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

For copies of this report, write to:

Bonneville Power Administration
Division of Fish and Wildlife - PJ
P.O. Box 3621
Portland, OR 97208

NEZ PERCE TRIBAL HATCHERY MASTER PLAN

AND

APPENDICES

Prepared by

Roy Edward Larson
Director of Operations
Nez Perce Tribe

And

Lars Mobrand
Mobrand Biometrics, Inc.

Prepared for

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

Project No. 83-350
Contract Number DE-AI79-BP36809

March 1992

TABLE OF CONTENTS

ACKNOWLEDGEMENTS viii

EXECUTIVE SUMMARY. ix
Introduction ix
Goals ix
Costs and Benefits ix
Supplementation x
Central Incubation and Rearing Facility xi
Satellite Facilities xi
Constraints xii
Monitoring and Evaluation xii
Genetics xii
Proposed Harvest Management Plans xiii
Division of Harvest xiii
Coordination Issues xiii
Recommendations xiv

CHAPTER I SUPPLEMENTATION APPROACH 1
Introduction 1
Columbia Basin Fish and Wildlife Program 1
Goals 1
Costs and Benefits 2
Part I - Nez Perce Tribal Hatchery Summary 4
Phases 4
Facilities 4
Central Incubation and Rearing Facility 5
Supplementation Products 11
Parameters and Conditions 13
Relationship to Subbasin Planning and Integrated Plan 16
Part II - Production Summary 20
Introduction 20
Spring Chinook 24
Summer Chinook 24
Fall Chinook 27
Summary and Totals 27
Facility Construction Cost Summary 28
Recommendations 30

CHAPTER II OPPORTUNITIES AND CONSTRAINTS 32
Introduction 32
Natural Production 32
Habitat 33
Smolt-to-Adult Survival 33
Broodstock Selection 34
Spring Chinook 35
Recommendations per Genetic Risk Assessment 37
Fall Chinook 38
Central Facilities 38

Constraints 39
Opportunities 39
Satellite Facilities 40
Lolo Creek 41
Opportunities- 41
Constraints 42
Meadow Creek 43
Opportunities 43
Constraints 43
Mill Creek 43
Opportunities 43
Constraints 44
Newsome Creek 44
Opportunities 44
Constraints 44
Slate Creek 45
Opportunities 45
Constraints 45
Meadow Creek 45
Opportunities 45
Constraints 46
South Fork **Clearwater River** 46
Opportunities 46
Constraints 47
Monitoring **and Evaluation** 47
Opportunities 47
Genetics 49
Introducing Genetic Diversity 50
Rules of Supplementation to Reduce Genetic Risks 51
The **50:50** Rule 52
Rules for Supplemental Spawners 53
First generation supplementation 53
Broodstock supplementation **beyond the first** generation 54

CHAPTER III OBJECTIVES AND STRATEGIES 56
Introduction 56
Species 56
Objective; 57
Spring Chinook Production Goals 57
Clearwater River 57
Lo10 **and Eldorado Creeks** 57
Meadow Creek 61
Mill Creek 62
Newsome Creek 63
Salmon River 64
Slate **Creek** 64
Selway River 64
Meadow **Creek** 64
Summer Chinook **Production Goals for** the Selway River 65
Meadow Creek 66
Fall Chinook **Production Goals for** the **Clearwater River** 67

CHAPTER IV MONITORING AND EVALUATION PLAN 69
Introduction 69
Procedures 69
Critical Uncertainties 70
Assumptions and The Model 72
Genetics 72
Other Uncertain& 73
Monitoring and Evaluation' 73
Experimental Response Variables 73
Risk Containment 74
Genetic Risk Assessment Response 75
Uncertainties 75
Spring Chinook 75
Summer Chinook 75
Fall Chinook 76
Monitoring Activities 76
Spring Chinook 76
Summer Chinook 77
Fall Chinook 77

CHAPTER V HARVEST MANAGEMENT PLANS 78
Introduction 78
Phase1 78
Phase II 78
Phase III 80
Areas/Gear 80
Incremental Harvest 80
Proposed Harvest Plan 81
Exceptional Harvest, Opportunities 82
Agency Coordination 83
Cultural Considerations 83
Designated Harvest Areas 84
Spring and Summer Chinook 84
Fall Chinook 84
Lo10 Creek Watershed 85
Meadow Creek 87
Mill Creek 88
Newsome Creek 88
Slate Creek 90
Meadow Creek, Selway River 92
Fall Chinook, South Fork Clearwater River 93

CHAPTER VI COORDINATION ISSUES 98
Introduction 98
Nez Perce Tribal Hatchery Management Structure 98
Technical Work Groups - The Working Level 98
Public Advisory Consideration 101
Operations and Maintenance 101
Monitoring and Evaluation 101
Habitat Restoration 103
Fishery Management Process 103
Recovery Plan for Endangered Species 104

Other Production Projects 104
Harvest 105

LITERATURE CITED: 106

GLOSSARY OF TERMS **112**
-Acronyms 127

LIST OF TABLES

Table I-l. Parameter Values used in NPTH Planning 18

Table I-2. Production Summary for Nez Perce Tribal Hatchery, sorted by species. 21

TABLE I-3. Cost summary for Nez Perce Tribal Hatchery Master Plan . . . . . : . . . . : 29

Table V-l. Tribal ceremonial and subsistence harvest schedule describing species, watershed, areas,' map coordinates with escapement levels required for a minimum and maximum harvest levels. 79

LIST OF FIGURES

Figure 1. Map of the Nez Perce Ceded Territory as described in the 1855 Treaty encompassing lands within the states of Idaho, Washington and Oregon 3

Figure 2. Map showing location of Nez Perce Tribal Hatchery Central Incubation and Rearing Facility, 21 miles east of Lewiston, Idaho on. Highway 12 East at Cherry Lane.. Location of auxiliary incubation and rearing facilities at Sweetwater Springs and rearing facility on Sweetwater Creek 6

Figure 3. Map of Lo10 Creek watershed showing locations of satellite facilities for juvenile and adult monitoring adult capture, smolt acclimation/release, juvenile rearing and adult holding 7

Figure 4. Map of South Fork Clearwater River showing locations of satellite facilities for juvenile and adult monitoring, adult capture, juvenile rearing, adult holding and smolt acclimation/release sites . . . 8

Figure 5. Map of Meadow Creek, Selway River showing locations of satellite facilities for juvenile and adult monitoring, adult capture and holding, juvenile rearing and release including the timed-release fed-fry zone 9

Figure 6. Map of Slate Creek watershed showing the locations of satellite facilities for juvenile and adult monitoring, adult capture/holding and juvenile rearing 10

Figure I-l. Production Bottlenecks 14

Figure I-2. NPTH smolt-to-adult spawner recruitment curve demonstrating relationships between natural and supplemented smolt production in relation to historical (3.6%) and present (0.44%) smolt-to-adult survival. The four points of sustainability are shown at the intersection of the straight and curved lines, S_{sa} = 0.44% and 3.6% 15

Figure I-3. Map showing locations of Nez Perce Tribal Hatchery production facilities for spring and summer chinook production in the Clearwater and Salmon River subbasins 25

Figure I-4. Map showing locations 'of Nez Perce Tribal Hatchery production facilities for fall chinook production in the Clearwater River subbasin 26

Figure III-l. Objectives and strategies for Nez Perce Tribal Hatchery Production 58

Figure V-l. Graphic presentation of run development and harvest management for Lo10 Creek watershed demonstrating minimum (240 adults) and maximum (400 adults) triggers for harvest management 82

Figure V-2. Map of Lo10 Creek watershed showing the location of spring chinook harvest including harvest area for Tribal Elders 86

Figure V-3. Map of South Fork Clearwater River showing the locations of spring chinook harvest areas 89

Figure V-4. Map of Slate Creek watershed showing the locations of spring chinook harvest areas 91

Figure V-5. Map of Meadow Creek, Selway River showing location of potential harvest site 94

Figure V-6. Map of South Fork Clearwater River showing the location of fall chinook haravest area 95

Figure VI-l. Diagram of Nez Perce Tribal Hatchery Management Structure 99

ACKNOWLEDGEMENTS

In integrating previous and current **efforts** to develop a master plan for the Net Perce Tribal Hatchery, a hatchery complex consisting of a central incubation and rearing facility with multiple satellite facilities, this report has drawn upon expertise, experience and **effort from** a number of agencies, sources and individuals. It is based around earlier work and reports by the Nez Perce Tribe, **CH_2M** Hill and other's reports.

In addition to **references** of sources in the text and appendices, the following were authors and/or contributors to this product:

Harry Wagner: contract officer and coordinator with NPPC. contributed history, interagency coordination, review and editing.

Steve Levy: BPA project manager and coordinator contributed management and technical coordination along with review and editing.

Lars **Mobrand:** project overview, experimental design and monitoring and evaluation planning and authorship for various sections.

Harry **Senn:** facility site selection and descriptions,. development and analysis of production alternatives.

John **Mack:** engineering feasibility evaluations and costs.

E.G. Crosthwaite: groundwater development and production evaluation:

Kenneth Sprenke and Associates: geophysical interpretations and hydrological developments.

Important assistance was also given by: Grant Walker, Norm **Wasson,** Jennifer Jose, Bruce **Lawrence,** Manuel Villalobos, Elizabeth T. Johnson, **Marilee** Coons, and Rudy Carter (Nez Perce **Fisheries Management** employees).

Members of the Nez Perce Tribal Hatchery Technical Advisory Committee periodically provided review and information and direction to the project.

Nez Perce Tribe
Columbia River Inter-Tribal Fish Commission
U.S. Fish and Wildlife Service
Bonneville Power Administration
U.S. Forest Service
Clearwater N.F.
Nez Perce N.F.
Idaho Department of Fish and Game

Maria Dunn and Gail Jackson (BPA): for special assistance with word processing and other secretarial skills which have facilitated development of this document.

Our special thanks to the staff of Columbia River Intertriial Fish Commission for office space and other technical support in preparing the document.

Arlene **Landry:** technical writing review and guidance in preparing the master plan and its appendices.

NEZ PERCE TRIBAL HATCHERY MASTER PLAN

EXECUTIVE SUMMARY

Introduction

This report describes the findings that have resulted from the effort to create a proposed Nez Perce Tribal Hatchery (NPTH) in northern Idaho. This effort has been undertaken because of low population densities of salmon in the Clearwater and Salmon River Basins.

The Northwest Power Planning Council (Council) has approved the NPTH concept. For the NPTH to proceed, the Council must approve a master plan and amend the Columbia Basin Fish and Wildlife Program (CBFWP). Requirements of the National Environmental Policy Act (NEPA) also must be met.

Goals

The goals of NPTH are to:

- Develop, increase, and reintroduce natural populations of spring, summer, and fall chinook in the Clearwater and Salmon River Basins.
- Sustain long-term preservation and genetic integrity of target fish populations.
- Keep the ecological and genetic impacts of-nontarget fish populations within acceptable limits.
- Provide harvest opportunities for both tribal and non-tribal anglers.

Costs and Benefits

The capital costs of the NPTH are expected to be $7 million.

Annual operating costs are expected to be $1 - $1.5 million.

Total adult returns are expected to be at least 3,000 to 4,000 and may range as high as 6,000 to 7,000 fish.

Spring chinook production would increase by 33 percent over baseline conditions with an additional 1,300 to 1,800 fish returning as a result of NPTH production.

Summer chinook numbers would rise from 0 to 600 or more adults.

Fall chinook numbers would rise from 20 to more than 1,000 adults.

Supplementation

Supplementation is the use of artificial propagation to increase or restore natural production. The proposed NPTH supplementation program consists of:

- natural production management
- hatchery broodstock selection and development
- selective harvest
- satellite release methods
- special hatchery facilities to restore natural production
- stock isolation
- genetic management
- low density rearing
- conditioning of fish to survive in the natural environment

Increasing smolt-to-adult survival is a critical element in the program.

Two central hypotheses of the NPTH supplementation effort are:

- Eggs brought to the hatchery for incubation, rearing and then release as pre-smolts into a target stream will survive (to returning adult) at a greater rate than eggs deposited in the spawning grounds by natural spawners.
- The mixture of natural and hatchery fish will reproduce successfully without adverse genetic effects and that undesired interactions with other populations will not occur.

To accomplish these goals, three types of supplementation facilities are planned:

- a Central-Incubation and Rearing Facilities (CIRF)
- auxiliary incubation and rearing facilities

- 13 satellite facilities located in tributary watersheds where natural salmon production either occurs or could occur

Central Incubation and Rearing Facility (CIRF)

The CIRF will mimic natural incubation temperatures for eggs and alevins and rear fry to approximately two to three inches in length to prepare them for final rearing at satellite facilities **or** in natural stream systems. Stock isolation will be used to prevent the spread of disease and to preserve and develop the genetic base of each stock.

The CIRF will produce the following products based on each species and the habitat conditions available:

1. Spring and summer chinook timed-release fed-fry used to restock natural habitat

2. Spring and **summer chinook** fed-fry to be reared in satellites for release as **"presmolts"** in the fall

3. Fry to be reared at satellites for release as **sub-**yearling smolts (Age-O fall chinook smolts)

4. Fry to be reared in satellites for release as yearling **smolts** (Age-l+ or full-term spring and summer chinook smolts).

The first product reduces the impact of extensive hatchery rearing and adapts fish to natural habitat early in their life while coordinating their release with conditions favorable to their survival.

The other forms of supplementation are designed to promote natural selection and to prevent hatchery production from dominating or forcing native fish to extinction.

Satellite Facilities

Satellite facilities will be used to rear juvenile salmon and capture, hold and spawn adults salmon in natural waters.

Satellite projects have been sited in watersheds where **instream** and riparian habitat has been enhanced and passage has been developed. .

Constraints

The key **factor** in the supplementation effort is **smolt-to-adult** survival. This is affected by passage of juveniles and adults through the dams and harvest of adults both in the Columbia River and in the ocean.

Other potential constraints are:

- o habitat and water quality might be degraded further.

- o survival parameters for either natural or hatchery production might be less than estimated.

Monitoring and Evaluation

The potential **risks and** benefits of supplementation are disputed among fisheries experts. To compensate for this situation, extensive monitoring and evaluation are proposed for the NPTH.

Year-round monitoring of juveniles will aid in **understanding** the effectiveness of various supplementation efforts and to redirect those **efforts** prior to adult returns. Adult monitoring at the stream mouth will:

- o give **specific information** on adult return **composition** and **numbers** for broodstock.

- o be used to help determine harvest opportunities and levels.

Uncertainties -that may. affect **NPTH success,** but **do not** lend themselves **to resolution** through' experimentation (within the context of the **NPTH** alone), are:

- o smolt-to-adult survival

- o reproductive success

- o long-term fitness

- o ecological interactions with other stocks

Genetics

Uncertainties remain about the long-term **genetic implications** of supplementation. NPTH production will entail four types of impacts and risks:

1. Extinction

2. Loss of Within Population Genetic Variability

3. Loss of Between-Population Genetic Variability

4. Anthropogenic Effects

Proposed Harvest Management Plans

To ensure a minimum level of adult returns, no harvest is likely to occur until at least five years after production has started.

In most watersheds, the minimum harvest goal was set by the number of adult returns exceeding 50 percent or more of the maximum goal for adult returns. When a watershed has a natural run of fish, harvest does not begin until adult returns equal 60 percent of the maximum adult return goal (e.g., Lolo Creek).

If hatchery production exceeds natural production, selective harvesting may be needed to prevent hatchery fish from overwhelming natural fish production.

Harvest areas designated in this report were selected by the Nez Perce Tribe's Department of Fisheries Management. Consideration was given to:

- protecting rebuilding and restoring the depleted fisheries resources
- the cultural needs of the Nez Perce people
- other fisheries resources managers and resource users

The areas designated fdr tribal harvest are on tributaries above monitoring sites.

Division of Harvest

The NPTH harvest management program does not address an equitable division of harvest between the Nez Perce Tribe and Idaho sports fishermen. This issue will be addressed-by the steering committee of the Nez Perce Tribe and the Idaho Department of Fish and Game (IDFG).

Coordination Issues

The Nez Perce Tribe is responsible, along with Idaho Department of Fish and Game (IDFG), U.S. Fish and Wildlife Service (USFWS), and other land and water management agencies, for managing fishery resources in Idaho subbasins.

NPTH planning has been included in both the Clear-water and Salmon River **Subbasin** Plans. NPTH production is designed to support recovery programs for any species **designated** by Endangered Species Recovery Plans.

Since September 1987, various agencies and interested groups have taken part in Technical Work Group (TWG) meetings related to the proposed NPTH. The TWG have guided the planning of NPTH and recommended policy. The TWG is composed of:

- Bonneville Power Administration
- Idaho-Department of Fish and Game (Boise **& Lewiston** Offices)
- Columbia River Inter-tribal Fish Commission
- U.S. Fish and Wildlife Service
    - Dworshak Hatchery **&** Fisheries Assistance Office
- U.S. Forest Service
    - Clearwater National Forest
        - Supervisor's Office **&** Pierce District
    - Nez **Perce** National Forest
        - Supervisor's Office
        - Clearwater, Elk City, and Salmon River Districts
- **Potlatch** Corporation
- land and mineral rights owners
- Pacific Northwest Utilities Conference Committee
- Idaho Salmon and Steelhead Unlimited

Recommendations

1. Build the following facilities:

   A. A Central Incubation and Rearing Facility (CIRF) at Cherry Lane, 21 miles east of Lewiston, Idaho on Clearwater River

   B. An Auxiliary Incubation and Rearing Facility at Sweetwater Springs, 10 miles southeast of Lewiston, Idaho

   C. Satellite facilities located in tributary watersheds:

   Clearwater River:
   Lo10 Creek Spring Chinook Facilities
   Permanent Monitoring/Evaluation and **Smolt** Acclimation/Release and Adult Recovery

Satellite at stream mouth.
Yoosa/Camp Creek Presmolt Rearing/Rearing and Adult Holding Satellite
Dollar/Eldorado Creek Presmolt Rearing and **Adult Holding** Satellite
Seasonal Adult Trap on Lo10 Creek at Bradford Bridge
Seasonal Adult Trap on Eldorado Creek below Falls

Mann Lake **Headgate** Age **1+ Smolt** Rearing Satellite

North Lapwai Valley Fall Chinook Smolt Rearing/Release and Adult Recovery/Holding Satellite

Selway River:

Fenn Pond Fall Chinook Acclimation/Release Satellite

Meadow Creek Summer Chinook Presmolt Rearing/Release and Adult Recovery/Holding and Monitoring **&** Evaluation Satellite

South Fork Clearwater River:

Stites/Luke's Gulch Fall Chinook Smolt Rearing/Release and Adult Recovery/Holding Satellite

Mill Creek Spring Chinook Presmolt Rearing/Release and Adult Recovery/Holding Satellite
Meadow Creek Spring Chinook Presmolt Rearing/Release and Adult Recovery/Holding Satellite
Newsome Creek Spring Chinook Presmolt Rearing/Release and Adult Recovery/Holding Satellite

Salmon River, Slate Creek:

Hurley Creek, Monitoring/Evaluation/Juvenile Acclimation/Release and Adult Recovery Satellite

Deadhorse Creek Spring Chinook Presmolt Rearing/Release and Adult Holding Satellite

E. Monitoring and evaluation facilities in each watershed where satellites are located:
- **Permanent**
  - Lo10 Creek Mouth, Clearwater River
  - Meadow Creek, Selway River
  - Slate Creek, Salmon River
- Seasonal Mobile Screw Trap Units
  - -Newsome,Meadow, Mill Creek, S.F. Clearwater River

2. Timed-release fed-fry stocking of remote unused habitat.
   - Meadow Creek, Selway River: Spring Chinook
   - Little Slate Creek, Salmon River: Spring Chinook

3. Monitoring and Evaluation of presmolt and'timed-release fed-fry to resolve uncertainties about the survival following release;
   - monitor following release in tributary mainstem.
   - monitor in winter in mainstem tributaries and rivers.
   - monitor in spring in mainstem tributaries and rivers.
   - monitor at Lower Granite Dam

4. Conduct sequential monitoring of'smolts at the dams.

5. Set a low level of harvest until the maximum adult return goal is achieved.

NEZ PERCE TRIBAL HATCHERY MASTER PLAN

CHAPTER I SUPPLEMENTATION APPROACH

Introduction

This report describes the findings that have resulted from the effort to create a proposed Nez **Perce** Tribal Hatchery (NPTH) in northern Idaho (Figure- 1). This **effort** has been undertaken because **only low** population **densities** of native salmon exist in the Clearwater and Salmon River Basins areas proposed for supplementation in this document.. **The** goal of the NPTH is to restore natural runs of spring, summer, and fall chinook in the watersheds of these basins.

This project has been known by several names. The current name for this project, which will be used throughout this report, is:

Nez **Perce** Tribal Hatchery **(NPTH)**

Columbia Basin Fish and Wildlife Program

The Northwest Power Planning Council (the Council) has 'approved the NPTH concept. For the NPTH to proceed, the Council must approve a master plan and amend the Columbia Basin Fish and Wildlife Program (CBFWP). The CRBFWP has guided development of this master plan. Requirements of the National Environmental Policy Act (NEPA) also must be met.

Goals

The goals of the NPTH are to:

- Develop, increase, and reintroduce natural populations of spring, summer, and fall chinook in the Clearwater and Salmon Rivers Basins.
- Sustain long-term preservation and genetic integrity of target fish populations.
- Keep the ecological and genetic impacts of nontarget fish populations within acceptable limits.
- Provide harvest opportunities for Tribal and non-Tribal anglers.'

Costs and Benefits

The capital costs of the NPTH **are** expected to be $7 million.

Annual operating costs are expected to be $1 - $1.5 million.

Total adult returns are expected to be at least 3,000 to 4,000 and may range as high as 6,000 to 7,000 fish.

Spring chinook production would increase by 33 **perrcent** over baseline **conditions** wjth **an additional** 1,300 to **1,800** fish returning as a result of **NPTH** production.

Summer chinook numbers would rise from 0 to 600 or more adults.

Fall chinook numbers would rise **fromm** 20 'to more than 1,000 adults.

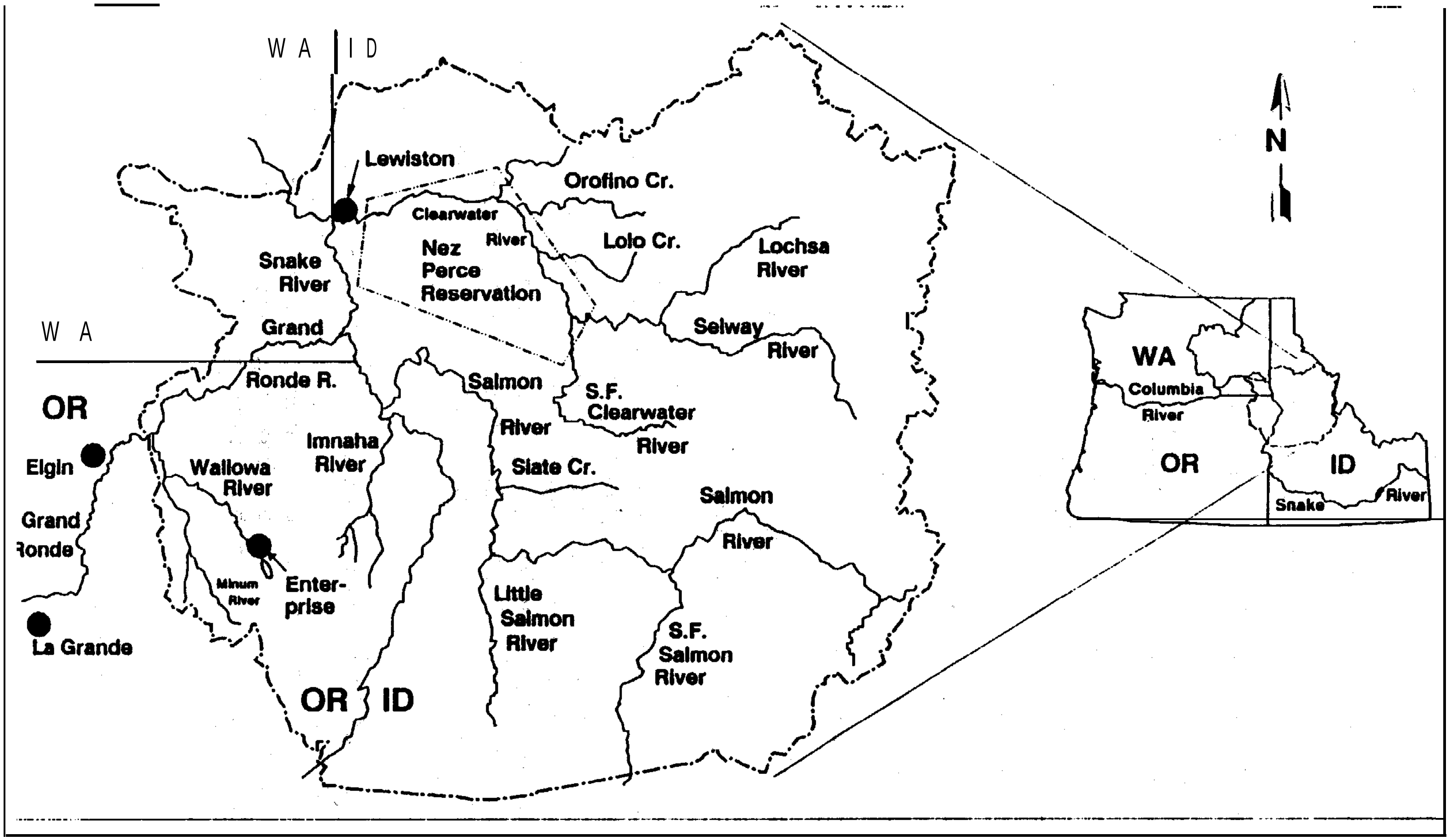


Figure 1. Map of Nez Perce Ceded Territory as described In the 1855 Treaty encompassing lands wlthln the states of Idaho, Washington and Oregon.

Part I - #es Perce Tribal Hatchery Summary

Phases

The NPTH supplementation program is based on three phases:

Phase I, Restoring natural production

Phase II, Maintaining supplemented natural production

Phase III, Supplementing harvest levels within the Clearwater -and Salmon River subbasins.

Phase I will try to restore the fish populations of tributary watersheds to levels that seed the natural habitat to the highest achievable level. This achievement will primarily be limited by the following factors:

- smolt-to-adult survival
- juvenile carrying capacity'
- genetic constraints

In other systems that have no natural populations, the goal is to reintroduce aparticular species and raise its level of natural and supplemented production to-the carrying capacity of the watershed.

