584	Wallowa River	AD
1986	Wallowa	Irrigon NFH	smolt	04/20/87	--	4.9	11,760	Wallowa River	AD
1986	Wallowa	Irrigon NFH	-smelt	04/14/87	--	5.0	16,250	Wallowa River	AD
1986	Wallowa	Irrigon NFH	smolt	04/30/87	--	5.0	37,750	Wallowa River	AD
1986	Wallowa	Irrigon NFH	smolt	04/30/87	--	7.0	38,710	Wallowa River	AD
1986	Wallowa	Irrigon NFH	-smelt	04/29/87	--	5.0	12,000	Hurricane Creek	AD
1986	Wallowa	Wallowa	smolt	04/22/87	04/28/87	4.4	50,385	Spring Creek	07-41-28
1986	Wallowa	Wallowa	smolt	04/22/87	04/28/87	4.4	391	Spring Creek	AD-LV

Table 1 (TR). (cent.) Hatchery releases of summer steelhead into the Grande Ronde River subbasin by brood yaar end if marked, by coded wi re tag code[a].

Bred Stock Yaar	Hatchery	Life Stage	Release Date (1)	Release Date (2)	Fish/ lb	Number Released	Release LoCat ion	CWT/ Fin clip[b]
986 Wa l lowa	Wallowa	molt	04/22/87	04/28/87	4.4	1,302	Spring Creek	..
986 Wal lowa	Wal lows	smolt	04/25/87	04/27/87	3.6	46,571	Spring Creek	07-41-25
986 Wal lowa	Wallowa	smol t	04/25/87	04/27/87	4.7	25,374	Spring Creek	07-40-25
986 Wa l lowa	Wallowa	smolt	04/25/87	04/27/87	4.7	26,136	Spring Creek	07-40-26
986 Wa l lowa	Wal lowa	smolt	04/25/87	04/27/87	3.6	1,619	Spring Creek	AD-LV
986 Wal lowa	Wal lows	Smelt	04/25/87	04/27/87	4.7	1,916	Spring Creek	AD-LV
986 Wal lowa	Wallows	smolt	04/25/87	04/27/87	3.6	110,811	Spring Creek	..
986 Wa l lowa	Wallowa	smolt	04/25/87	04/29/87	4.7	50,019	Spring Creek	07-41-26
986 Wallowa	Wallowa	Smelt	04/25/87	04/29/87	4.7	706	Spring Creak	AD-LV
986 Wal lows	Wallowa	smolt	04/25/87	04/29/87	4.7	273,888	Spring Crack	..
986 Wallowa	Wallowa	smolt	04/16/87	04/22/87	4.4	123,882	Granola Ronde R	AD
986 Wal lowa	Wal lowa	smolt	04/22/87	--	4.4	10,560	Catherine Creek	AD
986 Wal lows	Wal lows	smolt	04/25/87	--	4.4	222,526	Deer Crack	AD
986 Wal lowa	Lyons Ferry NFH	smolt	04/28/87	--	5.4	14,850	Wildcat Creek	AD
986 Wal lowa	Lyons Ferry NFH	smolt	06/29/87	--	5.8	17,997	Wildcat Creek	AD
986 Wallowa	Lyons Ferry NFH	smolt	04/28/87	04/29/87	5.9	19,488	Wildcat Creek	AD
987 Grande Ronde	Wallowa	smol t	04/16/88	--	..	29,424	Wallowa Hatchery	RV
987 Snake R	cottonwood Pond	Smelt	04/15/88	--	4.8	208,262	Grande Ronde River	..
987 Wallowa	Lyons Ferry	Smelt	04/29/88	--	6.1	12,414	Grande Ronde River	..
986 Wal lows	Irrigon NFH	smolt	04/08/87	04/24/87	4.6	74,658	Grande Ronde R	AD
987 Wal lows	Irrigon NFH	smelt	04/06/88	05 /04/88	4.8	132,399	Granola Ronde R	AD
987 Wal lows	Irrigon NFH	smol t	04/20/88	04/22/88	4.9	52,234	Granda Ronde R	AD
987 Wallowa	Irrigon NFH	smolt	0-4/25/88	05/02/88	5.0	58,095	Granola Ronde R	AD
987 Wal lows	Irrigon NFH	smolt	04/05/88	04/06/88	5.2	47,944	Granola Ronde R	AD
987 Wal lows	Irrigon NFH	smolt	04/07/88	04/22/88	5.4	79,353	Grande Ronde R	AD
987 Wa 1 lowa	Irrigon NFH	Smelt	04/16/88	--	5.5	16,913	Grande Ronde R	AD
987 Wal lows	Irrigon NFH	smolt	04/08/88	--	4.8	10,944	Catherine Creek	AD
987 Wa 1 lows	Irrigon NFH	Smelt	04/04/88	--	4.9	25,480	Catherine Creek	AD
987 Wal lows	Irrigon NFH	smolt	04/04/88	--	5.0	26,104	Catherine Creek	AD
987 Wallowa	Irrigon NFH	smolt	04/16/88	04118188	4.3	27,110	spring Creek	07-40-29
987 Wallowa	Irrigon NFH	Smelt	04/16/88	04/18/88	4.3	26,310	Spring Creek	07-40-30
987 Wal lows	Irrigon NFH	Smelt	04/16/88	04/18/88	4.7	26,986	Spring Crack	07-40-27
987 Wa 1 lowa	Irrigon NFH	smolt	04/16/ 88	04/18/88	4.7	27,442	Spring Creek	07-40-28
987 Wallowa	Irrigon NFH	Smelt	04/16/88	04/18/88	4.3	541	Spring Creek	AD-LV
1987 Wal lowa	Irrigon NFH	smolt	04/16/88	04/18/88	4.7	325	Spring Creek	AD-LV
1987 Wa 1 lows	Irrigon NFH	smolt	04/16/88	04/18/88	4.3	34,860	Spring Creek	..
1987 Wallowa	Irrigon NFH	Smelt	04/16/88	04/18/88	4.7	317,988	Spring Creek	--
1987 Wallowa	Irrigon NFH	smolt	04/18/88	04/19/88	4.8	25,436	Spring Creek	07-40-31
1987 Wallowa	Irrigon NFH	Smelt	04/18/88	04/19/88	4.8	25,425	Spring Creek	07-40-32
1987 Wallowa	Irrigon NFH	smolt	04/18/88	04/19/88	4.8	2,009	Spring Creek	AD-LV
1987 Wallowa	Irrigon NFH	smolt	04/18/88	04/19/88	4.8	7,993	Spring Creek	..
1987 Wallowa	1rrigon NFH	smolt	04/13/88	- -	5.1	223,196	Oaer Creek	AD
1987 Wal lows	1rrigon NFH	smolt	04/18/88	04/19/88	4.8	7,661	Wallowa River	AD

Table 1 (IR). (cont.) Hatchery releases of summer steelhead into the Grande Ronde River subbasin by brood year and if marked, by coded wire tag code[a].

Brood Year	Stock	Hatchery	Life Stage	Release Date (1)	Release Date (2)	Fish/ lb	Number Released	Release Location	CUT/ Fin clip[b]
1987	Wallowa	Irrigon NFH	smolt	05/02/88	--	5.0	4,375	Wallowa River	AD
1987	Wallowa	Irrigon NFH	molt	04/14/88	04/16/88	5.5	46,503	Wallowa River	AD
1987	Wallowa	Irrigon NFH	smolt	04/13/88	--	5.7	62,540	Wallowa River	AD
1987	Wallowa	Lyons Ferry NFH	smolt	04/28/88		6.0	50,640	Grande Ronde R	AD
1988	Wallowa	Irrigon NFH	fry	01/01/88	12/31/88	--	38,928	Wallowa River	--
1988	Wallowa	Cottonwood Pond	smolt	04/15/89[e]	--	5.3	222,050	Grande Ronde River	--
1988	Wallowa	Irrigon NFH	smolt	04/10/89	04/27/89	5.1	140,276	Grande Ronde R	AD
1988	Wallowa	Irrigon NFH	smolt	04/10/89	--	5.3	27,560	Grande Ronde R	AD
1988	Wallowa	Irrigon NFH	smolt	04/10/89	04/11/89	5.4	113,670	Grande Ronde R	AD
1988	Wallowa	Irrigon NFH	Smelt	0.4/11/89	04/22/89	5.5	62,756	Grande Ronde R	AD
1988	Wallowa	Irrigon NFH	smolt	04/20/89	04/24/89	3.8	26,718	Spring Creek	07-45-43
1988	Wallowa	Irrigon NFH	smolt	04/20/89	04/24/89	3.9	26,303	Spring Creek	07-45-42
1988	Wallowa	Irrigon NFH	Smelt	04/20/89	04/24/89	5.2	26,922	Spring Creek	07-46-50
1988	Wallowa	Irrigon NFH	smolt	04/20/89	04/24/89	5.3	26,526	Spring Creek	07-46-51
1988	Wallowa	Irrigon NFH	smolt	04/20/89	04124/89	3.8	427	Spring Creek	AD-LV
1988	Wallowa	Irrigon NFH	smolt	04/20/89	04/24/89	3.9	1,109	Spring Creek	AD-LV
1988	Wallowa	Irrigon NFH	Smelt	04/20/89	04/24/89	5.2	754	Spring Creek	AD-LV
1988	Wallowa	Irrigon NFH	smolt	04/20/89	04/24/89	5.3	749	Spring Creek	AD-LV
1988	Wallowa	Irrigon NFH	smolt	04/20/89	04/24/89	3.8	16,582	Spring Creek	--
1988	Wallowa	Irrigon NFH	Smelt	04/20/89	04/24/89	3.9	16,830	Spring Creek	--
1988	Wallowa	Irrigon NFH	smolt	04/20/89	04/24/89	5.2	178,412	Spring Creek	--
1988	Wallowa	Irrigon NFH	smolt	04/20/89	04/24/89	5.3	175,579	Spring Creek	--
1988	Wallowa	Irrigon NFH	smolt	04/24/89	04/25/89	5.2	25,622	Spring Creek	07-46-52
1988	Wallowa	Irrigon NFH	smolt	04/24/89	04/25/89	5.2	24,924	Spring Creek	07-46-55
1988	Wallowa	Irrigon NFH	smolt	04/24/89	04/25/89	5.2	2,186	Spring Creek	AD-LV
1988	Wallowa	Irrigon NFH	smolt	04/24/89	04/25/89	5.2	1,233	Spring Creek	--
1988	Wallowa	Irrigon NFH	smelt	04/10/89	04/11/89	5.4	24,678	Catherine Creek	AD
1988	Wallowa	Irrigon NFH	Smelt	04/12/89	--	5.5	37,923	Catherine Creek	AD
1988	Wallowa	Irrigon NFH	smolt	04/29/89	--	5.0	223,425	Deer Creek	AD
1988	Wallowa	Irrigon NFH	smolt	04/27/89	--	5.2	50,071	Deer Creek	AD
1988	Wallowa	Irrigon NFH	smolt	04/19/89	04/21/89	5.0	60,800	Wallowa River	AO
1988	Wallowa	Irrigon NFH	Smelt	04/25/89	--	5.4	27,270	Wallowa River	AD
1988	Wallowa	Irrigon NFH	Smelt	04/21/89	--	5.5	9,818	Wallowa River	AD
1988	Wallowa	Irrigon NFH	smolt	04/19/89	--	5.8	13,195	Wallowa River	AD
1989	Wallowa	Cottonwood Pond	Smelt	04/15/90[e]	--	5.0	179,250	Grande Ronde River	--
1989	Wallowa	Cottonwood Pond	Smelt	04/15/90[e]	--	5.3	59,750	Grande Ronde River	--
1989	Wallowa	Irrigon NFH	smolt	04/12/90	04/13/90	4.7	46,319	Grande Ronde R	AD
1989	Wallowa	Irrigon NFH	Smelt	04/13/90	04/17/90	5.0	152,725	Grande Ronde R	AD
1989	Wallowa	Irrigon NFH	Smelt	04/24/90	--	5.3	26,023	Grande Ronde R	AD
1989	Wallowa	Irrigon NFH	smolt	04/24/90	04/26/90	5.4	36,180	Grande Ronde R	AD
1989	Wallowa	Irrigon NFH	Smelt	04/25/90	--	5.6	32,200	Granda Ronde R	AD
1989	Wallowa	Irrigon NFH	Smelt	04/15/90	04/19/90	4.1	26,473	Spring Creek	07-51-21
1989	Wallowa	Irrigon NFH	Smelt	04/15/90	04/19/90	4.3	26,347	Spring Creek	07-51-20

Table 1 (TR). (cont.) Hatchery releases of sinner steelhead into the Grande Rode River subbasin by brood year and if marked, by coded wire tag Codes.

Brood Year	Stock	Hatchery	Life Stage	Release Date (1)	Release Data (2)	Fish/ lb	Number Released	Release LoCation	CWT/ Fin clip[b]
1989	Wallowa	Irrigon NFH	smolt	04/15/90	04/19/90	4.8	26,326	Spring Creek	07-51-23
1989	Wallowa	Irrigon NFH	smolt	04/15/90	04/19/90	5.9	26,771	Spring Crack	07-51-22
1989	Wallowa	Irrigon NFH	smolt	04/15/90	04/19/90	4.1	364	Spring Creek	AD-LV
1989	Wallows	Irrigon NFH	smolt	04/15/90	04/19/90	4.3	362	Spring Creek	AD-LV
1989	Wallowa	Irrigon NFH	smolt	04/15/90	04/19/90	4.8	313	Spring Creek	AD-LV
1989	Wallowa	Irrigon NFH	smolt	04/15/90	04/19/90	5.9	215	Spring Creek	AD- LV
1989	Wallowa	Irrigon NFH	smolt	04/15/90	04/19/90	4.1	18,244	Spring Creek	..
1989	Wallowa	Irrigon NFH	smolt	04115/90	04/19/90	4.3	18,346	Spring Creek	..
1989	Wallows	Irrigon NFH	smolt	04/15/90	04/19/90	4.8	51,812	Spring Creek	..
1989	Wallowa	Irrigon NFH	smolt	04/15/90	04/19/90	5.9	51,607	Spring Creek	..
1989	Wallowa	Irrigon NFH	smolt	04/19/90	--	5.1	25,961	Spring Creek	07-51-18
1989	Wallows	Irrigon NFH	-Smelt	04/19/90	--	5.1	26,231	Spring Creak	07-51-19
1989	Wallowa	Irrigon NFH	-Smelt	04/19/90	-"	5.1	655	Spring Creek	AD-LV
1989	Wallows	Irrigon NFH	smolt	04/19/90	-"	5.1	900	Spring Creak	--
1989	Wallows	Irrigon NFH	smolt	04/23/90	--	4.7	248,635	Spring Creek	AD
1989	Wallowa	Irrigon NFH	smolt	04/18/90	04/20/90	5.1	52,097	Catherine Creek	AD
1989	Wallowa	Irrigon NFH	smolt	04/20/90	--	5.6	33,180	Catherine Creek	AD
1989	Wallows	Irrigon NFH	-Smelt	04/19/90	--	4.8	223,379	Dear Creek	AD
1989	Wallowa	Irrigon NFH	smolt	04/30/90	--	5.4	50,036	Deer Creek	AD
1989	Wallowa	Irrigon NFH	smolt	04/18/90	--	5.0	12,000	Wallowa River	AD
1989	Wallows	Irrigon NFH	smolt	04/19/90	--	5.1	12,240	Wallowa River	AD
1989	Wallows	Irrigon NFH	smolt	04/27/90	--	5.4	23,220	Wallowa River	AD
	Wallows	Irrigon NFH	smolt	04/20/90	--	5.8	13,920	Wallowa River	AD
1989	Imnaha	Irrigon NFH	smolt	04126/90	--	6.7	3,216	Granola Ronde R	AD
1989	Imnaha	Irrigon NFH	smolt	04/23/90	--	6.8	27,200	Catherine Crack	AD
1989	Imnaha	Irrigon NFH	smolt	04123/90	--	6.8	21,760	Wallowa River	AD
1990	Wallowa	Cottonwood Pond	smolt	4/30191	--	5.3	252,799	Grande Ronde River	..
1990	Wallowa	Irrigon NFH	-smelt	04/08/91	04/10/91	4.9	96,094	Grande Ronde R	AD
1990	Wallowa	Irrigon NFH	smolt	04/10/91	--	5.4	49,907	Grande Ronde R	AD
1990	Wallowa	Irrigon NFH	smolt	04/30/91	--	5.7	49,037	Granola Ronde R	AD
1990	Wallows	Irrigon NFH	smolt	04/10/91	04/11/91	5.9	54,528	Grande Ronde R	AD
1990	Wallowa	Irrigon NFH	smolt	04/30/91	05/01/91	6.1	49,770	Grande Ronde R	AD
1990	Wallowa	Irrigon NFH	smolt	04122/91	--	3.9	25,868	Spring Creek	07-53-59
1990	Wallowa	Irrigon NFH	smolt	04/22/91	--	3.9	28,018	Spring Creek	07-53-60
1990	Wallowa	Irrigon NFH	smolt	04122/91	--	4.3	28,738	Spring Creek	07-54-44
1990	Wallowa	Irrigon NFH	smolt	04 /22/91	--	4.6	28,815	Spring Creek	07-54-43
1990	Wallows	Irrigon NFH	smolt	04/22/91	--	3.9	1,006	Spring Creek	AD-LV
1990	Wallowa	Irrigon NFH	smolt	04/22/91	--	4.3	285	Spring Creek	AD-LV
Iwo	Wallowa	Irrigon NFH	smolt	04122/91	--	4.6	346	Spring Crack	AO-LV
1990	Wallowa	Irrigon NFH	-Smelt	04/22/91	--	3.9	35,675	Spring Creek	..
1990	Wallowa	Irrigon NFH	smolt	04/22/91	--	4.3	174,306	Spring Creek	..
1990	Wallows	Irrigon NFH	smolt	04/22/91	--	4.6	174,089	Spring Creek	..

Table 1 (IR). (cont.) Hatchery releases of summer steelhead into the Grande Ronde River subbasin by brood yeer and if marked, by coded wire tag codes.

Brood Year	Stock	Hatchery	Life Stage	Release Date (1)	Release Date (2)	Fish/ lb	Number Released	Release Location	CWT/ Fin clip[b]
1%$0	Wallowa	Irrigon NFH	smolt	04/26/91	--	4.1	26,2S9	Spring Creek	07-53-51
1990	Wallowa	Irrigon NFH	smolt	04/26/91	--	4.4	27,267	Spring Creek	07-53-52
1990	Wallowa	Irrigon NFH	smolt	04/26/91	--	4.1	265	Spring Creek	AD - LV
1990	Wallowa	Irrigon NFH	smelt	04/26/91	--	4.4	382	Spring Creek	AD-LV
1990	Wallowa	Irrigon NFH	smolt	04/26/91	--	4.1	81,853	Spring Creek	--
1990	Wallowa	Irrigon NFH	smelt	04/26/91	--	4.4	85,761	Spring Creek	..
1990	Wallowa	Irrigon NFH	smolt	04/26/91	--	5.3	26,713	Deer Creek	07-53-53
1990	Wallowa	Irrigon NFH	smolt	04/26/91	--	5.3	24,751	Deer Creek	07-53-54
1990	Wallowa	Irrigon NFH	smolt	04/26/91	--	5.3	612	Deer Creek	AD-LV
1990	Wallowa	Irrigon NFH	smelt	04/26/91	--	5.3	411	Deer Creek	..
1990	Wallowa	Irrigon NFH	smolt	05/06/91	--	5.4	47,187	Deer Creek	AD
1990	Wallowa	Irrigon NFH	smolt	04/12/91	04/16/91	5.4	51,348	Catherine Creek	AD
1990	Wallowa	Irrigon NFH	smelt	04/11/91	04/12191	5.5	55,787	Catherine Creek	AD
1990	Wallowa	Irrigon NFH	smolt	04/11/91	--	5.9	4,366	Catherine Creek	AD

[a] Estimates of smolt releases from Irrigon, Wallowa, and Cascade hatcheries are from Oregon Department of Fish and Wildlife (unpublished data) and fry releases from Irrigon Hatchery are from Messmer et al. (1989). Estimates of smolt and fry releases from Ringgold and Tucannon hatcheries and Dworshak NFH are from Oregon Department of Fish and Wildlife et al. (1990) and from Cottonwood Pond from Washington Department of Wildlife (unpublished data). Estimates for unknown hatcheries are from Howell et al. (1985). Except where footnoted, estimates of smelt releases from Lyons Ferry Hatchery are from Oregon Department of Fish and Wildlife (unpublished data).

[b] AD = Adipose, LV = Left ventral, RV = Right ventral.

[c] Release dates unknown (only the year of release known). Standardized to the first and ast day of the year.

[d] Juveniles with this tag code were released as age 1 and 2 year old fish.

[e] Release dates unknown (only the month of release known). Standardized to the middle of the month for the month of release.

[f] Estimates are from Washington Department of Wildlife (unpublished data).

Table 2 (RH-1). Total returns of unmarked summer steelhead to the Big Canyon facility in the Grande Ronde River subbasin[a], by brood year. Estimates for each age category that are along the upward diagonal to the right of a given footnote were derived from the same reference.

	Total Age						
Brood Year	2	3	4	5	6	Total	Adult Total
1984	--	--	8	--	--	--	--
1985	--	7	9	--	--	--	--
1986	0[a]	17	--	--	--	--	--
1987	0[b]	--	--	--	--	--	--

[a] Estimate is modified from Messmer et al. (1989).
[b] Estimate is modified from Messmer et al. (1990).

Table 3 (RH-2). Total returns of Hatchery Wallowa stock summer steelhead to Wallowa Hatchery in the Grande Ronde River subbasin, by brood year. Estimates for each age category that are along the upward diagonal to the right of a given footnote were derived from the same reference.

	Total Age						
Brood Year	2	3	4	5	6	Total	Adult Total
1980	6[a]	566	44	--	--	616	616
1981	272[a]	247	2	--	--	521	521
1982	213[b]	114	19	--	--	346	346
1983	1,844[c]	1,507	10	--	--	3,361	3,361
1984	2,328[d]	1,312	2	--	--	3,642	3,642
1985	750[d]	488	7	--	--	1,245	1,245
1986	730[e]	437	--	--	--	--	--
1987	509f	.-	--	--	--	--	--

[a] Estimate is modified from Carmichael and Messmer (1985).
[b] Estimate is modified from Carmichael et al. (1986).
[c] Estimate is modified from Carmichael et al. (1987).
[d] Estimate is modified from Carmichael et al. (1988).
[e] Estimate is modified from Messmer et al. (1989).
[f] Estimate is modified from Messmer et al. (1990).

Table 4 (RH-3). Total returns of Hatchery Wallowa stock *summer* steelhead to the Big Canyon facility in the Grande Ronde River subbasin, by brood year. Estimates for each age category that are along the upward diagonal to the right of a given footnote were derived from the same reference.

	Total Age						
Brood Year	2	3	4	5	6	Total	Adult Total
1986	332[a]	124	--	--	--	--	--
1987	184[b]	--	--	--	--	--	--

[a] Estimate is modified from Messmer et al. (1989).
[b] Estimate is modified from Messmer et al. (1990).

Table 5 (RH-4). Total returns of Snake River stock summer steelhead to Wallowa Hatchery in the Grande Ronde River subbasin[a], by brood year.

	Total Age						
Brood Year	2	3	4	5	6	Total	Adult Total
1976[b]	--	--	28	--	--	--	--
1977[b]	--	177	83	--	--	--	--
1978	0	51	140	--	--	191	191

[a] Estimates are modified from Carmichael and Messmer (1985).
[b] Estimates may include Skamania stock adults returning from releases made in 1978. Total returns of Skamania stock adults are believed to be low because releases were made in the lower Grande Ronde River and few adults are believed to have returned to Wallowa Hatchery.

Table 6 (RH-5). Total returns of Pahsimeroi stock summer steelhead to Wallowa Hatchery in the Grande Ronde River subbasin, by brood year.

	Total Age						
Brood Year	2	3	4	5	6	Total	Adult Total
1979[a]	6	161	66	2	--	235	235

[a] Estimates are modified from Carmichael and Messmer (1985).

Table 7 (AL-1). Mean fork length by brood year and age class (freshwater.ocean) for Snake River stock summer steelhead collected at Wallowa Hatchery in the Grande Ronde River subbasin. Estimates within each freshwater age group that are along the upward diagonal to the right of a given footnote were derived from the same reference.

Mean Fork Length (cm)

Brood Year	1.1	1.2	1.3	2.1	2.2	2.3	3.1	3.2	3.3
1976	--	--	75	59[a]	70	--	59[a]	--	--
N	--	--	--	--	--	--	--	--	--
St. dev.	--	--	--	--	--	--	--	--	--
1977	59 [a]	69	--	59[a]	71	--	--	--	--
N	--	--	--	--	--	--	--	--	--
St. dev.	--	--	--	--	--	--	--	--	--
1978	--[a]	73	74	60[a]	72	--	--	--	--
N	--	--	--	--	--	--	--	--	--
et. dev.	--	--	--	--	--	--	--	--	--
1979	--[a]	--	--	--	--	--	--	--	--
N	--	--	--	--	--	--	--	--	--
St . dev.	--	--	--	--	--	--	--	--	--

[a] Estimate is modified from Carmichael and Messmer. (1985).

Table 8 (AL-2). Mean fork length by brood year and age class (freshwater.ocean) for Pahsimeroi stock summer steelhead collected at Wallowa Hatchery in the Grande Ronde River subbasin.

Mean Fork Length (cm)

Brood Year	1.1	1.2	1.3	2.1	2.2	2.3	3.1	3.2	3.3
1979	58[a]	69[a]	76[a]	62[a]	72[a]	77[b]	59[a]	67[b]	--
N	--	--	--	--	--	--	--	--	--
st. dev.	--	--	--	--	--	--	--	--	--

[a] Estimate is modified from Carmichael and Messmer. (1985).
[b] Estimate is modified from Carmichael et al. (1986).

Table 9 (AL-3). Mean fork length by brood year and age class (freshwater.ocean) for Hatchery Wallowa stock summer steelhead collected at Wallowa Hatchery in the Grande Ronde River subbasin. Estimates within each freshwater age group that are along the upward diagonal to the right of a given footnote were derived from the same reference.

Mean Fork Length (cm)

Brood Year	1.1	1.2	1.3	2.1	2.2	2.3	3.1	3.2	3.3
1980	58[a]	68	75	55[a]	70	--	47[b]	--	--
N	--	--	--	--	--		--	--	--
St. dev.	--	--	--	--	--		--	--	--
1981	58[a]	70	--	60[b]	69	--	--	--	--
N	--	--	--	--	--	--	--	--	--
St. dev.	--	--	--	--	--	--	--	--	--
1982	59[b]	69	--	62[c]	72	--	--	--	--
N	--	--	--	--	--	--	--	--	--
St. dev.	--	--		--	--	--	--	--	--
1983	61[c]	72	77	61[d]	74	--	--	--	--
N	--	--	--	--	--	--	--	--	--
St. dev.	--	.-	--	--	--	--	--		--
1984	58d	70	--	60[d]	73	--	--	--	--
N	--	--	--	--	--	--	--	--	--
St . dev.	--	--	--	--	--	--	--		--
1985	60d	70	76	63[e]	73	--	58[f]	--	--
N	--	--	--	--	--	--	--	--	--
St . dev.	--	--	--	--	--	--	--	--	--
1986	59[e]	71	--	65[f]	--	--		--	--
N	--	--	--	--	--	--	--	--	--
St. dev.	--	--	--	--	--	--	--	--	--
1987	59[f]	--	--	--	--	--	--	--	--
N	--	--	--	--	--	--	--	--	--
St. dev.	--	--	--	--	--	--	--		--

[a] Estimate is modified from Carmichael and Messmer. (1985).
[b] Estimate is modified from Carmichael et al. (1986).
[c] Estimate is modified from Carmichael et al. (1987).
[d] Estimate is modified from Carmichael et al. (1988).
[e] Estimate is modified from Messmer et al. (1989).
[f] Estimate is modified from Messmer et al. (1990).

Table 10 (AL-4). Mean fork length by brood year and age class (freshwater.ocean) for Hatchery Wallowa stock summer steelhead collected at the Big Canyon facility in the Grande Ronde River subbasin. Estimates within each freshwater age group that are along the upward diagonal to the right of a given footnote were derived from the same reference.

Mean Fork Length (cm)

Brood Year	1.1	1.2	1.3	2.1	2.2	2.3	3.1	3.2	3.3
1986	58 [a]	71	--	62[b]	--	--	--	--	--
N	89	67	--	21	--	--	--	--	--
st. dev.	--	--	--	--	--	--	--	--	--
1987	59[b]	--	--	--	--	--	--	--	--
N	97	--	--	--	--	--	--	--	--
st. dev.	--	--	--	--	--	--	--	--	--

[a] Estimate is modified from Messmer et al. (1989).
[b] Estimate is modified from Messmer et al. (1990).

Table 11 (AC-l). Age composition (freshwater.ocean) by brood year for Hatchery Wallowa stoc
collected at Wallowa Hatchery in the Grande Ronde River subbasin. Estimates within eac
that are along the upward diagonal to the right of a given footnote were derived from th

		Age Composition (%)									
Brood Year	N	1.1	1.2	1.3	1.4	2.1	2.2	2.3	2.4	3.1	3.2
1980	--	1[a]	<1	1	--	92[a]	5	0	--	<1[b]	--
1981	--	52 [a]	43	0	--	4[b]	1	0	--	0[c]	--
1982	--	61[b]	24	0	--	9[c]	6	0	--	0[d]	--
1983	--	55[c]	44	<1	--	<1[d]	<1	0	--	0[d]	--
1984	--	64[d]	35[d]	0[e]	--	<1[d]	<1[e]	0[f]	--	0[e]	--

a Sample size used to estimate age composition, by brood year, was derived from data in Car

b ~~P~~'size used to estimate age composition, by brood year, was derived from data in Carm

[c] Sample size used to estimate age composition, by brood year, was derived from data in Carm

d Sample size used to estimate age composition, by brood year, was derived from data in Carmic

[e] Sample size used to estimate age composition, by brood year, was derived from data in Mess

[f] Sample size used to estimate age composition, by brood year, was derived from data in Mess

Table 12 (AC-2). Age composition (freshwater.ocean) by brood year for Pahsimeroi stock summer steelhead collected at Wallowa Hatchery in the Grande Ronde River subbasin[a].

Brood Year	N	Age Composition (%) 1.1	1.2	1.3	1.4	2.1	2.2	2.3	2.4	3.1	3.2	3.3
1979	--	2	12	<1	--	57	27	<1	--	1	<1	--

[a] Sample size used to estimate age composition, by brood year, for the 1979 brood year was derived from data in Carmichael and Messmer (1985).

Table 13 (AC-3). Age composition (freshwater.ocean) by brood year for Snake River stock summer steelhead collected at Wallowa Hatchery in the Grande Ronde River subbasin[a].

Brood Year	N	Age Composition (%) 1.1	1.2	1.3	1.4	2.1	2.2	2.3	2.4	3.1	3.2	3.3
1978	--	0	2	3	--	25	70	0	--	0	--	--

[a] Sample size used to estimate age composition, by brood year, for the 1978 brood year was derived from data in Carmichael and Messmer (1985).

Table 14 (AC-a). Age composition (freshwater.ocean) by run year for Hatchery Wallowa stock summer steelhead collected at Wallowa Hatchery in the Grande Ronde River subbasin[a].

		Age Composition (%)										
Run Year	N	1.1	1.2	1.3	1.4	2.1	2.2	2.3	2.4	3.1	3.2	3.3
1985-86	1960	94	4	0	--	2	<1	0	--	0	--	--
1986-87	3855	60	39	0	--	<1	<1	0	--	0	--	--
1987-88	2073	36	62	<1	--	1	<1	0	--	0	--	--
1988-89	1220	60	39	0	--	1	<1	0	--	0	--	--
1989-90	953	53	41	<1	--	4	1	0	--	<1	--	--

[a] Estimates are modified from Carmichael et al. (1987) for the 1985-86 run year, from Carmichael et al. (1988) for the 1986-87 through 1987-88 run years, from Messmer et al. (1989) for the 1988-89 run year, and from Messmer et al. (1990) for the 1989-90 run year.

Table 15 (AC-b). Age composition (freshwater.ocean) by run year for Hatchery Wallowa stock summer steelhead collected at the Big Canyon facility in the Grande Ronde River subbasin[a].

Run Year	N	Age Composition (%)										
		1.1	1.2	1.3	1.4	2.1	2.2	2.3	2.4	3.1	3.2	3*3
1988-89	--	100	0	0	--	0	0	0	--	0	--	--
1989-90	--	60	36	0	--	4	0	0	--	0	--	--

[a] Estimates are modified from Messmer et al. (1989) for the 1988-89 run year and from Messmer et al. (1990) for the 1989-90 run year.

Table 16 (AS-l). Percent females by brood year and age class (freshwater.ocean) for Hatchery Wallowa stock summer steelhead collected at Wallowa Hatchery in the Grande Ronde River subbasin. Estimates within each freshwater age group that are along the upward diagonal to the right of a given footnote were derived from the same reference.

