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STOCK SUMMARY REPORTS for COLUMBIA RIVER
COLUMBIA RIVER ANADROMOUS SALMONIDS

COLUMBIA RIVER ANADROMOUS SALMONIDS Volume V
Idaho

Subbasins for the coordinated information system

Annual Report 1992

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

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STOCK SUMMARY REPORTS
for
COLUMBIA RIVER ANADROMOUS SALMONIDS

Volume V: Idaho Subbasins

for
THE COORDINATED INFORMATION SYSTEM

Prepared by:

Sharon Keifer
Idaho Department of Fish and Game
Boise, ID 83707

Mike Rowe
Shoshone-Bannock Tribes
Fort Hall, ID 83203

Keith Hatch
Columbia River Inter-Tribal Fish Commission
Portland, OR 97232

Prepared for:

U.S. Department of Energy
Bonneville Power Administration
Division of Fish and Wildlife
P.O. Box 3621
Portland, OR 97208

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VOLUME V

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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 shared 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 Much of this knowledge exists only in unpublished form in agency and individual files.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; and the final draft of Kiefer et al. 1992) are available in five separate volumes for Oregon (2), Washington (2), and Idaho (1). 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.

ACKNOWLEDGEMENTS

Many thanks are due to the numerous people who contributed to the preparation of the information contained in this report. Those from the Idaho Department of Fish and Game included Terry Elms-Cockrum, Charlie Petrosky, and Stan Allen. Helen Morrison and Ann Roseberry of the Columbia River Inter-Tribal Fish Commission worked on the draft and final documents, and Phil Roger, CIS project leader, saw it through to completion.

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 and/or 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 finer 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 mimimum goal for these reports).

Authorship

This final draft document has several authors. Shoshone-Bannock staff submitted the Mainstem Snake and Upper Salmon sockeye sections of this report, and all other sections were submitted by the Idaho Department of Fish and Game (IDFG). The views represented in this volume have only received brief agency review by IDFG, and are not intended to represent policy statements. These views also do not necessarily represent the views of other CIS participants. This reference document compiles data and information from many sources, and the reader is advised to obtain original published reports indentified in the reference sections in order to cite or interpret data.

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 December 3 1, 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 may be 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 (Wold et al. 1987), 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 RR), 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 arc 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 arc 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 (although Idaho reported the age class value differently, the "Total % Female" value is the same). 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 Tiig

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

Length was the most universally measured parameter of smolt size. Mean length, range, and sample size basis were displayed for outmigrating smolts (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 rare, 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 carcasses 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 spawners.
- (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 smolts
- (AC) Age composition (freshwater.ocean)
- (AS) Percent females by brood year and age class
- (AL) Mean fork length by brood year 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 Smolt 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
MD-a, etc.	Migrational data
PD-a, etc.	Parr Density data
PT.-a, etc.	Pitt Tag data

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 Washington)
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 Washington 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:

Mainstem Snake

Clearwater
- Lower Mainstem
- South Fork
- Locksa
- Selway

Salmon River
- Lower-mainstem
- Little Salmon
- Mid-mainstem
- South Fork
- Middle Fork
- Upper Salmon
- Lemhi
- Pahsimeroi

The following Tables 1 through 6 summarize, by species, the presence or absence of the standardized (and some non-standardized) tabular data for the Idaho subbasins.

Table 1. Summary of available information for spring chinook in the mainstem Snake and four Clearwater subbasins.

	MAINSTEM SNAKE	LOWER CLEARWATER	SOUTH FORK CLEARWATER	LOCHSA	SELWAY
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 2. Summary of available Information for summer steelhead in the mainstem Snake and- four Clearwater subbasins.

	MAINSTEM SNAKE	LO WEB CLEARWATER	SOUTH FORK CLEARWATER	LOCHSA	SELWAY
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					
J UVENILE LIFE HISTORY					
TIMING	✓	✓			
SMOLT LENGTH		✓	✓		
# SMOLTS					
BIOCHEMICAL					
DISEASE	✓	✓			

Table 3. Summary of available information for spring chinook in eight subbasins of the Salmon River.

	LOWER SALMON	LITTLE SALMON	MID MAIN-STEM	SOUTH FORK SALMON	MIDDLE FORK SALMON	UPPER SALMON	LEMHI	PAHSIMEROI
HABITAT	✓	✓	✓		✓	✓	✓	
SUBBASIN DISTRIBUTION								
PRODUCTION								
HATCHERY RELEASES		✓				✓	✓	
HATCHERY RETURNS		✓				✓	✓	
SUBBASM 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 available information for summer chinook in eight subbasins of the Salmon River, Idaho.

	LOWER SALMON	LITTLE SALMON	MID MAIN-STEM	SOUTH FORK SALMON	MIDDLE FORK SALMON	UPPER SALMON	LEMHI	PAHSIMEROI
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 available information for summer steelhead in eight subbasins of the Salmon River, Idaho.

	LOWER SALMON	LITTLE SALMON	MID MAIN-STEM	SOUTH FORK SALMON	MIDDLE FORK SALMON	UPPER SALMON	LEMHI	PAHSIMEROI
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 available information for sockeye in eight subbasins of the Salmon River, Idaho.

	LOWER SALMON	LITTLE SALMON	MID MAIN-STEM	SOUTH FORK SALMON	MIDDLE FORK SALMON	UPPER SALMON	LEMHI	PAHSIMEROI
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								

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MAINSTEM SNAKE RIVER SUBBASIN

Naturally Produced Spring Chinook Salmon

GEOGRAPHIC LOCATION

The Snake River meets the Columbia River at River Mile (RM) 324 (Figure 1). Salmon and steelhead have access for spawning, rearing, and/or migrating to 250 miles of mainstem Snake River up to Hells Canyon Dam, the upper limit of accessible river to anadromous fish. The Snake River subbasin for purposes of this report is defined as the Snake River mainstem from where the Snake enters Idaho (RM 139) to Hells Canyon Dam (RM 247) and all Idaho tributaries within this section except the Clear-water and Salmon rivers.

ORIGIN

Spring chinook are native to the Idaho portion of the Snake River. Since the early 1980's, spring chinook have been outplanted in the Hells Canyon area. The effect of the adult returns from these hatchery outplants on the indigenous population is unknown.

DISTRIBUTION

The total amount of habitat that can be used for both spawning and rearing is minimal and limited to only a few tributaries (Table 1). Rearing only habitat is more plentiful as it includes some mainstem water (Table 2).

PRODUCTION

There is no information on total production of spring chinook in the Idaho portion of the Snake River. Tributary monitoring of juvenile chinook production is limited to two streams - Sheep and Granite creeks. Idaho Department of Fish and Game has documented no chinook parr production from 1985 to 1990 in either stream.

ADULT LIFE HISTORY

The freshwater life history for adult spring chinook is assumed to be similar to that of spring chinook from the Salmon River.

Adult Escapement

Adult returns in the Hells Canyon area of the Snake River ranged from 0 to 2,631 fish from 1958 to 1980 (Table 3). Escapement in the late 1950's and 1960's most likely includes only those fish that were returning to upriver streams (e.g., Payette, Boise, Burnt, Powder rivers), subsequently blocked by construction of the Hells Canyon hydroelectric complex (Brownlee, Oxbow, and Hells Canyon dams).

Harvest

No information is available regarding ocean or Columbia River harvest. Terminal harvest in recent years has been limited and the natural component of the harvest when there has been a fishery is unknown.

Spawner Escapement

No information is currently available. Redds are not counted in this subbasin.

Adult Characteristics

No information is available on adult characteristics of natural spring chinook from the Idaho portion of the Snake River subbasin.

JUVENILE LIFE HISTORY

The freshwater life history for juvenile spring chinook is assumed to be similar to that of spring chinook from the Salmon River.

BIOCHEMICAL - GENETIC CHARACTERISTICS

No information available.

DISEASES

No information available.

REFERENCES

All Lower Snake references appear at the end of the hatchery produced summer steelhead section.

MAINSTEM SNAKERIVER

Figure 1 (AD). The **mainstem** Snake River from Ice Harbor to Hells Canyon Dam. There is no anadromous fish access above Hells Canyon Dam. Based on the BPA Geographic Information System.

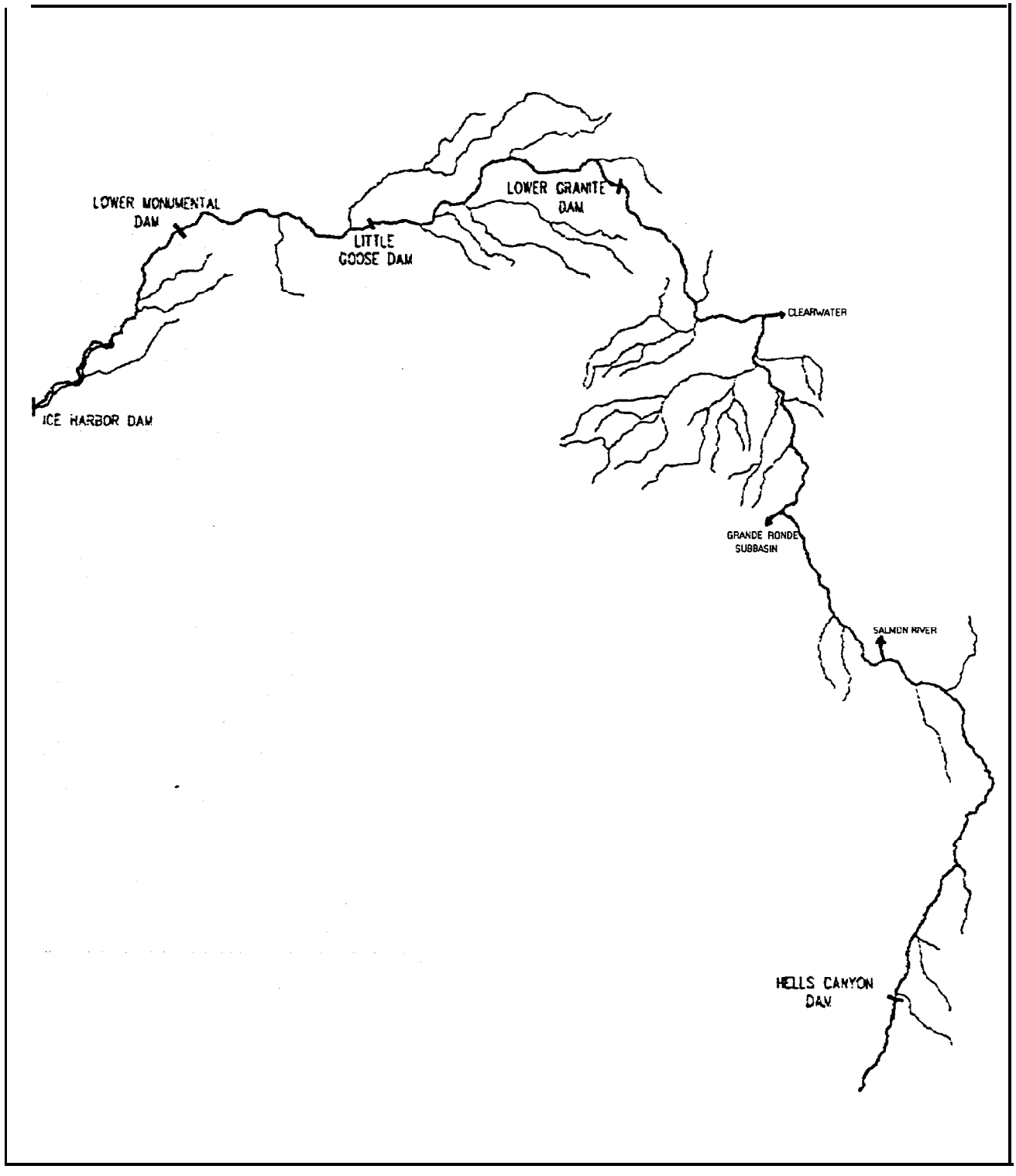

Table 1 (HB-1). Estimated amount of spawning and rearing habitat by quality of Snake River spring chinook production area. This data is derived from the Presence/Absence database of Northwest Power Planning Council, 1991.

	Excellent	Good	Fair[A]	Poor[A]	Unknown	Total	Confidence[B]
Miles (%)	0	0	37.5	62.5	0	5.6	M
Acres (%)	0	0	30.2	69.8	0	12.6	M

*Ratings of fair and poor habitat quality may reflect natural physical features such as gradient and channel type, as well as human-caused degradation.
[B]'Confidence' indicates the reproducibility and accuracy of the estimates made and was rated as high, medium or low by the respective agencies.

Table 2 (HB-2). Estimated amount of rearing only habitat by quality of Snake River spring chinook production area. This data is derived from the Presence/Absence database of Northwest Power Planning Council, 1991.

	Excellent	Good	Fair[A]	Poor[A]	Unknown	Total	Confidence[B]
Miles (%)	100.0	0	0	0	0	60.4	M
Acres (%)	100.0	0	0	0	0	2509.1	M

*Ratings of fair and poor habitat quality may reflect natural physical features such as gradient and channel type, as well as human-caused degradation
[B]'Confidence' indicates the reproducibility and accuracy of the estimate made, and was rated as high, medium or low by the respective agencies.

Table 3 (RN-a). Escapement of Snake River spring chinook to dam construction sites in Hells Canyon (1958 to 1967) and Hells Canyon Dam trap (1968 to 1980) by year.

Year	Total escapement
1958	762
1959	1250
1960	2631
1961	2047
1962	1050
1963	339
1964	829
1965	705
1966	1945
1967	1177
1968	835
1969	924
1970	6
1971	0
1972	0
1973	0
1974	0
1975	0
1976	0
1977	0
1978	0
1979	0
1980	0

Reference: Smith, W. E., Idaho Power Company, unpublished data.

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MAINSTEM SNAKE RIVER SUBBASIN

Hatchery Produced Spring Chinook Salmon

GEOGRAPHIC LOCATION

Oxbow Hatchery is part of the Idaho Power Company's mitigation plan for the Hells Canyon hydroelectric complex (Brownlee, Oxbow, and Hells Canyon dams). The hatchery is owned by Idaho Power Company, managed by Idaho Department of Fish and Game, and is located on the Oregon shore of the Snake River at River Mile (RM) 270. The adult trap for Oxbow Hatchery is at Hells Canyon Dam (RM 247), the upper limit of accessible river to anadromous fish. Adult fish are held at Oxbow and eventually transferred to Rapid River Hatchery.

ORIGIN

Adult returns from outplanted smolts into the Hells Canyon area began about 1980, which for this report is considered the beginning of the Snake River hatchery spring chinook stock. Snake River hatchery spring chinook are essentially a mid-Snake River stock. The broodstock used for outplanting smolts is primarily a combination of fish that have returned to the Hells Canyon Dam trap and Rapid River Hatchery. Rapid River spring chinook were collected from the middle Snake River at Hells Canyon Dam from 1964 to 1969. Since then, the hatchery has relied solely upon hatchery returns for broodstock (Abbott and Ball 1991).

DISTRIBUTION

Hatchery releases of spring chinook into the Hells Canyon area are listed in Table 1. Broodstock have been either Hells Canyon or Rapid River fish except in 1984 when smolts from Leavenworth stock were outplanted.

Coded wire tag information indicates minimal straying by adults produced by spring chinook smolts stocked in Hells Canyon (Table 2). The exception is Rapid River where 41% and 50% of the total coded wire tag recoveries from smolts stocked in 1984 (tag codes 102704 and 102705, respectively) were reported. This high "straying" rate is not surprising since these fish were raised at Rapid River Hatchery.

PRODUCTION

The mitigation goal for Oxbow Hatchery is to provide, to the extent possible, sufficient numbers of adult spring chinook to produce one million smolts (Washington Department of Fisheries et al. 1990). Only once (1981) has this goal been met (Table 1).

Many of the characteristics of the Snake River hatchery spring chinook stock are similar to the Rapid River spring chinook stock. In many years Oxbow adult returns are mixed with Rapid River fish for spawning purposes.

Egg

Eggs hatch at Rapid River Hatchery in late September through December. Swim-up is in late January to early April (Howell et al. 1984). Egg eye-up for brood years 1985-87 ranged from 63.9 to 91.4% (Levendofske et al. 1988, 1989, 1991) and averaged 85.4% from 1980-87 (S. W. Kiefer, Idaho Department of Fish and Game, unpublished data).

In 1987 fish from Oxbow were spawned separately from Rapid River adults. Percent eye-up for the brood year was 89 % for Oxbow eggs and 92 % for Rapid River eggs (Levendofske et al. 1991).

Frv-Fingerling

At Rapid River Hatchery eyed-egg to fry survival for brood years 1985-87 averaged 91.9 % and ranged from 89.5 to 95.9% (Levendofske et al. 1988, 1989, 1991). Fry to smolt survival is generally about 75 % except when significant disease outbreaks occur (B. Hutchinson, Idaho Department of Fish and Game, personal communication).

Smolt

No information available.

Jack and Adult

Prespawning mortality at Oxbow Hatchery for spring chinook ranged from 0 to 17% from 1986 to 1990 (Burton 1988a; Burton 1988b; B. R. Snider, Idaho Department of Fish and Game, personal communication; Bertellotti and Young 1990; D. S. Young, Idaho Department of Fish and Game, unpublished data). In 1983, the only other year in which prespawning mortality information was available, 19% of the adults died prior to spawning (McLin 1984). Smolt to adult survival for smolts released in 1983 through 1985 was 0.21, 0.11, and 0.18%, respectively (Burton 1988b).

ADULT LIFE HISTORY

The freshwater life history for adult spring chinook is assumed to be similar to that of spring chinook from Rapid River Hatchery (Figure 1).

Adult Escapement

Generally, Snake River spring chinook enter the Columbia River in late February through early May. Coded wire tag information indicates the presence of Snake River hatchery spring chinook in the mainstem Columbia in late March through May (P. Hassemer, Idaho Department of Fish and Game, personal communication). Snake River spring chinook are counted at Lower Granite Dam from 1 March through 17 June.

Harvest

Information is not available to fully quantify ocean or Columbia River harvest although coded wire tag recoveries indicate some harvest in the treaty fishery on the mainstem Columbia (Table 2). Terminal harvest for spring chinook since 1980 has been limited and the hatchery component of the harvest when there has been a fishery is unknown.

Spawner Escapement

Chinook trapping at Hells Canyon Dam will begin in early May (Burton 1986) and continue into mid July (D. S. Young, Idaho Department of Fish and Game, unpublished data). Returns of hatchery spring chinook to the Hells Canyon Dam trap have ranged from no fish in 1982 to 760 fish in 1985 (Table 3).

Spawn taking at Rapid River Hatchery where Oxbow Hatchery spring chinook are spawned has commenced as early as 2 August (Levendofske et al. 1989) and has been completed as late as 18 September (Howell et al. 1985).

Adult Characteristics

Snake River hatchery spring chinook return primarily as 4 year old (2 ocean) fish, representing 47.5 to 73.3 % of the return for brood years 1982 to 1985 (Tables 4 and 5). Mean fork length for 4 year old (2 ocean) fish ranged from 73 to 76 cm for 1987 to 1990 returns (Table 6). For the same time period, 5 year old (3 ocean) fish ranged in length from 83 to 88 cm. Age assignments are based on standard length frequency criteria and should be considered estimates. Only in 1990 were fished aged using a known age technique (scale evaluation).

For the three years (1985, 1987, 1990) for which data is available, females represented 45 to 60% of the returning adults (Table 7). Fecundity during those years ranged from 3614 to 4008 eggs/female (Table 8).

JUVENILE LIFE HISTORY

The freshwater life history for juvenile spring chinook is assumed to be similar to that of spring chinook from Rapid River Hatchery (Figure 1). Smolt age at release ranges from 19 to 20 months, depending upon the time of egg take (S. W. Kiefer, Idaho Department of Fish and Game, unpublished data). Smolts have historically been trucked from Rapid River Hatchery to Hells Canyon in March for release into the Snake River. Howell et al. (1985) stated that the average size at release following about 20 months of rearing ranged from 117 to 138 mm fork length and 28 to 15 per pound for brood years 1967-81.

BIOCHEMICAL - GENETIC CHARACTERISTICS

No information available.

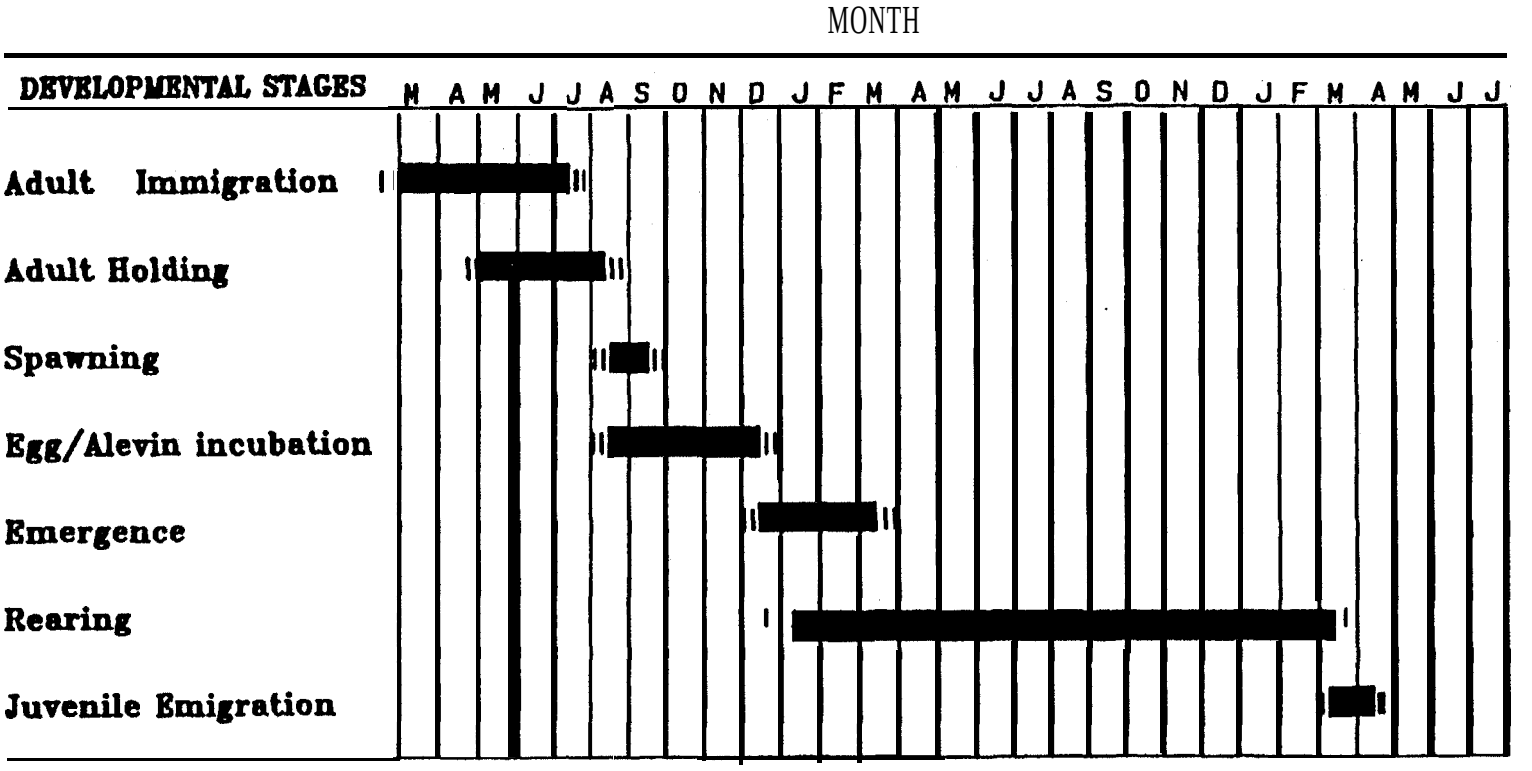
DISEASES

Diseases of Snake River spring chinook include enteric redmouth disease, bacterial kidney disease, and erythrocytic inclusion body syndrome (Table 9).

REFERENCES

All Lower Snake River references appear in one reference section at the end of the hatchery produced summer steelhead section.

Figure 1 (TT). Freshwater life history for spring chinook salmon spawned and reared at the Rapid River (Circle C) Hatchery.



Notes:

1. The developmental stage timing represents basin-wide averages, local conditions may cause some variability.
2. Solid bars indicate periods of heaviest adult immigration, spawning and juvenile emigration.

Table 1 (TR-1). Hatchery spring chinook releases into the Snake River below Hells Canyon by brood years, 1979-1989.

Brood Year	Brood-stock	Hatchery	Life Stage	Release Date (1)	Release Date (2)	Fish/lb	Number Released	Release Location	CWT
1979	Rapid River	Rapid River	smolt	1981			1,001,700	Hells Canyon	
1981	Rapid River	Rapid River	smolt	1983			250.050	Hells Canvon	
1982	Rapid River	Rapid River	smolt	1984			500,850	Hells Canyon	
1983	Rapid River	Rapid River	smolt	1984			437,360	Hells Canyon	
1984	Rapid River	Rapid River	smolt	1986			140,000	Hells Canyon	
1984	Leavenworth	Dworshak NFH	smolt	3/19/86	3/31/86		164,286	Snake R. @ Lower Granite	
1985	Rapid River	Rapid River/ Pahsimeroi	smolt	1987			444.700	Hells Canvon	
1986	Hells Canyon	Rapid River	smolt	3/22/88	3/23/88	19.8	400,600	Hells Canyon	
1987	Hells Canvon	Rapid River	smolt	3/21/89	3/23/89	20.0	500,000	Hells Canyon	
1988	Hells Canyon	Rapid River	smolt	3/20/90	3/22/90	29.9	55 1,200	Hells Canyon	
1989	Hells Canyon	Rapid River	smolt	3/19/91	3/21/91	22.5	500,500	Hells Canyon	

Reference: Kiefer, S. W., Idaho Department of Fish and Game, personal communication.

Table 2 (AE-a). Recoveries of coded wire tagged Snake River spring chinook released at Hells Canyon Dam.

Hatchery/ Release site	Tag code	Number tagged	Total recov-eries	Recovery site	Run year	Recovery method	Number recov-ered	Total number estimated (PSMFC)
Rapid River Hatchery/ Hells Canyon Dam	102318	40,300	113	Marine	1983	ODFW juvenile sampling seine	1	1
				Columbia R.	1985	ODFW test fishery net	1	1
						Gillnet	1	2
						Treaty ceremonial	2	5
					1986	Treaty ceremonial	1	3
				Sawtooth H.	1985	Spawner survey	1	na*
				Rapid River H.	1985	Spawner survey	1	na*
					1986	Spawner survey	1	na*
	102717	41,075	92	Columbia R.	1985	sport	2	11
						ODFW test fishery net	1	1
						Gillnet	1	2
						Treaty ceremonial	3	7
					1986	Gillnet	2	7
						ODFW test fishery net	1	1

*Not available

Table 2 (cont.), Recoveries of coded wire tagged Snake River spring chinook released at Hells Canyon Dam.

Hatchery/ Release site	Tag code	Number tagged	Total recov-eries	Recovery site	Run year	Recovery method	Number recov-ered	Total number estimated (PSMFC)
Rapid River Hatchery/ Hells Canyon Dam	102717	41,075	92	Columbia R.	1986	Treaty ceremonial	1	3
				Rapid River H.	1986	Spawner survey	2	na*
	102704	41,900	18	Columbia R.	1986	sport	1	9
						Treaty ceremonial	1	3
				Rapid River H.	1986	Spawner survey	9	na*
					1987	Spawner survey	1	na'
	102705	41,175	39	Columbia R.	1986	ODFW test fishery net	2	2
						Treaty ceremonial	2	7
					1987	Treaty ceremonial	1	2
				Rapid River H.	1986	Spawner survey	16	na'

*Not available

Reference: Hassemer, P., Idaho Department of Fish and Game, personal communication.

Table 3 (RH-a). Total returns of Snake River spring chinook to Hells Canyon Dam trap by year.

Year	Total return
1981	1
1982	0
1983	16
1984	*
1985	760
1986	395
1987	547
1988	471
1989	87
1990	30

'No fish trapped due to high flows and inoperative trap

References: Bertellotti and Young 1990.
Burton 1986.
Burton 1988a.
Burton 1988b.
Graham 1982.
Graham 1983.
McLin 1984.
Schriever 1985.
Snider, B. R., Idaho Department of Fish and Game, personal communication.
Young, D. S., Idaho Department of Fish and Game, unpublished data.

Table 4 (RH-1). Returns by age of Snake River spring chinook to the Hells Canyon Dam trap by brood year.

Brood Year	Total Age* 2	3	4	5	6	Total	Adult Total
1980	0	-	-	111	0	111	111
1981	0	-	582	62	0	644	644
1982	0	61	317	156	0	534	473
1983	0	14	387	413	0	814	800
1984	0	4	43	29	0	76	72
1985	0	13	55	7	0	75	62
1986	0	3	23			26	23

'In some years only a subsample of the total number of returns was aged.

References: Bertellotti and Young 1990.
Burton 1988b.
Kiefer, S. W., Idaho Department of Fish and Game, personal communication.
Schriever 1985.
Snider, B. R., Idaho Department of Fish and Game, personal communication.
Whitesel, T., Oregon Department of Fish and Wildlife, personal communication.

Table 5 (AC-l). Age composition percentage (freshwater.ocean) by brood year for Snake River spring chinook trapped at Hells Canyon Dam. In this nomenclature, the freshwater and ocean ages sum to the total age of the fish.

Age Composition (%)*

Brood Year	N	2.1	2.2	2.3
1982	534	11.4	59.4	29.2
1983	814	1.7	47.5	50.7
1984	76	5.3	56.6	38.2
1985	75	17.3	73.3	9.3

*Age determined by fork length at hatchery; l-ocean ≤ 61 cm, 2-ocean 62 cm - 79 cm, 3-ocean > 79 cm: BY 1985 age 2.3 fish aged by scales.

References: Bertellotti and Young 1990.
Burton 1988b.
Kiefer, S. W., Idaho Department of Fish and Game, personal communication.
Schriever 1985.
Snider, B. R., Idaho Department of Fish and Game, personal communication.
Whitesel, T., Oregon Department of Fish and Wildlife, personal communication.

Table 6 (AL-a). Mean fork length by year and age class (freshwater.ocean) for Snake River spring chinook trapped at Hells Canyon Dam.

Mean fork length (cm)*

Year	2.1	2.2	2.3
1987	57	73	88
N	4	387	156
std. dev.	5.4	3.1	4.5
1988	49	76	87
N	13	43	413
std. dev.	5.7	3.2	4.1
1989	51	75	84
N	3	55	29
std. dev.	4.0	3.2	5.4
1990		76	83
N		23	7
std. dev.		4.8	4.7

*Age determined by fork length at hatchery; 1 -ocean ≤ 61 cm, 2-ocean 62 - 79 cm, 3-ocean > 79 cm: except for 1990 fish which were aged by scale.

References: Bertellotti and Young 1990.
Burton 1988b.
Snider, B. R., Idaho Department of Fish and Game, personal communication.
Whitesel, T., Oregon Department of Fish and Wildlife, personal communication.

Table 7 (AS-a). Percent females by year for Snake River spring chinook trapped at Hells Canyon Dam.

Year	N	Females (%)
1981	1	0
1982	0	0
1983	16	na[1]
1984	0	0
1985	733	45
1986	362	m[2]
1987	536	47
1988	393	m
1989	87	m
1990	30	60

'Not available
*Fish trapped at Hells Canyon Dam mixed with Rapid River fish, no separate identification of sex by stock.

References: Dredge, B., Idaho Department of Fish and Game, personal communication.
Levendofske, Miller, and Lanier 1991.
Whitesel, T., Oregon Department of Fish and Wildlife, personal communication.

Table 8 (AF-a). Mean fecundity by year for Snake River spring chinook trapped at Hells Canyon Dam.

Year	N	Mean fecundity
1985	268	4008
1986	na*	na
1987	177	3923
1988	na	na
1989	na	na
1990	17	3614

*Not available

References: Levendofske, Chapman, and Lowell 1988.
Levendofske, Miller, and Lanier 1991.
Whitesel, T., Oregon Department of Fish and Wildlife, personal communication.

Table 9 (TD-1). Parasites and diseases of Snake River spring chinook at hatcheries located in the Snake River.

Disease type	Hatchery	Infection
Bacteria	Rapid River	Enteric redmouth disease (*Yersinia ruckeri*)
Bacteria	Rapid River	Bacterial kidney disease (*Renibacterium salmoninarum*)
virus	Rapid River	Erythrocytic inclusion body syndrome

References: Abbott 1984.
Levendofske, Chapman, and Lowell 1988.
Levendofske, Chapman, and Steiner 1989.
Levendofske, Miller, and Lanier 1991.

MAINSTEM SNAKE RIVER SUBBASIN

Naturally Produced Summer Steelhead

GEOGRAPHIC LOCATION

The Snake River meets the Columbia River at River Mile (RM) 324. Salmon and steelhead have access for spawning, rearing, and/or migrating to 250 miles of mainstem Snake River up to Hells Canyon Dam, the upper limit of accessible river to anadromous fish. The Snake River subbasin for purposes of this report is defined as the Snake River mainstem from where the Snake enters Idaho (RM 139) to Hells Canyon Dam (RM 247) and all Idaho tributaries within this section except the Clear-water and Salmon rivers.

ORIGIN

Summer steelhead are native to the Idaho portion of the Snake River. These fish are A-strain steelhead. Since the late 1960's, steelhead have been outplanted in the Hells Canyon area. The effect of the adult returns from these hatchery outplants on the indigenous population is unknown.

DISTRIBUTION

The total amount of habitat that can be used for both spawning and rearing is limited (Table 1). Rearing only habitat is more plentiful as it includes mainstem water (Table 2).

PRODUCTION

There is no information on total production of steelhead in the Idaho portion of the Snake River. Tributary monitoring of juvenile steelhead production is limited to four streams - Captain John, Wolf, Sheep, and Granite creeks. Idaho Department of Fish and Game has documented steelhead (age-l and -2 fish) production from 1985 to 1990 in the four streams. Densities ranged from 0 to 25 steelhead/100 m (Table 3).

ADULT LIFE HISTORY

The freshwater life history for adult summer steelhead is assumed to be similar to that of summer steelhead from the Salmon River.

Adult Escapement

Thompson et al. (1958) identified two peak migration periods when steelhead entered the Snake River - late September and early April to mid-May (Washington Department of Fisheries et al. 1990). Between 1959 and 1967 return of steelhead adults ranged from 779 to 5,092 fish (Table 4). These escapement figures likely include only those fish that were returning to upriver streams (e.g., Payette, Boise, Burnt, Powder rivers), eventually blocked by construction of the Hells Canyon hydroelectric complex (Brownlee, Oxbow, and Hells Canyon dams).

Asotin Creek (RM 145) is a tributary in the Snake River subbasin located in Washington. Eldred (1961), as cited by Howell et al. (1984), noted that Asotin Creek outmigrants predominantly returned to the stream beginning in mid-February and peaking in March and April, two years from the time of release.

Harvest

No information is available regarding ocean or Columbia River harvest. The natural component of the harvest in the sport catch (Table 5) is assumed to be minimal as the fishery targets hatchery steelhead.

Soawner Escapement

No information is currently available. Redds are not counted in this subbasin.

In Asotin Creek, the spawning period is April and May (Howell et al. 1984).

Adult Characteristics

Information on the characteristics of naturally produced summer steelhead in the Snake River subbasin is limited to two sampling periods in the early 1960's. The 1963-64 adult return of steelhead included 77 % females but the sample size was small (Table 6). The following year (1964-65) females represented 51% of the total return of adults. Mean fecundity for these two sampling periods was 2,116 and 2,646 eggs/female, respectively (Table 7). Although these fish were most likely destined for upstream tributaries, characteristics are assumed to be similar.

As cited in Howell et al. (1984), females represented 65% of the adult return of summer steelhead to Asotin Creek from 1955 to 1961 (Eldred and Douglas 1960; Eldred 1961). Howell et al. (1984) also noted that Kray (1959) reported that eighteen females taken from Asotin Creek in 1954 averaged 3,615 eggs per female.

JUVENILE LIFE HISTORY

The freshwater life history for juvenile summer steelhead is assumed to be similar to that of summer steelhead from the Salmon River. In Asotin Creek most smolts likely outmigrate in late April and May as 170-200 mm 2-year olds (Howell et al. 1984).

BIOCHEMICAL - GENETIC CHARACTERISTICS

No information available.

DISEASES

No information available.

REFERENCES

All Lower Snake River references appear in one reference section at the end of the hatchery produced summer steelbead section.

MAINSTEM SNAKERIVER

Table 1 (HB-1). Estimated amount of spawning and rearing habitat by quality of Snake River summer steelhead production area. This data is derived from the Presence/Absence database of Northwest Power Planning Council, 1991.

	Excellent	Good	Fair[A]	Poor[A]	Unknown	Total	Confidence[B]
Miles (%)	60.5	16.3	15.6	7.6	0	39.2	M
Acres (%)	48.5	8.2	40.6	2.7	0	80.5	M

*Ratings of fair and poor habitat quality may reflect natural physical features such as gradient and channel type, as well as human-caused degradation

[B]'Confidence' is meant to indicate the reproducibility and accuracy of the estimates made, and was rated as high, medium or low by the respective agencies.

Table 2 (HB-2). Estimated amount of rearing only habitat by quality of Snake River summer steelhead production area. This data is derived from the Presence/Absence database of Northwest Power Planning Council, 1991.

	Excellent	Good	Fair[A]	Poor[A]	Unknown	Total	Confidence[B]
Miles (%)	55.9	0	44.1	0	0	108.0	M
Acres (%)	48.1	0	51.9	0	0	5211.3	M

*Ratings of fair and poor habitat quality may reflect natural physical features such as gradient and channel type, as well as man-caused degradation.

[B]'Confidence' is meant to indicate the reproducibility and accuracy of the estimates made, and was rated as high, medium or low by the respective agencies.

Table 3 (PD-a). Densities of juvenile (age 1 and 2) Snake River summer steelhead as fish per 100 m^2 and percent of rated carrying capacity (%K) for Idaho tributaries to the Snake River, 1985-90.

		Year					
Stream		1985	1986	1987	1988	1989	1990
Captain John	fish/100m^2	11.46	25.69	11.39	na*	2.80	6.40
	%K	57	128	57	-	14	32
	sites	2	2	2	-	2	2
Granite	fish/100m^2	18.01	16.60	9.28	25.73	10.71	11.17
	%K	90	83	46	129	54	56
	sites	3	3	3	3	3	3
Sheep	fish/100m^2	9.66	12.71	14.39	9.83	11.82	4.14
	%K	48	64	72	49	59	21
	sites	2	2	2	2	2	2
Wolf	fish/100m^2	17.54	8.89	12.22	5.56	11.43	0
	%K	88	44	61	28	57	0
	sites	1	1	1	1	1	1

*Not available.

Reference: Rich, B., Idaho Department of Fish and Game, unpublished data.

Table 4 (RN-a). Escapement of Snake River summer steelhead to dam construction sites in Hells Canyon (1958 to 1967) and Hells Canyon Dam trap (1968 to 1971) by year.

Year	Total escapement
1959	4414
1960	4557
1961	1971
1962	1798
1963	1140
1964	806
1965	779
1966	4195
1967	5092

Reference: Smith, W. E., Idaho Power Company, unpublished data.

Table 5 (RS-a). Sport catch of summer steelhead in the Snake River, above the confluence of the Salmon River to Hells Canyon Dam, by fish run year (1 June to 31 May).

Year	Total catch
1976-77	50
1977-78	na'
1978-79	0[2]
1979-80	7
1980-81	100
1981-82	126
1982-83	1308
1983-84	1046
1984-85	553
1985-86	1204
1986-87	1477
1987-88	572
1988-89	837
1989-90	1448
1990-91	711

'No data available.
[2]Season closed.

Reference: McArthur, T., Idaho Department of Fish and Game, unpublished data.

Table 6 (AS-a). Percent females by trapping year (fall-spring) for Snake River summer steelhead trapped at Hells Canyon Dam.

Year	N	Females (%)[1]
1963-64	13	77
1964-65	162	51

*in some years based upon subsample of total return

Reference: Reingold 1966.

Table 7 (AF-a). Mean fecundity by year for Snake River summer steelhead trapped at Hells Canyon Dam.

Year	N	Mean fecundity
1964	10	2116
1965	82	2646

Reference: Reingold 1966.

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MAINSTEM SNAKE RIVER SUBBASIN

Hatchery Produced Summer Steelhead

GEOGRAPHIC LOCATION

Oxbow Hatchery is part of Idaho Power Company's mitigation plan for the Hells Canyon hydroelectric complex (Brownlee, Oxbow, and Hells Canyon dams). The hatchery is owned by Idaho Power Company, managed by Idaho Department of Fish and Game, and is located on the Oregon shore of the Snake River at River Mile (RM) 270. The adult trap for Oxbow Hatchery is at Hells Canyon Dam (RM 247), the upper limit of accessible river to anadromous fish. Adult fish are spawned at Oxbow and most of the resultant eyed-eggs are then transferred to Niagara Springs Hatchery (NSH): in some years eggs are reared on site.

ORIGIN

Adult returns from outplanted smolts into the Hells Canyon area began in the mid-1960's, which for this report is considered the beginning of the Snake River hatchery summer steelhead stock. Since 1986 the highest percentage of wild steelhead recorded at the Hells Canyon trap was 10% in 1986 (Burton 1988a).

Snake River hatchery summer steelhead are essentially a mid-Snake River stock. Although other steelhead stocks have been planted in the Hells Canyon area, the majority of outplants have been with fish from Hells Canyon stock (Table 1). These fish are predominantly A-strain steelhead although some B-strain fish have been documented at the Hells Canyon trap (Graham 1982, 1983). This differentiation of A- vs. B-strain steelhead was made solely on length of fish and may not indicate a difference in strain as much as within strain variation.

DISTRIBUTION

Hatchery releases of summer steelhead into the Hells Canyon area are listed in Table 1. In 1987 through 1990 Oregon Department of Fish and Wildlife stocked Imnaha and Wallowa broodstock fingerlings in the Snake River (Table 1). A portion of these outplants could have conceivably negotiated their way through the hydroelectric system to migrate to the ocean.

PRODUCTION

The mitigation goal for Oxbow Hatchery is to provide sufficient numbers of steelhead to produce 200,000 pounds of smolts (Washington Department of Fisheries et al. 1990). Only in 1989 and 1990 were 200,000 or more pounds of smolts stocked (Table 1).

Snake River hatchery stock which have been raised on-site at Oxbow have been stocked in the Little Salmon River drainage (McLin 1984, Schriever 1985, Burton 1986, Burton 1988a).

Egg

Eye-up for Snake River summer steelhead at Oxbow Hatchery from 1965 to 1990 has averaged 85 % with a range of 4.8 to 99.0% (Burton 1988b; B. R. Snider, Idaho Department of Fish and Game, personal communication; Bertellotti and Young 1991; D. S. Young, Idaho Department of Fish and Game, unpublished data).

Frv-Fingerling

For Snake River steelhead reared on-site at Oxbow Hatchery eyed-egg to fry survival averaged 65.0% (range 0 - 94.8%) from 1983 to 1987 (McLin 1984, Schriever 1985, Burton 1986, 1988a, 1988b). Eyed-egg to fry survival for Snake River steelhead reared at NSH averaged 92.0 % (range 85.2 - 98.3%) for 1982, 1983, 1986, and 1989 (Billman 1983, Quidor 1984, Miller 1988, Baker and Mower-y 1991).

In 1982 eyed-egg to fall fingerling/presmolt survival for Snake River steelhead reared at NSH was 45.6 % (Billman 1983). Eyed-egg to fall fmgerlinglpresmolt survival for all steelhead (primarily Oxbow and Pahsimeroi stocks) reared at NSH averaged 63.2% for 1980 to 1982, 1984, and 1989 (Quidor 1980, 1981, Billman 1983, Mower-y 1985, Baker and Mowery 1991).

Smolt

Eyed-egg to smolt survival for all steelhead (primarily Oxbow and Pahsimeroi stocks) reared at NSH was 67.2% in 1980 (Quidor 1980). In 1981 and 1982 fall fmgerlinglpresmolt to smolt survival for all steelhead at NSH was 98.8% and 80.7%, respectively (Quidor 1981, Bilhnan 1983).

At NSH from the 1969-70 to 1989-90 production seasons, the average survival of steelhead from the time the fish (primarily eggs but also fry and fmgerlings) were received at the hatchery to stocking as fingerlings or smolts was 59.7% with a five-year (1985-86 to 1989-90) average of 75.2% (Baker and Mowery 1989).

Jack and Adult

Prespawning mortality at Oxbow Hatchery for summer steelhead ranged from 2 to 14 % from 1981 to 1990, except for 1989 when disease and other problems resulted in 35 % prespawning mortality (Graham 1981, 1983; McLin 1984; Schriever 1985; Burton 1986, 1988a, 1988b; B. R. Snider, Idaho Department of Fish and Game, personal communication; Bertellotti and Young 1990; D. S. Young, Idaho Department of Fish and Game, unpublished data).

ADULT LIFE HISTORY

Figure 1 shows the freshwater life history for adult Snake River hatchery steelhead.

Adult Escapement

Trapping at Hells Canyon Dam for summer steelhead occurs in both the fall and spring. Fall trapping usually starts in September and ends in December. Spring trapping occurs mostly in March and April. Most adults are trapped in the fall (range 47 - 100%) rather than the spring with an occasional fish caught in June while trapping for chinook (Graham 1981, 1983; McLin 1984; Burton 1986, 1988a, 1988b; B. R. Snider, Idaho Department of Fish and Game, personal communication; Bertellotti and Young 1990; D. S. Young, Idaho Department of Fish and Game, unpublished data).

Adult returns to the Hells Canyon Dam trap from fall 1967 to spring 1990 ranged from 34 to 3209 (Table 2).

Harvest

Information is not available to fully quantify ocean or Columbia River harvest. Harvest figures for the sport fishery which targets hatchery steelhead are presented in Table 3.

Spawner Escapement

Trapping of steelhead adults used as hatchery broodstock occurs in both the fall and spring. Spawn taking at Oxbow Hatchery commenced as early as mid-March (D. S. Young, Idaho Department of Fish and Game, unpublished data) and has been completed as late as the end of May (Graham 1980, 1981, 1983).

Adult Characteristics

Snake River hatchery summer steelbead return primarily as 2 year old (1 ocean) fish (Table 4) averaging 64% for brood years 1982 to 1987 (Table 5). Mean total length for 2 year old (1 ocean) fish averaged 62 cm for brood year 1982 to 1987 returns and 73 cm for 3 year old (2 ocean) returns for the same time period (Table 6). Age assignments are based on standard length frequency criteria and should be considered estimates.

Since the 1979-80 trapping year females have represented 58 % of the adult return (Table 7). Percentage of females by age averaged 47 % for 2 year old (1 ocean) fish and 73 % for 3 year old (2 ocean) fish for brood years 1984 to 1987 (Table 8). Mean fecundity for all females spawned ranged from 3181 to 6096 eggs/female since 1966 (Table 9).

JUVENILE LIFE HISTORY

The freshwater life history for juvenile summer steelhead is graphically shown in Figure 1 for the Oxbow hatchery. Presmolts are traditionally stocked in October or November. Smolts are stocked in April (Table 1). Presmolts range from 21 to 26 fish/pound and smolts range from about 4 to 18 fish/pound (Table 1). Presmolts averaged 119 mm in length in 1985 (Mowery 1988). The average length of smolts stocked in 1986 was 201 mm (Mowery 1988) and in 1990 it was 220 mm (Baker and Mowery 1991).

BIOCHEMICAL - GENETIC CHARACTERISTICS

No information available.

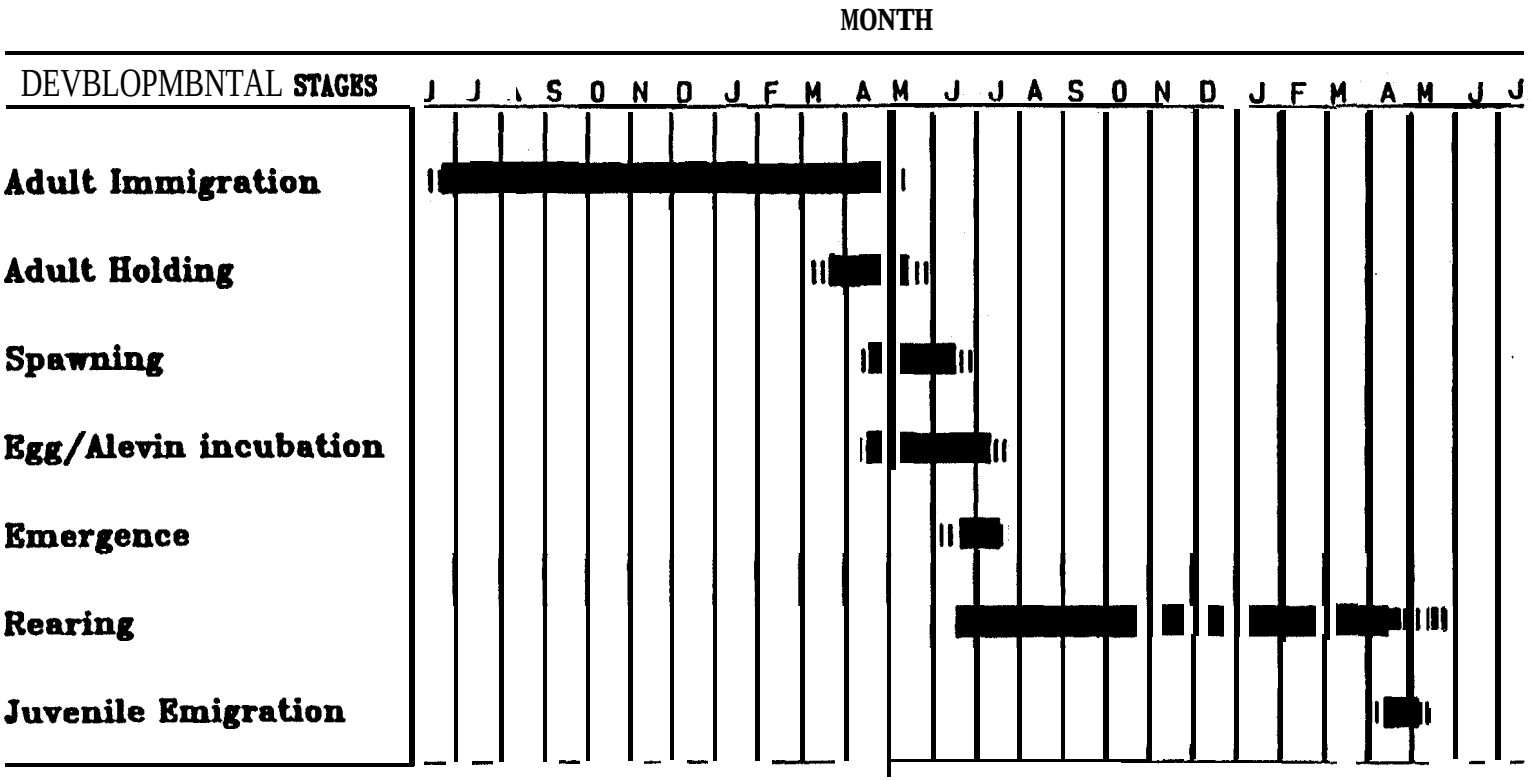
DISEASES

Diseases of Snake River hatchery summer steelhead reared at Niagara Springs and Oxbow hatcheries include bacterial kidney disease, infectious hematopoietic necrosis, and infectious pancreatic necrosis (Table 10).

REFERENCES

All Mainstem Snake references appear at the end of the hatchery produced summer steelhead section.

Figure 1 (TT). Freshwater life history for summer steelhead spawned and reared at the Oxbow Hatchery.



Notes:

1. The developmental stage timing represents basin-wide averages, local conditions may cause some variability.
2. Solid bars indicate periods of heaviest adult immigration, spawning and juvenile emigration.

Table 1 (TR-1). Hatchery steelhead releases into the Snake River below Hells Canyon Dam, by brood years, 1977-1990. Coded wire tag codes displayed for brood year 1986. No tags were released brood years 198 7-1990.

Brood Year	Brood-stock	Hatchery	Life Stage	Release Date (I)	Release Date (2)	Fish/lb	Number Released	Release Location	CWT
1966	Hells Canyon A	Niagara Springs	smolt	1967 spring			587.513	Hells Canvon	
1967	Hells Canyon A	Niagara Springs	smolt	1968 Spring			342,144	Hells Canyon	
1968	Hells Canyon A	Niagara Springs	smolt	1969 Spring			109,200	Hells Canyon	
1969	Hells Canyon A	Niagara Springs	pre-smolt	1969 Fall			757.500	Hells Canvon	
1969	Hells Canyon A	Niagara Springs	smolt	1970 spring			385,900	Hells Canyon	
1970	Hells Canyon A	Niagara Springs	pre-smolt	1970 Fall			670,960	Hells Canyon	
1971	Hells Canyon A	Niagara Springs	pre-smolt	1971 Fall			215.625	Hells Canvon	
1972	Hells Canyon A	Niagara Springs	pre-smolt	1972 Fall			630,900	Hells Canyon	
1975	Hells Canyon A	Niagara Springs	pre-smolt	1975 Fall			40.977	Hells Canyon	
1976	Hells Canyon A	Niagara Springs	smolt	1977 spring			141,005	Hells Canyon	
1977	Hells Canyon A	Niagara Springs	pre-smolt	1977 Fall			281,208	Hells Canyon	
1975	Hells Canyon A	Niagara Springs	smolt	1977			126.000	Hells Canvon	
1977	Unknown A	private	F-F'	1977			20,436	Hells Canyon	
1978	DNFH B[b]	DNFH	F-F	1978			150	Hells Canyon	
1978	Hells Canyon A	Niagara Springs	F-F	1978			344.944	Hells Canyon	
1979	Hells Canyon A	Niagara Springs	pre-smolt	1979 Fall			205,560	Hells Canyon	
1979	DNFH B	DNFH	F-F	1979			1.800	Hells Canyon	
1979	Hells Canyon A	Niagara Springs	smolt	1980			348.220	Hells Canvon	
1980	Hells Canyon A	Hagerman NFH	pre-smolt	1980 Fall			191,400	Hells Canyon	

Table 1 (cont.). Hatchery steelhead releases into the Snake River below Hells Canyon Dam, by brood years, 1977-1990. Coded wire tag codes displayed for brood year 19 16. No tags were released brood years 1987- 1 9 30.

Brood Year	Brood-stock	Hatchery	Life Stage	Release Date (1)	Release Date (2)	Fish/lb	Number Released	Release Location	CWT
1980	Hells Canyon A	Niagara Springs	smolt	1981			612,760	Hells Canyon	
1981	Hells Canyon A	Niagara Springs	smolt	1982			354,680	Hells Canyon	
1982	Hells Canyon A	Niagara Springs	smolt	1983			92,750	Hells Canyon	
1983	Hells Canyon A	Niagara Springs	pre-smolt	1983 Fall			220,270	Hells Canyon	
1983	DNFH B	DNFH	adult	1983			611	Smake R.	
1983	Hells Canyon A	Niagara Springs	smolt	1984			408,430	Hells Canyon	
1983	Hells Canyon A	Hagerman NFH	smolt	1984			50,487	Hells Canyon	
1984	Hells Canyon A	Niagara Springs	pre-smolt	1984 Fall			630,500	Hells Canyon	
1984	Hells Canyon A	Niagara Springs	smolt	1985			414,712	Hells Canyon	
1985	Hells Canyon A	Niagara Springs	pre-smolt	1985 Fall			330,520	Hells Canyon	
1985	Hells Canyon A	Hagerman NFH	pre-smolt	1985 Fall			56,833	Hells Canyon	
1985	Hells Canyon A	Niagara Springs	smolt	1986			819,495	Hells Canyon	
1986	Hells Canyon A	Niagara Springs	pre-smolt	11/21/86	11/21/86	21.0	39,995	Hells Canyon	102953
1986	Hells Canyon A	Niagara Springs	smolt	3/28/87	3/30/87	18.0	39,950	Hells Canyon	102954
1986	Hells Canyon A	Niagara Springs	smolt	3/28/87	3/30/87	18.0	760,050	Hells Canyon	Untagged
1987	Hells Canyon/Pah. A	Niagara Springs	pre-smolt	10/19/87	10/21/87	25.9	404,000	Hells Canyon	
1987	Sawtooth A	Hagerman NFH	ore-smolt	10/22/87	11/5/87	26.4	344.049	Hells Canyon	
1987	Wallowa R.	Irrigon	F-F	11/23/87		44.8	145,360	Snake River	
1987	Wallowa R.	Irrigon	F-F	11/24/87	11/30/87	38.8	155,225	Snake River	

Table 1 (cont.). Hatchery steelhead releases into the Snake River below Hells Canyon Dam, by brood years, 1977-1990. Coded wire tag codes displayed for brood year 1986. No tags were released brood years 1987-1990.

Brood Year	Brood-stock	Hatchery	Life Stage	Release Date (1)	Release Date (2)	Fish/lb	Number Released	Release Location	CWT
1987	Imnaha R.	Irrigon	F-F	11/30/87		62.1	37,939	Snake River	
1987	Hells Canyon A	Niagara Springs	smolt	4/18/88	4/28/88	4.5	877,400	Hells Canyon	
1988	Wallow R.	Irrigon	F-F	11/22/88		48.5	52,263	Snake River	
1988	Imnaha R.	Irrigon	F-F	11/22/88		50.1	42,064	Snake River	
1988	Hells Canyon A	Niagara Springs	smolt	4/20/89	4/28/89	4.1	735,500	Hells Canyon	
1989	Hells Canyon A	Oxbow	adult	1989			601	Hells Canyon	
1989	Imnaha R.	Irrigon	F-F	11/14/89		67.0	24,588	Snake River	
1989	Wallowa R.	Irrigon	F-F	11/14/89		72.2	9,025	Snake River	
1989	Hells Canyon A	Niagara Springs	smolt	4/20/90	4/29/90	3.9	947,200	Hells Canyon	
1990	Hells Canyon A	Oxbow	adult	4/24/90	4/26/90	0.2	233	Hells Canyon	
1990	Wallowa R.	Irrigon	F-F	11/20/90		53.8	140,787	Snake River	
1990	Imnaha R.	Irrigon	F-F	11/21/90		57.1	71,698	Snake River	
1990	Hells Canyon A	Niagara Springs	smolt	4/22/91	5/2/91	3.6	912,000	Hells Canyon	

[a] F-F designates a fry or fingerling release.
[b] Dworshak National Fish Hatchery.
[c] Hells Canyon A/Pahsimeroi A.

Reference: Kiefer, S. W., Idaho Department of Fish and Game, personal communication.
Olsen, E., Oregon Department of Fish and Wildlife, personal communication.

Table 2 (RH-a). Total returns of Snake River summer steelhead to Hells Canyon Dam trap by trapping year (fall - spring).

Year	Total return
1967-68	1609
1968-69	1466
1969-70	441
1970-71	284
1971-72	700
1972-73	435
1973-74	126
1974-75	34
1975-76	258
1976-77	201
1977-78	186
1978-79	36
1979-80	339
1980-81	158
1981-82	205
1982-83	874
1983-84	1116
1984-85	1383
1985-86	2438
1986-87	3209
1987-88	2524
1988-89	2729
1989-90	2728

References: Bertellotti and Young 1990.
Burton 1988b.
Snider, B. R., Idaho Department of Fish and Game, personal communication.
Young, D. S., Idaho Department of Fish and Game, unpublished data.

Table 3 (RS-a). Sport catch of summer steelhead in the Snake River, above the confluence of the Salmon River to Hells Canyon Dam, by fish run year (1 June to 3 1 May).

Year	Total catch
1976-77	50
1977-78	na[1]
1978-79	0[2]
1979-80	7
1980-81	100
1981-82	126
1982-83	1308
1983-84	1046
1984-85	553
1985-86	1204
1986-87	1477
1987-88	572
1988-89	837
1989-90	1448
1990-91	711

'No data available.
[2]Season closed.

Reference: McArthur, T., Idaho Department of Fish and Game, unpublished data.

Table 4 (RH-1). Returns by age of Snake River summer steelhead to the Hells Canyon Dam trap by brood year.

Brood Year	Total Age* 2	3	4	5	6	Total	Adult Total
1982	235	18	0	0	0	253	253
1983	72	136	0	0	0	208	208
1984	1607	845	0	0	0	2452	2452
1985	1025	910	0	0	0	1935	1935
1986	1614	1244	0	0	0	2858	2858
1987	1483	324	0	0	0	1807	1807
1988	529					529	529

*In some years only a subsample of the total number of returns was aged.

References: Bertellotti and Young 1990.
Burton 1988b.
Kiefer, S. W., Idaho Department of Fish and Game, personal communication.
Snider, B. R., Idaho Department of Fish and Game, personal communication.
Young, D. S., Idaho Department of Fish and Game, unpublished data.

Table 5 (AC-l). Age composition percentage (freshwater.ocean) by brood year for summer steelhead trapped at Hells Canyon Dam. In this nomenclature, the freshwater and ocean ages sum to the total age of the fish.

Age Composition (%)*

Brood Year	N	1.1	1.2
1982	253	92.9	7.1
1983	208	34.6	65.4
1984	2452	65.5	34.5
1985	1935	53.0	47.0
1986	2858	56.5	43.5
1987	1807	82.1	17.9

*Age determined by total length at hatchery: l-ocean males ≤ 69 cm, females ≤ 66 cm; 2-ocean males > 69 cm, females > 66 cm.

References: Bertellotti and Young 1990.
Burton 1988b.
Kiefer, S. W., Idaho Department of Fish and Game, personal communication.
Snider, B. R., Idaho Department of Fish and Game, personal communication.
Young, D. S., Idaho Department of Fish and Game, unpublished data.

Table 6 (AL-a). Mean total length by brood year and age class (freshwater.ocean) for Snake River summer steelhead trapped at Hells Canyon Dam.

Mean total length (cm)'

Brood Year	1.1	1.2
1982	62	na[2]
N	235	na
std. dev.	3.7	na
1983	na	72
N	na	136
std. dev.	na	3.4
1984	61	75
N	1607	845
std. dev.	3.2	4.1
1985	61	74
N	1025	910
std. dev.	3.3	4.1
1986	62	74
N	1614	1244
std. dev.	3.0	4.0
1987	62	70
N	1483	324
std. dev.	4.5	2.8

[1]Age determined by total length at hatchery: l-ocean males ≤ 69 cm, females ≤ 66 cm; 2-ocean males > 69 cm, females > 66 cm.
[2]Not available.

References: Bertellotti and Young 1990.
Burton 1988b.
Kiefer, S. W., Idaho Department of Fish and Game, personal communication.
Snider, B. R., Idaho Department of Fish and Game, personal communication.
Young, D. S., Idaho Department of Fish and Game, unpublished data.

Table 7 (AS-a). Percent females by trapping year (fall-spring) for Snake River summer steelhead trapped at Hells Canyon Dam.

Year	N	Females (%)[1]
1979-80	339	57
1980-81	158	73
1981-82	205	43
1982-83	a74	na*
1983-84	1116	73
1984-85	1383	61
1985-86	2438	48
1986-87	3209	54
1987-88	2524	56
1988-89	2729	56
1989-90	2728	60

'In some years based upon subsample of total return.
[2]Not available.

References: Bertellotti and Young 1990.
Burton 1988b.
Kiefer, S. W., Idaho Department of Fish and Game, personal communication.
Snider, B. R., Idaho Department of Fish and Game, personal communication.
Young, D. S., Idaho Department of Fish and Game, unpublished data.

Table 8 (AS-l). Percent females by brood year and age class (freshwaterocean) for Snake River summer steelhead trapped at Hells Canyon Dam.

Females (%)

Brood Year	N	1.1	1.2	Total % Female
1984	2452	53	66	57
1985	1935	43	76	58
1986	2858	47	69	56
1987	1807	46	82	52

*Age determined by total length at hatchery: l-ocean males ≤ 69 cm, females ≤ 66 cm; 2-ocean males > 69 cm, females > 66 cm.

References: Bertellotti and Young 1990.
Burton 1988b.
Kiefer, S. W., Idaho Department of Fish and Game, personal communication.
Snider, B. R., Idaho Department of Fish and Game, personal communication.
Young, D. S., Idaho Department of Fish and Game, unpublished data.

Table 9 (AF-a). Mean fecundity by year for Snake River summer steelhead trapped at Hells Canyon Dam.

Year	N	Mean fecundity
1966	1145	3181
1967	2547	3212
1968	801	3189
1969	701	4203
1970	272	5610
1971	175	4419
1972	412	4732
1973	321	4359
1974	73	4246
1975	9	6019
1976	182	4244
1977	143	4136
1978	102	4434
1979	22	6096
1980	136	4473
1981	69	5302
1982	68	4327
1983	444	5138
1984	279	4708
1985	700	4253
1986	332	3964
1987	618	4613
1988	1065	4638
1989	334	3955
1990	565	4177

References: Bertellotti and Young 1990.
Burton 1988a, 1988b.
Snider, B. R., Idaho Department of Fish and Game, personal communication.
Young, D. S., Idaho Department of Fish and Game, unpublished data.

Table 10 (TD-1). Parasites and diseases of Snake River summer steelhead at hatcheries located in the Snake River.

Disease type	Hatchery	Infection
Bacteria	Niagara Springs	Bacterial kidney disease (*Renibacterium salmoninarum*)
Virus	Niagara Springs	Infectious hematopoietic necrosis
Virus	Niagara Springs	Infectious pancreatic necrosis
Virus	Oxbow	Infectious pancreatic necrosis

References: Baker and Mowery 1991.
Billman 1983.
Burton 1986, 1988b.
Graham 1981, 1983.
Miller 1988.
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LOWER CLEARWATER RIVER, CLEARWATER SUBBASIN
(including the North Fork to Dworshak Dam and the Middle Fork to the confluence of the Lochsa and Selway Rivers)

Naturally Produced Spring Chinook

GEOGRAPHIC LOCATION

The mainstem Clearwater River is formed by the joining of its South and Middle forks. The mainstem is 75 miles long and enters the Snake River 139 river miles upstream of the Columbia River (Figure 1) (Mallet 1974, Nez Perce Tribe and Idaho Department of Fish and Game 1990). The mainstem is an important migration corridor for adult and juvenile steelhead and salmon, and it is an overwintering area for juveniles. The lower river is not noted as spawning habitat for spring chinook. The lower drainage is characterized by rolling plateaus to the south and north with steep-sided canyons intersecting the mainstem valley (Nez Perce Tribe and Idaho Department of Fish and Game 1990). Lower Clearwater tributaries are small except for the Potlatch River and Lolo Creek. Tributaries of the lower Clearwater region typically drain lands managed for agricultural crops, grazing and timber harvest (Nez Perce Tribe and Idaho Department of Fish and Game 1990). Land ownership is a mix of private, Nez Perce Tribal, state and federal entities. Land use practices have degraded many of the streams in the lower Clearwater. Many of the production tributaries suffer from low summer flows and high temperatures. Spring chinook utilize primarily the Lo10 Creek drainage for spawning and rearing, but as flows decrease in the late summer, parr may utilize the mainstem river.

The Middle Fork of the Clearwater originates at the confluence of the Lochsa and Selway rivers. It joins the South Fork to form the mainstem Clearwater River. The Middle Fork is classified as recreational for the length of the river (22 miles), pursuant to the Wild and Scenic Rivers Act. Clear and Maggie creeks are the only significant natural production tributaries. These are limited by high summer water temperature and sedimentation. Kooskia National Fish Hatchery is located at the mouth of Clear Creek and operates an electric weir to trap returning steelhead and spring chinook.

The North Fork of the Clearwater and its tributaries represented 627 miles of stream utilized by chinook and steelhead (Mallet 1974). Although chinook were almost eliminated by Lewiston Dam in 1927, Dworshak Dam eliminated all of the North Fork's anadromous runs when it was completed on the North Fork in 1971. About two river miles of the North Fork remain accessible to salmon and steelhead. Little, if any natural production occurs in the North Fork. Dworshak National Fish Hatchery (NFH) is located at river mile 2 of the North Fork near Orofino, Idaho. Spring chinook and steelhead are trapped and reared at this facility.

ORIGIN

Spring chinook were probably indigenous throughout the Clearwater drainage prior to construction of Lewiston Dam in 1927. Inadequate adult fish passage at the dam's one fishway virtually eliminated salmon runs into the basin and probably affected the passage of steelhead. In 1939, two additional fishways were constructed and in the mid-1960's, improvements were made. In 1973, Lewiston Dam was removed (Nez Perce Tribe and Idaho Department of Fish and Game 1990).

Dworshak Dam was authorized in 1962. It was completed in the late 1960's and completely blocked all anadromous fish migration. Kooskia National Fish Hatchery (NFH) was constructed in the mid-1960's as part of Dworshak Dam mitigation. Since 1970's, the hatchery has released spring

smolts and fingerlings into the lower Clearwater River. Kooskia NFH has reared a number of different spring chinook broodstocks which are described by Howell et al. (1985) and the Cleat-water Subbasin Plan (Nez Perce Tribe and Idaho Department of Fish and Game 1990). In 1981, the Lower Snake River Compensation Plan authorized and funded additional raceways at Dworshak NFH to raise spring chinook. Dworshak has also reared a variety of broodstocks and has released juveniles into the lower Clearwater mainstem and tributaries. The Clearwater Subbasin Plan (Nez Perce Tribe and Idaho Department of Fish and Game 1990) also describes the broodstock history of Dworshak NFH.

Lindland and Bowler (1988) reported that 8.1 million smolts and 3.7 million fry/fingerlings were released into Clear Creek from Kooskia NFH, 1971-1987. Also, 5.1 million smolts and 0.9 million fry/fingerling spring chinook were released into Clear Creek, the North Fork, and the lower mainstem Cleat-water River from Dworshak NFH during 1981 through 1987. Lesser numbers of spring chinook have also been released into the Lo10 Creek drainage. Table 11 of the Clearwater Subbasin Plan (Nez Perce Tribe and Idaho Department of Fish and Game 1990) summarizes hatchery spring chinook releases into the lower Cleat-water, 1977-1987.

During efforts to supplement lower Cleat-water spring chinook production, there was little evaluation of the different outplants or measurement of production of indigenous fish. Adults returning to supplemented drainages such as Lo10 Creek are of hatchery production, natural production, or mixed production origin. Because of the mixture of hatchery and naturally produced parents in the broodstock history, Idaho Department of Fish and Game classifies lower Cleat-water spring chinook as natural (Idaho Department of Fish and Game 1992).

DISTRIBUTION

Available spawning and rearing habitat for spring chinook in the lower Clearwater was described in the Presence/Absence database (Tables 1 and 2). This information was, developed for the Northwest Power Planning Council for subbasin planning and modeling.

PRODUCTION

There is very little information describing naturally produced spring chinook survival factors. Scully and Petrosky (1991) reported survival of hatchery fry, stocked in Eldorado Creek, to parr was 15.2 percent. Idaho Department of Fish and Game (IDFG) monitored spring chinook parr production in the Lolo Creek drainage, 1985-199 1. The overall weighted mean for IDFG monitoring transects was 12.9 parr per 100 m^2 and 18.1 percent of estimated carrying capacity (Table 3). Parr carrying capacity ratings for spring chinook were derived from the Presence/Absence database used for development of the Clearwater Subbasin Plan. Parr densities were determined by snorkel counts.

ADULT LIFE HISTORY

Adult Escapement

Specific time of migration and escapement for spring chinook returning to the lower Clearwater has not been identified for the ocean or Columbia or Snake rivers. The University of Idaho implemented adult timing research in 1991 which should provide information about Snake River timing (Bjornn et al. 1992).

Harvest

Information is not available regarding the rate of contribution of this stock to ocean, Columbia River or Snake River harvests.

Harvest of naturally produced spring chinook from the lower Clearwater probably accounted for only a very small percentage of Idaho's sport harvest because production was so low. For the period 1959-1974, sport harvest in the entire Clearwater drainage accounted for less than one percent of Idaho's chinook harvest (Horner and Bjomn 1981). It is likely that few naturally produced spring chinook were harvested from the lower Clearwater River after the development of Lewiston Dam.

Information regarding occurrence and magnitude of tribal harvest of naturally produced lower Cleat-water spring chinook is not available.

Spawner Escapement

Information is not available.

Adult Characteristics

Information about adult characteristics of naturally produced spring chinook inhabiting drainages such as Lo10 Creek is not available.

JUVENILE LIFE HISTORY

Juvenile life history timing is generally similar to Figure 2. Although not illustrated in the figure, there is typically a fall emigration of spring chinook presmolts from the upper ends of tributaries to lower in the drainage for winter rearing.

BIOCHEMICAL/GENETIC CHARACTERISTICS

Marshall (1992) described electrophoretic data for juvenile spring chinook collected from Lo10 Creek.

DISEASES

Information is not available.

REFERENCES

All Lower Clearwater references appear in one reference section at the end of the hatchery produced summer steelhead section.

Figure 1 (TD). Anadromous salmonid distribution in the Clearwater subbasin as represented by summer steelhead.

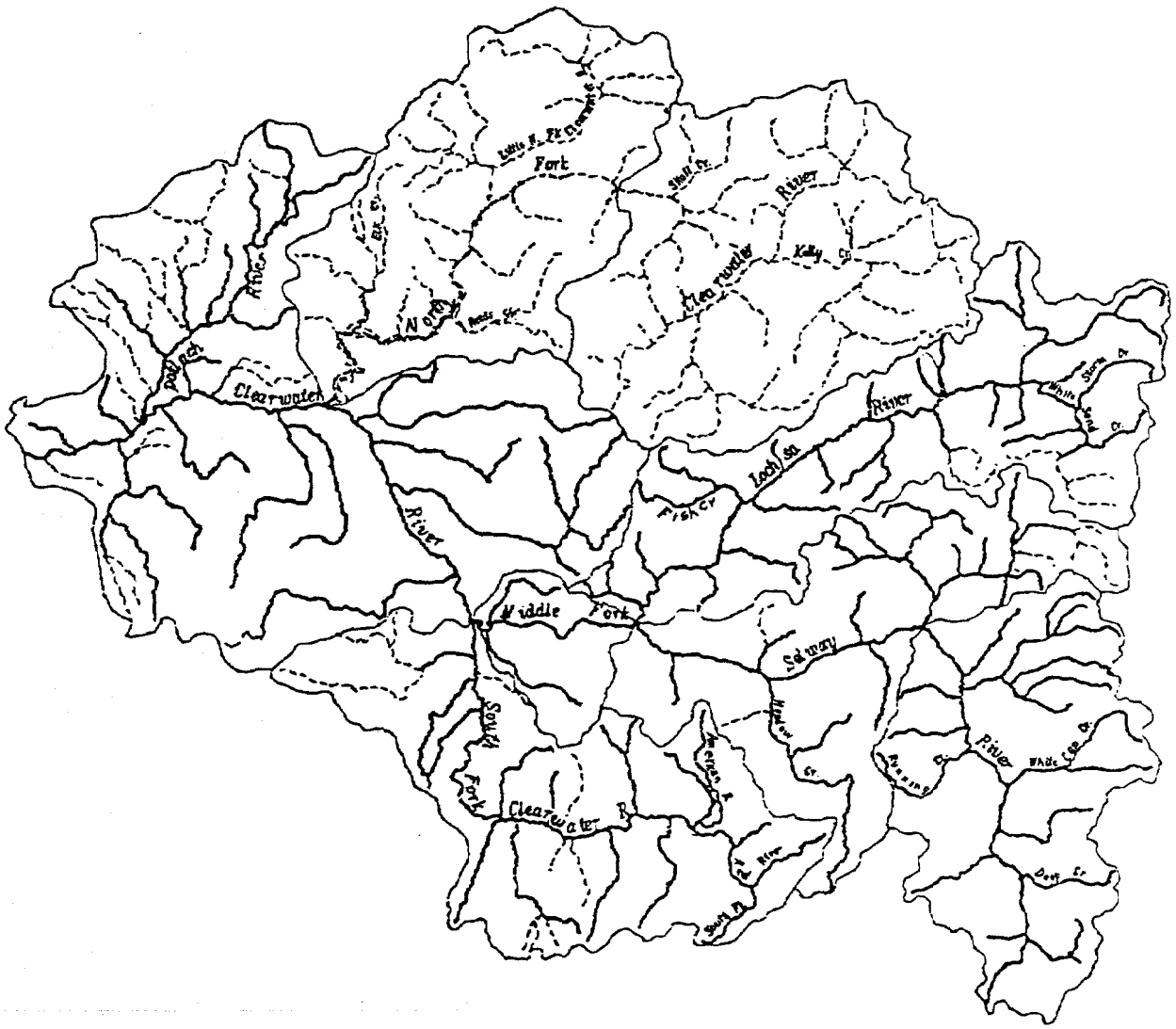
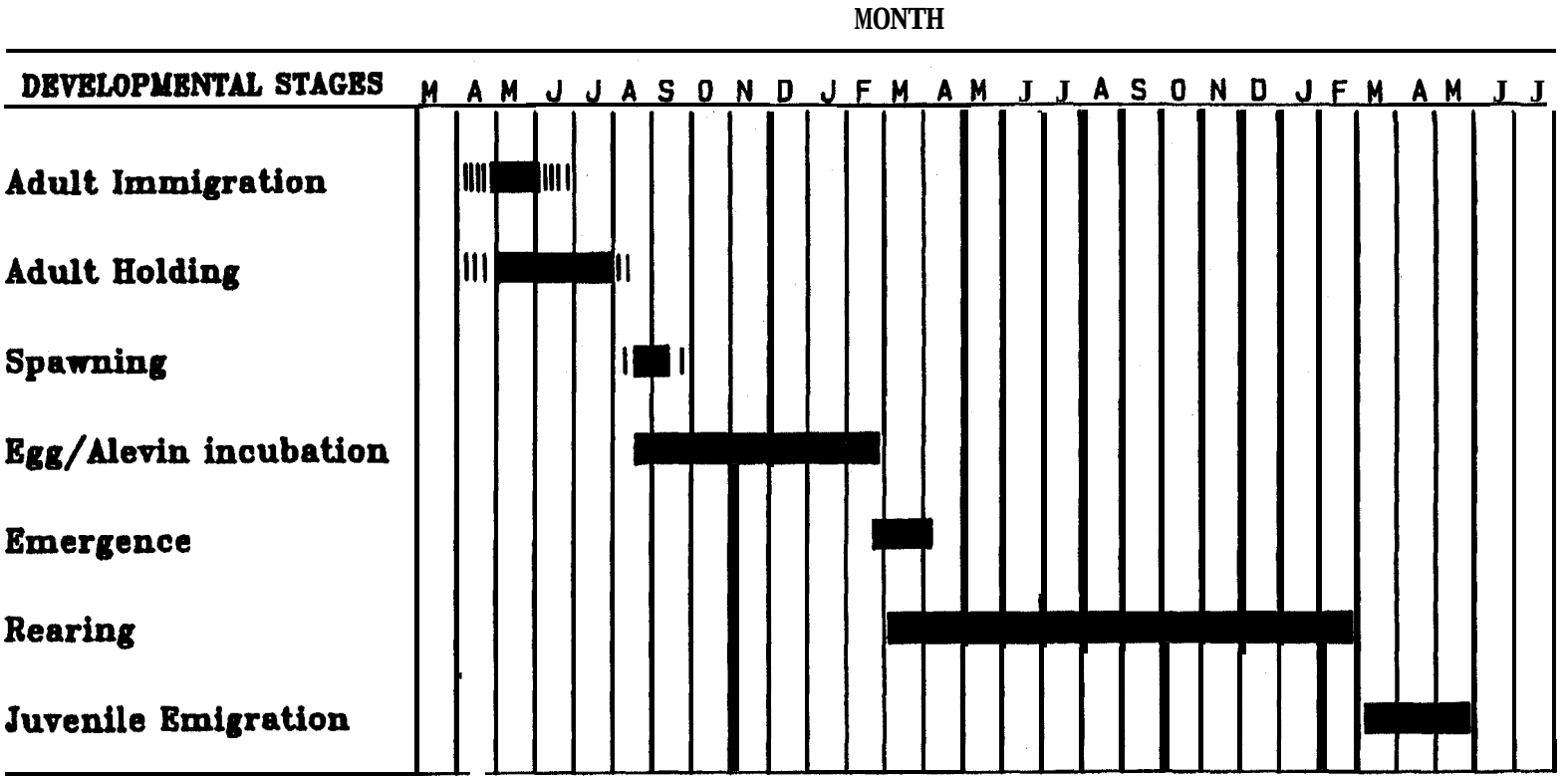


Figure 2. (TT). Freshwater life history for naturally produced spring chinook salmon in the Clearwater River subbasin.



Notes:

1. The developmental stage timing represents basin-wide averages, local conditions may cause some variability.
2. Solid bars indicate periods of heaviest adult immigration, spawning and juvenile emigration.

Table 1 (HB). Estimated amount of spawning and rearing habitat (Use Type 1) by quality of Cleat-water River (mouth to Kooskia including the lower North Fork Cleat-water below Dworshak Dam) spring chinook production area.

	Excellent	Good	Fair"	Poor"	Unknown	Total	Confidence[b]
Miles (%)	0	30	29	41		88.1	M
Acres (%)	0	26	16	58		284.6	M

[a] Ratings of fair and poor habitat quality may reflect natural physical features such as gradient and channel type, as well as degradation caused by humans.
[b] 'Confidence' is meant to indicate the reproducibility and accuracy of the estimates made, and will be rated as high, medium or low by the respective agencies.

Source: Presence/Absence database, Northwest Power Planning Council, 1991.

Table 2 (HB). Estimated amount of rearing only habitat (Use Type 2) by quality of Clear-water River (mouth to Kooskia including the lower North Fork Cleat-water below Dworshak Dam) spring chinook production area.

	Excellent	Good	Fair'	Poor"	Unknown	Total	Confidence[b]
Miles (%)	0	3	13	84		50.4	M
Acres (%)	0	2	15	83		1890.8	M

[a] Ratings of fair and poor habitat quality may reflect natural physical features such as gradient and channel type, as well as degradation caused by humans.
[b] 'Confidence' is meant to indicate the reproducibility and accuracy of the estimates made, and will be rated as high, medium or low by the respective agencies.

Source: Presence/Absence database, Northwest Power Planning Council, 1991.

Table 3 (PD-a). Natural chinook parr densities as fish per $100m^2$ (CHINOD) and percent of rated carrying capacity (CHPERCC), Lower Clearwater River drainage 1985-1991.

	Year						
	1985	1986	1987	1988	1989	1990	1991
Eldorado Creek							
CHINOD=	0.00	2.04	1.35	5.83	1.58	0.46	0.00
CHPERCC=	0.00	2.65	1.75	7.57	2.05	0.60	0.00
N =	1	1	1	1	1	1	1
Lolo Creek							
CHINOD=	7.04	18.63	19.05	31.17	9.85	6.31	11.63
CHPERCC=	9.25	24.38	26.20	44.75	13.10	12.50	15.60
N=	6	6	6	6	6	6	6

Source: B. Rich, IDFG, unpublished.

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LOWER CLEARWATER RISER, CLEARWATER SUBBASIN
(including the North Fork to Dworshak Dam and the Middle Fork to the confluence of the Lochsa and Selway Rivers)

Hatchery Produced Spring Chinook

GEOGRAPHIC LOCATION

Dworshak NFH is located at river mile 2 of the North Fork Cleat-water River (North Fork), near Orofmo, Idaho. Hatchery water is taken from the North Fork Clear-water River below Dworshak Dam. Kooskia NFH is located near the mouth of Clear Creek, a tributary to the Middle Fork Clearwater River. Kooskia NFH is designed to rear 1.2 million spring chinook smolts but poor water quality has limited production to 800,000 smolts (Nez Perce Tribe and Idaho Department of Fish and Game 1990).

Dworshak National Fish Hatchery (NFH) was built in 1969 by the U.S. Corps of Engineers to mitigate for the loss of the North Fork Clear-water steelhead run, which was blocked by construction of Dworshak Dam. In 1984, the Lower Snake River Compensation Plan authorized and funded an additional 30 raceways to rear 70,000 pounds of spring chinook smolts. Construction was completed in 1982 and the first hatchery spring chinook returns occurred in 1984. Kooskia NFH was completed in 1967 to rear and release spring chinook into the Middle Fork Clearwater River. This hatchery was also authorized and constructed as part of Dworshak Dam mitigation. Both hatcheries are funded and operated by the U.S. Fish and Wildlife Service.

ORIGIN

Spring chinook were probably indigenous throughout the Clearwater drainage prior to construction of Lewiston Dam in 1927. Inadequate adult fish passage at the dam's one fishway virtually eliminated salmon runs into the basin and probably affected the passage of steelhead. In 1939, two additional fishways were constructed and in the mid-1960's, improvements were made. In 1973, Lewiston Dam was removed (Nez Perce Tribe and Idaho Department of Fish and Game 1990). However, by that time, Dworshak Dam had been constructed. The dam, completed in the late 1960's, completely blocked all remaining anadromous fish returning to the North Fork of the Clearwater River.

The first action toward reestablishment of chinook salmon in the Clearwater Basin began in 1947. From 1947-1953, fish managers took about 100,000 spring chinook eggs annually from the headwaters of the Middle Fork Salmon River and planted them in the Little North Fork of the Clearwater River. Because some of the fish were fin-clipped, inspection of returning adult at Lewiston Dam proved some were returning (Nez Perce Tribe and Idaho Department of Fish and Game 1990).

Large scale hatchery production of spring chinook smolts began in the Clear-water subbasin with the advent of the Dworshak Dam mitigation production at Kooskia NFH. Since Kooskia NFH began production, hatchery spring chinook from this facility have been planted primarily into the Middle Fork of the Clearwater River. Spring chinook production from Dworshak NFH have been stocked primarily in the Lolo Creek drainage, the mainstem Clearwater, and the lower North Fork.

Prior to 1987, low adult returns to Dworshak and Kooskia NFH necessitated acquisition of eggs from other spring chinook hatcheries to maintain production (Nez Perce Tribe and Idaho Department of Fish and Game 1990). Five different broodstocks have been reared at these two hatcheries

(Table 1). Howell et al. (1985) and the Clear-water Subbasin Plan (Nez Perce Tribe and Idaho Department of Fish and Game 1990) provide further detail about the broodstock sources. In many years, adults returning to Dworshak and Kooskia NFH have been pooled and then eggs were split between the two stations. Spring chinook broodstock from outside of Idaho has not. been utilized at either hatchery in recent years.

DISTRIBUTION

Tables 11,13, and 14 of the Clearwater Subbasin Plan (Nez Perce Tribe and Idaho Department of Fish and Game 1990) summarizes hatchery spring chinook releases into the lower Clearwater, 1975-1987.

Tables 2 and 3 of this report summarize the release of spring chinook into the lower Clearwater for brood years 1982-1990. Coded wire tag (CWT) codes are identified for brood years 1982-1990. Other marks or tag releases have not been compiled.

PRODUCTION

Egg to Smolt

Cumulative survival from eyed egg to released smolt averaged 70.7 percent for spring chinook reared at Dworshak NFH, brood years 1987- 1991 (Table 4).

Smolt

PIT tagged Dworshak NFH spring chinook were detected during the 1988, 1989, and 1990 spring migrations. PIT tag detections at Snake and Columbia river dams provide a relative measure of minimum survival from tagging to the dams. Giorgi (1991) reported that the 1988 and 1989 PIT tag detections at Lower Granite Dam were 23.5 and 28 percent, respectively. The 1990 detection at Lower Granite, Little Goose, and McNary dams combined was 51 percent for a low BKD test group and 42 percent for a high BKD test group (Matthews et al. 1992). Because fish are detected in collector systems, most of the detected fish are assumed to be transported. Inbasin migration mortality factors as well as losses in Lower Granite Reservoir and through upper Snake River dams are represented. Specific mortality factors have not been fully segregated to determine stock specific influence on detection rates.

Giorgi (1991) summarized freeze-brand detections for spring chinook released from Dworshak NFH, 1985-1990 (Table 5). Detections ranged 11.6-28.9 percent and averaged 22.3 percent. Giorgi (1991) also estimated that the survival percentage of smolts released at Dworshak NFH to Lower Granite Dam was 44.3 percent in 1988 and 52.8 percent in 1989. He made his estimate by applying a fish guidance efficiency of 0.53 percent to the PIT tag detections for the two years.

Smolt to Adult

Howell et al. (1985) reported the percentage of smolts released from Kooskia NFH returning to the hatchery averaged 0.09 percent for release years 1971-1980. For brood years 1979-1986, the percentage of smolts released from Kooskia NFH returning to the hatchery averaged 0.14 percent (Table 6). This return estimate does not include hatchery fish which were harvested in the Clearwater basin. The percentage of smolts released from Dworshak NFH returning to the hatchery averaged 0.19 percent for brood years 1982-1986 (Table 7). This estimate also does not account for harvested fish.

Miller et al. (1991) described the return percentage of various broodstocks reared at Dworshak NFH (Table 1). Smolt-to-adult return of CWT smolts released from Dworshak NFH averaged 0.05 percent, brood years 1984-1987 (Table 8).

Adult

Prespawn mortality of hatchery spring chinook ponded at Dworshak and Kooskia NFH averaged 16.9 percent for return years 1983-91 (Table 9).

ADULT LIFE HISTORY

Adult Escapement

Chinook crossing Bonneville Dam through May 31 are counted as springs, as are those crossing lower Granite Dam through June 17. Specific time of migration and escapement for hatchery spring chinook returning to the lower Cleat-water has not been identified for the ocean, Columbia River, or Snake River. The University of Idaho implemented adult timing research in 1991 which should provide information about Snake River timing (Bjornn et al. 1992).

Harvest

Information was not fully summarized for this report regarding the rate of contribution of Dworshak and Kooskia NFH spring chinook to ocean, Columbia River and Snake River harvests. Carmichael (1991) summarized CWT recoveries for brood years 1983-1985 (Table 10). No CWTs were recovered in the ocean catch. Columbia River catch accounted for 18 percent of the CWT recoveries for all three brood years combined.

In 1990, the first sport season for spring chinook salmon since 1978 occurred. The season was directed at spring chinook returning to Dworshak NFH. Ball (1992) estimated that nontribal anglers harvested 369 spring chinook.

With increasing returns to Dworshak NFH, a Nez Perce tribal fishery has developed in the Cleat-water River. Cowley (1989) reported that the bulk of the catch is made from the North Fork along the grounds of Dworshak NFH. Tribal harvest in 1988 and 1989 was estimated to be 240 and 346, respectively. Much smaller numbers are harvested from Clear Creek. In 1990, an estimated 5 15 spring chinook were harvested by tribal anglers (Cannamela 1992).

Spawner Escapement

Spring chinook generally arrive at Dworshak NFH in mid-May (Table 11). Spring chinook return to Kooskia NFH early May through late July. Low water in Clear Creek precludes collecting spring chinook at Kooskia NFH beyond July.

Brood year returns to Kooskia NFH ranged 52-3,285 for brood years 1969 through 1986 (Table 12). The average brood year return was 679 spring chinook. Brood year returns to Dworshak NFH ranged from 386 to 2,922 hatchery spring chinook and averaged 1,479 for brood years 1981-1986 (Table 13). Total age (freshwater age plus ocean age) usually ranged from 3 to 5 years. Howell et al. (1985) reported that age at maturity ranges from 3 to 6 years depending on the age of smolts at release and the number of years spent at sea. They reported that a one-ocean adult has had a lifespan of three years, including up to 20 months in the hatchery.

Howell et al. (1985) reported that spawntaking at Dworshak and Kooskia NFH has begun as early as August 13 and as late as September 1. Spawning generally takes place the third week of August. Earlier spawn timing after 1978 was due to shifting spawning operations from Kooskia NFH to Dworshak NFH, where fish are held in warmer water prior to spawning.

Adult Characteristics

Weights of returning hatchery spring chinook are not available. Length frequencies of hatchery spring chinook returning to Dworshak and Kooskia NFH in various years are presented in Tables 14 and 15.

Dworshak and Kooskia NFH spring chinook primarily spend 2 years at sea. Howell et al. (1985) reported that spring chinook returning to Kooskia NFH as one-ocean fish accounted for 0.4- 17 percent of the returns, spring chinook returning as two-ocean fish ranged from 38-91 percent of the returns, and three-ocean fish accounted for 1 .O-54 percent of the returns. Four-ocean fish comprised less than 5 percent of the returns.

For brood years 1969-1986, the two-ocean return of hatchery spring chinook dominated the Kooskia NFH brood year returns, averaging 66 percent (Table 16). For spring chinook returning to Dworshak NFH, the two-ocean return averaged 67 percent of the brood year return, 1981-1986 (Table 17). Although ocean age determination is based upon length frequency and not a known age technique, coded wire tag recoveries also indicate that the hatchery spring chinook returning to Dworshak NFH are primarily a two-ocean race (Table 8).

Howell et al. (1985) reported that the sex ratio for hatchery spring chinook returning to Kooskia NFH averaged 60 females to 40 males. For return years 1987-1991, the female proportion of the spring chinook return to Dworshak and Kooskia NFH was 53.3 percent (Table 18). Because spring chinook are not sexually mature when they are measured, sex is not reported by ocean age so the female component by brood year cannot be determined.

Mean fecundity by return year for hatchery spring chinook returning to Dworshak and Kooskia NF'H ranged from 3,466 to 4,592 eggs per female, 1985-1991 (Table 19). Fecundity over this time period averaged 3,967 eggs per female.

JUVENILE LIFE HISTORY

Figure 1 shows that general timing of life history. Smolts and other life stages are released directly from Dworshak and Kooskia NFH or transported by truck to off-station release sites. Spring chinook smolts have generally been released from March to early May. Dworshak NFH has experimented with accelerated rearing to release age 0 smolts. Howell et al. (1985) reported that depending on release dates and flow conditions, naturally migrating spring chinook smolts from KNFH reach the lower Columbia River at Jones Beach from April through June, l-8 weeks after release.

Migration data for freeze branded hatchery spring chinook from Dworshak NFH shows that for 1985-1990, the migration rate from the Clearwater River smolt trap to Lower Granite Dam ranged from 1.0 to 4.4 kilometers per day (Table 5).

BIOCHEMICAL/GENETIC CHARACTERISTICS

Marshall (1992) described electrophoretic data for Dworshak NFH spring chinook. Schreck et al. (1986) described electrophoretic data for Kooskia NFH spring chinook (Appendix Table 3).

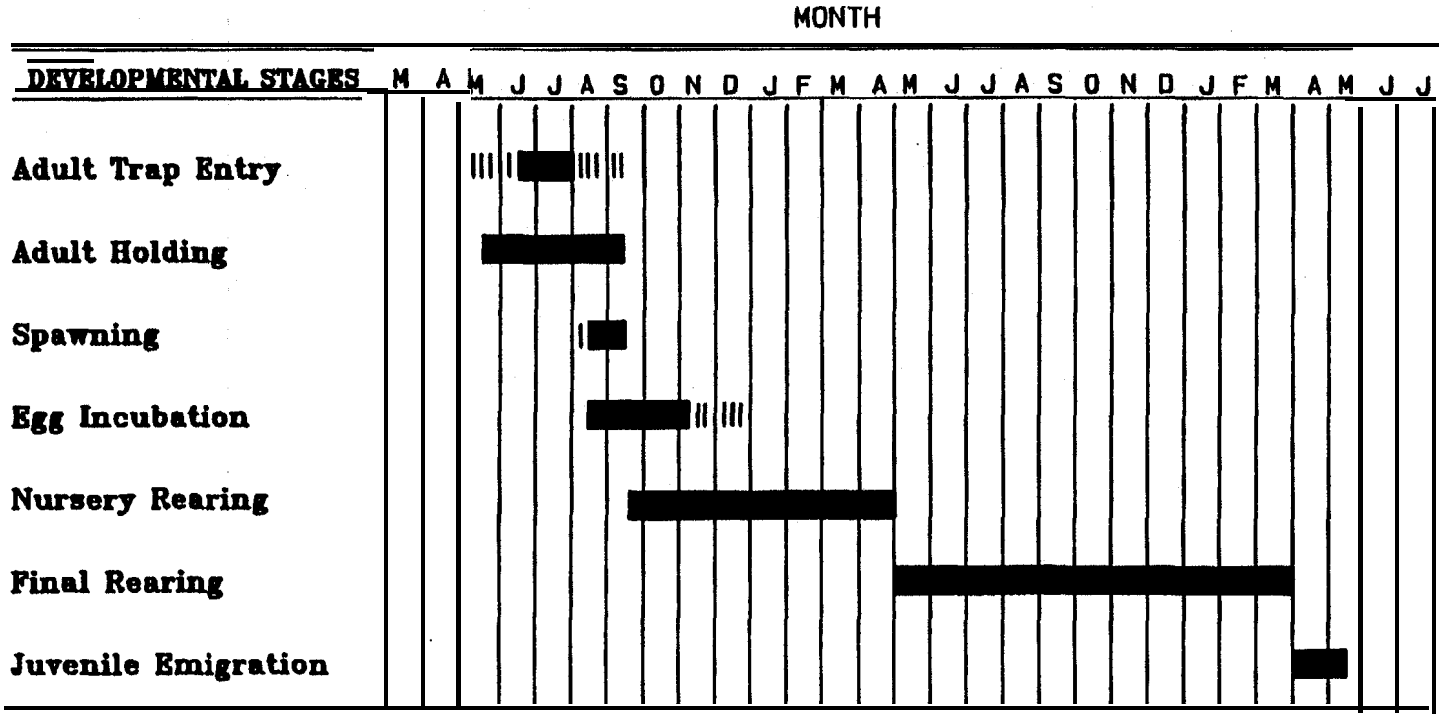
DISEASES

Major diseases of management concern, such as those potentially limiting fish transfers, which causes mortalities at Dworshak and Kooskia NFH include infectious hematopoietic necrosis virus (IHN), bacterial kidney disease (BKD) and a few others (Table 20). Substantial information about hatchery spring chinook diseases encountered at Dworshak and Kooskia NFH is reported in the Dworshak and Kooskia NFH annual reports, 1986 through 1991.

REFERENCES

All Lower Clear-water references appear in one reference section at the end of the hatchery produced summer steelhead section.

Figure (TT). Freshwater life history for hatchery spring chinook salmon at Dworshak/Kooskia National Fish Hatcheries in the Clearwater River subbasin.*



Notes:

* Data represents average timing observed by hatchery personnel.

1. The developmental stage timing represents basin-wide averages, local conditions may cause some variability.

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

Table 1 (TS-a). Identification of spring chinook broodstocks used at Dworshak and Kooskia National Fish Hatcheries and estimated smolt to adult rack return, release years 1983-1988 (Miller et al. 1991).

Release year	Dworshak NFH Genetic makeup	Dworshak NFH Rack return (%)	Kooskia NFH Genetic makeup	Kooskia NFH Rack return (%)
1983	75.1% LW[a] 12.3% RR 12.6% LE[c]	0.074	65% KK[b] 35% LE	0.097
1984	100% LE	0.283	89% KK-11% RR[d]	0.053
1985	67.8% LW 32.2% LE	0.257	100% KK	0.272
1986	100% LE	0.161	100% KK	0.148
1987	100% RR	0.098	100% CL”	0.126
1988	100% RR	0.190	100% CL	0.177

[a] LW = Little White Salmon.
[b] KK = Kooskia.
[c] LE = Leavenworth.
[d] RR = Rapid River.
[e] CL = Clearwater.

Table 2 (TR). Hatchery spring chinook releases into the Mainstem and North Fork of the Clearwater River by brood years, 1982-1989. Coded wire tag codes are displayed for brood years 1986-1989.

Brood Year	Brood-stock	Hatchery	Life Stage	Release Date (I)	Release Date (2)	Fish/lb	Number Released	Release Location	CWT
1982	Leavenworth	Dworshak NFH	pre-smolt	10/04/83	11 /02/83		75.179	Dworshak NFH[a]	
1982	Leavenworth	Dworshak NFH	smolt	03/19/84	04/04/84		259,589	Dworshak NFH”	
1982	Kooskia NFH	Kooskia NFH	smolt	1984			82,377	Dworshak NFH[a]	
1983	Little White Salmon	Kooskia NFH	F-F[b]	1984			267,406	Dworshak NFH[a]	
1983	Little White Salmon	Hagerman N F H	F-F[b]	1984			4 19,747	Mainstem Clearwater	
1983	Kooskia NFH	Kooskia NFH	F-F[b]	1984			56.683	Dworshak NFH”	
1983	Leavenworth	Dworshak NFH	F-F[b]	04/24/84			43,000	Dworshak NFH[a]	
1983	Little White Salmon	Dworshak NFH	F-F[b]	05/21/84			520,889	Dworshak NFH[a]	
1983	Leavenworth B	Dworshak NFH	smolt	04/03/85			365.791	Dworshak NFH[a]	
1983	Little White Salmon	Dworshak NFH	smolt	04/03/85			771,348	Dworshak NFH[a]	
1984	Leavenworth	Dworshak NFH	smolt	04/03/86		19.8	41,075	Dworshak NFH[a]	102520
1984	Leavenworth	Dworshak NFH	smolt	04/03/86		19.8	41.850	Dworshak NFH”	102843
1984	Leavenworth	Dworshak NFH	smolt	04/02/86		19.8	423,395	Dworshak NFH[a]	Untagged
1985	Rapid River	Dworshak NFH	F-F[b]	04/25/ 86			69,700	Dollar Creek	
1985	Rapid River	Rapid River	F-F[b]	1986			200.158	Eldorado Creek	
1985	Rapid River	Dworshak NFH	smolt	04/01/87	04/02/87	17.2	49,750	N. Fk. Clearwater	102936
1985	Rapid River	Dworshak NFH	smolt	04/01/87	04/02/87	17.2	1,660,960	N. Fk. Clearwater	Untagged
1986	Rapid River	Dworshak NFH	F-F[b]	05/12/87			119,090	Eldorado Creek	

Table 2 (cont.), Hatchery spring chinook releases into the Mainstem and North Fork of the Clearwater River by brood years, 1982-1989. Coded wire tag codes are displayed for brood years 1986-1989.

Brood Year	Brood-stock	Hatchery	Life Stage	Release Date (1)	Release Date (2)	Fish/lb	Number Released	Release Location	CWT
1986	Rapid River	Dworshak NFH	F-F[b]	05/12/87			133,158	Lolo Creek	
1986	Dworshak NFH	Dworshak NFH	pre-smolt	09/28/87		39.6	31,975	Dworshak NFH[a]	102814
1986	Dworshak NFH	Dworshak NFH	pre-smolt	09/28/87		39.6	30,125	Dworshak NFH[a]	102813
1986	Rapid River	Dworshak NFH	pre-smolt	09/28/87		39.6	10,725	Dworshak NFH[a]	102943
1986	Rapid River	Dworshak NFH	pre-smolt	09/28/87		39.6	53.850	Dworshak NFH[a]	051751
1986	Rapid River	Dworshak NFH	pre-smolt	09/28/87		39.6	9,800	Dworshak NFH[a]	102930
1986	Rapid River	Dworshak NFH	pre-smolt	09/28/87		39.6	53,850	Dworshak NFH”	102934
1986	Rapid River	Dworshak NFH	pre-smolt	09/28/87		39.6	2,005	Dworshak NFH[a]	Untagged
1987	Dworshak NFH	Dworshak NFH	smolt	03/30/88		20.6	63,337	Dworshak NFH[a]	104055
1987	Dworshak NFH	Dworshak NFH	smolt	03/30/88		20.6	60,934	Dworshak NFH[a]	104056
1987	Dworshak NFH	Dworshak NFH	smolt	03/30/88		20.6	64.015	Dworshak NFH[a]	104057
1987	Dworshak NFH	Dworshak NFH	smolt	03/30/88		23.5	944,866	Dworshak NFH”	Untagged
1987	Dworshak NFH	Dworshak NFH	age 0 smolt	03/30/88		85.6	62,697	Dworshak NFH[a]	104052
1987	Dworshak NFH	Dworshak NFH	age 0 smolt	03/30/88		85.6	62,185	Dworshak NFH[a]	104053
1987	Dworshak NFH	Dworshak NFH	age 0 smolt	03/30/88		85.6	62,817	Dworshak NFH[a]	104054
1987	Dworshak NFH	Dworshak NFH	age 0 smolt	03/30/88		85.6	35,038	Dworshak NFH[a]	Untagged
1987	Rapid River	Rapid River	F-F[b]	05/05/88		294	53,200	Eldorado Creek	

Table 2 (cont.). Hatchery spring chinook releases into the Mainstem and North Fork of the Clearwater River by brood years, 1982-1989. Coded wire tag codes are displayed for brood years 1986-1989.

Brood Year	Brood-stock	Hatchery	Life Stage	Release Date (1)	Release Date (2)	Fish/lb	Number Released	Release Location	CWT
1987	Rapid River	Rapid River	F-F[b]	05/05/88		294	103,800	Lo10 Creek	
1987	Rapid River	Rapid River	F-F[b]	05/25/88		160	43,722	Lolo Creek	
1987	Dworshak NFH	Dworshak NFH	ore-smolt	09/28/88		33.1	63.766	N. Fk. Clearwater	054010
1987	Dworshak NFH	Dworshak NFH	pre-smolt	09/28/88		33.1	63,961	N. Fk. Clearwater	054011
1987	Dworshak NFH	Dworshak NFH	pre-smolt	09/28/88		33.1	64,363	N. Fk. Clearwater	054012
1987	Dworshak NFH	Dworshak NFH	smolt	03/29/89	03/30/89	18.3	63,555	Dworshak NFH[a]	054013
1987	Dworshak NFH	Dworshak NFH	smolt	03/29/89	03/30/89	18.3	66,380	Dworshak NFH[a]	054014
1988	Dworshak NFH	Dworshak NFH	pre-smolt	03/30/89		76.9	61,613	N. Fk. Clearwater	054016
1988	Dworshak NFH	Dworshak NFH	pre-smolt	03/30/89		76.9	66,107	N. Fk. Clearwater	054017
1988	Dworshak NFH	Dworshak NFH	pre-smolt	03/30/89		76.9	67,946	N. Fk. Clearwater	054018
1988	Dworshak NFH	Dworshak NFH	pre-smolt	03/30/89		76.9	10,793	N. Fk. Clearwater	Untagged
1987	Dworshak NFH	Dworshak NFH	smolt	03/29/89	03/30/89	18.3	66,947	Dworshak NFH[a]	054015
1987	Dworshak NFH	Dworshak NFH	smolt	03/29/89	03/30/89	20.5	1,056,041	Dworshak NFH[a]	Untagged
1988	Dworshak NFH	Dworshak NFH	smolt	04/05/90		18.4	67,624	Dworshak NFH[a]	052162
1988	Dworshak NFH	Dworshak NFH	smolt	04/05/90		17.7	67,262	Dworshak NFH[a]	052163
1988	Dworshak NFH	Dworshak NFH	smolt	04/05/90		18.8	65,686	Dworshak NFH[a]	052205
1988	Dworshak NFH	Dworshak NFH	smolt	04/05/90		18.4	64.522	Dworshak NFH[a]	232930

Table 2 (cont.). Hatchery spring chinook releases into the Mainstem and North Fork of the Clearwater River by brood years, 1982-1989. Coded wire tag codes are displayed for brood years 1986-1989.

Brood Year	Brood-stock	Hatchery	Life Stage	Release Date (1)	Release Date (2)	Fish/lb	Number Released	Release Location	CWT
1988	Dworshak NFH	Dworshak NFH	smolt	04/05/90		18.0	57,089	Dworshak NFH[a]	23293 1
1988	Dworshak NFH	Dworshak NFH	smolt	04/04/90	04/05/90	17.2	25,369	Dworshak NFH[a]	052260
1988	Dworshak NFH	Dworshak NFH	smolt	04/04/90	04/05/90	18.6	25,483	Dworshak NFH”	05226 1
1988	Dworshak NFH	Dworshak NFH	smolt	04/04/90	04/05/90	15.6	25,685	Dworshak NFH”	052262
1988	Dworshak NFH	Dworshak NFH	smolt	04/04/90	04/05/90	16.8	22,645	Dworshak NFH[a]	052263
1988	Dworshak NFH	Dworshak NFH	smolt	04/04/90	04/05/90	15.7	24,801	Dworshak NFH	052305
1988	Dworshak NFH	Dworshak NFH	smolt	04/04/90	04/05/90	18.2	24,582	Dworshak NFH[a]	052306
1988	Dworshak NFH	Dworshak NFH	smolt	04/04/90	04/05/90	18.2	780,679	Dworshak NFH”	Untagged
1988	Dworshak NFH	Dworshak NFH	smolt	03/28/90	04/05/90	18.0	492,902	Dworshak NFH”	
1988	Dworshak NFH	Dworshak NFH	smolt	03/28/90		18.0	256,900	Eldorado Creek	
1989	Dworshak NFH”	Dworshak NFH	smolt	04/04/91		18.4	15,683	Dworshak NFH”	05243 1
1989	Dworshak NFH	Dworshak NFH	smolt	04/04/9 1		18.4	15,710	Dworshak NFH”	052432
1989	Dworshak NFH	Dworshak NFH	smolt	04/04/9 1		21.3	15,587	Dworshak NFH[a]	052433
1989	Dworshak NFH	Dworshak NFH	smolt	04/04/9 1		18.6	15,881	Dworshak NFH”	052434
1989	Dworshak NFH	Dworshak NFH	smolt	04/04/9 1		20.9	16.720	Dworshak NFH”	052435
1989	Dworshak NFH	Dworshak NFH	smolt	04/04/9 1		21.3	16,669	Dworshak NFH”	052436

Table 2 (cont.). Hatchery spring chinook releases into the Mainstem and North Fork of the Clearwater River by brood years, 1982-1989. Coded wire tag codes are displayed for brood years 1986-1989.

Brood Year	Brood-stock	Hatchery	Life Stage	Release Date (1)	Release Date (2)	Fish/lb	Number Released	Release Location	CWT
1989	Dworshak NFH	Dworshak NFH	smolt	04/04/91		21.4	16,715	Dworshak NFH"	052437
1989	Dworshak NFH	Dworshak NFH	smolt	04/04/91		20.3	16.611	Dworshak NFH"	052438
1989	Dworshak NFH	Dworshak NFH	smolt	04/04/91		19.8	15,842	Dworshak NFH[a]	052439
1989	Dworshak NFH	Dworshak NFH	smolt	04/04/91		20.7	33,553	Dworshak NFH"	052440
1989	Dworshak NFH	Dworshak NFH	smolt	04/04/91		21.5	33.145	Dworshak NFH[a]	052441
1989	Dworshak NFH	Dworshak NFH	smolt	04/04/91		22.5	32,742	Dworshak NFH[a]	052442
1989	Dworshak NFH	Dworshak NFH	smolt	04/04/91		21.0	3 1,527	Dworshak NFH[a]	052443
1989	Dworshak NFH	Dworshak NFH	smolt	04/04/91		22.5	33,010	Dworshak NFH[a]	052444
1989	Dworshak NFH	Dworshak NFH	smolt	04/04/9 1		19.7	32,903	Dworshak NFH'	052445
1989	Dworshak NFH	Dworshak NFH	smolt	04/04/91		23.5	52,664	Dworshak NFH"	103025
1989	Dworshak NFH	Dworshak NFH	smolt	04/04/9 1		22.7	46,402	Dworshak NFH[a]	052446
1989	Dworshak NFH	Dworshak NFH	smolt	04/04/9 1		22.4	47,668	Dworshak NFH[a]	052447
1989	Dworshak NFH	Dworshak NFH	smolt	04/04/9 1		21.7	38,836	Dworshak NFH[a]	052508
1989	Dworshak NFH	Dworshak NFH	smolt	04/04/9 1		22.6	37,471	Dworshak NFH[a]	052509
1989	Dworshak NFH	Dworshak NFH	smolt	04/04/9 1		22.5	38,244	Dworshak NFH[a]	052510
1989	Dworshak NFH	Dworshak NFH	smolt	04/04/9 1		18.6	23.832	Dworshak NFH"	052512
1989	Dworshak NFH	Dworshak NFH	smolt	04/04/9 1		17.5	23,193	Dworshak NFH"	052513

Table 2 (cont.). Hatchery spring chinook releases into the Mainstem and North Fork of the Clearwater River by brood years, 1982-1989. Coded wire tag codes are displayed for brood years 1986- 1989.

Brood Year	Brood-stock	Hatchery	Life Stage	Release Date (1)	Release Date (2)	Fish/lb	Number Released	Release Location	CWT
1989	Dworshak NFH	Dworshak NFH	smolt	04/04/91		18.5	28,455	Dworshak NFH[a]	052511
1989	Dworshak NFH	Dworshak NFH	smolt	04/03/91	04/04/91	20.6	418,821	Dworshak NFH[a]	Untagged
1989	Dworshak NFH	Dworshak NFH	smolt	03/26/91	03/27/91	21.4	199,456	Eldorado Creek	

[a] Dworshak National Fish Hatchery (NFH) as a release location refers to the hatchery site, located at the confluence of the North Fork and mainstem Clearwater River and is used interchangeably with North Fork Clearwater.

[b] F-F designates a fry or fingerling release.

Table 3 (TR). Hatchery spring chinook releases into the Middle Fork Clearwater River by brood years, 1982-1989. Coded wire tag codes displayed for brood year 1988. No coded wire tags released brood year 1989.

Brood Year	Brood-stock	Hatchery	Life Stage	Release Date (1)	Release Date (2)	Fish/lb	Number Released	Release Location	CWT
1982	Leavenworth NFH	Kooskia NFH	F-F”	05/05/83	06/06/83		217,186	Clear Creek[b]	
1982	Leavenworth NFH	Dworshak NFH	pre-smolt	09/19/83	09/23/83		132,651	Clear Creek[b]	
1982	Rapid River	Dworshak NFH	pre-smolt	09/23/83	11110183		279,927	Clear Creek[b]	
1982	Kooskia NFH	Hagerman NFH	F-F	06/14/83		24.7	34.800	Clear Creek[b]	102515
1982	Kooskia NFH	Hagerman NFH	F-F’	06/14/83		24.7	52,368	Clear Creek[b]	Untagged
1982	Kooskia NFH	Kooskia NFH	smolt	03/21/84	03/26/84		245,753	Clear Creek[b]	
1982	Kooskia NFH	Dworshak NFH	smolt	03/26/84			169,787	Clear Creek[b]	
1982	Rapid River	Dworshak NFH	smolt	03/26/84	04/04/84		51,714	Clear Creek[b]	
1983	Dworshak NFH	Kooskia NFH	F-F’	05/02/84			153,163	Clear Creek[b]	
1983	Little White Salmon	Kooskia NFH	pre-smolt	11/01/84			53,423	Clear Creek[b]	
1983	Kooskia NFH	Kooskia NFH	smolt	03/22/85	03/28/85		301,753	Clear Creek[b]	
1984	Kooskia NFH	Kooskia NFH	smolt	03/26/86			35 1.405	Clear Creek[b]	
1985	Kooskia NFH	Kooskia NFH	smolt	03/24/87			763,900	Clear Creek[b]	
1986	Kooskia NFH	Kooskia NFH	smolt	03/22/88		20.5	778,407	Clear Creek[b]	

Table 3 (cont.). Hatchery spring chinook releases into the Middle Fork Clearwater River by brood years, 1982-1989. Coded wire tag codes displayed for brood year 1988. No coded wire tags released brood year 1989.

Brood Year	Brood-stock	Hatchery	Life Stage	Release Date (1)	Release Date (2)	Fish/lb	Number Released	Release Location	CWT
1987	Kooskia NFH	Kooskia NFH	smolt	03/29/89		20.8	384,235	Clear Creek[b]	
1987	Kooskia NFH	Kooskia NFH	adult				28	Clear Creek[b]	
1988	Kooskia NFH	Kooskia NFH	smolt	04/12/90		20.7	48.392	Clear Creek[b]	051927
1988	Kooskia NFH	Kooskia NFH	smolt	04/12/90		20.7	9,937	Clear Creek[b]	052142
1988	Kooskia NFH	Kooskia NFH	smolt	04/12/90		20.7	47,247	Clear Creek[b]	051928
1988	Kooskia NFH	Kooskia NFH	smolt	04/12/90		20.7	9.246	Clear Creek[b]	052143
1988	Kooskia NFH	Kooskia NFH	smolt	04/12/90		20.7	288,878	Clear Creek[b]	Untagged
1989	Kooskia NFH	Kooskia NFH	smolt	04/16/91		19.1	381,173	Clear Creek[b]	
1990	Kooskia NFH	Kooskia NFH	F-F'	04/16/91		21.0	15.446	Clear Creek[b]	

[a] Clear Creek release location is at the Kooskia NFH site.

[b] F-F designates a fry or fingerling release.

Table 4 (TS-a). Survival summary for spring chinook salmon reared entirely at Dworshak National Fish Hatchery, brood years 1987-1991 (Olsen et al. 1991).

	Percent surviving from previous stage				
Brood year	Eyed egg	Tanked fry	Ponded fingerling	Released smolt	Cumulative survival
1987	92.5	86.2	97.4	93.8	72.8
1988	96.0	93.9	76.5	93.0	64.1
1989	92.8	94.2	89.2	96.5	75.2
1990	94.2	98.2	95.6	---	---
1991	89.1	96.1	---	---	---
Average	92.9	96.1	89.7	94.4	70.7

Table 5 (MD-a). Migration data for freeze branded spring chinook salmon from Dworshak National Fish Hatchery release site to the Clearwater River trap[a] and to Lower Granite Dam (LGD), 1985-1990.

Year	Median release date	Median passage date, Snake trap	Migration rate (km/day)	Mean Q (kcfs) Clearwater R.	Median arrival at LGD	Migration rate (km/day)	Mean Q(kcfs) at LGD	Percent brands observed at LCD
1985	--[b]	4/4	--	--	4/27	2.7	94	27.7
1986	--	4/2	--	--	4/21	3.2	97	11.6
1987	4/1	4/4	18.3	7.2	4/24	3.1	37	18.0
1988	3/30	4/1[c]	27.5	9.8	5/27	1.1	54	28.9[e]
	3/30	3/31	55.0	9.6	4/20	3.1	38	
	9/28/87	3/28[d]	--	--	4/12	4.1	30	
	3/30	3/31	55.0	9.6	4/20	3.1	38	
	3/30	3/31	55.0	9.6	4/21	2.9	39	
	3/30	3/31	55 .0	9.6	4/20	3.1	38	
	3/30	3/31	55.0	9.6	4/21	2.9	39	
1989	3/29	3/30	55.0	23.5	4/23	2.6	82	22.7[e]
	9/28/88	3/30[d]	--	--	6/1	1.0	83	
	3/30	3/31	55.0	23.3	4/25	2.5	83	
	3/30	4/3[c]	13.8	22.2	5/31	1.1	84	
1990	--	4/5	--	--	4/19	4.4	51.3	25.0[e]
	4/5	4/6	55.0	21.1	5/6	2.4	58.2	
	--	4/6	--	--	4/29	2.6	57.8	
	--	4/6	--	--	4/26	2.9	56.7	

[a] Clearwater River trap Located approximately 10km upstream from the convergence of Clearwater River and Snake River arms of Lower Granite Reservoir.
[b] Data not reported.
[c] Fall release of spring chinook.
[d] Age 0 spring chinook.
[e] Combined for all brand groups and releases.

Sources: Buettner and Nelson 1990, 1991.
Giorgi 1991.

Table 6 (RH-a). Percentages of spring chinook smolts released at Kooskia National Fish Hatchery that returned as adults for brood years 1979-1986.

Brood year	Smolts released	Total brood year return	Percent of brood year return
1979[a]	557,200	440	0.08
1980	127,289	135	0.11
1981	461,269	607	0.13
1982[a]	267,406	249	0.09
1983[a]	301,753	821	0.27
1984	3513405	521	0.15
1985	763,900	965	0.13
1986	778,407	1,100	0.14

[a] Subyearlings released but not included in adult return calculation.

Source: S. W. Kiefer, IDFG, unpublished.

Table 7 (RH-b). Percentages of spring chinook smolts released at Dworshak National Fish Hatchery that returned as adults for brood years 1982-1986.

Brood year	Smolts released	Total brood year return	Percent of brood year return
1982	341,966	735	0.21
1983	1,137,139	2,922	0.26
1984	506,320	815	0.16
1985	1,710,710	1,620	0.09
1986	1,133,152[b,c]	2,398	0.21

[a] An additional 75,179 BY 1982 presmolts were released in the fall 1983. These are not included in the adult return calculation.

[b] An additional 192,330 BY 1986 presmolts were released in the fall 1987. These are not included in the adult return calculation.

[c] An additional 222,737 BY 1987 age 0 smolts were released at the same time as BY 1986 smolts. These are not included in the adult return calculation.

Source: S. W. Kiefer, IDFG, unpublished.

Table 8 (TS-a). Number of coded wire-tagged hatchery spring chinook salmon that were reared at and returned to Dworshak National Fish Hatchery, brood years 1984-1987.

Tag code	Brood year	Date released	Number tagged released	Site released (#/lb)	Release site	Purpose	Year returned 1984	1985	1986	1987	1988	1989	1990	1991[a]	Total returns	Percent return
10/25/20	1984	1986	41,075	19.8	N.F. Clear.	Ident.				0	21	9	-	-	30	0.07
10/28/43	1984	1986	41,850	19.8	N.F. Clear.	Ident. Diet feed trials				2	22	10	-	-	34	0.08
10/29/36	1985	1987	49,750	24.0	H.F. Clear.	Production					2	3	1	-	6	0.01
05/17/51	1986	1987	53,850	39.6	N.F. Clear.	Fall Rel.						4	18	0	22	0.04
10/28/13	1986	1987	30,125	39.6	N.F. Clear.	Fall Ret.						2	9	0	11	0.04
10/29/30	1986	1987	9,800	39.6	N.F. Clear.	fall Ret.						0	3	0	3	0.03
10/29/34	1986	1987	53,850	39.6	N.F. Clear.	fall Rel.						0	25	0	25	0.05
10/40/52	1986	1988	62,700	85.6	N.F. Clear.	Age 0						0	0		0	0.00
10/40/53	1986	1988	62,175	85.6	N.F. Clear.	Age 0						0	0	8	0	0.00
10/40/54	1986	1988	62,825	85.6	N.F. Clear.	Age 0						0	0	0	0	0.00
10/40/55	1986	1988	62,350	20.6	N.F. Clear.	Spr. Rel.						5	69	1	75	0.12
10/40/56	1986	1988	60,950	20.6	N.F. Clear.	Spr. Rel.						4	107	0	111	0.18
10/40/57	1986	1988	64,025	20.6	N.F. Clear.	Spr. Ret.						3	58	1	62	0.10
10/28/14	1986	1987	31,975	22.7	N.F. Clear.	Fall Rel.						0	5	0	5	0.02
10/29/43	1986	1987	10,725	22.7	N.F. Clear.	Fall Rel.						0	6	0	6	0.06
05/40/10	1987	1988	63,775	33.1	N.F. Clear.	Fall Rel.							0	1	1	inc.
05/40/11	1987	1988	63,975	33.1	N.F. Clear.	Fall Rel.							0	0	0	inc.
05/40/12	1987	1988	64,375	33.1	N.F. Clear.	Fall Ret.							0	0	0	inc.

[a] 1991 recoveries are preliminary

Source: Cannamela et al. 1991.
D. Cannemela, IDFG, unpublished

Table 9 (TS-b). Pre-spawning mortality for hatchery spring chinook[a] ponded at Dworshak and Kooskia National Fish Hatcheries, 1983-1991.

Return year	Fish[b] trapped (#)	Fish[b] ponded (#)	Mortalities (#)	Prespawning mortality (%)
1983	373	373	49	13.1
1984	423	423	73	17.3
1985	863	863	265	30.7
1986	799	799	89	11.1
1987	2,704	2,001	528	26.4
1988	2,567	2,020	252	12.5
1989	2,673	1,750	236	13.5
1990	3,183	2,828	194	6.9
1991	632	601	125	20.8

[a] Prespawning mortality calculated as a proportion of fish ponded, not of the entire run because fish released for natural spawning are generally not held in the hatchery.
[b] Spring chinook trapped and ponded at Dworshak and Kooskia National Fish Hatcheries combined.

Sources: Olson 1986, 1988a, 1988b, 1989, 1990, 1991.
Miller 1988.
Miller et al. 1987.
Nez Perce Tribe and Idaho Department of Fish and Game 1990.

Table 10 (AHa). Coded wire tag recovery information for Dworshak and Kooskia National Fish Hatcheries spring chinook[a].

	Brood Year			
	1983[b]	1984[c]	1985[d]	Combined
Number of CWT released	48,100	78,837	49,750	176,687
Total number of CWT recovered[e]	7(<.1)	78(.1)	6(<.1)	91(.1)
Ocean catch	0	0	0	0
Columbia River catch	3 (43)	12(15)	1(17)	16(18)
Columbia R. sport	1	1	0	2
Columbia R. gillnet	1	4	1	5
Treaty C & S	0	6	0	8
Test net		1		1
Other FW sport	0(0)	0(0)	0(0)	0(0)
Subbasin Escapement	4(57)	66(85)	5(83)	75(82)
Hatchery	4	66	5	75

[a] Percentages are in ( ). Numbers are unexpanded and represent observed recoveries.
[b] Carson NFH broodstock reared at Kooskia NPH.
[c] Carson NFH broodstock reared at Dworshak NFH.
[d] Rapid River Hatchery broodstock reared at Dworshak NFH.
[e] Percent of total number of CWT recovered is proportion of total CWT release. All other percentages displayed as proportion of total CWT recovered.

Source: Carmichael 199 1.

Table 11 (AT-a). Dates of ladder operation for spring chinook collection at Dworshak National Fish Hatchery.

Return Year	Ladder opened	Ladder closed	Date spawning began
1988	05/17	09/06	08/22
1989	05/26	09/14	08/2 1
1990	05/18	09/10	08/20
1991	05/23	09/12	08/26

Sources: U.S.Fish and Wildlife Service 1988.
Olson 1988b, 1989, 1990, 1991.

Table 12 (RH-a). Return of hatchery spring chinook to Kooskia National Fish Hatchery, brood years 1969-1988."

Total Age

Brood Year	3	4	5	Total	Total adult
1969	5	45	2	52	47
1970	5	35	27	67	62
1971	16	284	106	406	390
1972	15	286	154	455	440
1973	409	2,539	336	3,284	2,875
1974	333	1,676	264	2,273	1,940
1975	23	100	3	126	103
1976	11	55	78	144	133
1977	9	168	139	316	307
1978	1	116	141	258	257
1979	3	231	206	440	437
1980	1	80	54	135	134
1981	55	449	103	607	552
1982	26	159	64	249	223
1983	21	607	193	821	800
1984	16	363	142	521	505
1985	39	717	209	965	926
1986	107	921	72	1,100	993
1987	11	77	inc.[b]	inc.	inc.
1988	16	inc.	inc.	inc.	inc.

[a] Count at Kooskia NFH weir was sample method. Ocean age was delineated by fork length criteria as follows:

1981-1986: Age 3 = $\leq$56 cm.
Age 4 = 57-81 cm.
Age 5 = $\geq$82 cm.

[b] inc. = incomplete brood year information.

Source: R. Roseberg, DNFH, unpublished.

Table 13 (RH). Return of hatchery spring chinook to the Dworshak National Fish Hatchery, brood years 1981-1986."

Total Age

Brood Year	3	4	5	Total	Total adult
1981	14	281	91	386	372
1982	13	346	376	735	722
1983	78	1,604	1,240	2,922	2,844
1984	25	569	221	815	790
1985	163	1,322	135	1,620	1,457
1986	156	1,892	350	2,398	2,242
1987	7	98	inc.[b]	inc.	inc.
1988	10	inc.	inc.	inc.	inc.

[a] Count at Dworshak NFH weir was sample method. Ocean age was delineated by fork length criteria as follows:

1981-1986: Age 3 = $\leq$56 cm.
Age 4 = 57-81 cm.
Age 5 = $\geq$82 cm.

[b] inc. = incomplete brood year information.
[c] During the 1985 return year 5 additional fish were caught but not measured; 1987 - 12 fish, 1989 - 1 fish, 1990 - 8 fish, and 1991 - 9 fish were also caught but not measured.

Source: R. Roseberg, DNFH, unpublished.

Table 14 (AL-a). Dworshak National Fish Hatchery spring chinook total lengths 1983, 1985, 1990 and 1991[a].

Length cm	1983 No. fish	1986 No. fish	1990[b] No. fish	1991 No. fish[c]
< 40			1	
40			2	
41		2	1	
42			1	
43				
44		3		
45				
46		11		
47			1	
48		9		1
49				
50				1
51		15		2
52			1	2
53				
54		23	1	
55				
56		16	2	1
57				
58		8	1	
59			1	
60			3	
61		11	3	1
62			2	
63		4	9	
64			6	
65			14	
66		6	26	1
67			29	
68			33	4
69		20	58	2
70			93	7
71	3	32	157	2
72			194	2
73			199	8
74	2	65	241	3
75			193	5
76	1	87	171	4
77			149	2
78			127	4
79	1	73	74	2
80			45	3
81	2	37	31	5
82			20	2
83			17	4
84	1	24	12	4
85			8	4
86		14	8	7
87			14	7
88			5	2
89		12	6	8
90			9	5
91		5	10	1
92			5	2
93			5	2
94		3	4	3
95			2	
96		2	2	
97			2	1
98				
99		1	1	1
100			1	
101				
102				1
103			1	
104				
>104			1	

[a] Total Lengths with half increments were rounded up to the nearest inch and then all lengths were converted from inches to centimeters in 1983 and 1986.
[b] four additional mini-jacks were collected in 1990.
[c] Blanks indicate no fish of this size were collected and measured.
Sources: R. Roseberg, DNFH, unpublished.

Table 15 (AL-a). Kooskia National Fish Hatchery spring chinook total lengths 1985, 1986, 1990 and 1991[a].

Length cm	1985 No. fish	1986 No. fish	1990 No. fish	1991 No. fish
< 40				
40				
41				
42				
43				1
44	[b]			1
45				
46		1		2
47				
48		1	1	
49				
50			1	
51		3	2	
52				
53				3
54		8	1	
55			1	
56		8	4	
57			1	
58	1	10		
59				
60			2	
61	1	8	3	2
62			2	
63	3	3	4	
64			5	2
65			8	1
66	5	7	14	2
67			17	
68			17	4
69	25	12	34	5
70			42	3
71	56	22	51	6
72			64	7
73			76	9
74	118	28	103	4
75			105	5
76	97	24	73	7
77			98	5
78			59	5
79	97	21	43	11
80			33	7
81	40	24	35	16
82			27	19
83			24	19
84	15	17	17	16
85			20	28
86	5	22	11	34
87			18	31
88			16	32
89	5	19	13	45
90			7	21
91	9	18	16	27
92			7	17
93			7	11
94	5	13	5	7
95			5	11
96	5	6	3	13
97			5	7
98			1	5
99	1	6	2	
100				
101				1
102	3	1		
103				
104	3			
>104	1	1		

[a] Total lengths with half increments were rounded up to the nearest inch and then all lengths were converted from inches to centimeters in 1983 and 1986.
[b] Blanks indicate no fish of this size were collected and measured.
Sources: R. Roseberg, DNFH, unpublished.

Table 16 (AC). Age composition percentage (freshwater.ocean) by brood year" for hatchery spring chinook salmon returning to Kooskia National Fish Hatchery, brood years 1969-1986.

Age Composition (%)

Brood Year	N	2.1	2.2	2.3
1969	52	9.6	86.5	3.9
1970	67	7.5	52.2	40.3
1971	406	3.9	70.0	26.1
1972	455	3.3	62.9	33.8
1973	3,284	12.5	77.3	10.2
1974	2,273	14.7	73.7	11.6
1975	126	18.2	79.4	2.4
1976	144	7.6	38.2	54.2
1977	316	2.8	53.2	44.0
1978	258	0.4	45.0	54.6
1979	440	0.7	52.5	46.8
1980	135	0.7	59.3	40.0
1981	607	9.1	74.0	16.9
1982	249	10.4	63.9	25.7
1983	821	2.6	73.9	23.5
1984	521	3.1	69.7	27.2
1985	965	4.0	74.3	21.7
1986	1,100	9.7	83.7	6.6

[a] Count at Kooskia NFH weir was sample method. In the 1989 return year, 7 additional fish were counted but not measured. Ocean age was delineated by fork length criteria as follows:

1981-1986: l-ocean = $\leq$56 cm.
2-ocean = 57-81 cm.
3-ocean = $\geq$82 cm.

In this nomenclature, the freshwater and ocean ages sum to the total age of the fish.

Source: Miller et al. 1991

Table 17 (AC). Age composition percentage (freshwater.ocean) by brood year[a] for hatchery spring chinook salmon returning to Dworshak National Fish Hatchery, brood years 1981-1986.

		Age Composition (%)		
Brood Year	N	2.1	2.2	2.3
1981	386	3.6	72.8	23.6
1982	735	1.8	47.1	51.1
1983	2,922	2.7	54.9	42.4
1984	815	3.1	69.8	27.1
1985	1,620	10.1	81.6	8.3
1986	2,398	6.5	78.9	14.6

[a] Count at Dworshak NFH weir was sample method. Ocean age was delineated by fork length criteria as follows:

1981-1986: l-ocean = $\leq$56 cm.
2-ocean = 57-81 cm.
3-ocean = $\geq$82 cm.

In this nomenclature, the freshwater and ocean ages sum to the total age of the fish.

Source: Miller et al. 1991.

Table 18 (AS-a). Annual return of spring chinook identified by sex to the Dworshak/Kooskia complex, 1987-1991.

Return year	Males"	(%)	Females	(%)
1987	1,130	(47.4)	1,574	(58.2)
1988	1,218	(51.3)	1,349	(52.6)
1989	1,319	[illegible]	1,251	(48.7)
1990	1,339	(45.1)	1,627	(54.9)
1991	304	(48.1)	328	(51.9)

[a] Return numbers are a combination of jacks and adult males.

Source: Miller et al. 1987, 1990, 1991.
Miller 1988, 1990.

Table 19 (AF-a). Mean fecundity by return year for spring chinook returning to the Dworshak/Kooskia complex, 1985-1991.

Return year	Number of[a] females spawned	Number of green eggs	Mean fecundity
1985	378	1,587,600	4,200
1986	NR[b]	1,241,176	
1987	930	3,316,340	3,566
1988	1,065	4,890,970	4,592
1989	950	3,516,306	3,701
1990	1,333	4,833,104	3,626
1991	242	995,842	4,117

[a] Combination of Dworshak and Kooskia adult females.
[b] NR = not reported.

Sources: Olson 1986, 1988a, 1988b, 1989, 1990, 1991.
Miller 1988.
Miller et al. 1987

Table 20 (TD). Parasites and diseases of spring chinook at the Dworshak/Kooskia complex, 1985-1991[a].

Disease Type	Hatchery	Infection
bacteria	Dworshak	*Renibacterium salmoninarum* (Bacterial kidney disease)
protozoa	Dworshak	*Myxobolus cerebralis (Whirling disease)*
bacteria	Dworshak	*Yersinia ruckeri* (Enteric Redmouth Disease)
virus	Dworshak	Hrythrocytic Inclusion Body Syndrome (RIBS)
virus	Dworshak	Infectious Hematopoietic Necrosis (IHN)

[a] Disease history only represents pathogens isolated at the hatchery and not necessarily a disease outbreak.

Sources: Olson 1986, 1988a, 1988b, 1989, 1990, 1991.
Miller 1988.
Miller et al. 1987.

LOWER CLEARWATER RIVER, CLEARWATER SUBBASIN
(including the North Fork to Dworshak Dam and the Middle Fork to the confluence of the Lochsa and Selway rivers)

Naturally Produced Summer Steelhead (A-Run)

GEOGRAPHIC LOCATION

The Clearwater River, in north-central Idaho, originates in the Bitterroot Mountains on the Idaho-Montana border and flows westerly across the state to Lewiston where it joins the Snake River (Figure 1). The river drains about 9,640 square miles and the drainage ranges in elevation from 9,000 feet mean sea level (msl) to 725 feet msl (IDFG 1992). Only the lower portion of the drainage is classified as A-run steelhead production area. The lower tributary streams are generally small, except for the Potlatch River.

A-run steelhead streams in the lower Clearwater (including Middle Fork Clear-water and lower South Fork Cleat-water rivers) typically drain lands managed for agricultural crops, grazing and and timber harvest (Nez Perce Tribe and Idaho Department of Fish and Game 1990). Land ownership is a mix of private, Nez Perce tribal, state and federal. Land-use practices have degraded many of the streams. Kucera and Johnson (1986) and the Clearwater Subbasin Plan (Nez Perce Tribe and Idaho Department of Fish and Game 1990) cite the following habitat problems: high soil erosion rates, especially from agricultural crop lands; high bedload movement rates; altered channel morphology and riparian areas; variable stream flows with severely limited late summer flows; and high summer temperatures in lower tributary reaches.

ORIGIN

A-run summer steelhead are native to tributaries downstream of the Lochsa and Selway rivers, and in the lower South Fork Clear-water River drainage. Some influence of B-run steelhead is probable due to past releases from Dworshak National Fish Hatchery and adult straying.

DISTRIBUTION

Available spawning and rearing habitat for A-run steelhead in the lower Clearwater River drainage was described in the Presence/Absence database (Figure 1, Table 1). This information was developed for the Northwest Power Planning Council for subbasin planning and modeling.

Both A-run and B-run steelhead rear in the mainstem Clearwater River. Subbasin planning data for rearing only are summarized in the B-run Natural Steelhead section of this chapter.

PRODUCTION

There is limited information describing survival and production factors for Lower Clearwater River A-run summer steelhead. The Nez Perce Tribe (NPT) inventoried physical stream habitat and juvenile rainbow-steelhead trout abundance in Bedrock, Cottonwood, Big Canyon, Jacks and Mission creeks during 1983 and 1984 (Kucera and Johnson 1986). The NPT also assessed outmigration timing and magnitude for Bedrock and Cottonwood creeks. The Idaho Department of Fish and Game (IDFG) monitored rainbow-steelhead parr density in Big Canyon Creek during 1985-1991.

Survival from egg deposition to parr or smolt stages has not been studied for lower Clearwater A-run steelhead.

Smolt yield (projected from December population estimates) from Bedrock Creek was estimated at 5,290 in 1984 (brood year 1982) and 4,339 in 1985 (brood year 1983); in Cottonwood Creek respective smolt yield for the two years was estimated at 2,074 and 3,371 (Kucera and Johnson 1986). Mainstem rearing was postulated to be important to total smolt yield and adult returns but could not be quantified.

Mean densities of yearling rainbow-steelhead in the NPT studies in 1983-1984 were generally high and varied by stream, month and year (Table 2). Yearling densities ranged up to 81.5 parr per 100 m^2 in Big Canyon Creek in July, 1983. Densities decreased through the fall both years, with December densities ranging between 3 .O parr per 100 m^2 and 12.8 parr per 100 m .

The IDFG monitored steelhead parr production in Big Canyon Creek, 1985-1991. Densities averaged 8.2 parr per 100 m^2 and 137 percent of rated carrying capacity (Table 3). Densities were largest in 1985 and smallest in 1991. The steelhead parr density estimates include an unknown proportion of resident rainbow trout. Parr carrying capacity ratings for steelhead were derived from the Presence/Absence database used for development of the Clearwater Subbasin Plan. Parr densities were determined by snorkel counts.

Juvenile steelhead densities in the mainstem Clearwater River in summer 1989-1990 were considerably less than observed in the tributaries (Table 4). The fall and winter estimates were likely conservative because direct observation techniques were used (snorkeling and SCUBA) while fish tended to occupy substrate cover.

ADULT LIFE HISTORY

Adult Escapement

Summer steelhead crossing Bonneville Dam through August 24 are counted as A-run, and those after that date are counted as B-run. Escapement of Cleat-water A-run steelhead has not been partitioned from the aggregate A-run at Bonneville or Lower Granite dams.

Harvest

Information is not available regarding harvest of lower Clearwater River A-run steelhead in the ocean and Columbia River. Since the mid-1980's, sport harvest of steelhead possessing an adipose tin has not been allowed in the Snake River or in Idaho. Although quantitative data are lacking, the Clearwater Subbasin Plan (Nez Perce Tribe and Idaho Department of Fish and Game 1990) state that A-run steelhead returning to streams within the boundaries of the Nez Perce Reservation provided a major food source for the Nez Perce Tribe.

Spawner Escapement

Information is not available regarding spawner escapement into lower Clearwater River tributaries,

Adult Characteristics

Little information is available on age of spawners, length-frequency of adults, percent female, or fecundity. The Clearwater Subbasin Plan (Nez Perce Tribe and Idaho Department of Fish and

Game 1990) cite limited, unpublished data that adults electrofished by Nez Perce tribal biologists in several Nez Perce Reservation streams fell mainly into three categories, l-ocean A-run, 2-ocean A-run, and l-ocean B-run.

JUVENILE LIFE HISTORY

Juvenile life history is generally similar to Figure 2. Although not illustrated in the figure, typically there is a fall emigration of presmolts to lower in the drainage or the mainstem Clearwater River for winter rearing (Kucera and Johnson 1986).

Subyearling rainbow-steelhead moved downstream in Bedrock and Cottonwood creeks primarily in late spring and late fall (Kucera and Johnson 1986). Yearling outmigration peaked in late fall; and age 2 smolts emigrated primarily in May. Very little movement occurred in summer, low-flow conditions.
Johnson and Kucem (1985) documented summer-autumn habitat utilization of subyearling steelhead in Bedrock, Cottonwood and Big Canyon creeks. Subyearling trout occupied similar depths and velocities during summer and autumn, but used larger substrate sizes (cobble and boulder) in autumn than in summer (gravel and cobble). Habitat selection, particularly for substrate size, was most pronounced in autumn.

Kucera and Johnson (1986) noted that the mean length of Cottonwood Creek smolts (154 mm) was smaller than the average (181 mm) for wild steelhead smolts from the lower Clearwater River measured by Scully et al. (1984). Mean length and weight of subyearling and yearling rainbow-steelhead in five lower Clearwater River tributaries between May and December, 1983-1984 are shown in Tables 5 and 6.

BIOCHEMICAL/GENETIC CHARACTERISTICS

Milner and Teel (1986) reported electrophoretic data for A-run summer steelhead from Mission, Cottonwood, Bedrock and Big Canyon creeks and other Snake River steelhead populations.

DISEASES

Information has not been compiled.

REFERENCES

All Lower Clearwater references appear in one reference section at the end of the hatchery produced summer steelhead section.

Figure 1 (TD). Summer steelhead distribution in the Clearwater subbasin based on the NPPC presence/absence database.

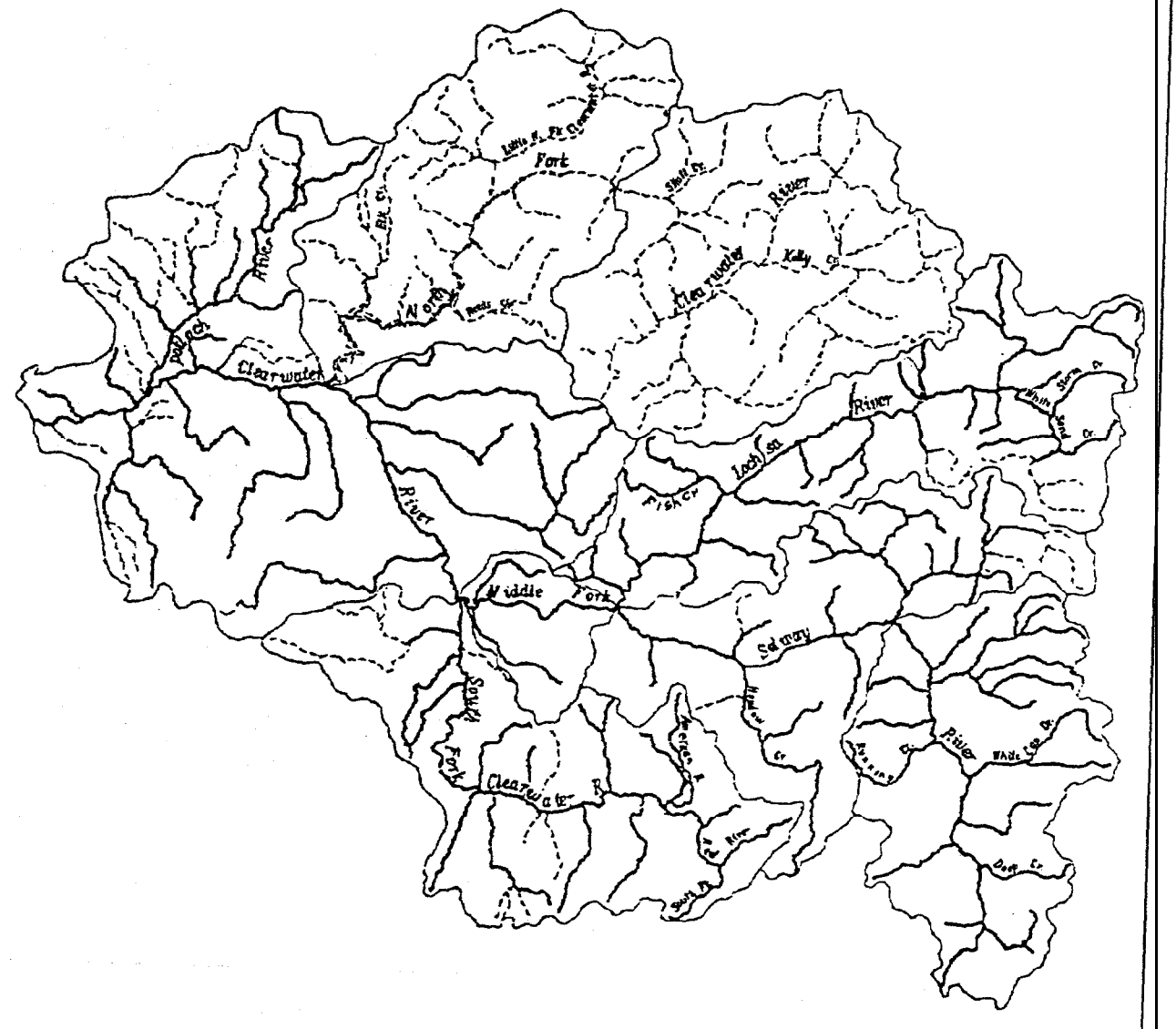
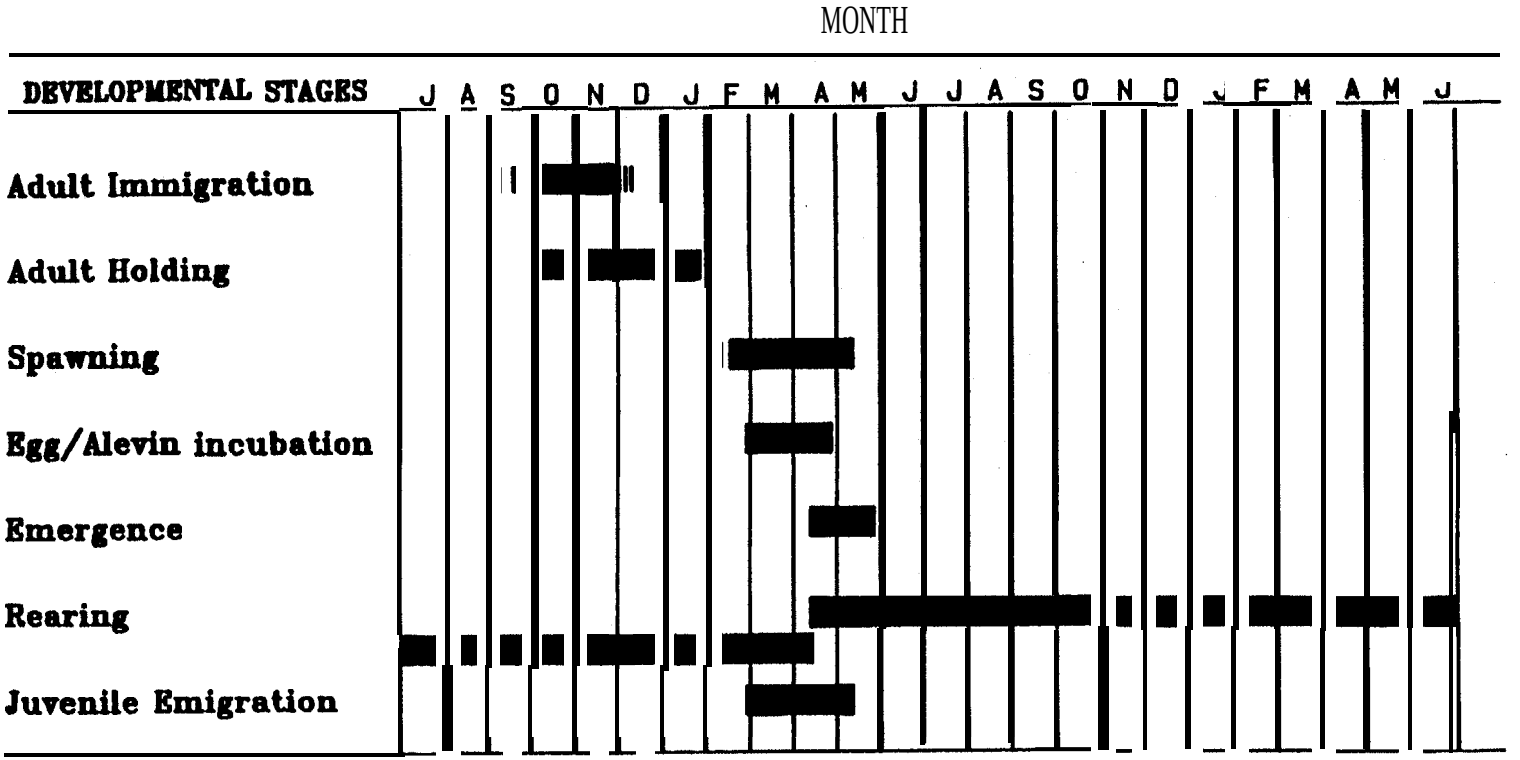


Figure 2 (TT). Freshwater life history for wild A-run steelhead Clearwater River subbasin.



Notes:

1. The developmental stage timing represents basin-nide averages, local conditions may cause some variability.
2. Solid bars indicate periods of heaviest adult immigration, spawning and juvenile emigration.

Table 1 (HB). Estimated amount of spawning and rearing habitat (Use Type 1) by quality of Clear-water River (mouth to Kooskia including the lower North Fork Clearwater below Dworshak Dam) A-run steelhead production area.

	Excellent	Good	Fair"	Poor"	Unknown	Total	Confidence[b]
Miles (%)	0.0	6 7	31 23	63.70		526.19 454.9	M M
Acres (%)							

[a] Ratings of fair and poor habitat quality may reflect natural physical features such as gradient and channel type, as well as degradation caused by humans.
[b] 'Confidence' is meant to indicate the reproducibility and accuracy of the estimates made, and will be rated as high, medium or low by the respective agencies.

Source: Presence/Absence database, Northwest Power Planning Council, 1991.

Table 2 (PD-a). Mean density (number/100m^2) of yearling rainbow-steelhead by month in five tributaries to Lower Clearwater River, 1983-1984.

Year	Stream	Number of study areas	Mav	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
		2						9.0		
1983	Bedrock	2	16.0	23.5	15.5	12.3	9.8	15.8	11.0	7.5
	Cottonwood		14.5	20.8	17.0	17.0	16.0	[illegible]	16.0	7.8
	Big Canyon	1	10.0	54.0	81.5	60.0	11.0	51.5	9.0	3.0
	Jacks	1	32.5	32.0	24.0	26.5	20.0	12.0		8:0
	Mission		3.0	8.0	6.0	6.0	4.0	2.0		
		3								
1984	Bedrock	2	24.8	48.5	67.5	45.0	28.3	23.0	17.0	12.8
	Cottonwood		18.8	22.3	30.3	24.8	20.0	18.8	18.0	10.8

Source: Kucera and Johnson 1986.

Table 3 (PD-b). Parr density and percent of rated carrying capacity (PCC) for A-run steelhead in the Lower Clearwater River drainage (Snake River to Kooskia including the lower North Fork Clearwater below Dworshak Dam), 1985-1991. Densities estimated by snorkel counts.

Stream name	Year	Sample size	Ages 1+ & 2+ density (#/100m²)	Density std. dev.	PCC for 1+ & 2+	PCC std. dev.
		1				
Big Canyon Creek	85	1	16.97	NA[a]	282.83	NA
Big Canyon Creek	86		8.48	NA	141.33	NA
Big Canyon Creek	87	1	9.70	NA	161.67	NA
Big Canyon Creek	88	1	4.85	NA	80.83	NA
Big Canyon Creek	89	1	4.85	NA	80.83	NA
Big Canyon Creek	90	1	10.74		179.00	NA
Big Canyon Creek	91	1	1.79	NA	29.33	NA

[a] Not applicable.

Source: B. Rich, IDFG, unpublished.

Table 4 (PD-c). Mean density (number/100m²) of rainbow-steelhead rearing in the lower mainstem Cleat-water River, at upstream (North Fork and Big Canyon) and downstream (Potlatch River and Bedrock Creek) sites, by season, 1989-1990.

Year	Season	Sites	Rainbow-steelhead age 0+	Rainbow-steelhead age I+
1989	Summer	Upstream	0.028	0.019
		Downstream	0.005	0.009
	Fall	Upstream	0.000	0.002
		Downstream	0.000	0.000
	Winter	Upstream	0.000	0.000
		Downstream		0.000
1990	Summer	upstream	0.145	0.165
		Downstream	0.057	0.003
	Fall	Upstream	0.000	0.370
		Dpwnstream	0.000	0.001

Source: Arnsberg et al. 1992.

Table 5 (SL-a). Mean total length (mm) of yearling rainbow-steelhead by month in five tributaries to Lower Clearwater River, 1983-1984.

Year	Stream	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
					Subyearling				
1983	Bedrock	--	53.9	66.7	73.3	80.4	89.6	90.5	91.9
	Cottonwood	--	57.8	68.1	74.1	77.8	84.0	88.9	89.2
	Big Canyon	--	56.0	65.4	70.0	77.2	92.3	98.1	93.9
	Jacks		48.2	58.7	66.3	69.8	72.6	75.3	77.4
	Mission		49.8	59.5	65.1	70.7	73.6	--	80.0
1984	Bedrock		55.7	67.5	71.7	76.0	79.9	81.7	82.3
	Cottonwood	--	51.0	65.2	70.3	75.9	77.6	78.7	79.4
	Mean =		53.2	64.4	70.1	75.4	81.4	85.5	84.9
					Yearling				
1983	Bedrock	119.4	30.6	134.3	129.7	132.2	136.7	134.5	134.6
	Cottonwood	131.0	38.7	141.6	143.9	146.9	150.0	150.7	149.4
	Big Canyon	140.6	45.7	152.0	149.2	170.3	166.1	167.7	158.9
	Jacks	111.4	11.4	116.8	115.7	121.8	125.5	122.7	136.8
	Mission	139.4	53.3	147.5	147.8	150.3	156.1		159.2
1984	Bedrock	112.7	28.2	133.3	128.3	130.0	135.4	135.8	133.7
	Cottonwood	109.6	24.7	124.4	124.3	126.4	125.3	127.8	126.0
	Mean =	123.4	33.2	135.7	134.1	139.7	142.1	119.9	142.7

Source: Kucera and Johnson 1986.

Table 6 (PD-d). Mean weight (gm) of yearling rainbow-steelhead by month in five tributaries to Lower Clearwater River, 1983-1984.