In most cases, existing populations qre declining. Phase II will try to maintain the natural population through hatchery supplementation. A production model (Support Document 8.00, NPTH Production Model) has been developed and used to predict the level of supplementation needed to restore and maintain the carrying capacity of the watershed. The model addresses the production parameters described in Table I-l. This methodology is described in the Supplementation Products section of this chapter.

Phase III will identify harvest. levels and try to maintain them through supplementation and harvest management (see Chapter IV, Harvest Management). The model has been a great aid.in identifying-the time dnd levels of harvest opportunities and the interaction between natural and hatchery production.

Facilities

To achieve the goals of the NPTH program, five types of facilities have been designed:

- a Central Incubation and Rearing Facility (CIRF) at **Cherry Lane,** Idaho **(Figure** 2)
- an auxiliary incubation and rearing facility at Sweetwater Springs in Idaho **(Figure** 2)
- a rearing facility on Sweetwater Creek (Figure 2)
- multiple satellite facilities located in tributary watersheds (Figures 3-6)
- monitoring facilities for both adults and juveniles in each watershed where satellites are located (Figures 3-6)

These facilities are discussed and shown in drawings in Support Document 3.00, Facility Conceptual Designs. The **CIRFs** and satellite facilities are simple, yet versatile. Biological aspects of these facilities are discussed in Appendices 2.00, Site Selection and Evaluation Processes and 3.00, Facility Conceptual Designs.

Central Incubation and Rearing Faaility **(CIRF)**

The CIRF will incubate eggs and **alevins and** rear fry to approximately two to three inches to prepare them for final rearing at the satellite facilities or in natural stream systems. Water quality and temperatures will be **controlled** at the CIRF to match the needs of each species **and the** biological requirements of the watershed into which fry will be released..

Stock isolation will control diseases and maintain the genetic identity of each stock. Full-term smolts will not be produced at the Cherry **Lane** CIRF. This will control long-term operational costs and promote naturalization of fish after release.

The satellite facilities will be used to rear juvenile salmon and capture, hold, and spawn adult salmon in natural waters. Satellite facilities are located in tributary watersheds **where** natural populations have declined **orbecome** extinct but where water quality and habitat are capable of producing salmon. This program should lead to the re-naturalization of fish cultured in the NPTH.

Monitoring and evaluation facilities (Appendices 2.00, 3.00) in each watershed will identify the successes or failures of natural and hatchery production. Adults and juveniles will be monitored to understand the effectiveness of various supplementation programs and to redirect the production programs. The elements and detail of monitoring are described in Chapter IV, Monitoring and Evaluation.

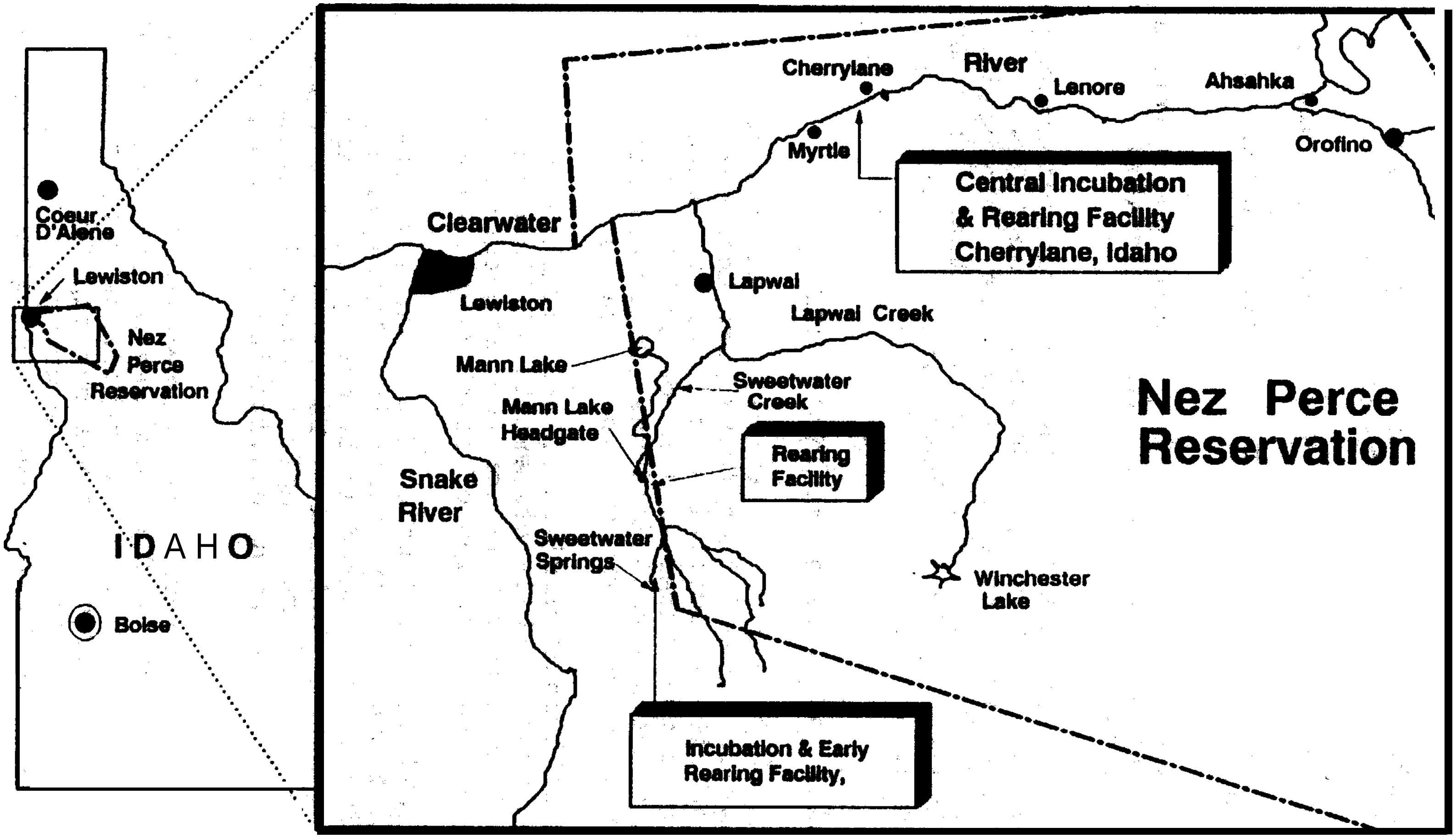


Figure 2. Map showing location of Nez Perce Tribal Hatchery Central Incubation and Rearing Facility, 21 miles east of, Lewiston, Idaho on Highway 12 East at Cherrylane. Location of auxillary incubation and rearing facilities on Sweetwater Springs and rearing facility on Sweetwater Creek.

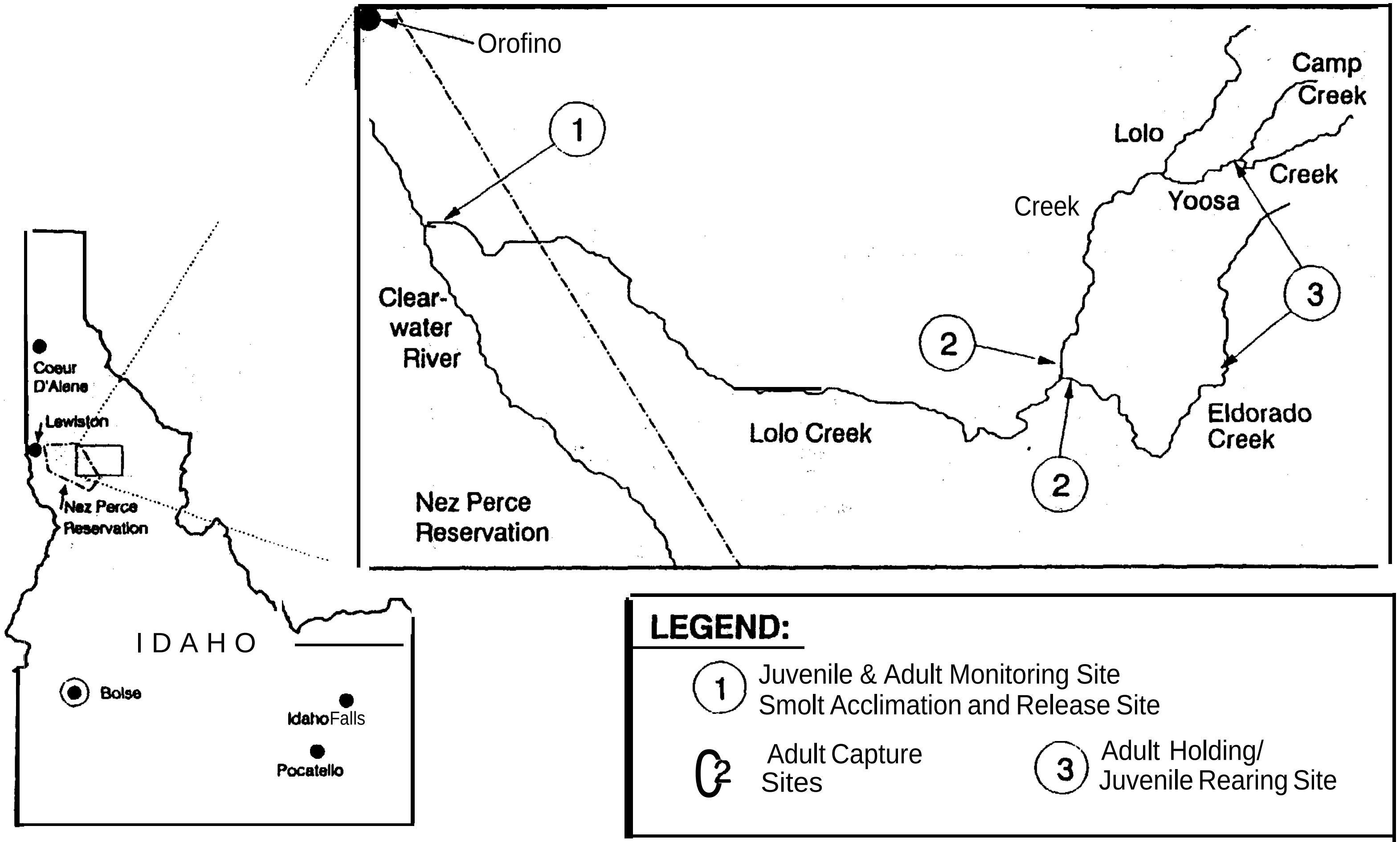


Figure 3. Map of **Lolo** Creek watershed showing locations of satellite facilities for juvenile and adult monitoring, adult capture, smolt acclimation/release, juvenile rearing and adult holding.

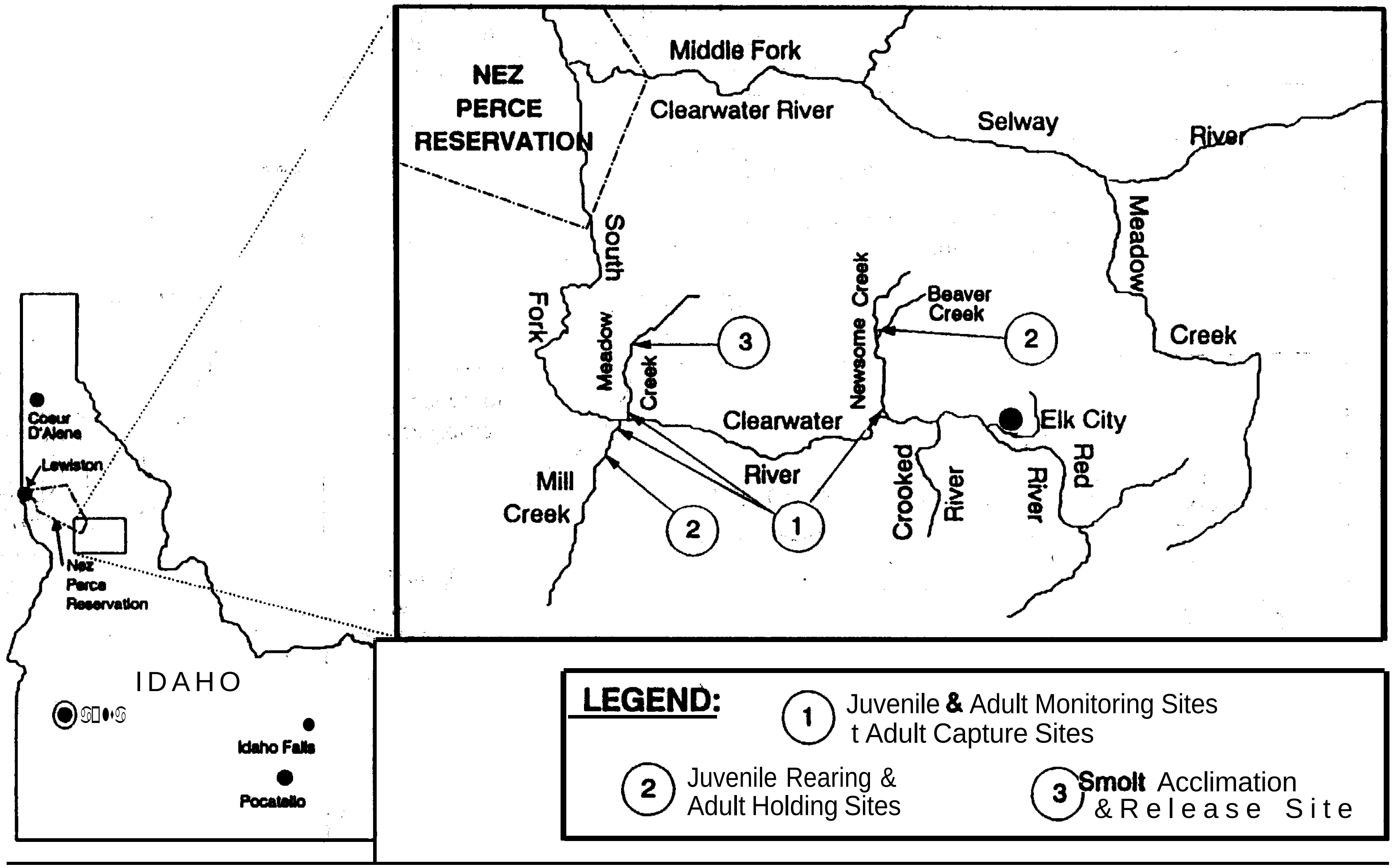


Figure 4: Map of South **Fork Clearwater River** showing locations of satellite facilities for juvenile and adult monitoring, adult **capture,** juvenile rearing, **adult holding** and smolt acclimation/release **sites.**

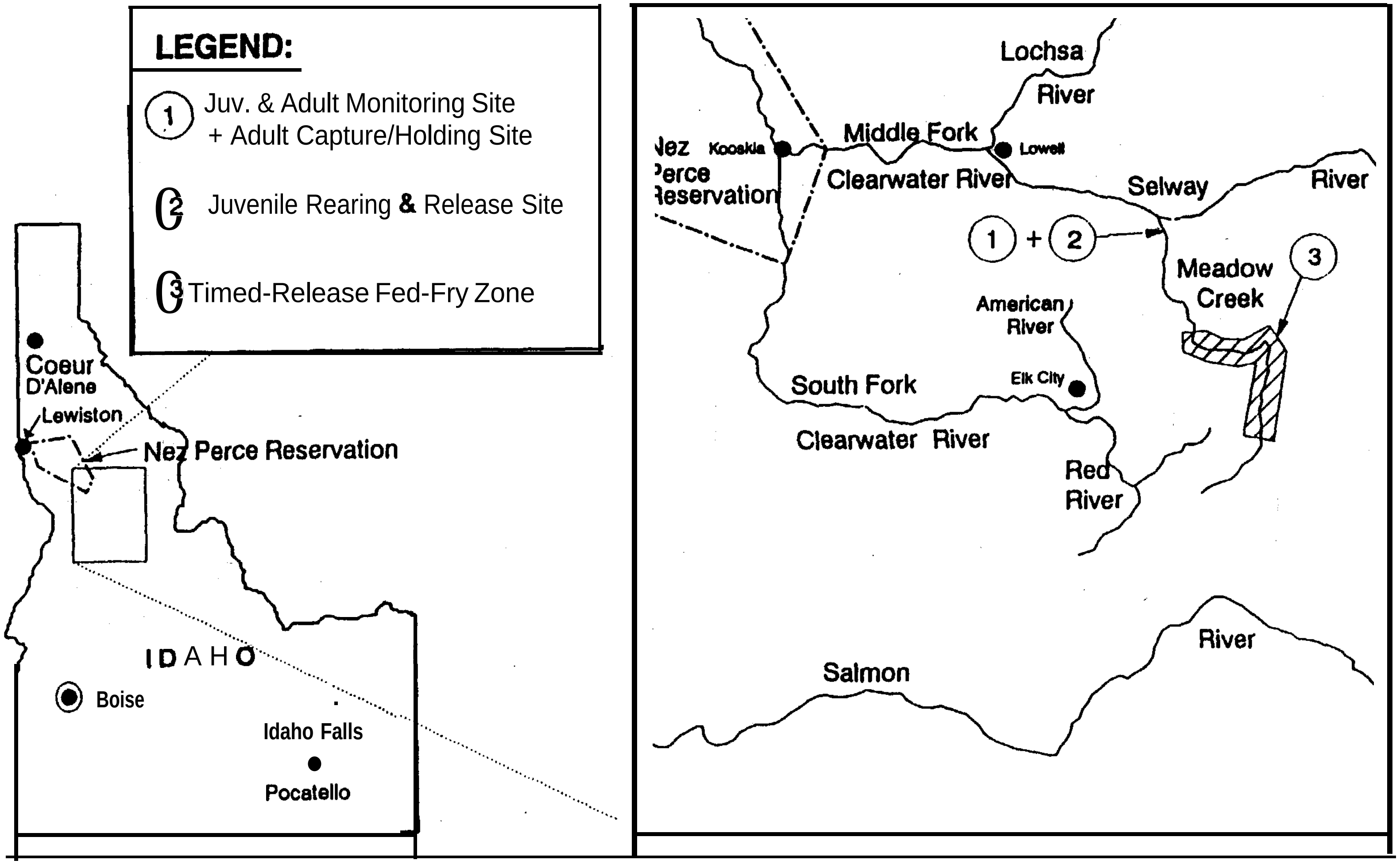


Figure 5: Map of Meadow Creek, Selway River, showing locations of satellite facilities for juvenile & adult monitoring, adult capture & holding, juvenile rearing & release Including the timed-release fed-fry zone.

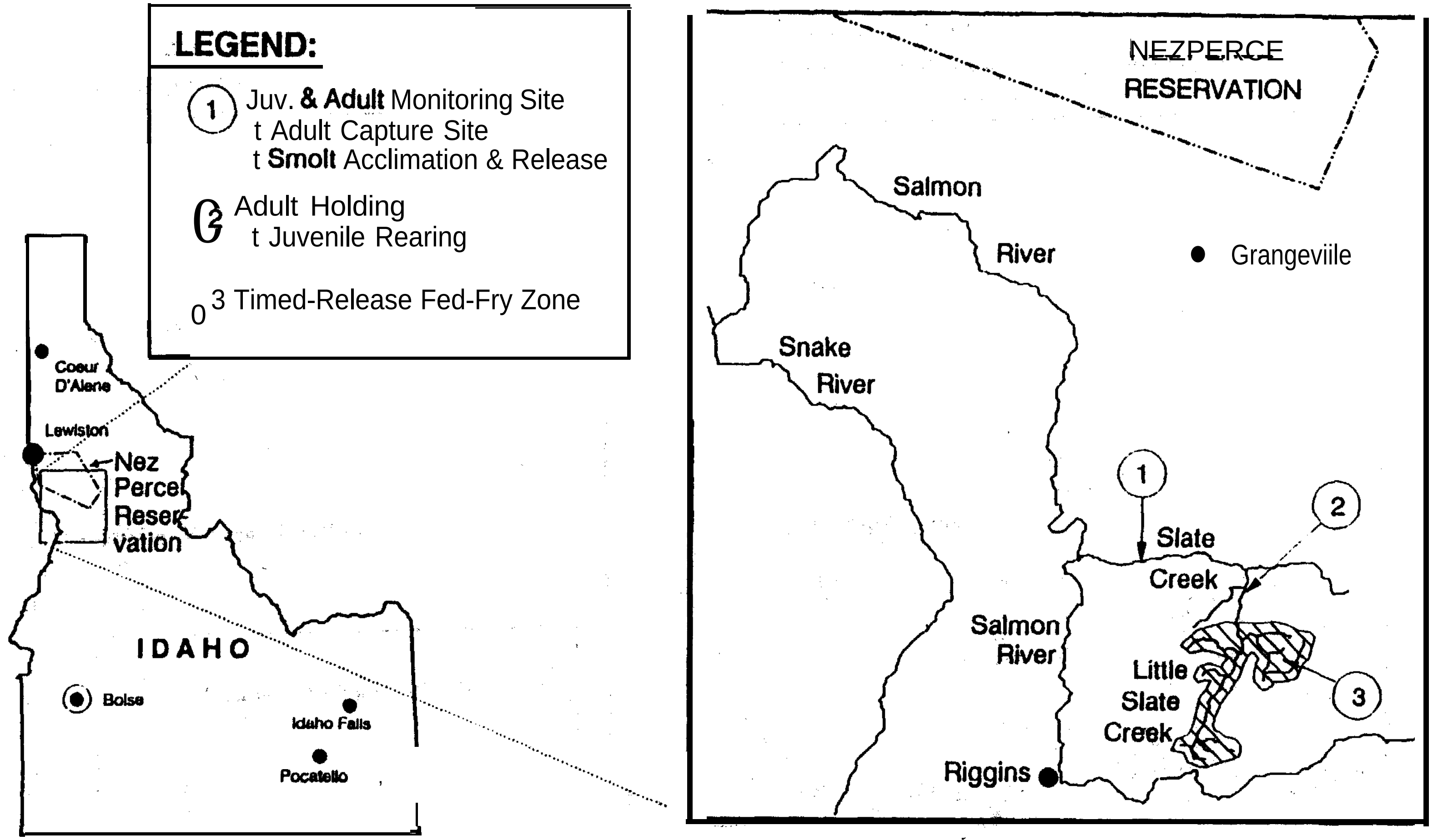


Figure 6: Map of Slate Creek watershed showing the locations of satellite facilities for juvenile and adult monitoring, adult capture/holding and juvenile rearing.

Supplementation Products

The NPTH program will use fry from the CIRF to produce:

- timed-release fed-fry (TRFF) -used to-restock natural habitat
- fed-fry to be reared in satellites for release in the fall as presmolts
- fry to be **reared** at satellites for release as sub-yearling smolts (Age-O smolts)
- fry to be reared in satellites for release as yearling smolts (Age-l+ or full-term smolts)

Timed-release fed-frv **(TRFF)** will be released directly into natural habitats where access is restricted either by climate and/or management policy (e.g., wilderness areas). These fish are reared in the hatchery.until water and food conditions in the natural environment favor their survival. The target size for release is usually two to four grams per fish. The timing of their release will match their natural emergence timing. The goal of this type of production is to reduce the impact(s) of artificial rearing and provide extended development in a natural environment. TRFF production will comprise about 10 percent of the production program. Spring and summer chinook are the species to be produced in this manner. TRFF supplementation will be used in two geographical areas:as discussed in Chapter III, Proposed Goals, Objectives, and Strategies.

Presmolt Production: Fed-fry for presmolt production will be produced for outplanting and rearing in the various satellite facilities and **released in** the fall of the year. In general, they will be reared in low density conditions in earthen basin ponds to mimic the conditions of a presmolt reared in the stream. Presmolt production will make up about 38% of the program. Husbandry techniques will be used **to condition** these fish to respond to:

- water velocity (current)
- natural feeding
- **instream habitat** structures
- predator avoidance

Age 0 smolt (sub-yearling) production will be used to produce fall chinook which historically migrated from the Snake River subbasin as sub-yearlings (Horner and Bjornn 1979). Lyons Ferry Hatchery currently is rearing and releasing sub-yearling fall chinook smolts (Bugert, et al 1990). Age 0 smolt production will compose about 40 percent Of the program.

Aae 1+ smolt production will produce summer and/or spring chinook .smolts. Other species could be produced (e.g., fall, coho, sockeye) Nevertheless, water supplies are limited and low density rearing ($\leq$0.1 lb/ft^3/in) is a major production goal. Full-term smolt production would range from 150,000 to 200,000 fish or about 12 percent of the program.

Two of the reasons presmolts and TRFF will be produced instead of full-term smolts are:

1. the Nez Perce Tribe's (NPT) desire to have gravel-to-gravel management

2 . climatic conditions and the limited quantities of water for incubation and rearing

The first reason requires using the hatchery to rebuild or re-establish natural runs of salmon. The rearing of presmolts in the natural environment is intended to adapt fish to the stream to aid in restoring natural-&instincts and thus restore natural production.

The second reason requires that the hatchery depend on satellite facilities to produce presmolts; 'Severe winter, conditions prohibit successful operation of a hatchery in the tributary areas where water and habitat could otherwise support natural production. Access to the upland tributary areas is often restricted at the time smolts need to be released.

Ground water resources in the warmer low-lands along the Clearwater River are Limited and prevent production of sufficient numbers a full-term chinook smolts. The limited supplies of ground water along the mainstem of the Clearwater River could be used to produce Age 0 fall chinook smolts for release into waters that historically allowed production of this species.

For spring chinook, the only natural waters supporting their production are the upper tributaries of the Clearwater and Salmon subbasins. Hence, the need for satellite rearing facilities in these areas.

Presmolt production has some disadvantages compared to smolt production: the presmolt fish culture process cannot promote survival of the fish up to the time of smoltification.

On the other hand, TRFF and presmolts will adapt to the natural environment to survive. This reduces the impact of hatchery culturing and genetic alteration. In addition, the'long-term cost of equipment and personnel to produce the presmolt is less than for raising smolts. Presmolts are imprinted to the natural habitat and should return to the specific habitat in which they were raised and released.

Parameters and Conditions.

The historical level of smolt-to-adult survival probably will never be achieved again, but it is important to increase the present S_{sa} = 0.44 percent to some greater level (e.g., 0.88 percent). The increased S_{sa} will result in maintenance of and restoration of runs, especially in the upper basins, Snake, Clearwater, Salmon, etc. This will help resolve the lack of harvests in the upper Columbia subbasins.

To understand presmolt production better, the NPTH study team developed a model to relate natural and hatchery production (Support Document 8.00, NPTH Production Model).