		Females (%)										
Brood Year	N	1.1	1.2	1.3	1.4	2.1	2.2	2.3	2.4	3.1	3.2	3.3
1980	--	--	--	--	--	.-	88	--	--	0[a]	--	--
1981	--	--	83	88	--	73[a]	0	--	--	--	--	--
1982	--	42[a]	71	--	--	69[b]	100	--	--	--	--	--
1983	--	49[b]	71	100	--	40[c]	75	--	--	--	--	--
1984	--	43[c]	78	--	--	90[c]	50	--	--	--	--	--
1985	--	46[c]	80	0	--	22[d]	60	--	--	100[e]	--	--
1986	--	30[d]	73	--	--	56 [e]	--	--	--	--	--	--
1987	--	33[e]	--	--	--	--	--	--	--	--	--	--

[a] Estimate is modified from Carmichael et al. (1986).
[b] Estimate is modified from Carmichael et al. (1987).
[c] Estimate is modified from Carmichael et al. (1988).
[d] Estimate is modified from Messmer et al. (1989).
[e] Estimate is modified from Messmer et al. (1990).

Table 17 (AS-2). Percent females by brood year and age class (freshwater.ocean) for Pahsimeroi stock summer steelhead collected at Wallowa Hatchery in the Grande Ronde River subbasin.

		Females (%)										
Brood Year	N	1.1	1.2	1.3	1.4	2.1	2.2	2.3	2.4	3.1	3.2	3*3
1979	--	--	--	--	--	--	--	-loos	--	--	-loos	--

[a] Estimate is modified from Carmichael and Messmer. (1985).

Table 18 (AS-3). Percent females by brood year and age class (freshwater.ocean) for Hatchery Wallowa stock summer steelhead collected at the Big Canyon facility in the Grande Ronde River subbasin. Estimates within each freshwater age group that are along the upward diagonal to the right of a given footnote were derived from the same reference.

		Females (%)										
Brood Year	N	1.1	1.2	1.3	1.4	2.1	2.2	2.3	2.4	3.1	3.2	3.3
1986	--	58	[a] 83	--	--	85[b]	--	--	--	--	--	--
1987	--	51[b]	--	--	--	--	--	--	--	--	--	--

[a] Estimate is modified from Messmer et al. (1989).
[b] Estimate is modified from Messmer et al. (1990).

Table 19 (AF-a). Mean fecundity by run year for Hatchery Wallowa stock summer steelhead returning to Wallowa Hatchery in the Grande Ronde River subbasin[a].

Run Year	N	Mean Fecundity	st. dev.
1985-86	812	5,029	--
1986-87	590	5,674	--
1987-88	551	5,493	--
1988-89	400	5,408	--
1989-90	462	5,249	--

[a] Estimates for the 1985-86 through 1989-90 run years are from Messmer et al. (1990) .

Table 20 (AE). Emigration of coded wire tagged hatchery summer steelhead released as juveniles into the Grand. Ronde River subbasin[a,b].

Hatchery/Release site	Recovery site, Run Year(s)	Recovery Method	Number Recovered	Total Number Estimated, (PSMFC)
Grande Ronde	Deschutes River	Trap Returns		
	1981	--	1	1
	1982	--	5	5
	1983	--	4	4
	1984	--	22	22
	1985	--	16	16
	1987	--	23	23
Grande Ronde	Umatilla River	Trap Returns		
	1989	--	3	3
Grande Ronde	Deschutes River	Hatchery Returns		
	1979	--	1	1
	1980	--	7	7
	1981	--	8	8
	1982	--	1	1
	1983	--	11	11
	1984	--	--	--
	1985	--	3	3
	1986	--	--	--
	1987	--	9	9
	1988	--	16	16
	1989	--	3	3

[a] Based on the following tag codes: 07-16-14, 07-16-27, 07-22-01, 07-22-02, 07-37-62, 07-37-63, 07-38-01, 07-38-02, 07-40-25, 07-40-26, 07-41-25, 07-41-26, 09-06-13, 09-16-36, 62-16-27, 63-28-39, 63-28-40, 63-33-06, 63-38-43.

[b] Estimates are modified from the Pacific States Marine Fisheries Commission coded wire tag database.

Table 21 (TD). Parasites and diseases of summer steelhead at hatcheries releasing juveniles into the Grande Ronde River subbasin[a].

Disease type	Hatchery	Specific Pathogen
Parasite	Irrigon	*Ichthyobodo sp.* (Costia)
Parasite	Irrigon	*Ichthyophthirius sp.* (Ich)
Paraeite	Irrigon	*Gyrodactylus*
Parasite	Wallowa	*Ceratomyxa shasta*
Parasite	Unknown[c]	*Myxidium minteri*
Parasite	Unknown[c]	*Dermocystidium sp.*
Parasite	Unknown[c]	*Chloromyxum sp.*
Bacteria	Irrigon	*Flexibacter columnaris* (Columnaris)
Bacteria	Irrigon	*Flexibacter psychrophilus*
Bacteria	Irrigon	Bacterial gill disease
Bacteria	Irrigon	*Aeromonas spp.*
Bacteria	Irrigon	*Pseudomonas spp.*
Bacteria	Irrigon	Motile gill bacteria
Bacteria	Irrigon	*Renibacterium salmoninarum* (Bacterial kidney disease)
Bacteria	Irrigon[b]	*Cytophaga psychrophila* (Cold water disease)
Bacteria	Wallowa	*Aeromonas spp.*
Bacteria	Wallowa	*Pseudomonas spp.*
Bacteria	Wallowa	*Renibacterium salmoninarum* (Bacterial kidney disease)
Bacteria	Wallowa	*Yersinia ruckeri* (Enteric Red Mouth disease)
Bacteria	Wallowa	*Myxobolus cerebralis* (Whirling disease)
Bacteria	Wallowa[c]	Bacterial gill disease
Bacteria	Wallowa[c]	*Ichthyobodo sp.* (Costia)
Bacteria	Wallowa[c]	*Flexibacter columnaris* (Columnaris)
Bacteria	Wallowa	*Flexibacter psychrophilus*
Bacteria	Unknown[c]	*Cytophaga psychrophila* (Cold water disease)
Bacteria	Cascade[c]	*Renibacterium salmoninarum* (Bacterial kidney disease)
Bacteria	Cottonwood Pond[d]	*Renibacterium salmoninarum* (Bacterial kidney disease)
Bacteria	Lyons Ferry[d]	*Flavobacterium cytophaga*
Virus	Irrigon	Erythrocytic Inclusion Body Syndrome (EIBS)
Virus	Wallowa[b]	Infectious Hematopoietic Necrosis (IHN)
Virus	Lyons Ferry[d]	Infectious Hematopoietic Necrosis (IHN)

Table 21 (TD). (cont.) Parasites and diseases of summer steelhead at hatcheries releasing juveniles into the Grande Ronde River subbasin[a].

Disease type	Hatchery	Specific Pathogen
Virus	Lyons Ferry[d]	Erythrocytic Inclusion Body Syndrome (EIBS)
Fungi	Irrigon	*Phoma herbarum* (Internal fungi)
Fungi	Irrigon[b]	External fungi
Fungi	Wallowa[b]	External fungi

[a] Except where footnoted, data are from a letter dated 2/92 from Warren Groberg, Oregon Department of Fish and Wildlife, Fish Pathology, La Grande, Oregon.
[b] Data are from a telephone interview on 1/9/92 with Warren Groberg, Oregon Department of Fish and Wildlife, Fish Pathology, La Grande, Oregon.
[c] Data are from Howell et al. (1985).
[d] Data are from Washington Department of Wildlife unpublished data).

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IMNAHA RIVER SUBBASIN

Naturally Produced Spring Chinook Salmon

GEOGRAPHIC LOCATION

The Imnaha River subbasin covers 980 square miles in the extreme northeast corner of Oregon. From its source in the Wallowa Mountains, the Imnaha River flows north to northeast to where it enters the Snake River at RM 191.7 (Figure 1); approximately 516 miles from the mouth of the Columbia River. The mouth of the Imnaha River is located above Bonneville, The Dalles, John Day, and McNary dams in the mainstem Columbia River and Ice Harbor, Lower Monumental, Little Goose, and Lower Granite dams in the mainstem Snake River.

ORIGIN

Spring chinook are indigenous to the Imnaha River subbasin. Columbia River run timing for these fish is late spring, early summer, perhaps more appropriately calling these fish summer chinook. The distinction between spring and summer chinook is artificial and the Imnaha run timing overlaps it (Personal communication with Brad Smith 10/1/92, District Fish Biologist, Oregon Department of Fish and Wildlife, Enterprise, Oregon). Non-indigenous stocks introduced into the subbasin include the Snake River and Lookingglass Creek stocks (see IMNAHA RIVER SUBBASIN, Hatchery Produced Spring Chinook Salmon, PRODUCTION).

DISTRIBUTION

Subbasin

Spring chinook were historically distributed throughout the mainstem and major tributaries of the Imnaha River. There are currently no man-made barriers that block spring chinook from historical spawning and rearing areas. Mud and debris slides resulting from habitat degradation may in some years impede or block passage of upstream migrants. Spring chinook primarily spawn in "the mainstem (a 30-mile section from Freezeout Creek to the Blue Hole), Big Sheep Creek (an 11.5-mile section from Coyote Creek to 0.25 miles above Lick Creek) and Lick Creek (a 2.8-mile section from the confluence to the crossing of Forest Service Road 39)" ('Thompson and Haas 1960, cited by Nez Perce Tribe of Idaho 1990) and (Carmichael and Boyce 1986, cited by Nez Perce Tribe of Idaho et al. 1990). Spawning was documented for the first time in the South Fork Imnaha River in 1988 (Nez Perce Tribe of Idaho et al. 1990). The quality of the spawning and rearing habitat varies throughout the subbasin (Tables 1 and 2).

Approximations of the temporal distribution of adult immigration, adult holding, incubation, emergence, rearing, and juvenile outmigration are presented in Figure 2 (Nez Perce Tribe of Idaho et al. 1990). The methodology that was used to generate these approximations is unknown.

PRODUCTION

Harvest

Sport

Subbasin: The sport fishery was closed in 1974 and has remained closed through the 1991 run year. There are no brood year specific estimates prior to the 1974 season closure. Run year specific estimates are available from Oregon Department of Fish and Wildlife (unpublished data).

Treaty

Subbasin: The **Imnaha** River subbasin is located on lands ceded to the United States by the Nez Perce Tribe of Idaho. The Nez Perce Tribe of Idaho along with the Confederated Tribes of the **Umatilla** Indian Reservation have reserved usual and accustomed fishing sites located within the subbasin.

Tribal ceremonial and subsistence fisheries are allowed to harvest spring chinook at target levels jointly established by the Oregon Department of Fish and Wildlife and the Nez Perce Tribe of Idaho. "The only data available for tribal chinook harvest is from 1973 when 39 Indians harvested 54 chinook in four days. The Nez Perce Tribe closed their subsistence fishing for chinook in 1984 and had a partial closure in 1985. The fishery has been open during all other years, however, tribal **harvest** is considered to be insignificant" (Carmichael and Boyce 1986, cited by Nez Perce Tribe of Idaho et al. 1990).

ADULT LIFE HISTORY

Escapement

Subbasin

Timing: Spring chinook return to the **Imnaha** River subbasin from early May through early August (Smith 1975, cited by Howell et al. 1985).

Spawning Area

Timing: Data collected from spawning ground surveys indicates that spawning occurs **from** August through early September with peak spawning occurring around the last week of August. An approximation of the temporal distribution of spawning is presented in Figure 2 **(Nez Perce** Tribe of Idaho et al. 1990). The methodology that was used to generate this approximation is unknown.

Fry emerge in February **(Gaumer** 1968, cited by Howell et al. 1985).

Numbers: There are no brood year specific estimates of spawner escapement to the **Imnaha** River subbasin. Spawning ground counts are available **from** Oregon Department of Fish and Wildlife (unpublished data).

- -

No information is available on the immigration of naturally produced spring chinook into the **Imnaha** River subbasin.

Few stray hatchery spring chinook have been recovered on spawning ground surveys or at hatchery facilities located in the subbasin (Table 3). Recoveries include one stray fish that was released as a juvenile fish in the Rapid River. Coded wire tag recoveries were primarily from hatchery jacks and adults returning from subbasin hatchery production releases (Table 3).

Fork Length

Fork length was estimated for spring chinook collected at trapping facilities located in the Imnaha River subbasin (see IMNAHA RIVER SUBBASIN, Hatchery Produced Spring Chinook Salmon, ORIGIN). Age was determined based on a combination of scale analyses and tag code.

Annual estimates of mean fork length ranged from 52 cm to 58 cm for age 3 fish, 76 cm to 79 cm for age 4 fish, 93 cm to 95 cm for age 5 fish, and 112 cm to 122 cm for age 6 fish (Table 4).

Age Structure

Age structure was estimated for spring chinook collected on spawning ground surveys and at trapping facilities located in the Imnaha River subbasin (see ADULT LIFE HISTORY, Fork Length). Age was determined based on a combination of scale analyses and tag code.

Spring chinook return to the Imnaha River subbasin as three year old jacks and 4, 5, and 6 year old fish with the greatest percentage returning as three and four year old fish (Tables 5-7). Annual estimates of age structure, by brood year, ranged from 5% to 12% age 3 fish, 28% to 73% age 4 fish, 15% to 67% age 5 fish, and was O% for age 6 fish (Table 5).

Annual estimates of age structure, by run year, ranged from O% to 29% age 3 fish, 18% to 72% age 4 fish, 16% to 81% age 5 fish, and O% to 3% age 6 fish (Tables 6 and 7).

Sex Ratio

Sex ratios (percent females) were estimated for spring chinook collected at trapping facilities located in the Imnaha River subbasin (see ADULT LIFE HISTORY, Fork Length). Some misidentification of early run fish may have occurred but the numbers are believed to be low. Age was determined based on a combination of scale analyses and tag code.

Annual estimates of sex ratio was O% for age 3 fish; ranged from 27% to 40% for age 4 fish and 68% to 79% for age 5 fish; and was O% for age 6 fish (Table 8).

Fecundity

Fecundity was estimated for spring chinook collected at trapping facilities located in the Imnaha River subbasin (see ADULT LIFE HISTORY, Fork Length). Fecundity, by age class, was determined by estimating the number of eggs per gram in a sub-sample of eggs taken from a female and then multiplying the estimate by the estimate of total grams of eggs spawned. Added to the total estimate was the number of eggs retained in the carcass. Age was determined based on a combination of scale analyses and tag code.

Annual estimates of fecundity ranged from 3,890 to 4,340 eggs per female for age 4 fish and 4,920 to 6,430 eggs per female for age 5 fish (Table 9).

JUVENILE LIFE HISTORY

Age Structure

Spring chinook migrate as age 1 + smelts (see ADULT LIFE HISTORY, Age structure, Tables 5-7).

Migration Timing

Fingerlings migrate extensively through the upper Imnaha River from July through September but 'few moved through lower Big Sheep Creek or the lower Imnaha apparently because of high water temperatures in the lower reaches. From October to December, as water temperatures decreased, young of the year (modal size 7.5 cm) migrated through the lower Imnaha and Big Sheep Creek and into the Snake River, where they reared until the following spring" (Howell et al. 1985). Data indicates that "juvenile chinook may move into many smaller tributaries in the lower river to rear, even though adults do not spawn in them because of low water" (Gaumer 1968, cited by Howell et al. 1985).

Smelts migrate through both the upper and lower Imnaha River subbasin from March through June. "Few yearling chinook were left in the river by late summer. Most of the larger fish trapped in lower Big Sheep Creek were precocious males" (Gaumer 1968, cited by Howell et al. 1985).

"Imnaha juvenile chinook primarily emigrated past Ice Harbor and McNary dams in April and May. Most of these fish were yearlings; however, 35% (13 of 37 recoveries of marked fish) were 2-year olds" (Howell et al. 1985).

BIOCHEMICAL-GENETIC CHARACTERISTICS .

Wild juvenile spring chinook from the Imnaha River were analyzed electrophoretically at selected protein-coding loci. Relative allele nobilities and allele frequencies were determined for 18 enzyme systems (Appendix Tables 1 and 3). No rare alleles were detected.

Schreck et al. (1986) classified Columbia River Basin chinook salmon into several clusters of similar stocks based on biochemical, morphological and life history characters. Columbia River Basin chinook stocks segregate into two primary groups. The first group contains spring chinook from east of the Cascade Mountains and summer chinook from Idaho. The second group contains spring chinook from west of the Cascades, summer chinook from the upper Columbia, and all fall chinook stocks. The first primary group is composed of 4 subgroups. At the subgroup level, wild spring chinook from the Imnaha River were found to be most similar to other stocks of wild spring chinook from the lower Snake and upper Columbia rivers, and Round Butte Hatchery spring chinook. This subgroup is characterized by the earliest average time of spawning, the highest average length of the anal fin base and interorbital width, and the lowest average number of branchiostegal rays. This subgroup also has the greatest average frequency of the common tripeptide aminopeptidase allele. The spawning areas of this subgroup of stocks have a steeper average slope than the other subgroups.

Figure 1. The Imnaha River subbasin.

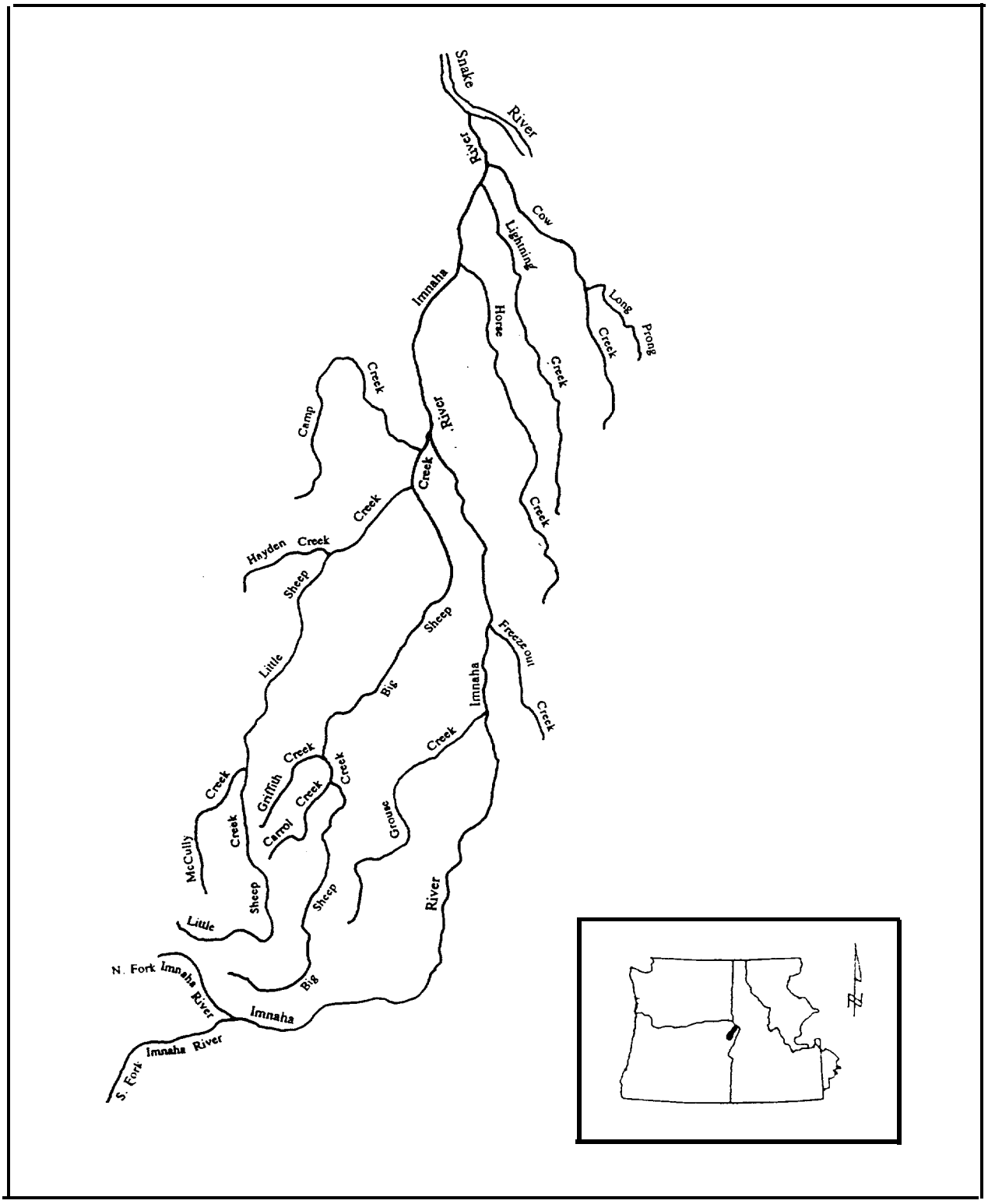
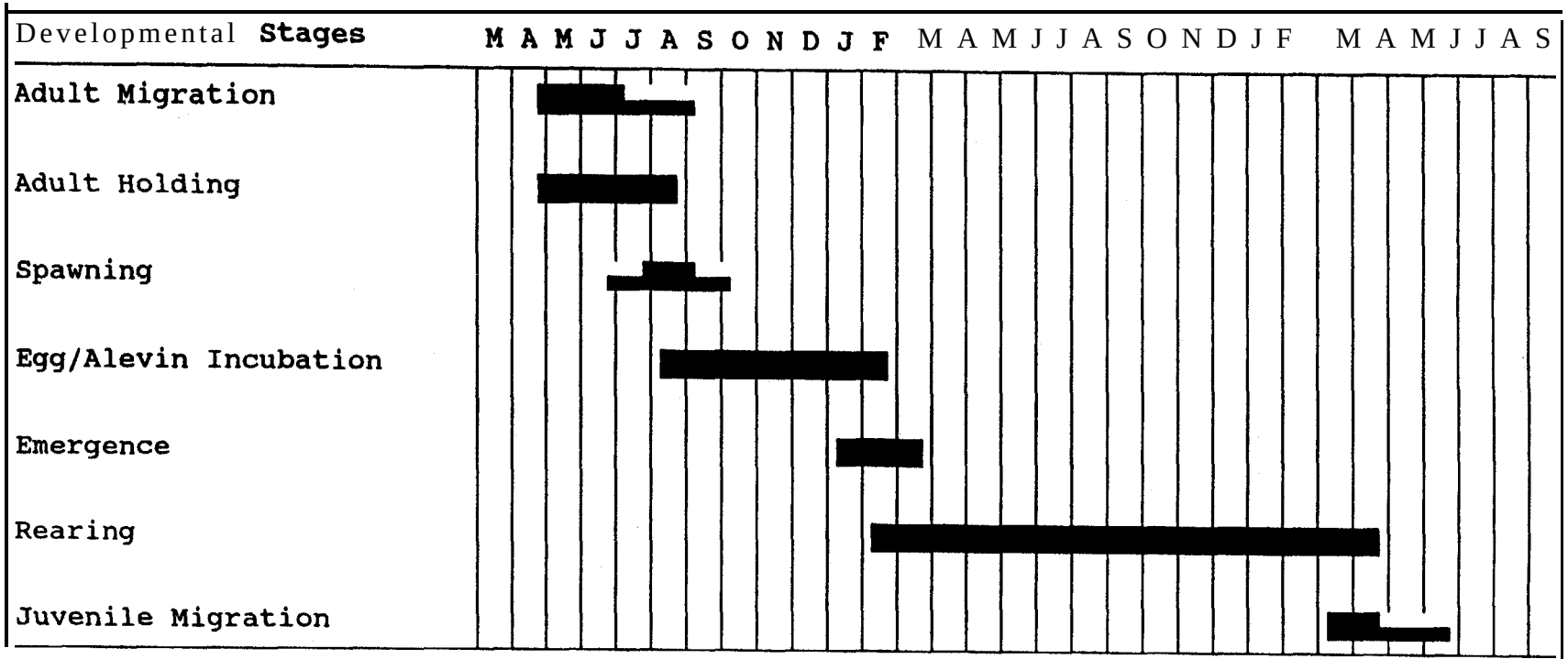


Figure 2 (TT). Freshwater **life** history for **wild** and natural spring/summer chinook, Imnaha **River subbasin** (Nez **Perce Tribe** of Idaho et al. 1990).



Notes:

1. The developmental stage timing represents basin-wide averages, local conditions may cause some variability.

2. Double thick bars indicate periods of heaviest adult migration, spawning and juvenile outmigration.

Table 1 (HB-1). Estimated amount of spawning and rearing habitat by quality of Imnaha River subbasin spring chinook salmon production area[a].

Distance/ Area	Excellent	Good	Fair[b]	Poor[b]	Unknown	Total	Confi-dence
Miles (%)	75.8	0.0	0.0	24.2	--	90.8	--
Acres (%)	--	--	--	--	--	--	--

[a] Estimates are modified from the Northwest Power Planning Council's presence/absence database.
[b] Ratings of fair and poor habitat quality may reflect natural physical features such as waterfall barriers, as well as degradation caused by humans.

Table 2 (HB-2). Estimated amount of rearing only habitat by quality of Imnaha River subbasin spring chinook salmon production area[a].

Distance/ Area	Excellent	Good	Fair[b]	Poor[b]	Unknown	Total	Confi-dence
Miles (%)	100.0	0.0	0.0	0.0	--	44.0	--
Acres (%)	--	--	--	--	--	--	--

[a] Estimates are modified from the Northwest Power Planning Council's presence/absence database.
[b] Ratings of fair and poor habitat quality may reflect natural physical features such as waterfall barriers, as well as degradation caused by humans.

Table 3 (AI). Non-harvest recoveries of coded wire tagged hatchery spring chinook salmon in the Imnaha River subbasin[a, b]

Hatchery/Release site	Recovery site, Run Year(s)	Recovery Method	Number Recovered	Total Number Estimated, (PSMFC)
Imnaha River	Imnaha River 1988	Spawner Surveys --	3	3
Imnaha River	Imnaha River 1985	Trap Returns --	13	13
	1986	--	15	15
	1987	--	22	22
	1988	--	17	17
Snake River[c]	Imnaha River 1988	Trap Returns --	1	1
Rapid River	Imnaha River 1988	Trap Returns --	1	1
Grande Ronde	Imnaha River 1986	Trap Returns --	3	3

[a] Based on the following tag codes: 07-28-20, 07-28-60, 07-30-12, 07-30-13, 07-30-16, 07-30-17, 07-33-63, 10-30-15, 23-18-63.
[b] Estimates are modified from the Pacific States Marine Fisheries Commission coded wire tag database.
[c] This fish is assumed to have originated from the Imnaha River subbasin based on the fact that few strays are recovered in the subbasin.

Table 4 (AL) . Mean fork length by brood year and age class (freshwater.ocean) for Imnaha River wild spring chinook salmon collected at the Imnaha River weir in the Imnaha River subbasin. Estimates within each freshwater age group that are along the upward diagonal to the right of a given footnote were-derived from the same reference.

Mean Fork Length (cm)

Brood Year	1.1	1.2	1.3	1.4	2.1	2.2	2.3	2.4
1979		--	--	--		--	--	112
N	--	--	--	--		--	--	--
St. dev.	--	--	--	--	--	--	--	--
1980		--	--	--	--	--	94	--
N	--	--	--	--	--	--	--	--
St. dev.	--	--	--	--	--	--	--	--
1981	--	--	--	--	--	79	93	--
N	--	--	--	--	--	--	--	--
St. dev.	--	--	--	--	--	--	--	--
1982	--	--	--	--	58[a]	77	94	--
N	. .	--	--	--	--	--	--	--
St. dev.	--	--	--	--	--	--	--	--
1983	--	--	--	--	57[b]	78	95	122
N	--	--	--	--	--	--	--	--
St. dev.	--	--	--	--	--	--		--
1984	--	--	--	--	52[c]	79[d]	94	--
N	--	--	--	--	--	--	--	--
St. dev.	--	--	--	--	--	--	--	--
1985	--	--	--	--	--	76	--	--
N	--	--	--	--	--	--	--	--
St. dev.	--	--	--		--	--	--	--
1986	--	--	--	--	57[e]	--	--	--
N	--	--	--	--	--	--	--	--
st. dev.	--	--	--	--	--	--	--	--

[a] Estimate is modified from Carmichael et al. (1986).
[b] Estimate is modified from Carmichael et al. (1987).
[c] Estimate is modified from Carmichael et al. (1988).
[d] Estimate is modified from Messmer et al. (1989).
[e] Estimate is modified from Messmer et al. (1990).

Table 5 (AC). Age composition (freshwater.ocean) by brood year for wild spring chinook salmon collected at the Imnaha River weir in the Imnaha River subbasin. Estimates within each freshwater age group that are along the upward diagonal to the right of a given footnote were derived from the same reference.

Brood Year	N	1.1	1.2	1.3	1.4	2.1	2.2	2.3	2.4	3.1	3.2	3.3
						Age Composition (%)						
1981	--	--	--	--	--	5[a]	48	47	0	--	--	--
1982	--	--	--	--	--	12[a]	73	15	0	--	--	--
1983	--	--	--	--	--	5[a]	28[b]	67[c]	0[d]	--	--	--

[a] Sample size used to estimate age composition, by brood year, was derived from data in Carmichael et al. (1987).
[b] Sample size used to estimate age composition, by brood year, was derived from data in Carmichael et al. (1988).
[c] Sample size used to estimate age composition, by brood year, was derived from data in Messmer et al. (1989).
[d] Sample size used to estimate age composition, by brood year, was derived from data in Messmer et al. (1990).

Table 6 (AC-a). Age composition (freshwater.ocean) by run year for wild Imnaha River spring chinook salmon sampled on spawning ground surveys in the Imnaha River subbasin[a].

Run Year	N	Age Composition (%) 1.1	1.2	1.3	1.4	2.1	2.2	2.3	2.4	3.1	3.2	3.3
1961	--	--	--	--	--	14	32	54	0	--	--	--
1962	--	--	--	--	--	5	57	38	0	--	--	--
1963	--	--	--	--	--	18	32	50	0	--	--	--
1964	--	--	--	--	--	5	56	38	1	--	--	--
1965	--	--	--	--	--	10	60	30	0	--	--	--
1966	--	--	--	--	--	13	36	52	0	--	--	--
1967	--	--	--	--	--	3	64	31	1	--	--	--
1968	--	--	--	--	--	1	39	59	1	--	--	--
1969	--	--	--	--	--	4	58	38	0	--	--	--
1970	--	--	--	--	--	0	41	57	2	--	--	--
1971	--	--	--	--	--	10	59	30	1	--	--	--
1972	--	--	--	--	--	1	23	76	0	--	--	--
1973	--	--	--	--	--	0	24	76	0	--	--	--
1974	--	--	--	--	--	0	44	53	3	--	--	--
1975	--	--	--	--	--	0	19	81	0	--	--	--
1976	--	--	--	--	--	0	57	43	0	--	--	--

[a] Estimates are from Bennett (1975) and Oregon Department of Fish and Wildlife (unpublished data), as cited by Howell et al. (1985).

Table 7 (AC-b). Age composition (freshwater.ocean) by run year for wild Imnaha River spring chinook salmon collected at the Imnaha River weir in the Imnaha River subbasin[a].

Run Year	N	Age Composition (%)										
		1.1	1.2	1.3	1.4	2.1	2.2	2.3	2.4	3.1	3.2	3*3
1984	36	--	--	--	--	29	34	37	0	--	--	--
1985	151	--	--	--	--	21	62	16	1	--	--	--
1986	319	--	--	--	--	7	64	29	0	--	--	--
1987	165	--	--	--	--	2	72	26	0	--	--	--
1988	358	--	--	--	--	5	18	77	0	--	--	--
1989	264	--	--	--	--	14	46	40	0	--	--	--

[a] Estimates are modified from Carmichael et al. (1987) for the 1984-86 run years, from Carmichael et al. (1988) for the 1987 run year, from Messmer et al. (1989) for the 1988 run year, and from Messmer et al. (1990) for the 1989 run year.

Table 8 (AS). Percent females by brood year and age class (freshwater.ocean) for wild spring chinook salmon collected at the Imnaha River weir in the Imnaha River subbasin. Estimates within each freshwater age group that are along the upward diagonal to the right of a given footnote were derived from the same reference.

		Females (%)										
Brood Year	N	1.1	1.2	1.3	1.4	2.1	2.2	2.3	2.4	3.1	3.2	3.3
1979	--	--	--	--	--	--	--	--	0	--	--	--
1980	--	--	--	--	--	--	--	79	--	--	--	--
1981	--	--	--	--	--	--	37	71	--	--	--	--
1982	--	--	--	--	--	0[a]	29	77	--	--	--	--
1983	--	--	--	--	--	0[b]	27	68	--	--	--	--
1984	--	--	--	--	--	0[c]	40	69	--	--	--	--
1985	--	--	--	--	--	0[d]	27	--	--	--	--	--
1986	--	--	--	--	--	0[e]	--		--	--	--	--

[a] Estimate is modified from Carmichael et al. (1986).
[b] Estimate is modified from Carmichael et al. (1987).
[c] Estimate is modified from Carmichael et al. (1988).
[d] Estimate is modified from Messmer et al. (1989).
[e] Estimate is modified from Messmer et al. (1990).

Table 9 (AF). Mean fecundity by brood year and age class (freshwater.ocean) for Imnaha River wild spring chinook salmon collected at the Imnaha River weir in the Imnaha River subbasin[a].

	Fecundity (eggs/female)							
Brood Year	1.1	1.2	1.3	1.4	2.1	2.2	2.3	2.4
1983	--	--	--	--	--	--	6,430	--
N	--	--	--	--	--	--	--	--
St. dev.	--	--	--	--	--	--	--	
1984	--	--	--	--	--	3,890	4,920	--
N	--	--	--	--	--	--	--	--
St. dev.	--	--	--	--	--	--	--	
1985	--	--	--	--	--	4,340	--	--
N	--	--	--	--	--	--	--	--
St. dev.	--	--	--	--	--	--	--	--

[a] Estimates are from Oregon Department of Fish and Wildlife (unpublished data).