Year	Stream	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
					Subyearling				
1983	Bedrock	--	1.5	2.4	2.3	3.8	4.6	6.2	6.5
	Cottonwood	--	1.9	2.8	3.2	4.0	4.7	6.0	5.9
	Big Canyon	--	1.6	1.8	2.8	4.1	6.8	8.4	6.6
	Jacks	--	1.0	1.5	2.1	3.1	3.2	3.8	3.4
	Mission	--	1.2	1.5	2.4	3.1	3.2	--	4.6
1984	Bedrock	--	1.5	3.0	3.3	4.1	5.0	4.9	5.1
	Cottonwood	--	1.0	2.5	3.4	4.1	4.5	4.4	4.4
	Mean =	--	1.4	2.2	2.8	3.8	4.6	5.6	5.2
					Yearling				
1983	Bedrock	17.7	19.5	17.6	14.8	17.4	21.1	21.1	20.3
	Cottonwood	22.9	21.8	24.8	21.9	27.0	28.3	28.5	27.2
	Big Canyon	28.5	25.7	30.6	24.7	43.7	41.5	38.8	31.5
	Jacks	14.0	12.2	13.0	12.4	14.7	19.0	16.5	17.3
	Mission	27.7	31.8	27.0	23.0	25.7	31.1		32.9
1984	Bedrock	13.3	20.3	22.1	18.8	19.5	22.2	18.8	18.4
	Cottonwood	14.2	21.3	19.0	18.6	18.5	17.8	18.3	17.6
	Mean =	19.8	21.8	22.0	19.1	23.8	25.8	23.7	23.6

Source: Kucera and Johnson 1986.

LOWER CLEARWATER RIVER, CLEARWATER SUBBASIN
(including the North Fork to Dworshak Dam and the Middle Fork to the confluence of the Lochsa and Selway Rivers)

Naturally Produced Summer Steelhead (B-Run)

GEOGRAPHIC LOCATION

The mainstem Clearwater River is formed by the joining of its South and Middle forks. The mainstem is 75 miles long and enters the Snake River 139 river miles upstream of the Columbia River (Figure 1, prior A-run steelhead section) (Mallet 1974, Nez Perce Tribe and Idaho Department of Fish and Game 1990). The mainstem is an important migration corridor for adult and juvenile steelhead and salmon, and it is an overwintering area for juveniles. The lower river is not noted as spawning habitat for steelhead. The lower drainage is characterized by rolling plateaus to the south and north with steep-sided canyons intersecting the mainstem valley (Nez Perce Tribe and Idaho Department of Fish and Game 1990). Lower Clear-water tributaries are small except for the Potlatch River and Lo10 Creek. Tributaries of the lower Clearwater region typically drain lands managed for agricultural crops, grazing and timber harvest (Nez Perce Tribe and Idaho Department of Fish and Game 1990). Land ownership is a mix of private, Nez Perce Tribal, state and federal entities. Land use practices have degraded many of the streams in the lower Clearwater. Many of the production tributaries suffer from low summer flows and high temperatures. Steelhead utilize tributaries for spawning and rearing, but as flows decrease in the late summer, parr may utilize the mainstem river.

The Middle Fork of the Clearwater originates at the confluence of the Lochsa and Selway rivers. It joins the South Fork to form the mainstem Clearwater River. The Middle Fork is classified as recreational for the length of the river (22 miles), pursuant to the Wild and Scenic Rivers Act. Clear and Maggie creeks are the only significant natural production tributaries. These are limited by high summer water temperature and sedimentation. Kooskia National Fish Hatchery is located at the mouth of Clear Creek and operates an electric weir to trap returning steelhead and spring chinook.

The North Fork of the Clearwater and its tributaries represented 627 miles of stream utilized by chinook and steelhead (Mallet 1974). Although chinook were almost eliminated by Lewiston Dam in 1927, Dworshak Dam eliminated all of the North Fork's anadromous runs when it was completed on the North Fork in 1971. About two river miles of the North Fork remain accessible to salmon and steelhead. This area is not noted for much natural production. Dworshak National Fish Hatchery (NFH) is located at river mile 2 of the North Fork near Orofmo, Idaho.

ORIGIN

Steelhead were probably indigenous throughout the Clearwater drainage prior to construction of Lewiston Dam. Steelhead production in the Clearwater subbasin was reduced by construction of Lewiston Dam in 1927. Inadequate adult fish passage at the dam's one fishway virtually eliminated salmon runs into the basin and probably affected the passage of steelhead. In 1939, two additional fishways were constructed and in the mid-1960's, improvements were made. In 1973, Lewiston Dam was removed (Nez Perce Tribe and Idaho Department of Fish and Game 1990).

Dworshak Dam was authorized in 1962. It was completed in the late 1960's and completely blocked all anadromous fish migration. The dam eliminated 60 percent of the highest quality habitat for steelhead in the Clearwater National Forest (Espinosa 1983). The broodstock for Dworshak

was developed from the native North Fork Clearwater steelhead run. The first smolt release was in 1970 with a release of nearly 1.4 million smolts. Since Dworshak NFH began production, hatchery steelhead from this facility have been planted in several tributaries of the lower Clear-water. From 1978-1987, Clear Creek received about 1.2 million steelhead smolts of Dworshak NFH origin. The Lo10 Creek drainage received 1.9 million steelhead fry, 427,641 smolts, and 3,827 adults from Dworshak NFH from 1974-1987. The Potlatch River also received a considerable number of hatchery steelhead fry and adults during this time period (Lindland and Bowler 1988). Table 22 of the Clear-water Subbasin Plan (Nez Perce Tribe and Idaho Department of Fish and Game 1990) summarizes hatchery steelhead releases into the lower Clearwater, 1977-1987. Steelhead supplementation continues to occur annually in the Lo10 Creek drainage and in Clear Creek. Some steelhead adults escape or are released above the Kooskia NFH weir, but production is low.

Many of the tributaries of the lower Clearwater have the potential to support natural steelhead production, but little is known about adult escapement or characteristics. Several tributaries support A-run steelhead production; this information is described in the A-run steelhead section of this chapter. Tributaries which have not received supplementation of B-run steelhead from Dworshak NFH would presumably support native steelhead although straying of hatchery steelhead returning to Dworshak NFH may occur. Other than tributaries identified supporting A-run steelhead, steelhead returning to the other lower Clearwater tributaries are classified as B-run on the basis of ocean age component, size at age, and timing. B-run steelhead generally enter the Columbia River from August through December and are larger than A-run steelhead of comparable ocean age.

During efforts to supplement lower Clearwater steelhead production, there was little evaluation of the different outplants or measurement of production of indigenous fish. Natural production currently maintains steelhead runs into smaller, unsupplemented tributaries. Adults returning to supplemented drainages such as Lo10 Creek are of native, second generation hatchery, or mixed hatchery and native origin. Because of the mixture of hatchery and natural production in the broodstock history, Idaho Department of Fish and Game classifies lower Clearwater B-run steelhead as natural (Idaho Department of Fish and Game 1992). However, several of the A-run steelhead production tributaries have had little or no hatchery influence. These are described in the A-run steelhead section.

DISTRIBUTION

Available spawning and rearing habitat for B-run steelhead in the lower Cleat-water was described in the Presence/Absence database (Tables 1 and 2). This information was developed for the Northwest Power Planning Council for subbasin planning and modeling.

PRODUCTION

There is no available information describing steelhead survival factors. Idaho Department of Fish and Game (IDFG) monitored steelhead parr production in the Lo10 Creek drainage, 1985-1991. The overall weighted mean for IDFG monitoring transects was 3.9 parr per 100 m^2 and 34.7 percent of estimated carrying capacity (Table 3). Parr carrying capacity ratings for steelhead were derived from the Presence/Absence database used for development of the Clearwater Subbasin Plan. Parr densities were determined by snorkel counts.

ADULT LIFE HISTORY

Adult Escaoement

Specific time of migration and escapement for steelhead returning to the lower Clearwater has not been identified for the ocean or Columbia or Snake rivers. The University of Idaho implemented adult timing research in 1991 which should provide information about Snake River timing (Bjornn et al. 1992).

Adult steelhead that migrate in the fall overwinter in the Snake and lower Clearwater rivers. The time of entry of steelhead into the Clearwater subbasin was from July through June, noted when fish were counted at the Lewiston Dam from the 1949-1950 run year through the 1971-1972 run year. Up until the 1958-1959 run year, an average of 79 percent of the steelhead run crossed Lewiston Dam during March-May. An average of only 16 percent of the run crossed during September-November. Beginning with the 1958-1959 run year, an average of 42 percent of the steelhead run crossed Lewiston Dam during March-May, and 56 percent crossed in September-November (S. W. Kiefer, IDFG, personal communication).

Steelhead run estimates for the entire Clearwater drainage ranged from 3,167-43,1996 for the run years 1949-1950 through 1971-1972 (Nez Perce Tribe and Idaho Department of Fish and Game 1990). There was little hatchery steelhead production in the Clearwater drainage during this period.

Harvest

Information is not available regarding the rate of contribution of this stock to ocean, Columbia River or Snake River harvests. Since the mid-1980's, the harvest of steelhead possessing an adipose fin has not been allowed in the Snake River or in Idaho.

Only limited sport harvest information is available. Tributaries of the lower Clearwater, excluding the mainstems of the North and Middle forks, have been closed to sport steelhead harvest since at least the mid-1970's. The average harvest of steelhead during the period 1966-67 through 1970-71 was 6,744 (Ortmann 1975). Most of the harvest occurred in the mainstem Clearwater River. Howell et al. (1985) documented fall and spring catch of steelhead, 1969-1971. Harvest by run-year averaged 2,102 steelhead. Most of the catch through 1971 would have been composed of wild fish, returning to the entire Clearwater Basin.

Information regarding occurrence and magnitude of tribal harvest of naturally produced lower Clearwater steelhead is not available.

Spawner Escaoement

Studies conducted in the Clearwater drainage indicated that the spring steelhead migration began when water temperature reached 39 F° (Metsker 1959).

In 1990, 6 steelhead redds were counted in the Lolo Creek drainage for a density of 2.9 redds per mile in the counted transect (Rich et al. 1992).

Adult Characteristics

There is information describing the wild steelhead run entering the Clearwater River as a single stock (Whitt 1954, Whitt and Pratt 1955, and Keating 1958) but there is very little information that describes the steelhead runs returning specifically to lower Clearwater tributaries.

Information describing the original North Fork steelhead stock was gathered when the wild fish were captured to develop broodstock for Dworshak NFH. The run was predominately a two-ocean run. Fecundity of the wild fish. spawned at Dworshak NFH, 1969-1971 averaged 6,044 eggs per female (Table 4).

Information about adult characteristics of the native steelhead inhabiting drainages such as the Potlatch River or Lolo Creek is not available.

JUVENILE LIFE HISTORY

Juvenile life history timing is generally similar to Figure 1. Although not illustrated in the figure, there is typically a fall emigration of steelhead presmolts from the upper ends of tributaries to lower in the drainage for winter rearing.

BIOCHEMICAL/GENETIC CHARACTERISTICS

Information from the lower Clearwater is only available from naturally produced steelhead believed to be A-run (see A-run steelhead section).

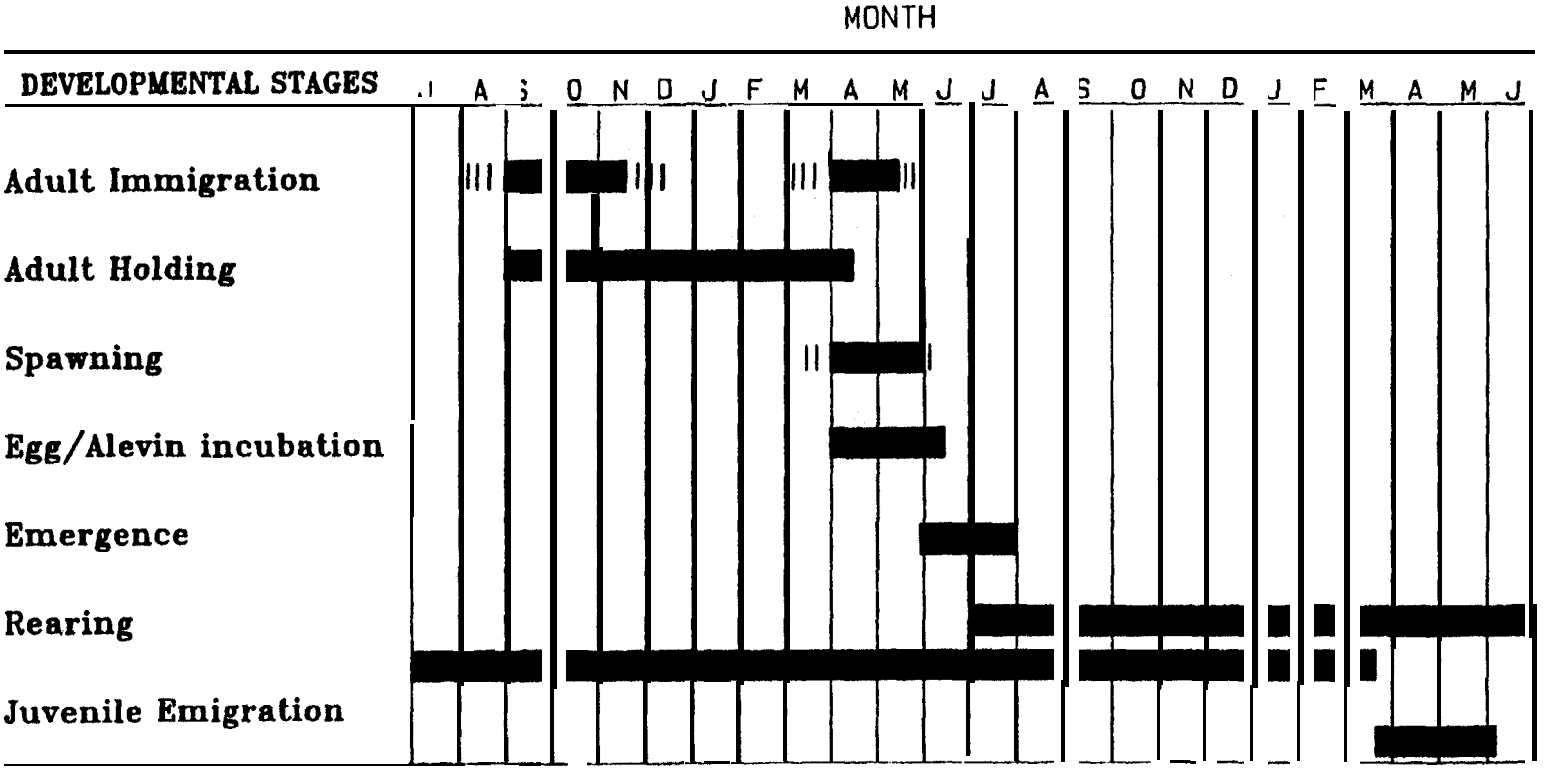
DISEASES

Information has not been compiled.

REFERENCES

All Lower Clear-water references appear in one reference section at the end of the hatchery produced summer steelhead section.

Figure 1. Freshwater life history for natural B-run steelhead Clearwater River subbasin.



Notes:

1. The developmental stage timing represents basin-wide averages, local conditions may cause some variability.
2. Solid bars indicate periods of heaviest adult immigration, spawning and juvenile emigration.

Table 1 (HB). Estimated amount of spawning and rearing habitat (Use Type 1) by quality of Clearwater River (mouth to Kooskia including the lower North Fork Clearwater below Dworshak Dam) B-run steelhead production area.

	Excellent	Good	Fair[a]	Poor"	Unknown	Total	Confidence[b]
	0						
Miles (%)(%	0	40 32	48 67	12 1		294.1 82.7	M M
Acres (%)							

[a] Ratings of fair and poor habitat quality may reflect natural physical features such as gradient and channel type, as well as degradation caused by humans.
[b] 'Confidence' is meant to indicate the reproducibility and accuracy of the estimates made, and will be rated as high, medium or low by the respective agencies.

Source: Presence/Absence database, Northwest Power Planning Council, 199 1.

Table 2 (HB). Estimated amount of rearing only habitat (Use Type 2) by quality of Clearwater River (mouth to Kooskia including the lower North Fork Clearwater below Dworshak Dam) B-run steelhead production area.

	Excellent	Good	Fair"	Poor"	Unknown	Total	Confidence[b]
Miles (%)	0	3	13	84		50.4	M
Acres (%)	0	2	15	83		1890.8	M

[a] Ratings of fair and poor habitat quality may reflect natural physical features such as gradient and channel type, as well as degradation caused by humans.
[b] 'Confidence' is meant to indicate the reproducibility and accuracy of the estimates made, and will be rated as high, medium or low by the respective agencies.

Source: Presence/Absence database, Northwest Power Planning Council, 1991.

Table 3 (PD-a). Parr density and percent of rated carrying capacity (PCC) for B-run steelhead in the Lower Cleat-water River drainage (Snake River to Kooskia including the lower North Fork Clear-water below Dworshak Dam), 19851991. Densities estimated by snorkel counts.

Stream name	Year	Sample size	Ages 1+ & 2+ density (#/100m²)	Density std. dev.	PCC for 1+ & 2+	PCC std. dev.
Eldomdo Creek	85	4	6.00	2.77	13.85	27.70
Eldorado Creek	86	4	4.64	4.89	60.00	48.93
Eldorado Creek	87		[illegible]	3.56	46.38	35.63
Eldorado Creek	88	4	3.83	5.87	38.33	58.68
Eldorado Creek	89	4	1.46	.99	14.55	9.94
Eldorado Creek	90	10	5.03	5.52	50.28	55.20
Eldorado Creek	91	4	7.41	5.63	74.08	56.52
	85	6				
Lo10 Creek	86	6	2.40	2.12	17.12	15.11
Lolo Creek	87	6	5.38	6.05	38.44	43.21
Lolo Creek	88	6	6.23	3.68	44.48	26.26
Lolo Creek	89	6	4.50	2.94	32.12	20.97
Lolo Creek	90	9	1.90	2.30	13.60	16.39
Lolo Creek			3.15	4.83	22.51	34.53
Lolo Creek	91	6	4.04	1.92	28.86	13.69

Source: B. Rich, IDFG, unpublished.

Table 4 (AF-a). Fecundity of wild North Fork steelhead spawned for broodstock at Dworshak National Fish Hatchery, 1969-1971.

Year	Number of females spawned	Number of eggs	Average eggs per female
1969	1,877	11,472,500	6,112
1970	1,809	11,627,946	6,428
1971	1,203	6,448,600	5,360

Source: Hatchery files

LOWER CLEARWATER RIVER, CLEARWATER SUBBASIN
(including the North Fork to Dworshak Dam and the Middle Fork to the confluence of the Lochsa and Selway Rivers)

Hatchery Produced Summer Steelhead

GEOGRAPHIC LOCATION

Dworshak NFH is located at river mile 2 of the North Fork Clearwater River (North Fork), near Orofmo, Idaho. Hatchery water is taken from the North Fork Clearwater River below Dworshak Dam. Since 1982, Kooskia NFH has assisted with early rearing of steelhead. Kooskia is located near the mouth of Clear Creek, a tributary to the Middle Fork Clear-water River. In addition, steelhead released from Dworshak NFH have also been reared at Hagerman NFH, located in the Hagerman Valley along the Snake River in southern Idaho.

Dworshak National Fish Hatchery (NFH) was built by the U.S. Corps of Engineers to mitigate for the loss of the North Fork Clear-water steelhead run, which was blocked by construction of Dworshak Dam. The hatchery is funded and operated by the U.S. Fish and Wildlife Service.

ORIGIN

Steelhead were probably indigenous throughout the Clear-water drainage prior to construction of Lewiston Dam. Steelhead production in the Clearwater subbasin was reduced by construction of Lewiston Dam in 1927. Inadequate adult fish passage at the dam's one fishway virtually eliminated salmon runs into the basin and probably affected the passage of steelhead. In 1939, two additional fishways were constructed and in the mid-1960's, improvements were made. In 1973, Lewiston Dam was removed (Nez Perce Tribe and Idaho Department of Fish and Game 1990).

Dworshak Dam was authorized in 1962. It was completed in the late 1960's and completely blocks all anadromous fish migration. The dam eliminated 60 percent of the highest quality habitat for steelhead in the Cleat-water National Forest (Espinosa 1983). The broodstock for Dworshak NFH was developed from the native North Fork Clear-water River steelhead run. Dworshak NFH started operating in April 1969 with a temporary weir to trap wild steelhead adults returning to the North Fork. The first smolt release was in 1970 with a release of nearly 1.4 million smolts. Adults from the hatchery release began returning in 1972 (Nez Perce Tribe and Idaho Department of Fish and Game 1990).

Since Dworshak NFH began production, hatchery steelhead from this facility have been planted in several tributaries of the lower Clearwater. However, most of the hatchery steelhead releases have been into the mainstem and lower North Fork.

Hatchery steelhead returning to the lower Clearwater arc classified as B-run on the basis of ocean age component, size at age, and timing. B-run steelhead generally enter the Columbia River from August through December and are larger than A-run steelhead of comparable ocean age.

DISTFUBUTION

Tables 8-10 of Lindland and Bowler (1988) summarize the releases of hatchery steelhead of Dworshak NFH origin into Clear Creek, the Lo10 drainage, and the Potlatch River during the years 1977-1987. Table 22 of the Clearwater Subbasin Plan (Nez Perce Tribe and Idaho Department of Fish and Game 1990) summarizes hatchery steelhead releases into the lower Clearwater, 1977-1987.

Tables 1 and 2 of this report summarize the release of steelhead into the lower Clearwater for brood years 1982-1990. Coded wire tag (CWT) codes are identified for brood years 1986-1990. Other marks or tag releases have not been compiled.

PRODUCTION

Egg to Smolt

Cumulative survival from eyed egg to released smolt averaged 29.5 percent for steelhead reared at Dworshak NFH, brood years 1988-1990 (Table 3). Eyed eggs are also distributed to other stations for rearing before they are returned to Dworshak NFH as fingerlings. Eyed eggs distributed to Hagerman NFH are returned to Dworshak NFH as fingerlings up to two months later than the eyed eggs distributed to Kooskia NFH. This explains some of the variation in survival from fmgerling to smolt release for eyed eggs reared at Dworshak NFH and off-station (Table 4).

PIT tagged Dworshak NFH steelhead were detected during the 1989 spring migration. PIT tag detections at Snake and Columbia river dams provide a relative measure of minimum survival from tagging to the dams. The 1989 detection at Lower Granite, Little Goose, and McNary dams was 80.5 percent. Because fish are detected in collector systems, most of the detected fish are assumed to be transported. Inbasin migration mortality factors as well as losses in Lower Granite Reservoir and through upper Snake River dams are represented. Specific mortality factors have not been fully segregated to determine stock specific influence on detection rates.

Smolt to Adult

Howell et al. (1985) reported the percent return of smolts released from Dworshak NFH retuning to the Clear-water River averaged 0.55 percent for release years 1970-1980. For release years 1983-1987, the percent return of smolts released from Dworshak NFH returning to the hatchery averaged 0.49 percent (Table 5). This return estimate does not include hatchery fish which were harvested in the Clearwater basin.

Recovery of CWTs can also provide an estimate of smolt to adult survival to various parts of the basin. The recovery percentage of 3 CWT steelhead groups released in 1978 and 1987 into Clear Creek of the Middle Fork Clearwater ranged O-29-0.51 percent and averaged 0.42 percent (Table 6). This included all recoveries, not just the hatchery rack returns. Recoveries at the hatchery rack ranged 0.01-O. 18 percent.

The recovery percentage of 26 CWT steelhead groups released in 1977-1984 and 1986 into the mainstem and North Fork of the Clearwater ranged 0.03-3.24 percent and averaged 0.69 percent (Table 7). This included all recoveries, not just the hatchery rack returns. Recoveries at the hatchery rack ranged 0.01-1.01 percent and averaged 0.29 percent.

Adult

Prespawn mortality of hatchery steelhead ponded at Dworshak NFH averaged 6.1 percent for return years 1977-78 through 1986-87 (Table 8).

ADULT LIFE HISTORY

Adult Escapement

Specific time of migration and escapement for hatchery steelhead returning to the lower Cleat-water has not been identified for the ocean, Columbia River, or Snake River. Hatchery steelhead released from Dworshak NFH have been recovered as one or two-ocean fish in the North Pacific Ocean June through August. The University of Idaho implemented adult timing research in 1991 which should provide information about Snake River timing (Bjornn et al. 1992).

Adult steelhead that migrate in the fall overwinter in the Snake and lower Clearwater rivers. The time of entry of steelhead into the Clear-water subbasin was from July through June, noted when fish were counted at the Lewiston Dam from the 1949-1950 run year through the 1971-1972 run year. Up until the 1958-1959 run year, an average of 79 percent of the steelhead run crossed Lewiston Dam during March-May. An average of only 16 percent of the run crossed during September-November. Beginning with the 1958-1959 run year, an average of 42 percent of the steelhead run crossed Lewiston Dam during March-May, and 56 percent crossed in September-November (S. W. Kiefer, IDFG, personal communication).

Harvest

Some harvest information is available regarding the occurrence of Dworshak NFH steelhead in Columbia River harvests. For 26 CWT releases from Dworshak NFH from 1977-1984 and in 1986, the expanded estimate of CWT fish harvested in the Zone 6 fishery ranged from 0.01-2.0 percent of a tag group (Table 7). However, other than the hatchery rack, the Zone 6 fishery is the other major interception point for Dworshak NFH steelhead CWTs. The expanded estimate of Zone 6 fishery interceptions of Dworshak NFH CWTs ranged from 7.5-82.7 percent of the number of CWTs recovered from each tag release. Howell et al. (1985) reported that Dworshak NFH steelhead with CWTs have been caught in Canadian and Japanese gill net fisheries and in experimental sampling in the ocean in almost all months. Dworshak NFH steelhead have also been recovered in fisheries in the North Pacific Ocean in several years.

Since the mid-1980's, only steelhead missing their adipose fin could be harvested in the Snake River or in Idaho. Releases of hatchery steelhead in the lower Clearwater have contributed a major portion of the harvest in the Snake and Clear-water rivers. The estimated sport harvest of hatchery steelhead in the lower Clearwater averaged 11,794 steelhead for the 1980-81 through 1990-91 run years (Table 9). Although this represents a mixed stock harvest of hatchery fish returning primarily to the lower Clear-water and to the South Fork, all of the fish are of Dworshak NFH origin. Mauney (1991) estimated that sport harvest generally accounted for 52 percent of the Dworshak Hatchery steelhead returning to the Clearwater River.

Howell et al. (1985) reported fall steelhead fishing effort and catch rates for Nez Perce tribal anglers fishing the lower Cleat-water River, 1976-1983. The number of fish harvested ranged from 27-374 during this time period and most of the harvest was presumed to be hatchery steelhead. Tribal anglers harvested 1,242-4,210 hatchery steelhead for run years 1985-86 through 1989-1990 (Mauney 1991). Mauney (1991) estimated that inbasin Nez Perce tribal harvest generally accounted for 9 percent of the Dworshak Hatchery steelhead returning to the Clear-water River.

Spawner Escapement

Timing of steelhead arrival at Dworshak and Kooskia NFH is generally October through May (Table 10). Prior to 1989, steelhead traps were not opened until the spring, thus the hatchery run was not documented arriving until January.

Howell et al. (1985) reported the run size by migration class of Dworshak NFH steelhead returning to the Cleat-water River, 1972-1984. The run ranged from 1, 841 during the 1974-75 run year to 25,413 in 1977-78. They also reported that annual returns to Dworshak NFH during the same period ranged from 1,560 in 1974-75 to 12,730 in 1977-78. More recent annual returns to Dworshak and Kooskia NFH ranged 2,606-14,982 and averaged 6,412 for run years 1980-81 through 1990-91 (Table 11).

Brood year returns to Dworshak NFH ranged from 3,622-10,643 hatchery steelhead and averaged 5,940 for brood years 1982-1986 (Table 12). Total age (freshwater age plus ocean age) ranged from 2 to 4 years. This notation understates by one year the actual age at the time of spawning because adults spend 7-9 months back in freshwater before spawning. Thus, a one-ocean adult that was released as a l-year-old smolt has actually had a total life of 3 years.

Howell et al. (1985) reported that spawntaking at Dworshak NFH has begun as early as January 26 and as late as April 26. A majority of the fish have generally spawned by mid-April.

Adult Characteristics

Weights of returning hatchery steelhead are not available. Length frequency of hatchery steelhead returning to Dworshak NFH is given in Table 13. Miller et al. (1991) reported that at maturity, males and females average about 91 cm and 82 cm in length, respectively.

Howell et al. (1985) reported that age at maturity ranges from 3 to 6 years depending on the age of smolts at release and the number of years spent at sea. All steelhead smolts released from Dworshak NFH have reared one year in freshwater, beginning with the 1982 brood year release. Dworshak NFH steelhead primarily spend 2 years at sea. Howell et al (1985) reported that the steelhead adults returning as one-ocean fish accounted for 2-56 percent of the returns, steelhead returning as two-ocean fish ranged from 42-90 percent of the returns, and three-ocean fish accounted for 0.3-52 percent of the returns for smolt release years 1970-1979. For brood years 1982-1986, the two-ocean return of hatchery steelhead dominated the brood year returns, averaging 90 percent (Table 14). The one-ocean component averaged 6 percent and the three-ocean component averaged 4 percent. Although ocean age determination is based upon length frequency and not a known age technique, coded wire tag recoveries also indicate that the hatchery steelhead returning to Dworshak NFH arc primarily a two-ocean race (Roseberg et al. 1992).

Howell et al. (1985) repotted that the sex ratio for hatchery steelhead returning to Dworshak NFH averaged 60 females to 40 males. For return years 1986-1991, the female proportion of the hatchery steelhead return to Dworshak NFH was 62.8 percent. However, in 1991, females only accounted for 28.6 percent of the return.

Females accounted for an average of 70.1 percent of the brood year return for brood years 1983-1986 (Table 15). The two-ocean age component was the dominant age class. Few females return as one-ocean fish.

Mean fecundity by return year for hatchery steelhead returning to Dworshak and Kooskia NFH ranged from 6,000 to 7,115 eggs per female, 1985-1991 (Table 16). Fecundity over this time period averaged 6,728 eggs per female.

JUVENILE LIFE HISTORY

Most eggs are collected from broodstock which enters the Dworshak NFH ladder, although a few steelhead are collected at Kooskia. Eggs are eyed at Dworshak NFH and eyed eggs are split among Dworshak NFH, Kooskia NFH, and Hagerman NFH for early rearing. Steelhead are returned as fingerlings to Dworshak NFH. Figure 1 shows the general timing of life history. One year old smolts are released directly from Dworshak NFH or transported by truck from Dworshak to the Middle Fork Clearwater or other lower Cleat-water tributaries for release. Steelhead smolts have been released from mid-April to early May. Hatchery steelhead smolts do residualize but the rate of residualism is unknown. It probably varies with rearing and environmental conditions.

Migration data for freeze branded hatchery steelhead from Dworshak NFH shows that for 1985-1990, the migration rate from release to Lower Granite Dam ranged from 6.8 to 12.3 kilometers per day (Table 17).

BIOCHEMICAL/GENETIC CHARACTERISTICS

Howell et al. (1985) reported that hatchery steelhead returning to Dworshak NFH had a uniquely high frequency of the allele for the peptidase locus that distinguished this group of fish from all other Columbia River systems that had been examined up to that time. Schreck et al. (1986) reported isozyme gene frequencies for Dworshak NFH steelhead (Appendix Table 4).

DISEASES

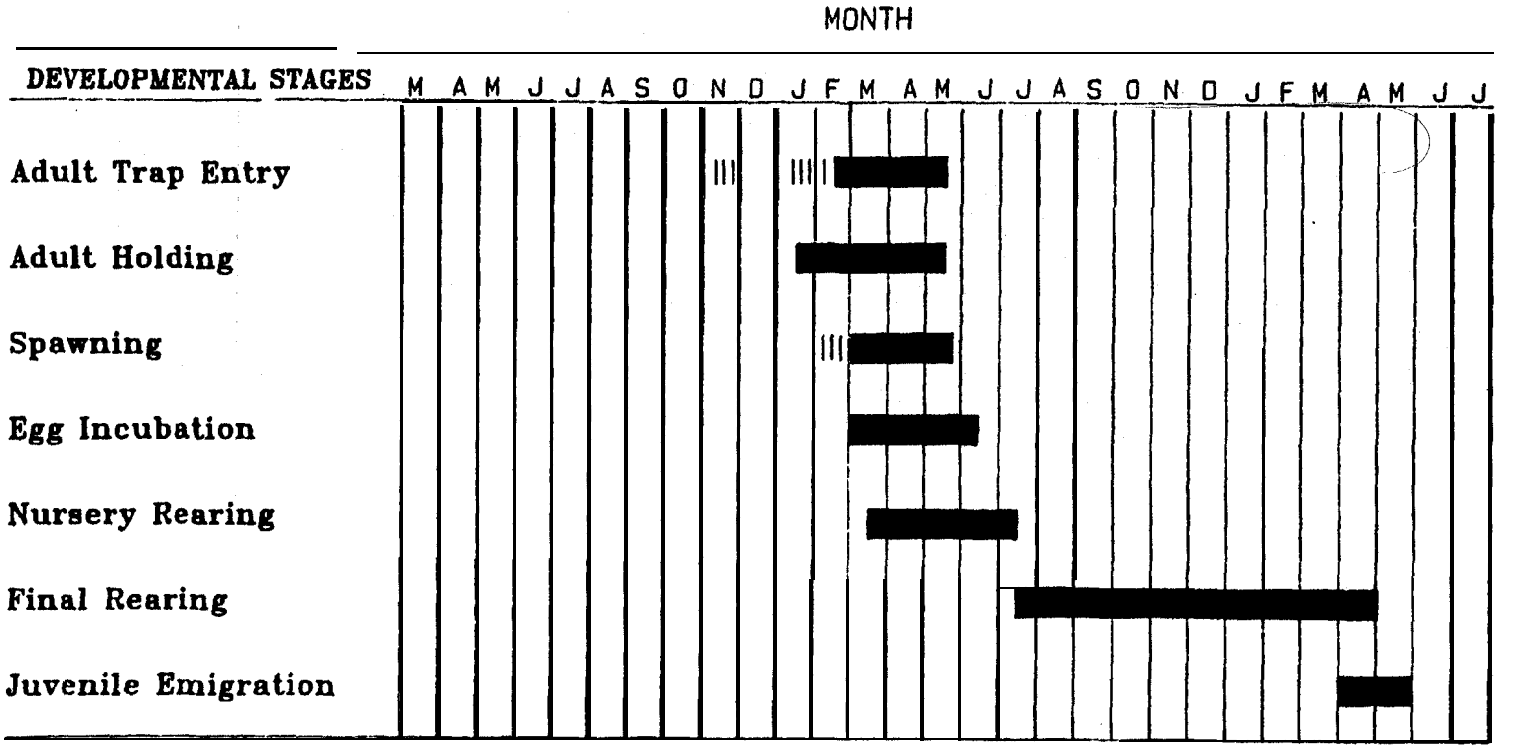
The major disease of management concern, such as those potentially limiting fish transfers (Table 18), which causes mortalities at Dworshak NFH is infectious hematopoietic necrosis virus (IHN). Howell et al (1985) described the history of IHN at Dworshak and Kooskia NFH. It first appeared at Dworshak NFH in 1980 in adult Kooskia spring chinook which were being held at Dworshak NFH. Losses of juvenile steelhead began in 1981 and have been a chronic problem since. Dworshak NFH began culling IHN positive fish in 1982. Kooskia NFH is considered free of the virus.

Howell et al. (1985) also cite Ichthyopthirius as occasionally causing disease problems. They also noted that prior to mineral additions in 1981, steelhead at Dworshak NFH suffered from an ion exchange imbalance. Substantial information about hatchery steelhead diseases encountered at Dworshak and Kooskia NFH is reported in Dworshak NFH annual reports, 1986 through 1991.

REFERENCES

All Lower Clearwater references appear in one reference section at the end of the hatchery produced summer steelhead section.

Figure 1. Freshwater life history for hatchery B-run steelhead at Dworshak National Fish Hatchery in the Clearwater River subbasin.*



Notes:

* Data represents average timing observed by hatchery personnel.

1. The developmental stage timing represents basin-wide averages, local conditions may cause some variability.
2. Solid bars indicate periods of heaviest adult immigration, spawning and juvenile emigration.

Table 1 (TR-1). Hatchery steelhead releases into the Mainstem and North Fork of the Clearwater River by brood years, 1982-1990. Coded wire tag codes displayed for brood years 1986-1990.

Brood Year	Brood-stock	Hatchery	Life Stage	Release Date (1)	Release Date (2)	Fish/lb	Number Released	Release Location	CWT
1982	Dworshak NFH B[a]	Dworshak NFH	smolt	1983			1,362,811	Dworshak NFH[b]	
1982	Dworshak NFH B[a]	Dworshak NFH	smolt	1983			35,177	N. Fk. Clearwater	
1983	Dworshak NFH B[a]	Dworshak NFH	adult	1983			150	Lolo Creek	
1983	Dworshak NFH B[a]	Dworshak NFH	adult	1983			152	Potlatch River	
1983	Dworshak NFH B[a]	Dworshak NFH	F-F”	1983			625,000	Eldorado Creek	
1983	Dworshak NFH B’	Dworshak NFH	smolt	1984			1,208,319	Dworshak NFH[b]	
1984	Dworshak NFH B[a]	Dworshak NFH	smolt	1985			1,035,573	Dworshak NFH[b]	
1985	Dworshak NFH B[a]	Dworshak NFH	adult	1985			303	Lawyers Creek	
1984	Dworshak NFH B[a]	Dworshak NFH	smolt	1985			121.284	Eldorado Creek	
1985	Dworshak NFH B[a]	Dworshak NFH	adult	1985			810	Potlatch River	
1985	Dworshak NFH B[a]	Dworshak NFH	adult	1985			383	E. Fk. Potlatch River	
1985	Dworshak NFH B[a]	Dworshak NFH	adult	1985			1,150	Eldorado Creek	
1985	Dworshak NFH B[a]	Dworshak NFH	smolt	1986			204,662	Eldorado Creek	
1985	Dworshak NFH B[a]	Dworshak NFH	smolt	1986			1,239,541	Dworshak NFH[b]	
1986	Dworshak NFH B[a]	Dworshak NFH	smolt	04/20/87	04/23/87	7.5	19,675	Dworshak NFH[b]	051836
1986	Dworshak NFH B[a]	Dworshak NFH	smolt	04/20/87	04/23/87	7.5	18,825	Dworshak NFH[b]	102931
1986	Dworshak NFH B[a]	Dworshak NFH	smolt	04/22/87	04/23/87	5.9	20.625	Dworshak NFH[b]	102932

Table 1 (cont.). Hatchery steelhead releases into the Mainstem and North Fork of the Clearwater River by brood years, 1982-1990. Coded wire tag dodes displayed for brood years 1986-1990.

Brood Year	Brood-stock	Hatchery	Life Stage	Release Date (1)	Release Date (2)	Fish/lb	Number Released	Release Location	CWT
1986	Dworshak NFH B'	Dworshak NFH	smolt	04/23/87		5.6	19,050	Dworshak NFH[b]	102933
1986	Dworshak NFH B[a]	Dworshak NFH	smolt	04/20/87	04/23/87	5.7	1,128,405	Dworshak NFH[b]	g g e d
1987	Dwroshak NFH B[a]	Dworshak NFH	F-F'	1987			114,800	Lolo Creek	
1987	Dworshak NFH B[a]	Dworshak NFH	adult	1987			506	Mainstem	
1987	Dworshak NFH B[a]	Dworshak NFH	adult	1987			644	N. Fk. Clearwater	
1987	Dworshak NFH B[a]	Dworshak NFH	smolt	04/27/88		5.5	200,425	Lolo Creek	
1987	Dworshak NFH B[a]	Dworshak NFH	smolt	04/27/88		6.7	200,806	Eldorado Creek	
1987	Dworshak NFH B[a]	Dworshak NFH	smolt	03/30/88	05/04/88	7.0	14.333	Dworshak NFH[b]	051846
1987	Dworshak NFH B[a]	Dworshak NFH	smolt	05/02/88	05/04/88	5 . 9	19,843	Dworshak NFH[b]	051852
1987	Dworshak NFH B[a]	Dworshak NFH	smolt	05/02/88	05/04/88	6.2	19,873	Dworshak NFH[b]	051851
1987	Dworshak NFH B[a]	Dworshak NFH	smolt	05/02/88	05/04/88	5.7	16.604	Dworshak NFH[b]	051849
1987	Dworshak NFH B[a]	Dworshak NFH	smolt	05/02/88	05/04/88	6 . 2	19,796	Dworshak NFH[b]	051850
1987	Dworshak NFH B[a]	Dworshak NFH	smolt	05/04/88		5.6	21,056	Dworshak NFH[b]	051854
1987	Dworshak NFH B[a]	Dworshak NFH	smolt	05/02/88	05/04/88	5 . 5	18,835	Dworshak NFH[b]	051853
1987	Dworshak NFH B[a]	Dworshak NFH	smolt	05/02/88	05/04/88	5 . 9	8,153	Dworshak NFH[b]	102928
1987	Dworshak NFH B[a]	Dworshak NFH	smolt	05/02/88	05/04/88	5 . 9	8,020	Dworshak NFH[b]	102929
1987	Dworshak NFH B[a]	Dworshak NFH	smolt	05/02/88	05/04/88	8 . 0	15,424	Dworshak NFH[b]	051713
1987	Dworshak NFH B[a]	Dworshak NFH	smolt	05/02/88	05/04/88	8 . 0	15,539	Dworshak NFH[b]	051712

Table 1 (cont.). Hatchery steelhead releases into the Mainstem and North Fork of the Clearwater River by brood years, 1982-1990. Coded wire tag codes display :d for brood ye ırs 1986- 1990.

Brood Year	Brood-stock	Hatchery	Life Stage	Release Date (1)	Release Date (2)	Fish/lb	Number Released	Release Location	CWT
1987	Dworshak NFH B[a]	Dworshak NFH	smolt	05/02/88	05/04/88	8.0	15,414	Dworshak NFH[b]	051711
1987	Dworshak NFH B'	Dworshak NFH	smolt	05/02/88	05/04/88	6.7	12,886	Dworshak NFH[b]	051739
1987	Dworshak NFH B[a]	Dworshak NFH	smolt	05/02/88	05/04/88	6.7	12,948	Dworshak NFH[b]	051714
1987	Dworshak NFH B[a]	Dworshak NFH	smolt	03/30/88	05/04/88	6.3	1,070,764	Dworshak NFH[b]	Untagged
1988	Dworshak NFH B[a]	Dworshak NFH	smolt	05/01/89	05/03/89	4.9	109,480	Eldorado Creek	
1988	Dworshak NFH B[a]	Dworshak NFH	smolt	05/03/89		5.7	18.869	Dworshak NFH[b]	051947
1988	Dworshak NFH B[a]	Dworshak NFH	smolt	05/03/89		5.5	17,789	Dworshak NFH[b]	051838
1988	Dworshak NFH B[a]	Dworshak NFH	smolt	05/03/89		5.5	16,912	Dworshak NFH[b]	051837
1988	Dworshak NFH B[a]	Dworshak NFH	smolt	05/01/89		5.1	20.339	Dworshak NFH[b]	051945
1988	Dworshak NFH B[a]	Dworshak NFH	smolt	05/01/89		5.2	19,894	Dworshak NFH[b]	051946
1988	Dworshak NFH B[a]	Dworshak NFH	smolt	05/04/89		4.9	20,497	Dworshak NFH[b]	052043
1988	Dworshak NFH B[a]	Dworshak NFH	smolt	05/04/89		5.6	20.782	Dworshak NFH[b]	052042
1988	Dworshak NFH B[a]	Dworshak NFH	smolt	05/04/89		5.0	20,603	Dworshak NFH[b]	052041
1988	Dworshak NFH B[a]	Dworshak NFH	smolt	05/01/89	05/04/89	4.8	918,215	Dworshak NFH[b]	Untagged
1989	Dworshak NFH B[a]	Kooskia NFH	F-F	06/01/89	06/02/89	125	117.332	Eldorado Creek	
1989	Dworshak NFH B[a]	Kooskia NFH	F-F	06/02/89		125	58,666	Lolo Creek	
1989	Dworshak NFH B[a]	Dworshak NFH	F-F	06/07/89		87	65,354	Eldorado Creek	
1989	Dworshak NFH B[a]	Dworshak NFH	F-F	06/07/89		136	35,443	Lolo Creek	

Table 1 (cont.). Hatchery steelhead releases into the Mainstem and North Fork of the Clearwater River by brood years, 1982-1990. Coded wire tag codes display ·d for brood years 1986-19)0.

Brood Year	Brood-stock	Hatchery	Life Stage	Release Date (1)	Release Date (2)	Fish/lb	Number Released	Release Location	CWT
1989	Dworshak NFH B[a]	Dworshak NFH	smolt	04/25/90		6.7	199,700	Eldorado Creek	
1989	Dworshak NFH B[a]	Dworshak NFH	smolt	05/04/90		5.7	21,290	Dworshak NFH[b]	052047
1989	Dworshak NFH B[a]	Dworshak NFH	smolt	05/04/90		5.8	21,387	Dworshak NFH[b]	052049
1989	Dworshak NFH B[a]	Dworshak NFH	smolt	05/04/90		6.1	20.888	Dworshak NFH[b]	052048
1989	Dworshak NFH B[a]	Dworshak NFH	smolt	05/03/90	05/04/90	5.7	20,016	Dworshak NFH[b]	052044
1989	Dworshak NFH B[a]	Dworshak NFH	smolt	05/03/90	05/04/90	7.2	19,797	Dworshak NFH[b]	052045
1989	Dworshak NFH B[a]	Dworshak NFH	smolt	05/03/90	05/04/90	7.7	20.279	Dworshak NFH[b]	052046
1989	Dworshak NFH B[a]	Dworshak NFH	smolt	05/03/90	05/04/90	6.4	1,043,007	Dworshak NFH[b]	Untagged
1990	Dworshak NFH B[a]	Dworshak NFH	smolt	04/15/91	04/24/91	6.3	201,847	Eldorado Creek	
1990	Dworshak NFH B[a]	Dworshak NFH	smolt	05/01/91	05/04/91	7.3	19.773	Dworshak NFH[b]	052424
1990	Dworshak NFH B[a]	Dworshak NFH	smolt	05/01/91	05/04/91	6.1	20,320	Dworshak NFH[b]	052425
1990	Dworshak NFH B[a]	Dworshak NFH	smolt	05/01/91	05/04/91	6.6	19,858	Dworshak NFH[b]	052426
1990	Dworshak NFH B[a]	Dworshak NFH	smolt	05/01/91	05/04/91	5.3	19,515	Dworshak NFH[b]	052427
1990	Dworshak NFH B[a]	Dworshak NFH	smolt	05/01/91	05/04/91	5.5	20,293	Dworshak NFH[b]	052430
1990	Dworshak NFH B[a]	Dworshak NFH	smolt	05/01/91	05/04/91	5.2	20,547	Dworshak NFH[b]	052428
1990	Dworshak NFH B[a]	Dworshak NFH	smolt	05/01/91	05/04/91	5.6	20,499	Dworshak NFH[b]	052429

Table 1 (cont.). Hatchery steelhead releases into the Mainstem and North Fork of the Clearwater River by brood years, 1982-1990. Coded wire tag codes displayed for brood years 1986-1990.

Brood Year	Brood-stock	Hatchery	Life Stage	Release Date (1)	Release Date (2)	Fish/lb	Number Released	Release Location	CWT
1990	Dworshak NFH B	Dworshak NFH	smolt	04/29/91	05/04/91	5.8	1,771,698	Dworshak NFH[b]	Untagged

[a]Dworshak NFH B stock represents a Dworshak-Kooskia complex of broodstock collection. The majority of broodstock is collected at Dworshak NFH.

[b]Dworshak National Fish Hatchery (NFH) as a release location refers to the hatchery site located at the confluence of the North Fork and mainstem Clearwater River.

[c] F-F designates a fry or fingerling release.

Table 2 (TR-2). Hatchery steelhead releases into the Middle Fork Clear-water River by brood years, 1982-1990. Coded wire tag codes displayed for brood years 1986 and 1988. No coded wire tags released during brood years 1987, 1989-1990.

Brood Year	Brood-stock	Hatchery	Life Stage	Release Date (1)	Release Date (2)	Fish/lb	Number Released	Release Location	CWT
1982	Dworshak NFH B[a]	Dworshak NFH	smolt	1983			250,428	Clear Creek[b]	
1983	Dworshak NFH B[a]	Dworshak NFH	smolt	1984			246,123	Clear Creek[b]	
1984	Dworshak NFH B[a]	Dworshak NFH	smolt	1985			145,206	Clear Creek[b]	
1985	Dworshak NFH B[a]	Dworshak NFH	smolt	1986			165,483	Clear Creek[b]	
1986	Dworshak NFH B[a]	Dworshak NFH	smolt	04/17/87	04/16/87	6.1	21,025	Clear Creek[b]	051834
1986	Dworshak NFH B[a]	Dworshak NFH	smolt	04/16/87		6.6	19,425	Clear Creek[b]	051835
1986	Dworshak NFH B[a]	Dworshak NFH	smolt	04/17/87	04/16/87	6.3	116,102	Clear Creek[b]	Untagged
1987	Dworshak NFH B[a]	Dworshak NFH	smolt	04/22/88		5.7	254,898	Clear Creek[b]	
1988	Dworshak NFH B[a]	Hagerman NFH	smolt	05/08/89		5.0	15,294	Clear Creek[b]	104135
1988	Dworshak NFH B[a]	Hagerman NFH	smolt	05/08/89		5.0	15,482	Clear Creek[b]	104136
1988	Dworshak NFH B[a]	Hagerman NFH	smolt	05/08/89		5.0	14,375	Clear Creek[b]	104137
1988	Dworshak NFH B[a]	Hagerman NFH	smolt	05/08/89		4.9	3.996	Clear Creek[b]	Untagged
1988	Dworshak NFH B[a]	Dworshak NFH	smolt	04/24/89	04/25/89	4.8	208,201	Clear Creek[b]	
1989	Dworshak NFH B[a]	Dworshak NFH	smolt	04/25/90		7.0	374,040	Clear Creek[b]	
1990	Dworshak NFH B[a]	Dworshak NFH	smolt	04/15/91	04/24/91	6.5	369,190	Clear Creek[b]	

"Dworshak NFH B stock represents a Dworshak-Kooskia complex of broodstock collection. The majority of broodstock is collected at Dworshak NFH.

[b]Clear Creek release location is at the Kooskia NFH site.

Table 3 (TS-a). Survival summary of steelhead trout at Dworshak National Fish Hatchery (Olsen et al. 1991).

Brood year	Percent surviving from previous stage: Eyed-egg	Tanked fry	Ponded fingerling	Released smolt	Cumulative survival
1988	88.7	94.2	29.5	79.2	19.5
1989	86.7	97.9	21.9	92.3	17.2
1990	84.1	97.0	71.1	89.1	51.7
1991	80.3	87.5	55.9	NR[1]	NR
Average	85.0	94.2	44.6	86.9	29.5

[1] NR = data not reported yet.

Table 4 (TS-b). Percent survival of hatchery steelhead from fingerlings to smolt release at Dworshak National Fish Hatchery (NFH), segregated by early-rearing station[a].

Brood year	Dworshak NFH	Kooskia NFH	Hagerman NFH
1989	20.2	88.6	102.4
1990	66.7	87.3	98.0

[a] Early rearing station raises eyed eggs to fingerling stage.

Sources: Olson 1990, 1991.

Table 5 (TS-c). Percentages of smolts released from Dworshak National Fish Hatchery into the N. Fork of the Clearwater, brood years 1980 through 1986.

Brood year	Year released	Smolts released	Total brood year return[a]	Percent of brood year return
1982	1983	1,397,988	3,622	0.470
1983	1984	1,208,309	5,688	0.471
1984	1985	1,035,573	4,069	0.393
1985	1986	1,239,541	5,679	0.180
1986	1987	1,206,580	10,643	0.882

[a] Hatchery adult trap count was sample method. Brood year return does not include harvest. Adult returns based on length frequency criteria cited in Table 12.

Sources: Howell et al. 1985.
Miller et al. 1987.
R. Roseberg, USFWS, unpublished.
S. Kiefer, IDFG, unpublished.

Table 6 (RR-a). Coded wire tag recoveries for steelhead tag groups released in 1978 and 1987" into Clear Creek in the Middle Fork Clearwater drainage from Dworshak National Fish Hatchery.

Tag code and purpose[b]	Release date	Recoveries	Number tagged and size	Dworshak rack	Zone 6 fishery (expanded)	Idaho sport (unexpanded)	Other"	Total
101315	4/25/78		60,575 (9.1/lb.)					
		No. CUT recovered		6	a9	0	187	282
		% total CUT recovered		2.1%	31.6%	0.0%	66.3%	
100.0%								
		% of total tagged		0.01%	0.15%	0.00%	0.31%	0.47%
51834	4/17/87		21,027 (6.1/lb.)					
		No. CUT recovered		37	70	0	0	107
		% total CUT recovered		34.6%	65.4%	0.0%	0.0%	
100.0%								
		% of total tagged		0.18%	0.33%	0.00%	0.00%	0.51%
51835	4/16/87		19,422 (6.6/lb.)					
		No. CWT recovered		6	49	0	2	57
		% total CUT recovered		10.5%	86.0%	0.0%	3.5%	
100.0%								
		% of total tagged		0.03%	0.25%	0.00%	0.01%	0.29%

[a] Zone 6 (expanded) = Columbia River Net Fishery (expanded) for 1987.
[b] For futher details on purpose, see referenced publication.
[c] Other includes ocean, other racks, and non-Idaho racks.

Source: Roseberg et al. 1992.

Table 7 (RB-b). Coded wire tag recoveries for steelhead tag groups released 1977-1984 and 1986" into the mainstem and N. Fork of the Clearwater from Dworshak National Fish Hatchery.

Tag code and purpose[b]	Release date	Recoveries	Number tagged and size	Dworshak rack	Zone 6 fishery (expanded)	Idaho sport (unexpanded)	Other'	Total
101310	4/15/77		57,246 (5.0/lb.)					
(Age II)		No. CUT recovered		132	43	1	3	179
		% total CWT recovered		73.7%	24.0%	0.6%	0.18%	100.0%
		% of total tagged		0.23%	0.08%	0.00%	0.00%	0.31%
101311	4/20/77		40,206 (7.6/lb.)					
(Age I,		No. CUT recovered		47	16	0	0	63
Homing Ctrl.)		% total CWT recovered		74.6%	25.4%	0.0%	0.0%	100.0%
		% of total tagged		0.12%	0.04%	0.00%	0.00%	0.16%
101313	4/21/77		31,112 (9.0/lb.)					
(Transport		No. CUT recovered		37	3	0	0	40
Ctrl.)		% total CUT recovered		92.5%	7.5%	0.0%	0.0%	100.0%
		% of total tagged		0.12%	0.01%	0.00%	0.00%	0.13%
100231	4/21/78		100,600 (7.0/lb.)					
(Ctrl.)		No. CUT recovered		292	114	0	1	407
		% total CUT recovered		71.7%	28.0%	0.0%	0.2%	100.0%
		% of total tagged		0.29%	0.11%	0.00%	0.00%	0.40%
100533	5/23/79		30,098 (12.0/lb.)					
(Age I,		No. CUT recovered		19	4	1	0	24
Vol. Mig.		% total CUT recovered		79.2%	16.7%	4.2%	0.0%	100.0%
Ctrl.)		% of total tagged		0.06%	0.01%	0.01%	0.00%	0.08%

Table 7 (cont.). Coded wire tag recoveries for steelhead tag groups released 1977-1984 and 1986" into the mainstem and N. Fork of the Clearwater from Dworshak National Fish Hatchery.

Tag code and purpose[b]	Release date	Recoveries	Number tagged and size	Dworshak rack	Zone 6 fishery (expanded)	Idaho sport (unexpanded)	Other[c]	Total
050425	4106179		42,600 (7.7/lb.)					
(Age II -		No. CUT recovered		194	62	3	3	262
Hat. Rel.)		% total CUT recovered		74.0%	23.7%	1.1%	1.2%	100.0%
		% of total tagged		0.46%	0.15%	0.00%	0.00%	0.61%
050455	4/17/80		59,175 (7.6/lb.)					
(Sys.II,		No. CUT recovered		153	108	37	4	302
Age I)		% total CUT recovered		50.7%	35.8%	12.3%	1.3%	100.0%
		% of total tagged		0.26%	0.18%	0.06%	0.01%	0.51%
102119	5/02/80		40,000 (6.1/lb.)					
(Vol. Mig.)		No. CWT recovered		71	386	8	2	467
		% total CWT recovered		15.2%	82.7%	1.7%	0.4%	100.0%
		% of total tagged		0.18%	0.97%	0.02%	0.00%	1.17%
102161	4/25/80		49,200 (8.7/lb.)					
(Sys. III,		No. CUT recovered		165	55	33	1	254
Age I)		% total CWT recovered		65.0%	21.7%	13.0%	0.4%	100.0%
		% of total tagged		0.34%	0.11%	0.07%	0.00%	0.52%
102162	4/17/80		46,925 (6.5/lb.)					
(Sys. I,		No. CWT recovered		90	42	10	1	143
Age II)		% total CWT recovered		62.9%	29.4%	7.0%	0.7%	100.0%
		% of total tagged		0.19%	0.09%	0.02%	0.00%	0.30%
102251	5/04/81		38,200 (9.0/lb.)					
(Sys. I,		No. CUT recovered		4	3	3	0	10
Age II)		% total CUT recovered		40.0%	30.0%	30.0%	0.0%	100.0%
		% of total tagged		0.01%	0.01%	0.01%	0.00%	0.03%

Table 7 (cont.). Coded wire tag recoveries for steelhead tag groups released 1977-1984 and 1986" into the mainstem and N. Fork of the Clearwater from Dworshak National Fish Hatchery.

Tag code and purpose[b]	Release date	Recoveries	Number tagged and size	Dworshak rack	Zone 6 fishery (expanded)	Idaho sport (unexpanded)	Other'	Total
102252	5/04/81		39,300 (8.6/lb.)					
(Sys. II,		No. CWT recovered		34	29	3	5	71
Age I)		% total CUT recovered		47.9%	40.8%	4.2%	7.0%	100.0%
		% of total tagged		0.09%	0.07%	0.01%	0.01%	0.18%
102253	5/04/81		41,300 (9.2/lb.)					
(Sys. III,		No. CWT recovered		48	34	10	3	95
Age I)		% total CUT recovered		50.5%	35.8%	10.5%	3.2%	100.0%
		% of total tagged		0.12%	0.08%	0.02%	0.01%	0.23%
051024	5103182		41,400 (6.9/lb.)					
(Sys. I,		No. CUT recovered		187	287	24	27	525
Age II)		% total CUT recovered		35.6%	54.7%	4.6%	5.2%	100.0%
		% of total tagged		0.45%	0.69%	0.06%	0.07%	1.27%
051025	5103182		42,500 (7.4/lb.)					
(Sys. III,		No. CWT recovered		431	848	70	28	1377
Age I)		% total CUT recovered		31.3%	61.6%	5.1%	2.1%	100.0%
		% of total tagged		1.01%	2.00%	0.17%	0.06%	3.24%
051027	5/03/82		39,225 (5.3/lb.)					
(Sys. II,		No. CWT recovered		374	717	78	44	1213
Age I)		% total CUT recovered		30.8%	59.1%	6.4%	3.7%	100.0%
		% of total tagged		0.95%	1.83%	0.20%	0.11%	3.09%

Table 7 (cont.). Coded wire tag recoveries for steelhead tag groups released 1977-1984 and 1986" into the mainstem and N. Fork of the Clearwater from Dworshak National Fish Hatchery.

Tag code and purpose[b]	Release date	Recoveries	Number tagged and size	Dworshak rack	Zone 6 fishery (expanded)	Idaho sport (unexpanded)	Other'	Total
051349	5118183		24,575 (5.8/lb.)					
(I-salt		No. CUT recovered		15	32	4	1	52
parents)		% total CUT recovered		28.8%	61.5	7.7%	1.9%	100.0%
		% of total tagged		0.06%	0.13%	0.02%	0.00%	0.21%
051350	5/18/83		30,009 (5.4/lb.)					
(II-salt		No. CWT recovered		36	72	7	0	115
parents)		% total CUT recovered		31.3%	62.6%	6.1%	0.0%	100.0%
		% of total tagged		0.12%	0.24%	0.02%	0.00%	0.38%
051351	5/18/83		29,822 (5.6/lb.)					
(III-salt		No. CUT recovered		26	30	4	0	60
parents)		% total CUT recovered		43.3%	50.0%	6.7%	0.0%	100.0%
		% of total tagged		0.09%	0.10%	0.01%	0.00%	0.20%
051352	5119183		32,545 (6.5/lb.)					
(Ctrl.)		No. CUT recovered		18	23	5	3	49
		% total CUT recovered		36.7%	46.9%	10.2%	6.1%	100.0%
		% of total tagged		0.05%	0.07%	0.02%	0.01%	0.15%
102516	5/04/84		40,325 (6.8/lb.)					
(Early-		No. CUT recovered		175	121	21	14	331
spawned		% total CWT recovered		52.9%	36.6%	6.3%	4.2%	100.0%
progeny)		% of total tagged		0.43%	0.30%	0.05%	0.04%	0.82%

Table 7 (cont.). Coded wire tag recoveries for steelhead tag groups released 1977-1984 and 1986" into the mainstem and N. Fork of the Clearwater from Dworshak National Fish Hatchery.

Tag code and purpose[b]	Release date	Recoveries	Number tagged and size	Oworshak rack	Zone 6 fishery (expanded)	Idaho sport (unexpanded)	Other[c]	Total
102517	5/04/84		37,325 (5.8/lb.)					
(Mid-season		No. CWT recovered		288	164	28	0	480
spawned		% total CUT recovered		60.0%	34.2%	5.8%	0.0%	100.0%
progeny)		% of total tagged		0.77%	0.44%	0.08%	0.00%	1.29%
051335	5/04/84		39,525 (6.3/lb.)					
(Late-		No. CWT recovered		147	57	14	13	231
spawned		% total CWT recovered		63.6%	24.7%	6.1%	5.6%	100.0%
progeny)		% of total tagged		0.37%	0.14%	0.04%	0.03%	0.58%
051753	4/25/86		24,275 (7.7/lb.)					
(Sys. I,		No. CWT recovered		39	40	0	0	79
no reuse)		% total CWT recovered		49.4%	50.6%	0.0%	0.0%	100.0%
		% of total tagged		0.16%	0.16%	0.00%	0.00%	0.32%
102856	4/28/86		23,350 (5.4/lb.)					
(Sys. II,		No. CUT recovered		71	191	0	0	262
IHN		% total CUT recovered		27.1%	72.9%	0.0%	0.0%	100.0%
survivors)		% of total tagged		0.26%	0.69%	0.00%	0.00%	0.95%
051754	4/30/86		24,000 (5.5/lb.)					
(Sys. III,		No. CWT recovered		85	135	0	0	220
normal		% total CUT recovered		38.6%	61.4%	0.0%	0.0%	100.0%
reuse)		% of total tagged		0.35%	0.55%	0.00%	0.00%	0.90%

[a] Zone 6 (expanded) = Columbia River Net Fishery (expanded) for 1986.
[b] For further details on purpose, see referenced publication.
[c] Other includes ocean, other racks, and non-Idaho racks.
Source: Roseberg et al. 1992.

Table 8 (TS-d). Prespawning mortality for hatchery steelhead ponded at Dworshak National Fish Hatchery 1977-1987 (Nez Perce Tribe and Idaho Department of Fish and Game 1990).

Year	Number of steelhead ponded	Prespawning mortality	Percent prespawning mortality
1977	2,987	108	3.6
1978	6,396	868	13.6
1979	4,079	96	2.3
1980	2,519	140	5.5
1981	1,968	189	9.6
1982	3,054	250	8.2
1983	6,228	451	7.2
1984	3,284	63	1.9
1985	6,372	358	5.6
1986	3,947	154	3.9
1987	3,332	NR[a]	inc.[b]

[a] NR= not reported.
[b] Inc.. = incomplete information.

Table 9 (RS-a). Number of steelhead harvested by sport anglers from the fall of 1980 to the spring of 1991, from the lower Clearwater section, including the North and Middle Forks.

	Stream section			
Years	Clearwater River[a]	Middle Fork Clearwater[b]	N. Fork Clearwater[c]	Totals
1980 - 1981	3,679	cs[d]	256	3,935
1981 - 1982	385	cs	144	529
1982 - 1983	10,620	cs	1,201	11,821
1983 - 1984	6,852	cs	414	7,266
1984 - 1985	19,257	25	2,216	21,498
1985 - 1986	8,950	0	920	9,870
1986 - 1987	10,583	590	3,931	15,104
1987 - 1988	7,301	83	1,150	8,534
1988 - 1989	8,739	368	1,771	10,878
1989 - 1990	22,467	205	4,975	27,647
1990 - 1991	10,975	282	1,405	12,662

[a] Clear-water River from the Memorial Bridge at US Hwy. 12 at Lewistown upstream to the mouth of the Middle Fork Clear-water.
[b] Mouth of the Middle Fork upstream to a posted line 150 yards downstream of the mouth of Clear Creek.
[c] Mouth of the North Fork upstream to Dworshak Dam.
[d] cs = closed season.

Source: McArthur 1991.

Table 10 (AT-a). Timing of the steelhead ladder operation at Dworshak National Fish Hatchery, 1985-1991.

Return Year	Timing of ladder operation	
	Fall	Spring
1987	01/05	05/12
1988	01/04	05/10
1989”	10/11-12/2; 02/02-05/02	
1990”	10/11-10/27; 02/13-05/08	
1991”	10/23-11/28; 02/06-05/06	

[a] Intermittent periods of trap closure.

Sources: Olson 1988a, 1988b, 1989, 1990, 1991.

Table 11 (RH-a). Annual return of hatchery steelhead to Dworshak and Kooskia National Fish Hatcheries for run years 1980-81 through 1990-91.

Run year	Dworshak NFH	Kooskia NFH	Total
1980-81	1,968	638	2,606
1981-82	3,054	58	3,112
1982-83	7,672	38	7,710
1983-84	3,284	80	3,364
1984-85	14,018	964	14,982
1985-86	4,462	373	4,835
1986-87	5,286	145	5,431
1987-88	3,774	142	3,916
1988-89	6,041	NR[a]	inc.[b]
1989-90	10,613	22”	10,635
1990-91	7,865	40[d]	7,905

[a] NR = not reported.
[b] Inc. = incomplete information.
[c] Twenty two fish inventoried but 10 escaped. The remaining 11 were outplanted.
[d] Fish were released into the Middle Fork Clear-water.

Sources: Nez Perce Tribe and IDFG 1990.
Olson 1988a, 1988b, 1989, 1990, 1991.

Table 12 (RH). Return of adult steelhead to Dworshak NFH, brood years 1982-1988".

		Total Age		
Brood Year	N	2	3	4
1982	3,622	120	3,359	143[b]
1983	5,688	700	4,869[b]	119
1984	4,069	274[b]	3,478	317
1985	5,679	168	5,296	215
1986	10,643	428	9,901	314
1987	inc.[d]	487	7,333	inc.
1988	inc.	218	inc.	inc.

[a] Adult ladder collection was sample method. Returning fish are a combination of hatchery and naturally produced steelhead. Hatchery fish have l-year freshwater rearing. Total age delineated by total length criteria as follows:

Prior to 1988-89 run year:

Age 2 male = <76 cm total length (TL)
Age 3 male = >75 and <96 cm TL
Age 4 male = >95 cm TL
Age 2 female = <71 cm TL
Age 3 female = >70 and <94 cm TL
Age 4 female = >93 cm TL

1988-89 run year to present:

Age 2 male = <73 cm fork length (FL)
Age 3 male = >72 and <93 cm FL
Age 4 male = >92 cm FL
Age 2 female = <68 cm FL
Age 3 female = >67 and <91 cm FL
Age 4 female = >90 cm FL

[b] Does not include Lyons Ferry strays that returned in 1987 (19 age 2, 110 age 3). Also, ladder was operated intermittantly during spring, 1987.
[c] Does not include Lyons Ferry strays that returned in 1988 (7 age 2, 3 age 3).
[d] Inc. = incomplete brood year information.

Source: R. Roseberg, USFWS, pet-s. comm.

Table 13 (AL-a). Dworshak National Fish Hatchery steelhead total lengths for 1982-1988[a] and fork lengths for 1989-1990.

Length cm.	1982 No. fish	1983 No. fish	1984 No. fish	1985 No. fish	1986 No. fish	1987 No. fish	1988 No. fish	1989 No. fish	1990 No. fish	1991 No. fish
53										
54									2	1
55									[b]	I
56			1	4	1				2	2
57								1		5
58	5	1	2		1	6		3	I	7
59						5	1	2	5	7
60						8	4	2	I3	30
61	30	3	2	1	12	12	3	6	17	15
62						17	1	12	33	22
63	94	14	38	d	43	I3	3	21	52	25
64						29	5	23	52	33
65						35	9	45	74	15
66	205	15	136	17	143	35	14	54	71	15
67						35	17	48	62	15
68						33	16	57	48	12
69	208	24	286	20	265	14	18	30	38	14
70						21	26	51	30	9
71	143	I4	300	9	182	15	14	29	27	14
72						12	24	28	18	33
73						11	13	14	49	33
74	87	31	196	16	91	II	26	24	109	68
75						13	26	37	148	104
76	108	139	99	73	117	20	34	39	253	141
77						41	59	78	459	240
78						53	a4	83	661	338
79	184	408	78	238	324	83	128	166	873	454
80						154	215	262	1022	604
81	507	780	204	612	628	217	230	293	1188	691
82						322	353	397	1190	792
83						427	321	391	973	641
84	885	1300	312	1140	796	469	372	489	880	653
85						484	313	433	645	570
86	940	1392	270	1342	686	496	292	447	544	504
87						493	238	428	464	516
88						424	209	383	294	210
89	953	979	199	1220	464	321	146	325	238	222
90						293	146	331	177	227
91	710	716	227	750	309	200	89	209	143	152
92						179	68	195	88	107
93						129	60	124	61	a4
94	469	451	189	514	190	118	42	148	22	54
95						38	25	64	16	28
96	300	226	146	311	96	50	36	73	19	19
97						31	19	54	13	28
98						28	10	45	10	8
99	182	73	151	164	57	6	12	31	15	12
100						7	7	25	II	7
101						3	6	5	1	4
102	38	23	44	34	33	3	5	6	5	4
103							4	5	1	1
104	17	6	30	10	20		II	7	1	
>104	12	3	14	2	6	1	3	8	1	

[a] Total lengths were converted from inches to centimeters 1982-1986. Year is spring of run year.
[b] Blanks indicate no fish of this size were collected and measured.

Sources: R. Rosenberg, USFUS, unpublished.

Table 14 (AC). Percentage age composition of hatchery steelhead returning to Dworshak NFH, brood years 1982-1988.

		Age Composition (%)		
Brood year	N	1.1	1.2	1.3
1982	3,622	3	93	4
1983	5,688	12	86	2
1984	4,069	7	85	8
1985	5,679	3	93	4
1986	10,643	4	93	3
1987	inc.	inc.	inc.	inc.
1988	inc.	inc.	inc.	inc.

[a] Adult ladder collection was sample method. Returning fish are a combination of hatchery and naturally produced steelhead. In this nomenclature, the freshwater and ocean ages sum to the total age of the fish. Ocean age delineated by total length criteria as follows:

Prior to 1988-89 run year:

1-ocean male = <76 cm total length (TL)
2-ocean male = >75 and <96 cm TL
3-ocean male = >95 cm TL
1-ocean female = <71 cm TL
2-ocean female = >70 and <94 cm TL
3-ocean female = >93 cm TL

1988-89 run year to present:

1-ocean male = <73 cm fork length (FL)
2-ocean male = >72 and <93 cm FL
3-ocean male = >92 cm FL
1-ocean female = <68 cm FL
2-ocean female = >67 and <91 cm FL
3-ocean female = >90 cm FL

Source: R. Roseberg, USFWS, pers. comm.

Table 15 (AS-a). Females by brood year' and age class (freshwater.ocean) as a percentage of the entire brood return (N) of steelhead returning to Dworshak National Fish Hatchery.

Females (%)

Brood Year	N	1.1	1.2	1.3	Total % Female
1983	5,688	2.1	64.2	0.8	67.1
1984	4,069	0.7	67.8	3.0	71.5
1985	5,679	0.3	71.3	1.3	72.9
1986	10,643	0.9	67.0	1.1	69.0

[a] Adult ladder collection was sample method. Returning fish are a combination of hatchery and naturally produced steelhead. In this nomenclature, the freshwater and ocean ages sum to the total age of the fish. Ocean age delineated by total length criteria as follows:

Prior to 1988-89 run year:

l-ocean male = <76 cm total length (TL)
2-ocean male = >75 and <96 cm TL
3-ocean male = >95 cm TL
l-ocean female = <71 cm TL
2-ocean female = >70 and <94 cm TL
3-ocean female = >93 cm TL

1988-89 run year to present:

l-ocean male = <73 cm fork length (FL)
2-ocean male = >72 and <93 cm FL
3-ocean male = >92 cm FL
l-ocean female = <68 cm FL
2-ocean female = >67 and <91 cm FL
3-ocean female = >90 cm FL

Source: R. Roseberg, USFWS , pers. comm.

Table 16 (AR-a). Mean fecundity of steelhead returning to the Dworshak/Kooskia complex, 1985-1991.

Return year	Number of[a] females spawned	Number of green eggs	Mean fecundity
1985	1,256	7,536,000	6,000
1986	1,068	7,533,369	7,054
1987	1,324	8,465,986	6,394
1988	1,454	9,830,648	6,761
1989	1,821	12,331,081	6,772
1990	1,632	11,278,564	6,911
1991	1,549	11,000,296	7,115

[a] Combination of Dworshak and Kooskia adult females.

Sources: Olson 1986, 1988a, 1988b, 1989, 1990, 1991.
Miller 1988.
Miller et al. 1987

Table 17 (ST-a). Steelhead trout smolt travel time and migration rate from the head of Lower Granite Reservoir to Lower Granite Dam using fish passing the Clearwater River trap from Dworshak NFH releases, 1985-1990.

Year	Median passage date, Clearwater trap	Median arrival at LGD	Migration rate (km/day)	Mean Q(kcfs) at LGD
1985	4/29	5/4	12.3	83
1986	5/8	5/17	6.8	99
1987	4/22	5/1	6.8	63
1988	5/3[b]	5/11	7.7	72
	5/3	5/9	10.3	73
	5/3	5/10	8.8	78
1989	5/2	5/7	12.3	93
1990	5/4	5/10	8.8	74
	5/4	5/11	7.7	75
	5/5	5/12	7.7	78

[a] Clear-water River trap is located approximately 10 km upstream from the convergence of Clearwater and Snake River arms of Lower Granite Reservoir.
[b] Combined groups.

Sources: Buettner and Nelson 1991.

Table 18 (TD). Parasites and diseases of steelhead at the Dworshak/Kooskia complex, 1985- 1991".

Disease Type	Hatchery	Infection
bacteria	Dworshak	*Mvxobacteria*
virus	Dworshak	Infectious Hematopoietic Necrosis (IHNV)
protozoa	Dworshak	*Ichthyophthirius spp.* ("ICH")
bacteria	Dworshak	Enteric Redmouth Disease (ERM)
protozoa	Dworshak	*Myxobolus cerebalis (Whirling* Disease)
ectoparasite	Dworshak	*Costia spp.*
bacteria	Dworshak	Bacterial Gill Disease (BGD)
bacteria	Dworshak	*Flavobacteria*

[a] Disease history only represents pathogens isolated at the hatchery and not necessarily a disease outbreak.

Sources: Olson 1986, 1988a, 1988b, 1989, 1990, 1991.
Miller 1988.
Miller et al. 1987.

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SOUTH FORK CLEARWATER RIVER, CLEARWATER SUBBASIN

Naturally Produced Spring Chinook

GEOGRAPHIC LOCATION

The South Fork Clearwater River (South Fork) joins the Middle Fork Clearwater River to form the mainstem Clearwater River at Kooskia, 75 miles upstream from its mouth (Figure 1). The South Fork is 62.5 miles in length. Eleven miles of the mainstem South Fork are included in the Nez Perce Indian Reservation. There are rearing ponds for spring chinook salmon located at Crooked and Red rivers. Crooked River converges with the South Fork at river mile 58.5 and is 17 miles in length. Red River converges with the South Fork at river mile 62.5 and is 18 miles in length (Mallet 1974).

The South Fork drainage is primarily of basalt origin in the lower reaches and granitic origin in the middle to upper headwater areas. Much of the drainage has been affected by land use activities. Historically gold dredge and placer mining were the major land uses. The riparian vegetation has been extensively modified along the lower 30 miles of the mainstem and the lower tributaries (Nez Perce Tribe and Idaho Department of Fish and Game 1990). The headwaters of Johns and Tenmile creeks, and the mainstem South Fork are protected as part of the Gospel-Hump Wilderness.

ORIGIN

A diversion dam for hydroelectric power was built across the South Fork Cleat-water River at river mile 20 in 1910. This dam, near Harpster, blocked all upstream fish migration. Prior to construction of the dam, chinook were likely indigenous throughout the South Fork drainage. Beginning in 1935, a wooden fishway provided some fish passage. However, by this time, chinook were no longer in the Clearwater River because they had been blocked by Lewiston Dam near the mouth of the Clearwater River (Mallet 1974).

Lewiston Dam was constructed in 1927. Inadequate adult fish passage at the dam's one fishway virtually eliminated salmon runs into the basin. In 1939, two additional fishways were constructed and in the mid-1960's, improvements were made. In 1963, the Harpster Dam was removed. Then in 1973, Lewiston Dam was removed (Nez Perce Tribe and Idaho Department of Fish and Game 1990).

Efforts by Idaho Department of Fish and Game (IDFG) to reintroduce chinook salmon to the Clearwater drainage began in the 1950's and the program accelerated in the 1960's. Reintroduction of spring chinook into the South Fork drainage essentially began in 1970. Initially, eyed eggs were planted in incubation channels located in Red and Crooked rivers. A total of 14.4 million eggs were placed in the incubation channels during 1970-1978 (Lindland and Bowler 1988). In addition, from 1971-1987, about 2 million fry-fmgerlings, 1.4 million smolts, and 2,554 adults were stocked into the South Fork drainage (Nez Perce Tribe and Idaho Department of Fish and Game 1990). This includes releases from the Red River rearing pond, constructed in 1976 to rear spring chinook. Broodstock for the hatchery releases came primarily from Rapid River Fish Hatchery, but broodstock from Carson, Cowlitz, Dworshak, and Kooskia National Fish Hatcheries was also utilized. The Crooked River rearing pond was constructed in 1989. There is also an adult weir and trap at each tributary. These facilities are associated with Clearwater Anadromous Fish Hatchery.

Over the course of the early reintroduction program, there was little evaluation of the different outplants or measurement of production of indigenous fish. Information could not be recorded

separately because hatchery chinook were not differentially marked. Beginning in 1990, only spring chinook adults and jacks will be released into Crooked River in order to evaluate egg-to-parr survival at different densities (Kiefer and Forster 1992).

The 1991 brood year was the first year that all hatchery chinook smolts and presmolts were marked with an adipose fm-clip and coded wire tag (CWT) in order to differentiate them from naturally produced fish. Because of the mixed brood stock history and influence of hatchery fish, the IDFG classifies chinook in the South Fork drainage as natural (Idaho Department of Fish and Game 1992).

DISTRIBUTION

Available spawning and rearing habitat for the South Fork was described in the Presence/Absence database (Tables 1 and 2). This information was developed for the Northwest Power Planning Council for subbasin planning and modeling.

PRODUCTION

Detailed production and survival information is available for Crooked River because the IDFG is conducting intensive smolt monitoring in this drainage. Kiefer and Forster (1991, 1992) estimated egg-to-parr survival to be 15 percent for brood year 1989 spring chinook in Crooked River.

Beginning in 1988, spring chinook were tagged with passive integrated transponder (PIT) tags in Red and Crooked rivers. The majority of the parr tagged in Crooked River and Red River in 1988-1989 were Dworshak fry outplants, and were not naturally produced. PIT tag detections at Snake and Columbia River dams provide a relative measure of minimum survival from tagging to the dams. The 1989 detection percentage of spring chinook tagged as parr in Red River and Crooked River in 1988 was 0.8 percent and 1.8 percent at Lower Granite Dam, respectively (Matthews et al. 1990) (Table 3). The 1989 and 1990 detections at of spring chinook tagged as parr in Crooked River ranged 2.8-3.1 percent at Lower Granite, Little Goose, and McNary dams (Tables 3 and 4) (Matthews et al. 1990, Kiefer and Forster 1991, 1992). Because fish are detected in collector systems, most of the detected fish are assumed to be transported. Fish were tagged as late summer parr, thus overwinter mortality and inbasin migration mortality factors are represented, as well as losses in Lower Granite Reservoir and through upper Snake River dams. Specific mortality factors have not been fully segregated to determine stock specific influence on detection rates. Giorgi (1991) estimated survival from tagging to Lower Granite Dam for 1989 by expanding PIT tag detections by a Fish Guidance Efficiency (FGE) of 0.53. He reported survival to Lower Granite Dam as 3.4 percent for parr tagged in Crooked River in 1988 and 1.5 percent for parr tagged in Red River in 1988 (Table 3).

Spring chinook juveniles are monitored in Crooked River during the fall presmolt emigration and the spring smolt migration. Kiefer and Forster (1991, 1992) estimated survival of parr in Crooked River to smolts at the head of Lower Granite Dam (LGR) pool. Using PIT tag information for parr tagged in August 1988 and 1989, the parr-to-smolt survival at the head of the LGR pool was 5.2 percent in 1989 and 5.7 percent in 1990 for age 0 spring chinook. They also estimated that parr to smolt survival at the study site, based on a monthly survival rate method, was 13.7 percent and 12.1 percent for fish migrating in 1989 and 1990, respectively.

For spring chinook presmolts emigrating in the fall of 1989, Kiefer and Forster (1992) estimated that 7.3 percent survived to the head of LGR pool. Spring migrant survival to the head of LGR pool was much higher. They estimated that the survival of a spring smolt to the head of LGR pool was 40.1 percent in 1989 and 46.3 percent in 1990 (Kiefer and Forster 1991, 1992). Detection

percentages of PIT-tagged spring chinook migrating as spring smolts were 22 percent in 1989 and 26 percent in 1990 (Table 5). This is much higher than the overall detection percentages of Crooked River spring chinook (Table 4).

IDFG also monitored spring chinook parr production in the South Fork drainage, 1985-1991. The overall weighted mean for IDFG monitoring transects was 16.4 parr per 100 m^2 and 24.2 percent of estimated carrying capacity (Table 6). Parr carrying capacity ratings for spring chinook were derived from the Presence/Absence database used for development of the Subbasin Plan. Parr densities were determined by snorkel counts.

In addition to general monitoring, Kiefer and Forster estimated chinook parr abundance for Crooked River, 1988-1990. Parr abundance ranged from 3,678-101,947 parr (Table 7).

ADULT LIFE HISTORY

Adult Escapement

Chinook crossing Bonneville Dam through May 31 are counted as springs, as are those crossing Lower Granite Dam through June 17. Specific time of migration and escapement for South Fork spring chinook is not well documented in the ocean, Columbia River or the Snake River. The University of Idaho implemented adult timing research in 1991 which should provide more information about Snake River timing (Bjornn et al. 1992).

The time of entry of spring and summer chinook into the Clear-water subbasin was from April to July, noted when fish were counted at the Lewiston Dam. Chinook counts at the dam peaked in June-July, 1965-1972. Run estimates for the entire Clear-water drainage ranged from 5 in 1963 up to 7,700 chinook in 1977, although larger runs were associated with hatchery produced fish. From 1950-1964, the Lewiston Dam counts for spring, summer, and fall chinook were less than 100 fish (Nez Perce Tribe and Idaho Department of Fish and Game 1990).

Harvest

Information has not been compiled regarding rate of contribution of South Fork spring chinook to ocean, Columbia River or Snake River harvests.

During the period 1959-1976, the entire Clearwater drainage contributed less than one percent of Idaho's sport salmon harvest (Homer and Bjomn 1981). Information is not available regarding specific information about the sport harvest of salmon from the South Fork drainage. Sport harvest in the Clearwater drainage was not a common occurrence. Ortmann (1975) noted that the 1974 salmon season in the Cleat-water drainage was the second salmon season in 46 years.

Information regarding occurrence and magnitude of tribal harvest of South Fork spring chinook is not available.

Spawner Escapement

Escapement and timing information is not available for most of the South Fork drainage. Information is available for Crooked and Red rivers because weirs are located on both streams. Because many of the spring chinook trapped at the Red River weir are retained for hatchery production, most of the Red River escapement information is discussed in the hatchery section.

The Crooked River weir is located at the mouth of Crooked River. For the two years (1990 and 1991) that adult timing information is available, spring chinook arrived in June. It is likely that spring chinook usually arrive in mid-June, but construction delayed installation of the weir until late June in 1990 (Table 8).

All fish intercepted at the Crooked River weir have been released upstream to spawn in Crooked River or Relief Creek (Table 9). In addition, 157 spring chinook adults were outplanted on 1990 from Dworshak National Fish Hatchery (NFH) into Crooked River.

A temporary weir was manned at Red River, 1977-1985. A permanent weir was constructed in 1986. The weir is located 13 miles upstream from the mouth of Red River. At least one-third of the spring chinook intercepted at the Red River weir have been released upstream for natural spawning (Table 10). Known escapement above the weir ranged from 7 to 198 spring chinook, 1987-1991. The remainder of the intercepted spring chinook have been spawned for hatchery production.

As part of the Intensive Smolt Monitoring project, Kiefer and Forster (1992) estimated that female escapement in Crooked River ranged from 15 to 95 females during 1985-1990 (Table 11).

Redd and carcass counts have been conducted in index areas of the South Fork drainage since 1966 by IDFG. This program has evolved into a single peak count. Transect counts are made in four tributaries and are mostly conducted during the first two weeks of September (T. Elms-Cockrum, IDFG, personal communication).

Redd counts in the South Fork drainage have ranged from 6 in 1991 to 143 in 1987, 1974-1991 (Table 12). The counts are used by IDFG for trend information, not escapement estimates.

In 1990, Kiefer and Forster (1992) observed 11 percent prespawning mortality in the 35 spring chinook carcasses they examined at Crooked River. Mean egg retention for successful females was 16 eggs.

Adult Characteristics

Because many of the spring chinook trapped at the Red River weir are retained for hatchery production, biological information gathered at the Red River weir is discussed in the hatchery chinook section. Only two years of return information are available for Crooked River.
It is unknown whether fish entering the Crooked River and Red River weirs are the result of natural or hatchery production because most of the spring chinook were not differentially marked.

Weights of returning spring chinook are not available. Based on length frequency, the two-ocean age component is the strongest of the annual return to Crooked River (Tables 13 and 14). Ocean age composition was determined based on standard length frequency criteria and not known age techniques. Not enough adult return information exists yet to determine brood year composition.

On an annual return basis, females comprised an average of 29 percent of the Crooked River run (Table 14).

Fecundity of naturally spawning fish is not available. Fecundity of spring chinook spawned at Red River for artificial production is discussed in the hatchery spring chinook section.

JUVENILE LIFE HISTORY

Juvenile life history timing is generally similar to Figure 2. Although not illustrated in the figure, there is a fall emigration of chinook presmolts to lower in the South Fork drainage for winter rearing. This had been documented by the Intensive Smolt Monitoring Project. Kiefer and Forster (1991, 1992) estimated that 20.9, 6.4, and 16.4 percent of the spring chinook summer parr population in Crooked River migrated in the fall of 1988, 1989, and 1990, respectively. They estimated that the proportion of the 1988 parr population that migrated in the spring, 1989 was 25.8 percent. In 1990, 9.7 percent of the 1989 summer parr population migrated in the spring.

Mean fork length of spring chinook parr in Crooked River ranged from 54 to 95 mm, 1988-1990 (Table 15).

Substantial detail regarding juvenile migration timing from Crooked River can be found in Kiefer and Forster (1990, 1991, and 1992). Matthews et al. (1990) reported that fish originating in Crooked River tended to arrive in relative abundance at Lower Granite Dam later in the 1989 smolt outmigration. Their arrival at Lower Granite Dam generally peaked after June 1. Juveniles from Red River were present in low numbers throughout the smolt outmigration. PIT-tagged spring chinook arrived at Lower Gramte Dam from Crooked and Red rivers during the penod April 9-July 17, 1989.

Kiefer and Forster (1992) reported that chinook smolts from Crooked River having a fork length of 100 mm or larger had a significantly higher PIT tag detection rate than the other length groups that were analyzed (Table 5).

BIOCHEMICAL/GENETIC CHARACTERISTICS

Schreck et al. (1986) reported isozyme gene frequencies for spring chinook collected from Red River. Marshall (1992) reported an analysis of genetic characteristics of chinook baseline collections in Idaho. Her information also included allele frequencies of naturally produced spring chinook juveniles from Red River.

DISEASES

Information has not been compiled.

REFERENCES

All South Fork Clearwater references appear in one reference section at the end of the hatchery produced summer steelhead section.

Figure 1 (TD). Anadromous salmonid distribution in the Clearwater subbasin as represented by summer steelhead.

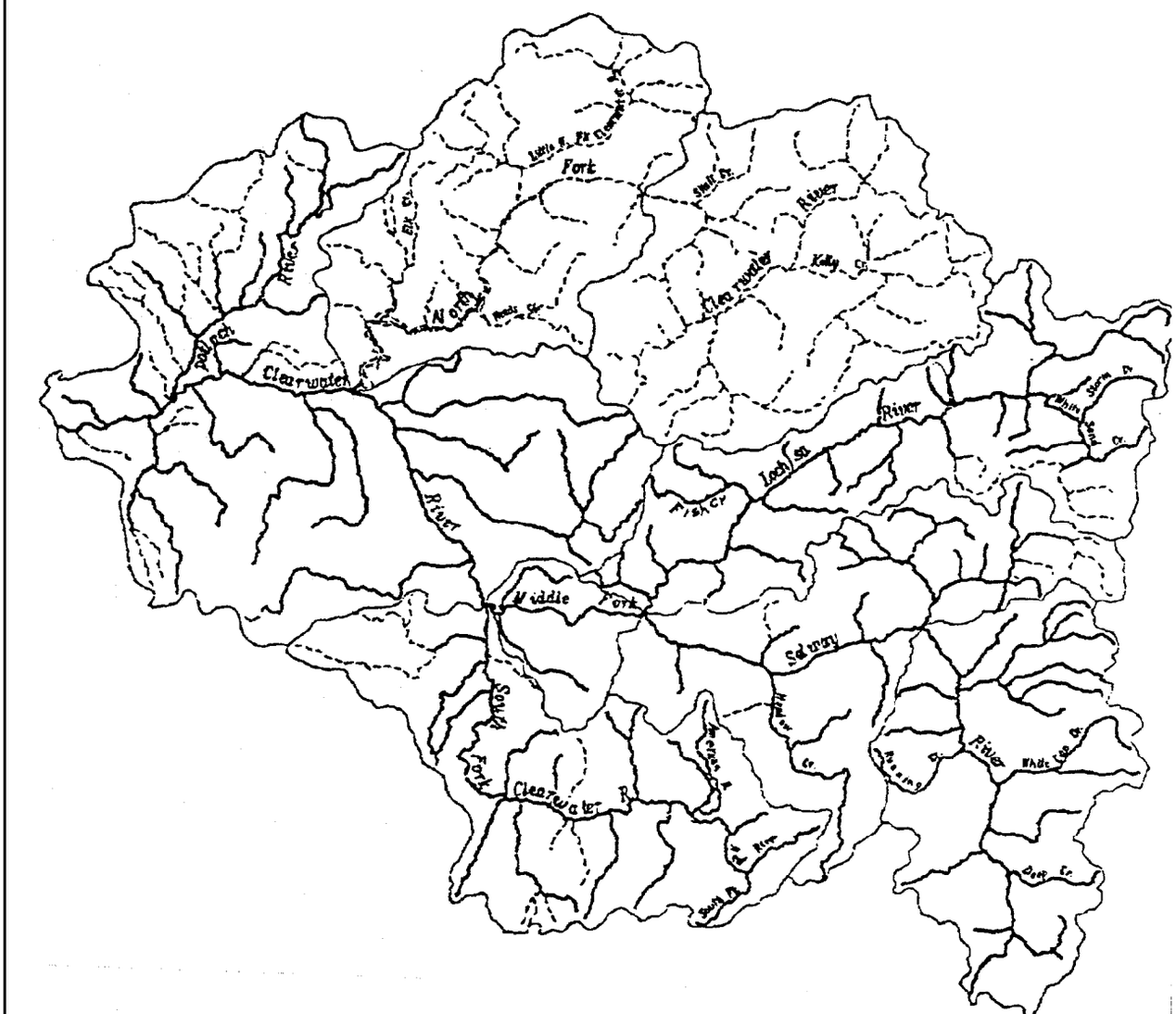
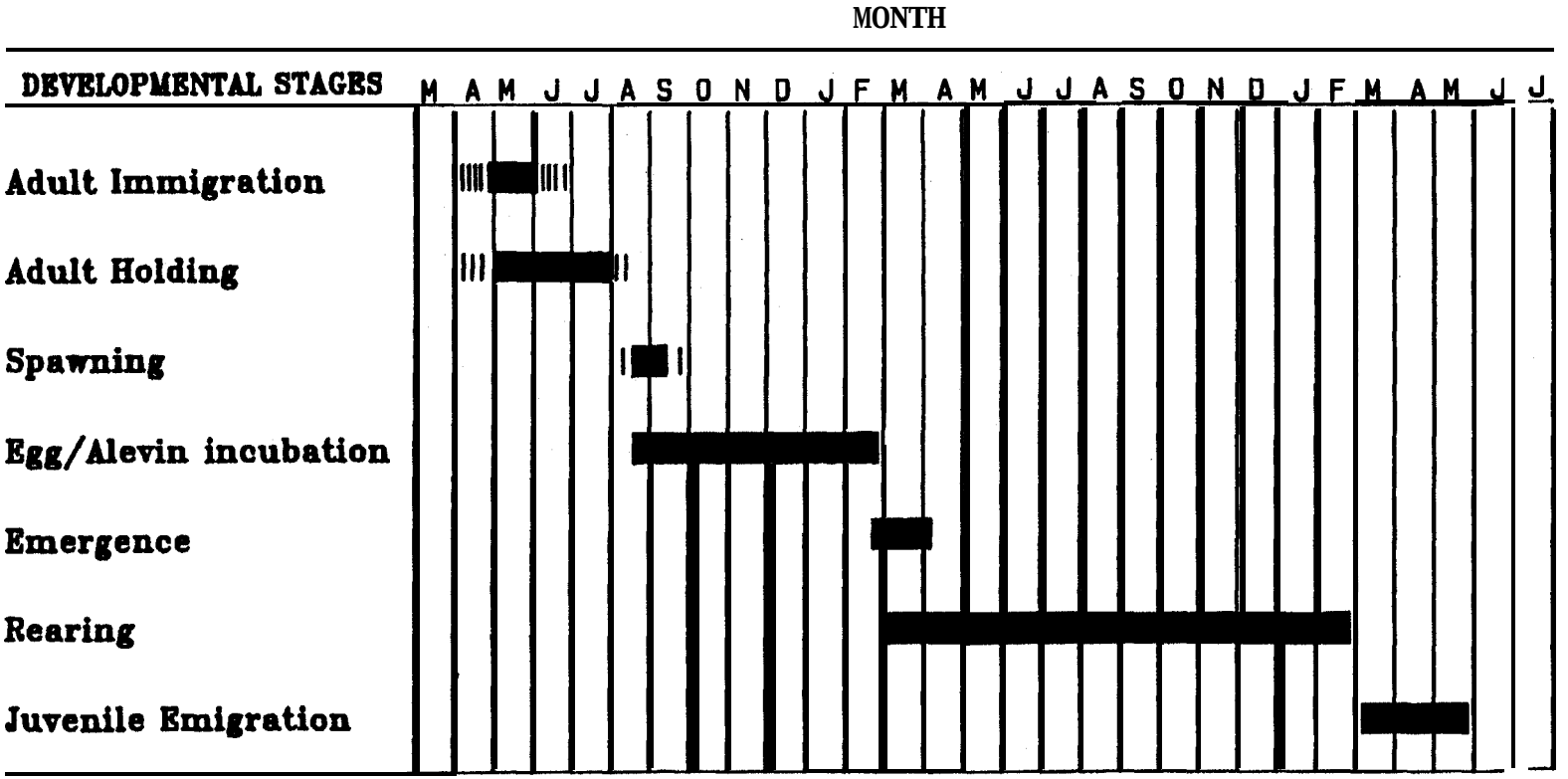


Figure 2 (TT). Freshwater life history for naturally produced spring chinook salmon in the Clearwater River subbasin.



Notes:

1. The developmental stage timing represents basin-wide averages, local conditions may cause some variability.
2. Solid bars indicate periods of heaviest adult immigration, spawning and juvenile emigration.

Table 1 (HB). Estimated amount of spawning and rearing habitat (Use Type 1) by quality of South Fork Clearwater River spring chinook production area.

	Excellent	G44d	I52r[a]	Poor"	Unknown	Total	Confidence[b]
Miles (%)(%)	21	37	50	122		467.5 265.1	M M
Acres (%)							

[a] Ratings of fair and poor habitat quality may reflect natural physical features such as gradient and channel type, as well as degradation caused by humans.
[b] 'Confidence' is meant to indicate the reproducibility and accuracy of the estimates made, and will be rated as high, medium or low by the respective agencies.

Source: Presence/Absence database, Northwest Power Planning Council, 1991.

Table 2 (HB). Estimated amount of rearing only habitat (Use Type 2) by quality of South Fork Clear-water River spring chinook production area.

	Excellent	Good	Fair"	Poor"	Unknown	Total	Confidence[b]
Miles (%)	0	0	49	51		55.1	M
Acres (%)	0	0	42	58		585.4	M

[a] Ratings of fair and poor habitat quality may reflect natural physical features such as gradient and channel type, as well as degradation caused by humans.
[b] 'Confidence' is meant to indicate the reproducibility and accuracy of the estimates made, and will be rated as high, medium or low by the respective agencies.

Source: Presence/Absence database, Northwest Power Planning Council, 1991.

Table 3 (TS-a). Number of fish[a] released, detection rates at Snake River dams, and estimated minimum survival to Lower Granite Dam[b] for natural spring chinook tagged in Crooked and Red rivers.

	Crooked River	Red River
Recovery year	1989	1989
Number PIT[c] tagged and released	2,464	2,532
Percent detected at Lower Granite Dam	1.8	0.8
Percent estimated survival to Lower Granite Dam	3.4	1.5
Percent detected at Lower Granite, Little Goose, and McNary dams	2.8	1.5

[a] Fish are tagged as parr during July-August.
[b] No spill occurred at Lower Granite Dam in 1989 and PIT tag detection rates were expanded by Fish Guidance Efficiency (FGE) = 0.53 to estimate survival from instream tagging to dam detection.
[c] PIT = Passive integrated transponder.

Sources: Matthews et al. 1990.
Giorgi 1991.

Table 4 (PT-a). Detections at the lower Snake and Columbia River smolt collecting dams" of August PIT-tagged spring chinook parr from Crooked River, 1989 and 1990.

	Detected in 1989			Detected in 1990		
Stratum	Number tagged	Number detected	Percent detected	Number tagged	Number detected	Percent detected
CR-I	1,009	21	2.1	460	23	5.0
CR-II	930	15	3.5	530	18	3.4
CR-III	696	25	3.6	1,395	24	1.7
CR-IV	343	10	2.9	772	27	3.5
Canyon	0			282	16	5.7
Relief Cr.	0			408	11	2.7
Total	2,478	71	2.9	3,847	119	3.1

[a] Lower Granite, Little Goose, McNary.

Source: Kiefer and Forster 1991, 1992.

Table 5 (SL-a). Spring chinook smolt length and PIT tag detection for Crooked River, spring 1989 and 1990.

	1989			1990		
Length (mm)	Number tagged	Number detected	Percent detected	Number tagged	Number detected	Percent detected
< 70	46	3	7	24	7	26
70 - 79	338	52	15	349	82	23
80 - 89	493	123	25	709	180	25
> 89	174	57	33			
90 - 99				367	101	27
> 99				34	15	44
Total	1,051	235	22	1,483	385	26

Source: Kiefer and Forster 1991, 1992.

Table 6 (PD-a). Natural chinook parr densities as fish per $100m^2$ (CHINOD) and percent of rated carrying capacity (CHPERCC) for the South Fork Clearwater River drainage, 1985-1991.

	Year						
	1985	1986	1987	1988	1989	1990	1991
Johns Creek							
CHINOD=	NS[a]	NS	NS	0.49	0.00	0.50	0.10
CHPERCC=	NS	NS	NS	1.10	0.00	1.13	0.23
N =	NS	NS	NS	3	4	4	3
Tenmi le Creek							
CHINOD=	0.00	35.30	0.15	NS	NS	0.45	NS
CHPERCC=	0.00	80.23	0.34	NS	NS	1.02	NS
N=	1	1	1	NS	NS	5	NS
Newsome Creek							
CHINOD=	0.00	19.41	2.65	5.38	15.98	0.00	2.62
CHPERCC=	0.00	44.11	6.02	12.23	36.32	0.00	5.96
N=	1	1	3	3	3	4	4
Crooked River							
CHINOD=	45.85	29.51	8.75	30.30	34.08	1.24	0.00
CHPERCC=	61.48	41.78	11.37	51.11	56.11	1.61	0.00
N=	7	12	7	14	15	24	19
Relief Creek							
CHINOD=	NS	NS	NS	18.48	92.75	0.00	NS
CHPERCC=	NS	NS	NS	24.00	120.45	0.00	NS
N=	NS	NS	NS	2	3	4	NS
crooked R., E.							
CHINOD=	NS	NS	NS	0.00	0.00	NS	0.00
CHPERCC=	NS	NS	NS	0.00	0.00	NS	0.00
N=	NS	NS	NS	2	2	NS	1
Crooked R.. W.							
CHINOD=	NS	NS	NS	0.00	0.00	NS	0.00
CHPERCC=	NS	NS	NS	0.00	0.00	NS	0.00
N=	NS	NS	NS	2	2	NS	2
Red River							
CHINOD=	44.36	31.25	38.34	25.57	16.94	15.66	4.81
CHPERCC=	76.33	43.84	71.08	42.04	30.74	27.72	8.39
N=	6	7	7	8	8	8	8

Table 6 (PD-a) (cont.). Natural chinook parr densities as fish per $100m^2$ (CHINOD) and percent of rated carrying capacity (CHPERCC) for the South Fork Clearwater River drainage, 1985-1991.

	Year						
	1985	1986	1987	1988	1989	1990	1991
Moose Butte Creek							
CHINOD=	NS	NS	NS	NS	NS	NS	16.30
CHPERCC=	NS	NS	NS	NS	NS	NS	21.17
N=	NS	NS	NS	NS	NS	NS	1
American River							
CHINOD=	2.97	4.38	1.21	41.90	82.68	0.58	0.12
CHPERCC=	3.86	5.69	1.57	54.42	107.37	0.76	0.15
N=	2	2	2	2	2	2	2

[a] NS = not sampled.

Source: B. Rich, IDFG, unpublished.

Table 7 (PD-a). Estimated chinook parr abundance for Crooked River, 1988-1990".

Sample[b] year	Brood year	Parr abundance	+2 SE
1988	1987	60,509	19,831
1989	1988	101,947	34,196
1990	1989	3,678	1,928

[a] Site is from Crooked River weir upstream to headwaters.
[b] Sampling is done by snorkeling in late summer.

Sources: Kiefer and Forster 1990, 1991, 1992.

Table 8 (AT-a). Timing of the spring chinook run to the Crooked River weir, 1990 - 1991.

Return Year	First fish	Last fish	Date spawning began
1990	06/29	09/23	[a]
1991	06/17	09/11	[a]

[a] All fish released to spawn naturally.

Sources: J. McGehee, IDFG, unpublished.
J. McGehee and R. Lanier, IDFG, unpublished.

Table 9 (RN-a). Number of spring chinook adults returning to the Crooked River weir and released to spawn naturally, 1990-1991.

Year	Total	Jacks	Adult Males	Females
1990	27	2	17	9
1991[b]	20	2	13	5

[a] AU fish trapped were released upstream to spawn naturally except 1 jack and 1 female mortality.
[b] Five males and 1 female released into Crooked River above the weir. Eight males, 4 females and 2 jacks released into Relief Creek. One male mortality.

Sources: J. McGehee, IDFG, unpublished.
J. McGehee and R. Lanier, IDFG, unpublished.

Table 10 (RN-b). Number of spring chinook adults released upstream of the Red River weir to spawn naturally, 1987-1991.

Year	Total	Jacks	Adult Males	Adult Females
1987	198	NR[a]	181	82
1988	158	2	20	75
1989	36	2		14
1990	45	0	31	12
1991	7		4	3

[a] NR =-not reported.

Sources: McGehee 1991.
J. McGehee, IDFG, unpublished.
J. McGehee and R. Lanier, IDFG, unpublished.

Table 11 (RN-c). Estimated chinook salmon adult escapement, redd counts, and number of eggs deposited for Crooked River, 1985 - 1990 (Kiefer and Forster 1992).

	Brood Year					
	1985	1986	1987	1988	1989	1990
Female escapement[a]	16	14	27	43	15	95
Trend redd count	10	9	17	27	3	[b]
Ground redd count				43	15	10[c]
Eggs per female[d]			4,010		4,400	4,200
Estimated eggs deposited	67,536	59,094	108,270	181,503	66,000	399,000

[a] Female escapement was estimated for 1985 - 1987 based on l/l ratio of females escapement to ground redd counts observed in USR, and 43127 ratio of ground to trend redd counts observed in 1988. Female escapement in 1988 and 1989 was assumed to equal the ground redd count. Pre-spawning mortality included.
[b] See Discussion section of this report.
[c] Redd counts were conducted before 157 adult chinook (86 females) were outplanted into Crooked River from Dworshak National Fish Hatchery.
[d] Average number of eggs/female obtained from nearby Red River trapping facility in 1985 and 1987. We used 1985 and 1987 average from brood years for which data were not available.

Table 12 (RN-d). South Fork Clearwater River drainage spring chinook index redd counts, 1974-1991".

Year	Newsome Creek	Crooked River	Red River	American River	Totals
1974	NC[b]	5	12'	NC	17
1975	6	33	20	NC	59
1976	5	13	15	NC	33
1977	17	21	50	NC	88
1978	8	17	52	NC	77
1979	3	4	20	NC	27
1980	2	6	31	7	46
1981	7	9	47	12	75
1982	5	4	82	21	112
1983	7	12	85	9	113
1984	NC	22	65'	NC	87
1985	5	10	92	23	130
1986	4	9	82	14	109
1987	14	17	81	31	143
1988	20	27	51'	12	110
1989	4	3	45	1	53
1990	0	10	66	2	78
1991	0	NC[d]	5	1	6

[a] No counts prior to 1974.
[b] NC = No count taken.
[c] Ground count rather than normal aerial count.
[d] Only one female released above the weir.

Source: P. Hassemer, IDFG, unpublished.

Table 13 (AL-a). Fork lengths of spring chinook trapped at the Crooked River weir, 1990- 1991.

Length cm.	1991 No. fish	1990 No. fish
<42		
42		
43		
44		
45		
46		
47		
48		
49	1	
50	[a]	
51	1	
52		
53		
54		
55		
56		
57		
58		
59		
60		
61		
62		1
63		
64	1	1
65		
66	1	
67	1	
68	1	1
69	2	
70		1
71	1	
72	2	5
73		
74		5
75		
76	1	6
77	1	
78		2
79		
80		2
81	1	
82	1	1
83		
84	1	1
85		
86		1
87	1	
88		
89		
90		
91		
92		
93	1	
94	1	1
95	1	
96		
97		
98		
99		
>100		1

[a] Blanks indicate no fish in this size collected and measured.

Sources: J. McGehee, IDFG, unpublished.
J. McGehee and R. Lanier, IDFG, unpublished.

Table 14 (AC-e). Sex and age composition[a] percentage by return year for spring chinook returning to the Crooked River weir, 1990 - 1991.

		One-ocean (%)		Two-ocean (%)			Three-ocean (%)		
Year	N	Male		Male	Female		Male	Female	
1990	29	2	(7)	15	8	(79)	2	2	(14)
1991	20	2	(10)	8	5	(65)	5	0	(25)

[a] Ocean age delineated by fork length criteria as follows:

1987-91: Jacks = < 64 cm
2-ocean = 64 - 82 cm
3-ocean = > 82 cm

[b] Total number of fish includes both males and females for this age class.

Sources: McGehee 199 1.
C. L. Walker, IDFG, unpublished.
J. McGehee, IDFG, unpublished.
J. McGehee and R. Lanier, IDFG, unpublished.

Table 15 (SL-a). Average fork lengths (mm) of chinook parr from PIT tagging strata on Crooked River, August 1990.

Stratum	1988 Number measured	1988 Mean length	1989 Number measured	1989 Mean length	1990 Number measured	1990 Mean length
I	1,007	69	460	73	160	54
II	431	67	530	70	95	67
Canyon	2	95	282	69	141	70
Relief Creek	0		408	69		
III	696	68	1,377	72	218	67
IV	342	70	767	71	201	66
Total	2,478	74	3,824	71	815	65

Source: Kiefer and Forster 1990, 1991, 1992.

SOUTH FORK CLEARWATER RIVER, CLEARWATER SUBBASIN

Hatchery Produced Spring Chinook

GEOGRAPHIC LOCATION

The South Fork Clearwater River (South Fork) joins the Middle Fork Clearwater River to form the mainstem Clearwater River 75 miles upstream from the mouth of the Clearwater River at Kooskia. In the 1960's, incubation channels for eyed eggs were constructed in Crooked and Red rivers. Crooked River converges with the South Fork at river mile 58.5 and is 17 miles in length. Red River converges with the South Fork at river mile 62.5 and is 18 miles in length (Mallet 1974). The channels were no longer in use for spring chinook by 1980. Currently, a rearing pond for spring chinook salmon is located along both tributaries.

Red River pond was constructed in 1976 pursuant to the Columbia River Fisheries Development Program. The facility had a temporary weir to trap adults returning to Red River. The pond is located near the confluence of the North and South forks of Red River, about 13 miles upstream from the mouth. The water source is the South Fork of Red River (McGehee 1991). The pond was designed and operated for final rearing of spring chinook, with early rearing done at other facilities. Fish are released into the pond as fry or fingerlings in June-July. Fish have usually been released as presmolts in the fall but spring releases have also been made (Howell et al. 1985). In 1986, improvements such as a permanent weir were implemented pursuant to the Lower Snake River Compensation Program (LSRCP). The weir is located near the pond. Red River became a LSRCP facility affiliated with Clearwater Anadromous Fish Hatchery (CAFH). Idaho Department of Fish and Game (IDFG) operates the facility.

The Crooked River pond is similar in function to Red River pond. The pond has been in use since 1989, and 1990 was the first year that the adult weir was operable. The pond and adult weir are also LSRCP facilities, built as part of CAFH. Crooked River adult weir and pond is operated by IDFG. The adult weir is located near the mouth of Crooked River, but the rearing pond is located several miles upstream. Returning spring chinook collected at the Crooked River weir must be transported 28 miles to Red River because there is no adult holding facility. There, Crooked River fish can be held separately from fish trapped at Red River.

ORIGIN

A diversion dam for hydroelectric power was built across the South Fork Clearwater River at river mile 20 in 1910. This dam, near Harpster, blocked all upstream fish migration. Prior to construction of the dam, chinook were likely indigenous throughout the South Fork drainage. Beginning in 1935, a wooden fishway provided some fish passage. However, by this time, chinook were no longer in the Clearwater River because they had been blocked by Lewiston Dam near the mouth of the Clear-water River (Mallet 1974).

Lewiston Dam was constructed in 1927. Inadequate adult fish passage at the dam's one fishway virtually eliminated salmon runs into the basin. In 1939, two additional fishways were constructed and in the mid-1960's, improvements were made. In 1963, the Harpster Dam was removed. Then, in 1973, Lewiston Dam was removed (Nez Perce Tribe and Idaho Department of Fish and Game 1990).

Efforts by Idaho Department of Fish and Game (IDFG) to reintroduce chinook salmon to the Clearwater drainage began in the 1950's and the program accelerated in the 1960's. Reintroduction

of spring chinook into the South Fork drainage essentially began in 1970. Initially, eyed eggs were planted in incubation channels located in Red and Crooked rivers. A total of 14.4 million eggs were placed in the incubation channels during 1970-1978 (Lindland and Bowler 1988). In addition, from 1971-1987, about 2 million fry-fingerlings, 1.4 million smolts, and 2,554 adults were stocked into the South Fork drainage (Nez Perce Tribe and Idaho Department of Fish and Game 1990). This includes releases from Red River rearing pond. Broodstock for the hatchery releases came primarily from Rapid River broodstock, but broodstock from Carson, Cowlitz, Dworshak, and Kooskia National Fish Hatcheries (NFH) was also utilized.

Over the course of the early reintroduction program, there was little evaluation of the different outplants or measurement of production of indigenous fish. Information could not be recorded separately because hatchery chinook were not differentially marked. The 1991 brood year was the first year that all hatchery chinook smolts and presmolts were marked with an adipose fin-clip and coded wire tag in order to differentiate them from naturally produced fish.

DISTRIBUTION

Table 16 of Lindland and Bowler (1988) summarizes eyed egg releases into the Red River incubation channel, 1970-1976. Tables 18 and 19 of Lindland and Bowler (1988) summarize eyed egg plants into the Crooked River incubation channel and the subsequent fry distribution. Cannamela et al. (1991) summarize the number of spring chinook and their marks released into Red River for brood years 1970-1987. Table 11 of the Clearwater Subbasin Plan (Nez Perce Tribe and Idaho Department of Fish and Game 1990) summarizes releases of spring chinook into the South Fork drainage, 1977-1987.

This report summarizes releases of spring chinook into the South Fork drainage since brood year 1982 (Table 1). Coded wire tag (CWT) codes are identified for brood years 1986-1989. CWT chinook are marked with an adipose fm clip. Other marks or tag releases have not been compiled.

'PRODUCTION

The design capacity of Red River pond is 15,000 pounds of spring chinook at 20 fish to the pound (Cannamela 1991). The capacity of Crooked River pond is 40,000 pounds of spring chinook at 20 fish to the pound (Cannamela 1991). Size of fall presmolt releases from the ponds have generally been 26 fish to the pound or less (Table 1).

Egg-to-Smolt

Refer to the hatchery spring chinook section of the lower Clear-water chapter for production information pertaining to spring chinook released from Dworshak and Kooskia NFH into the South Fork drainage. Information has not been compiled for Crooked River pond production information. Adults intercepted at the weir have not been spawned for artificial propagation. For females collected at the Red River weir and spawned in 1991, the average egg eye-up was 53.2 percent. The average survival of fingerlings released in the summer into Red River pond to a fall presmolt was 97.2 percent for brood years 1986-1987 (Frew 1989 and McGehee 1991).

Passive integrated transponder (PIT) tag detection rates at Snake River dams provide a relative measure of minimum survival to the dams. In 1990, 801 of the hatchery chinook in the Crooked River pond and 800 in the Red River ponds were tagged in September prior to their October release. The detection percentage for all three dams combined (Lower Granite, Little Goose, and McNary) in 1991 was 8.2 percent and 3.9 percent for Crooked River and Red River, respectively. Mortality

due to tagging was thought to be low (D. Cannamela, IDFG, pers. comm.). Because fish are detected in collector systems, most of the detected fish are assumed to be transported. Thus, overwinter and inbasin mortality factors are represented by PIT tag detections as well as losses in Lower Granite Reservoir and through upper Snake River dams. Specific mortality factors have not been fully segregated to determine stock specific influence on detection rates.

Smolt-to-Adult

Lindland and Bowler (1988) reported that survival of CWT chinook returning to Red River ranged 0.016-0.084 percent for brood years 1977-1979 (Table 2). For brood years 1982-1985, the smolt-to-adult return to Red River ranged from O-0.02 percent based on CWT information (Table 3). The percentage of smolts released in Red River that returned as tagged and untagged adults ranged 0.02-0.18 percent for brood years 1984-1986 (Table 4). Estimating survival using the total return of spring chinook to the weir probably overestimates the survival of hatchery fish because adults and jacks were also returning from natural production in the drainage.

Jack and Adult

Prespawning mortality at Red River was higher prior to the 1986 improvements (Nez Perce Tribe and Idaho Department of Fish and Game 1990). Since then, prespawning mortality of ponded spring chinook has averaged 28 percent (Table 5).

ADULT LIFE HISTORY

Adult Escapement

Chinook crossing Bonneville Dam through May 31 are counted as springs, as are those crossing Lower Granite Dam through June 17. Specific time of migration and escapement for South Fork spring chinook is not well documented in the ocean, Columbia River or the Snake River. The University of Idaho implemented adult timing research in 1991 which should provide more information about Snake River timing (Bjomn et al. 1992).

The time of entry of spring and summer chinook into the Clearwater subbasin was from April to July, noted when fish were counted at the Lewiston Dam. Chinook counts at the dam peaked in June-July, 1965-1972. Run estimates for the entire Clearwater drainage ranged from 5 in 1963 up to 7,700 chinook in 1977, although larger runs were associated with hatchery produced fish (Nez Perce Tribe and Idaho Department of Fish and Game 1990).

Harvest

Information has not been compiled regarding rate of contribution of South Fork spring chinook to ocean, Columbia River or Snake River harvests. Howell et al. (1985) stated that CWT recoveries in the early 1980's indicated a light harvest in Columbia River fisheries.

During the period 1959-1976, the entire Clearwater drainage contributed less than one percent of Idaho's sport salmon harvest (Homer and Bjomn 1981). Information is not available regarding specific information about the sport harvest of hatchery spring chinook from the South Fork drainage. Sport harvest in the Clear-water drainage was not a common occurrence. Ortmann (1975) noted that the 1974 salmon season in the Clearwater drainage was the second salmon season in 46 years.

Information regarding occurrence and magnitude of tribal harvest of hatchery spring chinook from the South Fork is not available.

Spawner Escapement

Escapement and timing information is not available for most of the South Fork drainage. Information is available for Crooked and Red rivers because weirs are located on both streams. Because fish arriving at Crooked River weir have been released for natural spawning, spawner escapement information for Crooked River is discussed in the natural spring chinook section. Typically, the temporary weir at Red River was not installed until late June to mid-July because of high water. The arrival of the first fish was not noted, 1983-1985 (Lindland and Bowler 1986). Arrival of spring chinook at the permanent Red River weir has ranged from late May to early July (Table 6). Timing of arrival appears to have gotten progressively later during the period 1987-1991. Weir installation during this period was May 14 in 1987 and within the second week of June during the other years.

Fish intercepted at the Red River weir are a mixture of hatchery and naturally produced fish that cannot be differentiated except for hatchery fish with CWTs. Returns of spring chinook to the Red River weir by brood year ranged from 35 to 247 spring chinook, brood years 1984-1986 (Table 7). As stated in the table, ocean age has been assigned based on length frequency, not known age techniques. This means that brood year designation may be inaccurate if, for example, one brood year exhibits an unusual growth pattern such as being atypically large or small.

Known escapement to the weir annually ranged from 18 to 519 spring chinook, 1987-1991 (Table 8). At least one-third of the spring chinook intercepted at the Red River weir have been released upstream for natural spawning. The remainder have been spawned for hatchery production.

Hatchery personnel begin spawning spring chinook at Red River in August.

Adult Characteristics

Weights of returning chinook are not available. Spring chinook longer than 104 cm were only collected in 1984 and 1985 (Table 9). Average fork length of spring chinook collected at the weir and of carcasses collected during spawning surveys ranged 28.8-34.1 inches (Table 10). All lengths measured in 1986 were from carcasses collected during spawning ground surveys. Since 1986, fork lengths have been measured as fish are intercepted at Red River weir.

The Clearwater Subbasin Plan (Nez Perce Tribe and Idaho Department of Fish and Game 1990) reported total age and sex structure for the 1982-1986 return years using data from spawning ground surveys and data collected at the weir. The age composition was 1.6 percent age three, 50.1 percent age four, and 48.3 percent age five. Sex ratios during 1982- 1984 averaged 57.6 percent age four females and 44.6 percent age five females.

More recent information shows that the two-ocean age component is the strongest of the brood year return (Table 1 1), but not always of the annual return (Table 12). To date, ocean age has been assigned and reported based on standard length frequency criteria derived from CWT information. Thus, assignment of ocean age is an estimate, and not based on known-age techniques. Known age composition based on CWT return for brood years 1977-1979, also shows that generally spring chinook return to Red River as two-ocean fish (Table 3).

Females by brood year and age class averaged 37 percent for brood years 19841986 (Table 13).

The percentage of females returning annually to the Red River weir ranged 33-53 percent and averaged 41 percent.

Average number of eggs per female ranged from 4,010 to 5,067 for the period 1987-1991 (Table 14).

JUVENILE LIFE HISTORY

Refer to the hatchery spring chinook section of the lower Clearwater chapter for early rearing information. Spring chinook fry or fingerlings are released into the Red and Crooked river ponds in June or July. Presmolts are released from the pond in October. There is typically a fall emigration of chinook presmolts to lower in the South Fork drainage for winter rearing.

Buettner and Nelson (1991) reported that freeze branded chinook released from Red River in the fall arrived at the Clearwater River trap in mid-April and at Lower Granite Dam in mid-May in 1988 and 1989 (Table 15).

BIOCHEMICAL/GENETIC CHARACTERISTICS

Refer to hatchery chinook sections of the lower Clearwater or Little Salmon chapters for genetic information about hatchery fish released into the ponds.

DISEASES

Refer to the hatchery spring chinook section of the lower Clearwater chapter for diseases encountered during early rearing of chinook at Dworshak and Kooskia NFH. Disease information pertaining to the Crooked River rearing pond has not been compiled.

Diseases encountered during rearing at the Red River pond include bacterial kidney disease (BKD) and infectious hematopoietic necrosis (IHN) (Table 16). Howell reported that spring chinook ponded in 1977 developed a heavy infestation of *Ichthyophthirius sp.* In 1987, all of the eggs collected from spring chinook returning to Red River were destroyed because infectious pancreatic necrosis (IPN) was detected (Lindland and Bowler 1988).

REFERENCES

All South Fork Clearwater references appear in one reference section at the end of the hatchery produced summer steelhead section.

Table 1 (TR). Hatchery spring chinook releases into the South Fork Clearwater River by brood years, 1982-1989. Coded wire tag codes displayed for brood years 1986-1989. Red River and Crooked River in "hatchery" column refer to satellite pond facilities for Clearwater Fish Hatchery.

Brood Year	Brood-stock	Hatchery	Life Stage	Release Date (1)	Release Date (2)	Fish/lb	Number Released	Release Location	CWT
1982	Kooskia	Hagerman NFH	F-F'	1983			95,414	Red River	
1982	Rapid River	Rapid River	ore-smolt	1983			260,000	Red River @ pond	
1982	Rapid River	Rapid River	smolt	1984			40,000	Red River @ pond	
1983	Red River[b]	Red River	smolt	1985			80,000	Red River	
1985	Rapid River	Sawtooth	pre-smolt	1986			251,300	Crooked River	
1984	Red River	Red River	smolt	1986			136,800	Red River @ pond	
1985	Rapid River	Sawtooth	pre-smolt	1986			96,400	Red River	
1985	Rapid River	Rapid River	F-F	1986			102,282	Newsome Creek	
1985	Rapid River	Rapid River	F-F	1986			349,650	Crooked River	
1985	Rapid River	Rapid River	F-F	1986			49.437	Ten Mile Creek	
1985	Rapid River	Sawtooth	smolt	1987			227,500	Crooked R.	
1985	Rapid River	Sawtooth	smolt	1987			98,800	Red River	
1986	Rapid River	Red River	pre-smolt	09/28/87	10/02/87	26.0	46,100	Red River @ pond	104001
1986	Rapid River	Red River	pre-smolt	09/28/87	10/02/87	26.0	186,994	Red River @ pond	Untagged

Table 1 (TR) (cont.), Hatchery spring chinook releases into the South Fork Clearwater River by brood years, 1982-1989. Coded wire tag codes displayed for brood years 1986-1989. Red River and Crooked River in "hatchery" column refer to satellite pond facilities for Clearwater Fish Hatchery.

Brood Year	Brood-stock	Hatchery	Life Stage	Release Date (1)	Release Date (2)	Fish/lb	Number Released	Release Location	CWT
1987	Rapid River	Rapid River	F-F	05/12/88		256	113,800	American River	
1987	Dworshak NFH	Dworshak NFH	F-F	05/24/88		152	81,501	American River	
1987	Rapid River	Rapid River	F-F	05/13/88	05/16/88	258	200;100	Crooked River	
1987	Rapid River	Rapid River	F-F	05/13/88		256	100,160	Meadow Creek	
1987	Rapid River	Rapid River	F-F	05/12/88		256	112,100	Newsome Creek	
1987	Rapid River	Rapid River	F-F	05/16/88		258	50,100	Red River	
1987	Rapid River	Rapid River	F-F	06/10/88		226	150,100	Ten Mile Creek	
1987	Dworshak NFH	Dworshak NFH	F-F	05/24/88		157	84,766	Newsome Creek	
1988	Red River	Red River	adult"	09/13/88			158	Red River-above weir	
1987	Dworshak NFH	Red River	pre-smolt	10/17/88		25.5	54,365	Red River @ pond	104002
1987	Dworshak NFH	Red River	pre-smolt	10/17/88		25.5	236,835	Red River @ pond	Untagged
1987	Dworshak NFH	Dworshak NFH	smolt	03/27/89	03/30/89	19.9	199,690	Crooked River	
1988	Rapid River	Rapid River	F-F	05/30/89		250	100,278	Ten Mile Creek	

Table 1 (TR) (cont.). Hatchery spring chinook releases into the South Fork Clearwater River by brood years, 1982-1989. Coded wire tag codes displayed for brood years 1986-1989. Red River and Crooked River in "hatchery" column refer to satellite pond facilities for Clearwater Fish Hatchery..

Brood Year	Brood-stock	Hatchery	Life Stage	Release Date (1)	Release Date (2)	Fish/lb	Number Released	Release Location	CWT
1988	Rapid River	Rapid River	F-F	06/07/89	06/09/89	196	201,924	Crooked River	
1988	Rapid River	Rapid River	F-F	06/13/89		169	100,628	Newsome Creek	
1988	Rapid River	Rapid River	F-F	06/14/89		169	100,097	w. Fk. Newsome Creek	
1988	Rapid River	Rapid River	F-F	06/22/89	06/26/89	183	150,770	American River	
1988	Rapid River	Rapid River	F-F	06/26/89		183	39,163	Meadow Creek	
1989	Red River	Red River	adult[c]	09/04/89			36	Red River-above weir	
1988	Red River/ Dworshak NFH	Red River	pre-smolt	10/18/89		35.0	240,500	Red River @ pond	
1988	Kooskia NFH	Kooskia NFH	smolt	03/28/90	23.3		300,400	Crooked River	
1990	Red River	Red River	adult[c]	08/31/90			45	Red River-above weir	
1990	Crooked River	Crooked River	adult[c]	08/31/90			27	Crooked R. above weir	
1990	Dworshak NFH	Dworshak NFH	adult				157	Crooked River	
1989	Rapid River	Crooked River	pre-smolt	10/17/90		27.0	21,220	Crooked R. @ pond	104307

Table 1 (TR) (cont.). Hatchery spring chinook releases into the South Fork Clear-water River by brood years, 1982-1989. 'Coded wire tag codes displayed for brood years 1986-1989. Red River and Crooked River in "hatchery" column refer to satellite pond facilities for Clearwater Fish Hatchery.

Brood Year	Brood-stock	Hatchery	Life Stage	Release Date (1)	Release Date (2)	Fish/lb	Number Released	Release Location	CWT
1989	Rapid River	Crooked River	pre-smolt	10/17/90		27.0	21,713	Crooked R. @ pond .	104308
1989	Rapid River	Crooked River	pre-smolt	10/17/90		27.0	21,213	Crooked R. @ pond	104309
1989	Rapid River	Crooked River	pre-smolt	10/17/90		32.9	274,941	Crooked R. @ pond	Untagged
1989	Kooskia NFH/Red River	Red River	pre-smolt	10/23/90		27.0	20,675	Red River @ pond	104304
1989	Kooskia NFH/Red River	Red River	pre-smolt	10/23/90		27.0	20,675	Red River @ pond	104305
1989	Kooskia NFH/Red River	Red River	pre-smolt	10/23/90		27.0	20,548	Red River @ pond	104306
1989	Kooskia NFH/Red River	Red River	pre-smolt	10/23/90		27.9	211,301	Red River @ pond	Untagged
1989	Kooskia NFH	Kooskia NFH	smolt	03/25/91	03/27/91	24.5	124,071	Red River	
1989	Dworshak NFH	Dworshak NFH	smolt	03/25/91		21.6	63,004	Red River	

[a] F-F designates a fry or fingerling release.
[b] Red River = mix of Red River and Rapid River.
[c] Adults released above the weir are a mixture of hatchery and naturally produced fish.

Table 2 (RH-a). Number of coded wire-tagged spring chinook returning to the Red River weir, brood years 1977-1979.

Tag code	Brood year	Year released	Number tagged released	Purpose	Returns 1980	1981	1982	1983	1984	Total returns	Percent return
10/03/28	1977	09/21/78	37,200	Pond Evaluation	024			-	-	6	0.016
10/21/12	1978	09/28/79	43,800	Pond Evaluation		0	27	11	-	38	0.084
10/21/27	1979	09/18/80	51,000	Contribution		-	0	23	3	26	0.051

Sources: Cannamela et al. 1991.
Lindland and Bowler 1986.

Table 3 (RH-a). Number of coded wire-tagged spring chinook returning to the Red River weir, brood years 1982-1987.

Tag code	Brood year	Year released	Number tagged released	Size released (#/lb)	Purpose	Returns 1985	1986	1987	1988	1989	1990	1991	Total returns	Percent return
10/24/59	1982	10/20/83	60,900	21.0	Fall Release	0	0	12	-	-	-	-	12	0.02
10/24/63	'1982	04/17/84	40,725	21.0	Spring Release	0	0	8	-	-	-	-	8	0.02
10/29/57	1985	03/18/87	30,100	32.0	Spring Release				0	0	0	-	0	0.00
10/29/62	1985	03/18/87	19,200	32.0	Spring Release				0	0	0	-	0	0.00
10/29/51	1985	1986	49,475	20.0	Fall Release				0	0	0	-	0	0.00
10/40/01	1986	10/05/87	46,100		Fall Release					0	3	0	3	0.006
10/40/02	1987	10/12/88	54,375	25.0	Fall Release						0	0	0	inc.

Sources: Cennamela et al. 1991.
D. Cannamela, IDFG, unpublished.

Table 4 (RH-a). Percentages of smolts released in Red River that returned as adults for brood years 1984-1986.

Brood year	Year released	Smolts released	Total brood year return[a]	Percent of brood year return
1984	1986	136,800	235	0.18
1985	1987	98,800[b]	51	0.03
1986	1988	233,094[c]		0.02

[a] Includes naturally produced adults intercepted at the weir that cannot be distinguished from hatchery chinook.
[b] An additional 96,400 presmolts released in Fall 1986 that are not included in the return percentage.
[c] Entire release consisted of presmolts released in the Fall, 1987.

Source: S. W. Kiefer, IDFG, unpublished.

Table 5 (PM-a). Pre-spawning mortality of ponded spring chinook[a] at the Red River pond, 1987-1991.

Return year	Fish trapped (#)	Fish ponded (#)	Mortalities (#)	Prespawning mortality (%)
1987	519	321	146	45.5
1988	391	236	82	34.7
1989	104	68	18	20.5
1990	53	38	2	21.1
1991	18	11		18.2

[a] Prespawning mortality calculated as a proportion of fish ponded, not of the entire run because fish released for natural spawning are generally not held in the hatchery.

Sources: McGehee 1991.
J. McGehee, IDFG, unpublished.
J. McGehee and R. Lamer, IDFG, unpublished.

Table 6 (AT-a). Timing of the spring chinook run to the Red River weir, 1987 to 1991.

Return Year	First fish	Last fish	Date spawning began
1987	05/29	09/14	08/05
1988	06/10	09/13	08/09
1989	06/13	09/04	08/08
1990	07/04	09/15	08/31[a]

[a]All fish released to spawn naturally.

Sources: McGehee 1991.
J. McGehee, IDFG, unpublished.
J. McGehee and R. Lanier, IDFG, unpublished.
C. Walker, IDFG, unpublished.

Table 7 (RH). Brood year return of spring chinook to the Red River we?', brood years 1984-1988.

Total Age

Brood Year	3	4	5	N	Adult total
1984	35	132	80	247	212
1985	3	19	13	35	32
1986	5	38	8	51	46
1987	2	9	inc.[a]	inc.	inc.
1988	1	inc.	inc.	inc.	inc.

[a] Ocean age delineated by fork length criteria as follows:

1984-88: Jacks = <64 cm
2-ocean = 64 - 82 cm
3-ocean = > 82 cm
(Based on CWT return data)

In this nomenclature, the freshwater and ocean ages sum to the total age of the fish.

Sources: McGehee 1991.
C. L. Walker, IDFG, unpublished.
J. McGehee, IDFG, unpublished.

Table 8 (RN-a). Number and sex of spring chinook returning annually to the Red River weir, 1983-1991.

Year	Total[a]	Jacks	Adult Males	Adult Females
1983”	138		65[b]	73
1984”	111	2	44	65
1985”	125		56[b]	69
1986”				
1987	519	33	264	220
1988	394	5	182	209
1989			50	49
1990	103	2	35	16
1991	18	1	6	7

[a] Temporary weir in place. Weir was not a complete barrier and fish escaped upstream.
[b] Number of fish includes jacks and adult males.
[c] No spring chinook trapped due to construction.

Sources: Lindland and Bowler 1986.
McGehee 1991.
C. L. Walker, JDFG, unpublished.
J. McGehee, IDFG, unpublished.

Table 9 (AL-a). Fork lengths of spring chinook measured at Red River weir and during carcass surveys, 1981-1991.

Length cm.	1991 No. fish	1990 No. fish	1989 No. fish	1988 No. fish	1987 No. fish	1986 No. fish	1985 No. fish	1984 No. fish	1983 No. fish	1982 No. fish	1981 No. fish
43							1				
44	1	[a]									
45											
46							1			2	
47											
48			1	1	1						
49											
50											
51											
52			1								
53				1							
54			1								
55											
56					2						
57											
58					2						
59											
60			1								
61				1	4	4	3	1	1	4	
62			1								
63											
64			1		19	3	1		3	3	1
65	1										
66	1	3		3	23	5	6	1	10	15	1
67											
68		3	2								
69				8	70	12	2	2	20	13	1
70	1	4	1								
71				16	82	17	6	3	43	27	5
72	2	9	3								
73											
74		6	6	20	99	14	7	9	47	15	2
75											
76		7	1	25	65	9	3	5	31	18	5
77	1										
78	1	2	6								
79				30	31	6	1	5	30	23	
80		2	3								
81	1			30	24	2	4	4	26	7	2
82	1	2	2								
83											
84	1	2	5	32	21	2	3	8	26	7	
85	1										
86		2	9	47	26	3	21	8	24	3	
87											
88		1	11								
89				68	22	2	17	11	24	3	1
90	1	2	12								
91	1			51	10	1	30	5	16	1	1
92		2	7								
93	4										
94			6	28	8	1	29	2	5	2	
95											
96		1	10	16	2		18	5	IO	2	
97											
98		2	6								
99				11	5		15	8	5		
100			4								
101											
102			4	4	1		15		2		
103											
104		1		2			11				
>104							17	17			

[a] Blanks indicate no fish of this size were collected and measured.

Sources: Pollard et al. 1982; Pollard 1983, 1984, 1985; Hall-Griswold and Cochnauer 1986, 1988a, 1988b; White and Cochnauer 1989; J. McGehee, IDFG, unpublished; J. McGehee and R. Lanier, IDFG, unpublished.

Table 10 (AL-a). Average fork length for spring chinook measured at Red River weir and during carcass surveys (Nez Perce Tribe and Idaho Department of Fish and Game 1990).

Year	Sample type	Average fork length (in.)	Sample size
1982	Carcass	29.2	145
1983	Weir/Carcass	31.3	322
1984	Carcass	34.1	75
1985	Weir/Carcass	35.8	211
1986	Carcass	28.8	82
1987	Weir	30.7	519

Table 11 (AC). Age composition percentage by brood year" (freshwater.ocean) of spring chinook salmon returning to the Red River weir.

Age Composition (%)

Brood Year	N	3	4	5
1984	247	14.2	53.4	32.4
1985	35	8.6	54.3	37.1
1986	51	9.8	74.5	15.7

[a] Ocean age delineated by fork length criteria as follows:

1984-86: Jacks = < 64 cm
2-ocean = 64 - 82 cm
3-ocean = > 82 cm

In this nomenclature, the freshwater and ocean ages sum to the total age of the fish.

Sources: McGehee 199 1.
C. L. Walker, IDFG, unpublished.
J. McGehee, IDFG, unpublished.

Table 12 (AC-e). Sex and age composition" percentage by return year for spring chinook returning to the Red River weir, 1987-1991.

		One-ocean (%)		Two-ocean (%)			Three-ocean (%)		
Year	N	Male		Male	Female		Male	Female	
1987	519	35	(7)		(377 total[b])	(73)		(107 total[b])	(21)
1988	394	3	(1)	57	75	(34)	125	134	(66)
1989	104	5	(5)	10	9	(18)	40	40	(77)
1990	53	2	(4)	26	12	(72)	9	4	(24)
1991	18	1	(6)	4	5	(50)	6	2	(44)

[a] Ocean age delineated by fork length criteria as follows:

1987-91: Jacks = < 64 cm
2-ocean = 64 - 82 cm
3-ocean = > 82 cm
(Based on CWT return data)

[b] Total number of fish includes both males and females for this age class.

Sources: McGehee 199 1.
C. L. Walker, IDFG, unpublished.
J. McGehee, IDFG, unpublished.
J. McGehee and R. Lanier, IDFG, unpublished.

Table 13 (AS). Percent females by brood year and age class[a] (freshwater-ocean) of spring chinook salmon returning to the Red River weir.

Females (%)

Brood Year	N	3	4	5	Total % Female
1984	247	0	30.4	16.2	46.6
1985	35	0	25.7	11.4	37.1
1986	51	0	23.5	3.9	27.4

[a] Ocean age delineated by fork length criteria as follows:

1984-86: Jacks = < 64 cm
2-ocean = 64 - 82 cm
3-ocean = > 82 cm

In this nomenclature, the freshwater and ocean ages sum to the total age of the fish. N is equal to the known male and female components of the brood.

Sources: McGehee 1991.
C. L. Walker, IDFG, unpublished.
J. McGehee, IDFG, unpublished.

Table 14 (AF-a). Mean fecundity by return year for spring chinook" returning to the Red River weir, 1987-1991.

Return year	Number of females spawned	Number of green eggs	Mean fecundity
1987	78	312,800	4,010[b]
1988	84	391,743	4,664
1989	31	136,400	4,400
1990	NA[c]		
1991	3	15,200	5,067

[a] Returning fish are a combination of hatchery and naturally produced spring chinook.
[b] All eggs subsequently destroyed because of Infectious Pancreatic Necrosis (IPN).
[c] NA = not applicable. Fish trapped at the weir were released upstream for natural spawning. Broodyear 1990 eggs were supplied from Dworshak National Fish Hatchery broodstock.

Sources: C. Walker, IDFG, unpublished.
J. McGehee, IDFG, unpublished.

Table 15 (MD-a). Migration data for freeze branded hatchery spring chinook salmon from Red River to the Clearwater River trap[a] and to Lower Granite Dam (LGD), 1988 and 1989.

Year	Median release date	Median passage date, Clearwater trap	Migration rate (km/day)	Median arrival at LGD	Migration rate (km/day)	Mean Q(kcfs) at LGD
1988	9/30/87	4/14	--	5/13	2.2	58
1989	10/17/88	4/17	--	5/11	2.6	99

[a] Clearwater River trap located approximately IO km upstream from the convergence of Clearwater and Snake River arms of Lower Granite Reservoir.
[b] Combined groups.

Sources: Buettner and Nelson 1991.
Giorgi 1991.

Table 16 (TD) . Parasites and diseases of spring chinook at the Red River satellite facility, 1986- 1991[a].

Disease Type	Hatchery	Infection
bacteria	Red River	*Renibacterium salmoninarum* (Bacterial kidney disease)
protozoa	Red River	*Ceratomyxa shasta*
virus	Red River	Infectious Hematopoietic Necrosis (IHNV)
virus	Red River	Infectious Pancreatic Necrosis (IPN)

[a] Disease history only represents pathogens isolated at the hatchery and not necessarily a disease outbreak.

Sources: Frew 1989.
McGehee 1991.
J. McGehee, IDFG, unpublished.
J. McGehee and R. Lanier, IDFG, unpublished.

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SOUTH FORK CLEARWATER RIVER, CLEARWATER SUBBASIN

Naturally Produced Summer Steelhead

GEOGRAPHIC LOCATION

The South Fork Clearwater River (South Fork) joins the Middle Fork Clearwater River to form the mainstem Clearwater River at Kooskia, 75 miles upstream from its mouth (Figure 1). The South Fork is 62.5 miles in length. Eleven miles of the mainstem South Fork are included in the Nez Perce Indian Reservation. In 1991, steelbead were trapped at a weir located near the mouth of Crooked River. Crooked River converges with the South Fork at river mile 58.5 and is 17 miles in length (Mallet 1974).

The South Fork drainage is primarily of basalt origin in the lower reaches and granitic origin in the middle to upper headwater areas. Much of the drainage has been affected by land use activities. Historically gold dredge and placer mining were the major land uses. The riparian vegetation has been extensively modified along the lower *30* miles of the mainstem and the lower tributaries (Nez Perce Tribe and Idaho Department of Fish and Game 1990). The headwaters of Johns and Tenmile creeks, and the mainstem South Fork are protected as part of the Gospel-Hump Wilderness.

ORIGIN

A diversion dam for hydroelectric power was built across the South Fork Clearwater River at river mile 20 in 1910. This dam, near Harpster, blocked all upstream fish migration. Prior to construction of the darn, steelhead were likely indigenous throughout the South Fork drainage. Beginning in 1935, a wooden fishway provided some passage for steelhead (Mallet 1974).

Lewiston Dam was constructed in 1927. Inadequate adult fish passage at the dam's one fishway virtually eliminated salmon runs into the basin and probably reduced steelhead runs as well. In 1939, two additional fishways were constructed and in the mid-1960's, improvements were made. In 1963, the Harpster Dam was removed which made the South Fork drainage accessible to steelhead for the first time in 14 years. Since that time, steelhead have had access to all former spawning areas in the South Fork drainage. Then in 1973, Lewiston Dam was removed (Nez Perce Tribe and Idaho Department of Fish and Game 1990).

Efforts by Idaho Department of Fish and Game (IDFG) to reintroduce steelhead to the Clearwater drainage began in the 1960's. The Clearwater River Fisheries Development Program was directed at restoring steelhead runs in the South Fork Clearwater drainage with the outplanting of adults and eyed eggs (Nez Perce Tribe and Idaho Department of Fish and Game 1990). From 1961- 1966, managers outplanted 1,534 adult steelhead trapped at Lewiston Dam into various South Fork tributaries. From 1962-1968, steelhead eggs were collected from adults trapped at Lewiston Dam. Eyed eggs were planted in incubation channels located in Red and Crooked rivers. The Red River incubation channel was constructed in 1964 and was utilized for steelhead in various years through 1969 and again in 1978-1980. Approximately 3.7 million eyed eggs were placed in the incubation channel. Broodstock during the late 1970's and early 1980's came from Dworshak National Fish Hatchery (NFH). An incubation channel constructed in Crooked River in 1966 was only utilized for 450,000 steelhead eggs that year (Lindland and Bowler 1988). In 1967, the first steelhead smolt release in the Clearwater drainage was 163,238 steelhead smolts released into the South Fork drainage. All subsequent steelhead supplementation originated from Dworshak NFH broodstock once the hatchery began production in 1969. The stock of adults returning to Dworshak NFH originated in the North Fork of the Clearwater. Between 1977 and 1989, incubation channels

located in Red River and Meadow Creek have periodically been utilized for a total of 14.8 million steelhead eggs (Lindland and Bowler 1988). According to the Clear-water Subbasin Plan, from 1967-1987, 7.6 million fry and fingerlings were planted in the South Fork drainage. From 1961-1987, 13,049 steelhead adults were placed in the South Fork drainage. Also, about- 4.3 million steelhead smolts were released in the South Fork drainage from 1976-1987 (Nez Perce Tribe and Idaho Department of Fish and Game 1990).

Over the course of the early reintroduction program, there was little evaluation of the different outplants or measurement of production of indigenous fish. Information could not be recorded separately until the mid-1980's because hatchery steelhead were not differentially marked. Because of the mixed brood stock history and influence of hatchery fish, the IDFG classifies steelhead in the South Fork drainage as natural (Idaho Department of Fish and Game 1992). Tributaries below Mill Creek are generally considered to be production streams for A-run steelhead, described in the lower Clear-water chapter. Steelhead returning to the rest of the South Fork Clearwater are classified as B-run on the basis of ocean age component, size at age, and timing. B-run steelhead generally enter the Columbia River from August through December and are larger than A-run steelhead of comparable ocean age.

DISTRIBUTION

Available spawning and rearing habitat for the South Fork was described in the Presence/Absence database (Tables 1 and 2). This information was developed for the Northwest Power Planning Council for subbasin planning and modeling.

PRODUCTION

Detailed production and survival information is available for Crooked River because the IDFG is conducting intensive smolt monitoring in this drainage.

Beginning in 1988, steelhead were tagged with passive integrated transponder (PIT) tags in Crooked River. PIT tag detections at Snake and Columbia River dams provide a relative measure of minimum survival from tagging to the dams. The 1989 and 1990 detections of steelhead tagged as parr in Crooked River ranged 9.9-27.3 percent at Lower Granite, Little Goose, and McNary dams for age 2+ and older steelhead (Table 3) Age 1 + steelhead have very low detection rates at the dams, indicating these fish usually rear an additional year before beginning their seaward migration (Kiefer and Forster 1991, 1992). Because fish are detected in collector systems, most of the detected fish are assumed to be transported. Fish were tagged as late summer parr, thus overwinter mortality and inbasin migration mortality factors are represented, as well as losses in Lower Granite Reservoir and through upper Snake River dams. Specific mortality factors have not been fully segregated to determine stock specific influence on detection rates.

Steelhead juveniles are monitored in Crooked River during the fall presmolt emigration and the spring smolt migration. Detection rates at the dams vary considerably between the fall and spring migrants. For steelhead migrating in the spring of 1989, the detection rate at the smolt collection dams for age 3 steelhead was 43.4 percent. From these detections, Kiefer and Forster (1991) estimated a spring smolt survival to be 53.3 percent for age 3 steelhead.

Using a method of PIT tag detections and detection rates for steelhead tagged at a mainstem Snake River trap, Kiefer and Forster (1991) estimated parr-to-smolt survival to the head of Lower Granite pool for parr PIT tagged in August 1988 to be 33.5 percent for age 2+ steelhead.

For steelhead migrating in the spring of 1990, the detection percentage at the three smolt collection dams was 39.3 percent for age 3 and older steelhead. For Fall 1989 migrating steelhead, 17.9 percent of the age 2+ and older steelhead were detected at the three dams (Kiefer and Forster 1992).

Using PIT tag information, Kiefer and Forster (1992) estimated that 14.1 percent of the steelhead parr tagged in August 1989 as age 2+ steelhead, and migrating in the spring of 1990 as age 3 steelhead survived to the head of Lower Granite Pool.

Kiefer and Forster (1992) also used detection rates for PIT-tagged emigrants to estimate fall and spring emigrant-to-smolt survival at the head of Lower Granite pool. For fall 1989 emigrants, they estimated that 25.4 percent of the age 2 + and older steelhead emigrants survived to Lower Granite pool. For spring 1990 emigrants, they estimated that Crooked River to Lower Granite pool survival rates were 8.0 percent of age 2 steelhead and 55.8 percent for age 3 and older steelhead (steelhead spring birthday).

IDFG also monitored steelhead parr production in the South Fork drainage, 1985-1991. The overall weighted mean for IDFG monitoring transects was 4.9 parr per 100 m^2 and 33.5 percent of estimated carrying capacity (Table 4). Parr carrying capacity ratings for steelhead were derived from the Presence/Absence database used for development of the Subbasin Plan. Parr densities were determined by snorkel counts.

In addition to general monitoring, Kiefer and Forster (1990, 1991, 1992) estimated ages 1 + and 2+ steelhead parr abundance for Crooked River, 1988-1990. Age 2+ parr abundance ranged from 1,798 to 4,543 parr (Table 5).

ADULT LIFE HISTORY

Adult Escapement

Specific time of migration and escapement for steelhead returning to the South Fork drainage has not been identified for the ocean, Columbia River, or Snake River. The University of Idaho implemented adult timing research in 1991 which should provide information about Snake River timing (Bjornn et al. 1992).

Adult steelhead that migrate in the fall overwinter in the Snake and lower Clear-water rivers. The time of entry of steelhead into the Clearwater subbasin was from July through June, noted when fish were counted at the Lewiston Dam from the 1949-1950 run year through the 1971-1972 run year. Up until the 1958-1959 run year, an average of 79 percent of the steelhead run crossed Lewiston Dam during March-May. An average of only 16 percent of the run crossed during September-November. Beginning with the 1958-1959 run year, an average of 42 percent of the steelhead run crossed Lewiston Dam during March-May, and 56 percent crossed in September-November (S. W. Kiefer, IDFG, personal communication).

Steelhead run estimates for the entire Clearwater drainage ranged from 3,167-43,1996 for the run years 1949-1950 through 1971- 1972 (Nez Perce Tribe and Idaho Department of Fish and Game 1990).

Harvest

Information is not available regarding the rate of contribution of this stock to ocean, Columbia River or Snake River harvests. Since the mid-1980's, the harvest of steelhead possessing-an adipose fin has not been allowed in the Snake River or in Idaho.

For adult steelhead, limited sport harvest information is available. Based on random samples of returned steelhead permits in the late 1960's and early 1970's, less than 20 steelhead were harvested from the South Fork in 1968 and 1969. This represented less than 2 percent of the annual steelhead harvest from the Clearwater drainage (Keating 1969, 1970). There was no report of steelbead harvested in the South Fork drainage in 1967, 1970, or 1971.

For juvenile steelhead, Kiefer and Forster (1992) conducted a creel survey in Crooked River in 1990 and estimated that 62 percent of the age 2+ naturally produced steelbead population was harvested.

Information regarding occurrence and magnitude of tribal harvest of South Fork steelhead is not available.

Spawner Escapement

Studies conducted in the Clearwater drainage indicated that the spring steelhead migration began when water temperature reached 39 F° (Metsker 1959).

Steelhead escapement information is not available for most of the South Fork drainage. Adult trap information is available from Crooked River in 1991 when both hatchery and naturally produced steelhead were intercepted. Natural steelhead arrived at the weir from April l&April 30. Run timing of all steelbead to the Crooked River weir was April 3-May 6. Forty-nine adult steelhead were trapped but only five were naturally produced. All of the steelhead were measured, sexed, scale sampled and immediately released above the weir to spawn naturally.

IDFG biologists conducted index steelhead redd counts in 1990 and 1991 (Table 6), but these cannot be used for escapement estimates. In 1990, steelhead redd density ranged from 18.9-34.6 redds per kilometer.

Adult Characteristics

There is some limited information available describing fork length. A sample of 5 naturally produced steelhead, intercepted at the Crooked River weir, ranged 85-89 cm in total length (Table 7). The average total length was 87 cm, which was 3 cm longer than the average total length of the hatchery fish.

The ocean age composition, based on length frequency criteria used at Dworshak NFH was 100 percent two-ocean.

Eighty percent of the naturally produced steelhead returning to the Crooked River weir in 1991 were females.

Fecundity information for natural South Fork steelhead is not available.

JUVENILE LIFE HISTORY

Juvenile life history timing is generally similar to Figure 2. Although not illustrated in the figure, there is a fall emigration of steelhead presmolts to lower in the South Fork drainage for winter rearing. This has been documented by the Intensive Smolt Monitoring Project. Kiefer and Forster (1991) estimated that 2.7 percent of the age 1 + and older steelhead parr population migrated during the period of August 3 l-October 30, 1989. For the fall 1990 migration the estimated that 7.7 percent of the age 1 and 34.4 percent of the age 2+ and older summer parr population migrated (Kiefer and Forster 1992). Typically, in the fall migration, most of the steelhead are age 2 + and older (Table 8).

For the spring migration, Kiefer and Forster (1991, 1992) estimated that 34.8 percent and 13.5 percent of the age 2+ and older summer parr population of steelhead migrated in 1989 and 1990, respectively. In the spring migration, most of the migrating steelhead were age 1 or age 3+.

The average fork length of steelhead parr tagged in Crooked River ranged from 95 to 152 mm, 1988-1990 (Table 9).

Kiefer and Forster (1992) found that for steelhead predominately only those larger than 129 mm were detected at smolt collection dams (Table 10). They also found that typically, steelhead travel time from Crooked River to the dams was less than chinook and leveled off after the period of April 30 through May 2 at about 8 days.

BIOCHEMICAL/GENETIC CHARACTERISTICS

Information has not been compiled.

DISEASES

Information has not been compiled.

REFERENCES

All South Fork Cleat-water references appear in one reference section at the end of the hatchery produced summer steelhead section.

Figure 1 (TD). Anadromous salmonid distribution in the Clearwater subbasin as represented by summer steelhead, based on the NPPC presence/absence data base (solid/dashed lines respectively) and the BPA Geographic Information System.