This work also identified the need to estimate the winter carrying capacity (Figure I-l) of the watersheds that could extend production beyond summer carrying capacity production. Stream and river reaches where waters are too hot for summer' production of salmonids are sufficiently cool for winter production of presmolts to smolts. Winter carrying capacity was calculated from Idaho Fish and Game Subbasin Presence and Absence files using standard techniques followed in Subbasin Planning (NPPC 1989). This method of estimating winter carrying capacity probably produces an underestimate.

The model incorporates information from the Sub-basin Planning (SBP) and Integrated System Planning (ISP) processes. It became apparent that it-would not be biologically sound to produce more presmolts than the habitat could support (see density dependent curve, Figure I-2)

Discussion of juvenile salmonid movements with U.S. Forest Service (USFS) and Idaho Department of Fish and Game (IDFG) biologists revealed that in the-fall of the year., when tributary water temperatures reach 7.0°C, mature parr move into river reaches (Personal communication R. Kiefer, 1991; Hillman 1986, Hillman et al. 1987). These parr appear to use nonproductive summer habitats as winter habitat..

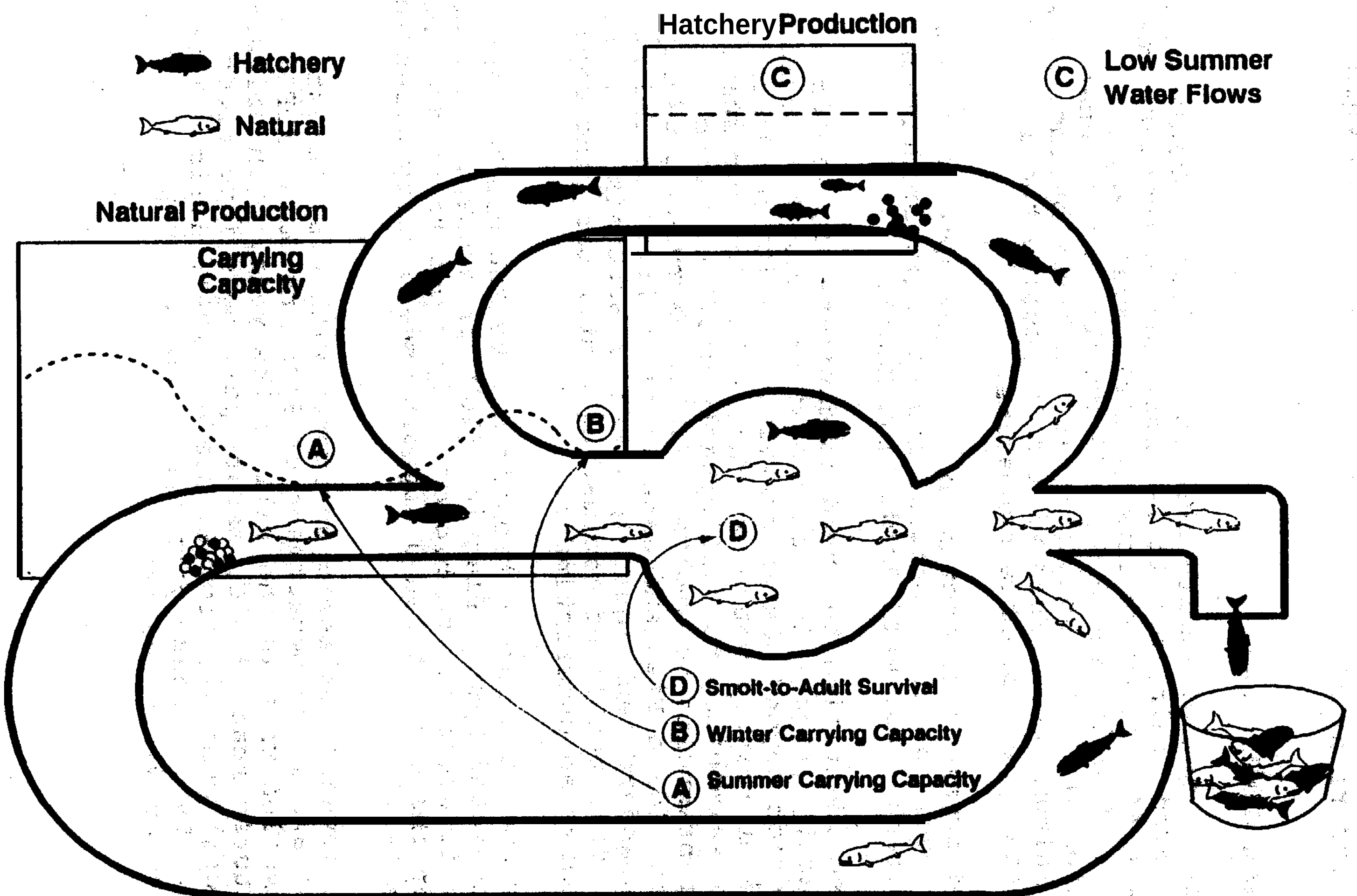


Figure I-1. Production Bottlenecks: ● Bottleneck A limits natural production ● Bottleneck C limits hatchery presmolt production ● Bottleneck B limits hatchery and natural production ● Bottleneck D limits hatchery and natural production

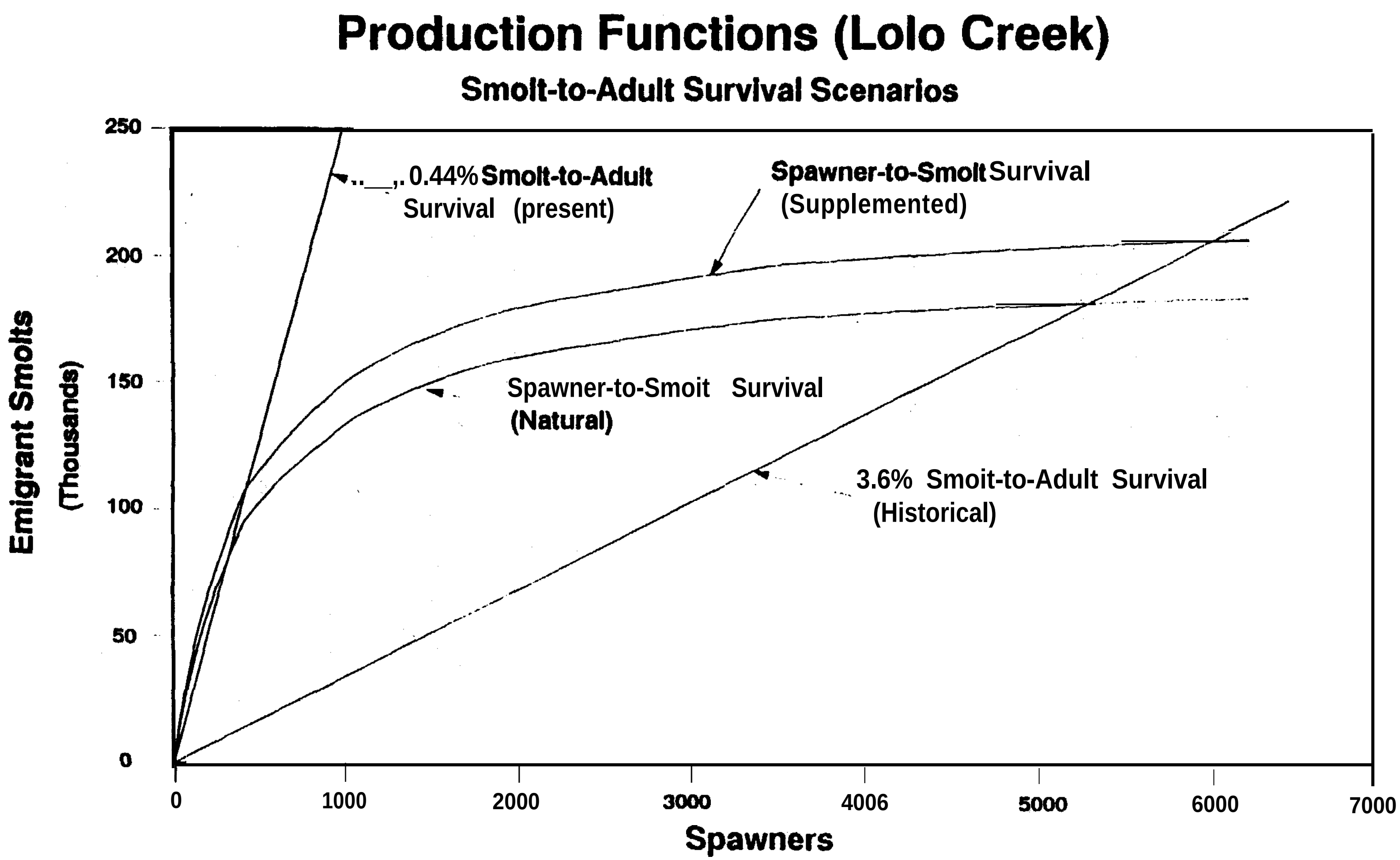


Figure i-2. NPTH smoit-to-adult spawner recruitment curve demonstrating relationships between natural and supplemented smoit production in relation to historical (3.6%) and present (0.44%) smoit-to-adult survival. The four points of sustainability are shown at the intersection of the straight and curved lines, S_{sa} = 0.44% and 3.6%.

Present S_{sa} suggests that supplementation must be continuous to rebuild runs and to sustain populations large enough to offer harvest opportunities. Supplementation also will tend to stabilize adults numbers returning to the subbasin each year.

NPTH continuous supplementation is different from the Idaho Fish and Game supplementation research program. The IDFG program assumes that S_{sa} from a short-term supplementation effort will be great enough to perpetuate a run. If passage improvements at the dams in the lower Snake and Columbia Rivers are made, S_{sa} may increase to a level where unsupplemented populations can sustain themselves.

In the meantime, improvements in supplementation and passage will be required to help 'existing stocks survive and to reseed habitat while we wait for passage improvements to increase S_{sa}.

The NPTH supplementation effort consists of:

- natural production management
- hatchery brood stock selection and development
- selective harvest
- satellite release methods
- hatchery design and operation
- stock isolation
- genetic management
- 'low density rearing
- conditioning of fish to survive in the natural environment

These components are described in more detail in the Chapter III, Proposed Objectives and Strategies and Appendix 1.00, Biological Criteria for Artificial Production.

Relationship to Subbasin Planning and Integrated Plan

The NPTH development has focused on meetjng the biological requirements of the species to be produced. Secondary consideration has been given to agency interaction and other non-biological policy issues.

The NPTH has been developed in conjunction with the Subbasin Planning Process (SBP). NPTH production was a preferred supplementation scenario in both the Clearwater and Salmon River

subbasin plans (Columbia System Planning 1990 and 1991). The Integrated System Plan (ISP) identifies NPTH as a Level 1 Early Implementation Activity of Subbaain Strategies, Actions 23 and 24, page 247 (ISP 1991).

The **Subbasin** Plans for the **Clearwater** (CSBP) and Salmon Rivers (SSBP) and the Integrated System Plan (ISP) have a goal **of** doubling the runs in the Columbia River Basin from 2.5 to 5.0 million returning adults (Columbia System Planning 1990 and 1991).

The NPTH model shows that significant progress toward the doubling goal will not occur unless smolt-to-adult survival, S_{sa} (Table I-l, Table of Parameters) is markedly increased. In the model, present day S_{sa} equals a value of 0.44 percent. Figure I-2 **demonstrates** that historically, S_{sa} equaled a value of three to five percent (Chapman 1981).

Given the other parameters for survival of various life **stages'** (Table I-l), the NPTH model shows the dramatic effect that reduction in smolt-to-adult survival from historical levels has had on productivity in the Salmon and Clearwater subbasins. All other parameters dealing with in-basin survival will need to be kept as high as possible to perpetuate existing runs of fish or to restore runs **of** fish. Even though NPTH production cannot aspire to produce the historical S_{sa} **levels,** the modest increase in production expected is **critically** important because of the present precarious condition of the stocks.

NPTH production could attempt to accomplish the ISP doubling goal by producing only smolts. Concerns with that approach include:

- the post release survival S of smolts from hatcheries to Lower Granite Dam, S_{pr} is e&al to or less than 50 percent (Table I-l)
- too many smolts may be produced
- genetic risks
- loss of wild stocks and natural stocks
- limited broodstock
- limited water resources

Table I-1. Parameter **Values used** in **NPTH** Planning. Production **parameters; survival** rates, production **levels**, fecundity, sex ratios, reproduction efficiency, broodstock **sources (native/imported) used to determine satellite production for smolts, presmolts and timed-release fed-fry.**

Parameters	Stream: Species:	Lolo Creek Clearwater R. (SC)	Slate Creek, Salmon R. (SC)	Newsome Creek SF Clearwater R. (SC)	Mill Creek, SF Clearwater R. (SC)	Meadow Creek, Selway R. (SC/SM)	SF Clearwater, Stites/Luke's Gulch (FC)	Meadow Creek, SF Clearwater R. (SC)
Carrying Capacity	summer winter	332,312 (1) 586,158 (2)	166,251 (1) 467,374 (2)	71,367 (1) 237,802 (2)	44,908 (1) 211,343 (2)	497,375 (1) 944,750 (2)	500,000 (7)	30,000 (8)
Pre-spawning Survival	hatchery: natural:	85% (3) 90% (6)	85% (3) 90% (6)	85% (3) 90% (6)	85% (3) 90% (6)	85% (3) 90% (6)	85% (3) 90% (6)	85% (3) 90% (6)
% Females (all Ages)	hatchery & natural	50% (6)	50% (6)	50% (6)	50% (6)	50% (6)	50% (6)	50% (6)
Eggs/Female (all ages)	hatchery & natural	4,000 (6)	4,000 (6)	4,000 (6)	4,000 (6)	5,000 (6)	4,315	4,000 (6)
Egg to Fry Survival	hatchery: natural:	72% (6) 40% (4)	72% (6) 40% (4)	72% (6) 40% (4)	72% (6) 40% (4)	72% (6) 40% (4)	85% 40%	72% (6) 40% (4)
Fry to Fall Presmolt Survival at low Dens.	hatchery: natural:	90% (6) 72% (4)	90% (6) 72% (4)	90% (6) 72% (4)	90% (6) 72% (4)	90% (6) 72% (4)	NA	90% (6) 72% (4)
Presmolt to Smolt Survival at low Density	hatchery & natural	72% (4)	72% (4)	72% (4)	72% (4)	72% (4)	95%	72% (4)
Post-release Survival *	hatchery	50% (3)	50% (3)	50% (3)	50% (3)	50% (3)	NA	50% (3)
Smolt to Adult Survival	hatchery & natural	0.44% (5)	0.44% (5)	0.44% (5)	0.44% (5)	0.44% (5)	0.25%	0.44% (5)
Natural Reproductive Efficiency	hatchery: natural:	80% (3) 100% (3)	80% (3) 100% (3)	80% (3) 100% (3)	80% (3) 100% (3)	80% (3) 100% (3)	80% UNKNOWN	80% (3) 100% (3)
% of Broodstock Imported	hatchery	0%	100%	0%	0%	0%	100%	100%

* Most critical uncertainty.
1. Standard method used in subbasin planning. 2. See Appendix I.
3. Salmon and Steelhead System Planning Documentation. Prepared by Monitoring and Evaluation Group, Northwest Power Planning Council.
4. System Planning assumed a 20.8% low density survival from egg to smolt. This rate used here is (.4x.72x.72=.207). Density dependent mortality is assumed (Beverton-Holt) for both fry to presmolt and presmolt to smolt.
5. System Planning assumed equal smolt to adult survival for natural and hatchery after a 50% post release loss for the latter.
6. Clearwater subbasin plan.
7. Age-0 smolts (age-0 migrants. 8. See Harvest Management.

Alternatives to massive hatchery production include:

- using timed-release fed-fry; presmolts, and limited numbers of **smolts** (Age-O and Age-l+)

- variations in husbandry techniques to promote natural production

These alternatives are consistent with **ISP** goals and support the principles of the Columbia River Basin Fish and Wildlife Plan.

NPTH production is designed to be biologically sound and promote opportunities for natural production. For example, natural production is given special attention in an item known as-the **50/50** Rule (Chapter III, Proposed Objectives and Strategies). The intent of this rule is to select for preferred genetic qualities associated with natural production.

Part II - Produotion summary

Introduction

Production involves three species of salmon: spring, summer, and fall chinook. Production is based on the following assumptions:

- a Central Incubation and Rearing Facility at Cherry Lane, Idaho
- an auxiliary incubation and rearing facility at Sweetwater Springs, Idaho.
- 13 satellite facilities

These facilities are summarized in Table I-2, Figures I-3 and Figure Z-4.

The Cherry Lane CIRF shall primarily function (see functions definitions in Table I-2.) as an incubation and fry/fingerling rearing facilities. At a later, date, it may have some fall chinook smolt rearing function. Some juvenile fall chinook production may occur at the Cherry Lane CIRF if there are insufficient ground water sources at satellite sites.

The Sweetwater Springs facility will be a backup to incubation with its primary function being to rear Age-O or Age-l+ smolts. Neither incubation and rearing facility will have the ability to directly capture adults for broodstock, but Sweetwater Spring will have the ability to hold broodstock in its 50 °F waters.

Satellite facilities will not incubate eggs but will serve a variety of other purposes (see functions Table I-2) such as:

- acclimating or rearing and releasing juveniles
- holding and/or capturing adults prior to spawning.

Table I-2 describes production by:

- geographical area
- type of facility
- function
- target species
- product

The bottom row (Summary and Totals) shows production by species, numbers of adults, total anticipated facility cost, and compares facility capacity (PCAP) with production maximums (PMAX) and

Table I-2. Production Summary for Nez Perce Tribal Hatchery, sorted by species. (PART 1 OF 3)

NPTH PRODUCTION FACILITIES: Subbasin Watershed: Location/Site Name/CIRF or Satellite: Functions: Ic/Ac/RrP/RrF/RrS/RI/Cp/Bs	SPECIES	NECESSARY TO IMPLEMENT PROGRAM ESTIMATED COST	NUMBER EGGS K = thousand KK = million	NUMBER FRY K = thousand KK = million	NUMBER FINGERLINGS K = thousand KK = million	NUMBER SMOLTS K = thousand	NUMBERS ADULT BROOD-STOCK Exact # (Range #)	TOTAL ADULT RETURN
Clearwater River, l.m. Cherry Lane, Kerby Farm, CIRF 1/ Ic/RrF/RrS*	SC,SM,FC	1 $3.0KK	5+KK	4+KK	1.5KK - 3.5KK	0	0	0
Clearwater River, l.m. Sweetwater Creek/Lapwai Creek Sweetwater Spring, Auxiliary CIRF 2/,3/ Ic/RrS/Bs	SC,SM,FC	1 $300K	2+KK	1.7KK	620K - 1.2KK	120K - 200K Age-1+ Smolts 20/lb 6,000-10,000lb	110 - 220 (150 - 250)	242 - 484 3/
Clearwater River, l.m. Lolo Creek Yoosa/Camp Creek Satellite Ac/RrP/RI/Bs	SC	1 $220K	[231.5K]	[187.5K]	[168.7K]	75K - 150K Presmolts 20-25/lb 3,750-7,500 lb	136 (136 - 250)	404+
Clearwater River, l.m. Eldorado/Lolo Creek Snow/Dollar Creek Satellite Ac/RrP/RI/Bs	SC	1 $200K	{231.5K}	{187.5K}	{168.7K}	(75K - 150K) Presmolts 20-25/lb 3,750-7,500 lb	{136} {136 - 250}	{404}
S.F. Clearwater River Meadow Creek Camp 58 Satellite Ac/RI/Cp	SC	1 $75K	[96.5K - 193K]	[69.5K - 139K]	[62.5K - 125K]	50K - 100K Age-1+ Smolts 20/lb 2,500-5,000 lb	0 [56 - 112]	110 - 120

Functions:

Ic =	Incubation	RrS =	Rear Age 0 or Age 1 + smolts
Ac =	Acclimation	RI =	Release
RrP =	Rear Presmolts	Cp =	Capture
RrF =	Rear Fry/Fingerlings	Bs =	Broodstock

LEGENDS:

l.m. = lower mainstem
CIRF = Central Incubation and Rearing Facility: eggs, fry, fingerlings to 2 or 3 inches.
1/ = production at Cherry Lane based on groundwater supply of 5 cubic feet per second, single pass rearing.
2/ = production at Sweetwater Springs based on spring water supply of 2 cubic feet per second, double pass rearing, second pass production 60% of first pass.
3/ = regardless of species, adults would return to mouth of Lapwai Creek or another satellite site to which juveniles were acclimated.
Rrs* = Additional groundwater available to support production of fall chinook Age-0 smolts.
SC,SM,FC = Spring Chinook, Summer Chinook, Fall Chinook
1 = priority site for one or more of the following: Incubation, Acclimation, Rear Presmolts, Rear Fry/Fingerlings, Rear Age-0 or Age-1 + smolts, Release Juveniles, Capture Adults, Hold Broodstock
[ ] = eggs, fry, fingerlings, smolts produced at another site; e.g. spring chinook Age-1 + Meadow Creek must be reared at Sweetwater Springs satellite.
{ } = production included in preceding row; not to be totaled with other numbers; this production is approximately 1/2 of preceding row.

Table I-2. Production Summary for Nez Perce Tribal Hatchery, sorted by species. (PART 2 OF 3)

NPTH PRODUCTION FACILITIES: Subbasin Watershed: Location/Site Name: Functions: Ic/Ac/RrP/RrF/RrS/RI/Cp/Bs	SPECIES	NECESSARY TO IMPLEMENT PROGRAM ESTIMATED COST	NUMBER EGGS K = thousand KK = million	NUMBER FRY K = thousand KK = million	NUMBER FINGERLINGS K = thousand KK = million	NUMBER SMOLTS K = thousand	NUMBERS ADULT BROOD-STOCK Exact # Range #	TOTAL ADULT RETURN
S.F. Clearwater River Mill Creek Two Mile Satellite: Ac/RrP/RI/Cp/Bs	SC	1 $250K	[62K]	[50K]	[45K]	40K Presmolts 20-25/lb 2,000-1,600 lb	36 (100-150)	108+
S.F. Clearwater River Newsome Creek Newsome/Beaver Creek Satellite: Ac/RrP/RI/Cp/Bs	SC	1 $200K	[77K]	[62K]	[55K]	50K Presmolts 20-25/lb 2,500-2,000 lb	45 (100-150)	136+
Salmon River, l.m. Slate Creek Hurley Creek Satellite Ac/RrP/RI/Cp/Bs	SC	1 $386K	[193K-386K]	[156K-312K]	[140K-280K]	125K-250K Presmolts 20-25/lb 6,250-12,500 lb	113-227 (250-300)	332 - 536
Salmon River, l.m. Little Slate Creek Deadhorse Creek Satellite Ac/RrP/TRFF/RI/Cp/Bs	SC	1 $240K	[193K-386K]	[156K-312K]	[140K-280K]	{125K-250K} Presmolts 20-25/lb 6,250-12,500 lb	{113-227} {250-300}	{332 - 536}
Clearwater River, m.f. Selway River Meadow Creek Satellite Ac/RrP/TRFF/RI/Cp/Bs	SC/SM	1 $100K	[278K]	[250K]	200K TRFF SC* 150-250/lb 1,333-800 lbs	100K SM+ Presmolts 20-25/lb 5,000-4,000 lb	130 (TRFF) 130(prsmlt) 75 (smolts) (130-200)	400+ SC 400+ SM

Functions:

Ic =	Incubation	RrS =	Rear Age 0 or Age 1+ smolts
Ac =	Acclimation	RI =	Release
RrP =	Rear Presmolts	Cp =	Capture
RrF =	Rear Fry/Fingerlings	Bs =	Broodstock

LEGENDS:

l.m. =	lower mainstem
CIRF =	Central Incubation and Rearing Facility: eggs, fry, fingerlings to 2 or 3 inches.
SC,SM =	spring chinook, summer chinook
1 =	first priority site for one or more of the following: Incubation, Acclimation, Rear Presmolts, Rear Fry/Fingerlings, Rear Age-0 or Age-1+ smolts, Release Juveniles, Capture Adults, Hold Broodstock.
[ ] =	eggs, fry, fingerlings, smolts produced at another site; e.g. spring chinook Age-1+ Meadow Creek must be reared at Sweetwater Springs satellite.
{ } =	production included in preceding row; not to be totaled with other numbers; this production is approximately 1/2 of preceding row.
m.f. =	middle fork
SC* =	spring chinook TRFF in Meadow Creek Upper Basin
SM+ =	summer chinook presmolts released in Lower Meadow Creek

Table I-2. Production Summary for Nez Perce Tribal Hatchery, sorted by species. (PART 3 OF 3)

NPTH PRODUCTION FACILITIES: Subbasin Watershed: Location/Site Name: Functions: Ic/Ac/RrP/RrF/RrS/RI/Cp/Bs	SPECIES	NECESSARY TO IMPLEMENT PROGRAM ESTIMATED COST	NUMBER EGGS K = thousand KK = million	NUMBER FRY K = thousand KK = million	NUMBER FINGERLINGS K = thoueand KK = million	NUMBER SMOLTS K = thouaand	# ADULT BROOD-STOCK Exact # Range #	TOTAL ADULT RETURN
S.F. Clearwater River Stites/Luke Gulch Satellite Ac/RrS/RI/Cp/Bs	FC	1.2 $300K	[310K-620K]	[280K-560K]	[526K]	250K-500K Age-O Smdta 50-70/lb 5,000-10,000 lb	170 - 340	825 - 1250
Clearwater River, l.m. Lapwai Creek North Lapwai Valley Satellite Ac/RrS/RI/Cp/Bs	FC	1,2 RrS? $400K	1310K-620K]	[280K-560K]	[526K]	250K-500K Age-O Smolts 50-70/lb 5,000-10,000 lb	170 - 340	625 - 1250
Clearwater River, l.m. Ldo Creek Mouth of Lolo Creek Satellite 4/ Ac/RI/Cp	FC	2.1 RrS? $75K	[310K-620K]	[280K-560K]	[526K]	250K-500K Age-O Smolts so-7onb 5,000-10,000 lb	170 - 340	825 - 1250
Ckerwater River, m.f. Selway River Fenn, Selwav River 4/ Ac/RI/Cp/Bs	Fc	2.1 RrS? $75K	[310K-620K]	[280K-560K]	[526K]	[250K-500K] Age-G Smolts 50-70/lb 5,000-10,000 lb	{170 - 340}	(826 - 1250}
Clearweter River, l.m. Sweetwater/Lapwai Creek Mann Lake Headgate Satellite 5/ Ac/RrS/RI	SC,SM,FC	2,1 RrS? $125K	[104K-174K]	[83K-139K]	[75K-125K]	60K - 100K Age-1 + Smolts 20 -25/lb 3,000-5,000 lb	62 - 100	132-220
SUMMARY AND TOTALS: Adult production: (Range) spring Chinook: 1331 - 1788 Summer Chinook: 400 + - 800 + Fall Chinook: 1260 - 5000	SC,SM,FC	N/A $5.55KK - $6.62KK	CAP: 7KK WAX: 3.3KK PMIN: 1.7KK	CAP: 5.7KK PMAX: 3.2KK	CCAP: 4.3KK(2.O") 3.1KK(2.5") 2.0KK(3.O") PMAX: 2.5KK(2") PMIN: 1.4KK(2")	SMOLT CAPACITY: 300K Age-1 + 600K Age-0 MAX LBS: 79,500 MIN LBS: 30,900	CAPACITY: >3100 PMAX: 2818 PMIN: 1143	CAP: >6158 PMAX: 6158 PMIN: 3740

LEGENDS:

1,2 = "1 represents a priority site for rearing and release of fall chinook smolts; "2" represents that further evaluation may change priority rating in some way; e.g., site may only be used for acclimation.
2,1 = "2" represents a second choice for release site, "1" represents that further evaluation may move the priority of developing site to a higher level.
RrS? = Unknown quantity of groundwater to support rearing smolts at this site.
PCAP = facility capacity PMIN = production minimum
PMAX = production maximum CCAP = carrying capacity
4/ = fall chinook production may be constrained due to limited availability of broodstock; only one site may be used to begin with; eventually, other sites will be utilized to redistribute fish throughout the subbasin waters.
5/ = ground water supply may need to be developed for winter operation to produce smolts.

production minimums (PMIN). Sizes, numbers, and pounds of. juvenile and adult fish are shown." Fingerling capacity was estimated on the basis of 5.0 cfs at Cherry Lane. Pump tests indicate that 10.0 to 11.0 cfs of ground water is availab18 (Sprenke and Ralston 1992).