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IMNAHA RIVER SUBBASIN

Hatchery Produced Spring Chinook Salmon

ORIGIN

The frost recorded release of juvenile hatchery fish into the subbasin is the 1982 brood release from the Hatchery Imnaha stock (Table 1). The subbasin was supplemented with juvenile hatchery fish from 1983-86 and from 1988-91 (Table 1). Hatchery adults were outplanted into the subbasin in 1966 (Table 1). Non-indigenous stocks introduced into the subbasin include the Snake River and Lookingglass Creek stocks (Table 1). Broodstock, for the current hatchery program, was developed from the Imnaha stock of spring chinook.

The Hatchery Imnaha stock was developed from native fish returning to the Imnaha River subbasin. Temporary trapping facilities were first installed in 1982 to collect hatchery brood stock. The trapping facilities were located at RM 46 in the mainstem of the Imnaha River. The trapping facility was installed late in the year and collected wild fish from the latter part of the run. A permanent trapping facility which includes a fish ladder and mechanical and electrical weirs was installed in 1988 at the same location. This trapping facility (Imnaha weir) is approximately 29.5 miles south of Imnaha, Oregon and is used to collect hatchery broodstock from both early and late components of the run.

Because of the low numbers of hatchery fish returning to the collection facilities a large percentage of the hatchery broodstock was comprised of wild fish. Because the hatchery program was only recently developed and because few hatchery fish were incorporated into the hatchery broodstock it is ‘believed that the Hatchery Imnaha stock may not be a unique hatchery stock.

The current hatchery program is designed to be in compliance with Oregon’s wild fish policy. Hatchery fish are only allowed to comprise up to 50% of the spawning population above the Imnaha River weir and the hatchery program collects no more than 50% of the wild run for hatchery broodstock.

DISTRIBUTION

Subbasin

Juvenile hatchery spring chinook are released at only two locations in the Imnaha River subbasin. Sites are located in the mainstem of the Imnaha River and in Big Sheep Creek (Table 1). Current releases of juvenile hatchery spring chinook are all made from the Imnaha Facility on the mainstem Imnaha River (Personal communication with Brad Smith 10/1/92, District Fish Biologist, Oregon Department of Fish and Wildlife, Enterprise, Oregon). Hatchery Imnaha stock smelts destined for release into the Imnaha River subbasin in 1987 (1985 brood) were released into the Grande Ronde River subbasin because of disease concerns at Lookingglass Hatchery.

Approximations of the temporal distribution of adult immigration, adult holding, incubation, emergence, rearing, and juvenile outmigration of hatchery reared spring/summer chinook are presented in Figure 1 (Nez Perce Tribe of Idaho et al. 1990). The methodology that was used to generate these approximations is unknown.

PRODUCTION

Releases

Egg

There are no records of releases in the subbasin.

Fry

There are no records of releases in the subbasin.

Fingerling

Hatchery facilities in which fingerlings were reared or acclimated prior to release in the subbasin include Lookingglass Hatchery (Table 1). One release of 56,235 fish was made in 1984 (Table 1). Size at release was 24.4 fish per pound (Table 1).

Smelt

Hatchery facilities in which smelts were reared or acclimated prior to release in the subbasin include Lookingglass Hatchery (Table 1). Annual numbers released ranged from 4,296 to 447,749 (Table 1). Size at release ranged from 32.0 to 8.8 fish per pound (Table 1).

Jack and Adult

There are only two recorded releases of adult spring chinook into the Imnaha River subbasin. Adult fish were collected at Hells Canyon Dam in 1966. There were 101 adults released into the Imnaha River and 18 adult fish released into Lick Creek (Table 1).

Harvest

sport

Subbasin: The sport fishery was closed beginning with the 1977 run year and has remained closed through the 1991 run year. There are no plans to re-open the fishery until both hatchery broodstock and subbasin escapement goals can be met. No estimates of historical harvest are available.

Treaty

Subbasin: The Imnaha River subbasin is located on lands ceded to the United States by the Nez Perce Tribe of Idaho. The Nez Perce Tribe of Idaho along with the Confederated Tribes of the Umat.ills Indian Reservation have reserved usual and accustomed fishing sites located within the subbasin.

Hatchery fish are not harvested at this time and no harvest is anticipated until returns exceed both hatchery broodstock needs and subbasin escapement goals. Excess hatchery fish that return to Lookingglass Hatchery, which is located in the Grande Ronde River subbasin, are made available to the tribes. No historical estimates of harvest are available.

ADULT LIFE HISTORY

Escapement

Columbia River

Timing: Data from recoveries of coded wire tagged hatchery fish, released as juvenile fish in the Imnaha River subbasin, indicate that the Hatchery Imnaha stock of spring chinook migrates through the mainstem of the Columbia River from early July through late August (Pacific States Marine Fisheries Commission unpublished data).

Hatchery Facilities

Timing: Wild and hatchery adult fish are trapped from 15 June through 14 September and are spawned from mid-August to 15 September (Carmichael et al. 1987 and 1988, and Messmer et al. 1989 and 1991). An approximation for hatchery fish of the temporal distribution of natural spawning in the subbasin is presented in Figure 1 (Nez Perce Tribe of Idaho et al. 1990). The methodology that was used to generate this approximation is unknown.

Numbers: Estimates of escapement are available at the Imnaha weir. Most fish escaping to the Imnaha weir are counted but because the trapping facility is not installed until after fish begin migrating past the trapping site an unknown percentage of the early segment of the run is not counted. Spring chinook are aged based on a combination of scale analyses and tag code.

Annual estimates of wild spring chinook escapement to the Imnaha weir, by brood year, ranged from 4 to 38 jacks and 36 to 395 adult fish (Table 2).

Annual estimates of Hatchery Imnaha stock spring chinook escapement to the Imnaha weir, by brood year, ranged from 7 to 116 jacks and 15 to 22 adult fish (Table 3).

Survival: Estimates of pre-spawning survival at hatchery facilities located in the Imnaha River subbasin are available from Carmichael et al. (1986, 1987, and 1988, and Messmer et al. 1989, 1990, and 1991).

Fork Length

Estimates of fork length are available for hatchery spring chinook collected at trapping facilities located in the Imnaha River subbasin (see ORIGIN). Estimates are available for the Hatchery Imnaha stock of spring chinook. Age was determined based on a combination of scale analyses and tag code.

Annual estimates of mean fork length ranged from 55 cm to 59 cm for age 3 fish, 71 cm to 76 cm for age 4 fish, and 87 cm to 90 cm for age 5 fish (Table 4).

Weight

Estimates of weight are available for hatchery spring chinook collected at trapping facilities located in the Imnaha River subbasin (see ORIGIN). Estimates are available for the Hatchery Imnaha stock of spring chinook. Age was determined based on a combination of scale analyses and tag code.

Annual estimates of mean weight ranged from 1.4 kg to 2.0 kg for age 3 fish, 3.5 kg to 5.0 kg for age 4 fish, and 7.2 kg to 8.4 kg for age 5 fish (Table 5).

Age Structure

Estimates of age structure are available for hatchery spring chinook collected at trapping facilities located in the Imnaha River subbasin (see ORIGIN). Estimates are available for the Hatchery Imnaha stock of spring chinook. Age was determined based on a combination of scale analyses and tag code.

Annual estimates of age structure, by brood year, ranged from 24% to 48% age 3 fish, 17% to 49% age 4 fish, 3% to 59% age 5 fish, and was O% for age 6 fish (Table 6).

Annual estimates of age structure, by run year, was 73% age 3 fish, 23% age 4 fish, and 4% age 5 fish (Table 7).

Sex Ratio

Sex ratios (percent females) are available for hatchery spring chinook collected at trapping facilities located in the Imnaha River subbasin (see ORIGIN). Estimates are available for the Hatchery Imnaha stock of spring chinook. Age was determined based on a combination of scale analyses and tag code.

Annual estimates of sex ratio was O% for age 3 fish and ranged from 20% to 68% for age 4 fish and 67% to 100% for age 5 fish (Table 8).

Fecundity

Estimates of fecundity are available for spring chinook collected at trapping facilities located in the Imnaha River subbasin (see ORIGIN) and spawned at hatchery facilities located in the Imnaha and Grande Ronde river subbasins. Estimates were derived using two separate methods. Fecundity, by age class, was determined by estimating the number of eggs per gram in a sub-sample of eggs taken from a female and then multiplying the estimate by the estimate of total grams of eggs spawned. Added to the total estimate was the number of eggs retained in the carcass. Mean fecundity, by run year, was estimated by dividing hatchery egg take by the number of females spawned. Estimates are available for the Hatchery Imnaha stock of spring chinook. Age was determined based on a combination of scale analyses and tag code.

Annual estimates of fecundity, by age category, ranged from 4,670 to 4,710 eggs per females for age 4 fish and from 5,440 to 6,420 eggs per female for age 5 fish (Table 9).

Annual estimates of mean fecundity, by run year, ranged from 4,709 to 5,673 eggs per female (Table 10).

Mark Recoveries

Few coded wire tagged hatchery fish, returning from subbasin hatchery production releases in the Imnaha River subbasin, have been recovered from spawning ground surveys or at hatchery facilities in subbasins other than the Imnaha River subbasin. Hatchery fish returning from subbasin hatchery releases were recovered in the Deschutes, Little White Salmon, and Lower Columbia river subbasins (Table 11).

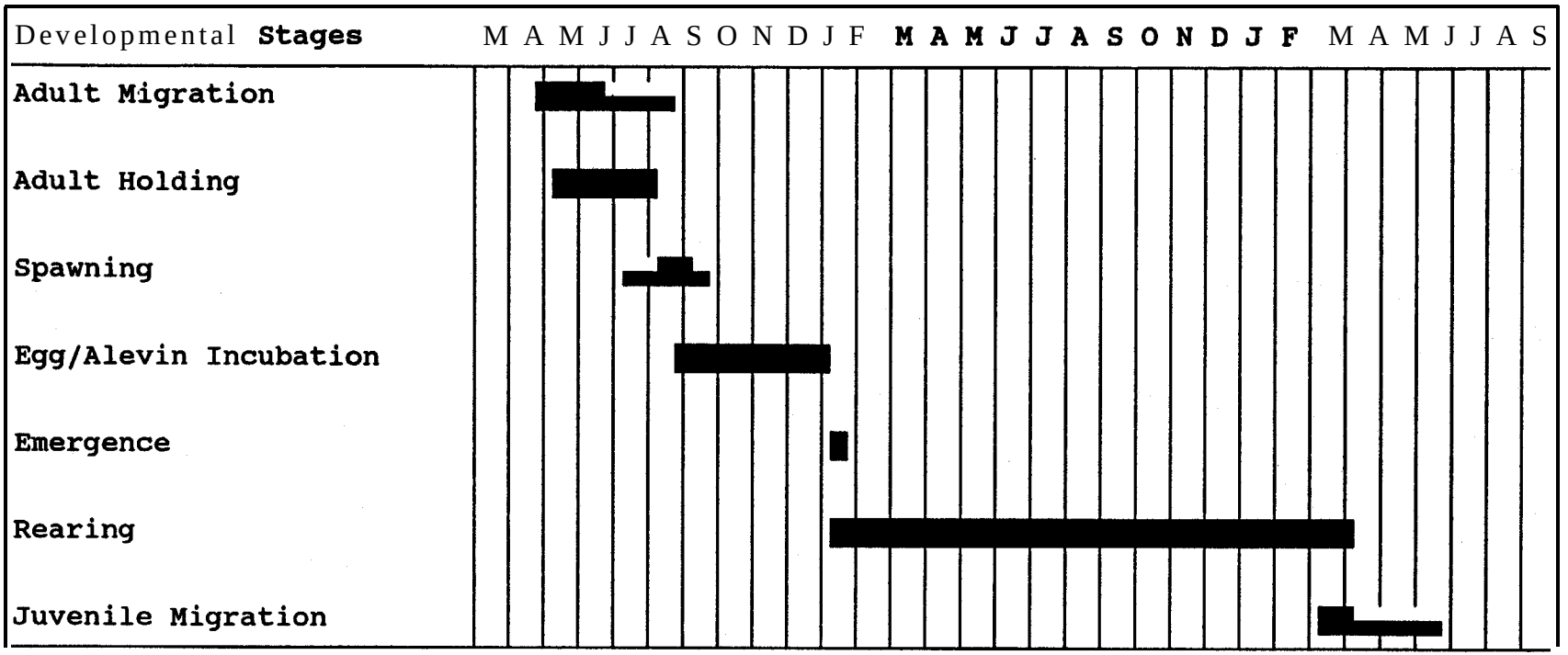
There are no freshwater recoveries, of subbasin hatchery production, reported at hatchery facilities or from spawning ground surveys outside of the Columbia River Basin.

DISEASES

Various parasites and infectious disease agents have been identified at hatchery facilities that rear or hold juvenile spring chinook prior to release in the Imnaha River subbasin (Table -12). Parasites include *Ichthyobodo sp.* (Costia), *Trichodina spp.*, and *Epistylis sp.* Bacterial diseases include *Rem"bacterium salmoninarum* (bacterial kidney disease), *Cytophaga psychrophila* (cold water disease), and *Yersinia ruckeri* (enteric red mouth disease). Viral diseases include Erythrocytic Inclusion Body Syndrome (EIBS) and Infectious Hematopoietic Necrosis (IHN).

Losses associated with bacterial and viral disease agents detected at ODFW hatchery facilities are minimized by various methods. The ODFW has a policy of disinfecting eggs by water hardening them in iodophor. This procedure is designed to kill bacterial and viral agents on the eggs and to reduce counts in the egg sac. Juvenile fish are fed erythromycin to minimize the spread of infection at hatchery facilities and to reduce mortalities associated with bacterial kidney disease (Telephone interview on 1/17/92 with Rich Holt, Oregon Department of Fish and Wildlife, Fish Pathology, Clackamas, Oregon).

Figure 1 (TT). Freshwater **life history** for hatchery reared **spring/summer** chinook, **in** the **Imnaha River subbasin** (Nez Perce **Tribe** of Idaho-et al. **1990)** .”-



Notes:

1. The developmental stage timing represents basin-wide averages, local conditions may cause some variability.

2. Double thick bars indicate periods of heaviest adult migration, spawning and juvenile outmigration.

Table 1 (TR). Hatchery releases of spring chinook salmon into the Imnaha River subbasin by brood year and if marked, by coded wire tag code[a].

Brood Year	Stock	Hatchery	Life Stage	Release Date (1)	Release Date (2)	Fish/ lb	Number Released	Release Location	CUT/ Fin clip[b]
..	Snake R	Hells Canyon Dam	adult	01/01/66	12/31/66	..	101	Imnaha River	..
..	Snake R	Hells Canyon Dam	adult	01/01/66	12/31/66	..	18	Lick Creek	..
1982	Imnaha	Lookingglass	smolt	03/22/84	..	32.0	23,970	Imnaha River	07-28-20
1982	Imnaha	Lookingglass	smolt	03/22/84	..	32.0	831	Imnaha River	AD
1982	Imnaha	Lookingglass	smolt	03/22/84	--	32.0	119	Imnaha River	No mark
1982	Lookingglass	Lookingglass	smolt	12/22/83	03/22/84	31.0	4 # 030	Imnaha River	07-28-60[c]
1982	Lookingglass	Lookingglass	smolt	12/22/83	03/22/84	31.0	190	Imnaha River	AD[c]
1982	Lookingglass	Lookingglass	smolt	12/22183	03/22/84	31.0	76	Imnaha River	No mark[c]
1983	Imnaha	Lookingglass	fing.	09/14/84	..	24.4	28,334	Imnaha River	07-30-12
1983	Imnaha	Lookingglass	fing.	09/14/84	..	24.4	27,537	Imnaha River	07-30-13
1983	Imnaha	Lookingglass	fing.	09/14/84	--	24.4	364	Imnaha River	AD
1983	Imnaha	Lookingglass	smolt	03/23/85	03/25/85	17.4	26,336	Imnaha River	07-30-16
1983	Imnaha	Lookingglass	smolt	03/23/85	03/25/85	17.4	26,745	Imnaha River	07-30-17
1983	Imnaha	Lookingglass	smolt	03/23/85	03/25/85	17.4	2,366	Imnaha River	AD
1983	Imnaha	Lookingglass	smolt	03/23/85	03/25/85	17.4	4,148	Imnaha River	No mark
1984	Imnaha	Lookingglass	smolt	03/28/86	..	10.8	34,563	Imnaha River	07-33-63
1984	Imnaha	Lookingglass	smolt	03/28/86	..	10.8	441	Imnaha River	AD
1984	Imnaha	Lookingglass	smolt	03/28/86	--	10.8	260	Imnaha River	No mark
1984	Lookingglass	Lookingglass	smolt	03/28/86	04/01/86	15.6	461	Imnaha River	07-34-01[c]
1984	Lookingglass	Lookingglass	smolt	03/28/86	04/01/86	15.6	14	Imnaha River	No mark[c]
1986	Imnaha	Lookingglass	smolt	03/21/88	..	9.9	46,760	Imnaha River	07-42-60
1986	Imnaha	Lookingglass	smolt	03/21/88	..	9.9	3,581	Imnaha River	AD
1986	Imnaha	Lookingglass	smelt	03/21/88	--	9.9	893	Imnaha River	No mark
1986	Imnaha	Lookingglass	smolt	03/22/88	..	11.0	49,711	Imnaha River	07-43-02
1986	Imnaha	Lookingglass	smolt	03/22/88	--	11.0	2,710	Imnaha River	AD
1986	Imnaha	Lookingglass	smolt	03/22/88	--	11.0	104	Imnaha River	No mark
1986	Imnaha	Lookingglass	smolt	04/20/88	..	8.9	45,343	Imnaha River	07-43-01
1986	Imnaha	Lookingglass	smolt	04/20/88	--	8.9	3,054	Imnaha River	AD
1986	Imnaha	Lookingglass	smolt	04/20/88	..	8.9	277	Imnaha River	No mark
1986	Imnaha	Lookingglass	smolt	04/21/88	..	8.8	44,536	Imnaha River	07-42-63
1986	Imnaha	Lookingglass	smolt	04/21/88	..	8.8	3,581	Imnaha River	AD
1986	Imnaha	Lookingglass	smolt	04/21/88	--	8.8	551	Imnaha River	No mark
1987	Imnaha	Lookingglass	smolt	04/05/89	..	16.0	45,195	Imnaha River	07-45-44
1987	Imnaha	Lookingglass	smolt	04/05/89	..	16.0	45,394	Imnaha River	07-45-45
1987	Imnaha	Lookingglass	smolt	04/05/89	..	16.0	44,002	Imnaha River	07-45-46
1987	Imnaha	Lookingglass	smolt	04/05/89	--	16.0	7,447	Imnaha River	AD
1987	Imnaha	Lookingglass	smolt	04/05/89	..	16.0	282	Imnaha River	No mark
1988	Imnaha	Lookingglass	smolt	03/31/90	..	12.6	51,281	Imnaha River	07-47-30
1988	Imnaha	Lookingglass	smolt	03/31/90	..	12.6	51,597	Imnaha River	07-47-29
1988	Imnaha	Lookingglass	smolt	03/31/90	..	12.6	707	Imnaha River	AD
1988	Imnaha	Lookingglass	smolt	03/31/90	..	12.6	97	Imnaha River	No mark
1988	Imnaha	Lookingglass	smolt	03/31/90	..	18.3	56,618	Imnaha River	07-47-34

Table 1 (IR). (cent.) Hatchery releases of spring chinook salmon into the Imnaha River subbasin by brood year and if marked, by coded wire tag Codes.

Brood Year	Stock	Hatchery	Life Stage	Release Data (1)	Release Date (2)	Fish/ lb	Number Released	Release LoCat i On	CWT/ Fin clip[b]
1988	Imnaha	Lookingglass	smolt	03/31/90	·-	18.3	56,514	Imnaha River	07-47-33
1988	Imnaha	Lookingglass	Smelt	03/31/90	··	18.3	1,359	Imnaha River	AD
1988	Imnaha	Lookingglass	molt	03/31/90	··	18.3	13,881	Imnaha River	No mark
1988	Imnaha	Lookingglass	smolt	03/31/90	··	15.3	20,988	Imnaha River	No mark
198s	Imnaha	Lookingglass	smolt	04/02/90	··	18.6	36,456	Imnaha River	No mark
19s8	Imnaha	Looki ngglass	Smelt	04/03/90	04/04/90	19.2	78,298	Imnaha River	No mark
1988	Imnaha	Look ingglass	Smelt	04/02/90	··	18.3	49,329	Big Sheep Cr	No mark
1988	Imnaha	Lookingglass	Smelt	04/02/90	··	18.6	30,624	Big Sheep Cr	No mark
1989	Imnaha	Lookingglass	Smelt	03/22/91	··	15.5	41,582	Imnaha River	07-50-40
1989	Imnaha	Looki ngglass	Smelt	03/22/91	··	15.5	1,300	Imnaha River	AD
1989	Imnaha	Lookingglass	Smelt	03/22/91	··	15.5	8,675	Imnaha River	No mark
1989	Imnaha	Lookingglass	Smelt	03/22/91	··	16.5	40,770	Imnaha River	07-40-43
1989	Imnaha	Looki ngglass	Smelt	03/22/91	··	16.5	2,190	Imnaha River	AD
1989	Imnaha	Looki ngglass	Smelt	03/22/91	··	16.5	13,888	Imnaha River	No mark
1989	Imnaha	Lookingglass	Smelt	03/22/91	··	22.2	42,804	Imnaha River	07-50-45
1989	Imnaha	Looki ngglass	Smelt	03/22/91	··	22.2	340	Imnaha River	AD
1989	Imnaha	Looki ngglass	Smelt	03/22/91	··	22.2	36,510	Imnaha River	No mark
1989	Imnaha	Looki ngglass	Smelt	03/22/91	··	22.5	42,834	Imnaha River	07-50-46
1989	Imnaha	Looki ngglass	Smelt	03/22/91	··	22.5	608	Imnaha River	AD
1989	Imnaha	Lookingglass	smolt	03/22/91	··	22.5	36,169	Imnaha River	No mark
1989	Imnaha	Looki ngglass	Smelt	04/09/91	··	20.5	81,570	Imnaha River	RV
1989	Imnaha	Looki ngglass	Smelt	04/09/91	··	14.8	49,669	Imnaha River	RV

[a] Estimates sre from Oregon Department of Fish and Wildlife (unpublished date).
[b] AD= Adipose, RV = Right ventral.
'Est imated numbers released into the Imnaha River. Due to problems at Lookingglass Hatchery a small percentage of the production releases from the 1982 and 1984 broods, intended for release into Look ingglass Creek, were accident ly released into the Imnaha River (personal communicat ion, Rich Carmichael, Oregon Department of Fish and Wildlife).

Table 2 (RH-1). Total returns of wild Imnaha stock spring chinook salmon to the Imnaha River weir in the Imnaha River subbasin, by brood year. Estimates for each age category along the upward diagonal to the right of a given footnote were derived from the same reference.

	Total Age						
Brood Year	2	3	4	5	6	Total	Adult Total
1978	--	--	--	--	0	--	--
1979	--	--	--	13	1	--	--
1980	--	--	12	24	0	--	36
1981	--	10[a]	94	91	0	195	185
1982	--	32[a]	205	43	0	280	248
1983	--	22[a]	118	277	0	417	395
1984	--	4[b]	62	104	--	--	
1985	--	19[c]	122	--	--	--	--
1986	--	38[d]	--	--	--	--	

[a] Estimate is modified from Carmichael et al. (1987).
[b] Estimate is modified from Carmichael et al. (1988).
[c] Estimate is modified from Messmer et al. (1989).
[d] Estimate is modified from Messmer et al. (1990).

Table 3 (MI-2). Total returns of Hatchery Imnaha stock spring chinook salmon to the Imnaha River weir in the Imnaha River subbasin, by brood year. Estimates for each age category along the upward diagonal to the right of a given footnote were derived from the same reference.

	Total Age						
Brood Year	2	3	4	5	6	Total	Adult Total
1982	--	14[a]	14	1	0	29	15
1983	--	7[a]	5	17	0	29	22
1984	--	16[b]	18[c]	6	--	--	.-
1985[d]	--	--	-.	--	--	--	--
1986	--	116[e]	--	--	--	--	--

[a] Estimate is modified from Carmichael et al. (1987).
[b] Estimate is modified from Carmichael et al. (1988).
[c] Estimate is modified from Messmer et al. (1989).
[d] The 1985 brood was released into the Grande Ronde River because of disease concerns at Lookingglass Hatchery. No fish from the 1985 brood release have been recovered in the Imnaha River subbasin.
[e] Estimate is modified from Messmer et al. (1990) .

Table 4 (AL). Mean fork length by brood year and age class (freshwater.ocean) for Hatchery Imnaha stock spring chinook salmon collected at the Imnaha River weir in the Imnaha River subbasin. Estimates within each freshwater age group that are along the upward diagonal to the right of a given footnote were derived from the same reference.

Mean Fork Length (cm)

Brood Year	1.1	1.2	1.3	1.4	2.1	2.2	2.3	2.4
1982	--	--	--	--	55[a]	74	95	--
N	--	--	--	--	--	--	--	--
st. dev.	--	--	--	--	--	--	--	--
1983	--	--	--	--	59[b]	71	90	--
N	--	--	--	--	--	--	--	--
st. dev.	--	--	--	--	--	--	--	--
1984	--	--	--	--	57[c]	76[d]	87	--
N	--	--	--	--	--	--	--	--
st. dev.	--	--	--	--	--	--	--	--
1985	--	--	--	--	--	--	--	--
N	--	--	--	--	--	--	--	
st. dev.	--	--	--	--	--	--	--	--
1986	--	--	--	--	55[e]	--	--	--
N	--	--	--	--	--	--	--	--
st. dev.	--	--	--	--	--	--	--	--

[a] Estimate is modified from Carmichael et al. (1986).
[b] Estimate is modified from Carmichael et al. (1987).
[c] Estimate is modified from Carmichael et al. (1988).
[d] Estimate is modified from Messmer et al. (1989).
[e] Estimate is modified from Messmer et al. (1990).

Table 5 (AU). Mean weight by brood year and age class (freshwater.ocean) for Hatchery Imnaha stock spring chinook salmon collected at the Imnaha River weir in the Imnaha River subbasin. Estimates within each freshwater age group that are along the upward diagonal to the right of a given footnote were derived from the same reference.

	Mean Weight (kg)							
Brood Year	1.1	1.2	1.3	1.4	2.1	2.2	2.3	2.4
1982	--	--	--	--	2.0[a]	3.8	8.4	--
N	--	--	--	--	--	--	--	--
st. dev.	--	--	--	--	--	--	--	--
1983	--	--	--	--	2.0[b]	3.5	7.2	--
N	--	--	--	--	--	--	--	--
st. dev.	--	--	--	--	--	--	--	--
1984	--	--	--	--	1.4[c]	5.0[d]	--	--
N	--	--	--	--	--	--	--	--
st. dev.	--	--	--	--	--	--	--	--

[a] Estimate is modified from Carmichael et al. (1986).
[b] Estimate is modified from Carmichael et al. (1987).
[c] Estimate is modified from Carmichael et al. (1988).
[d] Estimate is modified from Messmer et al. (1989).

Table 6 (AC). Age composition (freshwater.ocean) by brood year for Hatchery Imnaha stock spring chinook salmon collected at the Imnaha River weir in the Imnaha River subbasin. Estimates within each freshwater age group that are along the upward diagonal to the right of a given footnote were derived from the same reference.

		Age Composition (%)										
Brood Year	N	1.1	1.2	1.3	1.4	2.1	2.2	2.3	2.4	3.1	3.2	3.3
1982	--	--	--	--	--	48 [a]	49	3	0	--	--	--
1983	--	--	--	--	--	24[a]	17[b]	59[c]	0[d]	--	--	--

[a] Sample size used to estimate age composition, by brood year, was derived from data in Carmichael et al. (1987).
[b] Sample size used to estimate age composition, by brood year, was derived from data in Carmichael et al. (1988).
[c] Sample size used to estimate age composition, by brood year, was derived from data in Messmer et al. (1989).
[d] Sample size used to estimate age composition, by brood year, was derived from data in Messmer et al. (1990).

Table 7 (AC-a). Age composition (freshwater.ocean) by run year for Hatchery Imnaha stock spring chinook salmon collected at the Imnaha River weir in the Imnaha River subbasin[a].

		Age Composition (%)										
Run Year	N	1.1	1.2	1.3	1.4	2.1	2.2	2.3	2.4	3.1	3.2	3.3
1987	--	--	--	--	--	73	23	4	--	--	--	--

[a] Estimates for the 1987 run year are from Carmichael et al. (1988)

Table 8 (AS). Percent females by brood year and age class (freshwater.ocean) for Hatchery Imnaha stock spring chinook salmon collected at the Imnaha River weir in the Imnaha River subbasin. Estimates within each freshwater age group that are along the upward diagonal to the right of a given footnote were derived from the same reference.

		Females (%)										
Brood Year	N	1.1	1*2	1.3	1.4	2.1	2.2	2.3	2.4	3.1	3.2	3.3
1982	--	--	--	--	--	0[a]	50	100	--	--	--	--
1983	--	--	--	--	--	0[b]	20	72	--	--	--	--
1984	--	--	--	--	--	0[c]	68[d]	67	--	--	--	--
1985	--	--	--	--	--	--	--	--	--	--	--	--
1986	--	--	--	--	--	0[e]	--	--	--	--	--	--

[a] Estimate is modified from Carmichael et al. (1986).
[b] Estimate is modified from Carmichael et al. (1987).
[c] Estimate is modified from Carmichael et al. (1988).
[d] Estimate is modified from Messmer et al. (1989).
[e] Estimate is modified from Messmer et al. (1990).

Table 9 (AF). Mean fecundity by brood year and age class (freshwater.ocean) for Hatchery Imnaha stock spring chinook salmon collected at the Imnaha River weir in the Imnaha River subbasin[a].

	Fecundity (eggs/female)							
Brood Year	1.1	1.2	1.3	1.4	2.1	2.2	2.3	2.4
1983	--	--	--	--	--	--	6,420	--
N	--	--	--	--	--	--	--	--
st. dev.	--	--	--	--	--	--	--	--
1984	--	--	--	--	--	4,710	5,440	--
N	--	--	--	--	--	--	--	--
st. dev.	--	--	--	--	--	--	--	--
1985	--	--	--	--	--	4,670	--	--
N	--	--	--	--	--	--	--	--
st. dev.	--	--	--	--	--	--	--	--

[a] Estimates are from Oregon Department of Fish and Wildlife (unpublished data).

Table 10 (AF-a). Mean fecundity by run year for Hatchery Imnaha stock spring chinook salmon collected at the Imnaha River weir in the Imnaha River subbasin.

Run Year	N	Mean Fecundity	st. dev.
1983	31	5,286	--
1984	11	4,709	--
1985	--	5,078	--
1986	59	4,753	--
1987	39	4,805	--
1988	92	5,673	--
1989	54	4,892	--

[a] Estimates are from Messmer et al. (1990).

Table 11 (AR). Emigration of coded wire tagged hatchery spring chinook salmon released into the Imnaha River subbasin[a,b].

Hatchery/Release site	Recovery site, Run Year(s)	Recovery Method	Number Recovered	Total Number Estimated, (PSMFC)
Imnaha River	Deschutes River	Trap Returns		
	1987	--	4	4
Imnaha River	Grande Ronde	Hatchery Returns		
	1986	--	1	1
Imnaha River	L White Salmon R.	Hatchery Returns		
	1987	--	1	1
	1988	--	2	2
Imnaha River	Columbia River[c]	Hatchery Returns		
	1988	--	1	1
Imnaha River	Columbia River[d]	Hatchery Returns		
	1988	--	1	1

[a] Based on the following tag codes: 07-30-16, 07-30-17, 07-28-20, 07-33-63, 07-42-63.
[b] Estimates are modified from the Pacific States Marine Fisheries Commission coded wire tag database.
[c] Recovery site in the mainstem Columbia River below Bonneville Dam.
[d] Recovery site in the mainstem Columbia River between McNary and Priest Rapids dams.

Table 12 (TD). Parasites and diseases of spring chinook salmon at hatcheries releasing juveniles into the Imnaha River subbasin[a].

Disease type	Hatchery	Specific Pathogen
Parasite	Lookingglass	*Ceratomyxa shasta*
Parasite	Lookingglass	*Ichthyobodo sp.* (Costia)
Parasite	Lookingglass[b]	*Epistylis sp.*
Parasite	Lookingglass[b]	*Trichodina spp.*
Bacteria	Lookingglass	Bacterial gill disease
Bacteria	Lookingglass	Motile gill bacteria
Bacteria	Lookingglass	*Renibacterium salmoninarum* (Bacterial kidney disease)
Bacteria	Lookingglass	*Aeromonas spp.*
Bacteria	Lookingglass	*Pseudomonas spp.*
Bacteria	Lookingglass	*Flexibacter psychrophilus*
Bacteria	Lookingglass	Furunculosis (*Aeromonas salmonicida*)
Bacteria	Lookingglass	*Ichthyophthirius sp.*
Bacteria	Lookingglass[b]	*Cytophaga psychrophila* (Cold water disease)
Bacteria	Lookingglass	*Yersinia ruckeri* (Enteric Red Mouth disease)
Virus	Lookingglass[c]	Viral Erythrocytic Necrosis (vEN)
Virus	Lookingglass	Infectious Hematopoietic Necrosis (IHN)
Virus	Lookingglass	Erythrocytic Inclusion Body Syndrome (EIBS)
Fungi	Lookingglass[b]	External fungi

[a] Except where footnoted, data are from a letter dated 2/92 from Warren Groberg, Oregon Department of Fish and Wildlife, Fish Pathology, La Grande, Oregon.