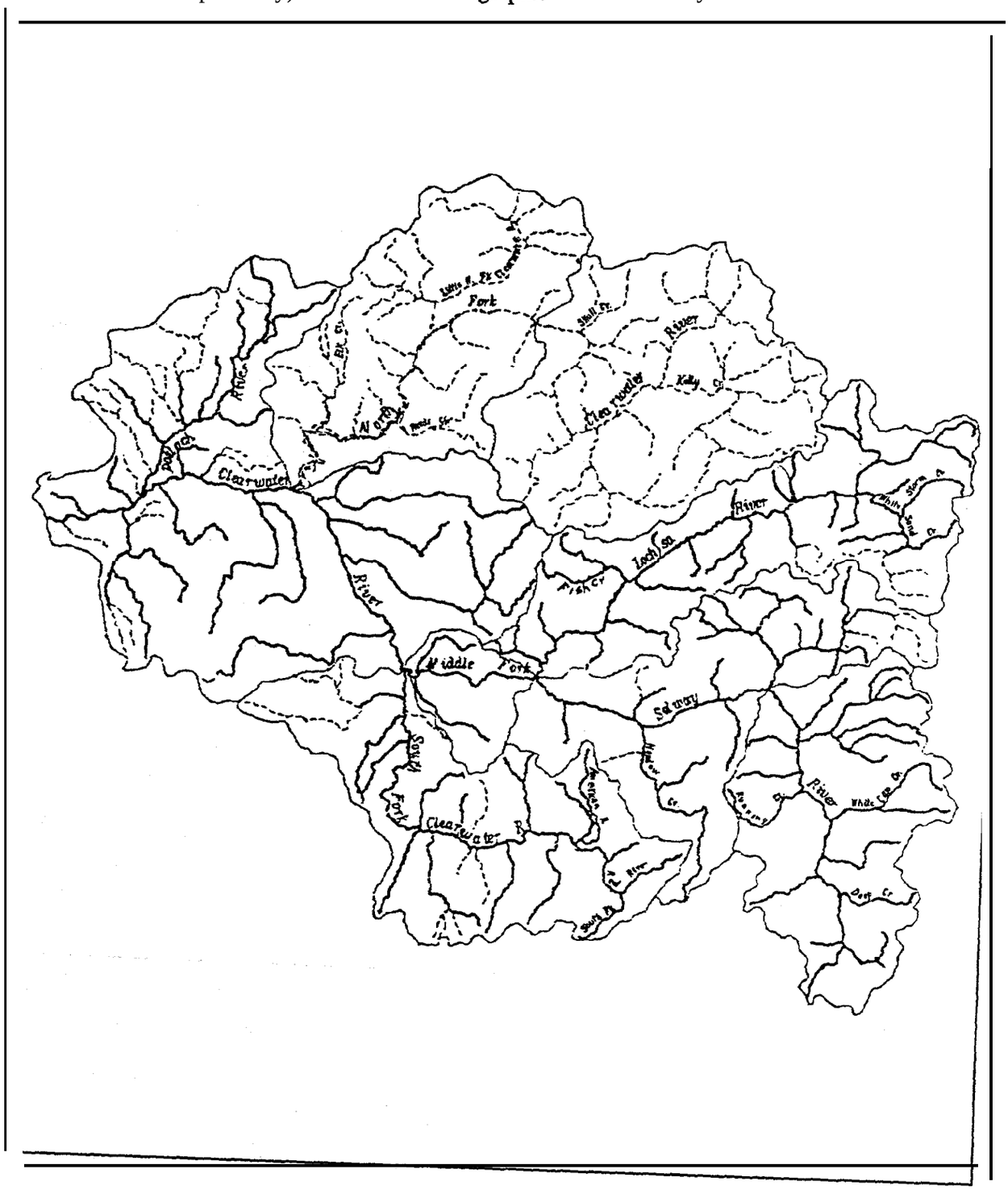
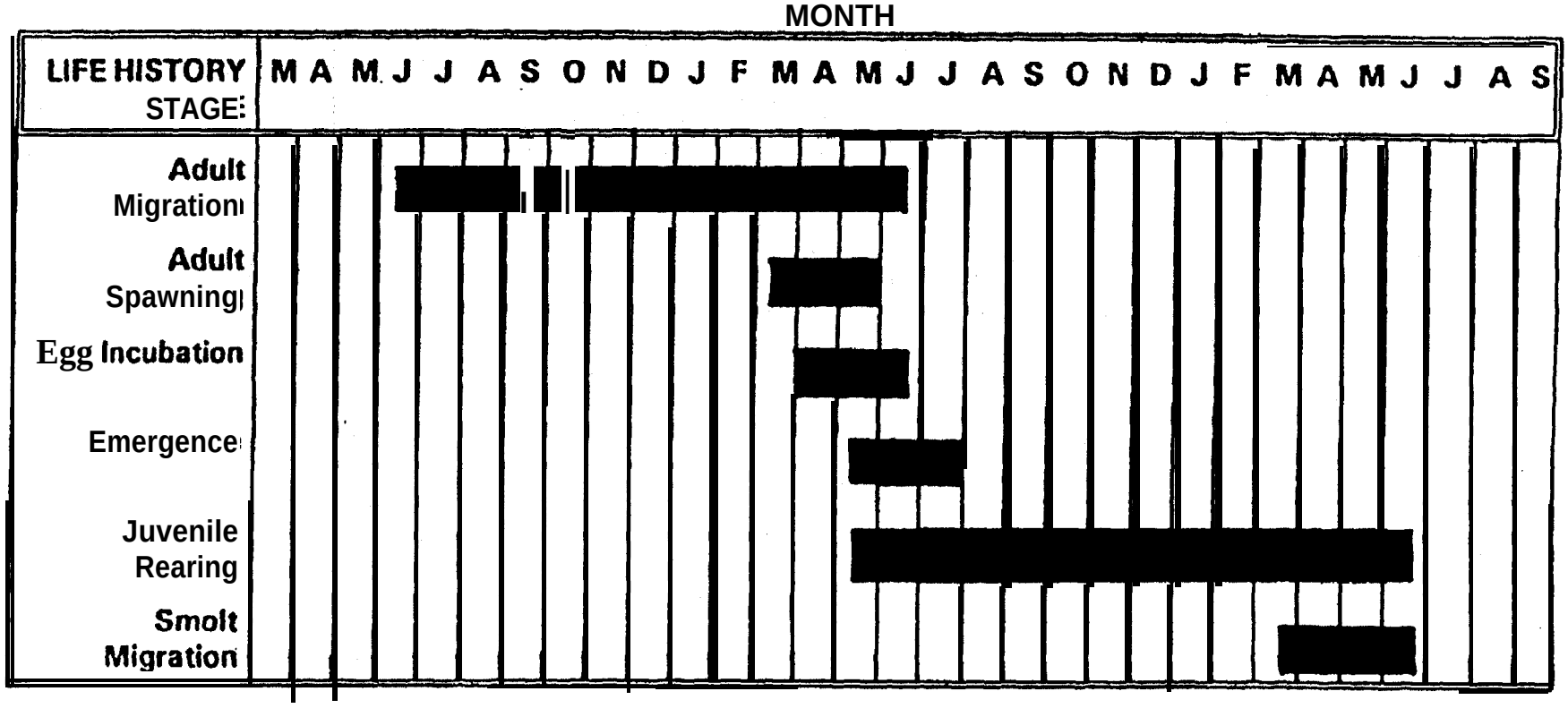


Figure 2 ('IT). Freshwater life history for naturally produced summer steelhead in the Clearwater River subbasin.



a Timing represents the basin-wide average. Local conditions cause variability in timing. Juvenile freshwater rearing is L-3 years duration.

Table 1 (HB). Estimated amount of spawning and rearing habitat (Use Type 1) by quality of South Fork Clearwater River steelhead production area.

	Excellent	Good	Fair"	Poor"	Unknown	Total	Confidence[b]
				8			
Miles (%)	25 16	43 39	24 23	22		418.8 832	M M
Acres (%)							

[a] Ratings of fair and poor habitat quality may reflect natural physical features such as gradient and channel type, as well as degradation caused by humans.
[b] 'Confidence' is meant to indicate the reproducibility and accuracy of the estimates made, and will be rated as high, medium or low by the respective agencies.

Source: Presence/Absence database, Northwest Power Planning Council, 1991.

Table 2 (HB). Estimated amount of rearing only habitat (Use Type 2) by quality of South Fork Clear-water River steelhead production area.

	Excellent	Good	Fair"	Poor"	Unknown	Total	Confidence[b]
Miles (%)	0	0	23	77		36.5	M
Acres (%)	0	0	19	81		421.6	M

[a] Ratings of fair and poor habitat quality may reflect natural physical features such as gradient and channel type, as well as degradation caused by humans.
[b] 'Confidence' is meant to indicate the reproducibility and accuracy of the estimates made, and will be rated as high, medium or low by the respective agencies.

Source: Presence/Absence database, Northwest Power Planning Council, 199 1.

Table 3 (PT-a). Detections at the lower Snake and Columbia River smolt collecting dams of August PIT-tagged steelhead parr from Crooked River, 1989 and 1990.

	1989			1990		
Stratum	Number tagged	Number detected	Percent detected	Number tagged	Number detected	Percent detected
CR-I	12	2	16.7	33	1	3.0
CR-II	50	7	14.0	21	2	9.5
CR-III	7	5	71.4	53	5	9.4
CR-IV	2	2	100.0	89	15	16.9
Canyon	40	13	32.5	56	2	3.6
Relief Cr.	10	4	40.0	11	1	9.1
Total	121	33	27.3	263	26	9.9

Source: Kiefer and Forster 199 1, 1992.

Table 4 (PD-a). Parr density and percent of rated carrying capacity (PCC) for steelhead in the South Fork Clear-water River drainage. Densities estimated by snorkel counts.

Stream name	Year	Sample size	Ages 1+ & 2+ density (#/100m^2)	Density std. dev.	PCC for 1+ & 2+	PCC std. dev.
Meadow Creek	87	2	13.29	2.35	94.89	16.82
Meadow Creek	88	2	6.99	4.75	49.93	33.94
Meadow Creek	89	2	6.90	2.62	49.32	18.74
Meadow Creek	90	2	9.25	1.33	66.07	9.50
Johns Creek	88	3	7.86	3.08	39.30	15.40
Johns Creek	89	4	5.59	4.66	27.96	23.31
Johns Creek	90	4	12.39	6.24	67.53	38.72
Johns Creek	91	3	8.53	3.37	42.67	16.83
Tenmile Creek	85	1	6.07	NA[a]	30.35	NA
Tenmile Creek	86	1	3.27	NA	16.35	NA
Tenmile Creek	87	1	1.89	NA	9.45	
Temnile Creek	90	5	4.39	1.78	21.97	8 %
New some Creek	85	1	9.95	NA	71.07	NA
Newsome Creek	86	1	9.45	NA	67.50	NA
Newsome Creek	87	3	7.35	3.97	52.50	28.37
New some Creek	88	3	1.49	1.12	10.67	8.01
New some Creek	89	3	1.94	1.83	13.88	13.11
Newsome Creek	90	4	0.00	0.00	0.00	0.00
Newsome Creek	91	4	9.24	10.23	66.00	73.04
Crooked River	85	7	1.14	0.86	8.12	6.16
Crooked River	86	14	8.44	4.52	60.27	32.30
Crooked River	87	7	9.35	5.18	66.76	36.98
Crooked River	88	14	10.06	3.82	71.83	27.31
Crooked River	89	19	4.97	2.75	35.52	19.66
Crooked River	90	24	1.76	1.88	12.57	13.42
Crooked River	91	28	4.74	7.45	32.72	53.31
Relief Creek	88	2	21.28	7.65	106.40	38.25
Relief Creek	89	3	7.46	3.15	37.32	15.77
Relief Creek	90	4	0.34	0.67	1.69	3.37
Relief Creek	91	4	4.08	4.33	20.40	21.63
Crooked R., E.	88	2	0.39	0.55	1.95	2.76
Crooked R., E.	89	2	0.00	0.00	0.00	0.00
Crooked R., E.	91	1	0.00	NA	0.00	NA
Crooked R., W.	88	2	2.80	0.52	14.00	2.62
Crooked R., W.	89	2	0.00	0.00	0.00	0.00
Crooked R., W.	91	2	0.26	0.37	1.30	1.84

Table 4 (PD-a) (cont.). Parr density and percent of rated carrying capacity (PCC) for steelhead in the South Fork Clear-water River drainage. Densities estimated by snorkel counts.

Stream name	Year	Sample size	Ages 1+ & 2+ density (#/100m^2)	Density std. dev.	PCC for 1+ & 2+	PCC std. dev.
	85	6				
Red River	86	7	0.97	0.65	8.16	4.16
Red River			6.24	6.63	61.03	67.40
Red River	88	8	3.62	2.59	34.38	27.05
Red River	89	8	1.06	0.70	8.99	6.50
Red River		8	1.34	0.75	11.89	7.02
Red River	90	8	0.83	0.82	6.88	5.86
Red River	91		0.34	0.42	2.76	3.00
Moose Butte Cr.	91	1	3.84	NA	38.40	NA
	85					
American R.	86	2	2.51	1.12	17.93	7.98
American R.		2	13.70	4.21	97.82	30.05
American R.	87	2	11.81	3.82	84.36	27.27
American R.	89	2	5.21	3.26	37.18	23.28
American R.	90		7.12	2.57	50.86	18.38
American R.		2	13.59	0.40	97.07	2.83
American R.	91	2	3.54	0.38	25.25	2.67

[a] NA = not applicable.

Source: B. Rich, IDFG, unpublished.

Table 5 (PD-a). Estimated steelhead parr abundance for Crooked River", 1988-1990.

Sample[b] year	Brood year	Parr abundance	+2 SE
1988			
Age 1+	1987	22,522	4,046
Age 2+	1986	1,798	958
1989			
Age 1+	1988	9,293	1,593
Age 2+	1987	4,543	911
1990			
Age 1+	1989	2,344	644
Age 2+	1988	1,843	611

[a] Site is from Crooked River weir to headwaters.
[b] Sampling is done by snorkeling in late summer.

Sources: Kiefer and Forster 1990, 1991, 1992.

Table 6 (RN-a). South Fork Clear-water drainage steelhead index redd counts[a] conducted by Idaho Department of Fish and Game, 1990 and 1991.

		Number of redds			Redds/km	
Location	Reach	1990	1991	km	1990	1991
Crooked River	Canyon to bridge	128	4	3.7	34.6	1.1
	Bridge to Orogrande	91	5	4.8	18.9	1.0
	Mouth to weir	NC[b]	1	NM[c]	NA[d]	NM
	Weir to meanders	NC	9	NM	NA	NM
	Meanders	NC	25	NM	NA	NM
	Meanders to narrows	NC	6	NM	NA	NM
Red River	S. Fk. to Schissler Br.	2	NC	15.0	0.1	NA

[a] Counts were single peak counts conducted aerially in May.
[b] NC = not counted.
[c] NM = not measured.
[d] NA = not applicable.

Sources: Rich et al. 1992.
B. Rich, IDFG, unpublished.

Table 7 (AL-a). Total lengths of naturally produced steelhead trapped at the Crooked River weir, 1991.

Length cm.	1991 No. fish
< 70	
71	
72	
73	
74	
75	
76	
77	
78	
79	
80	
81	
82	
83	
84	
85	2
86	1
87	•
88	1
89	1
90	
91	
92	
93	
94	
95	
96	
97	
98	
99	
100	

[a] Blanks indicate no fish of this size collected and measured.

Source: J. McGehee, IDFG, unpublished.

Table 8 (AC-a). Percent age composition of spring and fall migrating juvenile steelhead in Crooked River, 1989-1990.

	Age Composition %	
	1989	1990
	Spring	
	48	
Age 1	29	34
		15
Age 3	23	51
	Fall	
Age 0	24	18
Age 1+	29	20
Age 2+	47	63

Sources: Kiefer and Forster 1991, 1992.

Table 9 (SL-a). Average fork lengths (mm) of steelhead parr from PIT tagging strata on Crooked River, August 1988-1990.

	1988		1989		1990	
Stratum	Number measured	Mean length	Number measured	Mean length	Number measured	Mean length
I	299	115	125	121	39	152
II	532	107	101	119	9	101
Canyon	146	123	203	117	136	135
Relief Creek	157	113	62	115		
III	76	100	158	121	81	121
IV	26	95	279	117	290	121
Total	1,236	109	928	118	555	126

Source: Kiefer and Forster 1990, 1991, 1992.

Table 10 (SL-a). Steelhead smolt length and PIT tag detection for Crooked River, spring 1989 and 1990.

	1989			1990		
Length (mm)	Number tagged	Number detected	Percent detected	Number tagged	Number detected	Percent detected
< 90				45	0	0
90 - 129				13	1	7.7
> 129				61	24	39.3
< 130	248	0	0			
130 - 149	38	16	42			
> 149	34	20	59			
Total	320	36	11	119	25	21.0

Source: Kiefer and Forster 1991, 1992.

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SOUTH FORK CLEARWATER RIVER, CLEARWATER SUBBASIN

Hatchery Produced Summer Steelhead

GEOGRAPHIC LOCATION

The South Fork Clearwater River (South Fork) joins the Middle Fork Clearwater River to form the mainstem Clear-water River 75 miles upstream from the mouth of the Clearwater River at Kooskia. In the 1960's, incubation. channels for steelhead eyed eggs were constructed in Crooked and Red rivers. Crooked river converges with the South For, at river mile 58.5 and is 17 miles in length. Adult steelhead were collected at Crooked River in 1991. Red River converges with the South Fork at river mile 62.5 and is 18 miles in length (Mallet 1974). An incubation channel constructed at Meadow Creek has been utilized for steelhead since 1980. Meadow Creek joins the South Fork at river mile 33 and is 15 miles in length.

ORIGIN

A diversion dam for hydroelectric power was built across the South Fork Clearwater River at river mile 20 in 1910. This dam, near Harpster, blocked all upstream fish migration. Prior to construction of the dam, steelhead were likely indigenous throughout the South Fork drainage. Beginning in 1935, a wooden fishway provided some passage for steelhead (Mallet 1974).

Lewiston Dam was constructed in 1927. Inadequate adult fish passage at the dam's one fishway virtually eliminated salmon runs into the basin and probably reduced steelhead runs as well. In 1939, two additional fishways were constructed and in the mid-1960's, improvements were made. In 1963, the Harpster Dam was removed which made the South Fork drainage accessible to steelhead for the first time in 14 years. Since that time, steelhead have had access to all former spawning areas in the South Fork drainage. Then in 1973, Lewiston Dam was removed (Nez Perce Tribe and Idaho Department of Fish and Game 1990).

Efforts by Idaho Department of Fish and Game (IDFG) to reintroduce steelhead to the Clearwater drainage began in the 1960's. The Clear-water River Fisheries Development Program was directed at restoring steelhead runs in the South Fork Clearwater drainage with the outplanting of adult and eyed eggs (Nez Perce Tribe and Idaho Department of Fish and Game 1990). From 1961- 1966, managers outplanted 1,534 adult steelhead trapped at Lewiston Dam into various South Fork tributaries. From 1962-1968, steelhead eggs were collected from adults trapped at Lewiston Dam. Eyed eggs were planted in incubation channels located in Red and Crooked rivers. The Red River incubation channel was constructed in 1964 and was utilized for steelhead in various years through 1969 and again in 1978-1980. Approximately 3.7 million eyed eggs were placed in the incubation channel. Broodstock during the late 1970's and early 1980's came from Dworshak National Fish Hatchery (NFH). An incubation channel constructed in Crooked River in 1966 was only utilized for 450,000 steelhead eggs that year (Lindland and Bowler 1988). In 1967, the first steelhead smolt release in the Clear-water drainage was 163,238 steelhead smolts released into the South Fork drainage. All subsequent steelhead supplementation originated from Dworshak NFH broodstock once the hatchery began production in 1969. The stock of adults returning to Dworshak NFH originated in the North Fork of the Clearwater. Between 1977 and 1989, incubation channels located in Red River and Meadow Creek have periodically been utilized for at total of 14.8 million steelhead eggs (Lindland and Bowler 1988). According to the Clear-water Subbasin Plan, from 1967-1987, 7.6 million fry and fingerlings were planted in the South Fork drainage. From 1961-1987, 13,049 steelhead adults were placed in the South Fork drainage. Also, about 4.3 million

steelhead smolts were released in the South Fork drainage from 1976-1987 (Nez Perce Tribe and Idaho Department of Fish and Game 1990).

Over the course of the early reintroduction program, there was little evaluation of the different outplants or measurement of production of indigenous fish. Information could not be recorded separately until the mid-1980's because hatchery steelhead were not differentially marked, Because of the mixed brood stock history and influence of hatchery fish, the IDFG classifies steelhead in the South Fork drainage as natural (Idaho Department of Fish and Game 1992). Steelhead returning to the South Fork Clearwater are also classified as B-run on the basis of ocean age component, size at age, and timing. B-run steelhead generally enter the Columbia River from August through December and are larger than A-run steelhead of comparable ocean age.

DISTRIBUTION

Tables 1 and 2 of Lindland and Bowler (1988) summarizes eyed egg plants into Red River and Meadow Creek incubation channels during the 1978-1987 period. Table 7 of Appendix A in their report summarizes steelhead releases into the South Fork, 1971-1987. Table 16 of the same report summarizes egg plants into the Red River incubation channel, 1962-1969. Table 22 from the Clearwater subbasin Plan (Nez Perce Tribe and Idaho Department of Fish and Game 1990) summarizes hatchery steelhead supplementation in the South Fork, 1977-1989.

Table 1 of this report summarizes the release of steelhead into the South Fork for brood years 1981-1990. Several tributaries have been stocked with hatchery steelhead. Coded wire tag (CWT) codes are identified for brood years 1986-1990. Other marks or tag releases have not been compiled.

PRODUCTION

Fry emergence from eggs placed in the Red River incubation channel ranged 74-85 percent (Lindland and Bowler 1988). Information pertaining to hatchery smolt survival is found in the hatchery steelhead section of the lower Clearwater chapter.

For CWT hatchery steelhead, Roseberg et al. (1992) estimated smolt to adult survival. Since estimates were generated from adults recovered in the Columbia, Snake and Clearwater rivers, the percentages do not reflect an adult return to the South Fork, or even to the Clearwater drainage. The survival information is also biased by any mortality attributed to tagging. They estimated that 0.69 percent of the brood year 1985 hatchery steelhead that were released in the South Fork and had CWTs survived from smolt to adult (Table 2). Incomplete returns for two brood year 1986 releases show a wide variance in smolt to adult survival. Fish released at 4.4 to the pound have shown a higher smolt to adult survival than smaller fish released as 6.5 fish to the pound. Roseberg et al, (1992) also estimated that the preliminary off-site return rate for brood year 1986 hatchery steelhead released in the South Fork was 0.36 percent.

ADULT LIFE HISTORY

Adult Escapement

Specific time of migration and escapement for hatchery steelhead returning to the South Fork drainage has not been identified for the ocean, Columbia River, or Snake River. The University of Idaho implemented adult timing research in 1991 which should provide information about Snake River timing (Bjornn et al. 1992).

Adult steelhead that migrate in the fall over-winter in the Snake and lower Clearwater rivers. The time of entry of steelhead into the Cleat-water subbasin was from July through June, noted when fish were counted at the Lewiston Dam from the 1949-1950 run year through the 1971-1972 run year. Up until the 1958-1959 run year, an average of 79 percent of the steelhead run crossed Lewiston Dam during March-May. An average of only 16 percent of the run crossed during September-November. Beginning with the 1958-1959 run year, an average of 42 percent of the steelhead run crossed Lewiston Dam during March-May, and 56 percent crossed in September-November (S. W. Kiefer, IDFG, personal communication).

For the 1985 brood year release of hatchery steelhead in the South Fork, Roseberg et al. (1992) estimated the straying rate by comparing the ratio of Zone 6 return rates for the South Fork release and control with release site return rate. They estimated the straying rate for this release was 21.2 percent.

Harvest

Information has not been compiled regarding the rate of contribution of this stock to ocean, Columbia River or Snake River harvests. For 3 CWT releases in the South Fork in 1987 and 1987, the expanded estimate of CWT steelhead harvested in the Zone 6 fishery ranged from O-03-0.61 percent of a tag group (Table 2). However, other than the Dworshak National Fish Hatchery rack, the Zone 6 fishery is apparently the other major interception point for South Fork hatchery steelhead.

Because of hatchery steelhead returns, the lower mainstem South Fork was reopened to steelhead fishing in the fall, 1984. Only hatchery steelhead, i.e. steelhead without an adipose fin, can be harvested. Up to 704 hatchery steelhead have been harvested during a run-year (Table 3). On average, harvest of hatchery steelhead from the South Fork accounted for 2.9 percent of the harvest in the Clear-water drainage.

Information regarding occurrence and magnitude of tribal harvest of hatchery steelhead in the South Fork is not available.

Spawner Escapement

In 1991, 44 hatchery steelhead were intercepted at the Crooked River weir from April 3 through May 6. The ratio of hatchery to naturally produced steelhead was almost 7 to 1. Number of hatchery steelhead escaping to other parts of the South Fork is unknown.

Adult Characteristics

There is some limited information available describing fork length. A sample of 44 hatchery steelhead intercepted at the Crooked River weir ranged 57-95 cm in total length (Table 4). The average total length was 84 cm.

The ocean age composition of the hatchery steelhead intercepted at the Crooked River weir, based on length frequency criteria used at Dworshak NFH, was 97.7 percent two-ocean. For brood year 1985 hatchery steelhead recovered with CWTS, the ocean age composition was 3.5 percent one-ocean, 62.3 percent two-ocean, and 34.2 percent three-ocean (Roseberg et al. 1992). This includes fish intercepted in the Columbia River as well as the Snake and Clearwater rivers.

Forty-one percent of the returning hatchery steelhead intercepted at the Crooked River weir in 1991 were females.

Fecundity is likely similar to fecundity of hatchery steelhead returning to Dworshak NFH, described in the lower Clearwater chapter.

JUVENILE LIFE HISTORY

Life history of hatchery reared steelhead is described in the hatchery steelhead section of the lower Clearwater chapter.

BIOCHEMICAL/GENETIC CHARACTERISTICS

Because Dworshak NFH steelhead are used for hatchery releases in the South Fork, refer to the hatchery steelhead section of the lower Clearwater chapter.

DISEASES

Refer to the hatchery steelhead section of the lower Clearwater chapter for information about diseases encountered while hatchery steelhead rear at Dworshak NFH.

REFERENCES

References appear at the end of this section.

Table 1 (TR). Hatchery steelhead releases into the South Fork Clearwater River by brood years, 1981-1990. Coded wire tag codes displayed for brood year 1986. No coded wire tag codes released during brood years 1987- 1990.

Brood Year	Brood-stock	Hatchery	Life Stage	Release Date (1)	Release Date (2)	Fish/lb	Number Released	Release Location	CWT
1981	Dworshak NFH B	Dworshak NFH	F-F”	1981			100,000	Crooked River	
1981	Dworshak NFH B	Dworshak NFH	F-F	1981			433,472	S. Fk. Clearwater	
1981	Dworshak NFH B	Dworshak NFH	F-F	1981			100,000	American River	
1981	Dworshak NFH B	Dworshak NFH	F-F	1981			30,000	Leggett Creek	
1981	Dworshak NFH B	Dworshak NFH	F-F	1981			100,000	Newsome Creek	
1981	Dworshak NFH B	Dworshak NFH	F-F	1981			100,000	Red River	
1982	Dworshak NFH B	Dworshak NFH	F-F	1982			381,811	s. Fk. Clearwater	
1982	Dworshak NFH B	Dworshak NFH	smolt	1983			496,471	s. Fk. Clearwater	
1983	Dworshak NFH B	Dworshak NFH	smolt	1984			39,858	Newsome Creek	
1983	Dworshak NFH B	Dworshak NFH	smolt	1984			15,850	Crooked River	
1983	Dworshak NFH B	Dworshak NFH	smolt	1984			228,842	S. Fk. Clearwater	
1983	Dworshak NFH B	Dworshak NFH	smolt	1984			117,177	American River	
1983	Dworshak NFH B	Dworshak NFH	smolt	1984			82.929	Red River	

Table 1 (TR) (cont.). Hatchery steelhead releases in o the South Fork Clearwater Riv :r by brood years, 1981-1990. Coded wire tag codes displayed for brood year 1986. No co(ed wire tag codes released during brood years 1987-1990.

Brood Year	Brood-stock	Hatchery	Life Stage	Release Date (1)	Release Date (2)	Fish/lb	Number Released	Release Location	CWT
1983	Dworshak NFH B	Dworshak NFH	smolt	1984			22,274	Newsome Creek	
1985	Dworshak NFH B	Dworshak NFH	adult	1985			1,859	Newsome Creek	
1984	Dworshak NFH B	Dworshak NFH	smolt	1985			95,286	Newsome Creek	
1984	Dworshak NFH B	Dworshak NFH	smolt	1985			162,111	American River	
1985	Dworshak NFH B	Dworshak NFH	adult	1985			1,224	American River	
1985	Dworshak NFH B	Dworshak NFH	adult	1985			1,733	Crooked River	
1984	Dworshak NFH B	Dworshak NFH	smolt	1985			42,235	Crooked River	
1985	Dworshak NFH B	Dworshak NFH	adult	1985			184	Newsome Creek	
1985	Dworshak NFH B	Dworshak NFH	smolt	1986			755,488	S. Fk. Clearwater	
1985	Dworshak NFH B	Dworshak NFH	smolt	1986			143,355	American River	
1985	Dworshak NFH B	Dworshak NFH	smolt	1986			140,820	Crooked River	
1985	Dworshak NFH B	Dworshak NFH	smolt	1986			212,188	Newsome Creek	
1985	Dworshak NFH B	Dworshak NFH	smolt	1986			8,904	Leggett Creek	

Table 1 (TR) (cont.). Hatchery steelhead releases into the South Fork Clearwater River by brood years, 1981-1990. Coded wire tag codes displayed for brood year 1986. No coded wire tag codes released during brood years 1987-1990.

Brood Year	Brood-stock	Hatchery	Life Stage	Release Date (1)	Release Date (2)	Fish/lb	Number Released	Release Location	CWT
1986	Dworshak NFH B	Dworshak NFH	F-F	1986			87,750	Crooked River	
1986	Dworshak NFH B	Dworshak NFH	adult	1986			360	American River	
1986	Dworshak NFH B	Dworshak NFH	smolt	04/13/87	04/15/87	4.4	26,125	Crooked River	102940
1986	Dworshak NFH B	Dworshak NFH	smolt	04/15/87		6.5	24,025	Crooked River	102941
1986	Dworshak NFH B	Dworshak NFH	smolt	04/13/87	04/15/87	5.4	150,012	Crooked River	Untagged
1987	Dworshak NFH B	Dworshak NFH	adult	1987			659	Crooked River	
1986	Dworshak NFH B	Dworshak NFH	smolt	1987			41,527	American River	
1986	Dworshak NFH B	Dworshak NFH	smolt	1987			202,857	Newsome Creek	
1986	Dworshak NFH B	Dworshak NFH	smolt	1987			298,020	S. Fk. Clearwater	
1987	Dworshak NFH B	Dworshak NFH	smolt	04/19/88		7.4	201,325	Crooked River	
1987	Dworshak NFH B	Dworshak NFH	smolt	04/20/88		7.1	190,708	Newsome Creek	
1987	Dworshak NFH B	Dworshak NFH	smolt	04/28/88		6.6	165,055	S. Fk. Clearwater	
1987	Dworshak NFH B	Dworshak NFH	smolt	04/20/88			56,885	American River	

Table 1 (TR) (cont.). Hatchery steelhead releases into the South Fork Clearwater River by brood years, 1981-1990. Coded wire tag codes displayed for brood year 1986. No coded wire tag codes released during brood years 1987-1990.

Brood Year	Brood-stock	Hatchery	Life Stage	Release Date (1)	Release Date (2)	Fish/lb	Number Released	Release Location	CWT
1988	Dworshak NFH B	Dworshak NFH	adult	04/21/88	04/25/88		540	American River	
1988	Dworshak NFH B	Dworshak NFH	eyed-eggs	05/13/88			1,021,808	Meadow Creek	
1988	Dworshak NFH B	Dworshak NFH	eyed-eggs	05/27/88			182,250	Red River	
1988	Dworshak NFH B	Dworshak NFH	smolt	04/25/89	04/26/89	6.8	109,898	Crooked River	
1988	Dworshak NFH B	Dworshak NFH	smolt	04/24/89	04/26/89	5.0	143,803	S. Fk. Clearwater	
1988	Dworshak NFH B	Hagerman NFH	smolt	04/26/88	05/01/89	4.4	90,673	Newsome Creek	
1989	Dworshak NFH B	Dworshak NFH	smolt	04/25/90		7.0	287.830	Mill Creek	
1989	Dworshak NFH B	Dworshak NFH	smolt	04/25/90		6.8	2 10,836	Newsome Creek	
1989	Dworshak NFH B	Dworshak NFH	smolt	04/25/90		6.9	214,633	Crooked River	
1989	Dworshak NFH B	Dworshak NFH	smolt	04/25/90		6.5	209,847	American River	
1989	Dworshak NFH B	Dworshak NFH	smolt	04/15/91	04/24/91	6.2	177,336	S. Fk. @ Mt. Idaho	
1990	Dworshak NFH B	Dworshak NFH	smolt	04/15/91	04/24/9 1	6.7	210.874	American River	
1990	Dworshak NFH B	Dworshak NFH	smolt	04/15/91	04/24/91	6.7	213,827	Red River	
1990	Dworshak NFH B	Dworshak NFH	smolt	04/15/91	04/24/91		290,421	S. Fk. @ Mill Creek	

[a] F-F designates a fry or fingerling release.

Table 2 (RR-a). Coded wire tag recoveries through 1990 for steelhead tag groups released into the South Fork of the Clearwater from Dworshak National Fish Hatchery.

Tag code	Release date	Release site	Number tagged	Dworshak rack	Zone 6 fishery (expanded)	Idaho sport (actual)	Other[a]	Total
51729[b]	4/18/86	S. Fk. Clearwater	49,675					
		No. CWT recovered		40	301	0	1	342
		% total CWT recovered		11.7%	88.0%	0.0%	0.3%	100.0%
		% of total tagged		0.081%	0.606%	0.00%	0.002 %	0.688 %
1 02940[c,d]	4/13/87	Crooked River	26,123					
		No. CWT recovered						146
		% total CWT recovered		42.5:	56.8:	0.0;	0.7;	100.0%
		% of total tagged		0.237 %	0.318%	0.00%	0.004%	0.559 %
102941[d,e]	4115187	Crooked River	24,013					
		No. CWT recovered		13	7	0		20
		% total CWT recovered		65.0%	35.0%	0.0%	0.0;	100.0%
		% of total tagged		0.054 %	0.029 %	0.00%	0.00%	0.083 %

[a] Other includes ocean, other racks, and non-Idaho racks.
[b] Smolts were 6.0 fish/lb.
[c] Smolts were 4.4 fish/lb.
[d] Incomplete returns. Does not include three-ocean fish.
[e] Smolts were 6.5 fish/lb.

Source: Roseberg et al. 1992.

Table 3 (RS-a). Number of steelhead harvested by nontreaty anglers from the fall of 1980 to the spring of 1991, from the South Fork of the Clearwater.

Years	Section 07"
1980 - 1981	CS[b]
1981 - 1982	c s
1982 - 1983	c s
1983 - 1984	c s
1984 - 1985	284
1985 - 1986	230
1986 - 1987	704
1987 - 1988	233
1988 - 1989	693
1989 - 1990	307
1990 - 1991	311

[a] South Fork of the Clear-water from its mouth upstream to the confluence of American and Red rivers.
[b] cs = Closed season.

Sources: Ortmann 1981.
Pollard 1984.
Partridge and Pollard 1983.
Cochnauer 1986.
Hall-Griswold and Cochnauer 1987.
McArthur 1988a, 1988b, 1989, 1990, 1991.
T. McArthur, IDFG, unpublished.

Table 4 (AL-a). Total lengths of hatchery steelhead trapped at the Crooked River weir, 1991.

Length cm.	1991 No. fish
44	
45	
46	
47	
48	
49	
50	
51	
52	
53	
54	
55	
56	
57	1
58	[a]
59	
60	
61	
62	
63	
64	
65	
66	
67	
68	
69	
70	
71	
72	
73	
74	1
75	
76	1
77	
78	3
79	4
80	1
81	3
82	1
83	3
84	4
85	4
86	3
87	5
88	2
89	1
90	
91	2
92	1
93	2
94	1
95	1
96	
97	
98	
99	
100	

[a] Blanks indicate no fish of this size collected and measured.

Source: J. McGehee, IDFG, unpublished.

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LOCHSA RIVER, CLEARWATER SUBBASIN

Naturally Produced Spring Chinook

GEOGRAPHIC LOCATION

The Lochsa River originates on the Idaho-Montana border and joins the Selway River at Lowell to form the Middle Fork Clearwater River (Figure 1). The mainstem Lochsa is 71 miles long. The drainage area covers approximately 1,180 square miles (Mallet 1974). Many of the streams that drain from the south originate in the Selway-Bitteroot Wilderness. Large tracts of roadless area are found in the Fish, Post Office, Pete King, and White Sands drainages (Idaho Department of Fish and Game 1992). Sixty-two miles of the mainstem Lochsa River are protected under the Wild and Scenic Rivers Act and they are classified as recreational. Most of the drainage is located within the Idaho batholith, a geologic area known for highly erodible soils (Nez Perce Tribe and Idaho Department of Fish and Game 1990).

ORIGIN

Spring chinook production in the Clearwater subbasin was reduced by construction of Lewiston Dam in 1927. Inadequate adult fish passage at the dam's one fishway virtually eliminated salmon runs into the basin. In 1939, two additional fishways were constructed and in the mid-1960's, improvements were made. In 1973, Lewiston Dam was removed (Nez Perce Tribe and Idaho Department of Fish and Game 1990).

Prior to construction of the dam, chinook were likely indigenous throughout the Clear-water Basin, but accurate records are lacking regarding which races were present. Timing of chinook passage at Lewiston Dam indicates there may have been summer chinook returning to the Clearwater drainage. In 1967, the only known spawning area of the remnant summer chinook mn was in the headwaters of the Lochsa River. Researchers noted a declining redd count in the summer chinook area, 1965-1968. An increase in 1969 was attributed to spring chinook reintroduction efforts in the Selway River (Nez Perce Tribe and Idaho Department of Fish and Game 1990). The Clearwater Subbasin Plan states that further attempts to distinguish the potentially native summer chinook run from the reintroduced spring chinook runs were abandoned as the majority of fish returns to the Clearwater River were the result of the reintroduction program. Fall chinook were also noted crossing Lewiston Dam (Nez Perce Tribe and Idaho Department of Fish and Game 1990). For management purposes, chinook populations in the Lochsa drainage have been classified by the Idaho Department of Fish and Game (IDFG) as spring chinook (Idaho Department of Fish and Game 1992).

Efforts by Idaho Department of Fish and Game (IDFG) to reintroduce chinook salmon to the Clearwater drainage began in the 1950's and the program accelerated in the 1960's. Many of the reintroduction actions in the 1960's took place in the Selway drainage. However, as part of the program in the early 1960's, fall chinook eggs were planted in Warm Springs Creek of the Lochsa drainage in 1960-1961 (Edson 1963). Spring chinook supplementation in the Lochsa drainage began in the 1970's. Fry, primarily from Rapid River broodstock, were released into the major tributaries, while White Sands Creek received most of the released smolts (Idaho Department of Fish and Game 1992). Progeny of broodstock collected at Kooskia National Fish Hatchery (NFH), Cowlitz NFH, Carson NFH, and Leavenworth NFH were also planted in the Lochsa through the 1980's. During 1972-1987, 3.7 million hatchery fry and fmgerlings and 1.5 million hatchery smolts were stocked into the Lochsa (Lindland and Bowler 1988). Spring chinook presmolts have been released from a rearing pond located at Powell since 1989. There is also an adult weir across the

Lochsa River at this site. These facilities are associated with Clearwater Anadromous Fish Hatchery.

Over the course of the reintroduction program, there was little evaluation of the different outplants or measurement of production of indigenous fish. Information could not be recorded separately because hatchery chinook were not differentially marked. The 1991 brood year was the first year that all hatchery chinook smolts and presmolts were marked with an adipose fin-clip and coded wire tag in order to differentiate them from naturally produced fish. Because of the mixed brood stock history and influence of hatchery fish, the IDFG classifies chinook in the Lochsa drainage as natural (Idaho Department of Fish and Game 1992).

DISTRIBUTION

Available spawning and rearing habitat for the Lochsa River was described in the Presence/Absence database (Tables 1 and 2). This information was developed for the Northwest Power Planning Council for subbasin planning and modeling.

PRODUCTION

There is some information available describing survival and production factors. IDFG biologists estimated fry-to-parr survival for stocked hatchery fry ranged from 6.8-32.9 percent in several Lochsa tributaries (Table 3). IDFG also monitored spring chinook parr production in the Lochsa drainage, 1985-199 1. The overall weighted mean for IDFG monitoring transects was 3.7 parr per 100 m^2 and 4.9 percent of estimated carrying capacity (Table 4). Parr carrying capacity ratings for spring chinook were derived from the Presence/Absence database used for development of the Cleat-water Subbasin Plan. Parr densities were determined by snorkel counts.

ADULT LIFE! HISTORY

Adult Escapement

Chinook crossing Bonneville Dam through May 31 arc counted as springs, as are those crossing Lower Granite Dam through June 17. Specific time of migration and escapement for Lochsa River spring chinook is not well documented in the ocean, Columbia River or the Snake River. The University of Idaho implemented adult timing research in 1991 which should provide more information about Snake River timing (Bjornn et al. 1992).

The time of entry of spring and summer chinook into the Clear-water subbasin was from April to July, noted when fish were counted at the Lewiston Dam. Chinook counts at the dam peaked in June-July, 1965-1972. Run estimates for the entire Clearwater drainage ranged from 5 in 1963 up to 7,700 chinook in 1977, although larger runs were associated with hatchery produced fish. From 1950-1964, the Lewiston Dam counts for spring, summer, and fall chinook were less than 100 fish (Nez Perce Tribe and Idaho Department of Fish and Game 1990).

Harvest

There is no information available regarding harvest specifically of Lochsa River spring chinook in the ocean, Columbia or Snake rivers.

During the period 1959-1976, the entire Clearwater drainage contributed less than one percent of Idaho's sport salmon harvest (Homer and Bjornn 1981). Information is not available regarding

specific information about the sport harvest of salmon from the Lochsa drainage. Sport harvest in the Clearwater drainage was not a common occurrence. Ortmann (1975) noted that the 1974 salmon

season in the Clear-water drainage was the second salmon season in 46 years. However, it appears that the Lochsa drainage remained closed.

Information regarding occurrence and magnitude of tribal harvest of Lochsa River spring chinook is not available.

Spawner Escapement

Escapement information is not available for the lower Lochsa drainage. Spring chinook returning to the upper Lochsa drainage have been intercepted at the Powell weir located near Walton Creek since 1989 (Table 5). The weir crosses the Lochsa River 66 miles upstream from its mouth. Because of high water, the weir is usually not installed until mid-July, when fish begin to enter. However, in 1990, the weir was installed in mid-June, and fish were already present (Table 6). Therefore, it is unknown have many spring chinook escape to the upper Lochsa drainage prior to weir installation. However, a peak in fish arrival typically occurs after August 15.

From 1989-1991, the majority of the spring chinook intercepted at the weir were released upstream to spawn naturally. Known spawner escapement above the weir ranged from 22-162, 1989-1991 (Table 7).

Redd and carcass counts have been conducted in index areas of the Lochsa drainage since 1966 by IDFG. This program has evolved into a single peak count. Transect counts are made in two tributaries and are conducted the last week of August (T. Elms-Cockrum, IDFG, personal communication).

Redd counts have ranged from 0 in 1967 to 112 in 1969, 1967-1991 (Table 8). The counts are used by IDFG for trend information, not escapement estimates.

Adult Characteristics

Because the majority of the spring chinook trapped at the Powell weir have been released for natural spawning, biological information gathered at the weir will be discussed here. It is unknown whether fish entering the weir arc the result of natural or hatchery production because until the 1991 brood year, they were not differentially marked.

Weights of returning spring chinook are not available. Based on length frequency, the two-ocean age component is the strongest of the annual return (Tables 9 and 10). The brood year 1986 information also illustrates a dominant two-ocean component (Tables 11 and 12).

On an annual return basis, females comprised 15-45 percent of the mn (Table 10). for a single brood year, the percentage of females was 35 percent of the return, primarily in the two-ocean age class (Table 13).

Fecundity of naturally spawning fish is not available. Fecundity of spring chinook spawned for artificially production is discussed in the hatchery spring chinook section.

BIOCHEMICAL/GENETIC CHARACTEFUSTICS

Marshall (1992) reported an analysis of genetic characteristics of chinook baseline collections in Idaho. Her information included allele frequencies of naturally produced spring chinook juveniles from Crooked Fork and Brushy Fork, tributaries to the upper Lochsa River.

DISEASES

Information has not been compiled.

REFERENCES

All Lochsa references appear in one reference section at the end of the hatchery produced summer steelhead section.

Figure 1 (TD). Anadromous salmonid distribution in the Clearwater subbasin as represented by summer steelhead, based on the NPPC presence/absence data base (solid/dashed lines respectively) and the BPA Geographic Information System.

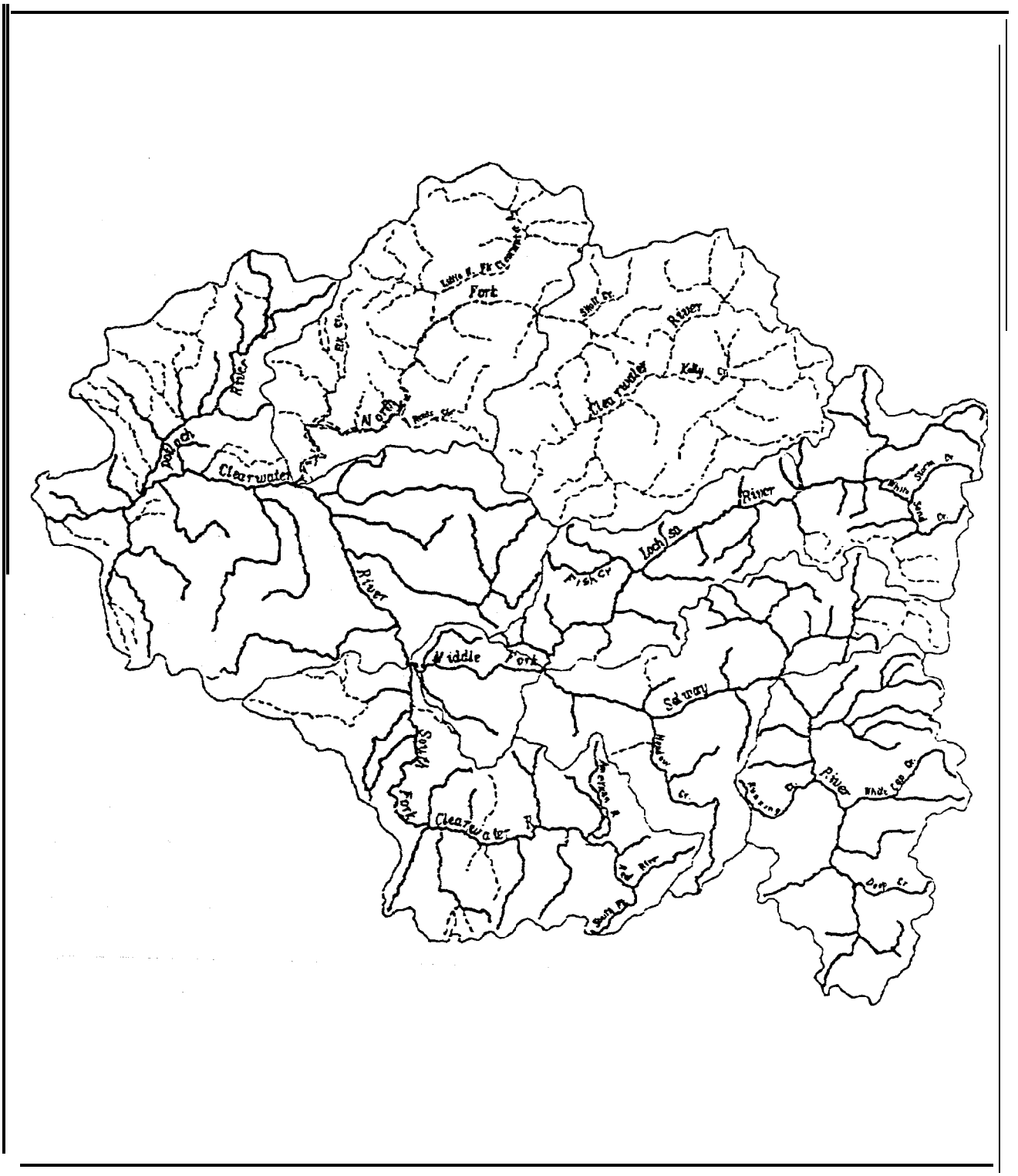

Table 1 (HB). Estimated amount of spawning and rearing habitat (Use Type 1) by quality of Lochsa River spring chinook production area.

	Excellent	G(30	Fair"	Poor"	Unknown	Total	Confidence[b]
Miles (%)	19 8	26	45 66	.01 6		236.6 897	M M
Acres (%							

[a] Ratings of fair and poor habitat quality may reflect natural physical features such as gradient and channel type, as well as degradation caused by humans.
[b] 'Confidence' is meant to indicate the reproducibility and accuracy of the estimates made, and will be rated as high, medium or low by the respective agencies.

Source: Presence/Absence database, Northwest Power Planning Council, 1991.

Table 2 (HB). Estimated amount of rearing only habitat (Use Type 2) by quality of Lochsa River spring chinook production area.

	Excellent	Good	Fair"	Poor[a]	Unknown	Total	Confidence[b]
Miles (%)	0	0	61	39		43.9	M
Acres (%	0	0	56	44		861.4	M

[a] Ratings of fair and poor habitat quality may reflect natural physical features such as gradient and channel type, as well as degradation caused by humans.
[b] 'Confidence' is meant to indicate the reproducibility and accuracy of the estimates made, and will be rated as high, medium or low by the respective agencies.

Source: Presence/Absence database, Northwest Power Planning Council, 1991.

Table 3 (PD-a). Natural chinook parr densities as fish per $100m^2$ (CHINOD) and percent of rated carrying capacity (CHPERCC), Lochsa River drainage 1985-1991.

	Year						
	1985	1986	1987	1988	1989	1990	1991
Lochsa River							
CHINOD=	0.00	0.14	0.00	0.00	0.02	0.76	0.18
CHPERCC=	0.00	0.32	0.00	0.00	0.05	0.04	0.42
N =	1	1	1	1	1	2	3
Old Man Creek							
CHINOD=	NS*	NS	NS	NS	NS	0.00	NS
CHPERCC=	NS	NS	NS	NS	NS	0.00	NS
N=	NS	NS	NS	NS	NS	1	NS
Fish Creek							
CHINOD=	NS	NS	NS	0.04	0.02	0.00	0.00
CHPERCC=	NS	NS	NS	0.03	0.02	0.00	0.00
N=	NS	NS	NS	2	2	4	2
Post Office Creek							
CHINOD=	NS	NS	NS	0.00	0.00	0.00	0.00
CHPERCC=	NS	NS	NS	0.00	0.00	0.00	0.00
N=	NS	NS	NS	2	2	4	2
Warm Springs Creek							
CHINOD=	NS	NS	NS	0.00	0.34	0.00	0.58
CHPERCC=	NS	NS	NS	0.00	0.44	0.00	0.75
N=	NS	NS	NS	1	1	1	1
White Sand Creek							
CHINOD=	0.05	0.68	0.33	0.30	0.05	0.05	0.33
CHPERCC=	0.11	1.55	0.75	0.68	0.11	0.06	0.75
N=	1	1	1	1	1	1	1
Crooked Fork Cr.							
CHINOD=	0.44	4.03	a.92	19.14	16.81	3.77	0.48
CHPERCC=	0.58	5.24	11.58	24.86	21.83	4.90	0.63
N=	2	2	2	4	4	6	2
Brushy Fork Cr.							
CHINOD=	NS	NS	NS	16.71	10.72	5.86	0.15
CHPERCC=	NS	NS	NS	21.70	13.92	7.61	0.20
N=	NS	NS	NS	2	2	4	2

* NS = not sampled.

Source: B. Rich, IDFG, unpublished.

Table 4 (TS-a). Mid-August parr survival from mid-May fry releases of spring chinook salmon into Lochsa River tributaries, 1986-1989.

Stream	Year	Number stocked	Number survived to mid-August (± 2SE as a percent)	Percent survival
White Sand Creek	1987	152,200	45,064 ± 23.0%	29.6
	1988	108,300	26,470 ± 5.9%	24.4
	1989	58,400	10,042 ± 17.2%	17.2
Big Flat Creek	1987	97,800	22,106 ± 13.0%	22.6
	1988	72,200	23,753 ± 4.8%	32.9
	1989	37,800	8,973 ± 12.0%	23.7
Crooked Fork Creek	1986	101,100	11,457 ± 53.0%	11.3
	1987	164,300	32,568 ± 25.0%	19.8
	1988	40,600	8,860 ± 16.8%	21.8
	1989	46,700	7,467 ± 31.9%	16.0
Hopeful Creek	1986	55,100	6,131 ± 136.0%	11.1
	1988	62,200	8,796 ± 9.0%	14.1
	1989	46,700	3,163 ± 22.2%	6.8

Source: Scully and Petrosky 1991.

Table 5 (RN-a). Number of spring chinook intercepted at the Powell weir, 1989-1991.

Year	Total[a]	Jacks	Adult Males	Adult Females
1989	174	22	103	44
1990	159	27	67	70
1991	33	7	21	5

Sources: J. McGehee, IDFG, unpublished.
J. McGeHee and R. Lanier, IDFG, unpublished.

Table 6 (AT-a). Timing of the spring chinook run to the Powell weir, 1989-1991.

Return Year	First fish	Last fish	Date spawning began[a]
1989	06/12	09/24	08/16
1991	07/24	09/19	09/20

"All fish released to spawn naturally.

Sources: J. McGehee, IDFG, unpublished.
J. McGehee and R. Lanier, IDFG, unpublished.

Table 7 (RN-a). Number of spring chinook released upstream of the Powell weir to spawn naturally, 1989-1991.

Year	Total	Jacks	Adult males	Adult females
1989[a]	154	27	83	44
1990	162	2	105	55
1991	22	6	13	3

[a] All fish trapped were released upstream to spawn naturally.

Sources: J. McGehee, IDFG, unpublished.
J. McGehee and R. Lanier, IDFG, unpublished.

Table 8 (RN-a). Lochsa River drainage spring chinook index redd counts, 1967-199 1.

Year	Crooked Fork Creek	Brushy Fork Creek	Totals
1967	0	NC’	0
1968	15	NC	15
1969	112	NC	112
1970	34	NC	34
1971	1	NC	1
1972	32	31	63
1973	60[b]	NC	60
1974	22’	6	28
1975	31”	4	35
1976	49’	13	62
1977	51[d]	15	66
1978	37	25	62
1979	6	12	18
1980	16	10	26
1981	27	25	52
1982	34	17	51
1983	7	6	13
1984	28	9	37
1985	47	14	61
1986	30	11	41
1987	28	8	36
1988	42	9	51
1989	8	9	17
1990	16	4	20
1991	9	1	10

"NC = no count taken.
[b] 1969 through 1973 = ground counts from Brushy Fork Creek to Haskell Creek Bridge.
[c] Aerial count from Brushy Fork Creek to Fox Creek.
[d] 1977 through 1989 = ground counts from Rock Creek to “Cliffs Hole”.

Source: P. Hassemer, IDFG, unpublished.

Table 9 (AL-a). Fork lengths of spring chinook intercepted at Powell weir, 1989-1991.

Length cm.	1991 No. fish	1990 No. fish	1989 No. fish
42			
43			
44	1		2
45			
46			
47			
48			12
49			
50			5
51			
52	1		2
53			
54		1	2
55			
56			1
57			
58	4		1
59			
60	1		
61			
62		2	2
63			
64		1	1
65			
66		1	4
67			
68	3	7	4
69			
70	2	IO	9
71			
72	1	17	18
73			
74		21	22
75			
76	2	28	16
77			
78	1	30	17
79			
80	3	28	15
81			
82	4	13	5
83			
8-4	3	6	4
85			
86	1	4	3
87			
88	2	5	
89			
90	3	2	
91			
92		2	1
93			
94			2
95			
96	1		1
97			
98		1	2
99			
100			2
101			
102			1

[a] Blanks indicate no fish in this size collected and measured.

Sources: J. McGehee, IDFG, unpublished.
J. McGehee and R. Lanier, IDFG, unpublished.

Table 10 (AC-e). Sex and age composition percentage by return year for spring chinook returning to the Powell weir, 1989-1991.

		One-ocean (%)		Two-ocean (%)			Three-ocean (%)		
Year	N	Male		Male	Female		Male	Female	
1989	154	27	(17.5)	71	40	(72.1)	4	12	(10.4)
1990	179	2	(1.1)	91	66	(87.7)	16	4	(11.2)
1991	33	7	(21.2)	13	3	(48.5)	8	2	(30.3)

[a] Ocean age delineated by fork length criteria as follows:

1989-91: l-ocean = C 64 cm
2-ocean = 64 - 82 cm
3-ocean = > 82 cm

In this nomenclature, the freshwater and ocean ages sum to the total age of the fish. N is equal to the known male and female components of the brood.

Sources: J. McGehee, IDFG, unpublished.
J. McGehee and R. Lanier, IDFG, unpublished.

Table 11 (RH). Brood year 1986 return of spring chinook to the Powell weir".

Total Age

Brood Year	3	4	5	N	Adult total
1986	27	157	10	194	167

[a] Weir count was sample method. Total age based on 2 year freshwater rearing and ocean age delineated by fork length criteria as follows:

1986: l-ocean = < 64 cm
2-ocean = 64 - 82 cm
3-ocean = > 82 cm

In this nomenclature, the freshwater and ocean ages sum to the total age of the fish. N is equal to the known male and female components of the brood.

Sources: J. McGehee, IDFG, unpublished.
J. McGehee and R. Lanier, IDFG, unpublished.

Table 12 (AC). Age composition percentage (freshwater.ocean) by brood year[a] of spring chinook salmon returning to the Powell weir.

Age Composition (%)

Brood Year	N	2.1	2.2	2.3
1986	194	13.9	80.9	5.1

[a] Weir count was sample method. Total age based on 2 year freshwater rearing and ocean age delineated by fork length criteria as follows:

1986: l-ocean = < 64 cm
2-ocean = 64 - 82 cm
3-ocean = > 82 cm

In this nomenclature, the freshwater and ocean ages sum to the total age of the fish. N is equal to the known male and female components of the brood.

Sources: J. McGehee, IDFG, unpublished.
J. McGehee and R. Lanier, IDFG, unpublished.

Table 13 (AS). Percent females by brood year and age class" (freshwater.ocean) of spring chinook salmon returning to the Powell weir.

Females (%)

Brood Year	N	2.1	2.2	2.3	Total % Female
1986	194	0	34	1	35

[a] Weir count was sample method. Total age based on 2 year freshwater rearing and ocean age delineated by fork length criteria as follows:

1986. l-ocean = < 64 cm
2-ocean = 64 - 82 cm
3-ocean = > 82 cm

In this nomenclature, the freshwater and ocean ages sum to the total age of the fish. N is equal to the known male and female components of the brood.

Sources: J. McGehee, IDFG, unpublished.
J. McGehee and R. Lanier, IDFG, unpublished.

LOCHSA RIVER, CLEARWATER SUBBASIN

Hatchery Produced Spring Chinook

GEOGRAPHIC LOCATION

The Lochsa River originates on the Idaho-Montana border and joins the Selway River at Lowell to form the Middle Fork Clear-water River. The mainstem Lochsa is 71 miles long. A rearing pond is located near Walton Creek, 66 miles upstream from the mouth of the Lochsa. The Powell rearing pond was built in 1989 as an off-site facility of the Clear-water Anadromous Fish Hatchery to rear chinook fry to presmolt size. There is also a weir across the river at this location to trap adult chinook.

ORIGIN

Spring chinook production in the Clearwater subbasin was reduced by construction of Lewiston Dam in 1927. Inadequate adult fish passage at the dam's one fishway virtually eliminated salmon runs into the basin. In 1939, two additional fishways were constructed and in the mid-1960's, improvements were made. In 1973, Lewiston Dam was removed (Nez Perce Tribe and Idaho Department of Fish and Game 1990).

Efforts by Idaho Department of Fish and Game (IDFG) to reintroduce chinook salmon to the Clearwater drainage began in the 1950's and the program accelerated in the 1960's. Many of the reintroduction actions in the 1960's took place in the Selway drainage. However, as part of the program in the early 1960's, fall chinook eggs from Snake River broodstock were planted in Warm Springs Creek of the Lochsa drainage in 1960 (40,000 eggs) and 1961 (250,000 eggs) (Edson 1963). Spring chinook supplementation in the Lochsa drainage began in the 1970's. Fry, primarily from Rapid River broodstock, were released into the major tributaries, while White Sands Creek received most of the released smolts (Idaho Department of Fish and Game 1992). Progeny of broodstock collected at Kooskia National Fish Hatchery (NFH), Cowlitz NFH, Carson NFH, and Leavenworth NFH were also planted in the Lochsa drainage through the 1980's. During 1972-1987, 3.7 million hatchery fry and fingerlings and 1.5 million hatchery smolts were stocked into the Lochsa drainage (Lindland and Bowler 1988). Spring chinook presmolts have been released from the Powell rearing pond located at Powell since 1989.

Over the course of the reintroduction program, there was little evaluation of the different outplants or measurement of production of indigenous fish. Information could not be recorded separately because hatchery chinook were not differentially marked. The 1991 brood year was the first year that all hatchery chinook smolts and presmolts were marked with an adipose fin-clip and coded wire tag in order to differentiate them from naturally produced fish.

DISTRIBUTION

Table 4 of Lindland and Bowler (1988) summarizes fry-fingerling and smolt releases into the Lochsa River drainage, 1972-1987. Table 11 of the Clearwater Subbasin Plan (Nez Perce Tribe and Idaho Department of Fish and Game 1990) also summarizes hatchery spring chinook releases, 1977-1987. Table 1 shows releases of spring chinook into the Lochsa drainage since brood year 1980. Coded wire tag (CWT) codes are identified for brood years 1987-1989. CWT chinook are marked with an adipose fm clip. Other marks or tag releases have not been compiled.

PRODUCTION

The production capability of the Powell rearing pond is 15,000 pounds of fish, or 375,000 chinook presmolts at 25 fish per pound (Cannamela 1991). Except for the brood year 1987 release, fall presmolt releases have been smaller than 25 fish per pound (Table 1).

Egg-to-smolt

Refer to the lower Clear-water hatchery spring chinook section for production information pertaining to spring chinook released from Dworshak and Kooskia NFH into the Lochsa drainage. Because the Powell rearing pond program is relatively new, only some production information has been reported. Eye-up of eggs collected from spring chinook intercepted at the Powell weir was 88.4 percent in 1990. The survival of fry released in June into the Powell pond to an October presmolt was 99.5 percent in 1989. Fish size increased from 89 per pound in June to 18 per pound in October (J. McGehee, IDFG, unpublished).

Passive integrated transponder (PIT) tag detection rates at Snake River dams provide a relative measure of minimum survival to the dams. In 1990, 801 of the hatchery chinook in the Powell rearing pond were tagged in September prior to their October release. The detection percentage for all three dams combined (Lower Granite, Little Goose, and McNary) was 2.5 percent in 1991. Because fish are detected in collector systems, most of the detected fish are assumed to be transported. Mortality due to tagging is thought to be low (D. Cannamela, IDFG, pers. comm.). Thus, overwinter and in-basin mortality factors are represented by PIT tag detections, as well as losses in Lower Granite Reservoir and through upper Snake River dams. Specific mortality factors have not been fully segregated to determine stock specific influence on detection rates.

Smolt-to-Adult

Only one brood year of information is available to determine smolt-to-adult survival. For brood year 1986, 200,105 smolts were released at White Sands Creek (Table 1). One hundred ninety-four returning adults and jacks were intercepted at the Powell weir during 1989-1991 for a smolt-to-adult return of 0.1 percent. This probably overestimates the survival of hatchery fish because adults and jacks were also returning from natural production in the drainage.

Brood year 1985 spring chinook were coded wire tagged, but no adults or jacks from these CWT releases were intercepted at the Powell weir (Table 2).

Jack and Adult

Prespawning mortality has ranged from 0 to 22.6 percent of the fish ponded at the Powell rearing pond (Table 3).

ADULT LIFE HISTORY

Adult Escapement

Chinook crossing Bonneville Dam through May 31 are counted as springs, as are those crossing Lower Granite Dam through June 17. Specific time of migration and escapement for Lochsa River hatchery spring chinook is not well documented in the ocean, Columbia River or the Snake River. The University of Idaho implemented adult timing research in 1991 which should provide more information about Snake River timing (Bjornn et al. 1992).

Harvest

There is no information available regarding harvest specifically of Lochsa River hatchery spring chinook in the ocean, Columbia or Snake rivers.

During the period 1959-1976, the entire Clear-water drainage contributed less than one percent of Idaho's sport salmon harvest (Homer and Bjomn 1981). Information is not available regarding specific information about the sport harvest of hatchery salmon from the Lochsa drainage.

Information regarding occurrence and magnitude of tribal harvest of Lochsa River hatchery spring chinook is not available.

Spawner Escapement

Hatchery spring chinook escapement information is not available for the lower Lochsa drainage. Spring chinook returning to the upper Lochsa drainage have been intercepted at the Powell weir since 1989. Because most of the fish intercepted at the weir have been released for natural spawning, spawner escapement information is described in the natural spring chinook section.

In 1989, all spring chinook intercepted at the weir were released upstream and brood year 1989 eggs were collected from Dworshak and Kooskia NFH complex broodstock. In 1990, 5 females were spawned and the remainder of the fish were released. In 1991, 8 females, 2 males and 1 jack were retained for spawning.

Spring chinook released from other sites have been encountered at the Powell weir. In 1990, 5 CWTs were collected from fish intercepted at the Powell weir that were released as smolts from Dworshak NFH. These were all brood year 1986 fish that had been released in 1988 (Cannamela, IDFG, pers. comm.). It is unknown whether these fish would have returned to Dworshak NFH to spawn if they had not been intercepted in the Lochsa River.

Adult Characteristics

Because the majority of the spring chinook trapped at the Powell weir have been released for natural spawning, most of the biological information gathered at the weir is discussed in the natural spring chinook section. It is unknown whether fish entering the weir are the result of natural or hatchery production because until the 1991 brood year, they were not differentially marked.

Fecundity of spring chinook spawned for artificial production ranged 4,500-4,800, 1990-1991 (Table 4).

JUVENILE LIFE HISTORY

Refer to the lower Clearwater hatchery spring chinook section for early rearing information. Spring chinook fry are released into the Powell rearing pond in June. Presmolts are released from the pond in October. There is typically a fall emigration of chinook presmolts to lower in the drainage or the mainstem Lochsa River for winter rearing.

BIOCHEMICAL/GENETIC CHARACTERISTICS

Information has not been compiled.

DISEASES

Refer to the lower Clearwater hatchery spring chinook section for diseases encountered during early rearing of chinook at Dworshak and Kooskia NFH. Disease information pertaining to the Powell rearing pond has not been compiled.

REFERENCES

All Lochsa references appear in one reference section at the end of the hatchery produced summer steelhead section.

Table 1 (TR). Hatchery spring chinook releases into the Lochsa River by brood year, 1980-1989. Coded wire tag codes displayed for brood years 1986-1989. Powell refers to Powell pond, a satellite facility for Clearwater Fish Hatchery, located on the upper Lochsa River at the confluence of White Sands and Crooked Fork Creeks.

Brood Year	Brood-stock	Hatchery	Life Stage	Release Date (1)	Release Date (2)	Fish/lb	Number Released	Release Location	CWT
1980	Cowlitz	Havden Creek	F-F[a]	1981			548,520	Brushy Fk. Creek	
1985	Rapid River	Rapid River	F-F	1986			115,352	Brushy Fk. Creek	
1985	Rapid River	Sawtooth	pre-smolt	1986			348,420	White Sands Cr.	
1985	Rapid River	Rapid River	F-F	1986			70,382	White Sands Cr.	
1985	Rapid River	Rapid River	F-F	1986			199,566	Crooked Fk. Creek	
1985	Rapid River	Sawtooth	smolt	1987			344,900	White Sands Cr.	
1986	Rapid River	Rapid River	F-F	1987			98,000	Big Flat Creek	
1986	Rapid River	Rapid River	F-F	1987			202,400	White Sands Cr.	
1986	Rapid River	Rapid River	F-F	1987			348,600	Crooked Fk. Creek	
1986	Dworshak NFH	Dworshak NFH	smolt	03/17/88	03/30/88	22.4	200,105	White Sands Cr.	
1987	Rapid River	Rapid River	F-F	05/11/88	06/14/88	209	228,000	White Sands Cr.	
1987	Rapid River	Rapid River	F-F	05/11/88		361	72,200	Big Flat Creek	
1987	Rapid River	Rapid River	F-F	05/10/88		153	137,800	Crooked Fk. Creek	

Table 1 (TR) (cont.). Hatchery spring chinook releases into the Lochsa River by brood year, 1980-1989. Coded wire tag codes displayed for brood years 1986-1989. Powell refers to Powell pond, a satellite facility for Clearwater Fish Hatchery, located on the upper Lochsa River at the confluence of White Sands and Crooked Fork Creeks.

Brood Year	Brood-stock	Hatchery	Life Stage	Release Date (1)	Release Date (2)	Fish/lb	Number Released	Release Location	CWT
1987	Rapid River	Rapid River	F-F	05/10/88		379	62,200	Hopeful Creek	
1987	Rapid River	Rapid River	F-F	06/02/88	06/03/88	185	202,000	Brushy Fk. Creek	
1987	Dworshak NFH	Dworshak NFH	smolt	03/29/89		19.8	21,609	Powell	1942
1987	Dworshak NFH	Dworshak NFH	smolt	03/29/89		20.0	21,148	Powell	1943
1987	Dworshak NFH	Dworshak NFH	smolt	03/29/89		20.0	19,953	Powell	1944
1987	Dworshak NFH	Dworshak NFH	smolt	03/28/89	03/29/ 89	20.0	137,928	Powell	Untagged
1988	Rapid River	Rapid River	F-F	06/20/89	06/21/89	183	200,067	White Sands Cr.	
1988	Rapid River	Rapid River	F-F	06/15/89		176	195,398	Brushy Fk. Creek	
1988	Dworshak NFH	Dworshak NFH	F-F	05/10/89		145	45,282	Big Flat Creek	
1988	Dworshak NFH	Dworshak NFH	F-F	05/10/89		170	56,629	White Sands Cr.	
1988	Dworshak NFH	Dworshak NFH	F-F	05/11/89		126	40,108	Hopeful Cr.	
1989	Lochsa	Powell	adult[b]	09/10/89			154	Lochsa above Powell	

Table 1 (TR) (cont.). Hatchery spring chinook releases into the Lochsa River by brood year, 1980-1989. Coded wire tag codes displayed for brood years 1986-1989. Powell refers to Powell pond, a satellite facility for Clearwater Fish Hatcher-v. located on the upper Lochsa River at the confluence of White Sands and Cr(oked Pork Creeks.

Brood Year	Brood-stock	Hatchery	Life Stage	Release Date (1)	Release Date (2)	Fish/lb	Number Released	Release Location	CWT
1987	Dworshak NFH/ Kooskia NFH	Powell	pre-smolt	10/19/89		17.8	314,500	Lochsa R. @ Powell	
1988	Kooskia NFH	Kooskia NFH	smolt	03/29/90		23.3	53,300	White Sands Cr.	
1988	Kooskia NFH	Kooskia NFH	smolt	03/29/90		23.2	50,100	Papoose Creek	
1988	Dworshak NFH	Dworshak NFH	smolt	03/26/90		18.1	236,000	White Sands Cr.	
1989	Dworshak NFH/ Kooskia NFH	Powell	pre-smolt	10123190		27.4	20,970	Lochsa R. @ Powell	104301
1989	Dworshak NFH/ Kooskia NFH	Powell	pre-smolt	10/23/90		27.4	21,546	Lochsa R. @ Powell	104302
1989	Dworshak NFH/ Kooskia NFH	Powell	pre-smolt	10/23/90		27.4	19,830	Lochsa R. @ Powell	104303
1989	Dworshak NFH/ Kooskia NFH	Powell	pre-smolt	1 0/23/90		27.4	244,758	Lochsa R. @ Powell	Untagged
1990	Powell	Powell	adult[b]	09/01/90			160	Lochsa above Powell	
1989	Dworshak NFH	Dworshak NFH	smolt	03/25/9 1	03/26/91	21.8	70,000	Papoose Creek	
1989	Dworshak NFH/ Kooskia NFH	Kooskia NFH	smolt	03/1 1191	03/22/91	23.6	180,764	Lochsa R. @ Powell	

[a] F-F designates a fry or fingerling release.
[b] Adults released above the weir are a mixture of hatchery and natural production.

Table 2 (RH-a). Number of coded wire-tagged spring chinook returning to the Powell facility, upper Lochsa River.

Tag code	Brood year	Year released	Nunber tagged released	Size released (#/lb)	Purpose	Returns 1988	Returns 1989	Returns 1990	Total returns	Percent
10/29/56	1985	1987	39,700	25.0	Evaluation	0	0	0	0	0.00
1 0/29/61	1985	1987	9,625	25.0	Evaluation	0	0	0	0	0.00

Source: D. Cannamela, IDFG, per. comm.

Table 3 (PM-a). Pre-spawning mortality of ponded spring chinook" at the Powell satellite facility, 1989-1991.

Return year	Fish trapped (#)	Fish ponded (#)	Mortalities (#)	Prespawning mortality (%)
1989[b]	154			. -
1990	179	53'	12	22.6
1991	33	11	0	0

[a] Prespawning mortality calculated as a proportion of fish ponded, not of the entire run because fish released for natural spawning are generally not held in the hatchery.
[b] All fish released to spawn naturally.
[c] Most of these fish were released after being ponded a short while.

Sources: J. McGehee, IDFG, unpublished.
J. McGehee and R. Lanier, IDFG, unpublished.

Table 4 (AF-a). Mean fecundity by return year for spring chinook returning to the Powell satellite facility on the Lochsa River, 1987-1991.

Return year	Number of females spawned	Number of green eggs	Mean fecundity
1989	5		
1990	2	24,000	4,800
1991		9,000	4,500

[a] All fish released to spawn naturally.

Sources: McGehee 1991.
J. McGehee, IDFG, unpublished.
J. McGehee and R. Lanier, IDFG, unpublished.

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LOCHSA RIVER, CLEARWATER SUBBASIN

Naturally Produced Summer Steelhead

GEOGRAPHIC LOCATION

The Lochsa River originates on the Idaho-Montana border and joins the Selway River at Lowell to form the Middle Fork Clearwater River (Figure 1). The mainstem Lochsa is 71 miles long. The drainage area covers approximately 1,180 square miles (Mallet 1974). Many of the streams that drain from the south originate in the Selway-Bitteroot Wilderness. Large tracts of roadless area are found in the Fish, Post Office, Pete King, and White Sands drainages (Idaho Department of Fish and Game 1992). Sixty-two miles of the mainstem Lochsa River are protected under the Wild and Scenic Rivers Act and they are classified as recreational. Most of the drainage is located within the Idaho batholith, a geologic area known for highly erodible soils (Nez Perce Tribe and Idaho Department of Fish and Game 1990).

ORIGIN

Steelhead production in the Clearwater subbasin was reduced by construction of Lewiston Dam in 1927. Inadequate adult fish passage at the dam's one fishway virtually eliminated salmon runs into the basin and probably affected the passage of steelhead. In 1939, two additional fishways were constructed and in the mid-1960's, improvements were made. In 1973, Lewiston Dam was removed (Nez Perce Tribe and Idaho Department of Fish and Game 1990).

Steelhead were probably indigenous throughout the Clearwater drainage prior to Lewiston Dam. Efforts to rebuild steelhead numbers in the Clearwater drainage started in 1961 pursuant to the Columbia River Fisheries Development Program but efforts did not take place in the Lochsa River. By the mid-1970's, steelhead returning to the Clearwater drainage had reached record low numbers (Nez Perce Tribe of Idaho and Idaho Department of Fish and Game 1990). Most of the steelhead supplementation in the Lochsa drainage took place during this time period. From 1973-1982, 6.7 million steelhead fry were planted in the Lochsa drainage. Progeny of adults returning to Dworshak National Fish Hatchery (NFH) were used. The stock of adults returning to Dworshak NFH originated in the North Fork of the Clearwater. Also, 1,200 smolts and 1,390 adults were stocked during this time period (Lindland and Bowler 1988). According to the Clearwater Subbasin Plan, from 1976-1982, 29,000 smolts and 2,584 adults were stocked into the Lochsa drainage.

Over the course of the reintroduction program, there was little evaluation of the different outplants or measurement of production of indigenous fish. There has not been any steelhead supplementation in the Lochsa drainage since 1982. Adults would likely have last returned from hatchery stocking in 1988. Natural production currently maintains the run. Adults returning to the drainage are of native, second generation hatchery, or mixed hatchery and native origin. Because of the mixture of hatchery and natural production in the broodstock history, Idaho Department of Fish and Game classifies this run as natural (Idaho Department of Fish and Game 1992). However, several tributaries, such as Fish Creek, have had little or no hatchery influence.

Steelhead returning to the rest of the Lochsa River are classified as B-run on the basis of ocean age component, size at age, and timing. B-run steelhead generally enter the Columbia River from August through December and are larger than A-run steelhead of comparable ocean age.

DISTRIBUTION

Available spawning and rearing habitat for the Lochsa River was described in the Presence/Absence database (Tables 1 and 2). This information was developed for the Northwest Power Planning Council for subbasin planning and modeling.

PRODUCTION

There is some information available describing survival and production factors. Espinosa (1987) estimated levels of biological potential for juvenile steelhead in Lochsa River tributaries during 1982-1987. He estimated that steelhead densities were 42-89 percent of rearing potential for U.S. Forest Service transects in lower Fish, lower Hungery, Pete Ring, and Deadman creeks. This was based on an estimate of 30 fish per $100m^2$ of rearing habitat as 100 percent of biological potential. Espinosa determined steelhead densities by snorkeling.

Idaho Department of Fish and Game (IDFG) monitored steelhead parr production in the Lochsa drainage, 1985-1991. The overall weighted mean for IDFG monitoring transects was 8.0 parr per $100\ m^2$ and 46.2 percent of estimated carrying capacity (Table 3). This included mainstem transects. Parr carrying capacity ratings for steelhead were derived from the Presence/Absence database used for development of the Clearwater Subbasin Plan. Parr densities were determined by snorkel counts.

ADULT LIFE HISTORY

Adult Escapement

Specific time of migration and escapement for steelhead returning to the Lochsa River drainage has not been identified for the ocean or Columbia or Snake rivers. The University of Idaho implemented adult timing research in 1991 which should provide information about Snake River timing (Bjornn et al. 1992).

Adult steelhead that migrate in the fall overwinter in the Snake and lower Clearwater rivers. The time of entry of steelhead into the Clearwater subbasin was from July through June, noted when fish were counted at the Lewiston Dam from the 1949- 1950 run year through the 1971- 1972 run year. Up until the 1958-1959 run year, an average of 79 percent of the steelhead run crossed Lewiston Dam during March-May. An average of only 16 percent of the run crossed during September-November. Beginning with the 1958-1959 run year, an average of 42 percent of the steelhead run crossed Lewiston Dam during March-May, and 56 percent crossed in September-November (S. W. Kiefer, IDFG, personal communication).

Steelhead run estimates for the entire Clearwater drainage ranged from 3,167-43,1996 for the run years 1949-1950 through 1971-1972 (Nez Perce Tribe and Idaho Department of Fish and Game 1990). There was little hatchery steelhead production in the Clearwater drainage during this period.

Harvest

Information is not available regarding the rate of contribution of this stock to ocean, Columbia River or Snake River harvest. Since the mid-1980's, the harvest of steelhead possessing an adipose fm has not been allowed in the Snake River or in Idaho.

Only limited sport harvest information is available. Based on random samples of returned steelhead

permits, less than 100 steelhead were harvested in 1967, 1970 and 1971. Steelhead were harvested February through April. In 1968-1969, the Lochsa River was the only Clearwater drainage where there was no reported catch by anglers in a random sample of steelhead permits (Keating 1969[a], 1969[b], 1971, Mallet 1972).

The Lochsa River has been closed to steelhead harvest since at least the mid-1970's. Information regarding occurrence and magnitude of tribal harvest of Lochsa River steelhead is not available.

Spawner Escapement

Studies conducted in the Clearwater drainage indicated that the spring steelhead migration began when water temperature reached 39 F° (Metsker 1959).

Steelhead escapement information is not available for the lower Lochsa drainage. Steelhead returning to the upper Lochsa drainage were intercepted at the Powell weir located near Walton Creek in 1990. The weir crosses the Lochsa River 66 miles upstream from its mouth. The weir was installed April 5 and fish arrived April 11-May 22. The majority of the steelhead arrived prior to April 21. Fifty-one adult steelhead were trapped. All were naturally produced except for one female. All fish were measured, sexed, scale sampled and immediately released above the weir to spawn naturally.

IDFG biologists conducted index steelhead redd counts in 1990 and 1991 (Table 4), but these cannot be used for escapement estimates. In 1990, steelhead redd density ranged from 0.1-2.3 redds per kilometer.

Adult Characteristics

There is some limited information available describing fork length. A sample of 5 1 steelhead, intercepted at the Powell weir, ranged 63-94 cm, total length (Table 5). Average fork length for 21 males was 81.3 cm and the range was 63.5-93.9 cm. Average fork length of 29 females was 8 1.3 cm. Females ranged in size from 75.2-87.2 cm. Average size of the males and females was 80.8 cm (P. Hassemer, IDFG, unpublished).

For the 1990 steelhead return to the Powell weir, the ocean age composition was estimated as 8 percent one-ocean and 92 percent two-ocean (Table 6).

The percentage of females in the 1990 steelhead return to the Powell weir was 59 percent (Table 6). All females in the run were two-ocean.

Fecundity information for Lochsa River steelhead is not available.

JUVENILE LIFE HISTORY

Juvenile life history timing is generally similar to Figure 2 in the Lower Clearwater summer steelhead section. Although not illustrated in the figure, there is typically a fall emigration of steelhead presmolts from the upper ends of tributaries to lower in the drainage or the mainstem Lochsa River for winter rearing.

BIOCHEMICAL/GENETIC CHARACTERISTICS

Isozyme gene frequencies for Columbia Basin steelhead, including the Lochsa River, were reported by Schreck et al. (1986) (Appendix Table 4).

DISEASES

Information has not been compiled.

REFERENCES

All Lochsa references appear in one reference section at the end of the hatchery produced summer steelhead section.

Figure 1 (TD). Anadromous salmonid distribution in the Clearwater subbasin as represented by summer steelhead, based on the NPPC presence/absence data base (solid/dashed lines respectively) and the BPA Geographic Information System.

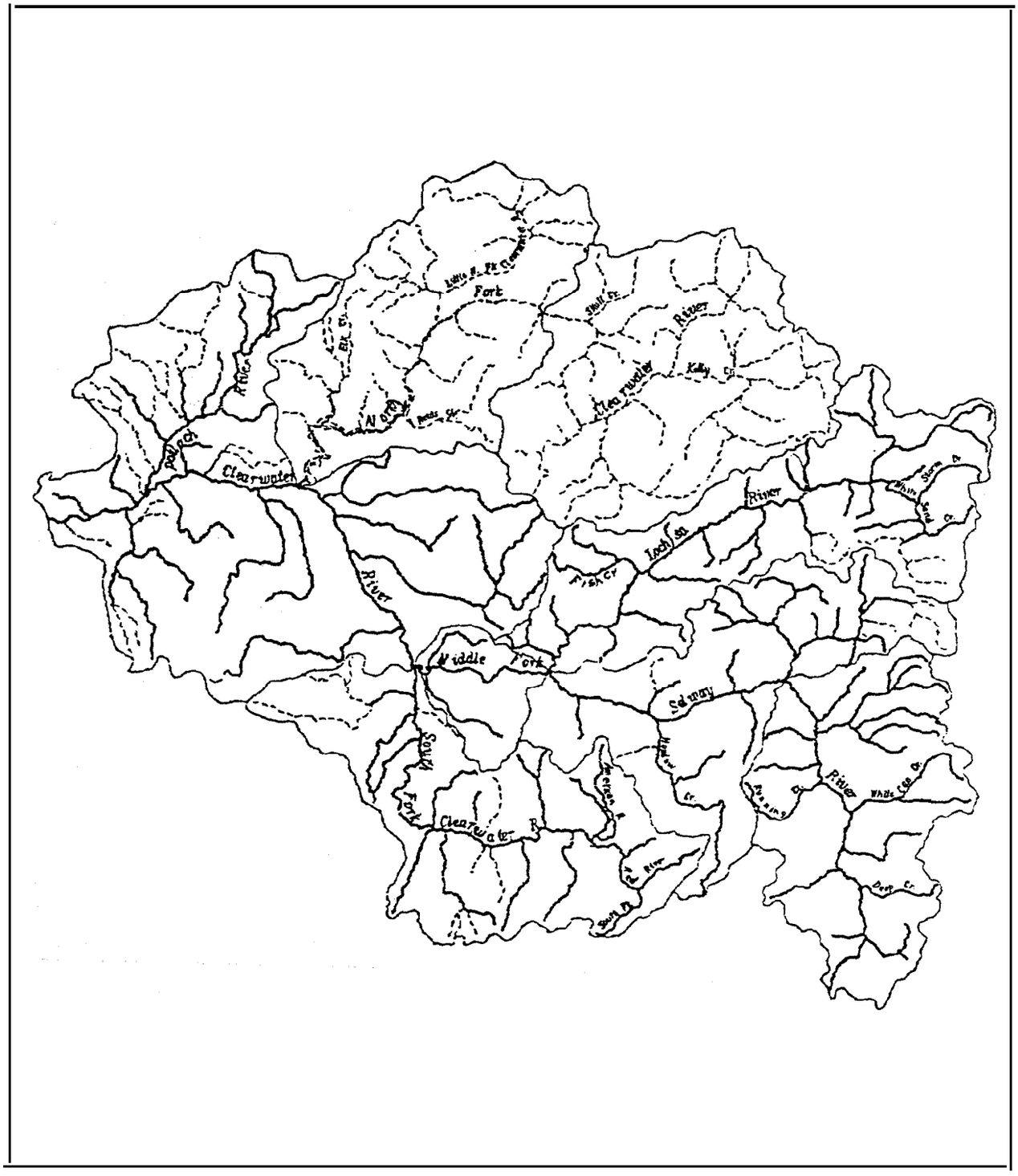

Table 1 (HB). Estimated amount of spawning and rearing habitat (Use Type 1) by quality of Lochsa River steelhead production area.

	Excellent	Good	Fair"	Poor[a]	Unknown	Total	Confidence[b]
Miles (%)	64	28	8	0		387.1	M
Acres (%)	54	40	6	0		1120.8	M

[a] Ratings of fair and poor habitat quality may reflect natural physical features such as gradient and channel type, as well as degradation caused by humans.
[b] 'Confidence' is meant to indicate the reproducibility and accuracy of the estimates made, and will be rated as high, medium or low by the respective agencies.

Source: Presence/Absence database, Northwest Power Planning Council, 1991.

Table 2 (HB). Estimated amount of rearing only habitat (Use Type 2) by quality of Lochsa River steelhead production area.

	Excellent	Good	Fair[a]	Poor"	Unknown	Total	Confidence[b]
Miles (%)	0	61	39	0		43.9	M
Acres (%)	0	56	44	0		861.4	M

[a] Ratings of fair and poor habitat quality may reflect natural physical features such as gradient and channel type, as well as degradation caused by humans.
[b] 'Confidence' is meant to indicate the reproducibility and accuracy of the estimates made, and will be rated as high, medium or low by the respective agencies.

Source: Presence/Absence database, Northwest Power Planning Council, 199 1.

Table 3 (PD-a). Parr density and percent of rated carrying capacity (PCC) for steelhead in the Lochsa River drainage. Densities estimated by snorkel counts.

Stream name	Year	Sample size	Ages 1+ & 2+ density (#/100m²)	Density std. dev.	PCC for 1+ & 2+	PCC std. dev.
Lochsa River	85	1	0.36	NA[a]	2.57	NA
Lochsa River	86	1	1.27	NA	9.07	NA
Lochsa River	87	1	0.45	NA	3.21	NA
Lochsa River	88	1	0.40	NA	2.86	NA
Lochsa River	89	1	0.09	NA	0.64	NA
Lochsa River	90	2	1.06	1.08	1.07	1.51
Lochsa River	91	1	0.96	NA	6.86	NA
Fire Creek	90	2	23.13	0.28	115.65	1.41
Split Creek	90	2	11.33	4.67	56.63	23.37
Old Man Creek	88	1	45.00	NA	225.00	NA
Old Man Creek	89	1	28.66	NA	143.30	NA
Old Man Creek	90	2	56.85	0.07	284.25	0.35
Old Man Creek	91	1	32.36	NA	161.80	NA
Fish Creek	88	2	13.51	3.50	135.05	35.00
Fish Creek	89	2	9.43	1.28	94.25	12.80
Fish Creek	90	4	11.01	3.33	110.10	33.31
Fish Creek	91	2	10.28	4.20	102.80	42.00
Post Office Cr.	88	2	0.86	0.26	6.15	1.82
Post Office Cr.	89	2	3.35	3.06	23.90	21.87
Post Office Cr.	90	4	4.85	0.05	32.89	11.27
Post Office Cr.	91	2	3.16	1.69	15.78	8.45
Warm Springs Cr.	88	1	4.06	NA	20.30	NA
Warm Springs Cr.	89	1	0.57	NA	2.85	NA
Warm Springs Cr.	90	1	3.56	NA	17.80	NA
Warm Springs Cr.	91	1	3.85	NA	19.25	NA
White Sand Cr.	85	1	0.95	NA	4.75	NA
White Sand Cr.	86	1	0.85	NA	4.25	NA
White Sand Cr.	87	1	0.88	NA	4.40	NA
White Sand Cr.	88	1	0.89	NA	4.45	NA
White Sand Cr.	89	1	0.43	NA	2.15	NA
White Sand Cr.	90	1	0.70	NA	3.50	NA
White Sand Cr.	91	1	0.22	NA	1.10	NA

Table 3 (PD-a) (cont.). Parr density and percent of rated carrying capacity (PCC) for steelhead in the Lochsa River drainage. Densities estimated by snorkel counts.

Stream name	Year	Sample size	Ages 1+ & 2+ density (#/100m^2)	Density std. dev.	PCC for 1+ & 2+	PCC std. dev.
Crooked Fork Cr.	85	2	1.12	0.69	5.58	3.43
Crooked Fork Cr.	86	2	1.17	0.94	5.83	4.70
Crooked Fork Cr.	87	2	1.64	0.10	8.20	0.50
Crooked Fork Cr.	88	4	5.60	0.82	28.00	4.08
Crooked Fork Cr.	89	4	6.81	2.15	34.05	10.77
Crooked Fork Cr.	90	6	6.51	4.42	32.55	22.12
Crooked Fork Cr.	91	2	0.00	0.00	0.00	0.00
Brushy Fork Cr.	88	2	4.20	2.77	21.00	13.86
Brushy Fork Cr.	89	2	8.41	2.26	42.03	11.28
Brushy Fork Cr.	90	4	12.51	2.43	62.53	12.15
Brushy Fork Cr.	91	2	5.12	3.02	25.58	15.10

[a] NA = not applicable.

Source: B. Rich, IDFG, unpublished.

Table 4 (RN-a). Lochsa River drainage steelhead index redd counts* conducted by Idaho Department of Fish and Game, 1990 and 1991.

		Number of redds			Redds/km	
Location	Reach	1990	1991	km	1990	1991
Lochsa River	Slide to weir	5	NC[b]	N-M"	NM	NA[d]
Crooked Fork Creek	Mouth to Hwy 12 bridge	15	NC	10.9	1.4	NA
	Hwy 12 bridge to Shotgun Cr.	18	NC	8.0	2.3	NA
White Sands Creek	Mouth to Storm Cr.	2	NC	19.8	0.1	NA
	Big Flat Cr. to Heather Cr.	10	7	6.1	1.6	1.1
Storm Creek	0.5 mi below Maud Cr. upstream to rock outcrop	11	1	8.2	1.3	0.1
Fish Creek	Pagoda Cr. to Hungry Cr.	6	NC	3.2	1.9	NA
	Hungry Cr. to Ash Cr.	3	0	14.6	0.2	0
Hungery Creek	Mouth to Doubt Cr.	2	0	2.3	0.9	0

[a] Counts were single peak counts conducted aerially in May.
[b] NC = Not counted.
[c] NM = not measured.
[d] NA = Not applicable.

Sources: B. Rich, IDFG, unpublished,
Rich et al. 1992.

Table 5 (AL-a). Total lengths of steelhead trapped at the Powell weir on the Lochsa River, 1990.

Length cm.	1990 No. fish
42	
43	
44	
45	
46	
47	
48	
49	
50	
51	
52	
53	
54	
55	
56	
57	
58	
59	
60	
61	
62	
63	
64	1
65	•
66	
67	
68	2
69	1
70	1
71	
72	2
73	1
74	
75	1
76	1
77	
78	3
79	3
80	3
81	4
a2	4
a3	7
a4	5
85	1
86	7
87	1
88	
89	1
90	1
91	
92	
93	
94	1
95	
96	
97	
98	
99	
100	

• Blanks indicate no fish in this size collected and measured.
Sources: J. McGehee, IDFG, unpublished.

Table 6 (AC-a). Ocean age composition[a], by sex, of steelhead trapped at the Powell weir, 1990.

Year	One-ocean Male	(%)	One-ocean Female	(%)	Two-ocean Male	(%)	Two-ocean Female	(%)
1990	4	(8)	0	(0)	17	(33)	30	(59)

[a] Ocean age was differentiated according to length based on the following criteria:

Females: 1-ocean = $\leq$70.5 cm total length
2-ocean = $>$ 70.5 cm total length

Males: 1-ocean = $\leq$75.5 cm total length
2-ocean = $>$ 75.5 cm total length

Source: J. McGehee, IDFG, unpublished.

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LOCHSA RIVER, CLEARWATER SUBBASIN

Hatchery Produced Summer Steelhead

GEOGRAPHIC LOCATION

The Lochsa River originates on the Idaho-Montana border and joins the Selway River at Lowell to form the Middle Fork Clearwater River. The mainstem Lochsa is 71 miles long. The drainage area covers approximately 1,180 square miles (Mallet 1974). Many of the streams that drain from the south originate in the Selway-Bitteroot Wilderness. Large tracts of roadless area are found in the Fish, Post Office, Pete King, and White Sands drainages (Idaho Department of Fish and Game 1992). Sixty-two miles of the mainstem Lochsa River are protected under the Wild and Scenic Rivers Act and they are classified as recreational. Most of the drainage is located within the Idaho batholith, a geologic area known for highly erodible soils (Nez Perce Tribe and Idaho Department of Fish and Game 1990).

ORIGIN

Steelhead production in the Clear-water subbasin was reduced by construction of Lewiston Dam in 1927. Inadequate adult fish passage at the dam's one fishway virtually eliminated salmon runs into the basin and probably affected the passage of steelhead. In 1939, two additional fishways were constructed and in the mid-1960's, improvements were made. In 1973, Lewiston Dam was removed (Nez Perce Tribe and Idaho Department of Fish and Game 1990).

Steelhead were probably indigenous throughout the Clearwater drainage prior to Lewiston Dam. Efforts to rebuild steelhead numbers in the Clearwater drainage started in 1961 pursuant to the Columbia River Fisheries Development Program but efforts did not take place in the Lochsa River. By the mid-1970's, steelhead returning to the Clearwater drainage had reached record low numbers (Nez Perce Tribe of Idaho and Idaho Department of Fish and Game 1990). Most of the steelhead supplementation in the Lochsa drainage took place during this time period. From 1973-1982, 6.7 million steelhead fry were planted in the Lochsa drainage. Progeny of adults returning to Dworshak National Fish Hatchery (NFH) were used. The stock of adults returning to Dworshak NFH originated in the North Fork of the Cleat-water. Also, 1,200 smolts and 1,390 adults were stocked during this time period (Lindland and Bowler 1988). According to the Clearwater Subbasin Plan, 29,000 smolts and 2,584 adults were stocked into the Lochsa drainage from 1976-1982 (Nez Perce Tribe and Idaho Department of Fish and Game 1990).

Over the course of the reintroduction program, there was little evaluation of the different outplants or measurement of production of indigenous fish. There has not been any steelhead supplementation in the Lochsa drainage since 1982. Adults would likely have last returned from hatchery stocking in 1988.

DISTRIBUTION

Table 6 of Lindland and Bowler (1988) summarized steelhead releases from Dworshak NFH into the Lochsa drainage, 1973-1987. Table 22 of the Clearwater Subbasin Plan (Nez Perce Tribe and Idaho Department of Fish and Game 1990) summarized the release of steelhead from Dworshak NFH, 1977-1987. Table 1 summarizes the release of steelhead into the Lochsa drainage for brood years 1980-1981. Coded-wire tag (CWT) 101312 was the only steelhead CWT released in the Lochsa drainage. The release was made April 20, 1987. The size of the release was 32,726 smolts (31,580 tagged) (Roseberg et al. 1992).

PRODUCTION

Information is found in discussion of information for Dworshak NFH in the lower Clearwater hatchery steelhead chapter.

ADULT LIFE HISTORY

Adult Escapement

Specific time of migration and escapement for steelhead returning to the Lochsa River drainage has not been identified for the ocean or Columbia or Snake rivers. The University of Idaho implemented adult timing research in 1991 which should provide information about Snake River timing (Bjornn et al. 1992).

Adult steelhead that migrate in the fall over-winter in the Snake and lower Clearwater rivers. The time of entry of steelhead into the Clearwater subbasin was from July through June, noted when fish were counted at the Lewiston Dam from the 1949-1950 run year through the 1971-1972 run year. Up until the 1958-1959 run year, an average of 79 percent of the steelhead run crossed Lewiston Dam during March-May. An average of only 16 percent of the run crossed during September-November. Beginning with the 1958-1959 run year, an average of 42 percent of the steelhead run crossed Lewiston Dam during March-May, and 56 percent crossed in September-November (S. W. Kiefer, IDFG, personal communication).

Of a group of 31,580 CWT steelhead smolts released in the Lochsa drainage in 1977, it was estimated that 8 fish from that group were recovered once fishery samples were expanded. One-half of these were recovered at the Dworshak NHF rack. This indicated that at least a portion of the release did not bypass the hatchery and return to the release site (Roseberg et al. 1992).

Harvest

Information is not available regarding the rate of contribution of this stock to ocean, Columbia River or Snake River harvest. Since the mid-1980's, the harvest of steelhead possessing an adipose fin has not been allowed in the Snake River or in Idaho.

The Lochsa River has been closed to steelhead harvest since at least the mid-1970's. Information regarding occurrence and magnitude of tribal harvest of Lochsa River steelhead is not available.

Soawner Escapement

Information about the return of hatchery steelhead to the Lochsa drainage is not available.

Adult Characteristics

Information pertaining to steelhead sampled in 1990 at the Powell weir is discussed in the natural steelhead chapter.

Of the expanded recoveries from CWT 101312 release, 75 percent of the steelhead were two-ocean and 25 percent were three-ocean (Roseberg et al. 1992)

JUVENILE LIFE HISTORY

For fry released into the Lochsa drainage, juvenile life history timing is generally similar to that illustrated in the lower Clear-water hatchery steelhead chapter. Although not illustrated in that figure, there is typically a fall emigration of steelhead presmolts from the upper ends of tributaries to lower in the drainage or the mainstem Lochsa River for winter rearing.

BIOCHEMICAL/GENETIC CHARACTERISTICS

Information is not available.

DISEASES

Refer to the lower Clearwater hatchery steelhead chapter for information about diseases encountered while hatchery steelhead rear at Dworshak NFH.

REFERENCES

All Lochsa references appear at the end of this section.

Table 1 (TR). Hatchery steelhead releases into the Lochsa River by brood years, 1981-1982. No coded wire tags have been released.

Brood Year	Brood-stock	Hatchery	Life Stage	Release Date (1)	Release Date (2)	Fish/lb	Number Released	Release Location	CWT
1981	Dworshak NFH	Dworshak NFH	F-F[a]	1981			140,500	Post Office Cr.	
1981	Dworshak NFH	Dworshak NFH	F-F	1981			340,000	Papoose Creek	
1981	Dworshak NFH	Dworshak NFH	F-F	1981			140,500	Pete King Creek	
1981	Dworshak NFH	Dworshak NFH	F-F	1981			250,000	Brushy Fk. Creek	
1981	Dworshak NFH	Dworshak NFH	F-F	1981			356,250	White Sands Cr.	
1981	Dworshak NFH	Dworshak NFH	F-F	1981			236,250	Lochsa R.	
1982	Dworshak NFH	Dworshak NFH	F-F	1982			58,000	Pete King Creek	
1982	Dworshak NFH	Dworshak NFH	F-F	1982			100,000	Squaw Creek	
1982	Dworshak NFH	Dworshak NFH	F-F	1982			58,000	Badger Creek	

[a] F-F designates a fry or fingerling release.

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SELWAY RIVER, CLEARWATER SUBBASIN

Naturally Produced Spring Chinook

GEOGRAPHIC LOCATION

The Selway River flows 99 miles from its headwaters to join with the Lochsa River to form the Middle Fork of the Clear-water River (Figure 1). About 74 percent of the drainage is classified as wilderness (Nez Perce Tribe and Idaho Department of Fish and Game 1990). The Wild and Scenic Rivers Act and Selway-Bitterroot Wilderness Area provide protection for the mainstem and a major portion of the tributaries. Selway Falls, located about 18 miles upstream from the mouth was a partial migration block to salmon until the Selway Falls fishway was completed in 1966 (Idaho Department of Fish and Game 1992).

ORIGIN

Spring chinook production in the Clearwater subbasin was reduced by construction of Lewiston Dam in 1927. Inadequate adult fish passage at the dam's one fishway virtually eliminated salmon runs into the basin. In 1939, two additional fishways were constructed and in the mid-1960's, improvements were made. In 1973, Lewiston Dam was removed (Nez Perce Tribe and Idaho Department of Fish and Game 1990).

Prior to construction of the dam, chinook were likely indigenous through the Clearwater Basin, but accurate records are lacking regarding which races were present. Timing of chinook passage at Lewiston Dam indicates there may have been some summer chinook returning to the Clear-water drainage. Fall chinook were also noted crossing Lewiston Dam (Nez Perce Tribe and Idaho Department of Fish and Game 1990). Both spring and summer chinook eggs were planted in the Selway River but it has not been confirmed whether spring or summer chinook or both races return to the Selway River. For management purposes, populations in these tributaries have been classified by the Idaho Department of Fish and Game (IDFG) as spring chinook (Idaho Department of Fish and Game 1992).

Efforts to reintroduce chinook salmon to the Clearwater drainage began in the 1950's and the program accelerated in the 1960's. Many of the reintroduction actions took place in the Selway drainage. The program was structured around eyed-egg plants in the upper Selway River where a number of incubation channels were constructed. The resulting fry were often distributed around the drainage. Broodstock came from spring and summer chinook sources in the Salmon River, spring and fall chinook from the lower Columbia River, and Snake River fall chinook (Nez Perce Tribe and Idaho Department of Fish and Game 1990). Both native and hatchery fish were utilized. Between 1961 and 1979, over 45 million eggs from primarily spring chinook, but also summer and fall chinook were placed in the Selway drainage (Idaho Department of Fish and Game 1992). Egg plants in the Selway drainage ceased after 1981 until 1985 when eggs were outplanted at the Indian Creek incubation channel. No fish have been outplanted into the Selway drainage since 1985.

Over the course of the reintroduction program, there was little evaluation of the different outplants or measurement of production of indigenous fish. Natural production has maintained the run since 1985. The mixture of stocks used in the Selway drainage makes it impossible to specify the origin of returning chinook. Because of the mixed brood stock history, the IDFG classifies chinook in the Selway drainage as natural (Idaho Department of Fish and Game 1992).

DISTRIBUTION

Available spawning and rearing habitat for the Selway River was described in the Presence/Absence database (Tables 1 and 2). This information was developed for the Northwest Power Planning Council for subbasin planning and modeling. The effect of Selway Falls on chinook passage to the upper Selway prior to the fishway is not well documented. Metsker (1959) estimated that for conditions in 1946-1955, adult chinook passage over Selway Falls was totall blocked 42 percent of the time and partially blocked 40 percent.

PRODUCTION

There is little information available describing survival and production factors. IDFG monitored spring chinook parr production in the Selway drainage, 1985-1991. The overall weighted mean for IDFG monitoring transects was 1.3 parr per 100 m^2 and 1.5 percent of estimated carrying capacity (Table 3). Parr carrying capacity ratings for summer chinook were derived from the Presence/Absence database used for development of the Clearwater Subbasin Plan. Parr densities were determined by snorkel counts.

ADULT LIFE HISTORY

Adult Escapement

Chinook crossing Bonneville Dam through May 31 are counted as springs, as are those crossing Lower Granite Dam through June 17. Specific time of migration and escapement for Selway River spring chinook is not well documented in the ocean, Columbia River or the Snake River. The University of Idaho implemented adult timing research in 1991 which should provide more information about Snake River timing (Bjornn et al. 1992).

The time of entry of spring and summer chinook into the Clear-water subbasin was from April to July, noted when fish were counted at the Lewiston Dam. Chinook counts at the dam peaked in June-July, 1965-1972. Run estimates for the entire Clearwater drainage ranged from 5 in 1963 up to 7,700 chinook in 1977, although larger runs were associated with hatchery produced fish. From 1950-1964, the Lewiston Dam counts for spring, summer, and fall chinook were less than 100 fish (Nez Perce Tribe and Idaho Department of Fish and Game 1990).

Harvest

Information is not available regarding the rate of contribution of this run of fish to ocean, Columbia, or Snake River harvest.

During the period 1959-1976, the entire Clearwater drainage contributed less than one percent of Idaho's sport salmon harvest (Homer and Bjomn 1981). Information is not available regarding specific information about the sport harvest of Salmon from the Selway drainage. There has not been a sport salmon harvest in the Selway River since at least 1976 (Nez Perce Tribe and Idaho Department of Fish and Game 1990).

Selway Falls is a primary fishing site for the Nez Perce Tribe (Nez Perce Tribe and Idaho Department of Fish and Game 1990). Information regarding occurrence and magnitude of tribal harvest on Selway River spring chinook is not available.

Spawner Escapement

Redd and carcass counts have been conducted in index areas of the Selway drainage since 1966 by IDFG. This program has evolved into a single peak count. Most of the mainstem and tributary transect counts are conducted the first two weeks of September by air (T. Elms-Co&rum, IDFG, personal communication).

Redd counts ranged from 15 in 1985 to 347 in 1973, 1966-1991 (Table 4). The majority of the redds have been counted in the mainstem Selway River. The counts are used by IDFG for trend information, not escapement estimates.

Adult Characteristics

Information specific to Selway River chinook populations is not available. The average adult age structure of spring and summer chinook passing over Lewiston Dam, 1965-1972, was 15.3 percent age 3, 64.3 percent age 4, and 20.4 percent age 5 (Nez Perce Tribe and Idaho Department of Fish and Game 1990).

No information regarding the sex ratio or fecundity of Selway River chinook is available.

JUVENILE LIFE HISTORY

Juvenile life history timing is generally similar to Figure 2 of the South Fork Clear-water Spring Chinook section. Although not illustrated in that figure, there is typically a fall emigration of chinook presmolts to lower in the drainage or the mainstem Selway River for winter rearing.

BIOCHEMICAL/GENETIC CHARACTERISTICS

Information has not been compiled.

DISEASES

Information has not been compiled.

REFERENCES

All Selway references appear in one reference section at the end of the summer steelhead section.

Figure 1 (TD). Anadromous salmonid distribution in the Clearwater subbasin as represented by summer steelhead, based on the NPPC presence/absence data base (solid/dashed lines respectively) and the BPA Geographic Information System.

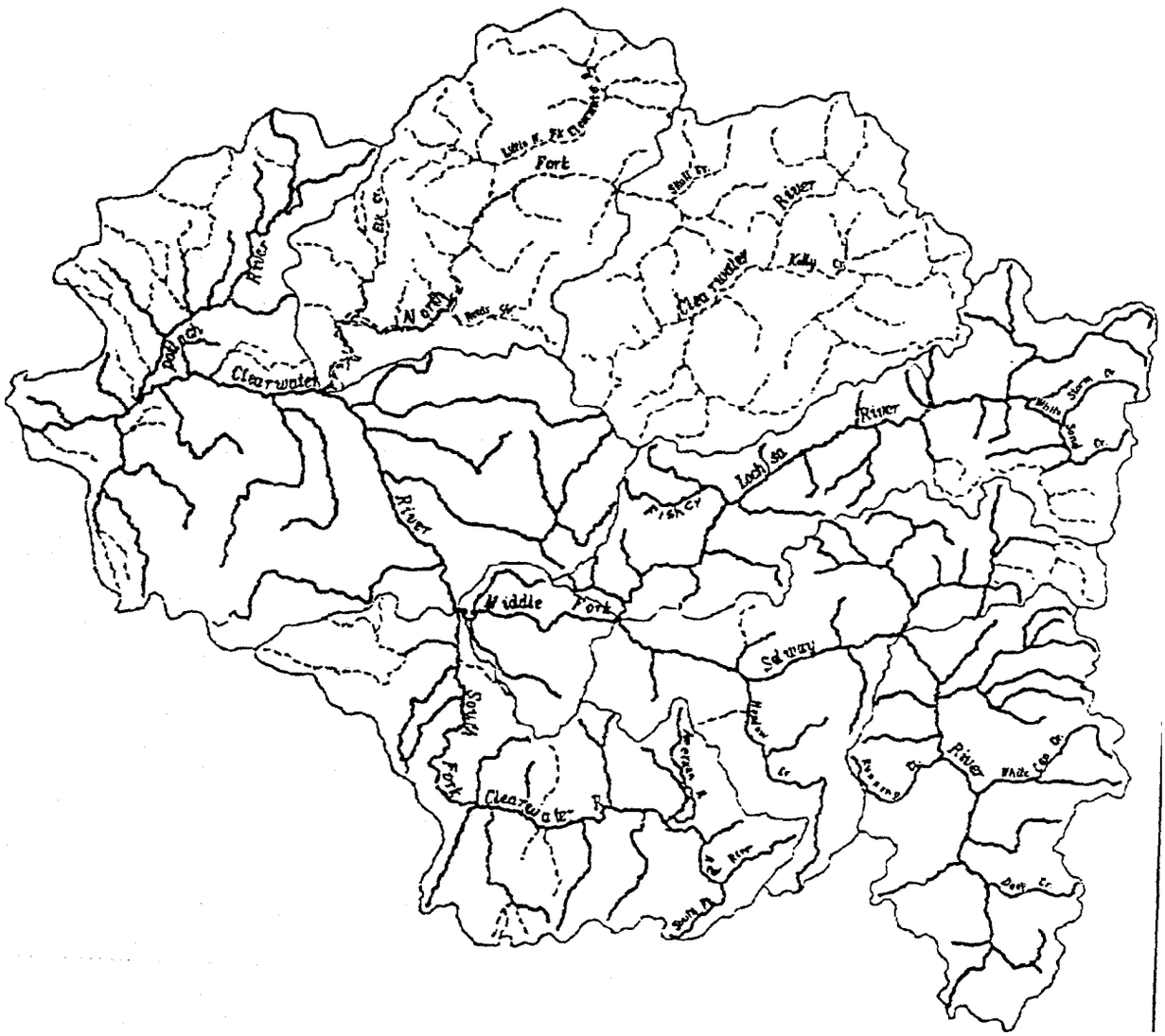

Table 1 (HB). Estimated amount of spawning and rearing habitat (Use Type 1) by quality of Selway River (below, above and including Moose Creek) spring chinook production area.

	Excellent	Good	Fair[a]	Poor"	Unknown	Total	Confidence[b]
Miles (%)	23	39	37	1		381.7	M
Acres (%	15	36	49	.2		1275.2	M

[a] Ratings of fair and poor habitat quality may reflect natural physical features such as gradient and channel type, as well as degradation caused by humans.
[b] 'Confidence' is meant to indicate the reproducibility and accuracy of the estimates made, and will be rated as high, medium or low by the respective agencies.

Source: Presence/Absence database, Northwest Power Planning Council, 1991.

Table 2 (HB). Estimated amount of rearing only habitat (Use Type 2) by quality of Selway River (below, above and including Moose Creek) spring chinook production area.

	Excellent	Good	Fair"	Poor"	Unknown	Total	Confidence[b]
Miles (%)	0	21	40	39		49.8	M
Acres (%)	0	15	37	48		1296.5	M

[a] Ratings of fair and poor habitat quality may reflect natural physical features such as gradient and channel type, as well as degradation caused by humans.
[b] 'Confidence' is meant to indicate the reproducibility and accuracy of the estimates made, and will be rated as high, medium or low by the respective agencies.

Source: Presence/Absence database, Northwest Power Planning Council, 1991.

Table 3 (PD-a). Natural chinook parr densities as fish per $100m^2$ (CHINOD) and percent of rated carrying capacity (CHPERCC), Selway River drainage 1985-1991.

	Year						
	1985	1986	1987	1988	1989	1990	1991
Selway River							
CHINOD=	0.91	4.63	7.28	9.31	8.80	5.13	4.13
CHPERCC=	1.79	4.46	7.06	8.95	8.31	5.44	4.47
N =	2	2	3	3	3	3	3
Gednev Creek							
CHINOD=	NS[a]	NS	NS	NS	NS	0.04	NS
CHPERCC=	NS	NS	NS	NS	NS	0.05	NS
N=	NS	NS	NS	NS	NS	2	NS
Meadow Creek							
CHINOD=	NS	NS	NS	0.84	NS	0.06	NS
CHPERCC=	NS	NS	NS	1.91	NS	0.13	NS
N=	NS	NS	NS	1	NS	10	NS
Sable Creek							
CHINOD=	NS	NS	NS	NS	NS	0.00	NS
CHPERCC=	NS	NS	NS	NS	NS	0.00	NS
N=	NS	NS	NS	NS	NS	5	NS
Otter Creek							
CHINOD=	NS	NS	NS	0.00	0.00	0.00	0.00
CHPERCC=	NS	NS	NS	0.00	0.00	0.00	0.00
N=	NS	NS	NS	1	1	1	1
Three Links Creek							
CHINOD=	NS	NS	NS	0.00	4.71	0.00	0.00
CHPERCC=	NS	NS	NS	0.00	10.70	0.00	0.00
N=	NS	NS	NS	1	1	1	1
Moose Creek							
CHINOD=	0.00	NS	0.22	0.48	0.11	0.34	0.08
CHPERCC=	0.00	NS	0.50	0.69	0.15	0.48	0.17
N=	1	NS	1	3	3	4	2

Table 3 (PD-a) (cont). Natural chinook parr densities as fish per $100m^2$ (CHINOD) and percent of rated carrying capacity (CHPERCC), Selway River drainage 1985-1991.

	Year						
	1985	1986	1987	1988	1989	1990	1991
Moose Creek, N.							
CHINOD=	0.47	NS	0.16	NS	0.03	0.09	0.00
CHPERCC=	0.61	NS	0.21	NS	0.04	0.12	0.00
N =	1	NS	1	NS	1	1	1
Bear Creek							
CHINOD=	NS	2.16	0.00	1.40	0.24	1.89	0.16
CHPERCC=	NS	2.81	0.00	1.82	0.31	2.45	0.20
N=	NS	2	2	2	2	2	2
Running Creek							
CHINOD=	0.00	1.23	0.42	0.00	0.00	0.00	0.30
CHPERCC=	0.00	1.59	0.54	0.00	0.00	0.00	0.39
N=	2	2	2	2	2	2	2
White Cap Creek							
CHINOD=	0.38	0.41	1.40	1.02	0.37	0.19	0.02
CHPERCC=	0.87	0.92	3.18	2.33	0.85	0.44	0.05
N=	2	2	3	3	3	3	6
Deep Creek							
CHINOD=	NS	NS	0.00	0.17	0.09	0.63	0.96
CHPERCC=	NS	NS	0.00	0.39	0.21	1.42	2.19
N=	NS	NS	2	2	2	2	3

[a] NS = not sampled.

Source: B. Rich, IDFG, unpublished.

Table 4 (RN-a). Selway River drainage spring chinook index redd counts, 1966-199 1.

Year	Selway River	Bear Creek	Running Creek	Whitecap Creek	Moose Creek	Totals
1966	36	8	NC”	NC	NC	44
1967	22	7	NC	NC	NC	29
1968	16	7	4	NC	NC	27
1969	57	6	21	NC	NC	84
1970	65	19	10	4	NC	98
1971	55	14	8	NC	NC	77
1972	175	25	11	8	13	232
1973	261	26	21	7	32	347
1974	66	10	4	2	15	97
1975	21	5	0	1	4	31
1976	58	14	3	4	15	94
1977	97	18	2	1	23	141
1978	125	13	6	NC	17	161
1979	21	3	2	2	4	30
1980	40	7	3	3	4	55
1981	47	8	NC	4	6	65
1982	38	8	NC	3	5	54
1983	26	8	NC	4	6	44
1984	30	6	NC	6	7	49
1985	15	NC	NC	NC	NC	15
1986	30	10	NC	7	9	56
1987	36	9	4	6	8	63
1988	38	10	2	5	7	62
1989	9	7	0	3	3	22
1990	24	6	1	2	2	35
1991	12	8	0	1	2	23

“NC = no count taken.

Source: P. Hassemer, IDFG, unpublished.

SELWAY RIVER, CLEARWATER SUBBASIN

Hatchery Produced Spring Chinook

GEOGRAPHIC LOCATION

The Selway River flows 99 miles from its headwaters to join with the Lochsa River to form the Middle Fork of the Clearwater River. Eyed eggs were placed in trenches or artificial redds dug in the gravel in the Selway River above the Little Clearwater River and in Bear Creek in 1961-1964. Incubation channels were then constructed on upper Selway tributaries, at Running Creek in 1964, Ditch Creek in 1966, and Indian Creek in 1966. An incubation channel was also constructed near Fenn Ranger Station on the lower Selway River in 1960-1961 (Lindland and Bowler 1988).

ORIGIN

Spring chinook production in the Cleat-water subbasin was reduced by construction of Lewiston Dam in 1927. Inadequate adult fish passage at the dam's one fishway virtually eliminated salmon runs into the basin. In 1939, two additional fishways were constructed and in the mid-1960's, improvements were made. In 1973, Lewiston Dam was removed (Nez Perce Tribe and Idaho Department of Fish and Game 1990).

Prior to construction of the dam, chinook were likely indigenous through the Cleat-water Basin, but accurate records are lacking regarding which races were present. Efforts to reintroduce chinook salmon to the Clearwater drainage began in the 1950's and the program accelerated in the 1960's. Many of the reintroduction actions took place in the Selway drainage where the restoration project started in 1960. About 1/2 million eggs from "fall-spawning" chinook were supplied from Spring Creek National Fish Hatchery for planting in the lower Selway. This program was expanded in 1961. About 1/2 million eggs from Spring Creek National Fish Hatchery were placed in the incubation channel near Fenn Ranger Station. During the summer, almost 900,000 chinook eggs were obtained from wild upper Salmon River stocks, including the Middle Fork and the South Fork. These were placed in the upper Selway near Magruder Ranger Station. The same year, about 600,000 eyed eggs from spring run chinook were transferred from Carson National Fish Hatchery near Bonneville Dam. These were planted in Bear Creek (Edson 1963).

Lindland and Bowler (1988) provide additional information about the restoration efforts in the Selway drainage. They state that from 1961-1964, almost 3.8 million eyed eggs from Salmon River spring and summer chinook were placed in the Selway River. During the same time interval, about 3.6 million eyed spring chinook eggs from the Carson National Fish Hatchery (NFH) were placed in Bear Creek.

From 1964-1969, about 2.4 million eyed spring chinook eggs from the Carson NFH were placed in the Running Creek channel. This channel was last used in 1970, when about 1/2 million eggs from Rapid River Hatchery, located in the Little Salmon River drainage, was used (Lindland and Bowler 1988).

From 1966-1968, approximately 1.7 million eyed spring chinook eggs from Carson NFH were placed in the Ditch Creek channel. This channel was also last used in 1970, when about 550,000 eggs from Rapid River Hatchery were placed in the channel (Lmdland and Bowler 1988).

The Indian Creek incubation channel was used for the longest time period. From 1966-1979

approximately 28.3 million eyed spring and summer chinook eggs were placed in the channel. A total of 11.1 million fry were enumerated from the channel during 1966-1978 and distributed to various locations in the Selway drainage (Lindland and Bowler 1988).

An incubation channel near Fenn Ranger Station on the lower Selway River was utilized for fall chinook eyed eggs from 1960-1967, during which time 6.7 million eggs were planted. Eggs were obtained from the Snake River in 1962, and Spring Creek Hatchery on the lower Columbia River. The fall chinook program was terminated in 1968 because of poor returns (Lindland and Bowler 1988).

The Cleat-water Subbasin Plan (Nez Perce Tribe and Idaho Department of Fish and Game 1990) provides an accounting of more recent hatchery outplants into the Selway drainage. In 1970, about 3.3 million eggs from Rapid River Hatchery were planted in Running, Ditch and Indian creeks in the Selway drainage. Starting in 1971 and continuing annually through 1981, IDFG planted eggs in the Indian Creek incubation channel. Spring chinook from Cowlitz NFH and Rapid River Fish Hatchery were used as brood stock.

Eyed egg plants in the Selway drainage ceased after 1981 until 1985 when about 1.5 million eggs from Rapid River Hatchery spring chinook were placed in the Indian Creek incubation channel. No fish have been outplanted into the Selway drainage since 1985.

Over the course of the reintroduction program, there was little evaluation of the different outplants or measurement of production of indigenous fish. The mixture of stocks used in the Selway drainage makes it impossible to specify the origin of returning chinook.

DISTRIBUTION

Summaries of eyed egg and fry plants in the Selway River during the 1960's are provided in Lindland and Bowler (1988). In their report, Tables l-4 summarized spring and summer chinook eyed egg plants into Selway River incubation channels, 1961-1979. Tables 5-15 summarize Indian Creek Hatching Channel fry distribution, 1969-1979. Table 20 summarizes fall chinook egg plants into the Fenn Incubation Channel, 1960-1967.

The Clear-water Subbasin Plan (Nez Perce Tribe and Idaho Department of Fish and Game 1990) describes hatchery supplementation with spring chinook in the Clearwater Subbasin, 1977-1987, in Table 11. In the Selway, eyed eggs were planted in the Indian Creek Incubation Channel and the resulting fry were released at the channel, Deep Creek, or Whitecap Creek.

Table 1 describes the two most recent brood-years of hatchery supplementation in the Selway River. Releases were made at the Indian Creek hatching channel.

PRODUCTION

There is little information available describing survival and production factors. Lindland and Bowler (1988) summarized emergence percentages measured at the incubation channels. During the years fry were enumerated at the Running Creek incubation channel, eyed egg-to-fry emergence ranged from 18-79 percent. For Ditch Creek, emergence percentages during the three years of enumeration ranged from 26-100 percent. At Indian Creek incubation channel, emergence ranged 17-74 percent and averaged 44 percent.

ADULT LIFE HISTORY

Adult Escapement

Chinook crossing Bonneville Dam through May 31 are counted as springs, as are those crossing Lower Granite Dam through June 17. Specific time of migration and escapement for Selway River spring chinook is not well documented in the ocean, Columbia River or the Snake River. The University of Idaho implemented adult timing research in 1991 which should provide more information about Snake River timing (Bjornn et al. 1992).

The time of entry of spring and summer chinook into the Clear-water subbasin was from April to July, noted when fish were counted at the Lewiston Dam. Passage at the dam peaked in June-July during 1965-1972. Run size during this period peaked in 1972 when a total of 3,467 chinook were counted at Lewiston Dam. Increasing runsize at Lewiston Dam occurred through the 1960's and early 1970's but drainage specific escapement information is not available (Lindland and Bowler 1988).

Harvest

Information is not available regarding the rate of contribution of this run of fish to ocean, Columbia, or Snake River harvest.

During the period 1959-1976, the entire Clearwater drainage contributed less than one percent of Idaho's sport salmon harvest (Horner and Bjornn 1981). Specific information about the sport harvest of hatchery salmon from the Selway drainage is not available. There has not been a sport salmon harvest in the Selway River since at least 1976 (Nez Perce Tribe and Idaho Department of Fish and Game 1990).

Selway Falls is a primary fishing site for the Nez Perce Tribe (Nez Perce Tribe and Idaho Department of Fish and Game 1990). Information regarding occurrence and magnitude of tribal harvest on Selway River hatchery spring chinook is not available.

Spawner Escapement

It is unknown how many indigenous and how many hatchery fish spawned in the Selway drainage during the years of reintroduction. Adults were never collected in the Selway for artificial production. The last year for hatchery fish to return from the 1985 eyed-egg plant would have been 1990.

Adult Characteristics

Information specific to Selway River hatchery chinook populations is not available. The average adult age structure of spring and summer chinook passing over Lewiston Dam, 1965-1972, was 15.3 percent age 3, 64.3 percent age 4, and 20.4 percent age 5 (Nez Perce Tribe and Idaho Department of Fish and Game 1990). Refer to information describing the various broodstocks used in the Selway drainage for further information.

No information regarding the sex ratio or fecundity of Selway River hatchery chinook is available.

JUVENILE LIFE HISTORY

Most of the hatchery production in the Selway drainage consisted of eyed-egg plants, made in the late fall. In some cases, fry were manually dispersed to other parts of the drainage, Refer to the life history information in the natural spring chinook section for timing information.

BIOCHEMICAL/GENETIC CHARACTERISTICS

Information is not available.

DISEASES

Information has not been compiled.

REFERENCES

The Selway references appear at the end of the summer steelhead section.

Table 1 (TR). Hatchery spring chinook releases into the Selway River by brood years. No coded wire tags have been released.

Brood Year	Brood-stock	Hatchery	Life Stage	Release Date (1)	Release Date (2)	Fish/lb	Number Released	Release Location	CWT
1980	Cowlitz	Indian Cr. Channel	F-F[a]	1981			1,436,800	Indian Cr. Channel	
1985	Rapid River	Pahsimeroi	eyed-eggs	1985			1,478,439	Indian Cr. Channel	

[a] F-F designates a fry or fingerling release.

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SELWAY RIVER, CLEARWATER SUBBASIN

Summer Steelhead (wild)

GEOGRAPHIC LOCATION

The Selway River flows 99 miles from its headwaters to join with the Lochsa River to form the Middle Fork of the Clearwater River. About 74 percent of the drainage is classified as wilderness (Nez Perce Tribe and Idaho Department of Fish and Game 1990). The Wild and Scenic Rivers Act and Selway-Bitterroot Wilderness Area provide protection for the mainstem and a major portion of the tributaries. Selway Falls, located about 18 miles upstream from the mouth was a partial migration block to steelhead until the Selway Falls fishway was completed in 1966 (Idaho Department of Fish and Game 1992).

ORIGIN

The Selway drainage is one of three major Idaho drainages supporting runs of wild, native, B-run steelhead. Hatchery steelhead have not been stocked in the drainage. Natural production maintains the run. These fish are classified as B-run on the basis of ocean age component, size at age, and timing. B-run steelhead generally enter the Columbia River from August through December and are larger than A-run steelhead of comparable ocean age.

Indigenous steelhead production in the Clearwater subbasin was reduced by construction of Lewiston Dam in 1927. Inadequate adult fish passage at the dam's one fishway virtually eliminated salmon runs into the basin and probably affected the passage of steelhead. In 1939, two additional fishways were constructed and in the mid-1960's, improvements were made. In 1973, Lewiston Dam was removed (Nez Perce Tribe and Idaho Department of Fish and Game 1990).

DISTRIBUTION

Available spawning and rearing habitat for the Selway River drainage was described in the Presence/Absence database (Tables 1 and 2). This information was developed for the Northwest Power Planning Council for subbasin planning and modeling. The effect of Selway Falls on steelhead passage to the upper Selway prior to the fishway is not well documented. Metsker (1959) estimated that for conditions in 1946-1955, steelhead passage over Selway Falls was totally blocked 58 percent of the time and partially blocked 23 percent.

PRODUCTION

There is little information available describing survival and production factors. Idaho Department of Fish and Game (IDFG) biologists have conducted steelhead parr monitoring since 1985. Parr densities have been determined by snorkel counts. For 1985-1991, the overall weighted mean of all sections and years for steelhead parr density in IDFG transects was 4.2 parr per 100 m^2 and 22.9 percent of estimated carrying capacity (Table 3). Parr carrying capacity ratings for summer steelhead were derived from the Presence/Absence database used for development of the Cleat-water Subbasin Plan.

ADULT LIFE HISTORY

Adult Escapement

Specific time of migration and escapement for steelhead returning to the Selway River drainage has not been identified for the ocean or Columbia or Snake rivers. The University of Idaho implemented adult timing research in 1991 which should provide information about Snake River timing (Bjornn et al. 1992).

Adult steelhead that migrate in the fall over-winter in the Snake and lower Clearwater rivers although harvest records show that fish were occasionally harvested in the Selway River during the late fall (Keating 1970 and 1971).

The time of entry of steelhead into the Cleat-water subbasin was from July through June, noted when fish were counted at the Lewiston Dam from the 1949-1950 run year through the 1971-1972 run year. Up until the 1958-1959 run year, an average of 79 percent of the steelhead run crossed Lewiston Dam during March-May. An average of only 16 percent of the run crossed during September-November. Beginning with the 1958-1959 run year, an average of 42 percent of the steelhead run crossed Lewiston Dam during March-May, and 56 percent crossed in September-November (S. W. Kiefer, IDFG, personal communication).

Steelhead run estimates for the entire Clear-water drainage ranged from 3,167-43,1996 for the run years 1949-1950 through 1971-1972 (Nez Perce Tribe and Idaho Department of Fish and Game 1990). There was little hatchery steelhead production in the Clearwater drainage during this period.

Harvest

Information is not available regarding the rate of contribution of this stock to ocean, Columbia River or Snake River harvest. Since the mid-1980's, the harvest of steelhead possessing an adipose fin has not been allowed in the Snake River or in Idaho.

Limited sport harvest information is available from the Selway River from 1958 and 1967- 1971. From 1954-1957, the Selway River was closed to steelhead harvest in the spring. The lower Selway was reopened in 1958. An intensive sport fishery ensued and biologists estimated from a creel survey that 1,100 steelhead were caught by 2,310 anglers in 55 days. The majority of the steelhead were caught in April. The Nez Perce Tribe also harvested an estimated 300 steelhead for a total harvest of 1,475 steelhead below Selway Falls (Metsker 1959).

Based on expansions of random samples of returned steelhead permits, an average of 166 steelhead were harvested annually from the Selway River during 1967-1971 (Keating 1969[a], Keating 1969[b], Keating 1970, Keating 1971, Mallet 1972). Annual harvest ranged 80-410 adult steelhead. Most of these steelhead were harvested in March.

The Selway River has been closed to steelhead harvest since at least the mid-1970's. Further information regarding occurrence and magnitude of tribal harvest on Selway River steelhead is not available.

Spawner Escapement

Studies conducted in the Clearwater drainage indicated that the spring steelhead migration began when water temperature reached 39 F° (Metsker 1959). Spawners move over Selway Falls February through May.

Spawner escapement information specific to the Selway River drainage is not available. IDFG biologists conducted index steelhead redd counts in 1990 and 1991 (Table 4), but these cannot be used for escapement estimates.

In 1958, the degree of sexual maturity was recorded for steelhead sampled in the sport catch at Selway Falls, March 18-May 11. Of the 197 steelhead that were observed, 65 percent were green, 30 percent were partially ripe or ripe, and 5 percent had spawned (Metsker 1959).

Adult characteristics

There is some limited information available describing fork length. A sample of 208 steelhead caught at Selway Falls in the spring, 1958, ranged 21-36 inches in fork length (Table 5). Average fork length for males was 28 inches and 29.5 inches for females (Metsker 1959). A sample of 9 steelhead collected from the Selway River in 1990 ranged in size 77-86.5 cm fork length and averaged 81.3 cm (32 inches) (P. Hassemer, IDFG, personal communication). Average size of the 3 males was 82.1 cm (32 inches) and average size of the 6 females was 80.8 cm (31.8 inches).

For 208 fish sampled from the sport catch in spring 1958, 63 percent were female (Metsker 1959).

JUVENILE LIFE HISTORY

Life history timing is likely similar to Figure 2 in the South Fork Clear-water steelhead section. Although not illustrated in that figure, there is typically a fall emigration of steelhead presmolts from the upper ends of tributaries to lower in the drainage or to the mainstem Selway River or lower in the Middle Fork Clearwater River for winter rearing.

BIOCHEMICAL/GENETIC CHARACTERISTICS

Isozyme gene frequencies for Columbia Basin steelhead, including the Selway River, were reported by Schreck et al. (1986) (Appendix Table 4).

DISEASES

Information is not available.

REFERENCES

All Selway references appear at the end of this section.

Table 1 (HB). Estimated amount of spawning and rearing habitat (Use Type 1) by quality of Selway River (below, above and including Moose Creek) steelhead production area.

	Excellent	Good	Fair[a]	Poor[a]	Unknown	Total	Confidence[b]
Miles (%)	90 82	15 7	0	3		1551.8 717.6	M M
Acres (%							

[a] Ratings of fair and poor habitat quality may reflect natural physical features such as gradient and channel type, as well as degradation caused by humans.
[b] 'Confidence' is meant to indicate the reproducibility and accuracy of the estimates made, and will be rated as high, medium or low by the respective agencies.

Source: Presence/Absence database, Northwest Power Planning Council, 1991.

Table 2 (HB). Estimated amount of rearing only habitat (Use Type 2) by quality of Selway River (below, above and including Moose Creek) steelhead production area.

	Excellent	Good	Fair[a]	Poor[a]	Unknown	Total	Confidence[b]
		43	31				M
Miles (%)	21	40	39	5		1298.7	M

[a] Ratings of fair and poor habitat quality may reflect natural physical features such as gradient and channel type, as well as degradation caused by humans.
[b] 'Confidence' is meant to indicate the reproducibility and accuracy of the estimates made, and will be rated as high, medium or low by the respective agencies.

Source: Presence/Absence database, Northwest Power Planning Council, 1991.

Table 3 (PD-a). Parr density" and percent of rated carrying capacity (PCC) for steelhead in the Selway River drainage.

Stream name	Year	Sample size	Ages 1+ & 2+ density (#/100m²)	Density std. dev.	PCC for 1+ & 2+	PCC std. dev.
Selway River	85	2	1.49	.47	7.45	2.33
Selway River	86	2	1.66	1.12	8.28	5.62
Selway River	87	3	1.34	1.19	6.68	5.97
Selway River	88	3	1.22	.67	6.08	3.34
Selway River	89	3	1.38	1.03	6.92	5.13
Selway River	90	3	1.64	.76	8.18	3.81
Selway River	91	3	1.92	1.74	9.58	8.71
Gedney Creek	90	2	7.35	1.28	36.73	6.40
Meadow Creek	88		.03	NA[b]	.50	NA
Meadow Creek	90	1:	12.10	6.74	69.55	30.01
Meadow Creek	91	2	3.34	2.45	23.86	17.47
Butte Creek	90	4	4.43	3.41	31.64	24.33
Sable Creek	90	5	9.05	2.54	45.27	12.71
Otter Creek	88	1	5.05	NA	36.07	NA
Otter Creek	89	1	10.29	NA	73.50	NA
Otter Creek	90	1	15.89	NA	113.50	NA
Otter Creek	91	1	11.23	NA	56.15	NA
Three Links Cr.	88	1	20.84	NA	104.20	NA
Three Links Cr.	89	1	11.23	NA	56.15	NA
Three Links Cr.	90	1	26.77	NA	133.85	NA
Three Links Cr.	91	1	14.59	NA	72.95	NA
Moose Creek	85	1	.11	NA	.55	NA
Moose Creek	87	1	1.86	NA	9.30	NA
Moose Creek	88		2.51	3.54	12.55	17.71
Moose Creek	89	3	.30	.35	1.52	1.73
Moose Creek	90	4	2.92	3.12	14.59	15.53
Moose Creek	91	2	3.30	2.18	16.50	10.89
Moose Creek, N.	85	1	3.75	NA	18.75	NA
Moose Creek, N.	87	1	.78	NA	3.90	NA
Moose Creek, N.	89	1	0.0	NA	0.0	NA
Moose Creek, N.	90	1	3.09	NA	15.45	NA
Moose Creek, N.	91	1	4.40	NA	22.00	NA

Table 3 (PD-a) (cont.). Parr density[a] and percent of rated carrying capacity (PCC) for steelhead in the Selway River drainage.

Stream name	Year	Sample size	Ages 1+ & 2+ density (#/100m²)	Density std. dev.	PCC for 1+ & 2+	PCC std. dev.
Bear Creek	86	2	.34	.20	1.70	.99
Bear Creek	87	2	3.32	.91	16.58	4.56
Bear Creek	88	2	3.52	.51	17.60	2.55
Bear Creek	89	2	1.29	.01	6.45	.07
Bear Creek	90	2	2.47	.26	12.33	1.31
Bear Creek	91	2	.11	.15	.53	.74
Running Creek	85	2	1.31	.86	6.53	4.28
Running Creek	86	2	.72	.44	3.60	2.19
Running Creek	87	2	3.60	.57	17.98	2.86
Running Creek	88	2	3.68	1.95	18.40	9.76
Running Creek	89	2	1.91	2.01	9.55	10.04
Running Creek	90	2	.68	.33	3.40	1.63
Running Creek	91	2	1.22	.20	6.10	.99
White Cap Creek	85	2	.94	.26	4.70	1.27
White Cap Creek	86	2	.70	.99	3.50	4.95
White Cap Creek	87	3	1.28	.86	6.38	4.29
White Cap Creek	88	3	2.07	1.16	10.33	5.79
White Cap Creek	89	3	2.30	.65	11.52	3.26
White Cap Creek	90	3	2.31	1.12	11.57	5.62
White Cap Creek	91	6	1.84	1.41	9.22	7.07
Deep Creek	87	2	3.97	.26	19.83	1.31
Deep Creek	88	2	5.79	2.76	28.95	13.79
Deep Creek	89	2	4.82	2.35	24.10	11.74
Deep Creek	90	2	5.58	1.61	27.90	8.06
Deep Creek	91	3	4.45	2.15	22.33	10.75

[a] Densities estimated by snorkel counts.
[b] NA = Not applicable.

Source: B. Rich, IDFG, unpublished.

Table 4 (RN-a). Selway River drainage steelhead index redd counts" conducted by Idaho Department of Fish and Game, 1990 and 1991.

		Number of redds			Redds/km	
Location	Reach	1990	1991	km	1990	1991
Running Creek	Roaded area	0	NC[b]	0.6	0	NA[c]
	Mouth to Eagle Cr.	0	0	3.4	0	0
Eagle Creek	Mouth to Forks	0	NC	3.4	0	NA
Selway River	Magruder Crossing to Little Clearwater	1	NC	3.4	0.3	NA
Whitecap Creek	1 mi. upstream Canyon Cr.	1	NC	1.6	0.6	NA
	2 mi. upstream Canyon Cr.	1	NC	3.2	0.9	NA
Bear Creek	Mouth to Cur Cr.	9	2	8.8	1.0	0.2
	Cub Cr. to Swamp Cr.	6	0	8.5	0.7	0

[a] Counts were single peak counts conducted aerially in May.
[b] NC = Not counted.
[c] NA = Not applicable.

Sources: B. Rich, IDFG, unpublished.
Rich et al. 1992.

Table 5 (AL-a). Fork lengths" of 208 steelhead measured in the sport catch at Selway Falls, March-May, 1958.

Length cm.	1958 No. fish[b]
< 40	
40	
41	
42	
43	
44	
45	
46	
47	
48	
49	
50	
51	
52	
53	4
54	
55	
56	1
57	
58	
59	
60	
61	6
62	2
63	
64	13
65	5
66	16
67	8
68	
69	19
70	IO
71	21
72	2
73	
74	15
75	4
76	9
77	2
78	
79	10
80	6
81	
82	18
83	4
84	1s
85	4
86	
87	6
88	
89	4
90	1
91	
92	3
93	
>94	

[a] Lengths were measured to the nearest 1/2 inch.
[b] Blanks indicate no fish in this size collected and measured.
Sources:Metsker 1959.

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LOWER SALMON RIVER. SALMON SUBBASIN
(mouth to French Creek)

Spring Chinook (wild)

GEOGRAPHIC LOCATION

The lower Salmon River flows 107 miles from French Creek to the mouth of the Salmon River . Much of this reach is a deep, rocky canyon. The mainstem Salmon River is characterized by a series of deep pools separated by rapids. A 53 mile section of the river from its mouth to Hammer Creek is being considered for inclusion in the Wild and Scenic Rivers System (Idaho Department of Fish and Game 1992). The mainstem serves as a migration corridor for salmon and steelhead adults and smolts. It also serves as an over-wintering area for salmon and steelhead juveniles. Chinook natural production takes place primarily in tributary streams which are mostly high gradient with unstable soils.

ORIGIN

Studies have not been conducted to confirm whether spring or summer chinook return to lower Salmon River tributaries, but these fish are believed to be spring-run. For management purposes, populations in these tributaries have been classified as spring chinook. Known naturally reproducing populations of chinook exist in Slate and Whitebird creeks (Idaho Department of Fish and Game 1992). Occasionally juvenile chinook are found in other tributaries. Hatchery chinook have not been stocked in tributaries or the mainstem of the lower Salmon River. The chinook run to tributaries has been maintained with natural spawning of native spring chinook. Straying from Rapid River Hatchery or other Salmon River stock may occur (Larson and Mobrand 1992). Naturally produced spring and summer chinook were listed as “threatened” by the National Marine Fisheries Service in 1992.

DISTRIBUTION

Available spawning and rearing habitat for the lower Salmon River was described in the Presence/Absence database (Table 1). This information was developed for the Northwest Power Planning Council for subbasin planning and modeling.

PRODUCTION

There is little information available describing survival and production factors. Idaho Department of Fish and Game (IDFG) monitored spring chinook parr production in lower Salmon River tributaries, 1985-1991. Densities were extremely low (Table 2). Parr carrying capacity ratings for summer chinook were derived from the Presence/Absence database used for development of the Salmon Subbasin Plan. Parr densities were determined by snorkel counts.

ADULT LIFE HISTORY

Adult Escapement

Chinook crossing Bonneville Dam through May 31 are counted as springs, as are those crossing Lower Granite Dam through June 17. Specific time of migration and escapement for lower Salmon River spring chinook is not well documented in the ocean, Columbia River or the Snake River. The

University of Idaho implemented adult timing research in 1991 which should provide more information about Snake River timing (Bjornn et al. 1992).

Harvest

There is no information available regarding harvest specifically of lower Salmon River spring chinook in the ocean, Columbia or Snake rivers.

General sport harvest of spring chinook in the mainstem Salmon River last occurred in 1978.

Information regarding occurrence and magnitude of tribal harvest on lower Salmon River spring chinook is not available.

Spawner Escapement

Redd counts were never conducted in lower Salmon River tributaries until recently. In 1990, the Nez Perce Tribe identified 6 adult chinook and 3 redds in Slate Creek. In 1991, they found 7 adult chinook and 3 redds in Slate Creek (Larson and Mobrand 1992).

Adult Characteristics

Information has not been compiled.

JUVENILE LIFE HISTORY

Juvenile life history timing is generally similar to that illustrated in the Little Salmon section. Although not illustrated in the figure, there is typically a fall emigration of chinook presmolts to lower in the drainage or the mainstem Salmon River for winter rearing.

BIOCHEMICAL/GENETIC CHARACTERISTICS

Information has not been compiled.

DISEASES

Information has not been compiled.

REFERENCES

All Lower Salmon references appear at the end of the hatchery produced summer steelhead section.

Table 1 (HB). Estimated amount of spawning and rearing habitat (Use Type 1) by quality of Salmon River (mouth to French Creek) spring chinook production area.

	Excellent	Good	Fair[a]	Poor[a]	Unknown	Total	Confidence[b]
Miles (%)	0	33	67	0		89.8	M
Acres (%)	0	22	78	0		143.6	M

[a] Ratings of fair and poor habitat quality may reflect natural physical features such as gradient and channel type, as well as degradation caused by humans.
[b] 'Confidence' is meant to indicate the reproducibility and accuracy of the estimates made, and will be rated as high, medium or low by the respective agencies.

Source: Presence/Absence database, Northwest Power Planning Council, 1991.

Table 2 (PD-a). Natural chinook parr densities as fish per 100m^2 (CHINDD) and percent of rated carrying capacity (CHPERCC), in the Lower Salmon River drainage, 1985-1991. Densities estimated by snorkel counts.

	Year						
	1985	1986	1987	1988	1989	1990	1991
Whitebird Creek							
CHINOD =	0.0	.303	.243	.280	0.0	0.0	0.0
CHPERCC =	0.0	.688	.550	.637	0.0	0.0	0.0
N =	3	4	4	3	3	3	2
Slate Creek							
CHINOD =	.093	.463	2.157	.263	.053	1.128	.50
CHPERCC =	.213	1.053	4.9	.598	.120	2.563	1.136
N =	3	3	3	4	4	4	5
Little Slate Creek							
CHINDD =	0.0	0.0	1.41	NS[a]	NS	NS	NS
CHPERCC =	0.0	0.0	3.2	NS	NS	NS	NS
N =	2	1	1	NS	NS	NS	NS

[a] NS = not sampled.
Source: B. Rich, IDFG, unpublished.

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LOWER SALMON RIVER, SALMON SUBBASIN
(mouth to French Creek)

Summer Steelhead (wild and natural)

GEOGRAPHIC LOCATION

The lower Salmon River flows 107 miles from French Creek to the mouth of the Salmon River . Much of this reach is a deep, rocky canyon. The mainstem Salmon River is characterized by a series of deep pools separated by rapids. A 53 mile section of the river from its mouth to Hammer Creek is being considered for inclusion in the Wild and Scenic Rivers System. The mainstem serves as a migration corridor for salmon and steelhead adults. It also serves as an overwintering area for salmon and steelhead juveniles. Steelhead natural production takes place primarily in tributary streams which are mostly high gradient with unstable soils. Steelhead are known to spawn and rear in at least 16 tributaries (Idaho Department of Fish and Game 1992).

ORIGIN

Steelhead were indigenous to tributaries of the lower Salmon River but no information describes the original stock. Hatchery steelhead smolts have been stocked at the mouths of some tributaries, and parr and fry have been stocked into tributary production areas. Both A-run and B-run progeny, classified based on adult characteristics of size, ocean age, and timing, have been stocked into Slate Creek. Because there is no broodstock collection facility in the lower Salmon, returning hatchery fish probably spawn naturally. Thus, natural production broodstock may be wild, indigenous steelhead, hatchery A-run and B-run steelhead, or a mixture thereof.

DISTRIBUTION

Available spawning and rearing habitat for the lower Salmon River was described in the Presence/Absence database (Tables 1 and 2). This information was developed for the Northwest Power Planning Council for subbasin planning and modeling.

PRODUCTION

There is little information available describing survival and production factors. Idaho Department of Fish and Game (IDFG) monitored steelhead parr densities in lower Salmon River tributaries, 1985-1991. Densities were higher in Whitebird Creek, a wild steelhead stream, than in other tributaries (Table 3). The overall weighted mean density for steelhead parr in the lower Salmon River was 15.1 parr per 100 m^2 in IDFG monitoring sections, 19851991. The mean percent of estimated carrying capacity was 93 percent. Parr carrying capacity ratings for steelhead were derived from the Presence/Absence database used for development of the Salmon Subbasin Plan. Parr densities were determined by snorkel counts.

ADULT LIFE HISTORY

Adult Escapement

Specific time of migration and escapement for steelhead returning to lower Salmon River tributaries has not been identified for the ocean or Columbia River. The University of Idaho implemented adult timing research in 1991 which should provide information about Snake River timing (Bjornn et al. 1992).

Adult steelhead enter the Salmon River in the fall and typically overwinter in the middle main reach of the Salmon River before ascending tributaries to spawning grounds. Tagging studies have shown that there is considerable milling of steelhead in wintering areas.

Harvest

There is no information available describing the rate of contribution of these steelhead to ocean or Columbia River steelbead harvest. Since the mid-1980's, the harvest of steelhead possessing an adipose fm has not been allowed in the Snake River or in Idaho.

Spawner Escapement

Timing of steelhead spawning in the Salmon River drainage can span two months, from early April to early June. It appears that adult fish usually enter tributaries after spring freshets. The major period of steelbead spawning begins in mid-April and extends through May when water temperature is above 4.5 C° (Ball 1985).

There is no estimate of escapement of spawners to lower Salmon tributaries.

Adult Characteristics

No other adult steelbead information is available for lower Salmon River tributaries.

JUVENILE LIFE HISTORY

Juvenile life history timing is generally similar to that illustrated in the Little Salmon section. Although not illustrated on the figure, there is typically a fall emigration of steelbead presmolts to lower in the drainage or the mainstem Salmon River for winter rearing.

BIOCHEMICAL/GENETIC CHARACTERISTICS

Information has not been compiled.

DISEASES

Information has not been compiled.

REFERENCES

All Lower Salmon references appear at the end of the hatchery produced summer steelhead section.

Table 1 (HB-1). Estimated amount of spawning and rearing habitat (Use Type 1) by quality of Salmon River (mouth to French Creek) steelhead production area.

	Excellent	Good	Fair[a]	Poor"	Unknown	Total	Confidence[b]
Miles (%)		35					
Acres (%)	48 31	35	28 16	61		293.1 323.1	M M

[a] Ratings of fair and poor habitat quality may reflect natural physical features such as gradient and channel type, as well as degradation caused by humans.
[b] 'Confidence' is meant to indicate the reproducibility and accuracy of the estimates made, and will be rated as high, medium or low by the respective agencies.

Source: Presence/Absence database, Northwest Power Planning Council, 1991.

Table 2 (HB-2). Estimated amount of spawning and rearing habitat (Use Type 2) by quality of Salmon River (mouth to French Creek) steelhead production area.

	Excellent	Good	Fair"	Poor"	Unknown	Total	Confidence[b]
Miles (%)	0	0	17	83		6	M
Acres (%)	0	0	12	88		1.7	M

[a] Ratings of fair and poor habitat quality may reflect natural physical features such as gradient and channel type, as well as degradation caused by humans.
[b] 'Confidence' is meant to indicate the reproducibility and accuracy of the estimates made, and will be rated as high, medium or low by the respective agencies.

Source: Presence/Absence database, Northwest Power Planning Council, 199 1.

Table 3 (PD-a). Parr density and percent of rated carrying capacity (PCC) for steelhead in the Lower Salmon River drainage, 1985-1991. Densities estimated by snorkel counts.

Stream name	Year	Sample size	Ages 1+ & 2+ density (#/100m²)	Density std. dev.	PCC for 1+ & 2+	PCC std. dev.
Whitebird Creek	85	3	21.98	4.75	109.88	23.77
Whitebird Creek	86	4	22.88	10.93	127.13	61.58
Whitebird Creek	87	4	11.95	11.36	60.66	55.72
Whitebird Creek	88	3	42.34	15.41	211.72	77.07
Whitebird Creek	89	3	27.44	6.51	137.18	32.55
Whitebird Creek	90	3	20.14	11.71	102.07	58.52
Whitebird Creek	91	2	20.48	9.92	102.38	49.60
Slate Creek	85	3	4.31	.60	25.12	9.18
Slate Creek	86	3	5.96	1.60	29.82	8.00
Slate Creek	87	3	4.46	1.54	25.96	11.76
Slate Creek	88	4	17.58	7.12	87.91	35.61
Slate Creek	89	4	11.51	8.34	57.56	41.72
Slate Creek	90	4	6.88	3.16	34.42	15.79
Slate Creek	91	5	11.63	5.49	58.17	27.46
Little Slate Creek	85	1	4.09	NA[a]	20.45	NA
Little Slate Creek	86	1	5.35	NA	26.75	NA
Little Slate Creek	87	1	6.63	NA	33.15	NA
Elkhom Creek	88	1	9.58	NA	47.90	NA

[a] Not applicable.

Source: B. Rich, IDFG, unpublished.

LOWER SALMON RIVER, SALMON SUBBASIN
(mouth to French Creek)

Hatchery Produced Summer Steelhead

GEOGRAPHIC LOCATION

The lower Salmon River flows 107 miles from French Creek to the mouth of the Salmon River. There are no steelhead hatcheries or broodstock collection facilities located in the lower Salmon River. Hatchery steelhead are transported by truck from other hatcheries in Idaho.

ORIGIN

Steelhead were indigenous to tributaries of the lower Salmon River but no information describes the original stock. Hatchery steelhead smolts have been stocked at the mouths of some tributaries to stage returning adults to provide harvest opportunity in the mainstem Salmon River. Parr and fry have been stocked into tributary production areas. Both A-run and B-run progeny, classified based on adult characteristics of size, ocean age, and timing, have been stocked into Slate Creek. Hatchery A-run steelhead are usually progeny of adult steelhead collected at Pahsimeroi Hatchery on the Pahsimeroi River, a tributary to the Salmon River. Progeny of hatchery steelhead returning to the Sawtooth Hatchery on the upper Salmon River have also been used. Hatchery B-run steelhead stocked into Slate Creek are progeny of either adults collected at Dworshak National Fish Hatchery on the North Fork Clear-water River or of large adults collected at the Pahsimeroi and East Fork Salmon River adult traps.

DISTRIBUTION

Table 1 lists releases in the lower Salmon River, brood years 1982-1990. During this period, coded wire tagged (CWT) fish were released only in brood years 1986 and 1987. Hatchery released steelhead presmolts and smolts are adipose fm clipped. CWT fish are marked with a left ventral fin clip.

PRODUCTION

There is little information available for hatchery steelhead once they are released into the lower Salmon River. For the A-run CWT release, the smolt to adult return was estimated as 0.15 percent, after the one-ocean return. For the B-run CWT release, the smolt to adult return was estimated as 0.30 percent, after the two-ocean return (D. Cannamela, IDFG, unpublished).

ADULT LIFE HISTORY

Adult Escapement

Specific time of migration and escapement for steelhead returning to lower Salmon River tributaries has not been identified for the ocean or Columbia River. The University of Idaho implemented adult timing research in 1991 which should provide information about Snake River timing.

Harvest

There is no information available describing the rate of contribution of these steelhead to ocean or Columbia and Snake river steelhead harvest. A limited number of CWTs have been released, but harvest recovery information was not summarized for this report.

Harvest of hatchery fish in the lower mainstem Salmon River ranged up to 6,682 during 1980-1991 (Table 2). This estimate is developed from a telephone survey. Harvest is of mixed hatchery steelhead stocks commingling in the Salmon River. Exploitation of hatchery fish released into the lower Salmon River has not been quantified but is assumed to be near 50 percent (Ball 1991).

Spawner Escapement

There is no empirical information available regarding how many returning hatchery steelhead spawn naturally in lower Salmon River tributaries because there are no counting facilities. Ball (1991) estimates that hatchery steelhead spawner escapement is approximately 50 percent of the return to Idaho.

Adult Characteristics

Refer to information describing the hatchery broodstock, such as the section on Pahsimeroi River hatchery steelhead.

JUVENILE LIFE HISTORY

Refer to information describing the rearing hatchery, such as the section on Pahsimeroi River hatchery steelhead.

BIOCHEMICAL/GENETIC CHARACTERISTICS

Refer to information describing the hatchery broodstock, such as the section on Pahsimeroi River hatchery steelbead.

DISEASES

Refer to information describing the hatchery broodstock, such as the section on Pahsimeroi River hatchery steelhead.

REFERENCES

All Lower Salmon references appear at the end of this summer steelhead section.

Table 1 (TR). Hatchery steelhead releases into the Lower Salmon River (mouth to French Creek) by brood year, 1982-1990. Coded wire tag codes displayed for brood years 1986-1987.

Brood Year	Brood-stock	Hatchery	Life Stage	Release Date (1)	Release Date (2)	Fish/lb	Number Released	Release Location	CWT
1982	Dworshak NFH B	Dworshak NFH	smolt	1983			171	Slate Creek	
1982	Pahsimeroi A	Magic Valley	smolt	1983			11,340	Allison Creek	
1982	Pahsimeroi A	Magic Valley	smolt	1983			32,700	Slate Creek	
1984	Pahsimeroi A	Pahsimeroi	F-F'	1984			25,000	Slate Creek	
1986	East Fork-Pahsim. B	Hagerman NFH	smolt	3/24/87		4.5	48,019	Slate Creek	10/29/26
1986	East Fork-Pahsim. B	Hagerman NFH	smolt	03/24/87		4.5	1,721	Slate Creek	Untagged
1986	Sawtooth A	Hagerman NFH	smolt	1987			13,401	Deer Cr. @ Salmon	
1987	Pahsimeroi A	Magic Valley	smolt	04/23/88	04/25/88	4.7	87,200	Hammer @ Salmon	
1987	Pahsimeroi Sawtooth A	Magic Valley	smolt	04/18/88	04/25/88	4.3	346,100	Slate Creek	
1987	Sawtooth A	Hagerman NFH	smolt	1988		4.8	50,050	Slate Creek	10/40/50
1987	Sawtooth A	Hagerman NFH	smolt	1988		4.8	672	Slate Creek	Untagged
1987	Sawtooth A	Magic Valley	smolt	04/11/88	04/14/88	4.6	100,000	French Creek	
1988	Pahsimeroi A	Magic Valley	smolt	04/28/89	04/29/89	4.0	136,000	Hammer @ Salmon	
1988	Pahsimeroi A	Magic Valley	smolt	04/24/89	04/27/89	4.1	300,600	Slate Creek	

Table 1 (TR) (cont.). Hatchery steelhead releases into the Lower Salmon River (mouth to French Creek) by brood years, 1982-1990.