Spring Chinook: Spring Chinook incubation and fry fingerling rearing is programmed to occur at the Cherry Lane CIRF. Fingerling to presmolt rearing and release as well as broodstock capture, holding and spawning will occur at satellite sites. Age-l+ smolts will be reared at the Sweetwater Spring Auxiliary CIRF or at the Mann Lake Dam site for harvest augmentation programs; e.g., Meadow Creek, South Fork Claarwater River, Slate Creek, Salmon River, or other sites yet to be designated. Age-l+ smolts spring chinook smolts may also be produced for reestablishing a stock in a particular watershed.

Production of Age-l+ spring chinook may be limited if there is insufficient ground water at the satellite site to produce fall chinook. The production of fall chinook smolts has priority over spring chinook.

At some future date, production of spring chinook as timed-release fed-fry will occur 'for release in the upper basin of Little Slate Creek and upper basin of Meadow Creek Selway River.

This form of supplementation emphasizes the use of natural habitat. It is the most economical'approach to production through supplementation.

All broodstock recapture will take place in the respective watershed tributaries.

Summer Chinook. Summer chinook incubation and fry/fingerling rearing will occur at the Cherry Lane CIRF. A satellite facility on lower Meadow Creek, Selway River will be used to rear and release presmolts or to acclimate and release smolts and to capture adults. Availability of broodstock will determine the supplementation product.-used at this site. Age-l + smolts may be used if broodstock is extremely limited. Adult andjuvenile monitoring will be'done through this facility. Broodstock capture and holding will occur.in facilities on Meadow Creek which can serve multiple functions of acclimating, rearing, or capturing and holding broodstock.

Table I-2 shows Lo10 and Eldorado/Lolo Creek-satellites with combined production of 150 thousand presmolts; this production will be divided between the two satellites as designated by the production for Eldorado Creek being in brackets, [ ]. The same production split is shown for Slate Creek satellite facilities.

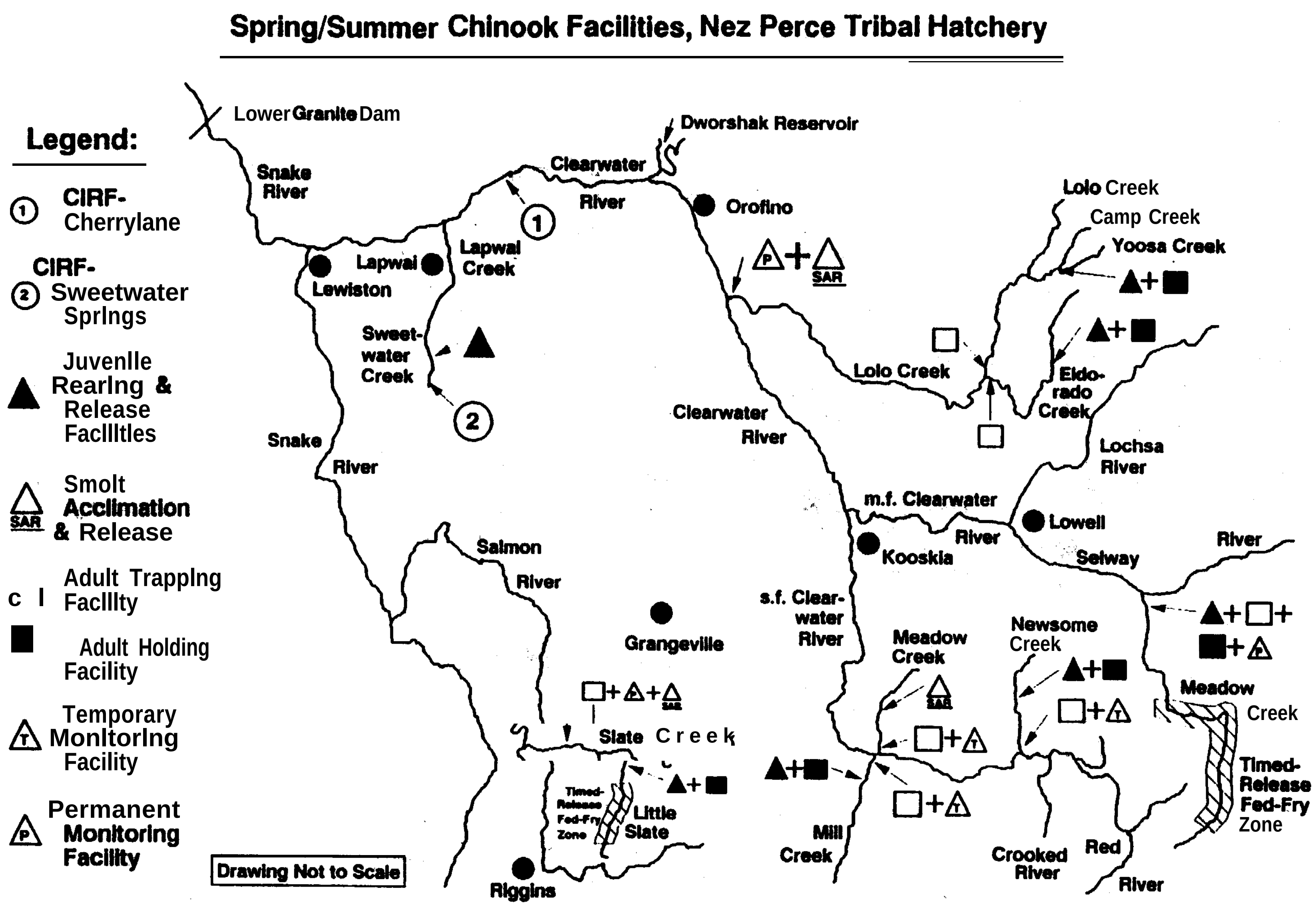


Figure I-3. Map showing locations of Nez Perce Tribal Hatchery production facilities for spring and summer chinook production in the Clearwater and Salmon River subbasins.

Fall Chinook Facilities, Nez Perce Tribal Hatchery

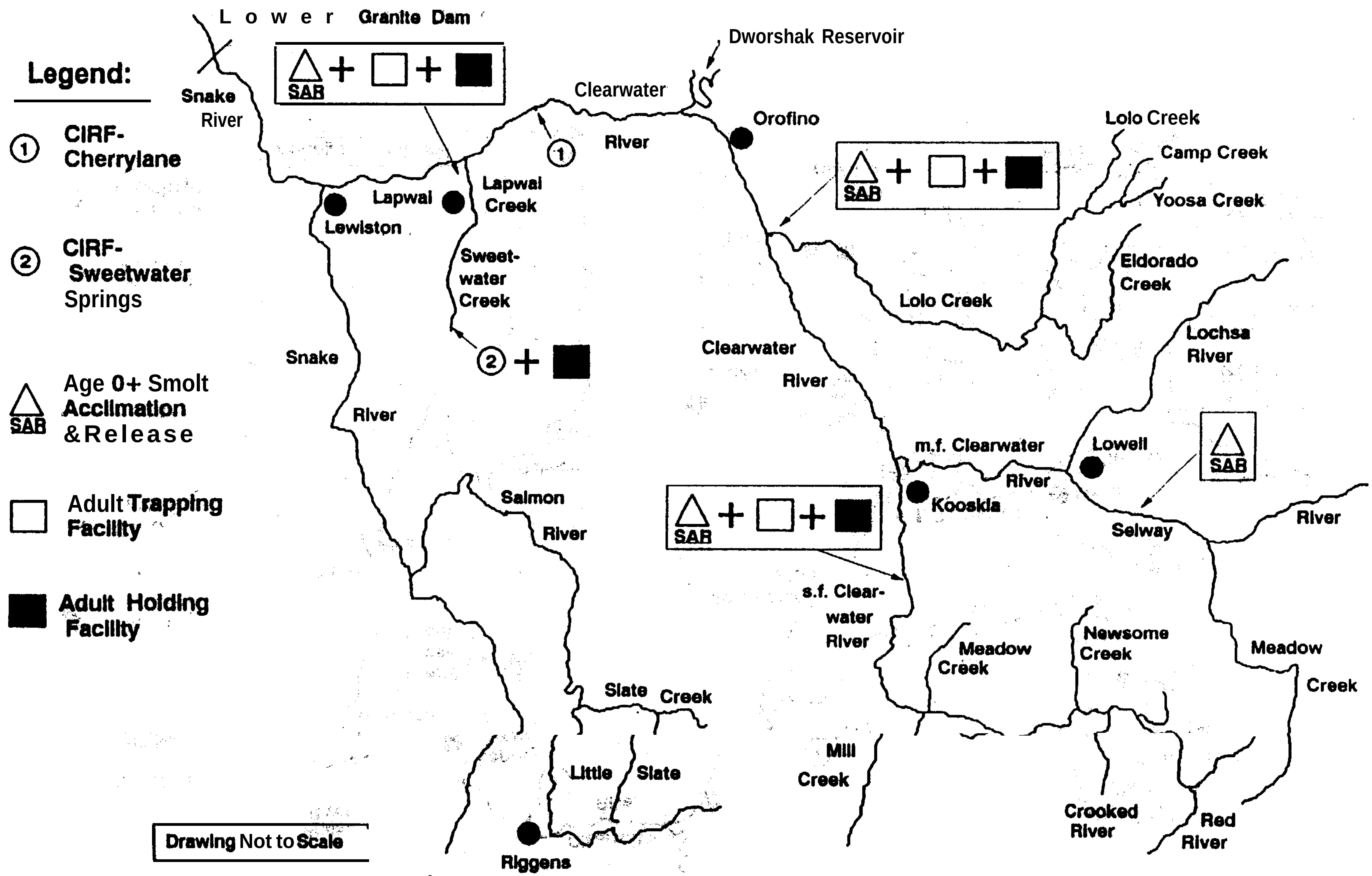


Figure I-4. Map showing locations of Nez Perce Tribal Hatchery production facilities for fall chinook production in the Clearwater River subbasin.

Fall Chinook:- Fall chinook incubation and fry rearing will occur at the Cherry Lane CIRF. Four fall chinook satellite sites are listed in Table I-2. A priority for their development is based on the success of finding 500 to 1000 gallons per minute (gpm) of groundwater at either the **Stites/Luke's** Gulch site, North Lapwai **Valley,** or some other site. At Luke's Gulch a 500 **gpm** ground water supply was confirmed in January 1992 (Sprenke and Ralston 1992). The North Lapwai Valley site has been tested at approximately 700 gpm; it is believed that additional ground water is available, but it will require additional drilling and pumping to confirm the quantity and quality. Fry-to-smolt rearing is intended to occur at the South Fork **Clearwater** River site of **Stites/Luke's** Gulch and the North Lapwai Valley site. Their production depends upon **adequate** ground water at these sites.

If there is insufficient groundwater or additional production is desired, rearing will have to occur at the Sweetwater Springs site. If this happens, the production of Age-l+ spring chinook smolts would be limited to the Mann Lake Dam site only.

Direct releases of fall chinook could occur **from** Sweetwater Springs **through Lapwai Creek if** a **diversion** screen **were installed** at the Mann Lake Dam. **Installing a** diversionscreen would promote survival of the indigenous A-strain steelhead stock. Sweetwater Springs' 2.0 cubic feet per second (cfs) water supply can be used to produce about 500,000 age-0 fall chinook smolts.

The Cherry Lane CIRF site has been identified (as of September 12, 1991) as having a ground water potential of 10 to 11 cfs (5000 gpm). This is approximately three times the amount originally sought. A portion of these waters could be allocated to fall chinook smolt production with acclimation occurring prior to release at one of the upriver sites, either Fenn or **Stites/Luke's** Gulch (Appendix 1, Table 1.16).

The Fenn Pond, Selway River site will be used for juvenile acclimation and release. The intent of having up to four direct release sites **-** **Stites/Luke's** Gulch, **Lolo,** North Lapwai Valley, and Fenn Creek **-** is to distribute returning adults to river areas for natural reproduction and to diversify selected harvest areas. Fall chinook adult recapture at **Stites/Luke's** Gulch and Lapwai Creek depends on a release of ground water combined with pumped river water and the addition of a chemical attractant to which the juveniles had been imprinted. Broodstock recovery for Lo10 and Fenn, Selway would occur through imprinting to those stream's waters.

Summarv and Totals: In Table l-2, adult production is shown as a range of values. Water resource development is the prime reason for this range. Adult returns will fluctuate over time because of changing conditions at dams and/or climactic change. The other totals and ranges are correlated with adult production. The basis **of** these totals is **found** in the survival **parameters** used for anticipating production **and** modeling, Table **I-1.**

Facility Construction Cost **Summary:** Cost estimates are based on conceptual design work done by **Fish** Management 'Consultants (Support **Document 3.00 and 4.00).** Preliminary design work needs to be done to refine and updhte **those** estimates. Asummaryof cost estimates and time line for the **following** facilities are based on similar facilities and on the **author's experience** (Table **I-3;** Appendix 3.00):

- monitoring nd evaluation facilities
- satellite facilities at **Fenn,** Selway River, Worth **Lapwai** Valley, **Stites/Luke's** Gulch, Meadow Creek, Selway
- the auxiliary incubation and rearing facility at Sweetwater Springs

The capital construction **costs** of the **NPTH** are expected to be $7 million. Operating costs are expected to be $1.0 to $1.5 million. Total adult returns **are** expected to be 3,000 to 4,000 spring chinook, an increase-by'33 **percent** over **baseline** conditions. Summer chinook numbers would rise from 0 to 600 adult and fall'chinook would rise **fromm** 20 to more than **1,000** adults.

TABLE I-3. Cost summary for **Nez Perce** Tribal **Hatchery** Master Plan. Costs **as anticipated** from facilities planned **from** Support **Document** 4.00, February 1992 and **NPTH92\BUDGET\O&MSLRYS.wk1.**

	PERSONNEL (K = $1,000)	CONSTRUCTION (KK = $1,000,000)	ANNUAL OPERATING (K = $1,000)	MAINTENANCE AND REPLACEMENT (K = $1,000)
NPTH HATCHERY - Permanent Personnel - Seasonal Personnel permanent benefits (33%) seasonal benefits (33%) - Administration (35%)	$817K ($213K) ($242K) ($70K) ($80K) ($212K)	$3.3KK CIRF $2.65KK Satellites $0.25KK Equipment: vehicles, fish tanks, fish trailer, computers, thermographs, etc.	$175K CIRF: utilitia, supplies, fish food, vehicle, office, grounds, fish health, repair, services, etc. $50K satellites: same as above.	$50K vehicles, computers, other equipment
MONITORING AND EVALUATION - Permanent Personnel - Seasonal Personnel Benefits (33%) Administration (35%)	$155 (60) (22) (33) (40)	$1.0KK Permanent Weirs (2) $0.2KK Mobile Traps (10) $0.05KK Equipment: vehicles, computers, stream survey equipment, etc.	$50K Office and field	$20K vehicles, traps, tags, computers, other equipment.
TOTAL ANNUAL PERSONNEL COSTS:	$972,000			
TOTAL CAPITAL CONSTRUCTION:		$7,425,000		
TOTAL ANNUAL UTILITIES AND OPERATING COST:			$275,000	
TOTAL REPAIRS AND REPLACEMENT:				$70,000
TOTAL ANNUAL OPERATION COST:	$1,317,000			

Recommendations:

1. Build the following facilities:

   A. A Central Incubation and Rearing Facility (CIRF) at Cherry Lane, 21 miles east of Lewiston, Idaho on Clearwater River

   B. An Auxiliary Incubation and Rearing Facility at Sweetwater Springs, 10 miles southeast of Lewiston, Idaho

   C. Satellite facilities located in tributary watersheds:

Clearwater River:

- Lo10 Creek Spring Chinook Facilities
  - Permanent Monitoring/Evaluation and Smolt Acclimation/Release Satellite at stream mouth.
  - Yoosa/Camp Creek Presmolt Rearing/Release and Adult Holding Satellite
  - Dollar/Eldorado Creek Presmolt Rearing and Adult Holding Satellite
  - Seasonal Adult Trap on Lo10 Creek at Bradford Bridge
  - Seasonai Adult Trap on Eldorado Creek below Falls
- Mann Lake Headgate Age 1+ Smolt Rearing Satellite
- North Lapwai Valley Fall Chinook Smolt Rearing/Release and Adult Recovery/Holding Satellite'

Selway River:

- Fenn Pond Fall Chinook Acclimation/Release Satellite
- Meadow Creek Summer Chinook Presmolt Rearing/Release and' Adult Recovery/Holding and Monitoring & Evaluation Satellite

South Fork Clearwater River:

- Stites/Luke's Gulch Fall Chinook Smolt Rearing/Release and Adult Recovery/Holding Satellite
- Mill Creek Spring Chinook Presmolt Rearing/Release and Adult Recovery/Holding Satellite
- Meadow Creek Spring Chinook Smolt Acclimation/Release and Adult Recovery Satellite
- Newsome Creek Spring Chinook Presmolt Rearing/Release and Adult Recovery/Holding Satellite

Salmon River, Slate Creek: . ,
Hurley Creek, **Monitoring/Evaluation/Smolt** Acclimation/Release and Adult Recovery Satellite

Deadhorse Creek **Spring** Chinook Presmolt Rearing/Release and **Adult Holding** Satellite

E. Monitoring and evaluation facilities in each watershed where satellites **are** located: ,
- Permanent
  - Lo10 Creek Mouth, Clearwater River
  - Meadow Creek, Selway River
  - Slate Creek, Salmon River
- Seasonal Mobile **Screw Trap** Units
  - -Newsome,Meadow, Mill Creek, S.F. Clearwater River

2. Timed-release fed-fry stocking of 'remote unused habitat.
   Meadow Creek, Selway River: Spring Chinook
   Little Slate Creek, Salmon River: Spring Chinook

3. Monitoring and Evaluation of **presmolt** and timed-release **fed-**fry to resolve uncertainties about the survival following release:
   monitor following release in tributary mainstem.
   monitor in winter in **mainstem** tributaries and rivers.
   monitor in spring in **mainstem** tributaries and rivers.
   monitor at Lower **Granite** Dam

4. Conduct sequential monitoring of smolts at the dams.

5. Set a low level of harvest until the maximum adult return goal is achieved.

CHAPTER II OPPORTUNITIES AND CONSTRAINTS

Introduction

Natural production in the Clearwater and Salmon River basins is characterized by relatively stable but low population densities. **This** is the result of-extremely low survival rates for out-migrant smolt to returning adult (Table I-l). Aside from the need to improve **passage** conditions to enhance smelt-to-adult survival, the opportunities to'increase production **are** limited. supplementation is one of the few tools available for this purpose.

The present species programmed for production at NPTH are spring, summer, and fall chinook. Other species that could be raised would be **coho,** sockeye, steelhead, and resident **salmonid** species.

Natural spawning and rearing habitat is available to sustain production of far **greater** numbers Of **smolts.** Nevertheless, the **NPTH study team beli**eves that, to compensate for the high smolt-to-adult mortality, populations have been reduced to places and densities where spawner-to-smolt survival is increased through minimal competition for, food and space. **This** ii the theory on **which** the NPTH program is based.

The study team further hypothesizes that supplementation will increase survival in the presmolt stages. Since most **of** the NPTH fish will be released as **presmolts in** the fall (approximately October 1st each year), the influence of density dependence in the natural environment is not fully, avoided.

The team also hypothesizes that-the main bottleneck to survival of **spring chinook** in the Snake River occurs Before the fall release time (Figure I-l., Chapter I). Thus, constraints to supplementation success include:

- the uncertain effect of density dependence in the winter habitat
- the ability of supplementation fish to survive at rates approaching those of natural fish (as predicted in Table I-l, Parameter Values)
- access to suitable broodstock

Natural Production

The intent of the NPTH program **is** to increase natural production in several tributaries of the **Clearwater** and Salmon Rivers in a manner that is cognizant of the **stream** ecology and the genetic resources of these target areas. This approach is biologically, environmentally, and culturally sound. This cautious, genetically sensible approach is in line with the requirements that may be imposed by the Endangered Species-Act. Some of the criteria used to select streams for supplementation are:

- habitat suitability

- status and origins of existing natural production

Spring chinook salmon in the Clearwater and lower Salmon Rivers are comprised of restored populations, but there still is a need to restore natural spawning stocks to seed unused habitat.

Summer and fall chinook natural populations are declining in the Salmon and Snake River subbasins. Redd counts on the Clearwater River in the years 1988-1990 showed that fall chinook had selected the lower **mainstem** Clearwater River as habitat for natural production (Personal communication, **Connor** 1990, Bugert 1989).

The focus of the NPTH program is not to generate a hatchery run but rather to restore natural populations. The **NPTH** model has addresses the number of natural broodstock that are needed to protect the natural population (Support Document 8.00, NPTH Production Model).

Habitat; **NPTH's** satellite facilities are in tributaries where both riparian and **instream** habitat projects are promoting salmon restoration programs (Espinosa 1983, Murphy and Johnson 1990, Personal communication Stowell, **Schomer,** Bear USFS). Each tributary has undergone alterations in overall watershed management (U.S. Forest Service Management Plans) to support juvenile and adult habitat improvements that are likely, over time, to promote natural production. The **Subbasin** Plans (SBP) and the Integrated System Plan (ISP) call for production programs that use these habitats in both the **Clearwater** and Salmon River subbasins. The NPTH supplementation program depends on natural habitat.

Smolt-to-Adult Survival

The key constraint in the supplementation effort is smolt-to-adult. survival. This is affected by passage of juveniles and adults through the dams and harvest of adults both in the Columbia River and in the ocean.

Other potential constraints are:

- further habitat and **water** quality degradation

- survival parameters for either natural or hatchery production might be less than estimated.

Fortunately, habitats for most species have been continuously upgraded within the subbasins during the last 10 years.

Prior to the Columbia and Snake River Dams, S_{sa} was estimated to have been 3.6 percent (Chapman 1981). S_{sa} has declined at Rapid River and McCall hatcheries to 0.02 percent or less (IDFG 1974). At Dworshak and Kooskia hatcheries, from 1973 to the present S_{sa} has ranged from 0.012 to 0.295 percent.

NPTH modeling has tested this 'level of S,,. If either the estimated survival factor (0.44 percent) or any of the other in-basin survival factors should decrease, stock extinction could occur. Figure I-2 or Table I-1 demonstrate 'the sensitivity of the S_{sa} factor. It would be desirable to increase S_{sa} to a level of at least 0.8 percent to 1.0 percent.

Broodstock Selection

The NPTH model was used to generate the minimum number of broodshock needed to start a program that could be monitored and evaluated effectively. Broodstock requirements are-based on achieving a return of at least 100 adults. This means that,' depending on fecundity, approximately at least 50 to 80 adults will be required as broodstock for each watershed during each of the first five years, Table I-2 Production Summary. It is desired that the broodstock program eventually would become self-' sustaining.

The Genetic Risk' Assessment from Cramer and Neeley (1992) makes specific recommendations for' selecting broodstock. The choices for selecting, donor stock were developed on the basis of genetic guidelines taken the Integrated System Plan (CBFWA 1991); Riggs (1990), Kapuscihski (1991) and Busak (1990). A prioritized list of donor stocks is as follows:

1. indigenous stocks from within the tributary

2. indigenous stocks from an adjacent tributaryfrom within the subbasin

3. naturalized stock from within the subbasin with a similar life history providing evidence of ability to successfully return to and-spawn within the subbasin's tributaries, or

4. other stock from the basin with preferred life history characteristics:

a. hatchery or other stock

which is known to originally be derived from indigenous or naturalized stock within the subbasin and

which still has preferred life history characteristics that provide evidence of ability to successfully return and spawn within the subbasin's tributaries, and

which has not been substantially altered by domestic selection, or

b. native indigenous stock from an adjacent subbasin with preferred life history characteristics, or

c. naturalized stock from an adjacent subbasin with preferred life history characteristics providing evidence of ability to successfully return and spawn within the subbasin's tributaries, or

d. hatchery or other stock which is known to originally have been derived from indigenous or naturalized stock from adjacent subbasin having preferred life history characteristics, or

5. stock from outside the basin with preferred life history characteristics

Spring Chinook

Clearwater River: The first choice of broodstock for the Clearwater drainage would have been indigenous spring chinook populations. Unfortunately, they no-longer,exist within the Clearwater subbasin.

The Lewiston Dam (1927-1972) on the lower Clearwater River at Lewiston (CBFWA, 1990) and the Harpster Dam (1910-62) (Murphy & Johnson 1990) blocked all.indigenous chinook salmon runs to the Clearwater subbasin (Murphy and Metsker 1962). R.W. Schowning (1947) described a Mr. John who used to fish below Selway Falls and reported that "he hasn't seen any spring or fall chinook up the Selway since three or four years after the Lewiston dam was completed." Schowning also described others who had noticed the disappearance of chinook from the Clearwater River.