[b] Data are from Carmichael et al. (1986), Carmichael et al. (1987), Carmichael et al. (1988), and Messmer et al. (1989).

[c] Data are from a telephone interview on 1/9/92 with Warren Groberg, Oregon Department of Fish and Wildlife, Fish Pathology, La Grande, Oregon.

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IMNAHA RIVER SUBBASIN

Naturally Produced Fall Chinook Salmon

GEOGRAPHIC LOCATION

The Imnaha River subbasin covers 980 square miles in the extreme northeast comer of Oregon. From its source in the Wallowa Mountains, the Imnaha River flows north to northeast to where it enters the Snake River at RM 191.7 (see Naturally Produced Spring Chinook Salmon, GEOGRAPHIC LOCATION, Figure 1); approximately 516 miles from the mouth of the Columbia River. The mouth of the Imnaha River is located above Bonneville, The Dalles, John Day, and McNary dams in the mainstem Columbia River and Ice Harbor, Lower Monumental, Little Goose, and Lo-wer Granite dams in the mainstem Snake River.

ORIGIN

The Imnaha River subbasin historically sustained a run of fall chinook salmon. The last observed spawning occurred in 1967 and the population is considered extinct (Nez Perce Tribe of Idaho et al. 1990).

Proposals are being considered to reintroduce fall chinook into the subbasin at some future date. Critical uncertainties are the availability of spawning and rearing habitat. "Winter water temperatures are low and may not provide sufficient temperature units for hatching. It is possible that successful spawners were those that spawned in gravels with spring water upwelling" (Nez Perce Tribe et al. 1990).

DISTRIBUTION

Subbasin

There is no information available on the historical temporal distribution of spawning and rearing in the subbasin but it is believed to have extended upstream as far as the town of Imnaha, Oregon (Nez Perce Tribe of Idaho et al. 1990). Spawning and rearing habitat is currently believed to exist in the lower 22.3 miles of the mainstem of the Imnaha River. The entire area is rated as having excellent spawning and rearing habitat (Tables 1 and 2).

Approximations of the temporal distribution of adult immigration and spawning are presented in Figure 1 (Nez Perce Tribe of Idaho et al. 1990). The methodology that was used to generate these approximations is unknown.

PRODUCTION

Harvest

Treaty

Subbasin: The Imnaha River subbasin is located on lands ceded to the United States by the Nez Perce Tribe of Idaho. The Nez Perce Tribe of Idaho along with the Confederated Tribes of the Umatilla Indian Reservation have reserved usual and accustomed fishing sites located within the subbasin.

There **are** no historical estimates of tribal harvest.

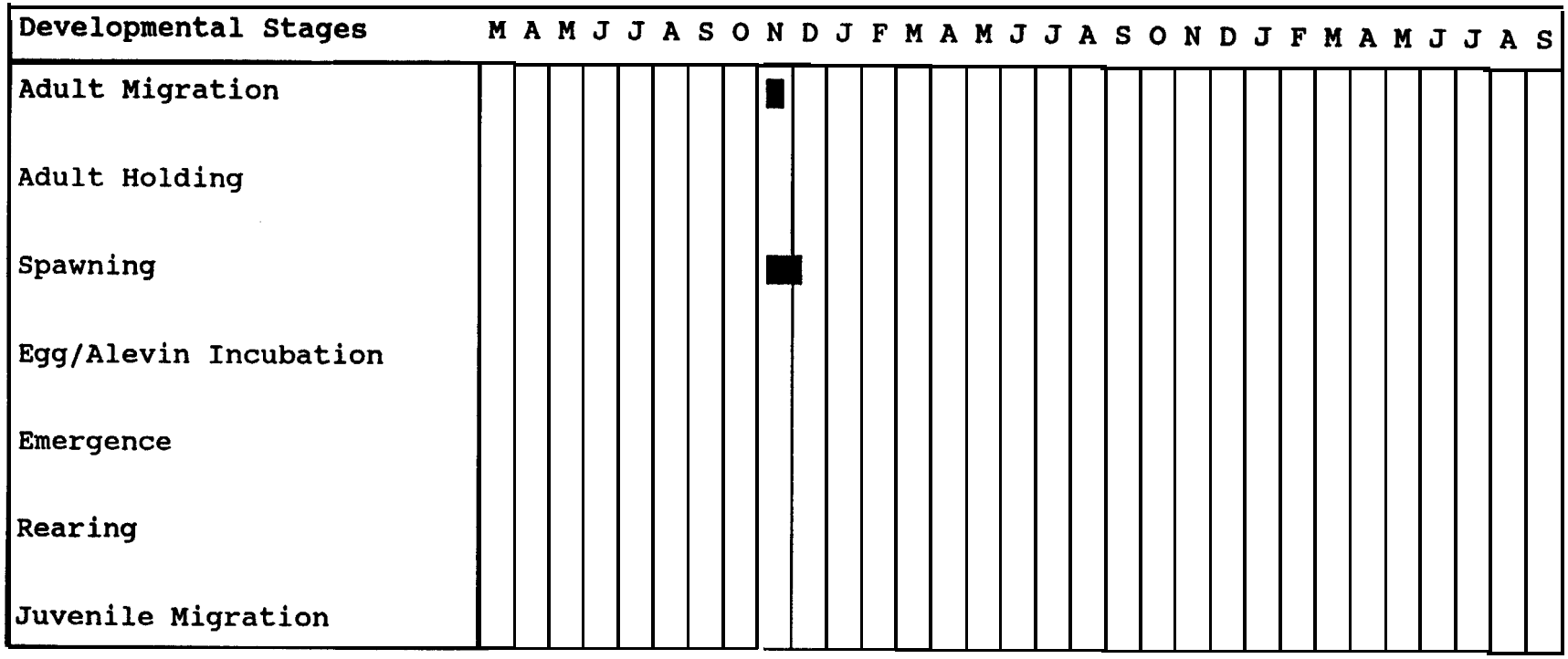
ADULT LIFE HISTORY

Escapemen

spawning Area

Numbers: No brood year specific estimates of spawner escapement are available. Spawning ground counts are available from Oregon Department of Fish and Wildlife (unpublished data).

Figure 1 (TT). Freshwater life history for fall chinook, Imnaha River subbasin (Nez Perce Tribe of Idaho et al. 1990).



Notes:

1. The developmental stage timing represents basin-wide averages. local conditions may cause some variability.
2. Bars indicate periods of heaviest adult migration and spawning.

Table 1 (HB-1). Estimated amount of spawning and rearing habitat by quality of Imnaha River subbasin fall chinook salmon production area[a].

Distance/ Area	Excellent	Good	Fair[b]	Poor[b]	Unknown	Total	Confi-dence
Miles (%)	100.0	0.0	0.0	0.0	--	22.3	--
Acres (%)	--	--	--	--	--	--	--

[a] Estimates are modified from the Northwest Power Planning Council's presence/absence database.
[b] Ratings of fair and poor habitat quality may reflect natural physical features such as waterfall barriers, as well as degradation caused by humans.

Table 2 (HB-2). Estimated amount of rearing only habitat by quality of Imnaha River subbasin fall chinook salmon production area[a].

Distance/ Area	Excellent	Good	Fair[b]	Poor[b]	Unknown	Total	Confi-dence
Miles (%)	0.0	0.0	0.0	0.0	--	0.0	--
Acres (%)	--	--	--	--	--	--	--

[a] Estimates are modified from the Northwest Power Planning Council's presence/absence database.
[b] Ratings of fair and poor habitat quality may reflect natural physical features such as waterfall barriers, as well as degradation caused by humans.

REFERENCES

Nez Perce Tribe of Idaho, Confederated Tribes of the Umatilla Indian Reservation, and Oregon Department of Fish and Wildlife. 1990. Imnaha River subbasin salmon and steelhead production plan. Columbia Basin System Planning Report to Northwest Power Planning Council, Portland, Oregon.

IMNAHA RIVER SUBBASIN

Naturally Produced Summer Steelhead

GEOGRAPHIC LOCATION

The Imnaha River subbasin covers 980 square miles in the extreme northeast corner of Oregon. From its source in the Wallowa Mountains, the Imnaha River flows north to northeast to where it enters the Snake River at RM 191.7 (see Naturally Produced Spring Chinook Salmon, GEOGRAPHIC LOCATION, Figure 1); approximately 516 miles from the mouth of the Columbia River. The mouth of the Imnaha River is located above Bonneville, The Dalles, John Day, and McNary dams in the mainstem Columbia River and Ice Harbor, Lower Monumental, Little Goose, and Lower Granite dams in the mainstem Snake River.

ORIGIN

Summer steelhead are indigenous to the Imnaha River subbasin. No non-indigenous stocks have been introduced into the subbasin (see IMNAHA RIVER SUBBASIN, Hatchery Produced Summer Steelhead, PRODUCTION).

DISTRIBUTION

Subbasin

Summer steelhead were historically distributed throughout most of the Imnaha River subbasin. There are currently no man-made barriers that block summer steelhead from historical spawning and rearing areas and summer steelhead are currently found in almost all of the available habitat. "Steep gradients in the head waters form the only serious blockage to anadromous fish " (Thompson and Haas 1960, cited by Nez Perce Tribe of Idaho et al. 1990). "Low flows could be a problem in upper Big and Little Sheep creeks due primarily to irrigation withdrawals for the Wallowa Valley Improvement Canal, with other problems being additional irrigation withdrawals, stream channelization, and riparian habitat degradation" (Nez Perce Tribe of Idaho et al. 1990). The quality of the spawning and rearing habitat varies throughout the subbasin (Tables 1 and 2).

Approximations of the temporal distribution of adult holding, incubation, and rearing are presented in Figure 1 (Nez Perce Tribe of Idaho et al. 1990). The methodology that was used to generate these approximations is unknown.

PRODUCTION

Harvest

sport

Subbasin: The sport fishery was closed to the harvest of unmarked fish in 1974 and has remained closed through the 1991-92 run year. The subbasin was re-opened to the sport harvest of adipose clipped fish in 1986 (see IMNAHA RIVER SUBBASIN, Hatchery Produced Summer Steelhead, PRODUCTION, HARVEST, Sport). No brood year specific estimates of sport harvest are available. Run year specific estimates of harvest prior to the season closure in 1974 are available from Oregon Department of Fish and Wildlife (unpublished data).

Treaty

Subbasin: The Imnaha River subbasin is located on lands ceded to the United States by the Nez Perce Tribe of Idaho. The Nez Perce Tribe of Idaho along with the Confederated Tribes of the Umatilla Indians have reserved usual and accustomed fishing sites located within the subbasin.

Tribal ceremonial and subsistence fisheries are allowed to harvest summer steelhead. No information is available on annual harvest but the numbers are believed to be low (Nez Perce Tribe of Idaho et al. 1990).

ADULT LIFE HISTORY

Escapement

Subbasin

Timing: Summer steelhead return to the Imnaha River subbasin as early as August and enter tributary streams during the fall and spring (James 1984, cited by Howell et al. 1985). An approximation of the temporal distribution of adult returns was also reported in Nez Perce Tribe of Idaho et al. (1990) and is presented in Figure 1. The methodology that was used to generate this approximation is unknown.

Spawning Area

Timing: Data collected from spawning ground surveys indicates that spawning occurs "between late April and early June in the Imnaha River system. However, fish spawn earlier in April in Camp Creek" (James 1984, cited by Howell et al. 1985). An approximation of the temporal distribution of spawning was also reported in Nez Perce Tribe of Idaho et al. (1990) and is presented in Figure 1. The methodology that was used to generate this approximation is unknown.

Fry first appear in the lower Big Sheep Creek and the upper Imnaha River in June and July (Gaumer 1968, cited by Howell et al. 1985). An approximation of the temporal distribution of emergence was also reported in Nez Perce Tribe of Idaho et al. (1990) and is presented in Figure 1. The methodology that was used to generate this approximation is unknown.

Numbers: There are no brood year specific estimates of spawner escapement to the Imnaha River subbasin. Spawning ground counts are available from Oregon Department of Fish and Wildlife (unpublished data).

Stray

No naturally or hatchery produced stray summer steelhead have been recovered on spawning ground surveys or at trapping facilities located in the subbasin. Coded wire tags were recovered from adult hatchery summer steelhead returning from subbasin hatchery production releases (Table 3).

Fork Length

Fork length was estimated for unmarked summer steelhead collected at a trapping facility located in Little Sheep Creek (see IMNAHA RIVER SUBBASIN, Hatchery Produced Summer Steelhead, ORIGIN). It is unknown what percentage of the unmarked fish are returns from subbasin hatchery production releases of unmarked fish. Age was determined based on scale analyses.

Annual estimates of mean fork length, by age category, ranged from 56 cm to 60 cm for 1 salt fish

and 66 cm to 73 cm for 2 salt fish (Table 4).

Age Structure

Age structure was estimated for unmarked summer steelhead collected at a trapping facility located in Little Sheep Creek (see ADULT LIFE HISTORY, Fork Length). Age was determined based on scale analyses.

Data indicates that naturally produced summer steelhead primarily return as 1 and 2 salt fish (Tables 5 and 6). Annual estimates of age structure, by age category and brood year, ranged from 50% to 87% 1 salt fish and 13% to 50% 2 salt fish (Table 5).

Annual estimates of age structure, by age category and run year, ranged from 50% to 94% 1 salt fish and 6% to 50% 2 salt fish (Table 6).

Sex Ratio

Sex ratio (percent females) was estimated for unmarked summer steelhead collected at a trapping facility located in Little Sheep Creek (see ADULT LIFE HISTORY, Fork Length). Age was determined based on scale analyses.

Annual estimates of sex ratio, by age category, ranged from 36% to 100% for 1 salt fish and 81% to 100% for 2 salt fish (Table 7).

Fecundity

Fecundity was estimated for unmarked summer steelhead collected at a trapping facility located in Little Sheep Creek (see ADULT LIFE HISTORY, Fork Length). Fecundity, by age class, was determined by estimating the number of eggs per gram in a sub-sample of eggs taken from a female and then multiplying the estimate by the estimate of total grams of eggs spawned. Added to the total estimate was the number of eggs retained in the carcass. Age was determined based on scale analyses.

Annual estimates of fecundity, by age category, ranged from 3,250 to 4,084 eggs per female for 1 salt fish and 4,933 to 5,488 eggs per female for 2 salt fish (Table 8).

JUVENILE LIFE HISTORY

Age Structure

The only information available is from an analysis of scales from unmarked adult fish collected at a trapping facility located in Little Sheep Creek (see ADULT LIFE HISTORY, Age Structure). Unmarked adults sampled at the Little Sheep Creek facility primarily migrated as age 2+ smolts (Tables 5 and 6).

Migration Timing

Juvenile summer steelhead migrate "downstream throughout the Imnaha River system during the spring (April through June) and fall (August through November)" (Howell et al. 1985). Age 2+ juvenile fish primarily migrate downstream during the spring (Howell et al. 1985). Age 2+ migrants are believed to be smelts based on the age structure of adult fish collected at a trap located in Little Sheep Creek. Adult fish collected in Little Sheep Creek had a scale pattern indicating that most had entered the ocean as age 2+ juvenile fish (Tables 5 and 6).

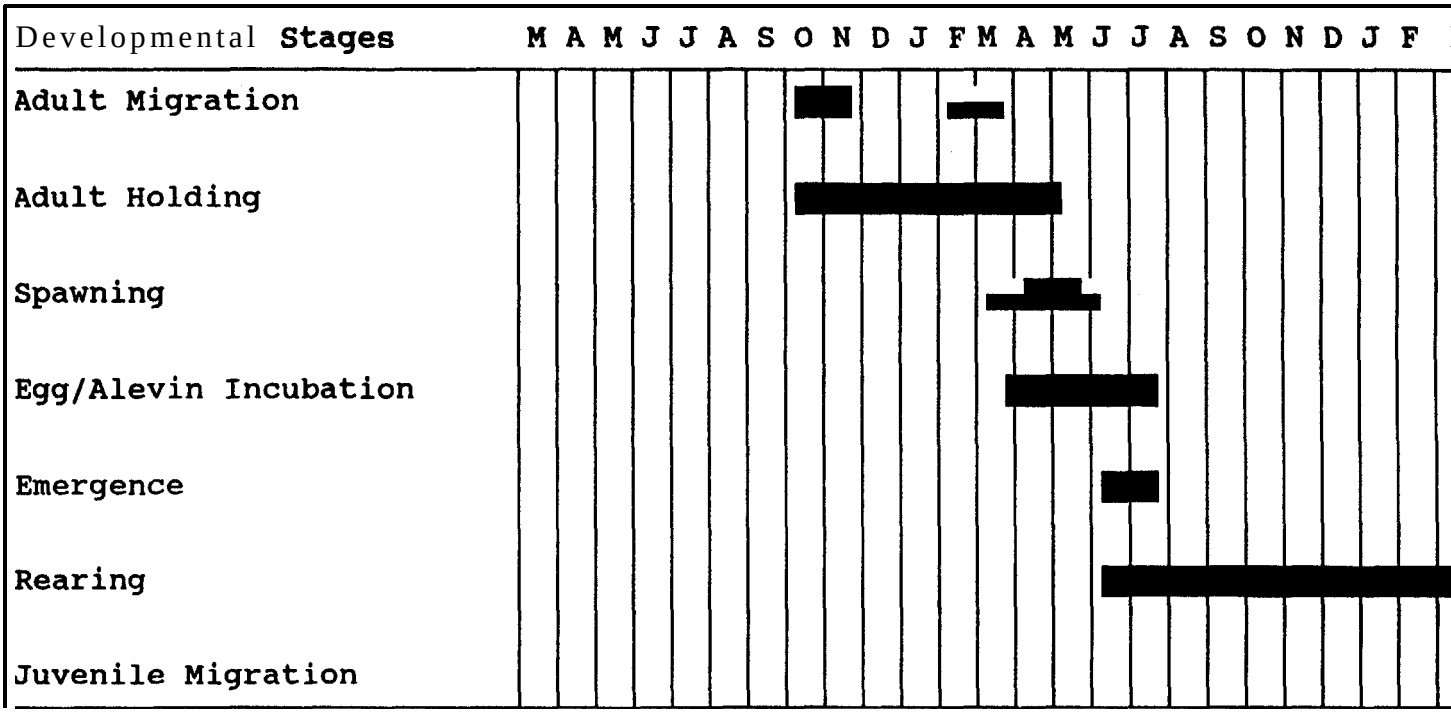
An approximation of the temporal distribution of juvenile outmigration was also reported in Nez Perce Tribe of Idaho et al. (1990) and is presented in Figure 1. The methodology that was used to generate this approximation is unknown.

BIOCHEMICAL-GENETIC CHARACTERISTICS

Wild juvenile summer steelhead from the Imnaha River were analyzed electrophoretically at selected protein-coding loci. Relative allele nobilities and allele frequencies were determined for 21 enzyme systems (Appendix Table 4). No rare alleles were detected.

Schreck et al. (1986) classified Columbia River Basin steelhead into several clusters of similar stocks based on biochemical, morphological and life history characters. Columbia River Basin steelhead stocks segregate into two primary groups, those from west of the Cascade Mountains and those from east of the Cascades. Wild summer steelhead from the Imnaha River cluster with other stocks from east of the Cascades. This primary group is composed of 3 subgroups. At the subgroup level, wild summer steelhead from the Imnaha River were found to be most similar to other wild summer steelhead stocks from tributaries of the Columbia between Fifteenmile Creek and the Entiat River, the lower Snake River and the Salmon River. This subgroup is characterized by the greatest average head length, maxillary length, head depth, and interorbital width. This subgroup also has the lowest average caudal peduncle length.

Figure 1 **(TT).** Freshwater **life** history for wild/natural summer steelhead, Im
subbasin (Nez Perce Tribe of Idaho-et **al. 1990).**



Notes:

1. **The developmental stage timing represents basin-wide averages, local co some variability.**

2. **Double thick bars indicate periods of heaviest adult migration, spawnin outmigration.**

Table 1 (ME-1). Estimated amount of spawning and rearing habitat by quality of Imnaha River subbasin summer steelhead production area[a].

Distance/ Area	Excellent	Good	Fair[b]	Poor[b]	Unknown	Total	Confi-dence
Miles (%)	85.8	0.0	0.0	14.2	--	203.4	--
Acres (%)	--	--	--	--	--	--	--

[a] Estimates are modified from the Northwest Power Planning Council's presence/absence database.
[b] Ratings of fair and poor habitat quality may reflect natural physical features such as waterfall barriers, as well as degradation caused by humans.

Table 2 (MB-2). Estimated amount of rearing only habitat by quality of Imnaha River subbasin summer steelhead production area[a].

Distance/ Area	Excellent	Good	Fair[b]	Poor[b]	Unknown	Total	Confi-dence
Miles (%)	100.0	0.0	0.0	0.0	--	83.2	--
Acres (%)	--	--	--	--	--	--	--

[a] Estimates are modified from the Northwest Power Planning Council's presence/absence database.
[b] Ratings of fair and poor habitat quality may reflect natural physical features such as waterfall barriers, as well as degradation caused by humans.

Table 3 (AI). Non-harvest recoveries of coded wire tagged hatchery summer steelhead in the subbasin[a, b]

Hatchery/Release site	Recovery site, Run Year(s)	Recovery Method	Number Recovered	Total N Estima (
Imnaha River	Imnaha River 1988	Trap Returns	168	

[a] Based on the following tag codes: 07-37-60, 07-37-61, 07-41-22.
[b] Estimates are modified from the Pacific States Marine Fisheries Commission coded wire tag

Table 4 (AL). Mean fork length by brood year and age class (freshwater.ocean) for wild summer steelhead collected at the Little Sheep Creek facility in the Imnaha River subbasin. Estimates within each freshwater age group that are *along* the upward diagonal to the right of a given footnote were derived from the same reference.

Mean Fork Length (cm)

Brood Year	1.1	1.2	1.3	2.1	2.2	2.3	3.1	3.2	3.3
1978	--	--	--		68	--	--	--	--
N	--	--	--	--	--	--	--	--	--
St. dev.	--	--	--	--	--	--	--	--	--
1979	--	--	--	58[a]	67	--	--	66	--
N	--	--	--	--	--	--	--	--	--
St. dev.	--	--	--	--	--	--	--	--	--
1980	--	73[a]	--	58[a]	69	--	57[b]	--	--
N	--	--	--	--	--	--	--	--	--
St. dev.	--	--	--	--	--	--	--	--	--
1981	--	67[b]	--	59[b]	67	--	--	--	--
N	--	--	--	--	--	--	--	--	--
St. dev.	--	--		--	--	--	--	--	--
1982	--	--	--	59[c]	64	--	--	--	--
N	--	--	--	--	--	--	--	--	--
St. dev.	--	--	--	--	--	--	--	--	--
1983	--	69	--	59[d]	71	--	--	--	
N	--	--	--	--	--	--	--	--	
st. dev.	--	--	--	--	--	--	--	--	--
1984	59[d]	71[d]	--	60[d]	68	--	--	--	--
N	--	--	--	--	--	--	--	--	--
St. dev.	--	--	--	--	--	--	--	--	--
1985	--	--	--	59[e]	69	--	56[f]	--	--
N	--	--	--	--	--	--	--	--	--
St. dev.	--	--	--	--	--	--	--	--	--

Table 4 (AL). (cont.) Mean fork length by brood year and age class (freshwater.ocean) for wild summer steelhead collected at the Little Sheep Creek facility in the Imnaha River subbasin. Estimates within each freshwater age group that are along the upward diagonal to the right of a given footnote were derived from the same reference.

Mean Fork Length (cm)

Brood Year	1.1	1.2	1.3	2.1	2.2	2.3	3.1	3.2	3.3
1986	--	--	--	57[f]	--	--	--	--	--
N	--	--	--	--	--	--	--	--	--
st. dev.	--	--	--	--	--	--	--	--	--

[a] Estimate is modified from Carmichael and Messmer (1985).
[b] Estimate is modified from Carmichael et al. (1986).
[c] Estimate is modified from Carmichael et al. (1987).
[d] Estimate is modified from Carmichael et al. (1988).
[e] Estimate is modified from Messmer et al. (1989).
[f] Estimate is modified from Messmer et al. (1990).

Table 5 (AC). Age Composition (freshwater.ocean) by brood year for wild summer steelhead coll
Sheep Creek facility in the Imnaha River subbasin. Estimates within each freshwater age
the upward diagonal to the right of a given footnote were derived from the same reference

		Age Composition (%)										
Brood Year	N	1.1	1.2	1.3	1.4	2.1	2.2	2.3	2.4	3.1	3.2	3
1980	--	0[a]	0	--	--	47[a]	50	--	--	3[b]	--	-
1981	--	0[a]	7	--	--	82b	11	--	--	0[c]	--	-
1982	--	0[b]	0	--	--	87[c]	13	--	--	0[d]	--	-
1983	--	0[c]	6	--	--	79[d]	15	--	--	0[d]	--	-
1984	--	24[d]	4[d]	--	--	40[d]	32 [e]	--	--	0[e]	--	-

[a] Sample size used to estimate age composition, by brood year, was derived from data in Carmi
(1985).
[b] Sample size used to estimate age composition, by brood year, was derived from data in Carmic
[c] Sample size used to estimate age composition, by brood year, was derived from data in Carmic
[d] Sample size used to estimate age composition, by brood year, was derived from data in Carmic
[e] Sample size used to estimate age composition, by brood year, was derived from data in Messm

Table 6 (AC-a). Age Composition (freshwater.ocean) by run year for wild summer steelhead co
Sheep Creek facility in the Imnaha River subbasin[a].

Run Year	N	Age Composition (%) 1.1	1.2	1.3	1.4	2.1	2.2	2.3	2.4	3.1	3.2
1982-83	45	0	0	--	--	68	32	--	--	0	0
1983-84	72	0	2	--	--	94	4	--	--	0	0
1984-85	163	0	4	--	--	47	45	--	--	3	1
1985-86	49	0	0	--	--	79	21	--	--	0	0
1986-87	110	16	5	--	--	74	5	--	--	0	0
1987-88	47	0	6	--	--	60	34	--	--	0	0
1988-89	56	0	0	--	--	59	41	--	--	0	0
1989-90	57	0	0	--	--	58	37	--	--	5	0

[a] Estimates are modified from Carmichael and Messmer (1985) for the 1982-83 through 1983-84
Carmichael et al. (1986) for the 1984-85 run year, from Carmichael et al. (1987) for the
Carmichael et al. (1988) for the 1986-87 through 1987-88 run years, from Messmer et al. (1
run year, and from Messmer et al. (1990) for the 1989-90 run year.

Table 7 (AS). Percent females by brood year and age class (freshwater.ocean) for wild summer steelhead collected at the Little Sheep Creek facility in the Imnaha River subbasin. Estimates within each freshwater age group that are along the upward diagonal to the right of a given footnote were derived from the same *reference.*

		Females (%)										
Brood Year	N	1.1	1.2	1.3	1.4	2.1	2.2	2.3	2.4	3.1	3.2	3.3
1979	--	--	--	--	--	--	--	--	--	--	100	--
1980	--	--	--	--	--	--	100	--	--	-loos	--	--
1981	--	--	-loos	--	--	89 [a]	90	--	--	--	--	--
1982	--	--	--	--	--	76[b]	100	--	--	--	--	--
1983	--	--	100	--	--	43[c]	81	--	--	--	--	--
1984	--	66[c]	100[c]	--	--	36[c]	83	--	--	--	--	--
1985	--	--	--	--	--	55[d]	81	--	--	100[e]	--	--
1986	--	--	--	--	--	51[e]	--	--	--	--	--	--

[a] Estimate is modified from Carmichael et al. (1986).
[b] Estimate is modified from Carmichael et al. (1987).
[c] Estimate is modified from Carmichael et al. (1988).
[d] Estimate is modified from Messmer et al. (1989).
[e] Estimate is modified from Messmer et al. (1990).

Table 8 (AF). Mean fecundity by brood year and age class (freshwater.ocean) for wild summer steelhead collected at the Little Sheep Creek facility in the Imnaha River subbasin[a].

	Mean Fecundity								
Brood Year	1.1	1.2	1.3	2.1	2.2	2.3	3.1	3.2	3.3
1984	--	--	--	--	4,933	--	--	--	--
N	--	--	--	--	--	--	--	--	--
St. dev.	--	--	--	--	--	--	--	--	--
1985	--	--		3,250	5,469	--	3,949	--	--
N	--	--	--	--	--	--	--	--	--
St. dev.	--	--	--	--	--	--	--	--	--
1986	--	--	--	4,084	5,392	--	--	--	--
N	--	--	--	--	--	--	--	--	--
St. dev.	--	--	--	--	--	--	--	--	--
1987	--	5,488	--	3,713	--	--	--	--	
N	--	--	--	--	--	--	--	--	--
St. dev.	--	--	--	--	--	--	--	--	--

[a]Estimates are from Oregon Department of Fish and Wildlife (unpublished data).

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IMNAHA RIVER SUBBASIN

Hatchery Produced Summer Steelhead

ORIGIN

The first recorded release of juvenile hatchery fish in the subbasin is the 1982 brood release from the Hatchery Imnaha stock (Table 1). The subbasin was supplemented with juvenile hatchery fish from 1983-91 (Table 1). No non-indigenous stocks have been introduced into the subbasin (Table 1). Hatchery broodstock was developed from the Imnaha stock.

The Hatchery Imnaha stock was developed from native fish returning to the Imnaha River subbasin.. Adult fish are collected at a trapping facility located at RM 5 on the mainstem of Little Sheep Creek (Little Sheep Creek facility) approximately eight miles from the town of Imnaha, Oregon. The trapping facility became fully operational in 1987. Hatchery broodstock were taken entirely from the wild run from 1982-84. Because of the low numbers of hatchery fish returning to the collection facility after 1984 the hatchery program has had to incorporate naturally produced summer steelhead into the hatchery broodstock. Because the hatchery program was only recently developed and because naturally produced fish were utilized for hatchery broodstock it is believed that the Hatchery Imnaha stock may not be a unique hatchery stock.

The current hatchery program is designed to be in compliance with Oregon's wild fish policy. Because of low smelt to adult survival rates for hatchery fish and the low numbers of wild fish returning to the broodstock collection facilities in Little Sheep Creek it may be difficult to comply with guidelines established in the wild fish policy.

DISTRIBUTION

Subbasin

Juvenile summer steelhead are released at only two locations in the Imnaha River subbasin. They include Little Sheep Creek and the mainstem of the Imnaha River (Table 1).

Approximations of the temporal distribution of hatchery summer steelhead adult immigration, adult holding, incubation, emergence, rearing, and juvenile outmigration are presented in Figure 1 (Nez Perce Tribe of Idaho et al. 1990). The methodology that was used to generate these approximations is unknown.

PRODUCTION

Releases

Egg

There are no records of releases in the subbasin.

Fry

Hatchery facilities in which fry were reared or acclimated prior to release in the subbasin include Wallowa Hatchery (Table 1). Only one release of 35,698 fish was made in 1988 (Table 1). No information is available on size at release.

Fingerling

There are no records of releases in the subbasin.

Smelt

Hatchery facilities in which smelts were reared or acclimated prior to release in the subbasin include Wallowa and Irrigon hatcheries (Table 1). Annual numbers released ranged from 64,785 to 331,513 ('Table 1). Size at release ranged from 10.2 to 4.3 fish per pound (Table 1).

Adult

There are no records of releases in the subbasin.

Harvest

sport

Subbasin: The sport fishery was closed to the harvest of both wild and hatchery fish in 1974. It was re-opened in 1986 to the harvest of adipose clipped fish in 1986 and has remained opened through the 1990-91 run year. Brood year specific estimates of sport harvest in the subbasin are available for the 1987-88 through 1990-91 run years from Oregon Department of Fish and Wildlife (unpublished data).

Treaty

Subbasin: The Imnaha River subbasin is located on lands ceded to the United States by the Nez Perce Tribe of Idaho. The Nez Perce Tribe of Idaho along with the Confederated Tribes of the Umatilla Indian Reservation have reserved usual and accustomed fishing sites located within the subbasin.

Tribal ceremonial and subsistence fisheries are allowed to harvest summer steelhead. No information is available on annual harvest but the numbers are believed to be low (Nez Perce Tribe of Idaho et al. 1990).

ADULT LIFE HISTORY

Escapement

Columbia River

Timing: Data from recoveries of coded wire tagged hatchery fish, returning from subbasin hatchery production releases in the Imnaha River subbasin, indicate that Hatchery Imnaha stock summer steelhead can be found in the mainstem of the Columbia River throughout the year (Pacific States Marine Fisheries Commission unpublished data).

Hatchery Facilities

Timing: Wild and hatchery adults are trapped from March to May and are spawned during April and May (Carmichael et al. 1987 and 1988, and Messmer et al. 1989, 1990, and 1991). An approximation of the temporal distribution of natural spawning was reported for hatchery fish in Nez Perce Tribe of Idaho et al. (1990) and is presented in Figure 1. The methodology that was used to generate this approximation is unknown.