Brood Year	Brood-stock	Hatchery	Life Stage	Release Date (1)	Release Date (2)	Fish/lb	Number Released	Release Location	CWT
1988	Pahsimeroi A	Niagara springs	smolt	04/29/89		4.0	7,200	Hammer @ Salmon	
1989	Pahsimeroi A	Niagara Springs	pre-smolt	09/19/89		5.7	100,600	French Creek	
1989	Dworshak NFH B	Magic Valley	pre-smolt	09/11/89		6.1	162,940	Slate Creek	
1989	Sawtooth A	Sawtooth	F-F	1989			197,450	Slate Creek	
1989	Sawtooth A	Sawtooth	F-F	1989			94,000	Partridge	
1989	Pahsimeroi A	Niagara Springs	smolt	04/18/90	04/20/90	4.8	229,000	Hammer @ Salmon	
1990	Pahsimeroi A	Magic Valley	smolt	04/22/91	04/25/91		186,300	Hammer @ Salmon	

[a] F-F designates a fry or fingerling release.

Table 2 (RS-a). Number of steelhead harvested by non-treaty anglers from the fall of 1980 to the spring of 1991, from lower Salmon River stream sections.

	Stream section			
Years	10[a]	11[b]	12[c]	Totals
1980 - 1981	699	527	1,370	2,596
1981 - 1982	2,707	1,600	2,375	6,682
1982 - 1983	164	241	363	768
1983 - 1984	1,457	910	877	3,244
1984 - 1985	1,358	730	470	2,558
1985 - 1986	1,444	910	1,697	4,051
1986 - 1987	2,588	1,637	1,536	5,761
1987 - 1988	682	1,036	695	2,413
1988 - 1989	798	688	556	2,042
1989 - 1990	1,552	1,512	477	3,541
1990 - 1991	506	499	182	1,187

[a] Stream section 10 extends from mouth of Salmon River to Whitebird Creek.
[b] Stream section 11 extends from Whitebird Creek to Little Salmon River.
[c] Stream section 12 extends from Little Salmon River to Vinegar Creek. Counts for Section 12 also included counts from Section 13 (Vinegar Creek to South Fork Salmon River) from fall 1980 to the fall of 1985 because separate counts were not recorded.

Sources: Ortmann 1981.
Pollard 1982, 1985.
Partridge and Pollard 1983.
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LITTLE SALMON RIVER, SALMON SUBBASIN

Naturally Produced Spring Chinook Salmon

GEOGRAPHIC LOCATION

The Little Salmon River enters the Salmon River at Riggins, Idaho, 82 miles upstream from the confluence of the Salmon and Snake rivers (Figure 1). About 145 stream miles are available for spring chinook spawning and rearing in this drainage. This excludes most of the Rapid River drainage which is managed for summer chinook.

ORIGIN

Spring chinook naturally spawning in the Little Salmon drainage are likely a mixture of returning Rapid River Hatchery fish and the returning progeny of naturally produced or mixed (naturally and hatchery produced) parents.

The history of outplanting spring chinook adults and juveniles in the Little Salmon drainage (see Little Salmon hatchery spring chinook) implies a strong influence of Rapid River Hatchery spring chinook on natural production. These fish were transferred from the Middle Snake River above the Idaho Power Company Hells Canyon hydroelectric project in the 1960's. Adult outplanting was common when large numbers of fish returned to the hatchery. For example, in 1973, over 6,000 adults from Rapid River Hatchery were outplanted into the Little Salmon drainage for harvest and natural production (Parrish et al. 1974). All naturally produced Snake River spring and summer chinook were listed as "threatened" by the National Marine Fisheries Service in 1992.

DISTRIBUTION

Available spawning and rearing habitat for the Little Salmon drainage was described in the Presence/Absence database (Tables 1 and 2). This information was developed for the Northwest Power Planning Council for subbasin planning and modeling.

PRODUCTION

There is little information specifically describing survival and production factors. As part of the evaluation for the Boulder Creek barrier removal in 1985, biologists stocked fry and eyed eggs from Rapid River Hatchery into the newly accessed habitat. Snorkel counts later indicated that the fry to parr survival was 28.1 percent and the eyed egg to parr survival was 1 .1 percent (Petrosky et al. 1988).

Idaho Department of Fish and Game (IDFG) monitors chinook parr production in the Little Salmon drainage. For 1985-90, the overall mean for IDFG monitoring transects was 5.0 parr per 100 m^2, and 11.4 percent of estimated carrying capacity (Table 3). Parr densities were estimated by snorkel counts and some transects from Rapid River were included. Parr carrying capacity ratings for spring chinook were derived from the Presence/Absence database used for development of the Salmon Subbasin Plan.

ADULT LIFE HISTORY

Adult Escapement

Chinook crossing Bonneville Dam through May 31 are counted as springs, as are those crossing

Lower Granite Dam through June 17. Specific time of migration and escapement for naturally spawning Little Salmon River spring chinook is not well documented in the ocean, Columbia River or the Snake River, The University of Idaho implemented adult timing research in 1991 which should provide more information about Snake River timing (Bjornn et al. 1992).

Harvest

No information is available regarding the contribution of naturally produced Little Salmon spring chinook to harvest in the ocean, Columbia or Snake rivers. When allowed, terminal harvest by treaty and non-treaty fishers in the Little Salmon drainage targets Rapid River Hatchery spring chinook. No information is available regarding incidental take of natural spawners.

Spawner Escapement

No information is currently available. Redds are not counted in this drainage.

Adult characteristics

There is no collection of naturally produced spring chinook adults. Adult characteristics are assumed to be similar to Rapid River Hatchery spring chinook.

JUVENILE LIFE HISTORY

Juvenile life history timing is generally similar to Figure 2. Although not illustrated in the figure, there is typically a fall emigration of chinook presmolts to lower in the drainage or the mainstem Salmon River for winter rearing.

BIOCHEMICAL/GENETIC CHARACTERISTICS

Information has not been compiled.

DISEASES

Information has not been compiled.

REFERENCES

All Little Salmon references appear at the end of the hatchery produced summer steelhead section.

Figure 1. Spring chinook distribution in the west half of the Salmon River **subbasin** based on the NPPC presence/absence data base and the BPA Geographic Information System.

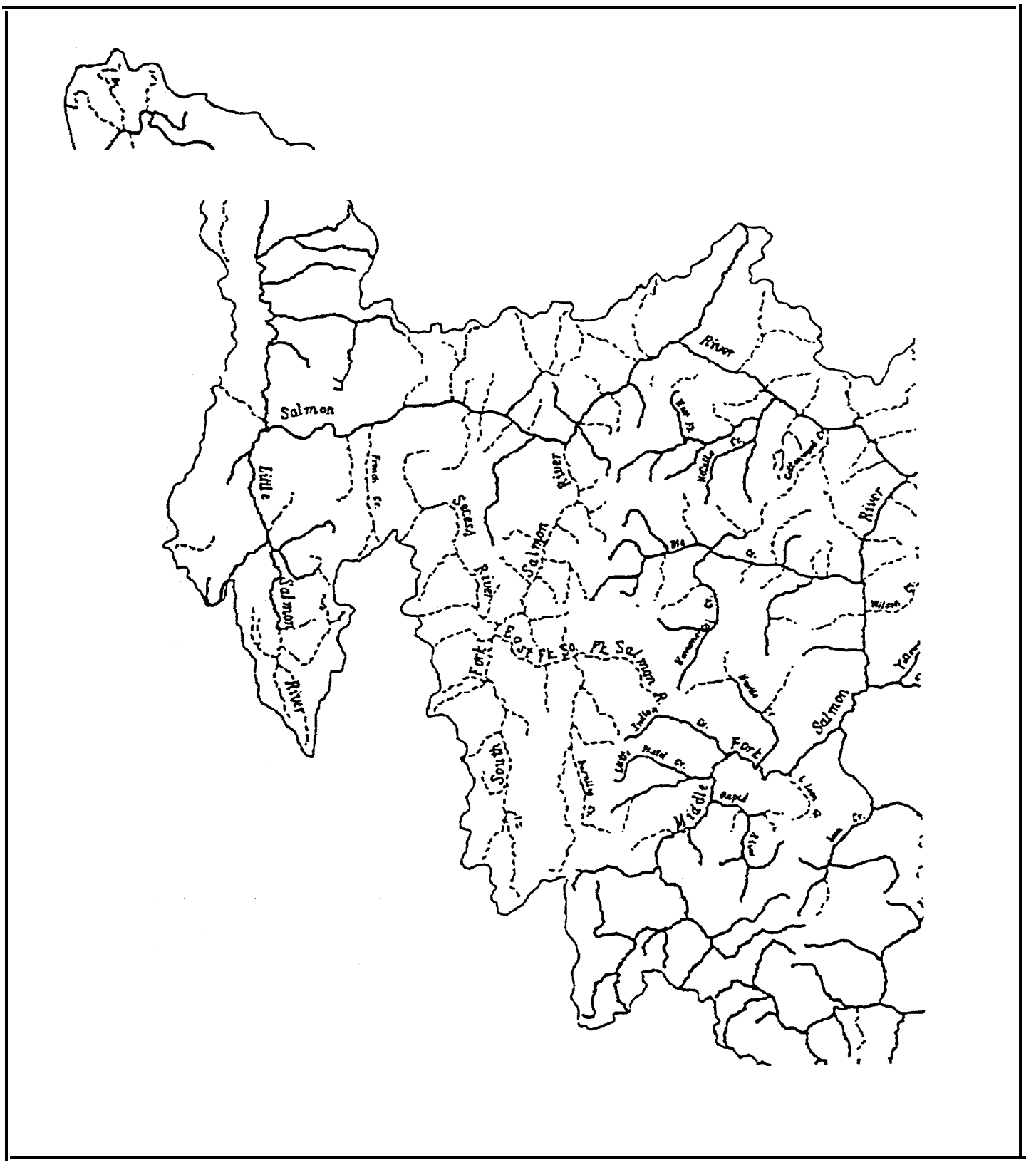
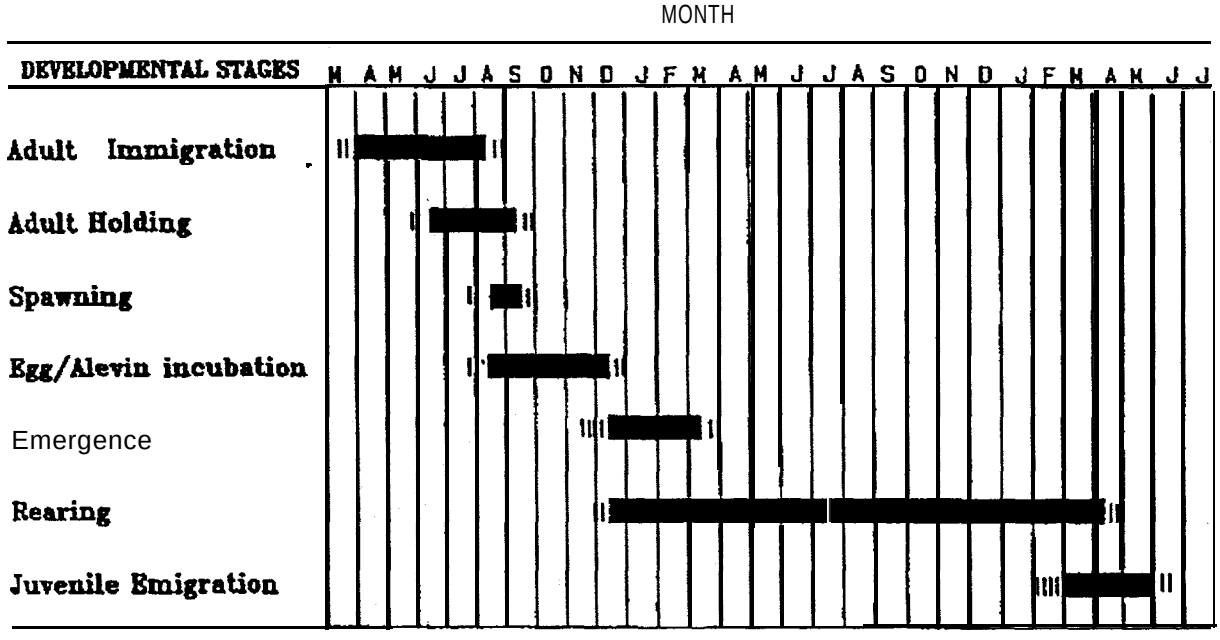


Figure 2 (TT). Freshwater life history for natural/wild spring chinook in the Salmon River subbasin.



Notes:

1. The developmental stage timing represents basin-wide averages, local conditions may cause some variability.
2. Solid bars indicate periods of heavi dult immigration, spawning and juvenile emigration.

Table 1 (HB-1). Estimated amount of spawning and rearing habitat (Use Type 1) by quality of Little Salmon River spring chinook production area.

	Excellent	Good	Fair[a]	Poor[a]	Unknown	Total	Confidence[b]
Miles (%)	0	21	73	6		145.3	M
Acres (%)	0	27	73	0		162.3	M

[a] Ratings of fair and poor habitat quality may reflect natural physical features such as gradient and channel type, as well as degradation caused by humans.
[b] 'Confidence' is meant to indicate the reproducibility and accuracy of the estimates made, and will be rated as high, medium or low by the respective agencies.

Source: Presence/Absence database, Northwest Power Planning Council, 1991.

Table 2 (HB-2). Estimated amount of rearing only habitat (Use Type 2) by quality of Little Salmon River spring chinook production area.

	Excellent	Good	Fair"	Poor"	Unknown	Total	Confidence[b]
Miles (%)	100	0	0	0		4.4	M
Acres (%	100	0	0	0		27.7	M

[a] Ratings of fair and poor habitat quality may reflect natural physical features such as gradient and channel type, as well as degradation caused by humans.
[b] 'Confidence' is meant to indicate the reproducibility and accuracy of the estimates made, and will be rated as high, medium or low by the respective agencies.

Source: Presence/Absence database, Northwest Power Planning Council, 199 1.

Table 3 (PD-a). Natural chinook parr densities as fish per $100m^2$ (CHINOD) and percent of rated carrying capacity (CHPERCC) for the Little Salmon River, 1985-1990.

	Year					
Measurement	1985	1986	1987	1988	1989	1990
CHINOD =	1.92	2.18	10.41	5.26	4.85	6.53
CHPERCC =	4.36	4.96	23.66	11.94	10.91	14.80
N =	7	10	7	7	7	8

Source: R. J. Scully, IDFG, unpublished.

LITTLE SALMON RIVER, SALMON SUBBASIN

Hatchery Produced Spring Chinook Salmon

GEOGRAPHIC LOCATION

Hatchery production of spring chinook salmon occurs at the Rapid River Hatchery. The Rapid River Hatchery production program is part of Idaho Power Company's mitigation for Brownlee, Oxbow and Hells Canyon dams on the middle Snake River. All facilities and costs of the program are provided by Idaho Power Company. The hatchery is operated by the Idaho Department of Fish and Game (IDFG), and is located 605 river miles from the Pacific Ocean on Rapid River, a tributary to the Little Salmon River which enters the Salmon River near Riggins, Idaho. The hatchery is located 3 miles upstream from the mouth of Rapid River, which is the water source for the hatchery. A weir and adult trap, located 1/2 mile downstream from the hatchery, intercepts all upstream migrating fish when it is in operation.

ORIGIN

Rapid River spring chinook were collected from the middle Snake River at Hells Canyon Dam beginning in 1964 through 1969 (Abbott and Ball 1991). These fish formerly occupied tributaries above Hells Canyon Dam such as the Powder River, Eagle Creek, and the Weiser River (Howell et al. 1985). Since then, the hatchery has relied solely upon returns to the Rapid River weir for broodstock.

DISTRIBUTION

Table 1 lists hatchery spring chinook releases into the Little Salmon drainage for brood years 1980-1989. Most smolt releases have been made at the hatchery site. Coded wire tag (CWT) codes are identified for brood years 1986-1989. CWT chinook are marked with an adipose fm clip. Other marks or tag releases have not been compiled.

PRODUCTION

Rapid River Hatchery was designed to rear 3 million spring chinook smolts. A production objective to annually stock 2 million smolts into the Salmon River drainage and 1 million smolts into the Snake River below Hells Canyon Dam satisfies Idaho Power Company's mitigation requirement. Production of three million spring chinook smolts has been achieved in most years. The Salmon River production component is primarily released into the Little Salmon drainage.

The hatchery has supplied various spring chinook life stages for several other programs in Idaho and Oregon. Howell et al. (1985) provides an accounting of fish exported from Rapid River Hatchery for brood years 1964-1982.

Egg

Incubation times are dependent upon temperature units. Howell et al. (1985) reported that eggs hatch at Rapid River Hatchery in late September through December; swim-up is in late January to early April. Egg eye-up for brood years 19851987 ranged from 63.9 to 91.4 percent (Levendofske et al. 1988, 1989, 1991). Data compiled for subbasin planning indicated an average eye-up survival for brood years 1980- 1987 of 85.4 percent (S. W. Kiefer, Idaho Department of Fish and Game, unpublished).

Frv-Fingerling

Eyed egg to fry survival for brood years 1985-1987 averaged 91.9 percent and ranged 89.5-95.9 percent (Levendofske et al. 1988, 1989, 1991). Fry to smolt survival is variable, but is generally about 75 percent except when significant disease outbreak occurs (B. Hutchinson, IDFG, personal communication).

Smolt

Information is not available to fully quantify in-basin smolt survival. Giorgi (1991) reported the percentage of branded fish released from Rapid River Hatchery which were collected at Lower Granite Dam (Table 2). The mean recovery was 16.8 percent for 1984-1990. Estimates of recovery ranged 7.2-27.6 percent.

Smolt-to-adult return rates to Rapid River Hatchery for the 1964-1985 brood years ranged from 0.02 to 0.87 percent (Levendofske et al. 1991; Levendofske et al., IDFG, unpublished). Howell et al. (1985) documented smolt-to-adult survival for brood years 1964-1978. Survival rates to the hatchery on the order of 0.8 percent have not been attained since brood year 1965. The average smolt-to-adult survival for brood years 1979-1986 was 0.15 percent and ranged 0.05- 0.28 percent (Table 3). Calculations do not include fish harvested in the Little Salmon drainage. Petrosky (1991) estimated smolt-to-adult survival, including harvested fish, for brood years 19751985. His estimates ranged 0.03-0.44 percent (Table 4).

Jack and Adult

Prespawning mortality at the hatchery averaged 17 percent for brood years 1980-1990, and ranged from 7.3 to 33.1 percent (Levendofske et al. 1980, 1981, 1983, 1988, 1989, 1991; Levendofske 1984, 1985; Abbott 1986; Levendofske et al., IDFG, unpublished).

ADULT LIFE HISTORY

Adult Escapement

Chinook crossing Bonneville Dam through May 31 are counted as springs, as are those crossing Lower Granite Dam through June 17. Specific time of migration and escapement for naturally spawning Little Salmon River spring chinook is not well documented in the ocean, Columbia River or the Snake River, The University of Idaho implemented adult timing research in 1991 which should provide more information about Snake River timing (Bjornn et al. 1992).

Information cited in Howell et al. (1985) indicated that timing of tagged fish recovered below Bonneville ranged from February 25 to May 24 (1978-83). In Zone 6, tagged fish (N=36) were collected from March 17 to May 23. Available information does not demonstrate peak timing in the Columbia River, but it can be generalized that the run enters the Columbia in late February through early May and crosses Bonneville Dam by the end of May.

Harvest

Information from coded wire tag recoveries regarding ocean and Columbia River harvest of Rapid River Hatchery spring chinook was not summarized for this report. Carmichael (1991) summarized information for brood years 1983-1985 (Table 5).

In the mid to late 1970's, and more recently since the mid-1980's, this run provided a significant sport fishery on the Little Salmon River. The Rapid River Hatchery spring chinook run has been harvested by the Nez Perce Indian Tribe in many years. Hassemer (1991) described sport and tribal harvest of spring chinook in the Little Salmon River for brood years 1981-1988 (Tables 6 and 7). Harvested fish were primarily of Rapid River Hatchery origin.

Spawner Escapement

Generally, arrival time at Rapid River Hatchery is earlier in low flow years, such as 1973 and 1977, and later in high flow years such as 1974 and 1975 (Howell et al. 1985). Prior to 1992, the earliest arrival was on April 25, 1973 (Parrish et al. 1974). The run has peaked as early as May 23 and as late as July 16 (Parrish et al. 1975; Parrish 1978). Over the last decade, run arrival at the Rapid River weir has usually peaked in early to mid-June (Table 8).

Recent returns of spring chinook to Rapid River Hatchery by brood year have ranged from 1,194 (brood year 1979) to 7,633 (brood year 1981) (Table 9). The Salmon Subbasin Plan (Idaho Department of Fish and Game et al. 1990) cited annual returns 1977-1987 ranging from 1,958 to 8,181 fish. Annual returns 1988-1991 were 3,780, 2,800, 2,606 and 1,193 chinook, respectively (Levendofske et al., IDFG, unpublished). The 1991 return was the lowest return to the hatchery in the last 14 years.

Spawning at Rapid River Hatchery has commenced as early as August 2 (Levendofske et al. 1989) and has been completed as late as September 18 (Howell et al. 1985).

Spawning practices have evolved from the exclusion of jacks to the random use of jacks in a 1: 1 ratio of males and females (Abbott and Ball 1991).

Adult characteristics

Weights of returning adult chinook are not available. Length frequency data of adults collected at the adult trap, 1986-1990, are listed in Table 10.

Howell et al. (1985) stated that the 1966-1978 brood years returned primarily as 4-year-old, 2-ocean fish, ranging from 55.3 to 88.2 percent of the brood. The 1979-1986 brood year information substantiates their observation (Table 11).

To date, ocean age has been reported based on standard length frequency criteria. Thus, assignment of ocean age is an estimate, and not based on known age techniques. Incorrect estimation of ocean age will affect brood year analyses. Limited coded wire tag data for brood years 1975-1978 (Table 12) indicates considerable overlap of ocean age lengths between brood years (Levendofske et al. 1980, 1983; Levendofske 1984).

Fish arriving at the adult trap are typically green and are not sexed at arrival when length measurements are taken. An estimate of the percent female by age class is only available for the 1989 return year (Table 13) and information for a complete brood year is not available.

Howell et al. (1985) stated that for return years 1978-1982, the combined run for the five years contained 56.2 percent females and 43.8 percent males. The percentage of females yearly ranged 53.4-58.7 percent. For return years 1980-1991, the percentage of females ranged from 38.0 to 57.7 and averaged 49.3 percent (Table 14).

The number of eggs per female ranged from 3,235 to 4,879 eggs, 1980-1991 (Table 15). Weighted average fecundity was 3,894 eggs per female, 1965-1983 (Howell et al. 1985), and 4,027, 1984-1991. Number of eggs was determined by Von Bayer method through brood year 1986 (B. Hutchinson, IDFG, personal communication). It is currently measured by volumetric displacement (Levendofske et al. 1991).

JUVENILE LIFE HISTORY

Smolt age at release ranges from 19 to 20 months, depending upon the time of egg take. Spring chinook smolts at Rapid River Hatchery are allowed to exit the rearing ponds at their own volition. Emigration usually begins in early March (Figure 1). Current practice is to let emigration occur naturally until mid to late March, when the remaining smolts are forced from the ponds. Emigration periods for the 1969-1989 brood years were in March and April. Since the mid-1980's, forced emigration has been moved forward from mid-April to mid-March.

Howell et al. (1985) stated that following about 20 months of hatchery rearing, smolt size at release ranged 117-138 mm fork length and 15-28 fish per pound for brood years 1967-1981. The current target smolt release size is 15-20 fish per pound.

Buettner and Nelson (1990, 1991) reported migration data for freeze branded chinook (Table 2). Smolt migration rates from Rapid River Hatchery to the Snake River trap ranged from 12 to 23 kilometers per day for the years 1984-1986, and 1989.

BIOCHEMICAL/GENETIC CHARACTERISTICS

Electrophoretic data for Rapid River Hatchery spring chinook were reported by Schreck et al. (1986) and Waples et al. (1991) (Appendix Tables 2 and 3).

DISEASES

Howell et al. (1985) reported that bacterial kidney disease (BKD) has been chronic at Rapid River Hatchery, although in recent years, this disease has not caused major mortalities at the hatchery site (Levendofske et al. 1991). During routine necropsies, minor levels of Renibacterium salmoninarium continue to be detected (Table 16). The procedure used to reduce BKD at Rapid River is to inject adults with erythromycin and to water-harden eggs in 2 ppm erythromycin solution. Juveniles are also fed erythromycin-medicated feed.

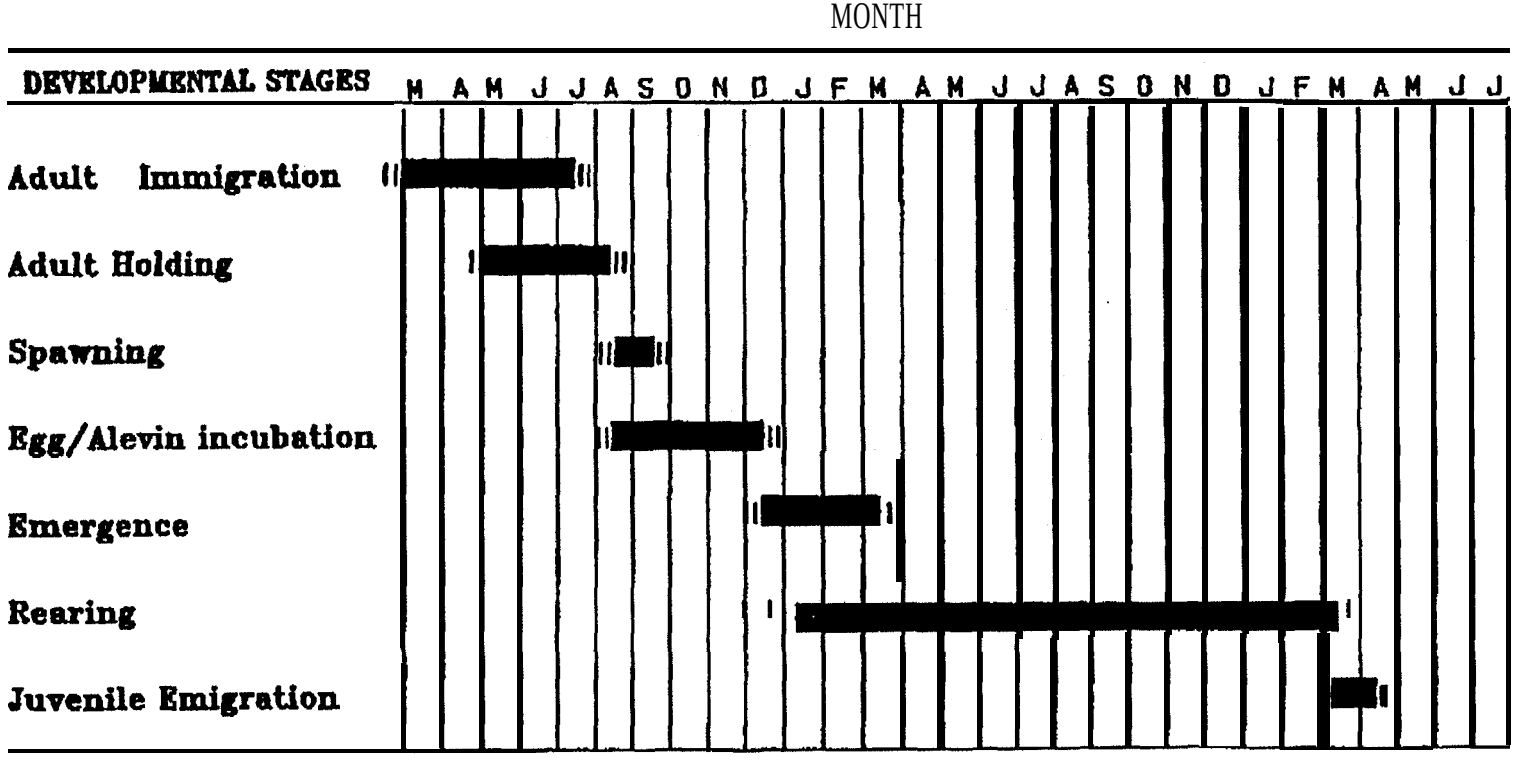
Erythrocyte inclusion body syndrome (EIBS) is another significant disease at the hatchery. Other diseases noted at the station include coldwater disease, bacterial gill disease, cataracts, and sunburn (Levendofske et al. 1980, 1983, 1988, 1989, 1991; Levendofske 1984, 1985).

Nitrogen bubble and gill net damage acquired in the Columbia and Snake rivers has been common for adult fish. Hatchery personnel documented that 18-30 percent of the returning adults were injured, for brood years 1985-91 (Table 17) (Levendofske et al. 1988, 1989, 1991; Levendofske et al., IDFG, unpublished, T.J. Elms-Co&urn, IDFG, unpublished). Adults were typically treated with malachite green or formaldehyde to prevent severe fungus infection (T. Rogers, IDFG, personal communication).

REFERENCES

All Little Salmon references appear at the end of the hatchery produced summer steelhead section.

Figure 1 (TT). Freshwater life history for spring chinook salmon spawned and reared at the Rapid River (Circle C) Hatchery.



Notes:

1. The developmental stage timing represents basin-wide averages, local conditions may cause some variability.
2. Solid bars indicate periods of heaviest adult immigration, spawning and juvenile emigration.

Table 1 (TR). Hatchery spring chinook releases into the Little Salmon River drainage by brood year, 1980-89. Coded'wire tag codes displayed for brood years 1986-89.

Brood Year	Brood-stock	Hatchery	Life Stage	Release Date (1)	Release Date (2)	Fish/lb	Number Released	Release Location	CWT
1980	Rapid River	Rapid River	smolt	03/25/82	04/05/82	28.0	1,473,733	Rapid River on-site	
1981	Rapid River	Rapid River	smolt	03/25/83	04/18/83	22.0	2,998,103	Rapid River on-site	
1982	Rapid River	Rapid River	smolt	03/05/84	04/10/84	20.0	3,246,197	Rapid River on-site	
1983	Rapid River	Rapid River	smolt	1985	1985		1,816,729	Rapid River on-site	
1984	Rapid River	Rapid River	pre-smolt	1985	1985		674,509	Rapid River on-site	
1985	Rapid River	Rapid River	smolt	03/26/86	04/07/86	22.0	1,594,688	Rapid River on-site	
1985	Rapid River	Rapid River	F-F'	1986	1986		100,590	Boulder Creek	
1985	Rapid River	Rapid River	smolt	03/23/87	04/05/87	22.5	2,836,400	Rapid River on-site	
1987	Rapid River	Rapid River	eyed-eggs	1987	1987		140,500	Boulder Creek	
1986	Rapid River	Rapid River	smolt	03/15/88	03/25/88	19.2	219,416	Rapid River on-site	103036
1986	Rapid River	Rapid River	smolt	03/15/88	03/25/88	19.2	53,900	Rapid River on-site	103037
1986	Rapid River	Rapid River	smolt	03/15/88	03/25/88	19.2	2,356,884	Rapid River on-site	Untagged
1987	Rapid River	Rapid River	F-F	1988	1988		30,000	Little Salmon	
1987	Rapid River	Rapid River	smolt	03/15/89	03/30/89	22.3	51,985	Rapid River on-site	103147

Table 1 (TR) (cont.). Hatchery spring chinook releases into the Little Salmon River drainage by brood year, 1980-89. Coded wire tag codes displayed for brood years 1986-89.

Brood Year	Brood-stock	Hatchery	Life Stage	Release Date (1)	Release Date (2)	Fish/lb	Number Released	Release Location	CWT
1987	Rapid River	Rapid River	smolt	03/15/89	03/30/89	22.3	51.198	Rapid River on-site	103148
1987	Rapid River	Rapid River	smolt	03/15/89	03/30/89	22.3	50,843	Rapid River on-site	103149
1987	Rapid River	Rapid River	smolt	03/15/89	03/30/89	22.3	53,151	Rapid River on-site	103150
1987	Rapid River	Rapid River	smolt	03115189	03/30/89	22.3	53,419	Rapid River on-site	103151
1987	Rapid River	Rapid River	pre-smolt	03/15/89	03/30/89	22.3	52,993	Rapid River on-site	103152
1987	Rapid River	Rapid River	smolt	03/15/89	03/30/89	20.0	2,005,911	Rapid River on-site	Untagged
1988	Rapid River	Rapid River	F-F	1989	1989		299,140	Little Salmon	
1988	Rapid River	Rapid River	F-F	1989	1989		200,641	Boulder Creek	
1988	Rapid River	Rapid River	smolt	03/12/90	03/21/90	27.1	55,100	Rapid River on-site	103213
1988	Rapid River	Rapid River	smolt	03/12/90	03/21/90	27.1	53,850	Rapid River on-site	103214
1988	Rapid River	Rapid River	smolt	03/12/90	03/21/90	27.1	55,725	Rapid River on-site	103215
1988	Rapid River	Rapid River	smolt	03/12/90	03/21/90	27.1	55,600	Rapid River on-site	103216
1988	Rapid River	Rapid River	smolt	03/12/90	03/21/90	27.1	56,025	Rapid River on-site	103217
1988	Rapid River	Rapid River	smolt	03/12/90	03/21/90	27.1	55,100	Rapid River on-site	103218

Table 1 (TR) (cont.). Hatchery spring chinook releases into the Little Salmon River drainage by brood year, 1980-89. Coded wire tag codes displayed for brood years 1986-89.

Brood Year	Brood-stock	Hatchery	Life Stage	Release Date (1)	Release Date (2)	Fish/lb	Number Released	Release Location	CWT
1988	Rapid River	Rapid River	smolt	03/12/90	03/21/90	25.2	2,189,000	Rapid River on-site	Untagged
1988	Rapid River	Rapid River	smolt	03/20/90	03/20/90	27.8	250.000	Little Salmon	
1989	Rapid River	Rapid River	smolt	03/15/91	04/05/91	24.1	19,500	Rapid River on-site	103401
1989	Rapid River	Rapid River	smolt	03/15/91	04/05/91	24.1	19,359	Rapid River on-site	103402
1989	Rapid River	Rapid River	smolt	03/15/91	04/05/91	24.1	19,198	Rapid River on-site	103403
1989	Rapid River	Rapid River	smolt	03/15/91	04/05/91	24.1	19,537	Rapid River on-site	103404
1989	Rapid River	Rapid River	smolt	03/15/91	04/05/91	24.1	20.438	Rapid River on-site	103405
1989	Rapid River	Rapid River	smolt	03/15/91	04/05/91	24.1	19,704	Rapid River on-site	103406
1989	Rapid River	Rapid River	smolt	03/15/91	04/05/91	24.1	18,763	Rapid River on-site	103407
1989	Rapid River	Rapid River	smolt	03/15/91	04/05/91	24.1	19.141	Rapid River on-site	103408
1989	Rapid River	Rapid River	smolt	03/15/91	04/05/91	24.1	19,856	Rapid River on-site	103409
1989	Rapid River	Rapid River	smolt	03/15/91	04/05/91	24.1	19,556	Rapid River on-site	103410
1989	Rapid River	Rapid River	smolt	03/15/91	04/05/91	24.1	20.026	Rapid River on-site	103411
1989	Rapid River	Rapid River	smolt	03/15/91	04/05/91	24.1	19,757	Rapid River on-site	103412

Table 1 (TR) (cont.). Hatchery spring chinook releases into the Little Salmon River drainage by brood year, 1980-89. Coded wire tag codes displayed for brood years 1986-89.

Brood Year	Brood-stock	Hatchery	Life Stage	Release Date (1)	Release Date (2)	Fish/lb	Number Released	Release Location	CWT
1989	Rapid River	Rapid River	smolt	03/15/91	04/05/91	24.1	19,600	Rapid River on-site	103413
1989	Rapid River	Rapid River	smolt	03/15/91	04/05/91	24.1	20,525	Rapid River on-site	103414
1989	Rapid River	Rapid River	smolt	03/15/91	04/05/91	24.1	19,878	Rapid River on-site	103415
1989	Rapid River	Rapid River	smolt	03/15/91	04/05/91	24.1	2,270,062	Rapid River on-site	Untagged
1989	Rapid River	Rapid River	smolt	03/21/91		22.5	100,100	Hazard Creek	

[a] F-F designates a fry or fingerling release.

Table 2 (TT-a). Migration data for freeze branded spring chinook salmon from Rapid River release site to the Snake River trap' and to Lower Granite Dam, 1984-1989.

Year	Median release date	Median passage date, Snake trap	Migration rate (km/day)	Mean Q(kcfs) Salmon R.	Mean Q(kcfs) Snake R.	Median arrival at LGD	Migration rate (km/day)	Mean Q(kcfs) at LGD	Percent brands observed at LGD
1984	4/1	4/18	13.4	10.1	79.3	Loner Granite migration not reported			10.7
1985	4/2	4/12	22.8	10.6	67.6	4/25	4.0	98	27.6
1986	3/27	4/10	16.3	15.4	82.9	4/20	12.9	88	23.7
1987	Insufficient recapture numbers at Snake River trap.								7.2
1988	Insufficient recapture numbers at Snake River trap.								9.9
1989	3/30	4/18	12.0	9.0	52.6	4/23	10.3	105	17.4
1990	Insufficient recapture numbers at Snake River trap.								21.2

[a] Snake River trap is located approximately 40 m downstream from the Interstate Bridge, between Lewiston, Idaho and Clarkston, Washington. This location is 0.5 km upstream from the convergence of the Snake and Clearwater rivers.

[b] Percentage of branded fish estimated recovered at Lower Granite Dam, 1984-1990, is included.

Sources: Buettner and Nelson 1990, 1991.
Giorgi 1991.

Table 3 (TS-a). Percentages of smolts released from Rapid River Hatchery that returned as adults, for brood years 1979 through 1986.

Brood year	Year released	Smolts released (x 1.000)	Total brood year return	Percent of brood year return
1979	1981	2,373	1,224	0.05
1980	1982	1,474	1,642	0.11
1981	1983	2,998	8,284	0.28
1982	1984	3,246	6,596	0.20
1983	1985	2,491	4,178	0.17
1984	1984	1,595	2,640	0.17
1985	1987	2,836	2,300	0.08
1986	1988	2,630	3,280	0.12

Sources: Levendofske et al. 1991.
Levendofske et al., IDFG, unpublished.
S. W. Kiefer, IDFG, unpublished.

Table 4 (TS-b). Rapid River Hatchery spring chinook smolt-to-adult (SAR) return, brood years 1975-1985.

Brood year	Smolt release (x 1,000)	Adult Return Rack	Harvest	Idaho[a]	SAR (%)	Recruit spawner[b]
1975	2,921	678	114	834	0.03	0.4
1976	2,414	1,978	1,305	3,456	0.14	2.1
1977	2,867	4,057	3,159	7,596	0.26	3.8
1978	2,605	4,291	838	5,399	0.21	3.0
1979	2,373	1,224	64	1,356	0.06	0.8
1980	1,474	1,642	166	1,903	0.13	1.9
1981	2,998	8,284	4,232	13,175	0.44	6.4
1982	3,246	6,596	3,435	10,559	0.33	4.7
1983	2,491	4,177	3,529	8,112	0.33	4.7
1984	1,594	2,640	2,568	5,482	0.34	5.0
1985	2,836	2,300	672	2,972	0.11	1.5
Mean	2,529	3,442	1,826	5,531	0.22	3.1
±2SE	± 337	± 1,413	± 953	± 2,398	± 0.08	± 1.2

[a] Assumes 95% pre-spawning survival. Idaho return comprised of hatchery rack and Idaho harvest components.
[b] Based on an average 690 spawners (female and male) required for one million smolt release.

Source: Petrosky 1991.

Table 5 (RB-a). Coded wire tag recovery information for Rapid River Hatchery spring chinook[a].

	Brood Year			
	1983	1984	1985	Combined
Number of CWT released	100,000	306,350	224,625	630,975
Total number of CWT recovered[b]	257(.3)	416(.1)	20(.009)	693(.1)
Ocean catch	1(.4)	1(.2)	0(0)	2(.3)
Canadian troll	1	1	0	2
Columbia River catch	45(17)	50(12)	13(65)	108(16)
Columbia R. sport	2	3	0	5
Columbia R. gillnet	23	10	2	35
Treaty C & S	17	26	11	54
Test net	3	11	0	14
Other FW sport	2(.8)	0(0)	0(0)	2(.3)
Subbasin Escapement	209(81)	365(88)	7(35)	581(84)
Hatchery	209	364		580
Spawning ground	0	1	0	1

[a] Percentages are in ( ). Numbers are unexpanded and represent observed recoveries.
[b] Percent of total number of CWT recovered is proportion of total CWT release. All other percentages displayed as proportion of total CWT recovered.

Source: Carmichael 199 1.

Table 6 (RS). Sport harvest of spring chinook in the Little Salmon River by brood year[a].

Total Age

Brood Year	2	3	4	5	6	Total	Adult Total
1981	0	0	2,124	458	0	2,582	2,582
1982	0	121	935	203	0	1,259	1,138
1983	0	37	203	285	0	525	488
1984	0	17	375	0	0	392	375
1985	0	31	0	116	0	147	116
1986	0	0	449	0	0	449	449
1987	0	0	0	inc.	0	inc.	inc.
1988	0	inc.	inc.	inc.	0	inc.	inc.

"Information derived from sport creel surveys of terminal fisheries in the Little Salmon River described by Hassemer (1991). Brood year reconstructed from lengths collected during creel surveys during 1986, 1987, and 1990 harvest seasons. Because lengths were not collected during the 1988 harvest season, age proportions of fish arriving at the Rapid River hatchery weir were used. Age was based on 2 year freshwater rearing and ocean age delineated by fork length criteria as follows:

1988: 1-ocean = $\leq$ 54 cm
2-ocean = 55 - 79 cm
3-ocean = $\geq$ 80 cm

Source: Hassemer 199 1.

Table 7 (RT). Tribal harvest of spring chinook in Rapid River and Little Salmon River by brood year[a].

Brood Year	Total Age 2	3	4	5	6	Total	Adult Total
1981	0	28	1,858	402	0	2,288	2,260
1982	0	106	1,404	737	0	2,247	2,141
1983	0	49	1,559	1,450	0	3,058	3,009
1984	0	134	1,910	74	0	2,118	1,984
1985	0	160	387	50	0	597	437
1986	0	83	905	0	0	988	905
1987	0	15	0	inc.	0	inc.	inc.
1988	0	0	inc.	inc.	0	inc.	inc.

[a]Nez Perce Tribal harvest is monitored by Nez Perce Tribal fishery biologists as described in Mauney (1990). Because lengths were not collected during Nez Perce tribal harvest seasons, age proportions of fish arriving at the Rapid River hatchery weir were used to reconstruct broodyear. Ageing assumed two years of freshwater rearing, and ocean age delineated by fork length criteria as follows:

1981-1988: l-ocean = $\leq$ = 54 cm
2-ocean = 55 - 79 cm
3-ocean = $\geq$ = 80 cm

Sources: Mauney 1990.
Hassemer 199 1.

Table 8 (AT-a). Timing of the spring chinook salmon run to Rapid River Hatchery, 1981 to 1991".

Year	First fish	Last fish	Peak of run
1981	05/06	07/17	06/16
1982	05/11	08/06	07/11
1983	05/22	08/06	07/11
1984	05/21	07/30	07/08
1985	05/10	07/24	06/16
1986	05/13	07/13	06/16
1987	05/04	07/27	05/24
1988	05/09	08/12	06108
1989	05/16	07/27	06/01
1990	05107	08/10	06/20
1991	05/21	08/17	06/29

[a] Peak day represents the first day of a one week interval, not the exact day of arrival at the adult trap.

Sources: Levendofske et al. 1981, 1983, 1984, 1988, 1989, 1991.
Levendofske 1985.
Abbott 1986.
Levendofske et al., IDFG, unpublished.

Table 9 (RH). Return of spring chinook to the Rapid River Hatchery by brood year[a].

Total Age

Brood Year	3	4	5	Total	Adult Total
1979	30	838	356	1,224	1,194
1980	94	1,349	199	1,642	1,548
1981	651	6,177	1,456	8,284	7,633
1982	351	5,090	1,155	6,596	6,245
1983	177	2,443	1,557	4,177	4,000
1984	210	2,051	379	2,640	2,430
1985	172	1,993	135	2,300	2,128
1986	428	2,431	421	3,280	2,852

[a] Hatchery weir count was sample method. Harvest estimates of Rapid River Hatchery fish are not included. Total age based on 2 year freshwater rearing and ocean age delineated by fork length criteria as follows:

1979-1986: l-ocean = 0 - 53 cm
2-ocean = 54 - 80 cm
3-ocean = $\geq$ 81 cm

[b]inc. = Incomplete brood year information

Sources: Levendofske et al. 1983, 1988, 1989, 1991.
Levendofske 1984, 1985.
Abbott 1986.
Levendofske et al., IDFG, unpublished.
S. W. Kiefer, IDFG, unpublished.
T. G. Levendofske, IDFG, unpublished.

Table IO (AL-a). Rapid River hatchery spring chinook fork lengths, 1986-1990.

Length cm.	1990 No. fish	1989 No. fish	1988 No. fish	1987 No. fish	1986 No. fish
> 40	1	5	3	5	4
40	6	1	5	2	a
41	3	6	9	11	16
42	1	12	9	IO	
43	2	30	26	21	42
44	3	30	19	17	
45	4	44	22	17	
46	8	41	23	31	57
47	3	51	16	26	
48	2	51	18	25	32
49	3	44	9	13	
50	2	37	7	10	
51		24	IO	4	19
52		19	4	12	
53	2	20	4	6	7
54	4	12	4	0	
55	2	IO	1	2	
56	2	IO	1	4	2
57	4	7	2	5	
58	6	6	2	9	IO
59	5	5	2	13	
60	a	9	1	13	
61	a	12	9	26	35
62	17	7	6	40	
63	22	17	7	42	
64	25	38	14	62	86
65	54	60	27	96	
66	73	78	50	129	313
67	99	104	62	153	
68	152	129	70	164	792
69	186	185	129	244	
70	205	231	141	269	
71	245	221	213	266	1362
72	296	205	173	222	
73	248	159	92	145	
74	252	163	203	152	1483
75	188	105	123	106	
76	141	68	189	a5	1007
77	67	64	a7	50	
78	50	23	52	44	
79	42	22	123	53	501
80	25	25	97	49	
81	14	28	167	42	261
a2	12	32	129	58	
a3	12	24	97	88	
84	10	32	206	95	195
85	11	40	192	82	
86	13	29	231	105	184
a7	a	29	105	88	
88	15	33	162	113	
a9	14	28	167	101	128
90	5	32	110	70	
91	2	16	192	69	95
92	11	11	27	56	
> 92[b]		44	324	158	
93				30	
94					49
95	2				
96					22
97					
98					
99					13
100					
101	1				
102					5
103	2				
104					2
105					
106					
IO?					1

a Blanks indicate no fish this size collected and measured.
b Does not include those fish >92 cm listed for 1986 and 1990.
Source: Levendofske et al., IDFG, unpublished.

Table 11 (AC). Age composition percentage (freshwater.ocean) by brood year for spring chinook returning to the Rapid River Hatchery".

Age Composition (%)

Brood Year	N	2.1	2.2	2.3
1979	1,224	2.4	68.5	29.1
1980	1,642	5.7	82.2	12.1
1981	8,248	7.8	74.6	17.6
1982	6,596	5.3	77.2	17.5
1983	4,177	4.2	58.5	37.2
1984	2,640	7.9	77.7	14.4
1985	2,300	7.5	86.6	5.9
1986	3,280	13.1	74.1	12.8

[a] Hatchery weir count was sample method. Harvest estimates of Rapid River Hatchery fish are not included. In this nomenclature, the freshwater and ocean ages sum to the total age of the fish. Age based on 2 year freshwater rearing and ocean age delineated by fork length criteria as follows:

1979-1985: l-ocean = 0 - 53 cm
2-ocean = 54 - 80 cm
2-ocean = $\geq$ 81 cm

Sources: Levendofske et al. 1983, 1988, 1989, 1991.
Levendofske 1984, 1985.
Abbott 1986.
Levendofske et al,, IDFG, unpublished.
S. W. Kiefer, IDFG, unpublished.
T. G. Levendofske, IDFG, personal communication.

Table 12 (AL-b). Known ocean age lengths of Rapid River spring chinook, brood years 1975-78, as determined by coded wire tag analysis".

Ocean Age	Fork length range (cm)
	Brood years 1975-78 combined
One-ocean	46 ------- 76
Two-ocean	43 _____ 89
Three-ocean	61 ------- 112
	Brood year 1977[b]
One-ocean	46-76 (Ocm < 71% < 54cm)
Two-ocean	53 - 79 (53 cm < 99% < 81 cm)
Three-ocean	76 - 97 (80 cm < 78 % < 97 cm)

[a] Standard length frequencies used to determine ocean age at the hatchery rack are as follows:

One-ocean = 0 - 53 cm
Two-ocean = 54 - 80 cm
Three-ocean = ≥ 81 cm

[b] BY 1977 is only year data for all age classes complete.

Sources: Levendofske et al. 1980, 1983.
Levendofske 1984.

Table 13 (AS). Percent females by brood year and age class for spring chinook returning to Rapid River Hatchery, Little Salmon River and to the Hells Canyon Trap, Snake River. Majority of the fish were collected at Rapid River".

Females (%)

Brood Year	N	2.1	2.2	2.3	Total % Female
1984	136[b]			59.5	inc.[c]
1985	666[b]		58.0		inc.[c]

[a] Total age based on 2 year freshwater rearing and ocean age delineated by fork length criteria as follows:

1984. 1985: l-ocean = 0 - 53 cm
2-ocean = 54-80 cm
3-ocean = $\geq$ 81 cm

In this nomenclature, the freshwater and ocean ages sum to the total age of the fish.

[b] Number of individuals sexed was a subsample of total run size.
[c] inc. = incomplete brood year information,

Sources: Levendofske et al., IDFG, unpublished.
S. W. Kiefer, IDFG, unpublished.

Table 14 (AS-a). Percent females by return year for spring chinook returning to Rapid River Hatchery. N is equivalent to the total number of fish sexed, including jacks.

Return year	N	Total percent female
1980	1,960	42.4
1981	3,263	55.5
1982	3,676	57.7
1983	1,958	53.3
1984	2,356	38.0
1985”	6,376	52.5
1986	6,723	55.5
1987”	3,598	49.8
1988[b]	3,985	56.2
1989	2,800	43.6
1990	2,606	48.1
1991	1,913	39.7

[a] Number of individuals sexed was a subsample of total run size.
[b] Sexed individuals includes fish transferred from Hells Canyon Trap, Snake River.

Sources: Levendofske et al. 1980, 1981, 1983, 1988, 1989, 1991.
Levendofske 1984, 1985.
Abbott 1986.
Levendofske et al., IDFG, unpublished.

Table 15 (AF-a). Mean fecundity by return year for spring chinook returning to Rapid River Hatchery.

Return year	N	Mean fecundity
1980	543	3,235
1981	1,666	3,675
1982	1,883	3,973
1983	859	4,016
1984	821	3,807
1985	2,962	3,531
1986	2,451[a]	3,629
1987	1,133	4,379
1988	1,645[a]	4,879
1989	1,082[b]	4,137
1990	1,063	3,967
1991	657	3,886

[a] Includes fish from Hells Canyon Trap, Snake River.
[b] Includes 40 females from Hells Canyon Trap, Snake River.

Sources: Levendofske et al. 1980, 1981, 1983, 1988, 1989, 1991.
Levendofske 1984, 1985.
Abbott 1986.
Levendofske et al., IDFG, unpublished.

Table 16 (TD). Parasites and diseases" of spring chinook at the Rapid River Hatchery located at the Little Salmon River.

Disease Type	Hatchery	Specific pathogen
Bacteria	Rapid River	*Aeromonas pseudomonas* (Bacterial Gill Disease)
Bacteria	Rapid River	*Yersinia ruckeri* (Enteric Red Mouth Disease)
Bacteria	Rapid River	*Cytophaga psychrophila* (Coldwater Disease)
Bacteria	Rapid River	*Renibacterium salmoninarium* (Bacterial Kidney Disease)
Virus	Rapid River	EIBS (Erythrocyte Inclusion Body Syndrome)

[a] Disease history only represents pathogens isolated at the hatchery and not necessarily a disease outbreak.

Sources: Levendofske 1984, 1985.
Levendofske et al. 1988, 1989, 1991.

Table 17 (IF-a). Percent and number of Rapid River Hatchery adult spring chinook injured by years 1980-1991. ums, or other" injuries in the Columbia and Snake River systems for return

Return Year	Gill Net Scars (#/%[b])	Nitrogen Bums (#/%[b])	Other (#/%[b])	Total Injured (#/%[c])	Total Run Size
1991	231 (48)	190 (39)	62 (13)	483 (25)	1,913
1990	298 (39)	225 (29)	250 (32)	773 (30)	2,606
1989	153 (35)	226 (51)	61 (14)	440 (19)	2,372
1988	78 (12)	228 (36)	330 (52)	636 (18)	3,608
1987	247 (29)	258 (31)	337 (40)	842 (22)	3,808
1986	577 (44)	292 (22)	456 (35)	1,325 (20)	6,546
1985	289 (23)	467 (38)	104 (8)[d]	860 (18)	6,727
1984	34 (10)	233 (66)	87 (24)	354 (15)	2,356
1983	24 (8)	157 (54)	112 (38)	293 (15)	1,958
1982	134 (23)	154 (26)	300 (51)	588 (16)	3,676
1981	239 (29)	211 (26)	364 (45)	814 (25)	3,263
1980	77 (24)	113 (36)	124 (40)	314 (16)	1,960

[a] Gaff and unrecognizable wounds.
[b] Percent of total injured fish.
[c] Percent of total run size.
[d] Gaff wounds only - no available information on other injuries.

Sources: Levendofske et al. 1980, 1981, 1982, 1983, 1986, 1987, 1988, 1991.
Levendofske 1984, 1985.
Levendofske et al., IDFG, unpublished.
T. J. Elms-Cockrum, IDFG, unpublished.

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LITTLE SALMON RIVER, SALMON SUBBASIN

Naturally Produced Summer Chinook

GEOGRAPHIC LOCATION

The Little Salmon River enters the Salmon River at Riggins, Idaho, 82 miles upstream from the confluence of the Salmon and Snake rivers. Rapid River, the major tributary, enters the Little Salmon River four river miles south of Riggins. The Rapid River mainstem is 21 miles long and the upper 17 miles is roadless and classified as wilderness.

ORIGIN

Summer chinook are indigenous to Rapid River. Rapid River Hatchery, a spring chinook hatchery, exists on Rapid River three miles from the mouth. The spring and summer runs of chinook have been maintained separately by segregating fish at the Rapid River adult fish trap. Timing and appearance of fish are the basis for segregation. Furthermore, marked fish (known hatchery spring chinook) are not released upstream of the weir. Spring chinook are retained at the hatchery while fish judged to be summer chinook are allowed to proceed upriver for natural spawning.

The Rapid River summer chinook run is classified for wild fish management by Idaho Department of Fish and Game (1992). Natural production sustains the run and it is not supplemented. However, because of proximity and overlap in run timing, it is likely that Rapid River Hatchery spring chinook adults have been misidentified and released into Rapid River to spawn with the wild, native summer chinook. For this reason, the summer chinook run is described as natural, not wild. All naturally produced Snake River spring and summer chinook were listed as "threatened" by the National Marine Fisheries Service in 1992.

DISTRIBUTION

In the Little Salmon drainage, only Rapid River is believed to be utilized by summer chinook. Available spawning and rearing habitat in Rapid River was described in the Presence/Absence database (Table 1). This information was developed for the Northwest Power Planning Council for subbasin planning and modeling.

PRODUCTION

There is little information available describing survival and production factors. Idaho Department of Fish and Game (IDFG) monitors chinook parr production in the Little Salmon drainage. For 1985-90, the overall mean for IDFG monitoring transects was 5 .O parr per 100 m^2, and 11.4 percent of estimated carrying capacity (Table 3). Parr densities were estimated by snorkel counts and some transects from Rapid River were included. Parr carrying capacity ratings for spring chinook were derived from the Presence/Absence database used for development of the Salmon Subbasin Plan. Egg-to-Parr survival estimates are planned for Rapid River summer chinook beginning in 1992 (C.E. Petrosky , IDFG , personal communication).

ADULT LIFE HISTORY

Adult Escapement

Summer chinook are counted at Bonneville Dam from June 1 through July 31. Snake River summer

chinook, primarily from the Salmon River, are counted at Lower Granite Dam from June 18 through August 17. Specific time of migration and escapement for summer chinook returning to Rapid River has not been identified for the ocean, or Columbia and Snake rivers. The University of Idaho implemented adult timing research in 1991 which should provide information about Snake River timing (Bjornn et al. 1992).

Harvest

There is no information available regarding harvest of Rapid River summer chinook in the ocean, Columbia or Snake rivers. Sport and treaty fisheries in the Little Salmon drainage are terminated upon the arrival of summer chinook to avoid impacting this run. Some fish may be taken incidentally in these terminal fisheries, but no information is available.

Spawner Escapement

Rapid River Hatchery trap records show the summer chinook run arriving in July, August, and September. Howell et al. (1985) displayed run size and duration for selected years, 1952-1983. The duration of the 1984-1991 runs extended into early September (Table 3)(Abbott 1986; Levendofske et al. 1988, 1989, 1991; Levendofske et al., IDFG, unpublished).

The 1984-1991 returns ranged from 68 to 1,269 summer chinook (Table 3). Reporting escapement by brood year for these years is not possible, due to lack of length frequency or scale information to assign ocean age.

No redd count information is available so information regarding the spawning period specific to Rapid River summer chinook is not available. Other summer chinook populations in Idaho generally spawn in September.

Adult Characteristics

Fork lengths are only available for the 1988-90 returns (Table 4). It should be noted that to date, ocean age has been assigned based on standard length frequency criteria, which was reported in Howell et al. (1985). Thus, assignment of ocean age is an estimate, and not based on known age techniques. Howell et al. (1985) reported that jacks and four-year-old fish predominated on a return year basis. For the 1985 brood year, four-year-old fish predominated (Table 5).

Percent females is not available by brood year because length frequency and sex information have not been recorded regularly in past years. For return years 1987 and 1990, the percentage of females in the total run was 44.2 and 48.5 percent, respectively (Levendofske 1991, Levendofske et al., IDFG, unpublished).

Fecundity information is not available.

JUVENILE LIFE HISTORY

Life history is likely similar to Figure 1. Although not illustrated in the figure, there is typically a fall emigration of chinook presmolts from the upper end of tributaries to lower in the drainage or to the mainstem Salmon River for winter rearing. Reingold (1966) reported that fall parr, migrating October through December, ranged 40-l 10 mm and averaged about 85 mm. Trap catch rates of summer chinook presmolts emigrating from Rapid River ranged from one fish per hour in October to 0.1 fish per hour in December.

BIOCHEMICAL/GENETIC CHARACTERISTICS

Information has not been compiled.

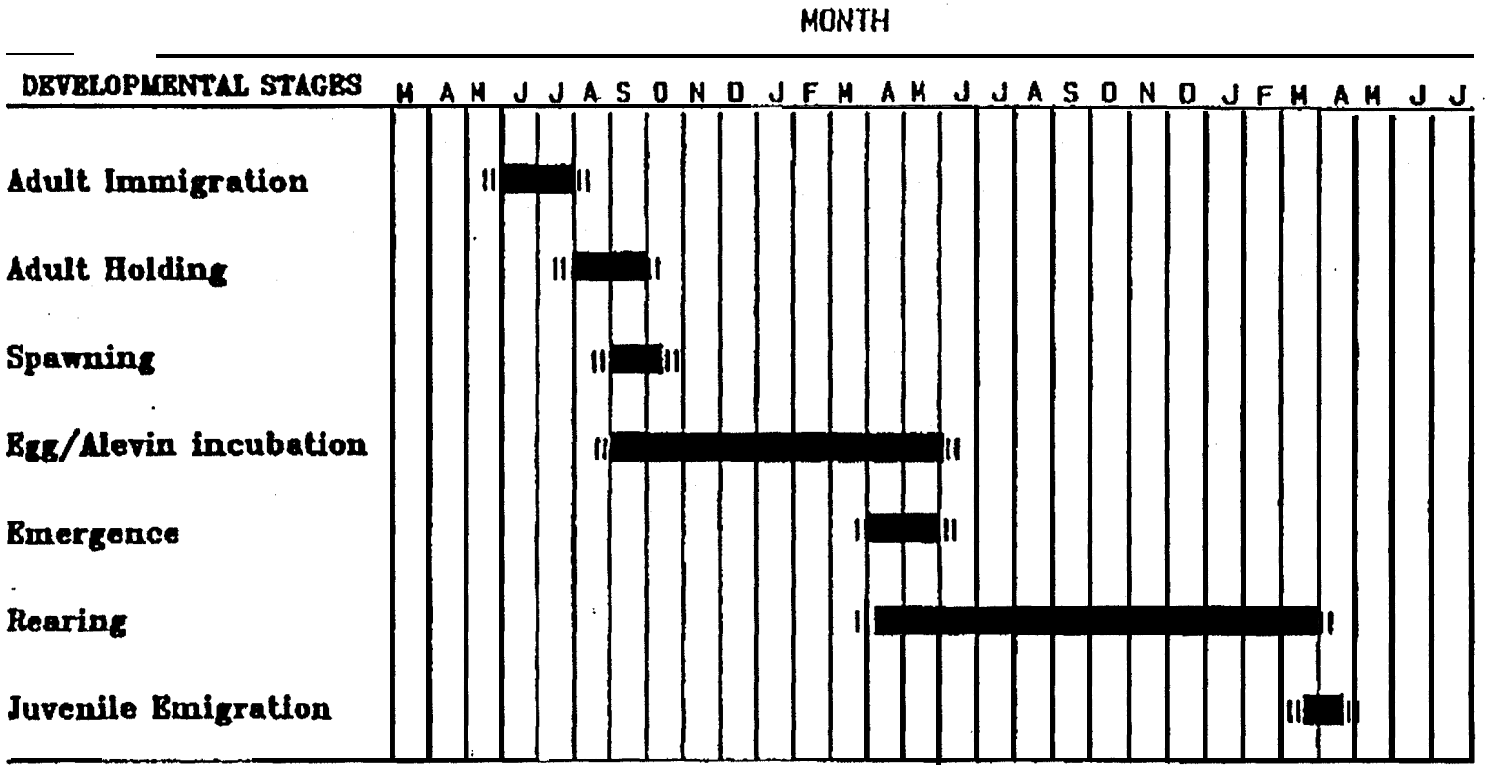
DISEASES

Information has not been compiled.

REFERENCES

All Little Salmon references appear at the end of the hatchery produced summer steelhead section.

Figure (TT). Freshwater life history for natural/wild summer chinook salmon in the Salmon River subbasin.



Notes:

1. The developmental stage timing represents basin-wide averages, local conditions may cause some variability.
2. Solid bars indicate periods of heaviest adult immigration, spawning and juvenile emigration.

Table 1 (HB). Estimated amount of spawning and rearing habitat (Use Type 1) by quality of Little Salmon River summer chinook production area.

	Excellent	Good	Fair[a]	Poor"	Unknown	Total	Confidence[b]
Miles (%)	0	0	100	0		36.3	M
Acres (%)	0	0	100	0		67.7	M

[a] Ratings of fair and poor habitat quality may reflect natural physical features such as gradient and channel type, as well as degradation caused by humans.
[b] 'Confidence' is meant to indicate the reproducibility and accuracy of the estimates made, and will be rated as high, medium or low by the respective agencies.

Source: Presence/Absence database, Northwest Power Planning Council, 1991.

Table 2 (PD-a). Natural chinook parr densities as fish per $100m^2$ (CHINOD) and percent of rated carrying capacity (CHPERCC) for the Little Salmon River, 1985-1990.

	Year					
Measurement	1985	1986	1987	1988	1989	1990
CHINOD =	1.92	2.18	10.41	5.26	4.85	6.53
CHPERCC =	4.36	4.96	23.66	11.94	10.91	14.80
N =	7	10	7	7	7	8

Source: R. J. Scully, IDFG, unpublished.

Table 3 (RN-a). Escapement of Rapid River summer chinook in the Little Salmon subbasin by return year, 1984-1991. Fish are counted at the Rapid River Hatchery weir and released upstream.

Return Year	Total Return	Number of Jacks[a]	Number of adults	Run Duration
1984	144	27	117	7/25 - 8/21
1985	1,269	172	1,097	6/28 - 9/1 1
1986	763	48	715	7/13 - 9/12
1987	68	7	61	7/16 - 9/15
1988	115	13	102	718 - 8/12
1989	82	13	69	7/18 - 8/28
1990	138	1	137	7/24 - 9/5
1991	153	12	141	7/7 - 9/17

[a] Number of jacks cited from Rapid River Hatchery brood year and annual run reports, not number reconstructed from length frequency criteria reported in Howell (1985).

Sources: Abbott 1986.
Levendofske et al. 1988, 1989, 1991.
Levendofske et al. IDFG, unpublished.

Table 4 (AL-a). Rapid River summer chinook fork lengths, 1986-1990.

Length cm.	1990 No. Fish	1989 No. Fish	1988 No. Fish	1987 No. Fish	1986 No. Fish
< 41		0	1		
42		0	0		
43			0		
44		8	1		
45		0	1		
46		0	4		
47		1	0		
48		1	2		
49		0	1		
50		0	0		
51		2	3		
52	1	2	0		
53		1	0		
54		0	0		
55		0	0		
56		2	0		
57		0	0		
58		1	0		
59		3	1		
60		0	0		
61		0	0		
62		1	0		
63	3	0	0		
64		0	1		
65	3	1	2		
66	2	1	2		
67	3	1	0		
68	5	1	2		
69	8	2	2		
70	13	4	3		
71	16	2	3		
72	5	4	4		
73	12	6	1		
74	17	6	2		
75	6	4	2		
76	8	3	3		
77	5	2	1		
78	6	0	2		
79	5	3	2		
80	8	1	3		
81		2	5		
82	2	0	5		
83	3	0	2		
84	1	1	8		
85		1	7		
86		1	6		
87		2	5		
88		1	6		
89		1	6		
90		0	8		
91		0	0		
92	1	0	8		
> 92		2			

[a] Blanks indicate no fish this size collected and measured.

Source: T. G. Levendofske, IDFG, unpublished.

Table 5 (AC). Age composition percentage (freshwater.ocean)[a] by brood year for summer chinook originating in the Rapid River. Lengths available only for the 1988-90 return years. In this nomenclature, the freshwater and ocean ages sum to the total age of the fish.

Age Composition (%)

Brood Year	N	2.1	2.2	2.3
1985	62	22.6	72.5	4.8

[a] Fish aged as 2 year freshwater age and ocean age according to fork length criteria as follows (Howell et. al. 1985):

1985: l-ocean = c 24 in. (<62 cm)
2-ocean = 24 to 33 in. (62-84 cm)
2-ocean = >33 in. (>84 cm)

Source: S. W. Kiefer, IDFG, unpublished.

LITTLE SALMON RIVER, SALMON SUBBASIN

Summer Steelhead (wild and natural)

GEOGRAPHIC LOCATION

The Little Salmon River enters the Salmon River at Riggins, Idaho, 82 miles upstream from the confluence of the Salmon and Snake rivers (Figure 1). About 145 stream miles are available for summer steelhead spawning and rearing in this drainage excluding Rapid River. Rapid River, the major tributary, enters the Little Salmon River four river miles south of Riggins, Idaho. The Rapid River mainstem is 21 miles long and the upper 17 miles is roadless and classified as wilderness.

ORIGIN

Summer steelhead are indigenous to the Little Salmon River drainage. Except for information describing the Rapid River steelhead run, no information describes the original stock. Excluding Rapid River, the Little Salmon drainage has received large numbers of juvenile hatchery steelhead from the Salmon, Snake, and Clear-water drainages. Hatchery fish, classified as A-run based on size, ocean age, and timing characteristics have been introduced from Oxbow, Pahsimeroi, and Sawtooth hatcheries. Hatchery fish, classified as B-run, have been transplanted from Dworshak National Fish Hatchery. Because there is no steelhead brood stock collection facility located in the Little Salmon drainage, returning hatchery fish probably spawn naturally. Thus, naturally produced steelhead in this drainage are likely a mixture of hatchery and naturally produced A-run and B-run fish. The run is described as natural because of the mixed brood history.

The steelhead run to Rapid River is a wild, native run. It is unknown whether this wild run typifies indigenous populations elsewhere in the Little Salmon drainage. Specific timing over Bonneville Dam is unknown, but for management purposes, the Rapid River steelhead are classified as A-run. Idaho Department of Fish and Game (IDFG) personnel enumerate and measure returning steelhead at the Rapid River Hatchery weir and release them upstream to spawn. Only fish possessing an adipose fin have been passed upstream of the Rapid River Hatchery weir to spawn since the mid-1980s. There is no documentation about how many adipose fin-clipped (hatchery-produced) fish may have been passed into Rapid River prior to 1984, but there were likely very few because augmentation with hatchery steelhead smolts in the Little Salmon drainage was not implemented on a large scale until then.

Steelhead supplementation does not occur in Rapid River, and natural production maintains the run. The Rapid River steelhead run is classified for wild fish management (Idaho Department of Fish and Game 1992).

DISTRIBUTION

Available spawning and rearing habitat for the Little Salmon drainage was described in the Presence/Absence database (Table 1). This information included Rapid River which is primarily of excellent quality. This information was developed for the Northwest power Planning Council for subbasin planning and modeling.

PRODUCTION

There is little information available describing survival and production factors. For 1985-89, natural steelhead parr densities in IDFG monitoring sections (Table 2) in the drainage averaged 11.1 parr

per 100 m^2 and averaged 55.7 percent of estimated carrying capacity. For wild steelhead during the same period, parr densities averaged 10.9 parr per 100 m^2 and averaged 54.6 percent of estimated carrying capacity (R. J. Scully, IDFG, unpublished). Parr densities were determined by snorkel counts. Parr carrying capacity ratings for summer steelhead were derived from the Presence/Absence database used for development of the Salmon Subbasin Plan.

IDFG researchers plan to develop egg-to-parr estimates for Rapid River steelhead beginning with brood year 1990 (C.E. Petrosky, IDFG, personal communication).

ADULT LIFE HISTORY

Adult Escapement

Specific time of migration and escapement for steelhead returning to the Little Salmon drainage has not been identified for the ocean, Columbia or Snake rivers. The University of Idaho implemented adult timing research in 1991 which should provide information about Snake River timing (Bjornn et al. 1992).

Harvest

There is no information regarding ocean or Columbia River harvest of naturally produced Little Salmon steelhead. Since the mid-1980s, the harvest of steelhead possessing an adipose fm has not been allowed in the Snake River or in Idaho.

Spawner Escapement

Steelhead ascend Rapid River later than is documented for other steelhead runs in Idaho. The earliest documented arrival at the Rapid River Hatchery weir was March 2, 1973 and the latest arriving fish was July 5, 1965 (Reingold 1966; Parrish et al. 1974). Generally, steelhead arrive at Rapid River April through June (Table 3). The run peaks in late April to early May.

Annual returns of steelhead to Rapid River have ranged from 39 to 299 fish, 1971-199 1 (Levendofske et al., IDFG, unpublished; C.E. Petrosky, IDFG, unpublished). Returns for brood years 1975-1986 ranged from 37 to 121 (S.W. Kiefer, IDFG, unpublished). There is no information currently available regarding naturally produced steelhead escapement to the rest of the Little Salmon drainage.

Timing of steelhead spawning in the Salmon River drainage can span two months, from early April to early June. it appears that adult fish usually enter tributaries after spring freshets. The major period of steelhead spawning begins in mid-April and extends through May hen water temperature is above 4.5 C° (Ball 1985). Attempts to count redds from a helicopter in the Rapid River drainage have not been successful, although redds have been observed in May (R. J. Scully, IDFG, personal communication).

Adult characteristics

Rapid River wild steelhead have ranged up to 90 cm total length, 1986-1991 (Table 5). Based on Reingold's (1966) observations, a three-year freshwater age was assigned to calculate brood year information. It should be noted that ocean age has been assigned based on standard length frequency criteria (K. Ball, IDFG, personal communication). Thus, assignment of ocean age is an estimate, and not based on known age techniques. However, scale collection from Rapid River

adult steelhead in 1990 indicated that fork length of one-ocean fish ranged 53-69 cm with a mean of 63 cm (N = 24). Fork length of two-ocean fish ranged 68-90 cm with a mean of 76 cm (N = 93)(P. Hassemer, IDFG, unpublished).

The two-ocean component generally predominates the brood year return, ranging from 5 1.3 to 76.9 percent for brood years 1975-1985 (Table 6).

Two-ocean females predominate the total brood year return (Table 7). For brood years 1975-1985, the total percentage of females in the run averaged 68.4 percent.

Fecundity information is not available.

JUVENILE LIFE HISTORY

Juvenile life history timing is probably similar to Figure 2. Although not illustrated in the figure, there is typically a fall emigration of steelhead juveniles from the upper ends of tributaries to lower in the Little Salmon drainage or the mainstem Salmon River for winter rearing.

Reingold (1966) indicated that young-of-the-year rainbow-s&Ahead, migrating October through December, ranged 40-80 mm total length. He collected scales from rainbow-steelhead which ranged 160-220 mm. These scales showed two annuli which indicated that these migrants had spent 3 growing seasons in Rapid River.

BIOCHEMICAL/GENETIC CHARACTERISTICS

Information has not been compiled.

DISEASES

Information has not been compiled.

REFERENCES

All Little Salmon references appear at the end of the hatchery produced summer steelhead section.

Figure 1. Anadromous salmonid distribution in the west half of the Salmon River subbasin -as represented by spring chinook, based on the NPPC presence/absence data base and the BPA Geographic Information System.

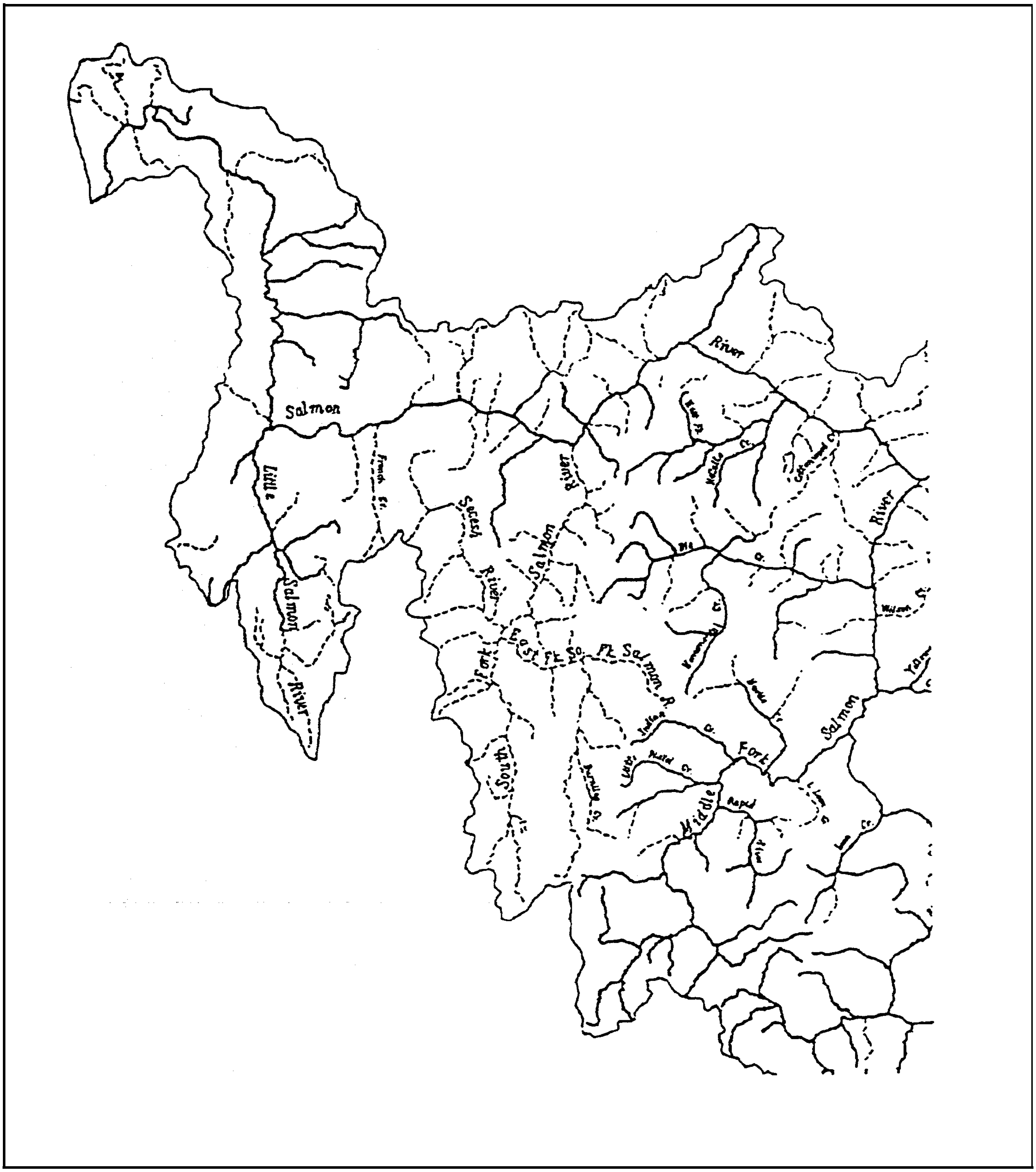
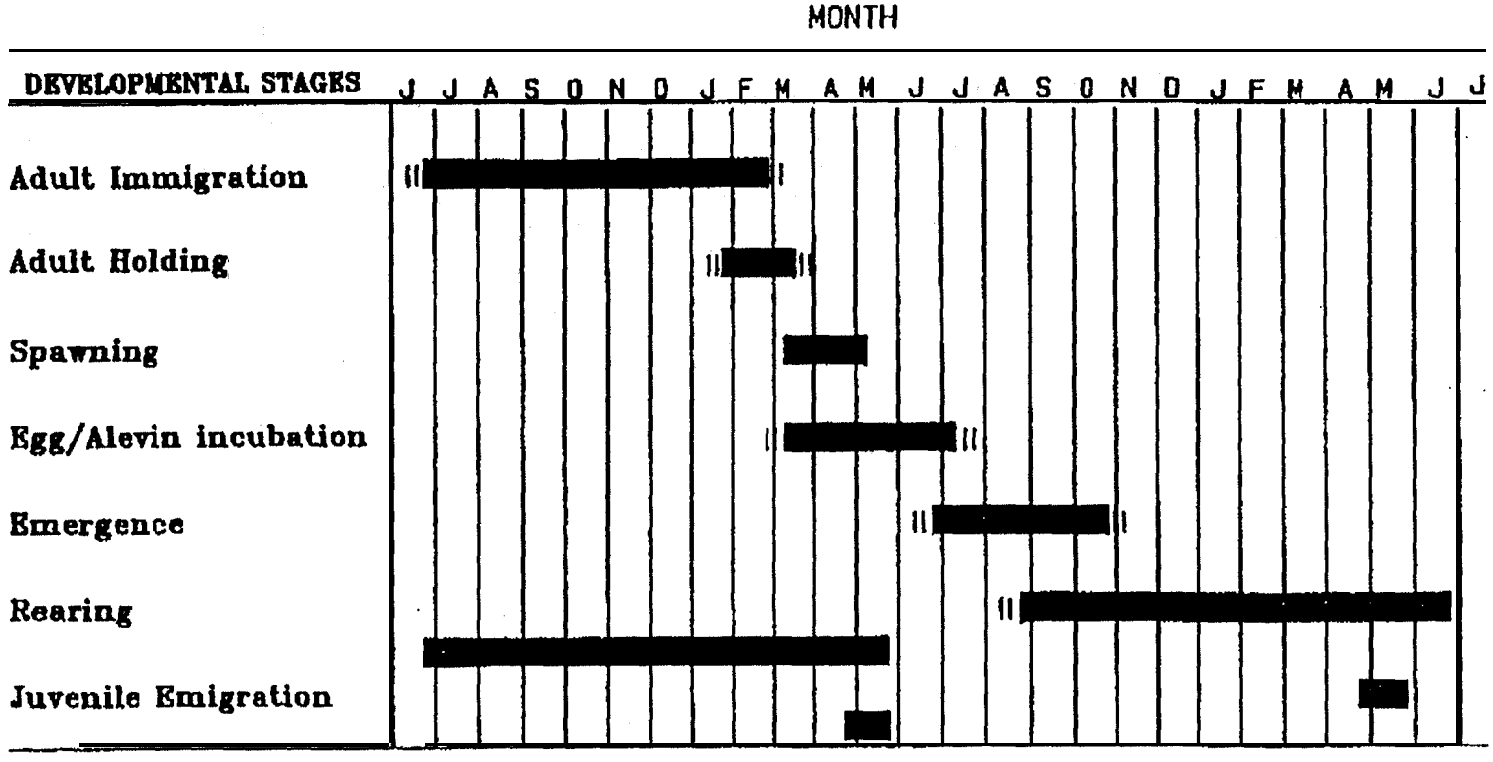


Figure 2 (TT). Freshwater life history for natural/wild steelhead runs in the Salmon River subbasin.



Notes:

1. The developmental stage timing represents basin-wide averages, local conditions may cause some variability.
2. Solid bars indicate periods of heaviest adult immigration, spawning and juvenile emigration.
3. Rearing and juvenile emigration take place over a three year period and are shown above in a rap-around fashion.

Table 1 (HB). Estimated amount of spawning and rearing habitat (Use Type 1) by quality of Little Salmon River summer steelhead production area.

	Excellent	Good	Fair"	Poor"	Unknown	Total	Confidence[b]
Miles (%)	57			0			
Acres (%)	99	24.6	19.4	0		227.5 294.5	M M

[a] Ratings of fair and poor habitat quality may reflect natural physical features such as gradient and channel type, as well as degradation caused by humans.
[b] 'Confidence' is meant to indicate the reproducibility and accuracy of the estimates made, and will be rated as high, medium or low by the respective agencies.

Source: Presence/Absence database, Northwest Power Planning Council, 1991.

Table 2 (PD-a). Parr density and percent of rated carrying capacity (PCC) for steelhead in the Little Salmon River drainage. Densities estimated by snorkel counts.

Stream name	Year	Sample size	Ages 1+ & 2+ density (#/100m²)	Density std. dev.	PCC for 1+ & 2+	PCC std. dev.
			Natural A-Run			
Boulder Cr.	84	4	6.93	3.50	34.64	17.51
Boulder, LSR	85	4	8.90	4.96	44.51	24.78
Boulder, LSR	86	3	11.76	10.48	58.80	52.39
Boulder, LSR	87	4	14.66	4.75	73.29	23.76
Boulder, LSR	88	4	12.95	4.20	64.75	20.99
Boulder, LSR	89	4	9.58	9.02	47.90	45.11
Hard Creek	86	2	1.26	1.23	6.30	6.15
Hazard Creek	85	1	11.71	0.00	58.55	0.00
Hazard Creek	86	1	1.95	0.00	59.75	0.00
Hazard Creek	87	1	4.54	0.00	72.70	0.00
Hazard Creek	88	1	9.44	0.00	97.20	0.00
Hazard Creek	89	1	0.13	0.00	50.65	0.00
Hazard Creek	86	2	31.78	3.11	58.90	15.56
ittle Salmon	85	2	10.13	2.09	50.67	10.43
Little Salmon	86	2	11.78	3.52	58.90	17.61
Little Salmon	87	2	6.46	1.24	32.27	6.19
Little Salmon	88	2	5.48	1.12	27.40	5.59
Little Salmon	89	2	9.41	5.35	47.05	26.73
			Wild A-Run			
Rapid River	85	1	8.54	0.00	42.70	0.00
Rapid River	86	1	14.39	0.00	71.95	0.00
Rapid River	87	1	14.37	0.00	71.85	0.00
Rapid River	88	1	21.84	0.00	109.20	0.00
Rapid River	89	1	13.03	0.00	65.15	0.00
Rapid R., W. Fk.	85	1	5.30	0.00	26.50	0.00
Rapid R., W. Fk.	86	1	3.49	0.00	17.45	0.00
Rapid R., W. Fk.	87	1	7.96	0.00	39.80	0.00
Rapid R., W. Pk.	88	1	14.07	0.00	70.35	0.00
Rapid R., W. Fk.	89	1	6.24	0.00	31.20	0.00

Source: R. J. Scully, IDFG, unpublished.

Table 3 (AT-a). Timing of summer steelhead run to Rapid River for various years, 1965- 199 1.

Run Year	First fish	Last Fish
1964-65	4/08/ 65	7/05/65
1972-73	3/02/73	6/20/ 73
1976-77	4/25/77	6/08/77
1977-78	4/13/78	6/20/78
1978-79	4/20/79	6/05/79
1979-80	4/04/80	5/31/80
1980-81	4/17/81	6/19/81
1983-84	4/27/84	6/17/84
1984-85	4/19/85	6/11/85
1987-88	4/18/88	6/22/88
1988-89	4/08/89	7/05/89
1989-90	4/05/90	6/10/90
1990-91	4/25/91	6/26/91

Sources: Reingold 1966.
Parrish et al. 1974.
Parrish 1978.
Parrish and Wimer 1978.
Parrish and Wimer 1980.
Levendofske et al. 1980.
Levendofske et al. 1981.
Levendofske 1985.
Levendofske et al., IDFG, unpublished.

Table 4 (RI-I). Return of summer steelhead to Rapid River by brood year[a].

Total Age

Brood Year	4	5	Total
1975	18	33	51
1976	43	63	106
1977	46	64	110
1978	13	24	37
1979	37	61	98
1980	39	41	80
1981	36	43	79
1982	31	55	86
1983	34	40	74
1984	28	93	121
1985	24	39	63
1986	7	inc.[b]	inc.

[a] Count at Rapid River Hatchery weir was sample method. Harvest estimates are not included. Total age based on 3 year freshwater rearing and ocean age delineated by total length criteria (return years 1979-80 through 1989-90) and fork length criteria (return year 1990-91) as follows:

male l-ocean = $\leq$ 69.5 cm (27") TL
male l-ocean = $<$ 68.0 cm FL

female l-ocean = $\leq$ 66.5 cm (26") TL
female l-ocean = $\leq$ 65.0 cm FL

[b] Incomplete brood year information.

Sources: Parrish and Wimer 1980.
Levendofske et al. 1980.
Levendofske et al. 1981.
Levendofske et al. 1983.
Levendofske 1984.
Levendofske 1985.
Levendofske et al. 1988.
K. Ball, IDFG, personal communication.
Levendofske et al., IDFG, unpublished.
S . W. Kiefer, IDFG unpublished.

Table 5 (AL-a). Rapid River wild steelhead total lengths for 1986-1990 and wild steelhead fork lengths, 1991.

Length cm.	1991 No. fish	1990 No. fish	1989 No. fish	1988 No. fish	1987 No. fish	1986 No. fish
< 40			1			
40						
41						
42						
43						
44						
45						
46						
47						
48						
49						
50						
51	1					
52						
53		1				
54						
55				1		
56	1			1	1	
57			1	1		
58	2	1	1	1	4	
59		2	1	4		
60		1	2			
61	3	4	6	3	6	8
62		1	1		1	
63		2	3	4	2	5
64	1	2	1	6	10	
65		5	4	2	2	
66		2	4	9	5	18
67			1			
68	1	2				10
69	1	2	3	5	1	
70	4	4	3	4	1	
71		3	5	7	7	12
72	4	7	5	2		
73	3	6	2	4		
74	5	13	3	8	6	2
75	1	14	1	6		
76	4	7	7	4	6	11
77		9	3	3	1	
78	6	4	1	3		
79	2	5	3	3	13	1
80	5	9	2	1		
81	1	1	1	2	5	5
82	1	1	1	2	1	
83		3	1			
84		1	1		1	1
85		1				
86						3
87		2				
88						
89					1	1
90		1				

[a] Blanks indicate no fish this size collected and measured.

Source: Levendofske et al., IDFG, unpublished.

Table 6 (AC). Age composition percentage (freshwater.ocean) by brood year for summer steelhead returning to Rapid River[ab].

Age Composition (%)

Brood Year	N	3.1	3.2	3.3
1975	51	35.3	64.7	
1976	106	40.6	59.4	
1977	110	41.8	58.2	
1978	37	35.1	64.9	
1979	98	37.8	62.2	
1980	80	48.7	51.3	
1981	79	45.6	54.4	
1982	86	36.1	63.9	
1983	74	45.9	54.1	
1984	121	23.1	76.9	
1985	63	38.1	61.9	

[a] Count at Rapid River Hatchery weir was sample method. Harvest estimates are not included. Total age based on 3 year freshwater rearing and ocean age delineated by total length criteria (return years 1979-80 through 1989-90) and fork length criteria (return year 1990-91) as follows:

male l-ocean = $\leq$ 69.5 cm (27") TL
male l-ocean = < 68.0 cm FL

female l-ocean = $\leq$ 66.5 cm (26") TL
female l-ocean = $\leq$ 65.0 cm FL

[b] Incomplete brood year information.
Note that the total age at spawning for these fish would range from five to six years of age.

Sources: Parrish and Wimer 1980.
Levendofske et al. 1980.
Levendofske et al. 1981.
Levendofske et al. 1983.
Levendofske 1984.
Levendofske 1985.
Levendofske et al. 1988.
K. Ball, IDFG, personal communication.
Levendofske et al., IDFG, unpublished.
S . W. Kiefer, IDFG unpublished.

Table 7 (AS-a). Percent females by brood year and age class (freshwater.ocean) for summer steelhead returning to Rapid River".

Females (%)

Brood Year	N	3.1	3.2	3.3	Total % Female
1975	51	19.6	54.9		74.5
1976	106	17.9	45.3		63.2
1977	110	23.6	50.9		74.5
1978	37	16.2	54.1		70.3
1979	98	18.4	49.0		67.4
1980	80	27.5	41.2		68.7
1981	79	13.9	50.6		64.5
1982	86	13.9	57.0		70.9
1983	74	16.2	51.3		67.5
1984	121	6.6	52.9		59.5
1985	63	15.9	55.5		71.4

[a] Count at Rapid River Hatchery weir was sample method. Harvest estimates are not included. Total age based on 3 year freshwater rearing and ocean age delineated by total length criteria (return years 1979-80 through 1989-90) and fork length criteria (return year 1990-91) as follows:

male l-ocean = $\leq$ 69.5 cm (27") TL
male l-ocean = < 68.0 cm F L

female l-ocean = $\leq$ 66.5 cm (26") TL
female l-ocean = $\leq$ 65.0 cm FL

Note that the total age at spawning for these fish would range from five to six years.

Sources:
Parrish and Wimer 1980.
Levendofske et al. 1980.
Levendofske et al. 1981.
Levendofske et al. 1983.
Levendofske 1984.
Levendofske 1985.
Levendofske et al. 1988.
K. Ball, IDFG, personal communication.
Levendofske et al., IDFG, unpublished.
S.W. Kiefer, IDFG unpublished.

LITTLE SALMON RIVER, SALMON SUBBASIN

Hatchery Produced Summer Steelhead

GEOGRAPHIC LOCATION

The Little Salmon River enters the Salmon River at Riggins, Idaho, 82 miles upstream from the confluence of the Salmon and Snake rivers. Hatchery steelhead are transported by truck to the Little Salmon drainage from Idaho hatcheries. Idaho Department of Fish and Game (IDFG) releases hatchery steelhead smolts at the mouths of tributaries near the lower end of the Little Salmon River. The purpose is to stage fish in the lower Salmon River to provide a mainstem harvest opportunity and to provide a tributary harvest opportunity in the Little Salmon River.

ORIGIN

Hatchery steelhead broodstock are not collected in the Little Salmon drainage. Hatchery A-run steelhead stocked in the Little Salmon drainage are usually progeny of adult steelhead collected at Pahsimeroi Hatchery on the Pahsimeroi River, a tributary to the Salmon River, or at the Hells Canyon Trap on the Snake River. Progeny of hatchery steelhead returning to the Sawtooth Hatchery on the upper Salmon River have also been used. Hatchery B-run steelhead stocked in the Little Salmon drainage are progeny of adult steelhead collected at Dworshak National Fish Hatchery on the North Fork of the Clear-water River.

DISTRIBUTION

Table 1 lists hatchery steelhead releases into the Little Salmon drainage, brood years 1983-1990. Coded wire tag (CWT) codes are identified for brood years 1987-1990. Hatchery released steelhead presmolts and smolts are adipose fin-clipped. CWT fish are marked with a left ventral fin-clip. Other marks or tag releases have not been compiled.

PRODUCTION

Although tributaries have been stocked with hatchery steelhead fry to attempt to boost natural production, an estimate for fry to smolt survival is not available.

Use of the passive integrated transponder (PIT) tag allows detection of smolts from tributaries arriving at upper Snake River dams. For brood year 1990 A-run steelhead, reared at Magic Valley and released into the Little Salmon drainage, the detection rate was 66.0 percent at Lower Granite Dam and 80.7 percent for the combined dams (Lower Granite, Little Goose, and McNary). For B-run steelhead smolts, reared at Hagerman National Fish Hatchery and released into the Little Salmon, the detection rate was 59.7 percent at Lower Granite Dam and 47.7 percent at the three dams combined.

Smolt to adult survival to Idaho for hatchery steelhead smolts released into the Little Salmon drainage has been variable, based on coded wire tag analyses. In 1984, both A-run and B-run hatchery smolts were released. The A-run fish smolt-to-adult return was 1.76 percent. The B-run return was 0.19 percent. Returns of A-run smolts released in 1986 exhibited a return of 0.41 percent after 2 ocean years. The return after 1 ocean year was 0.28 percent, However, for smolts released in 1987, the smolt-to-adult return after one ocean year was 0.02 percent, in a migration year adversely affected by low mainstem flow (Ball 1989, 1990, 1991).

ADULT LIFE HISTORY

Adult Escapement

Specific time of migration and escapement for hatchery steelhead returning to the Little Salmon River has not been identified for the ocean, Columbia or Snake rivers. The University of Idaho implemented adult timing research in 1991 which should provide information about Snake River timing (Bjornn 1992).

Harvest

Estimates of ocean, Columbia River, or Snake River harvest of hatchery steelhead has not been developed. A limited number of CWTs have been released in these fish, but the harvest recovery information outside of Idaho was not summarized for this report.

In the Salmon River, Little Salmon hatchery steelhead are harvested in the mainstem Salmon River and the Little Salmon River. This is the only Salmon River tributary open to steelhead fishing. Estimated sport harvest in the Little Salmon by run year is generated by a telephone survey (Table 2) (McArthur 1991; T.J. McArthur, IDFG, unpublished). However, because fall fish wander and stage, hatchery fish other than those originating in the Little Salmon River may have been harvested. Exploitation in the Little Salmon River has not been quantified, but it is assumed to be near 50 percent, as determined by coded wire tag analysis and creel information (Ball 1991).

Spawner Escapement

No empirical information is available regarding how many hatchery steelhead actually return to the Little Salmon drainage. Ball (1991) estimates that hatchery steelhead adult escapement back to the Little Salmon drainage is approximately 50 percent of the return to Idaho, with exploitation also being 50 percent.

Adult Characteristics

Refer to information describing the hatchery broodstock, such as the section on Pahsimeroi River hatchery steelhead.

JUVENILE LIFE HISTORY

Refer to information describing the rearing hatchery, such as the section on Pahsimeroi River hatchery steelhead.

BIOCHEMICAL/GENETIC CHARACTERISTICS

Refer to information describing the hatchery broodstock, such as the section on Pahsimeroi River hatchery steelhead.

DISEASES

Refer to information describing the hatchery broodstock, such as the section on Pahsimeroi River hatchery steelhead.

Table 1 (TR). Hatchery steelhead releases into the Little Salmon River drainage by brood years, 1983-1990. Coded wire tag codes displayed for brood years 1987-1990.

Brood Year	Brood-stock	Hatchery	Life Stage	Release Date (1)	Release Date (2)	Fish/lb	Number Released	Release Location	CWT
1983	Hells Canyon A	Oxbow	F-F”	1983			395,720	Boulder Creek	
1983	Hells Canyon A	Oxbow	F-F	1983			230,463	Hazard Creek	
1984	Hells Canyon A	Oxbow	F-F	1984			149,366	Boulder Creek	
1984	Hells Canyon A	Oxbow	F-F	1984			216,263	Hazard Creek	
1983	Pahsimeroi B[b]	Hagerman NFH	smolt	1984			95,624	Hazard Creek	
1983	Pahsimeroi A	Hagerman NFH	smolt	1984			96,425	Hazard Creek	
1985	Hells Canyon A	Oxbow	F-F	1985			140,736	Hazard Creek	
1984	Pahsimeroi A	Hagerman NFH	smolt	1985			308,103	Hazard Creek	
1985	Pahsimeroi A	Hagerman NFH	F-F	1985			91,688	Little Salmon	
1985	Sawtooth A	Hagerman NFH	pre-smolt	01/07/86	01/09/86		125,587	LSR[c] @ Hazard	
1985	Sawtooth A	Hagerman NFH	smolt	1986			302,303	Hazard Creek	
1986	Hells Canyon A	Oxbow	F-F	1986			94,700	Hazard Creek	
1986	Sawtooth A	Hagerman NFH	F-F	1986			27,431	Boulder Creek	

Table 1 (TR) (cont.). Hatchery steelhead releases into the Little Salmon River drainage by brood years, 1983-1990. Coded wire tag codes displayed for brood years 1987- 1990.

Brood Year	Brood-stock	Hatchery	Life Stage	Release Date (1)	Release Date (2)	Fish/lb	Number Released	Release Location	CWT
1986	Sawtooth A	Hagerman NFH	smolt	1987			299,098	Hazard Creek	
1987	Pahsimeroi Sawtooth A	Magic Valley	smolt	04/12/88	04/23/88	4.5	52,300	Hazard Creek	104049
1987	Pahsimeroi Sawtooth A	Magic Valley	smolt	04/12/88	04/23/88	4.5	649,000	Hazard Creek	Untagged
1988	Hells Canyon A	Oxbow	F-F	1988			91,800	Hazard Creek	
1988	Hells Canyon A	Oxbow	F-F	1988			378,500	Little Salmon	
1988	Hells Canyon A	Oxbow	F-F	1988			23 1,700	Boulder Creek	
1988	Pahsimeroi A	Magic Valley	smolt	04/19/89	04/26/89	4.2	15,209	Hazard Creek	104141
1988	Pahsimeroi A	Magic Valley	smolt	04/19/89	04/26/89	4.2	15,154	Hazard Creek	104142
1988	Pahsimeroi A	Magic Valley	smolt	04/19/89	04/23/89	4.2	15,927	Hazard Creek	104143
1988	Pahsimeroi A	Magic Valley	smolt	04/19/89	04/23/89	4.2	404,110	Hazard Creek	Untagged
1989	Pahsimeroi A	Niagara Springs	pre-smolt	09/19/89		5.7	100,600	Hazard Creek	
1989	Pahsimeroi A	Niagara Springs	smolt	04/15/90	04/16/90	4.4	15,501	Hazard Creek	104224
1989	Pahsimeroi A	Niagara Springs	smolt	04/15/90	04/16/90	4.4	15,004	Hazard Creek	104225
1989	Pahsimeroi A	Niagara Springs	smolt	04/15/90	04/16/90	4.4	15,250	Hazard Creek	104226

Table 1 (TR) (cont.). Hatchery steelhead releases into the Little Salmon River drainage by brood years, 1983-1990. Coded wire tag codes displayed for brood years 1987-1990.

Brood Year	Brood-stock	Hatchery	Life Stage	Release Date (1)	Release Date (2)	Fish/lb	Number Released	Release Location	CWT
1989	Pahsimeroi A	Niagara Springs	smolt	04/15/90	04/16/90	4.4	209,745	Hazard Creek	Untagged
1989	Sawtooth A	Hagerman NFH	smolt	04/23/90	05/01/90	4.2	80,465	LSR @ Hazard Cr.	
1989	DNFH B[d]	Hagerman N F H	smolt	04/30/90		4.5	14,841	LSR @ Hazard Cr.	104230
1989	DNFH B	Hagerman NFH	smolt	04/30/90		4.5	14.065	LSR @ Hazard Cr.	104231
1989	DNFH B	Hagerman NFH	smolt	04/30/90		4.4	13,416	LSR @ Hazard Cr.	104232
1989	DNFH B	Hagerman NFH	smolt	04/23/90	05/01/90	4.0	351,030	LSR @ Hazard Cr.	Untagged
1990	DNFH B	Hagerman NFH	smolt	10/23/90	10/25/90	24.4	120,323	Little Salmon	
1990	Pahsimeroi A	Magic Valley	smolt	04/26/91		3.5	21,809	LSR @ Hazard Cr.	104317
1990	Pahsimeroi A	Magic Valley	smolt	04/26/91		3.5	22,704	LSR @ Hazard Cr.	104318
1990	Pahsimeroi A	Magic Valley	smolt	04/26/91		3.5	21,484	LSR @ Hazard Cr.	104319
1990	Pahsimeroi A	Magic Valley	smolt	04/26/91		3.7	244,303	LSR @ Hazard Cr.	Untagged
1990	DNFH B	Hagerman NFH	smolt	04/17/91	4/30/91	4.4	457,110	Little Salmon	

[a] F-F designates a fry or fingerling release.
[b] Pahsimeroi B stock transferred from Dworshak NFH, North Fork Clearwater River.
[c] LSR = Little Salmon River
[d] DNFH = Dworshak National Fish Hatchery

Table 2 (RS-a). Estimated Little Salmon River steelhead sport harvest" by fish run year, 1985 to 1990 (the fish run year is calculated from June 1 to May 31). Tributary was closed to steelhead fishing for several years prior to 1985.

Fish run year					
85-86	86-87	87-88	88-89	89-90	90-91
93	877	439	224	1,720	174

[a] Harvest estimated from telephone survey.

Sources: McArthur 1991.
T.J. McArthur, IDFG, unpublished.

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MIDDLE MAIN SALMON RIVER, SALMON SUBBASIN
(French Creek to Middle Fork Salmon River)

Spring Chinook (wild)

GEOGRAPHIC LOCATION

The section of Salmon River between French Creek and the Middle Fork Salmon River (MFSR) is about 95 miles, of which 72 miles are not roaded. Through this reach, the Salmon River flows through a deep canyon. Much of this river segment drains the Frank Church River of No Return and Gospel Hump Wilderness areas. The mainstem Salmon River serves primarily as a migration corridor for salmon and steelhead adults and smolts and as a winter rearing area for salmon and steelhead juveniles.

There are about 113 named tributaries between French Creek and the MFSR. Many are small, steep, and intermittent. Chamberlain Creek is the major wild chinook production area for this segment of Salmon River drainage (Reingold 1982). Most habitat for chinook in Chamberlain Creek is pristine and virtually unchanged from the 1950s (Ball 1985). Chinook also occur in Bargamin, Horse, Sheep, and Crooked creeks.

ORIGIN

Chinook are indigenous to some of the larger tributaries of the middle main Salmon River such as Chamberlain Creek. Only Chamberlain Creek is known to have supported substantial numbers of both salmon and steelhead, although chinook spawning was also documented historically in Horse Creek (Reingold 1982). Studies have not been conducted to confii whether this is a spring or summer chinook run. For management purposes, populations in these tributaries have been classified as spring-run. There are no weirs in any of these tributaries nor have adults been collected to provide timing or age composition information. Redd counts have been conducted aerially, so carcass information is not available either.

Snake River spring and summer chinook were listed as “threatened” by the National Marine Fisheries Service in 1992.

Hatchery chinook have not been outplanted the middle main Salmon River or its tributaries. The chinook run to the middle main Salmon River has been managed under wild fish policy with natural production maintaining the run.

DISTRIBUTION

Available spawning and rearing habitat for the middle main Salmon River was described in the Presence/Absence database (Table 1). This information was developed for the Northwest Power Planning Council for subbasin planning and modeling. Much of the habitat is limited by gradient and channel morphology and is more suited to steelhead production.

PRODUCTION

There is no available information describing chinook survival factors. Tributary inventory studies conducted 1981-1983 found no juvenile chinook during snorkel, and hook and line sampling although chinook were believed to utilize inventoried tributaries (Reingold 1982, Ball 1983, Ball 1985). Beginning in 1985, efforts were intensified by Idaho Department of Fish and Game to

document juvenile chinook production in the larger tributaries. Parr monitoring in Chamberlain, Horse, Bargamin, and Sheep creeks have shown that juvenile chinook are rearing in these tributaries. However, Chamberlain Creek in its upper reaches (Chamberlain Basin) contains low gradient habitat more suited for chinook production. Annual means for Chamberlain Basin monitoring transects, 1985-91, are reported in Table 2 (R.J. Scully, Idaho Department of Fish and Game, unpublished). For 1985-91, the mean of annual means for Chamberlain Creek monitoring transects was 20.7 parr per 100 m^2 and 25.2 percent of estimated carrying capacity. For other middle main tributaries, including Horse, Bargamin, Sheep, and lower Chamberlain creeks (Table 2), the 1985-90 mean of annual means was 0.6 parr per 100 m^2 and 1.3 percent of estimated carrying capacity, a fraction of the parr densities found in Chamberlain Basin.

Parr densities were estimated by snorkel counts. Parr carrying capacity ratings for spring chinook were derived from the Presence/Absence database used for development of the Salmon Subbasin Plan.

ADULT LIFE HISTORY

Adult Escapement

Chinook crossing Bonneville Dam through May 31 are counted as springs, as are those crossing Lower Granite Dam through June 17. Specific time of migration and escapement for chinook returning to middle main Salmon River tributaries has not been identified for the ocean or Columbia River. The University of Idaho implemented adult timing research in 1991 which should provide information about Snake River timing (Bjornn et al. 1992).

Harvest

There is no information available for ocean, Columbia River, or Snake River harvest. Idaho has not had a general salmon season since 1978, so there is no terminal nontreaty harvest.

Spawner Escapement

Index redd counts were conducted in the Chamberlain Basin from the late 1950s through 1965 (T. Elms-Cockrum, Idaho Department of Fish and Game, unpublished). Counts were aerial surveys, conducted during the first 2 weeks of September (Table 3). Number of redds counted in index areas appeared to decrease after 1960. In the mid-1960s the redd counts were discontinued due to remoteness of the stream and the relatively small number of redds counted (Bjornn et al. 1966). However, index redd counts were resumed in 1985 for Chamberlain Creek as a result of increased monitoring in wild chinook production areas.

Adult Characteristics

There is no information available.

JUVENILE LIFE HISTORY

Life history timing is likely similar to that illustrated in the Little Salmon section. Although not illustrated in the figure, there is typically a fall emigration of chinook presmolts from the upper end of tributaries to lower in the drainages or to the mainstem Salmon River for winter rearing.

BIOCHEMICAL-GENETIC CHARACTERISTICS

Information has not been compiled.

DISEASES

Information has not been compiled.

REFERENCES

All Middle Mainstem Salmon references appear at the end of the summer steelhead section.

Table 1 (HB). Estimated amount of spawning and rearing habitat (Use Type 1) by quality of middle main Salmon River (French Creek to Middle Fork Salmon River) spring chinook production area.

	Excellent	Good	Fair"	Poor"	Unknown	Total	Confidence[b]
Miles (%)	11 15	36 37	48 47	51		219.7 168.2	M M
Acres (%)							

[a] Ratings of fair and poor habitat quality may reflect natural physical features such as gradient and channel type, as well as degradation caused by humans.
[b] 'Confidence' is meant to indicate the reproducibility and accuracy of the estimates made, and will be rated as high, medium or low by the respective agencies.

Source: Presence/Absence database, Northwest Power Planning Council, 1991.

Table 2 (PD-a). Wild chinook parr densities per $100m^2$ (CHINOD) and percent of rated carrying capacity (CHPERCC), middle main Salmon River (French Creek to Middle Fork Salmon River), 1985-91.

	Year						
Drainage	1985	1986	1987	1988	1989	1990	1991
Salmon Canyon tribs. (w/o Chamb. Basin)"							
CHINOD =	0.02	0.24	1.72	0.34	0.3	0.94	NA[b]
CHPERCC =	0.05	0.55	3.8	0.7	0.69	1.88	NA
Chamberlain Basin							
CHINOD =	23.32	36.33	18.09	NS	19.41	18.39	8.95
CHPERCC=	23.31	49.05	21.95	NS	22.78	22.98	11.07

[a] Tributaries include Horse, Bargamin, Sheep, and lower Chamberlain creeks.
[b] Data not available.
[c] NS = Chamberlain Creek not sampled in 1988.
Source: R. J. Scully, IDFG, unpublished.

Table 3 (RN-a). Idaho Department of Fish and Game index chinook redd counts for the Mid-Main Salmon River (French Creek to Middle Fork Salmon River), 1951-1965. Counts were discontinued in 1965 and resumed in 1985.

Year	Chamberlain Creek	W. Fk. Chamberlain
1951	25	
1952	56	
1953	10	
1954	No data available	
1955	No data available	
1956	No data available	
1957	34	
1958	38	117
1959	40	
1960"	91	109 187
1961"	24	27
1962	22	73
1963		
1964	16	
1965"	12	26
	Counts were discontinued until 1985	
1985	9	16
1986	Count not conducted	
1987	12	12
1988	20	6
1989	14	30
1990	17	35

[a] Counts for Chamberlain Basin, 1960-62 and 1964-65, are for comparable transects. Counts for 1985-1990 are comparable transects.

Sources: Hauck 1952, 1953, 1954.
Ortmann and Richards 1965.
T. J. Elms-Co&urn, IDFG, unpublished.

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MIDDLE MAIN SALMON RIVER, SALMON SUBBASIN
(French Creek to Middle Fork Salmon River)

Summer Steelhead (wild)

GEOGRAPHIC LOCATION

The section of Salmon River between French Creek and the Middle Fork Salmon River is about 95 miles, of which 72 miles are not roaded. Through this reach, the Salmon River flows through a deep canyon. Much of this river segment drains the Frank Church River of no Return and Gospel Hump Wilderness areas. The mainstem Salmon River serves primarily as a migration corridor for salmon and steelhead adults and smolts and as a winter rearing area for salmon and steelhead juveniles.

There are about 113 named tributaries between French Creek and the Middle Fork and many are small, steep, and intermittent. Many of the larger streams are important producers of wild steelhead, particularly Bargamin, Sabe, Chamberlain, Sheep, and Horse creeks.

ORIGIN

Steelhead are indigenous to many tributaries of the middle main Salmon River. Chamberlain Creek is known to have supported substantial numbers of both salmon and steelhead (Reingold 1982). Ball (1985) noted that steelhead have also been known to spawn in Horse and Bargamin creeks.

Ball (1985) stated that size of adult steelhead returning to middle main Salmon River tributaries is similar to other stocks of A-run fish, but adults have not been monitored for timing or age composition information. For management purposes, populations in the middle main Salmon River tributaries have been classified as A-run.

No hatchery fish have been outplanted into middle main Salmon River tributaries. Steelhead populations of tributaries to the middle main Salmon River have been managed under wild fish policy with natural production maintaining the run. These tributaries represent the largest contiguous production area for wild A-run steelhead in Idaho.

DISTRIBUTION

Available spawning and rearing habitat for the middle main Salmon River was described in the Presence/Absence database (Table 1). This information was developed for the Northwest Power Planning Council for subbasin planning and modeling.

PRODUCTION

There is no available information describing steelhead survival factors. Tributary inventories conducted 1981-1983 found juvenile rainbow-steelhead to be the most numerous species during snorkel and hook and line sampling (Reingold 1982, Ball 1983, Ball 1985). Tables 2 and 3 present rainbow-steelhead densities collected in 1981 and 1983. Densities ranged from 4.7 to 30.9 pan per 100 m^2 for Horse, Chamberlain, Sabe, and Bargamin creeks with an overall average of 13.7 parr per 100 m^2, in 1981. Although Ball (1985) noted that an unknown faction of juveniles may be resident rainbow, the numbers and sizes of mature rainbow and the percentage of residualized, precocial males led researchers to believe the majority were steelhead (Reingold 1982).

Beginning in 1985, efforts were intensified by Idaho Department of Fish and Game to document juvenile steelhead production in the larger tributaries. Standard parr monitoring was implemented in Chamberlain, Horse, Bargamin, and Sheep creeks. Annual monitoring information, 1985-89, is reported in Table 4 (R.J. Scully, Idaho Department of fish and Game, unpublished). Overall mean of all sections and years for 1985-89 was 10.4 parr per 100 m^2 and the mean estimated carrying capacity was 56.4 percent. Parr densities were estimated by snorkel counts. Parr carrying capacity ratings for summer steelhead were derived from the Presence/Absence database used for development of the Salmon Subbasin Plan.

ADULT LIFE HISTORY

Adult Escanement

Specific time of migration and escapement for steelhead returning to middle main Salmon River tributaries has not been identified for the ocean or Columbia River. The University of Idaho implemented adult timing research in 1991 which should provide information about Snake River timing (Bjornn et al. 1992).

Adult steelhead enter the Salmon River in the fall and typically overwinter in the middle main reach of the Salmon River before ascending tributaries to spawning grounds. Tagging studies have shown that there is considerable milling of steelhead in wintering areas.

Harvest

There is no information available for ocean or Columbia River harvest. Since the mid-1980s, the harvest of steelhead possessing an adipose fin has not been allowed in the Snake River or in Idaho.

Spawner Escanement

Timing of steelhead spawning in the Salmon River drainage can span two months, from early April to early June. It appears that adult fish usually enter tributaries after spring freshets. The major period of steelhead spawning begins in mid-April and extends through May when water temperature is above 4.5 C° (Ball 1985). Reingold (1982) found adult steelhead at the mouths of Chamberlain, Sabe, and Bargamin creeks in mid-April and completed redds were found on Chamberlain Creek on May 12.

Reingold (1982) estimated that adult escapements were less than 100 spawners in the early 1980s in streams such as Horse, Chamberlain, and Bargamin creeks, although Ball (1985) noted that there appeared to be an increase in the number of wild adult steelhead compared to the mid-1970s.

Adult Characteristics

There is no information available.

JUVENILE LIFE HISTORY

In 1981-83, length frequency of steelhead parr sampled by look and line in various middle main Salmon River tributaries, July through September, ranged from 90 to 290 mm total length (Table 5). Freshwater age by size class was not estimated.

BIOCHEMICAL-GENETIC CHARACTERISTICS

Wishard and Seeb (1983) electrophoretically examined collections of wild steelhead from the Middle Fork Salmon River and adjacent Chamberlain Creek and combined their results with those of earlier studies by other authors to identify the genetic structure and relationships of steelhead populations in the Columbia River Basin. They concluded that within the Snake River localized isolated breeding demes likely exist although the overall similarity among the majority of the populations was high. Their study did include a phenogram of Columbia River steelhead populations based upon 22 structural loci.

Ball (1983) interpreted the results of the analyses conducted by Wishard and Seeb (1983). When compared with electrophoretic results of other steelhead in the Columbia River Basin, it appeared that Chamberlain Creek steelhead did not stand out as a unique genetic stock. "At most loci, Chamberlain Creek steelhead appear to more closely resemble Snake River steelhead than steelhead from Middle Fork Salmon River tributaries" (Ball 1983, page 5).

As reported in Thurow (1987) cluster analyses based on preliminary electrophoretic analysis conducted by Schreck et al. (1985) illustrated that steelhead from Chamberlain Creek were similar to other Salmon and Clear-water river wild stocks sampled.

Electrophoretic data from several middle main tributaries, including Bargamin and Chamberlain creeks are reported in Appendix Table 4 (Schreck et al. 1986).

DISEASES

No information is available.

REFERENCES

All Middle Main Salmon references appear at the end of this section.

Table 1 (HB). Estimated amount of spawning and rearing habitat (Use Type 1) by quality of middle main Salmon River (French Creek to Middle Fork Salmon River) steelhead production area.

	Excellent	Good	Fair[a]	Poor[a]	Unknown	Total	Confidence[b]
Miles (%)	86	10	4	0		433.7	M
Acres (%)	84	12	4	0		467.2	M

[a] Ratings of fair and poor habitat quality may reflect natural physical features such as gradient and channel type, as well as degradation caused by humans.
[b] 'Confidence' is meant to indicate the reproducibility and accuracy of the estimates made, and will be rated as high, medium or low by the respective agencies.

Source: Presence/Absence database, Northwest Power Planning Council, 1991.

Table 2 (PD-a). Densities of rainbow-steelhead trout observed in four Mid-Main Salmon River tributaries, August - September 1981.

Stream	Transect number	Rainbow-steelhead per 100m²
Upper Horse	1	
	2	10.3
		17.6
	3	18.1
	4	27.7
	5	15.8
	Combined	16.9
Lower Horse	1	
	2	12.5 4.7
	4	30.9
	5	18.4 16.0
	Combined	12.5
Chamberlain	2	7.2
	3	14.1 8.8
	4	9.4
	5	8.3
	Combined	9.5
Sabe	1	15.4
	2	
	3	21.0 6.9
	4	16.9
	5	12.9
	Combined	13.4
Bargamin	1	
	2	9.3
		7.2
	3	7.4
	4	15.4
	5	11.5
	Combined	9.8

Source: Reingold 1982.

Table 3 (PD-b). Density of rainbow trout-juvenile steelhead in lower Crooked Creek, July 1983.

Transect no.	Rainbow-steelhead per 100m^2
2	14.7
3	15.3
	7.3
4	25.4
5	15.5
Total	13.0

Source: Ball 1985.

Table 4 (PD-c). Parr density and percent of rated carrying capacity (PCC) for steelhead in middle main Salmon River tributaries (French Creek to Middle Fork Salmon River), 1985-89[a].

Stream name	Year	Sample size	Ages 1+ & 2+ density (#/100m^2)	Density std. dev.	PCC for ages 1+ & 2+	Std.dev. for PCC
Bargamin Creek	85	2	4.75	1.24	23.73	6.19
Bargamin Creek	86	2	9.58	1.27	47.90	6.36
Bargamin Creek	87	2	14.65	0.38	73.28	1.87
Bargamin Creek	88	2	5.39	0.28	26.95	1.41
Bargamin Creek	89	2	5.43	0.64	27.15	3.18
Chamberlain, W.	85	2	6.72	2.70	48.00	19.29
Chamberlain, W.	86	2	10.61	7.52	75.75	53.68
Chamberlain, W.	87	2	6.09	2.83	43.50	20.21
Chamberlain, W.	89	2	14.69	7.41	104.93	52.93
Chamberlain	85	3	4.63	2.74	23.13	13.71
Chamberlain	86	3	14.42	4.89	72.08	24.44
Chamberlain	87	4	18.02	16.20	92.59	78.37
Chamberlain	88	2	7.63	4.25	38.17	21.25
Chamberlain	89	4	4.91	1.40	26.45	5.39
Horse Creek	85	1	10.89	0.00	54.45	0.00
Horse Creek	86	2	16.79	5.42	83.95	27.08
Horse Creek	87	2	12.57	9.06	62.85	45.33
Horse Creek	88	2	10.79	1.09	53.95	5.45
Horse Creek	89	2	10.37	1.40	51.85	7.00
Sheep Cr.	86	2	15.72	16.19	78.62	80.93
Sheep Cr.	87	2	15.84	19.11	79.20	95.53
Sheep Cr.	88	2	8.83	10.14	44.15	50.70
Sheep Cr.	89	2	7.13	3.55	35.65	16.76

[a] Densities estimated by snorkel counts.
Source: R. J. Scully, IDFG, unpublished.

Table 5 (SL). Lengths of rainbow-steelhead parr from middle main Salmon River tributaries (French Creek to Middle Fork Salmon River), 1981-83".

Location/Year	No. Fish	Total Length (avg.)	Total Length (range)	Reference
Horse Creek 1981	335	152 mm	90-239 mm	Reingold 1982
Chamberlain Creek 1981	171	196 mm	90-279 mm	Reingold 1982
Sabe Creek 1981	56	163 mm	129-239 mm	Reingold 1982
Bar-gamin Creek 1981	325	167 mm	90-289 mm	Reingold 1982
Bargamin Creek 1982	79	148 mm	110-229 mm	Ball 1983
Sabe and Hamilton Creeks 1982	92	191 mm	120-249 mm	Ball 1983
Five Mile Creek 1982	16	171 mm	130-239 mm	Ball 1983
Warren Creek 1983	54	157 mm	100-270 mm	Ball 1985
Crooked Creek 1983	216	147 mm	90-259 mm	Ball 1985
Lake Creek (trib. to Crooked Creek) 1983	83	165 mm	110-209 mm	Ball 1985
Sheep Creek 1983	70	159 mm	100-259 mm	Ball 1985

[a] Parr were collected by hook and line, July through September.

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SOUTH FORK SALMON RIVER, SALMON SUBBASIN

Summer Chinook (wild and natural)

GEOGRAPHIC LOCATION

As described by Thurow (1987), the South Fork Salmon River (SFSR) flows through the central Idaho Batholith, an area of granitic bedrock characterized by steep slopes and highly erodible soils. From its origin, the SFSR flows north for 160 km through the Salmon River mountains and joins the Salmon River 77 km above Riggins, Idaho (Figure 1). The watershed drains 3,290 km^2. Major tributaries are the East Fork of the South Fork, Johnson Creek and the Secesh River. Mining has significantly altered sections of the East Fork of the South fork. Mass erosion in the South Fork drainage began to occur during the 1950's following soil disturbances from logging and road construction. Major storm events in the 1960's accelerated erosion rates.

ORIGIN

Summer chinook are native to the South Fork drainage and information collected in the 1960's describes the wild, native stock. Since the late 1970's, Idaho Department of Fish and Game (IDFG) has released hatchery summer chinook annually into the SFSR, excluding the Secesh drainage. Therefore, both natural and hatchery production occurs in the SFSR drainage. Naturally produced Snake River summer chinook were listed as "threatened" by the National Marine Fisheries Service in 1992.

South Fork. Mainstem

Broodstock returning to the mainstem SFSR is a mixture of naturally and hatchery produced fish, thus this run is classified as natural. Origin of the hatchery broodstock is discussed in the hatchery summer chinook section. Hatchery fish have been released into the mainstem South Fork since the late 1970's. Operations associated with the McCall Hatchery have likely influenced the naturally spawning population in the mainstem South Fork. A weir, located about 70 miles upstream on the mainstem South Fork, near Warm Lake Creek, has intercepted adult summer chinook since 1980. One-third of the intercepted and untagged adults, randomly selected, are allowed to continue upstream to spawn naturally. The remaining fish are retained as McCall Hatchery broodstock. When a hatchery brood surplus occurs, more fish are passed upstream. Because not all returning hatchery fish are tagged, naturally produced fish cannot be differentiated from the hatchery fish at the weir and unknown proportions have been released upstream to spawn.

Stock identification efforts are continuing to facilitate identification of hatchery and natural spawners for genetic management purposes. Cochnauer and Elam (1990) collected scales from adults returning in 1988 to the South Fork weir. Their preliminary conclusion was that less than 10 percent of the run was of natural origin, but they recommended that more in-depth scale analysis and larger sample size was needed to build a discriminate analysis model. From his research, Sankovich estimated that about 30 percent of the run was of natural origin in 1991 (P. Sankovich, University of Idaho, personal communication).

Johnson Creek

Johnson Creek has also received an infusion of hatchery fish, primarily fry. Waples et al. (199 1) conducted electrophoretic analyses on several Salmon River chinook populations. They found genetic changes between 1981 and 1988 brood year samples from Johnson Creek and significant

changes in allele frequency at four gene loci. However, in comparison with McCall Hatchery samples, there remained substantial differences between the McCall Hatchery and Johnson Creek fish at a number of gene loci. They concluded that although genetic influence from outplanted McCall Hatchery fish could not be ruled out, it appeared that there had not been genetic influence on the native Johnson Creek population through brood year 1988.

Secesh River

The Secesh River summer chinook run is a wild, native run. Welsh and Corley (1968) reported that 112 adult summer chinook were transplanted into Summit Creek, a tributary of the Secesh River, in 1966. The fish were hauled from the adult trap below Hells Canyon Dam into an area of Summit Creek blocked by a barrier, which was subsequently removed. Frequent observations of the transplanted fish revealed only 10 redds and there was no further information regarding evidence of spawning success or any resulting production. One hundred eighty-nine redds were counted in parts of the spawning areas of the Secesh River drainage that year. There has been no juvenile anadromous fish supplementation in the Secesh drainage and natural production has sustained the run.

DISTRIBUTION

Available spawning and rearing habitat for the SFSR drainage was described in the Presence/Absence database (Tables 1 and 2). This information was developed for the Northwest Power Planning Council for subbasin planning and modeling.

PRODUCTION

There is little information describing survival and production factors. In 1986 and 1987, mid-May fry releases of hatchery summer chinook were made into upper Johnson Creek as part of barrier removal evaluation. Density estimates of mid-August parr indicated a fry-to-parr survival of 12.8 percent in 1986 and 13.3 percent in 1987 (Scully et al. 1990). Adults returned from these fry plants and estimates of their progeny's egg-to-parr survival in 1990 and 1991 are being developed (B. Rich, IDFG, personal communication). The preliminary conclusion is that survival was very low; sediment and/or hatchery influence may have been factors.

For 1985-1990, the overall weighted mean for IDFG monitoring transects was 15.9 parr per 100 m^2 and 35.4 percent of estimated carrying capacity (Table 3). Parr densities were estimated by snorkel counts. Parr carrying capacity ratings for summer chinook were derived from the Presence/Absence database used for development of the Salmon Subbasin Plan.

Passive integrated transponder (PIT) tag detection rates at Snake River dams provide a relative measure of minimum survival to the dams. Naturally produced summer chinook in the SFSR drainage have been tagged. Detection rates to Lower Granite Dam ranged from 3.9 to 9.9 percent, 1989-1991 (Table 4). Because fish are detected in collector systems, most of the detected fish are assumed to be transported. Fish were tagged as late summer parr, thus over-winter mortality and in-basin migration mortality factors are represented, as well as losses in Lower Granite Reservoir and through upper Snake River dams. Specific mortality factors have not been fully segregated to determine stock specific influence on detection rates. Giorgi (1991) presented an estimate of survival from tagging to Lower Granite Dam for 1989-1990 by expanding PIT tag detection rates by a Fish Guidance Efficiency (FGE) of 0.53 (Table 5). He estimated survival of fish tagged in the SFSR drainage to Lower Granite Dam ranged from 7.4 to 16.6 percent.

ADULT LIFE HISTORY

Adult Escanement

Chinook crossing Bonneville Dam from June 1 through July 31 are counted as summers as are those crossing Lower Granite Dam from June 18 through August 17. Specific time of migration and escapement for summer chinook returning to the SFSR drainage has not been identified for the ocean, Columbia or Snake rivers. The University of Idaho implemented adult timing research in 1991 which should provide information about Snake River timing (Bjornn et al. 1992).

Howell et al. (1985) reported that adult salmon tagged at Bonneville Dam June 6-July 7, 1966, were later recovered in the SFSR. In 1967, fish tagged at McNary Dam May-July 16 later appeared at the South Fork weir. Ortmann (1968) reported that on average, it took 33 days for fish to travel from Bonneville Dam to the SFSR in 1966, and 26 days to travel from McNary Dam to the SFSR in 1967.

Harvest

Information is not available regarding rate of contribution of naturally produced SFSR summer chinook to harvest in the ocean and Columbia River. Summer chinook are not harvested in the Snake River.

Through the early 1960's, the SFSR provided a popular sport fishing opportunity for summer chinook. Howell et al. (1985) reported a maximum harvest of nearly 4,000 summer chinook in this drainage in 1960, During 1959-1964, harvest in the SFSR drainage accounted for 12-26 percent of the Idaho salmon harvest (Homer and Bjomn 1981). The sport fishery for summer chinook was closed in 1965 because of low escapement and it has not been reopened since.

The South Fork drainage remains a traditional fishing site for tribal fishers. Ortmann (1966a) reported that in 1964 a complete check was obtained on Indian chinook salmon fishing in the "Glory Hole" downstream from the adult weir. Fishing occurred July 14-19, during which time 54 fish were taken. He also reported that little Indian fishing occurred elsewhere within the drainage. In 1987, 1988, and 1990, the Shoshone-Bannock Tribes fished between Goat Creek and the South Fork weir. Harvest was directed towardhatchery fish and was limited to about 100 fish or less (M. Rowe, Shoshone-Bannock Tribes, personal communication; S. Broderick, Shoshone-Bannock Tribes, personal communication).

Spawner Escapement

During 1963-1967, attempts were made to enumerate summer chinook escapement into the South Fork drainage by placing a weir on the mainstem South Fork about 38 miles from the mouth and two miles above the East Fork of the South Fork. However, this weir site is no longer in use. Ortmann (1968) reported that arrival dates ranging July 10-July 29 indicated that fish arrived later on a year of high spring runoff and earlier on a year of low spring runoff. He also reported that peak daily counts occurred during the first two weeks of the run and the entire run was in the South Fork by early September.

Ortmann (1968) reported that during 1964-1967, the SFSR adult escapement ranged from 12 to 19 percent of the summer chinook counted at Ice Harbor Dam. Howell et al. (1985) reported runs in the 1960's ranging 5,600-10,200 summer chinook and included estimates of harvest and spawning escapement for 1960-1964. Ortmann (1968) reported weir counts as high as 3,250 summer chinook

for 1964-1966 (Table 6). Harvest of summer chinook did occur on fish released above the weir in 1964. Currently, the majority of the summer chinook crossing Lower Granite Dam are destined for the South Fork Salmon River, but total spawner escapement to the South Fork drainage is unquantified.

Ortmann and Richards (1964) reported peak spawning in the Stolle Meadows area of the upper South Fork in the last few days of August, while spawning below Stolle Meadows peaked in mid-September.

Howell et al. (1985) reported spawning escapement estimates ranging from 3,924 to 6,259 for the period 1960-1963. Currently, spawning escapement can only be quantified for the upper South Fork Salmon River above the current weir and adult trap and has ranged from 157 to 866 fish for 1981-1991 (Table 7).

Redd and carcass counts have been conducted in index areas of the SFSR drainage since the 1950's by the IDFG. This program has evolved into a single peak count. Timing of the peak counts has been between August 22 and September 22, depending on the transect.

Since the late 1980's, the Nez Perce Tribe has been conducting multiple redd and carcass counts in Johnson and Lake creeks and the Secesh River (Kucera 1987; Kucera and Cowley 1988; Cowley and Kucera 1989). Timing of the counts has been between August 15 and September 11.

Index redd counts conducted by the IDFG are used for trend information, not escapement estimates. "Redd counts . . . while providing our best yearly trend information, introduce considerable positive bias when used to estimate the number of fish in an escapement, and should be recognized as trend indicators only" (Ortmann 1966a, p. 17). More recent information, discussed below, has shown that there can be negative bias as well.

Howell et al. (1985) reported redd counts for 1957-1970. More recent information, 1970-1991, has also been summarized (Table 8). Secesh and Lake Creek index redd counts for 1957-1991 peaked in 1960, and reached a low in 1975. Trend counts for Johnson Creek for 1957-1991 reached a high in 1960 and a low in 1984. Trend counts for the South Fork Salmon River reached a high in 1957 and a low in 1982 (P. Hassemer, IDFG, unpublished).

Ortmann (1968) reported redds per female in the SFSR drainage ranging from 0.7 to 1.6 for 1964-1967. He determined this by comparing a known female escapement above the old South Fork weir with redd counts. He indicated reliability was poor in some years due to timing and the difficulty of multiple redd interpretation. Similar comparisons of known female escapement with redds for the spawning area above the current South Fork weir indicate redd per female ratios of 0.3 to 0.9 (Table 9). Possible reasons for disparity between the 1964-1965 information and more recent information include a tendency for hatchery fish to spawn in large numbers just above the weir (R.J. Scully, IDFG, personal communication), redd superimposition or incomplete redd counts.

Adult Characteristics

Howell et al. (1985) reported summer chinook carcass age composition for return years 1960-1967 and concluded that this is principally a four-year-old spawning race. Using the same carcass information, age composition of summer chinook returning to the SFSR, Johnson Creek and the Secesh River is reported for brood years 1957-1962 (Table 10-12). The four-year-old class predominated most brood year returns and there was also a large proportion of three-year-old males (jacks). Assignment of ocean age was based on length frequency criteria and does not directly

represent known-age techniques, although length criteria were based on scale analyses completed in the early 1960's. However, incorrect assignment of ocean age will affect brood year analyses. Determination of ocean age composition using carcass information also introduces bias. Ortmann (1966b) reported a close correlation of age composition between weir and carcass- information except that jacks were less likely to be found on the spawning grounds.

Age composition information for return year was summarized from the 1960's weir information and from scale analyses of carcasses collected in 1961-1962 (Table 13). A two-ocean component is not as prevalent as illustrated by the brood year information in the previous table. However, return year information reflects weak or strong age class survival and not necessarily stock age composition.

Age composition for brood years 1982-1985 illustrates that predominance of the three-year-old and four-year-old age classes does not appear as strong as carcass information from the 1960's suggested (Tables 14-16).

Howell et al. (1985) reported that sex ratios lean heavily toward males due to the presence of jacks in the South Fork summer chinook population. Ortmann (1966a; 1966b) reported sex ratios by return year for the South Fork summer chinook run as 60 percent male and 40 percent female in 1964, for fish sexed at the weir. This observation correlated with a sample of fish harvested above the weir which was 59 percent male and 41 percent female. For the 1964-1967 returns, sex ratios were similar, except in 1965 (Table 6).

Sex composition information for return year was summarized from the 1960's weir information and from scale analyses of carcasses collected in the 1960's. This information indicates an overall predominance of males in the run, however, in the five-year-old age class, females dominated the return (Table 17).

The percent females by age class of carcasses surveyed during index redd counts in the South Fork, Johnson Creek, and the Secesh River was summarized for brood years 1957-1962 (Tables 18-20). As shown in the age composition tables, the two-ocean age class was the strongest. Richards (1961) noted differential post spawning die-off rates between the sexes with a trend of dead females being more numerous during later carcass surveys, thus use of carcass information to determine sex composition appears biased toward females. However, except for limited weir information, this is the only information available describing naturally spawning runs. Although variable, the female component of a brood return in the 1960's was generally 30-40 percent. More recent information describing the female proportion of the runs returning to the South Fork Salmon and Secesh rivers shows the female proportion has ranged up to 84 percent of the run (Tables 2 1 and 22).

The only wild stock fecundity information is from the 1960's, when native South Fork summer chinook returning to Stolle Meadows were collected and spawned for the Cleat-water drainage reintroduction program. Average fecundity ranged from 3,716 to 4,316, 1962-1964 (Table 23).

JUVENILE LIFE HISTORY

Matthews et al. (1990) reported lengths and weights for late summer parr collected in 1988 in the South Fork drainage (Table 24).

Life history timing is generally similar to Figure 2. Although not illustrated in the figure, there is typically a fall emigration of chinook presmolts from tributaries to lower in the South Fork drainage or the mainstem Sahnon River for winter rearing.

Ortmann (1968) reported that fry emerge from the gravel in April and May. Matthews et al. (1990) reported smolt migration timing in 1989 based on recovery of PIT tagged fish at Lower Snake River dams. In their study, timing of outmigration for individual stream populations passing Lower Granite Dam was reported for three day intervals from April 1 through July 22 as a proportion of the total recoveries at the dams. They reported recoveries of fish from the South Fork Salmon River at Lower Granite Dam from April 16 through June 20, 1989. Smolts migrating from the Secesh River and Lake Creek were detected at Lower Granite Dam from April 19 through July 19, 1989. During the 1989 outmigration, they found that naturally produced summer chinook tended to be in abundance at Lower Granite Dam much earlier than their spring chinook salmon counterparts. They reported that higher numbers of recoveries appeared to coincide with higher flows in the Snake River. Matthews et al. (1990) theorized that the early abundance of wild summer chinook at Lower Granite Dam suggested that these fish may have a propensity to migrate farther downstream in larger numbers as fall presmolts, than do the spring chinook. However, they also pointed out that migrational dynamics and survival rates would vary considerably under different environmental conditions such as low tributary streamflow.

BIOCHEMICAL/GENETIC CHARACTERISTICS

Allele frequency data is reported for summer chinook collected in the Secesh River (Appendix Table 1). Hlectrophoretic data is reported for summer chinook collected from Johnson Creek as cited from Waples et al. (Appendix Table 2). Schreck et al. summarized isozyme gene frequencies for Johnson Creek summer chinook (Appendix Table 3.)

DISEASES

Information has not been compiled.

REFERENCES

All South Fork references appear at the end of the hatchery produced summer steelhead section.

Figure 1. Anadromous sahnonid distribution in the west half of the Salmon River subbasin as represented by spring chinook, based on the NPPC presence/absence data base and the BPA Geographic Information System.

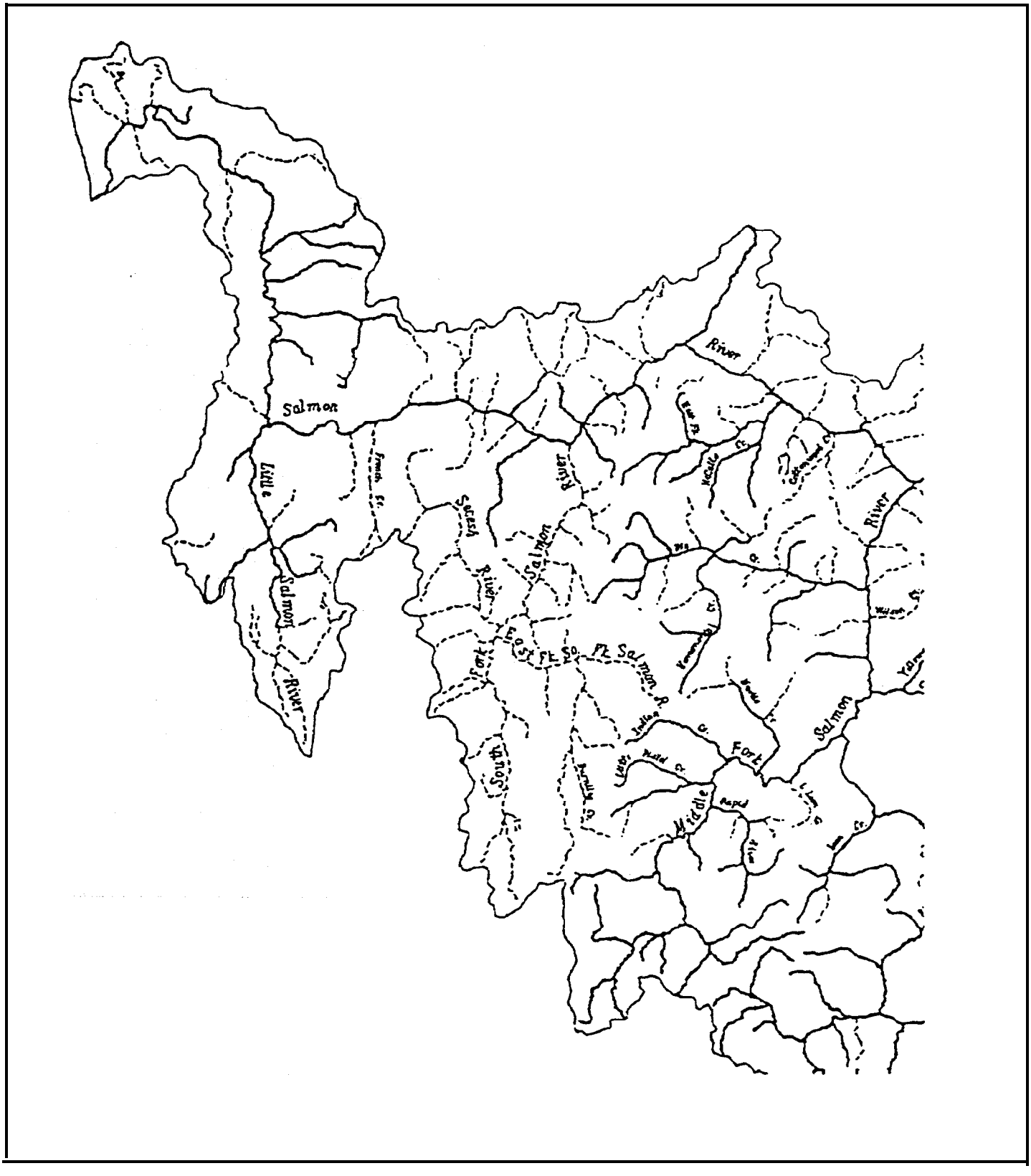
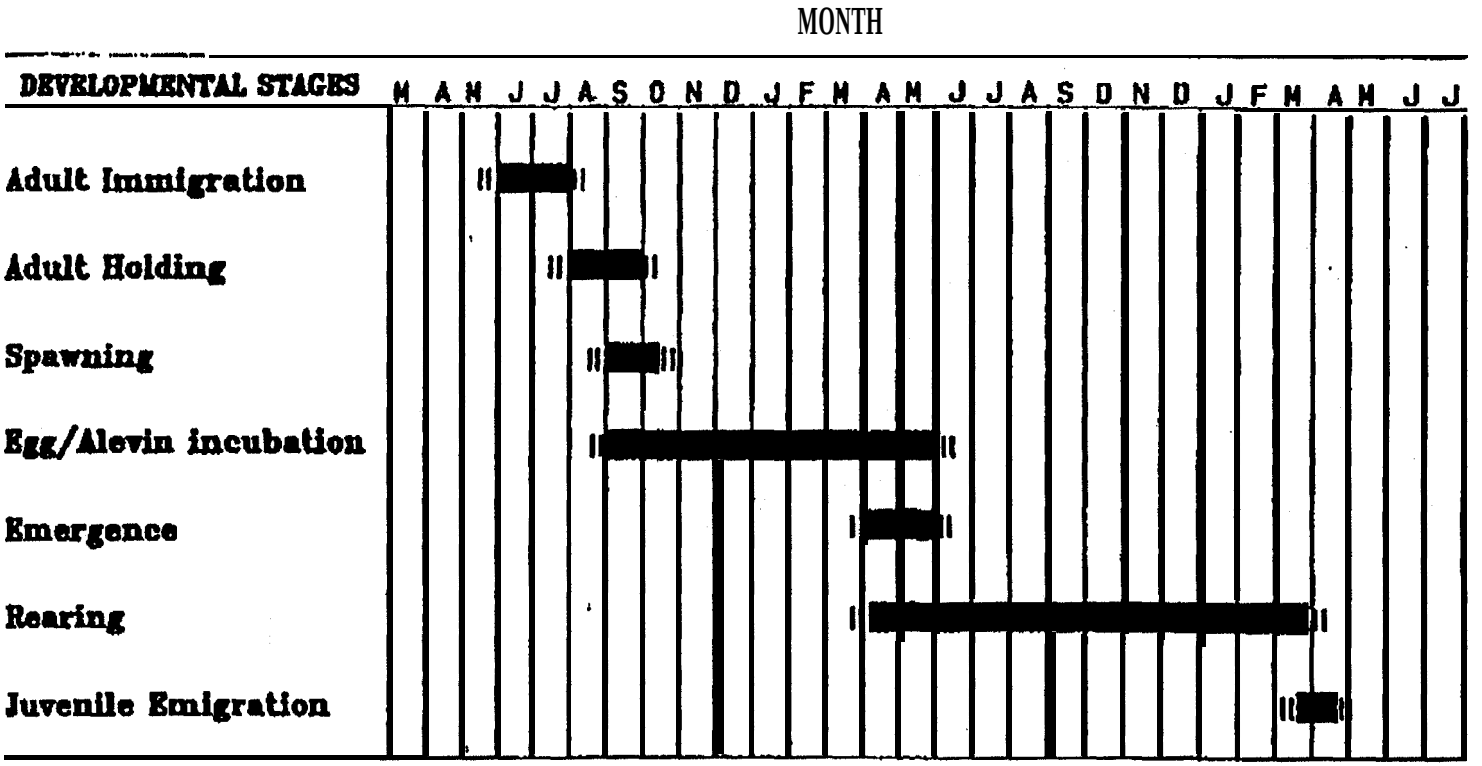


Figure 2 (TT). Freshwater life history for natural/wild summer chinook salmon in the Salmon River subbasin.



Notes:

1. the developmental stage timing represents basin-wide averages, local conditions may cause some variability.
2. Solid bars indicate periods of heaviest adult immigration, spawning and juvenile emigration.

Table 1 (HB-1). Estimated amount of spawning and rearing habitat (Use Type 1) by quality of South Fork Salmon River summer chinook production area.

	Excellent	Good	Fair[a]	Poor[a]	Unknown	Total	Confidence[b]
Miles (%)	6	38		8			
Acres (%)	3	27	48 44	26		1442.0 429.6	M M

[a] Ratings of fair and poor habitat quality may reflect natural physical features such as gradient and channel type, as well as degradation caused by humans.
[b] 'Confidence' is meant to indicate the reproducibility and accuracy of the estimates made, and will be rated as high, medium or low by the respective agencies.

Source: Presence/Absence database, Northwest Power Planning Council, 1991.

Table 2 (I-B-2). Estimated amount of rearing only habitat (Use Type 2) by quality of South Fork Salmon River summer chinook production area.

	Excellent	Good	Fair[a]	Poor[a]	Unknown	Total	Confidence[b]
Miles (%)	0	0	0	100		5.6	M
Acres (%	0	0	0	100		81.4	M

[a] Ratings of fair and poor habitat quality may reflect natural physical features such as gradient and channel type, as well as degradation caused by humans.
[b] 'Confidence' is meant to indicate the reproducibility and accuracy of the estimates made, and will be rated as high, medium or low by the respective agencies.

Source: Presence/Absence database, Northwest Power Planning Council, 199 1.

Table 3 (PD-a). Natural chinook parr densities as fish per $100m^2$ (CHINOD) and percent of rated carrying capacity (CHPERCC), South Fork Salmon River drainage, excluding the Secesh drainage, 1985 - 1990.

	Year					
Measurement	1985	1986	1987	1988	1989	1990
CHINOD=	41.22	12.29	19.56	6.26	11.95	4.41
CHPERCC=	93.68	26.02	44.31	12.88	25.88	9.81
N =	2	14	14	13	15	13

Source: R. J. Scully, IDFG, unpublished.

Table 4 (PT-a). Number of fish released and detection rates at Snake River dams for wild and natural summer chinook PIT tagged in the South Fork Salmon River drainage, 1989-91.

Recovery Year	Number PIT tagged and released[a]	Percent Detected @ Lower Granite Dam	Percent Detected @ all 3 dams[b]
		Secesh River	
1991	1,016	7.0	9.5
1990	2,359	6.6	10.2
1989	2,178	8.8	14.6
		Lake Creek	
1989	664	7.7	12.2
		South Fork Salmon River	
1991	986	9.9	14.4
1989	2,184	3.9	6.2

[a] Fish are tagged as parr, generally during the previous August.
[b] Lower Granite, Little Goose, McNary

Sources: Matthews et al. 1990.
S. Achord, NMFS, unpublished.

Table 5 (PT-b). PIT tag recoveries and estimated minimum survival to that site for summer chinook originating in the South Fork Salmon River drainage, 1989 - 1990[a]. This does not include PIT tag recoveries or survival estimates for fish passing Little Goose or McNary.

Recovery year	Number PIT tagged and released[b]	Percent detected at Lower Granite Dam	Percent estimated survival
		Secesh River	
1990	2,359	6.6	12.5
1989	2,178	8.8	16.6
		Lake Creek	
1989	664	7.7	14.5
		South Fork Salmon River	
1989	2,184	3.9	7.4

[a] No spill occurred at Lower Granite Dam, 1989-1990, and PIT tag detection rates were expanded by FGE = 0.53 to estimate survival from instream tagging to dam detection.
[b] Fish are trapped as parr, generally during the previous August.

Source: Giorgi 1991.

Table 6 (RN-a). Weir counts, sex composition, and approximate dates of arrival for wild summer chinook salmon returning to the South Fork Salmon River, 1964 - 1967.

Year	Weir count[a]	Percent males	Percent females	Date of first count
		60	40	
1964	2,895	78	22	July 10
1965	1,972	62		July 19
1966	3,250	59	38	July 29
1967	2,859		41	July 13

[a] Entire weir count was not always sexed.

Source: Ortmann 1968.

Table 7 (RN-b). Number of summer chinook adults released upstream of the South Fork Salmon River weir to spawn naturally, 1981-90. Fish are a combination of hatchery and naturally produced summer chinook.

Year	Total	Jacks	Adult Males	Adult Females
1981	227	72	99	155[a]
1982	157	13	119	45
1983	216	39		55
1984	337	165	174	124
1985	651	97	168	318
1986	566	110	257	212
1987	866	14	433	323
1988	850[b]	89	385	451
1989	237		77	71
1990	315	2	197	116
1991	288	171	44	73

[a] Unknown combination of adult males and females.
[b] Two jacks, 38 adults males, and 43 adult females hauled upstream to Stolle Meadows.

Sources: Hutchinson 1982, 1983, 1984, 1985.
Frew 1986, 1988, 1989.
McPherson 1990, 1991.
D. E. McPherson, IDFG, unpublished.

Table 8 (RN-c). Single and multiple South Fork Salmon River drainage summer index chinook redd counts, 1970-1991[a].

Year	Secesh R./Lake Cr. Single	Secesh R./Lake Cr. Multiple	Johnson Cr. Single	Johnson Cr. Multiple	South Fork Salmon R[b] Single	Total Single	Five year average single count
1970	63		130		527	720	
1971	80		183		421	684	
1972	87		220		577	884	
1973	62		271		586	919	
1974	21		107		218	346	711
1975	10		69		238	317	
1976	17		68		241	326	
1977	27		81		226	334	
1978	91		113		251	455	
1979	20		36		115	171	321
1980	20		24		116	160	
1981	53		45		126	224	
1982	65		37		111	213	
1983	98		63		185	346	
1984	c		17		165	182	225
1985	c		75		323	398	
1986	115		53		289	457	
1987	121	113	72	59	752	945	
1988	155	139	137	135	718	1,010	
1989	78	103	42	52	217	337	629
1990	55	NA[d]	56	NA[d]	386	497	
1991	112	NA[c]	64	NA	393	112	

[a] Single and multiple counts are not comparable to each other because of differing methodoloy and transects. Counts were conducted by both the Idaho Department of Fish and Game and the Nez Perce Tribe.
[b] Reduced by trapping at weir since 1980.
[c] Count not comparable to other years because of variable transect lengths.
[d] Count not available.

Sources: Cowley and Kucera 1989.
P. Hassemer, IDFG, unpublished.

Table 9 (RN-d). Number of redds counted in Idaho Department of Fish and Game index transects and number of summer chinook females released upstream of the South Fork weir to spawn.

Return Year	Number of Redds	Number of Females	Redds/ Female
1964	1,124	710	1.6
1965	656	446	1.5
1966	980	1,247	0.8[b]
1967	902	1,263	0.7[b]
1982	17	45	0.4
1983	15	55	0.3
1984	49	124	0.4
1985	111	318	0.3
1986	95	212	0.4
1987	216	323	0.7
1988	149	451	0.3
1989	43	71	0.6
1990	92	116	0.8
1991	56	73	0.8

[a] In 1964-67, wild fish were released above a weir located about 38 miles upstream of the mouth of the South Fork. In 1982-91, a mixture of hatchery and naturally produced summer chinook were released above a weir located about 70 miles upstream of the mouth. Redds were counted from the respective weir upstream to the mouth of Rice Creek, including Stolle Meadows.
[b] Redd count reliability rated as poor.

Sources: Ortmann 1968.
Pollard 1983, 1984, 1985.
Hall-Griswold and Cochnauer 1986, 1988a, 1988b.
White and Cochnauer 1989.
D. E. McPherson, IDFG, unpublished.
P. Hassemer, IDFG, unpublished.

Table 10 (AC-l). Age composition percentage (freshwater.ocean) by brood year[a] for wild summer chinook salmon returning to the South Fork Salmon River, including Stolle Meadows.

Age Composition (%)

Brood Year	N	2.1	2.2	2.3
1957	264	15	60	25
1958	763	31	62	7
1959	250	42	48	10
1960	263	32	54	14
1961	165	23	70	7
1962	413	43	41	16

[a] Carcass counts during IDFG index redd count surveys were the sample method. Total age was based on 2 year freshwater rearing. Ocean age was delineated by fork length criteria as follows:

1960-1962: l-ocean = <24 in.
2-ocean = 24-32 in.
3-ocean = >32 in.

1963-1967: l-ocean = <25 in.
2-ocean = 25 - 33 in.
3-ocean = ≥34 in.

In this nomenclature, the freshwater and ocean ages sum to the total age of the fish.

Sources: Bjomn et al. 1964.
Ortmann and Richards 1965.
Platts et al. 1966.
Welsh et al. 1966.
Corley and Welsh 1968.
Welsh and Corley 1968.
T. Elms-Co&rum, IDFG, unpublished.

Table 11 (AC-2). Age composition percentage (freshwater.ocean) by brood year[a] for wild summer chinook salmon returning to Johnson Creek, a tributary to the South Fork Salmon River.

Age Composition (%)

Brood Year	N	2.1	2.2	2.3
1957	118	23	50	27
1958	362	23	66	11
1959	250	34	54	12
1960	251	31	69	0
1961	89	39	53	8
1962	233	24	26	50

[a] Carcass counts during IDFG index redd count surveys were the sample method. Total age is based on 2 year freshwater rearing. Ocean age delineated by fork length criteria as follows:

1960-1962: 1-ocean = <24 in.
2-ocean = 24-32 in.
3-ocean = >32 in.

1963-1967: 1-ocean = <25 in.
2-ocean = 25 - 33 in.
3-ocean = ≥34 in.

In this nomenclature, the freshwater and ocean ages sum to the total age of the fish.

Sources: Bjornn et al. 1964.
Ortmann and Richards 1965.
Platts et al. 1966.
Welsh et al. 1966.
Corley and Welsh 1968.
Welsh and Corley 1968.
T. J. Elms-Cockrum, IDFG, unpublished.

Table 12 (AC-3). Age composition percentage (freshwater.ocean) by brood year[a] for wild summer chinook salmon returning to the Secesh River and Lake Creek in the Secesh drainage, a tributary to the South Fork Salmon River.

Age Composition (%)

Brood Year	N	2.1	2.2	2.3
1957	42	26	67	7
1958	108	47	53	0
1959	43	56	39	5
1960	56	27	73	0
1961	22	27	9	64
1962	118	8	59	33

[a] Carcass counts during IDFG index redd count surveys were the sample method. Total age is based on 2 year freshwater rearing. Ocean age delineated by fork length criteria as follows:

1960-1962: 1-ocean = <24 in.
2-ocean = 24-32 in.
3-ocean = >32 in.

1963-1967: 1-ocean = <25 in.
2-ocean = 25 - 33 in.
3-ocean = ≥34 in.

In this nomenclature, the freshwater and ocean ages sum to the total age of the fish.

Sources: Bjornn et al. 1964.
Ortmann and Richards 1965.
Platts et al. 1966.
Welsh et al. 1966.
Corley and Welsh 1968.
Welsh and Corley 1968.
T. J. Elms-Co&urn, IDFG, unpublished.

Table 13 (AC-a). Age composition percentage by return year for wild summer chinook returning to the South Fork Salmon River.