'Natural spawning (reintroduced) populations exist in Lolo Creek, mainstem Clearwater River, Newsome Creek, South Fork Clearwater River, Meadow Creek, Selway River as a result of multiple reintroduction by various agencies and from a variety of sources

(CBFWA 1990; **Horner** and Bjornn 1979). Spring and summer chinook were reintroduced from down-river and upriver stocks from Washington, northeast Oregon, and the Salmon River **subbasin** (Murphy and Johnson **1990).**

Recommendation for Broodstock (Cramer and Neeley 1992):

> "Spring chinook from Bworshak, Red River, and Sawtooth Hatcheries are recent derivatives of Rapid River Stock. Spring chinook from any of these hatcheries would provide ,a suitable donor 'stock for the target streams **of NPTH.** Dworshak stock should be placed as the last priority (except for -Altered Creek as previously discussed) because some mixing with kooskia chinook is likely to have occurred.**
>
> **"Spring** chinook from **Kooskia Hatchery** should be excluded from use in the **NPTH program.** Kooskia chinook are a Carson stock derivative and **important differences** have been demonstrated between Carson stock(upper Columbia) and Snake River spring chinook. use of Kooskia spring chinook would carry substantial genetic risks for developing a naturalized population of spring chinook in the Clearwater Basin."

Based on these recommendations, broodstock choices are listed in a priority order of each watershed in the Clearwater basin.

Lo10 Creek (spring chinook):

- o **Camp/Yoosa** Creek:
  - Lo10 Creek naturalized stock
  - Sawtooth Hatchery stock
  - Rapid River Stock
  - **Dworshak Hatchery** stock
- o **Dollar/Eldorado** Creek:
  - Bworshak Hatchery stock
  - Rapid River stock

Newsome Creek, **South Fork** Clearwater River (spring chinook):

- **o - Newsome** Creek naturalized stock
- o - Red River stock
- o --Rapid River stock
- o - Sawtooth Hatchery stock
- o - Dworshak Hatchery stock

Mill/Meadow Creek, South Fork Clearwater River (spring chinook):

- o - Red River stock
- o - Rapid River stock
- o - Sawtooth Hatchery stock
- o - Dworshak Hatchery stock

Meadow Creek, Selway River (spring chinook):

- o - Meadow Creek naturalized stock
- o - Red River stock
- o - Rapid River stock
- o - Sawtooth Hatchery stock
- o - Dworshak Hatchery stock

Salmon River (Slate Creek): Broodstock for Slate Creek would follow the same priority for selection as described for the Clearwater River.

Broodstock surveys in 1990 identified six adult chinook and three redds and in 1991 seven adult chinook and three redds in Slate Creek (Personal Communication, Nez Perce Tribe, 1990). The existing run could stem from either native indigenous stocks, strays from Rapid River Hatchery or other Salmon River stocks. The proposed broodstock for Slate Creek is Rapid River stock.

Broodstock Recommendations per Genetic Risk Assessment (Cramer and Neelev 1992):

Slate Creek, Salmon River (spring chinook):

- o - Slate Creek naturalized stock
- o - Rapid River Hatchery stock
- o - Sawtooth Hatchery stock

Summer Chinook

The history described in the Clearwater River Subbasin Plan and other documents indicate that there are no indigenous or naturalized summer chinook stock in the Clearwater River subbasin. The closest Idaho broodstock sources would be:

- o indigenous broodstocks in the Salmon Rivers (e.g., Middle Fork)[1]

- o the South Fork Salmon River, IDFG McCall Hatchery

- o the upper mainstem Salmon River hatchery stocks, IDFG Sawtooth Hatchery and Pahsimeroi Hatchery

[1] ESA protects using broodstock from this river.

Broodstock recommendations per Genetic Risk Assessment (Cramer and Neelev 1992):

Meadow Creek, Selway River (summer chinook):
o - Salmon River indigenous stock [2]

-Fall Chinook

Clearwater River: The history described in the Clearwater River Subbasin Plan-and other documents indicate that there are no indigenous or naturalized fall chinook stock in the Clearwater River subbasin. Two agencies, the Nez Perce Tribe and Washington Department of Fisheries, have recorded fall chinook redds in aerial surveys from 1988 through 1990 (Bugert 1990, Personal Com. Connor 1990, Murphy and Johnspn 1990) in the Clearwater River. Their origin could be either the Snake River indigenous stock or Umatilla'or Lyons Ferry hatchery stocks.

Cramer and Neeley (1992) make specific recommendations from their Genetic Risk Assessment:

> "Only Lyons Ferry Hatchery stock should be considered as a brood source for fall chinook 'in the Clearwafer River. This is the only remaining viable source of Snake River origin and has been shown to differ' substantially from upper Columbia fallchinook. Therefore, use of upper Columbia fall chinook would create a high genetic risk to Snake River fall chinook."

Broodstock recommendations per Genetic Risk Assessment (Cramer and Neelev 1992):

Clearwater satellite sites (fall chinook);
o - Lyons Ferry Hatchery stock

Central Facilities

The NPTH central incubation and rearing at Cherry Lane, Idaho is designed (Support Document 3.00, Figures 1, 3.01- 3.06) to isolate stocks and control temperature for at least four stocks of fish during incubation and rearing to greater than two inches in length. The CIRF could be retro-fitted to provide the same conditions for other stocks of fish.

---

[2] Note: ESA presently controls brood sources. ESA may provide some opportunities; e.g. captive broodstock developed from capture of emigrant smolts. Selway summer chinook restoration is a priority' management issue for the Tribe, ,

Constraints:

- Age 1+ Smolt rearing will not occur at the CIRF because the ground water temperature is too warm, a constant 62 oF (16.5 °C).

- Age 1+ Smolt production limited to approximately 200,000 at Sweetwater Springs and Mann Lake Headgate satellite.

- River recharge of the aquifer does not guarantee a pathogen free water source. Therefore, an ozonation facility will be used to kill particular pathogens and to oxygenate the water.

- Water supplies will have to be pumped and aerated at the Cherry Lane CIRF.

- Production at Sweetwater Springs limited by 2.0 cfs water supply.

Opportunities

- Management goal is to produce fish that adapt readily to natural habitat to restore lost stream production.

- A total of 10.0 to 11.0 cfs of ground water at Cherry Lane; testing estimates that the water source can provide this quantity of water as it is recharged from the river (Sprenke and Ralston, 1992).

- An extended CIRF facility could be developed at Sweetwater Spring where flows of 2.0 cfs (900 gpm) with a constant temperature of 50 °F (12.0 °C) have been documented (NPT 1990-91, Appendix 2.00, Site Selection and Evaluation Processes, Support Document 6.00, Water Data).

- Captive broodstock capability at Sweetwater Springs.

- Gravity flow at Sweetwater Spring CIRF site.

- Temperature of 50 F° degree at Sweetwater Springs would not require cooling for fish rearing or holding broodstock.

- Stock isolation will be used to prevent the spread of disease and to preserve and develop the genetic base of each stock.

- Stock isolation options at two CIRF facilities.

- Single pass water supplies will be used to rear all fish. This method of rearing reduces the incidence of disease and stress.

- The Cherry Lane ground water source is recharged from the Clearwater River (Support Document 6.27, **p.28,** Sprenke **&** Associates 1991).

- Complete temperature control of 34 to 62 **°F** (1-16.5 **°C)** during incubation and rearing provide hatching, emergence, and growth that would mimic that of any species occurring in a natural stream (Support Document 3.00, Facility Conceptual Design, Figure **3.04-3.06).**

- Temperature controlled incubation and growth to provide a product that can adapt to the natural environment by being the same size as if the fish were reared in the natural environment.

- Water temperature control can be used to control disease that would be exacerbated at certain temperatures.

Satellite **Facilities**

The ***NPTH*** study team considered many factors in choosing satellite sites where presmolts will be produced. Those factors include:

- physical accessibility
- acceptable physical sites
- water volume
- gravity flow
- habitat for naturalized production
- carrying capacity
- passage
- **cultural** fishing sites
- monitoring and evaluation sites **for** both juveniles and adults
- versatility of purposes **(adult** holding, acclimated smolt releases)
- anadromous fisheries management **programs**
- habitat restoration
- acceptable anadromous and resident species interactions
- harvest above monitoring sites

The following descriptions of watersheds address the most important opportunities and constraints.

Lolo Creek, Mainstem Clearwater River

Opportunities:

- Underseeded habitat in a large drainage.

- Harvest opportunity is culturally acceptable to Tribe.

- Watershed accessible eight months of the year, April through November.

- Water temperature is generally acceptable in the upper of the tributaries and probably will become more favorable as the U.S. Forest Service's **(USFS) watershed** management program begins to function to restore water quality and habitat within the stream through improved riparian protection.

- Habitat restoration has occurred through both USFS and Bonneville Power Administration (BPA) monies spent during the past 18 years to restore extensive tracts of **instream** and riparian habitat within this watershed. More than 20 miles of habitat have been improved.

This watershed is unique with regard to monitoring and evaluation for:

- presmolt production

- natural production

- juvenile out-migration

- adult migration

The physical nature of the Lo10 Creek watershed **offers** a unique opportunity for monitoring and evaluation of **NPTH presmolt** supplementation. A permanent **M&E facility** at the stream mouth could provide information on juvenile and adult movements that would be universally applicable to **other** streams in the Clearwater and Salmon River subbasins.

The separation of **Lolo** and Eldorado Creeks provide a second opportunity to monitor both juvenile and adult movement and to segregate the two adult populations for natural and hatchery origin.

The lengthy stream provides contrasting habitats. The lower 30 miles of Lolo Creek has no summer carrying capacity due to high summer temperatures, 80 °F. Yet, this stream segment is. anticipated to provide winter habitat for parr prior to emigration as smolts the following spring., The distance between stream mouth and the natural rearing areas 30 to 45 miles upstream provides an opportunity to evaluate the interactions of both natural and hatchery presmolts, winter carrying capacity', release strategies, fall and spring emigration, and other conditions associated with presmolt supplementation.' A good deal of information should be learned on the effectiveness of presmolt supplementation from its onset without having to wait for adult returns, Thus providing an opportunity for adaptive management. "

The satellite facilities also are capable of acclimating full-term smolts prior to, release. if that methodology is desired. Broodstock holding temperatures. at the Yoosa Creek site are favorable for produotion purposes (Support Document 6.00, Figure 6.01, 6.02).

Constraints: Cobble embeddedness and'fines (silt) have been a problem and the system is currently below the Desired Future Conditions of 80 percent of natural production capacity for anadromous salmonids (Personal communication, John Rhoades, 1991). Logging practices also have been a concern, but USFS management has made extensive efforts to protect anadromous fish.

Future mining activities are a concern, but most of the mining claims appear to .be.hobby-type rather than commercially valuable. The natural population estimate is less than 100 adults. Genetic makeup will have to be carefully managed to perpetuate and promote diversity in the population.

The monitoring facility at the mouth of Lolo Creek will need to be a major facility capable of enduring extreme flows during spring run off season when discharge can be in excess of 3900 cfs (Harenberg, et.al. 1989). This facility will be used to gather information and analyze juvenile and adult responses to supplementation. This information will apply to all NPTH satellites. It also will be important to the Idaho Salmon Supplementation program.

The lower thirty-mile-long canyon is 'n&n-productive summer habitat but appears to be suitable winter habitat.

Passage work on lower Eldorado Creek to provide access for chinook adults is underway '(Personal Communication, P. Kucera NPT 1991).

Meadow Creek, South Fork Clearwater River

Opportunities:

- Meadow Creek, South Fork Clearwater River provides an opportunity to conduct a cultural harvest above a monitoring point where it does not interfere with other stocks returning to the subbasin. This meets short-term cultural needs and provides for economical monitoring.

- Acclimated full-term smolts would be released- in the upper basin.

- Returning adults could be released to spawn naturally. Adult spawning observations and parr density studies would be conducted to evaluate success of natural production.

- Habitat recovery will help resident species to recover.

The long-term goal would be to restorenaturalized production-as habitat recovery progresses.

Constraints:

- Degraded habitat in the mid-portion of the watershed is producing high water temperatures (Support Document 6.00, Figure 6.12) which limits natural production in the remainder of the stream.

- Low summer flows limits habitat and water for producing presmolts.

- Adult passage into the upper watershed could be constrained by low flows if adults arrive later than June 15 or if "the passage improvements are destroyed by seasonal floods.

The NPTH should not use Meadow Creek, South Fork Clearwater River for natural production until temperature, riparian and' in-stream habitat quality are restored to acceptable levels. Several land exchanges' are in progress that could restore habitat over the' next 10 to 15 years.

Mill Creek, South Fork Clearwater River

Opportunities:

- Water volume and quality are sufficient to rear and release fish, not only for this watershed, but after the broodstock is built up. This will restore production to other' tributaries in the South Fork Clearwater River.

- o Harvest can be conducted above a **monitoring** site that is economically acceptable to the program.
- o Natural production can be established in this watershed.
- o satellite can be used as a **universal** broodstock holding site.
- o Abundant summer and winter'habitat.
- o Juvenile production could overwinter **in** the upper eight miles of the stream.

Constraints:

- o Habitat type is in the lower stream is not typical **for** chinook salmon. This will limit natural production of chinook.
- 0 Winter habitat for hatchery fish will **be** constrained to the lower two miles of the stream and the South Fork Clearwater River.

Newsome Creek, South Fork Clearwater River

opportwitiest

- o Under seeded anadromous fish habitat. **Restoration** has occurred within the watershed (approximately 10 miles).
- o A logging moratorium controls sediment contribution to **the** stream.
- o Naturalized run with some continuing **returns has occurred** over the past 12 **years** (Appendix 1.00, Table **1.61#).**
- o Water quality and flow are good.
- o Local electrical **power are** available at the **selected** site.
- o Full-term smolts could be acclimated and **released** from this **site.**
- o **Harvest** can be conducted **above** a **monitoring** site that **is** economically acceptable to the program.

Constraints:

- o Several active mining claims and abandoned **placer mines** pose threat to habitat quality: e.g., cobble **embeddedness and** fines.

Slate Creek, Salmon River

Opportunities:

- Underseeded habitat[3]
- Extensive anadromous fish habitat restoration has occurred over 10 miles of stream within the watersheds.
- Water quantity and quality are second only to Meadow Creek, Selway River.,
- Watershed is unseeded compared to its estimated carrying capacity.
- Harvest can be conducted above a monitoring site that is economically acceptable to the program.
- Harvest opportunity is culturally acceptable to Tribe.

Constraints:

- Mining claims in the upper basin pose some threat to fishery production.
- Future USFS timber harvest will have to be monitored to prevent sedimentation of restored habitat.
- Wild and Scenic River classification as "recreational" has some potential to restrict satellite facility development.[4]

Meadow Creek, Selway River

Opportunities:

- Unseeded natural habitat of more than 50 stream miles in a roadless area.[5]

---

[3] Natural production estimated at approximately 500 adults.

[4] USFS personnel have shown support for satellites and are working to show that project is compatible with Wild and Scenic classification.

[5] Estimate of smolt carrying capacity is 500,000 to 750,000. Estimated adult capacity in excess of 1,000 fish.

- Potential for no degradation of habitat quality.[6]
- Water quality and quantity
- Harvest can be conducted above a monitoring site that is economically acceptable to the program.
- Natural production can be' restored thiswatershed.'
- Site can be used as a universal broodstock holding facility for other lower mainstem Selway tributaries.
- Opportunity, to monitor the effectiveness of timed-release fed-fry as a method of restoring natural production,

Constraints:

- Limited access to the upper basin during all seasons.
- Potential adult passage barriers.[7]
- Limited access to area prohibits other forms of supplementation.

The proposed supplementation technique will use timed-release fed-fry to restore natural production. If necessary, trapping and airlifting adults into the upper basin could support naturalized production.

South Fork Clearwater River

Opportunities:

- Natural habitat that can be seeded for natural production.
- Year-round accessibility to site.
- 1.0 cfs ground water at 62 °F and river water.
- Ground water recharged by S.F. Clearwater River (Sprenke and Ralston 1992).
- Facility site land owned by Nez Perce Tribe.

---

[6] Area is roadless with ho- logging or mining impacts.

[7] Tribe has a proposal in Phase II NPPC Amendment process to evaluate and improve passage.

- Imprinting for homing through rearing; **acclimation** and release at single site.

- Adult recovery possible via artificial discharge of ground and surface water.

Constraints:

- Natural production of smolts may be constrained by **downstream** passage."

- Harvest above a S.F. Clearwater River mouth monitoring site does not appear to be **feasible.**[9]

- Recovery of broodstock at satellite facility not assured."

- All out-migrants may have **to be** tagged to **identify** broodstock.

Monitoring and Evaluatioq

The efficacy of the supplementation program 'depends on determining what is happening as rapidly as possible. Monitoring evaluations of juvenile success must be done without waiting for adults to return from the ocean. Survival of timed-release fed-fry and the presmolt releases **needs** to measured in the summer, fall, winter and spring in **mainstem** tributaries and at the stream mouth.

opportunities

- Monitoring at stream mouth to determine the success or failure of supplementation techniques on a year by year basis for adaptive management response.

- Monitoring at the stream mouth and **mainstem** tributaries to determine where presmolts overwinter.

---

[8] Growth of fall chinook smolts may be too slow to emigrate past Snake River dams while flows are high. Historically fall chinook smolts probably migrated in July and August when current river flows are lowest.

[9] Estimate of run will have to occur at Lower Granite Dam or from aerial surveys of Clearwater River.

[10] Similar condition exists at Dworshak Hatchery to which spring chinook **successfully** return.

- Adult monitoring **at the stream** mouth far harvest management.
- Adult monitoring **at stream** mouth to determine success or failure of supplementation treatments.
- Rapid analysis to provide new information for overall management in these subbasins and the Columbia **basin.**
- Monitoring and evaluation to determine the accuracy of the parameters used in the **NPTH** planning model to predict the production **levels.**[11]
- Contribute information to Integrated System Model and coordinated Information System.
- Determine if temperature at time of release influences natural and hatchery juvenile interactions and over all survival.
- Existing monitoring facilities at the mouth of the Clearwater River and at the confluence of the **Snake** and Clearwater Rivers has not given effective monitoring of juvenile out-migration.

---

[11] Success of presmolt supplementation and release strategies.

Genetics

This plan is designed to introduce genetic diversity into the Clearwater subbasin for the targeted chinook species while reducing the genetic risks to:

- existing and future naturalized runs of chinook
- indigenous stocks of non-target anadromous and resident species

Four potential types of genetic risk are listed below. The first three were given in the Integrated System Plan (Columbia Basin Fish and Wildlife Authority, 1990) and the fourth was identified by Busak (1990):

Risk 1. Population extinction

Risk 2. Loss of within&population genetic variability

Risk 3. Loss of among-population genetic variability

Risk 4. Domestication Selection

Indigenous chinook populations in the Clearwater subbasin are extinct. This occurred because the now decommissioned Lewiston and Clear-water dams prevented adult escapement for almost half a century. Thus, Risks 1 through 3, could not affect indigenous populations of chinook.

Nevertheless, there are naturalized chinook stocks in the subbasin that have the ability to survive and spawn. Further, the intent of this plan is to create natural spawning populations that will ultimately require no further supplementation. These populations should be developed in a manner that guarantees that they will be subject to minimal genetic risks.

Risk 1 will be prevalent due to:

- the existing size of natural populations
- the declining numbers of fish in each subsequent generation
- an exceedingly low smolt-to-adult survival rate

Risk 2 depends on Risk 1. To simultaneously protect and obtain natural stock(s) of broodstock for the NPTH program or any other program, low numbers of broodstook must be taken (Table ##). It will be difficult to sustain population numbers great enough to avoid inbreeding depression **because** of limited carrying capacity and low smolt-to-adult survival rates.

<u>Risk 3</u> may **become** a major **concern** for **existing** and developing. populations. Control of excessive **straying** from populations that -have been subjected to negative selection processes will continue to cause concern for‘fisheries manager+.

NPTH goals are to promote variability and selection **of** traits promoting the ability of supplemented stocks to spawn successfully in natural habitats (i.e., hatchery adult progeny **will successfully** adapt to surviving‘ **in natural** habitat). **Loss of natural stocks originally** native to **a specific subbasin means** that **reestablishment** of stocks within the **subbasin may not** contain the genetic diversity historically found there.

On the other hand, genetic diversity will **be promoted** as much as possible if the following actions are taken:

- o random selection of broodstock, stratified according to run time, sex, age, and size of fish
- o split gamete fertilization

Risk 4 **can be reduced** by:

- o random **selection** of broodstock from-throughout the run
- o release of hatchery fish
- o rotational selection of natural fish for hatchery broodstock

The -goal in selecting **broodstock** and **producing** juvenile **fish is** mimic **natural production** by **controlling temperature. The NPTH** model has placed restraints on **broodstock** management **to protect** natural production while supplementing or developing a natural stock (Appendix 1.00). Other factors such as density and conditioning of juveniles to **near-natural conditions** are **also** . thought to be beneficial in avoiding type 4 risk.

Introducing Genetia Diversity

It is unlikely that any single stock selected for **broodstock will** have the best possible genetic makeup for the tributary to be supplemented. Mechanisms should be found that will introduce genetic diversity **on which** natural selection can operate and -ultimately result in a better adapted populations. Cramer **and** Neeley (1992) make specific suggestions for NPTH **with** regard to maintaining and developing genetic diversity in the Genetic Risk analysis. Three'options could produce-the desired genetic diversity.

Option 1: Use more than one source for broodstock for a given tributary:

One option would be **to use** multiple sources for broodstock **for the** same tributary. This would introduce genetic variability from the onset.

Option 2: Introduce limited numbers of out-of-basin gametes:

In some cases, straying could be mimicked by introducing a limited number of spawners **from an out-**of-subbasin source.

Option 3: Use different broodstock for different tributaries:

If more than one suitable broodstock can be identified, it may be possible to assign the different sources to the different tributaries; This will increase genetic **variability among the populations.** Genetic diversity withinthe tributary would **also** be enhanced through natural straying among these populations.

Each of **these options** has different levels of genetic risks. The Genetic Risk Assessment will provide guidance in selecting among these **options** 'or additional options.*

Potential sources of broodstock are presented in Chapter II for each tributary proposed for **supplementation. The** Genetic -Risk Assessment will help the NPTH staff to evaluate the risks associated with these sources.-

Rules of Supplementation to Reduce Genetic Risks

The NPTH 'staff has developed **general rules for** supplemental and natural spawner **composition.** These **rules should** reduce genetic Risk **4** by:

- reducing the chance of introducing deleterious **hatchery-**selected traits, or
- increasing the chance that such introduced traits can be eliminated through natural selection without threatening the population.

These rules apply to two groups of spawners--natural spawners and supplemental spawners. Even for cases in which there is no existing naturalized population, the program will produce a natural spawning group after one generation of supplementation.

The 50:50 Rule for Natural Spawners

To reduce the effects of potentially deleterious hatchery-selected traits, escapement will be controlled in a manner that assures that at least half of the natural spawner's parents also spawned naturally. It may not be possible to greatly exceed this goal in the first few generations because of the depressed numbers of returning spawners.

There may be tributaries where the 50:50 rule cannot be applied, initially. Tributaries for which the 50:50 rule might be relaxed may have one of the following characteristics:

1. There is no naturalized population. In this case, the first generation would be totally comprised of supplemented fish. Thus, none of the returning fish for the second generation supplementation would be of natural origin.

2. A naturalized stock exists but is too few in number to permit its use both- as broodstock and as a 50 percent component of the natural spawning population.

3. A naturalized stock exists but is poorly adapted to the tributary. An alternative stock can be identified that has life-history characteristics that will likely result in its being far better adapted to'the tributary than the naturalized population.

In tributaries falling into categories two and three, the 50:50 rule may be relaxed. In category two, the naturalized population may be so small that it would be impossible to have enough naturalized fish to support a supplementation program under the 50:50 rule.

In category three, even if a naturalized population were poorly adapted, it clearly has characteristics permitting out-migrant and in-migrant passage survival through the dams of the main stem Snake and Columbia Rivers. Natural selection should be permitted to act on these characteristics in combination with those of the broodstock source. Thus, even a poorly adapted naturalized stock will be permitted to contribute to the gene pool but perhaps not at the 50:50 rule. .

In all cases, the 50:50 rule will be'adopted after the second cycle of supplementation. If returns from the second generation of supplementation are too small in number to permit using the 50:50 rule or are still poorly adapted, then the supplementation.

program may be regarded as a failure. The program for that tributary would have to be reevaluated.

Rules for Supplemental Spawners

First generation **supplementation broodstock**

The following list, which is an adaptation of the SMART analysis's genetic impact rating (Table **1-A**[12]**),** presents potential, initial sources **of** broodstock, in order of priority:

1. indigenous stocks from within the tributary

2. indigenous stocks from: an adjacent tributary from within the **subbasin**

3. naturalized stock -from within the **subbasin** with a **similar life** history or providing **evidence** of ability to return and spawn within **the subbasin's** tributaries

4. other stock from the basin with preferred life history characteristics,

   a. hatchery or other stock;

      0 which is known **to be** derived from indigenous or naturalized **stock** __**which originated** from the **subbasin**__ **and**

      which still has preferred life history characteristics that provide evidence of ability to **return** and **spawn within** the **subbasin's** tributaries,' and

      0 which has not been altered substantially by domestic selection, or

   b. native indigenous stock f__rom an **adjacent subbasin**__ with preferred life history **characteristics,** or

   c. naturalized stock __from an adjacent **subbasin**__ with **preferred** life history characteristics or providing evidence of ability to **[successfully]** return and spawn within the **subbasin's** tributaries, or

   d. hatchery or other **stock** which is known to have **been**

---

[12] Integrated System Plan, Columbia Basin Fish and Wildlife Authority

derived from, **indigenous or naturalized stock** **from an adjacent subbasin** and having preferred life history characteristics, or

5. stock from outside the basin with **preferred life** history characteristics

   a. native indigenous stock **from** outside, the sub basin with preferred life history characteristics, or

   b. **naturalized** stock from 'outside the **subbasin** with' **preferred life history characteristics** or providing evidence of ability to [successfully] return and **spawn within the subbasin's tributaries, or**

   c. hatchery or other **stock** having preferred life history characteristics or **providing evidence** of 'ability to return and spawn within the **subbasin's** tributaries

Priority. 1. **and 2.** for **broodstock cannot** be considered for the **Clearwater subbasin because no** indigenous stodk of **anadromous** salmonids **exist.**

Priority 4-b. broodstock **sources** may be available but indigenous stocks in **the** Snake **River** Basin are depressed for all Chinook runs. **The** NPTH plan **does not seek to threaten any depressed population** with extinction. **Appendix 1.00 discusses methods for supplementing natural** stocks while giving specific attention to the **Four Risks identified. NPTH actions** for broodstock will support restoration of **depressed stocks.**

Broodstock supplementation beyond tbe **first** generation

Broodstock will be taken **from first generation returns.** The rules **adopted will** depend on'th8 **broodstock sources** and on whether naturalized populations existed.