Numbers: Estimates of escapement are available at the Little Sheep Creek facility (see ORIGIN). The facility traps all summer steelhead that escape to the trapping site. Summer steelhead are aged based on a combination of scale analyses and tag code.

Annual estimates of summer steelhead escapement to the Little Sheep Creek facility, by brood year, ranged from 45 to 145 naturally produced fish (Table 2) and 28 to 731 Hatchery Imnaha stock fish (Table 3).

Survival: Estimates of pre-spawning survival at hatchery facilities located in the Imnaha River subbasin are available from Carmichael et al. (1986, 1987, and 1988, and Messmer et al. 1989, 1990, and 1991).

Fork Length

Fork length was estimated for hatchery summer steelhead collected at a trapping facility located in Little Sheep Creek (see ORIGIN). Estimates are available for the Hatchery Imnaha stock of summer steelhead. Age was determined based on scale analyses and tag code.

Annual estimates of mean fork length, by age category, ranged from 58 cm to 62 cm for 1 salt fish, 65 cm to 70 cm for 2 salt fish, and was 71 cm for 3 salt fish (Table 4).

Age Structure

Age structure was estimated for hatchery summer steelhead collected at a trapping facility located in Little Sheep Creek (see ORIGIN). Estimates are available for the Hatchery Imnaha stock of summer steelhead. Age was determined based on scale analyses and tag code.

Annual estimates of age structure, by age category and brood year, ranged from 80% to 95% 1 salt fish, O% to 15% 2 salt fish, and O% to 20% 3 salt fish (Table 5).

Annual estimates of age structure, by age category and run year, ranged from 15% to 100% 1 salt fish, O% to 85% 2 salt fish, and O% to 1% 3 salt fish (Table 6).

Sex Ratio

Sex ratios (percent females) were estimated for hatchery summer steelhead collected at a trapping facility located in Little Sheep Creek (see ORIGIN). Estimates are available for the Hatchery Imnaha stock of summer steelhead. Age was determined based on scale analyses and tag code.

Annual estimates of sex ratio, by age category, ranged from O% to 74% for 1 salt fish, 62% to 100% for 2 salt, and were 100% for 3 salt fish (Table 7).

Fecundity

Estimates of fecundity are available for summer steelhead spawned at hatchery facilities located in the Imnaha River subbasin (see ADULT LIFE HISTORY, Fork Length). Estimates were derived using two separate methods. Fecundity, by age class, was determined by estimating the number of eggs per gram in a sub-sample of eggs taken from a female and then multiplying the estimate by the estimate of total grams of eggs spawned. Added to the total estimate was the number of eggs retained in the carcass. Mean fecundity, by run year, was estimated by dividing hatchery egg take by the number of females spawned. Estimates are available for the Hatchery Imnaha stock of summer steelhead. Age was determined based on a combination of scale analyses and tag code.

Annual estimates of fecundity, by age category, ranged from 3,562 to 4,690 eggs per females for 1

salt fish and from 4,788 to 6,044 eggs per female for 2 salt fish (Table 8).

Annual estimates of mean fecundity, by run year, ranged from 4,291 to 5,281 eggs per female (Table 9).

Mark Recoveries

No stray coded wire tagged hatchery fish, returning from subbasin hatchery production releases in the Imnaha River subbasin, have been recovered on spawning ground surveys or at hatchery facilities located outside of the subbasin. Hatchery fish returning from subbasin hatchery production releases have been recovered in fisheries located in the Deschutes and Umatilla rivers in Oregon and in the Snake River below Hells Canyon Dam (Pacific States Marine Fisheries Commission unpublished data).

There are no freshwater recoveries, of subbasin hatchery production, reported at hatchery facilities or from spawning ground surveys outside of the Columbia River Basin.

JUVENILE LIFE HISTORY

Age Structure

Hatchery juveniles are primarily released as yearling smelts (Table 1).

BIOCHEMICAL-GENETIC CHARACTERISTICS

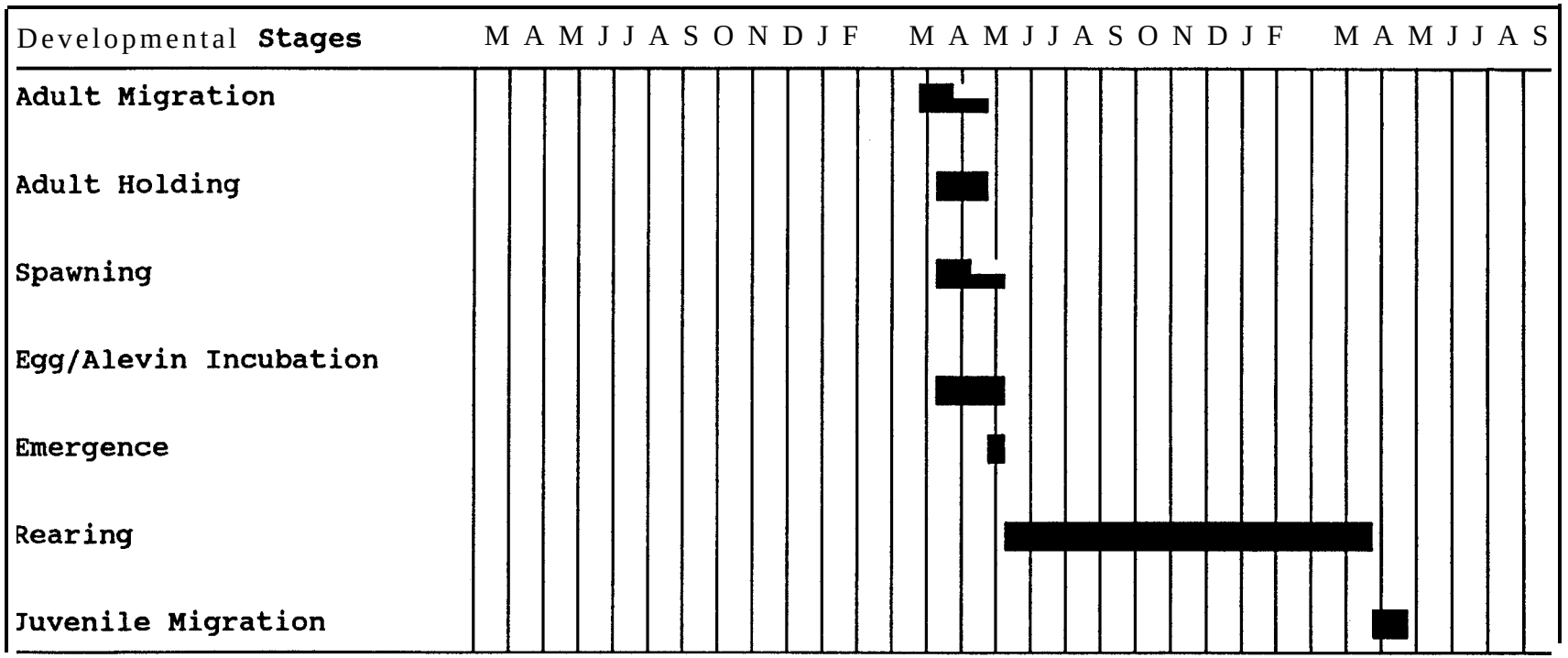
Hatchery juvenile summer steelhead from the Imnaha River were analyzed electrophoretically at selected protein-coding loci. Relative allele nobilities and allele frequencies were determined for 21 enzyme systems (Appendix Table 4). Two rare alleles were detected at the aconitate hydratase and isocitrate dehydrogenase-3,4 loci.

Schreck et al. (1986) classified Columbia River Basin steelhead into several clusters of similar stocks based on biochemical, morphological and life history characters. Columbia River Basin steelhead stocks segregate into two primary groups, those from west of the Cascade Mountains and those from east of the Cascades. Hatchery steelhead from the Imnaha River cluster with other stocks from east of the Cascades. This primary group is composed of 3 subgroups. At the subgroup level, hatchery summer steelhead from the Imnaha River were found to be most similar to other hatchery summer steelhead stocks from tributaries of the Columbia River and the lower Snake River, and 2 stocks of wild summer steelhead. This subgroup is characterized by the earliest average time of entry into freshwater, the greatest average frequency of the common glycerol-3-phosphate dehydrogenase allele, and the lowest average head depth.

DISEASES

Various parasites and infectious disease agents have been identified at hatchery facilities that rear or hold juvenile summer steelhead for subbasin hatchery production (Table 10). Parasites include *Ichthyobodo sp.* (Costia) and *Ichthyophthirius sp.* (Ich). Bacterial diseases include bacterial gill disease, *Cytophaga psychrophila* (Cold water disease), and *Flexibacter columnaris* (Columnaris). Viral diseases include Infectious Hematopoietic Necrosis (IHN).

Figure 1 (TT). Freshwater **life** history for hatchery produced summer **steelhead, Imnaha River subbasin** (Nez **Perce Tribe** of Idaho **et** al. 1990).



Notes:

1. The developmental stage timing represents basin-wide averages, local conditions may cause some variability.

2. Double thick bars indicate periods of heaviest adult migration, spawning and juvenile outmigration.

Table 1 (IR). Hatchery releases of summer steelhead into the Imnaha River subbasin by brood year and if marked, by coded wire tag code[a].

Brood Year	Stock	Hatchery	Life Stage	Release Date (1)	Release Date (2)	Fish/ lb	Number Released	Release Location	CWT/ Fin clip[b]
1982	Imnaha	Irrigon NFH	molt	05/02/83	..	5.0	10,375	Little Sheep Creek	No mark
1982	Imnaha,	Irrigon NFH	molt	05/04/83	..	5.5	13,640	Little Sheep Creek	No mark
1982	Imnaha	Irrigon NFH	smolt	05/03/83	..	7.4	16,428	Little Sheep Creek	No mark
1982	Imnaha	Irrigon NFH	smolt	05/05/83	..	6.0	6,360	Little Sheep Creek	No mark
1982	Imnaha	Wallowa	smolt	05105/83	..	5.6	24,920	Little Sheep Creek	No mark
1983	Imnaha	Irrigon NFH	smolt	04130/84	..	10.2	12,750	Little Sheep Creek	No mark
1983	Imnaha	Irrigon NFH	smolt	05/01/84	05/02/84	7.8	11,856	Little Sheep Creek	No mark
1983	Imnaha	Wallows	smolt	04/23/84	..	5.6	40,179	Little Sheep Creek	No mark
1984	Imnaha	Irrigon NFH	smolt	04/10/85	..	5.1	25,296	Little Sheep Creek	No mark
1984	Imnaha	Irrigon NFH	smolt	04/29/85	..	7.9	7,505	Little Sheep Creek	No mark
1984	Imnaha	Irrigon NFH	smolt	04/30/85	..	10.0	22,500	Little Sheep Creek	No mark
1984	Imnaha	Wallowa	Smelt	04/30/85	--	4.9	11,074	Little Sheep Creek	No mark
1984	mn	Wallowa	smolt	04/30/85	05/01/85	5.0	12,850	Little Sheep Creek	No mark
1985	Imnaha	Wallowa	smolt	04/25/86	04/30/86	5.5	27,128	Little Sheep Creek	07-37-60
1985	Imnaha	Wallowa	smolt	04/25/86	04/30/86	5.5	27,162	Little Sheep Creek	07-37-61
1985	Imnaha	Wallowa	smolt	04/25/86	04/30/86	5.5	576	Little Sheep Creek	AD-LV
1985	Imnaha	Wallowa	smolt	04/25/86	04/30/86	5.5	60,530	Little Sheep Creek	No mark
1986	Imnaha	Irrigon NFH	smolt	05/01/87	05/05/87	5.0	47,836	Little Sheep Creek	07-41-22
1986	Imnaha	Irrigon NFH	Smelt	05/01/87	05/05/87	5.0	3,461	Little Sheep Creek	AD-LV
1986	Imnaha	Irrigon NFH	Smelt	05/01/87	05/05/87	5.0	475	Little Sheep Creek	No mark
1986	Imnaha	Irrigon NFH	smolt	05/01/87	..	4.6	22,140	Little Sheep Creek	AD
1986	Imnaha	Irrigon NFH	smolt	05/04-87	05/05/87	5.0	15,840	Little Sheep Creek	AD
1986	Imnaha	Irrigon NFH	smolt	05/05/87	--	8.0	4,936	Little Sheep Creek	AD
1987	Imnaha	Irrigon NFH	smolt	04/14/88	--	5.3	27,329	Little Sheep Creek	07-40-33
1987	Imnaha	Irrigon NFH	smolt	04/14/88	..	5.3	27,545	Little Sheep Creek	07-40-34
1987	Imnaha	Irrigon NFH	smolt	04/14/88	..	5.3	741	Little Sheep Creek	AD-LV
1987	Imnaha	Irrigon NFH	smolt	04/14/88	--	5.3	191,379	Little Sheep Creek	--
1987	Imnaha	Irrigon NFH	smolt	04/21/88	04/22/88	4.3	26,101	Imnaha River	AD
1987	Imnaha	Irrigon NFH	Smelt	04/22/88	04/28/88	5.8	13,224	Imnaha River	AD
1987	Imnaha	Irrigon NFH	Smelt	04/27/88	--	5.9	45,194	Imnaha River	AO
1988	Imnaha	Wallowa	fry	01/01/88[c]	12/31/88[c]	..	35,698	Little Sheep Creek	--
1988	Imnaha	Irrigon NFH	smolt	04/21 /89	04/24/89	5.3	27,461	Little Sheep Creek	07-46-56
1988	Imnaha	Irrigon NFH	Smelt	04/21/89	04/24/89	5.3	27,235	Little Sheep Creek	07-46-57
1988	Imnaha	Irrigon NFH	Smelt	04/21/89	04/24/89	5.3	1,078	Little Sheep Creek	AD-LV
1988	Imnaha	Irrigon NFH	smolt	04/21/89	04/24/89	5.3	193,684	Little Sheep Creek	..
1988	Imnaha	Irrigon NFH	smolt	05/01/89	..	5.4	19,143	Imnaha River	AD
1988	Imnaha	Irrigon NFH	smolt	05/01/89	05/03/89	5.5	53,433	Imnaha River	AD
1989	Imnaha	Irrigon NFH	smolt	04/16/90	04/1 7/90	5.7	26,363	Little Sheep Creek	07-51-24
1989	Imnaha	Irrigon NFH	smolt	04/16/90	04/1 7/90	5.7	26,164	Little Sheep Creek	07-51-25
1989	Imnaha	Irrigon NFH	smolt	04/16/90	04/17/90	5.7	766	Little Sheep Creek	AD-LV
1989	Imnaha	Irrigon NFH	Smelt	04/16/90	04/1 7/90	5.7	196,270	Little Sheep Creek	--
1989	Imnaha	Irrigon NFH	smolt	04/25/90	04/26/90	6.7	65,660	Imnaha River	AD

Table 1 (TR). (cont.) Hatchery releases of summer steelheed into the Imnaha River subbasin by brood year and if marked, by coded wire tag Codes.

Brood Year	Stock	Hatchery	Life Stage	Release Date (1)	Release Date (2)	Fish/ lb	Number Released	Release Location	CUT/ Fin clip[b]
1989	Imnaha	Irrigon NFH	smolt	04/26/90	--	6.5	16,250	Imnaha River	AD
1990	Imnaha	Irrigon NFH	smelt	04/23/91	--	5.1	24,282	Little Sheep Creek	07-53-57
1990	Imnaha	Irrigon NFH	smolt	04/23/91	--	5.1	26,644	Little Sheep Creek	07-53-58
1990	Imnaha	Irrigon NFH	molt	04/23/91	--	6.4	23,948	Little Sheep Creek	07-53-55
1990	Imnaha	Irrigon NFH	smol t	04/23/91	--	6.4	19,516	Little Sheep Creek	07-53-56
I W O	Imnaha	Irrigon NFH	smelt	04/23/91	--	5.1	498	Little Sheep Creek	AD- LV
I W O	Imnaha	Irrigon NFH	smol t	04/23/91	--	6.4	1,312	Little Sheep Creek	AD- LV
I W O	Imnaha	Irrigon NFH	smolt	04/23/91	--	5.1	140,977	Little Sheep Creek	--
I W O	Imnaha	Irrigon NFH	smol t	04/23/91	--	6.4	763	Little Sheep Creek	..
1990	Imnaha	Irrigon NFH	smol t	04/23/91	--	6.4	2,566	Little Sheep Creek	AD
I W O	Imnaha	Irrigon NFH	smol t	05/03/91	--	6.0	4,560	Imnaha River	AD

[a] Estimates are f rom Oregon Department of Fish and Wildl ife (unpublished data).
[b] AD = Adipose, LV = Left ventral.
[c] Release dates unknown (only the year of release known). Standardized to the first and last day of the year.

Table 2 (R&l). Total returns of naturally produced Imnaha stock summer steelhead to the Little Sheep Creek Facility in the Imnaha River subbasin, by brood year. Estimates for each age category along the upward diagonal to the right of a given footnote were derived from the same reference.

	Total Age						
Brood Year	2	3	4	5	6	Total	Adult Total
1978	--	--	14	0	--	--	--
1979	--	32	3	2	--	--	--
1980	0[a]	68	77	0	--	145	145
1981	0[a]	84	10	0	--	94	94
1982	0[b]	39	6	0	--	45	45
1983	0[c]	87	16	0	--	103	103
1984	17[d]	31	23	0	--	71	71
1985	0[d]	33	24	--	--	--	--
1986	0[e]	33	--	--	--	--	--
1987	0[f]	--	--	--	--	--	--

[a] Estimate is modified from Carmichael and Messmer (1985).
[b] Estimate is modified from Carmichael et al. (1986).
[c] Estimate is modified from Carmichael et al. (1987).
[d] Estimate is ❑edified from Carmichael et al. (1988).
[e] Estimate is modified from Messmer et al. (1989).
[f] Estimate is modified from Messmer et al. (1990).

Table 3 (RH-2). Total returns of Hatchery Imnaha stock summer steelhead to the Little Sheep Creek facility in the Imnaha River subbasin, by brood year. Estimates for each age category along the upward diagonal to the right of a given footnote were derived from the same reference.

	Total Age						
Brood Year	2	3	4	5	6	Total	Adult Total
1982	52[a]	3	0	0	--	55	55
1983	20[b]	2	6	0	--	28	28
1984	618[c]	113	0	0	--	731	731
1985	689[c]	261	0	--	--	--	--
1986	45[d]	125	--	--	--	--	--
1987	799[e]	--	--	--	--	--	--

[a] Estimate is modified from Carmichael et al. (1986).
[b] Estimate is modified from Carmichael et al. (1987).
[c] Estimate is modified from Carmichael et al. (1988).
[d] Estimate is modified from Messmer et al. (1989).
[e] Estimate is modified from Messmer et al. (1990).

Table 4 (AL). Mean fork length by brood year and age class (freshwater.ocean) for Hatchery Imnaha stock summer steelhead collected at the Little Sheep Creek facility in the Imnaha River subbasin. Estimates within each freshwater age group that are along the upward diagonal to the right of a given footnote were derived from the same reference.

Mean Fork Length (cm)

Brood Year	1.1	1.2	1.3	2.1	2.2	2.3	3.1	3.2	3.3
1982	58[a]	65	--	--	--	--	--	--	--
N	--	--	--	--	--	--	--	--	--
St. dev.	--	--	--	--	--	--	--	--	--
1983	59[b]	--	71	58[c]	--	--	--	--	--
N	--	--	--	--	--	--	--	--	--
St. dev.	--	--	--	--	--	--	--	--	--
1984	59[c]	70	--	60[c]	--	--	--	--	--
N	--	--	--	--	--	--	--	--	--
St. dev.	--	--	--	--	--	--	--	--	--
1985	59[c]	70	--	--	--	--	--	--	--
N	--	--	--	--	--	--	--	--	--
St. dev.	--	--	--	--	--	--	--	--	--
1986	58[d]	70	--	62[e]	--	--	--	--	
N	--	--	--	--	--	--	--	--	--
St. dev.	--	--	--	--	--	--	--	--	--
1987	59[e]	--	--		--	--	--	--	--
N	--	--	--	--	--	--	--	--	--
St. dev.	--	--	--		--	--	--	--	--

[a] Estimate is modified from Carmichael et al. (1986).
[b] Estimate is modified from Carmichael et al. (1987).
[c] Estimate is modified from Carmichael et al. (1988).
[d] Estimate is modified from Messmer et al. (1989).
[e] Estimate is modified from Messmer et al. (1990).

Table 5 (AC). Age Composition (freshwater.ocean) by brood year for Hatchery Imnaha stock su
collected at the Little Sheep Creek facility in the Imnaha River subbasin. Estimates w
age group that are along the upward diagonal to the right of a given footnote were deri
reference.

		Age Composition (%)								
Brood Year	N	1.1	1.2	1.3	2.1	2.2	2.3	3.1	3.2	3.3
1982	--	95[a]	5	0	0[b]	0	0	0[c]	--	--
1983	--	73[b]	0	20	7[c]	0	0	0[c]	--	--
1984	--	84[c]	15[c]	0[d]	1[c]	0[d]	0[e]	0[d]	--	--

[a] Sample size used to estimate age composition, by brood year, was derived from data in Carm
[b] Sample size used to estimate age composition, by brood year, was derived from data in Carm
[c] Sample size used to estimate age composition, by brood year, was derived from data in Carm
[d] Sample size used to estimate age composition, by brood year, was derived from data in Mess
[e] Sample size used to estimate age composition, by brood year, was derived from data in Mess

Table 6 (AC-a). Age" Composition (freshwater.ocean) by run year for Hatchery Imnaha stock sum
collected at the Little Sheep Creek facility in the Imnaha River subbasin[a].

Run Year	N	Age Composition (%)								
		1.1	1.2	1.3	2.1	2.2	2.3	3.1	3.2	3.3
1984-85	52	100	0	0	0	0	--	0	--	--
1985-S6	23	88	12	0	0	0	--	0	--	--
1986-87	620	99	0	0	<1	0	--	0	--	--
1987-88	808	85	13	1	1	0	--	0	--	--
1988-89	306	15	85	0	0	0	--	0	--	--
1989-90	924	89	3	0	8	0	--	0	--	--

[a] Estimates are modified from Carmichael et al. (1986) for the 1984-85 run year, from Carmicha
the 1985-86 run year, from Carmichael et al. (1988) for the 1986-87 through 1987-88 run yea
al. (1989) for the 1988-89 run year, and from Messmer et al. (1990) for the 1989-90 run year

Table 7 (AS). Percent females by brood year and age class (freshwater.ocean) for Hatchery I
steelhead collected at the Little Sheep Creek facility in the Imnaha River subbasin. E
freshwater age group that are along the upward diagonal to the right of a given footnot
the same reference.

		Females (%)								
Brood Year	N	1.1	1.2	1.3	2.1	2.2	2.3	3.1	3.2	3.3
1980	--	--	--	--	--	--	--	--	--	--
1981	--	--	--	--	--	--	--	--	--	--
1982	--	74[a]	100	--	--	--	--	--	--	--
1983	--	71[b]	--	100	0[c]	--	--	--	--	--
1984	--	59[c]	81	--	71[c]	--	--	--	--	--
1985	--	50[c]	82	--	--	--	--	--	--	--
1986	--	49[d]	62	--	66[e]	--	--	--	--	--
1987	--	49[e]	--	--	--	--	--	--	--	--

[a] Estimate is modified from Carmichael et al. (1986).
[b] Estimate is modified from Carmichael et al. (1987).
[c] Estimate is modified from Carmichael et al. (1988).
[d] Estimate is modified from Messmer et al. (1989).
[e] Estimate is modified from Messmer et al. (1990).

Table 8 (AF). Mean fecundity by brood year and age class (freshwater.ocean) for Hatchery Imnaha stock summer steelhead collected at the Little Sheep Creek facility in the Imnaha River subbasin[a].

	Mean Fecundity								
Brood Year	1.1	1.2	1.3	2.1	2.2	2.3	3.1	3.2	3.3
1985	--	6,044	--	--	--	--	--	--	--
N	--	--	--	--	--	--	--	--	--
st. dev.	--	--	--	--	--	--	--	--	--
1986	4,099	5,879	--	4,255	--	--	--	--	--
N	--	--	--	--	--	--	--	--	--
st. dev.	--	--	--	--	--	--	--	--	--
1987	4,690	4,788		--	--	--	--		--
N	--	--	--	--	--	--	--	--	--
st. dev.	--	--	--	--	--	--	--	--	--
1988	3,562	--	--	--	--	--	--	--	--
N	--	--	--	--	--	--	--	--	--
st. dev.	--	--		--	--	--	--	--	--

[a] Estimates are from Oregon Department of Fish and Wildlife (unpublished data).

Table 9 (AF-a). Mean fecundity by run year for Hatchery Imnaha stock summer steelhead collected at the Little Sheep Creek facility in the Imnaha River subbasin[a].

Run Year	N	Mean Fecundity	st. dev.
1984-85	34	5,281	--
1985-86	94	4,530	--
1986-87	42	4,565	--
1987-88	162	4,291	--
1988-89	171	4,836	--
1989-90	129	5,876	--
1990-91	179	4,745	--

[a] Estimates are from Messmer et al. (1990).

Table 10 (TD). Parasites and diseases of summer steelhead at hatcheries releasing juveniles i
subbasin[a].

Disease type	Hatchery	Specific Pathogen
Parasite	Wallows	*Ceratomyxa shasta*
Parasite	Irrigon	*Ichthyobodo sp.* (Costia)
Parasite	Irrigon[b]	*Ichthyophthirius sp.* (Ich)
Bacteria	Wallows	*Aeromonas spp.*
Bacteria	Wallows	*Pseudomonas spp.*
Bacteria	Wallows	*Yersinia ruckeri* (Enteric Red Mouth disease)
Bacteria	Wallowa[b]	*Myxobolus cerebralis* (Whirling disease)
Bacteria	Wallowa	*Renibacterium salmoninarum* (Bacterial kidney diseas
Bacteria	Irrigon	Bacterial gill disease
Bacteria	Irrigon	Motile Gill Bacteria
Bacteria	I rrigon	*Aeromonas spp.*
Bacteria	I rrigon	*Pseudomonas spp.*
Bacteria	Irrigon	*Renibacterium salmoninarum* (Bacterial kidney d sease
Bacteria	Irrigon	*Flexibacter psychrophilus*
Bacteria	Irrigon[b]	*Cytophaga psychrophila* (Cold water disease)
Bacteria	Irrigon[b]	*Flexibacter columnaris* (Columnaris)
Bacteria	Wallowa[c]	Bacterial gill disease
Bacteria	Wallowa[c]	*Ichthyobodo sp.* (Costia)
Bacteria	Wallowa[c]	*Flexibacter columnaris* (Columnaris)
Bacteria	Wallowa	*Flexibacter psychrophilus*
Bacteria	Wallowa	*Myxobolus cerebralis* (Whirling disease)
Virus	Wallowa[b]	Infectious Hematopoietic Necrosis (IHN)
Fungi	Wallowa[b]	External fungi
Fungi	Irrigon[b]	External fungi

[a] Except where footnoted, data are from a letter dated 2/92 from Warren Groberg, Oregon Departn
Wildlife, Fish Pathology, La Grande, Oregon.
[b] Data are from a telephone interview on 1/9/92 with Warren Groberg, Oregon Department of Fish
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[c] Data from Howell et al. (1985).

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Appendix Table 1. Snake River chinook electrophoretic data from Waples et al. (1991).

Allele frequency data for 1988 brood-year samples of juvenile Snake River chinook salmon- Locus abbreviations are explained in Table 1. N is the number of fish scored for each locus. Allele mobility designations are explained in text. Alleles screened but not found in any samples are shown in parentheses after locus names.

Locus/ Allele	Marsh Creek	Johnson Creek	Upper Salmon River	Valley Creek	Secesh River	Lostine River	Imnaha River	McCall Hatchery	Sawtooth Hatchery	Looking. Hatchery	Imnaha Hatchery
*sAAT-1.2** (105)											
(N)	100	96	99	97	91	100	99	100	99	100	100
100	1.000	0.956	0.977	0.992	0.995	1.000	1.000	0.998	0.975	1.000	1.000
85	0.000	0.044	0.023	0.008	0.005	0.000	0.000	0.003	0.025	0.000	0.000
*sAAT-3** (90)											
(N)	100	97	99		92	99	100	100	89	99	98
100	1.000	1.000	0.865	0.5%	1.000	1.000	0.995	1.000	1.000	0.980	1.000
113	0.000	0.000	0.036	0.010	0.000	0.000	0.005	0.000	0.000	0.020	0.000
*sAAT-4** (130)											
(N)	98	86	89	97	76	95	98	68	89		
100	0.985	0.919	1.000	1.000	0.967	0.716	0.959	0.919	0.966	0.9%	0.9%
63	0.015	0.081	0.000	0.000	0.033	0.264	0.041	0.081	0.034	0.022	0.026
*mAAT-1** (-77)											
(N)	100	96	99	98	90	96	100	96	100	94	100
-100	1.000	0.990	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.995
-104	0.000	0.010	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.005
*ADA-1**											
(N)	100		99	99		100		100	100	100	100
100	0.910	0.9%	0.949	0.894	0.8%	0.970	Ok?	0.940	0.935	1.000	Looo
83	0.090	0.015	0.061	0.106	0.158	0.030	0.005	0.060	0.065	0.000	0.000
*ADH** (-170)											
(N)	99	97	99	99	92	100	100	100	100	100	100
-100	1.000	1.000	1.000	1.000	1.000	0.985	0.995	1.000	1.000	Iwo	1.000
-s2	0.000	0.000	0.000	0.000	0.000	0.016	0.005	0.000	0.000	0.000	0.000
*sAH** (69, 108, 116)											
(N)	100	97	99	99	92	100	100	100	100	100	100
100	1.000	1.000	1.000	1.000	1.000	0.995	1.000	0.990	0.995	1.000	0.985
86	0.000	0.000	0.000	0.000	0.000	0.005	0.000	0.010	0.005	0.000	0.015
*mAH-2**											
(N)	99	60		96	84	100	98	89	98	100	100
100	0.864	0.883	0.9%	0.807	0.958	0.900	0.929	0.933	0.918	0.885	0.915
86	0.116	0.117	0.082	0.193	0.042	0.100	0.071	0.067	0.082	0.115	0.085
*mAH-4** (112)											
(N)	100	94	99	99	91	100	100	100	100	100	100
100	1.000	1.000	1.000	1.000	1.000	0.990	0.990	0.985	1.000	1.000	0.990
119	0.000	0.000	0.000	0.000	0.000	0.010	0.010	0.015	0.000	0.000	0.010
*GAPDH-2**											
(N)	100	96	99	98	85	1.00	100	100	100	100	100
100	1.000	1.000	1.000	1.000	1.000	0.99s	1.000	1.000	1.000	1.000	1.000
22	0.000	0.000	0.000	0.000	0.000	0.005	0.000	0.000	0.000	0.000	0.000

Appendix Table 1. Cont.

Locus/ Allele	Marsh Creek	Johnson Creek	Upper Salmon River	Valley Creek	Secesh River	Lostine River	Imnaha River	McCall Hatchery	Sawtooth Hatchery	Looking. Hatchery	Imnaha Hatchery
*GAPDH-4**											
(N)	100	77		99	78	100	100		80	99	99
100	1.000	1.000	1.0%	1.000	0.974	0.945	0.995	0.9%	1.000	1.000	1.000
95	0.000	0.000	0.000	0.000	0.026	0.055	0.005	0.013	0.000	0.000	0.000
*βGLUA**											
(N)		92	99		86		100	100	100	97	98
100	1.0%	1.000	0.980	0.9%	0.994	0.9%	0.975	0.995	0.990	0.995	0.908
60	0.000	0.000	0.020	0.078	0.006	0.031	0.025	0.005	0.010	0.005	0.092
*GPI-B2*** *(24, 135)*											
(N)	100	97	99	99	92	100	99	100	97	100	100
100	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.859
60	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.141
*GR** (110)											
(N)	100	97	99	99	92	100	100	100	100	100	100
100	1.000	0.995	1.000	1.000	1.000	0.955	0.995	0.985	1.000	1.000	1.000
85	*0.000*	*0.005*	*0.000*	0.000	0.000	0.04s	0.005	0.015	0.000	0.000	0.000
*HAGH**											
(N)		66	99		89	100	100	100	99	99	100
100	0.9%	1.000	0.970	0.9%	0.955	0.975	0.990	0.960	0.939	0.944	0.950
143	0.098	0.000	0.030	0.051	0.046	0.025	0.010	0.040	0.061	0.056	0.050
*IDDH-1**											
(N)	59		57	74	87	100		99	58	100	90
100	0.907	1.0%	0.956	0.980	0.994	0.980	0.9%	0.975	0.897	0.960	0.978
0	0.093	0.000	0.044	0.020	0.006	0.020	0.053	0.025	0.103	0.040	0.022
*sIDHP-1** (63, 129, 142)											
(N)	100		99	99	92	100	100	100		100	100
100	0.870	0.7%	0.742	0.848	0.804	0.815	0.835	0.795	0.L%	0.920	0.805
74	0.115	0.216	0.217	0.091	0.196	0.185	0.140	0205	0.115	0.050	0.175
94	0.01s	0.010	0.040	0.061	0.000	0.000	0.025	0.000	0.046	0.030	0.020
*sIDHP-2** (50)											
(N)	100	97		99	92	100	100	100	100	100	100
100	0.s66	0.990	0.9%	0.949	1.000	0.975	1.000	1.000	0.945	1.000	1.000
127	0.036	0.010	0.025	0.051	0.000	0.025	0.000	0.000	0.055	0.000	0.000
*LDH-B1**											
(N)	100	97	99	99	92	99	100	100	100	100	100
100	1.000	0.990	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
48	0.000	0.010	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
*LDH-B2** (71. 134)											
(N)	100	97	99	99	92	100	too	100	100	100	100
100	0.985	0.995	0.980	0.970	0.973	1.000	Looo	0.990	0.995	0.990	1.000
112	0.016	0.005	0.020	0.030	0.027	0.000	0.000	0.010	0.005	0.010	0.000
*LDH-C** (90)											
(N)	100	97	99	99	92		100	100	97	100	100
100	1.000	0.918	1.000	0.995	0.962	1.(%	1.000	0.985	0.995	1.000	1.000
84	0.000	0.082	0.000	0.000	0.038	0.000	0.000	0.015	0.005	0.000	0.000
106	0.000	0.000	0.000	0.005	0.000	0.000	0.000	0.000	0.000	0.000	(?.000

Appendix Table 1. Cont.