Return Year	Ocean Age Method	N	Age Comuosition (%) 2.1	2.2	2.3
1961	scale”	152	43	27	30
1962	scale[b]	211	11	73	17
1964	length’	2,880	21	64	15
1965	length[d]	1,296	58	27	16
1966	length’	3,106	31	62	7
1967	length’	2,859[e]	28	50	22

[a] Ocean age determined by scale analyses of 20% of carcasses surveyed during redd counts. Fork length by ocean age were as follows:
1961: l-ocean = 16-28 in.
2-ocean = 21-33 in.
3-ocean = 22-38 in.

[b]Ocean age determined by scale analyses of 20% of carcasses surveyed during redd counts. Fork lengths by ocean age were as follows:
1962: l-ocean = 17-26 in.
2-ocean = 18-38 in.
3-ocean = 27-41 in.

“Length criteria used to determine ocean age were not reported. Fish were counted and measured as they were released from a trap placed in a weir across from the South Fork Salmon River.

[d]Ocean age delineated by fork length criteria as follows:
1965: l-ocean = <24 in.
2-ocean = 24-33 in.
3-ocean = >33 in.
Fish were counted and measured as they were released from a trap placed in a weir across the South Fork Salmon River.

[e]Actual number of fish counted at the weir. It is unknown whether all fish or a subsample were measured to determine age composition.

Sources: Ortmann and Richards 1964.
Ortmann and Richards 1965.
Ortmann 1966[a], 1966[b]
Ortmann 1968.

Table 14 (AC-b). Age composition percentage (freshwater.ocean) by brood year[a] for summer chinook salmon returning to the South Fork Salmon River. In this nomenclature, the freshwater and ocean ages sum to the total age of the fish.

		Age Comnosition (%)		
Brood Year	N	2.1	2.2	2.3
	64			
1982	396	17	25	58
1983		2	19	79
1984	61	7	47	46
1985	49	14	49	37

[a]Carcass counts during IDFG index redd count surveys was the sample method. Total age based on 2 year freshwater rearing and ocean age delineated by fork length criteria as follows:

1985: l-ocean = $\leq$ 21 in.
2-ocean = 22 - 32 in.
3-ocean = $\geq$ 33 in.

1986-89: l-ocean = $\leq$ 24 in.
2-ocean = 25 - 31 in.
3-ocean = $\geq$ 32 in.

Sources: Hall-Griswold and Cochnauer 1986, 1988a, 1988b.
White and Cochnauer 1989.
P. Hassemer, IDFG, unpublished.
T. J. Elms-Co&rum, IDFG, unpublished.

Table 15 (AC-c), Age composition percentage (freshwater.ocean) by brood yea.? for summer chinook salmon returning to Johnson Creek, a tributary to the South Fork Salmon River as collected by the Idaho Department of Fish and Game and the Nez Perce Tribe[a].

		Age Comnosition (%)		
Brood Year	N[b]	2.1	2.2	2.3
Idaho Department of Fish and Game carcass information				
1984	33	NA[c]	27	70
1985	19	21	58	21
Nez Perce Tribe carcass information				
1984	35	3	46	51
1985	17	23	54	23

'Carcass counts during index redd count suveys was sample method. Total age based on 2 year freshwater rearing and ocean age delineated by fork length criteria as follows:

1986-89: l-ocean = $\leq$ 24 in.
2-ocean = 25 - 31 in.
3-ocean = $\geq$ 32 in.

In this nomenclature, the freshwater and ocean ages sum to the total age of the fish.

[b] N = as reported by agency. However, both are a combination of IDFG and Nez Perce carcass counts as many of the transects surveyed overlap.
[c] NA = not available.

Sources: Hall-Griswold and Cochnauer 1986, 1988a, 1988b.
Kucera 1987.
Kucera and Cowley 1988.
Cowley and Kucera 1989.
White and Cochnauer 1989.
P. Hassemer, IDFG, unpublished.
T. J. Elms-Co&rum, IDFG, unpublished.

Table 16 (AC-d). Age composition percentage (freshwater.ocean) by brood year" for summer chinook salmon returning to the Secesh River and Lake Creek, tributaries to the South Fork Salmon River as collected by the Idaho Department of Fish and Game and the Nez Perce Tribe[b].

		Age Comnosition (%)		
Brood Year	N[b]	2.1	2.2	2.3
Idaho Department of Fish and Game carcass information				
	45		36	64
1983	139	0	31	68
1984	56	4	34	62
1985	82	6	74	NA[c]
Nez Perce Tribe carcass information				
1984	61	39	57	
1985	63	16	59	3:

[a]Carcass counts during index redd count suveys was sample method. Total age based on 2 year freshwater rearing and ocean age delineated by fork length criteria as follows:

1985: l-ocean = ≤ 21 in.
'L-ocean = 22 - 32 in.
3-ocean = ≥ 33 in.

1986-89: l-ocean = ≤ 24 in.
2-ocean = 25 - 31 in,
3-ocean = ≥ 32 in.

In this nomenclature, the freshwater and ocean ages sum to the total age of the fish.

[b] N = as reported by agency. However, both are a combination of IDFG and Nez Perce carcass counts as many of the transects surveyed overlap.
[c] NA = not available.

Sources: Hall-Griswold and Cochnauer 1986, 1988a, 1988b.
Kucera 1987.
Kucera and Cowley 1988.
Cowley and Kucera 1989.
White and Cochnauer 1989.
P. Hassemer, IDFG, unpublished.
T. J. Elms-Cockrum, IDFG, unpublished.

Table 17 (AC-e). Sex and age composition percentage by return year for wild summer chinook returning to the South Fork Salmon River.

Return Year	Ocean Age Method	N	Age Composition (%) 2.1 Male	2.1 Female	2.2 Male	2.2 Female	2.3 Male	2.3 Female
1961	scale[a]	152	43	0	17	10	1	29
1962	scale[b]	211	11	0	36	37	4	12
1964	length'	1,296	58	0	16	10	4	12
1965	length[d]	2,880	21	0	34	30	5	10
1966	length[c]	3,106	31	0	29	33	2	5

[a] Ocean age determined by scale analyses of 20% of carcasses surveyed during redd counts. Fork length by ocean age were as follows:

1961: l-ocean = 16-18 in.
2-ocean = 21-34 in.
3-ocean = 30-38 in.

[b] Ocean age determined by scale analyses of 20% of carcasses surveyed during redd counts. Fork lengths by ocean age were as follows:

1962: l-ocean = 15-10 in.
2-ocean = 17-22 in.
3-ocean = 2841 in.

[c] Length criteria used to determine ocean age were not reported. Fish were counted and measured as they were released from a trap placed in a weir across from the South Fork Salmon River.

[d] Ocean age delineated by fork length criteria as follows:

1965: l-ocean = <24 in.
2-ocean = 24-33 in.
3-ocean = >33 in.

Fish were counted and measured as they were released from a trap placed in a weir across the South Fork Salmon River.

Sources: Ortmann and Richards 1964.
Ortmann and Richards 1965.
Ortmann 1966a, 1966b, 1967.

Table 18 (AS-l). Percent females by brood year and age class[a] (freshwater.ocean) for wild summer chinook salmon returning to the South Fork of the Salmon River, including Stolle Meadows.

Females (%)

Brood Year	N	2.1	2.2	2.3	Total % Female
1957	262	<1	27	18	45
1958	760	0	40	6	46
1959	252	0	21	6	27
1960	263	0	29	11	40
1961	170	<1	32	6	38
1962	416	0	19	14	33

[a] Carcass counts during index IDFG redd count suveys was sample method. Total age based on 2 year freshwater rearing and ocean age delineated by fork length criteria as follows:

1960-1962: 1-ocean = <24 in. (males)
2-ocean = 24-32 in.
3-ocean = > 32 in.

1963-1967: 1-ocean = <25 in.
2-ocean = 25 - 33 in.
3-ocean = ≥34 in.

In this nomenclature, the freshwater and ocean ages sum to the total age of the fish. N is equal to the known males and female components of the brood.

Sources: Bjomn et al. 1964.
Ortmann and Richards 1965.
Platts et al. 1966.
Welsh et al. 1966.
Corley and Welsh 1968.
Welsh and Corley 1968.
T. J. Elms-Cockrum, IDFG, unpublished.

Table 19 (AS-2). Percent females by brood year and age class[a] (freshwater.ocean) for wild summer chinook salmon returning to Johnson Creek, a tributary to the South Fork Salmon River.

Females (%)

Brood Year	N	2.1	2.2	2.3	Total % Female
1957	118	0	17	24	41
1958	362	0	30	10	40
1959	251	0	25	10	35
1960	268	0	25	6	31
1961	73	0	11	8	19
1962	234	0	10	44	54

[a] Carcass counts during index IDFG redd count suveys was sample method. Total age based on 2 year freshwater rearing and ocean age delineated by fork length criteria as follows:

1960-1962: l-ocean = < 24 in. (males)
2-ocean = 24-32 in.
3-ocean = > 32 in.

1963-1967: 1-ocean = < 25 in.
2-ocean = 25 - 33 in.
3-ocean = ≥ 34 ill.

In this nomenclature, the freshwater and ocean ages sum to the total age of the fish. N is equal to the known males and female components of the brood.

Sources: Bjornn et al. 1964.
Ortmann and Richards 1965.
Platts et al. 1966.
Welsh et al. 1966.
Corley and Welsh 1968.
Welsh and Corley 1968.
T. J. Elms-Co&rum, IDFG, unpublished.

Table 20 (AS-3). Percent females by brood year and age class[a] (freshwater-ocean) for wild summer chinook salmon returning to the Secesh River and Lake Creek in the Secesh drainage, a tributary to the South Fork Salmon River.

Females (%)

Brood Year	N	2.1	2.2	2.3	Total % Female
1957	46	0	24	11	35
1958	117	<1	24	8	32
1959	48	0	23	10	33
1960	57	0	33	2	35
1961	23	0	4	22	26
1962	116	0	33	28	61

[a] Carcass counts during index IDFG redd count suveys was sample method. Total age based on 2 year freshwater rearing and ocean age delineated by fork length criteria as follows:

1960-1962: 1-ocean = <24 in. (males)
2-ocean = 24-32 in.
3-ocean = >32 in.

1963-1967: 1-ocean = <25 in.
2-ocean = 25 - 33 in.
3-ocean = ≥34 ill.

In this nomenclature, the freshwater and ocean ages sum to the total age of the fish. N is equal to the known males and female components of the brood.

Sources: Bjornn et al. 1964.
Ortmarm and Richards 1965.
Platts et al. 1966.
Welsh et al. 1966.
Corley and Welsh 1968.
Welsh and Corley 1968.
T. J. Elms-Co&rum, IDFG, unpublished.

Table 21 (AS-a). Percent females by brood year and age class[a] (freshwater.ocean) as a percentage of the sexed brood return (N) of summer chinook to the South Fork Salmon River.

		Age Composition (%)			
Brood Year	N	2.1	2.2	2.3	Total % Female
1982	64	0	11	33	44
1983	396	0	5	47	52
1984	61	0		16	39
1985	49	2	10	22	34

[a] Carcass counts during IDFG index redd count surveys was sample method. Total age based on 2 year freshwater rearing and ocean age delineated by fork length criteria as follows:

1985:
l-ocean = $\leq$ 21 in.
2-ocean = 22 - 32 in.
3-ocean = $\geq$ 33 in.

1986-89:
l-ocean = $\leq$ 24 in.
2-ocean = 25 - 31 in.
3-ocean = $\geq$ 32 in.

Sources:
Hall-Griswold and Cochnauer 1986, 1988a, 1988b.
White and Cochnauer 1989.
P. Hassemer, IDFG, unpublished.
T. J. Elms-Cockrum, IDFG, unpublished.

Table 22 (AS-b). Percent females by brood year and age class[a] (freshwater.ocean) as a percentage of the sexed brood return (N) of summer chinook to the Secesh River and Lake Creek, tributaries to the South Fork Salmon River.

Brood Year	N[b]	Age Composition (%) 2.1	2.2	2.3	Total % Female
	Idaho Department of Fish and Game carcass information				
1982	45	0	22	62	84
1983	139	2	27	45	72
1984	53	0	13	32	47
1985	82		46	13	NA[c]
	Nez Perce Tribe carcass information				
	65	0	14		
1984	58	0	33	31	45
1985				19	52

'Carcass counts during index redd count suveys was sample method. Total age based on 2 year freshwater rearing and ocean age delineated by fork length criteria as follows:

1985: l-ocean = $\leq$ 21 in.
2-ocean = 22 - 32 in.
3-ocean = $\geq$ 33 in.

1986-89: l-ocean = $\leq$ 24 in.
2-ocean = 25 - 31 in.
3-ocean = $\geq$ 32 in.

In this nomenclature, the freshwater and ocean ages sum to the total age of the fish.

[b] N = as reported by agency. However, both are a combination of IDFG and Nez Perce carcass counts as many of the transects surveyed overlap.
[c] NA = not available.

Sources: Hall-Griswold and Cochnauer 1986, 1988a, 1988b.
Kucera 1987.
Kucera and Cowley 1988.
Cowley and Kucera 1989.
White and Cochnauer 1989.
P. Hassemer, IDFG, unpublished.

Table 23 (AF-a). Fecundity and percent eye-up of eggs for wild summer chinook trapped and spawned at Stolle Meadows, South Fork Salmon River, 1962-64.

Year	Number of females	Number of green eggs	Eggs per female	Percent eye-up
1962	45	167,202	3,716	91.0
(subsamples)	10	36,540	3,654	95.6
	12	41,934	3,495	94.3
	10	38,346	3,835	86.1
	13	50,382	3,876	88.0
1963	18	70,620	3,923	91.4
1964	35	151,054	4,316	85.4

Sources: Welsh 1964a, 1964b.
Bell 1965.

Table 24 (PT.-a). Summary of numbers of fish PIT tagged and released, and average lengths and weights of wild and natural summer chinook parr in the South Fork drainage, 1988.

Tagging location	Number PIT taggged and released	Average length of tagged fish (mm)	Average weight of tagged fish (g)
Secesh River	2,178	69	4.1
Lake Creek	664	66	3.6
South Fork	2,184	63	3.4

Source: Matthews et al. 1990.

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SOUTH FORK SALMON RIVER, SALMON SUBBASIN

Hatchery Produced Summer Chinook

GEOGRAPHIC LOCATION

The SFSR enters the mainstem Salmon at river mile 133. A weir and adult trap on the mainstem South Fork is located near Warm Lake Creek, about 70 miles upstream from the mouth of the SFSR. Spawning occurs on-site and eggs are transported to McCall Hatchery. McCall Hatchery is located within the city limits of McCall, Idaho on the North Fork Payette River. This facility was completed in 1980 as part of the Lower Snake River Compensation Program, which provides mitigation for the four federal lower Snake River dams. McCall Hatchery was built by the Corps of Engineers and the program is funded through the U.S. Fish and Wildlife Service by Bonneville Power Administration. The facility is operated by Idaho Department of Fish and Game (IDFG).Hatchery water is collected from two inlets in Payette Lake, at the surface and at 50 feet, so that managers can regulate water temperature and quality (Idaho Department of Fish and Game et al. 1990).

ORIGIN

In 1974, summer chinook were selected from the fish ladder trap at Little Goose Dam and transported to Rapid River Hatchery for holding and spawning. This selection and collection system was used for the next four years. The adult fish were held at Rapid River Hatchery or Dworshak National Fish Hatchery. Summer chinook adults were collected at Lower Granite Dam in 1979 and 1980. During the period 1976-1980, smolts from Snake River summer chinook parentage were released in the South Fork Salmon River, upstream of the adult trapping facility which was being constructed. The South Fork adult trap was operable in time to intercept the 1980 return of summer chinook. All summer chinook adult were diverted and about half of them were retained for broodstock. These returns were a mixture of the progeny from adult Snake River fish taken at Little Goose and Lower Granite, and the native run that already existed. Since 1981, only fish returning to the SFSR adult trap have been used for McCall Hatchery broodstock.

DISTRIBUTION

Number of smolts released into the South Fork has ranged from 122,247 to 1,060,400, brood years 1982-1989 (Table 1). Howell et al. (1985) reported releases for brood years 1978-1982. Knox Bridge, located about 1 mile upstream of the adult trap, is the primary smolt release site. Coded wire tag (CWT) codes are identified for brood years 1986-1989. CWT fish are marked with an adipose fin-clip. Other marks or tag releases have not been compiled.

PRODUCTION

McCall Hatchery was designed to produce one million smolts at 16 smolts per pound for a total poundage of 61,300. Target rearing size has been 15-20 smolts to the pound. The 1984 brood year production was the first to reach the designed capacity of the hatchery (Howell et al. 1985). Timing of hatchery rearing is shown in Figure 1.

Egg

Incubation times are dependent upon temperature units. Howell et al. (1985) reported eye-up ranging from 67 to 92 percent for brood years 1980-1984. For this period, egg eye-up averaged 78

percent. For brood years 1985-1991, eye-up ranged from 74.8 to 90.4 percent and averaged 83.3 percent (Frew 1988, 1989; McPherson 1990, 1991; D.E. McPherson, IDFG, unpublished).

Frv-fingerling

Eyed egg to swim-up fry survival for brood years 1984-1988 ranged from 96.0 to 98.7 percent (Table 2). Survival of swim-up fry to ponding at about 250-350 fish per pound ranged from 93.6 to 97.3 percent. However, not all reported survival estimates have accounted for intermediate life stage releases such as fry or fmgerlings. Howell et al. (1985) reported that green egg-to-smolt release survival was 38 percent and 42 percent for brood years 1981 and 1982, respectively. Survival of green egg-to-release for brood year 1988 fish was 75 percent, including eyed eggs shipped off-station, and released fry, presmolts, and smolts (McPherson 1991). Average survival from green egg-to-smolt release, without adjustments for egg, fry, and presmolt releases, was 45.3 percent for brood years 1984-88.

Smolt

In-basin smolt survival has not been quantified. However, passive integrated transponder (PIT) tag detection rates provide a relative measure of minimum survival to the dams. Cannamela et al. (1991) cited 35.0-37.9 percent as minimum survival estimates for four PIT tag groups released to evaluate migration timing and survival to Lower Granite dam. These estimates were based on interrogations at Lower Granite, Little Goose, and McNary dams. Matthews et al. (1990) also reported detection rates for McCall Hatchery fish in the 1989 outmigration. Of 2,980 PIT tagged smolts released in the South Fork, 17.8 percent were detected at Lower Granite Dam and 29.1 percent were detected at all three dams. Giorgi (1991) estimated survival to Lower Granite Dam by applying a Fish Guidance Efficiency (FGE) of 0.53 to the Lower Granite Dam detection rate. This resulted in a survival estimate from smolt release to arrival at the dam of 33.6 percent for brood year 1987 fish. Giorgi pointed out that more effort is needed to properly define sampling efficiency if this information will be relied upon to calculate survival. Preliminary information for McCall Hatchery PIT tag detections in 1991 indicates that 24.2 percent were detected at Lower Granite Dam and 34.5 percent were detected at all three dams (N = 400) (S. Achord, National Marine Fisheries Service, personal communication). An FGE was not available to determine survival from release to arrival at Lower Granite Dam.

Giorgi also presented a summary of the percentage of branded fish released from McCall Hatchery that were estimated recovered at Lower Granite Dam for 1984-1990. Recoveries ranged 1.9- 16.4 percent and averaged 9.0 percent. However, Hutchinson (1984, 1985) reported both an estimate of the numbers of brands 'recovered and the total number of branded McCall Hatchery summer chinook estimated to have passed the dam. In 1983, he estimated 47 percent of the branded fish passed Lower Granite Dam; 11.7 percent of the branded fish were recovered at the dam. In 1984, he estimated 48 percent of the branded fish passed Lower Granite Dam; 11.9 percent of the branded fish were recovered.

Smolt-to-adult return rates for summer chinook returning to the South Fork weir averaged 0.56 percent and ranged from 0.03 to 1.12 percent, for brood years 1978-1986 (Table 3). This represents an overestimate of hatchery fish survival since researchers have estimated that 10 to 30 percent of the intercepted fish are probably from natural production (Cochnauer and Elam 1990; P. Sankovich, University of Idaho, personal communication). Smolt-to-adult survival for CWT groups ranged from 0.003 to 0.80 percent for brood years 1979-1985 (Table 4). Although CWT survival

estimates have the advantage of representing known brood years, there is evidence that the return of CWT fish is not always proportionate to unmarked fish. Thus, CWT information cannot be used as a definitive hatchery smolt-to-adult survival estimate.

Jack and Adult

Prespawning mortality of ponded fish at McCall Hatchery ranged 4.0-44.8 percent and averaged 16.3 percent for brood years 1980-1991 (Table 5). Brood years 1982 and 1983 were excluded because only female mortalities were reported.

ADULT LIFE HISTORY

Adult Escanement

Chinook crossing Bonneville Dam from June 1 through July 31 are counted as summers, as are those crossing Lower Granite Dam from June 18 through August 17. Howell et al. (1985) reported that Columbia River CWT recoveries from SFSR hatchery summer chinook have occurred March 31-July 7. More specific time of migration and escapement for hatchery summer chinook returning to the SFSR drainage has not been identified for the ocean, Columbia or Snake rivers. The University of Idaho implemented adult timing research in 1991 which should provide information about Snake River timing (Bjornn et al. 1992).

Harvest

Information was not fully summarized for this report regarding the rate of contribution of SFSR hatchery summer chinook to ocean and Columbia River harvest. Summer chinook are not harvested in the Snake River. Carmichael (1991) summarized CWT information for brood years 1983-1985 (Table 6). Ocean harvest accounted for less than 0.5 percent of the CWT recoveries and Columbia River harvest accounted for less than 3 percent for all three brood years combined.

The SFSR was a popular sport fishery until a closure on sport fishing in 1965. The drainage was completely closed to sport fishing prior to implementation of the McCall Hatchery program. The drainage has remained closed to sport fishing because of low escapement of naturally produced fish and few, if any surplus hatchery fish.

The South Fork is also an important fishery for tribal fishers. During 1987-1990, the Shoshone-Bannock tribes fished in the SFSR. Fishing occurred primarily between Goat Creek and the South Fork weir to target hatchery fish. Harvest was 45, 104, and 22 in 1987, 1988, and 1990, respectively (M. Rowe, Shoshone-Bannock Tribes, personal communication; S. Broderick, Shoshone-Bannock Tribes, personal communication). In 1989, the tribal season was closed because of low escapement.

Spawner Escanement

The summer chinook run generally arrives at the South Fork weir from late June through early September (Table 7). Hutchinson (1984) reported that fish jaw tagged at Lower Granite Dam June 21 -July 25 subsequently arrived at the South Fork weir July 31-August 10. The average days of travel was 26.

Fish intercepted at the South Fork weir are a mixture of hatchery and naturally produced fish that cannot be differentiated except for hatchery fish with CWTs. Beginning with brood year 1991, all

hatchery summer chinook will possess a CWT so that there will be an adipose fin-clip to differentiate hatchery from naturally produced summer chinook.

Returns by brood year ranged from 328 to 4,232 for brood years 1980-1986 (Table 8). As stated in the table, ocean age has been assigned based on length frequency, not known-age techniques. This means that brood year designation may be inaccurate if, for example, one brood year exhibits an unusual growth pattern such as being atypically large or small.

The Salmon Subbasin Plan (Idaho Department of Fish and Game et al.) cited annual returns to the South Fork weir ranging from 380 to 2,705 fish for 1980-1987. Annual returns 1988-1991 were 2,393; 938; 969; and 1,212, respectively.

Hatchery personnel spawned summer chinook collected at the South Fork weir during the period August 5-September 10, 1982-1991.

Adult Characteristics

Weights of returning chinook are not available. Howell et al. (1985) reported length frequency of chinook collected at the South Fork weir in 1981 and 1982. Few summer chinook larger than 107 cm fork length were collected, 1986-1991 (Table 9).

Four-year-old adults and three-year-old males (jacks) were the major age components of brood years 1980-1986 (Table 10). To date, ocean age has been assigned and reported based on standard length frequency criteria. Thus, assignment of ocean age is an estimate, and not based on known-age techniques. Historic and recent CWT data are being analyzed to evaluate the use of length criteria because there is some degree of overlap (Table 11). A comparison of estimated ocean age, from length frequency, with known ocean age, based on CWTs, shows that there can be substantial discrepancy (Table 12). For example, in 1988, returning four-year-old fish were atypically large, thus they were classified as five-year-olds. Ocean conditions such as El Nino have been cited as playing a part in size at return. Comparison of estimated brood year age composition (Table 10) with the known brood year age composition (Table 13) also illustrates the potential for incorrectly estimating ocean age and thus brood year. Known-age composition appears to be more variable with less predominance of four-year-old fish (Table 13).

The percentage of females by brood year and age class was less than 50 percent for brood years 1980-1986 (Table 14). The percentage of females returning annually to the South Fork adult trap ranged 14.7-54.0 percent and averaged 32.5 percent (Table 15).

Average number of eggs per female ranged from 3,895 to 5,107 for the period 1981-1991 (Table 16). Since 1984, the number of eggs has been determined by the water displacement method. The Von Bayer method was probably used in previous years.

JUVENILE LIFE HISTORY

Smolt age at release usually ranges from 19 to 20 months, depending upon the time of egg take. Smolts are trucked from McCall Hatchery to the Knox Bridge release site on the South Fork Salmon River. Release of brood years 1978-1983 smolts were in April, but brood years 1984-1989 smolts were released in March.

Average smolt size at release for brood years 1979-1988 was 134 mm and size ranged 125-143 mm. Average weight was 19.2 fish per pound and release weight ranged 15.6-21.3 fish per pound

(Wimer 1980; Hutchinson 1982, 1983, 1984, 1985; Frew 1986, 1988, 1989; McPherson 1990, 1991).

Use of brands and, more recently, PIT tags, have allowed determination of timing of McCall Hatchery fish from the South Fork Salmon River to Lower Granite Dam. Table 17 summarizes timing of Lower Granite Dam arrival for the 1982-1984 and 1989 outmigrants. Matthews et al. (1990) also reported that in 1989, the 50th and 90th percentiles of smolt passage at Lower Granite Dam occurred on May 11 and June 2, respectively.

Freeze brands have also allowed collection of migration data from the South Fork Salmon River to the Snake River smolt trap, as well as to Lower Granite Dam (Table 18). The Snake River smolt trap is located between Lewiston, Idaho and Clarkston, Washington. For the years 1984-1986 and 1989, the median passage date at the Snake River trap ranged from April 23 to May 11 with migration rates ranging 8.1-29.0 kilometers per day. Median arrival date at Lower Granite Dam was in the first half of May, with migration rates varying widely. This table also reports the percentage of freeze brands recovered at Lower Granite Dam (Giorgi 1991).

BIOCHEMICAL-GENETIC CHARACTERISTICS

Waples et al. (1991, p. 32) reported that after comparing 1981 or 1982 brood year McCall Hatchery juveniles with brood year 1988 fish, there was "little evidence of genetic change in the two samples from McCall Hatchery. Significant allele frequency differences were found at a single gene locus where the frequency of the 130 allele declined from 0.07 to 0.015. However, the overall G value for all loci was non-significant. Reasonable interpretation of these results is that effective population size was not too small and straying or transfers of genetically distinct stocks into the hatchery were not an important factor during 1981-1988." Waples et al. also stated that because broodstock is taken each year from a mixture of hatchery and naturally produced adults, the hatchery is not a closed population, and therefore these results apply to the effective size and stock history of the combined hatchery/natural population.

Allele frequency data for McCall Hatchery fish is reported in Appendix Table 1. Electrophoretic data was reported by Waples et al. (1991) (Appendix Table 2). Schreck et al. (1986) reported isozyme gene frequencies for McCall Hatchery fish (Appendix Table 3).

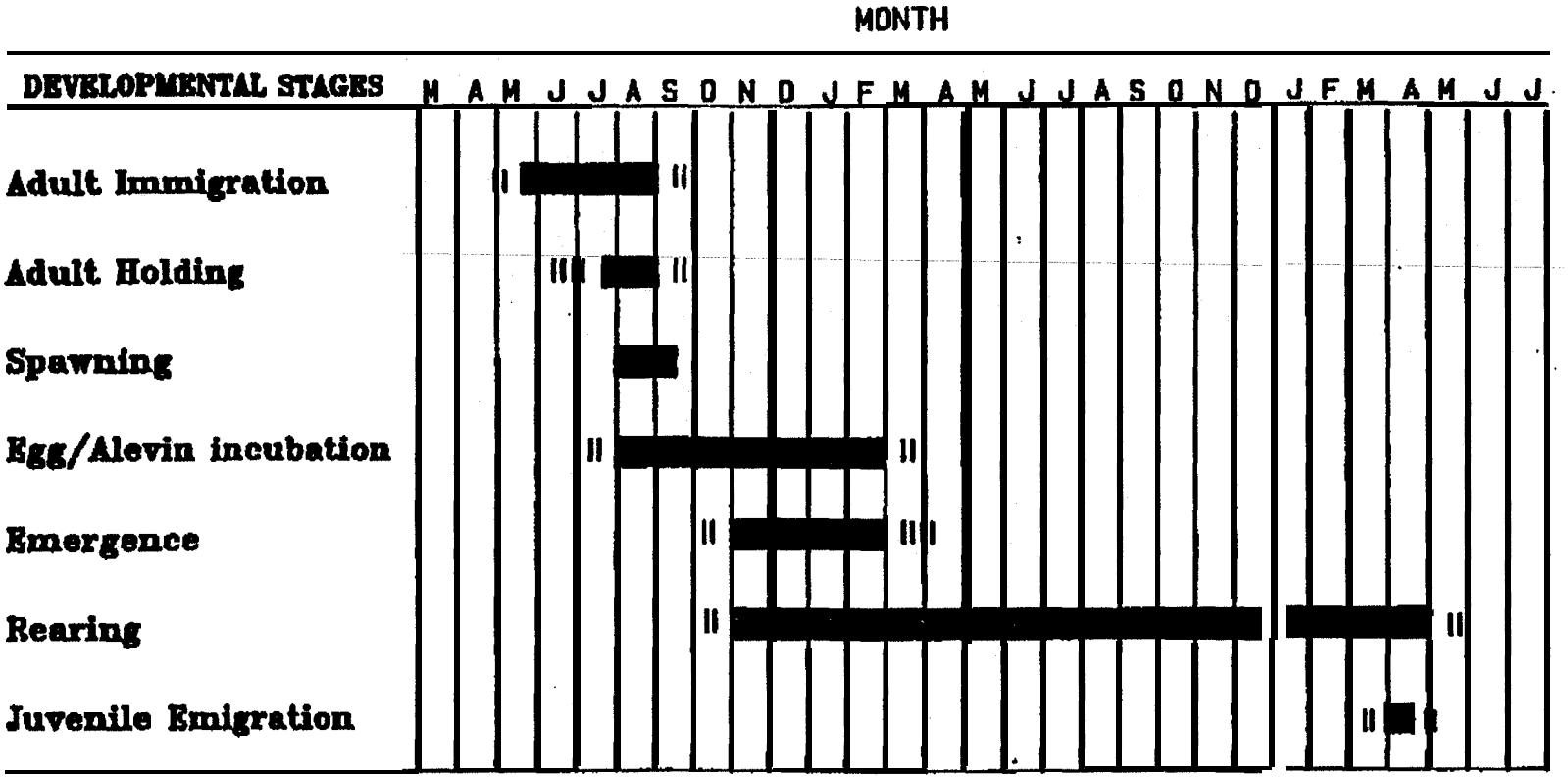
DISEASES

Few diseases of management concern, such as those potentially limiting fish transfers, have caused mortalities at the McCall Hatchery in recent years (Table 19). Other diseases which chronically occur, but do not cause substantial mortality, include Phoma herbarum, an internal fungus, and the myxosporidean, Ceratomvxa shasta. Ell et al. (1985) reported several diseases that had occurred at McCall Hatchery, including "spring thing" which caused considerable mortality in the early 1980's. This disease has since been diagnosed as a nutritional disease caused in part by dietary deficiency and the rearing of chinook fry for extended periods in water temperatures of 36-39 degrees F° (Frew 1986). The use of ten times the normal level of Pantothenic acid in the smaller fry feed has been successful in controlling "spring thing" (McPherson 1990). Bacterial Kidney Disease remains a major concern, but feed treatments of Gallimycin at 4.5 grams of active erythromycin phosphate per. 100 pounds of fish during the rearing cycle has been effective in reducing in-hatchery mortality (McPherson 199 1).

REFERENCES

All South Fork references appear at the end of the hatchery produced summer steelhead section.

Figure 1 (TT). Freshwater life history for summer chinook spawned at the South Fork Salmon River and reared at the McCall Hatchery.



Notes:

1. The developmental stage timing represents basin-wide averages, local conditions may cause some variability.
2. Solid bars indicate periods of heaviest adult immigration, spawning and juvenile emigration.

Table 1 (TR). Hatchery summer chinook releases into the South Fork Salmon River drainage by brood years, 1982-1989. Coded wire tag codes displayed for brood years 1986- 1989. "Above" weir as a release location refers to releases above the South Fork Salmon River weir, l&ted near Cabin Creek.

Brood Year	Brood-stock	Hatchery	Life Stage	Release Date (1)	Release Date (2)	Fish/lb	Number Released	Release Location	CWT
1982	SFSR	McCall	smolt	1984		15.6	269,880	South Fork @ Knox Bdg.	
1983	SFSR	McCall	F-F[a]	1984			30,990	South Fork @ Knox Bdg.	
1983	SFSR	McCall	smolt	1985			564,405	South Fork @ Knox Bdg.	
1984	SFSR	McCall	F-F	1985			50,149	South Fork @ Knox Bdg.	
1984	SFSR	McCall	F-F	1985			50,744	Johnson Cr.	
1984	SFSR	McCall	smolt	1985			970,348	South Fork @ Knox Bdg.	
1984	SFSR	McCall	adult[b]	1984			337	above weir	
1985	SFSR	McCall	F-F	1986			177,606	Johnson Cr.	
1985	SFSR	McCall	smolt	1987			958,300	South Fork @ Knox Bdg.	
1985	SFSR	McCall	adult[b]	1985			651	above weir	
1986	SFSR	McCall	eyed- eggs	11/03/86			3,000	South Fork @ Knox Bdg.	
1986	SFSR	McCall	F-F	1987			6,178	Rock Creek	
1986	SFSR	McCall	F-F	1987			22,246	Sand Creek	
1986	SFSR	McCall	smolt	03/21/88	03/24/88	18.7	247,825	South Fork @ Knox Bdg.	103032

Table 1 (TR) (cont.). Hatchery summer chinook releases into the South Fork Salmon River drainage by brood years, 1982-1989. Coded wire tag codes displayed for brood years 1986-1989. "Above" weir as a release location refers to releases above the South Fork Salmon River weir, located near Cabin Creek.

Brood Year	Brood-stock	Hatchery	Life Stage	Release Date (1)	Release Date (2)	Fish/lb	Number Released	Release Location	CWT
1986	SFSR	McCall	smolt	03/21/88	03/24/88	19.2	61,900	South Fork @ Knox Bdg.	103033
1986	SFSR	McCall	smolt	03/21/88	03/24/88	-18.9	750,675	South Fork @ Knox Bdg.	Untagged
1986	SFSR	McCall	adult[b]	1986			566	above weir	
1987	SFSR	McCall	F-F	1988			201,000	E. Fk. South Fork	
1987	SFSR	McCall	F-F	1988			366.800	Johnson Cr.	
1987	SFSR	McCall	F-F	1988			87,800	Sand Creek	
1987	SFSR	McCall	F-F	1988			101,900	Cabin Creek	
1987	SFSR	McCall	smolt	03/21/89	03/23/89	20.8	46,400	South Fork @ Knox Bdg.	103141
1987	SFSR	McCall	smolt	03/21/89	03/23/89	20.8	46,250	South Fork @ Knox Bdg.	103142
1987	SFSR	McCall	smolt	03/21/89	03/23/89	20.8	46,400	South Fork @ Knox Bdg.	103143
1987	SFSR	McCall	smolt	03/20/89	03/23/89	20.8	44,350	South Fork @ Knox Bdg.	103144
1987	SFSR	McCall	smolt	03/20/89	03/23/89	20.8	43,025	South Fork @ Knox Bdg.	103145
1987	SFSR	McCall	smolt	03/20/89	03/23/89	20.8	41,325	South Fork @ Knox Bdg.	103146
1987	SFSR	McCall	smolt	03/20/8989		20.8	707,250	South Fork @ Knox Bdg.	Untagged
1987	SFSR	McCall	adult[b]	1987			866	above weir	

Table 1 (TR) (cont.). Hatchery summer chinook releases into the South Fork Salmon River drainage by brood years, 1982-1989. Coded wire tag 'codes displayed for brood years 1986-19 39. "Above" weir as a release ocation refers to reieases above the South Fork Salmon River weir, located near Cabin Creek.

Brood Year	Brood-stock	Hatchery	Life Stage	Release Date (1)	Release Date (2)	Fish/lb	Number Released	Release Location	CWT
1988	SFSR	McCall	F-F	1989			201,100	E. Fk. South Fork	
1988	SFSR	McCall	F-F	1989			195,783	Johnson C r .	
1988	SFSR	McCall	pre-smolt	08/09/89	08/09/89	49.6	290,000	Johnson Cr.	
1988	SFSR	McCall	F-F	1989			290,000	Sand Creek	
1988	SFSR	McCall	adult[b]	1988			848	above weir	
1989	SFSR	McCall	adult[b]	1989			237	above weir	
1988	SFSR	McCall	smolt	03/20/90	03/23/90	21.0	251,158	South Fork @ Knox Bdg.	103034
1988	SFSR	McCall	smolt	03/20/90	03/23/90	21.0	62,378	South Fork @ Knox Bde.	103038
1988	SFSR	McCall	smolt	03/16/90	03/23/90	20.7	718,964	South Fork @ Knox Bdg.	Untagged
1990	SFSR	McCall	adult	1990		2.0	315	above weir	
1989	SFSR	McCall	smolt	03/18/91	03/21/91	23.9	20,807	South Fork @ Knox Bdg.	103434
1989	SFSR	McCall	smolt	03/1 8/91	03/21/91	23.9	21,463	South Fork @ Knox Bdg.	103435
1989	SFSR	McCall	smolt	03/18/91	03/21/91	23.9	22,608	South Fork @ Knox Bdg.	103436
1989	SFSR	McCall	smolt	03/18/91	03/21/91	23.9	21,620	South Fork @ Knox Bdg.	103437

Table 1 (TR) (cont.). Hatchery summer chinook releases into the South Fork Salmon River drainage by brood years, 1982-1989. Coded wire tag codes displayed for brood years 1986-1989. "Above" weir as a release location refers to releases above the South Fork Salmon River weir, located near Cabf ı Creek.

Brood Year	Brood-stock	Hatchery	Life Stage	Release Date (1)	Release Date (2)	Fish/lb	Number Released	Release Location	CWT
1989	SFSR	McCall	smolt	03/18/91	03/21/91	23.9	21,33 1	South Fork @ Knox Bdg.	103438
1989	SFSR	McCall	smolt	03/18/91	03121191	23.9	21,253	South Fork @ Knox Bdg.	103439
1989	SFSR	McCall	smolt	03/18/91	03/21/91	23.9	21,443	South Fork @ Knox Bdg.	103440
1989	SFSR	McCall	smolt	03/18/91	03/21/91	23.9	21,501	South Fork @ Knox Bdg.	103441
1989	SFSR	McCall	smolt	03/18/91	03/21/91	23.9	21,406	South Fork @ Knox Bdg.	103442
1989	SFSR	McCall	smolt	03/18/91	03/21/91	23.9	21,527	South Fork @ Knox Bdg.	103443
1989	SFSR	McCall	smolt	03/18/91	03/21/91	23.9	21,442	South Fork @ Knox Bdg.	103444
1989	SFSR	McCall	smolt	03/18/91	03/21/91	23.9	19,387	South Fork @ Knox Bdg.	103445
1989	SFSR	McCall	smolt	03/18/91	03/21/91	23.9	452,815	South Fork @ Knox Bdg.	Untagged

[a] F-F designates a fry or fingerling release.
[b] Adults released above the weir are a mixture of hatchery and naturally produced fish.

Table 2 (TS-a). South Fork Salmon River (SFSR) summer chinook survival at various life stages at McCall Hatchery, brood years 1984-88.

Brood year	Percent survival green egg to eyed egg	Percent survival eyed egg to swim-up fry	Percent survival swim-up fry to ponding	Percent survival ponding to smolt release
1984[a]	80.6	96.0	97.4	84.3
1985	74.8	96.8	95.1	90.8
1986	79.7	97.9	93.6	95.6
1987	81.2	97.8	97.3	89.1
1988	81.2	98.7	NR[b]	NR

[a] Does not take fry release into account.
[b] Not reported.

Sources: Frew 1986, '1988, 1989.
D. E. McPherson 1990, 1991.
S. W. Kiefer, IDFG, unpublished.

Table 3 (TS-b). Percentages of smolts released from SFSR (McCall Hatchery) that returned as adults for brood years 1978-1986[a].

Brood year	Year released	Smolts released	Total brood[b] year return	Percent of brood year return
1978	1980	124,800	747	0.598
1979	1981	248,926	541	0.217
1980	1982	122,247	1,368	1.119
1981	1983	183,896	2,057	1.119
1982	1984	269,880	2,295	0.850
1983	1985	564,405	4,228	0.749
1984	1986	970,483	1,968	0.203
1985	1987	958,300	328	0.034
1986	1988	1,060,400	1,560	0.150

[a] The age of subsequent adult returns was based length frequency criteria similar to Table 8. Returns 1988-1991 based on the following length frequencies:

1988.
l-ocean = <65 in.
2-ocean = 65-89 in.
3-ocean = > 89 in.

1989. 90. 91:
l-ocean = ≤66 in.
2-ocean = 67-89 in.
3-ocean = >89 in.

[b] Includes naturally produced adults intercepted at the weir that cannot be distinguished from hatchery chinook.

Source: McPherson 1990.

Table 4 (TS-c). Coded wire tag returns for marked groups of summer chinook salmon to the SFSR trap, broodyears 1979-1986.

Tag code	Brood year	Year released	Number tagged released	Number per pound	Purpose	Returns 1984	1985	1986	1987	1988	1989	1990	Total returns	Percent SAR
10-21-17	1979	1981	40,450	17.5	Id. ctrl.	10	-						10	0.02
10-21-18	1979	1981	40,850	17.5	Id. ctrl.	21	-						21	0.05
10-21-28	1979	1981	47,625	17.5	Id. ctrl.	15	-	-					15	0.03
10-24-12	1980	1982	40,775	20.0	Vib. vac.	219	35						254	0.62
10-24-13	1980	1982	40,500	20.0	Ctrl. Vib. Vac.	190	35						225	0.56
10-24-58	1981	1983	62,100	20.3	Hat. Eval.	187	294	16					497	0.80
10-27-38	1982	1984	50,000	15.8	Hat. Eval.		117	90	12				219	0.44
10-25-18	1983	1985	38,100	19.1	Hat. Eval.	-	-	28	66	83			177	0.46
10-X-33	1983	1985	40,100	19.1	Hat. Eval.	-	-	34	77	76			187	0.47
10-28-04	1984	1986	8,800	21.3	Production	-	-		1	9	0		IO	0.11
10-28-12	1984	1986	39,800	21.3	Production	-	-		7	26	1		34	0.08
10-30-10	1984	1986	105,375	21.3	Eval.& Contrib.	-	-		16	69	20		105	0.10
10-30-11	1984	1986	104,675	21.3	Eval.& Contrib.	-	-		16	45	19		80	0.08
10-30-12	1984	1986	105,325	21.3	Eval.& Contrib.	-	-		18	68	11		97	0.09
10-30-19	1985	1987	103,850	20.2	Eval.& Contrib.	-	-			0	2	1	3	.003
10-30-20	1985	1987	104,525	20.2	Eval.& Contrib.	-	-			0	6	0	6	.006
10-30-21	1985	1987	103,450	20.2	Eval.& Contrib.	-	-			2	6	1	9	.009
10-30-32	1986	1988	247,800	18.7	Eval. & Contrib.	-	-				104	137	241	inc.'
10-30-33	1986	1988	61,900	19.2	Eval. & Contrib.					-	16	36	52	inc.'

[a] Idaho control.
[b] Vibrio vaccination.
[c] Vibrio vaccination control.
[d] Hatchery evaluation.
[e] Evaluation and contribution.
[f] 1990 returns only reported for broodyear 1985.
[g] Incomplete broodyear return.

Source: Cannamela et al. 1991.

Table 5 (PM-a). Percent prespawn mortality of fish ponded at the South Fork Salmon River adult trap, brood years 1980-91.

Brood year	Number of fish ponded	Number of pre-spawn mortalities	Percent mortality of ponded fish
1980	175	7	4.0
1981	2 9 7	37	12.4
1092	392	4”	1.0
			0.7
1984	1,192	61	5.1
1985	1,587	279	li.6
1986	2,124	305	14.3
1987	1,839	343	18.6
1988	1,543	692	44.8
1989	732	52	23.1
1990	654	136	7.9
1991	924		14.7

[a] Only female mortalities reported.

Sources: Wimer 1980.
Hutchinson 1982, 1983, 1984, 1985.
Frew 1986, 1988, 1989.
McPherson 1990, 1991.

Table 6 (RB-a). Coded wire tag recovery information for SFSR summer chinook[a].

	Brood Year			
	1983	1984	1985	Combined
Number of CWT release	78,200	364,975	207,300	650,475
Total number of CWT recovered[b]	562(.7)	357(.1)	5(<.1)	920(.1)
Ocean catch	2(.4)	0(0)		3(.3)
Oregon troll	2	0	1(.2)	2
Washington troll	0	0	0	1
Columbia River catch	12(2)	6(2)	2(.4)	20(2)
Columbia R. sport	2	1	1	4
Columbia R. gillnet	7	4	0	11
Treaty C & S	3	1	1	5
Other FW sport	3(.5)	1(.3)	0(0)	4(.4)
Subbasin Escapement	541(96)	350(98)	2(.4)	893(97)
Hatchery	534	335	2	871
Spawning ground	7	15	0	22

[a] Percentages are in ( ). Numbers are unexpanded and represent observed recoveries.
[b] Percent of total number of CWT recovered is proportion of total CWT release. All other percentages displayed as proportion of total CWT recovered.

Source: Carmichael 1991.

Table 7 (AT-a). Timing of the summer chinook salmon run to SFSR weir, 1981 -1990[a].

Year	First fish	Last fish	Peak of run
1981	07/08	09/13	07/18
1982	07/21	09/07	07/28
1983	07/12	09/04	07/26
1984	07/09	09/05	07/26
1985[b]	07/05	09/10	NR[c]
1986	06/27	09107	07/15
1987	06/07	09/01	07/27
1988	06/21	09/05	6/26-27
			NR
1990[b]	06/19	09/19	NR
1991[b]	06/21	09/10	NR

[a] Hatchery fish are the major component of the run, but naturally produced fish are also present.
[b] Dates are actually for dates of trap operation.
[c] NR = not reported.

Sources: Hutchinson 1982, 1983, 1984, 1985.
Frew 1986, 1988.
McPherson 199 1.
D. E. McPherson, IDFG, unpublished.

Table 8 (RH). Return of summer chinook to the SFSR adult trap by brood year[a]. Returning fish are a combination of hatchery and naturally produced summer chinook.

		Total Age				
Brood	Year	2 3	4	5	Total	Adult Total
1980	0	504	713	151	1,368	864
1981	0	595	1,259	203	2,057	1,462
1982	0	828	1,265	202	2,295	1,467
1983	0	1,222	2,113	893	4,232	3,010
1984	0	384	1,392	192	1,970	1,584
1985	0	50	248	30	328	278
1986	0	495	911	154	1,560	1,065
1987	0	28	237	inc.[b]	inc.	inc.
1988	0	821	inc.	inc.	inc.	inc.

[a] Returning fish are a combination of hatchery and naturally produced summer chinook. Hatchery weir count was sample method. Total age based on 2 year freshwater rearing and ocean age delineated by fork length criteria as follows:

1983: l-ocean = ≤64 cm. Cited from Hutchinson 1983. No cite for 2 or 3 ocean. Used 1987 brood year report numbers.
1984: l-ocean = <65 cm, 26 in. Cited from Frew 1986. No cite for 2 or 3 ocean. Used 1987 brood year report numbers.
1985: l-ocean = <65 cm, 26 in.
2-ocean = 65-89 cm., 26-35 in.
3-ocean = >89 cm., 35 in.
Cited from Frew 1988.
1986: Used 1987 brood year report numbers.
1987: l-ocean = <65 cm.
2-ocean = 65-89 cm.
3-ocean = >89 cm.
Cited from McPherson 1990.
1988: Used same criteria as 1987 brood year report.
1989: l-ocean= (66 cm. Cited from D. E. McPherson, IDFG, unpublished.
Used 1987 broodyear report criteria to differentiate 2- and 3-ocean.
1990: Used same criteria as 1989.
1991: Used same criteria as 1989.

[b] inc. = incomplete brood year information

Sources:
Hutchinson 1983.
Frew 1986, 1988.
McPherson 1990.
T. Frew, IDFG, unpublished.
D. E. McPherson, IDFG, unpublished.

Table 9 (AL-a). SFSR summer chinook fork lengths, 1986-1990.

Length cm	1991 No. fish	1990 No. fish	1989 No. fish	1988 No. fish	1987 No. fish	1986 No. fish
< 40	3		1			2
40	2		0			[a]
41	1		1		1	1
42	5		1			4
43	1	1	2			9
44	a		2			a
45	11	1	3			
46	IO	1	9	6	13	7
47	19		16			IO
48	20		15	8		28
49	49		21			35
50	38	1	32			
51	62		46	7	73	75
52	51		30			93
53	75	1	48	7		140
54	57		38			
55	70		53			115
56	58	1	27	6	115	161
57	68		35			143
58	53		28	3		136
59	38		24			
60	32		17			91
61	28	2	14	4	133	72
62	19	1	6			42
63	19	1	5			28
64	14	5	4	9		
65	7	2	4			28
66	3	11	4	8	54	10
67	4	3	6			7
68	8	20	2			
69	8	22	6	26		25
70	IO	16	4			18
71	IO	33	6	74	191	47
72	5	43	13			52
73	13	51	16			
74	14	65	18	106		93
75	4	54	13			93
76	9	72	13	185	600	124
77	7	66	15			137
78	2	77	24			
79	5	69	13	215		170
80	5	73	14			117
81	6	65	12	154	904	137
82	6	62	7			100
83	4	40	2			
84	17	28	5	137		86
85	15	12	12			43
86	14	17	10	206	369	39
87	22	11	4			
88	34	6	14			18
89	15	6	19	281		27
90	33	4	20			25
91	25	6	28	363	164	34
92	20	6	16			
93	21	3	16			15
94	12	3	21	224		13
95	14	1	12			13
96	7	3	17	120		IO
97	4	3	12		70	
98	7		12			3
99	3		7	82		1
100	4		6			1
101	1		6			
102	1		3	46	14	2
103	2	1	6			0
104			1	40		1
105			2			1
106			2			
107			1	18	2	
>107		0	3	0	1	0

[a] Blanks indicate no fish this size collected and measured.

Sources: Frew 1986
McPherson 1990, 1991
D. E. McPherson, IDFG, unpublished.

Table 10 (AC). Age composition percentage (freshwater.ocean) by brood year for summer chinook returning to the SFSR adult, trap".

Age Composition (%)

Brood Year	N	2.1	2.2	2.3
1980	1,368	36.8	52.1	11.1
1981	2,057	28.9	61.2	9.9
1982	2,295	36.1	55.1	8.8
1983	4,232	28.9	50.0	21.1
1984	1,970	19.6	70.7	9.7
1985	328	15.2	75.6	9.1
1986	1,560	31.7	58.4	9.9

[a] Returning fish are a combination of hatchery and naturally produced summer chinook. In this nomenclature, the freshwater and ocean ages sum to the total age of the fish. Hatchery weir count was sample method. Ocean age delineated by fork length criteria, cited in Table 6.

Sources: Hutchinson 1983.
Frew 1986, 1988,
McPherson 1990.
T. Frew, IDFG, unpublished.
D. E. McPherson, IDFG, unpublished.

Table 11 (AL-b). Fork length groups of known age, SFSR hatchery summer chinook. Age was determined from coded wire tags".

Ocean age	Fork length range (mm)	Percentage of age class within specified range
	Brood year 1976	
One-ocean	401[b]	-----
Two-ocean	609 - 838	670 < 89 % < 820
Three-ocean	800 - 1067	810 < 88 % < 1067
	Brood year 1977	
One-ocean	281 - 812	270 < 95 % < 620
Two-ocean	648 - 965	640 < 89 % < 870
Three-ocean	850 - 1010	860 < 91 % < 1010
	Brood year 1979	
One-ocean	460 - 600	450 < 100% < 610
Two-ocean	680 - 1000	670 < 89 % < 880
Three-ocean	660 - 1070	870 < 78 % < 1070
	Brood year 1980	
One-ocean	420 - 730	450 < 99 % < 670
Two-ocean	560 - 1000	660 < 93 % < 870
Three-ocean	None collected	----

[a] The percentage of the age class falling within a specific range is included as an indication of length overlap.
[b] One fish measured.

Sources: Wimer 1980.
Hutchinson 1982, 1983, 1984, 1985.
T. J. Elms-Co&rum, IDFG, unpublished.

Table 12 (AL-c). Comparison of summer chinook ocean age estimates based on length frequencies (L-F) with known ages from coded wire tag (CWT) analyses for various return years at the SFSR trap.

Return year	Method	Ocean Age One-ocean	Two-ocean	Three-ocean
1980	L-F	51.5	46.1	2.4
1980	CWT	53.5	45 7	0.9
1984	L-F	39.2	50.7	10.2
1984	CWT	22.3	69.6	8.1
1985	L-F	37.1	53.3	9.6
1985	CWT	25.5	61.0	13.5
1987	CWT	24.3	68.3	7.5 5.4
1988	L-F	1.8 0.8	35.3	62.9
1988	CWT		79.4	19.8
1989	L-F	53.1	20.3	26.6
1989	CWT,	22.2	68.9	8.9
1990	L-F	2.9	84.6	12.5
1990	CWT	1.1	97.7	1.1

Source: G. Kruse, IDFG, unpublished.

Table 13 (AC-a). Age composition percentage (freshwater.ocean) by brood year for coded wire tagged summer chinook salmon returning to the SFSR adult trap.

Brood year	N	Percent Age Comnosition 2.1	2.2	2.3
1981	497	38	59	3
1982	219	17	41	6
1983	364	18	39	44
1984	326		66	16

Sources: Cannamela et al. 1991
T. J. Elms-Cockrum, IDFG, unpublished.

Table 14 (AS). Females by 'brood year and age class[a] (freshwater.ocean) as a percentage of the entire brood return (N) of summer chinook to the SFSR adult trap.

Females (%)

Brood Year	N	2.1	2.2	2.3	Total % Female
1980	1,368	0	30.5	7.6	38.1
1981	2,057	0	38.5	6.5	45.0
1982	2,295	0	23.7	5.2	28.9
1983	4,232	0	22.7	10.1	32.8
1984	1,970	0	41.7	5.4	47.1
1985	328	0	32.3	4.9	37.2

[a] Returning fish are a combination of hatchery and naturally produced summer chinook. In this nomenclature, the freshwater and ocean ages sum to the total age of the fish.Hatchery weir count was sample method. Ocean age was delineated by fork length criteria, cited in Table 6.

Sources: Hutchinson 1983.
Frew 1986, 1988.
McPherson 1990.
T. Frew, IDFG, unpublished.
D. E. McPherson, IDFG, unpublished.

Table 15 (AC-b). Sex composition of the summer chinook run returning to SFSR adult trap[a], 1980-1991.

Return year	Total return	Males	Percent	Females	Percent
1980	169	144	85.0	25	14.7
1981	524	326	62.2	198	37.8
1982	550	354	64.4	196	35.6
1983	937	697	74.3	240	25.6
1984	1,529	1,026	67.1	503	32.9
1985	2,238	1,342	60.0	896	40.0
1986	2,690	2,014	74.9	676	25.1
1987	2,705	1,626	60.1	1,079	39.9
1988	2,393	1,100	46.0	1,293	54.0
1989	938	689	73.5	249	26.5
1990	969	589	60.8	380	39.2
1991	1,212	977	80.6	235	19.4

[a] Returning fish are a mixture of hatchery and naturally produced fish.

Source: S. W. Kiefer, IDFG, unpublished.

Table 16 (AF-a). Mean fecundity by return year for summer chinook returning to the SFSR adult trap. Returning fish are a combination of hatchery and naturally produced summer chinook.

Return year	Numbers of females spawned	Mean fecundity
1981	124	3,895
1982	82	5,511
1983	180	3,976
1984	352	4,337
1985	477	4,347
1986	428	5,020
1987	662	4,698
1988	555	5,107
1989	150	4,933
1990	257	4,325
1991	138	5,102

Sources: Hutchinson 1982, 1983, 1984, 1985.
Frew 1986, 1988, 1989.
McPherson 1990, 1991.
D. E. McPherson, IDFG, unpublished.

Table 17 (PT.-a). Timing of arrival of branded and PIT-tagged SFSR hatchery summer chinook smolts at Lower Granite Dam.

Outmigration year	First Date of fish release	Duration of detection	Peak of detection
1982	April 8	April 19 - June 11	May 17 - 23
1983	April 4	April 23 - June 10	April 30 - May 6
1984	April 9	April 24 - June 12	May 22 - 28
1989	March 20	April 16 - June 20	May 10

Sources: Hutchinson 1983, 1984, 1985.
Matthews et al. 1990.

Table 18 (TR-a). Migration data for freeze branded hatchery summer chinook from the South Fork Salmon River release site to the Snake River trap' and to Lower Granite Dam[b].

Year	Median release date	Median passage date, Snake trap	Migration rate (km/day)	Mean Q(kcfs) Salmon R.	Mean Q(kcfs) Snake R.	Median arrival at LCD	Migration rate (km/day)	Mean Q(kcfs) at LGD	Percent brands recovered at LGD
1984	4/10	4/24	29.0	14.5	91.7	Lower Granite migration not reported			11.9
1985	4/2	4/17	27.1	14.0	71.0	5/14	1.9	85	16.4
1986	3/28	4/23	15.8	16.5	78.6	5/3	5.2	98	14.1
1987	Insufficient recapture numbers at Snake River trap.								3.5
1988	Insufficient recapture numbers at Snake River trap.								- -
1989	3/21	5/11	8.1	6.5	57.1	5/13	25.8	104	6.0
1990	Insufficient recapture numbers at Snake River trap.								

[a] Snake River trap is located approximately 40 m downstream from the Interstate Bridge, between Lewiston, Idaho and Clarkston, Washington. This location is 0.5 km upstream from the convergence of the Snake and Clearwater rivers.
[b] Percentage of branded fish estimated recovered at Lower Granite Dam is included.

Source: guettner and Nelson 1990, 1991.
Giorgi 1991.

Table 19 (TD). Parasites and diseases* of spring chinook at the McCall Hatchery located at the South Fork Salmon River.

Disease Type	Hatchery	Specific pathogen
Bacteria	McCall	*Renibacterium salmonarium* (Bacterial Kidney Disease)
virlls	McCall	IHN (Infectious Hematopoietic Necrosis)

[a] Disease history only represents isolated pathogens at the hatchery and not necessarily a disease outbreak.

Sources: Wimer 1980.
Hutchinson 1982, 1983, 1984, 1985.
Frew 1986, 1988, 1989.
McPherson 1990, 1991.

SOUTH FORK SALMON RIVER, SALMON SUBBASIN

Summer Steelhead (wild)

GEOGRAPHIC LOCATION

As described by Thurow (1987), the South Fork Salmon River (SFSR) flows through the central Idaho Batholith, an area of granitic bedrock characterized by steep slopes and highly erodible soils. From its origin, the SFSR flows north for 160 km through the Salmon River mountains and joins the Salmon River 77 km above Riggins, Idaho (Figure 1). The watershed drains 3,290 km*. Major tributaries are the East Fork 'of the South Fork, Johnson Creek and the Secesh River. Mining has significantly altered sections of the East Fork of the South fork. Mass erosion in the South Fork drainage began to occur during the 1950's following soil disturbances from logging and road construction. Major storm events in the 1960's accelerated erosion rates.

ORIGIN

Summer steelhead are indigenous to the SFSR drainage. Howell et al. (1985) reported stockings of up to 300,000 fry from Dworshak National Fish Hatchery (DNFH) during 1977-79. In 1980, 246,742 smolts from DNFH were stocked and an additional 6,400 smolts were stocked the following year. No hatchery steelhead have been stocked in the drainage since 1981 and it is believed that there was no genetic alteration of the indigenous stock due to translocation of hatchery fish because of poor survival. Thurow (1987, page 62) stated: "considering the large initial mortality on hatchery fry, the rearing mortality from surviving fry to smolt, and parr smolt-to-adult survival rates for the 1979 and 1980 smolt outmigration, I believe that few adults returned as a result of fry plants". Idaho Department of Fish and Game (IDFG) personnel collected data from mainstem spawning areas in 1983 (expected return of two-ocean adult which normally comprise 80 percent of DNFH returns) which supported this premise. In the area immediately below the stocking location, biologists captured only 17 hatchery steelhead, which comprised 30 percent of the fish sampled (Thurow 1987). Thurow theorized that interbreeding success would likely be poor, and thus, the population gene pool unaltered.

SFSR steelhead are considered B-run based on size at age, and timing characteristics. B-run steelhead generally enter the Columbia River from August through December, and are larger than A-run steelhead of comparable ocean age. The SFSR drainage is one of three major Idaho drainages currently managed for the production of wild, native steelhead. Natural production maintains the run.

DISTRIBUTION

Available spawning and rearing habitat for the SFSR drainage was described in the Presence/Absence database (Table 1). This information was developed for the Northwest Power Planning Council for subbasin planning and modeling. Thurow (1987) reported finding steelhead juveniles in 42 tributaries and the mainstem South Fork. Steelhead parr were the most abundant and widely distributed age-l and older salmonid.

PRODUCTION

Thurow (1987) estimated egg-to-fry survival on the Poverty Flat spawning area using emergence traps and egg deposition estimates. Egg-to-fry survival averaged 8 percent in 1984 and 10 percent in 1985. Survival in individual redds ranged 3-11 percent in 1984 and 3-16 percent in 1985.

Thurow (1987, page 31) stated: "These values closely approximate the predicted egg-to-fry survival for the existing percent fme sediment (30 to 35 percent).

Thurow (1987) used snorkel counts of fish to estimate rearing. In the mainstem SFSR, he conducted counts in July and August when juvenile steelhead maintain specific daytime stations and home ranges. Densities of age-l and older steelhead parr ranged from O-3.9 parr per 100 m^2 and averaged 1.0 and 1.2 per 100 m^2 in 1984 and 1985, respectively. Densities of steelhead parr in tributaries ranged O-10.5 per 100 m^2 in accessible snorkeled sections, and averaged 2.6 per 100 m^2, excluding the East Fork South Fork for 1984-85 combined. Densities of electrofished tributaries ranged O-3 1.6 juveniles per 100 m^2 and averaged 3.3 per 100 m^2. Thurow (1987) cited a study by Everest (1969) which reported a mean density of age I+ and older steelhead as 40 fish per 100 m^2 in South Fork tributaries as representative of fully seeded stream. Thus, Thurow suggested that current rearing densities in the SFSR drainage may be a fraction of the potential carrying capacity.

Parr monitoring conducted by IDFG has not reflected any substantial increases in steelhead parr production. Monitoring transects are located on the mainstem South Fork, and first order and lesser tributaries. For 1985-1989, the overall weighted mean of all sections and years for steelhead parr density in IDFG transects was 1.7 parr per 100 m^2 and 13.4 percent of estimated carrying capacity for mainstem and first order' transects (Table 3) (R.J. Scully, IDFG, unpublished). The overall weighted mean of all sections and years for steelhead parr density in IDFG transects in lesser tributaries was 1.8 parr per 100 m^2 and 11.5 percent of estimated carrying capacity for the same period (Table 4). Parr densities were determined by snorkel counts. Parr carrying capacity ratings for summer steelhead were derived from the Presence/Absence database used for development of the Salmon Subbasin Plan.

Thurow (1987) estimated a yield of 200,000 smolts as annual potential production based on estimated rearing area of 60,583 100 m^2 units. Subbasin planning estimated a potential smolt yield of 444,500 smolts based on estimated area of 72,549 100 m^2 units. Monitoring and evaluation is continuing to better determine the SFSR drainage's steelhead production potential.

ADULT LIFE HISTORY

Adult Escapement

Specific time of migration and escapement for steelhead returning to the SFSR drainage has not been identified for the ocean, or Columbia or Snake rivers. The University of Idaho implemented adult timing research in 1991 which should provide information about Snake River timing (Bjornn et al. 1992).

A portion of the steelhead destined for the SFSR drainage ascend the Salmon River in the fall, and the remainder overwinter in the Snake River. Thurow (1985) reported that wild steelhead are in the vicinity of the SFSR by mid-September. Significant numbers of steelhead appear to winter in the Mackay Bar area (a canyon just below the South Fork mouth) before ascending the South Fork to spawning grounds (Ortmann and Richards 1964). These fish do not enter the upper South Fork drainage during the fall months. Tagging studies have shown that there is considerable milling of steelhead in wintering areas. Steeihead caught in the extreme lower portion of the South Fork in the fall would not necessarily be part of the SFSR run (Richards 1962).

Harvest

Information is not available regarding the rate of contribution of this stock to ocean, Columbia River or Snake River harvest. Since the mid-1980's, the harvest of steelhead possessing an adipose fin has not been allowed in the Snake River or in Idaho.

In the 1960's, 10-15 percent of steelhead angling effort in the Salmon River drainage occurred in the SFSR. Annual harvest of steelhead ranged up to 813 steelhead, 1961-1967, when the steelhead fishery was monitored (Table 5). During this study, the drainage was open for steelhead fishing year round. Fish became available in March, with fishing activity in the SFSR March-May. The SFSR drainage has been closed for steelhead harvest since 1968.

Snawner Escapement

Adult steelhead ascend the SFSR in the spring and proceed to spawning areas. Fish have been observed as early as February 1 staging in the lower 55 kilometers. Spawning ground surveys indicate that steelhead arrived at Poverty Flat at river kilometer 90 by April 16 (Thurow 1987). Adult steelhead usually enter tributaries after spring freshets. Thurow observed the majority of spawners after March 15. He first observed mainstem SFSR redds on April 16 and in the SFSR tributaries on May 3.

Howell (1985) reported that historically the SFSR supported substantial steelhead runs which probably exceeded 3,000 fish. Thurow (1985) indicated that the populations had declined to fewer than 500 fish by 1977. Howell (1985) stated that the steelhead population had been reduced by damage to the fisheries habitat due to erosion, and accelerated hydroelectric development on the Columbia and Snake rivers.

In 1984, Thurow (1987) counted 407 redds and 292 adults. He estimated that this probably accounted for 60 percent of the potential spawning. In 1985, 536 redds and 658 adults were observed, which he estimated to account for 70 percent of the potential spawning. His conservative estimate was that the SFSR drainage spawning escapement was 800-900 steelhead in these years. Although it had been reported that the majority of spawning occurred in tributaries, Thurow found 70 to 80 percent of the spawning activity occurring in the mainstem SFSR.

Average redd densities on mainstem index areas were 12.9 and 14.5 redds per kilometer for 1984 and 1985, respectively. Average densities for tributary index areas were 2.8 and 1.9 per kilometer in 1984 and 1985, respectively. Redd densities ranged up to 9.8 redds per kilometer in tributary transects (Thurow 1987).

IDFG conducted index redd counts by helicopter and counted 147 steelhead redds in 1990 and 252 redds in 1991. Redds per km were highest in the Poverty Flat index area in 1984-1985 (Tables 6 and 7). Redds per km were highest in the Darling Cabin index area, 1990-1991 (Table 8).

Adult characteristics

Historical information regarding length, age, and sex characteristics of SFSR steelhead populations are sparse and essentially available from 3 sources: 1) information collected at a harvest check station in 1963, 2) information collected during 1983-1985 for Thurow's research project, and 3) information collected during adult steelhead surveys in 1990-1991 to provide management data. Most SFSR steelhead are large (Table 9). Ortmann (1964) reported fork length frequency of steelhead measured at harvest check stations in the SFSR. Eighty percent of the steelhead were

more than 27 inches (68 cm.) fork length, and the weighted average size (n = 112) was 31 inches (79 cm.). Mean fork length; of males was 32 inches (82 cm) and mean fork length of females was 30 inches (77 cm.). Thurow (1987) reported that 81 percent of the fish he collected exceeded 71 cm total length. Adult steelhead sampling with hook and line in 1990 produced fish which ranged 65-93 cm fork length (n = 67) with a mean of 83 cm. and a standard deviation of 58. Males averaged 85 cm and females averaged 81 cm. in fork length. In 1991, adult steelhead collected with hook and line ranged 69-109 cm fork length with a mean of 83 cm. (n = 53). Mean fork length of male steelhead was 87 cm, and mean fork length of female steelhead was 83 cm.

Known age from scale analysis is available for a sample of 65 steelhead collected at a harvest check station on the South Fork in 1963 (Ortmann 1964). Three-ocean, six year old fish predominated the sample (Table 10). Two-ocean, five year old fish comprised the smallest percentage of the sample. Proportions in each age class were similar between sexes.

For steelhead measured at the harvest check station in 1963, the sex ratio was 0.6 males to 1 female. The sex ratio of spawners observed by Thurow (1987) in 1984 and 1985 combined was 1 .1 males to 1 female (n = 547). The sex ratio of steelhead collected by hook and line in 1990 was 0.8 male to 1 female (n = 66). The sex ratio of steelhead collected in 1991 by hook and line was 0.4 male to 1 female (n = 51).

JUVENILE LIFE HISTORY

Life history timing is likely similar to Figure 2. Although not illustrated in the figure, there is typically a fall emigration of steelhead presmolts from the upper ends of tributaries to lower in the drainage or to the mainstem Salmon River for winter rearing.

Thurow (1987) monitored emergence timing on the Poverty Flat spawning area using emergence traps and noted that in 1984, fry emergence commenced July 14 and was 98 percent complete by August 10. Timing was slightly advanced in 1985, with fry emergence commencing July 3 and essentially completed by July 17. Fry emerged after dark.

Thurow classified juvenile steelhead as age-l (70-130 mm), age-II (130-200 mm), and age III (> 200 mm). The age frequency of steelhead parr observed by snorkeling in 1984 was 40 percent age-l, 52 percent age-II, and 8 percent age-III. In 1985, observed parr age proportions were similar to 1984 with 30 percent age-l, 59 percent age-II, and 11 percent age-III. Length frequency of steelhead parr sampled by electrofishing and hook and line in the SFSR drainage, July through September, 1984-1985, ranged 70-319 mm (Table 11).

BIOCHEMICAL/GENETIC CHARACTERISTICS

Twenty-one enzyme systems were compared between the Middle Fork and South Fork Salmon River steelhead populations. Thurow (1985) stated that results indicated genetic isolation between the two populations. In 1985, samples from the Secesh River and Johnson Creek were also compared. These were very similar, although significant difference occurred at the PEP-GL enzyme system, suggesting the heterogeneity of these populations. Cluster analysis illustrated that the SFSR steelhead were similar to other Salmon and Clearwater River wild stocks which were sampled, including Chamberlain, Horse, Sheep, the Middle Fork Salmon, and the Selway River (Thurow 1987). Isozyme gene frequencies for steelhead collected from the Secesh River and Johnson Creek were reported by Schreck et al. (Appendix Table 4).

DISEASES

No information is available.

REFERENCES

All South Fork references appear at the end of the hatchery produced summer steelhead section.

Figure 1. Anadromous **salmonid** distribution in the west half of the Salmon River **subbasin** -as represented by spring chinook, based on the NPPC presence/absence data base and the BPA Geographic Information System.

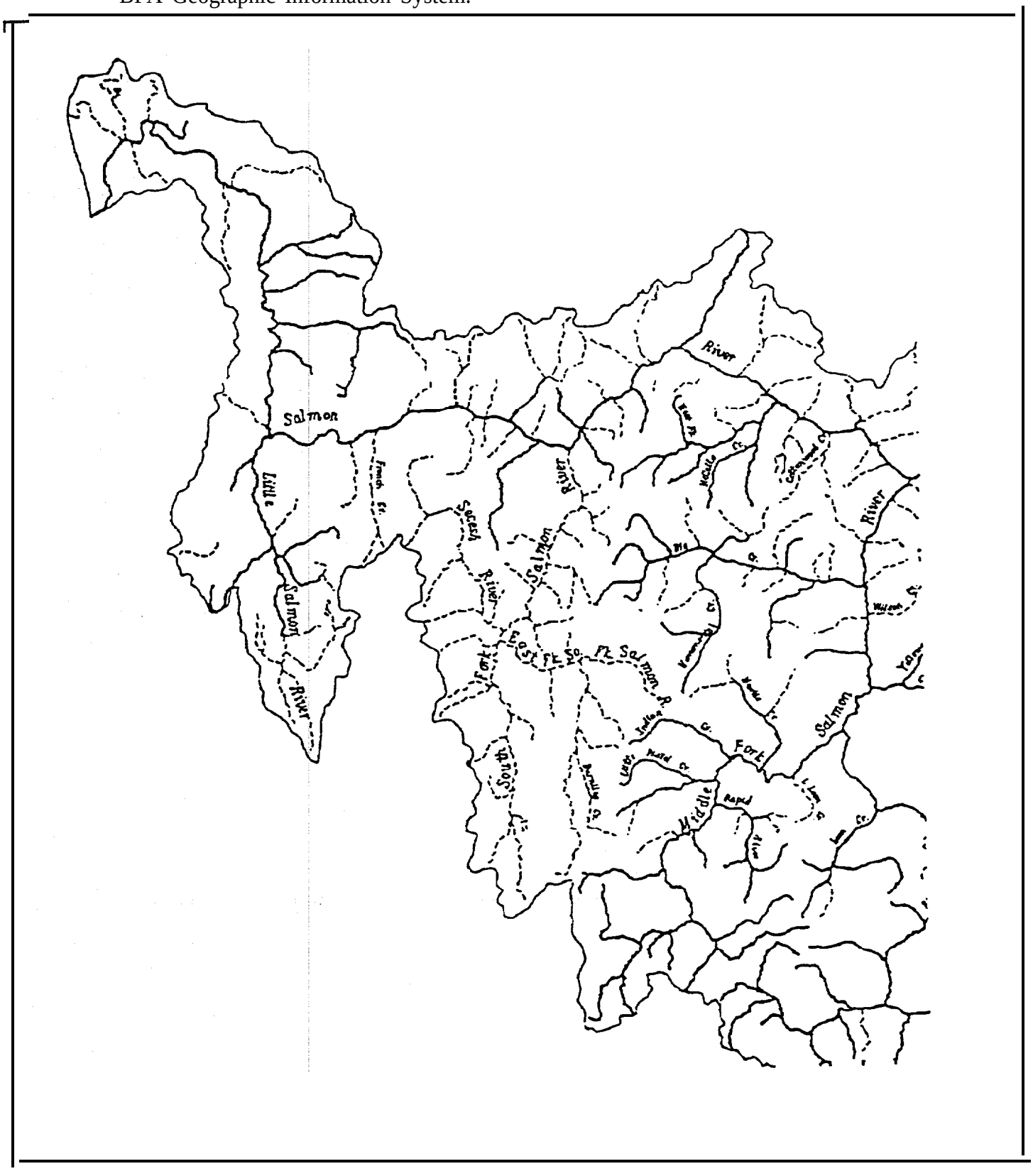
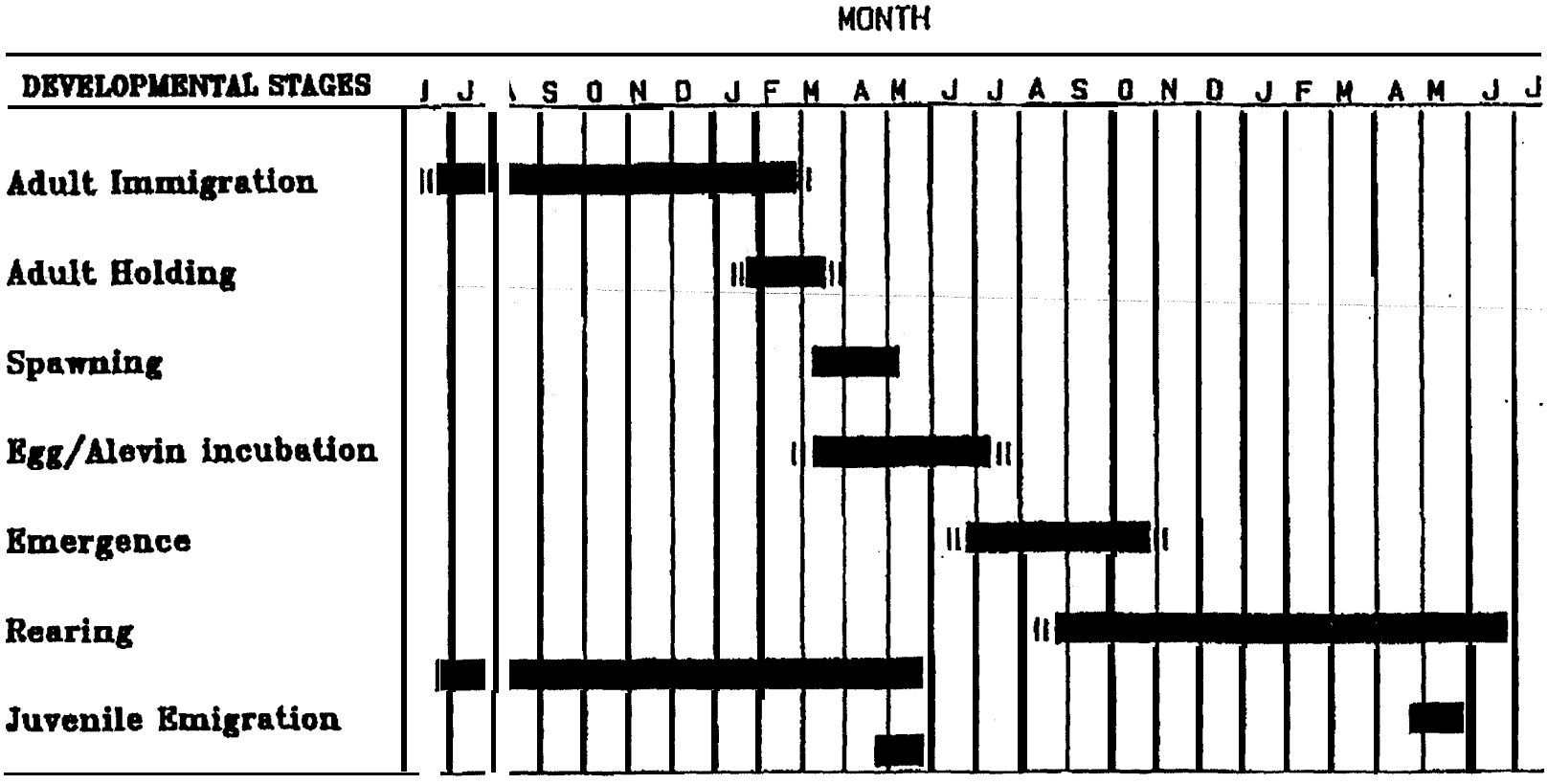


Figure 2 (TT). Freshwater life history for natural/wild steelhead runs in the Salmon River subbasin.



Notes:

1. The developmental stage timing represents basin-wide averages. local conditions may cause some variability.
2. Solid bars indicate periods of heaviest adult immigration, spawning and juvenile emigration.
3. Rearing and juvenile emigration take place over a three year period and are shown above in a rap-around fashion.

Table 1 (HB-1). Estimated amount of spawning and rearing habitat (Use Type 1) by quality of South Fork Salmon River steelhead production area.

	Excellent	Good	Fair[a]	Poor[a]	unk.	Total	Confidence[b]
		47	28	0			
Miles (%)	25 10	48	42	0		1792.7 540.5	Medium Medium
Acres (%)							

[a] Ratings of fair and poor habitat quality may reflect natural physical features such as gradient and channel type, as well as degradation caused by humans.
[b] 'Confidence' is meant to indicate the reproducibility and accuracy of the estimates made, and will be rated as high, medium or low by the respective agencies,

Source: Presence/Absence database, Northwest Power Planning Council, 1991.

Table 2 (HB-2). Estimated amount of rearing only habitat (Use Type 2) by quality of South Fork Salmon River steelhead production area.

	Excellent	Good	Fair[a]	Poor[a]	unk.	Total	Confidence[b]
Miles (%)	0	100 100	0 0	0		7.2 .5	Medium Medium
Acres (%)	0						

[a] Ratings of fair and poor habitat quality may reflect natural physical features such as gradient and channel type, as well as degradation caused by humans.
[b] 'Confidence' is meant to indicate the reproducibility and accuracy of the estimates made, and will be rated as high, medium or low by the respective agencies.

Source: Presence/Absence database, Northwest Power Planning Council, 1991.

Table 3 (PD-a). Parr density and percent of rated carrying capacity (PCC) for steelhead in the South Fork Salmon River and mainstem tributaries. Densities estimated by snorkel counts.

Stream name	Year	Sample size	Ages 1+ & 2+ Density (#/100m^2)	Density std. dev.	PCC for ages 1+ & 2+	Std.dev. for PCC
E. Fk. S. Fk.	86	3	3.68	1.46	31.22	18.33
E. Fk. S. Fk.	87	3	4.82	4.26	43.18	44.38
E. Fk. S. Fk.	88	3	2.98	2.58	24.59	20.29
E. Fk. S. Fk.	89	3	2.89	2.16	23.93	17.71
Salmon River, S.	84	1	0.30	0.00	3.00	0.00
Salmon River, S.	85	2	0.46	0.64	4.55	6.43
Salmon River, S.	86	7	1.37	1.48	10.59	10.30
Salmon River, S.	87	8	0.30	0.56	2.98	5.61
Salmon River, S.	88	6	0.71	1.19	5.26	8.46
Salmon River, S.	89	8	1.55	2.29	11.87	16.38
Secesh River	87	3	2.91	0.47	20.78	3.35
Secesh River	88	3	1.27	0.86	9.07	6.13
Secesh River	89	3	0.64	0.47	4.57	3.35

Source: R. J. Scully, IDFG, unpublished

Table 4 (PD-a). Parr density and percent of rated carrying capacity (PCC) for steelhead in the South Fork Salmon River drainage tributaries. Densities estimated by snorkel counts.

stream name	Year	Sample size	Ages 1+ & 2+ density (#/100m^2)	Density std. dev.	PCC for ages 1+ & 2+	Std.dev. for PCC
Dollar Cr., SF	86	1	1.87	0.00	13.36	0.00
Dollar Cr., SF	87	1	3.09	0.00	22.07	0.00
Dollar Cr., SF	88	1	7.11	0.00	50.79	0.00
Dollar Cr., SF	89	1	3.87	0.00	27.64	0.00
Johnson Cr.	84	6	2.10	2.77	10.47	13.83
Johnson Cr.	85	4	0.14	0.17	0.71	0.83
Johnson Cr.	86	7	1.28	1.47	8.18	9.94
Johnson Cr.	87	7	1.24	1.53	8.08	10.46
Johnson Cr.	88	8	2.15	3.05	11.73	15.27
Johnson Cr.	89	8	1.27	1.62	7.81	10.99
Lake Creek	87	2	2.60	2.86	18.54	20.46
Lake Creek	88	2	1.23	1.43	8.79	10.20
Lake Creek	89	2	1.75	0.91	12.46	6.51
Lick Creek	86	1	9.54	0.00	68.14	0.00
Lick Creek	88	1	5.04	0.00	36.00	0.00
Lick Creek	89	1	15.17	0.00	108.36	0.00
Rock Creek	84	1	0.00	0.00	0.00	0.00
Rock Creek	85	1	0.00	0.00	0.00	0.00
Rock Creek	86	1	0.28	0.00	2.00	0.00
Rock Creek	87	1	0.27	0.00	1.93	0.00
Rock Creek	88	1	0.00	0.00	0.00	0.00
Rock Creek	89	1	0.31	0.00	2.21	0.00
Sand Creek	84	1	0.00	0.00	0.00	0.00
Sand Creek	85	1	0.00	0.00	0.00	0.00
Sand Creek	86	1	0.05	0.00	0.36	0.00
Sand Creek	87	1	0.10	0.00	0.71	0.00
Sand Creek	88	1	0.00	0.00	0.00	0.00
Sand Creek	89	1	0.00	0.00	0.00	0.00

Source: R. J. Scully, IDFG, unpublished.

Table 5 (RS-a). Summary of check station data for steelhead fishery, South Fork of the Salmon River drainage, 1961 to 1967.

Year	Number of days check station operated	Angler days[a]	Catch[a]	Fish per angler day
1961	51	3,052	561	0.18
1962	37	1,722	369	0.21
1963	52	2,607	813	0.31
1964	32	3,016	737	0.24
1965	8	286	28	0.10
1966	28	1,305	168	0.13
1967	25	1,487	312	0.21

[a] Stations operated throughout fishing period so estimates would approximate complete pressure and catch data.

Source: Ortmann 1968.

Table 6 (RN-a). South Fork Salmon River mainstem steelhead index redd counts. Counts were multiple counts, conducted April through May, 1984 and 1985.

Location	1984	1985
Stolle (Warm Lake road to Rice Creek)		
Length surveyed	13.0 km	13.0 km[a]
Number of redds		7
Redds per km	2.26	1.9
Poverty (Boulder run to Campground Bridge)		
Length surveyed	1.5 km	1.5 km
Number of redds	125	93
Redds per km	83.3	62.0
Darling (Cabins to Binwall)		
Length surveyed	1.3 km	1.3 km
Number of redds	44	56
Redds per km	33.9	43.1
Oxbow (Breach to main road)		
Length surveyed	2.5 km	2.5 km
Number of redds	61	109
Redds per km	24.4	43.6

[a] Aerial survey.

Source: Thurow 1987.

Table 7 (RN-b). South Fork Salmon River tributary index steelhead redd counts. Counts were multiple redd counts, conducted April through May, 1984 and 1985.

Location	1984	1985
Burntlog (Mouth to 1st tributary above Buck Creek)		
Length surveyed	2.3 km	2.3 km[a]
Number of redds	9	7
Redds per km	3.9	3.0
East Fork South Fork (Mouth to Parks Creek)		
Length surveyed	21.0 km	21.0 km
Number of redds	16	17
Redds per km	0.8	0.8
Johnson Creek (Top Deadhorse Rapids to Clements Bridge)		
Length surveyed	4.8 km	4.8 km
Number of redds	47	26
Redds per km	9.8	5.4
Lick Creek (Mouth to 1st falls)		
Length surveyed	4.5 km	4.5 km
Number of redds	34	25
Redds per km	7.6	5.6
Secesh (Chinook Campground to Grouse Creek)'		
Length surveyed	10.0 km	10.0 km
Number of redds	11	5
Redds per km	1.1	0.5
Tamarack Creek		
Length surveyed		2.0 km
Number of redds	No count	3
Redds per km		1.5

[a] Aerial survey.
Source: Thurow 1987.

Table 8 (RN-c). South Fork Salmon River steelhead index redd counts conducted by Idaho Department of Fish and Game. Counts were single peak counts conducted aerially in May, 1990 and 1991.

Location	1990	1991
Poverty Flat		
Length surveyed	1.9 km	1.9 km
Number of redds	25	76
Redds per km	32.6	40.0
Darling Cabin		
Length surveyed	0.6 km	0.6 km
Number of redds	25	39
Redds per km	41.7	65.0
Oxbow		
Length surveyed	4.2 km	4.2 km
Number of redds	37	31
Redds per km	8.8	7.4
Krassel		
Length surveyed		2.0 km
Number of redds	No count	38
Redds per km		19.0
Johnson Creek		
Length surveyed	4.8 km	4.8 km
Number of redds	23	64
Redds per km	4.8	13.3

Source: B. Rich, IDFG, unpublished.

Table 9 (AL-a). Length frequency of adult steelhead trout in South Fork Salmon River 1963[a], 1983-85, 1990 and 1991. Fish in 1963 were measured at a harvest check station. Other years, fish were sampled by hook and line for research projects.

Centimeters	1963 Fork Length No. fish	1983-85 Total Length No. fish	1990 Fork Length No. fish	1991 Fork Length No. fish
61.0 - 63.5	4			
63.5 - 66.0	3		1	
66.0 - 68.6	7	3	1	
68.6 - 71.1	8		2	1
71.1 - 73.5	8	2	1	
73.5 - 76.0	4	2		1
76.0 - 78.7	9		3	6
78.7 - 81.0	12	3	13	6
81.0 - 83.5	14	4	18	17
83.5 - 86.0	9	2	5	7
86.0 - 88.9	10	8	10	7
88.9 - 91.4	15	8	10	3
91.4 - 94.0	5	11	3	3
94.0 - 96.5	2	5		1
96.5 - 99.0	2	3		
99.0 - 101.6		1		1

[a] Fish collected in 1963 originally measured in inches.

Sources: Ortmann 1964.
P. Hassemer, IDFG, unpublished.
R. Thurow , USFS, personal communication.

Table 10 (AL-b). Age length frequency distribution, by sex, of 65 steelhead recorded through harvest check station, South Fork Salmon River. Length was measured as fork length to lower whole inch.

Total Length (in)	(cm)	Age: Males 2/3	Males 3/2	Males 3/3	Females 2/3	Females 3/2	Females 3/3	Total
24 (in)	61.0 ( )							1
26	66.0					1		1
27	68.6		1			4		4
28	71.1		2			2		3
29	73.7				1	1		3
30	76.2				2		1	1
31	78.7						7	9
32	81.3				4		5	8
33	83.8				4		4	8
34	86.4	1		2			4	6
35	88.9	3	1	4			3	6
36	91.4	1		3			2	10
37	94.0	1						4
38	96.5							1
Total		6	4	9	14	9	23	65
Percent		9.2	6.2	13.8	21.5	13.8	35.4	99.9

Source: Ortmann 1964.

Table 11 (SL-c). Length frequency of steelhead trout parr sampled by hook-and-line and electrofishing in South Fork Salmon River tributaries[a], July - September 1984 and 1985.

Length range (mm)	Number of parr 1984	1985
70 - 79	1	13
80 - 89	9	42
90 - 99	22	36
100 - 109	22	30
110 - 119	27	53
120 - 129	53	46
130 - 139	82	58
140 - 149	68	59
150 - 159	65	54
160 - 169	64	58
170 - 179	67	55
180 - 189	57	45
190 - 199	43	37
200 - 209	27	27
210 - 219	18	15
220 - 229	16	9
230 - 239	7	8
240 - 249	4	1
250 - 259	2	2
260 - 269		2
270 - 279		1
280 - 289		
290 - 299		
300 - 309		
310 - 319		1
Total (N)	654	652

[a] Tributaries included: Bear, Blackmare, Buckbom, West Fork Buckhom, Bumtlog, Camp, Eaton, Cougar, Dollar, Elk, West Fork Elk, Fitsum, North Fork Fitsum, Johnson, Lick, Phoebe, Porphyry, Profile, Quartz, Riordan, Sheep, Sugar, Summit, Tamarack and Trapper creeks and the Secesh River.

Source: Thurow 1987.

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MIDDLE FORK SALMON RIVER, SALMON SUBBASW

Spring Chinook (wild)

GEOGRAPHIC LOCATION

From its origin at the confluence of Bear Valley and Marsh creeks, the Middle Fork Salmon River (MFSR) flows north-northeast for 107 miles through the Salmon River Mountains and enters the Salmon River 57 miles downstream from Salmon, Idaho (Figure 1). The MFSR drains 2,830 square miles of central Idaho and includes 685 miles of stream accessible to salmon and steelhead for spawning and rearing. The main river is classified "wild", as part of the Wild and Scenic Rivers System. Most of the drainage is within the Frank Church River of No Return Wilderness Area. The rugged topography and wilderness designation has preserved the majority of the MFSR habitat in good condition. The major exceptions are several headwater spawning streams, including Bear Valley, Marsh, Camas, Marble, Big and Loon creeks, which are outside the wilderness. These have been degraded by activities such as mining and grazing. Thurow (1982) provided a detailed description of the drainage.

ORIGIN

The MFSR spring chinook run is a wild, native run maintained by natural production.

DISTRIBUTION

Available spawning and rearing habitat for the MFSR was described in the Presence/Absence database (Tables 1 and 2). This information was developed for the Northwest power Planning Council for subbasin planning and modeling. Mallet (1974) listed 28 tributaries that contained spring chinook.

PRODUCTION

There is little information describing survival and production factors but estimates of egg-to-parr survival are available for some MFSR tributaries. Petrosky and Holubetz (1988) and Scully and Petrosky (1991) illustrated differences in egg-to-par-r survival, based upon percent surface sand (Tables 3 and 4). Estimates of egg-to-parr survival ranged 2.1-32.5 percent.

Thurow (1985) reported that juvenile chinook salmon were in extremely low abundance in the MFSR drainage. Researchers estimated parr abundance in the Marsh Creek redd count trend area and the remainder of Marsh Creek downstream as 77,913 parr in 1984 (Table 4). This is only 28 percent of the estimated smolt capacity for this area (C. Petrosky, IDFG, pers. comm.).

Idaho Department of Fish and Game (IDFG) biologists monitored spring chinook parr production in the MFSR, 1985-1991. The overall weighted mean for IDFG monitoring transects was 8.3 parr per 100 m^2 and 10.9 percent of estimated carrying capacity during this interval (Table 5). Parr densities were estimated by snorkel counts. Parr carrying capacity ratings for spring chinook were derived from the Presence/Absence database used for development of the Salmon Subbasin Plan.

Passive integrated transponder (PIT) tag detection rates at Snake River dams provide a relative measure of minimum survival to the dams. Detection rates at Lower Granite Dam for wild spring chinook parr tagged in the MFSR ranged 5.8-15.2 percent for 1990-1991 (Table 6). Because fish are detected in collector systems, most of the detected fish are assumed to be transported. Fish

were tagged as late summer parr, thus overwinter mortality and in-basin migration mortality factors are represented, as well as losses in Lower Granite Reservoir and through upper Snake River dams. Specific mortality factors have not been fully segregated to determine stock specific influence on detection rates. Giorgi (1991) presented an estimate of survival from tagging to Lower Granite Dam in 1990 by expanding PIT tag detection rates by a fish guidance efficiency (FGE) of 0.53. The range of survival was 10.9-13.4 percent and averaged 12.2 percent for fish tagged in Sulphur, Marsh, Elk, and Bear Valley creeks.

ADULT LIFE HISTORY

Adult Escapement

Chinook crossing Bonneville Dam through May 31 are counted as springs, as are those crossing Lower Granite Dam through June 17. Specific time of migration and escapement for MFSR spring chinook is not well documented in the ocean, Columbia River or the Snake River. The University of Idaho implemented adult timing research in 1991 which should provide more information about Snake River timing (Bjornn et al. 1992).

Pursuant to the Endangered Species Act, naturally produced Snake River spring and summer chinook were listed as "threatened" by the National Marine Fisheries Service in 1992. This listing affects all chinook in the MFSR drainage.

Harvest

Information is not available regarding rate of contribution of MFSR spring chinook to harvest in the ocean, or Columbia or Snake rivers.

On average, 24 percent of Idaho's salmon sport harvest, 1959-1978, came from the MFSR drainage (Homer and Bjornn 1981). Thurow (1985) cited Gebhards (1959) stating that from 1955-1958, the maximum annual sport harvest was 3,851 spring chinook. Howell et al. (1985) reported that chinook sport harvest in the MFSR ranged 349-1,906 and averaged 1,003 fish, 1969-1978. The MFSR has been closed to the sport harvest of spring chinook since 1978.

Information regarding occurrence and magnitude of tribal harvest of MFSR spring chinook is not available.

Spawner Escapement

By the first week of July, chinook are usually seen jumping at Dagger Falls on the upper MFSR. Nez Perce tribal biologists have conducted multiple ground redd counts in Big Creek since 1985. They have found that spawning in upper Big Creek generally peaked in mid-August and was completed by late August and early September (Kucera 1987, Kucera and Cowley 1988, Cowley and Kucera 1989). Hauck (1954) observed spawning beginning in mid-July in Elk Creek when water temperature was 52-53 F°.

Redd and carcass counts have been conducted by IDFG in index areas of the MFSR drainage since the late 1950's. This program has evolved into a single peak count. Aerial and ground counts are conducted, depending on the stream and transect. Marsh Creek and Sulphur Creek peak counts have been conducted during the last two weeks of August. Bear Valley Creek and Big Creek counts have been conducted during the last week of August and the first week of September.
Total spawner escapement to the MFSR is unquantified. Index redd counts conducted by the IDFG

are used for trend information, not escapement estimates. Ortmann (1966a, page 17) reported: "Redd counts . . . while providing our best yearly trend information, introduce considerable positive bias when used to estimate the number of fish in an escapement and should be recognized as trend indicators only".

Through 1991, tributary spring chinook redd counts ranged from 38 in 1980 to 2,261 in 1957 (Table 7). Mainstem redd counts ranged from 3 in 1978 to 213 in 1964 (Table 8).

Nez Perce tribal biologists conduct multiple redd counts in Big Creek. Results of multiple redd counts since 1985 have ranged from 34 to 144, 1986-1991 (Table 9). The highest density of redds in Big Creek was 8.2 redds per kilometer in 1988 (Cowley and Kucera 1989).

Adult Characteristics

Carcass fork lengths, collected during redd counts, have been compiled for 1960-1967 to describe the size of MFSR spring chinwk (Tables 10-13). These were years when large numbers of carcasses were measured. Fork lengths ranged 15-47 inches for carcasses measured in Big, Marsh, elk and Bear Valley creeks.

Howell et al. (1985) reported that MFSR chinwk spawners appeared to have 4 year-old males and 5 year-old females predominating the run. Age composition for return years 1961-1962 was summarized from scale analysis of 20 percent of the carcasses measured during redd counts in Bear Valley and Elk creeks, and Big Creek. This data shows that 71 percent of the males were two-ocean and 84 percent of the females were three-ocean (Table 14). Overall, 52 percent of the scales were from three-ocean fish.

Using carcass information, age composition of spring chinook returning to Marsh, Big, and Bear Valley and Elk creeks was compiled by brood year. Assignment of ocean age was based on length frequency criteria and does not directly represent known-age techniques, although length criteria were based on scale analyses completed in the 1960's. However, incorrect assignment of ocean age will affect brood year analyses. For Marsh and Bear Valley and Elk creeks, the three-ocean age class generally dominated the brood return. In Big Creek, the two-ocean age class was prevalent (Tables 15-17).

Howell et al. (1985) reported that spawning ground sampling 1961-1964 indicated male to female sex ratios ranging from 0.7: 1 to 1 .0:1. The percent females by age class of carcasses surveyed during index redd counts in Big, Marsh, Bear Valley and Elk creeks was summarized for brood years 1957-1962. As shown in Table 14, females generally dominated the three ocean age class for the brood year return (Tables 18-20). Females comprised a smaller proportion of the carcasses sampled in Big Creek than the other tributaries. Although use of carcass information to describe biological characteristics of a brood or run may introduce bias (see South Fork Salmon River wild and natural summer chinook chapter), it is the only information currently available describing MFSR chinook runs.

The only fecundity information is from the 1950's and 1960's when MFSR spring chinook were collected and spawned for the Clearwater River drainage reintroduction program. The mean fecundity for spring chinook collected in Elk Creek, 1951-1953, ranged from 4,730 to 5,110 eggs per female (Table 2 1). Mean fecundity for spring chinook collected from Bear Valley Creek, 1962-1969, ranged from 4,774 to 6,211 (Table 22).

JUVENILE LIFE HISTORY

Matthews et al. (1992) reported lengths and weights of chinook parr collected in MFSR tributaries in 1989 (Table 23). On average, the largest parr were collected in Elk Creek. In 1984-86, Richards and Cemera (1987) found substantial differences among strata in Bear Valley Creek in relation to length and weight of chinook salmon. In general, lengths and weights increased with increasing downstream distance from the headwaters. They attributed this to water temperature and its influence on growth. Bjornn (1978) reported that Marsh Creek fall parr chinook ranged 64-82 mm fork length, 1974-1976.

Life history timing is likely similar to Figure 2. Although not illustrated in the figure, there is typically a fall emigration of chinook presmolts from the upper ends of tributaries to lower in the drainage for winter rearing.

Matthews et al. (1992) reported that PIT-tagged smolts from the MFSR were recovered at Snake River dams from April 9 through July 18. Parr tagged in Marsh Creek had the earliest arrival at Lower Granite Dam. Parr tagged in Elk Creek had the latest arrival, 12 days later than Marsh Creek fish.

Matthews et al. (1992) recovered, weighed and measured PIT-tagged MFSR smolts to determine the increases in length from time of tagging to time of recovery at Lower Granite Dam. Spring chinook from Bear Valley showed the largest increase in size (Table 24).

BIOCHEMICAL/GENETIC CHARACTERISTICS

Waples et al. (1991) reported electrophoretic data for Marsh Creek in Appendix Table 1. Shreck et al. (1986) reported isozyme gene frequencies for MFSR spring chinook in Appendix Table 3. Marshall (1992) reported analysis of genetic characteristics of an Idaho chinook baseline collection made in 199 1, which included baseline information for spring chinook populations in Bear Valley and Camas creeks.

DISEASES

Information has not been compiled.

REFERENCES

All Middle Fork references appear at the end of the hatchery produced summer steelbead section.

Figure 1. Spring **chinook** distribution in the west half of the Salmon River **subbasin** based on the NPPC presence/absence data base and the BPA Geographic Information System.

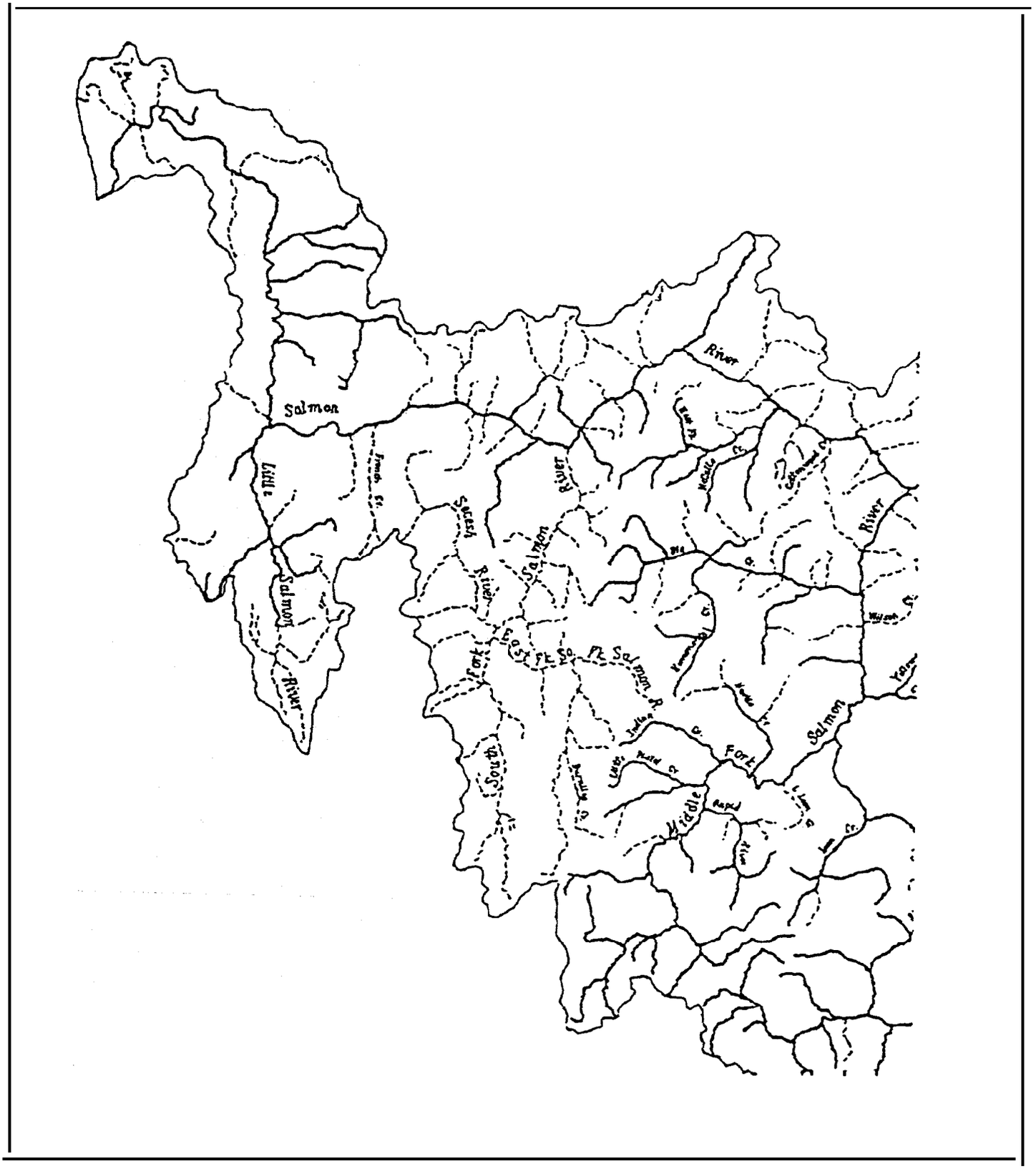
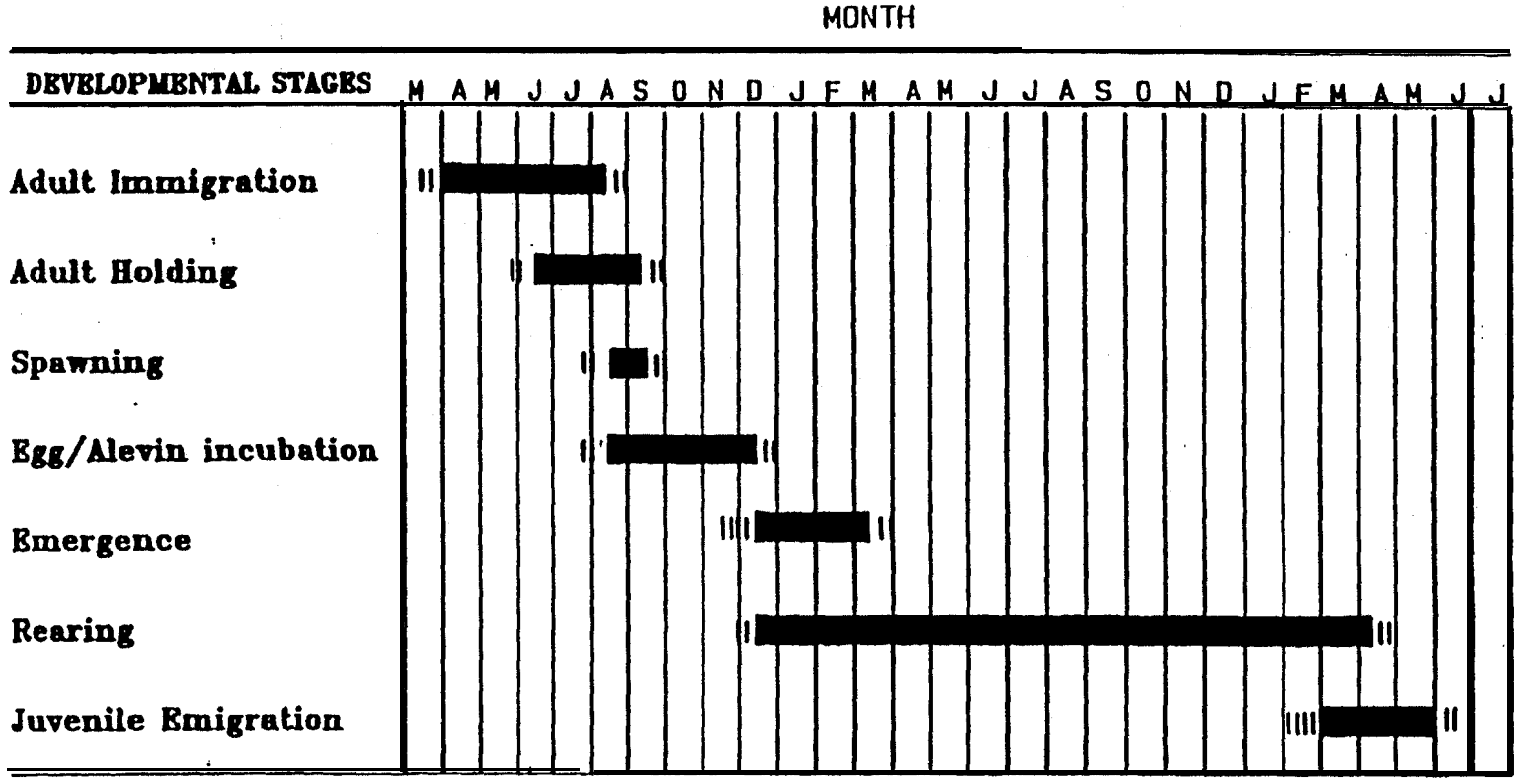


Figure 2 (TT). Freshwater life history for natural/wild spring chinook in the Salmon River subbasin.



Notes:

1. The developmental stage timing represents basin-wide averages, local conditions may cause some variability.
2. Solid bars indicate periods of heavi dult immigration, spawning and juvenile emigration.

Table 1 (HB). Estimated amount of spawning and rearing habitat (Use Type 1) by quality of Middle Fork Salmon River spring chinook production area.

	Excellent	Good	Fair"	Poor"	Unknown	Total	Confidence[b]
Miles (%)	9	47	39	5		680	M
Acres (%	4	42	52	2		2671.6	M

[a] Ratings of fair and poor habitat quality may reflect natural physical features such as gradient and channel type, as well as degradation caused by humans.
[b] 'Confidence' is meant to indicate the reproducibility and accuracy of the estimates made, and will be rated as high, medium or low by the respective agencies.

Source: Presence/Absence database, Northwest Power Planning Council, 1991.

Table 2 (HB). Estimated amount of rearing only (Use Type 2) habitat by quality of Middle Fork Salmon River spring chinook production area.

	Excellent	Good	Fair'	Poor[a]	Unknown	Total	Confidence[b]
				0			
Miles (%)	0 0	100 100	0 0	0		325.7 23.2	M M
Acres (%							

[a] Ratings of fair and poor habitat quality may reflect natural physical features such as gradient and channel type, as well as degradation caused by humans.
[b] 'Confidence' is meant to indicate the reproducibility and accuracy of the estimates made, and will be rated as high, medium or low by the respective agencies.

Source: Presence/Absence database, Northwest Power Planning Council, 199 1.

Table 3 (TS-a). Spring chinook egg to parr survival estimates" by percent sand categories.

Percent surface sand	stream	Year	Percent survival
<30 %	Marsh Creek	1985	32.5
30-40 %	Sulphur Creek	1989	11.6
>40%	Elk Creek	1985	6.2
		1986	1.7
		1987	1.2
	Bear Valley Cr.[b]	1984	8.2
		1985	2.2
		1986	1.2
		1989	2.1

[a] The analysis assumes a fecundity of 5,900 eggs/female and 1.5 redds/female.
[b] Shoshone-Bannock tribe data on parr abundance.

Source: Scully and Petrosky 1991.

Table 4 (TS-a). Estimated egg-to-parr survival for chinook populations with a predominance of three-ocean spawners, Middle Fork Salmon River drainage.

Stream	Reach	Brood year	IDFG redd count	Summer total parr abundance	Percent survival[a] 1 redd/ female	Percent survival[a] 1.5 redds/ female	Percent[b] surface sand
Marsh Creek	drainage	1984	61	77,913	21.6	32.5	17.8
Sulphur Creek	main stem	1988	NR[c]	NR	NR	11.6	NR
Elk Creek	main stern	1984	27	6,559	1.1	1.7	49.2
		1985	28	1,885	0.8	1.2	49.2
		1986	55	2,581			49.2
						8.2	
Bear Valley Creek	main stem	1983	56	18,100[d]	1.5	2.2	47.5
		1984	55	4,814[d]	0.8	[illegible]	47.5
		1985	134	6,274[d]	[illegible]	1.2	47.5
		1988	NR	NR	NR	2.1	NR

[a] Assumes 5,900 eggs perfemale (1981- 1984 average, Sawtooth Hatchery) and either 1 .0 redds/female (Bjornn 1978), or 1.5 redds/female (Ortmann 1968).
[b] OEA (1987 a,b) data for C-channels.
[c] NR = not reported.
[d] Shoshone-Bannock Tribes data (Konopacky et al. 1986; Richards and Cemera 1987).

Sources: Petrosky and Holubetz 1988.
Scully and Petrosky 1991.

Table 5 (PD-a). Natural chinook parr densities as fish per 100m^2 (CHINOD) and percent of rated carrying capacity (CHPERCC), Middle Fork Salmon River drainage 1985-1991.

	Year						
	1985	1986	1987	1988	1989	1990	199-l
Big Creek							
CHINOD=	2.68	8.06	1.41	2.44	5.48	1.99	0.73
CHPERCC=	2.73	8.93	2.87	3.56	7.76	13.45	1.66
N =	3	4	3	3	3	4	2
Rush Creek							
CHINOD=	NS[a]	NS	NS	NS	NS	0.19	NS
CHPERCC=	NS	NS	NS	NS	NS	0.43	NS
N=	NS	NS	NS	NS	NS	1	NS
Monumental Creek							
CHINOD=	12.02	9.30	33.21	7.14	2.96	6.92	0.86
CHPERCC=	17.41	12.20	43.16	9.27	3.84	11.19	1.12
N=	5	5	5	5	5	6	3
Camas Creek							
CHINOD=	2.90	4.01	0.0	1.92	1.83	3.39	1.76
CHPERCC=	3.77	5.21	0.0	2.49	2.37	4.40	2.28
N=	3	4	1	3	4	4	3
Loon Creek							
CHINOD=	2.95	19.73	0.12	7.15	1.94	0.66	0.59
CHPERCC=	6.70	44.84	0.26	16.24	4.41	1.49	1.34
N=	5	5	2	2	5	5	3
Marble Creek							
CHINOD=	0.0	0.0	NS	0.0	0.0	0.0	NS
CHPERCC=	0.0	0.0	NS	0.0	0.0	0.0	NS
N=	1	1	NS	1	1	3	NS
Pistol Creek							
CHINOD=	0.53	5.80	9.53	11.41	11.90	0.80	NS
CHPERCC=	1.20	13.17	21.66	25.92	27.04	1.81	NS
N=	2	2	2	2	2	2	NS
Sulphur Creek							
CHINOD=	9.13	32.17	20.77	31.61	71.27	5.40	3.00
CHPERCC=	8.45	29.79	19.23	29.27	65.99	5.00	2.78
N=	2	3	3	3	3	3	3

Table 5 (PD-a) (cont.). Natural chinook parr densities as fish per 100m² (CHINOD) and percent of rated carrying capacity (CHPERCC), Middle Fork Salmon River drainage 1985-1991.

	Year						
	1985	1986	1987	1988	1989	1990	1991
Marsh Creek							
CHINOD=	15.68	7.40	33.22	29.96	37.08	2.74	1.84
CHPERCC=	22.97	10.10	44.45	43.90	54.36	5.19	2.57
N=	6	5	5	5	5	5	5
Beaver Creek							
CHINOD=	11.83	17.93	3.22	18.01	9.95	0.20	0.66
CHPERCC=	15.36	23.28	4.18	23.38	12.92	0.26	0.85
N=	2	2	2	2	2	2	2
Cape Horn Creek							
CHINOD=	37.09	13.52	68.13	48.20	35.48	7.33	18.63
CHPERCC=	34.34	12.52	63.08	44.63	32.85	6.79	17.25
N=	2	2	2	2	2	4	2
Knapp Creek							
CHINOD=	12.02	3.59	5.25	5.62	10.97	1.89	5.86
CHPERCC=	11.13	3.32	4.86	5.21	10.16	1.75	5.43
N=	2	2	2	2	2	3	6
Bear Valley Creek							
CHINOD=	0.97	1.80	1.99	3.72	1.83	0.29	0.69
CHPERCC=	1.26	2.34	2.59	4.83	2.38	0.38	0.89
N=	2	7	7	7	7	8	7
Elk Creek							
CHINOD=	2.61	1.64	0.98	5.97	5.04	0.28	0.06
CHPERCC=	5.94	3.72	2.23	13.56	11.46	0.64	0.14
N=	4	4	4	4	4	4	4
Bearskin Creek							
CHINOD=	0.15	NS	0.0	0.59	0.15	0.20	0.0
CHPERCC=	0.34	NS	0.0	1.34	0.34	0.46	0.0
N=	1	NS	1	1	1	6	6

[a] NS = not sampled.
Source: B. Rich, IDFG, unpublished.

Table 6 (PT-a). Number of fish released and detection rates at Snake River dams for wild spring chinook PIT' tagged in the Middle Fork Salmon River drainage, 1990-1991.

Recovery Year	Number PIT tagged and released[b]	Percent Detected @ Lower Granite Dam	Percent Detected @ all 3 dams[b]
		Bie Creek	
		7.2	
1990	2,026	9.3	11.1
1991	724		13.1
		Bear Valley Creek	
		5.8	8.9
1990	1,357	12.5	19.3
		Elk Creek	
1990	16	6.2	12.5
1991	248	12.9	20.7
		Marsh Creek	
1990	2,496	7.1	10.4
1991	861	6.9	10.8
		Sulphur Creek	
1990	2,509	6.6	10.0
		Cane Horn Creek	
1991	164	15.2	12.3

[a] PIT = Passive Integrated Transponder
[b] Fish are tagged as parr July-August.

Sources: Matthews et al. 1992.
S. Achord, NMFS, per. comm.

Table 7 (RN-a). Wild spring chinook index redd counts in Middle Fork Salmon River tributaries, 1957-1991.

Year	Bear Valley Creek	Elk Creek	Marsh Creek Drainage	Sulphur Creek	Upper Big Creek	Totals
1957	791	398	458	381	233	2,261
1958	341	410	262	131	140	1,284
1959	381	516	95	100	69	1,161
1960	386	346	316	79	159	1,286
1961	629	384	546	239	382	2,180
1962	484	426	345	169	231	1,655
1963	460	654	372	332	181	1,999
1964	576	425	709	97	51	1,858
1965	301	203	404	43	75	1,026
1966	534	525	406	142	127	1,734
1967	445	420	650	134	67	1,716
1968	574	483	466	142	90	1,755
1969	356	349	235	138	90	1,168
1970	334	302	456	93	68	1,253
1971	108	173	281	58	32	652
1972	221	212	312	71	60	876
1973	287	369	518	78	96	1,348
1974	130	108	210	30	28	506
1975	215	169	201	50	77	712
1976	76	61	48	14	22	221
1977	129	86	98	5	9	327
1978	184	208	270	64	9s	821
1979	69	49	47	15	15	195
1980	15	8	9	2	4	38
1981	60	23	63	7	22	175
1982	39	9	40	3	7	98
1983	56	38	33	8	27	162
1984	55	27	60	0	42	184
1985	134	28	108	10	70	350
1986	74	55	101	65	67	362
1987	102	149	150	11	36	448
1988	283	330	217	41	101	972
1989	15	35	44	2	30	126
1990	62	42	57	22	20	203
1991	47	54	40	26	13	180

Source: P. Hassemer, IDFG, unpublished.

Table 8 (RN-b). Wild chinook" index redd counts for the mainstem Middle Fork Salmon River, 1960-1978.

Year	Mainstem[b] Middle Fork Salmon River
1960	46
1961	79
1962	61
1963	49
1964	213
1965	39
1966	91
1967	30
1968	31
1969	15
1970	62
1971	14
1972	33
1973	18
1974	23
1975	10
1976	1
1977	12
1978	3'

[a] Unknown whether spawners are spring or summer chinook. Spawners are listed as unclassified.
[b] Counts were made from Big Creek to Bear Valley Creek.
[c] Mainstem counts were deleted from the index counts after 1978.

Sources: Welsh et al. 1966,
Holubetz et al. 1972.
Hoss et al. 1976.
Ball et al. 1979.

Table 9 (RN-c). Number of chinook redds and redds per kilometer counted[a] by Nez Perce tribal biologists in Big Creek, 1986-1991.

Year	Number of redds	Redds per kilometer
1986	71	4.7
1987	48	2.7
1988	144	8.2
1989	47	2.7
1990	36	2.1
1991	34	1.9

[a] Multiple ground redd counts were conducted by tribal biologists.

Sources: Cowley and Kucera 1989.
Kucera, NPT, pers. comm.

Table 10 (AL-a). Big Creek spring chinook carcass fork lengths collected during index redd counts, 1960-1967.

Fork length in.	1960 No. fish	1961 No. fish	1962 No. fish	1963 No. fish	1964 No. fish	1965 No. fish	1966' No. fish	1967 No. fish
14								
15		2	[b]					
16		2	1	2				
17		6						
18	1	2	3	2	3			3
19		9	1	1	1	1		2
20		4	3	2	2			1
21		2				1		
22		2						
23	1			3				
24		3		2				
25	2	3	3	1	1			1
26	6	8	3	5	2	1		
27	3	11	9	4	2	1		4
28	3	16	4	7	5	2		2
29	5	14	7	6	4	1		6
30	1	11	3	1	1	3		2
31		4	4	2	1			1
32	4	9	6	3	1			
33	2	16	2	8	2	2		
34	1	12	9	10	5	1		
35		17	7	5	2	2		1
36	1	9	3	10	7	5		
37	1	7	1	5	3			2
38		2	1	2	1	1		4
39		1	1	3				1
40								
41			1	1				
42								
43								
44								
45								
46								1

[a] No length frequencies were reported for 1966.
[b] Blanks indicate no fish of this size were collected and measured.

Sources: Bjornn 1961.
Bjornn et al. 1963.
Bjomn et al. 1964.
Ortmann and Richards 1964.
Bjornn et al. 1966.
Platts et al. 1966.
Corley and Welsh 1968.
Welsh and Corley 1968.

Table 11 (AI-b). Marsh Creek spring chinook carcass fork lengths collected during index redd counts, 1960-1967.

Fork length in.	1960 No. fish	1961 No. fish	1962 No. fish	1963 No. fish	1964 No. fish	1965 No. fish	1966 No. fish	1967 No. fish
14								
15								
16				1				
17						2		2
18	2	[a]	1	2	2	2		3
19	2	2	1	2	3	1	3	3
20		1				1		
21	1	1	1	1				
22	3			1				
23			1			1		1
24	1		1	1	1		1	
25		6	3	4	5	1	3	
26	4	8	1	5	5	2	4	2
27	5	10	8	7	7	6	9	3
28	13	10	22	12	12	7	21	1
29	10	9	27	15	23	6	30	5
30	11	9	17	13	19	5	13	9
31	11	10	18	11	14	11	8	7
32	8	8	5	7	17	7	11	4
33	11	11	9	13	6	4	4	6
34	14	14	15	24	23	4	5	7
35	6	26	17	34	14	9	11	10
36	15	7	21	20	53	18	25	26
37	7	8	9	8	37	7	30	23
38	5	9	6	12	17	10	12	10
39		6	1	7	21	2	8	9
40		2	3	9	11	1	4	5
41		2	2	2	3		1	3
42		2		3	2		3	2
43				2	1		6	
44							2	
45								
46								

[a] Blanks indicate no fish of this size were collected and measured.

Sources: Bjornn 1961.
Bjornn et al. 1963.
Bjornn et al. 1964.
Ortmann and Richards 1964.
Bjornn et al. 1966.
Platts et al. 1966.
Corley and Welsh 1968.
Welsh and Corley 1968.

Table 12 (AL-c). Bear Valley Creek spring chinook carcass fork lengths collected during index redd counts, 1960-1967.

Fork length in.	1960 No. fish	1961 No. fish	1962 No. fish	1963 No. fish	1964 No. fish	1965 No. fish	1966 No. fish	1967 No. fish
14								
15	2	[a]	1					1
16	1	2		3	1	4		3
17	2	8	2	4	4	6	2	7
18	2	11	5	3	2	7	7	7
19	1	5	2	4	2	5	12	9
20		6	1	1	2			10
21		1	1	1			2	3
22			1				1	2
23	3	3	2	2			2	1
24	5	3	11	2	2		5	1
25	3	9	15	7	2	6	11	5
26	8	22	28		10	10	16	2
27	13	46	40	15	16	16	36	12
28	12	58	45	18	31	19	54	9
29	10	45	35	14	18	24	64	10
30	4	34	26	14	12	21	60	22
31	10	22	22	14	8	16	46	15
32	3	38	12	13	5	7	21	18
33	2	65	39	24	6	7	15	7
34	2	76	46	33	11	14	30	43
35	3	75	66	49	27	20	50	29
36	5	61	50	37	27	17	78	63
37	3	15	9	49	10	14	62	40
38	2	15	8	21	13	10	45	31
39	1	8	15	16	10	4	26	13
40		8	7	3	8	1	34	16
41	2	5	4	5	6	6	22	12
42		2	1	7	1	1	21	9
43			3	1	3		14	4
44			1				6	1
45							5	
46							1	

[a] Blanks indicate no fish of this size were collected and measured.

Sources: Bjomn 1961.
Bjomn et al. 1963.
Bjomn et al. 1964.
Ortmann and Richards 1964.
Bjomn et al. 1966.
Platts et al. 1966.
Corley and Welsh 1968.
Welsh and Corley 1968.

Table 13 (AL-d). Elk Creek spring chinook carcass fork lengths collected during index redd counts, 1960-1967.

Fork length in.	1960 No. fish	1961 No. fish	1962 No. fish	1963 No. fish	1964 No. fish	1965 No. fish	1966 No. fish	1967 No. fish
14								
15		1	[a]			1		
16		1			2			
17	2	8	3		3	4	4	1
18	2	6	1	1	2	3	1	12
19	2	2	2	2	1	2	3	5
20		2	1		1		2	4
21		3	2	1		1	1	2
22	1		1		1			
23	1		3				1	
24	2	3	2	1	3		1	
25	6	5	12	6	6	1		1
26	8	15	23	11	8		7	4
27	13	25	19	3	14	9	16	8
28	13	25	29	19	24	6	26	8
29	9	33	28	11	20	12	33	21
30	16	26	23	9	13	7	28	12
31	7	18	16	7	8	9	33	10
32	4	20	21	5	4	7	17	9
33	9	43	19	13	7	5	12	7
34	6	39	29	21	21	15	17	26
35	3	38	49	36	31	23	28	20
36	3	34	23	27	23	20	40	75
37	1	12	13	14	19	10	51	50
38		6	7	19	12	5	28	51
39	1	8	8	10	3	3	17	25
40		2	4	5	2	1	15	15
41	1	1	3	2	4	3	6	7
42			1	3	2	1	5	13
43			1			2	8	4
44	1							1
45							1	3
46							1	
47							1	

[a] Blanks indicate no fish of this size were collected and measured.

Sources: Bjomn 1961.
Bjomn et al. 1963.
Bjomn et al. 1964.
Ortmann and Richards 1964.
Bjomn et al. 1966.
Platts et al. 1966.
Corley and Welsh 1968.
Welsh and Corley 1968.

Table 14 (AC-a). Age composition" and length-frequency distribution of samples of 20 percent of the chinook carcasses from Bear Valley, Elk and Big Creeks, 1961-1962.

Length (in.)	Male Age group 3,	4,	5,	Female Agg r o u p 3 2	4 2	5 2	Combined Age group 3,	4,	5 2
15	2						2		
16	1						1		
17	8	1					8	1	
18	4						4		
19	2						2		
20	3						3		
21		1						1	
22		1						1	
23									
24		5						5	
25		7			2			9	
26		15			2			17	
27		24						24	
28		25			2	1		27	1
29		17	1		6			23	1
30		6	1		7	4		13	5
31		4			4	5		8	5
32		1			1	10		2	10
33		2	3		1	20		3	23
34					1	28		1	28
35			3		2	48		2	51
36			3			20			23
37		1				5		1	5
38			2			1			3
39		1	7			2		1	9
40			2						2
41			3						3
42									
43			1						1
Totals	20	111	26	0	28	144	20	139	170
Percent	13	71	16		16	84	6	42	52

[a] Age composition was determined by scale analysis.
Sources: Ortmann and Richards 1964, 1965.

Table 15 (AC-l). Age composition percentage (freshwater.ocean) by brood year[a] for wild spring chinook salmon returning to Marsh Creek, a tributary to the Middle Fork Salmon River. In this nomenclature, the freshwater and ocean ages sum to the total age of the fish.

Age Composition %

Brood Year	N	2.1	2.2	2.3
1957	157	5	40	55
1958	240	1	40	59
1959	276	1	25	74
1960	155	5	55	40
1961	166	3	23	74
1962	203	4	44	52

[a] Carcass counts during index redd count suveys was sample method. Total age based on 2 year freshwater rearing and ocean age delineated by fork length criteria as follows:

1960-67: l-ocean = <24 in.
2-ocean = 24 - 31 in.
3-ocean = > 31 in.

Sources: Bjornn, et al. 1964, 1966.
Corley and Welsh 1968.

Table 16 (AC-2). Age composition percentage (freshwater.ocean) by brood year' for wild spring chinook salmon returning to Bear Valley and Elk Creeks in the Bear Valley drainage, a tributary to the Middle Fork Salmon River. In this nomenclature, the freshwater and ocean ages sum to the total age of the fish.

Age Composition %

Brood Year	N	2.1	2.2	2.3
1957	835	1	47	52
1958	848	6	45	49
1959	438	6	36	58
1960	416	5	47	48
1961	850	2	19	79
1962	1,062	3	41	56

[a] Carcass counts during index redd count suveys was sample method. Total age based on 2 year freshwater rearing and ocean age delineated by fork length criteria as follows:

1960-67: l-ocean = <24 in.
2-ocean = 24 - 31 in.
3-ocean = >31 in.

Sources: Bjomn, et al. 1964, 1966.
Corley and Welsh 1968.

Table 17 (AC-3). Age composition percentage (freshwater.ocean) by brood year" for wild spring chinook salmon returning to Big Creek, a tributary to the Middle Fork Salmon River. In this nomenclature, the freshwater and ocean ages sum to the total age of the fish.

Age Composition %

Brood Year	N	2.1	2.2	2.3
1957	103	1	69	30
1958	109	27	30	43
1959	61	13	53	34
1960	34	21	47	32
1961	14	43	57	0
1962	11	18	0	82

[a] Carcass counts during index redd count suveys was sample method. Total age based on 2 year freshwater rearing and ocean age delineated by fork length criteria as follows:

1960-1967: l-ocean = <24 in.
2-ocean = 24 - 31 in.
3-ocean = >31 in.

Sources: Bjomn, et al. 1964, 1966.
Corley and Welsh 1968.

Table 18 (AS-l). Percent females by brood year and age class[a] (freshwater.ocean) for wild spring chinook salmon returning to Big Creek, a tributary of the Middle Fork Salmon River. In this nomenclature, the freshwater and ocean ages sum to the total age of the fish. N is equal to the known male and female components of the brood.

% Females

Brood Year	N	2.1	2.2	2.3	Total % Female
1957	101	0	21	26	47
1958	109	0	9	34	43
1959	60	0	10	33	43
1960	34	0	18	21	39

[a] Carcass counts during index redd count surveys was sample method. Total age based on 2 year freshwater rearing and ocean age delineated by fork length criteria as follows:

1960-67: l-ocean = <24 in.
2-ocean = 24 - 31 in.
3-ocean = >31 in.

Sources: Bjornn, et al. 1964, 1966.
Corley and Welsh 1968.

Table 19 (AS-2). Percent females by brood year and age class[a] (freshwater.ocean) for wild spring chinook salmon returning to Marsh Creek, a tributary to the Middle Fork Salmon River. In this nomenclature, the freshwater and ocean ages sum to the total age of the fish. N is equal to the known male and female components of the brood.

% Females

Brood Year	N	2.1	2.2	2.3	Total % Female
1957	154	1	14	35	50
1958	225	0	20	45	65
1959	268	0	12	56	68
1960	155	0	34	32	66
1961	166	0	9	52	61
1962	198	<1	15	38	53

[a] Carcass counts during index redd count suveys was sample method. Total age based on 2 year freshwater rearing and ocean age delineated by fork length criteria as follows:

1960-67: l-ocean = <24 in.
2-ocean = 24 - 31 in.
3-ocean = >31 in.

Sources: Bjornn, et al. 1964, 1966.
Corley and Welsh 1968.

Table 20 (AS-3). Percent females by brood year and age class' (freshwater.ocean) for wild spring chinook salmon returning to Bear Valley and Elk Creeks in the Bear Valley drainage, a tributary to the Middle Fork Salmon River. In this nomenclature, the freshwater and ocean ages sum to the total age of the fish. N is equal to the known male and female components of the brood.

% Females

Brood Year	N	2.1	2.2	2.3	Total % Female
1957	835	0	10	42	52
1958	846	<1	10	37	47
1959	441	0	7	43	50
1960	413	0	15	35	50
1961	859	<1	3	54	57
1962	1,057	0	8	41	49

[a] Carcass counts during index redd count suveys was sample method. Total age based on 2 ear freshwater rearing and ocean age delineated by fork length criteria as follows:

1960-67: l-ocean = <24 in.
2-ocean = 24 - 31 in.
3-ocean = >31 in.

Sources: Bjomn, et al. 1964, 1966.
Corley and Welsh 1968.

Table 21 (AF-a). Mean fecundity by return year for wild spring chinook returning to Elk Creek in the Middle Fork Salmon River drainage, 1951-1953.

Return year	Number of females spawned	Number of green eggs	Mean fecundity
1951	26	132,860	5,110
1952	20	98,654	4,932
1953	28	132,470	4,730

Source: Hauck 1954.

Table 22 (AF-a). Mean fecundity by return year for wild spring chinook returning to Bear Valley Creek in the Middle Fork Salmon River drainage, 1962-1969.

Return year	Number of females spawned	Number of green eggs	Mean fecundity
1962	34	187,378	5,511
(subsamples)		34,865	6,973
	2:	112,030	5,335
	3	13,760	4,587
	3	14,448	4,816
	1	5,555	5,555
	1	6,720	6,720
1963	69	402,868	5,839
1964	76	452,214	5,950
1965	NA[a]	NA	NA
1966	109	626,897	5,571
1967	26	161,475	6,211
1968	40	190,944	4,774
1969	41	217,392	5,302

[a] NA = no information available.

Sources: Bell 1965.
Gray 1969.
Hoss 1970.
Richards 1967.
Welsh 1964a, 1964b.

Table 23 (PT-a). Summary of the numbers collected, numbers PIT tagged and released, and average lengths and weights of wild spring chinook salmon collected in the Middle Fork Salmon River in 1989 (Matthews et al. 1992).

Tagging location	Number collected	Number PIT tagged and released	Average fork length of tagged fish (mm)	Average weight of tagged fish (g)
Sulphur Creek	2,599	2,509	70	3.8
Elk Creek	16	16	73	4.2
Marsh Creek	2,810	2,496	67	3.6
Bear Valley Creek	1,610	1,557	68	4.2
Big Creek	2,456	2,026	65	3.7

[a] Fish <50 mm were not tagged.

Table 24 (SL-a). Increases in length (mm) and weight (g) for wild spring chinook salmon from time of tagging in summer 1989 to time of recovery at Lower Granite Dam in spring 1990 (Matthews et al. 1992).

	Length increase			Weight increase		
Stream	N		Range	N		Range
Bear Valley Creek	3	46.0	41 .o-49.0	3	9.2	7.1-11.0
Sulphur Creek	16	29.9	17.0-43.0	15	6.7	1.1-10.7
Marsh Creek	16	33.9	16.0-49.0	11	6.9	2.6-11.8
Big Creek	7	34.3	13.0-51 .o	7	6.6	2.0-10.1

[a] Tagged fish were recovered during PIT-tag detection/diversion tests.

MIDDLE FORK SALMON RIVER, SALMON SUBBASIN

Summer Chinook (wild)

GEOGRAPHIC LOCATION

From its origin at the confluence of Bear Valley and Marsh creeks, the Middle Fork Salmon River (MFSR) flows north-northeast for 107 miles through the Salmon River Mountains and enters the Salmon River 57 miles downstream from Salmon, Idaho. The MFSR drains 2,830 square miles of central Idaho and includes 685 miles of stream accessible to salmon and steelhead for spawning and rearing. The main river is classified "wild", as part of the Wild and Scenic Rivers System. Most of the drainage is within the Frank Church River of No Return Wilderness Area. The rugged topography and wilderness designation has preserved the majority of the MFSR habitat in good condition. The major exceptions are several headwater spawning streams, including Bear Valley, Marsh, Camas, Marble, Big and Loon creeks, which are outside the wilderness. These have been degraded by activities such as mining and grazing. Thurow (1982) provided a detailed description of the drainage.

ORIGIN

Idaho Department of Fish and Game (IDFG) has classified chinook returning to the lower ends of Big and Loon creeks as summer chinook since the 1960's. These populations seem to spawn at a later time than chinook returning to the upper part of these tributaries. The MFSR summer chinook run is a wild, native run maintained by natural production.

DISTRIBUTION

Available spawning and rearing habitat for the MFSR was described in the Presence/Absence database (Table 1). This information was developed for the Northwest power Planning Council for subbasin planning and modeling. Summer chinook are believed to utilize the mainstem of Big Creek, from the mouth to Crooked Creek, and the mainstem of Loon Creek, from the mouth to Mayfield Creek.

PRODUCTION

There is no information describing survival and production factors of summer chinook. Refer to the spring chinook section for estimates of egg-to-par-r survival.

ADULT LIFE HISTORY

Adult Escapement

Chinook crossing Bonneville Dam from June 1 are counted as summers, as are those crossing Lower Granite Dam from June 18 through August 17. Specific time of migration and escapement for MFSR summer chinook is not well documented in the ocean, Columbia River or the Snake River. The University of Idaho implemented adult timing research in 1991 which should provide more information about Snake River timing (Bjornn et al. 1992).

Pursuant to the Endangered Species Act, naturally produced Snake River spring and summer chinook were listed as "threatened" by the National Marine Fisheries Service in 1992. This listing affects all chinook in the MFSR drainage.

Harvest

Information is not available regarding rate of contribution of MFSR summer chinook to harvest in the ocean, or Columbia or Snake rivers.
On average, the MFSR drainage comprised 24 percent of Idaho's salmon sport harvest, 1959-1978 (Homer and Bjomn 1981). However, harvest information specific to lower Loon and lower Big creeks is not available. The MFSR drainage has been closed to the sport harvest of chinook since 1978.

Information regarding occurrence and magnitude of tribal harvest of MFSR summer chinook is not available.

Spawner Escapement

Nez Perce tribal biologists have conducted multiple ground redd counts in Big Creek since 1985. They have found that spawning in lower Big Creek generally peaked about the first week of September. This is 2-3 weeks later than spring chinook spawning in upper Big Creek (Kucera 1987, Kucera and Cowley 1988, Cowley and Kucera 1989). All of the tribal information for Big Creek is reported in the spring chinook section.

Redd and carcass counts have been conducted in index areas of the MFSR drainage since the late 1950's by IDFG. This program has evolved into a single peak count. Lower Loon is counted the first week of September. This redd count was made between the last week of August and the first week of September. MFSR summer chinook redd counts peaked in 1957 at 960 redds, 1957-1991 (Table 2).

Total spawner escapement to the MFSR is unquantified. Index redd counts conducted by the IDFG are used for trend information, not escapement estimates. Ortmann (1966a, page 17) reported: "Redd counts . . . while providing our best yearly trend information, introduce considerable positive bias when used to estimate the number of fish in an escapement and should be recognized as trend indicators only.

Adult Characteristics

Information has not been compiled. Few carcasses have been collected from lower Big Creek and there are no records of carcasses collected in Loon Creek. Kucera (1987) reported that salmon spawning in lower Big Creek exhibited later timing than those spawning in upper Big Creek, but they were of comparable size, based on carcass lengths.

JUVENILE LIFE HISTORY

Life history timing is likely similar to Figure 1. Although not illustrated in the figure, there is typically a fall emigration of chinook presmolts from the upper ends of tributaries to lower in the drainage for winter rearing.

BIOCHEMICAL/GENETIC CHARACTERISTICS

Information has not been collected from lower Loon and Big creeks.

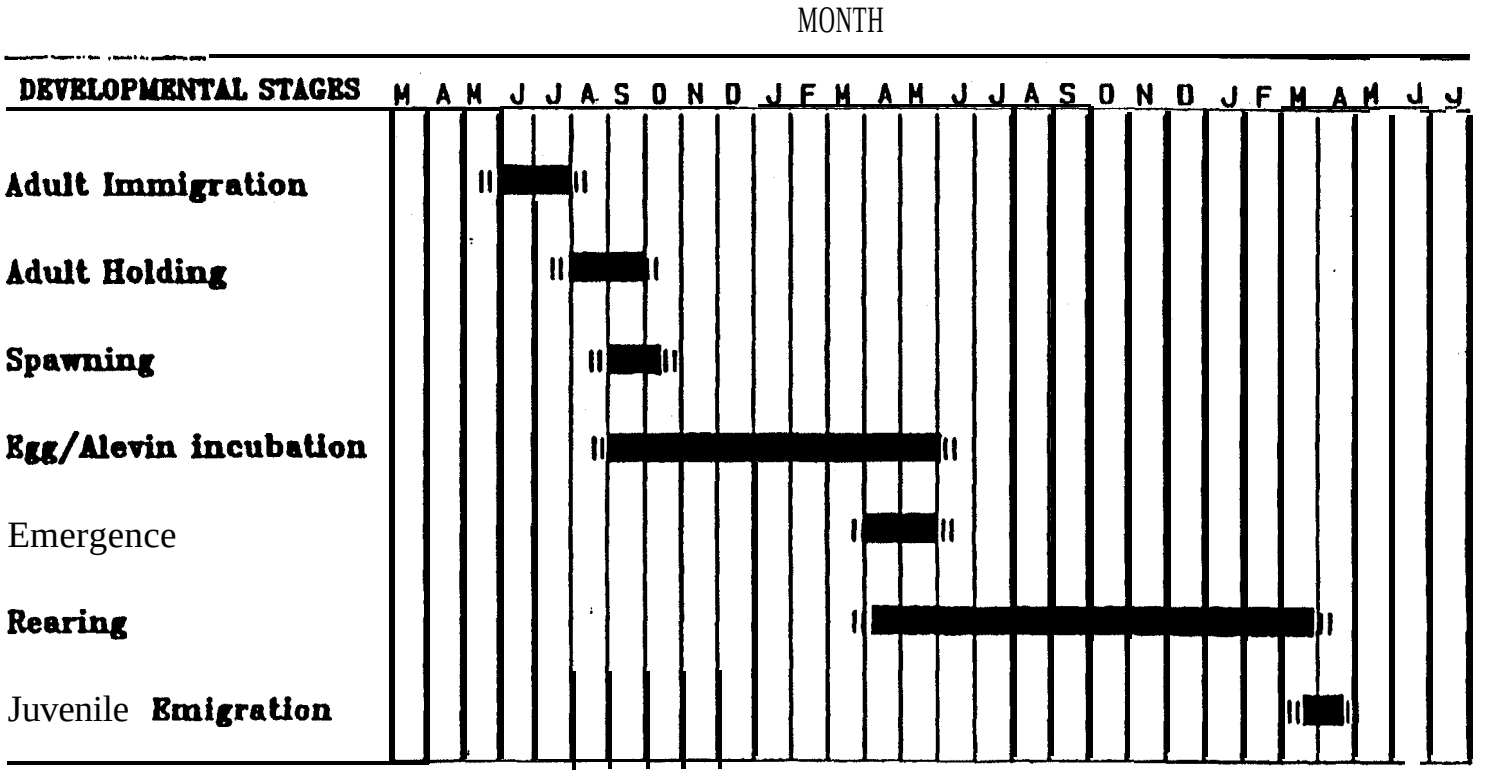
DISEASES

Information has not been compiled.

REFERENCES

All Middle Fork references appear at the end of the hatchery produced summer steelhead section.

Figure 1 (TT). Freshwater life history for natural/wild summer chinook salmon in the Salmon River subbasin.



Notes:

1. The developmental stage timing represents basin-wide averages, local Conditions may cause some variability.
2. Solid bars indicate periods of heaviest adult immigration, spawning and juvenile, emigration.

Table 1 (HB). Estimated amount of spawning and rearing (Use Type 1) habitat by quality of Middle Fork Salmon River summer chinook production area.

	Excellent	Good	Fair[a]	Poor[a]	Unknown	Total	Confidence[b]
Miles (%)	0	37	63	0		45.2	M
Acres (%)	0	32	68	0		254	M

[a] Ratings of fair and poor habitat quality may reflect natural physical features such as gradient and channel type, as well as degradation caused by humans.
[b] 'Confidence' is meant to indicate the reproducibility and accuracy of the estimates made, and will be rated as high, medium or low by the respective agencies.

Source: Presence/Absence database, Northwest Power Planning Council, 1991.

Table 2 (RN-a). Wild summer chinook index redd counts in the Middle Fork Salmon drainage, 1957-1991".

Year	Loon Creek	Lower Big Creek
1957	425	535
1958	193	338
1959	123	217
1960	334	352
1961	131	160
1962	157	360
1963	261	220
1964	361	121
1965	166	83
1966	49	51
1967	96	94
1968	135	33
1969	110	72
1970	43	23
1971	79	52
1972	150	NC'
1973	78	NC!
1974	34	NC
1975	32	NC
1976	31	NC
1977	62	NC
1978	29	NC
1979	NC	NC
1980	9	NC
1981	30	NC
1982	23	NC
1983	7	NC
1984	4	NC
1985	28	NC
1986	21	NC
1987	23	23
1988	5	
1989	16	
1990	NC	
1991	5	

"NC = no count taken.
Source: P. Hassemer, IDFG, unpublished.

MIDDLE FORK SALMON RIVER, SALMON SUBBASIN

Summer Steelhead (wild)

GEOGRAPHIC LOCATION

From its origin at the confluence -of Bear Valley and Marsh creeks, the Middle Fork Salmon River (MFSR) flows north-northeast for 107 miles through the Salmon River Mountains and enters the Salmon River 57 miles downstream from Salmon, Idaho (Figure 1). The MFSR drains 2,830 square miles of central Idaho and includes 685 miles of stream accessible to salmon and steelhead for spawning and rearing. The main river is classified "wild", as part of the Wild and Scenic Rivers System. Most of the drainage is within the Frank Church River of No Return Wilderness Area. The rugged topography and wilderness designation has preserved the majority of the MFSR habitat in good condition. The major exceptions are several headwater spawning streams, including Bear Valley, Marsh, Camas, Marble, Big and Loon creeks, which are outside the wilderness. These have been degraded by activities such as mining and grazing. Thurow (1982) provided a detailed description of the drainage.

ORIGIN

The MFSR drainage is one of three major Idaho drainages supporting runs of wild, native, B-run steelhead. Hatchery steelhead have not been stocked in the MFSR. Natural production maintains the run. These fish are classified as B-run on the basis of ocean age component and size at age. B-run steelhead generally enter the Columbia River from August through December and arc larger than A-run steelhead of comparable ocean age.

DISTRIBUTION

Available spawning and rearing habitat for the MFSR was described in the Presence/Absence database (Tables 1 and 2). This information was developed for the Northwest power Planning Council for subbasin planning and modeling. Thurow (1985) surveyed 540 km in 13 tributaries which were usable for spawning by steelhead. The mainstem MFSR also had suitable spawning substrate.

PRODUCTION

There is little information describing survival and production factors. Idaho Department of Fish and Game (IDFG) biologists have conducted steelhead parr monitoring since the early 1980's. Parr densities have been determined by snorkel counts. For 1981-83, Thurow (1985) reported that densities of steelhead in MFSR tributaries ranged 0.2-10 parr/100 m^2 and averaged 4 parr/100 m^2. Densities of steelhead in the mainstem were substantially lower at less than 1 parr/100 m^2. More recent steelhead parr monitoring conducted by IDFG has not reflected any increase in steelhead parr production. In fact, parr densities appear to have decreased since Thurow's work. Although monitoring transects are located on the mainstem MFSR and tributaries, only tributary densities are reported here, For 1985-1991, the overall weighted mean of all sections and years for steelhead parr density in IDFG transects was 1.5 parr per 100 m^2 and 8.8 percent of estimated carrying capacity (Table 3). Parr carrying capacity ratings for summer steelhead were derived from the Presence/Absence database used for development of the Salmon Subbasin Plan.

ADULT LIFE HISTORY

Adult Escapement

Specific time of migration and escapement for steelhead returning to the MFSR drainage has not been identified for the ocean, or Columbia or Snake rivers. The University of Idaho implemented adult timing research in 1991 which should provide information about Snake River timing (Bjornn et al. 1992).

Thurow (1982) reported that wild steelhead begin entering the upper Salmon River in the fall. A portion stop in pools below the MFSR, while others wander above and below. It appeared that most steelhead which enter the MFSR in the fall did not overwinter there, but reentered the Salmon River.

Harvest

Information is not available regarding the rate of contribution of this stock to ocean, Columbia River or Snake River harvest. Beginning with the fall of 1986, the harvest of steelhead possessing an adipose fm (non-hatchery) has not been allowed in the Snake River or in Idaho.

Steelhead harvest in the MFSR was limited by water levels and access conditions. Harvest averaged 430 fish annually during the late 1960's. The MFSR drainage has been closed to fishing for steelhead since 1974 in an attempt to sustain the wild steelhead stock (Thurow 1982).

Thurow (1982) reported that steelhead destined for the MFSR which remain in the main Salmon River for several months were susceptible to an intensive sport fishery. He estimated that exploitation rates of wild MFSR steelhead approached or exceeded 50 percent in the 1970's. Total Salmon River harvest of wild steelhead destined for the MFSR in the Salmon River ranged up to 1,760 steelhead (Thurow 1983). Harvest of MFSR steelhead in Section 4 of the mainstem Salmon River (South Fork Salmon River to MFSR) ranged from 98 to 925 steelhead for the period 1970-1983 (Table 4).

Because of concerns about low escapement of wild steelhead, a series of new regulations were implemented by IDFG in the Salmon River beginning in the spring of 1982. These were designed to protect wild steelhead. Bag and length limits and dorsal fin height regulations were used (Thurow 1982, 1983, 1985). By the 1983-84 season, dorsal fm height regulations required anglers to release the majority of wild fish, regardless of total length. Beginning in 1984, 100 percent of the hatchery steelhead smolts received an adipose fin clip. Current regulations in Idaho only allow harvest of
hatchery steelhead.

Spawner Escapement

In the spring, steelhead probably begin entering the MFSR soon after river ice jams melt. Thurow (1985) reported that the life history and movements of MFSR steelhead were complex and variable. He felt differences in time of entry into the upper Salmon River, migration speed, and seasonal staging were likely influenced by environmental and genetic factors. Reingold (1981) noted that steelhead spawning activity in the MFSR usually coincided with spring runoff and often conditions were not conducive to observing spawners. Thurow (1983) found steelhead staging in the lower 400 m of the MFSR in large numbers during March and April. Spawning activity commenced in early April and peak activity occurred in May (Thurow 1985). Orcutt et al. (1969) as cited by Thurow

(1982) studied spawning behavior of steelhead in the Salmon and Clearwater rivers. They reported steelhead spawning peaked April 20-May 10 at water temperatures of 2.5-8.5 C° (36-47 F°).

Steelhead spawning escapement diminished from approximately 5,000 in 1970-71 -to 500 (or less) in 1975-76 (Jeppson and Ball 1979 as cited by Thurow 1982) (Table 4). Thurow (1982) attributed much of the decline to mortalities to migrating steelhead at Snake and Columbia river dams.

Thurow conducted extensive steelhead redd count surveys but cautioned that "springtime visual surveys of spawning areas do not provide a reliable estimate of actual spawner abundance (Thurow 1982, page 15). However, steelhead redd counts could provide information regarding timing, location and biological data characterizing spawners. Thurow collected similar information in 1981 and 1983. Water conditions in 1982 were unsatisfactory for redd counts. In 1981, he observed 45 spawners and 22 redds for an average density of 1 spawner for every 5.8 km surveyed (Thurow 1982). In 1983, Thurow observed 78 spawners and 80 redds for an average of 1 spawner or redd for every 5 km surveyed (Thurow 1985).

Peak index steelhead redd counts were conducted by IDFG biologists in 1990 and 1991 in the MFSR drainage. Redd densities were higher in 1990 and ranged up to 13.0 redds/cm in a section of Camas Creek (Table 5).

Adult characteristics

Adult steelhead were collected in the MFSR in 1981-1982 and 1990-1991. Fork lengths ranged between 48-93 cm (Table 6). Thurow (1982) reported that in 1981, steelhead spawners ranged from 61-91 cm and 57 percent were less than 71 cm long. He observed large proportions of smaller steelhead in Big, Camas, and Loon creeks. However, he reported that he captured 170 adult steelhead in the MFSR from 1981 to 1983 and 85 percent exceeded 76 cm (Thurow 1985).

For 45 adult male steelhead collected in 1990, fork length ranged 58-91 cm and averaged 72 cm. A sample of 132 females illustrated a similar average fork length of 73 cm. The size range for adult female steelhead was 57-85 cm fork length.

When he combined length frequencies of wild steelhead caught by project personnel and anglers, Thurow (1982) illustrated that two main size groups of wild steelhead were sampled in 1981 which separated by age at approximately 71 cm. Of 427 steelhead, 79 percent were 2-ocean fish, based on length. Thurow cited past data which suggested that a definite difference in size existed between wild fish above and below the MFSR. Wild steelhead sampled above the MFSR demonstrated A-run characteristics with a separation between 1 and 2 ocean fish at 66 cm. Wild steelhead sampled below the MFSR were similar to those sampled in 1981, suggesting B-run steelhead were entering the MFSR.

Ocean age composition was determined by scale analysis for adult steelhead collected in 1990. Three age classes appeared: one-ocean, two-ocean, and an intermediate group termed one-plus. The one-plus group showed considerable ocean growth outside the first ocean annulus, but it appeared that a second ocean annulus had been eroded away. IDFG biologists believe that the one-plus group consists of two-ocean steelhead that enter the freshwater environment earlier. The longer freshwater residence could result in more scale erosion, removing the second ocean annulus. Thus, 42 percent of the sample was one-ocean and 58 percent was likely two-ocean steelhead (Table 7).

Total age of MFSR steelhead probably ranges from 3 to 6 years. Because the MFSR steelhead spend 6-9 months back in freshwater before spawning, the sum of the juvenile freshwater and ocean

ages described in the "freshwater.ocean" notation understates the actual age at the time of spawning by one year (Petrosky, IDFG, pers. comm.)

Thurow (1982) observed that sex ratios for 34 spawners in tributaries averaged 1:1 in 1981. Thurow (1985) found that female steelhead appeared to be predominant in the early portions of the run, as sex ratios averaged 5.2 females per male in October-November 1981 and 3.3 females per male in March-April 1982. Information from adult fish collected in the spring 1982, 1990, and 1991 supports Thurow's observation that females predominate the MFSR steelhead run. For all three years, females comprised over 70 percent of the run (Table 8). Females also predominated both ocean-age classes (Table 7).

JUVENILE LIFE HISTORY

Life history timing is likely similar to Figure 2. Although not illustrated in the figure, there is typically a fall emigration of steelhead presmolts from the upper ends of tributaries to lower in the drainage or to the mainstem Salmon River for winter rearing.

Reingold (1981) classified juvenile fish length to approximately 120 mm (4.5 in) as Age I, longer than 120 mm to approximately 170 mm (6.5 in) as Age II, and larger rainbow as Age III. Although he classified all rainbow as steelhead, he noted it was possible that resident rainbow trout could have been included in the counts (Reingold 1981).