1. **First** generation **broodstock** derived **from naturalized** stock within the tributary:

   Only spawners of natural origin will be **selected** for **broodstock. This rule** will **be** relaxed if **the 50:50** 'rule cannot be achieved.

   In-this **case,** the strategy will be **to increase** the proportion **of natural origin** fish within **the** supplemental and natural **spawner** groups. This will involve adaptive escapement management which controls **which** fish are allowed to escape to spawn naturally.

If the supplementation program succeeds, broodstock in the third and subsequent generations could be comprised of natural origin stock while maintaining the ratio set for natural spawners.

2. First generation broodstock derived from an outside source and no naturalized population existed:

   This situation precludes the use of natural origin spawners in the second generation. The'strategies discussed under #1 would have to be delayed for one generation.

3. First generation broodstock derived from an outside source but there was a naturalized population:

   The second generation broodstock would be selected to attain, as nearly as possible through adaptive escapement management, the ratio set for natural spawners (normally, the 50:50 rule).

   If the supplementation program succeeds, broodstock in the third and subsequent generations could be comprised of natural origin stock while maintaining the ratio set for natural spawners.

CHAPTER III OBJECTIVES AND STRATEGIES

Introduotion

The concepts **that best fit** fishery production goals and the biological and physical conditions of' the Clearwater and Salmon subbasins are:

- a Central **Incubation** and Rearing Facility (CIRF) located along the lower **mainstem Clearwater** river, and
- satellite facilities located on tributaries that can support anadromous production.

Five tributary watersheds and three **mainstem** river areas were identified for supplementation in the Clearwater **subbasin** and one tributary watershed in the. Salmon River basin:

- Lo10 Creek
- **mainstem Clearwater** River
- Meadow Creek, South Fork Clearwater River
- Mill Creek, South Fork Clear-water River
- **Newsome** Creek, South Fork Clearwater River
- **mainstem** South Fork Clearwater River
- Meadow Creek, Selway River
- **mainstem** Selway River
- Slate Creek, lower **mainstem** Salmon River

Species:

The Nez **Perce** Tribe has identified three species for production;

- spring,
- summer, and
- fall chinook.

In **Lolo, Newsome, Mill,** Meadow, and Slate Creeks, spring chinook historically were present and/or remnant or restored populations exist. In Meadow Creek, Selway River, summer chinook are extinct, but there is a minimal run of spring chinook. In each of these tributaries, water and habitat quality is being restored to enhance anadromous salmbnid production.

Fall chinook historically were found in the **mainstem** and middle fork of the Clearwater River (Schoning 1947; Chapman 1940) and aerial and boating surveys in **1988-1990** identified limited numbers of fall chinook spawning in the river (Personal communications, Conner 1991). Ground water resources have been identified that can produce fall chinook smolts for release in this area.

Objectives

The objectives described below define minimal levels of success for adult production.

Analyses done by the Nez **Perce** Tribal Hatchery (NPTH) study team suggest that the stated objectives can be achieved by using the proposed strategies as outlined in Figure III-l. The assumptions used in these analyses and the effect **of** their **uncertainty** upon the likelihood.of success are discussed in Chapter IV.

The monitoring and evaluation plan described in Chapter IV addresses the **most** critical of these uncertainties and is a necessary part **of** the NPTH program. An effective monitoring and evaluation program will be needed to determine if the goals and objectives are met.

Spring Chinook Production Goals

Clearwater River

All of the watersheds in the Clearwater River **subbasin** and the Meadow-Creek watershed in the Selway River **subbasin** were selected because of the lack of existing runs **and** their quality habitat. **These watersheds** were the historical homes of salmon and were selected for restoration and/or reintroduction in the **Subbasin** Plan and Integrated System Plan

Lo10 **and Eldorado Creeks** Produotion Goals:

1. Lo10 Creek: Rebuild the existing natural run of spring chinook while preserving their genetic integrity and, maintaining the natural life history characteristics.

2. **Eldorado** Creek: Establish a naturalized run of spring chinook while developing a natural genetic integrity and maintaining the natural life history characteristics.

Figure 111-l. Objectives and strategies for Net Perce Tribal Hatchery Production.

		OBJECTIVES			STRATEGIES		
Tributary	Species	Natural Production A/	Interim Harvest Goal B/	"50:50" Rule E/	Phase I	Phase II	Phase III
Lolo Creek, Clearwater R.	SC	200	50	yes	40K local D/ 200K imported C,D/	150K local presmolts	150K local presmolts
Meadow Creek, SF Clearwater R.	SC	0	100	no	50K - 100K imported smolts	50K imported smolts	50K local ?/ smolts
Mill Creek, SF Clearwater R.	SC	50	10	yes.	40K imported presmolts	40K local presmolts	40K local presmolts
Newsome Creek, SF Clearwater R.	SC	65	17	yes	50K imported presmolts	50K local presmolts	50K local presmolts
Meadow Creek, Selway R.	SC	400	50	yes	200K imported TRFF	200K local TRFF.	200K local TRFF
	SM	400	50	yes	50K imported presmolts	100K local presmolts	100K local presmolts

A/ Desired annual contribution of adults from natural spawners.
B/ The interim harvest goal is the harvest predicted in-the harvest management plan when the upper harvest trigger is achieved. This harvest goal is restricted by smoit to adult survival which is expected to increase with improved juvenile passage: therefore, the future harvest level is expected to be modified; i.e., harvest is expected to increase as smolt to adult survivals are increased.
C/ Smolt release began in 1989 for five consecutive years to develop broodstock for NPTH; the program is currently being evaluated under a Lower Snake River Compensation Plan (LSRCP) program by the Nez Perce Tribe. The first three years releases were unmarked; the next two years releases are scheduled for marking for evaluation purposes.
D/ Imported means that it does not generate its own broodstock. Local means that it generates its own brwdstock.
E/ A rule for management of NPTH operations which specifies that at least 50 percent of a specified stock of fish, 50 out of every 100 fish that spawn in a natural environment, are the offspring of fish that spawned in the natural environment in the previousgeneration.
?/ Dependent on surplus broodstock being available from either NPTH or other Clearwater subbasin 'hatcheries.

Legend: SC: Spring Chinook; SM: Summer Chinook; Fall Chinook; TRFF: Fed-Fry.

Figure III-1. Objectives and strategies for Ner Perce Tribal Hatchery Production.

		OBJECTIVES			STRATEGIES		
Tributary	Species	Natural Production A/	Interim Harvest Goal B/	"50:50" Rule E/	Phase I	Phase II	Phase III
Slate Creek, Salmon River	SC	166	20	yes	50K-100K imported ?/ smolts 250K imported D/ presmolts	125K local D/	125K local D/
S.F. Clearwater River	FC	500	375	yes	500K age-0 smolts imported	500K age-0 smolts local	500K age-0 smolts local

A/ Desired annual contribution of adults from natural spawners.

B/ The interim harvest goal is the harvest predicted in the harvest management plan when the upper harvest trigger is achieved. This harvest goal is restricted by smolt to adult survival which is expected to increase with improved juvenile passage; therefore, the future harvest level is expected to be modified; i.e., harvest 'is expected to increase es smolt to adult survivals are increased.

C/ Smolt release began in 1989 for five consecutive years to develop, broodstock for NPTH; the program is currently being evaluated under a Lower Snake River Compensation Plan (LSRCP) program by the Net Perce Tribe. The first three years releases were unmarked; the next two years releases are scheduled for marking for evaluation purposes.

D/ Imported means that it does not generate its own broodstock. Local means that it genera&s its own broodstock.

E/ A rule for management of NPTH operations which specifies that at feast 50 percent of a specified stock of Ush, 50 out of every 100 fish that spawn in a natural environment, are the offspring of fish that spawned in the natural environment in the previous generation.

?/ Dependent on surplus broodstock being available from either NPTH or other Clearwater subbasin hatcheries.

Legend: SC: Spring Chinook; SM: Summer Chinook; FC: Fall Chinook; K= 1,000; TRFF: Timed-Release Fed-Fry.

3. Long-term goal: Restore self-sustaining populations in **Lolo** and Eldorado Creeks.

Sufficient Objectives

1. Upper Lo10 Creek: Rebuild annual average runs at a rate that would reach 200 adults within 20 years under present survival conditions.

2 **Eldorado Creek:** Establish and maintain a naturalized run of more than 200 spring chinook within 10 years under present survival conditions.

3. Upper **Lolo** and Eldorado Creeks: Achieve a minimum sustainable average'annual harvest of 20 adults within **seven** to **10** years and 50 or more adults within 15 to 20 years.

4. Upper Lo10 and Eldorado Creeks: Assure that no less than 50 percent of the natural spawning population is of natural parentage (i.e., the **"50:50** Rule" must be met).

5. Long-term goal: Sustain production fully within both watersheds using developed local broodstock.

Strategies

1. Upper **Lolo Creek:** Supplement the existing naturalized spring chinook populationusing local and imported **broodstock.**[13] **The 50:50** Rule will be used to guide **genetic** development.

2. Initially, at least an estimated 40,000 acclimated presmolts of natural origin will be released in the Upper Lo10 **Creek.**[14]

3. Eldorado Creek: Continue the current program 'of annually releasing 200,000 smolts until 1993 from best available **source** (See Broodstock Selection in Chapter [15] II).

---

[13] The Genetic Risk Assessment will direct the development of the broodstock-program.

[14] See Appendix 1.00 for detailed description **Of** broodstock development,

[15] Program will be evaluated for success; smolt outplants scheduled **to** be replaced with presmolt supplementation program in **1992.** See footnote 1.

4. Once a stable local broodstock becomes available (subject to the **50:50** Rule), a total of **150,000** acclimated presmolts will be released annually'to sustain natural production levels and support a limited harvest.

5. No harvest is expected in the near term (one to five years). In the long term, selective harvest may be used to meet the **50:50** Rule.

Spring Chinook Production **Goals** for Meadow **Creek** (South **Fork Clearwater River)**

1. Establish a naturalized run of spring chinook for harvest.

2. Establish a **naturalized** spawning population while preserving the genetic -integrity and maintaining the natural life history characteristics. This goal depends on restoring habitat and water quality.

3. In the long term, develop and-maintain a harvest in the Meadow Creek watershed consistent with maintaining natural production goals (provided habitat can be restored).

Sufficient Objectives

1. Create a minimum sustainable annual harvest of at least 40 adults within seven years and 80 or more adults within 15 years.

2. Establish and maintain a natural spawning population: natural genetic base of 25 to 50 percent (see **"Rules** of Supplementation **to Reduce** Genetic Risks in Chapter II).

Strategies

1. Release 50,000 acclimated smolts in the watershed for the next five to **15 or more years.** Evaluate improvements in natural habitat.

2. Allow escapement of 20 returning adults to spawn naturally to test establishment of naturalized' production.

3. Supplement the natural environment with either timed-release fed-fry (TRFF) or fall presmolt releases in Phase II or III (years 6 -20). This **depends** on restoring habitat and water quality in the'watershed.

Spring **Chinook Production** Goals fur Mill *Croak* (South **Fork**
Clearwater)

1. Establish a naturalized run of spring chinook while developing a natural genetic integrity and maintaining the natural life history characteristics of the stock.

2. Develop and maintain a supplemented harvest.

3. Rear **presmolts** forrelease into other South; Fork Clearwater tributaries (e.g., Peasely Creek, Silver Creek, American River, etc.).

4. Develop a broodstock holding facility to se&e future tributaries restoration activities, Phase II and beyond..

Sufficient Objectives

1. **Establish and** maintain a returning pdpulation'of 60 adults within.19 years and 90 or more adults within 20 **years**. Maintain a natural genetic base of at least 25 to 50 percent (see "Rules of Supplementation to Reduce **Genetic Risks"** in Chapter II).

2. Develop. and maintain a broodstock.to **provide a** self-sustained production in Phases II **and III,** years six to 10 and beyond.

3. Create a minimum annual sustainable harvest of 10 . . adults **within** seven years. All adults in excess **of** 90 fish may be harvested or used for brood to stock other tributaries.

Strategies

1. **Initially, an 40,000 acclimated presmolts**[16] will be released into lower Mill Creek (See Appendix 1 for detailed description of hatchery treatment and product definition).

2. Once **a** stable local **broodstock** becomes available (subject to a **variation** of the **50:50 Rule), 40,000** acclimated presmolts will be released annually to **sustain natural production levels** and support a limited harvest,

[16] NPTH production model has determined release numbers based on carrying capacity and **50:50** rule.

3. Allow escapement of returning adults to spawn naturally; to establish natural juvenile production based on a' variation of the 50:50 Rule (See Appendix 1.00 for a detailed descriptionof hatchery treatment an& product definition).

4. Rear and *release* presmolts to other South Fork Clearwater tributaries (e.g., American River).

Spring Chinook Production Goals for Newsome Creek (South Fork Clearwater)

1. Rebuild the existing naturalized spring chinook run while preserving genetic integrity and maintaining the natural life history characteristics.

2. Long-term goal is to restore.'a self-sustaining population.

3. Develop and maintain a harvest.

Sufficient Objeotioes

1. Work with the existing spring chinook stock and a donor Clearwater spring chinook stock to restore and maintain a run of at least 82 adults within seven years and 135 or more adults within 20 years.

2. Develop an annual minimum sustainable harvest of 17 adults within 10 years and 17 or more adults within 20 years.

Strategies

1. Initially; 50,000 acclimated presmolts[4] will be released *into* upper Newsome Creek (See Appendix 1.00 for detailed description of hatchery treatment and product definition.)

2. Once a stable local broodstock becomes available (subject to the 50:50 Rule), 50,000 acclimated presmolts will be 'released annually to sustain natural production levels and support limited a harvest.

3. In the long term,' sustain production fully within the watershed using only local broodstock.

4. No harvest is expected in the near term (less than six years). In the long term, selective harvest may be used to meet the 50:50 Rule.

---

[4] NPTH production model predicted. this number based on darrying capacity and the 50:50 rule.

Spring Chinook Production Goals for Salmon River - Slate Crook

1. Establish a naturalized run of spring chinook while developing a natural genetic integrity and maintaining the natural life history characteristics.

2. Establish a spring chinook return for harvest.

3. Long-term goal is to restore a self-sustaining population.

Sufficient Objectives

1. Establish a naturalized run of at least 200 adults within 10 years and 335 or more adults within 20 years.

2. Develop and maintain a, broodstock to provide for the natural genetic base (i.e., at least 28 percent natural spawners) See Appendix 1.00.

3. Develop a minimum sustainable annual harvest of 20 adults within seven years to a harvest of 100 or more adults within 20 years.

Strategies

1. Rear and release 250,000 imported (Rapid River) presmolts during Phase I (years l-5).

2. Rear and release 125,000 local (Slate Creek) presmolts and 125,000 imported presmolts (Rapid River) during Phase II and beyond (years 6-20+).

3. Release 50,000 to 100,000 acclimated smolts. (imported) for an anticipated supplemented harvest of 100 to 200 adults, probably in Phase II or III, if required to be self-generated.

4. Release timed-release fed-fry (TRFF) into upper Little Slate Creek basin to establish naturalized population in the upper watershed. These strategies are a variation Of the 50:50 Rule. The NPTH model predicts that natural production level may be as low as 28 percent of returning escapement.

Spring Chinook Goals for Selway River - Meadow Creek

Historically, spring chinook were probably abundant in the tributaries and upper reaches of the Selway River (e.g., McGruder area). Currently, a small number are scattered throughout the watershed.

1. Restore naturalized runs of spring chinook while developing their natural genetic integrity and maintaining their natural life history characteristics.

2. Long-term goal is to restore self-sustaininct population5 of spring chinook in Meadow Creek's upper basin.

3. Develop and maintain a spring chinook harvest.

Sufficient Objectives

1. Establish a minimum naturalized return of 100 adults within the next 10 years and up to 400 or more adults within 20 years.

2. Assure that no less than 50 percent of the naturalized spawning population is of natural parentage.

3. In the long term, sustain production fully within the watershed using only local broodstock.

4. Develop a minimum annual sustainable harvest of 20 adults within seven years and 50 or more adults within 15 years.

Strategies

1. Use sufficient adult broodstock to generate a return of at'least 100 adults.

2. Initially, an estimated 80,000 spring chinook TRFF will be released in the upper Meadow Creek basin.[5]

3. Once a stable local broodstock becomes available (subject to 50:50 Rule) 250,000 spring chinook TRFF will be released annually to sustain natural production levels and support a limited harvest.

4. Monitor and evaluate out-migration of TRFF to determine short-term success or failure.

Summer Chinook Production Goals for the Selway River

Historically, the Selway River was probably a summer chinook system (Schoning 1947). Summer chinook are currently extinct in the Selway River.

---

[5] See Appendix 1 for detailed description of hatchery treatment and product definition.

Summer chinook restoration is based on using enough broodstock (estimated between 50 to 80 fish) to cause a return of at least 100 adults based an fecundity and survival factors. If summer chinook broodstock cannot be obtained, spring chinook could be developed at this location to supplement the Selway River above Selway Falls.

Summer Chinook Goals for Meadow Creek, Selway River

1. Restore naturalized runs of spring and, summer chinook while developing their natural genetic integrity and maintaining their natural life history characteristics.

2. The long-term 'goal is of 'summer chinook releases in lower Meadow Creek is to restore-these fish'to the Selway River above Selway Falls.

3. Develop and maintain a summer chinook harvest.

Sufficient Objectives

1. Establish a minimum naturalized return of 100 adults within the next 10 years and up to 400 or more adults within 26 years.

2. Assure that no less than 50 percent of the naturalized spawning population is of natural parentage.

3. In the long term; sustain production fully 'within the watershed using only local broodstock.

4. Develop a minimum annual sustainable harvest of 20 adults within seven years and 50 or more adults within 15 years.

Strategies

1. Use sufficient adult broodstock to generate a return of at least 100 adults.

2. Initially, an estimated 50,000 summer chinook presmolts will be released in the upper Meadow Creek basin (See Appendix 1 for detailed description of hatchery treatment and product definition).

3. Once a stable local broodstock becomes available (subject to 50:50 Rule), 100,000 summer chinook presmolts will be released annually to sustain natural production levels and support a limited harvest.

4. Monitor and evaluate out-migration of presmolts to determine short-term success or failure.

Fall Chinook Produotion Goals for the Clearwater River Subbasin

<Priorities for production and release sites are as follows:

1. South Fork Clearwater River, Stites to Lukes Gulch area
2. North Lapwai Valley, mouth of Lapwai Creek
3. mouth of Lolo Creek
4. Fenn Pond on the lower Selway River

This priority is based on the presence of ground water at sites #1 and #2. Sites #3 and #4 would be developed in conjunction with or as extended acclimation/release to the first two rearing sites. Production will be expanded on a site-by-site basis, depending on the availability of broodstock.

1. Establish a naturalized run of fall chinook while developing their natural genetic integrity and maintaining the natural life history characteristics.

2. The long-term goal-is to restore self-sustaining populations of fall chinook.

3. Develop and maintain a harvest.

Sufficient Objectives:

1. Establish and maintain a naturalized run of 500 to 1250 or more adults over the next 10 to 20 years.

2. Assure that no less than 50 percent of the natural spawning populatian is of natural parentage.

3. In the long term, sustain production fully within the watershed using only local broodstock.

Strategies

1. Initially, a minimum of 80,000 Age-O acclimated smolts[6] will be released into the lower South Fork Clearwater River (See Appendix 1:00 for detailed description of hatchery treatments and product definition).

2. Once a stable local broodstock becomes available (subject to the 50:50 Rule), a minimum of 500,000 Age-O acclimated smolts will be released annually to sustain natural production levels and support a harvest, or

3 . Up to 175,000 Age-l smalts will reared and released in the lower part of the watershed, depending upon water resources available for production, or

---

[6] Smolts from Lyons Ferry Hatchery, up to 250,000 could be released each year from one or more sites.

4. Equivalent amounts of either Age-0 or Age-I smolts (from the Lyons Ferry Hatchery) will be acclimated and released from the following satellite 'sites:

- Luke's Gulch
- Lapwai Creek
- Lolo Creek
- Selway River

CHAPTER IV **MONITORING AND EVALUATION** PLAN

Introduotion

The potential risks and benefits of supplementation strategies are disputed among fisheries experts. To compensate for these uncertainties, extensive monitoring and evaluation are proposed for the Nez Perce Tribal Hatchery **(NPTH).**

Evaluation is the process of analyzing and comparing results. It is a key part of the adaptive management process- (Lee and Lawrence 1986). **NPTH's** monitoring and evaluation will:

- provide new information for overall management in the subbasins of the Clearwater and Salmon Rivers and the Columbia basin
- complement the Council's System Monitoring'and Evaluation Program
- help determine the accuracy of the parameters used in the Nez Perce Supplementation Model (NPSM) to predict production levels
- allow supplementation treatments to be quickly compared and changed

The efficacy of the supplementation program depends on determining what is happening as rapidly as possible.

Procedures

Two kinds of monitoring and evaluation actions will be done:

- experiments to resolve critical uncertainties about the survival of supplementation fish from **the time of** release to their arrival at Lower Granite Dam as outmigrant smolts
- risk containment that is **coordinated with** other supplementation programs in the region

The **survival** of timed-release **fed-fry and** fall released presmolt will be measured at the stream mouth as these animals leave the tributary watershed. Stream mouth monitoring could determine success or failure of these techniques from the **first year** onward. It also will set the stage for sequential monitoring at the dams as these fish undergo their juvenile to adult migration.

Adult monitoring at the stream mouth will give specific information on adult return composition and numbers for broodstock and determine harvest opportunities and levels.

Critical Uncertainties

The survival of fish from the time of liberation to the emigrant smolt stage is the critical uncertainty that can best be addressed by the project.

Critical Uncertainty: Can a survival rate be achieved for supplementation presmolts that is equal to or greater than half the corresponding rate for natural presmolts?

Little is known about overwinter rearing strategies. of natural fish. Juvenile downstream migration in the fall of the year has . . been observed front the tributaries (Personal communication R. Kiefer, 1991; Hillman 1986, Hillman et al. 1987) suggesting that at least some fish will use the river rather than tributary mainstem areas for winter rearing. How well juvenile fish survive when overwintering in rivers rather than tributaries is apparently not well understood. A thorough review of the literature will be conducted as a part of the preparation for the experimental work.

Little is known about how to achieve the best results from outplanted presmolts. For example:

- Will migratory behavior be manipulated through rearing and release treatments?
- Is pre-release conditioning of fish to recognize natural foods and habitatsand respond effectively to predators possible and; desirable.?
- Do "treatment A"[7] fish survive to Lower Granite Dam at a rate-greater than or equal to natural fish from the same tributary?
- Do "treatment B" fish survive better than Treatment AU fish to Lower Granite Dam?
- Do "treatment B" fish tend to migrate downstream out of the release stream earlier than "treatment A" fish?
- Do fish that over-winter in the tributaries survive at a higher rate to Lower Granite than. those that migrate in the fall?
- What factors other than supplementation treatment affect survival and migratory behavior?

---

[7] "Treatment A* and "treatment B" refer to detailed rearing and release strategies to be specified for each tributary.

The NPTH study team expects to refine rearing and release protocols as the design process proceeds, so that the project fits into the evolving regional experimental scheme.

Table I-2 illustrates the production results predicted by the Nez Perce Supplementation Model (the model) (Support Document 8.00). Supplementation increases the number of emigrant smolts for two reasons:.

- The effective carrying capacity is increased: supplementation presmolts essentially "backfill" habitat that was depleted by restrictive summer low-flow conditions.
- The advantage gained in the artificial environment enables the supplemented population to survive at a higher rate.

As illustrated by Figure I-2., supplementation benefits do not begin to approach historical -productivity levels. Nevertheless, the surplus productivity (the-area between the curve labeled "Spawner-to-Smolt Survival (Supplemented)" and the replacement line labeled "0.44% Smolt-to-Adult Survival (present)") is increased substantially. Conditions where smelt-to-adult survival constrain production may be the conditions under which supplementation would be most effective.. As smolt-to-adult survival increases toward historical levels, the relative benefits of supplementation diminish.

The objectives in Chapter III generally specify that-certain production goals will be met and that the 50:50 Rule be applied. The NPTH study team interpreted this to mean that the objectives will be met at the equilibrium point (i.e., in Figure I-2, the point. where the Spawner-to-Smelt Survival curve intersects the Smolt-to-Adult replacement line). If the critical assumption describe& in Chapter, III is not true; then'the objectives and the strategy must be reconsidered.

According to the model's view of nature (illustrated in Figure I-l), because of the constraints imposed by low smolt-to-adult survival, density dependent factors (i.e., carrying capacity) affect sustainability at relatively low population densities. A consequence of this is that, although the habitat may be sparsely used, the winter carrying capacity of the system is a relatively sensitive parameter.

Information about winter rearing capacity is scarce.. Extensive' effort to assess winter carrying capacity may not be warranted, but refinement of the current very crude estimates is probably prudent. In subbasin planning, it was generally assumed that summer carrying capacity was limiting smolt production.- By releasing fish in the fall, the summer rearing bottleneck is avoided. If the logic used in the NPTH modeling process is correct, the winter rearing capacity is no smaller than the summer capacity.

Speculation8 that winter rearing is possible *in* **the** larger tributaries," such as the Salmon **and the mainstem** Clearwater, which are considered poor **summer** habitat, **suggest** that winter capacity might be significantly larger than summer capacity.

Personal communication with Russ Keifer, **Idaho** Department of Fish and Game (IDFG) (1991) **and** Ken Witty, Oregon Department of Fish and Wildlife (ODFW) (1990) support the fact that at least some of the juveniles out-migrate in the fall from the Salmon and ***S.F.*** Clearwatef Rivers in Idaho and the Imnaha River in northeast Oregon. **Ken** Witty has said that fall out-migrant spring chinook **are** approximately 60 to **70** millimeter8 long. 'In the spring, when they arrive at Lower Granite Dam, they ar8 approximately 100 to 120 millimeters long.

If downstream rearing succeeds and becomes prevalent, then coordination among production projects in the region will become increasingly important. The reason coordination would become more important is that common nursery streams might become overstocked. This is additional impetus for addressing the carrying capacity-rearing distribution questions early in the project.