Locus/ Allele	Marsh Creek	Johnson Creek	Upper Salmon River	Valley Creek	Secesh River	Lostine River	Imnaha River	McCall Hatchery	Sawtooth Hatchery	Looking. Hatchery	Imnaha Hatchery
*sMDH-B1,2** (83)											
(N)	100	97	99	99		100	100	100	100	100	100
100	0.990	0.979	0.985	0.944	0.9%	0.988	0.985	0.993	0.980	0.993	0.943
121	0.010	0.015	0.013	0.056	0.003	0.013	0.015	0.008	0.020	0.008	0.057
70	0.000	0.005	0.003	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
*mMDH-1**											
(N)	92		99	99	13	95	100	92	100	100	100
-ioo	1.000	1.0%	1.000	1.000	1.000	1.000	0.996	1.000	1.000	1.000	1.000
-900	0.000	0.000	0.000	0.000	0.000	0.000	0.005	0.000	0.000	0.000	0.000
*mMDH-2**											
(N)	99	97	97	97	91	100	98	100	97	100	
100	0.646	0.598	0.485	0.557	0.753	0.735	0.658	0.735	0.526	0.800	0.6%
200	0.354	0.402	0.515	0.443	0.247	0.265	0.342	0.265	0.474	0.200	0.303
*sMEP-1** (105)											
(N)	95	97	99		89	96	98	99	99	100	93
100	0.079	0.077	0.030	0.0%	0.017	0.052	0.061	0.035	0.010	0.070	0.043
92	0.921	0.923	0.970	0.969	0.983	0.948	0.939	0.965	0.990	0,930	0.957
*sMEP-2***											
(N)	100	97	99	99	91	100	99	100	100	100	95
100	0.900	0.898	1.000	1.000	0.780	1.000	1.000	1.000	1.000	1.000	1.000
78	0.100	0.102	0.000	0.000	0.210	0.000	0.000	0.000	0.000	0.000	0.000
*MPI** (113)											
(N)	100	95	99	99	91	100	100	100	99	100	100
100	0.880	0.989	0.939	0.889	0.967	0.770	0.885	0.920	0.884	0.935	0.780
109	0.120	0.011	0.061	0.111	0.033	0.225	0.115	0.080	0.116	0.066	0.220
95	0.000	0.000	0.000	0.000	0.000	0.005	0.000	0.000	0.000	0.000	0.000
*PEPA** (86)											
(N)	100	97	99	99	92	100	100	100	100	100	100
100	0.995	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.995	1.000	1.000
90	0.005	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.005	0.000	0.000
*PEPB-1**											
(N)	100	94	99	99	92	100	100	100	100	100	99
100	0.945	0.856	0.879	0.904	0.902	0.960	0.915	0.935	0.870	0.805	0.909
130	0.050	0.027	0.091	0.096	0.085	0.015	0.0s0	0.015	0.090	0.095	0.030
-3s0	0.005	0.117	0.030	0.000	0.033	0.025	0.035	0.050	0.040	0.100	0.061
*PEPD-2**											
(N)	100	97	99	99	92	100	100	100	100	100	100
100	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.995	1.000	1.000	1.000
107	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.005	0.000	0.000	0.000
*PEP-LT**											
(N)	100	97	99	99	92	100	100	100	100	100	100
100	0.870	0.948	0.985	0.919	0.870	0.925	0.965	0.920	0.885	0.945	0.955
110	0.130	0.052	0.015	0.081	0.130	0.075	0.035	0,080	0.115	0.055	0.045
*PGK-2**											
(N)	100	97	99	99	92	100	100	100	95	100	100
100	0.065	0.067	0.101	0.187	0.152	0.086	0.100	0.110	0.142	0.085	0.120
90	0.935	0.933	0.899	0.813	0.848	0.915	0.900	0.890	0.858	0.915	0.880

Appendix Table 1. Cont.

Locus/ Allele	Marsh Creek	Johnson Creek	Upper Salmon River	Valley Creek	S. ecesh River	Lostine River	Imnaha River	McCall Hatchery	Sawtooth Hatchery	Looking. Hatchery	Imnaha Hatchery
*PGM-3,4** (88, 108)											
(N)	100	97	96		92	98	96		95	96	100
100	0.285	0.518	0.326	0.3%	0.462	0.510	0.484	0.4%	0.338	0.295	0.508
94	0.715	0.482	0.674	0.625	0.538	0.490	0.516	0.571	0.662	0.705	0.493
*sSOD-1** (680, 1260)											
(N)	100	97	97	99	90	99	100	100	100	100	100
-100	0.945	0.974	0.964	0.939	0.956	0.919	0.885	0.980	0.965	0.970	0.890
-260	0.055	0.026	0.036	0.061	0.044	0.081	0.115	0.020	0.035	0.030	0.110
*TPI-2.2**											
(N)	100	97	99	99	92	100	100	100	100	100	100
100	0.910	0.954	0.924	0.894	0.897	0.875	0.825	0.875	0.890	0.915	0.850
104	0.090	0.046	0.076	0.106	0.103	0.125	0.175	0.125	0.110	0.085	0.150

Allele frequencies at GPI-B2 and sMEP-2* are estimated indirectly and thus subject to higher variance than those for other loci; see text for discussion.

Appendix Table 2. Additional Snake River chinook electrophoretic data cited by Naples et. al .(1991)

Temporal comparisons of allele frequency in Snake River chinook sab.non populations for which old data are available (Milner et al. 1983; Milner et al. 1986). Brood years for samples are indicated below population names; other details are as in Appendix Table 1,

Locus/ allele	McCall 1981	Hatchery 1988	Johnson 1981	Creek 1988	Valley 1982	Creek 1988	Looking. Hatchery 1988	Rapid River H. 1981+84	Upper Salmon 1981	River 1988	Sawtooth Hatchery 1988
*sAAT-1,2**											
(N)	50	100	56	98	22	97	100	150	50	100	99
100	1.000	0.998	0.964	0.957	0.977	0.992	1.000	1.000	1.000	0.978	0.975
85	0.000	0.003	0.036	0.043	0.028	0.008	0.000	0.000	0.000	0.023	0.025
*sAAT-3**											
(N)	50	100	56	100		99	99	150	50	100	89
100	1.000	1.000	1.000	1.000	1.0?0	0.990	0.980	0.990	1.000	0.965	1.000
113	0.000	0.000	0.000	0.000	0.000	0.010	0.020	0.010	0.000	0.035	0.000
*ADA-1**											
(N)		100	56	100	22	99	100	150	48		100
100	0.9%	0.940	1.000	0.985	0.932	0.894	1.000	0.990	0.969	0.9%	0.935
83	0.100	0.060	0.000	0.016	0.068	0.106	0.000	0.010	0.031	0.051	0.065
*sAH**											
(N)		100	53		22	99	100	148	50	100	100
100	1.0%6	0.990	1.000	1.0%	1.000	1.000	1.000	0.993	1.000	1.000	0.995
86	0.000	0.010	0.000	0.000	O.000	0.000	0.000	0.007	0.000	0.000	0,005
*GR**											
(N-)	50	100	56	100	22	99	100	150	50	100	100
100	1.000	0.985	1.000	0.995	1.000	1.000	1.000	0.997	1.000	1,000	1.000
85	0.000	0.015	0.000	0.005	0.000	0.000	0.000	0.003	0.000	0,000	0,000
*HAGH**											
(N)		100	56	68	22	99	99	144	48	100	99
100	0.9%	0.960	0.991	1.000	0.955	0.949	0.944	0.913	0.917	0.970	0.939
143	0.030	0.040	0.009	0.000	0.045	0.061	0.056	0.087	0.083	0.030	0.061

Appendix Table 2. Continued.

Locus/ allele	McCall 1981	Hatchery 1988	Johnson 1981	Creek 1988	Valley 1982	Creek 1988	Looking, Hatchery 1988	Rapid River H. 1981+84	Upper Salmon 1981	River 1988	Sawtooth Hatchery 1988
*sIDHP-1**											
(N)		100	56	99	22		100	150	50		100
100[a]	0.7%	0.795	0,902	0.786	0.910	0.9%	0.950	0.920	0.840	0.7%	0.885
74	0,260	0.205	0.098	0.214	0.090	0.091	0,060	0.080	0.160	0.217	0.115
*sIDHP-2**											
(N)	50	100	66	99	22	99	100	150	50	99	100
100	1.000	1.000	1.000	0.990	0.910	0,949	1.000	1,000	1.000	0,975	0.945
127	0.000	0.000	0.000	0.000	0.090	0.051	0.000	0.000	0.000	0.025	0.055
*LDH-B2**											
(N)	50	100	56	98		99	100	150	50		100
100	1.000	0.990	1,000	0.995	0.9%	0.970	0.990	0.990	0.980	0.9?0	0,995
112	0.000	0.010	0.000	0.005	0.023	0.030	0,010	0.010	0,020	0.020	0,005
*LDH-C**											
(N)	50	100	56	100		99	100	150	48	100	97
100	0.970	0.985	0.982	0.920	1.0%	0.995	1,000	1,000	1.000	1.000	0.995
84[b]	0.030	0.015	0,018	0.080	0.000	0.000	0.000	0,000	0,000	0.000	0.005
106	0.000	0.000	0.000	0.000	0.000	0.005	0,000	0,000	0,000	0.000	0.000
*MDH-B1,2**											
(N)	50	100	56	98	22	99	100	149	49	99	100
100	0.996	0.993	1.000	0.980	0.989	0.944	0.993	1.000	1.000	0.985	0.980
121	0.005	0.008	0,000	0.015	0.011	0.056	0.008	0.000	0.000	0.013	0.020
70	0.000	0.000	0.000	0.005	0.000	0.000	0.000	0,000	0.000	0.003	0,000
*MPI**											
(N)	50	100	56	96	22	99	100	150	50	99	99
100	0.960	0.920	0.946	0.990	0.795	0.889	0.935	0.940	0.890	0.939	0.884
109	0.040	0.080	0.054	0.010	0.205	0.111	0.065	0.060	0,110	0.061	0.116
*PEPA**											
(N)		100	56	100	22	99	100	150		99	100
100	1.0%	1.000	1.000	1.000	0.977	1.000	1.000	1.000	0.9%	1.000	0,995
90	0.000	0.000	0.000	0.000	0.023	0.000	0.000	0.000	0.010	0.000	0.005

Appendix Table 2. Continued

Locus/ allele	McCall Hatchery 1981	McCall Hatchery 1988	Johnson Creek 1981	Johnson Creek 1988	Valley Creek 1982	Valley Creek 1988	Looking, Hatchery 1988	Rapid River H. 1981+84	Upper Salmon River 1981	Upper Salmon River 1988	Sawtooth Hatchery 1988
*PEPB-1**											
(N)	50	100	56	94	22	99	100	148	50	100	100
100[c]	0,930	0.985	0.991	0.973	0.818	0.904	0.905	0.892	0.860	0.910	0.910
130	0.070	0.015	0,009	0.027	0.182	0.096	0.095	0.108	0.140	0.090	0.090
*PEP-LT**											
(N)	50	100	56	100	22	99	100	150		100	100
100	0.890	0.920	0.929	0.950	0.841	0.919	0.946	0.963	0,9%	0.985	0.88.5
110	0.110	0.080	0.071	0.050	0.159	0.081	0.055	0.037	0.030	0,015	0.115
*PGK-2**											
(N)	50	100	S6	100	22	99	100	150	50	99	95
100	0,080	0.110	0.045	0.065	0.205	0.187	0.085	0.103	0.090	0,101	0.142
90	0.920	0.890	0,955	0.935	0.795	0.813	0.915	0.897	0.910	0,899	0.858
*sSOD-1**											
(N)	50	100		97	22	99	100	150	48	98	100
-1oo	0.980	0.980	0.9%	0.974	0.886	0.939	0,970	0.913	0.948	0.964	0.965
-260	0.020	0.020	0.027	0.026	0,114	0.061	0,030	0.087	0,052	0.036	0.035

[a]includes "94" allele
[b]Includes "90" allele
[c]Includes "-350" allele

Appendix Table 3. Columbia River chinock electrophoretic data from Schreck et al. (1996).

Isozyme gene frequencies and sample sizes (N) as determined by electrophoresis for chinook salmon stocks in Oregon, Washington and Idaho. Numbers at the top of each column are the relative nobilities for each allele present in the enzyme system. Minus signs indicate cathodal migration. An asterisk indicates that an allele was present at a frequency of less than .005. "Form" is the time of freshwater entry (S for spring, F for fall and SUM for summer). A pound sign (#) indicates that data for that stock was obtained from the Genetic Stock Identification Study (Milner et al. 1983).

Chinook salmon gene frequency data.

CHINOOK STOCK	FORM	ACONITATE HYDRATASE					ADENOSINE DEAMINASE			ALCOHOL DEHYDROGENASE		
		N	100	86	116	69	N	100	83	N	-100	-52
COWLITZ HATCHERY #	F	91	.82	.17	.02		98	.99	.01	49	.97	.03
COWLITZ HATCHERY	S	92	.83	.16	.01					95	.%	.04
KALAMA HATCHERY	F	91	.91	.08	.01					88	.88	.12
KALAMA HATCHERY	S	96	.s5	.14	.01					100	.%	.04
LEWIS HATCHERY	S	100	.98	.02			84	.92	.08	100	.98	.02
LEWIS HATCHERY	F	75	.77	.23						61	.94	.06
LEWIS RIVER	J?	82	.82	.16	.01					194	.97	.03
CLACKAMAS RIVER	F	47	.69	.30	.01		50	1.00		50	.99	.01
CLACKAMAS RIVER	S	79	.77	.20	.03					80	.99	.01
EAGLE CREEK HATCHERY	S	87	.76	.21	.03		100	1.00		100	.98	.02
EAGLE CREEK HATCHERY 85	S	95	.79	.17	.03	.01	60	1.00		100	.99	.01
MARION FORKS HATCHERY	S	97	*79	.19	.02		100	1.00		100	1.00	
SOUTH SANTIAM HATCHERY	S	98	.72	.27	.01		65	1.00		100	1.00	
THOMAS CREEK	S	95	.83	.16	.01					100	.98	.02
MCKENZIE HATCHERY	S	98	.79	.19	.02		50	1.00		100	1.00	
MCKENZIE HATCHERY 85	S	95	.85	.13	.02	.01	95	1.00		100	1.00	
DEXTER HATCHERY	S	9s	.75	.22	.03		100	1.00		100	1.00	
SANDY RIVER	F	56	.s4	.03	.03					56	1.00	
SANDY RIVER 85	F	48	.8s	.09	.03		49	1.00		49	.%	.04
WASHOUGAL RIVER	F	50	.s6	.13	.01		50	.99	.01	50	.95	.05
BONNEVILLE HATCHERY	F	93	1.00				93	1.00		87	.87	.13
CARSON HATCHERY	S	100	.s8	.02						200	1.00	
CARSON HATCHERY 85	S	100	.99	.01			75	.97	.03	97	.95	.05
LIT.WHITE SALMON HATCH.	S	100	.9s	.02						100	1.00	
LIT.WHITE SALMON HATCH. 85	S	98	.99	.1			88	.99	.01	9s	.99	.01
SPRING CREEK HATCHERY	F	100	1.00				100	1.00		82	.85	.15
KLICKITAT RIVER	F	50	.76	.23	.01		50	.99	.01	50	.%	.04
KLICKITAT HATCHERY #	S	50	.93	.07			50	.98	.02			
HOOD RIVER	F	42	.s8	.12								
DESCHUTES RIVER	F	85	.87	.06	.07					87	.93	.07
DESCHUTES RIVER 85	F	52	.s3	.14	.03		54	.98	.02	53	.84	.16
ROUND BUTTE HATCHERY	S	93	1.00				78	1.00		83	1.00	
ROUND BUTTE HATCHERY 85	S	98	.9s		.01		'50	100		98	1.00	
WARM SPRINGS RIVER #	S	50	1.00				50	1.00		50	1.00	

Chinook salmon gene frequency data (continued).

CHINOOK STOCK	FORM	N	ACONITATE HYDRATASE 100	86	116	69	N	ADENOSINE DEAMINASE 100	83	N	ALCOHOL DEHYDROGENASE -100	-52
WALLOWA-LOSTINE RIVER	S	47	1.00				47	1.00		47	1.00	
WALLOWA-LOSTINE RIVER 84	S	40	.99	.01						40	.98	.03
KOOSKIA HATCHERY STOCK	S	100	1.00							90	.99	.01
RED R. SF CLEARWATER #	S	40	1.00				40	.98	.03	40	1.00	
IMNAHA RIVER	S	87	.99	.01			87	1.00		87	.99	.01
IMNAHA RIVER 84	S	108	.99	.01						108	1.00	
RAPID RIVER HATCHERY #	S	50	.98	.02			50	.98	.02	50	1.00	
JOHNSON CREEK #	SUM	53	1.00				56	1.00		56	1.00	
McCALL HATCHERY #	SUM	50	1.00				50	.90	.10	50	1.00	
MIDDLE FORK SALMON	S	50	.98	.02						86	1.00	
EAST FK. SALMON R. STOCK	S	50	1.00				50	.98	.02	50	1.00	
VALLEY CREEK	SUM	20	1.00							50	1.00	
VALLEY CREEK #	S	22	1.00				22	.93	.07	22	1.00	
SAWTOOTH STOCK #	S	50	1.00				48	.97	.03	50	1.00	
YAKIMA RIVER	F	36	.97	.03			36	.97	.03	36	.99	.01
YAKIMA RIVER	S	50	.98	.02			42	.%	.04	50	1.00	
NACHES RIVER	S	37	1.00				50	1.00		50	.98	.02
HANFORD REACH	F	53	.89	.11						100	1.00	
HANFORD REACH 85	F	100	.81	.18	.01		100	1.00		100	.97	.04
PRIEST RAPIDS HATCHERY	F	100	.84	.16			50	1.00		100	.99	.01
WENATCHEE RIVER	S	194	.99	.01			50	.95	.05	199	1.00	
WENATCHEE RIVER	SUM	40	.83.	.19						50	1.00	
WENATCHEE RIVER 85	SUM	49	.83	.17			50	.99	.01	50	1.00	
LEAVENWORTH HATCHERY	S	89	.99	.03,						100	1.00	
LEAVENWORTH HATCHERY 85	S	100	1.00				100	.97	.04	100	1.00	
ENTIAT RIVER	S	128	.98	.02			50	.97	.03	133	1.a)	
WELLS DAM HATCHERY	SUM	98	.88	.12			98	1.00		100	1.00	
METHOW RIVER 83	S	53	.97	.03								
METHOW RIVER 84	S	50	.99	.01			50	.%	.04	50	1.00	
METHOW RIVER	SUM	85	.82	.18								

Chinook salmon gene frequency data (continued).

CHINOOK STOCK	FORM	GLUCOSE PHOSPHATE ISOMERASE-2 N	100	60	GLUCOSE PHOSPHATE ISOMERASE 1-3H N	STANDARD	VARIANT	GLUCOSE PHOSPHATE ISOMERASE-3 N	100	90
COWLITZ HATCHERY #	F	99	1.00					99	1.00	
COWLITZ HATCHERY	S	100	1*00		100	.90	.10	100	1.00	
KALAMA HATCHERY	F	100	1.00		100	1.00		100	1.00	
KALAMA HATCHERY	S	la)	1.00		100	.86	.14	100	1.00	
LEWIS HATCHERY	S	100	1.00		100	1.00		100	1.00	
LEWIS HATCHERY	F	96	.90	.10	96	1.00		100	1.00	
LEWIS RIVER	P	100	1.00		100	1.00		100	1.00	
CLACKAMAS RIVER	F	50	1.00		50	1.00		50	1.00	
CLACKAMAS RIVER	S	80	1.00		80	1.00		80	1.00	
EAGLE CREEK HATCHERY	S	100	1.00		100	1.00		100	1.00	
EAGLE CREEK HATCHERY 85	S	100	1.00		100	1.00		100	1.00	
MARION FORKS HATCHERY	S	100	1.00		100	1.00		100	1.00	
SOUTH SANTIAM HATCHERY	S	100	1.00		100	1.00		100	1.00	
THOMAS CREEK	S	100	1.00		100	.80	.20	100	1.00	
MCKENZIE HATCHERY	S	95	1.00		95	.90	.10	95	1.00	
MCKENZIE HATCHERY 85	s	100	1.00		100	1.00		100	1.00	
DEXTER HATCHERY	s	100	1.00		100	.%3	.17	100	1.00	
SANDY RIVER	F	66	1.00		66	1.00		66	1.00	
SANDY RIVER 85	F	49	. %	.04	49	1.00		49	1.00	
WASHOUGAL RIVER	F	50	.80	.20	50	1.00		50	1.00	
BONNEVILLE HATCHERY	F	93	1.00		93	1.00		93	1.00	
CARSON HATCHERY	s	100	1.00		1(XI	1.00		100	1.00	
CARSON HATCHERY 85	s	95	1.00		95	1.00		95	1.00	
LIT.WHITE SALMON HATCH.	S	50	1.00		50	1.00		50	1.00	
LIT.WHITE SALMON HATCH. 85	S	98	.90	.10	98	1.00		98	1.00	
SPRING CREEK HATCHERY	F	100	1.00		100	1.00		100	1.00	
KLICKITAT RIVER	F	50	1.00		50	1.00		50	1.00	
KLICKITAT HATCHERY #	S	50	1*OO					50	1.00	
HOOD RIVER	F	47	.99	.01	47	1.00		47	.99	.01
DESCHUTES RIVER	F	91	1.00		91	1.00		91	1.00	
DESCHUTES RIVER 85	F	51	1.00		51	.94	.06	51	.98	.02
ROUND BUTTE HATCHERY	s	100	1.00		100	1.00		100	1.00	
ROUND BUTTE HATCHERY 85	S	98	1.00		98	1.00		98	1.00	
WARM SPRINGS RIVER #	s	49	1.00					49	1.00	

Chinook salmon gene frequency data (continued).

CHINOOK STOCK	FORM	GLUCOSE PHOSPHATE ISOMERASE-2 N	100	60	GLUCOSE PHOSPHATE ISOMERASE 1-3H N	STANDARD	VARIANT	GLUCOSE PHOSPHATE ISOMERASE-3 N	100	90
WALLOWA-LOSTINE RIVER	S	47	.90	.10	47	1.00		47	1.00	
WALLOWA-LOSTINE RIVER 84	S	40	1.00		40	1.00		40	1.00	
KOOSKIA HATCHERY STOCK	S	78	1.00		78	1.00		78	1.00	
RED R. SF CLEARWATER #	S	40	1.00					40	1.00	
IMNAHA RIVER	S	87	1.00		87	1.00		87	1.00	
IMNAHA RIVER 84	S	108	1.00		la)	1.00		100	1.00	
RAPID RIVER HATCHERY #	S	50	1.00					so	1.00	
JOHNSON CREEK #	SUM	56	1.00					56	1.00	
McCALL HATCHERY #	SUM	50	1.00					50	1.00	
MIDDLE FORK SALMON	S	50	1.00		50	1.00		50	1.00	
EAST FK. SALMON R. STOCK	S	50	1.00		50	1.00		50	1.00	
VALLEY CREEK	SUM	48	1.00		48	1.00		48	1.00	
VALLEY CREEK #	S	22	1.00					22	1.00	
SAWTOOTH STOCK #	S	50	1.00					50	1.00	
YAKIMA RIVER	F	36	1.00		36	1.00		36	1.00	
YAKIMA RIVER	s	42	1.00		30	1.00		48	1.00	
NACHES RIVER	S	50	.94	.06	50	1.00		50	1.00	
HANFORD REACH	F	%	1.00		96	.80	.20	96	1.00	
HANFORD REACH 85	F	100	1.00		100	.90	.10	100	1.00	
PRIEST RAPIDS HATCHERY	F	91	1.00		91	.90	.10	91	1.00	
WENATCHEE RIVER	s	194	1.00		194	1.00		194	1.00	
WENATCHEE RIVER	SUM	50	1.00		50	1.00		50	1.00	
WENATCHEE RIVER 85	SUM	50	1.00		50	. %	.04	50	1.00	
LEAVENWORTH HATCHERY	s	95	1.00		95	1.00		95	1.00	
LEAVENWORTH HATCHERY 85	s	93	1.00		93	1.00		93	la)	
ENTIAT RIVER	s	133	1.00		133	1.00		133	1.00	
WELLS DAM HATCHERY	SUM	97	1.00		97	.83	.17	97	1.00	
METHOW RIVER 83	S	53	1.00		53	1.00		53	1.00	
METHOW RIVER 84	S	50	1.00		40	1.00		50	1.00	
METHOW RIVER	SUM	88	1.00		88	.89	.11	88	1.00	
WINTHROP HATCHERY #	S	129	1.00					129	.98	.02
OKANAGAN RIVER	SUM	100	.90	.10	100	.83	.17	100	1.00	
OKANAGAN RIVER 85	SUM	50	1.00		50	1.00		50	1.00	

Chinook salmon gene frequency data (continued).

CHINOOK STOCK	FORM	ASPARTATE AMINOTRANSFERASE			ISOCITRATE DEHYDROGENASE				L-LACTATE DEHYDROGENASE-4		
		N	100	90	N	100	74	127	N	100	120
COWLITZ HATCHERY #	F	6s	1.00		97	.97	.02	.01	99	1.00	
COWLITZ HATCHERY	S	100	1.00		100	.97	.03		100	1.00	
KALAMA HATCHERY	F	100	1.00		73	.9s	.01	.01	100	1.00	
KALAMA HATCHERY	s	100	1.00		88	.93	.07		100	1.00	
LEWIS HATCHERY	s	68	1.00		95	.87	.13		100	1.00	
LEWIS HATCHERY	F	194	1.00		87	.%	.01	.03	9s	1.(XJ	
LEWIS RIVER	F	100	1.00		99	.97	.01	.02	100	1.00	
CLACKAMAS RIVER	F	50	1.00		50	.91		.09	50	.99	.01
CLACKAMAS RIVER	s	80	1.00		76	.95	.01	.04	80	1.00	
EAGLE CREEK HATCHERY	s	90	1.00		100	1.00			100	1.00	
EAGLE CREEK HATCHERY 85	s	90	1.00		94	.91		.09	100	1.00	
MARION FORKS HATCHERY	s	100	1.00		100	1.00			100	1.00	
SOUTH SANTIAM HATCHERY	S	90	1.00		100	1.00			100	1.00	
THOMAS CREEK	s	100	1.00		89	.88	.11	.01	100	1.00	
MCKENZIE HATCHERY	S	100	1*00		70	.9s	.01	•	100	1.00	
MCKENZIE HATCHERY 85	s	50	1.00		97	.87	.02	.11	100	1.00	
DEXTER HATCHERY	S	100	1.00		100	1.00			85	1.00	
SANDY RIVER	F	66	1.00		56	.%	.02	.01	66	1.00	
SANDY RIVER 85	F	49	1.00		49	.%		.04	47	1.00	
WASHOUGAL RIVER	F	50	1.00		4s	.95	.02	.03	50	1.00	
BONNEVILLE HATCHERY	F	93	1.00						93	1.00	
CARSON HATCHERY	s	100	1.00		87	.97	.03		100	.9s	.02
CARSON HATCHERY 85	s	52	1.00		83	.90	.09	.01	100	1.00	
LIT.WHITE SALMON HATCH.	s	100	1.00						100	.98	.02
LIT.WHITE SALMON HATCH. 85	S	3s	1.00		07	.92	.08		98	1.00	
SPRING CREEK HATCHERY	F	100	1.00		100	1.00			100	1.00	
KLICKITAT RIVER	F	50	1000		50	.91	.02	.07	50	1.00	
KLICKITAT HATCHERY #	s	49	1.00		50	.90	.03	.07	50	1.00	
HOOD RIVER	F				41	.99	.01		47	1.00	
DESCHUTES RIVER	F	%	1.00		98	.98	.01	•	100	1.00	
DESCHUTES RIVER 85	F	52	1.00		54	.ss	.01	.02	54	1.00	
ROUND BUTTE HATCHERY	s	50	1.00		S2	.95	.05	*	93	1.00	
ROUND BUTTE HATCHERY 85	s	42	1.00		97	.s6	.14		9a	1.00	
WARM SPRINGS RIVER #	s	43	1.00		50	.83	017		50	1.00	
JOHN DAY RIVER	s	75	1.00		70	.87	.13		95	1.(XJ	
JOHN DAY RIVER 85	s	60	1.00		60	.94	.06	*	59	1.00	
SNAKE RIVER STOCK	F	100	.9s	.02	Ss	.99	.01		100	1.00	
TUCANNON RIVER	s	100	1.00		92	.95	.05		100	.99	.01
TUCANNON RIVER 85	s	50	1.00		34	.94	.03		50	1.00	
GRANDE RONDE RIVER	s	43	1.00		42	.92	.09		43	1.00	
GRANDE RONDE RIVER 84	s	8	1.00		34	.s7	.13		36	1 a)	

Chinook salmon gene frequency data (continued).

CHINOOK STOCK	FORM	ASPARTATE AMINOTRANSFERASE			ISOCITRATE DEHYDROGENASE				L-LACTATE DEHYDROGENASE-4		
		N	100	90	N	100	74	127	N	100	120
WALLOWA-LOSTINE RIVER	S	25	1.00		46	.86	.11	.03	47	1.00	
WALLOWA-LOSTINE RIVER 84	S	34	1.00		35	.s4	.15	.01	40	1.00	
KOOSKIA HATCHERY STOCK	S	80	l.(x)		73	.92	.08		100	.99	.01
RED R. SF CLEARWATER #	s	40	1.00		so	.94	.06		40	.95	.05
IMNAHA RIVER	S	87	1.00		84	.91	.09		87	1.00	
IMNAHA RIVER 84	S	100	1.00		89	.87	.13		108	1.00	
RAPID RIVER HATCHERY #	s	50	1.00		50	.97	.04		50	.98	.02
JOHNSON CREEK #	SUM	56	1.00		56	.95	.05		56	1.00	
McCALL HATCHERY #	SUM	50	la)		50	.s7	.13		50	1.00	
MIDDLE FORK SALMON	S	40	1.00		14	.s9	.11		50	. %	.04
EAST FK. SALMON R. STOCK	S	37	1.00		50	,97	.03		50	.99	.01
VALLEY CREEK	SUM	45	1.00		40	.98	.02		48	.98	.02
VALLEY CREEK #	s	22	1.00		22	.91	.05	.05	22	.9s	.02
SAWTOOTH STOCK #	s	50	1.00		50	.92	.08		50	.90	.02
YAKIMA RIVER	F	36	1.00		30	.91	.03	.06	36	.97	.03
YAKIMA RIVER	s	44	1.00		44	.s6	.14		50	1.00	
NACHES RIVER	s	50	1.00		50	.95	.04	.01	50	1.00	
HANFORD REACH	F	100	1.00		60	.92	.01	.07	100	1.00	
HANFORD REACH 85	F	100	1.00		91	.93	.06	.01	100	1.00	
PRIEST RAPIDS HATCHERY	F				65	.98″	.02		92	1.00	
WENATCHEE RIVER	s	1s0	1.00		160	.86	.14		199	.99	.01
WENATCHEE RIVER	SUM				44	.9s	.01	.01	50	1.00	
WENATCHEE RIVER 85	SUM	50	1.00		50	.89	.01	.10	50	1.00	
LEAVENWORTH HATCHERY	s				96	.90	•	.10	100	.97	.03
LEAVENWORTH HATCHERY 85	s	75	1.00		94	.93	.07		100	l a)	
ENTIAT RIVER	s	123	1.00		105	.81	.19		132	.98	.02
WELLS DAM HATCHERY	SUM								98	1.00	
METHOW RIVER 83	s	50	1.00		39	.89	.02	.09	43	1.(M	
METHOW RIVER 84	s	43	1.00		37	.81	.19		50	.99	.01
METHOW RIVER	SUM	20	1.00		71	.95	.04	•			
WINTHROP HATCHERY #	s	50	1.00		129	.97	03	.01	129	1.00	
OKANAGAN RIVER	SUM				84	.93	.06	.01	96	1.00	
OKANAGAN RIVER 85	SUM	50	1.00		50	.92		.08	50	1.00	

Chinook salmon gene *frequency* data (continued).