Thurow used slightly different length ranges to describe juvenile steelhead age composition in 1982-1983 (Table 9). Thurow (1982) observed that during both 1980 and 1981, length frequencies of the hook-and-line caught juvenile steelhead illustrated considerable overlap of age groups. Thurow (1985) assumed that most steelhead-rainbow less than 250 mm were juvenile steelhead. Otolith nuclei measurements supported that hypothesis.

Juvenile steelhead were observed and classified by length group while snorkeling in mainstem and tributary transects. For mainstem transects, Age 2^+ juvenile steelhead predominated in 1980 and 1983 (Table 9). In tributaries, the juvenile age composition was not always similar to the age proportions found in the mainstem transects but age 3^+ comprised the smallest proportion of the population in both the mainstem and tributary transects (Table 10).

Thurow (1985) observed precocial male steelhead ranging 17-23 cm on redds with adult steelhead in MFSR tributaries.

BIOCHEMICAL/GENETIC CHAIUCTERISTICS

Steelhead populations of the MFSR drainage were electrophoretically examined by Wishard (1982) and Wishard and Seeb (1983). Wishard (1982) reported that electrophoretic data indicated local breeding groups existed. Wishard and Seeb (1983) also concluded that heterogenous results from their analysis indicated that locally isolated populations of steelhead existed within the MFSR drainage.

Isozyme gene frequencies for Columbia Basin steelhead were reported by Schreck et al. (1986) (Appendix Table 4). Data for the MFSR was obtained from Wishard and Seeb (1983).

DISEASES

Information has not been compiled.

REFERENCES

All Middle Fork references appear at the end of the hatchery produced summer steelhead section.

Figure 1. Anadromous **salmonid** distribution in the west half of the **Salmon** River **subbasin** as represented by spring chinook, based on the NPPC presence/absence data base and the BPA Geographic Information System.

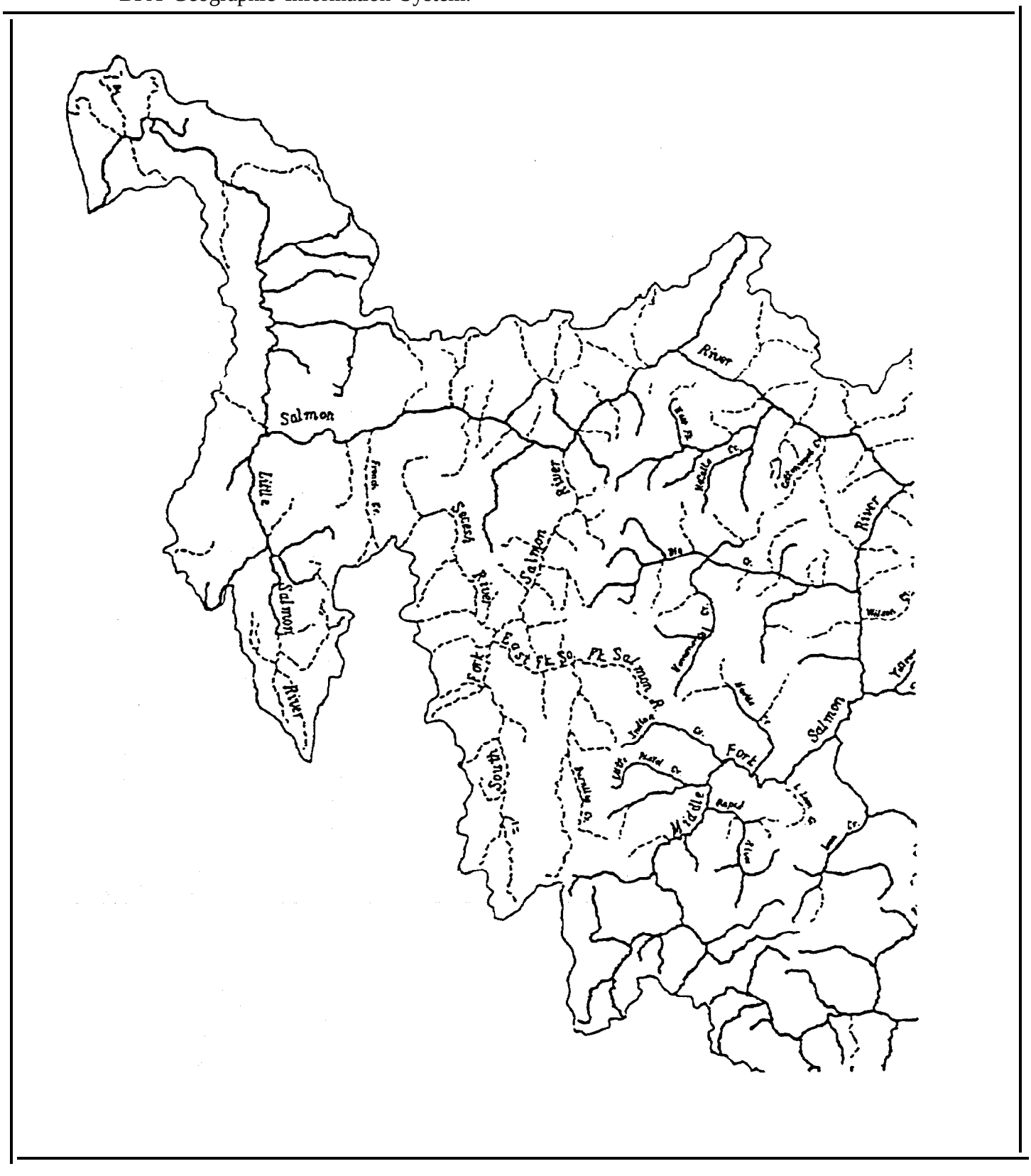
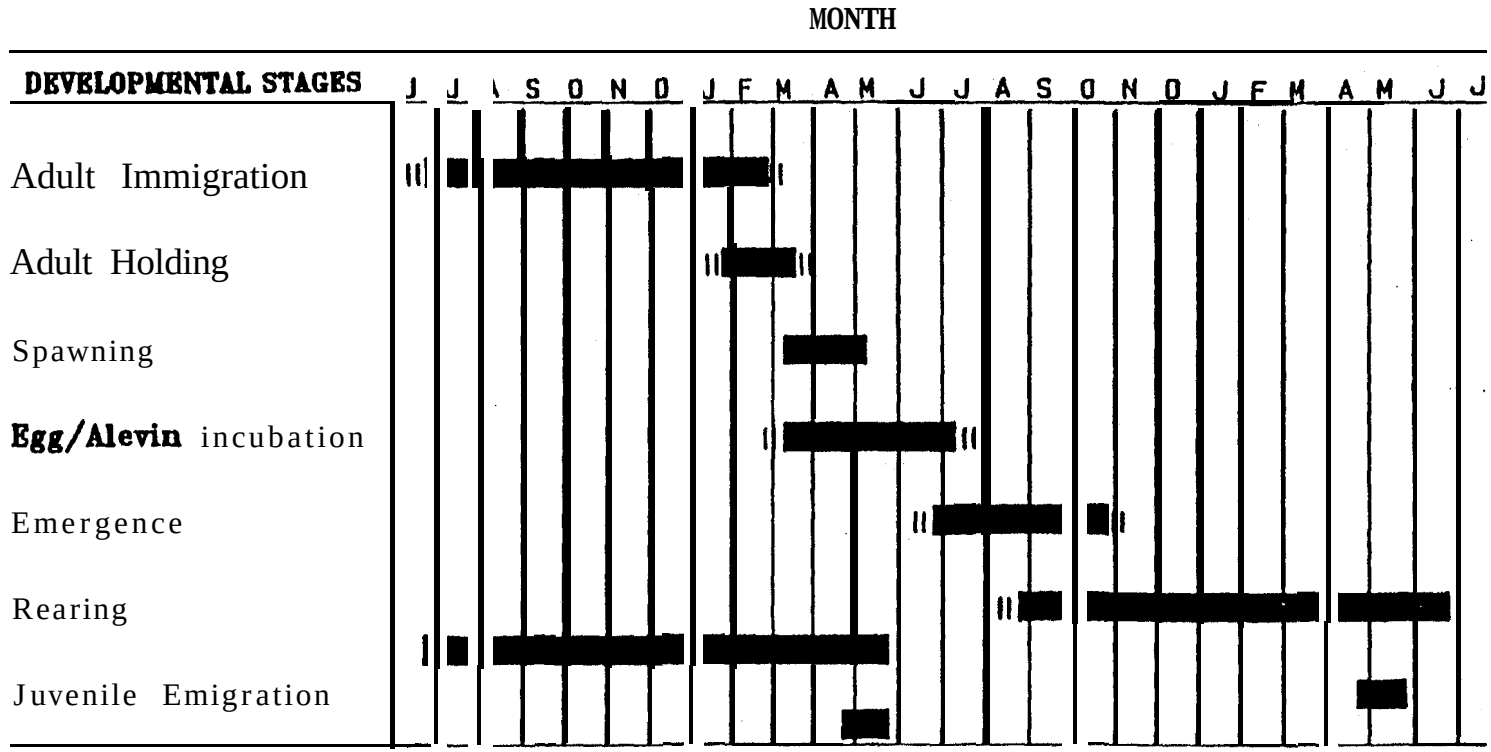


Figure 2 (TT). Freshwater life history for natural/wild steelhead runs in the Salmon River subbasin.



Notes:

1. The developmental stage timing represents basin-wide averages, local conditions may cause some variability.
2. Solid bars indicate periods of heaviest adult immigration, spawning and juvenile emigration.
3. Rearing and juvenile emigration take place over a three year period and are shown above in a rap-around fashion.

Table 1 (HB). Estimated amount of spawning and rearing (Use Type 1) habitat by quality of Middle Fork Salmon River steelhead production area.

	Excellent	Good	Fair"	Poor"	Unknown	Total	Confidence[b]
			10				
Miles (%)	48 67	21 19	32	21		3210.8 983.6	M M
Acres (%)							

[a] Ratings of fair and poor habitat quality may reflect natural physical features such as gradient and channel type, as well as 'degradation caused by humans.
[b] 'Confidence' is meant to indicate the reproducibility and accuracy of the estimates made, and will be rated as high, medium or low by the respective agencies.

Source: Presence/Absence database, Northwest Power Planning Council, 1991.

Table 2 (HB). Estimated amount of rearing only (Use Type 2) habitat by quality of Middle Fork Salmon River steelhead production area.

	Excellent	Good	Fair[a]	Poor"	Unknown	Total	Confidence[b]
Miles (%)	100	0	0	0		23.2	M
Acres (%)	100	0	0	0		325.7	M

[a] Ratings of fair and poor habitat quality may reflect natural physical features such as gradient and channel type, as well as degradation caused by humans.
[b] 'Confidence' is meant to indicate the reproducibility and accuracy of the estimates made, and will be rated as high, medium or low by the respective agencies.

Source: Presence/Absence database, Northwest Power Planning Council, 1991.

Table 3 (PD-a). Parr density and percent of rated carrying capacity (PCC) for steelhead in the Middle Fork Salmon River tributaries[a].

Stream name	Year	Sample size	Ages 1+ & 2+ density (#/100m²)	Density std. dev.	PCC for 1+ & 2+	PCC std. dev.
Big Creek	85	3	2.20	2.26	12.15	11.06
Big Creek	86	4	6.25	7.18	35.91	35.92
Big Creek	87	3	0.23	0.34	1.15	1.70
Big Creek	88	3	3.07	3.23	17.09	15.96
Big Creek	89	3	0.92	0.92	4.79	4.39
Big Creek	90	4	3.25	5.60	16.73	27.74
Big Creek	91	2	0.35	0.50	1.75	2.48
Rush Creek	90	1	2.69	NA[b]	13.45	NA
Monumental Cr.	85	5	4.37	5.35	30.23	38.87
Monumental Cr.	86	5	2.63	1.84	16.90	13.88
Monumental Cr.	87	5	3.20	1.81	21.64	14.42
Monumental Cr.	88	5	3.79	2.03	23.42	10.76
Monumental Cr.	89	5	0.70	0.70	4.30	4.10
Monumental Cr.	90	6	0.08	0.15	0.53	1.06
Monumental Cr.	91	3	0.00	0.00	0.00	0.00
Camas Creek	85	3	4.79	5.86	23.93	29.28
Camas Creek	86	4	2.29	1.85	11.44	9.26
Camas Creek	87	1	0.00		0.00	NA
Camas Creek	88	3	2.57	2.%	12.83	13.02
Camas Creek	89	4	1.06	0.89	5.31	4.47
Camas Creek	90	4	1.25	1.80	6.25	9.01
Camas Creek	91	3	0.93	0.56	4.63	2.81
Loon Creek	85	5	2.67	2.60	13.36	13.00
Loon Creek	86	5	7.45	5.94	37.25	29.70
Loon Creek	87	2	0.00	0.00	0.00	0.00
Loon Creek	88	2	9.46	6.05	47.32	30.23
Loon Creek	89	5	1.69	3.36	8.46	16.80
Loon Creek	90	5	1.86	2.40	9.30	11.99
Loon Creek	91	3	0.56	0.93	2.82	4.66
Marble Creek	85	3	1.02	0.52	5.58	2.23
Marble Creek	86	3	4.15	6.57	21.01	32.64
Marble Creek	87	2	1.64	1.81	8.20	9.05
Marble Creek	88	3	0.31	0.54	2.13	3.83
Marble Creek	89	4	0.00	0.00	0.00	0.00
Marble Creek	90	5	0.48	0.57	2.92	3.80
Marble Creek	91	2	0.00	0.00	0.00	0.00

Table 3 (PD-a) (cont.). Parr density and percent of rated carrying capacity (PCC) for steelhead in the Middle Fork Salmon River tributaries.

Stream name	Year	Sample size	Ages 1+ & 2+ density (#/100m²)	Density std. dev.	PCC for 1+ & 2+	PCC std. dev.
Pistol Creek	85	2	2.90	1.49	14.48	7.46
Pistol Creek	86	2	9.44	4.09	47.18	20.47
Pistol Creek	87	2	4.20	2.48	20.98	12.41
Pistol Creek	88	2	4.54	4.93	22.68	24.64
Pistol Creek	89	2	4.04	2.14	20.23	10.71
Pistol Creek	90	2	2.26	1.69	11.28	8.45
Sulphur Creek	85	2	0.54	0.76	3.82	5.40
Sulphur Creek	86	3	1.37	1.29	9.76	9.22
Sulphur Creek	87	3	1.76	1.54	12.57	11.00
Sulphur Creek	88	3	2.57	2.29	18.38	16.33
Sulphur Creek	89	3	4.29	0.81	30.67	5.79
Sulphur Creek	90	3	3.35	0.96	23.93	6.87
Sulphur Creek	91	3	0.43	0.05	3.07	0.38
Marsh Creek	85	6	0.76	0.70	5.16	4.74
Marsh Creek	86	5	0.69	0.65	5.85	5.13
Marsh Creek	87	5	1.05	0.60	10.15	6.70
Marsh Creek	88	5	0.90	1.20	11.37	20.43
Marsh Creek	89	5	1.42	1.53	12.83	17.08
Marsh Creek	90	5	0.76	1.16	4.04	5.62
Marsh Creek	91	5	0.39	0.64	2.58	3.35
Beaver Creek	85	2	1.28	0.11	9.11	0.76
Beaver Creek	86	2	1.04	1.48	7.46	10.56
Beaver Creek	87	2	0.37	0.44	2.64	3.13
Beaver Creek	88	2	1.83	0.85	13.08	6.06
Beaver Creek	89	2	0.93	0.66	6.64	4.74
Beaver Creek	90	2	0.11	0.16	0.78	1.11
Beaver Creek	91	2	1.68	0.45	12:oo	3.24
Cape Horn Cr.	85	2	0.08	0.11	0.57	0.81
Cape Horn Cr.	86	2	0.42	0.06	3.04	0.46
Cape Horn Cr.	87	2	0.44	0.62	3.11	4.39
Cape Horn Cr.	88	2	2.11	2.98	15.07	21.31
Cape Horn Cr.	89	2	0.06	0.09	0.46	0.66
Cape Horn Cr.	90	4	0.13	0.15	0.91	1.06
Cape Horn Cr.	91	2	0.85	0.08	6.07	0.61
Knapp Creek	85	2	0.64	0.08	4.57	0.61
Knapp Creek	86	2	0.42	0.40	3.00	2.83
Knapp Creek	87	2	1.76	2.49	12.57	17.78
Knapp Creek	88	2	2.86	0.82	20.43	5.86
Knapp Creek	89	2	1.68	0.78	12.00	5.56
Knapp Creek	90	3	1.36	1.37	9.69	9.77
Knapp Creek	91	1	0.61	NA	4.36	NA

Table 3 (PD-a) (cont.). Parr density and percent of rated carrying capacity (PCC) for steelhead in the Middle Fork Salmon River tributaries.

Stream name	Year	Sample size	Ages 1+ & 2+ density (#/100m²)	Density std. dev.	PCC for 1+ & 2+	PCC std. dev.
Bear Valley Cr.	85	2	0.06	0.08	0.60	0.85
Bear Valley Cr.	86	7	0.63	1.21	3.46	6.08
Bear Valley Cr.	87	7	0.28	0.56	1.55	2.78
Bear Valley Cr.	88		0.70	1.20	4.58	6.54
Bear Valley Cr.	89	7	0.02	0.04	0.17	0.45
Bear Valley Cr.	90	8	0.14	0.25	0.89	1.27
Bear Valley Cr.	91	7	0.53	0.88	3.94	4.08
	85					
Elk Creek	86	4	0.71	0.63	7.10	6.27
Elk Creek		4	0.22	0.28	2.23	2.83
Elk Creek	87	4	0.00	0.00	0.00	0.00
Elk Creek	89	4	0.17	0.14	1.72	1.37
Elk Creek	90	4	0.00	0.02	0.00	0.25
Elk Creek		4	0.00	0.00	0.00	0.00
Elk Creek	91			0.00		0.00
Bearskin Creek	85	1	0.00	NA	0.00	NA
Bearskin Creek	87	1	0.00	NA	0.00	NA
Bearskin Creek	88	1	0.00	NA	0.00	NA
		1	[illegible]			NA
Bearskin Creek	90	6	0.04	0.%	0.00	0.97
Bearskin Creek	91	5	0.00	0.00	0.00	0.00

[a] Densities estimated by snorkel counts.
[b] NA = not applicable.

Source: B. Rich, IDFG, unpublished.

Table 4 (RN-a). Estimated annual escapements of wild steelhead trout to the Middle Fork Salmon River (MFSR), 1970-1983" (Thurow 1983).

Fish year	MFSR steelhead entering sec. 4[b]	MFSR steelhead harvested steelhead sec. 4	MFSR harvest	Exploitation rate Sec. 4	Exploitation rate Secs. 1-4[c]	MFSR escapement
1970-7 1	6,053	784	129	0.16		5,123
1971-72	5,223	925	27	0.18		4.269
1972-73	2,778	523		0.20		2,228
1973-74	3,079	400	c.s.[d]	0.13		2,659
1974-75	600	c.s.	"			600
1975-76	500	c.s.	"			500
1976-77	1,559	229	"	0.1;		1,330
1977-78	2,428	653	"	0.27		1,775
1978-79	< 1,000"	c.s.	"			< 1,000
1979-80	< 1,000	98[f]	"			< 1,000
1980-81[h]	2,566	665	"	0.26	0.50	1,900
1981-82[h]	2,896	885	"	0.31	0.47	2,011
1982-83[h]	2,100	40[g]	"	0.02		2,060

[a] The reader is cautioned that these estimates are not absolute, but are based on the best available data.
[b] Section 4 = South Fork to Middle Fork Salmon River.
[c] Sections l-3 = Mouth of Salmon to South Fork Salmon *River.*
[d] *c.s.* = closed season.
[e] No creel data available to calculate estimates.
[f] Closed season for steelhead larger than 28 inches, estimated catch includes steelhead <28".
[g] Estimated 540 wild steelhead released.
[h] Projections based on limited data.

Table 5 (RN-b). Middle Fork Salmon River steelhead index redd counts' conducted by Idaho Department of Fish and Game, 1990 and 1991.

Location		Number of redds 1990	Number of redds 1991	km	Redds/km 1990	Redds/km 1991
Sulphur Creek	Ridge to Trail	12	3	2.4	4.7 0.6	1.2 0.9
Bear Valley Creek	Fir Cr. Bridge to Poker Bridge	30	11	4.0	7.5	2.7
	Poker Bridge to Elk Cr.	32	21	5.0	6.4	4.2
Marsh Creek	Capehom Bridge to Knapp Cr.	23	1	3.4	6.8	0.3
Loon Creek	Falconberry to Rock Cr.	38	17	5.5	6.9	3.1
Camas Creek	West Fk. to Duck Cr.	31	23	2.4	12.9	9.5
	Duck Cr. to Furnace Cr.	24	3	9.3	2.6	0.3
	West Fk., mouth to Flume Cr.	6	1	2.9	2.1	0.3
Big Creek	Cougar Cr. to Rush Cr.	21	NA[b]	3.7	5.7	-
	Cabin Cr. to Cave Cr.	23	NA	1.8	13.0	
	Cougar Cr. to Cave Cr.	NA	25	5.5		4.6

[a] Counts were single peak counts conducted aerially in May.
[b] NA = not applicable. Two transects combined in 1991.

Sources: B. Rich, IDFG, unpublished.
Rich et al. 1992.

Table 6 (AL-a). Fork lengths by sex of wild steelhead collected" from the Middle Fork Salmon River, 1981, 1982, 1990 and 1991.

Fork length	1981[b]		1982		1990		1991	
cm.	Male	Female	Male	Female	Male	Female	Male	Female
<42								
43								
44								
45								
46								
47								
48								1
49								
50								
51	[c]							1
52								
53				1				
54								
55								
56								1
57						1		
58		1		2	1	2		1
59				1				1
60		1	1	1		1	1	
61					5	2		3
62				4	1	5	3	2
63				2	1	3	2	1
64		1	1		3	2		
65			2	1	3	1	1	
66					2	1		
67				2	3	4	2	
68			1	2	3	1		2
69					3	1	1	
70		1		1	1	4	1	1
71					1	4	1	2
72				2		1		3
73	1		2	5		6		2
74		1	1	5	2	5		10
75		3		7		6	1	5
76				1		4		5
77		2		10	1	7	1	10
78		4	3	16	2	10	1	4
79	1	1	1	8	1	3	1	
80		3	4	14	1	5	2	2
81		1	1			2	2	4
82		1	2	5	3	1	1	3
83			4	7	1	3	3	
84	1	1	3	4	1			1
85			3	4		2	2	2
86			1		3		1	2
87								
88	1		3	2	1		1	
89				1	1			
90								
91					1			
92			1					
93				1				
94								
95								

[a] Hook and line was collection method.
[b] Fish were collected October-November.
[c] Blanks indicate no fish of this size were collected and measured.
Source: P. Hassemer, IDFG, unpublished.

Table 7 (AS-a). Sex and ocean-age proportions for steelhead collect& in spring, 1990, from the Middle Fork Salmon River.

	One-ocean (%)	One-ocean plus (%)[b]	Two-ocean (%)
Male	25 (19)	4 (3)	16 (12)
Female	30 (23)	35 (26)	22 (17)
Total	55 (42)	39 (29)	38 (29)

[a] Steelhead were collected with hook and line.
[b] Steelhead which had second ocean annulus eroded away.

Source: P. Hassemer, IDFG, unpublished.

Table 8 (AS-a). Sex ratios for steelbead collected[a] in spring 1982, 1990 and 1991 from the Middle Fork Salmon River.

Year	Male (%)	Female (%)
1982	34 (24)	109 (76)
1990	45 (34)	87 (66)
1991	28 (29)	69 (77)

[a] Steelhead were collected with hook and line.

Source: P. Hassemer, IDFG, unpublished.

Table 9 (JC-a). Estimated age frequency" of juvenile steelhead observed[b] in twenty mainstem Middle Fork Salmon River transects.

	Percent of iuvenile steelhead observed		
Year	Age 1+	Age II+	Age III+
1980	36	53	11
1981	45	42	13
		43	12
1983	25	56	19

[a] Age based on total lengths as follows:

1980-81:
Age I+ = 70 - 120 mm
Age II+ = 120 - 170 mm
Age III+ = > 170 mm

1982-83:
Age I+ = 70 - 120 mm
Age II+ = 130-200mm
Age III+ = > 200 mm

[b] Snorkeling during July-September was observation method.

Sources: Reingold 198 1.
Thurow 1982, 1983, 1985.

Table 10 (JC-b). Estimated age frequency" of juvenile steelhead observed[b] in Middle Fork Salmon River tributaries.

	Percent of iuvenile steelhead observed		
Year	Age 1+	Age II+	Age III+
1981	36	59	5
1982	53	41	6
1983	41	48	11

[a] Age based on total lengths as follows:

1981: Age I+ = 70 - 120 mm
Age II+ = 120-170mm
Age III+ = > 170 mm

1982-83: Age I+ = 70 - 120 mm
Age II+ = 130 - 200 mm
Age III+ = > 200mm

[b] Snorkeling during July -September was observation method.

Sources: Thurow 1982, 1983, 1985.

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UPPER SALMON RIVER SUBBASIN
(Middle Fork Salmon River to headwaters of the Salmon
and East Fork rivers, excluding the Lemhi and Pahsimeroi rivers)

Naturally Produced Spring Chinook

GEOGRAPHIC LOCATION

The upper Salmon River area includes the mainstem Salmon River from the Middle Fork Salmon River at RM 191 to the headwaters at RM 402, the major tributaries North Fork Salmon River, East Fork Salmon River, the Yankee Fork Salmon River, Panther and Valley creeks, and numerous smaller tributaries (Figure 1). The Salmon River between the Middle Fork and North Fork, 40 miles long, is classified as "recreational" under the Wild and Scenic River Act. The headwaters area, upstream from Thompson Creek, lies within the Sawtooth National Recreation Area. The mainstem in this area is very accessible. Salmon, Challis and Stanley are the only primary population centers in the upper Salmon drainage. Logging, mining, ranching and recreation are the major industries.

ORIGIN

Spring chinook are native to the upper Salmon River. The upper Salmon River drainage has been stocked with hatchery spring chinook, and the Idaho Department of Fish and Game (IDFG) has classified the spring chinook as natural (fish whose parents spawned naturally but have some ancestral hatchery history).

Pursuant to the Endangered Species Act, naturally produced Snake River spring and summer chinook were listed as threatened by the National Marine Fisheries Service (NMFS) in 1992. This listing affects all naturally produced salmon in the upper Salmon River.

Spring chinook spawning upstream of the Sawtooth Hatchery weir and East Fork weir are a mix of natural and hatchery origin.

DISTRIBUTION

IDFG has classified as spring chinook those fish which return to the mainstem Salmon above Redfish Lake Creek; to Valley Creek above Stanley Lake Creek; to the East Fork above Herd Creek; and all other streams in the area. Upper Panther Creek historically also may have supported spring chinook, but mine pollution extirpated chinook populations by the early 1960's (Corley 1967).

Available spawning and rearing habitat for the upper Salmon River is described in the Presence/Absence database (Tables 1 and 2). This information was developed for the Northwest Power Planning Council for subbasin planning and modeling. Almost 800 miles of stream are available to spring chinook for spawning and/or rearing (Tables 1 and 2). Most of this habitat is in fair to good condition.

PRODUCTION

Total production of spring chinook in the upper Salmon River is unavailable. However, production and survival information for various areas is available.
Reingold (1967) estimated total chinook production in 1966 from the Salmon River drainage just

upstream from the town of Salmon and the East Fork just upstream from its confluence with the Salmon River. Total smolt outmigration from the Salmon River from February to May 1966 was estimated at 930,000 fish; fall (September to December) outmigration was an estimated 642,000 presmolts. Total production for the Salmon River drainage above the town of Salmon in 1966 was 1,572,000 spring/summer chinook. In the East Fork, total production for March to November 1966 was 396,800 spring/summer chinook migrants.

IDFG has estimated total parr production in the Salmon River above the Sawtooth weir. Production ranged from 14,000 parr in 1989 to 88,000 parr in 1988 (Table 3). Parr production for other streams is presented in Table 4.

The Shoshone-Bannock Tribes have monitored parr production in both Yankee Fork and Herd Creek (a tributary of the East Fork Salmon River) since 1984 and 1985, respectively. In Yankee Fork, the highest estimated number of naturally produced parr was 13,500 fish in 1985 (Konopacky et al. 1986). Conversely, in 1990, parr production was estimated as only 4,300 fish, which included both natural and hatchery fish (M. Rowe, Shoshone-Bannock Tribes, unpublished). Parr production in Herd Creek ranged from just over 3,000 fish in 1986 (Richards and Cemera 1987) to 45,600 fish in 1989 (Rowe et al. 1989).

IDFG has monitored parr densities in a number of upper Salmon River streams since 1985 (Table 5). Highest densities of parr have been documented in Valley Creek and the mainstem Salmon River. The overall average parr density for the upper Salmon River from 1985 to 1991 based on data from these streams was 8.6 parr/100 m^2. This density was about 14.1% of the carrying capacity.

Similar to parr production, egg to fry survival information is not available for the entire upper Salmon River drainage, but does exist for certain streams or areas. Kiefer and Forster (1991, 1992) estimated egg to fry survival for the area above the Sawtooth weir at 2.1 to 6.7% (Table 3). Depending on number of redds/female, Petrosky and Holubetz (1988) found egg to parr survival to range from 8.7% in Herd Creek to 74.0% in Valley Creek (Table 4).

Kiefer and Forster (1992) monitored redds constructed by naturally produced spawners and adult outplants in the upper Salmon River for brood years 1988 and 1989. Egg to parr survival for progeny of natural spawners for these two years was 25.1% and 12.3 % , respectively. Egg to parr survival for progeny of adult outplants for these two years was 16.1% and 4.6 % , respectively. (Table 6).

Beginning in 1988, spring chinook were tagged with passive integrated transponder (PIT) tags in the upper Salmon River. Detections at the dams of PIT-tagged chinook salmon parr in the spring of 1990 averaged 4.1% (Table 7). Because these parr were tagged in August, the 4.1% survival includes both overwintering and inbasin migration mortality, plus some reservoir loss. For chinook smolts tagged in the spring of 1988 and 1989, the detection rate ranged from 19.4 to 33.7% with an average detection rate of 22.1% in 1990 (Table 8). Parr to smolt survival from the upper Salmon River area to Lower Granite Dam was 10.9 % for migration year 1990 (Kiefer and Forster 1992).

ADULT LIFE HISTORY

The freshwater life history for adult spring chinook is similar to the generic life history table for spring chinook throughout the Salmon River subbasin (Figure 2).

Adult Escapement

Chinook crossing Bonneville Dam through May 31 are counted as springs, as are those crossing Lower Granite Dam through June 17. Specific time of migration and escapement-for upper Salmon River spring chinook is not well documented in the ocean, Columbia River or the Snake River. The University of Idaho implemented adult timing research in 1991 which should provide more information about Snake River timing (Bjornn et al. 1992).

Harvest

Information is not available regarding harvest of upper Salmon River spring chinook in the ocean and Columbia River.

Traditionally, sport harvest of these fish occurred in both the mainstem Salmon River and its major tributaries. During 1959-78, an estimated 25 to 46 percent of the annual Idaho chinook salmon harvest (total for spring and summer) occurred in the upper Salmon River (Homer and Bjornn 1981). Most of the harvest was upstream of the Pahsimeroi River. IDFG has not allowed sport harvest of spring or summer chinook in the main Salmon River since 1978.

Quantitative information regarding occurrence and magnitude of tribal harvest on upper Salmon River chinook was not investigated.

Spawner Escapement

An estimate of total spring chinook spawner escapement into the upper Salmon River is not available. Based on redd counts of spring chinook in upper Salmon River index streams, adult escapement has steadily declined since 1957 (Table 9). Spring chinook redd counts are generally conducted during the last week of August and the first week of September. Both ground and aerial counting methods are used depending upon the index stream.

The numbers of spring chinook passed above the Sawtooth weir to spawn naturally ranged from 204 in 1984 to 876 in 1986 (Table 10). During the same time period at the East Fork weir, a low of 43 spring chinook were passed over in 1991 and a high of 202 spring chinook were passed in 1988 (Table 11).

Adult Characteristics

Extensive carcass surveys were done in three areas in the upper Salmon River from 1960 to 1967. Length data for spring chinook kelts from the upper Salmon River mainstem, Valley Creek, and East Fork showed a range of 14 in. (36 cm) to 44 in. (112 cm) (Tables 12, 13, 14). Age composition information from the carcass surveys (brood years 1957 to 1962) indicated the majority of adult returns to the three areas were 5 year old (3 ocean) fish (Tables 15, 16, 17).

Females from the same brood years represented slightly less than half the returning fish in the upper Salmon River mainstem and East Fork, and almost 60% in Valley Creek (Tables 18, 19, 20). The fecundity of wild spring chinook returning to the upper Salmon River mainstem ranged from 2,214 to 6,924 eggs per female from 1962 to 1969 (Table 21).

JUVENILE LIFE HISTORY

Juvenile life history is generally similar to Figure 2. Although not illustrated in the figure, there is typically a fall emigration of chinook presmolts from the tributaries to the mainstem Salmon River for winter rearing. Kiefer and Forster (1992) found that an average of 62% (1988-90) of the chinook parr population emigrated from the area above the Sawtooth weir in the fall. In 1988 and 1990, Kiefer and Forster (1990, 1992) estimated that 34% and 15 % of the chinook parr emigrated in the spring.

Data from IDFG PIT tagging studies of chinook parr in 1987 showed an average total length of 75 mm in four upper Salmon River stream sections. The average weight of parr was 5.3 grams (Table 22). From 1988 to 1990, average total lengths of natural spring chinook salmon tagged in August in the upper Salmon River ranged from 75 to 92 mm (Table 23). Spring chinook parr captured by the National Marine Fisheries Service (NMFS) in Valley and Alturas Lake creeks in 1989 averaged 66 and 77 mm fork length, respectively (Table 24). Average weights were 3.7 g in Valley Creek and 5.7 g in Alturas Lake Creek. Matthews et al. (1992) reported an average increase in length of 41.5 mm from time of tagging in 1989 to time of recovery at Lower Granite Dam in 1990.

Travel time for spring chinook smolts from the upper Salmon River to Lower Granite Dam appears to decrease the later the fish are tagged and released. In 1990 the travel time ranged from 52 to 23 days (Kiefer and Forster 1992). The travel time ranged from 75 to 30 days in 1989 (Kiefer and Forster 1991) and 65 to 25 days in 1988 (Kiefer and Forster 1990). In 1988, upper Salmon River spring chinook smolts arrived at Lower Granite Dam as early as 19 April and as late as 28 June with the peak arrival in late May and early June (Kiefer and Forster 1990). Work by Kiefer and Forster (1991, 1992) indicates that larger smolts may have greater migration survival based upon PIT tag detections at lower Snake and Columbia River dams (Table 8).

BIOCHEMICAL/GENETIC CHARACTERISTICS

Waples et al. (1991) described allele frequency data for upper Salmon River chinook populations, including the headwaters of the Salmon River and Valley Creek (Appendix Tables 1 and 2). Schreck et al. (1986) also described electrophoretic data for Valley Creek and East Fork chinook (Appendix Table 3). Marshall (1992) analyzed genetic characteristics of chinook populations from Valley Creek, the East Fork, the North Fork and Yankee Fork.

DISEASES

Information has not been compiled.

REFERENCES

All Upper Salmon references appear in one reference section at the end of the hatchery produced summer steelhead section.

Figure 1. Anadromous salmonid distribution in the East half of the Salmon River subbasin as represented by summer steelhead, based on the NPPC presence/absence data base and the BPA Geographic Information System.

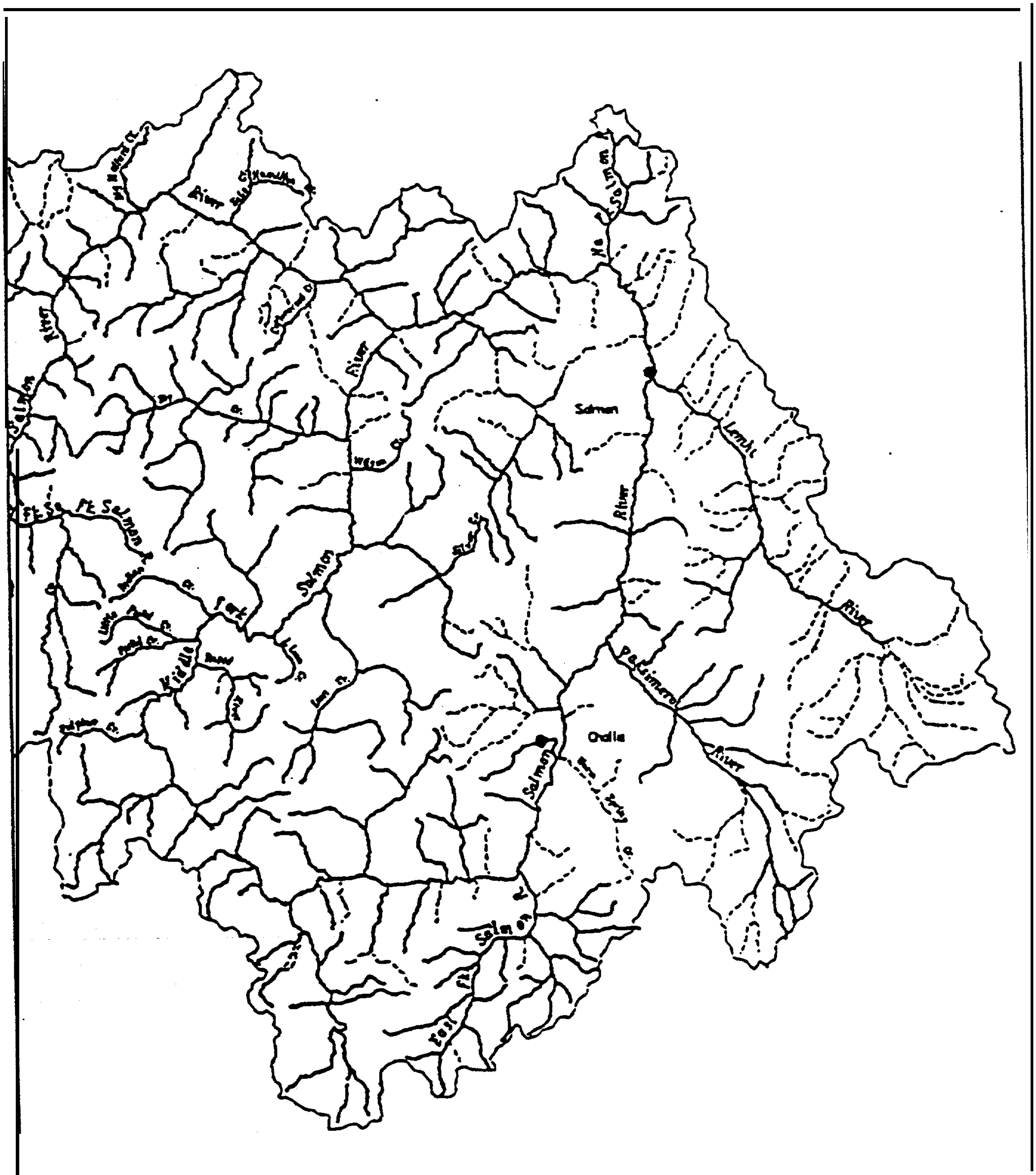
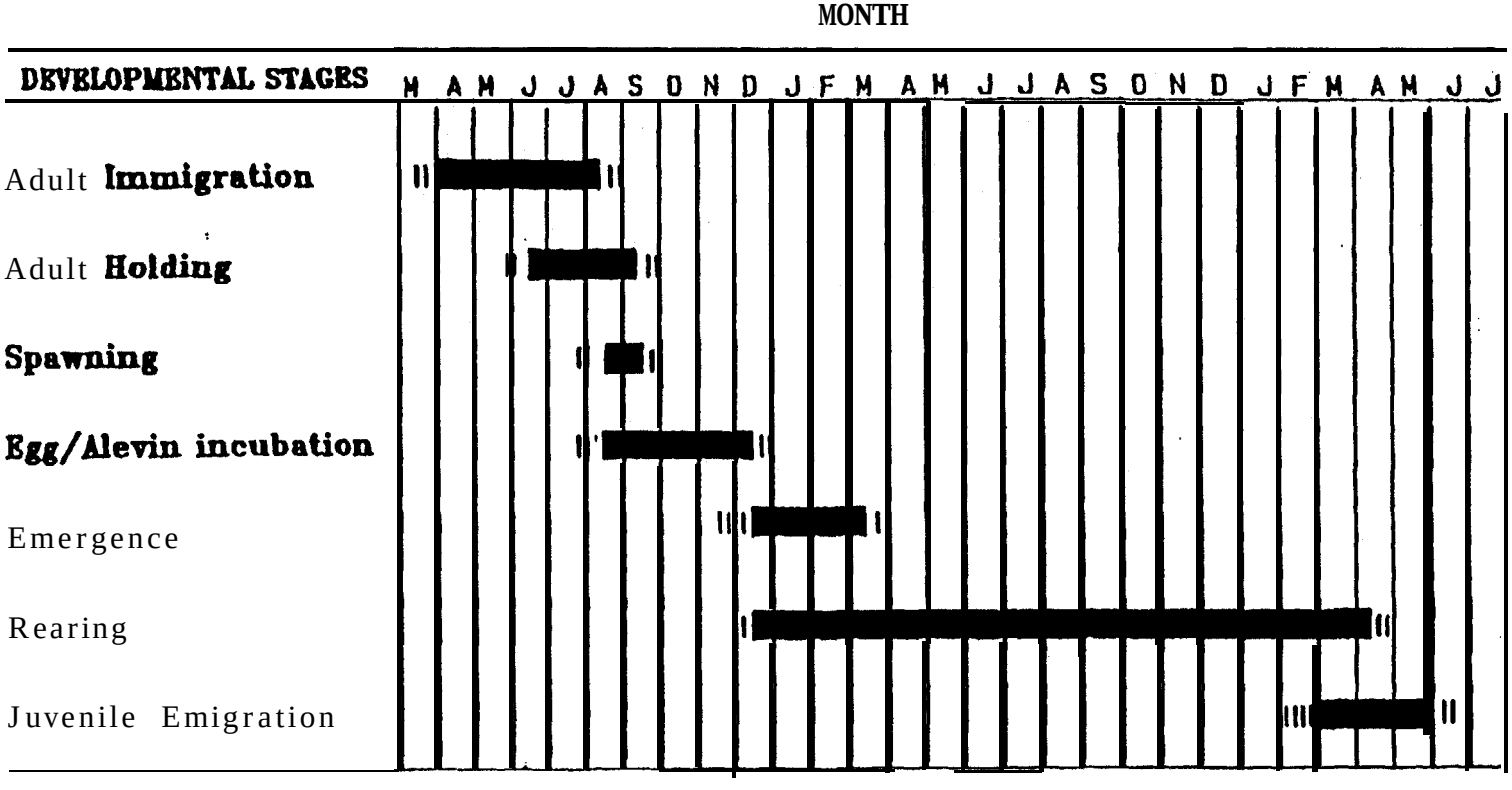


Figure 2 ('IT). Freshwater life history for natural/wild spring chinook in the Salmon River subbasin.



Notes:

1. The developmental stage timing represents basin-wide averages, local conditions may cause some variability.
2. Solid bars indicate periods of heavi dult immigration, spawning and juvenile emigration.

Table 1 (HB). Estimated amount of spawning and rearing habitat (Use Type 1) by quality of the upper Salmon River (Middle Fork Salmon to headwaters including tributaries") spring chinook production area.

	Excellent	Good	Fair[b]	Poor[b]	Unknown	Total	Confidence'
			41	14			
Miles (%)(%	14 9	47 36	25	14		777.5 1120	M M
Acres (%							

[a] This area includes tributaries from the Middle Fork Salmon River to the Salmon River headwaters, and the main Salmon River from Redfish Lake Creek to its headwaters.
[b] Ratings of fair and poor habitat quality may reflect natural physical features such as gradient and channel type, as well as degradation caused by humans.
[c] 'Confidence' is meant to indicate the reproducibility and accuracy of the estimates made, and will be rated as high, medium or low by the respective agencies.

Source: Presence/Absence database, Northwest Power Planning Council, 1991.

Table 2 (HB). Estimated amount of rearing only habitat (Use Type 2) by quality of the upper Salmon River (Middle Fork Salmon to headwaters including tributaries") spring chinook production area.

	Excellent	Good	Fair"	Poor"	Unknown	Total	Confidence"
Miles (%)	0	50	50	0		10	M
Acres (%)	0	50	50	0		181.8	M

[a] This area includes tributaries from the Middle Fork Salmon River to the Salmon River headwaters, and the main Salmon River from Redfish Lake Creek to its headwaters.
[b] Ratings of fair and poor habitat quality may reflect natural physical features such as gradient and channel type, as well as degradation caused by humans.
[c] 'Confidence' is meant to indicate the reproducibility and accuracy of the estimates made, and will be rated as high, medium or low by the respective agencies.

Source: Presence/Absence database, Northwest Power Planning Council, 1991.

Table 3 (RB). Natural spring chinook production information" for the upper Salmon River, brood year 1984 to 1990.

	Brood Year						
	1984	1985	1986	1987	1988	1989	1990
Total escapement		625	876	506	552	470[b]	615
Female escapement		180	248	252	275	73[b]	167"
Helicopter redd count		83	105	124	76	52	60
Ground redd count					261	123	107
Eggs per female[d]		4,530	5,156	5,399	5,653	5,456	4,501
Estimated eggs (in thousands) deposited	1,095.1	815.4	1,278.7	1,360.5	1,554.4	671.1	481.6
Parr production (in thousands)	73.5		65.7	70.3	88.0	14.2	NA[e]
Egg-to-Parr survival	6.7%		5.1%	5.2%	5.1%	2.1%	NA

[a] Total escapement, female escapement, and eggs/female data are from Sawtooth Hatchery brood year reports. Redd count data are from Idaho Department of Fish and Game redd count reports.
[b] Portions of the Sawtooth Fish Hatchery weir were pulled from June 12-16 due to high water and uncounted fish probably passed the weir.
[c] Chinook escapement above Sawtooth Hatchery was reduced by at least 65 fish due to a rotenone kill.
[d] Number is average eggs/female observed at Sawtooth Fish Hatchery.
[e] NA = not available.
Sources: Kiefer and Forster 1991, 1992.

Table 4 (TS-a). Estimated survival from egg-to-par-r for chinook populations with a predominance of 5_2 spawners, upper Salmon River drainage.

Stream	Reach	Brood year	IDFG redd count	Summer total abundance	Percent survival* 1 redd/ female	Percent survival* 1.5 redds/ female	Percent[b] surface sand
Valley Creek	main stem	1984	21	61,126	49.3	74.0	30.2
Salmon River	above Valley Creek	1984	76	76,102	17.0	25.5	19.8
Herd Creek	main stem	1985	8[c]	9,274”	8.7	13.0	34.1”
		1986	31[c]	37,444”	9.1	13.6	34.1”

[a] Assumes 5,900 eggs per female (1981-1984 average, Sawtooth Hatchery) and either 1.0 redds/female (Bjornn 1978), or 1.5 redds/female (Ortmann 1968).
[b] OEA (1987 a,b) data for C-channels.
[c] Shoshone-Bannock Tribes data (Richards, personal communication).

Sources: Petrosky and Holubetz 1988.

Table 5 (PD-a). Natural chinook parr densities as fish per 100m^2 (CHINOD) and percent of rated carrying capacity (CHPERCC), upper Salmon River drainage 1985-1991.

	Year						
	1985	1986	1987	1988	1989	1990	1991
Salmon River							
CHINOD=	8.82	13.11	11.92	8.86	13.21	3.27	3.21
CHPERCC=	15.61	24.31	21.05	15.81	19.82	1.93	6.94
N =	21	10	19	21	20	22	15
Salmon River, N. Fork							
CHINOD=	8.28	3.07	6.96	4.78	4.66	0.41	1.36
CHPERCC=	10.76	3.99	9.04	6.21	6.04	0.52	1.78
N=	2	2	2	2	2	2	2
Morgan Creek							
CHINOD=	NS	NS	NS	NS	0.00	0.21	NS
CHPERCC=	NS	NS	NS	NS	0.00	1.75	NS
N=	NS	NS	NS	NS	1	1	NS
Salmon River, E. Fork.							
CHINOD=	6.75	4.67	6.97	8.08	10.51	0.50	NS
CHPERCC=	8.21	4.45	6.80	8.16	10.73	2.48	NS
N=	4	4	4	4	4	3	NS
Thompson Creek							
CHINOD=	NS	NS	NS	NS	0.00	0.00	0.00
CHPERCC=	NS	NS	NS	NS	0.00	0.00	0.00
N=	NS	NS	NS	NS	2	2	1
Valley Creek							
CHINOD=	26.14	6.53	21.39	16.45	34.81	7.10	2.68
CHPERCC=	55.74	9.51	48.02	36.48	66.08	16.10	5.64
N=	4	4	4	4	4	4	4
Redfish Lake Creek							
CHINOD=	NS	1.54	2.57	1.49	1.32	0.58	0.40
CHPERCC=	NS	2.01	3.34	1.94	1.72	0.74	0.52
N=	NS	2	2	2	2	2	2

Table 5 (cont.). Natural chinook parr densities as fish per $100m^2$ (CHINOD) and percent of rated carrying capacity (CHPERCC), upper Salmon River drainage 1985-1991.

	Year						
	1985	1986	1987	1988	1989	1990	1991
Alturas Lake Creek							
CHINOD=	12.46	12.27	19.58	8.65	17.53	1.31	NS
CHPERCC=	11.54	11.36	18.12	8.01	16.23	1.22	NS
N=	1	1	2	3	3	5	NS
Beaver Creek							
CHINOD=	NS	NS	NS	NS	NS	0.00	NS
CHPERCC=	NS	NS	NS	NS	NS	0.00	NS
N=	NS	NS	NS	NS	NS	1	NS

[a] NS = not sampled.

Source: B. Rich, IDFG, unpublished.

Table 6 (RH-a). Estimated egg-to-parr survival rates (%) from the headwaters of the upper Salmon River adult outplants and natural spawners, brood years 1987 to 1989 (Kiefer and Forster 1992).

Adult origin	Population parameter	Brood years 1987	1988	1989
Adult outplants	Females outplanted	5	30	9
	Egg deposition	26,995	169,590	50,400
	Parr production	8,625	27,438	2,295
	Egg-to-Parr survival	32.0%	16.1%	4.6%
Natural spawners	Redds observed	0	6 33,918	4
	Egg deposition			22,400
	Parr production		8,500	2,759
	Egg-to-pat-r survival		25.1%	12.3 %

Table 7 (PT-a). Detections at the lower Snake and Columbia River smolt collecting darns" of spring chinook parr from upper Salmon River, PIT-tagged in August 1989 and detected in 1990.

Stratum	Number tagged	Detected in 1990 Number detected	Percent detected
SR-3	604	17	2.8
SR-7	545	29	5.3
SR-9	781	43	5.5
SR-10	213	24	11.3
HC-1	199	8	7.0 9.9
FC-2	420	23	5.5
SC-1	235	14	6.0
SC-2	536	10	1.9
ALC-1	1,036	5	0.5
ALC-3	144	5	3.5
BC-2	276	14	5.1
PC-1	148	7	4.7
PC-2	161	9	5.6
TOTALS	5,379	222	4.1

[a] Lower Granite, Little Goose, McNary.

Source: Kiefer and Forster 1992.

Table 8 (SL-a). Spring chinook smolt length and PIT tag detection at lower Snake and Columbia River smolt collection dams" for upper Salmon River, spring 1988 and 1990.

	1988			1990		
Length (mm)	Number tagged	Number detected	Percent detected	Number tagged	Number detected	Percent detected
< 80			20.7	126	27	21.4
80 - 89			25.3	479	93	19.4
> 89			29.5			
90 - 99				375	87	23.2
> 99				83	28	33.7
Total				1,063	235	22.1

[a] Lower Granite, Little Goose, and McNary dams.

Source: Kiefer and Forster 1991, 1992.

Table 9 (RN-a). Upper Salmon River drainage spring chinook index redd counts, 1957-1991”.

Year	Alturas Lake Creek”	Upper East Fork[b]	Upper Salmon River”	Upper Valley Creek	Upper Yankee Fork	Totals
1957	110	572	1,118	225	47	2,072
1958	107	427	535	75	38	1,182
1959	18	223	502	24	10	777
1960	33	122	720	83	43	1,001
1961	30	818	813	227	192	2,080
1962	138	334	638	157	60	1,327
1963	86	646	638	141	128	1,639
1964	80	405	706	199	146	1,536
1965	101	138	472	204	77	992
1966	119	511	699	219	112	1,660
1967	74	614	943	253	250	2,134
1968	110	622	637	330	234	1,933
1969	41	174	313	350	53	931
1970	68	468	432	202	67	1,237
1971	50	370	619	89	57	1,185
1972	143	448	748	182	115	1,636
1973	153	665	414	125	104	1,461
1974	42	346	338	127	54	907
1975	60	348	509	189	60	1,166
1976	16	75	378	NC’	40	509
1977	85	168	698	18	6	975
1978	303	841	1707	141	33	3,025
1979	29	57	205	25	18	334
1980	7	6	47	6	0	66
1981	4	76	363	2	16	461
1982	9	28	42	1	0	80
1983	27	121	161	8	0	317
1984	3	NC	71	6	NC	80
1985	7	NC	76	1	5	89
1986	14	NC	134	13	15	176
1987	9	NC	162	31	0	202
1988	1	NC	146	12	1	160
1989	7	NC	102	23	7	139
1990	0	NC	97	3	13	113
1991	3	21	83	2	6	115

[a] Reduced by trapping at Sawtooth Hatchery site beginning 1981.
[b] Trap installed in 1984, no comparable counts for trend area 1984-89.
[c] NC = no count taken.
Source: P. Hassemer, IDFG, unpublished.

Table 10 (RN-b). Number of spring chinook adults released upstream of the Sawtooth Hatchery weir to spawn naturally. Fish are a combination of hatchery and naturally produced spring chinook.

Year	Total	Jacks	Adult Males	Adult Females
1984	205 .		140[a]	65
1985	625		445”	180
1986	876	36	592	248
1987	506	2	252	252
1988	552	29	218	305
1989	470	293	104	73
1990	615	58	390	167
1991	238	49	95	94

[a] Unknown combination of adult males and jacks.

Sources: Rogers 1985, 1986, 1988, 1989, 1990.
R. Alsager, IDFG, unpublished.
T. Rogers, IDFG, unpublished.

Table 11 (RN-c). Number of spring chinook adults released upstream of the East Fork Salmon River weir to spawn naturally”.

Year	Total	Jacks	Adult Males	Adult Females
1984	142		124[b]	18
1985	65	5	96	
1986	126	0	61	2:
1987	98	4		37
1988	202	13	46 99	99
1989	69		71	10
1990	88	7	31[c]	10
1991	43	3		9

[a] Fish are a combination of hatchery and naturally produced spring chinook.
[b] Unknown combination of adult males and jacks:
[c] Includes 9 ponded, unused, then released males.

Sources: Rogers 1985, 1986, 1988, 1989, 1990.
R. Alsager, IDFG, unpublished.
T. Roger, IDFG, unpublished.

Table 12 (AL-a). Salmon River (upper) spring chinook carcass fork lengths collected during index redd counts , 1960-1967.

Length in.	1960 No. fish	1961 No. fish	1962 No. fish	1963 No. fish	1964 No. fish	1965 No. fish	1966 No. fish	1967 No. fish
14	1							
15	1	1			1			1
16	1	3	3	1			3	
17		7	9	5	6	1	4	3
18	2	14	4	5	15	4	3	2
19		2	6	14	1	5	9	11
20		1	1	22	12	2	4	5
21	1	4	3	11	4	3	10	8
22		3	4	11	1	7	7	3
23	1	4	3	16		3	4	3
24	1	2	6	11	9	2	2	4
25		3	6	11	2	1	7	6
26	2	4	6	9	8	4	7	4
27		8	7	11	6	7	16	13
28	5	4	7	12	3	4	16	14
29	3	8	7	19	7	4	16	5
30	3	5	14	19	16	5	16	15
31	5	13	6	12	8	3	19	13
32	4	9	9	10	19	2	14	15
33	7	19	9	16	5	4	7	7
34	5	17	8	30	23	1	7	2
35	3	24	13	48	17	2	10	3
36	3	19	15	43	69	2	20	23
37	1	12	6	43	12	8	23	32
38	3	8	4	28	31	2	13	18
39		2	3	15	16	1	10	13
40		5	3	11	15		8	13
41		1	2	16	3		2	2
42	1	3	1	5	13		2	4
43			1	6	3	3		2
44				4	3	1	2	4
45								
46								

[a] Blanks indicate no fish of this size were collected and measured.

Sources: Bjomn 1961.
Bjornn et al. 1963.
Bjomn et al. 1964.
Ortmann and Richards 1964.
Bjomn et al. 1966.
Platts et al. 1966.
Corley and Welsh 1968.
Welsh and Corley 1968.

Table 13 (AL-b). East Fork Salmon River spring chinook carcass fork lengths collected during index redd counts , 1960-1967.

Length in.	1960 No. fish	1961 No. fish	1962 No. fish	1963 No. fish	1964 No. fish	1965 No. fish	1966 No. fish	1967 No. fish
14								
15								
16		1	1	1	[a]		3	
17	1	2		2	2		1	
18	4	2			4		5	1
19		1	2	2	2		1	1
20			2	1				2
21		1	1			2	1	3
22			1	2				2
23			4	1		1	1	1
24	1	1		1			2	2
25		3	6	8			3	2
26	2	5	4		4	1	3	2
27	1	2	3	7	2	1	5	8
28	3	1	4	9	2	2	11	6
29	3	7	10	6	6	2	12	8
30	4	2	12	7	7	2	17	3
31	2	4	10	7	9	2	15	11
32	3	11	8	5	3	6	7	17
33	4	12	6	6	4	1	6	16
34	3	11	10	28	17	2	12	4
35		14	9	55	9	1	13	9
36	4	17	11	37	28	3	27	35
37	1	6	9	26	20	2	19	36
38	1	7	6	44	16	3	18	29
39		4	1	27	12		6	20
40		2	3	35	18	1	8	15
41		3	4	11	11		7	12
42	1	3	6	9	5	1	6	12
43			2	3	3	1	4	6
44			2		2		2	6
45								
46								

[a] **Blanks** indicate no fish of this size were collected and measured.

Sources: Bjomn 1961.
Bjornn et al. 1963.
Bjomn et al. 1964.

Table 14 (AL-c). Valley Creek spring chinook carcass fork lengths collected during index redd counts , 1960-1967.

Length in.	1960 No. fish	1961 No. fish	1962 No. fish	1963 No. fish	1964 No. fish	1965 No. fish	1966 No. fish	1967 No. fish
14								
15								
16	1	2	[a]		2		1	
17		3					2	2
18		2	1		1			2
19					1	2	2	
20	1							
21	1						1	2
22			2	2		1	1	
23			1				2	1
24	4	1	2	2		1	1	
25		2	5			1	1	2
26	2	4	3		2	2	8	
27	1	3	2		4	3	10	1
28	5	6	3	1	5	3	8	2
29	3	4	2		2	3	13	3
30	7	8	1		3		9	5
31	5	5	2	1	3	1	11	6
32	3	8	5	1		4		4
33	9	11	9	1	4		1	3
34	3	13	7	4	12	4	10	7
35	2	17	4	10	9	3	5	12
36	2	7	5	9	8	4	27	19
37	2	4	3	2	2	1	9	15
38	1	3		6	2	2	13	19
39	1	3	1	1			9	15
40			1	3	4	2	4	IO
41				2			3	5
42	1			1			6	2
43				1				1
44						1		9
45								
46								

[a] Blanks indicate no fish of this size were collected and measured.

Sources: Bjomn 1961.
Bjomn et al. 1963.
Bjomn et al. 1964.
Ortmann and Richards 1964.
Bjomn et al. 1966.
Platts et al. 1966.
Corley and Welsh 1968.
Welsh and Corley 1968.

Table 15 (AC). Age composition percentage (freshwaterocean) by brood year for wild spring chinook returning to the headwaters of the Salmon River[a].

Age Composition (%)

Brood Year	N	2.1	2.2	2.3
1957	124	5	39	56
1958	375	10	16	74
1959	365	9	28	63
1960	174	51	34	15
1961	186	21	16	63
1962	260	10	38	52

[a] Carcass counts during index redd count surveys was sample method. Total age based on 2 year freshwater rearing and ocean age delineated by fork length criteria as follows:

1957-1962: l-ocean = <24 in.
2-ocean = 24 - 31 in.
3-ocean = > 31 in.

In this nomenclature, the freshwater and ocean ages sum to the total age of the fish.

Sources: Bjomn et al. 1964, 1966.
Corley and Welsh 1968.

Table 16 (AC-l). Age composition percentage (freshwater.ocean) by brood year for wild spring chinook returning to upper Valley Creek, a tributary to the upper Salmon River[a].

Age Composition (%)

Brood Year	N	2.1	2.2	2.3
1957	85	3	24	73
1958	79	5	43	52
1959	53	13	9	78
1960	42	5	45	50
1961	105	4	13	83
1962	185	1	34	65

[a] Carcass counts during index redd count surveys was sample method. Total age based on 2 year freshwater rearing and ocean age delineated by fork length criteria as follows:

1957-1962: l-ocean = <24 in.
2-ocean = 24 - 31 in.
3-ocean = >31 in.

In this nomenclature, the freshwater and ocean ages sum to the total age of the fish.

Sources: Bjornn et al. 1964, 1966.
Corley and Welsh 1968.

Table 17 (AC). Age composition percentage (freshwater.ocean) by brood year[a] for wild spring chinook salmon returning to the East Fork Salmon River.

Age Composition (%)

Brood Year	N	2.1	2.2	2.3
1957	87	5	29	66
1958	342	2	15	83
1959	211	5	25	70
1960	62	18	48	34
1961	150	5	7	88
1962	239	1	29	70

[a] Carcass counts during index redd count surveys was sample method. Total age based on 2 year freshwater rearing and ocean age delineated by fork length criteria as follows:

1963-1967: l-ocean = <24 in.
2-ocean = 24 - 31 in.
3-ocean = >31 in.

In this nomenclature, the freshwater and ocean ages sum to the total age of the fish. N is equal to the known male and female components of the brood.

Sources: Bjornn et al. 1964, 1966.
Corley and Welsh 1968.

Table 18 (AS). Percent females by brood year and age class (freshwater.ocean) for wild spring chinook salmon returning to the headwaters of the Salmon River".

Females (%)

Brood Year	N	2.1	2.2	2.3	Total % Female
1957	123	0	19	42	61
1958	372	<1	6	51	57
1959	366	<1	3	45	48
1960	188	1	9	9	19
1961	188	1	5	47	53
1962	262	0	13	40	53

[a] Carcass counts during index redd count surveys was sample method. Total age based on 2 year freshwater rearing and ocean age delineated by fork length criteria as follows:

1957-1962: l-ocean = <24 in.
2-ocean = 24 - 31 in.
3-ocean = > 31 in.

In this nomenclature, the freshwater and ocean ages sum to the total age of the fish.

Sources: Bjomn et al. 1964, 1966.
Corley and Welsh 1968.

Table 19 (AS-l). Percent females by brood year and age class (freshwater.ocean) for wild spring chinook salmon returning to upper Valley Creek, a tributary to the upper Salmon River".

Females (%)

Brood Year	N	2.1	2.2	2.3	Total % Female
1957	80	0	8	45	53
1958	92	0	35	34	69
1959	50	0	2	48	50
1960	42	2	14	29	45
1961	108	0	11	58	69
1962	185	0	16	50	66

[a] Carcass counts during index redd count surveys was sample method. Total age based on 2 year freshwater rearing and ocean age delineated by fork length criteria as follows:

1957-1962: l-ocean = <24 in.
2-ocean = 24 - 31 in.
3-ocean = > 31 in.

In this nomenclature, the freshwater and ocean ages sum to the total age of the fish.

Sources: Bjomn et al. 1964, 1966.
Corley and Welsh 1968.

Table 20 (AS). Percent females by brood year and age class" (freshwater.ocean) for wild spring chinook salmon returning to the upper East Fork Salmon River.

Females (%)

Brood Year	N	2.1	2.2	2.3	Total % Female
1957	87	0	10	36	46
1958	342	0	8	49	57
1959	213	0	8	44	52
1960	59	0	14	15	29
1961	153	0	3	54	57
1962	289	0	11	45	56

[a] Carcass counts during index redd count surveys was sample method. Total age based on 2 year freshwater rearing and ocean age delineated by fork length criteria as follows:

1963-1967: l-ocean = <24 in.
2-ocean = 24 - 31 in.
3-ocean = > 31 in.

In this nomenclature, the freshwater and ocean ages sum to the total age of the fish. N is equal to the known male and female components of the brood.

Sources: Bjomn et al. 1964, 1966.
Corley and Welsh 1968.

Table 21 (AF-a). Mean fecundity by return year for wild spring chinook returning to Decker Flat in the Upper Salmon River drainage, 1962-1969.

Return year	Number of females spawned	Number of green eggs	Mean fecundity
1962	71	403,783	5,687
(subsamples)	5	36,480	7,296
	2	9,180	4,590
	8	36,608	4,576
	2	12,320	6,160
	5	28,923	5,785
	24	134,820	5,618
	10	56,823	5,682
	15	88,629	5,909
1963	70	456,938	6,528
1964	92	637,043	6,924
1965			
1966	105	655,556	6,243
1967	78	438,650	5,624
1968	75	225,725	3,010
1969	92	203,700	2,214

Sources: Bell 1965.
Gray 1969.
Hoss 1970.
Richards 1967.
Welsh 1964a, 1964b.

Table 22 (SL-a). Length and weight data for PIT-tagged chinook parr from the upper Salmon River study area, 1987.

	Total Length (mm)				Weight (gm)			
Location	Number of fish	mean	min.	max.	Number of fish	mean	min.	max.
All fish	1,768	75	52	142[a]	1,389	5.3	1.8	33.1[a]
Pole Creek	218	82	61	99	211	6.9	2.9	11.1
Alturas Lake Cr.	127	72	60	123	127	4.9	2.6	23.8
Smiley Creek	60	75	67	116	60	5.4	3.6	12.8
Salmon River	1,363	74	52	142	991	5.0	1.8	33.1

[a] PIT tags were implanted inadvertently into a few yearling chinook.

Source: Kiefer and Apperson 1988.

Table 23 (SL-b). Average total lengths of PIT tagged chinook parr from upper Salmon River, 1988-1990.

Tag site[a]	Rearing type	1988 Number tagged	1988 Average length (mm)	1989 Number tagged	1989 Average length (mm)	1990 Number tagged	1990 Average length (mm)
FC-2A	Adult outplant	302	59	420	61	-	-
SR-PC3B	Adult outplant			93	44	516	53
SR-FC3A	Adult outplant					347	56
FC-1	Natural	8	79	81	81	7	92
ALC- 1 C	Natural	414	83	1,043	77	-	
SR-3A	Natural	45	72	92	78	-	
SR-3B	Natural	992	76	511	79	55	79
SR-35A	Natural	610	71			-	
SR-4BRB	Natural	761	76	-	-	-	
SR-7A	Natural	309	80	545	77	-	-
SR- 10A	Natural	0	-	213	80	99	81
SR-9A	Natural	-		397	76	70	79
SR-9B	Natural		-	386	77		-
SR-HC1	Natural	-	-	199	75	5	75
SR-SC 1	Natural	-	-	237	78	3	87
SR-7SA	Natural	-	-		-	25	87
SR-AClC	Natural					407	76
SR-PC 1B	Natural				-	13	89
PC-1B	Fry outplant	46	99	143	91		-
PC-2B	Fry outplant	215	85	161	82		-
SC-1	Fry outplant	107	98			-	
SR-SC2B	Fry outplant			534	85	-	
SR-BC2	Eyed-egg			276	61		
SR-ALC3	Eyed-egg	-	-	144	59	-	-
SR-8A	Mixed	22	80			-	-
SR-9	Mixed	33	88			-	-

[a] For tag site descriptions please see referenced publication.
Sources: Kiefer and Forster 1988, 1989, 1992.

Table 24 (PT-a). Summary of the numbers collected, numbers PIT tagged and released, and average lengths and weights of wild spring chinook salmon collected from the upper Salmon River drainage in 1989 (Matthews et al. 1992).

Tagging location	Number collected	Number PIT tagged and released	Average fork length of tagged fish (mm)	Average weight of tagged fish (g)
Valley Creek	3,342	2,498	66	3.7
Alturas Lake Creek	1,107	1,036	77	5.7

[a] Fish <50 mm were not tagged.

UPPER SALMON RIVER, SALMON SUBBASIN
(Middle Fork Salmon River to headwaters of the Salmon and East Fork rivers, excluding the Lemhi and Pahsimeroi rivers)

Hatchery Produced Spring Chinook

Sawtooth Fish Hatchery (FH) and the East Fork Trap are part of the Lower Snake River Compensation Plan (LSRCP) to compensate for losses of anadromous fish caused by lower Snake River dams. The complex was completed in 1985. Both facilities were constructed by the U.S. Corps of Engineers. Bonneville Power Administration provides funds to the U.S. Fish and Wildlife Service to administer the facilities. They are operated by the Idaho Department of Fish and Game.

GEOGRAPHIC LOCATION

Sawtooth FH is located along the upper Salmon River, five miles south of Stanley in Custer county. The hatchery is the highest altitude chinook salmon hatchery in the nation and is 897 miles from the Pacific Ocean. The water source is the Salmon River and three production wells. A weir crosses the Salmon River at the hatchery site, trapping all returning spring chinook. Fish passively enter the adult trap for the hatchery. Hatchery personnel at Sawtooth FH trap, spawn, and rear spring chinook to smolt size (IDFG et al. 1990). The East Fork Trap is located 16 miles upstream of the mouth of the East Fork Salmon River. A weir across the East Fork Salmon River at the site also traps all returning chinook. Holding and spawning facilities are located on-site. Eggs collected at the East Fork Trap are transferred back to Sawtooth FH for rearing.

ORIGIN

The spring chinook hatchery broodstock consists of the indigenous spring chinook of the upper Salmon River and East Fork Salmon River and returns from Rapid River Hatchery offspring that biologists released at the Sawtooth Hatchery site from 1977 to 1979 (IDFG et al. 1990). A temporary weir was used beginning in 1981 to begin trapping spring chinook returning to the Stanley Basin to initiate a Sawtooth FH broodstock.

During the early to mid-1970's there were releases of several Salmon Basin stocks including Rapid River Hatchery spring chinook, upper Salmon spring chinook, and Lemhi River Spring chinook. In 1967, broodstock from the Marion Forks Hatchery was used because of a loss of the Salmon River eggs, but survival was very poor. These releases occurred during the operation of Decker Pond, an experimental culture station to determine if spring chinook could be raised in the Stanley Basin. The pond was constructed in 1966 and operated through the late 1970's. The program was discontinued with the decision to build Sawtooth FH (IDFG et al. 1990).

DISTRIBUTION

Tables 1 and 2 list hatchery spring chinook releases into the Upper Salmon River for brood years 1976-1988. Fish are released into the mainstem Salmon River and East Fork Salmon River. They are also released into the Yankee Fork. Coded wire tag (CWT) codes are identified for brood years 1981-1989. CWT fish are marked with an adipose fm-clip. Other marks or tag releases have not been- compiled.

PRODUCTION

Sawtooth Hatchery is designed to rear 2.4 million spring chinook smolts at a target release size of 15-20 per pound. Progeny of East Fork and Salmon River broodstock are reared-there. The program's goal for returns back to the Snake River basin is 19,455 adults (Rogers 1986, IDFG et al. 1990).

Timing of hatchery rearing is shown in Figure 1.

Egg

For brood years 1984-1988, eye-up of Sawtooth eggs averaged 89.8 percent. During the same period, eye-up of East Fork eggs averaged 87.0 percent (Table 3).

Frv-fingerling

For Sawtooth broodstock, the percent survival of green egg-to-fry averaged 86.3 percent for brood years 1984-1988. The percent survival from green egg-to-smolt release averaged 78.5 percent (Table 3).

For East Fork broodstock, the percent survival of green egg-to-fry averaged 83.4 percent for brood years 1984-1988. The percent survival from green egg-to-smolt release averaged 75 .O percent (Table 3).

Smolt

In-basin smolt survival has not been quantified. Giorgi (1991) estimated survival to Lower Granite Dam by applying a Fish Guidance Efficiency (FGE) of 0.53 to the Lower Granite Dam detection rates for fish injected with Passive Integrated Transponder (PIT) tags detected in 1989. He estimated that the survival of spring chinook tagged and released from Sawtooth FH was 19.8 percent for brood year 1987 fish released in spring. Giorgi pointed out that more effort is needed to properly define sampling efficiency if this information will be relied upon to calculate survival.

Giorgi (1991) also presented a summary of the percentage of branded fish released from Sawtooth FH that were estimated recovered at Lower Granite Dam, 1984-1990 (Table 4). The percentage of brands observed at Lower Granite Dam ranged from 1.9-10.8 percent.

Smolt-to-adult return rates for spring chinook returning to the Sawtooth weir averaged 0.44 percent, brood years 1981-1986 (Table 5). This represents an overestimate of hatchery fish survival since researchers have estimated that 10 to 30 percent of the intercepted fish are probably from natural production (Cochnauer and Elam 1990). Smolt-to-adult survival for CWT groups averaged 0.15 percent for 13 groups released 1983 through 1988 (Table 6).

Smolt-to-adult return rates for spring chinook returning to the East Fork weir averaged 0.06 percent, brood years 1984-1986 (Table 7). This represents an overestimate of hatchery fish survival since researchers have estimated that 10 to 30 percent of the intercepted fish are probably from natural production (Cochnauer and Elam 1990). Smolt-to-adult survival for CWT groups averaged 0.005 percent for 3 groups released 1985 through 1986 (Table 8).

Adult

Prespawning mortality of ponded fish at Sawtooth FH and the East Fork Trap ranged 1.7-l 8.7 percent, 1983-1991 (Table 9).

ADULT LIFE HISTORY

Adult Escapement

Chinook crossing Bonneville Dam from March 1 through May 31 are counted as springs, as are those crossing Lower Granite Dam from March 1 through June 17. More specific time of migration and escapement for hatchery spring chinook returning to the upper Salmon River drainage has not been identified for the ocean, Columbia or Snake rivers. Adult timing research implemented by the University of Idaho in 1991 should provide more information about Snake River timing (Bjornn et al. 1992).

Harvest

Information has not been completely summarized regarding rate of contribution of upper Salmon hatchery spring chinook to ocean, or Columbia and Snake rivers harvest. Carmichael (1991) summarized CWT information for Sawtooth releases, brood years 1983-1985 (Table 10). Ocean catch was not detected.

The upper Salmon River was completely closed to sport fishing prior to implementation of the Sawtooth and East Fork programs.

Information regarding occurrence and magnitude of tribal harvest of upper Salmon River hatchery spring chinookwas not investigated.

Spawner Escapement

The spring chinook run generally arrives at the Sawtooth and East Fork weirs from late May through mid-September (Tables 11 and 12).

Spring chinook intercepted at both weirs are a mixture of hatchery and naturally produced fish that cannot be differentiated except for hatchery fish with CWTs or other marks, In brood year 1991, all hatchery spring chinook were marked with an ad-clip and CWT. Future releases will be totally marked in some manner so that hatchery and natural fish can be separated at weirs.

Returns to Sawtooth FH by brood year ranged from 276 to 1,978 spring chinook for brood years 1981-1986 (Table 13). Returns to the East Fork Trap ranged 82-609 spring chinook during the same period (Table 14). As stated in the tables, ocean age has been assigned based on length frequency, not known-age techniques. This means that brood year designation may be inaccurate if, for example, one brood year exhibits an unusual growth pattern such as being atypically large.

Spawning generally occurs July through September.

Adult Characteristics

Weights of returning chinook are not available. Most of the spring chinook intercepted at the Sawtooth weir and East Fork trap are less than 107 cm fork length (Tables 15 and 16).

In brood years 1984 and 1985, three-ocean spring chinook were the major component of the brood year returns intercepted at Sawtooth weir. Two-ocean returns dominated the other brood years, according to both length frequency and CWT analyses (Tables 17 and 18). A comparison of estimated ocean age, from length frequency, with known ocean age, based on CWTs, show that there can be substantial discrepancy between the two methods (Table 19).

For brood years 1982-1984, three-ocean spring chinook were the major component of the brood year returns intercepted at the East Fork trap (Table 20).

The percentage of females by brood year averaged 44.4 percent for returns intercepted at Sawtooth weir, brood years 1981-1986 (Table 21). The percentage of females by brood year averaged 33.2 percent for returns intercepted at the East Fork weir, brood years 1983-1986 (Table 22). Mostly three-ocean females returned to the East Fork.

For spring chinook intercepted at the Sawtooth weir, the average number of eggs per female was 5,315 eggs from 1981 through 1991 (Table 23). For spring chinook intercepted at the East Fork Trap, the average number of eggs per female was 5,939 eggs from 1984 through 1991 (Table 24).

JUVENILE LIFE HISTORY

Smolt age at release usually ranges from 19 to 20 months, depending upon the time of egg take.

Freeze brands have allowed collection of migration data from the upper Salmon River to the Snake River smolt trap, as well as to Lower Granite Dam (Table 4). The migration rate of smolts released in the upper Salmon and detected at the Snake River Trap ranged from 19.4-38.7 km/day during the period of 1984-1986 and 1989.

BIOCHEMICAL/GENETIC CHARACTERISTICS

Waples et al. (1991) reported allele frequency data for Sawtooth FH spring chinook (Appendix Tables 1 and 2). Schreck et al. (1986) also reported electrophoretic data for Sawtooth FH spring chinook (Appendix Tabie 3). Marshall (1992) reported genetic characteristics of spring chinook from broodstock collected at the Past Fork Trap.

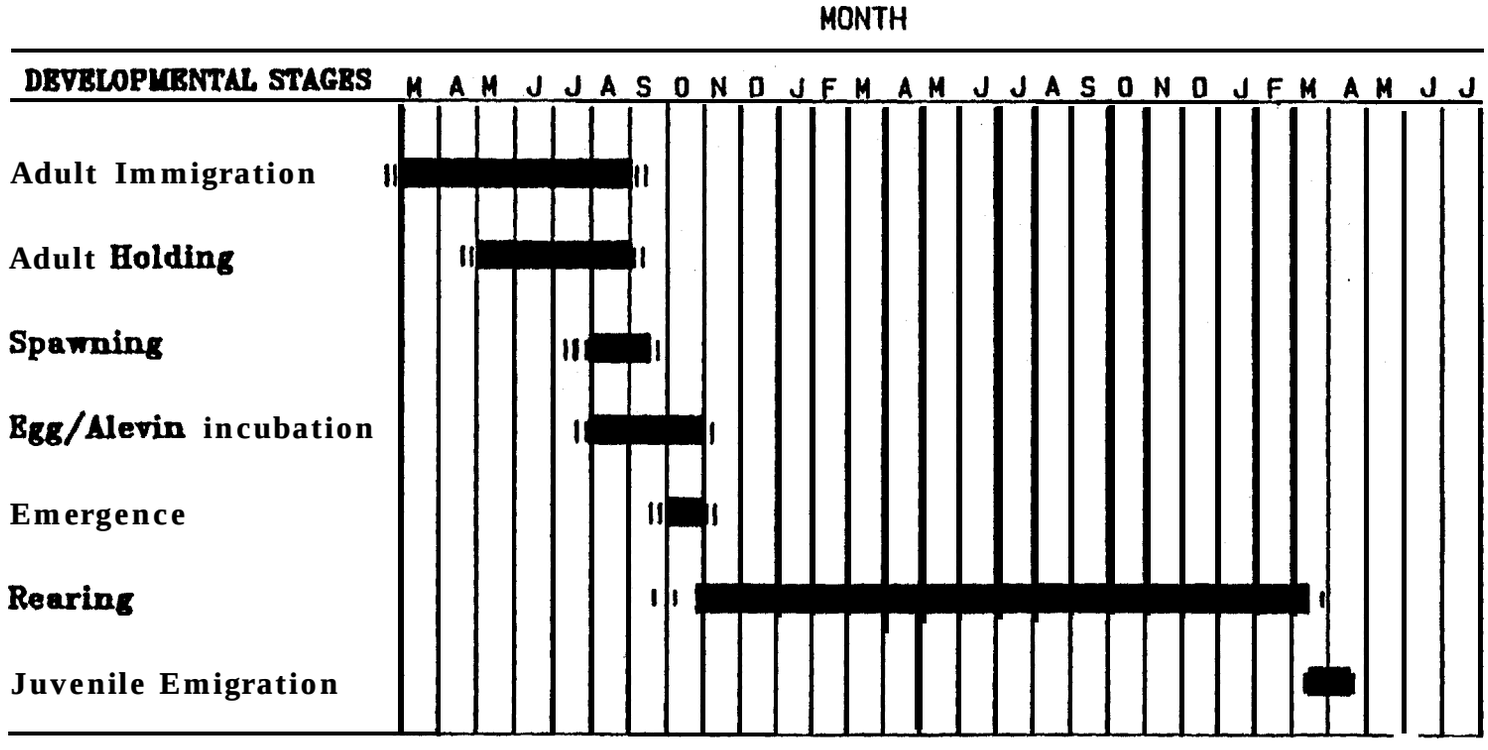
DISEASES

The major disease of management concern, such as those potentially limiting fish transfers, for upper Salmon River hatchery fish is Bacterial Kidney Disease (BKD) (Table 25). Feed treatments of erythromycin during the rearing cycle have been effective in reducing in-hatchery mortality. Adults held for broodstock are also injected with erythromycin to reduce mortality.

REFERENCES

All Upper Salmon references appear in one reference section at the end of the hatchery produced summer steelhead section.

Figure 1. Freshwater life history for spring chinook spawned at the East Fork trap and Sawtooth Hatchery, and reared at Sawtooth Hatchery.



Notes:

1. The developmental stage timing represents basin-wide averages, local conditions may cause some variability.
2. Solid bars indicate periods of heaviest adult immigration, spawning and juvenile emigration.

Table 1 (TR), Hatcherv spring chinook releases into the Upper Salmon River (from Middle Fork Salmon River to Sawtooth and East Fork weirs) by brood year, 1976-1988. No coded wire tags have be en releaskd.

Brood Year	Brood-stock	Hatchery	Life Stage	Release Date (1)	Release Date (2)	Fish/lb	Number Released	Release Location	CWT
1976	Rapid River	Mackay	F-F"	06/09/77		189	45,360	North Fork	
1976	Rapid River	Mackay	F-F	06/12/77		189	56,700	W.Fk. Yankee	
1976	Rapid River	Mackay	F-F	06/14/77		189	46,305	Panther Creek	
1977	Rapid River	Mackay	F-F	08/21/78		481	75,036	Yankee Fork	
1976	Rapid River	Mackay	smolt	05/30/78		72	52,120	W. Fk. Yankee	
1977	Rapid River	Mackay	F-F	08/16/78		481	102,934	Valley Creek	
1977	Rapid River	Mackay	F-F	03/30/78		1,440	50,400	Indian Creek	
1985	Sawtooth	Sawtooth	adult	1985			61	Yankee Fork	
1985	Rapid River[b]	Pahsimeroi	adult	1985			659	Yankee Fork	
1985	Rapid River[b]	Pahsimeroi	F-F	1986			386,348	Yankee Fork	
1986	Sawtooth	Sawtooth	adult	1986			61	Yankee Fork	
1986	Rapid River[b]	Pahsimeroi	adult	1986			1,505	Yankee Fork	
1986	Rapid River[b]	Pahsimeroi	adult	1986			3,383	Panther Creek	

Table 1 (cont.). Hatchery spring chinook releases into the Upper Salmon River (from Middle Fork Salmon River to Sawtooth and Fast Fork weirs) by brood year, 1976-1988. No coded wire tags have been released.

Brood Year	Brood-stock	Hatchery	Life Stage	Release Date (1)	Release Date (2)	Fish/lb	Number Released	Release Location	CWT
1986	Rapid River[b]	Sawtooth	F-F	1987			157,877	Yankee Fork	
1987	Rapid River"	Pahsimeroi	adult	1987			600	Yankee Fork	
1986	Rapid River"	Sawtooth	smolt	03/14/88	03/18/88	20.0	725,300	Yankee Fork	
1987	Rapid River	Rapid River	F-F	1988			50,100	Yankee Fork	
1988	Rapid River[b]	Pahsimeroi	adult	1988			397	Yankee Fork	
1987	Sawtooth	Sawtooth	smolt	03/22/89		24.0	198,200	Yankee Fork	
1988	Sawtooth	Sawtooth	F-F	1989		178	125.000	Yankee Fork	
1989	Rapid River[b]	Pahsimeroi	adult	1989			38	Yankee Fork	
1988	Sawtooth	Sawtooth	smolt	03/20/90		20.7	200,800	Yankee Fork	
1989	Rapid River	Sawtooth	F-F	07/20/90		111	50,000	Yankee Fork (ponds)	
1989	Rapid River	Sawtooth	pre-smolt	10/10/90		45.5	491,290	Yankee Fork	

[a] F-F designates a fry or fingerling release.
[b] Rapid River stock returning to Pahsimeroi Hatchery.
[c] Rapid River stock returning to Rapid River Hatchery.

Table 2 (TR). Hatchery spring chinook releases into the Headwaters of the Salmon River (from Sawtooth and East Fork weirs, upstream to the headwaters) by brood year, 1981-1981)“. Coded wire tag codes displayed for brood years 1986-1989.

Brood Year	Brood-stock	Hatchery	Life Stage	Release Date (1)	Release Date (2)	Fish/lb	Number Released	Release Location	CWT
1981	Sawtooth	McCall	smolt	1983			167,895	Sawtooth	
1982	Sawtooth	McCall	smolt	1984			230,550	Sawtooth	
1983	Sawtooth	McCall	smolt	1985			420,060	Sawtooth	
1985	Sawtooth	Sawtooth	adult	1985			19	Salmon R.	
1984	Sawtooth	Sawtooth	smolt	1986			347,481	Salmon R.	
1984	East Fork	Sawtooth	smolt	1986			108,690	East Fork	
1986	Sawtooth	Sawtooth	adult[b]	1986			876	Salmon R.-above weir	
1986	East Fork	East Fork trap	adult[b]	1986			126	East Fork-above weir	
1985	Sawtooth	Sawtooth	smolt	1987			1,185,080	Sawtooth	
1985	East Fork	Sawtooth	smolt	1987			195,100	East Fork	
1986	Sawtooth	Sawtooth	pre-smolt	10/06/87		23.0	100,600	Sawtooth	
1987	Sawtooth	Sawtooth	adult[b]	1987			12	Frenchman Creek	
1987	Sawtooth	Sawtooth	adult[b]				506	Salmon R.	
1987	East Fork	East Fork trap	adult[b]				98	East Fork	
1986	Sawtooth	Sawtooth	smolt	03/15/88		20.5	246,565	Sawtooth	103030
1986	Sawtooth	Sawtooth	smolt	03/15/88		20.5	62,100	Sawtooth	103031
1986	Sawtooth	Sawtooth	smolt	03/15/88		20.5	1,296,224	Sawtooth	Untagged

Table 2 (cont.). Hatchery spring chinook releases into the Headwaters of the Salmon River (from Sawtooth and East Fork weirs, upstream to the headwaters) by brood year, 198 l-1989". Coded wire tag codes displayed for brood years 1986-1989.

Brood Year	Brood-stock	Hatchery	Life Stage	Release Date (1)	Release Date (2)	Fish/lb	Number Released	Release Location	CWT
1986	East Fork	Sawtooth	smolt	03/15/88	03/16/88	19.4	46.600	East Fork	102937
1986	East Fork	Sawtooth	smolt	03/15/88	03/16/88	19.4	202,600	East Fork	Untagged
1987	Sawtooth	Sawtooth	F-F'	1988			24,000	Pole Creek	
1987	Sawtooth	I Sawtooth	F-F	1988			24.000	Smilev Creek	
1988	Sawtooth	Sawtooth	adult[b] 9 8 8				32	Pole Creek	
1988	Sawtooth	Sawtooth	adult[b]	1988			32	Frenchman Creek	104144
1988	Sawtooth	Sawtooth	adult[b]	1988			552	Salmon R.	104145
1988	East Fork	East Fork trap	adult[b]	1988			202	East Fork	104146
1988	Sawtooth	Sawtooth	eyed-eggs	1988			27,800	Beaver Creek	Untagged
1987	Sawtooth	Sawtooth	pre-smolt	10/12/88		20.4	21,400	Hell Roaring Creek	
1987	Sawtooth	Sawtooth	pre-smolt	10/12/88		20.4	21,400	Alturas Lake Creek	
1987	Sawtooth	Sawtooth	pre-smolt	10/12/88		19.6	49,700	Sawtooth	102935
1987	Sawtooth	Sawtooth	ore-smolt	10/12/88		20.0	50,275	Sawtooth	103138
1987	Sawtooth	Sawtooth	pre-smolt	10/12/88		21.0	50,400	Sawtooth	103139
1987	Sawtooth	Sawtooth	pre-smolt	10/12/88		20.0	797,225	Sawtooth	Untagged
1987	East Fork	Sawtooth	smolt	03/20/89	03/21/89	19.5	59,529	East Fork	103035
1987	East Fork	Sawtooth	smolt	03/20/89	03/21/89	19.5	245,771	East Fork	Untagged
1987	Sawtooth	Sawtooth	smolt	03/15/89		23.4	48.386	Sawtooth	103140

Table 2 (cont.). Hatchery spring chinook releases into the Headwaters of the Salmon River (from Sawtooth and East Fork weirs, upstream to the headwaters) by rood year, 198 .-1989". C ded wire tag codes displayed for brood years 1986-1989.

Brood Year	Brood-stock	Hatchery	Life Stage	Release Date (1)	Release Date (2)	Fish/lb	Number Released	Release Location	CWT
1987	Sawtooth	Sawtooth	smolt	03/15/89		19.6	50,635	Sawtooth	104048
1987	Sawtooth	Sawtooth	smolt	03/20/89	03/21/89	24.0	49,805	Sawtooth	104051
1987	Sawtooth	Sawtooth	smolt	03/15/89	03/21/89	22.3	952,774	Sawtooth	Untagged
1988	Sawtooth	Sawtooth	F-F	06/27/89		74	51,000	Alturas Lake Cr.	
1988	Sawtooth	Sawtooth	F-F	1989			126,100	Salmon R.	
1988	East Fork	Sawtooth	F-F	06/21/89		78	88,000	East Fork	
1988	Sawtooth	Sawtooth	F - F	1989			71,500	Smiley Creek	
1988	Sawtooth	Sawtooth	F - F	1989			71,500	Pole Creek	
1989	Sawtooth	Sawtooth	adult[b]	1989			470	Salmon R.	
1989	East Fork	East Fork trap	adult'	1989			69	East Fork	
1988	Sawtooth	Sawtooth	pre-smolt	10/12/89		31.3	45,275	Sawtooth	103222
1988	Sawtooth	Sawtooth	pre-smolt	10/12/89		39.0	46,525	Sawtooth	103223
1988	Sawtooth	Sawtooth	ore-smolt	10/12/89		35.1	303,600	Sawtooth	Untagged
1988	East Fork	Sawtooth	smolt	03/20/90	03/21/90	22.3	47,225	East Fork	103211
1988	East Fork	Sawtooth	smolt	03/20/90	03/21/90	22.3	47,425	East Fork	103212
1988	East Fork	Sawtooth	smolt	03/20/90	03/21/90	22.3	419,950	East Fork	Untagged
1988	Sawtooth	Sawtooth	smolt	03/17/90	03/21/90	23.0	47,500	Sawtooth	103220
1988	Sawtooth	Sawtooth	smolt	03/17/90	03/21/90	23.0	50,305	Sawtooth	103221

Table 2 (cont.). Hatchery spring chinook releases into the Headwaters of the Salmon River (from Sawtooth and East Fork weirs, upstream to the headwaters) by brood year, 1981-1989[a]. Coded wire tag codes displayed for brood years 1986-1989.

Brood Year	Brood-stock	Hatchery	Life Stage	Release Date (1)	Release Date (2)	Fish/lb	Number Released	Release Location	CWT
1988	Sawtooth	Sawtooth	smolt	03/17/90	03/21/90	23.0	51,700	Sawtooth	103224
1988	Sawtooth	Sawtooth	smolt	03/17/90	03/21/90	23.0	51,125	Sawtooth	104008
1988	Sawtooth	Sawtooth	smolt	03/17/90	03/21/90	23.0	1,299,570	Sawtooth	Untagged
1989	Sawtooth	Sawtooth	pre-smolt	08/16/90		25.0	2,000	Salmon R.	
1990	Sawtooth	Sawtooth	adult[b]	09/14/90			703	Salmon R.	
1990	East Fork	East Fork trap	adult[b]	09/14/90			88	East Fork	
1989	East Fork	Sawtooth	smolt	03/05/91		30.7	98,300	East Fork	
1989	Sawtooth	Sawtooth	smolt	03/08/91	03/13/91	31.5	21,662	Sawtooth	103416
1989	Sawtooth	Sawtooth	smolt	03/08/91	03/13/91	31.5	21,772	Sawtooth	103417
1989	Sawtooth	Sawtooth	smolt	03/08/91	03/13/91	31.5	20,710	Sawtooth	103418
1989	Sawtooth	Sawtooth	smolt	03/08/91	03/13/91	24.4	21,276	Sawtooth	103419
1989	Sawtooth	Sawtooth	smolt	03/08/91	03/13/91	24.4	21,235	Sawtooth	103420
1989	Sawtooth	Sawtooth	smolt	03/08/91	03/13/91	24.4	10,586	Sawtooth	103421
1989	Sawtooth	Sawtooth	smolt	03/08/91	03/13/91	26.0	17,062	Sawtooth	103422
1989	Sawtooth	Sawtooth	smolt	03/08/91	03/13/91	26.0	22,018	Sawtooth	103423
1989	Sawtooth	Sawtooth	smolt	03/08/91	03/13/91	26.0	19,928	Sawtooth	103424
1989	Sawtooth	Sawtooth	smolt	03/08/91	03/13/91	24.8	22,100	Sawtooth	103425
1989	Sawtooth	Sawtooth	smolt	03/08/91	03/13/91	24.8	14,779	Sawtooth	103426

Table 2 (cont.). Hatchery spring chinook releases into the Headwaters of the Salmon River (from Sawtooth and Fast Fork weirs, upstream to the headwaters) by brood year, 1981-1989[a]. Coded wire tag codes displayed for brood years 1986-1989.

Brood Year	Brood-stock	Hatchery	Life Stage	Release Date (1)	Release Date (2)	Fish/lb	Number Released	Release Location	CWT
1989	Sawtooth	Sawtooth	smolt	03/08/91	03/13/91	24.8	11,597	Sawtooth	103427
1989	Sawtooth	Sawtooth	smolt	03/08/91	03/13/91	28.7	21.179	Sawtooth	103428
1989	Sawtooth	Sawtooth	smolt	03/08/91	03/13/91	28.7	22,448	Sawtooth	103429
1989	Sawtooth	Sawtooth	smolt	03/08/91	03/13/91	28.7	22,103	Sawtooth	103430
1989	Sawtooth	Sawtooth	smolt	03/08/91	03/13/91	22.3	14,908	Sawtooth	104130
1989	Sawtooth	Sawtooth	smolt	03/08/91	03/13/91	22.3	13,942	Sawtooth	104131
1989	Sawtooth	Sawtooth	smolt	03/08/91	03/13/91	25.5	14,311	Sawtooth	104211
1989	Sawtooth	Sawtooth	smolt	03/08/91	03/13/91	25.5	14,993	Sawtooth	104212
1989	Sawtooth	Sawtooth	smolt	03/08/91	03/13/91	21.8	11,903	Sawtooth	104217
1989	Sawtooth	Sawtooth	smolt	03/08/91	03/13/91	21.8	17,500	Sawtooth	104218
1989	Sawtooth	Sawtooth	smolt	03/08/91	03/13/91	21.8	272,583	Sawtooth	Untagged

[a] Sawtooth release location refers to the Salmon River at the Sawtooth Hatchery site. East Fork release location refers to the East Fork Salmon River at the East Fork adult trap site.
[b] Adults released above the weirs are a mixture of hatchery and naturally produced fish.
[c] F-F designates a fry or fingerling release.

Table 3 (TS-a). Sawtooth and East Fork hatchery spring chinook survival at various life stages, brood years 1984-1988.

Brood year	Percent survival green egg to eyed-egg	Percent survival green egg to fry	Percent survival green egg to release
		Sawtooth	
1984[a]	80.0	66.8	57.7
1985	92.9	92.3	83.5
1986	91.9	89.5	83.7
1987	93.1	92.4	86.0
1988	91.2	90.3	81.4
		East Fork	
1984[a]	80.0	70.6	63.4
1985	89.4	85.5	79.6
1986	90.8	88.4	82.9
1987	82.5	81.3	73.0
1988	92.1	91.2	76.2

[a] Eggs were incubated and hatched at Pahsimeroi Hatchery. Fish were returned to Sawtooth at 500/lb.

Sources: Rogers 1986, 1988, 1989, 1990.
Alsager 1991.
R. Alsager, IDFG, unpublished.

Table 4 (TR-a). Migration data for freeze branded spring chinook salmon from the Sawtooth Hatchery release site to the Snake River trap" and to Lower Granite Dam (LGD), 1984-1989.

Year	Median release date	Median passage date, Snake trap	Migration rate (km/day)	Mean Q (kcfs) Salmon R.	Mean Q (kcfs) Snake R.	Median arrival at LGD	Migration rate (km/day)	Mean Q(kcfs) at LGD	Percent brands observed at LGD
1984	3/28	4/21	29.0	11.8	84.0	Lower Granite migration not reported			8.8
1985	3/27	4/14	38.7	9.6	60.1	5/4	2.6	89	10.8
1986	3/17	4/14	24.9	13.6	81.4	4/23	5.7	89	6.3
1987	Insufficient recapture numbers at Snake River trap.								1.9
1988	Insufficient recapture numbers at Snake River trap.								3.7
1989	3/15	4/20	19.4	6.1	51.0	4/23	17.2	112	3.9
1990	Insufficient recapture numbers at Snake River trap.								6.2

[a] Snake River trap is located approximately 40 m downstream from the Interstate Bridge, between Lewiston, Idaho and Clarkston, Washington. This location is 0.5 km upstream from the convergence of the Snake and Clearwater rivers.

Sources: Buettner and Nelson 1990, 1991.
Giorgi 1991.

Table 5 (TS-a). Percentages of smolts released from Sawtooth Hatchery that returned as adults for brood years 1981-1986[a].

Brood year	Year released	Smolts released	Total brood year return[b]	Percent of brood year return
1981	1983	186,375	2,027	1.087
1982	1984	230,550	2,086	0.905
1983	1985	420,060	1,821	0.433
1984	1986	347,484	293	0.084
1985	1987	1,185,061	530	0.045
1986	1988	1,705,489	1,921	0.113

[a] Returns based on length frequency criteria cited in Table 13.
[b] Also includes returning naturally produced adults.
[c] Includes 100,600 presmolts.

Source: S. W. Kiefer, IDFG, unpublished.

Table 6 (RH-a). Number of coded wire-tagged hatchery spring chinook salmon returning to Sawtooth Hatchery.

Tag code	Brood year	Date released	Number tagged released	Size released (#/lb)	Release site	Purpose	Year returned 1984	1985	1986	1987	1988	1989	1990	1991	Total returns	Percent
10-24-08	1981	1983	35,075	28.7	Salmon R. Above Sawtooth	Hatchery evaluation	3	51	15						69	0.20
10-25-35	1981	1983	51,450	28.7	Salmon R. Above Sawtooth	Hatchery evaluation	2	69	9						80	0.16
10-27-08	1982	1984	51,025	17.0	Salmon R. Above Sawtooth	Hatchery evaluation	-	83	218	77	-				378	0.70
10-27-09	1982	1984	50,600	17.0	Salmon R. Above Sawtooth	Hatchery evaluation	-	72	183	77	-				332	0.70
10-26-34	1983	1985	41,200	22.5	Salmon R. Above Sawtooth	Hatchery evaluation	-		0	2	2				4	0.00
10-26-35	1983	1985	38,150	22.5	Salmon R. Above Sawtooth	Hatchery evaluation	-		2	1	4				7	0.02
10-28-45	1984	1986	37,550	26.3	Sawtooth H.	Hat. eval.	-			1	2	2	-	-	5	0.01
10-28-46	1984	1986	38,300	26.3	Sawtooth H.	Hat. eval.	-			1	1	1	-	-	2	0.005
10-30-16	1985	1987	100,450	24.0	Sawtooth H.	Hat. eval.	-				1	10	0	-	11	0.01
10-30-17	1985	1987	101,175	22.9	Sawtooth H.	Hat. eval.	-				0	3	1	-	4	0.004
10-30-18	1985	1987	101,850	22.9	Sawtooth H.	Hat. eval.	-				0	4	0	-	4	0.004
10-30-30	1986	1988	246,600	20.5	Sawtooth H.	Hat. eval.	-					5	65	15	85	0.034
10-30-31	1986	1988	62,100	20.5	Sawtooth H.	Hat. eval.	-					0	24	5	29	0.047

Sources: Cannamela et al. 1991.
Cannamela 1992.
D. Cannamela, IDFG, unpublished.

Table 7 (TS-b). Percentages of smolts released into the East Fork Salmon River that returned as adults for brood years 1984-1986[a].

Brood year	Year released	Smolts released (x 1000)	Total brood year return[b]	Percent of brood year return
1984	1986	108,690	75	0.069
1985	1987	195,100	88	0.045
1986	1988	249,200	160	0.064

[a] Returns based on length frequency criteria cited in Table 14.
[b] Also includes returning naturally produced adults.

Source: S. W. Kiefer, IDFG, unpublished.

Table 8 (RH-a). Number of coded wire-tagged spring chinook returning to the East Fork Salmon River weir.

Tag code	Brood year	Year released	Number tagged released	Size released (#/lb)	Purpose	Site released	Returns 1988	Returns 1989	Returns 1990	Returns 1991	Total returns	Percent
10/29/21	1985	03/87	30,575	30.0	Eval. & Contrib.	E.F. Salmon R.	0	0	1	-	1	0.003
10/29/63	1985	03/87	19,625	30.0	Eval. & Contrib.	E.F. Salmon R.	0	0	0	-	0	0.000
10/29/37	1986	03/16/88	46,600	30.0	Eval. & Contrib.	E.F. Salmon R.	-	15		0	6	0.013

Source: Cannamela 1992.

Table 9 (TS-c). Prespawning mortality of spring chinook collected at the Sawtooth and East Fork weirs, brood years 1983-1991.

Adult collection site	Year	Number of fish ponded	Percent prespawning mortality
Sawtooth	1983	406[a]	8.9
East Fork	1983	117[a]	3.4
Sawtooth	1984	201	NR[b]
East Fork	1984	52	NR[b]
Sawtooth	1985	881	5.1
East Fork	1985	161	0.6
Sawtooth	1986	893	18.7
East Fork	1986	68	8.8
Sawtooth	1987	838	4.2
East Fork	1987	174	4.6
Sawtooth	1988	933	4.2
Past Fork	1988	346	14.2
Sawtooth	1989	418	4.8
Past Fork	1989	59	5.1
Sawtooth	1990	873	3.0
East Fork	1990	57	1.7
Sawtooth	1991	328	4.4
East Fork	1991	19	3.2

[a] All fish trapped were ponded.
[b] NR = not reported.

Sources: Moore 1983.
Rogers 1985, 1985, 1986, 1988, 1990, 1991.
R. Alsager, IDFG, unpublished.

Table 10 (TS-d). Coded wire tag recovery information for Sawtooth Hatchery spring chinook".

	Brood year		
	1983[b]	1985	Combined"
Number of CWT released	79,350	201,625	280,975
Total number of CWT recovered[d]	14(.018)	2(.001)	16(.006)
Ocean catch	0	0	0
Columbia River catch	1(7)	2(100)	3(19)
Treaty C & S	1	2	3
Other FW sport	0	0	0
Subbasin escapement	13(93)	0	13(81)
Hatchery	13	0	13

[a] Percentages are in ( ). Numbers are unexpanded and represent observed recoveries.
[b] Rapid River Hatchery broodstock.
[c] Upper Salmon River broodstock collected at Sawtooth weir.
[d] Percent of total number of CWT recovered is proportion of total CWT release. All other percentages displayed as proportion of total CWT recovered.

Source: Carmichael 199 1.

Table 11 (AT-a). Timing of the adult ladder operation at Sawtooth weir, 1983 to 1991.

Return Year	Ladder operation began	Ladder operation terminated	Peak run timing
1983	07/19	09/09	4th wk. July
1984	07/07	09/06	3rd wk. July
1985	06/14	09/15	2nd wk. June
1986	06/20	09/09	1st wk. July
1987	05/13	09/08	1st wk. June
1988	05/23	09/06	3rd wk. June
1989	06/07	09/11	2nd wk. July
1990	05/21	09/14	1st wk. July
1991	06/07	09/15	2nd wk. July

Sources: Rogers 1985, 1986, 1988, 1989, 1990.
R. Alsager, IDFG, unpublished.
T. Rogers, IDFG, unpublished.

Table 12 (AT-b). Timing of the adult ladder operation at the East Fork weir, 1984 to 1991.

Return Year	Ladder operation began	Ladder operation terminated	Peak run timing
1984	06/20	08/07	3rd wk. July
1985	06/11	09/04	3rd wk. June
1986	05/27	09/09	2nd wk. Aug.
1987	05/11	09/03	3rd wk. June
1988	06/01	09/01	4th wk. June
1989	06/07	09/07	3rd wk. Aug.
1990	06/04	09/14	3rd wk. Aug.
1991	06/03	09/05	3rd wk. Aug.

Sources: Rogers 1985, 1986, 1988, 1989, 1990.
R. Alsager, IDFG, unpublished.
T. Rogers, IDFG, unpublished.

Table 13 (RH-1). Return of spring chinook by brood year[a] to the Sawtooth Hatchery weir on the headwaters of the Salmon River[b], brood years 1981-1987.

	Total Age				
Brood Year	3	4	5	Total	Adult Total
1981	49	1,182	796	2,027	1,978
1982	292	922	875	2,086	1,794
1983	51	452	1,318	1,821	1,770
1984	17	86	190	293	276
1985	80	286	164	530	450
1986	412	1,212	297	1,921	1,509
1987	112	201	inc.[c]	inc.	inc.

[a] Hatchery weir count was sample method. Total age based on 2 year freshwater rearing and ocean age delineated by fork length criteria as follows:

1984-87:
1-ocean = <22 in., 55 cm.
2-ocean = 22-32 in., 55-81 cm.
3-ocean = >32 in., <81 cm.

1988-90:
1-ocean = ≤64 cm.
2-ocean = 65-82 cm.
3-ocean = ≥83 cm.

1991.
1-ocean = ≤64 cm. (male)
2-ocean = 65-82 cm. (male)
2-ocean = ≤82 cm. (female)
3-ocean = ≥83 cm.

[b] Returning fish are a combination of hatchery and naturally produced spring chinook.
[c] inc. = Incomplete brood year information.

Sources: Alsager 1991.
R. Alsager, IDFG, unpublished.
T. Rogers, IDFG, unpublished.

Table 14 (RH-2). Return of spring chinook by brood year[a] to the East Fork Salmon River weir, brood years 1981-1987.

	Total Age				
Brood Year	3	4	5	Total	Adult Total
1981	22	193	102	317	295
1982	51	87	181	319	268
1983	5	90	519	614	609
1984	1	23	51	75	74
1985	6	55	27	88	82
1986	22	106	32	160	138
1987	12	24	inc.[b]	inc.	inc.

[a] Hatchery weir count was sample method. Total age based on 2 year freshwater rearing and ocean age delineated by fork length criteria as follows:

1984-87: 1-ocean = <22 in., 55 cm.
2-ocean = 22-32 in., 55-81 cm.
3-ocean = >32 in., <81 cm.

1988-90: 1-ocean = ≤64 cm.
2-ocean = 65-82 cm.
3-ocean = ≥83 cm.

1991: 1-ocean = ≤64 cm. (male)
2-ocean = 65-82 cm. (male)
2-ocean = ≤82 cm. (female)
3-ocean = ≥83 cm.

Returning fish are a combination of hatchery and naturally produced spring chinook.

[b] inc. = Incomplete brood year information.

Sources: Alsager 1991.
R. Alsager, IDFG, unpublished.
T. Rogers, IDFG, unpublished.

Table 15 (AL-a). Fork lengths of spring chinook collected at the Sawtooth Hatchery weir, 1986-1991.

Length cm.	1991 No. fish	1990 No. fish	1989 No. fish	1988 No. fish	1987 No. fish	1986 No. fish
< 40	.	٤	4			7
40	2	1	2			
41						7
42		2	8	2		
43	3				2	9
44	4	3	12	7		
45	2					
46	1	3	17	5	4	15
47	2					
48	2	7	35	IO	3	6
49	2					
50	3	2	40	16		7
51	2				8	
52	3	6	40	8		
53					6	4
54		2	45	11		
55	1					4
56	2	4	65	5	9	
57	2					
58	1	17	45	4	8	18
59	6					
60	6	IO	39	3		IO
61	3				30	
62	8	24	35	8		
63	5					27
64	8	37	32	2	43	
65	6					
66	3	47	16	6	64	49
67	10					
68	14	109	19	4		66
69	12				88	
70	16	108	21	4		
71	13				72	126
72	15	169	29	8		
73	IO					185
74	19	206	47	9	63	
75	12					
76	12	203	43	13	38	233
77	9					
78	8	170	44	7		200
79	13				31	
80	8	102	33	12		
81	14				28	181
82	7	90	27	23		
83	16					163
84	12	53	19	40	23	
85	16					
86	21	32	10	62	44	112
87	26					
88	26	26	15	115		86
89	29				75	
90	23	16	20	193		
91	20				113	92
92	27	11	22	172		
93	15					71
94	20	13	18	166	172	
95	12					
96	12	8	14	132		48
97	5				165	
98	7	2	IO	105		
99	2				116	26
100	5	0	18	123		
101						12
102	2	0	5	71	60	
103						
104	1	3	39	139	31	5
105						
106		0				
107					20	
> 107		0	0	0	28	0

[a] Blanks indicate no fish of this size collected and measured.

Sources: R. Alsager, IDFG, unpublished.
T. Rogers, IDFG, unpublished.

Table 16 (AL-a). Fork lengths of spring chinook collected at the East Fork Salmon River weir, 1986-1991.

Length cm.	1991 No. fish	1990 No. fish	1989 No. fish	1988 No. fish	1987 No. fish	1986 No. fish
< 40	[a]	0	1			1
40	1	0	0			
41						0
42		0	1			
43						0
44		0	0			
45						
46		0	1			1
47						
48	1	1	1	1		2
49						
50	1	0	1	1		1
51					1	
52		0	1	0		
53					4	2
54		1	3	0		
55						2
56		0	2	1		
57						
58	3	3	6	0	1	0
59						
60		1	1	1		5
61					7	
62		2	1	2		
63						2
64	1	5	3	1	5	
65						
66	1	9	3	2	14	4
67						
68	3	13	3	0		9
69	3				11	
70	3	11	7	0		
71	2				10	17
72		14	11	1		
73						12
74	4	12	6	0	18	
75						
76	4	14	4	4	7	17
77	1					
78	1	17	8	6		17
79					13	
80		9	8	2		
81					8	13
82	1	6	6	7		
83	4					6
84	3	6	2	12	6	
85						
86	3	2	5	21	8	9
87						
88	2	1	4	34		12
89					15	
90	6	1	7	59		
91	4				19	19
92		7	10	66		
93						22
94	2	2	4	50	24	
95	1					
96	2	4	2	48		9
97	1				23	
98		1	0	57		
99					28	3
100	2	1	4	55		
101	1					8
102	1	1	1	43	18	
103						
104		1	11	74	15	1
105						
106		0				
107					7	
>107		0	0	0	10	0

[a] Blanks indicate no fish of this size collected and measured.

Sources: R. Alsager, IDFG, unpublished.
T. Rogers, IDFG, unpublished.

Table 17 (AC). Age composition percentage (freshwater.ocean) by brood year' for spring chinook returning to the Sawtooth Hatchery weir on the headwaters of the Salmon Rive?, brood years 1981-1986.

Age Composition (%)

Brood Year	N	2.1	2.2	2.3
1981	2,027	2.4	58.3	39.3
1982	2,086	13.9	44.2	41.9
1983	1,821	2.8	24.8	72.4
1984	293	5.8	29.4	64.8
1985	530	15.1	54.0	30.9
1986	1.921	21.4	63.1	15.5

[a] Hatchery weir count was sample method. Ocean age delineated by fork length criteria, cited in Table 13.
[b] Returning fish are a combination of hatchery and naturally produced spring chinook. In this nomenclature, the freshwater and ocean ages sum to the total age of the fish.

Sources: Alsager 1991.
R. Alsager, IDFG, unpublished.
T. Rogers, IDFG, unpublished.

Table 18 (AC-a). Age composition percentage (freshwater.ocean) by brood year for coded wire tagged spring chinook salmon returning to the Sawtooth Hatchery.

Brood year	N	Percent Age Comnosition 2.1	2.2	2.3
1981	149	3.3	80.6	16.1
1982	710	21.8	56.5	21.7
1983	11	18.2	27.3	54.5
1984	7	14.3	42.9	42.9
1985		5.2	89.5	5.3
1986	1::	4.4	78.1	17.5

Sources: Cannamela et al. 1991.
Cannamela I 992.

Table 19 (AL-c). Comparison of spring chinook ocean age estimates based on length frequencies (L-F) with known ages from coded wire tag (CWT) analyses for various return years at the Sawtooth Hatchery weir.

Return year	Method	Percent ocean age One-ocean	Two-ocean	Three-ocean
1985	CWT	35.1	64.9	4.1 0.4
1986	L-F	3.1 0.5	77.7	19.2
1986	CWT		93.9	5.6
1987	L-F	3.0	35.7	61.3
1987	CWT	1.3	3.8	95.0
1988	L-F	50.2	30.0	19.8
1989	CWT	26.5	43.5	30.1
1990	L-F	10.7	86.8	2.5
1990	CWT	0.0	98.9	1.1

Source: G. Kruse, IDFG, unpublished.

Table 20 (AC). Age composition percentage (freshwater.ocean) by brood year[a] for spring chinook returning to the East Fork Salmon River" weir, brood years 1981-1986.

		Age Composition (%)		
Brood Year	N	2.1	2.2	2.3
1981	317	6.9	60.9	32.2
1982	319	16.0	27.3	56.7
1983	614	0.8	14.7	84.5
1984	75	1.3	30.7	68.0
1985	88	6.8	62.5	30.7
1986	160	13.7	66.3	20.0

[a] Hatchery weir count was sample method. Ocean age delineated by fork length criteria as cited in Table 14.
[b] Returning fish are a combination of hatchery and naturally produced spring chinook. In this nomenclature, the freshwater and ocean ages sum to the total age of the fish.

Sources: Alsager 199 1.
R. Alsager, IDFG, unpublished.
T. Rogers, IDFG, unpublished.

Table 21 (AS). Percent females by brood year and age class[a] (freshwater.ocean) for spring chinook returning to the Sawtooth Hatchery weir on the headwaters of the Salmon River[b], brood years 1981-1986.

Females (%)

Brood Year	N	2.1	2.2	2.3	Total % Female
1981	2,027	0	22.5	28.5	51.0
1982	2,086	0	ND[c]	27.7	inc.[d]
1983	1,821	0	6.7	44.7	51.4
1984	293	0	13.0	32.8	45.8
1985	530	0	22.6	19.6	42.2
1986	1,921	0	20.8	10.6	31.4

[a] Hatchery weir count was sample method. Ocean age delineated by fork length criteria as cited in Table 13.
[b] Returning fish are a combination of hatchery and naturally produced spring chinook. In this nomenclature, the freshwater and ocean ages sum to the total age of the fish. N is equal to the entire brood return, male and female.
[c] ND = No data. Length frequency by sex not available.
[d] inc. = Incomplete brood year information.

Sources: Alsager 1991.
R. Alsager, IDFG, unpublished.
T. Rogers, IDFG, unpublished.

Table 22 (AS). Percent females by brood year and age class" (freshwater.ocean) for spring chinook returning to the East Fork Salmon River we?, brood years 1981-1986.

Females (%)

Brood Year	N	2.1	2.2	2.3	Total % Female
1981	317	0	9.1	ND[c]	inc.[d]
1982	319	0	ND	27.6	inc.
1983	614	0	4.1	42.2	46.3
1984	75	0	14.7	25.3	40.0
1985	88	0	12.5	10.2	22.7
1986	160	0	13.1	10.6	23.7

[a] Hatchery weir count was sample method. Ocean age delineated by fork length criteria as cited in Table 14.
[b] Returning fish are a combination of hatchery and naturally produced spring chinook. In this nomenclature, the freshwater and ocean ages sum to the total age of the fish. N is equal to the entire brood return, male and female.
[c] ND = No data. Length frequency by sex not available.
[d] inc. = Incomplete brood year information.

Sources: Alsager 199 1.
R. Alsager, IDFG, unpublished.
T. Rogers, IDFG, unpublished.

Table 23 (AF-a). Mean fecundity by return year for spring chinook returning to the Sawtooth Hatchery weir on the headwaters of the Salmon River".

Return year	N	Mean fecundity
1981	82	4,047
1982	128	5,511
1983		5,080
1984	100	6,017
1985	313	4,533
1986	360	5,654
1987	426	6,388
1988	513	6,083
1989	137	5,456
1990	318	4,501
1991	166	5,192

[a] Returning fish are a combination of hatchery and naturally produced spring chinook.

Sources: Rogers 1985, 1986, 1988, 1989, 1990.
R. Alsager, IDFG, unpublished.
T. Rogers, IDFG, unpublished.

Table 24 (AF-a). Mean fecundity by return year for spring chinook returning to the East Fork Salmon River[b] weir.

Return Year	N	Mean fecundity
1984	25	6,852
1985	44	5,572
1986	66	6,259
1987	131	6,357
1988		5,557
1989	20	5,920
1990	18	5,475
1991	7	5,520

[a] Returning fish are a combination of hatchery and naturally produced spring chinook.

Sources: Rogers 1985, 1986, 1988, 1989, 1990.
R. Alsager, IDFG, unpublished.
T. Rogers, IDFG, unpublished.

Table 25 (TD). Parasites and diseases" of spring chinook reared at the Sawtooth Hatchery[b].

Disease Type	Hatchery	Specific pathogen
Bacteria	Sawtooth/East Fork	*Renibacterium salmoninarium* (Bacterial Kidney Disease)
virus	Sawtooth/East Fork	IHNV (Infectious
virus	Sawtooth/Past Fork	IPNV (Infectious pancreatic necrosis)
Protozoa	Sawtooth/East Fork	*Myxobolus cerebralix* (Whirling Disease)

[a] Disease history only represents pathogens isolated at the hatchery and not necessarily a disease outbreak.
[b] Broodstock is collected at the East Fork Salmon River weir and Sawtooth weir on the headwaters of the Salmon River.

Sources: Rogers 1985, 1986, 1988, 1989, 1990.
Alsager 1991.
R. Alsager, IDFG, unpublished.

UPPER SALMON RIVER, SALMON SUBBASIN
(Middle Fork Salmon River to headwaters of the Salmon and East Fork Rivers, excluding the Lemhi and Pahsimeroi rivers)

Summer Chinook (wild)

GEOGRAPHIC LOCATION

The upper Salmon River area includes the mainstem Salmon River from the Middle Fork Salmon River at RM 191 to the headwaters at RM 402, the major tributaries North Fork Salmon River, East Fork Salmon River, the Yankee Fork Salmon River, Panther and Valley creeks, and numerous smaller tributaries. The Salmon River between the Middle Fork and North Fork, 40 miles long, is classified as "recreational" under the Wild and Scenic River Act. The headwaters area, upstream from Thompson Creek, lies within the Sawtooth National Recreation Area. The mainstem in this area is very accessible. Salmon, Challis and Stanley are the only primary population centers in the upper Salmon drainage. Logging, mining, ranching and recreation are the major industries.

ORIGIN

The upper Salmon River has been stocked with hatchery spring chinook but not summer chinook. The Idaho Department of Fish and Game (IDFG) has classified the summer chinook as wild. Pursuant to the Endangered Species Act, naturally producing Snake River spring and summer chinook were listed as threatened by the National Marine Fisheries Service in 1992. This listing affects the upper Salmon River summer chinook.

DISTRIBUTION

IDFG has classified those fish returning to the mainstem Salmon downstream from Redfish Lake Creek, to Valley Creek downstream from Stanley Lake Creek, and to the East Fork downstream of Herd Creek as summer chinook. Spawning primarily occurs in the mainstem upstream of the Pahsimeroi River, with Indian Riffles just downstream of the Yankee Fork supporting the major spawner concentration. Lower Panther Creek may have historically supported summer chinook, but mine pollution extirpated chinook populations by the early 1960's (Corley 1967).

Available spawning and rearing habitat for the upper Salmon River was described in the Presence/Absence database (Tables 1 and 2). This information was developed for the Northwest Power Planning Council for subbasin planning and modeling.

PRODUCTION

There is no information describing survival and production factors of summer chinook.

IDFG monitored chinook parr densities in the upper Salmon River drainage, 1985-1991. Because most sections were in spring chinook production areas and the rearing areas overlap for spring and summer chinook, all parr density data are reported in the spring chinook section of this chapter.

ADULT LIFE HISTORY

Adult Escanement

Chinook crossing Bonneville Dam from June 1 through July are counted as summers, as are those crossing Lower Granite Dam from June 18 through August 17. Specific time of migration and escapement for upper Salmon River summer chinook is not well documented in the ocean, Columbia River or the Snake River. The University of Idaho implemented adult timing research in 1991 which should provide more information about Snake River timing (Bjomn et al. 1992).

Harvest

Information is not available regarding harvest of upper Salmon River summer chinook in the ocean and Columbia River. Summer chinook are not harvested in the Snake River.

Traditionally, sport harvest of these fish occurred in the mainstem Salmon river and tributaries. During 1959-78, an estimated 25-46 percent of the annual Idaho chinook salmon harvest (total for spring and summer) occurred in the upper Salmon River (Homer and Bjomn 1981). Most of the harvest was upstream of the Pahsimeroi River. IDFG has not allowed sport harvest of spring or summer chinook in the main Salmon River since 1978.

Information regarding occurrence and magnitude of tribal harvest on upper Salmon River summer chinook was not investigated.

Spawner Escanement

IDFG has conducted redd counts on the upper Salmon River from 1957 to present. Total redd counts have declined dramatically, ranging from 2,920 in 1957 to 15 in 1980 (Table 3). Timing of summer chinook redd counts have ranged from the last week of July to the first week of October. In general, the counts are conducted aerially during the first half of September.

Adult Characteristics

Information regarding age and sex composition of summer chinook spawners in the upper Salmon River is not available.

JUVENILE LIFE HISTORY

Juvenile life history is generally similar to Figure 1. Although not illustrated in the figure, there is typically a fall emigration of chinook presmolts from summer rearing areas to lower in the drainages or further downstream in the mainstem Salmon River for winter rearing.

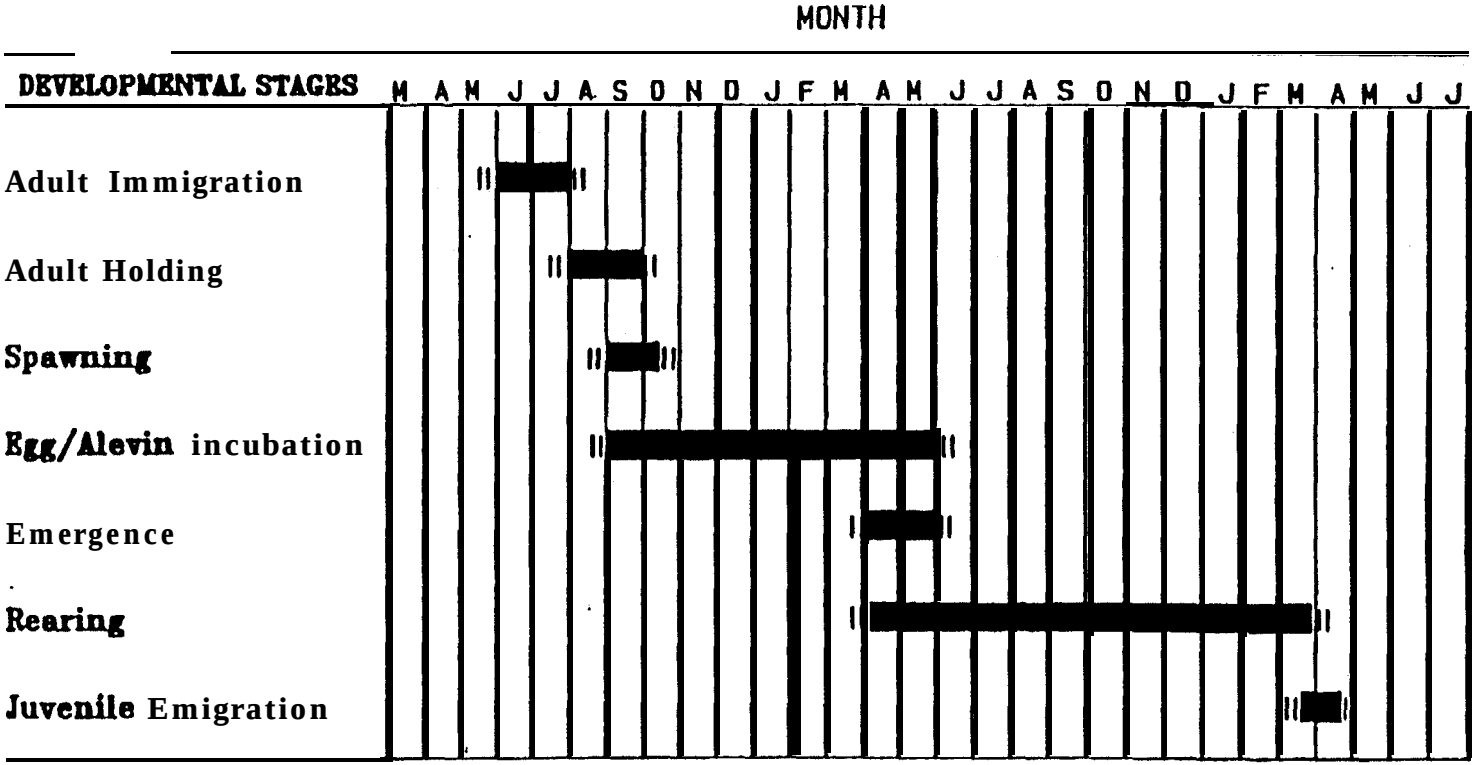
BIOCHEMICAL/GENETIC CHARACTERISTICS

Information has not been compiled.

DISEASES

Information has not been compiled.

Figure 1 (TT). Freshwater life history for natural/wild summer chinook salmon in the Salmon River subbasin.



Notes:

1. The developmental stage timing represents basin-wide averages, local conditions may cause some variability.
2. Solid bars indicate periods of heaviest adult immigration, spawning and juvenile emigration.

Table 1 (HB). Estimated amount of spawning and rearing (Use Type 1) habitat by quality of the upper Salmon River (Middle Fork Salmon to headwaters including tributaries[a]) wild summer chinook production area.

	Excellent	Good	Fair[b]	Poor[b]	Unknown	Total	Confidence[c]
Miles (%)	0	48	52	0		52.6	M
Acres (%)	0	46	54	0		760.6	M

[a] This area includes the main Salmon River from Cow Creek to Redfish Lake Creek, lower Valley Creek, and the lower Fast Fork Salmon River.
[b] Ratings of fair and poor habitat quality may reflect natural physical features such as gradient and channel type, as well as degradation caused by humans.
[c] 'Confidence' is meant to indicate the reproducibility and accuracy of the estimates made, and will be rated as high, medium or low by the respective agencies.

Source: Presence/Absence database, Northwest Power Planning Council, 1991.

Table 2 (HB). Estimated amount of rearing only (Use Type 2) habitat by quality of the upper Salmon River (Middle Fork Salmon to headwaters including tributaries') wild summer chinook production area.

	Excellent	Good	Fair[b]	Poor[b]	Unknown	Total	Confidence[c]
Miles (%)	0	25	75	0		41.2	M
Acres (%)	0	25	75	0		749	M

[a] This area includes the main Salmon River from Cow Creek to Redfish Lake Creek, lower Valley Creek, and the lower Fast Fork Salmon River.
[b] Ratings of fair and poor habitat quality may reflect natural physical features such as gradient and channel type, as well as degradation caused by humans.
[c] 'Confidence' is meant to indicate the reproducibility and accuracy of the estimates made, and will be rated as high, medium or low by the respective agencies.

Source: Presence/Absence database, Northwest Power Planning Council, 199 1.

Table 3 (RN-a). Upper Salmon River drainage wild summer chinook index redd counts, 1957-199 1.

Year	Upper Salmon River	Lower Valley Creek	Lower East Fork	Totals
1957	2,406	331	183	2,920
1958	362	47	NC”	409
1959	336	70	192	598
1960	818	141	303	1,262
1961	356	162	198	716
1962	467	115	195	777
1963	195	50	265	510
1964	415	71	306	792
1965	201	57	131	389
1966	390	184	216	790
1967	365	79	234	678
1968	223	63	235	521
1969	120	22	138	280
1970	150	41	123	314
1971	220	147	149	516
1972	412	39	161	612
1973	224	77	138	439
1974	200	45	49	294
1975	45	80	38	163
1976	44	43	39	126
1977	94	63	136	293
1978	349	219	NC	568
1979	NC	15	33	48
1980	11	4	0	15
1981	75	17	43	135
1982	39	8	14	61
1983	111	28	27	166
1984	51	15	7	73
1985	126	1	9	136
1986	104	16	41	161
1987	200	59	62	321
1988	150	33	85	268
1989	77	26	51	154
1990	52	9	19	80
1991	68	3	23	94

“NC = no count taken.
Source: P. Hassemer, IDFG, unpublished.

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UPPER SALMON RIVER, SALMON SUBBASIN
(Middle Fork Salmon River to headwaters of the Salmon and East Fork Rivers, excluding the Lemhi and Pahsimeroi rivers)

Naturally Produced Summer Steelhead

GEOGRAPHIC LOCATION

The upper Salmon River area includes the mainstem Salmon River from the Middle Fork Salmon River at RM 191 to the headwaters at RM 402, the major tributaries North Fork Salmon River, East Fork Salmon River, the Yankee Fork Salmon River, Panther and Valley creeks, and numerous smaller tributaries (Figure 1). The Salmon River between the Middle Fork and North Fork, 40 miles long, is classified as "recreational" under the Wild and Scenic River Act. The headwaters area, upstream from Thompson Creek, lies within the Sawtooth National Recreation Area. The mainstem in this area is very accessible. Salmon, Challis and Stanley are the only primary population centers in the upper Salmon drainage. Logging, mining, ranching and recreation are the major industries.

ORIGIN

Steelhead are native to the upper Salmon River. The upper Salmon River has been stocked with hatchery steelhead, and the Idaho Department of Fish and Game (IDFG) has classified this run of steelhead as natural.

Steelhead spawning upstream of the Sawtooth Hatchery weir and East Fork weir are a mix of natural and hatchery origin. Hatchery steelhead can be differentiated from naturally produced steelhead by the lack of an adipose fin. Naturally produced steelhead in the upper Salmon River are classified as A-run, based upon adult characteristics of size, ocean age, and timing. Snake River A-run steelhead were released extensively in the upper Salmon River drainage. In addition, the upper Fast Fork Salmon River satelite facility is managed for hatchery B-run steelhead, and some B-run influence on the natural population is likely in this drainage.
Upper Panther Creek historically supported steelhead, but mine pollution essentially extirpated steelhead in the upper part of this drainage (IDFG et al. 1990). Excess A-run hatchery adults and fry have been restocked recently in upper portions of the drainage.

DISTRIBUTION

Available spawning and rearing habitat for the upper Salmon River was described in the Presence/Absence database (Tables 1 and 2). This information was developed for the Northwest Power Planning Council for subbasin planning and modeling.

PRODUCTION

Detailed production and survival information is available for the upper Salmon River upstream of the Sawtooth Hatchery weir because the IDFG is conducting intensive smolt monitoring in this portion of the drainage.

Beginning in 1987, steelhead were tagged with passive integrated transponder (PIT) tags in the upper Salmon River. PIT tag detections at Snake and Columbia River dams provide a relative index of minimum survival from tagging to the dams. The 1990 detections of steelhead tagged as parr in the upper Salmon River in August 1989 was 6.2 percent at Lower Granite, Little Goose and

McNary dams for age 2 + and older steelhead (Table 3). Age 1 + steelhead have very low detection rates at the dams, indicating these fish usually rear an additional year before beginning their seaward migration (Kiefer and Forster 1991, 1992). Because fish are detected in collector systems, most of the detected fish are assumed to be transported. Fish were tagged as late summer parr, thus overwinter mortality and inbasin migration mortality factors are represented, as well as losses in Lower Granite Reservoir and through lower Snake River dams. Specific mortality factors have not been fully segregated to determine stock-specific influence on detection rates.

Steelhead juveniles are monitored in the upper Salmon River during the fall presmolt emigration and spring smolt migration. Kiefer and Forster (1990, 1992) presented detection rates at lower Snake and Columbia River dams of upper Salmon River steelhead parr for spring 1988 and 1990 (Table 4). PIT-tagged parr smaller than 130 mm were not detected in spring 1990, and only 0.6 % were detected in 1988. Larger parr were detected at rates up to 25 % in the two years.

Female escapement above the Sawtooth Hatchery ranged from 92 to 383, and egg deposition ranged from 520,000 to 1,859,000 for 1985-89 (Table 5).

Total abundance of steelhead parr in the upper Salmon River above Sawtooth Hatchery ranged from 5,400 in 1990 to 20,100 in 1987 (Table 6). Steelhead egg-to-parr survival could not be estimated in the upper Salmon River because of the confounding factor of fry outplants (Kiefer and Forster 1992).

The Shoshone-Bannock Tribes have monitored density and abundance of summer steelhead parr in the East Fork Salmon River and in off-channel developments of the Yankee Fork of the Salmon River. Steelhead parr densities generally have been low in both areas. Mean density of steelhead parr (age 1 + and older) in the East Fork ranged from 0.1 per 100 m^2 pool to 3.5 per 100 m^2 pool in late June, 1989 (Rowe, et al. 1989).

IDFG monitored steelhead parr production in the upper Salmon River drainage, 1985-1991. The overall mean for IDFG monitoring sections was 1.7 parr per 100 m^2 and 12.8 percent of carrying capacity (Table 7). Tributaries that are lower in the drainage, such as the North Fork Salmon River and Panther, Moyer, Morgan and Pine creeks, tended to have higher parr densities and a higher percentage of rated carrying capacities. Parr capacity ratings for steelhead were derived from the Presence/Absence database used for development of the Salmon Subbasin Plan. Parr densities were determined by snorkel counts.

ADULT LIFE HISTORY

Adult Escapement

Specific time of migration and escapement for upper Salmon River steelhead is not well documented in the ocean, Columbia River or the Snake River. The University of Idaho implemented adult timing research in 1991 which should provide more information about Snake River timing (Bjornn et al. 1992).

Adult steelhead enter the Salmon River beginning in the fall and typically overwinter in the middle main or upper reach of the mainstem Salmon River before ascending tributaries and the headwaters to spawning grounds. Some also over-winter as far downstream as the Lower Snake and Columbia rivers. Tagging studies have shown that there is considerable milling of steelhead in wintering areas.

Harvest

There is no information available specifically describing the rate of contribution of these steelhead to ocean or Columbia River steelhead harvest. Since the mid-1980's, the harvest of-steelhead possessing an adipose fm has not been allowed in the Snake River or in Idaho.

Quantitative information regarding occurrence and magnitude of tribal harvest on upper Salmon River naturally produced steelhead is not available.

Spawner Escapement

Timing of steelhead spawning in the Salmon River drainage can span two months, from early April to early June. It appears that adult fish usually enter tributaries after spring freshets. The major period of steelhead spawning begins in mid-April and extends through May when water temperature is above 4.5 C°.

Steelhead escapement information is not available for most of the upper Salmon. Adult trap information is available for the headwaters of the Salmon River and the East Fork.
Total numbers of steelhead intercepted at the Sawtooth Hatchery weir ranged from 261 to 2,212 in 1985-91; numbers of natural fish ranged from 12 to 129 (Table 8). Number of hatchery and natural adults released above the Sawtooth weir ranged from 91 in 1991 to 1,056 in 1986 (Table 9). Total numbers of steelhead intercepted at the East Fork weir ranged from 77 to 454 in 1985-91; numbers of natural fish ranged from 6 to 25 (Table 10). Number of hatchery and natural adults released above the East Fork weir ranged from 0 in 1985 to 465 in 1986 (Table 11). At both years the releases often include a large proportion of males (Tables 9 and 11).

IDFG biologists conducted steelhead redd counts in 1990 and 1991, to determine feasibility od the method in indexing spawner escapement and correlations with subsequent parr densities (Rich et al. 1992). The number of steelhead redds per kilometer ranged from 0 to 2.1, except for a large concentration (37.4/km) below the Sawtooth weir in 1990 (Table 12).

Adult Characteristics

Total lengths for naturally produced steelhead are reported for the 1986-199 1 return years at Sawtooth Hatchery and East Fork weirs (Tables 13 and 14). Brood year information cannot be calculated because the freshwater age of naturally produced steelhead is unknown. Ocean age is determined according to length criteria.

Recent return years have been dominated by one-ocean returns for males and two-ocean returns for females for natural steelhead in both the upper Salmon and East Fork weirs (Tables 15 and 16).

The percentage of females for return years 1986-1991 averaged 51 percent in the upper Salmon River (Table 15) and 56 percent in the East Fork (Table 16).

Fecundity of naturally produced upper Salmon steelhead has not been measured.

JWENILE LIFE HISTORY

Juvenile life history is generally similar to Figure 2. Although not illustrated in the figure, there is a fall emigration of steelhead presmolts to from the headwaters upper Salmon River to lower in the drainage for winter rearing. This has been documented by the Intensive Smolt Monitoring Project.

Kiefer and Forster (1991) estimated that 14 percent of the age 1+ and 89 percent of the age 2+ and older parr population of summer 1990 migrated during the fall 1990.

Kiefer and Forster (1992) estimated that 40 percent of the age 1 + and 58 percent of the age 2 + and older summer 1989 parr population migrated in spring 1990.

The total length of steelhead parr PIT-tagged in the headwaters of the Salmon River generally averaged about 130 mm in 1987-1990 (Tables 17 and 18). Mean weight of PIT-tagged parr averaged 29 grams in 1987 (Table 18).

Kiefer and Forster (1992) found that for steelhead, predominately only those larger than 130 mm in the spring were detected at smolt collection dams. They estimated steelhead travel time from the headwaters of the Salmon River to the dams at 34 days in spring 1990. Small sample size (13 detections) precluded development of a seasonal travel time curve for steelhead smolts that year.

BIOCHEMICAL/GENETIC CHARACTERISTICS

Information has not been compiled.

DISEASES

Information has not been compiled.

REFERENCES

All Upper Salmon references appear in one reference section at the end of the hatchery produced summer steelhead section.

Figure 1. Summer steelhead distribution in the East half of the Salmon River subbasin based on the NPPC presence/absence data base and the BPA Geographic Information System.

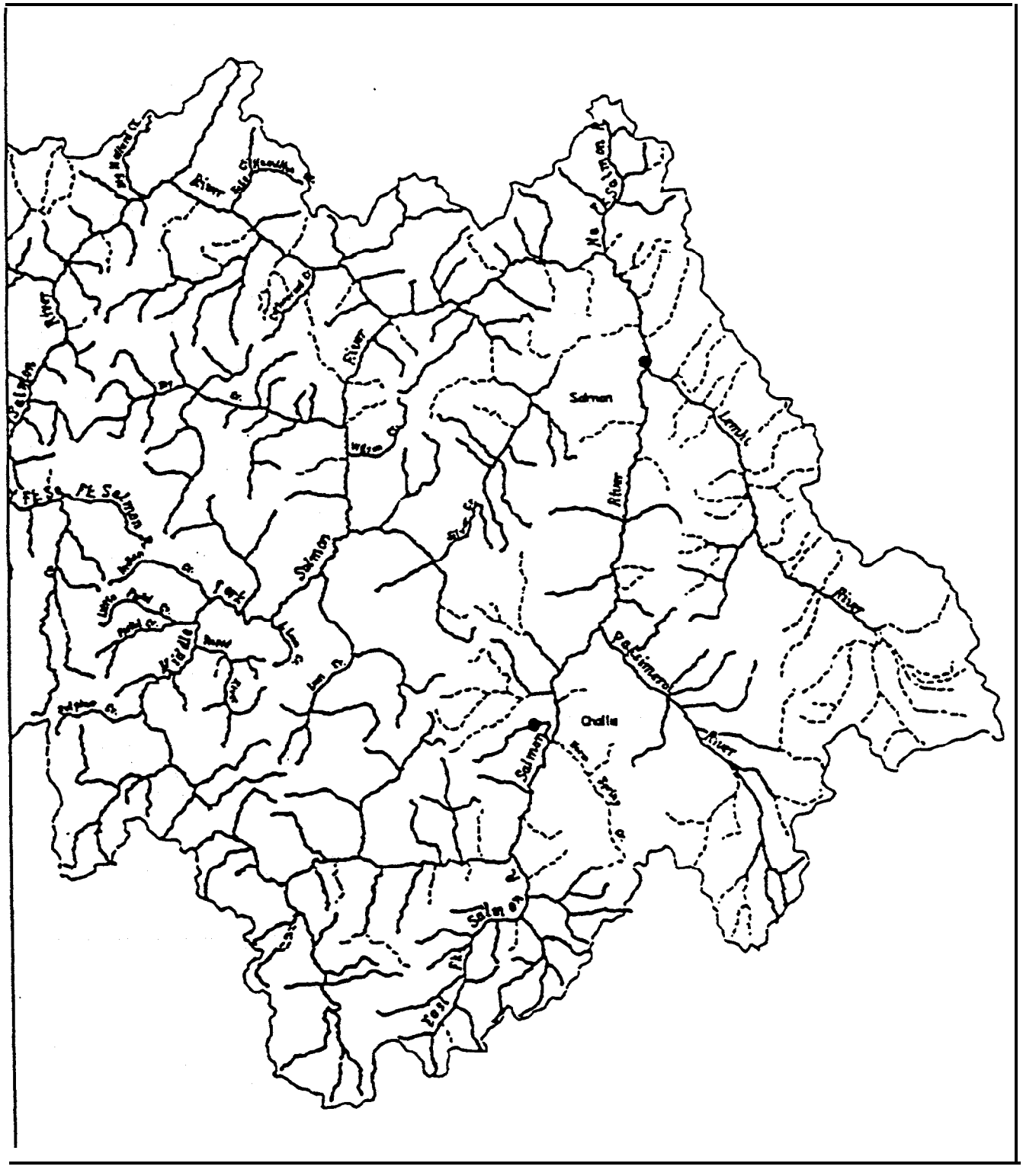
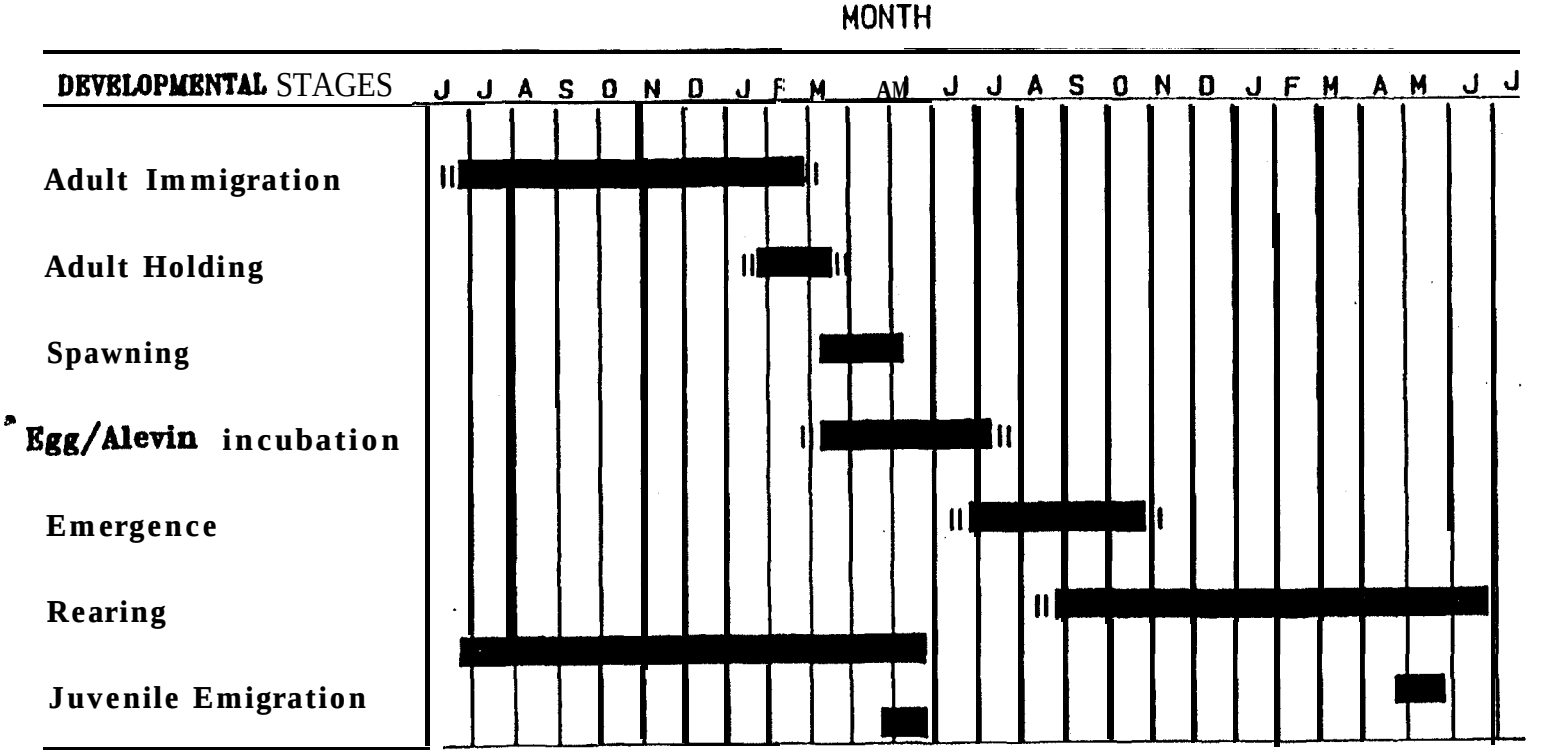


Figure 2 ('IT), Freshwater life history for natural/wild steelhead runs in the Salmon River subbasin.



Notes:

1. The developmental stage timing represents basin-wide averages, local conditions may cause some variability.
2. Solid bars indicate periods of heaviest adult immigration, spawning and juvenile emigration.
3. Rearing and juvenile emigration take place over a three year period and are shown above in a rap-around fashion.

Table 1 (HB). Estimated amount of spawning and rearing (Use Type 1) habitat by quality of the upper Salmon River (Middle Fork Salmon to headwaters including tributaries") wild steelhead production area.

	Excellent	Good	Fair[b]	Poor"	Unknown	Total	Confidence"
		35	28				
Miles (%)	28 17	55	24	9 4		2283.3 1157.2	M M
Acres (%							

[a] This area includes tributaries from the Middle Fork Salmon River to the Salmon River headwaters, and the main Salmon River from Redfish Lake Creek to its headwaters.
[b] Ratings of fair and poor habitat quality may reflect natural physical features such as gradient and channel type, as well as degradation caused by humans.
[c] 'Confidence' is meant to indicate the reproducibility and accuracy of the estimates made, and will be rated as high, medium or low by the respective agencies.

Source: Presence/Absence database, Northwest Power Planning Council, 1991.

Table 2 (HB). Estimated amount of rearing only (Use Type 2) habitat by quality of the upper Salmon River (Middle Fork Salmon to headwaters including tributaries") wild steelhead production area.

	Excellent	Good	Fair[b]	Poor[b]	Unknown	Total	Confidence"
Miles (%)	0	29	71	0		51.2	M
Acres (%)	0	29	71	0		930.8	M

[a] This area includes tributaries from the Middle Fork Salmon River to the Salmon River headwaters, and the main Salmon River from Redfish Lake Creek to its headwaters.
[b] Ratings of fair and poor habitat quality may reflect natural physical features such as gradient and channel type, as well as degradation caused by humans.
[c] 'Confidence' is meant to indicate the reproducibility and accuracy of the estimates made, and will be rated as high, medium or low by the respective agencies.

Source: Presence/Absence database, Northwest Power Planning Council, 1991.

Table 3 (PT-a). Detections at the lower Snake and Columbia River smolt collecting darns" of August PIT-tagged steelhead age 2+ parr from upper Salmon River, 1990.

Stratum	Detected in 1990		
	Number tagged	Number detected	Percent detected
SR-3	39	2	5.1
SR-7			12.5
	8	1	5.4
SR-10	10	1	10.0
HC-1	12	0	8.3
FC-1	16		0
FC-2	0	-	
SC-1	11	2	18.2
SC-2	0		
ALC-1	0		
ALC-3	0		
BC-2	0		
PC-1	55	1	1.8
PC-2	8	0	0
TOTALS	321	20	6.2

[a] Lower Granite, Little Goose, McNary.

Source: Kiefer and Forster 1992.

Table 4 (SL-a). Steelhead smolt length and PIT tag detection at lower Snake and Columbia River smolt collected dams for upper Salmon River, spring 1988 and 1990.

	1988			1990		
Length (mm)[a]	Number tagged[b]	Number detected[b]	Percent detected	Number tagged	Number detected	Percent detected
< 90				75	0	0
90 - 129			-	38	0	0
> 129				62	16	25.8
< 130			0.6	-	-	-
130 -139			10.0			
140 - 149			12.5			
150 - 159			25.0	-	-	
Total				175	16	9.1

[a] Different length classes were defined for the two years.
[b] Numbers tagged and detected were not reported.

Source: Kiefer and Forster 1990, 1992.

Table 5 (RN-a). Adult steelhead trout escapement and estimate of eggs deposited (in thousands) for upper Salmon River, brood year 1985 to 1990" (Kiefer and Forster 1992).

	Brood Year					
	1985	1986	1987	1988	1989	1990
Total escapement	206	1,956	979	635	378	528[b]
Female escapement	92	322	383	136	157	219[b]
Eggs per female[b]	5,640	4,468	4,854	5,069	5,637	4,734
Estimated eggs deposited	518.8	1,438.7	1,859.0	689.3	885.0	1,036.7

[a] Total escapement, female escapement, and eggs/female data arc from Sawtooth Hatchery brood year reports.
[b] 1990 totals include 170 adult steelhead (105 females) from Pahsimeroi Hatchery released into the Salmon River.

Table 6 (PD-a). Estimated steelbead parr abundance for the headwaters of the Salmon River", 1987-1990.

Sample[b] year	Brood year	Parr abundance	+2 SE
1987			
Age 1+	1986	14,280	3,956
Age 2+	1985	5,852	2,952
1988			
Age 1+	1987	5,325	2,006
Age 2+	1986	2,090	1,531
1989			
Age 1+	1988	4,858	2,236
Age 2+	1987	3,256	788
1990			
Age 1+	1989	4,065	841
Age 2+	1988	1,310	527

[a] Site is from the Sawtooth weir upstream.
[b] Sampling is done by snorkeling in late summer.

Sources: Kiefer and Apperson 1988.
Kiefer and Forster 1990, 1991, 1992.

Table 7 (PD-a). Parr density and percent of rated carrying capacity (PCC) for summer steelhead in the upper Salmon River drainage. Densities estimated by snorkel counts.

Stream name	Year	Sample size	Ages 1+ & 2+ density (#/100m²)	Density std. dev.	PCC for 1+ & 2+	PCC std. dev.
Salmon River	85	21	2.96	3.32	21.48	23.47
Salmon River	86	10	3.37	5.49	24.74	38.91
Salmon River	87	20	0.31	0.92	2.20	6.59
Salmon River	88	22	1.32	2.75	9.66	19.58
Salmon River	89	21	1.48	3.09	10.63	22.03
Salmon River	90	23	1.25	2.36	9.12	16.80
Salmon River	91	33	0.20	0.35	1.77	3.36
Panther Creek	85	3	0.47	0.42	5.69	4.76
Panther Creek	86	4	3.92	5.68	24.84	26.26
Panther Creek	87	5	2.89	2.88	21.87	15.46
Panther Creek	88	5	4.22	3.43	36.19	26.65
Panther Creek	89	5	3.53	2.06	32.15	21.54
Panther Creek	90	5	3.22	0.80	31.08	26.26
Panther Creek	91	4	1.81	1.02	13.04	12.82
Moyer Creek	85	1	5.48	NA[a]	27.40	NA
Moyer Creek	86	1	12.85	NA	64.25	NA
Moyer Creek	87	1	13.96	NA	69.80	NA
Moyer Creek	88	1	15.54	NA	77.70	NA
Moyer Creek	89	1	9.04	NA	45.20	NA
Moyer Creek	90	1	16.68	NA	83.40	NA
Moyer Creek	91	1	1.80	NA	9.00	NA
Salmon, N. Pk.	85	2	13.22	15.71	68.36	75.36
Salmon, N. Pk.	86	2	9.20	8.52	49.37	37.80
Salmon, N. Pk.	87	2	7.71	5.52	42.63	21.81
Salmon, N. Pk.	88	2	7.57	4.51	42.54	15.92
Salmon, N. Fk.	89	2	4.24	3.20	23.34	13.02
Salmon, N. Pk.	90	2	6.19	7.37	32.00	35.36
Salmon, N. Pk.	91	2	5.56	6.10	29.16	28.62
Salmon, E. Pk.	85	4	1.85	2.80	12.44	20.32
Salmon, E. Pk.	86	4	1.41	0.77	8.37	6.29
Salmon, E. Pk.	87	4	1.15	0.86	6.62	5.12
Salmon, E. Pk.	88	4	2.44	1.36	14.45	10.86
Salmon, E. Pk.	89	4	2.32	1.84	14.17	13.92
Salmon, E. Pk.	90	3	1.01	0.86	6.50	6.78
Salmon, E. Pk.	91	3	1.40	2.12	9.77	12.37

Table 7 (cont.) (PD-a). Parr density and percent of rated carrying capacity (PCC) for summer steelhead in the upper Salmon River drainage. Densities estimated by snorkel counts.