Assumptions and The Model

For detailed information on assumptions used in the model, the parameters used to predict population response8 and the hypotheses that will be tested see Appendix 4.00 and Support Document 8.00.

Genetics

The Council's monitoring and **evaluation** group (MEG) has attempted to address genetic concerns. The report, A Guide to **Genetic Impact Monitoring** **(NPPC** May 199% identified four **areas** of genetic impacts or risks:

Risk 1. Extinction

Risk 2. Loss of Within-Population Genetic Variability

Risk 3. Loss of Between-Population Genetic Variability

Risk 4. Anthropogenic Effects

NPTH production will entail each of these types of risk. Monitoring and-evaluation will be essential to control these risks.

Genetic Resource Assessment **(GRA)** has been developed for to determine the impacts of **NPTH** production in the Clearwater and Salmon River subbasins (Cramer and Neeley 1992). The **GRA has** reviewed each subbasin, tributary watershed and stock supplementation program. Particular attention has been given to the history of stocks and hatchery operations within each subbasin.. Specific recommendations were made regarding broodstock on the basis of comparisons of life history, genetic information, stock characteristics, and environment.

NPTH production modeling has set specific goals for minimum natural production in each satellite system (see Chapter III, Objectives and Strategies).

Other Uncertainties

Among the uncertainties that may affect NPTH success, but do not lend themselves to resolution through experimentation (within the context of the NPTH alone), are:

- smolt-to-adult survival
- reproductive success
- long-term fitness
- ecological interactions with other stocks

These uncertainties are shared with mast supplementation projects. They probably can best be resolved within the context of a regionally integrated experimental plan.

Such a plan is evolving as a result of the Regional Assessment of Supplementation Project (RASP) and other on-going efforts.. This regional effort is expected to provide guidance in identifying when, where, and how certain standard monitoring activities will be conducted. For example, the Council's monitoring and evaluation group (MEG) is developing guidelines for genetics risk assessment and monitoring, and RASP is investigating the concept of risk containment monitoring.

Monitoring and Evaluation

Experimental Response Variables

The current plan is to rely primarily on passive integrated transponder (PIT) tag interrogation, which generates recapture histories of individual fish. These data can be used to test hypotheses and develop maximum likelihood estimators, a number of analytical procedures have been developed for PIT tag information.

A general monitoring scheme might look as follows:

1. Mark 10,000 (preliminary number to be refined later as trapping efficiencies are better understood) fish per treatment group with PIT tags prior to release.

2. Interrogate fish (sampling rate50-100%) at the mouth of each of six tributaries using PIT tag detectors.

3. Sample fish for PIT tag information at existing facilities at Lower Granite, Little Goose, and McNary Dams.

The tributary monitoring stations would be used to measure migratory response to different release treatments. This sampling would begin at the time of release and would continue through the spring outmigration. Mobile PIT tag detectors are being tested by the National Marine Fisheries Service (NMFS) for use in smaller tributaries. The results have been promising (Personal communication, Al Giorgi 1991).

Site-specific feasibility questions and trapping efficiencies need to be addressed as the experimental program is refined during the design phase. Where possible and practical, 100 percent trapping efficiency should be sought.

The PIT tag readings at tributary mouths would also be used to partition the outmigrant smolts into two.groups, depending on which side of the trap they spent the winter. Multiple recapture analysis methods (e.g., Burnham et al 1987) would be attempted to compare survival rates between the two groups. The assumption of equal recapture probabilities for the two groups is uncertain because of:

- seasonal sampling schedules
- variable efficiencies
- transportation practices at Lower Granite, Lower Goose, and McNary Dams

Existing traps in the Clearwater and the Snake Rivers' (near Lewiston) operate only in the spring and have low capture rates.

These sampling questions need to'be addressed in a broader context since they affect the ability to effectively evaluate relative performance of all experimental programs in the Snake Basin.

Risk Containment

Risk containment monitoring will be used to track long-term trends of unstable responses and extreme or sudden changes in the more stable variables.

Variables and concerns that need to be addressed through risk containment monitoring include:

- smolt-to-adult survival
- reproductive success

- long-term fitness
- ecological interactions

Environmental variation (for use in interpretation of results) also should be monitored at some appropriate level.

The specific elements of the risk containment monitoring program (i.e., specifically what is measured, how often, where, etc.) will be determined after more guidance from regional planning efforts becomes available. NPTH will coordinate with and participate in those efforts as appropriate. The Regional Assessment of Supplementation Project (RASP) is expected to offer an approach to containing risks in a regionally consistent and efficient manner.

Genetic Risk Assessment Response To Monitoring and Evaluation

The Genetic Risk Assessment (Cramer and Neeley 1992) has responded to the' NPTH master plan by'reviewing the document (Draft 1) and has made the following comments and recommendations;

Uncertainties

Spring Chinook

1. Is spawning time of the donor stock properly timed to avoid mortality to eggs as a result of high temperatures' in the fall?
2. Is 'spawning time of the donor stock properly timed to produce fry emergence at the optimal time for survival?
3. Does assortative mating occur and how can it be mimicked in the hatchery?
4. Is time of adult entry'into the home stream properly timed to enable over-summer survival equally for all fish in the population?
5. Will releases of parr in the fall displace naturally produced salmonids from their winter habitat?

Summer Chinook

1. Is spawning time of the donor stock properly timed to avoid mortality to eggs as a result of high temperatures in the fall?

2. Will summer chinook maintain spatial or temporal isolation from spring chinook at the time of spawning?

3. Is spawning time of the donor stock properly timed to produce peak fry emergence at the optimal time for survival?

4. Does assortative mating occur and how can it be mimicked in the hatchery?

5. Is time of adult entry into the home stream properly timed to enable over-summer survival equally for all fish in the population?

Fall

1. Is spawning time of the donor stock properly timed to avoid mortality to eggs as a result of high temperatures in the fall?

2. Does assortative mating occur and how can it be mimicked in the hatchery?

3. Is time of adult entry into the home stream properly timed to enable over-summer survival equally for all fish in the population?

4. Will any of the planned-release practices lead to substantial straying?

Monitoring Activities

Spring Chinook

1. Survey spawning weekly and mark redds so that time of' spawning can later be identified for each redd. Once eggs should have reached eyeing, sample egg survival'and look for any relationship of differences in survival to spawning time or-river temperature..

2. Record size and external characteristics of natural spawning pairs to evaluate assortative mating.

3. Fin mark all hatchery fish so they can be identified as adults by fishermen and biologists regulating escapement and breeding in the hatchery.

4. Conduct'standardized snorkel surveys to evaluate rearing density of chinook and other fish species. This will be used for between year comparisons to evaluate carrying capacity and effects on nontarget species.

5. Trap juveniles near the stream mouth to estimate numbers and timing of outmigrating fish. These data are needed to

estimate **survival** of **hatchery** releases and assess displacement of naturally produced fish.

6. Retain a random sampler of a least 100 juveniles from hatchery production each year for electrophoretic analysis to track allele frequencies.

Summer Chinook

1. Survey spawning weekly and mark redds so that time of spawning can later be identified for each redd. Once eggs should have reached eyeing, sample egg survival and look for any relationship of differences in **survival** to **spawning** time or river temperature.

2. Record size and external characteristics of natural spawning pairs to evaluate assortative mating.

3. Fin mark all hatchery fish so they can be identified as adults by fishermen and biologists regulating escapement and breeding in the hatchery.

4. Conduct standardized snorkel surveys to evaluate rearing density of chinook and other fish species. This will be used for between year comparisons to evaluate carrying capacity and effects on non-target species.

5. Trap juveniles near the stream mouth to estimate numbers and timing of outmigrating fish. These data are needed'to estimat8 survival of **hatchery** releases and assess displacement of naturally produced **fish.**

6. Survey spawned carcasses to recover- **CWTs** to evaluate and assess contribution and interbreeding with spring chinook.

Fa11 Chinook

1. Record size and external characteristics of natural'spawning pairs to evaluate assortative mating.

2. Fin mark all hatchery fish so they **can** be identified as adults by fishermen and biologists regulating escapement and breeding in the hatchery.

3. Trap juveniles near the stream mouth to estimate numbers and timing of outmigrating fish. These data are needed to estimate shrvival of hatchery releases and **assess** displacement of naturally produced fish.

4. Survey spawned carcasses to recover **CWTs** to evaluate straying and assess contribution.

CHAPTER V HARVEST MANAGEMENT PLANS

Introduction

Three phases of harvest management are planned for the Nez Perce Tribal Hatchery (NPTH) production. These phases encompass at least the first three generations of production (a period of at least 15 years or more). Tentatively, Phase I, II, and III each consist of five years. Phase III may consist of 10 or more years. The salmon life cycle for spring, summer, and fall chinook is five years for each generation of spawning fish.

Harvest in any of the three phases will depend upon numbers of fish returning to the watersheds and/or subbasins. If rebuilding is exceptionally slow, 20 or more years (four + generations) may be required before a harvest opportunity occurs.

Phase I of harvest management will cover the first five years (the first generation of fish). During Phase I, the goal will be to increase the presentnatural production to the target level in Table V-l. In streams where the stock has become extinct, the goal will be to establish a new run of fish while providing broodstock for both hatchery supplementation and natural spawning.

In either o&se, harvest during Phase I is not likely to occur as the minimum escapement goal (Table. V-1) will probably not be achieved during that time. The minimum escapement goal will take precedence over all-other needs, for the resource.

Phase II harvest management would cover years; six through ten (the second generation of fish). Harvest during. Phase II would be conditional upon the numbers of fish returning to a particular watershed. The minimum escapement goals in Table V-1 would have to be achieved prior to harvest. Harvest during Phase II is anticipated to be limited to perhaps 10 to 100 fish.

Limited returns in Phase II could delay harvest until the third generation of fish is being produced '(after the 10th year). If runs have not achieved the minimum escapement needed to assure both hatchery andnatural broodstock -returns,. then no harvest would occur. Assuming the best of conditions, it is anticipated that harvest probably would not-occur until seven years after the project starts.

Phase.11 tribal harvests would be confined to areas above weirs where actual numbers of returning adults are known and broodstock (natural and hatchery) has already been collected and harvest numbers determined. In some cases, it may be necessary to trap and haul natural spawners above the harvest area to insure their protection.

Table V-l. Tribal ceremonial and subsistence harvest schedule describing species, watershed, areas, map coordinates with escapement levels required for a minimum and maximum harvest levels.

Species: Watershed: - site names:	Coordinator: (township, - range, section, quarter)	Adult Returns to Designated Stream: Total Number Adults:	Adult Returns to Designated Stream: Harvest Level: [# fish (% harvested)]
Spring Chimok 1/ Lolo Cr., Clearwater R. 1- lower Lolo Cr. 2- Lolo Cr. Falls 3- Eldorado Cr. Falls	 1- T35N,R2E,S14,SE1/4 2- T34N,R6E,S7,SE1/4 3- T34N,R6E,S17,SE1/4	0 - 240 241 - 399 2/ 400 401 and up A*: Alternate Options	0 up to 20 (33% excess of 240) 50 (12.5%) 50 plus 50% over 400 A*: Alternate Options
Spring Chinook 3/ Meadow Cr., S.F. Clearwater R. 1- Meadow Cr. Falls (acclimated smolt release of 20,000 fish per year)	I- T29N,R4E,S23	0 to 55 56 to 109 110 111 B*: Alternate Options, harvest augmentation.	0 up to 55 (100% of excess) 55 55 plus 100% of excess B*: Alternate Options, harvest augmentation.
Spring Chinook Mill Cr., S.F. Clearwater R. 1- stream segment 1st to 2nd bridge.	1- T29N,R4E,S27	0 to 90 91 and above C*: Alternate Options for increased harvest.	0 10 harvest 100% excess of 90) C*: Alternate Options, for increased harvest.
spring Chinook Newsome Cr., S.F. Clearwater R. 1- section 17 or 1st to 2nd bridge	I- T29N,R7E,S17	0 to 82 83 to 134 135 136 and above A*: Alternate Options	0 up to 17 (33% excess of 82) 17 (12.6%) 17 plus 50% over 136 A*: Alternate Options
Spring Chinook Slate Cr., l.m. Salmon R. 1- section 36 2- section 33	I- T27N,R2E,S36 2- T27N,R3E,S33	0 to 200 201 to 334 335 336 and above A*: Alternate Options	0 up to 20 (15% excess 200) 20 20 plus 50% over 335 A*: Alternate Options
Spring/Summer Chinook 4/,5/ Meadow Cr., Selway R. 1- S.E. 1/4, section 11 2- N.E. 1/4, section 14	1- T31N,R9E,S11,SE1/4 2- T31N,R9E,S14,SE1/4	0 to 199 200 to 399 400 401 and above A*: Alternate Options	0 up to 20 (25% excess 200) 50 50 plus 50% over 401 A*: Alternate Options
Fall Chinook S.F. Clearwater R. 1- section 17 (?) 2- OTHER TO BE DETERMINED 6/	1- T31N,R4E,S17 2- TO BE DETERMINED 6/	0 to 750 750 to 1250 1251 and above A*: Alternate Options	0 up to 375 (75% above 750) 375 plus 50% excess 1251 A*: Alternate Options

FOOTNOTES: Table V-I.

1/ Natural and hatchery stock developed simultaneously.
2/ Harvest not initiated until 60% of maximum goal k achieved.
3/ Harvest restricted to allow natural spawning to test quality of the watershed.
4/ Watershed supplemented with fall-release presmolts in stream mile 1.
5/ Watershed supplemented with Timed-release Fed-fry in upper basin roadless area.
6/ Actual harvest sites and methods to bo determined based on actual areas to which fish return.
A* Alternative harvest plans discussod in written section of these watersheds.
B* Alternative harvest pkn discussed in written section of Meadow Crook, S.F. Clearwater River.
C* Alternative harvest pkn discussed in written section of Mill Crock, S.F. Clearwater River.

Phass III harvest management would probably occur in years 12 through 20 after production starts. If returns are depressed, the first harvest might not occur until Phase III.

Tribal harvest would continue to be targeted in areas above weirs where fish had been counted andbroodstock had been collected; Harvest numbers and times of fishing would be set and monitored as accurately as possible to ensure that natural spawning escapement would occur. Some natural fish might have to be trapped and hauled above the fishing zone to assure minimum escapement for natural production.

Areas/Gear: The selection of fishing gear will have a major impact on the mortality of hatchery and natural broodstock.

The use'of "dip nets only" would allow for a larger overall harvest and selective release .of broodstock with minimal handling damage. This type of gear also would promote a more rapid redevelopment of the fishery.

The fishery may expand to the mainstem Clearwater River after the third life cycle (12 to 20 years). This river fishery may include scaffolds and weirs fished with set nets (dip nets tied in place), night drift spear fishing, gaffs, hook and line, and snag hooks.

Incremental Harvest: This concept would allow harvest to occur above some minimum level of escapement that would sustain the run and continue to increase harvest based on an increasing run size.

This means that a variable harvest rate would be allowed even when the optimum escapementthat would provide full broodstock for both the stream and the hatchery is not achieved (Table U-1). Nevertheless, it would allow broodstock escapement to increase with increased run size.

When 'the run is large and sufficient to sustain a harvest of more than about 500 fish, incremental harvest appears to be realistic. When the run size is small and the harvest is less than 100-500 fish, a different approach will be required.

The "incremental harvest" concept will need to be developed after runs have been developed. Until smolt-to-adult passage survivals are increased; escapement levels likely will be restricted to levels where incremental harvests are not likely to be appropriate.

Proposed Harvest Plan

The harvest plan is based on:

- achieving a minimum level of adult returns before harvest
- setting a low level of harvest until the maximum adult return goal is achieved (Figure V-l)

In most watersheds, the minimum harvest goal is set by the number of adult returns exceeding 50 percent or more of the maximum goal for adult returns (Table V-l). Initial harvest levels after achieving minimum escapement range from 15 to 100 percent, depending on the goals and amount of protection sought for natural production and broodstock (Table V-l).

When a watershed has an existing, natural run of fish, harvest does not begin until adult returns equal 60 percent of the maximum adult return goal (e.g., Lolo Creek [Table V-l, Figure V-l]). The maximum harvest levels were developed from the NPTH model and represent a random, nonselective harvest based on equal proportions of hatchery and natural adult fish returning to the mouth of each stream.

A simple form of' incremental harvest is developed when run escapement exceeds the maximum goal which allows some of the surplus fish to be used for other broodstock purposes. Except for'fall chinook, harvests are constrained to tributary watersheds above a-weir where monitoring and broods'tock collection can occur. Ideally, the minimum adult return required for harvest would be equal to the genetic minimum viable population (MVP) which has been estimated to be at least 200 to 500 animals (Thomas, 1990). Oregon Fish and Wildlife policy has set MVP at 300 adult fish.

The run size in some of the streams for this project is either nonexistent or far below the'propdsed MVP. Some watersheds may never have had populations equal to MVP because of limited capacity for juveniles. Populations less than MVP in tributary stream probably were a part of their mainstem river system's MVP within each subbasin (e.g., Mill Creek, South Fork of the Clearwater River)

Harvest levels have been set by specifying numbers of natural and hatchery (marked) fish to be harvested in equal proportions. If the two types of fish cannot be distinguished without wounding the animal, then harvest levels will be constrained to 50 'percent of the surplus to protect natural production (see Table V-l and discussion for individual watersheds).

A possible alternative to this scenario would be for the Nez Perce Tribal fishermen to:

- monitor their harvest
- fish only with dip nets, and
- stop the harvest when the maximum number of natural or hatchery fish are harvested

If selective harvest cannot be realized by Tribal fishermen, then, in some cases, harvest by hatchery personnel may have-to occur at weirs to maintain the 50:50 Rule for natural spawning populations (see Appendix VII, NPTH Model).

Figure V-l shows an example of the development 'of the run numerically and the minimum adult return required prior to initiating a controlled harvest. When the maximum adult return goal is exceeded. harvest is increased to include, the maximum base harvest number (Table V-1, Figure V-l), of 50 fish plus fifty percent of the fish in excess of the maximum adult return goal of 400 fish.

240 Minimum Escapement

Run Size	0	50	'100	150	200	250	300	350.	400	450	500	550
# Harvest	0	0	0	0	0	3	20	36	50	75	100'	125
% Harvest	0	0	0	0	0	1	6.6	10	12	17	20	25

Maxim&Escapement 400'

Figure, V-l,. Graphic presentation 'of run development and harvest management for Lolo Creek., watershed demonstrating minimum (240 adults) and maximum (400 adults) triggers -for harvest management.

Exceptional Harvest Opportunities

Harvest in area& other than in designated tributary areas might occur if excessively large escapements were recorded at either Lower Granite Dam or some other mainstem river enumeration facility upriver'of Lower Granite Dam.

Escapement levels would have to be greater than the number of adults required to fulfill both hatchery and natural spawning escapements'. Recommended harvest under this condition would not exceed 50 percent of the surplus.

The balance of the surplus would either be taken as broodstock to restore or establish runs in other watersheds or allowed to spawn naturally. The decision to have such a harvest would be made by the management agencies involved (e.g., the Nez Perce Tribe, Idaho Department of Fish and Game (IDFG); U.S. Fish and Wildlife Service (USFWS), etc.).

The NPTH production model has identified the potential for hatchery production to exceed natural production in production years six through 10. This condition may make selective harvest mandatory to prevent hatchery production from overwhelming natural production.

Agency Coordination

NPTH's harvest management plan does not address the division of harvest between the Nez Perce Tribe and Idaho sports fishermen. Nevertheless, the plan is designed to respond to the conditions and needs of the fishery. Further agency coordination of harvest management will be necessary as run rebuilding occurs, as described in Chapter VI, Coordination Issues. The Steering Committee comprised of the Tribe and IDFG will oversee harvest issues affecting Tribal members- and sports fishermen.

The following brief discussion of the issues may be useful.

Tribal harvest is confined mostly to the tributaries of the mainstem rivers in areas not customarily fished by sportsmen and. the tribal harvest levels are relative&y--low. Maximum numbers. for spring and summer chinook are estimated to be 20 to 95 fish for each area with the exception of fall chinook which is estimated to be as great as 375 fish.

Sports fish harvests would occur prior to tributary fisheries in the South Fork of the Clearwater River but not in the mainstem Clearwater and Salmon rivers. Escapement controlling Tribal harvest in South Fork tributaries would be subjected to sports fishing prior to Tribal harvest.

It may be possible under the United States/Canada Treaty to designate new mainstem areas for sport fish harvest downstream of the mouth of the Lolo and Slate Creek that would avoid mixed stock harvest..

Cultural Considerations: There are multiple references to the ancestral and Treaty rights to fishing for the Nez Perce Tribe (US v.Oregon). Harvest areas designated in this report were selected by the Nez Perce Tribe's Department of Fisheries Management by considering:

- first, protecting and rebuilding the depleted fisheries resources
- second, the cultural needs of the Nez Perce people.

The Nez Perce Tribal Executive Committee and their Fish and Wildlife Subcommittee will coordinate and administer Tribal fisheries.

Designated Harvest Areas

Spring and Summer Chinook: All spring and summerchinook harvest locations are above monitoring sites within the tributaries. While harvest monitoring will be complicated by the multiple sites for returns, the Nez Perce Tribal Executive Committee (NPTEC) haschosen to provide monitoring and enforcement to secure harvest levels.

NPTEC also 'chose a minimum harvest level even though there is question of protecting'the broodstock. Cultural practices of the' Nez Perce Tribe do not allow selective harvest (catch and release of unmarked fish). Thus, harvest will be constrained to minimum levels. Extensive marking will be necessary to separate and identify hatchery from natural fish. Marking, setting harvest levels, and monitoring the harvest likely will provide sufficient information for accurate harvest management.

Fall Chinook: The present harvest location restricts harvest to the South Fork Clear-water River to avoid conflicts with the United States v. Canada Treaty'and-to designate an area that-is manageable. Harvest is anticipated to be restricted to minimum levels to ensure that natural production and broodstock are protected.

In the future, the NPTEC and the NPTH/IDFG steering committee will set policy for harvest management as described in this report (see Chapter VI, Figure VI-l).

Areas designated for tribal harvest are listed in Table V-l. These harvest zones are located on tributaries above monitoring sites where'satellite production occurs. Maps designating the area for harvest are shown in Figures V-2 through V-6.

Redesignation of harvest areas may occur as adult returns develop. Some harvest areas have not been specified yet because of uncertainty related to broodstock collection facilities and lack of knowledge regarding areas where fall chinook are accessible to harvest.

Specifics of fall chinook harvest will be written during the next two to 10 years using information developed during the endangered species listing process and refined as returns are monitored during Phase I and II.

Lolo Creek Watershed: Fisheries harvest in this watershed has historical significance to the Nez Perce Tribe. The physical characteristics of the stream support traditional fishing methods used by the Tribe, especially at the falls on Lolo and Eldorado Creeks (Figure V-2).

Riparian and stream habitat enhancement and passage work by the U.S. Forest. Service (USFS) supports the Tribe's fish enhancement work.

The harvest will be managed to protect the natural spawning population. The run will be monitored at the mouth of Lolo Creek and the fishery will be conducted upstream from that site.

Three areas are suggested for harvest (Table V-l):

1. upstream of the mouth of Lolo Creek
2. at Lolo Creek Falls
3. at Eldorado Creek Falls

Site 1 on lower Lolo Creek upstream of the mouth (Figure V-2) would be used by Tribal elders who were unable to access either of the two upstream sites. Lolo Creek Falls would be the harvest site used to target the Lolo Creek natural run. The Eldorado Creek run will be managed by counting escapement through a weir at the lower satellite facility and conducting a fishery at the falls and cascades upstream in the designated area (Figure V-2).

A minimum total escapement of 240 adults into Lolo Creek will be required prior to conducting a fishery. Thirty-three percent of the surplus in excess of 240 fish up to a total escapement of 400 fish would be harvested.

An escapement of more than 400 fish into Lolo Creek will be required prior to conducting a maximum harvest. The NPTH production model predicts a 50 fish harvest is sustainable at this level of escapement.

If surplus hatchery fish need to be harvested, gear restrictions would be required for a Tribal subsistence fishery. Dip nets would be required to allow release of natural or hatchery fish in order to harvest the exact numbers of each type of fish.

If gear restrictions are not used, the recommended harvest level at maximum escapement would be 50 percent of the surplus in excess of the maximum. This would be needed to protect the natural run from over harvesting.

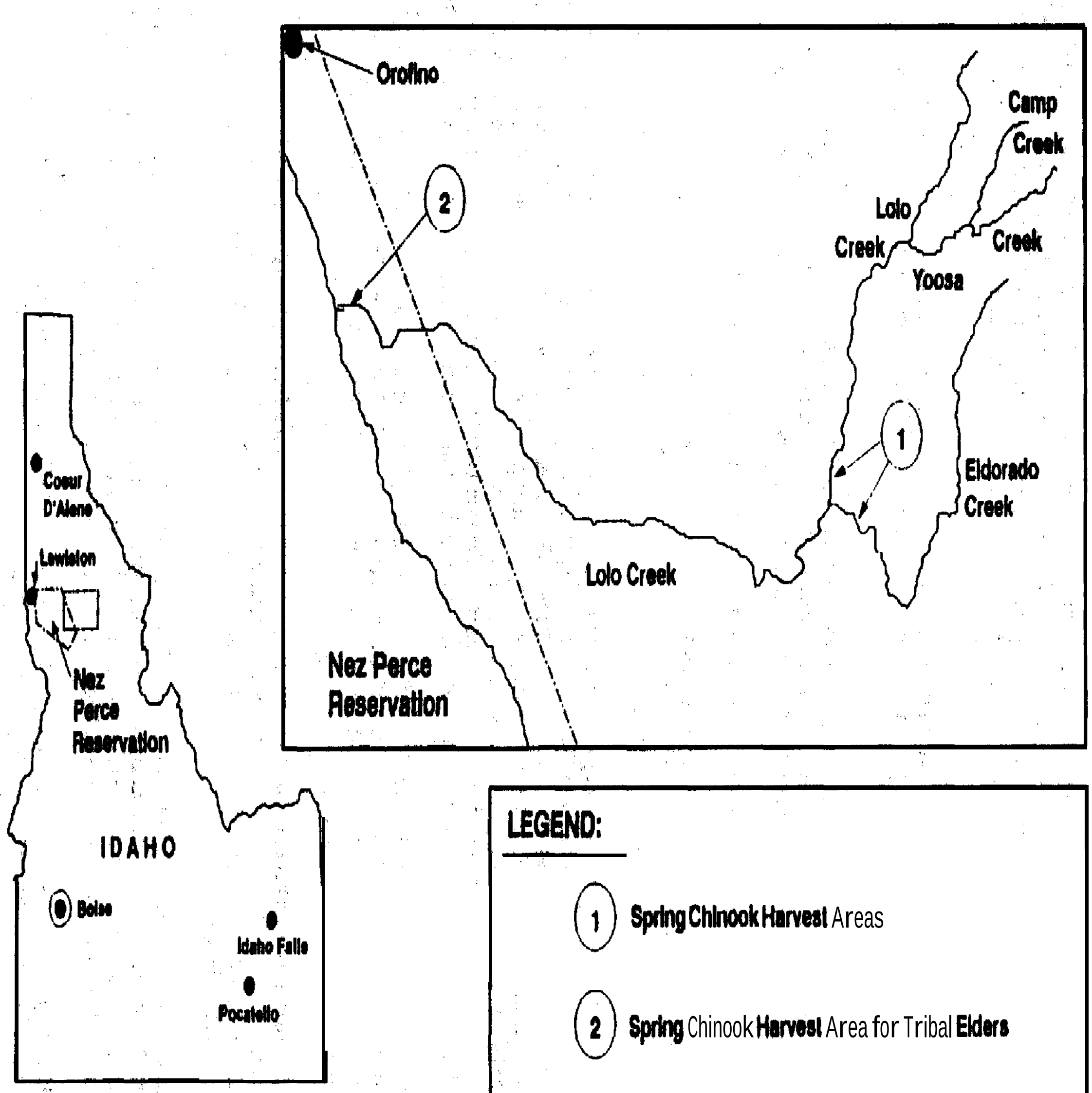


Figure V-2. Map of Lolo Creek watershed showing the locations spring chinook harvest areas including harvest area for Tribal Elders.