CHINOOK STOCK	FORM	L-LACTATE DEHYDROGENASE-5			MALATE DEHYDROGENASE-1&2				MALATE DEHYDROGENASE-3&4			
		N	100	90	N	100	140	27	N	100	121	70
COWLITZ HATCHERY #	F	96	.99	.01	99	1.00			99	1.00		
COWLITZ HATCHERY	s	100	.99	● l	100	1.00			100	.99	.01	
KALAMA HATCHERY	F	1(XI	1.00		100	1.00			100	.98	.02	
KALAMA HATCHERY	s	100	.99	.01	100	1.00			100	.99	.01	
LEWIS HATCHERY	s	80	1.00		50	1.00			100	.9s	.02	
LEWIS HATCHERY	F	98	1.00		100	1.00			90	.99	.01	
LEWIS RIVER	F	100	1.00		100	1.00			94	.98	.02	
CLACKAMAS RIVER	F	50	.99	● l	50	1.00			50	.93	.07	
CLACKAMAS RIVER	s	87	1.00		80	1.00			80	.97	.03	
EAGLE CREEK HATCHERY	s	87	1.00		100	1.00			100	.95	.05	
EAGLE CREEK HATCHERY 85	s	100	● 99	.01	100	1.00			100	.97	.03	
MARION FORKS HATCHERY	s	100	1.00		100	1.00			98	.92	.08	
SOUTH SANTIAM HATCHERY	s	100	1.00		94	1.00			100	.95	.05	
THOMAS CREEK	s	100	1.00		100	l.(u)			99	.92	.08	
MCKENZIE HATCHERY	s	100	● 99	.01	100	1.00			99	.93	.07	
MCKENZIE HATCHERY 85	s	100	1.00		100	1*00			97	.94	.06	
DEXTER HATCHERY	s	85	1.00		100	1.00			100	.93	.07	
SANDY RIVER	F	66	1.00		66	1.00			66	1.00		
SANDY RIVER 85	F	47	.99	.01	49	1.00			49	.98	.02	
WASHOUGAL RIVER	F	50	1.00		50	1.00			50	.97	.03	
BONNEVILLE HATCHERY	F	83	1.00		93	1.00			8s	.92	.08	
CARSON HATCHERY	s	100	1.00		100	1.00			100	1.00	●	
CARSON HATCHERY 85	s	85	1.00		100	1.00			100	.99	.01	
LIT.WHITE SALMON HATCH.	s	92	1.00		100	1.00			100	.98	.02	
LIT.WHITE SALMON HATCH. 85	S	89	1.00		98	1.00			96	.94	.06	
SPRING CREEK HATCHERY	F	100	1.00		la)	1.00			100	.92	.08	
KLICKITAT RIVER	F	50	.96	.04	50	1.00			50	.99	.01	
KLICKITAT HATCHERY #	s	50	1.00		50	1.00			50	.97	.03	
HOOD RIVER	F	47	1.00		47	1.00			47	.99		.01
DESCHUTES RIVER	F	100	1.00		100	1.00			100	.97	.01	.02
DESCHUTES RIVER 85	F	53	.99	.01	54	1.00			54	.%	.01	.02
ROUND BUTTE HATCHERY	S	93	1.00		93	1.00			100	.99	.01	
ROUND BUTTE HATCHERY 85	s	83	1.00		98	1.00			9s	.9s	.02	
WARM SPRINGS RIVER #	S	46	1.00		50	.99	.01		49	1.00		
JOHN DAY RIVER	s	96	1.00		100	.99"	.01		100	1.00		
JOHN DAY RIVER 85	s	59	1.00		60	1.00			60	.%	.04	
SNAKE RIVER STOCK	F	100	.99	.01	100	1.00			100	.95	.01	.04
TUCANNON RIVER	s	100	1.00		100	1.00			100	1.00		
TUCANNON RIVER 85	s	29	.94	● 06					50	1.00		
GRANDE RONDE RIVER	s	43	1.00		43	1.00			43	1.00		
GRANDE RONDE RIVER 84	s				36	1.00			36	.98	.02	

Chinook salmon gene frequency data (continued).

CHINOOK STOCK	FORM	L-LACTATE DEHYDROGENASE-5			MALATE DEHYDROGENASE-1&2				MALATE DEHYDROGENASE-3&4			
		N	100	90	N	100	140	27	N	100	121	70
WALLOWA-LOSTINE RIVER	S	47	1.00		47	1.00			45	.95	.05	
WALLOWA-LOSTINE RIVER 84	S	40	1.00		40	1.00			40	1.00		
KOOSKIA HATCHERY STOCK	S	100	1.00		90	1.00			100	.98	.02	
RED R. SF CLEARWATER #	S	40	1.00		80	1.00			78	.99	.01	
IMNAHA RIVER	S	87	1.00		87	1.00			87	.99	.01	
IMNAHA RIVER 84	S	107	1.00		108	1.00			108	.98	.02	
RAPID RIVER HATCHERY #	S	50	1.00		50	1.00			49	1.00		
JOHNSON CREEK #	SUM	56	.98	.02	56	1.00			56	1.00		
McCALL HATCHERY #	SUM	50	.97	.03	50	1.00			50	.99	.01	
MIDDLE FORK SALMON	S	50	1.00						50	.98	.02	
EAST FK. SALMON R. STOCK	S	3'7	1.00		50	1.00			50	.98	.02	
VALLEY CREEK	SUM	48	1.00		45	1.00			40	.97	.03	
VALLEY CREEK #	S	22	1.00		22	1.00			22	.99	.01	
SAWTOOTH STOCK #	S	48	1.00		50	1.00			49	1.00		
YAKIMA RIVER	F	36	1.00		36	1.00			36	1.00		
YAKIMA RIVER	S	50	1.00		50	1.00			50	1.00		
NACHES RIVER	S	50	1.00		50	1.00			50	.98	.01	.01
HANFORD REACH	F	100	.97	.03	100	1.00			98	.97	.01	.01
HANFORD REACH 85	F	100	.99	.01	100	1.00			100	. %	.03	.01
PRIEST RAPIDS HATCHERY	F	100	.98	.02	100	1.00			100	.98	.01	.02
WENATCHEE RIVER	S	181	1.00		195	1.00	*		95	.97	.03	
WENATCHEE RIVER	SUM	45	.99	.01	50	1.00			48	.97	.01	.02
WENATCHEE RIVER 85	SUM	50	.96	.04	50	1.00			50	.95	.01	.04
LEAVENWORTH HATCHERY	S	100	1.00		100	1.00			100	.99	.01	
LEAVENWORTH HATCHERY 85	S	97	1.00		95	1.00			99	.97	.03	
ENTIAT RIVER	S	121	1.00		132	1.00	•		31	.99	.01	
WELLS DAM HATCHERY	SUM	90	.99	.01	98	1.00			98	.98	.01	.01
METHOW RIVER 83	S	50	.99	.01	43	1.00			45	.97	.03	
METHOW RIVER 84	S	49	1.00		50	.99	•	•	50	.97	.03	
METHOW RIVER	SUM	80	.99	.01	88	1.00			87	.97	.02	.01
WINTHROP HATCHERY #	S	129	1.00		2.29	1.00			129	.99	.01	
OKANAGAN RIVER	SUM	100	.93	.07	100	1.00			95	.97	.02	.01
OKANAGAN RIVER 85	SCM	50-	*%	.05	50	1.00			50	. %	.02	.02

Chinook salmon gene frequency data (continued).

CHINOOK STOCK	FORM	MANNOSE PHOSPHATE ISOMERASE N	100	109	9s	113	IPEPTIDASE N	100	90	TRIPEPTIDE AMINOPEPTIDASE N	100	130	45
COWLITZ HATCHERY #	F	99	.49	.4a	.03		99	.92	.08	99	.94	.06	
COWLITZ HATCHERY	s	99	.47	.50	.03		100	.99	.01	100	.91	.09	
KALAMA HATCHERY	F	56	.63	.37			100	1.00		100	.70	.30	
KALAMA HATCHERY	s	100	.57	.43			100	1.00		100	.95	.05	
LEWIS HATCHERY	s	72	.85	.15			100	.98	.02	9s	.95	.05	
LEWIS HATCHERY	F	85	.53	.45	.02		98	.95	.05	95	.93	.07	
LEWIS RIVER	F	100	● 49	.48	.03		100	.84	.16	100	. %	.04	
CLACKAMAS RIVER	F	49	.45	.55			50	.97	.03	49	.94	.06	
CLACKAMAS RIVER	S	7 9	.47	.s3			80	1.00		80	. %	.04	
EAGLE CREEK HATCHERY	S	84	. 6 1	. 3 8		.01	100	1.00		99	.92	.0s	
EAGLE CREEK HATCHERY 85	s	69	.43.	.59			100	1.00		91	.90	.09	.01
MARION FORKS HATCHERY	s	95	.46	.54			100	1.00		98	.91	.09	
SOUTH SANTIAM HATCHERY	s	97	.50	.50			100	1.00		95	.65	.35	
THOMAS CREEK	S	95	.42	.58			100	1.00		100	.87	.13	
MCKENZIE HATCHERY	s	97	.47	.52	.01		100	1.00		99	.87	.13	
MCKENZIE HATCHERY 85	S	%	. 5 2	. 4 8			96	1.00					
DEXTER HATCHERY	s	88	.53	.47			100	1.00		100	.83	.17	
SANDY RIVER	F	64	.55	.44	.01		66	1.00		66	.95	.05	
SANDY RIVER 85	F	49	.50	.49	.01		49	.99	.01	49	.93	.07	
WASHOUGAL RIVER	F	49	.50	.4s	.02		50	.85	.15	50	. %	.04	
BONNEVILLE HATCHERY	F	87	.59	.40	.01		93	1.00		92	.83	.17	
CARSON HATCHERY	S	99	.90	.10			100	1.00		100	.91	.09	
CARSON HATCHERY 85	s	97	.s9	.11			95	1.00		80	. %	.04	
LIT.WHITE SALMON HATCH.	s	96	.s2	.18			100	.99	.01	99	.94	.06	
LIT.WHITE SALMON HATCH. 85	s	80	.79	.23,			n	1.00		93	.95	●05	
SPRING CREEK HATCHERY	F	96	.54	.43	.03		100	.94	.06	96	.83	.17	
KLICKITAT RIVER	F	50	.6a	.31	.01		50	.95	.05	49	.81	.19	
KLICKITAT HATCHERY #	S	50	.73	.26	.01		so	.99	● /	50	.95	.05	
HOOD RIVER	F	-					47	1.00		47	.93	.07	
DESCHUTES RIVER	F	99	.79	.21			100	.97	.03	99	.97	.03	
DESCHUTES RIVER 85	F	53	.79	.21			54	.92	.08	52	. %	.04	
ROUND BUTTE HATCHERY	s	93	.S4	.16			93	1.00		93	.96	.02	
ROUND BUTTE HATCHERY 85	S	-					98	1.00		77	. %	.04	
WARM SPRINGS RIVER #	S	50	● 84	.16			50	.97	03	48	.97	.03	
JOHN DAY RIVER	s	93	.91	.09			100	1.00		85	.99	.01	
JOHN DAY RIVER 85	S	5 5	.ss	.32			60	.99	.01	60	.99	.01	
SNAKE RIVER STOCK	F	100	.S2	.18			100	.99	.01	86	.87	.13	
TUCANNON RIVER	s	100	.90	.10			100	1.00		90	.99	.01	
TUCANNON RIVER 85	s	49	.90	.10			50	1.00		38	.99	.01	
GRANDE RONDE RIVER	S	36	.92	.08			43	1.00		43	.98		.02
GRANDE RONDE RIVER 84	s	36	.90	.10			36	.99	.01	35	. %	.04	

Chinook salmon gene frequency data (continued).

CHINOOK STOCK	FORM	MANNOSE PHOSPHATE ISOMERASE N	100	109	95	113	DIPEPTIDASE N	100	90	TRIPEPTIDE AMINOPEPTIDASE N	100	130	45
WALLOWA-LOSTINE RIVER	S	45	.76	.24			47	1.00		43	.96	.04	
WALLOWA-LOSTINE RIVER 84	s	39	.74	.26			35	1.00		40	.99	.01	
KOOSKIA HATCHERY STOCK	s	74	.95	.05			91	.9s	.02	71	.99	.01	
RED R. SF CLEARWATER #	s	40	.9s	.05			40	1.00		36	.94	.06	
IMNAHA RIVER	s	86	.80	.20			87	.99	.01	87	.99	.01	.01
IMNAHA RIVER 84	s	99	.82	.18			108	1.00		108	1.00		
RAPID RIVER HATCHERY #	s	50	.95	.05			50	1.00		50	.90	.10	
JOHNSON CREEK #	SUM	S6	.95	.05			56	1.00		56	.99	.01	
McCALL HATCHERY #	SUM	50	.%	.04			50	1.00		50	.93	.07	
MIDDLE FORK SALMON	s	50	●%	.04			50	1.00		37	.97	.03	
EAST FK. SALMON R. STOCK	s	50	1.00				50	1.00		50	1.00		
VALLEY CREEK	SUM	35	.07	.13			45	1.00		32	1.00		
VALLEY CREEK #	s	22	.80	.23.			22	.98	.02	22	.82	.18	
SAWTOOTH STOCK #	S	50	.89	.11			50	.99	.01	50	.86	.14	
YAKIMA RIVER	F	36	.92	.08			36	1.00		35	.84	.16	
YAKIMA RIVER	s	50	.86	.14			50	.98	.02	47	.95	.05	
NACHES RIVER	s	46	.77	.23			50	1.00		49	.98	.02	
HANFORD REACH	F	99	.72	.27	.01		100	1.00		100	.77	.23	
HANFORD REACH 85	F	99	.54	.46			100	.99	.01	99	.82	.18	
PRIEST RAPIDS HATCHERY	F	88	.74	.26			100	1.00		94	.68	.32	
WENATCHEE RIVER	s	165	.90	.10			191	.99	.01	181	.91	.09	
WENATCHEE RIVER	SUM	34	.66	.34			50	1.00					
WENATCHEE RIVER 85	SUM	50	.63	.37			50	.94	.06	50	●74	.26	
LEAVENWORTH HATCHERY	s	100	.90	.10			100	.99	.01	100	.87	.13	
LEAVENWORTH HATCHERY 85	s	93	.83	.17			100	●99	.01	90	1.00		
ENTIAT RIVER	S	132	.90	.10			132	.99	.01	118	.94	.06	
WELLS DAM HATCHERY	SUM	76	.71	.29			98	1.00		98	●66	.34	
METHOW RIVER 83	s	36	.85	.15			53	1.00		53	.90	.10	
METHOW RIVER 84	s	50	.97	.03			50	1*QO		50	.97	.03	
METHOW RIVER	SUM	-					88	1.00		86	.73	.27	
WINTHROP HATCHERY #	S	22	.70	.30			22	1.00		22	.99	.01	
OKANAGAN RIVER	SUM	92	.74	.26			100	1.00		96	.68	.32	
OKANAGAN RIVER 85	SUM	50	.63	●37			50	.99		48	.69	.31	

Chinook salmon gene frequency data (continued).

CHINOOK STOCK	FORM	PHOSPHO-GLUCOMUTASE N	-100	-60	PHOSPHOGLYCERATE KINASE-2 N	100	90	64	SUPEROXIDE DISMUTASE N	-100	-260	1250
COWLITZ HATCHERY #	F	99	.99	.01	50	.79	.21		98	.65	.35	
COWLITZ HATCHERY	s	100	1.00						99	.57	.43	
KALAMA HATCHERY	F	100	1.00		52	.88	.12		80	.58	.42	
KALAMA HATCHERY	s	100	1.00						100	.66	.34	
LEWIS HATCHERY	s	100	1.00		100	.14	.s6		50	.56	.44	
LEWIS HATCHERY	F	100	1.00						47	.48	.52	
LEWIS RIVER	F	100	1.00						194	.56	.44	
CLACKAMAS RIVER	F	49	1.00		49	.s6	.14		49	.86	.14	
CLACKAMAS RIVER	s	80	1.00						28	.84	.16	
EAGLE CREEK HATCHERY	s	100	1.00		95	.06	.94		98	.67	.33	
EAGLE CREEK HATCHERY 85	s	100	1.00		91	.97	.03		99	.74	.26	
MARION FORKS HATCHERY	s	50	1.00		77	.9s	.02		100	.s0	.20	
SOUTH SANTIAM HATCHERY	s	100	1.00		99	● 94	.06		99	.84	.16	
THOMAS CREEK	s	100	1.00		100	.93	.07		100	.81	.19	
MCKENZIE HATCHERY	s	100	1.00		84	.8s	.12		100	.81	.19	
MCKENZIE HATCHERY 85	s	100	1.00		60	.88	.12		9a	.79	.21	
DEXTER HATCHERY	s	100	1.00		94	.90	.10		100	.92	.0s	
SANDY RIVER	F	66	1.00									
SANDY RIVER 85	F	49	1.00		49	.82	.18		49	.56	.44	
WASHOUGAL RIVER	F	50	.96	.04	42	.71	.29		50	.48	.52	
BONNEVILLE HATCHERY	F	93	1.00		93	1.00			83	.52	.48	
CARSON HATCHERY	s	100	1.00		100	.02	.98		97	.81	.19	
CARSON HATCHERY 85	s	100	1.00		96	.12	.88		93	.77	.23	
LIT.WHITE SALMON HATCH.	s	100	1.00		72	.12	.88		100	.78	.22	
LIT.WHITE SALMON HATCH. 85	S	98	1.00		98	.09	.31		92	.85	.15	
SPRING CREEK HATCHERY	F	100	1.00		91	.91	.09		80	.58	.42	
KLICKITAT RIVER	1?	50	1.00		50	.61	.39		45	.54	.46	
KLICKITAT HATCHERY #	s	50	1.00		50	.57	.43		50	.69	.31	
HOOD RIVER	F	47	1.00									
DESCHUTES RIVER	F	100	1.00						76	.70	.30	
DESCHUTES RIVER 85	F	54	1.00		53	.52	.48		52	.63	.38	
ROUND BUTTE HATCHERY	s	93	1.00		93	.45	.55		81	.56	.44	
ROUND BUTTE HATCHERY 85	s	98	1.00		so	.18	.82		95	.65	.35	
WARM SPRINGS RIVER #	s	50	1.00		50	.32	.68		50	.s4	.46	
JOHN DAY RIVER	s	95	1.00		39	.06	.94		81	.73	.27	
JOHN DAY RIVER 85	s	60	1.00		60	.2s	● 72		60	.70	.30	
SNAKE RIVER STOCK	F	100	1.00		51	.67	.33		88	.64	.36	
TUCANNON RIVER	s	93	1.00		77	.06	.94		54	.78	.22	
TUCANNON RIVER 85	s	50	1.00		27	● O2	.98		40	.86	.14	
GRANDE RONDE RIVER	s	43	1.00		37	.23	.77		43	.79	.21	
GRANDE RONDE RIVER 84	s	36	1.00						36	.85	.15	

Chinook salmon gene frequency data (continued).

CHINOOK STOCK	FORM	PHOSPHO-GLUCOMUTASE N	-100	-60	PHOSPHOGLYCERATE KINASE-2 N	100	.	90	64	SUPEROXIDE DISMUTASE N	-100	-260	1250
WALLOWA-LOSTINE RIVER	,s	47	1.00		45	.07		.92	.01	47	.79	.21	
WALLOWA-LOSTINE RIVER 84	S	40	1.00		90			1.00		40	.86	.14	
KOOSKIA HATCHERY STOCK	s	100	1.00		46	.04		.%		99	.84	.16	
RED R. SF CLEARWATER #	S	40	1.00		40	.15		.85		40	.95	.05	
IMNAHA RIVER	s	87	1.00		78	.15		.85		87	.89	.11	
IMNAHA RIVER 84	s“	108	1.00		90			1.00		87	.87	.13	
RAPID RIVER HATCHERY #	S	50	1.00		50	● 15		.85		50	.%	.04	
JOHNSON CREEK #	SUM	56	1.00		56	.05		.%		56	.97	.03	
MCCALL HATCHERY #	SUM	50	1.00		50	.08		.92		50	.98	.02	
MIDDLE FORK SALMON	S	50	1.00		50	.05		.95		35	.80	.20	
EAST FK. SALMON R. STOCK	S	50	1.00							50	.98	.02	
VALLEY CREEK	SUM	48	1.00		43	.20		.80		48	.94	.06	
VALLEY CREEK #	s	22	1.00		22	.21		.80		22	.89	.11	
SAWTOOTH STOCK #	s	50	1.00		50	.09		.91		48	.95	.05	
YAKIMA RIVER	F	36	1.00		36	.38	●	62		36	.85	.15	
YAKIMA RIVER	s	50	1.00		30	.17		.83		50	.76	.24	
NACHES RIVER	s	49	1.00		50	.3S		.62		49	.70	.30	
HANFORD REACH	F	100	1.00		39	.74		.26					
HANFORD REACH 85	F	100	1.00		100	.65		.36		100	.53	.47	
PRIEST RAPIDS HATCHERY	F	100	1.00							92	.50	.50	
WENATCHEE RIVER	s	184	1.00		76	.09		.91		170	.82	.18	●
WENATCHEE RIVER	SUM	50	1.00										
WENATCHEE RIVER 85	SUM	50	1.00		50	.58		.42		50	.46	.53	.01
LEAVENWORTH HATCHERY	s	100	1.00		76	.03		.97		100	.84	.16	
LEAVENWORTH HATCHERY 85	s	100	1.00		79	.12		.88		94	.71	.29	
ENTIAT RIVER	s	128	1.00		35	.03		.97		130	.76	.24	
WELLS DAM HATCHERY	SUM	98	1.00		74	● 64		.36		97	.58	.42	
METHOW RIVER 83	s	53	1.00							36	.67	.33	
METHOW RIVER 84	S	50	1.00		35	.03		.97		50	.77	.23	
METHOW RIVER	SUM	88	.99	.01						76	.49	.51	
WINTHROP HATCHERY #	s	123	1.00		98	.50		.50		129	.74	.26	
OKANAGAN RIVER	SUM	100	1.00		49	.70		.30					
OKANAGAN RIVER 85	SUM	50	1.00		50	.68		.32		50	.52	.48	

Appendix Table 4. Columbia River steelhead electrophoretic data from Schreck et al. (1936).

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Isozyme gene frequencies and sample sizes (N) as determined by electrophoresis for steelhead trout stocks in Oregon, Washington and Idaho. Numbers at the top of each column are the relative nobilities for each allele present in the enzyme system. Minus signs indicate cathodal migration. An asterisk indicates that an allele was present at a frequency of less than .005. "Form" is the time of freshwater entry (S for summer and W for winter). A pound sign (#) indicates that data for that stock was obtained from the Genetic Analysis of Columbia River Steelhead Trout (Wishard and Seeb 1983) prepared for the Idaho Department of Fish and Game.

Steelhead trout gene frequency data (continued).

STOCK	FORM	CREATINE KINASE			GLUCOSE PHOSPHATE ISOMERASE-1				GLUCOSE PHOSPHATE ISOMERASE-2		
		N	100	70	N	100	130	25	N	100	120
BIG CREEK HATCHERY	W	100	1.00		100	1.00			100	1.00	
BIG CREEK HATCHERY 85	W	95	1.00		95	1.00			95	1.00	
GRAYS RIVER	W	100	1.00		100	1.00			100	1.00	
ELOCHOMAN HATCHERY	W	100	1.00		100	1.00			100	1.00	
COWLITZ HATCHERY NATIVE	W	99	1.00		91	1.00			91	1.00	
COWLITZ HATCHERY CHAMBERS	W	83	1.00		95	1.00			95	1.00	
COWLITZ HATCHERY SKAMANIA	S	80	1.00		90	1.00			90	1.00	
S.F. TOUTLE RIVER	W	50	1.00		50	1.00			50	1.(XI	
COWEEMAN RIVER	W	74	1.00		74	1.00			74	1.00	
EAGLE CREEK HATCH.(BIG CRK.)	W	100	1.00		98	1.00			98	1.00	
EAGLE CREEK HATCHERY 85	W	50	1.00		50	1.00			50	1.00	
EAGLE CREEK HATCH.(NATIVE)	W	100	1.00		80	1.00			80	1.00	
EAGLE CREEK HATCHERY 85	W	86	1.00		88	1.00			88	1.00	
MARION FORKS HATCHERY	W	100	1.00		100	.86	.14		100	1.00	
THOMAS CREEK 83	W				100	1.00			100	1.00	
THOMAS CREEK 84	W	55	1.00		55	1.00			55	1.00	
THOMAS CREEK 85	W	24	1.00		24	1.00			24	1.00	
WILEY CREEK	W	100	1.00		100	1.00			100	1.00	
WILEY CREEK 85	W	27	1.00		27	1.00			27	1.00	
SOUTH SANTIAM HATCHERY	S	97	1.00		97	1.00			97	1.00	
CALAPOOYA RIVER	W				100	1.00			100	1.00	
CALAPOOYA RIVER 84	W	47	1.00		47	1.00			47	1.00	
LEABURG HATCHERY	S	100	1.00		95	1.00			95	1.00	
LEABURG HATCHERY 85	S	50	1.00		50	1.00			50	1.00	
MCKENZIE RIVER	S	50	1.00		48	1.00			48	1.00	
SANDY RIVER	W	100	1.00		100	1.00			100	1.00	
WASHOUGAL HATCHERY	S	100	1.00		95	1.00			95	1.(N	
WASHOUGAL HATCHERY 85	S	100	1.00		100	1.00			100	1.00	
WASHOUGAL HATCHERY	W	99	1.00		100	1.00			100	1.00	
HAMILTON CREEK	W	53	1.00		53	.99		.01	53	1.00	
WIND RIVER	S	50	1.00		50	.91		.09	50	1.00	
WIND RIVER 85	S	25	1.00		25	. %		.04	25	1.00	
HOOD RIVER	W	50	1.00		50	1.00			50	1.00	
KLICKITAT RIVER	S	100	1.00		100	1.00			100	1.00	
FIFTEENMILE CREEK	W	82	1.00		82	1.00			82	. %	.04
FIFTEENMILE CREEK 85	W	50	1.00		50	1.00			48	.95	.05
DESCHUTES RIVER	S	170	1.00		170	1.00			178	1.00	
ROUND BUTTE HATCHERY	S	93	.%	.04	100	1.00			100	1.00	
ROUND BUTTE HATCHERY 85	S	100	.96	.04	100	1.00			100	1.00	
JOHN DAY RIVER	S	100	1.00	*	100	1.00			100	1.00	
JOHN DAY RIVER 85	S	50	.98	.02	50	1.00			50	1.00	

Steelhead trout gene frequency data (continued).

STEELHEAD STOCK	FORM	CREATINE KINASE N	100	-/0	GLUCOSE PHOSPHATE ISOMERASE-1 N	100	130	25	GLUCOSE PHOSPHATE ISOMERASE-2 N	100	120
UMATILLA RIVER	S	100	1.00		100	1.00			100	1.00	
UMATILLA HATCHERY	S	100	1.00		100	1.00			100	1.00	
WALLA WALLA RIVER	S	40	1.00		40	1.00			40	1.00	
TOUCHET RIVER	S	50	1.00		50	1.00			50	1.00	
TUCANNON RIVER	s	113	.99	.01	113	1.00			113	1.00	
TUCANNON RIVER 85	S	50	.99	.01	50	1.00			50	1.00	
GRANDE RONDE RIVER	S	50	1.00		50	1.(X3			50	1.00	
GRANDE RONDE RIVER 84	s	110	1.00		110	1.00			110	1.00	
WALLOWA-LOSTINE	S	73	1.00		73	1.00			73	1.00	
WALLOWA-LOSTINE 84	s	62	1.00		62	1.00			62	1.00	
WALLOWA HATCHERY	s	100	.99	.01	100	1.00			100	1.00	
MISSION CREEK	s	30	1.00		30	1.00			30	1.00	
BIG CANYON/COTTONWOOD CRKS.	S	88	1.00		88	1.00			88	1.00	
DWORSHAK HATCHERY	s	73	1.00		73	1.00			73	1.00	
SELWAY RIVER	S	98	1.00		97	1.00			98	1.00	
LOCHSA RIVER	S	50	1.00		47	1.00			50	1.00	
IMNAHA RIVER	s	81	1.00		96	1.00			96	1.00	
IMNAHA RIVER 84	S	58	1.00		58	1.00			58	1.00	
IMNAHA HATCHERY	s	100	1.00		100	.90	.10		100	1.00	
SHEEP & BARGAMIN CRKS.	s	120	1.00		120	1.00			120	1.00	
S.F.SALMON (SECESH RIVER)	S	61	1.00		61	1.00			61	1.00	
S.F.SALMON (JOHNSON CREEK)	S	50	.99	.01	50	1.00			50	1.00	
CHAMBERLAIN CREEK	S	-			97	.99	01				
HORSE CREEK	S	51	1.00		50	1.00			51	1.00	
MIDDLE FORK SALMON RIVER #	S	-			158	.97	.03		158	1.00	
PAHSIMEROI 'B' STOCK	S	50	1.00		50	1.00			50	1.00	
SAWTOOTH 'A' STOCK	S	50	1.00		50	1.00			50	1.00	
HELLS CANYON STOCK	s	100	1.00		100	1.00			100	1.00	
YAKIMA RIVER	S	48	.99	.01	48	1.00			48	1.00	
YAKIMA RIVER 84	s	49	.99	.01	49	1.00			49	1.00	
WENATCHEE RIVER	s	%	1.00		96	1.00			96	1.00	
ENTIAT RIVER	s	50	1.00		50	1.00			50	1.00	
WELLS HATCHERY	s	81	1.00		81	1.00			81	1.00	
METHOW RIVER	s	55	1.00		58	1.00			58	1.00	

Steelhead trout gene frequency data (continued).

STEELHEAD STOCK	FORM	GLUCOSE PHOSPHATE ISOMERASE-3 N	100	120	92	ASPARTATE AMINO-TRANSFERASE-1,2 N	100	112	ASPARTATE AMINO-TRANSFERASE-3 N	100	77
BIG CREEK HATCHERY	W	100	1*00						100	1.00	
BIG CREEK HATCHERY 85	W	95	1.00			85	1.00		89	1.00	
GRAYS RIVER	W	100	.99		.01				100	1.00	
ELOCHOMAN HATCHERY	W	100	.98		.02	100	1.00		100	1.00	
COWLITZ HATCHERY NATIVE	W	91	.%		.04	99	1.00		90	1.00	
COWLITZ HATCHERY CHAMBERS	W	95	.%		.04	80	1.00		100	1.00	
COWLITZ HATCHERY SKAMANIA	S	90	.98		.02	90	1.00		90	1.00	
S.F. TOUTLE RIVER	W	50	.%	.01	.03	50	1.00		50	1.00	
COWEEMAN RIVER	W	74	.89	.01	.10	74	1.00		74	1.00	
EAGLE CREEK HATCH. (BIG CRK.)	W	98	1.00			100	1.00		100	1.00	
EAGLE CREEK HATCHERY 85	W	50	1.00			50	1.00		50	1.00	
EAGLE CREEK HATCH. (NATIVE)	W	80	1.00			80	1.00				
EAGLE CREEK HATCHERY 85	W	88	1.00			92	1.00		95	1.00	
MARION FORKS HATCHERY	W	100	1.00						100	1.00	
THOMAS CREEK 83	W	100	1.00								
THOMAS CREEK 84	W	55	1.00						55	1.00	
THOMAS CREEK 85	W	24	1.00			24	1.00		24	1.00	
WILEY CREEK	W	100	1.00						100	1.00	
WILEY CREEK 85	W	27	1.00			27	1.00		27	1.00	
SOUTH SANTIAM HATCHERY	S	97	.95		.05	47	.94	.06	97	1.00	
CALAPOOYA RIVER	W	100	1.00								
CALAPOOYA RIVER 84	W	47	1.00			47	1.00		47	1.00	
LEABURG HATCHERY	S	95	.%		.04	100	.99	.01	100	1.00	
LEABURG HATCHERY 85	S	49	.92		.08	42	1.00		50	1.00	"
MCKENZIE RIVER	S	40	.93	.07		36	1.00		50	1.00	
SANDY RIVER	W	100	1.00			100	1.00		100	1.00	
WASHOUGAL HATCHERY	S	95	.92		.08	so	1.00		100	1.00	
WASHOUGAL HATCHERY 85	S	97	.94		.06	85	1.00		89	1.00	
WASHOUGAL HATCHERY	W	100	.99		.01	100	1.00		100	1.00	
HAMILTON CREEK	W	53	.98		.02				53	1.00	
WIND RIVER	S	5 0	.92		.08				50	1.00	
WIND RIVER 85	S	25	.94		.06	25	1.00		25	1.00	
HOOD RIVER	W	50	1.00			50	1.00		50	1.00	
KLICKITAT RIVER	S	100	.98	.02	*				100	1.00	
FIFTEENMILE CREEK	W	82	1.00								
FIFTEENMILE CREEK 85	W	50	l.(x)			45	1.00		37	1.00	
DESCHUTES RIVER	S	-				178	1.00		178	1.00	
ROUND BUTTE HATCHERY	S	100	.99		.01				100	1.00	
ROUND BUTTE HATCHERY 85	S	100	1.00			93	1.00		99	1.00	
JOHN DAY RIVER	S	100	1.00		*				78	1.00	
JOHN DAY RIVER 85	S	50	1.00			47	1.00		45	1.00	

Steelhead-trout gene frequency data (continued) .