Stream name	Year	Sample size	Ages 1+ & 2+ density (#/100m^2)	Density std. dev.	PCC for 1+ & 2+	PCC std. dev.
Williams Cr.	91	2	0.00	0.00	0.00	0.00
Morgan Cr.	88	1	10.26	NA[a]	73.29	NA
Morgan Cr.	89	2	9.38	3.46	66.96	24.70
Morgan Cr.	90	2	8.06	1.85	57.57	13.24
Morgan Cr.	91	2	3.70	0.69	26.43	4.95
Pine Cr.	87	2	4.04	4.96	20.20	24.82
Pine Cr.	88	2	0.00	0.00	0.00	0.00
Pine Cr.	90	2	11.78	0.08	58.90	0.42
Thompson Cr.	89	2	5.66	0.04	40.46	0.25
Thompson Cr.	90	2	1.42	1.90	10.18	13.59
Thompson Cr.	91	2	0.48	0.40	3.43	2.83
Warm Springs Cr.	90	1	0.67	NA	4.78	NA
Warm Springs Cr.	91	1	0.62	NA	4.43	NA
Valley Cr.	85	4	1.85	1.38	16.72	13.18
Valley Cr.	86	4	0.56	0.27	4.98	1.92
Valley Cr.	87	4	0.36	0.22	3.35	2.27
Valley Cr.	88	4	0.66	0.68	5.72	6.08
Valley Cr.	89	4	0.61	0.48	5.84	4.96
Valley Cr.	90	4	0.78	0.79	6.72	6.66
Valley Cr.	91	4	0.40	0.33	3.45	2.71
Redfish Lake Cr.	86	2	1.73	1.72	12.36	12.32
Redfish Lake Cr.	87	2	1.51	1.70	10.78	12.13
Redfish Lake Cr.	88	2	1.64	1.22	11.75	8.74
Redfish Lake Cr.	89	2	1.10	1.12	7.82	8.03
Redfish Lake Cr.	90	2	1.65	1.94	11.78	13.84
Redfish Lake Cr.	91	2	0.78	0.73	5.54	5.20
Gold Cr.	91	2	0.00	0.00	0.00	0.00
Huckleberry Cr.	91	4	0.54	0.68	3.84	4.87
Fourth of July Cr.	91	4	0.54	0.30	3.89	2.16
Pettit Lake Cr.	91	2	0.51	0.44	3.61	3.18

Table 7 (cont.) (PD-a). Parr density and percent of rated carrying capacity (PCC) for summer steelhead in the upper Salmon River drainage. Densities estimated by snorkel counts.

Stream name	Year	Sample size	Ages 1+ & 2+ density (#/100m²)	Density std. dev.	PCC for 1+ & 2+	PCC std. dev.
Alturas Lake Cr.	85	3	0.63	0.98	4.60	6.87
Alturas Lake Cr.	86	4	0.28	0.41	2.00	2.93
Alturas Lake Cr.	87	7	0.72	1.35	5.12	9.64
Alturas Lake Cr.	88	7	0.51	0.79	3.82	5.61
Alturas Lake Cr.	89	7	0.87	0.08	0.72	0.78
Alturas Lake Cr.	90	7	0.11	0.15	0.90	1.17
Alturas Lake Cr.	91	7	0.01	0.02	0.05	0.14
Yellowbelly Cr.	91	1	0.43	NA	0.00	NA
Pole Cr.	85	10	0.94	1.95	9.43	19.51
Pole Cr.	86	4	0.93	1.54	9.32	15.43
Pole Cr.	87	10	1.31	3.31	13.13	33.06
Pole Cr.	88	10	1.70	2.47	16.96	24.72
Pole Cr.	89	7	0.55	0.63	5.47	6.29
Pole Cr.	90	7	0.18	0.21	1.79	2.11
Pole Cr.	91	14	0.22	0.35	2.19	3.52
Beaver Cr.	85	4	0.23	0.27	2.28	2.72
Beaver Cr.	88	4	0.28	0.40	2.79	3.96
Beaver Cr.	89	4	0.41	0.52	4.10	5.16
Beaver Cr.	90	1	0.00	NA	0.00	NA
Beaver Cr.	91	4	0.12	0.23	1.15	2.30
Smiley Cr.	85	2	0.24	0.33	2.35	3.32
Smiley Cr.	87	2	0.00	0.00	0.00	0.00
Smiley Cr.	88	2	0.00	0.00	0.00	0.00
Smiley Cr.	89	2	1.21	0.38	12.10	3.82
Smiley Cr.	90	2	1.08	1.31	10.75	13.08
Smiley Cr.	91	9	0.83	0.17	0.83	1.66
Frenchman Cr.	87	2	0.00	0.00	0.00	0.00
Frenchman Cr.	88	2	0.51	0.71	3.61	5.10
Frenchman Cr.	89	2	3.76	0.30	26.90	2.17
Frenchman Cr.	90	1	0.00	NA	0.00	NA
Frenchman Cr.	91	7	0.00	0.00	0.00	0.00

[a] NA = not applicable.

Source: B. Rich, IDFG, unpublished.

Table 8 (RH-b). Number of naturally produced" and total number of steelhead intercepted at the Sawtooth Hatchery weir, 1985-1991.

Return year	Natural component	Males	Females	Total run (N)[b]	% Natural of total
1985	41			526	7.8
1986	30			2,212	1.3
1987	73	33	40	2,187	3.3
1988	129	62	67	990	13.0
1989	75	28	47	994	7.5
1990	81	39	42	1,056	7.7
1991	12	8	4	261	4.6

[a] Differentiated by possessing an adipose fin.
[b] Total run (N) is a combination of both hatchery and naturally produced fish.

Sources: Rogers 1986.
R. Alsager, IDFG, unpublished.
T. Rogers, IDFG, unpublished.

Table 9 (RN-a). Number of steelhead adults released upstream of the Sawtooth weir to spawn naturally, 1985-1991.

Year	Total	Adult Males	Adult Females
1985	206	114	92
1986	1,056	734	322
1987	979	596	383
1988	365	229	136
1989	378	221	157
1990	358	244	114
1991	91	76	15

Sources: Rogers 1985, 1986.
R. Alsager, IDFG, unpublished.
T. Rogers, IDFG, unpublished,

Table 10 (RN-c). Number of naturally produced" steelhead and total number of steelhead intercepted at the East Fork weir, 1985-1991.

Return year	Natural component	Males	Females	Total run (N)[b]	% Natural of total
1985	6			77	7.8
				443	
1986	unknov14	4		224	6.3
1987	17	10	10	210	9.5
1989	25	8	8	379	4.5
1990		12	17	454	5.5
1991	21		9	119	17.6

[a] Differentiated by possessing an adipose fin.
[b] Total run (N) is a combination of both hatchery and naturally produced fish.

Sources: Rogers 1986.
R. Alsager, IDFG, unpublished.
T. Rogers, IDFG, unpublished.

Table 11 (RN-d). Number of steelhead adults released upstream of the East Fork trap to spawn naturally, 1984-1991.

Year	Total	Adult Males	Adult Females
1984	40	22	18
1985	[a]	-	
1986	465	305	160
1987	111		49
1988	7	62	41
1989	224	178 31	46
1990	121	74	47
1991	51	35	16

[a] No fish released to spawn.

Sources: Rogers 1985, 1986.
R. Alsager, IDFG, unpublished.
T. Rogers, IDFG, unpublished.

Table 12 (RN-e). Upper Salmon River steelhead index redd counts[a] conducted by Idaho Department of Fish and Game, 1990 and 199 1.

		Number of redds			Redds/km	
Location	Reach	1990	1991	km	1990	1991
Valley Creek	Forks to Stanley Cr. brdg.	2	NC[b]	7.2	0.1	NA[c]
	Stanley Cr. brdg. to mouth	8	6	9.0	0.9	0.7
Salmon River	Redfish Lake Cr. to Sawtooth weir	101	24	2.7	37.4	1.5
	Sawtooth weir to Hell Roaring Cr.	33	13	16.6	2.0	0.8
	Hell Roaring Cr. to Alturas Lake Cr.	16	2	9.3	1.7	0.2
	Alturas Lake Cr. to Busterback Diversion	1	0	7.4	0.1	0
	Busterback Diversion to Highway 93 Bridge[d]	6	0	12.4	0.5	0
Alturas Lake Creek	Mouth to bridge	6	NC	2.9	2.1	NA
East Fork Salmon River	Germania Cr. to weir	9	3	8.5	1.1	0.3
	Weir to Herd Cr.	NC	15	NM[e]	NA	NM

[a] Counts were single peak counts conducted aerially in May.
[b] NC = not counted.
[c] NA = not applicable.
[d] Transect for 1991 count was Busterback Diversion to Pole Creek.
[e] NM = not measured.

Sources: Rich et al. 1992.
B. Rich, IDFG, unpublished.

Table 13 (AL-a). Lengths[a] of naturally produced[b] steelhead intercepted at the Sawtooth Hatchery weir, 1986-1991[a].

length cm.	1991[b] No. fish	1990 No. fish	1989 No. fish	1988 No. fish	1987 No. fish	1986 No. fish
<42						
43						
44						
45						
46			1	[c]		
47						
48						
49						
50					1	
51						
52		1	3			
53					3	
54				1		
55					6	2
56		1		9		
57						
58	2	9	7	9	7	2
59						
60		9	5	13	12	8
61						
62		5	5	14		
63					10	1
64		5	7	14		
65						
66			8	13	3	3
67						
68	1	9	6	14	5	
69						
70		6	5	11		
71	1				5	2
72		15	6	8		
73	1				9	2
74		10	6	8		
75	2					
76	1	5	8	5	2	2
77						
78		2	5	3	2	4
79	2					
80		2	3	4		
81	1				3	1
82		1				
83					3	1
84		1		1		
85						
86	1				1	
87						
88				1	1	1
89						
90						
91						
92						
93						
94						
95						
96						
97						
98						
99						1
100				1		

[a] Fork Lengths measured in 1991; in previous years total length was measured.
[b] Naturally produced steethead are differentiated from hatchery steelhead by the presence of an adipose fin.
[c] Blanks indicate no fish of this size collected and measured.

Sources: R. Alsager, IDFG, unpublished.
T. Rogers, IDFG, unpublished.

Table 14 (AL-b). Lengths[a] of naturally produced[b] steelhead intercepted at the East Fork weir, 1986-1991.

Length cm.	1991[b] No. fish	1990 No. fish	1989 No. fish	1988 No. fish	1987 No. fish	1986[c] No. fish
< 40						
40						
41						
42						
43						
44	1	[d]				
45						
46	1					
47	1					
48						
49						
50						
51						
52						
53						
54		2				
55					1	
56		1				
57	1					
58	3	2			2	
59	1					
60			1	1	1	
61						
62	1		1	2		
63					2	
64	1	1	1	1		
65						
66	1		1			
67						
68		1		2		
69						
70		1	2	4		
71					2	
72		5		1		
73	1				1	
74		2	2	1		
75	1					
76		2	3	6	1	
77	2					
78	1	1	2		1	
79						
80	2	5		1		
81					1	
82	2	1	1			
83					1	
84						
85	1					
86			1	1	1	
87						
88		1	2			
89						
90						

[a] Fork lengths measured in 1991; in previous years total length was measured.
[b] Naturally produced steelhead are differentiated from hatchery steelhead by the presence of an adipose fin.
[c] No naturally produced trapped in 1986 (T. Rogers, Idaho Department of Fish and Game, personal communication).
[d] Blanks indicate no fish of this size collected and measured.

Sources: R. Alsager, IDFG, unpublished.
T. Rogers, IDFG, unpublished.

Table 15 (AC-e). Ocean age composition and sex of the annual return of naturally produced steelhead to the upper Salmon River".

Return year[b]	One-ocean				Two-ocean				Three-ocean			
	Males	(%)	Females	(%)	Males	(%)	Females	(%)	Males	(%)	Females	(%)
1987"	29	(40)	12	(16)	3	(4)	20	(27)	1	(1)	8	(11)
1988[d]	51	(40)	30	(23)	10	(8)	35	(27)	1	(1)	2	(2)
1989	21	(28)	16	(21)	7	(9)	31	(41)	0	(0)	0	(0)
1990[d]	22	(27)	9	(11)	17	(21)	32	(40)	0	(0)	1	(1)
1991"	0	(0)	2	(17)	8	(67)	2	(17)	0	(0)	0	(0)

[a] Steelhead are intercepted at the Sawtooth weir. Ocean age composition based on length frequencies cited elsewhere.
[b] Spring of run year.
[c] Males > 80 cm and females > 76 cm classified as three-ocean.
[d] Males and females ≥ 84 cm classified as three-ocean in 1988 and 1990.
[e] Three-ocean fish considered indistinguishable by length from two-ocean.

Source: T. Rogers, IDFG, unpublished.

Table 16 (AC-e). Ocean age composition and sex of the annual return of naturally produced steelhead to the upper East Fork Salmon River[a].

Return year	One-ocean Males	(%)	One-ocean Females	(%)	Two-ocean Males	(%)	Two-ocean Females	(%)
1987[b]	4	(29)	3	(21)	0	(0)	7	(50)
1988	7	(35)	3	(15)	3	(15)	7	(35)
1989	6	(35)	2	(12)	3	(18)	6	(35)
1990	3	(12)	5	(20)	5	(20)	12	(48)
1991	9	(43)	2	(10)	3	(14)	7	(33)

[a] Steelhead are intercepted at the East Fork weir. Ocean age composition based on length frequencies cited in the hatchery steelhead section. Three-ocean fish considered indistinguishable by length from two-ocean.
[b] Spring of run year.

Source: T. Rogers, IDFG, unpublished.

Table 17 (AL-a). Average total lengths of PIT tagged steelhead parr from upper Salmon River, 1987-1990.

Tag site[a]	1988 Number tagged	1988 Average length (mm)	1989 Number tagged	1989 Average length (mm)	1990 Number tagged	1990 Average length (mm)
FC-2A	0		0			
SR-PC3B			1	118	0	
SR-FC3A		-	-		1	132
FC-1	45	143	61	122	25	133
ALC-1C	32	135	0		-	
SR-3A	0	-	124	71		
SR-3B	23	80	218	85	63	68
SR-35A	5	94				
SR-4BRB	4	117			-	-
SR-7A	3	143	11	145		
SR-10A	78	147	197	123	28;	130
SR-9A		-	106	103	274	132
SR-9B	-		316	109		-
SR-HC 1	-		65	103	23	105
SR-SC 1	-	-	67	109	41	136
SR-7SA	-	-			2	64
SR-AClC	-		-	-	84	133
SR-PC1B	-	-			13	89
PC-1B	62	146	113	124		
PC-2B	24	122	87	76		
SC-1	45	140	-			-
SR-SC2B			0	-	-	-
SR-BC2			0	-	-	
SR-ALC3		-	0	-		
SR-8A	163	140	-	-		
SR-9	112	142	-	-		

[a] For tag site descriptions please see referenced publication.
Sources: Kiefer and Apperson 1988.
Kiefer and Forster 1990, 1992.

Table 18 (AL-a). Length and weight data for PIT-tagged steelhead parr from the upper Salmon River study area, 1987.

Location	Length				Weight			
	Number of fish	mean	min.	max.	Number of fish	mean	min.	max.
All fish	1,461	130	55”	238[b]	1,398	29.4	4.8”	166.6[b]
Pole Creek	391	136	82	238	238	33.9	7.6	166.6
Alturas Lake Cr.	6	125	95	138	6	24.8	11.6	31.3
Smiley Creek	131	142	95	198	129	36.8	7.8	90.3
Salmon River	933	126	55	222	901	26.5	4.8	120.0

[a] PIT tags were implanted into primarily age 2+ steelhead.
[b] May include a few resident rainbow trout.

Source: Kiefer and Apperson 1988.

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UPPER SALMON RIVER, SALMON SUBBASIN
(Middle Fork Salmon River to headwaters of the Salmon
and East Fork rivers, excluding the Lemhi and Pahsimeroi rivers)

Hatchery Produced Summer Steelhead

GEOGRAPHIC LOCATION

Sawtooth Fish Hatchery (FH) and the East Fork Trap are part of the Lower Snake River Compensation Plan (LSRCP) to compensate for losses of anadromous fish caused by lower Snake River dams. The complex was completed in 1985. Both facilities were constructed by the U.S. Corps of Engineers. Bonneville Power Administration provides funds to the U.S. Fish and Wildlife Service (USFWS) to administer the facilities. They are operated by the Idaho Department of Fish and Game (IDFG). Both Sawtooth FH and the East Fork Trap serve to trap steelhead broodstock. In conjunction with the two facilities, three steelhead rearing hatcheries may be operated in conjunction with Sawtooth FH and the East Fork Trap. Magic Valley FH and Hagerman National Fish Hatchery (NFH) are also part of the LSRCP. Magic Valley FH is operated by IDFG, while Hagerman NFH is operated by the USFWS. Niagara Springs Hatchery is part of Idaho Power Company's anadromous fish mitigation program (see Pahsimeroi River chapter).

Sawtooth FH is located along the upper Salmon River, five miles south of Stanley in Custer County. The hatchery is 897 miles from the Pacific Ocean. A weir crosses the Salmon River at the hatchery site, trapping all returning steelhead. Hatchery personnel at Sawtooth FH trap and spawn returning hatchery steelhead. The East Fork Trap is located 16 miles upstream of the mouth of the East Fork Salmon River. A weir across the East Fork Salmon River at the site also traps all returning steelhead. Holding and spawning facilities are located on-site. Eggs from both facilities, and others such as Dworshak NFH in the Clearwater Subbasin are transferred to Magic Valley or Hagerman NFH for rearing of steelhead to smolt size. Both of the rearing facilities are located in the Hager-man Valley along the Snake River in south central Idaho.

ORIGIN

The Sawtooth FH steelhead broodstock was originally derived from a mixture of indigenous wild steelhead and returns from Pahsimeroi Hatchery A-run steelhead which had been stocked in the basin. The Pahsimeroi Hatchery steelhead broodstock was originally transplanted from the Snake River (see Pahsimeroi chapter). Currently, naturally produced steelhead are not included in the hatchery broodstock. The Sawtooth FH broodstock is considered A-run, based on timing and length at age. Typically, the one-ocean component dominates the return. There has been a continual infusion of Pahsimeroi Hatchery broodstock into the upper Salmon River since the Pahsimeroi Hatchery program began in the 1960's.

The East Fork steelhead broodstock was also originally derived from a mixture of indigenous wild steelhead and returns from Pahsimeroi Hatchery A-run steelhead and Dworshak NFH B-run steelhead which had been stocked in the drainage. However, soon after broodstock trapping in the East Fork was initiated, fishery managers began to build a B-run steelhead hatchery program by releasing progeny of B-run fish returning to the Pahsimeroi Hatchery. The East Fork program has also continued to receive progeny of Dworshak NFH broodstock. B-run fish are typically two ocean fish and are larger at a comparable ocean age, than A-run fish.

DISTRIBUTION

Tables 1 and 2 list hatchery steelhead releases into the upper Salmon River for brood years 1986-1990. Coded wire tag (CWT) codes are identified for brood years 1987-1990. Hatchery released steelhead presmolts and smolts are adipose fm clipped. CWT fish are marked with a left ventral fm clip. Other marks or tag releases have not been compiled. Most hatchery steelhead released in the upper Salmon River are smolts released on-site at Sawtooth FH or the East Fork Trap. Hatchery steelhead fry have also been stocked in a number of tributaries.

PRODUCTION

The mitigation goal of Magic Valley FH is to return 11,660 adult steelhead to the Snake Basin. The hatchery is designed to produce about 2 million smolts. The mitigation goal for Hagerman NFH is to return 13,600 adult steelhead to the Snake Basin. Hagerman NFH is designed to produce about 1.4 million smolts. Target smolt size at both hatcheries is 3-5 smolts to the pound.

Timing of hatchery rearing is shown in Figure 1.

Egg

Percent egg eye-up averaged 88.7 percent at Sawtooth FH and 83.0 percent at the East Fork Trap, 1986-1991 (Table 3).

Smolt

The percent survival of hatchery steelhead from eyed-egg to release for brood years 1987-1990 averaged 91.5 percent for A-run and 80.7 percent for B-run steelhead raised at Magic Valley FH (Table 4).

Smolt-to-adult return for hatchery steelhead returning to Sawtooth FH averaged 0.18 percent return, brood years 1982-1987 (Table 5). The average smolt-to-adult return for hatchery steelhead returning to the East Fork Salmon River Trap was 0.21 percent return (Table 6).

The average smolt-to-adult return for 7 CWT release groups returning to Sawtooth FH was 0.08 percent, brood years 1982-1985 (Table 7). The average smolt-to-adult return for 10 CWT release groups returning to the East Fork Trap was 0.04 percent, brood years 1982-1988 (Table 8).

Adult

The prespawning mortality of steelhead spawned at Sawtooth FH is less than 5 percent (Rogers 1986; R. Alsager, IDFG, unpublished; T. Rogers, IDFG, unpublished). The steelhead are usually ripe as they enter the hatchery and are spawned within a few days.

ADULT LIFE HISTORY

Adult Escapement

Specific time of migration and escapement for upper Salmon River hatchery steelhead in the ocean, and Columbia and Snake rivers has not been compiled. A-run steelhead are generally believed to cross Bonneville Dam prior to August 25. B-run steelhead are generally believed to cross after August 25. Adult timing research implemented by the University of Idaho in 1991 should provide

more information about Snake River timing (Bjornn 1992). Hatchery steelhead released in the upper Salmon River have been recorded in the North Pacific ocean June through November.

Ball (1992) reported that adult steelhead returning to Idaho rivers in the fall are several months sway from spawning and commonly wander into streams other than where they were released. He noted it is not unusual for these wandering fish to spend time in one or more rivers that are not their natural drainage. He indicated that such fish should not be considered strays as the majority would return to their release site or natal stream.

Harvest

Information has not been completely summarized regarding rate of contribution of upper Salmon hatchery steelhead to ocean, or Columbia or Snake rivers steelhead harvest.

Hatchery steelhead returning from the 1987 releases at Sawtooth FH were exploited at 75 percent during the 1989-90 season (Ball 1992). This is a typical level of exploitation for these hatchery fish. Hatchery steelhead released in the upper Salmon River provides sport harvest opportunity in Salmon River sections 18 and 19 (Table 9).

Information regarding occurrence and magnitude of tribal harvest of upper Salmon River hatchery steelhead was not investigated.

Spawner Escapement

Ball (1992) reported that very few of the off-site releases of hatchery steelhead in the upper Salmon are intercepted at the Sawtooth or East Fork weirs. Also, very few hatchery steelhead released at the weirs return to other hatchery racks. Straying of these hatchery steelhead appears to be insignificant.

Hatchery steelhead generally arrive at the Sawtooth and East Fork weirs March through mid-May (Tables 10 and 11).

The returns by brood year ranged 192-2,556 hatchery steelhead at Sawtooth FH, brood years 1982-1987 (Table 12). The returns by brood year at the East Fork Trap ranged 132-410 hatchery steelhead, brood years 1984-1987 (Table 13). Returns represent the return to the hatchery. Total escapement, including harvest has been calculated by Ball (1990, 199 1, 1992) but is not reported here. Total age ranges from 2 to 4 years for hatchery steelhead. This notation understates by one year the actual age at the time of spawning (or arrival at a tributary weir) because adults spend 7-9 months back in freshwater before spawning.

Adult Characteristics

Weights of returning hatchery steelhead are not available. The majority of hatchery steelhead trapped at the Sawtooth and East Fork weirs do not exceed 86 cm, total length (Tables 14 and 15).

The one-ocean component of the steelhead brood year usually comprises the majority of the return to Sawtooth FH (Table 16). Except for brood year 1987, the two-ocean component comprised the majority of the brood year return to the East Fork Trap (Table 17).

Females comprise less than 50 percent of the brood year return to Sawtooth FH (Table 18). Except for brood year 1984, females comprised less than 35 percent of the brood year return to the East Fork Trap (Table 19).

Fecundity of steelhead broodstock trapped at the Sawtooth weir ranged 4,019-5,637 eggs per female, 1985-1991 (Table 20). Fecundity of steelhead broodstock trapped at the East Fork weir ranged 4,037-6,792 eggs per female, 1985-1991 (Table 21).

JUVENILE LIFE HISTORY

One year old smolts are transported by truck from the Snake River Valley to the upper Salmon River. Migration data for hatchery steelhead smolts shows that steelhead released in the upper Salmon in early April typically reach the IDFG Snake River trap in mid-May (Table 22).

Released hatchery steelhead do residualize and contribute to the resident fishery in the upper Salmon River. The rate of residualism is estimated to range up to 10 percent. It probably varies with rearing and environmental conditions.

BIOCHEMICAL/GENETIC CHARACTERISTICS

Schreck et al. (1986) described electrophoretic data for Sawtooth FH steelhead (Appendix Table 4).

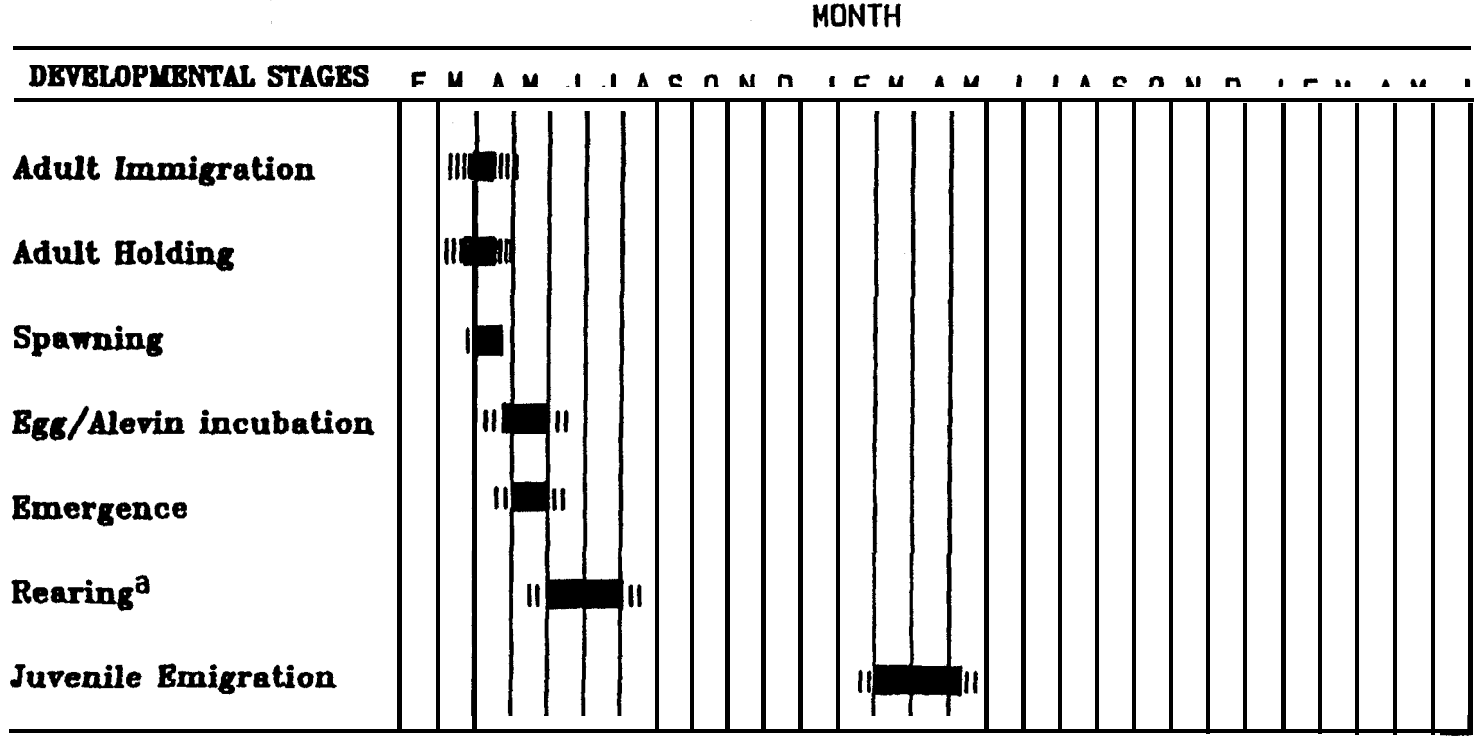
DISEASES

Diseases of management concern, such as those potentially limiting fish transfers include infectious hematopoietic necrosis detected at Magic Valley Hatchery (Tables 23 and 24).

REFERENCES

All Upper Salmon references appear in one reference section at the end of the hatchery produced summer steelhead section.

Figure 1 (TT). Freshwater life history for steelhead spawned at the East Fork and Sawtooth Hatchery traps and reared at Sawtooth Hatchery.



Notes:

1. The developmental stage timing represents basin-wide averages, local conditions may cause some variability.
2. Solid bars indicate periods of heaviest adult immigration, spawning and juvenile emigration.

[a] Fish released as fry. Denotes hatchery rearing only.

Table 1 (TR). Hatchery steelhead releases into the Headwaters of the Salmon River (from Sawtooth and East Fork weirs, upstream to the headwaters) by brood year, 1986-1990. Coded wire tag codes displayed for brood years 1988-1990.

Brood Year	Brood-stock	Hatchery	Life Stage	Release Date (1)	Release Date (2)	Fish/lb	Number Released	Release Location	CWT
1986	Sawtooth A	Hagerman NFH	smolt	1987			687,634	Sawtooth	
1986	East Fork B	Hagerman NFH	smolt	1987			485,078	East Fork	
1987	Sawtooth A	Sawtooth	F-F'	1987			174,580	Alturas Lake Creek	
1987	Sawtooth A	Sawtooth	F-F	1987			188,500	Pole Creek	
1987	Sawtooth A	Sawtooth	adult*	1987			979	Salmon River	
1987	East Fork A	East Fk.	adult*	1987			111	East Fork	
1987	Pahsimeroi B[a]	Pahsimeroi	adult	1987			54	East Fork	
1987	Sawtooth A	Haeerman NFH	smolt	1988			1,195,745	Sawtooth	
1987	Sawtooth/ Pahsimeroi A	Magic Valley	smolt	04/06/88	04/09/88	4.6	57,700	Sawtooth	
1987	East Fork B	Hagerman NFH	smolt	1988			303.564	East Fork	
1988	Sawtooth A	Sawtooth	F-F	1988			17,500	Redfish Lake Creek	
1988	Sawtooth A	Sawtooth	F-F	1988			104,800	Alturas Lake Creek	
1988	Sawtooth A	Sawtooth	F-F	1988			105,700	Pole Creek	
1988	Sawtooth A	Sawtooth	F-F	1988			327,700	Salmon R.	
1988	Pahsimeroi A	Pahsimeroi	adult	1988			83	Salmon R.	
1988	Sawtooth A	Sawtooth	adult*	1988			365	Salmon R.	
1988	East Fork B	East Fork trap	adult*	1988			72	East Fork	
1988	Sawtooth A	Magic Valley	smolt	04/10/89	04/19/89	4.4	857,200	Sawtooth	
1988	Sawtooth A	Haeerman NFH	smolt	1989			636,551	Sawtooth	

Table 1 (cont.). Hatchery steelhead releases into the Headwaters of the Salmon River (from Sawtooth and East Fork weirs, upstream to the headwaters) by brood year, 1986-1990. Coded wire tag c ·des displayed for brood years 1988-1990.

Brood Year	Brood-stock	Hatchery	Life Stage	Release Date (1)	Release Date (2)	Fish/lb	Number Released	Release Location	CWT
1988	East Fork B	Magic Valley	smolt	04/15/89	04/19/89	4.5	15,624	East Fork	104144
1988	East Fork B	Magic Valley	smolt	04/15/89	04/19/89	4.5	14.126	East Fork	104145
1988	East Fork B	Magic Valley	smolt	04/ I 5/89	04/19/89	4.5	14,314	East Fork	104146
1988	East Fork B	Magic Valley	smolt	04/15/89	04/19/89	4.5	309,236	East Fork	Untagged
1988	Dworshak NFH	Hagerman NFH	smolt	1989			436.576	East Fork	
1989	Sawtooth A	Sawtooth	F-F	1989			196,080	Salmon R.	
1989	Sawtooth A	Sawtooth	F-F	1989			9,500	Redfish Lake Creek	
1989	Sawtooth A	Sawtooth	F-F	1989			84,100	Alturas Lake Creek	
1989	Sawtooth A	Sawtooth	F-F	1989			80,900	Pole Creek	
1989	Sawtooth A	Sawtooth	adult*	1989			378	Salmon R.	
1989	East Fork B	East Fork trap	adult*	1989			224	East Fork	
1989	Sawtooth A	Magic Valley	smolt	04/12/90	04/13/90	4.2	39,620	Sawtooth	104059
1989	Sawtooth A	Magic Valley	smolt	04/05/90	04/21/90	4.2	1,159,080	Sawtooth	Untagged
1989	Sawtooth A	Hagerman NFH	smolt	04/05/90		4.6	14,597	Sawtooth	104214
1989	Sawtooth A	Hagerman NFH	smolt	04/05/90		4.7	15.482	Sawtooth	10421s
1989	Sawtooth A	Hagerman NFH	smolt	04/05/90	04/06/90	5.1	15,218	Sawtooth	104216
1989	Sawtooth A	Hagerman NFH	smolt	04/04/90	04/09/90	4.4	255,859	Sawtooth	Untagged
1990	Sawtooth A	Hagerman NFH	pre-smolt	1 0/05/90	10/17/90	39.6	304.907	Salmon R.	
1989	Dworshak NFH	Hagerman NFH	pre-smolt	09/05/90	09/07/90	32.8	540,733	East Fork	

Table 1 (cont.). Hatchery steelhead releases into the Headwaters of the Salmon River (from Sawtooth and East Fork weirs, upstream to the headwaters) by brood year, 19861990. Coded wire tag codes displayed for brood years 1988-1990.

Brood Year	Brood-stock	Hatchery	Life Stage	Release Date (1)	Release Date (2)	Fish/lb	Number Released	Release Location	CWT
1989	East Fork B	Magic Valley	smolt	04/14/90		4.1	40,905	East Fork	104058
1989	Dworshak NFH	Magic Valley	smolt	04/16/90	04/18/90	5.0	14.964	East Fork	104233
1989	Dworshak NFH	Magic Valley	smolt	04/16/90	04/18/90	5.0	15,157	East Fork	104234
1989	Dworshak NFH	Magic Valley	smolt	04/16/90	04/18/90	5.0	14,642	East Fork	104235
1989	East Fork B	Magic Valley	smolt	04/16/90		4.2	15.474	East Fork	104236
1989	East Fork B	Magic Valley	smolt	04/16/90		.2	15,971	East Fork	104237
1989	East Fork B	Magic Valley	smolt	04/16/90		4.2	14,958	East Fork	104238
1989	Dworshak NFH/ East Fork B	Magic Valley	smolt	04/07/90	04/18/90	4.6	792,129	East Fork	Untagged
1989	Dworshak NFH B	Hagerman NFH	smolt	04/11/90		3.8	64,150	East Fork	
1990	Pahsimeroi A	Pahsimeroi	adult	04/09/90	04/20/90		170	Salmon R.	
1990	Sawtooth A	Sawtooth	adult*	05/07/90			358	Salmon R.	
1990	East Fork B	East Fork trap	adult*	04/30/90			121	East Fork	
1990	Pahsimeroi A	Magic Valley	smolt	04/09/9 1	04/19/91	3.9	364.700	Sawtooth	
1990	Sawtooth A	Hager-man NFH	smolt	04/03/91	04/17/91	4.4	979,799	Sawtooth	
1990	Dworshak NFH B	Magic Valley	smolt	04/13/91		4.1	20,498	East Fork	104314
1990	Dworshak NFH B	Magic Valley	smolt	04/13/91		4.1	21.017	East Fork	10431s
1990	Dworshak NFH B	Magic Valley	smolt	04/13/91		4.1	20,312	East Fork	‘104316
1990	East Fork B	Magic Valley	smolt	04/15/91	04/16/91	4.3	22,525	East Fork	104320
1990	East Fork B	Magic Valley	smolt	04/15/91	04/16/91	4.3	22.483	East Fork	104321

Table 1 (cont.). Hatchery steelhead releases into the Headwaters of the Salmon River (from Sawtooth and East Fork weirs, upstream to the headwaters) by brood year, 1986-1990. Coded wire tag codes displayed for brood years 1988-1990.

Brood Year	Brood-stock	Hatchery	Life Stage	Release Date (1)	Release Date (2)	Fish/ lb	Number Released	Release Location	CWT
1990	East Fork B	Magic Valley	smolt	04/15/91	04/16/91	4.3	21,375	East Fork	104322
1990	Dworshak NFH/ East Fork B	Magic Valley	smolt	04/08/91	04/18/91	4.5	839,590	East Fork	Untagged
1991	Sawtooth A	Sawtooth	adult*	1991			91	Salmon R.	
1991	East Fork B	East Fork trap	adult*	1991			51	East Fork	

[a] Sawtooth release location refers to the Salmon River at the Sawtooth Hatchery site. Fast Fork release location refers to the Fast Fork Salmon River at the Fast Fork adult trap site.
[b] Originally transferred from Dworshak NFH.
[c] F-F desgiuates a fry or fingerling release.
[d] Adults released above the weirs are a mixture of hatchery and naturally produced fish.

Table 2 (TR). Hatchery steelhead releases into the Upper Salmon River (from Middle Fork Salmon River to Sawtooth and East Fork weirs) by brood year, 1987-1990. Coded wire tag codes displayed for brood years 1987-1989.

Brood Year	Brood-stock	Hatchery	Life Stage	Release Date (1)	Release Date (2)	Fish/lb	Number Released	Release Location	CWT
1987	Pahsimeroi A	Magic Valley	smolt	04/06/88	04/10/88	4.7	147,500	Salmon R. @ Shoup Brdg.	
1987	Pahsimeroi A	Niagara Springs	smolt	04/11/88	04/12/88	4.5	28,700	Salmon R. @ Shoup Brdg.	102819
1987	Pahsimeroi A	Niagara Springs	smolt	04/11/88	04/12/88	4.5	9,200	Salmon R. @ Shoup Brdg.	102927
1987	Pahsimeroi A	Niagara Springs	smolt	04/11/88	04/12/88	4.5	65,600	Salmon R. @ Shoup Brdg.	Untagged
1987	Sawtooth/ Pahsimeroi A	Magic Valley	smolt	04/04/88	04/10/88	4.7	253,100	North Fork Salmon River	
1987	Pahsimeroi A	Magic Valley	smolt	04/04/88	04/7/88	4.7	208,000	Yankee Fork Salmon River	
1988	Pahsimeroi A	Pahsimeroi	F-F[a]	1988			40,000	North Fork Salmon River	
1988	Sawtooth A	Sawtooth	F-F	1988			100,300	Yankee Fork Salmon River	
1988	Sawtooth A	Sawtooth	F-F	1988			242,000	W. Fk. Yankee Fork	
1988	Sawtooth A	Sawtooth	F-F	1988			83,600	Basin Creek	
1988	Sawtooth A	Sawtooth	F-F	1988			201,000	Valley Creek	
1987	Pahsimeroi A	Niagara Springs	smolt	04/12/88	04/13/88	3.9	102,800	Panther Creek	
1987	Sawtooth A	Magic Vally	smolt	04/11/88		4.6	162,800	Panther Creek	
1988	Pahsimeroi A	Magic Valley	smolt	04/17/89	04121189	4.3	104,500	Yankee Fork Salmon River	
1988	Pahsimeroi A	Niagara Springs	smolt	04/13/89	04/16/89	4.2	208,500	North Fork Salmon River	
1988	Pahsimeroi A	Niagara Springs	smolt	04/17/89	04/22/89	3.8	13,400	Salmon R. @ Shoup Brdg.	104147
1988	Pahsimeroi A	Niagara Springs	smolt	04/17/89	04/22/89	3.8	13,900	Salmon R. @ Shoup Brdg.	104148

Table 2 (cont.). Hatchery steelhead releases into the Upper Salmon River (from Middle Fork Salmon River to Sawtooth and East Fork weirs) by brood year, 1987- 1990. Coded wire tag codes displayed for brood years 1987-1989.

Brood Year	Brood-stock	Hatchery	Life Stage	Release Date (1)	Release Date (2)	Fish/lb	Number Released	Release Location	CWT
1988	Pahsimeroi A	Niagara Springs	smolt	04/17/89	04/22/89	3.8	15,947	Salmon R. @ Shoup Brdg.	104149
1988	Pahsimeroi A	Niagara Springs	smolt	04/17/89	04/22/89	3.8	166,543	Salmon R. @ Shoup Brdg.	Untagged
1989	Pahsimeroi A	Niagara Springs	pre-smolt	09/20/89		51.6	50,100	Twin Creek	
1989	Pahsimeroi A	Niagara Springs	pre-smolt	09/20/89		51.6	50,100	West Fork Hughes River	
1989	Pahsimeroi A	Niagara Springs	pre-smolt	09/21/89		46.2	50,400	Yankee Fork Salmon River	
1989	Pahsimeroi A	Niagara Springs	pre-smolt	09/19/89		57.5	50,000	Moyer Creek	
1989	Pahsimeroi A	Niagara Springs	pre-smolt	09/22/89		84.1	50,500	Spring Creek	
1989	Pahsimeroi A	Niagara Springs	pre-smolt	09/22/89		84.1	50,500	Indian Creek	
1989	Pahsimeroi A	Pahsimeroi	F-F	1989			35,000	Indian Creek	
1989	Pahsimeroi A	Pahsimeroi	F-F	1989			30.000	Sheeu Creek	
1989	Pahsimeroi A	Sawtooth	F-F	1989			25,000	Sheep Creek	
1989	Pahsimeroi A	Sawtooth	F-F	1989			73,500	West Fork Yankee Fork	
1989	Pahsimeroi A	Sawtooth	F-F	1989			100.000	Basin Creek	
1989	Pahsimeroi A	Sawtooth	F-F	1989			98,600	Valley Creek	
1989	Pahsimeroi A	Sawtooth	F-F	1989			25,000	Squaw Creek	
1989	Pahsimeroi A	Sawtooth	F-F	1989			182.100	Panther Creek	
1989	Sawtooth A	Hagerman NFH	smolt	04/09/90	04/11/90	4.3	200,295	Salmon R. @ Ellis Brdg.	
1989	Sawtooth A	Hagerman NFH	smolt	04/12/90		5.0	15,528	Salmon R. @ Shoup Brdg.	104227

Table 2 (cont.). Hatchery steelhead releases into the Upper Salmon River (from Middle Fork Salmon River to Sawtooth and East Fork weirs) by brood year, 1987-1990. Coded wire tag codes displayed for brood years 1987-1989.

Brood Year	Brood-stock	Hatchery	Life Stage	Release Date (1)	Release Date (2)	Fish/lb	Number Released	Release Location	CWT
1989	Sawtooth A	Hagerman NFH	smolt	04/12/90		5.0	15,196	Salmon R. @ Shoup Brdg.	104228
1989	Sawtootb A	Hagerman NFH	smolt	04/12/90		5.0	15,104	Salmon R. @ Shoup Brdg.	104229
1989	Sawtooth A	Hagerman NFH	smolt	04/12/90		4.7	154,418	Salmon R. @ Shoup Brdg.	Untagged
1989	Pahsimeroi A	Hagerman NFH	smolt	04/18/90	04/20/90	4.3	199,602	North Fork Salmon River	
1990	Pahsimeroi A	Magic Valley	smolt	04/20/91	04/21/91	3.9	97,800	Salmon R. @ Shoup Brdg.	
1990	Pahsimeroi A	Niagara Springs	smolt	04/15/91	04/17/91	3.9	23,280	Salmon R. @ Ellis Brdg.	104329
1990	Pahsimeroi A	Niagara Springs	smolt	04/15/91	04/17/91	3.9	22,388	Salmon R. @ Ellis Brdg.	104330
1990	Pahsimeroi A	Niagara Springs	smolt	04/15/91	04/17/91	3.9	21,826	Salmon R. @ Ellis Brdg.	104331
1990	Pahsimeroi A	Niagara Springs	smolt	04/15/91	04/17/91	3.9	106,906	Salmon R. @ Ellis Brdg.	Untagged
1990	Pahsimeroi A	Niagara Springs	smolt	04/19/91	04/22/91	3.6	21,605	North Fork Salmon River	104324
1990	Pahsimeroi A	Niagara Springs	smolt	04/19/91	04/22/91	4.0	23,782	North Fork Salmon River	104325
1990	Pahsimeroi A	Niagara Springs	smolt	04/19/91	04/22/91	3.7	22,244	North Fork Salmon River	104326
1990	Pahsimeroi A	Niagara Springs	smolt	04/18/91	04/23/91	3.7	90,769	North Fork Salmon River	Untagged
1990	Pahsimeroi A	Niagara Springs	smolt	04/18/91		3.7	48,200	Salmon R. @ Shoup Brdg.	

[a] F-F designates a fry or fingerling release.

Table 3 (TS-a). Percent eye-up of steelhead eggs at Sawtooth hatchery from broodstock collected at the Sawtooth and East Fork weirs.

Year	Percent eye-up	
	Sawtooth	East Fork
1986	88.7	86.9
1987	85.8	76.4
1988	87.1	81.2
1989	93.8	80.0
1990	89.3	86.7
1991	87.8	86.7

Source: Rogers 1988, 1989, 1991.
R. Alsager, IDFG, unpublished.

Table 4 (TS-a). Percent survival of eyed-eggs to release of hatchery steelhead raised at Magic Valley Fish Hatchery and released at the Sawtooth weir.

Brood year	Number of eyed-eggs	Stock	Percent rearing loss	Percent survival to stocked smolts
1987[a]	2,109,780[b]	A-strain (Pahsimeroi)	2.2	97.8[b]
1988	2,047,748	A-strain (Pahsimeroi)	9.7	90.3
		B-strain (East Fork)	1.2	98.8
1989	1,306,674	A-strain (Pahsimeroi)	8.3	91.7
		B-strain (DNFH[c]/Clearwater)	37.3	62.7
1990	1,269,100	A-strain (Pahsimeroi)	13.8	86.2

[a] First year new hatchery in production. Previous year eggs produced at Hagerman NFH.
[b] Total number is a combination of 915,252 eggs and 1,194,528 swim-up fry.
[c] DNFH = Dworshak National Fish Hatchery.

Sources: Ainsworth 1989, 1990.
Ainsworth and Engemann 1991.
Ainsworth and Rankin 1992.

Table 5 (TS-a). Percentages of hatchery A-run steelhead released at Sawtooth Hatchery that returned as adults, brood years 1982-1987.

Brood year	Year released	Smolts released	Total brood year return[b]	Percent of brood year return[c]
1982	1983	107,284	192	.18
1983	1984	681,314	2,556	.37
1984	1985	784,096	1,885	.24
1985	1986	699,715	1,082	.15
1986	1987	687,634	543	.08
1987	1988	1,253,445	887	.07

[a] Fry-fingerling and presmolt release not included in release information.
[b] Sawtooth weir count was sample method. Return does not include naturally produced fish returning 1982-1987. Does not include fish harvested prior to collection. Returns based on Table 7.
[c] Based on smolt release only.

Sources: Moore 1983.
Rogers 1988, 1989, 1990.
S. W. Kiefer, IDFG, unpublished.

Table 6 (TS-a). Percentages of hatchery B-run steelhead released at East Fork weir that returned as adults, brood years 1984-1987.

Brood year	Year released	Smolts released[a]	Total brood year return[b]	Percent of brood year return[c]
1984	1985	174,375	182	.68
1985	1986	621,149	372	.06
1986	1987	485,078	410	.08
1987	1988	303,564	132	.04

[a] Fry-fingerling and presmolt release not included in release information.
[b] Past Fork weir count was sample method. Return does not include naturally produced fish returning 1984-1987. Does not include fish harvested prior to collection. Returns based on Table 7.
[c] Based on smolt release only.

Sources: Rogers 1990.
S. W. Kiefer, IDFG, unpublished.

Table 7 (TR-a). Number of coded wire-tagged A-run steelhead trout reared at Hagerman NFH and released at Sawtooth Hatchery.

Tag code	Brood year	Year released	Number tagged released	Size released (#/lb)	Purpose	Site released	Returns 1985	1986	1987	1988	1989	1990	Total returns	Percent
5/13/33	1982	1983	38,825	2.1	Hatchery eval. Size at release large	Decker Flat[a]	21	2	1				24	0.06
5/13/34	1982	1983	39,125	5.3	Hatchery eval. Size at release small	Decker Flat	3	1	0				4	0.01
5/10/28	1983	1984	38,775	8.4	Hatchery eval. Size at release small	Decker Flat		11	1	0			12	0.03
5/10/29	1983	1984	36,800	5.0	Hatchery eval. Size at release large	Decker Flat		33	3	3			39	0.11
10/26/30	1984	1985	40,475	4.5	Id. Hat. eval. Migration	Sawtooth Hat.	- -		51	12	0	-	63	0.16
10/28/01	1985	1986	9,450	4.75	Ident.	Sawtooth Hat.	- -			6	2	-	8	0.08
10/28/44	1985	1986	39,125	4.41	Ident.	Sawtooth Hat.	- -			30	17	-	47	0.12
10/29/48	1986	1987	24,950	4.5	Eval.& Contrib.	Sawtooth Hat.	- -					4	4	inc.
10/29/39	1987	1988	51,925	4.89	Eval.& Contrib.	Sawtooth Hat.	- -					11	11	inc.

[a] Precursor to Sawtooth Hatchery.

Source: Cannameta 1991.

Table 8 (TR-b). Number of coded wire-tagged B-run steelhead trout reared at Hagerman NFH returning to the East Fork Salmon River weir.

Tag code	Brood year	Year released	Number tagged released	Size released (#/lb)	Purpose	Site released	Returns 1984	1985	1986	1987	1988	1989	1990	1991	Total returns	Percent
10/24/60	1982	1983	37,600	3.6	Hatchery eval. stock evaluation Pahsimeroi B	E.F. Salmon R.	-	3	8			-		-	11	0.03
10/26/31	1984	1985	39,375	4.6	Hatchery eval.	E.F. Salmon R.	-	-		10	3	-		-	13	0.03
10/26/36	1984	1985	35,225	4.8	Hatchery eval.	E.F. Salmon R.	-	-		5	10	-		-	15	0.04
10/28/02	1984	1985	8,100	4.4	Time release Middle	E.F. Salmon R.	-	-		0	7	-		-	7	0.09
10/28/03	1984	1985	16,950	4.8	Time release Middle	E.F. Salmon R.	-	-		0	11	-		-	11	0.06
10/28/54	1984	1985	25,525	4.3	Time release Late	E.F. Salmon R.	-	-		3	8	-		-	11	0.04
10/28/55	1984	1985	17,425	5.0	Time release Early	E.F. Salmon R.	-	-		0	6	-		-	6	0.03
10/28/20	1985	1986	25,325	4.62	Ident.	E.F. Salmon R.	-	-			0	9		-	9	0.04
10/29/49	1986	1987	24,150	4.5	Eval.& Contrib.	E.F. Salmon R.	-	-				0	7	-	7	0.03
10/29/38	1987	1988	51,725	4.98	Eval.& Contrib.	E.F. Salmon R.	-	-				0	2	-	2	0.004

Source: Cannamela 1991.

Table 9 (RS-a). Number of steelhead harvested by non-treaty anglers from the fall of 1980 to the spring of 1991, from upper Salmon River stream sections.

	Stream section				
Years	15 & 16	17[b]	18	19[d]	Totals
1980 - 1981	2,670	679	25	CS[e]	3,374
1981 - 1982	3,165	600	41	c s	3,806
1982 - 1983	5,991	1,591	156	305	8,043
1983 - 1984	9,586	2,822	621	629	13,658
1984 - 1985	2,327	407	48	108	2,890
1985 - 1986	7,569	2,680	389	1,601	12,239
1986 - 1987	11,656	2,662	614	1,573	16,505
1987 - 1988	2,500	328	127	150	3,105
1988 - 1989	3,693	810	320	512	5,335
1989 - 1990	6,099	617	269	430	7,415
1990 - 1991	1,485	210	183	320	2,198

[a] Stream sections 15 and 16 extend from Middle Fork Salmon River to North Fork Salmon River and from North Fork Salmon River to Lemhi River, respectively.
[b] Stream section 17 extends from Lemhi River to Pahsimeroi River.
[c] Stream section 18 extends from Pahsimeroi River to East Fork Salmon River.
[d] Stream section 19 extends above East Fork Salmon River.
[e] CS = closed season.
Source: T. McArthur, IDFG, unpublished.

Table 10 (AT-a). Adult weir operation dates for steelhead returning to the Sawtooth weir, 1985 to 1991.

Return Year	Weir operation began	Weir operation terminated	Date spawning began
1985	03/14	05/10	04/06
1986	03/17	04/28	03/25
1987	03109	05/01	03124
1988	03/03	05/03	03/30
1989	03/13	05/03	04/04
1990	03/21	05/07	04/03
1991	02/28	05/14	04/09

Sources: R. Alsager, IDFG, unpublished.
T. Rogers, IDFG, unpublished.

Table 11 (AT-a). Adult weir operation dates for steelhead returning to the East Fork satellite weir, 1985 to 1991.

Return Year	Weir operation began	Weir operation terminated	Date spawning began
1985	03/15	05/22	04/16
1986	03117	04/28	03/20
1987	03/12	04/30	03/23
1988	03/15	05/02	03/30
1989	03/20	05/03	04/10
1990	03/22	04/30	04/02
1991	03/27	05/10	04/08

Sources: R. Alsager, IDFG, unpublished.
T. Rogers, IDFG, unpublished.

Table 12 (RH). Return of adult A-run steelhead to the Sawtooth Hatchery weir, brood years 1981-1988".

Total Age

Brood Year	2	3	4	Total
1981	inc[b]	423	unk.[c]	inc.
1982	76	116	unk.[c]	192
1983	2,079	476	1	2,556
1984	1,606	275	4	1,885
1985	585	495	2	1,082
1986	420	122	1	543
1987	851	36	na[d]	887[d]
1988	213	inc.	inc.	inc.

[a] Adult ladder collection was sample method. Natural fish are subtracted from total return because of unknown freshwater age: number of wild fish returning in 1985 and 1986 not reported. Total hatchery escapement used for brood year reconstruction. The total ages listed above underestimate the final age at spawning because the adults return 7-9 months prior to spawning. Freshwater rearing is one year. Ocean age delineated by length criteria as follows:

1985: 50% of ≤66 cm (26") = l-ocean total length (TL)
50% of ≥66 cm (26") = 2-ocean (TL)
No male/female lengths

1986: Female 64cm (25") or less = l-ocean (TL)
Female 66cm (26") to 74 cm (29") = 2-ocean (TL)
Male 69cm (27") or less = l-ocean (TL)
Male 71cm (28") to 79cm (3 1") = 2-ocean (TL)

1987: Female 64cm (25") or less = l-ocean (TL)
Female 66cm (26") or longer = 2-ocean (TL)
Male 69cm (27") or less = l-ocean (TL)
Male 71cm (28") or longer = 2-ocean (TL)

1988: Female <66cm separates 1 & 2-ocean (TL)
Female ≥84cm = 3-ocean (TL)
Male <68cm separates 1 & 2-ocean (TL)
Male ≥84cm = 3-ocean (TL)

1989-1990: Female 66.5cm separates 1 & 2-ocean (TL)
Female ≥84cm = 3-ocean (TL)
Male 69.5cm separates 1 & 2-ocean (TL)
Male ≥84cm = 3-ocean (TL)

1991: Female <66cm = l-ocean fork length (FL)
Female ≥66cm = 2-ocean (FL)
Male < 68cm = l-ocean (FL)
Male ≥68cm = 2-ocean (FL)

[b] Inc. = incomplete brood year information.
[c] Fish >32" in 1985; males >32" and females >30", in 1986; males >81cm and females >77cm in 1987 were considered B-run stock and not included in brood year reconstruction of total returns.
[d] Number of 3-ocean fish assumed to be very small and indistinguishable from 2-ocean fish.

Sources: Rogers 1986, 1988, 1989, 1990.
R. Alsager, IDFG, unpublished.

Table 13 (RH). Return of adult hatchery B-run steelhead to the East Fork weir, brood years 1983-1988[a].

Total Age

Brood Year	2	3	4[b]	Total
1983	unk.	154		
1984	55	127		182
1985	63	309		372
1986	53	357		410
1987	72	60		132
1988	36	inc.[c]		inc.

[a] Adult ladder collection was sample method. Natural fish are subtracted from total return because of unknown freshwater age: number of wild fish returning in 1985 and 1986 not reported. Total hatchery escapement used for brood year reconstruction. The total ages listed above underestimate the final age at spawning because the adults return 7-9 months prior to spawning. Freshwater rearing is one year. Ocean age delineated by length criteria as follows:

1985- 85% of ≤66 cm (26") = l-ocean total length (TL)
50% of ≥66 cm (26") = 2-ocean (TL)

1986- Female 64cm (25") or less = l-ocean (TL)
Female 66cm (26") to 74 cm (29") = 2-ocean (TL)
Male 69cm (27") or less = l-ocean (TL)
Male 71cm (28") to 79cm (31") = 2-ocean (TL)

1987- Female <70.5cm = l-ocean (TL)
1990- Male < 75.5cm = l-ocean (TL)

1991- Female < 67cm = 1 -ocean fork length (FL)
Male < 74cm = l-ocean (FL)

[b] Based on length frequency. 4 year old fish (3-ocean) included with 3 year olds and cannot be differentiated based on length.
[c] Inc. = incomplete brood year information.

Sources: Rogers 1986, 1988, 1989, 1990.
R. Alsager, IDFG, unpublished.

Table 14 (AL-a). Lengths[a] of hatchery[b] steelhead collected at the Sawtooth weir, 1985-1991.

Length cm.	1991 No. fish	1990 No. fish	1989 No. fish	1988 No. fish	1987 No. fish	1986 No. fish	1985 No. fish
< 40				1			
40				1			
41							
42			1				
43							
44				1			
45							
46							
47							
48							
49							
50		4		1	50	4	
51							
52	2	19	3	4			
53	2				155	18	
54	7	45	10	18			
55	10				257	107	
56	22	138	35	47			3
57	26						
58	36	223	61	70	443	318	11
59	24						
60	25	221	86	173	400	652	
61	21						17
62	15	114	93	127			
63	5				231	654	
64	5	56	67	85			24
65	9						
66	4	22	31	63	110	318	42
67	3						
68	4	25	90	67	99	85	
69	5						59
70	3	23	113	61			
71	6				117	17	83
72	4	38	111	53			
73	1				146	1	
74	3	19	92	49			104
75	2						
76	4	12	60	19	65	1	81
77							
78		8	45	8	23	2	
79							43
80	1	3	15	10			
81					13	2	32
82		3	2	2			
83					4	2	
a4		2	2	1			12
85							
86						1	13
87							
88			2		1		
89							1
90							
91							
92							
93							
94							1
95							

[a] Fork lengths measured in 1991; in previous years total Length was measured.
[b] Total nunber of fish includes 41 wild steelhead which were not identified separately.
[c] Blanks indicate no fish of this size collected and measured.

Sources: R. Alsager, IDFG, unpublished.
T. Rogers, IDFG, unpublished.

Table 15 (AL-a). Lengths[a] of hatchery[b] steelhead collected at the East Fork weir, 1985-1991.

Length cm.	1991 No. fish	1990 No. fish	1989 No. fish	1988 No. fish	1987 No. fish	1986 No. fish	1985 No. fish
< 40							
40							
41							1
42							
43							
44							
45							
46							
47							
48							
49							
50				1	[c]		
51							1
52							
53							5
54	1	3					
55							
56		4					10
57							
58	1	6		1		3	11
59	1						
60	3	6	4	1	12	22	
61	1						15
62	6	12	9	9			
63	7				20	45	
64	5	13	9	14			10
65	2						
66	1	a	a	17	14	88	5
67	2						
68		5	1	10	5	59	
69							7
70	3	5	10	7			
71	2				7	41	2
72	5	16	9	7			
73	4				9	7	
74	1	10	28	20			4
75	6						
76	6	30	47	24	18	17	3
77	5						
78	5	104	45	27	29	31	
79	a						1
80	a	93	86	31			
81	6				38	55	1
a2	1	62	50	13			
a3	2				34	44	
84	1	39	47	5			1
a5							
86	3	a	6	2	20	27	
a7	1						
88		4	3		4	3	
a9	1						
90		1		1			
91						1	

[a] Forks lengths measured in 1991; in previous years total length was measured.
[b] Total number of fish includes 6 wild steelhead which were not identified separately.
[c] Blanks indicate no fish of this size collected and measured.

Sources: R. Alsager, IDFG, unpublished.
T. Rogers, IDFG, unpublished.

Table 16 (AC-l). Age composition percentage (freshwater.ocean) for A-run steelhead returning to the Sawtooth Hatchery weir, brood years 1982-1987.

Age Composition (%)

Brood Year	N	1.1	1.2	1.3
1982	192	39.6	60.4	-
1983	2,556	81.3	18.6	0.1
1984	1,885	85.2	14.6	0.2
1985	1,082	54.1	45.7	0.2
1986	543	77.3	22.5	0.2
1987	887	95.9	4.1	-

[a] Returning fish are a combination of hatchery and naturally produced A-run steelhead. In this nomenclature, the freshwater and ocean ages sum to the total age of the fish. Weir and adult trap count was sample method. Ocean age was delineated by fork length criteria, cited in Table 12. by brood year.
Note that the total age at the time of spawning for these fish ranges from three to five years.

Sources: Rogers 1986, 1988, 1989, 1990.
R. Alsager, IDFG, unpublished.

Table 17 (AC-2). Age composition percentage (freshwater.ocean) for B-run steelhead returning to the East Fork weir, brood years 1984-1987.

Age Composition (%)

Brood Year	N	1.1	1.2	1.3[b]
1984	182	30.2	69.8	
1985	372	16.9	83.1	
1986	410	12.9	87.1	
1987	132	54.5	45.5	

[a] Returning fish are a combination of hatchery and naturally produced B-run steelhead. In this nomenclature, the freshwater and ocean ages sum to the total age of the fish. Weir and adult trap count was sample method. Ocean age was delineated by fork length criteria, cited in Table 13 by brood year. Note that the total age at the time of spawning for these fish ranges from three to five years.
[b] Age class 1.3 is a small proportion of total, not differentiated from age 1.2.

Sources: Rogers 1986, 1988, 1989, 1990.
R. Alsager, IDFG, unpublished.

Table 18 (AS-l). Females by brood year' and age class (freshwater.ocean) as a percentage of the entire brood return (N) of A-run steelhead returning to the Sawtooth Hatchery weir.

Females (%)

Brood Year	N	1.1	1.2	1.3	Total % Female
1982	192	unk.	54.2		
1983	2,556	32.1	15.1	.04	47.2
1984	1,885	34.9	12.1	.05	47.1
1985	1,082	13.5	24.6		38.1
1986	543	26.3	12.9		39.2
1987	887	25.7	1.9		27.6

[a] Adult ladder collection was sample method. Natural fish are subtracted from total return because of unknown freshwater age. The number of wild fish returning in 1985 and 1986 was not reported. Total hatchery escapement used for brood year reconstruction. Note that the total age at the time of spawning for these fish ranges from three to five years. Freshwater rearing is one year. Ocean age delineated by length criteria as cited in Table 12.

Sources: Rogers 1986, 1988, 1989, 1990.
R. Alsager, IDFG, unpublished.

Table 19 (AS-l). Females by brood year' and age class (freshwater.ocean) as a percentage of the entire brood return (N) of B-run steelhead returning to the East Fork weir.

Females (%)

Brood Year	N	1.1	1.2	1.3	Total % Female
1983	154	unk.[b]	67.5		unk.
1984	182	11.5	57.7		69.2
1985	372	1.3	29.6		30.9
1986	410	2.7	29.3		32.0
1987	132	12.9	15.1		28.0

[a] Adult ladder collection was sample method. Natural fish are subtracted from total return because of unknown freshwater age: number of wild fish returning in 1985 and 1986 not reported. Total hatchery escapement used for brood year reconstruction. In this nomenclature, the freshwater and ocean ages sum to the total age of the fish. Freshwater rearing is one year. Ocean age delineated by length criteria as cited in Table 13. Note that the total age at the time of spawning for these fish ranges from three to five years.
[b] Only 2-ocean represented.

Sources: Rogers 1986, 1988, 1989, 1990.
R. Alsager, IDFG, unpublished.

Table 20 (AF-a). Mean fecundity by return year for steelhead returning to the Sawtooth weir, 1985-1991.

Return year	Number of females soawned	Number of green eggs	Mean fecundity
1985	272	1,516,294	5,575
1986	619	2,765,760	4,468
1987	722	3,504,400	4,854
1988	308	1,561,300	5,069
1989	301	1,696,700	5,637
1990	226	1,071,165	4,734
1991	33	132,630	4,019

Sources: Rogers 1986.
R. Alsager, IDFG, unpublished.
T. Rogers, IDFG, unpublished.

Table 21 (AF-a). Mean fecundity by return year for steelhead returning to the East Fork trap, 1985-1991.

Return year	Number of females soawned	Number of green eggs	Mean fecundity
	19		
1985	215	122,612	6,453
1986		1,460,240	6,792
1987	87	445,400	5,119
1988	79	448,034	5,671
1989	105	415,000	5,253
1990		537,015	5,114
1991	25	100,920	4,037

Sources: Rogers 1986.
R. Alsager, IDFG, unpublished.
T. Rogers, IDFG, unpublished.

Table 22 (TR-a). Migration data for freeze branded hatchery steelhead from Sawtooth Hatchery and East Fork Salmon River release sites to the Snake River trap[a] and to Lower Granite Dam (LGD), 1985 - 1990.

Year	Median release date	Median passage date, Snake trap	Migration rate (km/day)	Mean Q (kcfs) Salmon R.	Mean Q (kcfs) Snake R.	Median arrival at LCD	Migration rate (km/day)	Mean Q(kcfs) at LGD	Release site
1985	4/9	5/7	24.9	19.5	62.6	5/28	2.5	92	Sawtooth
1985	4/17	5/1	30.0	20.6	56.4	5/28	2.7	93	East Fork
1986	4/9	5/21	16.6	24.0	73.4	S/29	6.5	120	Sawtooth
1986	4/8	5/24	14.6	24.7	73.9	5/29	8.6	119	East Fork
1987	Insufficient recapture numbers at Snake River trap.								Sawtooth
1987	Insufficient recapture numbers at Snake River trap.								East Fork
1988	4/15	5/8	29.1	15.1	32.7	5/25	2.9	68	Sawtooth
1990	Insufficient recapture numbers at Snake River trap.								Sawtooth

[a] Clearwater River trap is located approximately 10 km upstream from the convergence of Clearwater River and Snake River arms of Lower Granite Reservoir.
[b] Combined groups.

Sources: Buettner and Nelson 1989.
Buettner and Nelson 1991.

Table 23 (TD). Parasites and diseases" of steelhead collected at the Sawtooth Hatchery weir and reared at Magic Valley.

Disease Type	Hatchery	Specific pathogen
virus	Magic Valley	IHNV (Infectious hematopoietic necrosis)
virus	Magic Valley	IPNV (infectious pancreatic necrosis)
bacteria	Magic Valley	*Yersinia ruckeri* (Enteric red mouth disease)

[a] Disease history only represents pathogens isolated at the hatchery and not necessarily a disease outbreak.

Sources: Moore 1983.
Vaughn 1984, 1986.
Ainsworth 1989, 1990.
Rogers 1984, 1985, 1986, 1988, 1989, 1990, 1991.
R. Alsager, IDFG, unpublished.
M. Graham, IDFG, unpublished.

Table 24 (TD). Parasites and diseases" of steelhead collected from the East Fork Salmon River and reared at Magic Valley.

Disease Type	Hatchery	Specific pathogen
Virus	Magic Valley	IHNV (Infectious hematopoietic necrosis)
Virus	Magic Valley	IPNV (Infectious pancreatic necrosis)
Bacteria	Magic Valley	*Renibacterium salmoninarum* (Bacterial kidney disease)

[a] Disease history only represents pathogens isolated at the hatchery and not necessarily a disease outbreak.

Sources: Moore 1983.
Vaughn 1984, 1986.
Ainsworth 1989, 1990.
Rogers 1984, 1985, 1986, 1988, 1989, 1990, 1991.
R. Alsager, IDFG, unpublished.
M. Graham, IDFG, unpublished.

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UPPER SALMON SUBBASIN

Snake River Sockeye Salmon (Wild)

GEOGRAPHIC LOCATION

Snake River sockeye salmon (Oncorhynchus Redfish presently return only to Redfish Lake. Lake is located 900 miles from the Pacific Ocean in the Sawtooth Valley near Stanley, Idaho (elevation of 6,500 feet). The outlet to the lake, Redfish Lake Creek, joins the Salmon River at River Mile 382 above the Snake River.

ORIGIN

Historically, Snake River sockeye salmon were native to the upper Salmon Subbasin, rearing in Redfish, Alturas, Stanley, Pettit, Yellow Belly, and possibly Hell Roaring and Little Redfish lakes. In the Payette River system sockeye were found in the Big, Little, and Upper Payette lakes. Warm Lake in the South Fork Salmon River system was possibly occupied as well. In recent years, Snake River sockeye salmon have returned only to Redfish Lake, although Bjornn et al. (1968) documented sockeye salmon adult returns in Alturas Lake.

The outplanting of sockeye salmon in the upper Salmon River lakes (Table 1), appears to have been unsuccessful.

DISTRIBUTION

Presently all 610 hectares of Redfish Lake are available for sockeye salmon spawning and rearing. Other presently available habitat in the upper Salmon River is Alturas Lake (334 ha). With passage improvement, potential sockeye salmon habitat exists in Stanley, Pettit, and Yellow Belly lakes.

PRODUCTION

Bjomn et al. (1968) estimated total sockeye salmon smolt production from Redfish Lake from 1955 to 1966 (Table 2). Production during this time period averaged 26,840 smolts per year.

Bowles and Cochnauer (1984) estimated the potential smolt production in Alturas Lake under present conditions at 1,090 smolts/ha of lake surface for a total production potential of 364,060 smolts.

ADULT LIFE HISTORY

The timing of various freshwater life history stages for adult sockeye salmon is shown in Figure 1.

Adult Escapement

The majority of Snake River sockeye enter the Columbia River in June and July. Those arriving at Redfish Lake do so from mid-July to the end of August (Bjornn et al. 1968). From 1954 to 1966 and 1985 to 1987, adult returns to Redfish Lake ranged from 11 to 4,361 fish (Table 3).

Snake River sockeye salmon represent only a small percentage of the total sockeye salmon escapement in the Columbia River system. Mullan (1986) reported that Snake River sockeye salmon represented 0.1 to 2.8% (average 0.8%) of the total sockeye salmon escapement to the

Columbia River from 1954 to 1981. The dramatic decline of sockeye from the Snake River occurred before counts were initiated at Ice Harbor Dam in 1962. During the 1960's, a portion of the remaining lakes producing sockeye were blocked to adult entry and the lakes were chemically treated and converted to resident species management (TAC 1991). Adult escapement from 1975 to 1990 past Lower Granite Dam ranged from 0 fish in 1990 to 531 fish in 1976 (Table 4).

Harvest

No information is available regarding ocean harvest.

Under the US vs. Oregon Columbia River Fish Management Plan, the mainstem escapement goal for sockeye is 75,000 fish over Bonneville Dam (all stocks). Treaty fisheries on runs less than 75,000 are not to exceed 7% or less depending on the run size. Between 1973 and 1982 there were no commercial sockeye seasons. In 1983, a 3 % mainstem harvest took place on a run size of 100,500. In 1984 a 21% harvest took place on a run of 161,600. Run sizes to the Columbia between 1985 and 1990 were 200K, 60K, 145K, 100K, 48K, and 50K respectively. Mainstem harvest rates during this same period were 41%, 10%, 47%, 49%, 5%, and 1% (TAC 1991). No terminal harvest has occurred in recent years.

Spawner Escapement

Redd counts in Redfish Lake from 1977 to 1989 ranged from 0 to 25 redds (Hall-Griswold 1990). Estimated numbers of spawning sockeye in Redfish Lake were 26 in 1981, 50 in 1982, 0 in 1983, and 22 in 1984 (Howell et al. 1984).

Adult Characteristics

Information on the age composition of adult Snake River sockeye salmon is limited. Hauck (1955) reported that 4% of the adult returns in 1953 were 3-year-old fish, 79% were 4-year-old fish, and 17% were 5-year-old fish (Table 5). From 1953 to 1965 and in 1986, returning adults ranged in length from 43.1 cm to 66.0 cm (Table 6).

The percentage of female adult sockeye salmon returning to Redfish Lake from 1954 to 1964 ranged from 43 to 57 % (Table 7). In 1986, Warren (1988) reported that 76% of the adult sockeye salmon return to the weir were females (Table 7). Fecundity of a lone female spawned in 1985 was 2,900 eggs. Fecundity of 13 females spawned the following year averaged 2,430 eggs/female (Table 8).

Bjomn et al. (1968) estimated average smolt-to-adult survival for sockeye salmon emigrating from Redfish Lake from 1955 to 1964 at 0.79% (range 0.07 to 1.83%). Chapman et al. (1990) used the 1955 to 1964 data from Bjomn et al. to calculate an average smolt-to-adult survival of 1.60 % . He also estimated smolt-to-adult survival at Lower Granite dam between 1981 and 1987 as ranging between 0.42 to 0.31%, with dam fish guidance efficiencies of 45 and 33 %, respectively.

JUVENILE LIFE HISTORY

The juvenile life history for sockeye salmon is shown in Figure 1. Juveniles generally migrate to the ocean following one to two summers (though one individual with 3 years freshwater growth was reported by Hauck (1955). From 1956 to 1966, Bjomn et al. (1968) found the age composition of the total migrants to range from 2 to 98 % for age I and age II smolts (Table 9). For brood years 1953 to 1964, age I smolts ranged in length from 43 to 130 mm (average 90 mm) and age II smolts migrated at 72 to 185 mm (Table 10).

Bjornn et al. (1968) reported sockeye salmon egg-to-smolt survival at 0.6 to 143.8% in Redfish Lake for brood years 1954 to 1963. The highest survival rates observed by the Bjornn group were attributed to migrating kokanee or residual sockeye, which are indistinguishable from the progeny of sea-run sockeye. Chapman et al. (1990) estimated the average egg-to-smolt survival at Lower Granite Dam for the years 1979 to 1988 at 0.7% (range 0.2 to 2.0%).

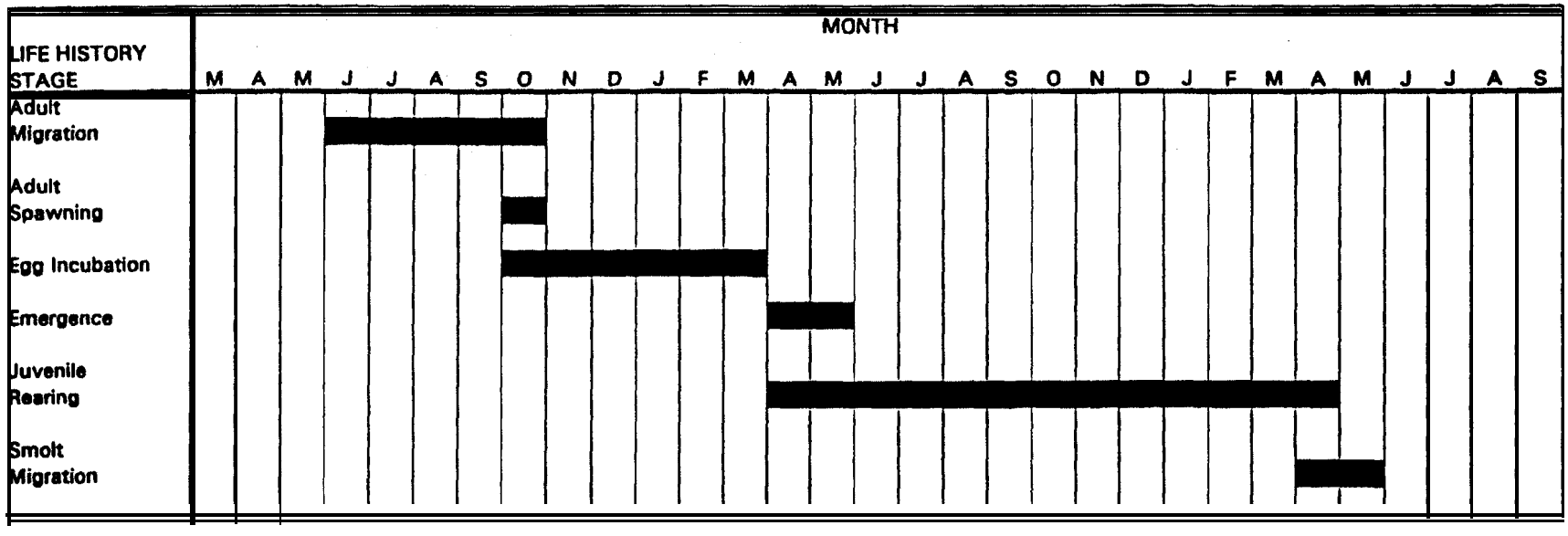
BIOCHEMICAL - GENETIC CHARACTERISTICS

No information available.

DISEASES

No information available.

Figure 1 (TT). F h life history of Snake River sockeye salmon in Redfish Lake, Idaho[a].



[a]Juvenile freshwater rearing is 1-2, occasionally 3, years duration.

Table 1 (TR-a). Hatchery releases of sockeye salmon into the Snake River subbasin by brood year.

Brood year	Stock	Hatchery	Life stage	Release date (1)	Release date (2)	Fish /lb	Number released	Release site	CWT code
1920		Evergreen	Fry	06/19/21	08/02/21		40.300	Alturas Lake	
1980	Babine Lake /Fulton River	American Falls	Fry	6/23/81		41.4	173,880	Stanley Lake	
1981	Babine Lake /Fulton River	American Falls	Fry	6/24/82		48.9	260,393	Stanley Lake	
1982	Babine Lake /Fulton River	Mackay	Fry	6/20/83		73.0	150,015	Stanlev Lake	
1982	Babine Lake /Fulton River	Mackay	Fry	6/20/83		46580	0 , 8 0 0	Alturas Lake	
1983	Babine Lake /Fulton River	Mackay	Fry	6/6/84		70.0	147,000	Stanley Lake	
1983	Babine Lake /Fulton River	Mackay	Fry	6/6/84		70.0	63,000	Alturas Lake	

Reference: Hall-Griswold 1990.
Howell et al. 1985.

Table 2 (JM). Number of natural juvenile Snake River sockeye salmon smolts that migrated from Redfish Lake, 1955-1966. Estimates of the total numbers of migrants made by examining the histogram of daily catches and subjectively extrapolating the daily catch curve for the part of the run missed.

Year	Number
1955	54,000
1956	38,029
1957	65,000
1958	41.000
1959	13,000
1960	2,133
1961	21,600
1962	23,000
1963	23,320
1964	6,492
1965	19,000
1966	15,500

Reference: Bjomn et al. 1968.

Table 3 (RN-a). Escapement of Snake River sockeye salmon to the Redfish Lake Creek weir, for years 1954-1966 and 1985-1987.

Year	Number
1954	998
1955	4,361
1956	1,381
1957	523
1958	55
1959	290
1960	75
1961	11
1962	39
1963	395
1964	335
1965	17
1966	61
1985	11
1986	29
1987	16

References: Bjornn et al. 1968.
Hall-Griswold and Cochnauer 1986.
Hall-Griswold and Cochnauer 1988.
Warren 1988.

Table 4 (RN-b). Escapement of Snake River sockeye salmon past Lower Granite Dam, 1975-1990.

Year	Number
1975	209
1976	531
1977	458
1978	123
1979	25
1980	96
1981	218
1982	211
1983	122
1984	49
1985	35
1986	15
1987	29
1988	23
1989	2
1990	0

Reference: U. S. Army Corps of Engineers 1991.

Table 5 (AC-a). Age composition percentage (freshwater.ocean) in 1953 for Snake River sockeye salmon originating from Redfish Lake. Age determined from otoliths.

Age Composition (%)

Year	N	2.1	2.2	2.3	3.1	3.2
1953	24	4.2	79.1	12.5	0	4.2

Reference: Hauck 1955.

Table 6 (AL-a). Length-frequency distribution of Snake River sockeye salmon originating from Redfish Lake for years 1953-1965 and 1986.

Fork Length (mm)	1953-1965	1986
431-444	1	
445-456	1	
457-469	1	
470-482	2	2
483-494	8	
495-507	14	
508-520	37	4
521-532	75	6
533-545	134	
546-558	165	
559-571	156	7
572-583	513	
584-596	108	
597-609	51	
610-621	32	3
622-634	8	1
635-644	9	
645-660	2	

Reference: Bjomn et al. 1968.
Warren 1988.

Table 7 (AS-a). Percent females by year for Snake River sockeye salmon originating from Redfish Lake for years 1954-1964 and 1986.

Year	N	Females (%)
1954	998	43.5
1955	4,361	45.8
1956	1,381	43.1
1957	523	52.6
1958	55	45.5
1959	290	44.8
1960	75	45.3
1961	11	54.5
1962	39	46.2
1963	395	51.1
1964	335	57.3
1986	29	75.9

Reference: Bjornn et al. 1968.
Warren 1988.

Table 8 (AF-a). Mean fecundity for Snake River sockeye salmon originating from Redfish Lake, 1985 and 1986.

Year	N	Mean fecundity
1985	1	2,900
1986	13	2,430

Reference: Hall-Griswold and Cochnauer 1986.
Warren 1988.

Table 9 (JC-a). Age composition percentage of natural juvenile Snake River sockeye salmon smolts that migrated from Redfish Lake, 1956-1966. Age determined from scales.

Age Composition (%)

Year	Age I	Age II
1956	34.2	65.8
1957	59.9	40.1
1958	2.1	97.9
1959	24.2	75.8
1960	32.4	67.6
1961	97.1	2.9
1962	91.4	8.6
1963	98.0	2.0
1964	66.5	33.5
1965	46.2	53.8
1966	76.6	23.4

Reference: Bjomn et al. 1968.

Table 10 (SL-a). Average fork length (mm) for age I Snake River sockeye salmon smolts and the ranges of lengths by age for sockeye smolts passing the Redfish Lake Creek weir by brood year, 1953-1964.

Brood year	Age I Average fork length (mm)	Age I Fork length range (mm)	Age II Fork length range (mm)
1953			69-125
1954	67.4	43-88	88-135
1955	76.7	58-93	72-118
1956	70.7	43-87	78-126
1957	87.7	72-103	133-185
1958	117.4	97-130	111-141
1959	105.4	87-120	112-150
1960	102.5	88-l 19	106-126
1961	93.3	77-118	96-142
1962	82.1	67-104	82-l 14
1963	87.5	76-102	116-148
1964	100.2	81-118	

Reference: Bjomn et al. 1968

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LEMHI RIVER, SALMON SUBBASIN

Naturally Produced Spring Chinook

GEOGRAPHIC LOCATION

The Lemhi River, a spring-fed stream in east-central Idaho, flows 56 miles from its source to the Salmon River at river mile 259 (Figure 1). The drainage is bordered by the Lemhi and Bitterroot mountain ranges. The valley is mostly privately owned, and is heavily irrigated for hay and grazing. The river is overappropriated for irrigation and is totally dewatered in the lower reach during low water years, impeding adult and juvenile migration. The source streams, Eighteen Mile and Texas creeks, as well as most minor tributaries are dewatered for irrigation. A major tributary, Big Springs Creek flows parallel to the Lemhi River for five miles, joining it 46 miles from the mouth. Hayden Creek, 20 miles long, flows from the Lemhi Mountain Range, entering the Lemhi River 33 miles above the mouth. Big Springs Creek and the Lemhi River are productive streams in terms of water chemistry.

ORIGIN

Spring chinook are native to the Lemhi River drainage. There is limited historical evidence that summer chinook may also have been produced, but the construction of a 2-m high diversion dam for hydroelectric power production near the mouth in 1897 and irrigation diversions would have eliminated the run; spring chinook were able to enter the river during spring runoff (Bjomn 1966).

The Lemhi River spring chinook run has been maintained primarily by natural production. The Idaho Department of Fish and Game (IDFG) designates the Lemhi River spring chinook as natural, rather than wild, because of hatchery fish influence in the drainage. From 1966 to 1982 a small hatchery was operated on Hayden Creek which tested the rearing of steelhead and chinook salmon in earthen ponds. All naturally produced Snake River spring and summer chinook were listed as "threatened" by the National Marine Fisheries Service in 1992.

DISTRIBUTION

Available spawning and rearing habitat for the Lemhi River was described in the Presence/Absence database (Table 1). This information was developed for the Northwest Power Planning Council for subbasin planning and modeling.

PRODUCTION

Survival and production factors for Lemhi River spring chinook were studied during 1962-75 by Bjomn (1978). The study involved monitoring escapements and juvenile emigrants past weirs located on Big Springs Creek and the upper Lemhi River, just upstream of Hayden Creek.

Survival from egg deposition to smolt-sized (fall-spring) migrant stage ranged from 4 % to 16% (Table 2). The Lemhi River study was one of four data sources used to develop density dependent egg-to-smolt survival functions for the System Planning Model for subbasin planning.

Estimated migrant-to-adult return rates to the Lemhi River weir ranged from 0.18 % to 1.22 % for brood years 1963-1971 (Table 3). Adjusted for Columbia River harvest, the return rates ranged from 0.18% to 2.19%.

IDFG monitored spring chinook parr production in the Lemhi River drainage, 1985-1991. Densities were generally low (Table 4), averaging 4.3 parr per 100 m^2 and 4.2 percent of estimated carrying capacity. Densities were lowest in the Hayden Creek (including Bear Valley Creek) sections. Parr carrying capacity ratings for spring chinook were derived from the Presence/Absence database used for development of the Salmon Subbasin Plan. Parr densities were determined by snorkel counts.

ADULT LIFE HISTORY

Adult Escapement

Chinook crossing Bonneville Dam through May 31 are counted as springs, as are those crossing Lower Granite Dam through June 17. Specific time of migration and escapement for Lemhi River spring chinook is not well documented in the ocean, Columbia River or the Snake River. The University of Idaho implemented adult timing research in 1991 which should provide more information about Snake River timing (Bjomn et al. 1992).

Harvest

Information is not available regarding harvest of Lemhi River spring chinook in the ocean and Columbia River.

Traditionally, sport harvest of these fish occurred the Lemhi and the mainstem Salmon rivers. During 1959-78, an estimated 1.5 to 11.8 percent of the annual Idaho chinook salmon harvest (total for spring and summer) occurred in the Lemhi River (Homer and Bjomn 1981). IDFG has not allowed sport harvest of spring chinook in the Lemhi River or in the main Salmon River since 1978. Quantitative information regarding occurrence and magnitude of tribal harvest on Lemhi River spring chinook is not available.

Spawner Escapement

Adult spring chinook into the upper Lemhi River were counted, measured and identified by sex at the weir located upstream of Hayden Creek from 1962-1975. Adult run timing at the weir was mid-May to early September, and usually bimodal with peaks in June and August; spawning time was unimodal (Bjomn 1978).

IDFG conducted redd counts in the Lemhi River from 1957 to present. Redds were counted each year for most of the accessible spawning area upstream of Hayden Creek, excluding Big Springs Creek. Counts for the lower Lemhi River (below Hayden Creek) were discontinued in 1985. Single, peak counts were conducted between August 25 and September 23 from the ground and air.

Total redd counts ranged from 32 in 1989 to 1,871 in 1961 (Table 5). Adults counted at the weir ranged from 428 to 1843 during 1964-1974 (Table 6). The numbers of females counted past the weir (adjusted for harvest) were similar to total redd counts upstream of the weir (average ratio females:redds counted = 0.97; Table 6).

Adult Characteristics

Lemhi River spring chinook age and sex composition of spawners has been monitored from carcass surveys on spawning grounds and at the Lemhi weir. Assignment of ocean age was based on length criteria and does not directly represent known-age techniques, although length criteria were based on scale analyses completed in the early 1960s. However, incorrect assignment of ocean age will affect

brood year analyses. Determination of ocean age composition using carcass information can also introduce bias.

Length-frequency distributions of carcasses from run years 1960-1967 are presented in Table 7. IDFG carcass surveys from brood years 1957-1962 indicate a small proportion of age 2.1 and variable proportions of ages 2.2 and 2.3 (Table 8). The percent females by brood year ranged from 28% to 51% (Table 9), with age 2.3 having the largest percentage females. More recent carcass surveys were not summarized here because of small numbers of recoveries.

The age structures of adult chinook caught in the Lemhi weir trap from brood years 1962-1969 are shown in Tables 10 and 11. For run years 1965 and 1966, females made up slightly less than half the age 2.2 fish and slightly more than half the age 2.3 fish at the weir (Table 12). Bjomn (1978) noted that age structure of fish examined on the spawning grounds was similar to that of fish observed at the weir. However, in some years there was a trend for relatively fewer males being detected in the spawning ground surveys (Bjornn 1978).

Average fecundity of Lemhi River spring chinook in 1962-1968 was 4,794 (Table 13).

JUVENILE LIFE HISTORY

Juvenile life history is generally similar to Figure 2. Downstream movements begin shortly after emergence in February and continue through until smoltification the following spring (Table 14). Peak periods of movement are spring and fall (Table 15). For brood years 1964-1974 the percentage emigrating in the fall ranged from 56 to 90% of the total smolt-sized emigrants (Bjornn 1978). Winter rearing occurs in headwaters, lower in the drainage and in the mainstem Salmon River.

BIOCHEMICAL/GENETIC CHARACTERISTICS

Information has not been compiled.

DISEASES

Information has not been compiled.

REFERENCES

All Lemhi references appear in one reference section at the end of the hatchery produced summer steelhead section.

Figure 1. Anadromous salmonid distribution in the East half of the Salmon River subbasin as represented by summer steelhead, based on the NPPC presence/absence data base and the BPA Geographic Information System.

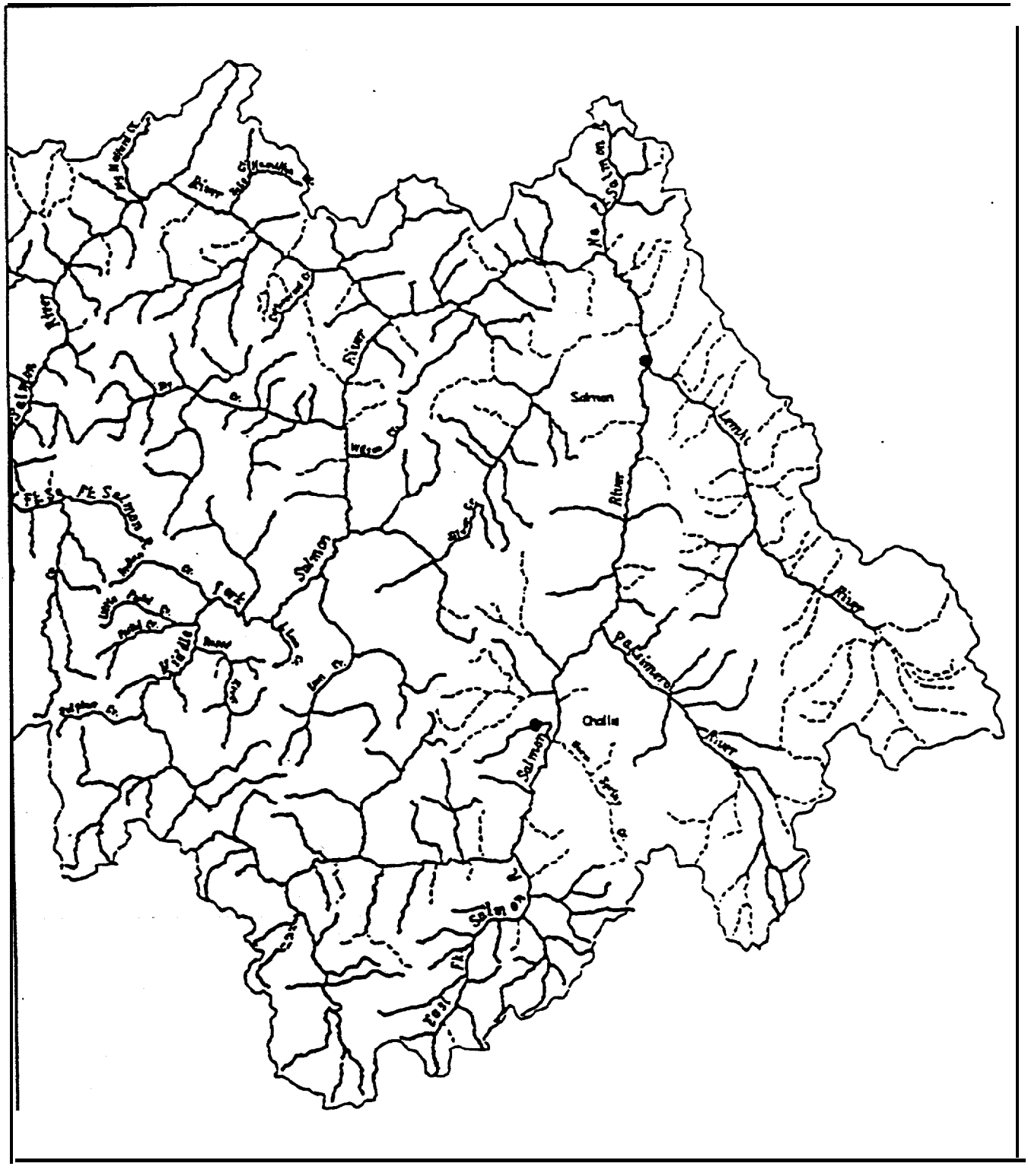
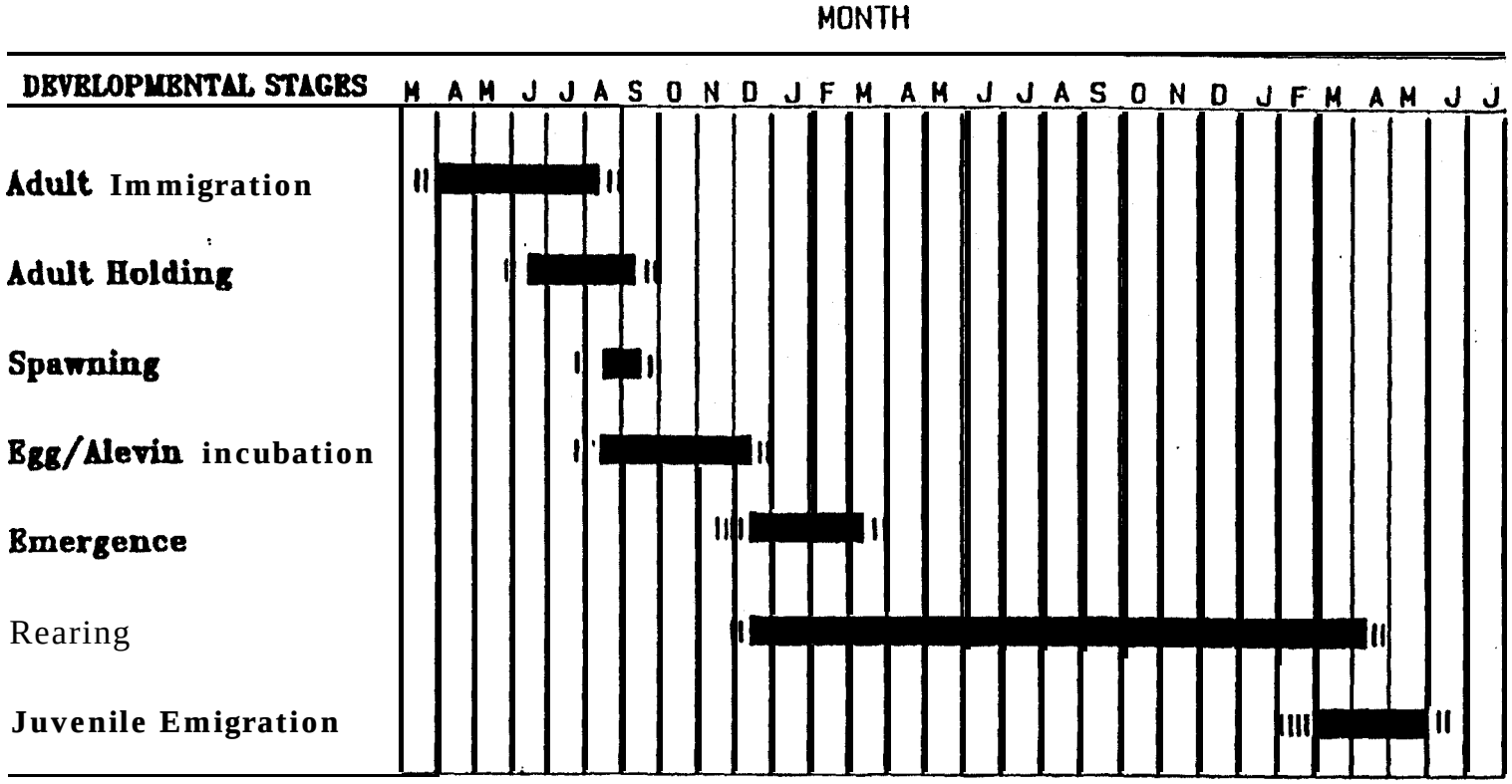


Figure 2 (TT). Freshwater life history for natural/wild spring chinook in the Salmon River subbasin.



Notes:

1. The developmental stage timing represents basin-wide averages, local conditions may cause some variability.
2. Solid bars indicate periods o f heavi dult immigration, spawning and juvenile emigration.

Table 1 (HB). Estimated amount of spawning and rearing habitat (Use Type 1) by quality of Lemhi River spring chinook production area.

	Excellent	Good	Fair[a]	Poor[a]	Unknown	Total	Confidence[b]
Miles (%)	18	38					
Acres (%)	18	34	47 41	31		301.5 85.2	M M

[a] Ratings of fair and poor habitat quality may reflect natural physical features such as gradient and channel type, as well as degradation caused by humans.
[b] 'Confidence' is meant to indicate the reproducibility and accuracy of the estimates made, and was rated as high, medium or low by the respective agencies.

Source: Presence/Absence database, Northwest Power Planning Council, 1991.

Table 2 (JM-a). Estimated number of eggs deposited in the upper Lemhi River by adult salmon; number of fry, fingerlings, and smolt-sized fish migrating downstream past the Lemhi Weir in spring, summer, or fall-winter-spring, respectively; proportion of eggs deposited that survived to migrant stage, year classes 1963-1974.

Year-class	Estimated egg deposition (thousands)	Downstream migrants (thousands)				Proportion of eggs surviving to migrant stage	
		Spring (fry)	Summer (fingerlings)	Fall-spring (smolts)	Total	Total migrants	Fall-spring migrants
			33				
1963			35	174			
1964		794		401	-		
1965	1,794	389	11	185	585	.33	.103
1966	2,738	301	14	109	416	.15	.040
1967	3,169	591		238	841	.27	.075
1968	3,774	759	11	297	1,061	.28	.079
1969	1,219	267	19	129	407	.33	.106
1970	2,258	910	3	245	1,174	.52	.109
1971	1,417	103	15	225	331	.23	.159
1972	2,530	577	8	284	876	.35	.112
1973	2,375	527	10	310”	845”	.36[a]	.131
1974	921	266		219[b]			.238[b]

[a] Includes smolts produced from 900,000 chinook fingerlings released in spring 1974.
[b] Includes smolts from 1,140,300 fingerlings released in spring 1975. The fall-spring smolt estimate was incomplete because it included only the fall 1975 migrants.

Source: Bjomn 1978.

Table 3 (RH). Estimated number of chinook salmon adults of each year-class that spawned; number of smolts leaving the upper Lemhi River; adults returning by age group; percentage survival from smolt to returning adult with and without adjustment of adult returns for the percentage of the spring chinook run harvested in the Columbia River, year-classes 1963-1973.

Year-class	Count of adults at Lemhi River weir[a]	Smolts produced	Number of returning adults: Age 3	Age 4	Age 5	Total	Percentage survival	Adult returns adjusted for harvest in Columbia River: Number of adults	Percentage survival
1963		174,000	59	899	1.165	2,123	1.22	3,818	2.19
1964	1,075	401,000	73	738	‘205	1,016	0.25	1,664	0.41
1965	765	185,000	39	516	519	1,074	0.58	1,879	1.02
1966	1,473	109,000	34	680	156	870	0.81	1,582	1.45
1967	1,844	238,000	18	642	628	1,288	0.54	2,279	0.96
1968	1,943	297,000	33	521	696	1,254	0.42	2,668	0.90
1969	755	129,000	36	334	167	537	0.42	1,099	0.85
1970	1,217	278,000[b]	21	244	675	940	0.34	1,116	0.40
1971	831	286,000[b]	13	198	302”	513	0.18	521	0.18
1972	1,185	284,000	27[c]	309”		-	-	-	-
1973	1,043	310,000[d]	19[c]		-	-	-	-	-

[a] Adults not counted in 1963 and count incomplete in 1964.
[b] Includes smolts from Big Springs Creek
[c] Estimated from redd counts in 1975 and 1976 and the relation between redds and female escapement in previous years.
[d] Includes some smolts from hatchery fingerling releases.

Source: Bjomn 1978.

Table 4 (PD-a). Natural chinook parr densities as fish per $100m^2$ (CHINOD) and percent of rated carrying capacity (CHPERCC), Lemhi River drainage 1985-1991.

	Year						
	1985	1986	1987	1988	1989	1990	1991
Lemhi River							
CHINOD=	1.28	3.06	22.9	32.5	NS[a]	.54	1.56
CHPERCC=	1.18	2.84	21.2	30.1	NS	.51	1.45
N =	2	2	2	2	NS	2	2
Hayden Creek							
CHINOD=	10.84	0.0	0.0	.06	1.42	.44	0.0
CHPERCC=	14.08	0.0	0.0	.07	1.84	.58	0.0
N=	2	2	2	2	2	2	2
Bear Valley Creek							
CHINOD=	0.0	0.0	0.0	0.0	1.72	0.0	0.0
CHPERCC=	0.0	0.0	0.0	0.0	2.23	0.0	0.0
N=	1	1	1	1	1	1	1
Big Springs Creek							
CHINO=	.47	1.17	4.91	12.55	1.53	0.0	0.0
CHPERCC=	.44	1.08	4.55	11.62	1.42	0.0	0.0
N=	1	1	1	1	1	1	1

[a] NS = not sampled.

Source: B. Rich, IDFG, unpublished.

Table 5 (RN-a). Lemhi River drainage index spring chinook redd counts, 1957-199 1".

Year	Lemhi River
1957	1,023
1958	675
1959	524
1960	1,434
1961	1,871
1962	1,455
1963	364
1964	1,151
1965	454
1966	819
1967	804
1968	589
1969	360
1970	371
1971	407
1972	507
1973	485
1974	215
1975	366
1976	241
1977	474
1978	796
1979	154
1980	47
1981	126
1982	163
1983	50
1984	35
1985	93
1986	157
1987	155
1988	179
1989	32
1990	80
1991	55

Source: P. Hassemer, IDFG, unpublished.

Table 6 (RB). Number of spring chinook intercepted at the Lemhi River weir; number removed for artificial spawning; estimated number females available to spawn upstream from the weir (natural mortality not included); number of redds counted during spawning ground surveys in the Lemhi River upstream from Hayden Creek, 1964-1974.

Year	Fish intercepted	Females held for spawning	Estimated escapement of females	Number of redds
1964	1,074[a]	27		1,038
1965	765	0	394	433
1966	1,473	13	625	738
1967	1,834	234	969	786
1968	1,943	139	808	572
1969	743	46	281	328
1970	1,217	47	502	358
1971	832	65	334	392
1972	1,185	0	549	473
1973	1,043	0	502	433
1974	428	0	206	237

[a] Incomplete count; weir not in operation until June 24.

Source: Bjomn 1978.

Table 7 (AL-a). Lemhi River spring chinook carcass fork lengths taken from spawning ground redd index counts , 1960-1967.

Length in.	1960 No. fish	1961 No. fish	1962 No. fish	1963 No. fish	1964 No. fish	1965 No. fish	1966 No. fish	1967 No. fish
14								
15	1	1	[a]					
16		3	1					
17		2						
18	2	2		1	1			
19								
20	1			1				1
21		1						
22	1	1						
23	1							
24					1		2	3
25		5	2		2	1	3	
26	4	9	4	3	7	1	3	1
27	6	19	13	2	12	1	6	2
28	14	34	43	4	44	4	24	5
29	12	50	64	7	31	6	36	18
30	24	37	54	12	39	5	31	15
31	14	37	28	5	18	3	12	8
32	16	41	17	3	14	1	15	11
33	14	38	25	5	7	3	7	14
34	21	26	21	20	13		5	24
35	8	25	9	11	10	2	7	7
36	6	15	14	12	5		16	14
37	4	2	5	4	2	1	2	15
38	1							9
				2			1	7
39		1	2	4	1		1	7
41							2	2
42							1	5
43							1	
44								
45								
46								

[a] Blanks indicate no fish of this size were collected and measured.

Sources:
Bjomn 1961.
Bjomn et al. 1963.
Bjomn et al. 1964.
Ortmann and Richards 1964.
Bjomn et al. 1966.
Platts et al. 1966.
Corley and Welsh 1968.
Welsh and Corley 1968.

Table 8 (AC). Age composition percentage (freshwater.ocean) by brood year[a] for wild spring chinook salmon returning to the Lemhi River.

Age Composition (%)

Brood Year	N	2.1	2.2	2.3
1957	296	2	65	33
1958	271	1	76	23
1959	93	0	35	65
1960	165	1	93	6
1961	77	0	22	78
1962	177	0	34	66

[a] Carcass counts during index redd count surveys was sample method. Total age based on 2 year freshwater rearing and ocean age delineated by fork length criteria as follows:

1963-67: l-ocean = <24 in.
2-ocean = 24 - 31 in.
3-ocean = >31 in.

In this nomenclature, the freshwater and ocean ages sum to the total age of the fish. N is equal to the known male and female components of the brood.

Sources: Bjomn et al. 1964.
Bjomn et al. 1966.
Corley and Welsh 1968.

Table 9 (AS). Percent females by brood year and age class[a] (freshwater.ocean) for wild spring chinook salmon returning to the Lemhi River.

Females (%)

Brood Year	N	2.1	2.2	2.3	Total % Female
1957	506	0	10	41	51
1958	515	0	8	38	46
1959	235	0	5	38	43
1960	220	0	15	34	49
1961	183	<1	10	18	28
1962	253	0	3	24	31

[a] Carcass counts during index redd count surveys was sample method. Total age based on 2 year freshwater rearing and ocean age delineated by fork length criteria as follows:

1963-67: l-ocean = <24 in.
2-ocean = 24 - 31 in.
3-ocean = >31 in.

In this nomenclature, the freshwater and ocean ages sum to the total age of the fish. N is equal to the known male and female components of the brood.

Sources: Bjomn et al. 1964.
Bjomn et al. 1966.
Corley and Welsh 1968.

Table 10 (RH). Return of spring chinook salmon caught in the upstream trap of the Lemhi weir, brood years 1962-1971.[a]

Total Age

Brood Year	3	4	5	N
1962	0	201	849	1,050
1963	12	886	1,183	2,081
1964	72	749	204	1,025
1965	40	513	523	1,076
1966	38	681	158	877
1967	24	641	628	1,293
1968	33	521	696	1,250
1969	36	332	167	535
1970	21	244	inc.[b]	inc.
1971	17	inc.	inc.	inc.

[a] Reconstructed from return year carcass information.
[b] Inc. = incomplete brood year information.

Sources: Bjomn 1978.
T. J. Elms-Co&urn, IDFG, unpublished.

Table 11 (AC). Percentage age composition of spring chinook salmon caught in the upstream trap of the Lemhi River weir, brood years 1962-1969[a].

		Age Composition (%)		
Brood year	N	2.1	2.2	2.3
1962	1,050	0	19	81
1963	2,081	(<1)	43	57
1964	1,025	7	73	20
1965	1,076	4	47	49
1966	877	4	78	18
1967	1,293	2	50	48
1968	1,250	3	42	55
1969	535	7	62	31

[a] Reconstructed from return year information.

Sources: Bjomn 1978.
T. J. Elms-Cockrum, IDFG, unpublished.

Table 12 (AS-a). Percentage of spring chinook salmon in a random sample removed from the upstream trap of the Lemhi weir classified as males and females in each age group, 1965 and 1966.

Age group	1965			1966		
	Number of fish in sample	Percentage males	Percentage females	Number of fish in sample	Percentage males	Percentage females
Age 2.1	0	-	-	11	100	-
Age 2.2	96	54	46	201	55	45
Age 2.3	92	38	62	97	47	53

Source: Bjornn 1978.

Table 13 (AF-a). Mean fecundity by return year for wild spring chinook returning to the Lemhi River, 1962-1968.

Return year	Number of females spawned	Number of green eggs	Mean fecundity
1962	106	505,811	4,772
	7	31,620	4,517
	11	55,581	5,053
	28	135,810	4,850
	18	85,344	4,741
		3,456	3,456
	4:	194,000	4,732
1963	39”	231,860	6,101
1964	27	114,660	4,247
1965	NA[b]	NA	NA
1966	13	63,103	4,854
1967	235	1,108,389	4,717
1968	138	647,400	4,691

[a] A total of 57 ounces of eggs were given to Area Fisheries Biologist for use in hatching channel experiments. Average number of eggs per females was obtained using 38 females instead of 39.
[b] NA = no information available.

Sources: Bell 1965.
Gray 1969.
Hoss 1970.
Richards 1967.
Welsh 1964a, 1964b.

Table 14 (AL-b). Brood year and length frequency of juvenile spring chinook salmon collected at a downstream migrant trap 33 miles above the mouth of the Lemhi River, 1966.

Month	Brood Year	Fork Length (mm)
January	1964	90-100
February	1964	90-100
	1965	30-40
March	1964	95-105
	1965	35-45
April	1964	100-110
	1965	35-45
May	1964	105-115
	1965	40-50
June	1964	110-120
	1965	55-65
July	1965	70-80
August	1965	80-90
September	1965	90-100
October	1965	90-100
November	1965	95-105
December	1965	95-105

Source: Reingold 1967.

Table 15 (ST-a). Monthly proportion of estimated spring chinook migrants passing a downstream migrant trap on the Lemhi River, 1965-1966.

Month	1965 estimated number of migrants	Percent of total	1966 estimated number of migrants	Percent of total
January	11,630	3.6	17,300	6.1
February	15,060	4.6	26,500	9.3
March	14,200	4.4	66,400	23.3
April	14,350	4.4	25,300	8.9
May	11,420	3.5	32,400	11.4
June	1,420	.4	1,700	.6
July	10,340	3.2	1,700	.6
August	16,820	5.2	8,300	2.9
September	59,710	18.4	21,100	7.4
October	86,380	26.5	33,200	11.7
November	52,920	16.3	39,100	13.7
December	30,770	9.5	11,800	4.1

Source: Holubetz 1967.
Reingold 1967.

LEMHI RIVER, SALMON SUBBASIN

Hatchery Produced Spring Chinook

GEOGRAPHIC LOCATION

The Lemhi River, a spring-fed stream in east-central Idaho, flows 56 miles from its source to the Salmon River at river mile 259. The drainage is bordered by the Lemhi and Bitterroot mountain ranges. The valley is mostly privately owned, and is heavily irrigated for hay and grazing. The river is overappropriated for irrigation and is totally dewatered in the lower reach during low water years, impeding adult and juvenile migration. The source streams, Eighteen Mile and Texas creeks, as well as most minor tributaries are dewatered for irrigation. A major tributary, Big Springs Creek flows parallel to the Lemhi River for five miles, joining it 46 miles from the mouth. Hayden Creek, 20 miles long, flows from the Lemhi Mountain Range, entering the Lemhi River 33 miles above the mouth. Big Springs Creek and the Lemhi River are productive streams in terms of water chemistry.

The Hayden Creek Research Station, which reared and released hatchery chinook during 1966-1982, is located about three miles upstream of the confluence with the Lemhi River. Water can be drawn from a 52-degree-Fahrenheit spring or directly from Hayden Creek.

ORIGIN

Spring chinook are native to the Lemhi River drainage. There is limited historical evidence that summer chinook may also have been produced, but the construction of a 2-m high diversion dam for hydroelectric power production near the mouth in 1897 and irrigation diversions would have eliminated the run; spring chinook were able to enter the river during spring runoff (Bjornn 1966).

Hayden Creek Research Station was constructed in 1966 to initiate and investigate pond rearing techniques of summer steelhead. In 1970 the station also began annual fall releases of 5-month-old pond-reared spring chinook; the first spring chinook smolt release was in 1976. From 1980 to 1982 the station released only spring chinook. Since 1982 the station has been used as a research facility for the University of Idaho, with no production releases.

Hayden Creek hatchery spring chinook originated from a mix of Lemhi River natural and Rapid River hatchery stocks.

DISTRIBUTION

Hatchery spring chinook have been released into Hayden Creek and its tributary Bear Valley Creek, the Lemhi River and Big Springs Creek since 1967 (Table 1). Hayden Creek Hatchery released fall pre-smolts and smolts into Hayden Creek. Other releases into the Lemhi River drainage have been primarily fry into the upper Lemhi River and Big Springs Creek in the late 1960s and early 1970s.

PRODUCTION

The capacity of both ponds at the Hayden Creek facility was about 500,000 spring chinook smolts (Reingold 1973). Since 1982 the station has been used as a research facility for the University of Idaho. It has potential for producing chinook salmon for supplementation research but substantial water quality, disease and homing problems would have to be overcome (IDFG 1992).

Egg

Eye-up of green eggs ranged from 90 to 93 percent for brood years 1968, 1975 and 1976 (Reingold and Ledington 1970; Anderson 1977b, 1978).

Frv-Fingerling

Survival from eyed egg to ponded fingerling was not consistently reported. For brood years 1968 and 1978, survival was 81 percent and 75 percent, respectively (Reingold and Ledington 1970; Beers 1979).

Smolt

Eyed egg to smolt survival data were not reported. In-basin smolt survival has not been quantified.

Jack and Adult

Prespawning mortality of ponded adults at Hayden Creek was not consistently reported. Prespawning mortality was 6 percent in 1977 , 22 percent in 1978, and 25 percent in 1979 (Anderson 1978, 1979; Beers 1979). Turbidity from seining the holding pond and handling stress were problems in 1978.

ADULT LIFE HISTORY

Adult Escanement

Chinook crossing Bonneville Dam through May 31 are counted as springs, as are those crossing Lower Granite Dam through June 17. Specific time of migration and escapement for Hayden Creek hatchery spring chinook was not well documented in the ocean, Columbia River or the Snake River.

Harvest

Information is not available regarding harvest of Hayden Creek hatchery spring chinook in the ocean and Columbia River.

Traditionally, sport anglers harvested spring chinook from the Lemhi and the mainstem Salmon rivers. IDFG has not allowed sport harvest of spring chinook in the Lemhi River or in the main Salmon River since 1978.

Information regarding the occurrence and magnitude of tribal harvest on Lemhi River natural spring chinook or Hayden Creek hatchery fish is not available. In 1989, 35 Rapid River adults and jacks from Pahsimeroi Hatchery were released into the Lemhi River for Shoshone-Bannock tribal harvest (Table 1). In 1990 five Pahsimeroi Hatchery summer chinook jacks were released for the same purpose.

Spawner Escanement

Adults returned to the Hayden Creek facility from late May to early September (Anderson 1978, 1979; Beers 1979).

Since the station's construction, adult bypassing was a problem due to poor ladder attraction flows and spring seeps upstream of the trap (Beers 1981). In 1979, a morpholine homing experiment was initiated to attract returning adults, however, no results were published.

Adult Characteristics

Length, weight, and percent female of returning adult spring chinook were not summarized in the Hayden Creek Research Station reports.

Age composition for brood years 1971-1974 was dominated by 2-ocean adults (Tables 2 and 3). Ocean age has been assigned and reported based on standard length frequency criteria, and not on known-age techniques.

Average number of eggs per female ranged from 2,879 to 4,043 for the period 1974-1981 (Table 4).

Fingerling or smolt to adult return for spring chinook returning to Hayden Creek Hatchery averaged 0.03 percent and ranged from 0 percent to 0.08 percent for brood years 1971-1976 (Table 5). Not all returning adults entered the trap. In 1975 and 1976 the portion of the run that failed to enter the adult trap was estimated to be 48 percent and 37 percent respectively (Anderson 1977a).

JUVENILE LIFE HISTORY

Smolt age at release usually ranged from 19 to 20 months, depending on time of egg take. Smolts were generally released in April as yearlings. Accelerated rearing in spring water was attempted for the 1976 brood year, and age-0 smolts were released in April 1977 (Table 1) at an age of 7 to 8 months.

BIOCHEMICAL/GENETIC CHARACTERISTICS

Information has not been compiled.

DISEASES

Bacterial Kidney Disease caused spring chinook mortalities at the Hayden Creek facility, and was a management concern (Table 6). In the 1970s, spring chinook also reportedly contracted bacterial gill disease, systemic bacterial infection, and the gill parasites Costia and Trichodina (Anderson 1975, 1977b, 1978, 1979; Beers 1979). There were also general water quality problems with rearing in spring water, including low dissolved oxygen levels, and high levels of ionic zinc and copper (Anderson 1977b). During high runoff, turbidity from the Hayden Creek water source was also a problem.

REFERENCES

All Lemhi references appear in one reference section at the end of the hatchery produced summer steelhead section.

Table 1 (TR). Hatchery spring chinook releases into the Lemhi River by brood year, 1967-1990[a].

Brood Year	Brood-stock	Hatchery	Life Stage	Release Date (1)	Release Date (2)	Fish/lb	Number Released	Release Location	CWT'
1967	Lemhi River	Hayden Creek	F-F[b]	12/67			156,000	Big Springs Creek	
1968	Lemhi River	Hayden Creek	F-F	12/68			171,000	Big Springs Creek	
1969	Lemhi River	Kooskia NFH	F-F	05/70			21,000	Big Springs Creek	
1970	Lemhi River	Kooskia NFH	F-F	06/71			8,900	Big Springs Creek	
1970	Lemhi R./Rapid R.	Hayden Cr./Rapid R.	F-F	06/71			255,500	Big Springs Creek	
1971	Rapid River	Hayden Creek	F-F	10/72			3 12,000	Hayden Creek	
1971	Lemhi R./Rapid R.	Hayden Creek	F-F	06/72			291,600	Big Springs Creek	
1972	Rapid River	Hayden Creek	F-F	1 0/73			151,000	Hayden Creek	
1973	Rapid River	Hayden Creek	F-F	09/74			350,000	Hayden Creek	
1973	Lemhi R./Rapid R.	Hayden Creek	F-F	05/74			900,000	Lemhi River	
1974	Rapid River	Hayden Creek	F-F	1 0/75			276,000	Hayden Creek	
1974	Rapid River	Hayden Creek	smolt	04/76			6,000	Hayden Creek	
1974	Lemhi R./Rapid R.	Hayden Creek	F-F	06/75			1,140,300	Lemhi River	
1975	Rapid R./Hayden Cr.	Hayden Creek	F-F	09/76			255,000	Hayden Creek	
1975	Rapid River	Rapid River	F-F	07/76			34,700	Bear Valley Cr.	

Table 1 (TR) (cont.). Hatchery spring chinook releases into the Lemhi River by brood year, 1967-1990a.

Brood Year	Brood-stock	Hatchery	Life Stage	Release Date (1)	Release Date (2)	Fish/lb	Number Released	Release Location	CWT[a]
1976	Rapid River	Hayden Creek	smolt[c]	04/77			99,000	Hayden Creek	
1976	Rapid R./Hayden Cr.	Hayden Creek	F-F	09/77	10/77		161,500	Hayden Creek	
1976	Rapid River	Havden Creek	smolt	04/78			15,300	Hayden Creek	
1977	Rapid River	Hayden Creek	smolt	04/79			176,500	Hayden Creek	
1978	Rapid River	Hayden Creek	smolt	04/80			424,400	Hayden Creek	
1979	Rapid R./Hayden Cr.	Hayden Creek	smolt	04/81			606,000	Hayden Creek	
1980	Rapid R./Hayden Cr.	Hayden Creek	smolt	04/82			16.922	Havden Creek	
1984	Rapid River	Havden Creek	smolt	04/86			528	Hayden Creek	
1989	Rapid River	Pahsimeroi	adult[d]	1989			35	Lemhi River	
1990	Pahsimeroi	Pahsimeroi	adult[e]	1990			5	Lemhi River	

[a] Coded Wire Tag codes not summarized.
[b] F-F designates a fry or fingerling release.
[c] Accelerated rearing in spring water.
[d] Release for Shoshone-Bannock tribal harvest.
[e] Summer chinook jacks; release for Shoshone-Bannock Tribal harvest.

Sources: Beers 1983.
Bjornn 1978.

Table 2 (RH). Return of hatchery spring chinook salmon caught in trap at Hayden Creek Research Station, brood years 1971-1979.[a]

Total Age

Brood Year	3	4	5	N
1971	38	120	10	168
1972	27	89	4	120
1973	9	45	13	67
1974	5	74	7	86
1976	6	31	inc.[b]	inc.
1977	17	83	inc.	inc.
1978	5	94	inc.	inc.
1979	13	inc.	inc.	inc.

[a] Returns from brood year 1975 could not be separated from a subyearling smolt release of brood year 1976.
[b] Inc. = incomplete brood year information.

Sources: Beers 1983.

Table 3 (AC). Age composition percentage (freshwater.ocean) by brood year? for hatchery spring chinook salmon returning to Hayden Creek Research Station, brood years 1971 - 1974.

Age Composition %

Brood Year	N	2.1	2.2	2.3
1971	168	22.6	71.4	6.0
1972	120	22.5	74.2	3.3
1973	67	13.4	67.2	19.4
1974	86	5.8	86.1	8.1

[a] Trap recoveries was sample method. Total age based on 2 year freshwater rearing and ocean age delineated by fork length criteria as follows:

1971-74:

Male: l-ocean = <24 in.
2-ocean = 24 - 35 in.
3-ocean = >35 in.

Female: l-ocean = N/A
2-ocean = 24 - 33 in.
3-ocean = >33 in.

Sources: Beers 1983.

Table 4 (AF-a). Mean fecundity by return year for hatchery spring chinook returning to the Hayden Creek Research Station, 1974-1981.

Return year	Number of females spawned	Number of green eggs	Mean fecundity
1974	55	218,000	3,964
1975	31	110,000	3,548
1979	14	56,600	4,043
1980	10	28,787	2,879
1981	33	112,115	3,397

Sources: Anderson 1975, 1977b, 1978.
Beers 1979, 1981, 1982.

Table 5 (TR-a). Percentages of spring chinook smolts released from Hayden Creek Hatchery that returned as adults for brood years 1971 - 1976.

Brood year	Release date	Fingerlings/ Smolts released	Total returns	Percent return
1971	1972 (Oct)	312,000	168	0.05
1972	1973 (Oct)	151,000	120	0.08
1973	1974 (Oct)	350,000	67	0.02
1974	1975 (Oct)	276,000	86	0.03
1974	1976 (Apr)	6,000	0	0.00
1975	1976 (Sept)	255,000		
1976	1977 (Sept)	99,000[a]		
		354,000	44[a]	0.01”

[a] Returns not separable by brood year.

Sources: Beers 1983.

Table 6 (TD). Parasites and diseases" of spring chinook at the Hayden Creek Research Station, Hayden Creek, Lemhi River drainage.

Disease Type	Hatchery	Specific pathogen
Bacteria	Hayden Creek Research Station	*Renibacterium salmonarium* (Bacterial Kidney Disease)

[a] Disease history only represents pathogens isolated at the hatchery and not necessarily a disease outbreak.

Sources: Anderson 1977b, 1979.
Beers 1979.

LEMHI RIVER, SALMON SUBBASIN

Naturally Produced Summer Steelhead

GEOGRAPHIC LOCATION

The Lemhi River, a spring-fed stream in east-central Idaho, flows 56 miles from its source to the Salmon River at river mile 259 (Figure 1). The drainage is bordered by the Lemhi and Bitterroot mountain ranges. The valley is mostly privately owned, and is heavily irrigated for hay and grazing. The river is overappropriated for irrigation and is totally dewatered in the lower reach during low water years, impeding adult and juvenile migration. The source streams, Eighteen Mile and Texas creeks, as well as most minor tributaries are dewatered for irrigation. Several of these may be accessible to steelhead adults and juveniles in the spring before irrigation begins. A major tributary, Big Springs Creek flows parallel to the Lemhi River for five miles, joining it 46 miles from the mouth. Hayden Creek, 20 miles long, flows from the Lemhi Mountain Range, entering the Lemhi River 33 miles above the mouth. Big Springs Creek and the Lemhi River are productive streams in terms of water chemistry.

ORIGIN

Summer steelhead were native to the Lemhi river drainage, but the construction of a 2-m high diversion dam for hydroelectric power production near the mouth in 1897 and irrigation diversions had virtually eliminated the run (Bjornn 1966). A reintroduction program began in 1962 using a Snake River A-run stock transferred from Pahsimeroi Hatchery and a Clear-water B-run stock. Fry were introduced into the drainage from an incubation channel on Big Springs Creek, and from hatchery plants into Big Springs Creek and the upper Lemhi River (Bjornn 1978). More recent hatchery introductions have been primarily Pahsimeroi A-run steelhead (see Lemhi River Summer St&head-Hatchery section).

The Idaho Department of Fish and Game (IDFG) designates the Lemhi River summer steelhead as natural, rather than wild, because of hatchery fish influence in the drainage. The mn is classified as A-run, although some Clearwater River B-run influence is possible.

DISTRIBUTION

Available spawning and rearing habitat for the Lemhi River was described in the Presence/Absence database (Table 1). This information was developed for the Northwest Power Planning Council for subbasin planning and modeling.

PRODUCTION

Survival and production factors for Lemhi River summer steelhead were studied during 1962-75 by Bjomn (1978). The study involved fry introductions and monitoring juvenile emigrants and escapements past weirs located on Big Springs Creek and the upper Lemhi River, just upstream of Hayden Creek.

In 1962-1967 steelhead eyed-eggs were placed into an incubation channel on Big Springs Creek, and swim-up fry were enumerated. Survival from egg to fry averaged 68 percent, ranging from 40 percent to 95 percent (Table 2). Survival was significantly reduced in the three years when stream flows increased and deposited silt and organic debris on the eggs in the incubation channel gravel (Bjomn 1978).

Fry were also released into Big Springs Creek from the hatchery in 1968-1973. Juveniles reared both in Big Springs Creek and the upper Lemhi River to the migrant stage (yearling fall migrant or spring smolt). Survival from fry to smolt-sized migrant past the Lemhi weir ranged from 1.5 percent to 3.8 percent during 1962-1973 (Table 3). Fish that reared to smolt-sized migrants entirely within Big Springs Creek represented 0.4 percent to 1.2 percent of the fry released.

Estimated migrant-to-adult return rates to the Lemhi River weir ranged from 0.5 percent to 2.2 percent for brood years 1963-1970 (Table 4). These percentages were not adjusted for Columbia River or Idaho harvest.

IDFG monitored steelhead parr production in the Lemhi River drainage, 1985-1991. Densities averaged 6.0 parr per 100 m^2 and 28 percent of estimated carrying capacity (Table 5). Densities were largest in the Lemhi River and Big Springs Creek sections and smallest in the Hayden Creek and Bear Valley Creek sections. The steelhead parr density estimates include an unknown proportion of resident rainbow trout. Parr carrying capacity ratings for steelhead were derived from the Presence/Absence database used for development of the Salmon Subbasin Plan. Parr densities were determined by snorkel counts.

ADULT LIFE HISTORY

Adult Escapement

Summer steelhead crossing Bonneville Dam through August 24 are counted as A-run, and those after that date are counted as B-run. The Pahsimeroi River and Snake River stocks are classified as A-run, and the Clear-water River stock is classified as B-run. Specific time of migration and escapement for Lemhi River steelhead is not well documented in the ocean, Columbia River or the Snake River. The University of Idaho implemented adult timing research in 1991 which should provide more information about Snake River timing (Bjornn et al. 1992).

Harvest

Information is not available regarding harvest of Lemhi River steelhead in the ocean and Columbia River.

Traditionally, sport harvest of these fish occurred the mainstem Salmon River from September through April. The Lemhi River has been closed to steelhead sport harvest since the 1970s. IDFG has not allowed sport harvest of wild and natural steelhead in the Salmon River subbasin since the spring 1983 season (S. Yundt, IDFG, pers. comm.).

Quantitative information regarding occurrence and magnitude of tribal harvest on Lemhi River steelhead is not available.

Spawner Escapement

Adult steelhead from the upper Lemhi River were counted and measured at the Lemhi weir from 1966 to 1974. The run timing at the weir ranged from late March to late May, with a peak about May 1 (Bjornn 1978).

Number of adults captured at the weir ranged from 17 to 76 during 1967-1975 (Table 6).

Adult Characteristics

Age of spawners was estimated at the Lemhi weir, and not was based on known age techniques. Assignment of ocean age was based on the stock expected to return each year and-respective length criteria. Length of A-run fish averaged 3-4 inches shorter than B-run fish of the same age (Bjornn 1978). Separation of lengths into various year-classes was sometimes difficult, especially in 1972 when returns of 2-ocean A-run and one-ocean B-run fish coincided. Scales were of little use in verifying ocean age criteria because of reabsorption.

Tabular data on length-frequency of adults captured at the weir were not reported. However, Figure 27 in Bjornn (1978) indicates that length distributions varied considerably during 1968-1974.

Total age of adult fish at the time of sampling ranged from 3 to 4 for brood years 1962-1971 (Table 7). This notation understates by one year the actual age at the eventual time of spawning (or arrival at a tributary weir) because adults spend 7-9 months back in freshwater before spawning. Virtually all smolts from the upper Lemhi drainage had a freshwater age of 2 years (Bjornn 1978).

Lemhi River steelhead returned to the Lemhi weir primarily at age 2.2 (84 percent; weighted average, 1962-1969) (Table 8). Age 2.1 and age 2.3 returns averaged 12 percent and 4 percent of the return, respectively.

The percent females at the Lemhi weir was not reported. Bjornn (1978) assumed an average 64 percent females in calculating potential egg deposition by brood year.

Average fecundity of Lemhi River steelhead was not reported. Bjomn (1978) assumed an average 4,000 eggs per female for A-run fish and 5,500 eggs per female for B-run fish in calculating potential egg deposition by brood year.

JUVENILE LIFE HISTORY

Juvenile life history is generally similar to Figure 2. Although not illustrated in the figure, typically there is a fall emigration of presmolts to lower in the drainage or the mainstem Salmon River for winter rearing. Peak downstream movements occur in spring and fall (Table 9). The percentage of smolt-sized fish emigrating in the fall ranged from 36 to 82 percent of the total emigrants for brood years 1963-1973 (Table 10). These emigrants averaged about 180 mm total length in September and 200 mm the following May (Table 11).

BIOCHEMICAL/GENETIC CHARACTERISTICS

Information has not been compiled.

DISEASES

Information has not been compiled.

REFERENCES

All Lemhi references appear in one reference section at the end of the hatchery produced summer steelhead section.

Figure 1. Summer steelhead distribution in the East half of the Salmon River subbasin based on the NPPC presence/absence data base and the BPA Geographic Information System.

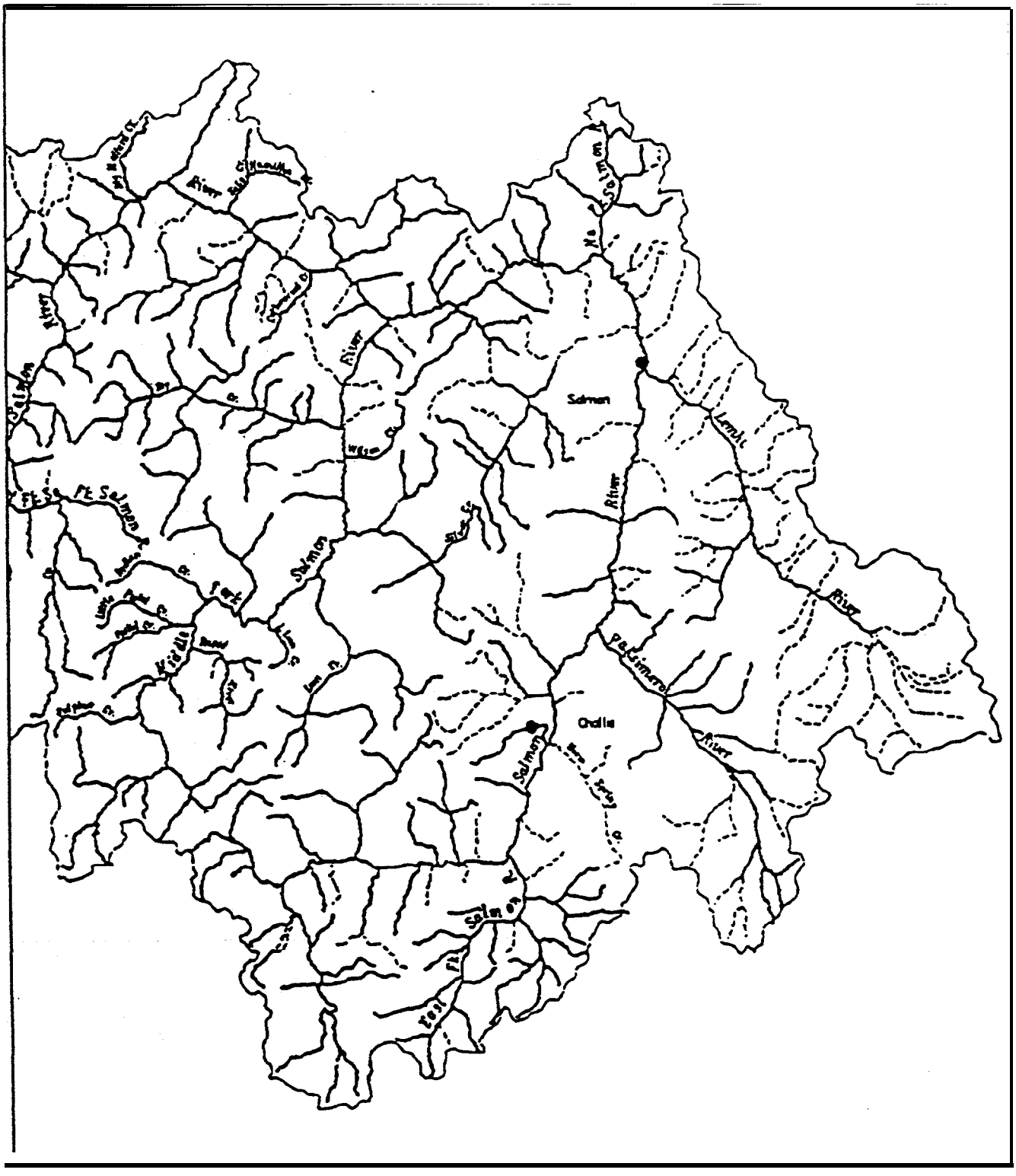
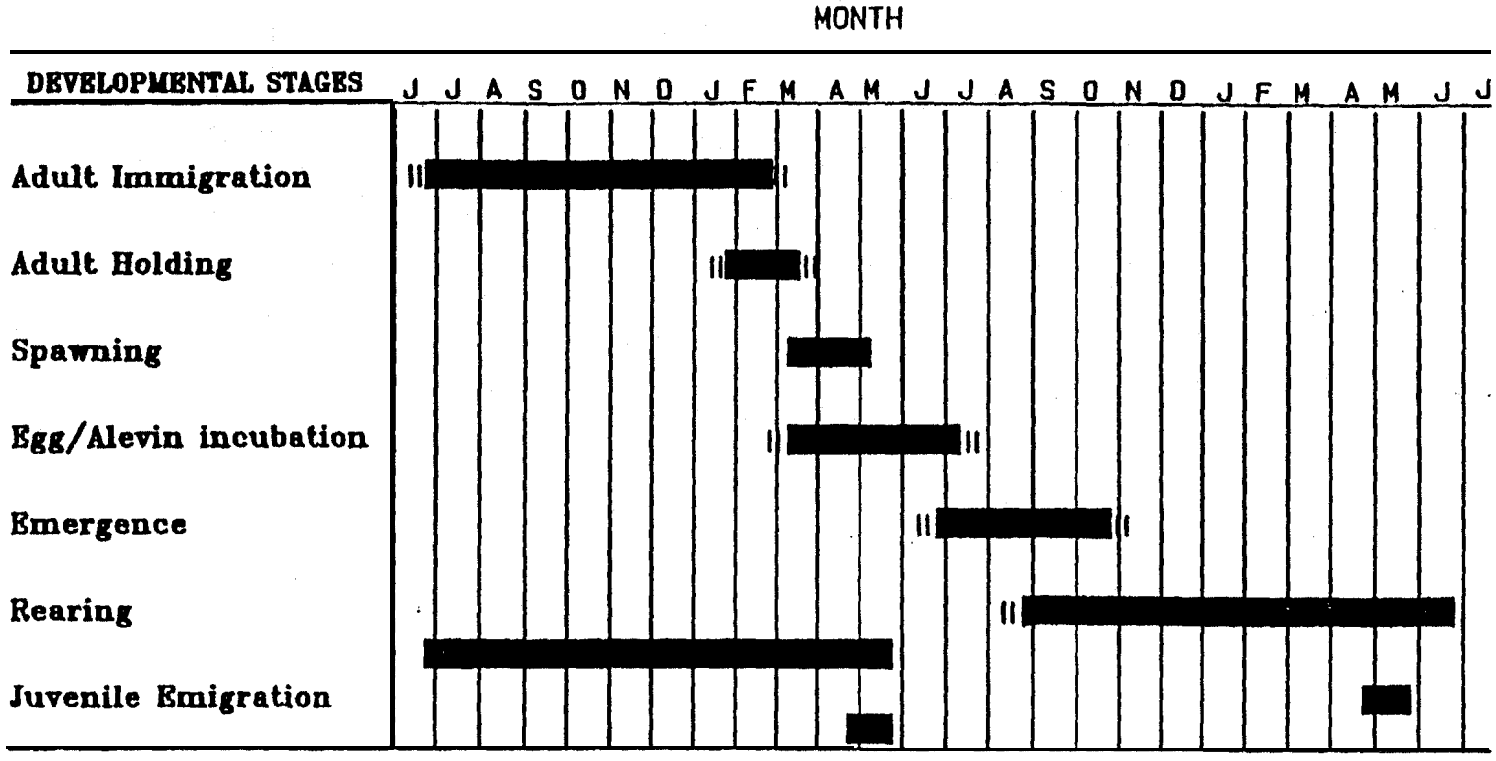


Figure 2 (TT). Freshwater life history for natural/wild steelhead runs in the Salmon River subbasin.



Notes:

1. The developmental stage timing represents basin-wide averages, local conditions may cause some variability.
2. Solid bars indicate periods of heaviest adult immigration, spawning and juvenile emigration.
3. Rearing and juvenile emigration take place over a three year period and are shown above in a rap-around fashion.

Table 1 (HB). Estimated amount of spawning and rearing habitat (Use Type 1) by quality of Lemhi River steelhead production area.

	Excellent	G30l	F28"	Poor"	Unknown	Total	Confidence[b]
Miles (%)(%)	40 31	31	37	21		132.2 97.6	M M
Acres (%							

[a] Ratings of fair and poor habitat quality may reflect natural physical features such as gradient and channel type, as well as degradation caused by humans.
[b] 'Confidence' is meant to indicate the reproducibility and accuracy of the estimates made, and will be rated as high, medium or low by the respective agencies.

Source: Presence/Absence database, Northwest Power Planning Council, 1991.

Table 2 (JM-a). Number of steelhead trout eyed eggs placed in Big Springs Creek incubation channel and number of swim-up fry collected in the trap, 1962 - 1967.

Year	Placement of eggs in gravel		Fry collected in trap	Percentage of eggs collected as fry
	Date	Number		
1962	June 19, 21	69,200	65,900	95.2
1963	May 27, 31	460,100	195,700	42.5
1964	June 2, 10	333,100	298,900	89.7
1965	May 28, June 9	337,000	152,500	45.3
1966[a]	--	144,000	137,300	95.3
1967	May 28, June 3	549,500	217,300	39.5

[a] Record of egg placement date for 1966 lost.

Source: Bjornn 1978.

Table 3 (TS-a). Number of steelhead trout fry released into Big Springs Creek; number of yearling rainbow-steelhead that migrated from Big Springs Creek; number of yearlings of Big Springs Creek origin that migrated from the upper Lemhi River; percentage survival from fry to yearling migrants, year-classes 1962-1973.

Year class	Fry released	Yearling migrants		Percentage survival fry-to-migrant	
		Big Springs Creek	Lemhi River	Big Springs Creek	Lemhi River
1962	64,500	800		1.2	
1963	193,300	1,100	3,000	0.6	1.6
1964	298,400	2,400	4,800	0.8	1.6
1965	151,500	1,500	2,900	1.0	1.9
1966	136,900	800	3,100	0.6	2.3
1967	213,600	1,700	3,300	0.8	1.5
1968	219,000	2,300	8,300	1.1	3.8
1969	322,400	1,900	5,700	0.6	1.8
1970	206,000	1,400	3,300	0.7	1.6
1971	136,800	1,400	2,300	1.0	1.7
1972	358,200	3,200	9,100	0.9	2.5
1973	853,200	3,500	19,000	0.4	2.2

Source: Bjornn 1978.

Table 4 (TS-b). Estimated number of steelhead smolts of Big Springs Creek origin that migrated from the upper Lemhi River; number of adult steelhead from each brood year trapped at the Lemhi River weir at different ages; percent smolt-to-adult survival, brood years 1963 - 1970.

Brood year	Number of smolts	Number of returning adults				Percent survival
		Age 2.1	Age 2.2	Age 2.3	Total	
1963	3,000	0	13	1	14	0.5
1964	4,800	0	50	3	53	1.1
1965	2,900	2	50	3	55	1.9
1966	3,100	3	24	2	29	0.9
1967	3,300	17	54	2	73	2.2
1968	8,300	20	46	0	66	0.8
1969	5,700	2	41	2	45	0.8
1970	3,300	7	20	inc.[a]	inc.	inc.

[a] Inc. = incomplete return.

Source: Bjomn 1978.

Table 5 (PD). Parr density and percent of rated carrying capacity (PCC) for steelhead in the Lemhi River drainage. Densities estimated by snorkel counts.

stream name	Year	Sample size	Ages 1+ & 2+ Density (#/100m²)	Density std. dev.	PCC for 1+ & 2+	PCC std. dev.
Lemhi River	85	2	14.10	3.68	70.50	18.38
Lemhi River	86	2	11.76	.59	58.80	2.97
Lemhi River	87	2	12.10	6.56	60.50	32.81
Lemhi River	88	2	11.16	12.51	55.78	62.54
Lemhi River	90	2	8.73	9.45	13.65	47.24
Lemhi River	91	2	2.42	2.21	12.12	11.07
Hayden Creek	85	2	.19	.27	.95	1.34
Hayden Creek	86	2	1.82	2.41	9.08	12.06
Hayden Creek	87	2	.34	.48	1.70	2.40
Hayden Creek	88	2	1.97	2.09	9.85	10.46
Hayden Creek	89	2	1.14	1.07	5.72	5.34
Hayden Creek	90	2	.21	.29	1.02	1.45
Bear Valley Cr.	85	1	0.0	NA[a]	0.0	NA
Bear Valley Cr.	86	1	.13	NA	.65	NA
Bear Valley Cr.	87	1	.26	NA	1.30	NA
Bear Valley Cr.	88	1	2.15	NA	10.75	NA
Bear Valley Cr.	89	1	1.00	NA	5.00	NA
Bear Valley Cr.	90	1	.34	NA	1.70	NA
Bear Valley Cr.	91	1	.08	NA	.40	NA
Big Springs Cr.	85	1	39.43	NA	197.15	NA
Big Springs Cr.	86	1	10.42	NA	52.10	NA
Big Springs Cr.	87	1	19.52	NA	97.60	NA
Big Springs Cr.	88	1	6.14	NA	30.70	NA
Big Springs Cr.	89	1	9.59	NA	47.95	NA
Big Springs Cr.	90	1	5.34	NA	26.70	NA
Big Springs Cr.	91	1	1.26	NA	6.30	NA

[a] NA = not applicable.

Source: B. Rich, IDFG, unpublished.

Table 6 (AC-a). Number of adult steelhead intercepted at the Lemhi River weir, 1967-1975.

Return year	Age 2.1	Age 2.2	Age 2.3	Total
1967	0	17	inc.[a]	17
1968	0	13	1	14
1969	2	50	1	53
1970	3	50	3	56
1971	17	24	3	44
1972	20	54	2	76
1973	2	46	2	50
1974	7	41	0	48
1975	9	20	2	31

[a] Inc. = incomplete return.

Source: Bjomn 1978.

Table 7 (RH). Total age of adult steelhead[a] of Big Springs origin at time of sampling at the Lemhi River weir, brood years 1962-1971.

Total Age

Brood Year	N	3	4	5
1962	18	0	17	1
1963	14	0	13	1
1964	53	0	50	3
1965	55	2	50	3
1966	29	3	24	2
1967	73	17	54	2
1968	66	20	46	0
1969	45	2	41	2
1970	27[b]	7	20	inc.[c]
1971	inc.	9	inc.	inc.

[a] Mostly 2 year old smolts.
[b] Incomplete count: age 3 and 4 only.
'Inc. = incomplete brood year information.

This notation understates by one year the actual age at the eventual time of spawning because adults spend 7-9 months in freshwater before spawning.

Source: Bjomn 1978.

Table 8 (AC). Percentage age composition of adult steelhead" of Big Springs origin trapped at the Lemhi River weir, brood years 1962-1971.

		Age Composition (%)		
Brood year	N	2.1	2.2	2.3
1962	18	0	94	6
1963	14	0	93	7
1964	53	0	94	6
1965	55	4	91	5
1966	29	10	83	7
1967	73	23	74	3
1968	66	30	70	0
1969	45	4	92	4
1970	27[b]	26	74	inc.[c]
1971	inc.	inc.	inc.	inc.

[a] Mostly 2 year old smolts.
[b] Incomplete count: age 2.1 and 2.2 only.
[c] Inc. = incomplete brood year information.

Note that the eventual total age at spawning for these fish would range from 4 to 6 years.

Source: Bjomn 1978.

Table 9 (JM-a). Monthly proportion of estimated steelhead migrants passing a downstream migrant trap on the Lemhi River, 1965-1966.

Month	1965 estimated number of migrants	Percent of total	1966 estimated number of migrants	Percent of total
January	0	0	0	0
February	0	0	20	.2
March	320	3.3	300	3.2
April	1,210	12.3	800	8.5
May	2,850	29.0	3,600	38.3
June	470	4.8	700	7.4
July	110	1.1	150	1.6
August	820	8.3	580	6.2
September	3,130	31.8	1,400	14.9
October	540	5.5	1,000	10.6
November	180	1.8	570	6.1
December	200	2.1	280	3.0

Source: Holubetz 1967.
Reingold 1967.

Table 10 (JM-a). Total estimated number of smolt-sized rainbow-steelhead trout migrating downstream past the Lemhi weir site; number during fall (August-December) and spring (March-June); percentage of total migrating in fall, year classes 1963-1973.

Year-class	Number of migrants			Percentage migrating in fall
	Total[a]	Fall	Spring	
1963	7,000	2,500	4,400	36
		3,400		41
1964	11,300	2,700	6,500	31
		[illegible]		30
1966	12,200	4,000	6,100	33
1968	20,800	17,100	3,600	82
1969	11,000	3,000	6,000	41
1970	6,300	5.700	3,200	48
		[illegible]		52
1971	79,800	49,200	30,000	62
1973	82,600	59,600	22,500	72

[a] Yearlings that migrated during the winter included in the total number.

Source: Bjornn 1978.

Table 11 (AL-a). Mean total length" of yearling rainbow-steelhead trout migrating downstream and caught in the Big Springs Creek and Lemhi River weirs during September following their second summer and as age 2 smolts the following May, brood years 1962-1973.

Brood year	Big Springs Creek				Lemhi River			
	September		May		Sevtember		May	
	Number	Length	Number	Length	Number	Length	Number	Length
1962	27	188	73	208			-	-
1963	50	184	140	206	-		570	210
1964	382	176	140	189	750	17;	880	194
1965	231	177	153	184	222	179	589	202
1966	3	188	219	187	37	179	350	201
1967	134	185	180	194	91	192	355	206
1968	179	173	332	194	385	193	415	204
1969	369	179	385	200	401	184	311	201
1970	229	174	183	205	112	180	102	206
1971	91	158	405	193	49	180		
1972	76	168	995	195	1461	168	658	196
1973	315	175	803	192	751	166	1256	191

[a] Mean total lengths are measured in millimeters (mm).

Source: Bjomn 1978.

LEMHI RIVER, SALMON SUBBASIN

Hatchery Produced Summer Steelhead

GEOGRAPHIC LOCATION

The Lemhi River, a spring-fed stream in east-central Idaho, flows 56 miles from its source to the Salmon River at river mile 259. The drainage is bordered by the Lemhi and Bitterroot mountain ranges. The valley is mostly privately owned, and is heavily irrigated for hay and grazing. The river is overappropriated for irrigation and is totally dewatered in the lower reach during low water years, impeding adult and juvenile migration. The source streams, Eighteen Mile and Texas creeks, as well as most minor tributaries are dewatered for irrigation. A major tributary, Big Springs Creek flows parallel to the Lemhi River for five miles, joining it 46 miles from the mouth. Hayden Creek, 20 miles long, flows from the Lemhi Mountain Range, entering the Lemhi River 33 miles above the mouth.

The Hayden Creek Research Station, which reared and released hatchery steelhead during 1966-1978, is located about three miles upstream of the confluence with the Lemhi River. Water can be drawn from a 52-degree-Fahrenheit spring or directly from Hayden Creek.

ORIGIN

Summer steelhead were native to the Lemhi River drainage. The construction of a 2-m high diversion dam for hydroelectric power production near the mouth in 1897 and irrigation diversions virtually eliminated the run (Bjornn 1966). A steelhead reintroduction program incorporating hatchery and natural stocks began in 1962 in the upper Lemhi River and Big Springs Creek.

Hayden Creek Research Station was constructed in 1966 to initiate and investigate pond rearing techniques of summer steelhead. From 1970 through 1979 the station reared and released both steelhead and spring chinook. From 1980 to 1982 the station released only spring chinook. Since 1982 the station has been used as a research facility for the University of Idaho.

Hayden Creek Research Station experimented with rearing summer steelhead stocks from the Pahsimeroi Hatchery (Snake River A-run) and the Clearwater River, Idaho, and a lower Columbia River stock from Skamania Hatchery, Washington.

DISTRIBUTION

Hatchery summer steelhead were released as smolts into Hayden Creek from 1967 through 1979 (Beers 1983, Reingold 1975). Hatchery releases into the Lemhi River drainage for brood years 1982-1989 were primarily fry-fingerling and adults from Pahsirneroi Hatchery (Table 1). Releases for 1977 through 1987 are summarized in the Salmon River Subbasin Plan (Idaho Department of Fish and Game et al. 1990).

PRODUCTION

The capacity of both ponds at Hayden Creek facility was about 500,000 steelhead smolts (Reingold 1973). Steelhead smolts have not been reared or released since 1979. Since 1982 the station has been used as a research facility for the University of Idaho.

Egg

Eye-up of green eggs was 80 percent for brood years 1976 and 1977 (Anderson 1977a, 1978).

Frv-Fingerling

Eyed egg to ponded fmgerling survival was not reported consistently. For brood years 1973, 1974, 1976 and 1977, survival was 85, 50, 91 and 98 percent, respectively (Anderson 1977a, 1978; Reingold 1975). .

Smolt

Eyed egg to smolt survival data were not reported consistently. Survival in the pond ranged from 39 percent for brood year 1972 to 99 percent for brood years 1966 and 1967 (Table 2). Of these, the percentage of sub-smolts ranged from 19 percent to 52 percent. The two year rearing cycle produced 13 percent and 19 percent precocious males for brood years 1970 and 1971; shorter rearing cycles produced one percent or less (Table 2). In-basin smolt survival was not quantified.

Adult

Prespawning mortality of ponded adults at Hayden Creek was not reported consistently. In 1976 prespawning mortality was 10 percent (Anderson 1977a).

ADULT LIFE HISTORY

Adult Escapement

Summer steelhead crossing Bonneville Dam through August 24 are counted as A-run, and those after that date are counted as B-run. The Pahsimeroi River, Snake River and Skamania Hatchery stocks are classified as A-run, and the Clearwater stock is classified as B-run. Specific time of migration and escapement for Hayden Creek hatchery steelhead was not well documented in the ocean, Columbia River or the Snake River.

Harvest

Information is not available regarding harvest of Hayden Creek hatchery steelhead in the ocean and Columbia River.

The Lemhi River has been closed to steelhead harvest since the 1970s. Sport harvest of hatchery steelhead occurs in the main Salmon River from September through April. Information regarding harvest of Hayden Creek hatchery steelhead is limited. In fall 1971 and spring 1972, six of 577 steelhead inspected at the North Fork, Idaho, check station carried fm clips that identified them as Hayden Creek origin (Reingold 1972).

Information regarding the occurrence and magnitude of tribal harvest on Hayden Creek hatchery steelhead is not available.

Spawner Escapement

Adults returned to the Hayden Creek facility from early April to late May (Anderson 1977a). Since the station's construction, adult bypassing was a considerable problem due to poor channel and

trap location, small ladder attraction flows and spring seeps upstream of the trap (Anderson 1979, Beers 1981).

Adult Characteristics

Length, weight, and percent female of returning adult steelhead were not summarized in the Hayden Creek Research Station reports. In 1976 the return was 70 percent female (Anderson 1977a).

Total age of adults at the time of sampling ranged from 2 to 4 years for brood years 1970-1977 (Table 3). This notation understates by one year the actual age at spawning (or rack return) because adults spend 7-9 months in freshwater before spawning.

Two-ocean adults predominated for both one and two year freshwater rearing strategies (Table 4). Ocean age was assigned and reported based on standard length frequency criteria, and not on known-age techniques.

Average number of eggs per female ranged from 4,000 to 4,957 for the period 1973-1981 (Table 5).

Fingerling or smolt to adult return for spring chinook returning to the Hayden Creek facility averaged 0.01 percent and ranged from 0 to 0.08 percent for brood years 1970-1977 (Table 6). The Skamania stock returned very poorly. Only eight steelhead identified as Skamania stock returned from a 1976 release of 128,000 smolts, and none returned from a 1975 release of 65,000 smolts (Beers 1981).

Not all returning adults entered the trap. In 1978 Anderson (1979) estimated that at least three out of four returning hatchery adults bypassed the trap and spawned in Hayden Creek.

JUVENILE LIFE HISTORY

The Hayden Creek Research Station experimented with one and two year rearing of smolts; smolt age at release was 11-12 months and 23-24 months, respectively.

BIOCHEMICAL/GENETIC CHAIUCTERISTICS

Information has not been compiled.

DISEASES

No diseases of major management concern, such as those potentially limiting fish transfers, were reported for Hayden Creek hatchery steelhead. In the 1970s summer steelhead reportedly contracted bacterial gill disease, systemic bacterial infection, and the gill parasites Costia and Trichodina (Anderson 1977b, 1979, Beers 1979). There were also general water quality problems with rearing in spring water, including low dissolved oxygen levels, and high levels of ionic zinc and copper (Anderson 1977b). During high runoff, turbidity from the Hayden Creek water source was also a problem.

REFERENCES

All Lemhi references appear at the end of this summer steelhead section,

Table 1 (TR). Hatchery steelhead releases into the Lemhi River by brood year, 1982-1989[a].

Brood Year	Brood-stock	Hatchery	Life Stage	Release Date (1)	Release Date (2)	Fish/lb	Number Released	Release Location	CWT
1982	Pahsimeroi A	Pahsimeroi	adult	1982			173	Lemhi R.	
1982	Hayden Cr./ Pahsimeroi A	Hayden Cr.	F-F[b]	1982			164,853	Lemhi R.	
1982	Hayden Cr./ Pahsimeroi A	Hayden Cr.	F-F	1982			91,545	Bear Valley. Creek	
1982	Hayden Cr./ Pahsimeroi A	Hayden Cr.	F-F	1982			285,007	Big Springs Creek	
1983	Pahsimeroi A	Pahsimeroi	F-F	1983			305,000	Big Springs Creek	
1983	Pahsimeroi A	Pahsimeroi	adult	1983			557	Lemhi R.	
1983	Pahsimeroi A	Pahsimeroi	adult	1983			162	Big Springs Creek	
1984	Pahsimeroi A	Pahsimeroi	F-F	1984			270,000	Lemhi R.	
1984	Pahsimeroi A	Pahsimeroi	adult	1984			2,553	Lemhi R.	
1984	Pahsimeroi A	Pahsimeroi	adult	1984			501	Big Springs Creek	
1985	Pahsimeroi A	Pahsimeroi	F-F	1985			822,680	Lemhi R.	
1985	Pahsimeroi A	Pahsimeroi	adult	1985			721	Lemhi R.	
1986	Pahsimeroi A	Pahsimeroi	F-F	1986			612,500	Lemhi R.	
1986	Pahsimeroi A	Pahsimeroi	adult	1986			682	Lemhi R.	
1986	Pahsimeroi A	Pahsimeroi	F-F	1986			105,000	Hayden Creek	

Table 1 (TR) (cont.). Hatchery steelhead releases into the Lemhi River by brood year, 1982-1989.

Brood Year	Brood-stock	Hatchery	Life Stage	Release Date (1)	Release Date (2)	Fish/lb	Number Released	Release Location	CWT
1987	Pahsimeroi A	Pahsimeroi	F-F	1987			87,500	Lemhi R.	
1987	Pahsimeroi A	Pahsimeroi	F-F	1987			185,000	Hayden Creek	
1987	Pahsimeroi A	Pahsimeroi	adult	1987			959	Hayden Creek	
1987	Pahsimeroi A	Pahsimeroi	adult	1987			50	Bear Vly. Cr.	
1988	Pahsimeroi A	Pahsimeroi	F-F	1988			169,500	Lemhi R.	
1988	Pahsimeroi A	Pahsimeroi	F-F	1988			157,500	Hayden Creek	
1989	Pahsimeroi A	Pahsimeroi	pre-smolt	09/21/89		46	100,200	Lemhi R.	
1989	Pahsimeroi A	Pahsimeroi	F-F	1989		2500	55,000	Lemhi R.	

[a] No coded wire tags have been released since 1977.
[b] F-F designates a fry or fingerling release.

Table 2 (TR-a). Summary of steelhead pond rearing program at the Hayden Creek Research Station, brood years 1966 - 1973.

Brood year	Rearing length	Release date	No. fish released	No. fish stocked	Pond survival	Percent sub-smolts	Percent precocious males	Percent smolts	Average fish size
1966[a]	8 mos.	May '67	187,000	189,000	99	19	0	81	190 mm
1967[a]	4 mos.	May '68	372,000	375,000	99	50	0	50	164 mm
1968	1 year	May '69	87,400	170,000	51	52	0	48	151 mm
1969[a]	1 year	May '70	189,000	218,500	86	46	0	54	159 mm
1970[a]	1 year	Apr '71	72,000	152,000	47	41	1	58	164 mm
1970[a]	2 year	Apr '72	87,500	152,000	58	19	19	62	196 mm
1971	2 year	Apr '73	32,000	73,000	48	26	13	61	169 mm
1972	1 1/2 year	Nov '73	42,000	108,000	39	44	0	56	157 mm
1973[a]	5 mos.	Apr '74	79,700	101,000	79	27	0	73	167 mm

[a] Graded prior to ponding.

Source: Reingold 1975.

Table 3 (RH). Return of hatchery adult summer steelhead caught in trap at Hayden Creek Research Station, brood years 1970-1977."

Total Age

Brood Year	2	3	4	N
1970[b]	5	17		22
1970[c]		3	2	5
1971[c]		2	23	25
1973[c]		6	20	26
1975[b]	0	8		8
1976[b]	0	0		0
1977[b]	0	33		33

[a] Returns not separable from brood year 1972 presmolt release and 1973 one year smolt release.
[b] One year freshwater rearing, return at total age 3 and 4.
[c] Two year freshwater rearing, return at total age 4 and 5.

This notation understates by one year the actual age at spawning (or rack return) because adults spend 7-9 months in freshwater before spawning.

Sources: Beers 1983.

Table 4 (AC). Age composition percentage (freshwater.ocean) by brood year" for hatchery summer steelhead returning to the Hayden Creek Research Station.

Age Composition (%)

Brood Year	N	1.1	1.2	2.1	2.2
1970[b]	22	22.7	77.3		
1970[c]	5			60.0	40.0
1971[c]	25			8.0	92.0
1973[c]	26			23.1	76.9
1975[b]	8	0	100.0		
1976[b]	0				
1977[b]	33	0	100.0		

[a] Trap recoveries was sample method. Ocean age delineated by fork length criteria as follows:

1970-77: l-ocean = <26 in.
2-ocean = ≥26 in.

[b] One year smolt release, return at age 1.1 and 1.2,
[c] Two year smolt release, return at age 2.1 and 2.2.

Note that the eventual total age at spawning for these fish would range from 3 to 5 years.

Sources: Beers 1983.

Table 5 (AF-a). Mean fecundity by return year for hatchery summer steelhead returning to the Hayden Creek Research Station, 1973, 1976 and 1981.

Return year	Number of females spawned	Number of green eggs	Mean fecundit
1973	20	80,000	4,000
1976	27	121,000	4,481
1981	16	79,153	4,957

Sources: Reingold 1973.
Anderson 1977a.
Beers 1982.

Table 6 (TR-a). Percentages of steelhead smolts released from Hayden Creek Hatchery that returned as adults for brood years 1970 - 1977.

Brood year	Release date	Fingerlings/ Smolts released	Total returns	Percent return
1970	1971 (May)	72,000	22	0.03
1970	1972 (Mar)	87,500	5	0.01
1971	1973 (Apr)	31,700	25	0.08
1972	1973 (Nov)	47,000		
1973[a]	1974 (Apr)	80,000		-
1973	1975 (Apr)	229,000	26	0.01
1975	1976 (Apr)	125,000	8	0.01
1976	1977 (Apr)	199,000	0	0.00
1977	1978 (Apr)	236,800	33	0.01

[a] Returns not separable by brood year.

Sources: Beers 1983.

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PAHSIMEROI RIVER, SALMON SUBBASIN

Naturally Produced Summer Chinook

GEOGRAPHIC LOCATION

The Pahsimeroi River is a spring-fed stream meandering 49 miles to join the Salmon River at river mile 304 (Figure 1). The drainage is approximately 845 square miles and is bordered by the Lemhi and Lost River mountain ranges. The Pahsimeroi Valley is mostly privately owned. The valley is heavily irrigated for hay and grazing, particularly in the lower drainage. Most major tributaries are dewatered in the lower reaches during the irrigation season, making them inaccessible to adult chinook. Water percolates through the alluvial fan in the upper valley and enters the river through ground water and springs lower in the valley. This and the sedimentary geology makes the Pahsimeroi River similar to the Lemhi River. These drainages are more productive than most other streams in the upper Salmon basin.

ORIGIN

Summer chinook are native to the Pahsimeroi drainage but information describing the original stock is limited. A weir and adult trap was constructed on the river in 1969 to intercept chinook and steelhead. By 1973, numerous hatchery summer chinook adults were probably returning to the drainage and wild fish information could not be recorded separately because hatchery summer chinook were not differentially marked. The 1991 brood year was the first year that all hatchery chinook were marked with an adipose fin-clip and coded wire tag in order to differentiate them from naturally produced fish.

Hatchery production began when wild summer chinook broodstock was collected at the weir and spawned in 1969. Hatchery-reared juveniles were released in the river 1970-1978, and from 1983 to the present.

Natural production of summer chinook in the Pahsimeroi drainage has been maintained by releasing chinook above the Pahsimeroi weir or from fish escaping upriver prior to weir installation. However, in 1975 and 1976, and from 1981-1985, no summer chinook were released above the weir (Table 1). It is unknown how many fish escaped upriver prior to weir installation. Weir installation during these years varied from May 26 to July 8.

A policy of releasing at least one-third of the summer chinook run for natural production above the weir was implemented in the mid-1980's. When a hatchery brood surplus occurs, more fish are passed upstream. Unknown proportions of hatchery and naturally produced summer chinook are released upstream to spawn. Because of sustained hatchery chinook influence on natural production in this drainage, this run is classified as natural rather than wild.

DISTRIBUTION

Available spawning and rearing habitat for the Pahsimeroi River was described in the Presence/Absence database (Table 2). This information was developed for the Northwest Power Planning Council for subbasin planning and modeling.

PRODUCTION

There is little information available describing survival and production factors. Idaho Department of

Fish and Game (IDFG) biologists monitored summer chinook parr production in the Pahsimeroi River, 1985-1989. Summer chinook parr density averaged 31.1 parr per 100 m^2 and averaged 40.4 percent of estimated carrying capacity (Table 3). Parr carrying capacity ratings for summer chinook were derived from the Presence/Absence database used for development of the Salmon Subbasin Plan. Parr densities were determined by snorkel counts.

ADULT LIFE HISTORY

Adult Escavement

Chinook crossing Bonneville Dam from June 1 through July 31 are counted as summers, as are those crossing Lower Granite Dam from June 18 through August 17. Stock specific escapement and timing data prior to entry into the Pahsimeroi River is not available. The University of Idaho implemented adult timing research in 1991 which should provide more information on Snake River timing (Bjornn 1992).

Pursuant to the Endangered Species Act, naturally produced Snake River summer chinook were listed as "threatened" by the National Marine Fisheries Service in 1992.

Harvest

Information is not available regarding the rate of contribution of Pahsimeroi River naturally produced summer chinook to ocean or Columbia River chinook harvest. Harvest of summer chinook is not allowed in the Snake River because of low escapement.

Because of low escapement, IDFG has not allowed sport harvest of summer chinook in the Pahsimeroi River or the mainstem Salmon River since 1978. Traditionally, sport harvest of these fish occurred in the mainstem Salmon River where they were commingled with other runs.

Information regarding occurrence and magnitude of tribal harvest on Pahsimeroi River summer chinook is not available.

Svawner Escavement

During the years when wild summer chinook were returning, 1969-1972, the timing of arrival at the Pahsimeroi weir was primarily July through September (Table 4). More recent run timing for naturally produced summer chinook cannot be specified because they cannot be differentiated from the hatchery chinook.

The IDFG conducted redd counts in index areas of the Pahsimeroi River drainage during the 1960's from September 13 to September 24. IDFG counted redds from the air and the ground (Table 5). Air and ground counts were not directly comparable because of differences in transect length. Air counts for 1963-67 are half or less of those counted during 1960-62. IDFG discontinued the redd counts in 1969 because a weir and adult trap were constructed as part of Pahsimeroi Hatchery that would intercept returning chinook.

Escapement of naturally produced summer chinook to the Pahsirneroi weir is unknown. Currently, approximately one-third of the summer chinook intercepted at the Pahsimeroi River weir are released upstream for natural spawning (Table 1). Little or no spawning takes place downstream from the weir. Adults released upstream are a mixture of fish from hatchery and natural production. Spawner escapement has ranged from O-369 over the last 23 years.

Spawning generally takes place in September (Figure 2).

Adult Characteristics

There is no information specific to naturally produced adults except fecundity. Wild summer chinook were collected for broodstock, 1969-1972. For all years combined, mean fecundity of the wild fish was 5,366 eggs per female (Table 6). On average, eye-up was 81 percent.

Other adult characteristics are probably similar to those described for the Pahsimeroi River hatchery summer chinook.

JUVENILE LIFE HISTORY

Life history timing is generally similar to Figure 2. Although not illustrated on the figure, there is typically a fall emigration of chinook presmolts to lower in the drainage or the mainstem Salmon River for winter rearing. In 1966, Reingold (1967) trapped juvenile migrants with a trap at the end of an irrigation ditch fish screen bypass pipe. The trap was located about 2 miles upstream from the mouth of the Pahsimeroi River. A total of 3,441 juvenile chinook were collected and marked with a freeze brand. He documented two year classes of fish emigrating from the river. Brood year 1964 smolts were collected January through June and ranged from 85-115 mm fork length. Brood year 1965 fry and presmolts were trapped throughout the year and ranged from 30-105 mm fork length (Table 7). Presmolts migrating September through December were generally 90-105 mm.

Reingold (1967) estimated the total number of migrants by using mark and recapture information collected at the trap. About 39 percent of the estimated number of migrants moved downstream March through June. More of the migrants, about 47 percent, moved downstream September through December. He noted that the highest percentage of the estimated chinook migrants moved downstream in November (Table 8).

BIOCHEMICAL/GENETIC CHARACTERISTICS

Marshall (1992) reported an analysis of genetic characteristics of chinook baseline collections in Idaho. Her information included allele frequencies of naturally produced summer chinook juveniles from the Pahsimeroi River.

DISEASES

Information has not been compiled.

REFERENCES

All Pahsimeroi references appear at the end of the hatchery produced summer steelhead section.

Figure 1. Anadromous **salmonid** distribution in the East half of the Salmon River **subbasin** as represented by summer steelhead, based on the NPPC presence/absence data base and the BPA Geographic Information System.

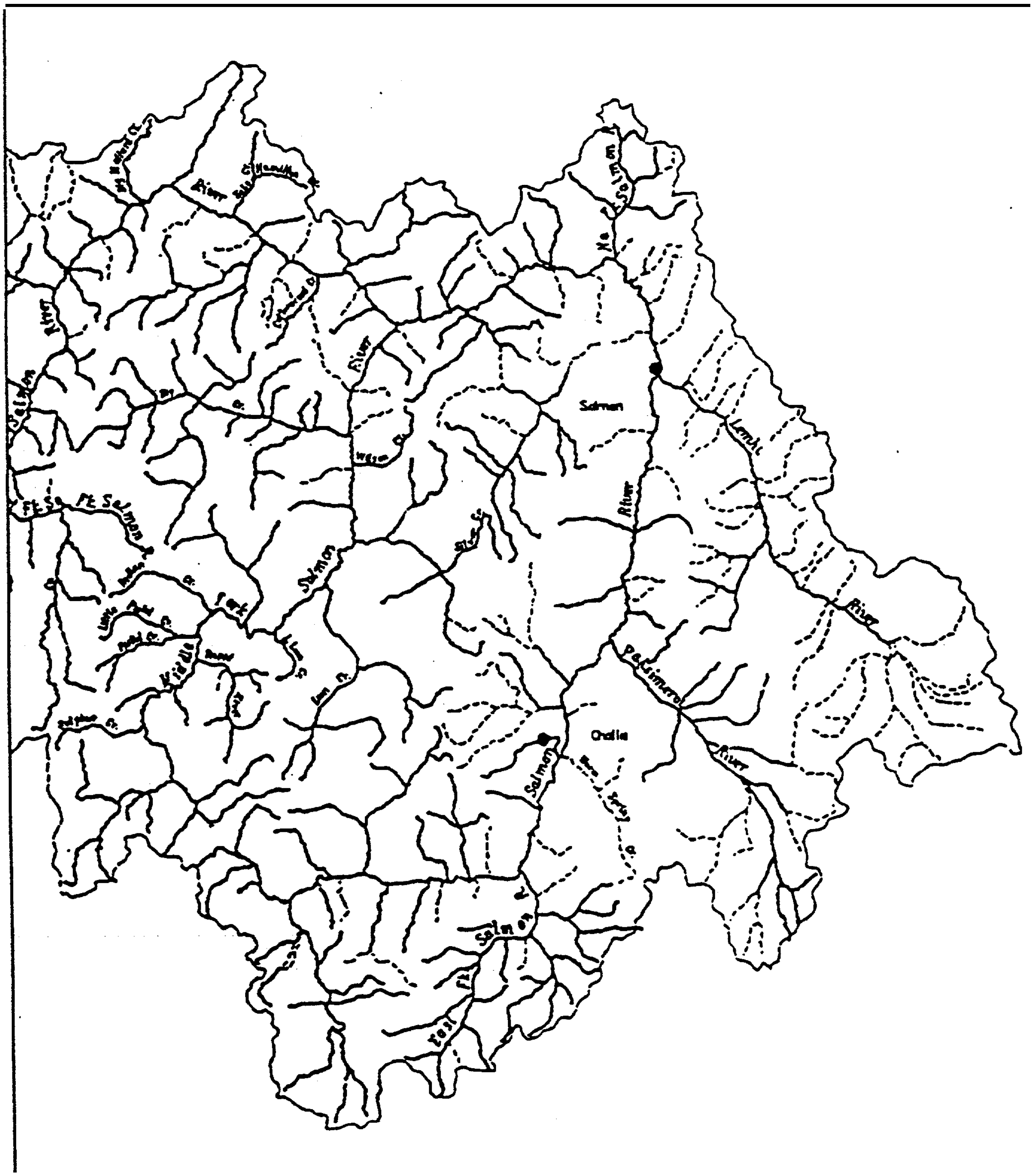
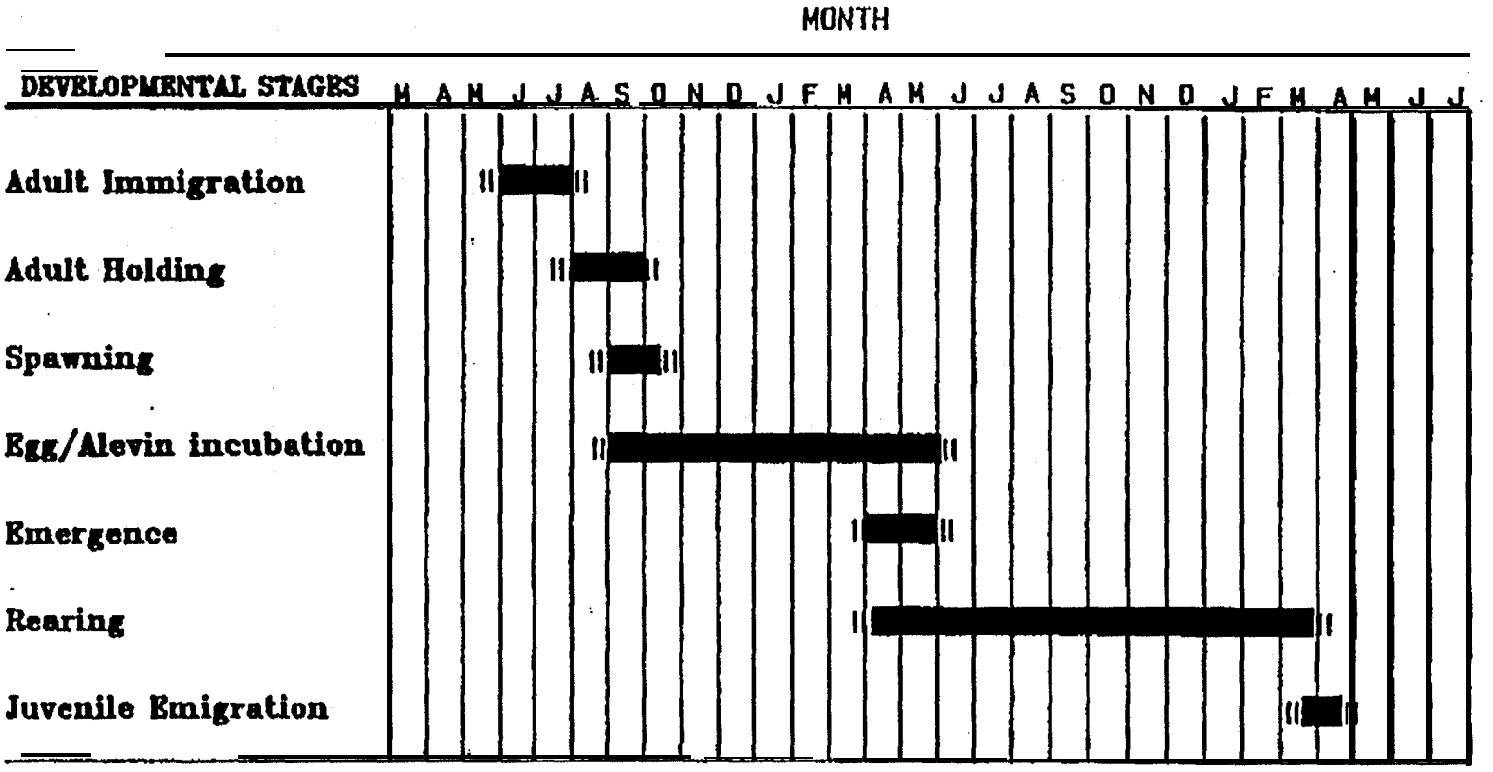


Figure 2 (TT). Freshwater life history for natural/wild summer chinook salmon in the Salmon River subbasin.



Notes:

1. The developmental stage timing represents basin-wide averages, local conditions may cause some variability.
2. Solid bars indicate periods of heaviest adult immigration, spawning and juvenile emigration.

Table 1 (RN-a). Number of summer chinook adults released upstream of the Pahsimeroi weir to spawn naturally, 1969-1991.

Year	Total	Jacks	Adult Males	Adult Females
1969	364		280[a]	84
1970	358		206[a]	152
1971	119		87”	32
1972	192	40	112	40
1973	369		166	203
1974	67		35”	32
1975[b]				
1976[b]				
1977	24		20	4
1978				
1979	33	1	18	14
1980	46	13	29	4
1981[b]				
1982[b]				
1983[b]				
1984[b]				
1985[b]				
1986	100		60[b]	40
1987	228	8	151	69
1988	260	33	112	115
1989	82	33	25	24
1990	149	15	65	69
1991	76	6	30	40

[a] Unknown proportion of jacks to adult males.
[b] All fish were held for spawning.
[c] Trap not installed.

Sources: Moore 1980, 1989.
Chapman 1990.
Moore and Rensel-Hislop 1991.
B. Moore and J. Chapman, IDFG, unpublished.
B. Moore and J. Rensel, IDFG, unpublished.

Table 2 (HB). Estimated amount of spawning and rearing habitat (Use Type 1) by quality of Pahsimeroi River summer chinook production area.

	Excellent	Good	Fair[A]	Poor[A]	Unknown	Total	Confidence[B]
Miles (%)	41	59	0	0		21	M
Acres (%)	37	63	0	0		86.4	M

[A] Ratings of fair and poor habitat quality may reflect natural physical features such as gradient and channel type, as well as degradation caused by humans.
[B] 'Confidence' is meant to indicate the reproducibility and accuracy of the estimates made, and will be rated as high, medium or low by the respective agencies.

Source: Presence/Absence Database, Northwest Power Planning Council.

Table 3 (PD). Natural chinook parr densities per 100 m^2 (CHINOD) and percent of rated carrying capacity (CHPERCC) for the Pahsimeroi River, 1985-1989.

	Year				
Measurement	1985	1986	1987	1988	1989
CHINOD =	0.8	6.59	12.87	11.89	123.5
CHPERCC =	1.04	8.57	16.72	15.45	160.4

Source: R.J. Scully, IDFG, unpublished

Table 4 (AT-a). Timing of the wild summer chinook run to the Pahsimeroi River weir, 1969-1972.

Return Year	First fish trapped	Last fish trapped	Percent trapped June	Percent trapped July	Percent trapped August	Percent trapped September
1969	06/13	09/30	10.4	49.8	6.8	33.0
1970	05/18	09/28	18.1	17.3	14.4	49.8
1971	07/01	1 0/06[b]	0.0	27.1	32.4	38.2
1972	06/27	09/26	0.6	31.8	37.5	30.1

[a] Number of fish trapped in May comprised .4 percent of total run.
[b] Number of fish trapped in October comprised 2.3 percent of total run.

Source: J. Rensel-Hislop, IDFG, unpublished.

Table 5 (RN). Idaho Department of Fish and Game air and ground index redd counts' for the Pahsimeroi River, 1960-69.

Year	Air	Ground
1960	216	NC[b]
1961	103	NC[b]
1962	114	284
1963	58	75
1964	50	99
1965	17	16
1966	40	113
1967	50	66
1968		
1969[d]		

[a] Air and ground counts are not directly comparable as transect lengths can vary from year to year.
[b] NC = no ground surveys counted.
[c] Not counted due to turbid water conditions.
[d] Redd counts discontinued.

Sources: Bjornn 1961.
Bjomn and Richards 1961.
Bjomn et al. 1963, 1964, 1966.
Ortmann and Richards 1965.
Platts et al. 1966.
Corley and Welsh 1968.
Welsh and Corley 1968, 1969.
Corley et al. 1971.
T. Elms-Co&rum, IDFG, unpublished.

Table 6 (AF-a). Mean fecundity by return year for wild summer chinook returning to the Pahsimeroi weir, 1969-1972.

Return year	Number of females spawned	Number of green eggs	Mean fecundity	Eye-up (%)
1969	96	464,150	4,835	94.9
1970	74	443,772	5,997	76.5
1971	62	356,628	5,752	81.3
1972	75	382,930	5,106	73.5

Source: J. Rensel-Hislop, IDFG, unpublished.

Table 7 (AL-a). Brood year and length frequency of juvenile chinook salmon collected at a downstream migrant trap" on the Pahsimeroi River, 1966.

Month	Brood Year	Fork Length (mm)
January	1964	85-95
February	1964	85-95
	1965	3040
March	1964	90-100
	1965	35-45
April	1964	95-105
	1965	45-55
May	1964	105-l 15
	1965	55-65
June	1964	105-l 15
	1965	70-80
July	1965	75-85
August	1965	80-90
September	1965	90-100
October	1965	95-105
November	1965	95-105
December	1965	95-105

"Migrant trap was located two miles upstream from the mouth of the Pahsimeroi River.

Source: Reingold 1967.

Table 8 (JM-a). Monthly proportion of estimated summer chinook migrants passing a downstream migrant trap on the Pahsimeroi River, 1966.

Month	Estimated number of migrants	Percent of total
January	7,000	4.7
February	6,000	4.0
March	10,000	6.7
April	15,000	10.0
May	8,000	5.3
June	26,000	17.3
July	4,000	2.7
August	3,000	2.0
September	7,000	4.7
October	20,000	13.3
November	33,000	22.0
December	11,000	7.3

Source: Reingold 1967.

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PAHSIMEROI RIVER, SALMON SUBBASIN

Hatchery Produced Summer Chinook

Pahsimeroi River summer chinook are spawned and reared at Pahsimeroi Hatchery, which is owned and funded by Idaho Power Company. Idaho Department of Fish and Game (IDFG) operates the facility, which has been in production since the mid-1960's. The hatchery is part of mitigation for anadromous fish production lost due to construction of the Hells Canyon Dam complex on the Snake River.

GEOGRAPHIC LOCATION

The Pahsimeroi River is a spring-fed stream meandering 49 miles to join the Salmon River at river mile 304. Pahsimeroi Hatchery is located about 1 mile upstream from the mouth of the Pahsimeroi River. The facilities include an adult trap and weir which intercepts all adult chinook and steelhead when in operation. Pahsimeroi Hatchery utilizes both river and ground water for rearing fish. Smolts are reared off-site in earthen ponds, about six miles upstream from the main hatchery facility.

ORIGIN

Pahsimeroi Hatchery was constructed as part of a program to transfer the middle Snake River steelhead run to the Salmon River drainage. Biologists then began collecting summer chinook eggs to rear in 1969. Eggs were collected from the indigenous Pahsimeroi River summer chinook run. Early reports indicate that fish arriving prior to July 15 were allowed upstream to spawn naturally and those arriving afterward were held in the hatchery. During the 1970's, eggs were reared to fry at Mackay Hatchery and shipped back and released as fingerlings (Idaho Department of Fish and Game et al. 1990). This practice evolved into a smolt program in the 1980's. With hatchery expansion in 1980, Rapid River Hatchery spring chinook were introduced and reared at Pahsimeroi Hatchery. However, IDFG continued to trap and rear summer chinook. Hatchery spring chinook were released into the Pahsimeroi River from 1983-1986. After 1986, returning spring chinook were used for other programs. In 1987, the hatchery chinook program was converted back to solely summer chinook production. The hatchery summer chinook broodstock is a mixture of hatchery and naturally produced fish because the two cannot be distinguished as they arrive intermingled at the weir. In addition to Pahsimeroi River stock, progeny from South Fork Salmon River broodstock were released into the Pahsimeroi River, 1987-1990.

DISTRIBUTION

Table 1 lists hatchery summer chinook releases into the Pahsimeroi River for brood years 1975-1989. Coded wire tag codes (CWT) are identified for brood years 1976 and 1977. Through brood year 1989, no additional CWTs have been released. Other marks or tag releases have not been compiled.

Smolts are released directly from the rearing ponds.

PRODUCTION

Pahsimeroi Hatchery is designed to produce 1 million smolts with a target rearing size of 15-20 smolts to the pound. Because of low hatchery adult escapement, eggs were transferred from McCall Hatchery (South Fork Salmon River summer chinook) to augment the number of eggs collected at

Pahsimeroi (Table 2). With the additional eggs, the hatchery reached rearing capacity with the brood years 1988 and 1989 production.

Timing of hatchery rearing is shown in Figure 1.

Egg

Eye-up of green eggs for brood years 1984-1991 averaged 92 percent and ranged from 80-97 percent (Moore 1988a, 1988b, 1989; Chapman 1990; B. Moore and J. Rensel 1991; B. Moore and J.R. Hislop, IDFG, unpublished).

Egg-fingerling

Eyed egg to ponded fingerling survival for brood years 1984-1988 ranged from 69.6-97.2 percent and averaged 84.9 percent (Table 3).

Smolt

Eyed egg to smolt survival ranged from 63.0-86.9 percent and averaged 77.2 percent for brood years 1984-1988 (Table 3). Green egg to smolt survival was not reported by the hatchery because varying egg sources and eye-up percentages were pooled during these brood years.

In-basin smolt survival has not been quantified.

Fingerling or smolt-to-adult return for summer chinook returning to the Pahsimeroi River averaged 0.290 percent and ranged from 0.016 to 0.825 percent, for brood years 1969-1986 (Table 4). Smolt-to-adult return averaged 0.499 percent for brood years 1981-1986. This represents an overestimate of hatchery fish survival since some of the fish intercepted at the weir are from natural production.

Jack and Adult

Prespawning mortality of ponded adults at Pahsimeroi Hatchery ranged 1.2-23.3 percent and averaged 10.9 percent for brood years 1980-1991 (Table 5). Prespawning mortality has decreased substantially since 1988.

ADULT LIFE HISTORY

Adult Escapement

Chinook crossing Bonneville Dam from June l-July 31 are counted as summers, as are those crossing Lower Granite Dam from June 1 8-August 17. Specific time of migration and escapement for Pahsimeroi Hatchery summer chinook has not been identified for the ocean, or the Columbia or Snake rivers. Adult timing research implemented by the University of Idaho in 199 1 should provide more information about Snake River timing (Bjornn 1992).

Harvest

Information is not available regarding rate of contribution of Pahsimeroi River hatchery summer chinook to ocean or Columbia River chinook harvest. Harvest of summer chinook is not allowed in the Snake River because of low escapement.

Because of low escapement, IDFG has not allowed sport harvest of summer chinook in the Pahsimeroi River or the mainstem Salmon River since 1978. Traditionally, sport harvest of these fish occurred in the mainstem Salmon River where they were commingled with other runs.

Information regarding the occurrence and magnitude of tribal harvest on Pahsimeroi River summer chinook is not available.

Spawner Escapement

Adults generally return to the Pahsimeroi River from late June through early September (Table 6).

Fish intercepted at the Pahsimeroi weir are a mixture of hatchery and naturally produced fish. Typically, one-third of these fish are released upstream for natural production. Returns to the adult trap by brood year ranged from 17 to 1,162 fish for brood years 1969-1986 (Tables 7 and 8). As noted in Table 6, ocean age has been assigned based on length frequency, not known-age techniques. This means that brood year designation may be inaccurate if, for example, one brood year exhibits an unusual growth pattern such as being atypically large or small. Ocean conditions such as El Nino have been cited as playing a part in size at return.

The Salmon Subbasin Plan (Idaho Department of Fish and Game et al. 1990) cited annual returns to the Pahsimeroi weir ranging from 46 to 473 fish for 1980-1987. Annual returns for 1988 through 1991 were 838, 347, 470, and 238 fish, respectively (Moore and Rensel 1991; B. Moore and J.R. Hislop, IDFG, unpublished; B. Moore and J. Rensel, IDFG, unpublished).

From 1980 through 1991, spawning of summer chinook at Pahsimeroi Hatchery has generally started the last week of August.

Adult Characteristics

Weight of returning adult summer chinook are not available. Length of summer chinook returning 1986-1991 ranged up to over 106 cm fork length (Table 9).

Age composition for brood years 1969-1972 and 1977-1986 has been variable (Tables 10 and 11). Information for brood years 1973-1976 could not be calculated. Fish were either not collected or the trap was not installed during the return years needed to complete brood year information.

For brood years 1969-1972, the percent females ranged 39.2-72.5 percent and averaged 44.3 percent (Table 12). For brood years 1977-1986, the percent females ranged 13.3-57.0 percent and averaged 38.7 percent (Table 13). Females comprised less than 50 percent of the brood in most years.

Average number of eggs per female ranged 4,388-6,424 for the period 1981-1991 (Table 14). Egg counting methodology has changed from the Von Bayer method to water displacement. Since 1990, an electronic egg counter has been used by hatchery personnel.

JUVENILE LIFE HISTORY

Smolt age at release usually ranges from 19 to 20 months, depending upon the time of egg take. Smolts are generally released around mid-March.

BIOCHEMICAL/GENETIC CHARACTERISTICS

No information has been compiled.

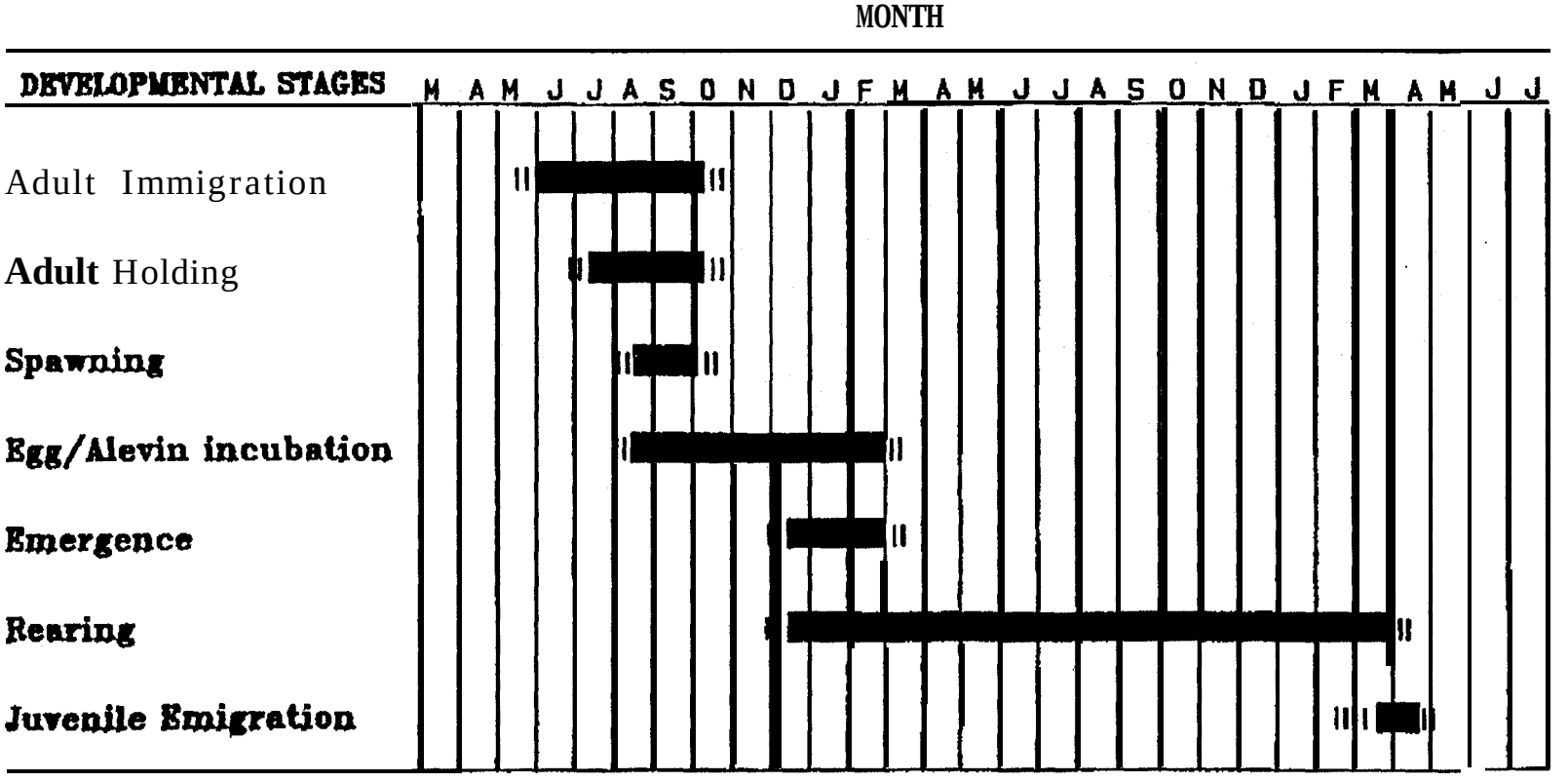
DISEASES

Whirling disease and bacterial kidney disease are the major diseases of management concern, such as those potentially limiting fish transfers, which have caused mortalities at the Pahsimeroi Hatchery in recent years (Table 15). The first confirmed case of Whirling Disease was diagnosed in the brood year 1986 fish (1988 smolt release). Moore (1989) reported that a small portion of the juveniles were affected and no major losses occurred. Whirling disease appears to be chronic at Pahsimeroi Hatchery and has been detected every year since. Foott and Hauck (1989) reported that a high prevalence and intensity of infection for Myxobolus cerebralis occurs in the production chinook at Pahsimeroi Hatchery. Tubifex worms have been documented as the intermediate host for this parasite and are ubiquitous fauna to earthen ponds such as at Pahsimeroi Hatchery.

REFERENCES

All Pahsimeroi references appear at the end of the hatchery produced summer steelhead section.

Figure 1 (TT). Freshwater life history for summer chinook spawned and reared at the Pahsimeroi Hatchery.



Notes:

1. The developmental stage timing represents basin-wide averages, local conditions may cause some variability.
2. Solid bars indicate periods of heaviest adult immigration, spawning and juvenile emigration.

Table 1 (TR). Hatchery summer chinook releases into the Pahsimeroi River by brood year, 1976-1989. No coded wire tags have been released since brood year 1977.

Brood Year	Brood-stock	Hatchery	Life Stage	Release Date (1)	Release Date (2)	Fish/lb	Number Released	Release Location	CWT
1976	Pahsimeroi	Pahsimeroi	smolt	1977			231,937	Pahsimeroi	100213
1977	Pahsimeroi	Mackay	F-F"	1978		60	289,900	Pahsimeroi	
1977	Pahsimeroi	Pabsimeroi	smolt	1978			209.144	Pahsimeroi	100327
1978	Pahsimeroi	Pahsimeroi	adult	1978			205	Pahsimeroi - above weir	
1980	Pahsimeroi	Pahsimeroi	adult	1980			46	Pahsimeroi - above weir	
1981	Pahsimeroi	Pahsimeroi	smolt	03/10/83		22	13,690	Pahsimeroi	
1982	Pahsimeroi	Pabsimeroi	smolt	04/01/84		19	55,803	Pahsimeroi	
1983	Pahsimeroi	Pabsimeroi	smolt	1985			209.152	Pahsimeroi	
1984	Pahsimeroi	Pabsimeroi	smolt	03/15/86		16.5	12,095	Pahsimeroi	
1986	Pahsimeroi	Pahsimeroi	adult	1986			100	Pahsimeroi - above weir	
1985	Pahsimeroi	Pabsimeroi	smolt	1987		16	258,600	Pahsimeroi	
1987	Pahsimeroi	Pahsimeroi	adult	1987			228	Pahsimeroi - above weir	
1986	SFSR[b]/Pahsimeroi	Pabsimeroi	smolt	03/19/88		15.6	598,500	Pahsimeroi	
1988	Pahsimeroi	Pahsimeroi	adult	1988			260	Pahsimeroi - above weir	
1987	SFSR/ Pahsimeroi	Pahsimeroi	smolt	03/19/89		15.9	1.016.300	Pahsimeroi	

Table 1 (TR) (cont.). Hatchery summer chinook releases into the Pahsimeroi River by brood year, 1976-1989. No coded wire tags have been released since brood year 1977.

Brood Year	Brood-stock	Hatchery	Life Stage	Release Date (1)	Release Date (2)	Fish/lb	Number Released	Release Location	CWT
1989	Pahsimeroi	Pabsimeroi	adult	1989			82	Pahsimeroi -above weir	
1988	SFSR/ Pahsimeroi	Pahsimeroi	smolt	03/19/90		16.9	1,058,000	Pahsimeroi	
1990	Pabsimeroi	Pabsimeroi	adult	10/06/90			149	Pahsimeroi -above weir	
1989	Pahsimeroi	Pabsimeroi	smolt	03/13/91	03/22/9 1	15.5	227,500	Pahsimeroi -above weir	

[a] F-F designates a fry or fingerling release.
[b] South Fork Salmon River.

Table 2 (ET-a). Proportion of Pahsimeroi and South Fork Salmon River summer chinook eyed-eggs reared and released at Pahsimeroi Hatchery, brood years 1985-1988.

Brood year	Number of Pahsimeroi eyed-eggs[a]	Percent of total eggs	Number of South Fork Salmon Eyed-eggs[b]	Percent of total
		37		63
1986	432,939	54	370,048	46
				48
1987	1,001,913	52	607,072	24

[a] Pahsimeroi eyed-eggs calculated using number of green eggs and average eye-up survival: 1985 = 92.9%, 1986 = 90.9%, 1987 = 93.1% and 1988 = 95.1%. Eggs measured by water displacement method.
[b] Number as measured by water displacement upon arrival at Pahsimeroi Hatchery.

Sources. Chapman 1990.
Moore 1988, 1989.
B. Moore, IDFG, unpublished.

Table 3 (TS-a). Pahsimeroi Hatchery summer chinook survival at various life stages, brood years 1984-1988.

Brood year	Percent survival green egg to eyed-egg[a]	Percent survival eyed-egg to ponded fingerling	Percent survival ponding to smolt release	Percent survival eyed-egg to smolt release
1984	80.0	69.6	90.4	63.0
1985	92.9	90.6	89.5	81.1
1986	90.9	79.6	93.1	74.2
1987	93.1	87.7	92.5	81.1
1988	90.9	97.2	89.4	86.9

[a] For Pahsimeroi stock only.

Sources: Chapman 1990.
Moore 1988a, 1988b, 1989.
Moore and Rensel 199 1.

Table 4 (TS-a). Percentages of summer chinook smolts released from Pahsirneroi Hatchery that returned as adults for brood years 1968 - 1986.

Brood year	Release date	Fingerlings/ Smolts released	Total returns	Percent return
1969	1970	300,000	479	0.160
1970	1971	250,000	40	0.094
1971	1972	250,000	633	0.016
1972	1973	347,000		0.182
1973	1974	330,000	unk.[a]	unk.
1974	1975	114,000	unk.	unk.
				unk.
1975	1976	121,000	ur43	0.018
1976	1977	238,000	45	0.021
	NR	0		NC.[c]
1979	NR[b]	0	127	NC.
			35	NC.
1980	1983	13,700	113	0.825
1982	1984	55,800	357	0: 640
1983	1985	209,150	1, 91	0.560
1984	1986	12,100	298	0.752
1985	1987	258,600		0.115
1986	1988	598,500	603	0.101

[a] unk. = Unknown adult return because weir was not installed.
[b] NR = No hatchery summer chinook smolts released.
[c] NC = Percent return cannot be calculated because adult returns were from unquantified naturally produced smolts.

Sources: Chapman 1990.
Moore 1982, 1983, 1985, 1988a, 1988b, 1989.
Moore and Rensel 199 1.
B. Moore and J. Rensel, IDFG, unpublished.

Table 5 (PM). Pre-spawning mortality of ponded summer chinook[a] at the Pahsirneroi Hatchery, 1981-1991.

Brood year	Fish trapped (#)	Fish ponded (#)	Mortalities (#)	Prespawning mortality (%)
1981	35	35	1	2.8
1982	39	39	4	10.2
1983	109	109	16	14:X
1984	37	37	6	16.2
1985	83	83	12	14.4
1986	345	245	40	16.3
1987	474	246	42	17.1
1988	763	503	117	23.3
1989	347	265	5	1.9
1990	470	321	5	1.6
1991	238	162	2	1.2

[a] Prespawn mortality calculated as a proportion of fish ponded, not of the entire run because fish released for natural spawning are generally not held in the hatchery.

Sources: Moore 1982, 1983, 1985, 1988a, 1988b, 1989.
Chapman 1990.
Moore and Rensel 1991.
B. Moore and J. Rensel-Hislop, IDFG, unpublished.
B. Moore and J. Rensel, IDFG, unpublished.

Table 6 (AT-a). Timing of the summer chinook run to the Pahsimeroi River weir, 1973-199 1.

Return Year	First fish trapped	Last fish trapped	Percent trapped June	Percent trapped July	Percent trapped August	Percent trapped September
1973	05/19[b]	09/28	7.1		18.6	24.5
1974	07/08	09/24	0.0	47.6 36.6	41.2	22.2
1975	07/02	09/23	0.0		40.5	33.7
1976	07/08	09/21	0.0	25.8 58.4	20.8	20.8
1977	05/20[b]	09/30	7.2	51.6	11.6	26.9
1978[d]						
1979	08/09	09/28	0.0	0.0	9.1	90.9
1980	09/03	09/28	0.0	0.0	0.0	100.0
1981	06/29	09/30	2.8	28.6	8.6	60.0
1982	07/06	09/23	0.0	23.1	35.9	41.0
1983	06/07	09/30	1.9	41.7	32.0	24.4
1984	06/22	09/26	3.7	76.9	3.7	15.7
1985"	07/10	09130	0.0	45.3	18.9	35.8
1986[f]	07/10	09/26	0.0	57.1	35.5	7.4
1987[g]	06/11	09/30	47:o	17.6	23.7	11.7
1988"	06/24	10/10	19.4	54.8	7.1	17.6
1989'	06/24	09/25	9.5	70.8	10.7	9.0
1990	06/19	1 0/06	11.9	70.8	12.6	4.5
1991[j]	07/01	09/25	0.0	78.2	16.4	5.4

[a] These fish are a combination of hatchery and wild summer chinook.
[b] Less than 3 percent of these fish were trapped in May.
[c] Less than 2 percent of these fish were trapped in October.
[d] Trap was not installed.
[e] An additional 1925 fish were trapped from May 25-July 9 that were classified as spring chinook.
[f] An additional 6557 fish were trapped from May 20-July 9 that were classified as spring chinook.
[g] An additional 2175 fish were trapped from May 10-June 10 that were classified as spring chinook.
[h] An additional 391 fish were trapped from May 14-June 23 that were classified as spring chinook.
[i] An additional 73 fish were trapped from May 26-June 23 that were classified as spring chinook.
[j] An additional 6 fish were trapped from June 3-June 30 that were classified as spring chinook.

Source: J. Rensel-Hislop, IDFG, unpublished.

Table 7 (RH-1). Return of summer chinook to the Pahsimeroi weir, brood years 1969-1976."

	Total Age				
Brood Year	3	4	5	Total	Total adult
1969	40	425	14	479	439
1970	20	138	76	234	214
1971	3	5	32	40	37
1972	8	189	436	633	625
1973	53	115	unk.[b]	unk.	unk.
1974	7	unk.	32	unk.	unk.
1975	unk.	0	4	unk.	4
1976	1	29	13	43	42

[a] Returning fish are a combination of hatchery and naturally produced fish. In this nomenclature, the freshwater and ocean ages sum to the total age of the fish. Weir and adult trap count was sample method. Ocean age reported from the Pahsimeroi Hatchery database (unpublished). No length criteria were available.
[b] Adult trap was not installed in 1978.

Source: J. Rensel-Hislop, IDFG, unpublished.

Table 8 (RH-2). Return of summer chinook to the Pahsirneroi River weir, brood years, 1977- 1988".

Total Age

Brood Year	3	4	5	Total	Adult Total
1977	13	24	8	45	32
1978	4	27	90	121	117
1979	4	3	10	17	13
1980	8	16	11	35	27
1981	11	72	30	113	102
1982	27	278	52	357	330
1983	37	409	716	1,162	1,125
1984	13	47	31	91	78
1985	75	181	42	298	223
1986	135	389	79	603	468
1987	39	139	inc.[b]	inc.	inc.
1988	20	inc.	inc.	inc.	inc.

[a] Returning fish are a combination of hatchery and naturally produced summer chinook. Weir and adult trap count was sample method. Total age based on 2 year freshwater rearing and ocean age delineated by fork length criteria derived from hatchery reports and personal communication as follows:

1980: l-ocean= <22"; 2-ocean= 22-34"; 3-ocean=>34".
1981-1982: l-ocean= (22"; 2-ocean= 23-34"; 3-ocean=>34".
1983: l-ocean= (22"; 2-ocean=23-32"; 3-ocean=>32".
1984: l-ocean= (23"; no citations for other age classes - used 34" as age break.
1985: l-ocean= <56 cm; 2-ocean= 56-82 cm; 3-ocean= >82 cm.
1986: l-ocean= <60 cm; 2-ocean= 60-82 cm; 3-ocean=> 82 cm.
1987: l-ocean= <61 cm; 2-ocean= (male) 65-85 cm, (female) >89 cm; 3-ocean= (male) >92 cm, (female) >88 cm.
1988: l-ocean= ≤64 cm; 2-ocean= 65-83 cm; 3-ocean = >83 cm.
1989: l-ocean= <65 cm; 2-ocean= (male) 65-85 cm, (female) <84 cm; 3-ocean= (male) >85 cm, (female) >83 cm.
1990: J= (64 cm'; 2-ocean= 65-82 cm; 3-ocean= ≥83 cm. [a] 5 males >64 cm also classified as jacks.
1991: l-ocean= ≤61 cm, 2-ocean= 62-82 cm; 3-ocean ≥83 cm.

[b] inc. = incomplete brood year information.

Sources: Moore 1980, 1984, 1985.
Chapman 1990.
Moore and Rensel 1991.
B. Moore and J. Rensel, IDFG, unpublished.
B. Moore and J. Rensel-Hislop, IDFG, unpublished.

Table 9 (AL-a). Pahsimeroi River summer chinook fork lengths, 1986-1991.

Length cm.	1991 No. fish	1990 No. fish	1989 No. fish	1988 No. fish	1987 No. fish	1986 No. fish
< 40		[a]				
40				1		
41						
42			3			
43						
44			4	1		
45		1	2			
46	1		7	1		
47	5	2	1			
48			14	8		
49		2	9	5		
50			8	5		
51	2		11	7		
52	1		13	6		
53		2	4	13		
54		2	6	8		
55			10	1		
56	2		7	2		
57	3		6	2		
58	2	1	7	4		
59	1	1	6	1		
60		1	6	1	2	
61		2	7	5	2	
62		3	2		4	
63		8	1	1		
64	1	11	2	3		
65	3	7	4	1		
66	4	11	1	2	2	1
67	8	11	6		2	2
68	4	9	6		7	5
69	3	19	1	2	8	7
70	6	19	4	4	6	5
71	10	20	10	1	9	8
72	6	26	5	2	4	12
73	9	42	10		9	13
74	6	30	6	1	14	38
75	15	31	12	2	11	36
76	8	24	14	2	2	39
77	7	36	19	3	22	22
78	13	35	12	5	13	27
79	11	31	20	3	24	20
80	9	20	19	5	31	18
81	8	14	15	4	13	16
82	6	17	11	8	29	9
83	5	9	1	4	20	3
84	9	4	3	6	44	5
85	12	3	9	21	29	6
86	6	3	4	13	43	5
87	10	7	1	31	20	2
88	8	4	1	39	15	3
89	5	4		38	24	2
90	4	2	2	49	6	
91	1	2		55	10	1
92	6			57	4	1
93	7	1		71	4	
94	2	3	2	56	11	
95	2			59	4	1
96			2	38		1
97			1	32	5	
98	2		1	31	2	
99			2	19		
100			1	22		
101				17	4	
102		1		13	2	
103			2	14		
104		1	2	5		
105			2	12		
>106				18		

[a] Blanks indicate no fish of this size collected and measured.

Sources: Chapman 1990.
Moore 1989.
Moore and Rensel 1991.
B. Moore and J. Rensel, IDFG, unpublished.
B. Moore and J. Rensel-Hislop, IDFG, unpublished.

Table 10 (AC-l). Age composition percentage (freshwater.ocean) by brood year for summer chinook returning to the Pahsimeroi River weir, 1969-1972[a].

		Age Composition (%)		
Brood year	N	2.1	2.2	2.3
1969	479	8.4	88.7	2.9
1970	234	8.5	59.0	32.5
1971	40	7.5	12.5	80.0
1972	633	1.3	29.8	68.9

[a] Returning fish are a combination of hatchery and naturally produced fish. In this nomenclature, the freshwater and ocean ages sum to the total age of the fish. Weir and adult trap count was sample method. Ocean age reported from Pahsimeroi Hatchery database (unpublished). No length criteria were available.

Source: J. Rensel-Hislop, IDFG, unpublished.

Table 11 (AC-2). Age composition percentage (freshwater.ocean) for summer chinook returning to the Pahsimeroi River weir, brood years 1977-1986.

Age Composition (%)

Brood Year	N	2.1	2.2	2.3
1977	45	28.9	53.3	17.8
1978	121	3.3	22.3	74.4
1979	17	23.5	17.6	58.9
1980	35	22.9	45.7	31.4
1981	113	9.7	63.7	26.5
1982	357	7.5	77.9	14.6
1983	1,162	3.2	35.2	61.6
1984	91	14.3	51.6	34.1
1985	298	25.2	60.7	14.1
1986	603	22.4	64.5	13.1

[a] Returning fish are a combination of hatchery and naturally produced summer chinook. In this nomenclature, the freshwater and ocean ages sum to the total age of the fish. Weir and adult trap count was sample method. Ocean age was delineated by fork length criteria, as cited in Table 7.

Sources: Moore 1980, 1984, 1985.
Chapman 1990.
Moore and Rensel 1991.
B. Moore and J. Rensel, IDFG, unpublished.
B. Moore and J. Rensel-Hislop, IDFG, unpublished.

Table 12 (AS-l). Females by brood year' and age class (freshwater.ocean) as a percentage of the entire brood return (N) of summer chinook returning to the Pahsimeroi River weir.

Females (%)

Brood Year	N	2.1	2.2	2.3	Total % Female
1969	479	0	47.6	1.7	49.3
1970	234	0	32.9	21.8	54.7
1971	40	0	10.0	62.5	72.5
1972	633	0	8.7	30.5	39.2

[a] Returning fish are a combination of hatchery and naturally produced summer chinook. In this nomenclature, the freshwater and ocean ages sum to the total age of the fish. Weir and adult trap count was sample method. Ocean age reported from Pahsimeroi Hatchery database (unpublished). No length criteria were available.

Source: J. Rensel-Hislop, IDFG, unpublished.

Table 13 (AS-2). Females by brood year' and age class (freshwater.ocean) as a percentage of the entire brood return (N) of summer chinook returning to the Pahsimeroi River weir.

Females (%)

Brood Year	N	2.1	2.2	2.3	Total % Female
1977	45	0	8.9	4.4	13.3
1978	121	0	10.7	46.3	57.0
1979	17	0	5.9	29.4	35.3
1980	35	0	8.6	11.4	20.0
1981	113	0	23.0	15.0	38.0
1982	357	0	44.8	7.6	52.4
1983	1,162	0	16.6	31.0	47.6
1984	91	0	27.5	19.8	47.3
1985	298	0	25.5	9.1	34.6
1986	603	0	32.8	8.6	41.4

[a] Returning fish are a combination of hatchery and naturally produced summer chinook. In this nomenclature, the freshwater and ocean ages sum to the total age of the fish. Weir and adult trap count was sample method. Ocean age was delineated by fork length criteria, cited in Table 7.

Sources:
Moore 1980, 1984, 1985.
Chapman 1990.
Moore and Rensel 199 1.
B. Moore and J. Rensel, IDFG, unpublished.
B. Moore and J. Rensel-Hislop, IDFG, unpublished.

Table 14 (AF-a). Mean fecundity by return year for summer chinook returning to the Pahsimeroi weir, 1973-1991.

Return year	Number of females spawned	Number of green eggs	Mean fecundity
1973	91	496,860	5,460
1974	45	219,240	4,872
1975	66	249,546	5,545
1976	175	302,040	4,576
1977		901,410	5,151
1978[a]			
1979[b]			
1980[b]			
1981	4	22,772	5,693
1982	13	75,402	5,800
1983	4	261,188	5,804
1984	24	23,999	5,999
1985		127,332	5,305
1986	106	476,281	4,493
1987	122	696,005	5,704
1988	164	1,053,536	6,424
1989	66	290,400	4,400
1990	151	662,641	4,388
1991	87	437,157	5,025

[a] Trap not installed, no fish spawned.
[b] All summer chinook released upstream, no summer chinook spawned.

Sources: Chapman 1990.
Moore 1981, 1983, 1984, 1985, 1988a, 1988b, 1989.
Moore and Rensel 1991.
B. Moore and J. Rensel, IDFG, unpublished.
B. Moore and J. Rensel-Hislop, IDFG, unpublished.

Table 15 (TD). Parasites and diseases" of Pahsimeroi summer chinook at the Pahsimeroi Hatchery in the Pahsimeroi River, 1982-1988.

Disease Type	Hatchery	Infection
bacteria	Pahsimeroi	*Renibacterium salmoninarum* (Bacterial kidnev disease)
protozoa	Pahsimeroi	*Myxobolus cerebralix* *(Whirling disease)*

[a] Disease history only represents pathogens isolated at the hatchery and not necessarily a disease outbreak.

Sources: Moore 1983, 1984, 1985, 1988a, 1988b, 1989.
Chapman 1990.
Moore and Rensel 1991.

PAHSIMEROI RIVER, SALMON SUBBASIN

Naturally Produced Summer Steelhead

GEOGRAPHIC LOCATION

The Pahsimeroi River is a spring-fed stream meandering 49 miles to join the Salmon River at river mile 304 (Figure 1). The drainage is approximately 845 square miles and is bordered by the Lemhi and Lost River mountain ranges. The Pahsimeroi Valley is mostly privately owned. The valley is heavily irrigated for hay and grazing, particularly in the lower drainage. Most major tributaries are dewatered in the lower reaches during the irrigation season. Water percolates through the alluvial fan in the upper valley and enters the river through ground water and springs lower in the valley. This and the sedimentary geology makes the Pahsimeroi River similar to the Lemhi River. These drainages are more productive than most other streams in the upper Salmon basin.

ORIGIN

Summer steelhead are indigenous to the Pahsimeroi drainage, but information describing the original stock is not available. An adult weir was constructed on the Pahsimeroi River in 1969 but by then, numerous hatchery steelhead adults were returning to the drainage. Wild fish information was not recorded separately. The hatchery run of steelhead was initiated from steelhead broodstock transplanted from the middle Snake River, beginning in 1966. This was done as part of Idaho Power Company's mitigation for the Hells Canyon hydroelectric complex. The first smolt release from mid-Snake broodstock was 65,000 smolts but releases increased to over 1 million hatchery steelhead smolts in 1967.

In 1969, the first year that the Pahsimeroi River adult steelhead return could be enumerated, 52 of the 850 intercepted adults were wild fish (Reingold 1970). Presence of eroded dorsal fms on hatchery fish was the distinguishing character. Natural production has been maintained by releasing steelhead above the Pahsimeroi weir. Steelhead adults were released or outplanted above the weir for natural production most years since 1969. A policy of releasing at least 1/3 of the steelhead run above the weir was implemented in the early 1980's. Prior to 1989, fish released above the weir were a combination of hatchery and naturally produced fish but records prior to 1986 do not indicate the proportion of each. Since 1988, all steelhead released above the weir for natural production have been of natural origin (Table 1). However, because of the sustained hatchery steelhead influence on natural production, this run is classified as natural, rather than wild.

Pahsimeroi River steelhead are considered A-run, primarily based upon the proportion of l-ocean adults and size at age.

DISTRIBUTION

Available spawning and rearing habitat for the Pahsimeroi River was described in the Presence/Absence database (Table 2). This information was developed for the Northwest Power Planning Council for subbasin planning and modeling.

PRODUCTION

There is little information available describing survival and production factors for this run of steelhead. Idaho Department of Fish and Game (IDFG) biologists monitored steelhead parr production in the Pahsimeroi River, 1985-1989. Steelhead parr density averaged 27.4 parr per 100

m^2 and averaged 136.7 percent of estimated carrying capacity (Table 3). Parr carrying capacity ratings for steelhead were derived from the Presence/Absence database used for development of the Salmon Subbasin Plan. Parr densities were determined by snorkel counts and contain a substantial proportion of resident rainbow trout, which cannot be differentiated from steelhead.

ADULT LIFE HISTORY

Adult Escapement

A-run steelhead are generally believed to cross Bonneville Dam prior to August 25. Adult Escapement and specific time of migration for naturally produced Pahsimeroi River steelhead in the ocean, Columbia and Snake rivers has not been determined. The University of Idaho implemented adult timing research in 1991 which should provide more information about Snake River timing (Bjornn et al. 1992).

Harvest

There is no information available regarding the rate of contribution of naturally produced Pahsimeroi River steelhead to ocean or Columbia River steelhead harvest.

Since the mid-1980's, the harvest of steelhead possessing an adipose fin has not been allowed in the Snake River or in Idaho because of low escapement.

Snawner Escapement

Steelhead rarely enter the Pahsimeroi River in the fall. They overwinter in the Salmon and Snake rivers and ascend the Pahsimeroi River in the spring.

The number of A-run steelhead, hatchery and natural combined, released upstream of the Pahsimeroi weir ranged from 36 to 1,605 steelhead, 1980-1991 (Table 5). Escapement of natural steelhead (possessing an adipose fin) above the weir ranged from 26 to 460 steelhead, 1986-199 1 (Table 4).

Timing of steelhead spawning in the Salmon River drainage can span two months, from early April to early June. It appears that adult fish usually enter tributaries after spring freshets. The major period of steelhead spawning begins in mid-April and extends through May when water temperature is above 4.5 C° (Ball 1985a).

Adult Characteristics

Total lengths for naturally produced steelhead are reported for the 1987-1991 return years (Table 6). Lengths of natural steelhead were not reported separately from hatchery steelhead prior to 1987. Brood year information cannot be calculated because the freshwater age of naturally produced steelhead is unknown. Ocean age is determined according to length criteria.

Recent return years have been dominated by 2-ocean returns (Table 7).

The percentage of females in the annual return has generally been about 60 percent (Table 8).

Fecundity of natural Pahsimeroi steelhead has not been measured.

JUVENILE LIFE HISTORY

Life history timing is likely similar to Figure 2. Although not illustrated in the figure, there is typically a fall emigration of steelhead juveniles from tributaries to lower in the Pahsimeroi drainage or mainstem Salmon River for winter rearing. Reingold (1968, 1969) reported trapping wild steelhead juveniles about 2 miles upstream from the mouth of the Pahsimeroi River in 1967 and 1968. The average length of 249 wild steelhead collected March 15-November 28, 1967 was 182 mm total length. The average length of 206 wild steelhead collected in 1968 was 187 mm total length. Reingold (1969) also reported that in 1968, the juvenile steelhead condition factor in January was 1.1.

BIOCHEMICAL/GENETIC CHARACTERISTICS

Information has not been compiled.

DISEASES

Information has not been compiled.

REFERENCES

All Pahsimeroi references appear at the end of the hatchery produced summer steelhead section.

Figure 1. Summer steelhead distribution in the East half of the Salmon River subbasin based on the NPPC presence/absence data base and the BPA Geographic Information System.

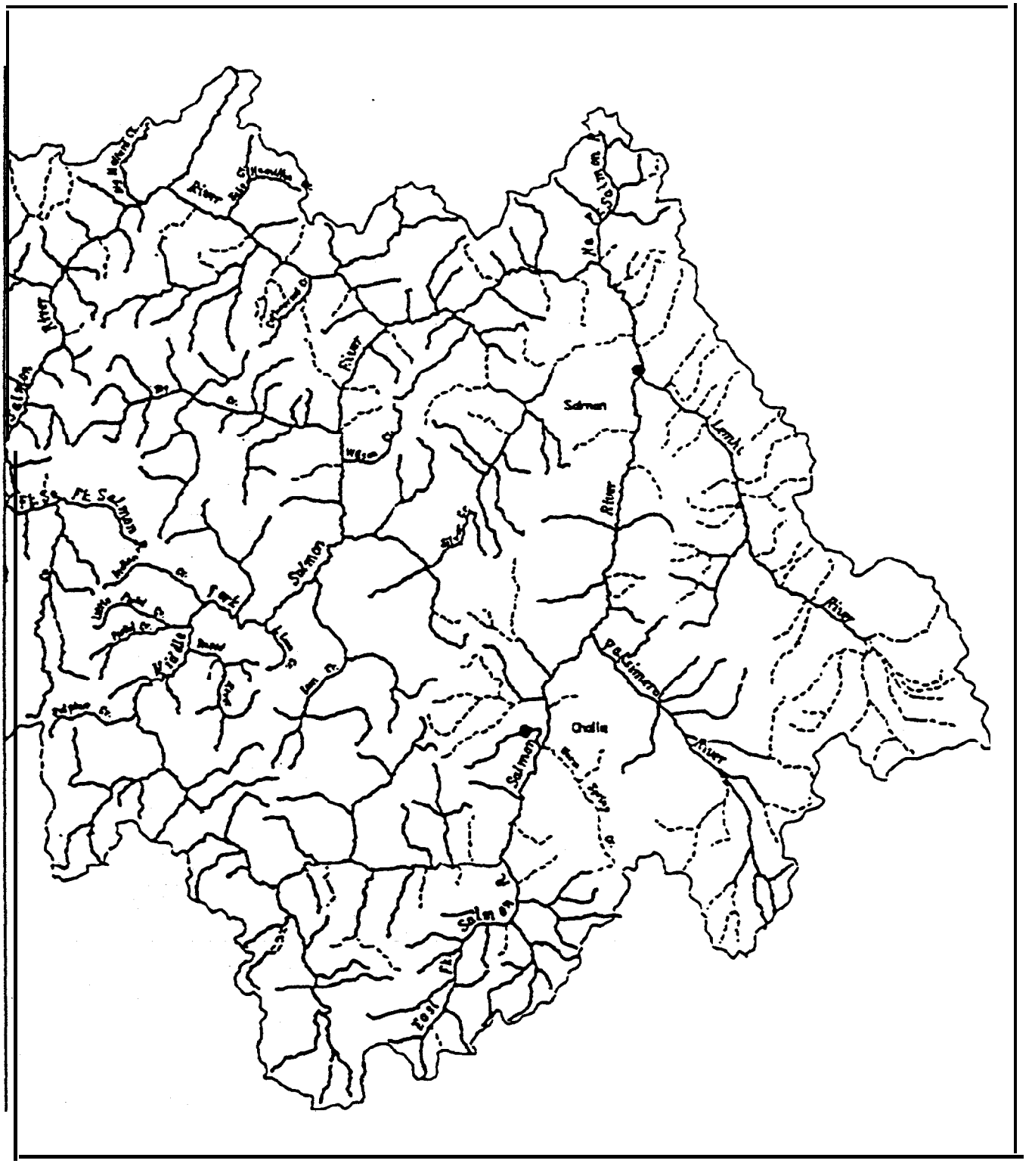
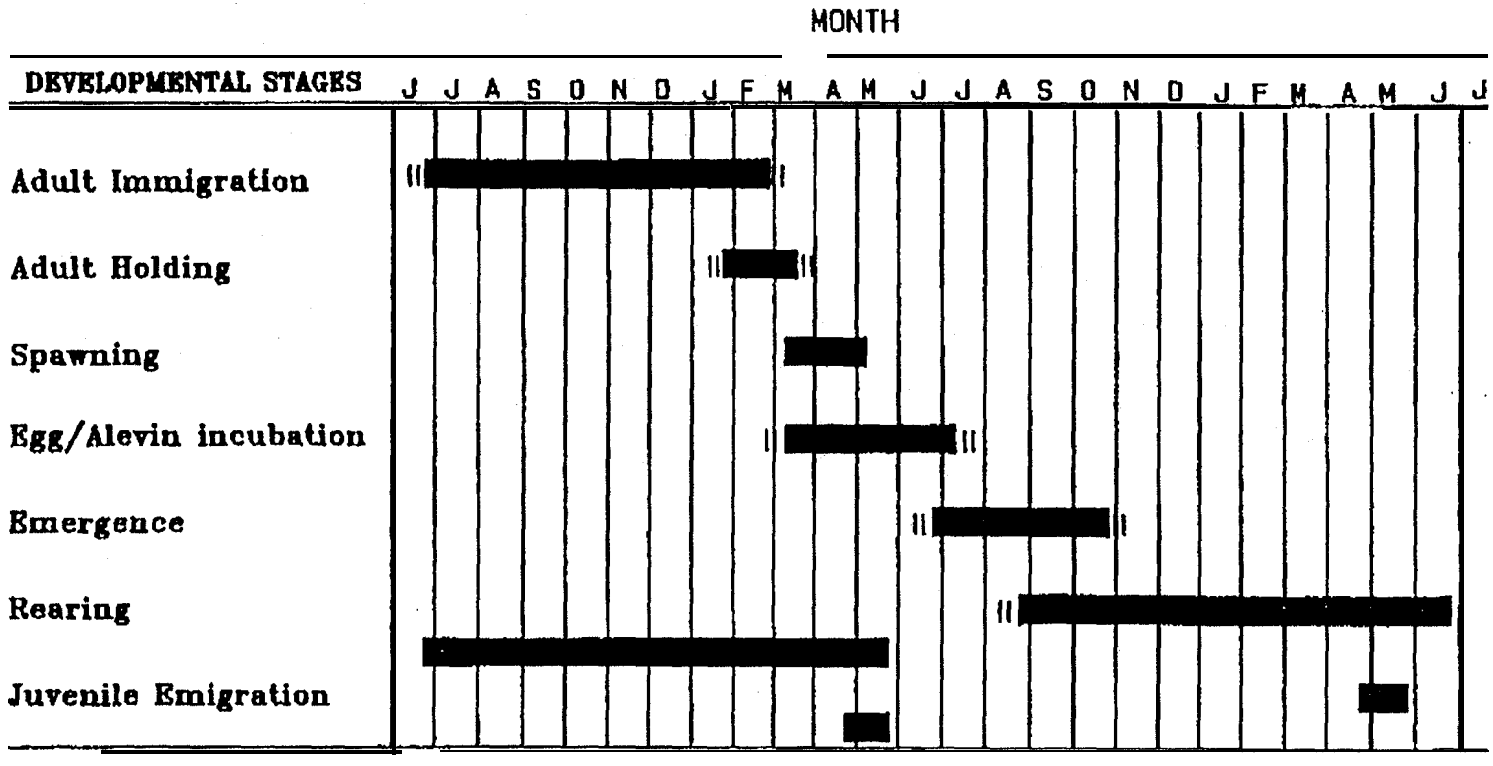


Figure 2 (TT). Freshwater life history for natural/wild steelhead runs in the Salmon River subbasin.



Notes:

1. The developmental stage timing represents basin-wide averages, local conditions may cause some variability.
2. Solid bars indicate periods of heaviest adult immigration, spawning and juvenile emigration.
3. Rearing and juvenile emigration take place over a three year period and are shown above in a rap-around fashion.

Table 1 (RN-a). Percent of naturally produced steelhead released upstream of the Pahsimeroi weir, 1986 - 1991.

Year	Percent of Natural Steelhead
	8.9
1986	16.4
1988	<100[a]
1989	100
	100
1990	100

[a] Data reported as "mostly natural fish" (Moore, IDFG, unpublished).

Sources: J. Chapman, IDFG, unpublished.
B. Moore, IDFG, unpublished.
B. Moore and J. Chapman, IDFG, unpublished.
B. Moore and J. Rensel, IDFG, unpublished.
B. Moore et al., IDFG, unpublished.

Table 2 (HB). Estimated amount of spawning and rearing habitat (Use Type 1) by quality of Pahsimeroi River steelhead production area.

	Excellent	Good	Fair[A]	Poor[A]	Unk.	Total	Confidence[B]
			0				
Miles (%)	45 51	55 49	0	0 0		21 86.7	M M
Acres (%)							

[a] Ratings of fair and poor habitat quality may reflect natural physical features such as gradient and channel type, as well as degradation caused by humans.
[b] 'Confidence' is meant to indicate the reproducibility and accuracy of the estimates made, and will be rated as high, medium or low by the respective agencies.

Source: Presence/Absence database, Northwest Power Planning Council, 1991.

Table 3 (PD). Parr density" and percent of rated carrying capacity (PCC) for steelhead in the Pahsirneroi River drainage.

Stream name	Year	Sample size	Ages 1+ & 2+ density (#/100m[a])	Density std. dev.	PCC for ages 1+ & 2+	Std.dev. for PCC
Pahsimeroi	85	2	36.6	35.3	183.2	176.5
Pahsimeroi	86	2	21.5	16.1	107.2	80.3
Pahsimeroi	87	2	48.6	44.4	243.1	221.9
Pahsimeroi	88	2	8.2	1.5		7.5
Pahsimeroi	89	2	21.9	10.0	109.3 41.2	49.8

[a] Densities estimated by snorkel counts.

Source: B. Rich, IDFG, unpublished.

Table 4 (RN-a). Escapement of naturally produced steelhead to the Pahsimeroi River and the proportion of natural fish in the total run, 1986-1991.

Return year	Total	Males	Females	Total run (N)[a]	Percent natural fish of total run
1986	70	13	57	4,505	1.6
1987	259	120	139	5,033	5.1
1988	460	168	292	1,981	23.2
1989	166	60	106	1,926	8.6
1990	118	47	71	2,092	5.6
1991	26	9	17	719	3.6

[a] Total run (N) is the combination of hatchery and naturally produced fish. Number of naturally produced steelhead was not reported prior to 1986.

Sources: J. Chapman, IDFG, unpublished.
B. Moore, IDFG, unpublished.
B. Moore and J. Chapman, IDFG, unpublished.
B. Moore and J. Rensel, IDFG, unpublished.
B. Moore et al., IDFG, unpublished.

Table 5 (RN-a). Number of steelhead adults released or outplanted upstream of the Pahsimeroi weir to spawn naturally, 1980-1991.

Year	Total[a]	Jacks	Adult Males	Adult Females
1980	36		35	4
1981	266		156	110
1982	425		[b]	[b]
1983	325		150	175
1984	1,605		732	873
1985	843		309	534
1986	782		392	390
1987	1,572		[b]	[b]
1988	401		245	156
1989	166”		60	106
1990	118		47	71
1991	26[c]		9	17

[a] Total includes natural fish.
[b] Sex not delineated.
[c] All fish released were of natural origin.

Sources: Moore 1980.
J. Chapman, IDFG, unpublished.
B. Moore, IDFG, unpublished.
B. Moore and J. Chapman, IDFG, unpublished.
B. Moore and J. Rensel, IDFG, unpublished.
B. Moore et al., IDFG, unpublished.

Table 6 (AL-a). Pahsimeroi natural steelhead total lengths, 1987-1991.

Length cm.	1991 No. fish	1990 No. fish	1989 No. fish	1988 No. fish	1987 No. fish
< 40					
40					
41					
42					
43					
44					
45					
46					
47					
48					
49					
50			1	2	[a]
51					
52				2	
53					1
54				2	3
55			1	1	3
56				4	6
57	2		3	I0	7
58	1	1	2	13	15
59	3	3	2	17	28
60	1	5	7	20	17
61		5	6	34	11
62		5	9	40	30
63		6	6	31	14
64		1	5	31	19
65		4	5	35	I0
66		3	6	31	7
67		3	1	16	3
68	1	6	I0	21	2
69	2	6	9	20	3
70	3	4	6	26	4
71	4	7	11	11	8
72	1	3	8	19	10
73	2	5	16	18	12
74	2	I0	12	13	9
75		9	14	I0	8
76		8	7	2	11
77		8	5	6	5
78		5	4	7	12
79		1	1	3	1
80		1	2	4	
81		2		3	
82		2	2	2	
a3		1	1	1	
84		1	1		
85			3		
86		1		3	
87					
88		2		1	
89					
90				1	

[a] Blanks indicate no fish this size collected and measured.

Sources: J. Chapman, IDFG, unpublished.
B. Moore and J. Rensel, IDFG, unpublished.
B. Moore et al., IDFG, unpublished.

Table 7 (AC-a). Ocean age proportions by return yea.? for natural steelhead returning to the Pahsimeroi River.

Return year	Ocean Age (%) 1 (%)	2(%)	N
1987	175 (67.6)	84 (32.4)	259
1988	303 (65.9)	157 (34.1)	460
1989	59 (35.5)	107 (64.5)	166
1990	41 (34.7)	77 (65.2)	118
1991	10 (38.5)	16 (61.5)	26

"Freshwater age is unknown so brood year cannot be determined. Pahsimeroi River weir count was sample method. Ocean age delineated by fork length criteria as cited in the following:

1986: Male l-ocean = ≤ 69 cm
Male 2-ocean = 70-81 cm
Female l-ocean = ≤ 66 cm
Female 2-ocean = 67-77 cm
(B. Moore, IDFG, unpublished).

1987-: Male l-ocean = ≤ 69 cm total length
1988 Male 2-ocean = > 69 *cm* total length
(B. Moore, IDFG, unpublished).

1989-: Male ≤ 69.5 cm total length
1990 Female ≤ 66.5 cm total length
(B. Moore, et al., IDFG, unpublished).
B. Moore and J. Rensel. IDFG. unpublished).

1991: Male ≤ 67 cm total length
Female ≤ 65 cm total length

Sources: Moore 1980.
J. Chapman, IDFG, unpublished.
B. Moore, IDFG, unpublished.
B. Moore and J. Rensel, IDFG, unpublished.
B. Moore et al., IDFG, unpublished.

Table 8 (AS-a). Percent females by return year[a] and ocean age class for natural steelhead returning to the Pahsimeroi River.

Return year	N	Percent 1-ocean female	Percent 2-ocean female	Percent female total
1987	259	40.1	13.5	53.6
1988	460	36.7	26.7	63.4
1989	166	17.5	46.4	63.9
1990	118	14.4	45.8	60.2
1991	26	19.2	46.1	65.3

[a]Pahsimeroi River weir count was sample method. Ocean age delineated by fork length criteria, cited in Table 7. Freshwater age is unknown so brood year cannot be determined.

Sources: Moore 1980.
J. Chapman, IDFG, unpublished.
B. Moore, IDFG, unpublished.
B. Moore and J. Rensel, IDFG, unpublished.
B. Moore et al., IDFG, unpublished.

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PAHSIMEROI RIVER, SALMON SUBBASIN

Hatchery Produced Summer Steelhead

GEOGRAPHIC LOCATION

The Pahsimeroi River is a spring-fed stream meandering 49 miles to join the Salmon River at river mile 304. Pahsimeroi Hatchery is located about 1 mile upstream from the mouth of the Pahsimeroi River. The facilities include an adult trap and weir on the Pahsimeroi River which intercepts all chinook and steelhead when in operation. Pahsimeroi Hatchery utilizes both river and ground water for rearing fish.

Niagara Springs Hatchery is located in the Snake River Canyon near Wendell, Idaho. The hatchery utilizes spring water which is a constant 58°F. Smolts are reared in raceways and trucked back to the Pahsimeroi River for release, a distance of approximately 230 miles.

Hatchery summer steelhead entering the Pahsimeroi River are collected and spawned at Pahsimeroi Hatchery, which is owned and funded by Idaho Power Company. Idaho Department of Fish and Game (IDFG) operates this facility, which has been in production since the mid-1960's. The hatchery is part of the mitigation for anadromous fish production lost due to construction of the Hells Canyon Dam complex on the Snake River.

Production of steelhead smolts for release into the Pahsimeroi River occurs primarily at Niagara Springs Hatchery. Pahsimeroi steelhead eggs have also been reared at other hatcheries in Idaho, including Hager-man National Fish Hatchery and Magic Valley Hatchery. The progeny from these other rearing hatcheries have often been destined for release sites other than the Pahsimeroi River. Niagara Springs is also owned and financed by Idaho Power Company as part of mitigation for the Hells Canyon Dam complex. The hatchery is operated by IDFG.

The purpose of the Pahsimeroi and Niagara Springs hatchery complex was to relocate a portion of the Snake River steelhead run into the Salmon River and enhance the steelhead run below Hells Canyon Dam.

ORIGIN

Pahsimeroi and Niagara Springs hatcheries were constructed as part of a program to transfer the middle Snake River steelhead run to the Salmon River drainage. The hatchery run of steelhead was initiated from wild steelhead collected from the middle Snake River beginning in 1966. These fish were collected at Hells Canyon Dam and originally inhabited waters of the upper Snake such as the Weiser and Powder rivers. Middle Snake river steelhead were considered A-run, primarily based on the proportion of l-ocean adults and size at age.

Hatchery steelhead smolts were first released into the Pahsimeroi River in 1966. The first smolt release from mid-Snake broodstock was 65,000 smolts but releases increased to over 1 million hatchery steelhead smolts in 1967. Broodstock was collected from Hells Canyon Dam until at least 1969, when completion of a weir and adult trap allowed collection of adult steelhead from the Pahsimeroi River. Since then, steelhead collected at the Pahsimeroi weir have been the primary source of broodstock.

In 1974, managers released Clearwater River B-run steelhead smolts from Dworshak National Fish Hatchery into the Pahsimeroi River. These fish were characterized by a large proportion of 2-ocean

fish and larger size at age. The B-run fish were substituted for Pahsimeroi progeny lost when the steelhead at Niagara Springs Hatchery suffered an infectious pancreatic necrosis (IPN) epizootic and were destroyed. Managers continued to stock B-run smolts from Dworshak National Fish Hatchery in the late 1970's and early 1980's as part of management and a variety of research projects. B-run steelhead returning to the Pahsimeroi River were also spawned and reared. Because of length and timing overlap, crosses between A-run and B-run adults were likely during the hatchery spawning. Stocking of B-run progeny into the Pahsimeroi River was discontinued in 1983. Remaining Pahsimeroi Hatchery B-run adults and progeny were transferred to the East Fork Salmon River program (IDFG et al. 1990). Because the use of B-run steelhead in the Pahsimeroi River has been discontinued, the program and stock characteristics are not further described. All steelhead referred to in this chapter, unless specified, are considered A-run summer steelhead.

DISTRIBUTION

Table 1 lists hatchery steelhead releases into the Pahsimeroi River for brood years 1975-1989. Coded wire tag (CWT) codes are identified for brood years 1986-1990. Hatchery released steelhead presmolts and smolts are adipose fm clipped. Coded wire tagged fish are marked with a left ventral fm clip. Other marks or tag releases have not been compiled. Smolts are released just below the weir, directly into the Pahsimeroi River.

PRODUCTION

The mitigation goal of Niagara Springs Hatchery is to rear 400,000 pounds of steelhead, of which 200,000 pounds is targeted for release into the Salmon River. Target smolt size is 3-5 smolts to the pound.

Timing of hatchery rearing is shown in Figure 1.

Egg

Eye-up of green eggs at Pahsimeroi Hatchery for brood years 1981-1991 ranged from 72-O-96.3 percent and averaged 84.7 percent (B. Moore. IDFG, unpublished; B. Moore et al., IDFG, unpublished; B. Moore and J. Chapman, IDFG, unpublished; B. Moore and J. Rensel, IDFG, unpublished; J. Chapman, IDFG, unpublished).

Frv-fingerling

Eyed egg to fry survival since brood year 1980 has generally been higher than 85 percent (Quidor 1980; Quidor 1981; Quidor 1984; Miller 1988). However, there was a heavy outbreak of infectious hematopoietic necrosis (IHN) in the spring of 1982 and Pahsimeroi steelhead fry mortality reached 89.1 percent by the end of September (Billman 1983).

Eyed egg to fry survival at Niagara Springs Hatchery was 92.3 percent for brood year 1989 Pahsimeroi Hatchery A-run steelhead (Baker and Mowery 1991).

Smolt

The percent survival of hatchery steelhead from eyed-egg to release for brood years 1981-1990 ranged 38.8-90.8 percent and averaged 66.4 percent at Niagara Springs Hatchery (Table 2). These survival percentages include releases prior to the smolt stage for some years. Progeny were primarily from Pahsimeroi broodstock.

In-basin smolt survival has not been quantified. Preliminary information indicates that of 500 Pahsimeroi steelhead PIT-tagged at Niagara Springs Hatchery in 1990, 312 (62.4 percent) were detected at Lower Granite Dam in 1991, and 367 (73.4 percent) were detected at Lower Granite, Little Goose or McNary dams (Cannamela, IDFG, unpublished).

Howell et al. (1985) reported that major influences on smolt to adult return were fish health at release, emigration conditions, and adult harvest rate. For brood years 1966-1978, the adult return to the Salmon River of Pahsimeroi hatchery steelhead smolts ranged from 0.02-0.7 percent (Howell et al. 1985). These survival estimates included adult steelhead harvested in the Salmon River sport harvest. The low value of 0.02 percent resulted from downstream migration during the 1973 drought which caused almost a total loss of migrating smolts.

The percent smolt-to-adult return for brood year 1980 and 1981 steelhead which were coded wire tagged and reared at Niagara Springs was 0.2 1 and 0.62 percent, respectively (Table 3).

The percent smolt-to-adult return for three groups of brood year 1978 CWT steelhead reared at Hagerman National Fish Hatchery and released in the Pahsimeroi River ranged from 0.2-0.4 percent.

The average smolt-to-adult return for brood years 1979-1987 was 0.47 percent and ranged from 0.22-l .35 percent (Table 4). These survival estimates only include fish collected at the Pahsimeroi weir. They do not include fish harvested prior to the weir.

Adult

Prespawning mortality of steelhead ponded for spawning at Pahsimeroi Hatchery was less than one percent for brood years 1987-1991 (J. Chapman 1990; Moore and Rensel 1991; B. Moore and J. Rensel, IDFG, unpublished; B. Moore et al., IDFG, unpublished).

ADULT LIFE HISTORY

Adult Escapement

Specific time of migration and escapement for Pahsimeroi River hatchery steelhead in the ocean, and Columbia and Snake rivers has not been compiled. A-run steelhead are generally believed to cross Bonneville Dam prior to August 25. Harvest recoveries in the Deschutes River have occurred July through October. Harvest recoveries in the Salmon River have occurred February through April and September through November (Howell et al. 1985). Adult timing research implemented by the University of Idaho in 1991 should provide more information about Snake River timing (Bjornn 1992).

Harvest

Information has not been completely summarized regarding rate of contribution of Pahsimeroi River hatchery steelhead to ocean, or Columbia or Snake rivers steelhead harvest. Harvest information derived from CWTs from brood years 1979-1980 shows the majority of harvest occurred in the Idaho sport harvest and Zone 6 Treaty fishery (Table 5).

This run supports a large part of the steelhead harvest in the mainstem Salmon River. The Pahsimeroi River is not open to sport steelhead harvest. Howell et al. (1985) reported Salmon River sport harvest contribution for brood years 1965-1979. Ball (1985b) reported that 71 percent

of the steelhead harvest in the Salmon River for the 1981-82 season was likely of Pahsimeroi hatchery origin. He found that exploitation averaged 50.6 percent through 1983 for returns of Pahsimeroi hatchery steelhead.

Spawner Escapement

Few hatchery steelhead enter the Pahsimeroi River in the fall. They overwinter in the Salmon and Snake Rivers and ascend the Pahsimeroi River in the spring. The major portion of this run is trapped in March and April (Table 6). However, prior to 1979, generally 5 percent or more of the run returned in May. This proportion decreased through time, with more fish returning earlier until 1991, when 3.5 percent of the run returned in May.

Howell et al. (1985) reported the returns of steelhead to the Pahsimeroi River for brood years 1966-1978. He included sport harvest and hatchery returns. For brood years 1979-1987, escapement of hatchery steelhead to the Pahsimeroi weir ranged from 1,534-14,303 (Table 7). For the more recent brood years, total escapement, including harvest, has not been calculated. As noted in this table, ocean age has been assigned based on length frequency, not on known-age techniques. Thus, assignment of ocean age is an estimate, and not based on known-age techniques. Ocean conditions such as El Nino have been cited as playing a part in size at return.

The Salmon Subbasin Plan (IDFG et al. 1990) cited annual steelhead returns to the Pahsimeroi weir ranging from 1,624 to 13,786 for 1980-1987, including naturally produced steelhead intercepted at the weir. Annual returns of just hatchery steelhead for 1988-1991 were 1,521; 1,760; 1,974; and 693 steelhead, respectively (Chapman, IDFG, unpublished; Moore, IDFG, unpublished; Moore and Rensel,IDFG, unpublished).

Howell et al. (1985) noted that spawning at Pahsimeroi Hatchery commenced as early as March 10 and as late as April 12. From 198 1-1991, spawning at the hatchery has begun in mid to late March.

Adult Characteristics

Weights of returning hatchery steelhead are not available. Length frequency of hatchery steelhead returning 1987-1991 ranged 50-89 cm, total length (Table 8).

Howell et al. (1985) reported that as high as 91 percent and as low as 49 percent of a brood year has returned as one-ocean fish. The average one-ocean component for brood years 1965-1979 was 76 percent.

For brood years 1979-1987, the one-ocean component ranged from 29.2-82.0 percent of a brood year and it averaged 59.3 percent over this period (Table 9).

For brood years 1980-1981, the one-ocean component of CWT steelhead ranged from 73.5-91.2 percent (Table 10).

Howell et al. (1985) reported the sex ratios of returning adults for annual runs 1980-1983. The annual percentage of females in the combined runs for the four years was 58.8 percent.

The percentage females for brood years 1979-1987 ranged from 48.3-66.9 percent and averaged 56.8 percent (Table 11).

The average number of eggs per female ranged from 3,625 to 5,948 for 1980-199 1 (Table 12).

Average fecundity for the 12 years combined was 4,893. In 1987, Pahsimeroi Hatchery personnel spawned one-ocean and two-ocean females separately. Average number of eggs per one-ocean female was 4,344. Average number of eggs per two-ocean female was 6,313 (Moore, IDFG, unpublished).

Egg counting methodology has changed from the Von Bayer method to water displacement. Since 1990, an electronic egg counter has been used by hatchery personnel.

JUVENILE LIFE HISTORY

One year old smolts are transported by truck from the Snake River Valley to the Pahsimeroi River. Smolts have been released in mid-April since the late 1980's. Hatchery steelhead smolts do residualize and contribute to the resident fishery in the Pahsimeroi River. The rate of residualism is unknown, but probably varies with rearing and environmental conditions.

BIOCHEMICAL/GENETIC CHARACTERISTICS

No information has been compiled.

DISEASES

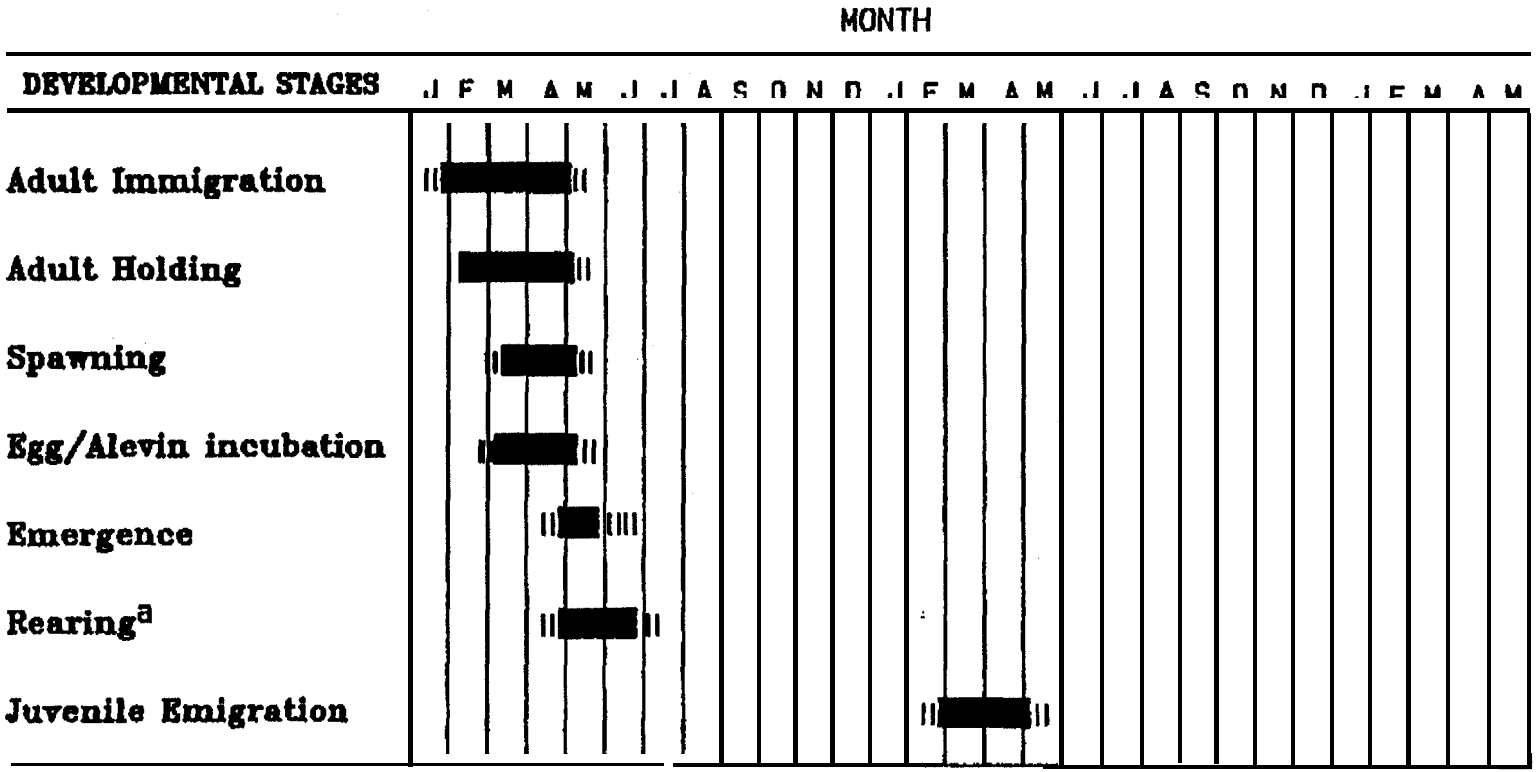
Diseases of management concern, such as those potentially limiting fish transfers, which have caused mortalities at the Pahsimeroi Hatchery in recent years include several viruses (Table 15). Diseases noted at the rearing hatcheries, primarily Niagara Springs, have also been included. Howell et al. (1985) reported that two viral diseases have caused periodic acute problems at Niagara Springs. Infectious pancreatic necrosis (IPN) led to the intentional destruction of the 1973 brood year production. Infectious hematopoietic necrosis (IHN) significantly reduced production in 1981 and 1982.

Diseases noted in hatchery records since brood year 1983 include Furunculosis, Bacterial gill disease, Cytophaga psychrophila, Myxobacteria and Columnaris. Through detected, none appear to have caused significant loss of steelhead production.

REFERENCES

All Pahsimeroi references appear at the end of this summer steelhead section.

Figure 1 (TT). Freshwater life history for steelhead spawned and reared at the Pahsimeroi Hatchery.



Notes:

1. The developmental stage timing represents basin-wide averages, local conditions may cause some variability.
2. Solid bars indicate periods of heaviest adult immigration, spawning and juvenile emigration.

[a] Fish released as fry. Denotes hatchery rearing only.

Table 1 (TR). Hatchery steelhead releases into the Pahsimeroi River by brood years, 1981-1990. Coded wire tag codes displayed for broc 1 years 1986-1990.

Brood Year	Brood-stock	Hatchery	Life Stage	Release Date (1)	Release Date (2)	Fish/lb	Number Released	Release Location	CWT
1981	Pahsimeroi A	Hagerman NFH	smolt	03/30/82	04/07/82	2.5	60,784	Pahsimeroi	
1981	Pahsimeroi B[a]	Hagerman NFH	smolt	04/01/82	04/07/82	3.8	58.281	Pahsimeroi	
1981	Pahsimeroi A	Niagara Springs	smolt	1982			995,205	Pahsimeroi	
1982	Pahsimeroi A	Pahsimeroi	F-F[b]	1982			399,872	Pahsimeroi	
1982	Pahsimeroi A	Pahsimeroi	adult”	1982			425	Pahsimeroi above weir	
1982	Pahsimeroi A	Niagara Springs	smolt	1983			496,140	Pahsimeroi	
1982	Pahsimeroi A	Hagerman NFH	smolt	02/28/83	03/01/83	3.1	84,194	Pahsimeroi	
1982	Pahsimeroi A	Magic Valley	smolt	1983			40,681	Pahsimeroi	
1983	Pahsimeroi A	Niagara Springs	pre-smolt	1983/Fall			228,800	Pahsimeroi	
1983	Pahsimeroi A	Pahsimeroi	F-F	1983			167,500	Pahsimeroi	
1983	Pahsimeroi A	Pahsimeroi	adult”	1983			200	Pahsimeroi above weir	
1983	Pahsimeroi A	Pahsimeroi	adult	1983			125	Spring Cr.	
1984	Pahsimeroi A	Pahsimeroi	adult[c]	1984			780	Pahsimeroi above weir	
1984	Pahsimeroi A	Pahsimeroi	adult	1984			825	Spring Cr.	
1983	Pahsimeroi A	Niagara Springs	smolt	1984			752.195	Pahsimeroi	

Table 1 (TR) (cont.). Hatchery steelhead releases into the Pahsimeroi River by brood years, 1981-1990. Coded wire tag codes displayed for brood years 1986-1990.

Brood Year	Brood-stock	Hatchery	Life Stage	Release Date (1)	Release Date (2)	Fish/lb	Number Released	Release Location	CWT
1984	Pahsimeroi A	Niagara Springs	smolt	1985			878,530	Pahsimeroi	
1984	Pahsimeroi A	Niagara Springs	smolt	1985			156,742	Pahsimeroi E. Fk.	
1985	Pahsimeroi A	Pahsimeroi	F-F	1985			253,950	Pahsimeroi	
1985	Pahsimeroi A	Pahsimeroi	adult‘	1985			543	Pahsimeroi above weir	
1985	Pahsimeroi A	Pahsimeroi	adult	1985			300	Spring Cr.	
1985	Pahsimeroi A	Niagara Springs	smolt	1986			614,038	Pahsimeroi	
1986	Pahsimeroi A	Pahsimeroi	F-F	1986			115,900	Pahsimeroi above weir	
1986	Pahsimeroi A	Pahsimeroi	adult[c]	1986			800	Pahsimeroi	
1986	Pahsimeroi A	Niagara Springs	smolt	03/30/87	04/01/87	4.0	25,200	Pahsimeroi	102950
1986	Pahsimeroi A	Niagara Springs	smolt	03/30/87		4.1	9.625	Pahsimeroi	102960
1986	Pahsimeroi A	Niagara Springs	smolt	03/30/87	04/01/87	4.0	677,375	Pahsimeroi	Untagged
1987	Pahsimeroi A	Pahsimeroi	adult”	1987			1,573	Pahsimeroi above weir	
1987	Pahsimeroi A	Pahsimeroi	F-F	1987			268,950	Pahsimeroi	
1987	Pahsimeroi A	Niagara Springs	smolt	04/08/88	04/14/88	4.5	32,369	Pahsimeroi	102955
1987	Pahsimeroi A	Niagara Springs	smolt	04/08/88	04/14/87	4.5	633,43 1	Pahsimeroi	Untagged

Table 1 (TR) (cont.). Hatchery steelhead releases into the Pahsimeroi River by brood years, 1981-1990. Coded wire tag codes displayed for brood years 1986-1990.

Brood Year	Brood-stock	Hatchery	Life Stage	Release Date (1)	Release Date (2)	Fish/lb	Number Released	Release Location	CWT
1988	Pahsimeroi A	Pahsimeroi	F-F	1988			110,000	Pahsimeroi	
1988	Pahsimeroi A	Pahsimeroi	adult”	1988			401	Pahsimeroi above weir	
1988	Pahsimeroi A	Niagara Springs	smolt	04/07/89	04/13/89	4.8	14,465	Pahsimeroi	104150
1988	Pahsimeroi A	Niagara Springs	smolt	04/07/89	04/13/89	4.8	13.334	Pahsimeroi	104151
1988	Pahsimeroi A	Niagara Springs	smolt	04/07/89	04/13/89	4.8	13,107	Pahsimeroi	104152
1988	Pahsimeroi A	Niagara Springs	smolt	04/07/89	04/13/89	4.8	5,393	Pahsimeroi	104153
1988	Pahsimeroi A	Niagara Springs	smolt	04/07/89	04/13/89	4.8	462,001	Pahsimeroi	Untagged
1989	Pahsimeroi A	Pahsimeroi	adult[d]	1989	1989		166	Pahsimeroi	
1989	Pahsimeroi A	Niagara Springs	smolt	04/10/90	04/11/90	4.2	14,909	Pahsimeroi	104221
1989	Pahsimeroi A	Niagara Springs	smolt	04/10/90	04/11/90	4.2	14,339	Pahsimeroi	104222
1989	Pahsimeroi A	Niagara Springs	smolt	04/10/90	04/11/90	4.2	15,127	Pahsimeroi	104223
1989	Pahsimeroi A	Niagara Springs	smolt	04/10/90	04/11/90	4.2	457.225	Pahsimeroi	Untagged
1990	Pahsimeroi A	Magic Valley	smolt	04/18/90	04/19/90	3.8	135,100	Pahsimeroi	
1990	Pahsimeroi A	Pahsimeroi	adult	04/24/90			118	Pahsimeroi	
1990	Pahsimeroi A	Niagara Springs	smolt	04/08/91	04/09/91	3.4	20,550	Pahsimeroi	104323

Table 1 (TR) (cont.). Hatchery steelhead releases into the Pahsimeroi River by brood years, 1981-1990. Coded wire tag codes displayed for brood years 1986-1990.

Brood Year	Brood-stock	Hatchery	Life Stage	Release Date (1)	Release Date (2)	Fish/lb	Number Released	Release Location	CWT
1990	Pabsimeroi A	Niagara Springs	smolt	04/11/90	04/13/91	3.6	22,328	Pahsimeroi	104327
1990	Pahsimeroi A	Niagara Springs	smolt	04/13/91	04/14/91	3.8	22,395	Pahsimeroi	104328
1990	Pahsimeroi A	Niagara Springs	smolt	04/08/91	04/14/91	3.6	409,727	Pahsimeroi	Untagged

[a] Originally transferred from Dworshak NFH.
[b] F-F designates a fry or fingerling release.
[c] Adults released above the weir are a mixture of hatchery and naturally produced fish.
[d] Adults released above the weir are naturally produced.

Table 2 (TS-a). Niagara Springs production history for brood years 1981-1990.

Production season	Egg total	Total mortality	Number released	Percent eyed-egg to release survival
1980-81	2,195,426	720,172	1,475,254	67.2
1981-82	2,302,370	953,015	1,349,355	58.6
1982-83	2,929,527	1,794,387	1,135,140	38.8
198344	3,459,008	1,849,313	1,609,695	46.5
1984-85	2,932,164	706,071	2,226,093	75.9
1985-86	2,914,492	903,999	2,010,493	69.0
1986-87	2,274,371	422,476	1,851,895	81.4
1987-88	2,929,069	775,569	2,153,500	73.5
1988-89	2,680,332	1,014,132	1,666,200	62.2
1989-90	2,759,192	252,892	2,506,300	90.8
10-year average	2,737,595	939,203	1,798,392	66.4

Source: Baker and Mowery 199 1.

Table 3 (TR-a). Returns of coded wire tagged hatchery A-run steelhead to the Pahsimeroi River'.

Tag code	Brood year	Year released	Number tagged released	Size released (#/lb)	Purpose	Site released	Returns 1981	1982	1983	1984	1985	1986	1987	1988	1989	Total returns	Percent
10/22/39	1980	1981	49,550	3.7	Id. stock eval.	Pahsimeroi R.	- -	94	9	0	-	-	-	-	103	0.21
05/10/20	1981	1982	58,950	2.5	Id. stock eval.	Pahsimeroi R.	- - -	269	97	0	-	-	-	366	0.62

[a] Fish were reared at Hagerman National Fish Hatchery.

Source: Cannamela 1991.

Table 4 (TS-a). Percentages of hatchery A-run steelhead in the Pahsimeroi River that returned as adults for brood years 1979-1987.

Brood year	Year released	Smolts released	Total brood year return[b]	Percent of brood year return[c]
1979	1980	1,110,810	3,464	0.312
1980	1981	922,982	4,542	0.492
1981	1982	1,055,989	14,302	1.354
1982	1983	621,015	2,549	0.410
1983	1984	792,195	5,118	0.646
1984	1985	1,035,272	3,537	0.342
1985	1986	614,038	1,617	0.263
1986	1987	712,200	1,586	0.223
1987	1988	665,800	1,534	0.230

[a] Fry-fingerling and presmolt release not included in release information.
[b] Pahsimeroi weir count was sample method. Return does not include naturally produced fish returning 1986-1991. Does not include fish harvested prior to collection. Returns based on Table 7.
[c] Based on smolt release only.

Sources: IDFG et al. 1990.
S. W. Kiefer, IDFG, unpublished.

Table 5 (AE-a). Coded wire tag recoveries from hatchery A-run steelhead smolts released in the Pahsimeroi River, 1979-1981.

	1978 Brood year 1979 Release		1979 Brood year 1980 Release		1980 Brood year 198 1 Release"
Years of recovery:	1980-1982	1980-1982	1981-1983	1981-1983	1982-1983
Tag code:	10-03-43	10-03-44	10-21-57	10-21-56	10-22-41 to 43
Fisher-v					
Columbia River sport	3	7	4	5	NR
Columbia River Indian	16	32	22	4	11
Ocean	0	1	2	3	NR
Idaho Sport[b]	30	48	61	76	68
Miscellaneous	1	2	4	2	2
Deschutes River	NR[c]	NR	7	10	17
Hatchery Return	119	186	108	142	232

[a] Incomplete recovery information.
[b] These recoveries are raw totals unexpanded for sampling rate.
[c] NR = Category not reported.

Sources: Ball 1984.
Ball 1985b.

Table 6 (AT-a). Pahsimeroi River steelhead run-timing, 1969-1991.

Return Year	First fish trapped	Last fish trapped	Percent trapped February	Percent trapped March	Percent trapped April	Percent trapped May
			0.0			
1969	03/10	05/26	0.8	6.3	69.1	24.6
1970	02/17	05/25	[illegible]	9.2	52.4	28.9
1971	03/08	05/27	0.0	22.0	78.3	12.5
1972	02/15	05/30	0.3	[illegible]	53.8	23.8
1973	02/27	05/21	0.0	10.6	75.9	13.5
1974	03/08	05/31	0.0	11.9	80.6	7.5
1975	03/06	05/23	[illegible]	3.9	71.5	24.6
1976	03/05	05/11	0.0	22.1	74.1	3.8
1977	02/21	05/31	0.3	0.9	91.2	7.6
1978	02/24	05/26	0.6	56.3	35.0	8.1
1979	03/09	05/18	0.0	15.1	77.1	7.8
1980	03/07	05/13	0.0	8.1	90.0	1.9
1981	02/13	05/05	7.0	59.1	33.7	0.2
1982	02/24	05/14	0.1	53.4	45.9	0.6
1983	02/28	05/22	2.5	63.2	31.9	0.6[a]
1984	02/27	05/21	[illegible]	66.1	32.5	0.8
1985	02/21	05/09	1.4	6.5	92.8	0.3[b]
1986	02/21	04/30	1.1	75.7	22.7	0.0
			[illegible]	44.5		0.0
1987	02/10	04/29	2.9	47.0	38.7	0.0
1989	02/19	04/25	1.1	[illegible]	51.9	0.0
1990	02/22	04/26	0.8	49.3	49.9	0.0
1991	02/28	05/14	0.1	31.2	65.2	3.5

[a] Total number of fish trapped in 1983 includes 79 fall run fish.
[b] Total number of fish trapped in 1985 includes 7 fall run fish.
[c] Total number of fish trapped in 1986 includes 6 fall run fish.

Source: Moore and Rensel-Hislop 1991.

Table 7 (RH). Escapement[a] of hatchery A-run steelhead to the Pahsimeroi River by brood yea?.

Total Age

Brood Year	3	4	Total
1979	1,011	2,453	3,464
1980	2,119	2,423	4,542
1981	11,284	3,019	14,303
1982	1,525	1,024	2,549
1983	3,087	2,031	5,118
1984	2,743	794	3,537
1985	727	890	1,617
1986	870	716	1,586
1987	1,258	276	1,534
1988	417	inc.	inc.

[a] Does not include fish harvested.
[b] For return years 1986-1991 known natural fish have been excluded because of unknown freshwater age. Pahsimeroi River weir count was sample method. Ocean age delineated by fork length criteria as cited in the following:
Note that the total age reported represents the age of adults at spawning.

1981: No length reported (B. Moore, personal communication): Moore 1983.
1982: Male l-ocean A-run, 50% of run 22-25.5" total length: Moore 1984.
Male 2 ocean A-run, 50% of run 25.5-31" total length
Female l-ocean A-run, 22% of Nn 21-25.5" total length
Female 2-ocean A-run, 78% of run 25.531" total length
1983: l-ocean A-run, 21-25.5" total length: (B. Moore, IDFG, unpub).
2-ocean A-Nn, 25.5-31" total length
1984: Male l-ocean = 72% of A-run: (B. Moore, IDFG, uopub).
Male 2-ocean = 28% of A-run
Female 2-ocean = 10.1% of A-run
1985: Male l-ocean = 5169.5 cm total length: (B. Moore, IDFG, unpub).
Male 2-ocean = 69.5-81.5 cm total length
Female l-ocean = 51-66.5 cm total length
Female 2-ocean = 66.5-77.5 cm total length
1986: Male l-ocean = ≤ 69 cm: (B. Moore, IDFG, unpub).
Male 2-ocean = 70-81 cm
Female l-ocean = ≤ 66 cm
Female 2-ocean = 67-77 cm
1987-: Male l-ocean = ≤ 69 cm total length
1988 Male 2-ocean = > 69 cm total length
(B. Moore, IDFG, unpub.)
1989-: Male ≤ 69.5 cm total length
1990 Female ≤ 66.5 cm total length
(B. Moore, et al., JDFG, unpub.;
B. Moore and J. Rensel, IDFG, unpub.)
1991: Male ≤ 67 cm total length
Female ≤ 65 cm total length
(B. Moore and J. Rensel, IDFG, unpub.)

Sources: Moore 1980; J. Chapman, IDFG, unpublished; B. Moore, IDFG, unpublished; B. Moore and J. Chapman, IDFG, unpublished; B. Moore and J. Rensel, IDFG, unpublished; B. Moore et al., IDFG, unpublished.

Table 8 (AL-a). Pahsimeroi hatchery A-Run steelhead total lengths, 1987-1991.

Length cm.	1991 No. fish	1990 No. fish	1989 No. fish	1988 No. fish	1987 No. fish
< 40					
40					
41					
42					
43					
44					
45					
46					
47					
48					
49					
50	2	1	'	1	1
51	4				1
52	4	1			
53	9	4	1	1	2:
54	28	12	3	6	48
55	33	15	9	19	66
56	50	35	26	19	118
57	52	57	50	24	168
58	57	104	92	61	227
59	50	151	90	65	368
60	34	170	142	88	378
61	35	205	115	80	257
62	13	166	115	90	349
63	14	131	68	70	265
64	14	85	62	69	286
65	10	50	40	56	41
66	10	43	31	41	67
67	15	31	38	36	74
68	31	48	42	62	108
69	31	40	49	60	123
70	34	67	64	78	167
71	25	85	87	84	168
72	29	88	112	98	227
73	18	71	75	93	281
74	29	67	94	100	213
75	14	66	82	55	116
76	15		68	51	165
77	11	54	60	46	125
78	7	31	47	23	126
79	7	19	32	20	56
80	4	15	20	11	61
81		12	18	a	53
82	3	7	a	2	19
83	1	6	11	3	16
84		5	3		4
85		1	4	1	4
86					
87			1		
88					
89			1		
90					

[a] Blanks indicate no fish this size collected and measured.

Sources: J. Chapman, IDFG, unpublished.
B. Moore and J. Rensel, IDFG, unpublished.
B. Moore et al., IDFG, unpublished.

Table 9 (RH). Age composition percentage (freshwater.ocean) by brood year[a] for hatchery steelhead returning to the Pahsimeroi River.

Age Composition (%)

Brood Year	N	1.1	1.2
1979	3,464	29.2	70.8
1980	4,542	46.7	53.3
1981	14,303	78.9	21.2
1982	2,549	59.8	40.2
1983	5,118	60.3	39.7
1984	3,537	77.6	22.4
1985	1,617	45.0	55.0
1986	1,586	54.9	45.1
1987	1,534	82.0	18.0

[a] Pahsimeroi River weir count was sample method. Ocean age delineated by fork length criteria, cited in Table 7.

Note that the total age at the time of spawning for these fish ranged from three to four years.

Sources: Moore 1980.
J. Chapman, IDFG, unpublished.
B. Moore, IDFG, unpublished.
B. Moore and J. Chapman, IDFG, unpublished.
B. Moore and J. Rensel, IDFG, unpublished.
B. Moore et al., IDFG, unpublished.

Table 10 (RH-a). Age composition percentage (freshwater.ocean) by brood year for coded wire tagged hatchery A-run steelhead returning to Pahsimeroi Hatchery".

Brood year	N	Percent Age Composition		
		1.1	1.2	1.3
1980	103	91.2	8.7	0
1981	366	73.5	26.5	0

[a] Smolts were reared at Hagerman NFH. 1980 CWT = 10-22-39; 1981 CWT = 05-10-20.

Source: Cannamela et al. 1991.

Table 11 (AS). Percent females by brood year[a] and age class (freshwater.ocean) for hatchery A-run steelhead returning to the Pahsimeroi River.

Females (%)

Brood Year	N	1.1	1.2	Total % Female
1979	3,464	12.6	41.1	53.7
1980	4,542	30.7	17.6	48.3
1981	14,303	49.7	17.2	66.9
1982	2,549	26.2	30.1	56.3
1983	5,118	30.4	29.0	59.4
1984	3,537	37.4	17.7	55.1
1985	1,617	16.7	37.3	54.0
1986	1,586	27.5	32.9	60.4
1987	1,534	45.8	11.1	56.9

[a]Pahsimeroi River weir count was sample method. Ocean age delineated by fork length criteria, cited in Table 7.

Note that the total age at the time of spawning for these fish ranges from three to four years.

Sources: Moore 1980.
J. Chapman, IDFG, unpublished.
B. Moore, IDFG, unpublished.
B. Moore and J. Chapman, IDFG, unpublished.
B. Moore and J. Rensel, IDFG, unpublished.
B. Moore et al., IDFG, unpublished.

Table 12 (AF-a). Mean fecundity by return year for steelhead returning to the Pahsimeroi weir, 1981-1991. A-run fish only.

Return year	Number of females spawned	Number of green eggs	Mean fecundity
1980	897	3,251,702	3,625
1981	1,580	6,527,702	4,130
1982	1,315	7,058,420	5,367
1983	1,532	7,320,024	4,778
1984	1,677	6,616,632	3,945
1985	1,388	7,260,785	5,231
1986	979	5,384,206	5,499
1987	1,216	6,219,644	5,114
1988	983	5,846,960	5,948
1989	1,005	5,433,876	5,407
1990	1,094	5,773,543	5,277
1991	342	1,855,681	5,426

Sources: Moore 1980.
J. Chapman, IDFG, unpublished.
B. Moore, IDFG, unpublished.
B. Moore and J. Chapman, IDFG, unpublished.
B. Moore and J. Rensel, IDFG, unpublished.
B. Moore et al., IDFG, unpublished.

Table 13 (TD). Parasites and diseases[a] of Niagara Springs steelhead at the Niagara Springs Hatchery in the Snake River, 1980-1990.

Disease Type	Hatchery	Infection
virus	Niagara Springs	Infectious hematopoietic necrosis virus (IHNV)
virus	Niagara Springs	Infectious pancreatic necrosis virus (IPNV)
virus	Hagerman NFH	Infectious pancreatic necrosis virus (IPNV)
bacteria	Hagerman NFH	Bacterial kidney disease (*Renibacterium salmoninarum*)

[a] Disease history only represents pathogens isolated at the hatchery and not necessarily a disease outbreak.

Sources: Quidor 1980, 1981, 1984.
Billman 1983.
Miller 1988.
Mowery 1985, 1988, 1989.
Mowery and Harryman 1990.

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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	99	92	99	100	100	89	99	98
100	1.000	1.000	0.965	0.990	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		95
100	0.985	0.919	1.000	1.000	0.967	0.716	0.959	0.919	0.966	0.9%	0.974
63	0.015	0.081	0.000	0.000	0.033	0.284	0.041	0.081	0.034	0.022	0.026
*mAAT-1** (-77)											
(N)	100	96	99	98	90	96	loo	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**											
		97		99	92	100	100	100	100	100	100
100	0.100	0.985	0.9%	0.894	0.842	0.970	0.995	0.940	0.935	1.000	1.000
83	0.090	0.015	0.051	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	loo
-100	1.000	1.000	1.000	1.000	I.000	0.985	0.995	1.000	1.000	1.000	1.000
-52	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	loo	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	98	96	84	100	98	89	98	100	100
100	0.884	0.883	0.918	0.807	0.958	0.900	0.929	0.933	0.918	0.885	0.915
88	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	100	100	100	100	100	100
100	1.000	1.000	1.000	1.000	1.000	0.995	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	99	78	100	100	40	80	99	99
100	1.000	1.000	1.000	1.000	0.974	0.945	0.995	0.988	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)	94	92	99	96	86	97	100	100	100	97	98
100	1.000	1.000	0.980	0.922	0.994	0.969	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	3.000	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	0.956	0.995	0.985	1.000	1.000	1.000
85	0.000	0.005	0.000	0.000	0.000	0.045	0.005	0.015	0.000	0.000	0.000
*HAGH**											
(N)	97	66	99	99	89	100	100	100	99	99	100
100	0.902	1.000	0.970	0.949	0.955	0.975	0.990	0.960	0.939	0.944	0.950
143	0.098	0.000	0.030	0.051	0.045	0.025	0.010	0.040	0.061	0-056	0.050
*IDDH-1**											
(N)	59	95	57	74	87	100	76	99	58	100	90
100	0.907	1.000	0.956	0.980	0.994	0.980	0.947	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** 100 (83, 129, 97 142)				99	99	92	100	100	loo	100	100
(N)	100	0.870	0.773	0.742	0.848	0.804	0.815	0.835	0.795	0.840	0.920	0.805
74	0.115	0.216	0.217	0.091	0.196	0.185	0.140	0.205	0.115	0.050	0.175
94	0.015	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	99	92	100	100	100	100	loo	loo
100	0.965	0.990	0.975	0.949	1.000	0.975	1.000	1.000	0.945	1.000	1.000
127	0.035	0.010	0.025	0.051	0.000	0.025	0.000	0.000	0.055	0.000	0.000
*LDH-B1**											
IN)	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	100	100	100	loo	100
100	0.935	0.995	0.980	0.970	0.973	1.000	1.000	0.990	0.995	0.990	1.000
112	0.015	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	99	100	100	97	100	100
100	1.000	0.918	1.000	0.995	0.962	1.000	1.000	0.985	0.995	1.000	1.000
84	0.000	0.052	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	0.000

Appendix Table 1. Cont.

Locus/ Allele	Marsh Creek	Johnson Creek	Upper Salmon River	Valley Creek	Secesh River	Losline River	Imnaha River	McCall Hatchery	Sawtooth Hatchery	Looking. Hatchery	Imnaha Hatchery
*sMDH-B1,2** (83)											
(N)	100	97	[illegible]	99	92	100	100	100	100	100	loo
100	0.990	0.979	[illegible]	0.944	0.997	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	49	99	99	13	'95	100	92	100	100	100
-100	1.000	1.000	moo	1.000	1.000	LOOO	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	O.OOO	0.000	0.000
*mMDH-2**											
(N)	99	97	97	97	91	100		100	97	100	99
loo	0.646	0.598	0.485	0_.557	0.753	0.735	0.6%	0.735	0.526	0.800	0.697
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	97	89	96	98	99	99	100	93
100	0.079	0.077	0.030	0.031	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	loo	100	95
100	0.900	0.898	1.000	1.000	0.790	1.000	1.000	1.000	1.000	1.000	1.000
78	0.100	0.102	0.000	0.000	0210	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	0.860	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	0.065	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)	loo	97	99	99	92	100	100	100	100	100	loo
loo	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)	[illegible]	[illegible]	99	99	92	100	100	100	100	100	99
100	0.905	0.8:	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	0.065	0.015	0.050	0.015	0.090	0.095	0.030
-350	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)	loo	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	0.085	0.100	0.110	0.142	0.085	0.120
90	0.935	0.933	0.899	0.813	0.848	0915	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	Secesh River	Lostine River	Imnaha River	McCall Hatchery	Sawtooth Hatchery	Looking. Hatchery	Imnaha Hatchery
*PGM-3,4** (88, 108)											
(N)	100	97	96	98	92	98	96	99	95	96	100
100	0.285	0.518	0.326	0.375	0.462	0.510	0.484	0.429	0.338	0.295	0.508
94	0.715	0.482	0.674	0.625	0.538	0.490	0.616	0.571	0.662	0.705	0.493
*sSOD-1** (580, 1260)											
(N)	100	97	97	99	90	99	100	100	100	loo	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**											
									100	100	100
100	0.100	0.954	0.924	0.899	0.897	0.875	0.825	0.875	0.890	0.915	0.850
104	0.090	0.046	0.076	Ct.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 salmon 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 Hatchery 1981	McCall Hatchery 1988	Johnson Creek 1981	Johnson Creek 1988	Valley Creek 1982	Valley Creek 1988	Looking. Hatchery 1988	Rapid Fi. 1981+84	Upper Salmon River 1981	Upper Salmon River 1988	Sawtooth Hatchery 1988
*sAAT-1,2**											
(N)	60	100	56	98		97	100	150	50	100	99
100	1.000	0.998	0.964	0.957	0.9%	0.992	1.000	1.000	1.000	0.978	0.975
85	0.000	0.003	0.036	0.043	0.023	0.008	0.000	0.000	0.000	0.023	0.025
*sAAT-3**											
(N)	50	100	56	100	22	99	99	150	50	100	89
100	1.000	1.000	1.000	1.000	1.000	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	0.036	0.000
*ADA-1**											
(N)	50	100	56	100	22	99	100	150	48	99	100
100	0.900	0.940	1.000	0.986	0.932	0.894	1.000	0,990	0.969	0.949	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)	50	100	53		22	99	100	148	50	100	100
100	1.000	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	0.000	0.000	0.000	0.007	0.000	0.000	0.005
*GR**											
(N)	50	100	56	100	22	99	100	150	60	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)	50	100	56	68	22	99	99	144	48	100	99
100	0.970	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 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
*sIDHP-1**											
(N)	50	100	56	99	22	99	100	150'	50	99	100
100'	0.740	0.795	0.902	0.786	0.910	0.909	0.950	0.920	0.840	0.783	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	22	99	100	150	50	99	100
100	1.000	0.990	1.000	0.995	0.977	0.970	0.990	0.990	0.980	0.980	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	22	99	100	150		100	97
100	0.970	0.985	0.982	0,920	1.000	0.995	1.000	1.000	1.0%	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	0.006
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	0.995	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	66	96	22	99	100	150	60	99	99
100	0.960	0.920	0.946	0.990	0,795	0.889	0,936	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)	50	100	56	100	22	99	100	150	50	99	100
100	1.000	1.000	1.000	1.000	0.977	1.000	1.000	1.000	0.990	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**	50										
(N)	0.930	100	56	94	22	0.9;	100	148	50	100	100
100'		0.985	0.991	0.973	0.818		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**	50		56	100	22	99					
(N)	0.890	100	0.929	0.950	0.841	0.919	100	150	50	100	100
100		0.920					0.945	0.963	0,970	0.985	0.885
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	56	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	56	97	22	99	100	150		98	100
-100	0.980	0.980	0.973	0.974	0.886	0,939	0,970	0,913	0.9::	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

"Includes "94" allele
[b]Includes "90" allele
'Includes "-350" allele

Appendix Table 2, Additional Snake River chinook electrophoretic data cited by Waples et. al. (1991)

Temporal comparisons of allele frequency in Snake River chinook salmon 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 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
*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	0.023	0.008	0.000	0.000	0.000	0.023	0.025
*sAAT-3**											
(N)	50	100	56	100	22	99	99	150	50	100	89
100	1.000	1.000	1.000	1.000	1.000	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	160	48	99	100
100	0.9%	0.940	1.000	0.985	0.932	0.894	1.000	0.990	0.969	0.949	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)	50	100	53	99	22	99	100	148	50	100	100
100	1.000	0.990	1.000	1.000	1.000	1.000	1.000	0.993	1.000	1.000	0.995
86	0.000	0.010	0.000	0.000	0.000	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)	50	100	56	68	22	99	99	144	48	100	99
100	0.970	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	0.051	0.056	0.087	0.083	0.030	0.061

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
*sIDHP-1**											
(N)	50	100	56	99		99	100	150	50	99	100
100[a]	0.740	0.795	0.902	0.786	0.9%	0.909	0.950	0,920	0.840	0.783	0.885
74	0.260	0.20s	0.098	0.214	0.090	0.091	0.050	0.080	0.160	0.217	0.115
*sIDHP-2**											
(N)	50	100	56	99	22	99	100	150	50	99	100
100	2.000	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	22	99	100	150	50	99	100
100	1.000	0.990	1.000	0.995	0.977	0.970	0.990	0.990	0.980	0.980	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)		100	56	100	22	99	100	150	48	100	97
100	0.9%	0.986	0,982	0.920	1.000	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)	SO	100	66	98	22	99	100	149	49		100
100	'0.995	0.993	1.000	0.980	0.989	0.944	0.993	1.000	1.000	0.9%	0,880
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	0.006	0,000	0.000	0.000	0.000	0.000	0.003	0.000
*MPI**											
(N)	50	too	66	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)	50	100	66	100	22	99	100	160	60	99	100
100	1.000	1.000	1.000	1.000	0.977	1.000	1.000	1,000	0.990	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 3. Columbia River chinock electrophoretic data from Schreck et al, (1936).

Isoayme 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 mobilities 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	.96	.04
KALAMA HATCHERY	F	91	.91	.08	.01		–			88	.88	.12
KALAMA HATCHERY	S	96	.85	.14	.01		–			loo	.96	.04
LEWIS HATCHERY	S	100	.98	.02			84	.92	.08	100	.98	.02
LEWIS HATCHERY	F	75	.77	.23			–			61	.94	.06
LEWIS RIVER	F	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		loo	.98	.02
EAGLE CREEK HATCHERY 85	S	95	.79	.17	.03	.01	60	1.00		loo	.99	.01
MARION FORKS HATCHERY	S	97	.79	.19	.02		100	1.00		loo	1.00	
SOUTH SANTIAM HATCHERY	S	98	.72	.27	.01		65	1.00		100	1.00	
THOMAS CREEK	S	95	.83	.16	.01					loo	.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	98	.75	.22	.03		100	1.00		100	1.00	
SANDY RIVER	F	56	.94	.03	.03					56	1.00	
SANDY RIVER 85	F	48	.88	.09	.03		49	1.00		49	.96	.04
WASHOUGAL RIVER	F	50	.86	.13	.01		50	.99	.01	50	.95	.05
BONNEVILLE HATCHERY	F	93	1.00				93	1.00		87	.87	.13
CARSON HATCHERY	S	100	.98	.02						100	1.00	
CARSON HATCHERY 85	S	100	.99	.01			75	.97	.03	97	.95	.05
LIT.WHITE SALMON HATCH.	S	100	.98	.02						loo	1.00	
LIT.WHITE SALMON HATCH. 85	S	98	.99	.01			88	.99	.01	98	.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	.96	.04
KLICKITAT HATCHERY #	S	50	.93	.07			50	98	.02			
HOOD RIVER	F	42	.88	.12								
DESCHUTES RIVER	F	85	.87	.06	.07					87	.93	.07
DESCHUTES RIVER 85	F	52	.83	.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	.99		.01		50	100		98	1.00	
WARM SPRINGS RIVER #	S	50	1.00				50	1.00		50	l.w	
JOHN DAY RIVER	S	78	1.00				76	.99	.01	78	.99	.01
JOHN DAY RIVER 85	S	60	.98	.02			60	1.00		60	1.00	
SNAKE RIVER STOCK	P	97	.93	.06	.01					97	.91	.09
TUCANNON RIVER	S	93	.99	.01						93	1.00	
TUCANNON RIVER 85	S	34	.97	.03			38	.97	.03	28	1.00	
GRANDE RONDE RIVER	S	43	.98	.02			43	1.00		43	1.00	
GRANDE RONDE RIVER 84	S	26	.98	.02						36	.99	.01

Chinook salmon gene frequency data (continued).

CHINOOK STOCK	FORM	ACONITATE HYDRATASE N	100	86	116	69	ADENOSINE DEAMINASE N	100	83	ALCOHOL DEHYDROGENASE N	-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	a7	.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		4	2	.96	.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		loo	.99	.01
WENATCHEE RIVER	S	194	.99	.01			50	.95	.05	199	1.00	
WENATCHEE RIVER	SUM	40	.81	.19						50	1.00	
WENATCHEE RIVER 85	SUM	49	.83	.17			50	.99	.01	50	1.00	
LEAVENWORTH HATCHERY	s	89	.99	.01						100	1.00	
LEAVENWORTH HATCHERY 85	S	100	1.00				100	.97	.04	loo	1.00	
ENTIAT RIVER	S	128	.98	.02			50	.97	.03	133	1.00	
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	.96	.04	50	1.00	
METHOW RIVER	SUM	85	.82	.18								
WINTHROP HATCHERY #	s	50	.92	.07	.01		129	.97	.03	129	.98	.02
OKANAGAN RIVER	SUM	loo	.78	.22						90	.97	.03
OKANAGAN RIVER 85	SUM	50	.75	.24	.01		50	1.00		49	.99	.01

Chinook salmon gene f requency 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	loo	1.00	
KALAMA HATCHERY	F	100	1.00		100	1.00		loo	1.00	
KALAMA HATCHERY	s	loo	1.00		100	.86	.14	100	1.00	
LEWIS HATCHERY	s	loo	1.00		100	1.00		100	1.00	
LEWIS HATCHERY	F	96	.90	.10	96	1.00		100	1.00	
LEWIS RIVER	F	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	loo	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	loo	1.00		100	1.00		100	1.00	
THOMAS CREEK	s	100	1.00		100	.80	.20	loo	1.00	
MCKENZIE HATCHERY	S	95	1.00		95	.90	.10	95	1.00	
MCKENZIE HATCHERY 85	S	loo	1.00		100	1.00		100	1.00	
DEXTER HATCHERY	s	100	1.00		100	.83	.17	100	1.00	
SANDY RIVER	F	66	1.00		66	1.00		66	1.00	
SANDY RIVER 85	F	49	.96	.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		100	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	1.00					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	
JOHN DAY RIVER	S	79	1.00		79	1.00		79	1.00	
JOHN DAY RIVER 85	s	60	1.00		60	1.00		60	1.00	
SNAKE RIVER STOCK	F	100	.90	.10	100	1.00		100	1.00	
TUCANNON RIVER	s	100	.86	.14	loo	1.00		100	1.00	
TUCANNON RIVER 85	s	44	1.00		44	1.00		44	1.00	
GRANDE RONDE RIVER	s	43	1.00		43	1.00		43	1.00	
GRANDE RONDE RIVER 84	S	36	1.00		36	1.00		36	1.00	

Chinook salmon gene frequency data (continued).

CHINOOK STOCK	FORM	GLUCOSE PHOSPHATE ISOMERASE-2			GLUCOSE PHOSPHATE ISOMERASE 1-3H			GLUCOSE PHOSPHATE ISOMERASE-3		
		N	100	60	N	STANDARD	VARIANT	N	loo'	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		100	1.00		100	1.00	
RAPID RIVER HATCHERY #	S	50	1.00					50	1.00	
JOHNSON CREEK #	SUM	56	1.00					56	1.00	
McCALL HATCHERY #	SUM	50	1.00					so	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	96	1.00		96	.80	.20	96	1.00	
HANFORD REACH 85	F	100	1.00		loo	.90	.10	loo	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	.96	.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	1.00	
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	loo	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	68	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	.98	.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		loo	1.00	
LEWIS HATCHERY	F	194	1.00		87	.96	.01	.03	98	1.00	
LEWIS RIVER	F	100	1.00		99	.97	.01	.02	loo	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		loo	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			loo	1.00	
THOMAS CREEK	S	100	1.00		89	.88	.11	.01	100	1.00	
MCKENZIE HATCHERY	S	100	1.00		70	.98	.01	*	100	1.00	
MCKENZIE HATCHERY 85	S	50	1.00		97	.87	.02	.11	loo	1.00	
DEXTER HATCHERY	S	100	1.00		100	1.00			85	1.00	
SANDY RIVER	F	66	1.00		56	.96	.02	.01	66	1.00	
SANDY RIVER 85	F	49	1.00		49	.96		.04	47	1.00	
WASHOUGAL RIVER	F	50	1.00		48	.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	.98	.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	38	1.00		87	.92	.08		98	1.00	
SPRING CREEK HATCHERY	F	100	1.00		100	1.00			100	1.00	
KLICKITAT RIVER	F	50	1.00		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	96	1.00		98	.98	.01	•	100	1.00	
DESCHUTES RIVER 85	F	52	1.00		54	.98	.01	.02	54	1.00	
ROUND BUTTE HATCHERY	S	50	1.00		82	.95	.05	•	93	1.00	
ROUND BUTTE HATCHERY 85	S	42	1.00		97	.86	.14		98	1.00	
WARM SPRINGS RIVER #	S	43	1.00		50	.83	.17		50	1.00	
JOHN DAY RIVER	S	75	1.00		70	.87	.13		95	1.00	
JOHN DAY RIVER 85	S	60	1.00		60	.94	.06	*	59	1.00	
SNAKE RIVER STOCK	F	100	.98	.02	88	.99	.01		loo	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	.08		43	1.00	
GRANDE RONDE RIVER 84	S	8	1.00		34	.87	.13		36	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
WALLOWA-LOSTINE RIVER	S	25	1.00		46	.86	.11	.03	47	1.00	
WALLOWA-LOSTINE RIVER 84	S	34	1.00		35	.84	.15	.01	40	1.00	
KOOSKIA HATCHERY STOCK	S	80	1.00		73	.92	.08		100	.99	.01
RED R. SF CLEARWATER #	S	40	1.00		80	.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	1.00		50	.87	.13		50	1.00	
MIDDLE FORK SALMON	S	40	1.00		14	.89	.11		50	.96	.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	.98	.02
SAWTOOTH STOCK #	S	50	1.00		50	.92	.08		50	.98	.02
YAKIMA RIVER	F	36	1.00		30	.91	.03	.06	36	.97	.03
YAKIMA RIVER	S	44	1.00		44	.86	.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	180	1.00		160	.86	.14		199	.99	.01
WENATCHEE RIVER	SUM	-			44	.98	.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		loo	1.00	
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	1.00	
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 D - 3 6 4			
		N	100	90	N	100	140	27	N	loo	121	70
COWLITZ HATCHERY #	F	96	.99	.01	99	1.00			99	1.00		
COWLITZ HATCHERY	S	100	.99	.01	100	1.00			100	.99	.01	
KALAMA HATCHERY	F	100	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	.98	.02	
LEWIS HATCHERY	F	98	1.00		loo	1.00			90	.99	.01	
LEWIS RIVER	F	100	1.00		100	1.00			94	.98	.02	
CLACKAMAS RIVER	F	50	.99	.01	50	1.00			so	.93	.07	
CLACKAMAS RIVER	S	87	1.00		80	1.00			80	.97	.03	
EAGLE CREEK HATCHERY	S	07	1.00		loo	1.00			100	.95	.05	
EAGLE CREEK HATCHERY 85	s	100	.99	.01	loo	1.00			100	.97	.03	
MARION FORKS HATCHERY	S	100	1.00		loo	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	1.00			99	.92	.08	
MCKENZIE HATCHERY	S	100	.99	.01	100	1.00			99	.93	.07	
MCKENZIE HATCHERY 85	s	100	1.00		loo	1.00			97	.94	.06	
DEXTER HATCHERY	S	85	1.00		loo	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			88	.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		100	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	.96	.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			98	.98	.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	.96	.04	
SNAKE RIVER STOCK	F	100	.99	.01	100	1.00			100	.95	.01	.04
TUCANNON RIVER	S	loo	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	so	1.00		so	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			so	.99	.01	
MIDDLE FORK SALMON	S	50	1.00						50	.98	.02	
EAST FK. SALMON R. STOCK	S	37	1.00		so	1.00			50	.98	.02	
VALLEY CREEK	SUM	48	1.00		4s	1.00			48	.97	.03	
VALLEY CREEK #	S	22	1.00		22	1.00			22	.99	.01	
SAWTOOTH STOCK #	S	48	1.00		so	1.00			49	1.00		
YAKIMA RIVER	F	36	1.00		36	1.00			36	1.00		
YAKIMA RIVER	S	so	1.00		so	1.00			50	1.00		
NACHES RIVER	S	so	1.00		so	1.00			so	.98	.01	.01
HANFORD REACH	F	100	.97	.03	100	1.00			98	.97	.01	.01
HANFORD REACH 85	F	100	.99	.01	loo	1.00			100	.96	.03	.01
PRIEST RAPIDS HATCHERY	F	loo	.98	.02	100	1.00			100	.98	.01	.02
WENATCHEE RIVER	S	181	1.00		19s	1.00	*		95	.97	.03	
WENATCHEE RIVER	SUM	45	.99	.01	50	1.00			48	.97	.01	.02
WENATCHEE RIVER 85	SUM	so	.96	.04	so	1.00			50	.95	.01	.04
LEAVENWORTH HATCHERY	S	100	1.00		100	1.00			loo	.99	.01	
LEAVENWORTH HATCHERY 85	S	97	1.00		9s	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	so	.99	.01	43	1.00			45	.97	.03	
METHOW RIVER 84	S	49	1.00		so	.99	•	*	·□	.97	.03	
METHOW RIVER	SUM	80	.99	.01	88	1.00			87	.97	.02	.01
WINTHROP HATCHERY #	S	129	1.00		129	1.00			129	.99	.01	
OKANAGAN RIVER	SUM	100	.93	.07	100	1.00			9s	.97	.02	.01
OKANAGAN RIVER 85	SUM	50	.95	.05	50	1.00			so	.96	.02	.02

Chinook salmon gene frequency data (continued).

CHINOOK STOCK	FORM	MANNOSE PHOSPHATE ISOMERASE N	100		95	113	DIPEPTIDASE N	100	90	TRIPEPTIDE AMINOPEPTIDASE N	loo	130	45
COWLITZ HATCHERY #	F	99	.49	.48	.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	8s	.53	.45	.02		98	.95	.05	95	.93	.07	
LEWIS RIVER	F	100	.49	.48	.03		loo	.a4	.16	100	.96	.04	
CLACKAMAS RIVER	F	49	.45	.55			50	.97	.03	49	.94	.06	
CLACKAMAS RIVER	s	79	.47	.53			80	1.00		80	.96	.04	
EAGLE CREEK HATCHERY	s	84	.61	.38		.01	100	1.00		99	.92	.08	
EAGLE CREEK HATCHERY 85	S	69	.41	.59			100	1.00		91	.90	.09	.01
MARION FORKS HATCHERY	S	9s	.46	.54			100	1.00		98	.91	.09	
SOUTH SANTIAM HATCHERY	S	97	.50	.50			100	1.00		95	.65	.35	
THOMAS CREEK	S	9s	.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	96	.52	.48			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	.48	.02		50	.85	.15	so	.96	.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	.89	.11			9s	1.00		80	.96	.04	
LIT.WHITE SALMON HATCH.	S	96	.82	.18			100	.99	.01	99	.94	.06	
LIT.WHITE SALMON HATCH. 85	S	80	.79	.21			71	1.00		93	.95	.05	
SPRING CREEK HATCHERY	F	96	.54	.43	.03		100	.94	.06	96	.83	.17	
KLICKITAT RIVER	F	SO	.68	.31	.01		so	.95	.05	49	.81	.19	
KLICKITAT HATCHERY #	S	50	.73	.26	.01		so	.99	.01	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	.96	.04	
ROUND BUTTE HATCHERY	S	93	.84	.16			93	1.00		93	.98	.02	
ROUND BUTTE HATCHERY 85	s	-					98	1.00		77	.96	.04	
WARM SPRINGS RIVER #	s	so	.84	.16			so	.97	.03	48	.97	.03	
JOHN DAY RIVER	S	93	.91	.09			100	1.00		85	.99	.01	
JOHN DAY RIVER 85	S	55	.88	.12			60	.99	.01	60	.99	.01	
SNAKE RIVER STOCK	F	100	.a2	.18			100	.99	.01	86	.87	.13	
TUCANNON RIVER	s	loo	.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	.96	.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			3s	1.00		40	.99	.01	
KOOSKIA HATCHERY STOCK	S	74	.95	.05			91	.98	.02	71	.99	.01	
RED R. SF CLEARWATER #	s	40	.95	.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			so	1.00		50	.90	.10	
JOHNSON CREEK #	SIMS	6	.95	.05			56	1.00		56	.99	.01	
McCALL HATCHERY #	SUM	50	.96	.04			so	1.00		so	.93	.07	
MIDDLE FORK SALMON	s	50	.96	.04			50	1.00		37	.97	.03	
EAST FK. SALMON R. STOCK	S	50	1.00				so	1.00		so	1.00		
VALLEY CREEK	SUM	35	.87	.13			45	1.00		32	1.00		
VALLEY CREEK #	S	22	.80	.21			22	.98	.02	22	.82	.18	
SAWTOOTH STOCK #	s	50	.89	.11			50	.99	.01	so	.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		loo	.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	sw	50	.63	.37			so	.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	1.00		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			PHOSPHOGLYCERATE KINASE-2				SUPEROXIDE DISMUTASE			
		N	-100	-60	N	100	90	64	N	-100	-260	1250
COWLITZ HATCHERY #	F	99	.99	.01	so	.79	.21		98	.65	.35	
COWLITZ HATCHERY	S	100	1.00						99	.57	.43	
KALAMA HATCHERY	F	loo	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	.86		50	.56	.44	
LEWIS HATCHERY	F	100	1.00						47	.48	.52	
LEWIS RIVER	F	loo	1.00						194	.56	.44	
CLACKAMAS RIVER	F	49	1.00		49	.86	.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	.98	.02		100	.80	.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	.88	.12		100	.81	.19	
MCKENZIE HATCHERY 85	S	100	1.00		60	.88	.12		98	.79	.21	
DEXTER HATCHERY	S	100	1.00		94	.90	.10		100	.92	.08	
SANDY RIVER	F	66	1.00									
SANDY RIVER 85	F	49	1.00		49	.82	.18		49	.56	.44	
WASHOUGAL RIVER	F	so	.96	.04	42	.71	.29		50	.48	.52	
BONNEVILLE HATCHERY	F	93	1.00		93	1.00			83	.52	.48	
CARSON HATCHERY	S	loo	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	.91		92	.85	.15	
SPRING CREEK HATCHERY	F	loo	1.00		91	.91	.09		80	.58	.42	
KLICKITAT RIVER	F	so	1.00		50	.61	.39		45	.54	.46	
KLICKITAT HATCHERY #	S	50	1.00		SO	.57	.43		so	.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		80	.18	.82		95	.65	.35	
WARM SPRINGS RIVER #	S	so	1.00		50	.32	.68		50	.54	.46	
JOHN DAY RIVER	S	95	1.00		39	.06	.94		81	.73	.27	
JOHN DAY RIVER 85	S	60	1.00		60	.28	.72		60	.70	.30	
SNAKE RIVER STOCK	F	loo	1.00		51	.67	.33		88	.64	.36	
TUCANNON RIVER	S	93	1.00		77	.06	.94		54	.78	.22	
TUCANNON RIVER 85	S	so	1.00		27	.02	.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			PHOSPHOGLYCERATE KINASE-2				SUPEROXIDE DISMUTASE			
		N	-100	-60	N	100	90	64	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	loo	1.00		46	.04	.96		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		so	.15	.85		50	.96	.04	
JOHNSON CREEK #	SUM	56	1.00		56	.os	.96		56	.97	.03	
MCCALL HATCHERY #	SUM	50	1.00		so	.08	.92		SO	.98	.02	
MIDDLE FORK SALMON	S	50	1.00		SO	.05	.95		35	.80	.20	
EAST FK. SALMON R. STOCK	S	so	1.00						SO	.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		so	.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	.38	.62		49	.70	.30	
HANFORD REACH	F	100	1.00		39	.74	.26					
HANFORD REACH 85	F	loo	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	so	1.00									
WENATCHEE RIVER 85	SUM	so	1.00		so	.58	.42		50	.46	.53	.01
LEAVENWORTH HATCHERY	S	100	1.00		76	.03	.97		100	.84	.16	
LEAVENWORTH HATCHERY 85	S	loo	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	so	1.00		3s	.03	.97		SO	.77	.23	
METHOW RIVER	SUM	88	.99	.01	-				76	.49	.51	
WINTHROP HATCHERY #	S	123	1.00		98	.so	.50		129	.74	.26	
OKANAGAN RIVER	SUM	100	1.00		49	.70	.30					
OKANAGAN RIVER 85	SUM	so	1.00		so	.68	.32		50	.52	.48	

Appendix Table 4. Co'iumbia River steelhead electrophoretic data from Schreck et al. (1986).

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 mobilities 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	2s	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			9.5	1.00	
GRAYS RIVER	W	100	1.00		100	1.00			100	1.00	
ELOCHOMAN HATCHERY	W	100	1.00		l o o	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		9s	1.00			9s	1.00	
COWLITZ HATCHERY SKAMANIA	S	80	1.00		90	1.00			90	1.00	
S.F. TOUTLE RIVER	W	so	1.00		50	1.00			so	1.00	
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			so	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		9s	1.00			9s	1.00	
LEABURG HATCHERY 85	S	so	1.00		50	1.00			50	1.00	
MCKENZIE RIVER	S	so	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		9s	1.00			9s	1.00	
WASHOUGAL HATCHERY 85	S	100	1.00.		100	1.00			100	1.00	
WASHOUGAL HATCHERY	W	99	1.00		loo	1.00			100	1.00	
HAMILTON CREEK	W	53	1.00		53	.99		.01	53	1.00	
WIND RIVER	S	so	1.00		so	.91		.09	so	1.00	
WIND RIVER 85	S	25	1.00		25	.96		.04	2s	1.00	
HOOD RIVER	W	50	1.00		so	1.00			so	1.00	
KLICKITAT RIVER	S	100	1.00		100	1.00			100	1.00	
FIFTEENMILE CREEK	W	82	1.00		82	1.00			82	.96	.04
FIFTEENMILE CREEK 85	W	50	1.00		so	1.00			48	.95	.05
DESCHUTES RIVER	S	170	1.00		170	1.00			178	1.00	
ROUND BUTTE HATCHERY	S	93	.96	.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	so	.98	.02	50	1.00			50	1.00	

Steelhead trout gene frequency data (continued).

STEELHEAD STOCK	FORM	CREATINE KINASE			GLUCOSE PHOSPHATE ISOMERASE-1				GLUCOSE PHOSPHATE ISOMERASE-2		
		N	100	70	N	100	130	25	N	100	120
UMATILLA RIVER	s	100	1.00		100	1.00			loo	1.00	
UMATILLA HATCHERY	s	loo	1.00		loo	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	1.00			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	loo	.99	.01	100	1.00			100	1.00	
MISSION CREEK	S	36	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	loo	1.00		100	.90	.10		loo	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	96	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).

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			8 5	1.00		89	1.00	
GRAYS RIVER	w	100	.99		.01				100	1.00	
ELOCHOMAN HATCHERY	W	100	.98		.02	loo	1.00		100	1.00	
COWLITZ HATCHERY NATIVE	W	91	.96		.04	99	1.00		90	1.00	
COWLITZ HATCHERY CHAMBERS	W	95	.96		.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	.96	.01	0 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			loo	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						loo	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	.96		.04	100	.99	.01	100	1.00	
LEABURG HATCHERY 85	S	49	.92		.08	42	1.00		50	1.00	
MCKENZIE RIVER	S	48	.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	50	1.00		100	1.00	
WASHOUGAL HATCHERY 85	S	97	.94		.06	85	1.00		89	1.00	
WASHOUGAL HATCHERY	W	100	.99		.01	loo	1.00		loo	1.00	
HAMILTON CREEK	W	53	.98		.02				53	1.00	
WIND RIVER	s	50	.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	1.00			45	1.00		37	1.00	
DESCHUTES RIVER	s	-				178	1.00		178	1.00	
ROUND BUTTE HATCHERY	s-	100	.99		.01				loo	1.00	
ROUND BUTTE HATCHERY 85	s	loo	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 AMINOTRANSFERASE-1,2 N	100	112	ASPARTATE AMINOTRANSFERASE-3 N	100	77
UMATILLA RIVER	s	loo	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		50	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	.99		.01	-			116	1.00	
S.F.SALMON (SECESH RIVER)	S	61	.99	.01							
S.F.SALMON (JOHNSON CREEK)	s	50	1.00			50	1.00		50	.99	.01
CHAMBERLAIN CREEK	•	[illegible]	[illegible]	.01							
HORSE CREEK	•	[illegible]	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	50	1.00			50	.99	.01	50	1.00	
HELLS CANYON STOCK	s	9s	.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	96	.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).

S[redacted]		ISOCITRATE					LACTATE				MALATE				
STOCK	FORM	DEHYDROGENASE-3,4					DEHYDROGENASE-4				DEHYDROGENASE-1,2				
		N	100	40	120	71	N	100	76	111	N	100	140	70	40
BIG CREEK HATCHERY	W	98	.70	.14	*	.16	100	.96	.04		100	1.00			
BIG CREEK HATCHERY 85	w	n	.64	.12	.01	.23	92	.95	.05		95	1.00			
GRAYS RIVER	W	94	.69	.12		.19	100	.80	.20		100	1.00			
- -	W	8 9	.75	.13	.01	.11	99	.85	.15		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	[illegible]	50	.81	.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	70	.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	5 8	.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	6 8	.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	50	.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	.71	.13	.01	.15	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 N	100	40	120	71	LACTATE DEHYDROGENASE-4 N	100	76	111	MALATE DEHYDROGENASE-1,2 N	100	140	70	40
UMATILLA RIVER	S	98	.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	40	.62	.16		.23	40	.36	.64		40	.99			.01
TOUCHET RIVER	s	49	.61	.17		.21	50	.45	[illegible]		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	.58		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'	96	.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	96	.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	94	.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	.28	.72		[illegible]				
CHAMBERLAIN CREEK +	s	97	.67	.15	.01	.18	97	.24	.73	.03	97	1.00			
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	38	.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	95	.38	.61	.01	96	1.00			
ENTIAT RIVER	s	50	.60	.19	*	.21	50	.29	.69	.02	50	.99	.01		
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					NADP+ MALATE DEHYDROGENASE			MANNOSE PHOSPHATE ISOMERASE			
		N	100	83	110	90	N	100	85	N	100	94	110
BIG CREEK HATCHERY	W	100	.92	.08			100	.80	.20	loo	1.00		
BIG CREEK HATCHERY 85	W	92	.90	.10		*	67	.90	.01	95	1.00		
GRAYS RIVER	w	9 9	.88	.10	.01	.01	90	.83	.17	100	1.00		
ELOCHOMAN HATCHERY	w	9 4	.89	.08		.03	100	.95	.05	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	loo	1.00		
MARION FORKS HATCHERY	w	100	.96	.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	1.00		
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	loo	.84	.13	.03		100	.96	.04	loo	1.00		
LEABURG HATCHERY 85	S	50	.83	.15	.02	.01	50	.92	.08	50	1.00		
MCKENZIE RIVER	s	50	.87	.12		.01	50	.96	.04	50	1.00		
SANDY RIVER	w	98	.92	.08	*		95	.88	.12	100	1.00		
WASHOUGAL HATCHERY	s	94	.82	.18			92	.82	.18				
WASHOUGAL HATCHERY 85	s	100	.91	.09			100	.96	.04	95	1.00		
WASHOUGAL HATCHERY	W	100	.88	.12			100	1.00		100	1.00		
HAMILTON CREEK	W	51	.89	.06	.04	.01	53	.89	.11	53	1.00		
WIND RIVER	S	49	.96	.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	so	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	50	.96	.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	loo	.99	•	•	*	50	1.c.n		100	1.00		
JOHN DAY RIVER 85	S	50	.99	.01	.01		50	.99	.01	50	.99	.01	

Steelhead trout gene frequency data (continued).

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 RIVER	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	.98	.01	.01		113	1.00					
TUCANNON RIVER 85	s	50	.99	A l			50	1.00		so	.96	.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	.96	.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		so	.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	1.00		
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	96	.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		50	.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				l	W l .	W	
COWLITZ HATCHERY NATIVE	W	99	1.00				99	1.00				99	1.00		
COWLITZ HATCHERY CHAMBERS	W	100	1.00				1	c o l .	W			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	.96	.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			1	c Q l .	W			l	w l .	w	
WILEY CREEK 85	W	27	.96	.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	.96	.04			100	1.00				100	1.00		
WASHOUGAL HATCHERY	S	100	.95	.01		.04	100	1.00				100	.98	.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	1.00				50	1.00				50	1.00		
WIND RIVER 85	S	25	1.00				25	1.00				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				loo	1.00		
FIFTEENMILE CREEK	W	82	1.00				82	1.00				82	.96	.01	.03
FIFTEENMILE CREEK 85	W	50	.98	.02			49	.98		.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	.96		.04
JOHN DAY RIVER 85	S	49	.92	.08			51	.98			.02	50	.99		.01

Steelhead trout gene frequency data (continued).

STOCK	FORM	DIPEPTIDASE N	100	110	85	95	TRIPEPTIDE AMINOPEPTIDASE N	loo	129	74	50	PHOSPHO-GLUCOMUTASE-1 N	-100	-115	-85
UMATILLA RIVER	S	9 8	.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	.		.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			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	130				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			loo	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	.96	.04			51	1.00				50	1.00		
MIDDLE FORK SALMON RIVER #	S	277	.96	.04			277	.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	96	.96	.04	.01		loo	.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	96	.94	.06			96	1.00				96	1.00		
ENTIAT RIVER	S	49	.96	.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		

Steelhead troutgene 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	9s	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		loo	.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	loo	1.00					80	.74	.26	
MARION FORKS HATCHERY	w	loo	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	.96	.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	loo	1.00					93	.96	.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 N	-100	-140	L-IDITOL DEHYDROGENASE N	100	195	SUPEROXIDE DISMUTASE N	100	152	48
UMATILLA RIVER	S	100	1.00		100	1.00		96	.95		.05
UMATILLA HATCHERY	S	loo	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	13.3	.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	.07	50	.90	.10	
GRANDE RONDE RIVER 84	s	llo	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	loo	1.00		100	1.00		100	.99		.01
MISSION CREEK	S	30	1.00					30	.92	.07	.02
BIG CANYON/COTTONWOOD CRKS.	S	88	.98	.02				88	.93	.01	.06
DWORSHAK HATCHERY	S	73	1.00					73	1.00		
SELWAY RIVER	s	98	.97	.03				98	.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		58	1.00		58	.90	.02	.09
IMNAHA HATCHERY	S	loo	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	.89	.04	.07
CHAMBERLAIN CREEK	S	97	1.00					97	.96	.01	.03
HORSE CREEK	S	50	1.00					so	1.00		
MIDDLE FORK SALMON RIVER #	S	277	1.00					277	.91	.01	.08
PAHSIMEROI 'B' STOCK	S	50	.99	.01				50	1.00		
SAWTOOTH 'A' STOCK	S	50	1.00					50	.91	.01	.08
HELLS CANYON STOCK	s	100	.99	.01				100	.95	.01	.04
YAKIMA RIVER	S	48	.98	.02	48	1.00		47	.92	.04	.04
YAKIMA RIVER 84	S	49	1.00		49	1.00		49	.86		.14
WENATCHEE RIVER	S	96	1.00					96	.91	.03	.06
ENTIAT RIVER	s	50	1.00		50	1.00		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