STEELHEAD STOCK	FORM	GLUCOSE PHOSPHATE ISOMERASE-3 N	100	120	92	ASPARTATE AMINO-TRANSFERASE-1, 2 N	100	112	ASPARTATE AMINO-TRANSFERASE-3 N	100	77
UMATILLA RIVER	s	100	1.00			100	1.00				
UMATILLA HATCHERY	s	100	1.00						100	.98	.02
WALLA WALLA RIVER	s	40	1.00			34	1.00		30	1.00	
TOUCHET RIVER	s	50	1.00			44	1.00		so	1.00	
TUCANNON RIVER	s	113	1.00			103	1.00		103	1.00	
TUCANNON RIVER 85	s	50	1.00			50	1.00		50	1.00	
GRANDE RONDE RIVER	s	50	1.00			50	1.00		50	1.00	
GRANDE RONDE RIVER 84	s	110	.99	.01		110	1.00		60	1.00	
WALLOWA-LOSTINE	s	73	1.00			36	1.00				
WALLOWA-LOSTINE 84	S	62	1.00						62	1.00	
WALLOWA HATCHERY	s	100	1.00			100	1.00		100	1.00	
MISSION CREEK	s	30	1.00						30	1.00	
BIG CANYON/COTTONWOOD CRKS.	s	88	1.00						88	"1.00	
DWORSHAK HATCHERY	s	73	1.00						72	.91	.09
SELWAY RIVER	s	97	.99		.01	-			97	1.00	
LOCHSA RIVER	s	50	1.00						50	.99	.01
IMNAHA RIVER	s	96	1.00			86	1.00		96	1.00	
IMNAHA RIVER 84	s	58	1.00			58	1.00		58	1.00	
IMNAHA HATCHERY	s	100	1.00			100	1.00		83	1.00	
SHEEP & BARGAMIN CRKS.	S	120	. 9 9		.01	-			116	1.00	
S.F.SALMON (SECESH RIVER)	S	61	. 9 9	.01							
S.F.SALMON (JOHNSON CREEK)	s	50	1.00			50	1.00		50	.99	.01
CHAMBERLAIN CREEK	s	97	.99	.01							
HORSE CREEK	s	so	1.00						50	1.00	
MIDDLE FORK SALMON RIVER #	s	277	.99	.01							
PAHSIMEROI 'B' STOCK	s	50	1.00			50	1.00		47	1.00	
SAWTOOTH 'A' STOCK	s	so	1.00			50	.99	.01	50	1.00	
HELLS CANYON STOCK	s	95	.97	.03		75	.99	.01	94	1.00	
YAKIMA RIVER	s	48	1.00			48	1.00		48	1.00	
YAKIMA RIVER 84	s	49	1.00			49	1.00		49	.98	.02
WENATCHEE RIVER	s	%	.97	.03		96	1.00		96	1.00	
ENTIAT RIVER	s	50	1.00			50	1.00				
WELLS HATCHERY	S	81	.98	.01	.01	50	1.00		100	.99	.01
METHOW RIVER	S	58	.96	.04					58	1.00	

Steelhead trout gene frequency data (continued).

STEELHEAD STOCK	FORM	ISOCITRATE DEHYDROGENASE-3,4 N	100	40	120	71	LACTATE DEHYDROGENASE-4 N	100	76	111	MALATE DEHYDROGENASE-1,2 N	100	140	Q	40
BIG CREEK HATCHERY	W	98	.70	.14	*	.16	100	.96	.04		100	1.00			
BIG CREEK HATCHERY 85	w	71	.64	.12	.01	.23	92	.95	.05		95	1.00			
GRAYS RIVER	W	94	.69	.12		.19	100	.80	.20		100	1.00			
ELOCHOMAN HATCHERY	w	89	.75	.13	.01	.11	99	.85	.3.5		100	.99		.01	
COWLITZ HATCHERY NATIVE	W	90	.68	.12	.01	.19	99	.90	.10		99	1.00			
COWLITZ HATCHERY CHAMBERS	w	100	.65	.16	.02	.17	100	.90	.10		100	.99		.01	
COWLITZ HATCHERY SKAMANIA	S	88	.66	.14	.01	.19	90	.88	.12		90	1.00			
S.F. TOUTLE RIVER	W	39	.61	.19	.02	.18	50	.80	.20		50	1.00			
COWEEMAN RIVER	W	72	.69	.16	•	.17	74	.87	.13		74	1.00			
EAGLE CREEK HATCH.(BIG CR.)	W	95	.64	.20	.06	.10	100	.92	.08		100	1.00			
EAGLE CREEK HATCHERY 85	w	47	.65	.12	.08	.15	50	.83.	.17	.02	50	1.00			
EAGLE CREEK HATCH. (NATIVE)	s	94	.70	.12	.03	.15	80	.78	.22		70	1.00			
EAGLE CREEK HATCHERY 85	s	m	.61	.14	.06	.19	91	.91	.09		100	1.00			
MARION FORKS HATCHERY	w	94	.64	.13	.02	.21	100	.53	.47		100	1.00			
THOMAS CREEK 83	w	58	.72	.04		.24	100	.60	.40		50	.98		.02	
THOMAS CREEK 84	w	52	.73	.12		.15	55	.71	.29		55	.98		.02	
THOMAS CREEK 85	W	23	.62	.15		.23	24	.50	.50		24	1.00			
WILEY CREEK	w	-					100	.55	.45	.01	100	1.00			
WILEY CREEK 85	w	26	.62	.22		.16	27	.76	.24		27	.97		.03	
SOUTH SANTIAM HATCHERY	s	89	.70	.18	.02	.10	96	.80	.20		94	.99		.01	
CALAPOOYA RIVER	w	68	.74	.04	.01	.21	98	.41	.59		100	.99		.01	
CALAPOOYA RIVER 84	w	46	● 71	.12		.17	47	.48	.52		47	1.00			
LEABURG HATCHERY	s	97	.62	.19	.05	.14	100	.88	.12		90	1.00			
LEABURG HATCHERY 85	s	50	.66	.15	.02	.18	50	.81	.19		50	1.00			
MCKENZIE RIVER	s	44	.71	.18	.01	.10	50	.70	.30		50	1.00			
SANDY RIVER	W	97	.74	.13		.13	100	.90	.10		100	1.00			
WASHOUGAL HATCHERY	s	95	.64	.21	*	● 15	99	.80	.20		100	1.00			
WASHOUGAL HATCHERY 85	S	76	.65	.19	.01	.15	100	.80	.20		100	1.00			
WASHOUGAL HATCHERY	W	69	.68	.11	.03	.18	99	.91	.09		100	1.00			
HAMILTON CREEK	w	so	.72	.13		.16	53	.88	.12		53	.99		.01	
WIND RIVER	S	42	.66	.18		.16	50	.79	.20	.01	50	1.00		•	
WIND RIVER 85	S	24	.58	.32	.01	.08	25	.78	.22		25	1.00			
HOOD RIVER	w	43	● 62	.18		.20	50	.91	.09		50	1.00			
KLICKITAT RIVER	S	92	● n	.3.3	.01	.3.5	100	.60	.40		100	1.00			
FIFTEENMILE CREEK	w	82	.68	.09	.01	.22	81	.65	.35		82	1.00			
FIFTEENMILE CREEK 85	W	50	.73	.08	.01	.19	50	.56	.44		50	1.00			
DESCHUTES RIVER	S	231	.69	.13	*	.18	266	.39	.61		267	1.00	•		
ROUND BUTTE HATCHERY	s	97	.68	.15		.17	100	.44	.56		100	1.00			
ROUND BUTTE HATCHERY 85	s	95	.60	.20	.01	.20	100	.42	.53	.06	100	.99	*01		
JOHN DAY RIVER	s	73	.71	.12	.01	.17	100	.30	.70		100	1.00	*		
JOHN DAY RIVER 85	s	47	.67	.13	.02	.18	50	.40	.60		50	1.00			

Steelhead trout gene frequency data (continued).

STEELHEAD STOCK	FORM	ISOCITRATE DEHYDROGENASE-3, 4					LACTATE DEHYDROGENASE-4					MALATE DEHYDROGENASE-1 ,2				
		N	100	40	120	71	N	100	76	111		N	100	140	70	40
UMATILLA RIVER	s	90	.66	.19		.15	99	.42	.58			100	.99	.01		
UMATILLA HATCHERY	s	90	.66	.12		.22	100	.57	.43			100	1.00			
WALLA WALLA RIVER	S	4 0	.62	.16		.23	40	.36	.64			40	.99			.01
TOUCHET RIVER	S	49	.61	.17		.21	50	.45	.s5			50	.99	.01		
TUCANNON RIVER	s	106	.64	.17		.19	112	.33	.67			113	1.00			
TUCANNON RIVER 85	s	49	.62	.19		.19	50	.29	.70	.01		50	.99	.02		
GRANDE RONDE RIVER	s	50	.70	.15		.14	49	.25	.75			50	.98	.02		
GRANDE RONDE RIVER 84	S	74	.72	.12		.17	109	.39	.61			110	1.00			
WALLOWA-LOSTINE	S	72	.75	.14		.12	73	.34	.66			73	.99		.01	
WALLOWA-LOSTINE 84	s	57	.71	.12	*	.17	62	.36	.64							
WALLOWA HATCHERY	S	92	.67	.16		.17	100	.24	.77			100	1.00			
MISSION CREEK +	s	30	.64	.13		.23	30	.42	.5S			30	.99	.01		
BIG CANYON/COTTONWOOD CRKS.+	s	86	.58	.15		.28	88	.16	.84			88	.99	.01		
DWORSHAK HATCHERY +	S	71	.65	.22		.13	73	.23	.77			73	.99	.01		
SELWAY RIVER +	s	%	.62	.15		.24	98	.34	.66			98	1.00			
LOCHSA RIVER +	s	43	.68	.12		.20	50	.27	.73			50	.99	.01		
IMNAHA RIVER	s	%	.70	.14		.16	96	.29	.71			96	1.00			
IMNAHA RIVER 84	s	57	.72	.13		.15	58	.28	.72			58	1.00			
IMNAHA HATCHERY	s	87	.74	.08	•	.18	99	.39	.61			50	1.00			
SHEEP & BARGAMIN CRKS. +	S	9 4	.57	.18		.25	120	.29	.70	.02		120	1.00			
S.F.SALMON (SECESH RIVER)	S	56	.64	.24		.12	61	.25	.75			61	1.00	*		
S.F.SALMON (JOHNSON CREEK)	s	47	.57	.33	.01	.10	50	.2S	.72			50	1.00			
CHAMBERLAIN CREEK +	s	97	.67	.15	.01	.18	97	.24	.73	.03		97	loo			
HORSE CREEK +	S	40	.68	.07	.01	.24	50	.28	.72			50	1.00			
MIDDLE FORK SALMON RIVER #	S	158	.67	.15		.18	277	.33	.66	.01		277	1.00			
PAHSIMEROI 'B' STOCK	S	3 S	.68	.09	.01	.22	50	.29	.71			50	.99	.01		
SAWTOOTH 'A' STOCK	S	28	.73	.08	.02	.17	50	.43	.56	.01		50	1.00			
HELLS CANYON STOCK	S	67	.63	.19		.18	100	.21	.74	.06		100	1.00			
YAKIMA RIVER	S	46	.65	.15	.02	.18	48	.68	.32			48	1.00			
YAKIMA RIVER 84	S	46	.62	.16		.22	49	.61	.39			49	.99	.02		
WENATCHEE RIVER	s	73	.62	.21	.01	.17	9S	.38	.61	.01		96	1.00			
ENTIAT RIVER	S	5 0	.60	.19	*	.21	50	.29	.69	.02		50	.99	C)I		
WELLS HATCHERY	S	81	.66	.18		.16	81	.26	.74			81	.98	.02		
METHOW RIVER	s	53	.66	.14		.20	58	.29	.71			58	.99	.01		

Steelhead trout gene frequency data (continued).

STEELHEAD STOCK	FORM	MALATE DEHYDROGENASE-3, 4 N	100	83	110	90	NADP+ MALATE DEHYDROGENASE N	100	85	MANNOSE PHOSPHATE ISOMERASE N	100	94	110
BIG CREEK HATCHERY	W	100	.92	.08			100	.80	.20	100	1.00		
BIG CREEK HATCHERY 85	w	92	.90	.10		•	67	.90	.01	95	1.00		
GRAYS RIVER	w	99	.88	.10	.01	.01	90	● 83	.17	100	1.00		
ELOCHOMAN HATCHERY	W	94	.89	.08		.03	100	.95	.0s	57	1.00		
COWLITZ HATCHERY NATIVE	w	86	.91	.09			77	.62	.38	99	1.00		
COWLITZ HATCHERY CHAMBERS	w	99	.93	.07			98	.84	.16	100	1.00		
COWLITZ HATCHERY SKAMANIA	s	88	.82	.17	.01		85	.78	.22	90	1.00		
S.F. TOUTLE RIVER	w	50	.88	.11		.02	50	.63	.37	50	1.00		
COWEEMAN RIVER	w	74	.87	.04		.09	74	.80	.20	74	1.00		
EAGLE CREEK HATCH. (BIG CR.)	W	100	.89	.11			98	.83	.17	100	1.00		
EAGLE CREEK HATCHERY 85	w	50	.86	.11	.04		45	.94	.06	50	1.00		
EAGLE CREEK HATCH. (NATIVE)	W	95	.85	.15		.01				90	1.00		
EAGLE CREEK HATCHERY 85	W	88	.84	.10	.06		63	.98	.02	100	1.00		
MARION FORKS HATCHERY	w	100	.%	.04			100	1.00		76	1.00		
THOMAS CREEK 83	w	97	.93	.07			80	1.00					
THOMAS CREEK 84	w	46	.93	.07			55	1.00		55	la)		
THOMAS CREEK 85	w	24	.97	.03			24	1.00		24	1.00		
WILEY CREEK	w	97	.90	.10	*		100	1.00		100	1.00		
WILEY CREEK 85	w	26	.90	.01		.09	27	1.00		27	1.00		
SOUTH SANTIAM HATCHERY	s	95	.91	.07	.02		92	.96	.04				
CALAPOOYA RIVER	w	89	.99	.01						50	1.00		
CALAPOOYA RIVER 84	W	46	.96	.04			47	1.00		47	1.00		
LEABURG HATCHERY	s	100	.84	.13	.03		100	.%	.04	100	1.00		
LEABURG HATCHERY 85	s	50	.83	.15	.02	.01	50	.92	.08	50	1.00		
MCKENZIE RIVER	s	50	.87	.12		● l	50	.%	.04	50	1.00		
SANDY RIVER	w	98	.92	.08	•		95	.88	.12	100	1.00		
WASHOUGAL HATCHERY	s	94	.02	.18			92	.82	.18				
WASHOUGAL HATCHERY 85	s	100	.91	.09			100	.%	.04	95	1.00		
WASHOUGAL HATCHERY	w	100	.88	.12			100	2.00		100	1.00		
HAMILTON CREEK	w	51	.s9	.06	.04	.01	53	.89	.11	53	1.00		
WIND RIVER	s	49	.%	.04			50	.84	,16	50	1.00		
WIND RIVER 85	S	25	.97			.03	25	.83	.17	25	1.00		
HOOD RIVER	w	50	.91	.09	.01		50	.94	.06	50	1.00		
KLICKITAT RIVER	s	91	.91	.06	.02	.01	100	1.00		100	1.00		
FIFTEENMILE CREEK	w	82	.97	.01	.02		50	.94	.06				
FIFTEENMILE CREEK 85	W	5 0	.%	.03	.01		50	1.00		45	.99	.01	
DESCHUTES RIVER	s	267	.96	.04	*	*	267	1.00					
ROUND BUTTE HATCHERY	S	98	.96	.04	•		100	1.00		100	1.00		
ROUND BUTTE HATCHERY 85	s	100	.99	.01			98	1.00		100	.98	.01	.02
JOHN DAY RIVER	s	100	.99	•	*	•	50	la)		100	1.00		
JOHN DAY RIVER 85	s	50	.99	.01	.01		50	.99	.01	50	.99	.01	

Steelhead trout gene frequency data (continued).

STEELHEAD STOCK	FORM	MALATE DEHYDROGENASE-3,4 N	100	83	110	90	NADP+ MALATE DEHYDROGENASE N	100	85	MANNOSE PHOSPHATE ISOMERASE N	100	94	110
UMATILLA -	s	100	.98	*	.02		100	1.00		100	1.00		
UMATILLA HATCHERY	S	100	.98	.01	.01		100	1.00		50	1.00		
WALLA WALLA RIVER	S	40	.98	.02			40	1.00		30	.99	.01	
TOUCHET RIVER	S	50	.97	.01	.01	.02	50	1.00		50	.99	.01	
TUCANNON RIVER	s	112	.9a	.01	.01		113	1.00					
TUCANNON RIVER 85	S	50	.99	.01			50	1.00		50	.%	.03	.01
GRANDE RONDE RIVER	S	50	.99	.01			50	1.00					
GRANDE RONDE RIVER 84	s	110	.99	•		.01	110	1.00		50	1.00		
WALLOWA-LOSTINE	s	73	.95	.01	.04		73	1.00		73	.99	.01	
WALLOWA-LOSTINE 84	S	62	.95	.01	.04	.01	62	1.00		62	1.00		
WALLOWA HATCHERY	s	100	.%	.01	.03		100	1.00		100	1.00		
MISSION CREEK	s	30	1.00							30	.95	.05	
BIG CANYON/COTTONWOOD CRKS.	s	88	1.00							88	.90	.10	
DWORSHAK HATCHERY	s	73	.99		.01					73	1.00		
SELWAY RIVER	s	98	1.00		*					98	.95	.04	.01
LOCHSA RIVER	S	50	.99		.01					40	1.00		
IMNAHA RIVER	s	96	1.00				94	1.00		96	.98	.01	.01
IMNAHA RIVER 84	s	58	1.00				58	1.00		58	1.00		
IMNAHA HATCHERY	s	100	1.00				100	1.00		100	1.00		
SHEEP & BARGAMIN CRKS.	s	120	.99		.02					120	.99	.02	
S.F.SALMON (SECESH RIVER)	S	61	.98		.02		61	1.00		61	1.00		
S.F.SALMON (JOHNSON CREEK)	S	50	.99	.01			50	1.00		50	.99	.01	
CHAMBERLAIN CREEK	s	97	.98		.01	.01				97	.98	.02	
HORSE CREEK	s	50	.99		.01	.01				50	1.00		
MIDDLE FORK SALMON RIVER #	s	277	.98	.02						277	1.00		
PAHSIMEROI 'B' STOCK	s	50	1.00				50	1.00		50	1.(M		
SAWTOOTH 'A' STOCK	S	50	.99	.01			50	1.00		50	.95	.05	
HELLS CANYON STOCK	s	100	.98	.02			96	1.00		100	.99	.01	
YAKIMA RIVER	S	48	.98	.02	.01		48	1.00		48	1.00		
YAKIMA RIVER 84	s	49	1.00				49	1.00		49	1.00		
WENATCHEE RIVER	S	%	*94	.02		.04	96	1.00		96	.99	.01	
ENTIAT RIVER	S	50	*99	*	•		40	1.00		50	1.00		
WELLS HATCHERY	S	76	.99		.01		76	1.00		81	1.00		
METHOW RIVER	S	58	.98	.01	.01		58	1.00		58	.99	.01	

Steelhead trout gene frequency data (continued).

STOCK	FORM	DIPEPTIDASE					TRIPEPTIDE AMINOPEPTIDASE					PHOSPHO-GLUCOMUTASE-1				
		N	100	110	85	95	N	100	129	74	50	N	100	115	85	
BIG CREEK HATCHERY	w	100	1.00				100	1.00				100	1.00			
BIG CREEK HATCHERY 85	w	95	1*00				95	1.00				95	.99			.01
GRAYS RIVER	w	100	.99	.01			100	1.00				100	1.00			
ELOCHOMAN HATCHERY	w	99	1.00				90	1.00				100	1.00			
COWLITZ HATCHERY NATIVE	w	99	la)				99	1.00				99	1.00			
COWLITZ HATCHERY CHAMBERS	w	100	1.00				100	1.00				100	1.00			
COWLITZ HATCHERY SKAMANIA	s	90	1.00				90	1.00				90	1.00			
S.F. TOUTLE RIVER	w	50	1.00				50	.99		.01		50	1.00			
COWEEMAN RIVER	w	74	1.00				73	.99	.01			74	1.00			
EAGLE CREEK HATCH. (BIG CR.)	W	100	1.00				100	1.00				100	1.00			
EAGLE CREEK HATCHERY 85	w	50	1.00				50	.95	.05			50	1.00			
EAGLE CREEK HATCH. (NATIVE)	w	100	1.00				40	1.00				70	1.00			
EAGLE CREEK HATCHERY 85	w	100	1.00				95	.94	.06			100	1.00			
MARION FORKS HATCHERY	W	90	*94	.06			85	1.00				100	1.00			
THOMAS CREEK 83	w	100	.99	.01			100	1.00				68	1.00			
THOMAS CREEK 84	w	55	.%	.04			55	1.00				55	1.00			
THOMAS CREEK 85	W	24	.94	.06			24	1.00				24	1.00			
WILEY CREEK	w	100	.96	.04			100	1.00				100	1.00			
WILEY CREEK 85	W	27	.%	.04			27	.98	.02			27	1.00			
SOUTH SANTIAM HATCHERY	S	97	.94	.06			97	1.00				47	1.00			
CALAPOOYA RIVER	w	100	1.00									100	1.00			
CALAPOOYA RIVER 84	w	47	.99	.01			47	1.00				47	1.00			
LEABURG HATCHERY	s	95	.95	.05			100	1.00				95	1.00			
LEABURG HATCHERY 85	s	47	.99	.01			43	1.00				50	1.00			
MCKENZIE RIVER	s	50	.97	.03			50	1.00				50	.98			.02
SANDY RIVER	w	100	.%	.04			100	1.00				100	1.00			
WASHOUGAL HATCHERY	S	100	.95	.01		.04	100	1.00				100	9S	.02		
WASHOUGAL HATCHERY 85	S	89	.99	.01			82	.99		.01		100	1.00			
WASHOUGAL HATCHERY	w	100	1.00				100	1.00				100	1.00			
HAMILTON CREEK	w	53	.97	.03			53	.99	.01			53	1.00			
WIND RIVER	s	50	2.00				50	1.00				50	1.00			
WIND RIVER 85	s	25	1.00				25	1000				25	1.00			
HOOD RIVER	W	50	.99	.01			50	.99	01			50	.99			.01
KLICKITAT RIVER	s	100	.91	.05	.04		60	1.00				100	1.00			
FIFTEENMILE CREEK	w	82	1.00				82	1.00				82	.%	.01	.03	
FIFTEENMILE CREEK 85	W	50	.98	.02			49	.9s		.02		50	1.00			
DESCHUTES RIVER	s	264	.92	.06	.01	.01	267	1.00		•		262	.99	*	.01	
ROUND BUTTE HATCHERY	S	97	.93	.07			100	.99	.01			78	1.00			
ROUND BUTTE HATCHERY 85	S	98	.91	.08	.01		93	.97		.03		100	.97	.01	.03	
JOHN DAY RIVER	s	100	.91	.09			100	1.00				100	.%		.04	
JOHN DAY RIVER 85	s	49	.92	.08			51	.98			.02	50	.99		.01	

Steelhead trout gene frequency data (continued).

STEELHEAD STOCK	FORM	DIPEPTIDASE N	100	110	85	95	TRIPEPTIDE AMINOPEPTIDASE N	100	129	74	50	PHOSPHO-GLUCOMUTASE-1 N	-100	-115	-85
UMATILLA RIVER	S	98	.90	.10			100	1.00				100	1.00		
UMATILLA HATCHERY	s	100	.95	.05			100	.99	.01			100	1.00		
WALLA WALLA RIVER	S	40	.83	.18			40	.90	.04		.06	40	1.00		
TOUCHET RIVER	s	47	.93	.07			48	.98	.02			50	.97	.03	
TUCANNON RIVER	s	112	.88	.11	*		112	1.00	*			100	.99	.01	
TUCANNON RIVER 85	s	50	.90	.10			50	.99		.01	.	50	1.00		
GRANDE RONDE RIVER	s	50	.93	.04	.03		50	1.00				50	.99		.01
GRANDE RONDE RIVER 84	s	110	.90	.09	.01		110	.99		.01		110	1.00		
WALLOWA-LOSTINE	s	73	1.00				73	1.00				73	1.00		
WALLOWA-LOSTINE 84	s	62	.93	.07			52	1.00				62	1.00		
WALLOWA HATCHERY	s	100	.93	.06	.01		100	1.00				100	1.00		
MISSION CREEK	s	30	.80	.20			30	1.00				30	.98		.02
BIG CANYON/COTTONWOOD CRKS.	S	88	.89	.09	.02		88	1.00				88	.99		.01
DWORSHAK HATCHERY	s	73	.54	.45			73	1.00				73	1.00		
SELWAY RIVER	S	98	.82	.18			98	1.00				95	1.00		
LOCHSA RIVER	S	46	.71	.29			50	1.00				49	1.00		
IMNAHA RIVER	s	100	.97	.03			100	1.00				96	1.00		
IMNAHA RIVER 84	S	58	.94	.06			58	1.00				58	1.00		
IMNAHA HATCHERY	s	100	.99	.01			100	1.00				100	1.00		
SHEEP & BARGAMIN CRKS.	s	120	.97	.04			120	1.00				120	1.00		
S.F.SALMON (SECESH RIVER)	S	61	.98	.02			57	1.00				61	1.00		
S.F.SALMON (JOHNSON CREEK)	S	50	.83	.16		.01	50	1.00				50	1.00		
CHAMBERLAIN CREEK	S	92	.95	.04		.01	97	1.00							
HORSE CREEK	S	50	.%	.04			51	1.00				50	1.00		
MIDDLE FORK SALMON RIVER #	S	277	.%	.04			2n	.99	.01			277	1.00		
PAHSIMEROI 'B' STOCK	S	50	.54	.46			50	1.00				50	1.00		
SAWTOOTH 'A' STOCK	S	50	.95	.05"			50	1.00				50	1.00		
HELLS CANYON STOCK	s	%	.%	.04	.01		100	.99	.01			100	1.00		
YAKIMA RIVER	S	48	.91	.09			48	1.00				48	1.00		
YAKIMA RIVER 84	s	49	.82	.18			49	1.00				49	1.00		
WENATCHEE RIVER	s	%	.94	.06			96	1.00				96	1.00		
ENTIAT RIVER	s	49	.%	.04			40	1.00				50	1.00		
WELLS HATCHERY	S	81	.91	.09			81	1.00				61	1.00		
METHOW RIVER	S	58	.95	.05			58	1.00				58	1.00		

SteelMad trout gene frequency data (continued) .

STOCK	FORM	PHOSPHO-GLUCOMUTASE-2 N	-100	-140	L-IDITOL DEHYDROGENASE N	100	195	SUPEROXIDE DISMUTASE N	100	152	48
BIG CREEK HATCHERY	w	100	1.00		100	1,00		98	.60	.40	
BIG CREEK HATCHERY 85	w	95	1.00					86	.60	.40	
GRAYS RIVER	W	100	1.00		100	1.00		96	,68	.32	.01
ELOCHOMAN HATCHERY	w	100	1.00		100	1.00		98	.68	.32	
COWLITZ HATCHERY NATIVE	W	99	1.00		99	1.00		88	.61	.39	
COWLITZ HATCHERY CHAMBERS	w	100	1.00		100	1.00		100	.66	.34	
COWLITZ HATCHERY SKAMANIA	S	90	1.00		90	1.00		90	.78	.22	
S.F. TOUTLE RIVER	W	50	1.00		50	1.00		49	.58	.42	
COWEEMAN RIVER	W	74	1.00					66	.66	.34	
EAGLE CREEK HATCH. (BIG CR.)	w	100	1.00		100	1.00		99	.65	.35	
EAGLE CREEK HATCHERY 85	W	50	1.00					50	.75	.25	
EAGLE CREEK HATCH. (NATIVE)	w	70	1.00		100	1.00		64	.74	.26	
EAGLE CREEK HATCHERY 85	w	100	1.00					80	.74	.26	
MARION FORKS HATCHERY	w	100	1.00		100	1.00		97	.45	.55	
THOMAS CREEK 83	w	68	1.00					58	.58	.43	
THOMAS CREEK 84	w	55	1.00		55	1.00		55	.63	.37	
THOMAS CREEK 85	w	24	1.00					24	.56	.44	
WILEY CREEK	w	100	1.00		100	1.00		100	.62	.38	
WILEY CREEK 85	w	27	1.00		27	1.00		27	.65	35	
SOUTH SANTIAM HATCHERY	s	47	1.00		97	1.00		97	.72	.28	
CALAPOOYA RIVER	w	100	1.00					59	.57	.43	
CALAPOOYA RIVER 84	w	47	1.00		47	1.00		47	.59	.41	
LEABURG HATCHERY	s	95	1.00		100	1.00		97	.78	.22	
LEABURG HATCHERY 85	S	50	.97	.03	50	1.00		50	.66	.34	
MCKENZIE RIVER	S	50	1.00		50	1.00		50	.65	.35	
SANDY RIVER	w	100	1.00		100	1.00		99	.76	.24	
WASHOUGAL HATCHERY	s	100	1.00		93	1.00		96	.82	.18	
WASHOUGAL HATCHERY 85	s	100	1.00		100	1.00		98	.69	.31	
WASHOUGAL HATCHERY	w	100	1.00					92	.60	.40	
HAMILTON CREEK	w	53	1.00		53	1.00		53	.71	.29	
WIND RIVER	S	50	1.00		50	1.00		50	.70	.30	
WIND RIVER 85	S	25	1.00					25	.82	.18	
HOOD RIVER	W	50	1.00					47	.73"	.27	
KLICKITAT RIVER	s	100	.%	.04	100	1.00		99	.78	.21	.01
FIFTEENMILE CREEK	w	82	1.00		82	1.00		76	.93	.06	.01
FIFTEENMILE CREEK 85	W	50	1.00		50	1.00		50	.79	.15	.06
DESCHUTES RIVER	s	267	1.00					266	.92	.04	.04
ROUND BUTTE HATCHERY	s	78	.99	.01				100	.91	.05	.04
ROUND BUTTE HATCHERY 85	s	100	1.00		100	1.00		98	.87	.09	.05
JOHN DAY RIVER	s	100	1.00					93	.%	.03	.01
JOHN DAY RIVER 85	S	50	1.00		50	1.00		50	.98		.02

Steelhead trout gene frequency data (continued).

STEELHEAD STOCK	FORM	PHOSPHO-GLUCOMUTASE-2			L-IDITOL DEHYDROGENASE			SUPEROXIDE DISMUTASE			
		N	-100	-140	N	100	195	N	100	152	48
UMATILLA RIVER	S	100	1.00		100	1.00		96	.95		.05
UMATILLA HATCHERY	s	100	1.00		100	1.00		100	.98	.02	
WALLA WALLA RIVER	S	40	1.00		40	1.00		40	.86	.01	.13
TOUCHET RIVER	S	50	1.00		50	1.00		50	.99		.01
TUCANNON RIVER	s	113	.99	.01	113	1.00		113	.93	.06	.02
TUCANNON RIVER 85	S	50	1.00		50	1.00		50	.94		.06
GRANDE RONDE RIVER	S	50	1.00		50	.93	.0?	50	.90	.10	
GRANDE RONDE RIVER 84	s	110	1.00		110	1.00		110	.93	.01	.06
WALLOWA-LOSTINE	s	73	1.00		73	1.00		73	.95	.03	.02
WALLOWA-LOSTINE 84	s	62	.99	.01	62	1.00		62	.90	.03	.07
WALLOWA HATCHERY	s	100	1.00		100	1.00		100	.99		.01
MISSION CREEK	S	30	1.00					30	.92	.07	.02
BIG CANYON/COTTONWOOD CRKS.	S	88	.9s	.02				88	.93	.01	.06
DWORSHAK HATCHERY	S	73	1.00					73	1.00		
SELWAY RIVER	S	9S	.97	.03				9s	.91	.04	.05
LOCHSA RIVER	S	50	1.00					50	.90		.10
IMNAHA RIVER	S	87	1.00		96	1.00		86	.95	.04	.01
IMNAHA RIVER 84	S	58	1.00		50	1.00		58	.90	.02	.09
IMNAHA HATCHERY	S	100	1.00		100	1.00		89	.91	.03	..06
SHEEP & BARGAMIN CRKS.	S	120	.99	.01				120	.87	.01	.13
S.F.SALMON (SECESH RIVER)	s	61	1.00		61	.99	.01	61	.89		.11
S.F.SALMON (JOHNSON CREEK)	S	50	1.00					49	.s9	.04	.07
CHAMBERLAIN CREEK	s	97	1.00					97	.%	.01	.03
HORSE CREEK	S	50	1.00					50	1.00		
MIDDLE FORK SALMON RIVER #	S	277	1.00					277	.91	.01	.09
PAHSIMEROI 'B' STOCK	S	50	.99	.01				50	1.00		
SAWTOOTH 'A' STOCK	S	50	1.00					50	.91	.01	.0s
HELLS CANYON STOCK	s	100	.99	.01				100	.95	.01	.04
YAKIMA RIVER	S	48	.9s	.02	48	1.00		47	.92	.04	.04
YAKIMA RIVER 84	s	49	1.00		49	1.00		49	.86		.14
WENATCHEE RIVER	s	%	1.00					96	.91	.03	.06
ENTIAT RIVER	S	50	1.00		50	1*OO		49	.96		.04
WELLS HATCHERY	s	61	1.00					81	.90	.01	.09
METHOW RIVER	S	58	1.00		58	1.00		58	.97	.01	.02