Harvest Options A*: When **maximum** escapement **is exceeded,** several' options could **be** considered:

- Option 1 - Take **all surplus** fish, **for broodstock needs.**
- Option 2 - Harvest **50 percent of** the surplus **regardless** of production origin (natural or hatchery).
- Option 3 - Harvest a greater percentage of the surplus, even to the point **of 100 percent harvest.**

For example, if the escapement exceeds the **"maximum" by** 100 fish, total harvest could be 25 natural fish, 25 hatchery fish, and **50 of** either hatchery **or** natural **origin.** The harvest might consist **of** 75 natural **fish,** and 25 **hatchery** fish, or **the** reverse of'25 natural fish and 75 hatchery **fish.**

The management options listed above will be resolved on an annual basis for'each watershed. The **ideal harvest would be to have an** equal number of both **hatchery and** natural **fish** in the harvest; The balance of-the **surplus** natural escapement **could spawn** or they, might be used as broodstock to support other restoration activities.

Meadow Creek, South Fork **Clearwater River Watershed:** **The harvest** in this watershed for **the short** term will be based on establishing or restoring a **new** run of spring-chinook **salmon** using acclimated smolt releases **of 50,000** fish per year:

This method of restoration is **considered** the only economically:- acceptable **approach given** the current stream habitat and water quality conditions in the **watershed.** See Chapter **V, "Objectives** and Strategies**"** for the reasoning **for this type** of **production.**

This supplementation effort is deiigned mainly to **provide a** harvest.

Long-term **establishment** of **natural** produqtion'and **presmolt** releases **in this watershed depends on** improving:

- in-stream and riparian habitat, and
- water quality and **temperature**

Restoration of riparian habitat **will require** at least **15 years to** change enough **to** sustain natural **production.**

The harvest area recommended '(Table Y-l, Figure V-3) exists in a series of cascade& and water falls upstream from the footbridge near the mouth in section 23, range 4 east, township 29 north.

Enumeration of the **run would** occur at **a temporary weir located in** the area of the foot bridge near the mouth of the stream.

Two harvest **scenarios are**.-presented. The first would prescribe a minimum adult return of 55 adults into Meadow Creek prior to conducting a fishery. This would ensure that **broodstock** is maintained to support production. All. of the surplus exceeding 55 fish would be harvested.

Harvest Option B* for Meadow Creek (Table V-1): Total harvest **could** occur on all fish returning to Meadow Creek and/or some specified number of fish would **be allowed to** escape and spawn naturally **without** providing hatchery **broodstock.** The balance of the fish **would be harvested. Broodstock** would continually be supplied from **some hatchery (NPTH, Dworshak** National Fishery Hatchery, or Clear-water Anadromous Fish Hatchery) to provide a ceremonial and subsistence harvest.

Mill Creek, South Fork Clearwater River: The harvest **in** this watershed for the short term will be based on establishing or restoring a new run of spring chinook salmon by using Clearwater River stocks. The harvest area (Table V-1, Figure V-3) recommended exists between the first and second road bridges crossing the stream in section 27, range 4 east, township 29 north. **Enumeration** of the run would occur at a temporary weir located near **the mouth** of **the stream.**

A minimum adult return of 90 adults into Mill Creek **will be** required prior **to conducting** a fishery in order to secure natural production and hatchery broodstock. All adult escapement exceeding 90 fish may be harvested.

Harvest Option C* (Table V-1). **These options** may need to be developed. because of limited **natural habitat** for **chinook or** to protect natural 'steelhead production in this watershed. Habitat in this watershed is primarily steelhead habitat rather than chinook habitat. If this should be dase, harvest levels would need to be raised to control natural production. In this case, the goal might be **to only** achieve **25 to** 33 **percent** natural production. Hatchery **broodstock** production **would** be a goal in this watershed for enhancing either natural or hatchery production.

Newsome Creek, South Fork Clearwater **River:** The **harvest** in this watershed for the near term will be based'on establishing or restoring a new run of spring **chinook salmon** by using **Clearwater** River stocks. **Harvest** will be managed to **protect** the, **natural** spawning population by monitoring the run at the mouth of **Newsome** Creek and by conducting the **fishery(ies)** upstream from that site.

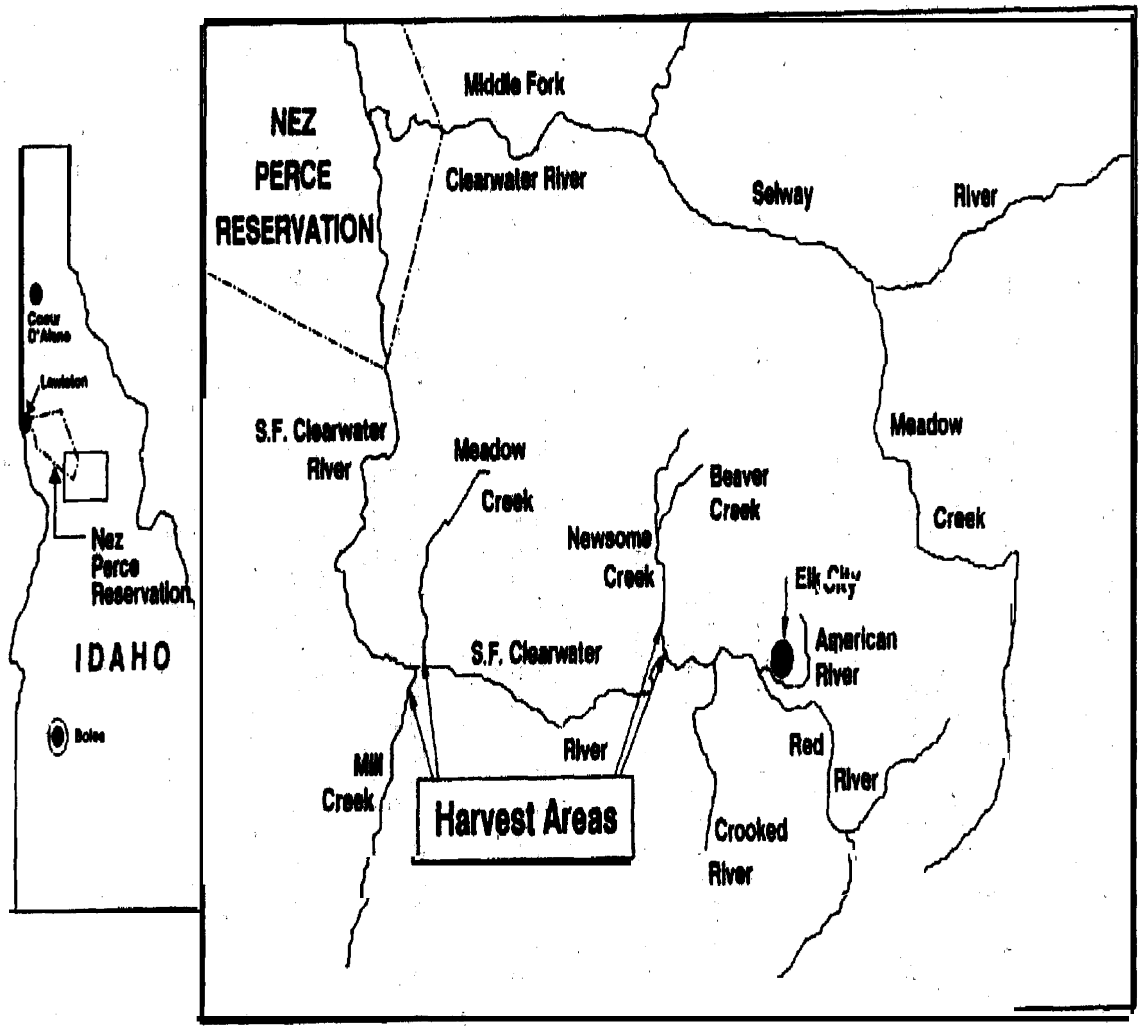


Figure V-3. Map of South Fork Clearwater River showing the locations of spring chinook harvest areas.

Two areas have been identified for harvest (Table V-l, Figure V-3):

- section 17
- the stream segment between the first and second bridges crossing the main stream.

A minimum adult return of 82 adults into Newsome Creek will be required before conducting a fishery. Thirty-three percent in excess of 83 fish, up to 134 fish may be harvested. Maximum harvest for this escapement is 17 fish. When escapement exceeds 136 fish, 17 fish plus 50 percent in excess of 136 fish may be harvested.

Harvest Option *A*: When maximum'escapement is exceeded, several options could be consideredd:

- Option 1 - Take all surplus fish for broodstock needs.
- Option 2 - Harvest 50 percent of the surplus regardless of production origin, either natural or hatchery.
- Option 3 - Harvest a greater percentage or all, of the surplus.

These management options will be resolved on an annual basis for each watershed. The ideal harvest would be to have an equal number of both hatchery and natural *fish* in the harvest. The balance escapement could spawn or they might be used as broodstock to support other restoration activities.

Slate Creek, Lower Mainstem Salmon Rivers t in this watershed will be based on establishing or restoring a new run of spring chinook salmon by using Rapid River stock. Some natural spawning occurs at a very low'level; six adults were counted in 1990 (Personal Communications, Nez Perce Tribe, 1991). The natural fish will be monitored as the program develops.

Harvest will be managed by monitoring the run at the mouth of Hurley Creek (approximately four miles upstream of the mouth of Slate Creek) and conducting the fishery(ies) upstream from that site. Two areas have been identified for harvest (Table V-l, Figure V-4):

1. Section 36, range 2 east, township 27 north
2. Section 33, range 3 east, township 27 north

These harvest areas probably will be on cascades and pools where the gradient is greatest.

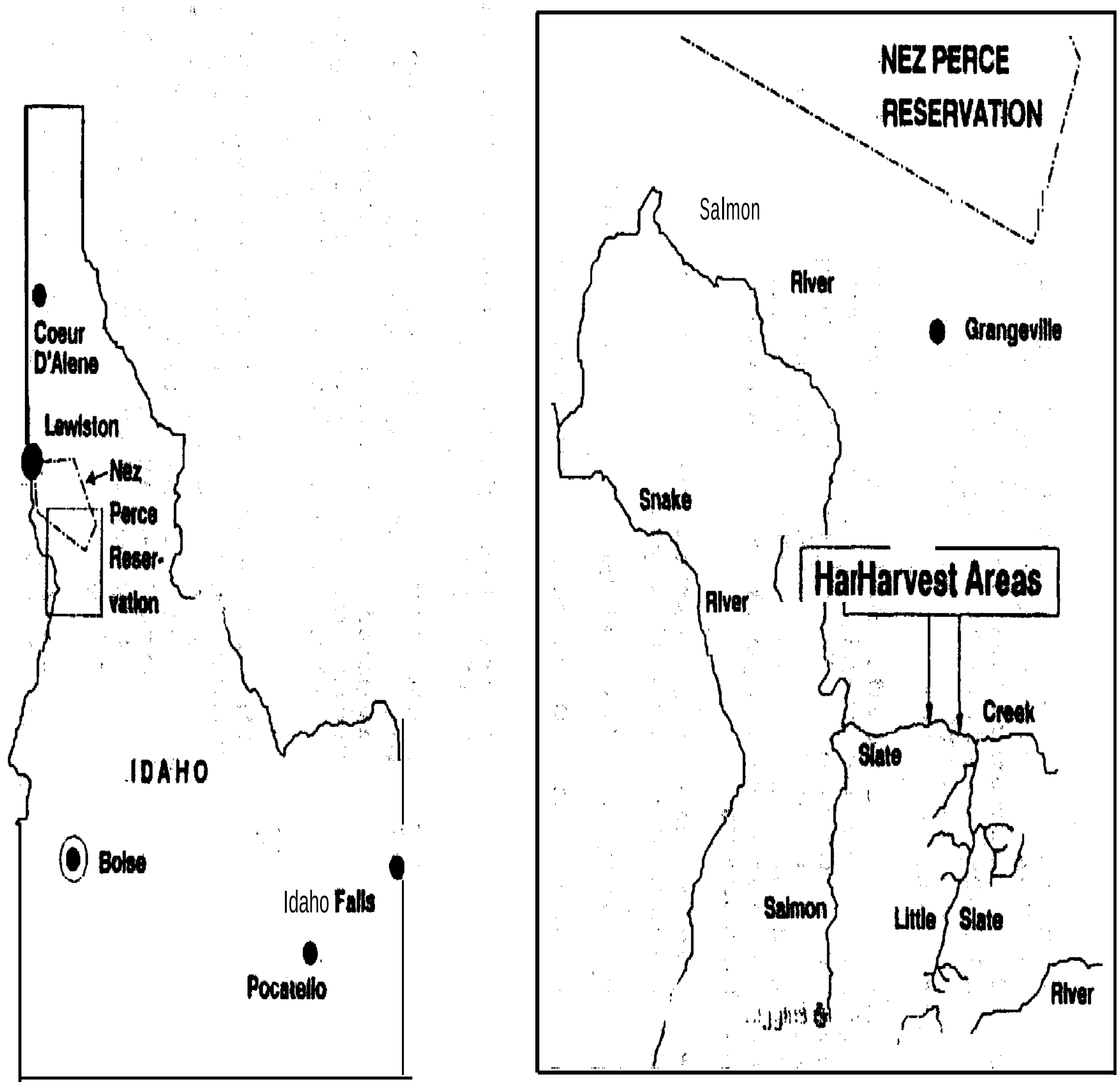


Figure V-4 Map of Slate Creek watershed showing the locations of spring chinook harvest areas.

A minimum adult return of 200 adults into Slate Creek will be required prior to conducting a fishery. When escapement ranges between 201 and 334 fish, 15 percent of those fish may be harvested up to a maximum of 20 fish; When escapement exceeds 335 fish, 20 fish plus 50 percent in excess of 335 fish may be harvested.

An alternative to this scenario may be developed based on acclimated smolt releases for sustaining a harvest. If this action is implemented, appropriate management coordination-will occur. Releases would be differentially marked and gear restrictions would be necessary to selectively harvest hatchery fish and release natural spawners.

If selective harvest is not used, natural production probably would decrease from the 50 percent goal to a level of 25 to 33 percent natural production. Tentatively, such a harvest would be based on release of 50,000 to 100,000 acclimated smolts with a potential harvest of 220 fish. Production of those fish would occur at either the Sweetwater Springs satellite facilities or at a state or federal hatchery.

Harvest Option A*: When maximum escapement is exceeded, several additional options could be considered.

- Option 1 - Take all surplus fish for broodstock needs.
- Option 2 - Harvest 50 percent of the surplus regardless of production origin, either natural or hatchery.
- Option 3 - Harvest a greater percentage of the surplus, even to the point Of 100 percent.

These management options will be resolved on an annual basis for each watershed. The ideal harvest would be to have an equal number of both hatchery and natural fish in the harvest. The balance of the natural escapement could spawn or they might be used as broodstock to support other restoration activities.

Meadow Creek, Selway River: The harvest in this watershed will be based on establishing or restoring a new run of spring and/or summer chinook salmon. Clearwater stock will be used for spring chinook and South Fork Salmon River stock will be used for summer chinook. Some natural spawning occurs at a low level. Natural escapement will be monitored and appropriate action will be taken to preserve the natural genetic resource.

Harvest will be managed by monitoring the run at or near the mouth of Meadow Creek and conducting the fishery(ies) upstream from that site.

Two areas (Table V-l, Figure V-5) have been identified for harvest:

1. **SE 1/4,** section **11, range** 9 east, township 31 north

2. NE **1/4** section 14, range 9 east, township 31 north

These harvest areas probably will focus on cascades and pools where the gradient is greatest.

A minimum adult return of 200 adults into Meadow **Creek will** be required prior to conducting a fishery, When escapement is between 201 and 399 fish, 25 percent of these fish may be harvested, up to 20 fish. When escapement is 400 adults, 50 fish may be harvested. When **escapement exceeds** of 401 fish, **50** fish plus 50 percent of the surplus may be harvested.

Harvest Option A*: When maximum escapement is exceeded, several options could be considered:

- Option 1 - Take all surplus fish **for broodstock** needs.

- Option 2 --Harvest 50 percent of the surplus regardless of production origin, **either natural** or hatchery.

- Option 3 - Harvest a greater percentage **of** the surplus, even to the point of 100 percent harvest.

These management options will be resolved on an annual basis for each watershed.

The ideal harvest would be to have an equal number of both hatchery and natural fish in the harvest. The balance of the natural escapement could spawn or they might be used as broodstock to support other restoration activities.

Fall Chinook, South Fork Clearwater River: The harvest in this watershed.'will be based on 'establishing or restoring a new run of fall chinook salmon. Some natural **spawning has** been documented by **Conners** (1988-1990) **in the** lower **mainstem** of the Clearwater' River. Natural spawners will be **monitored.**

Harvest **will** be managed **by monitoring the run** at Little Goose and Lower Granite Dam or by **aerial and** river surveys and conducting a fishery based on surveys. A **potential area** has been identified for **harvest** (Table V-l, Figure V-6) in **the** South Fork of the Clearwater River from its mouth upstream to the southern boundary of the **Nez Perce** Reservation.

Other harvest areas may need to be developed **as** a result of monitoring the run movement in **the Clearwater subbasin.** Future harvest areas- could be within the lower **mainstem** Clearwater 'River

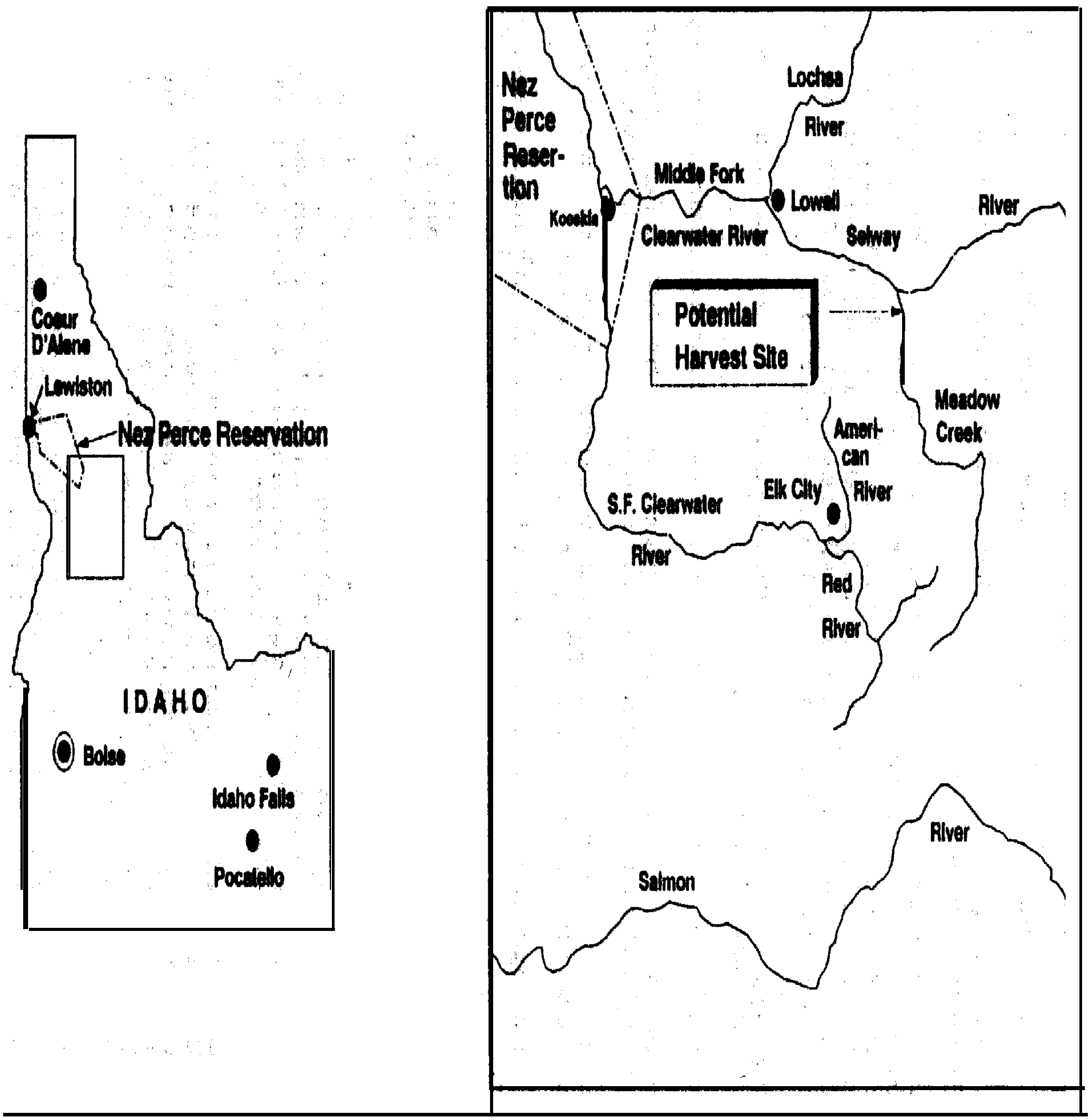


Figure V-5: Map of Meadow Creek, Selway River, showing location of potential harvest site.

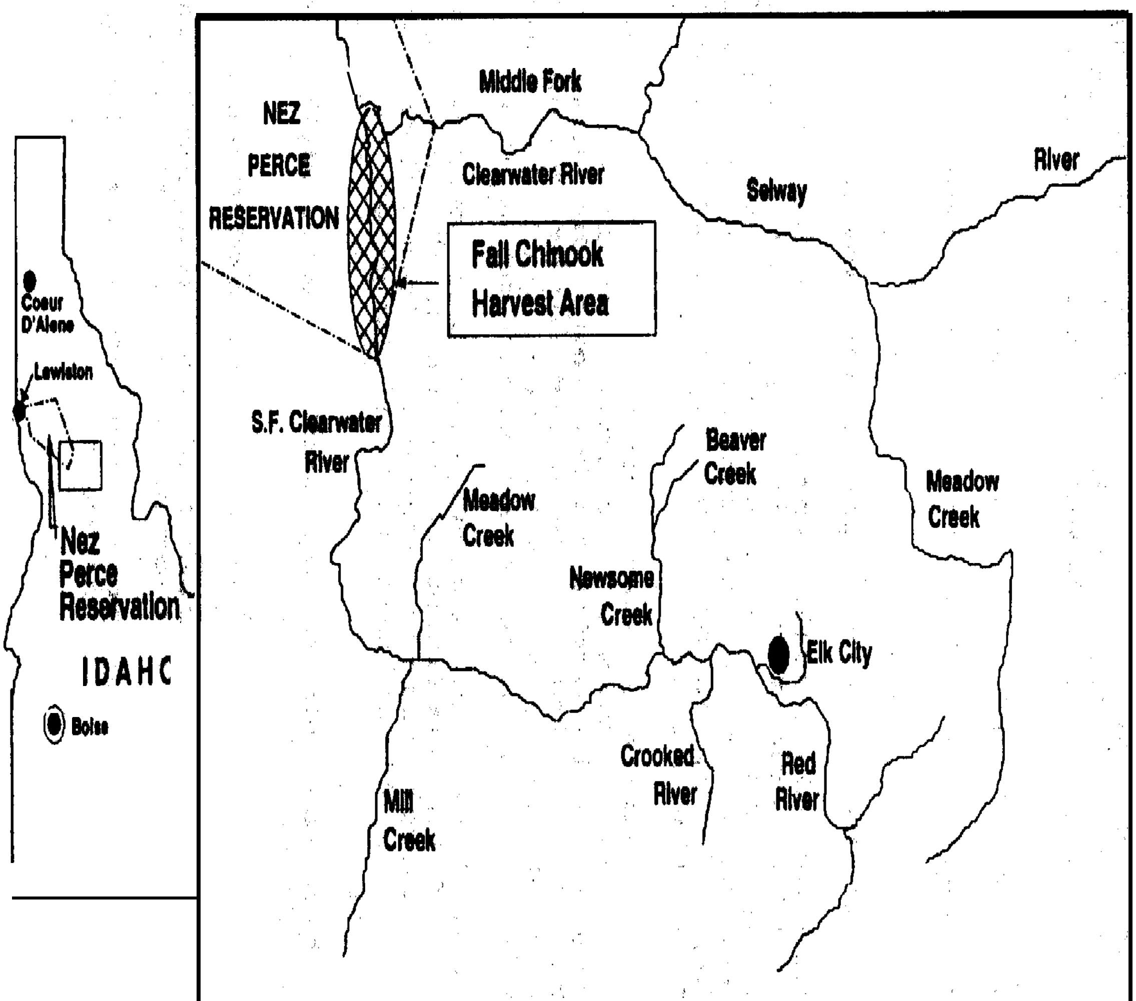


Figure V-6. Map of South Fork Clearwater River showing the location of fall chinook harvest area.

(mouth-to-mouth of North Fork), upper mainstem Clearwater River (North Fork to mouth South Fork), South Fork Clearwater River, Middle Fork Clearwater River, and Selway River.

Until fish returns and the areas they occupy become known, only a best guess of actual harvest areas can be predicted. Harvest areas will be selected to protect spawning areas. Gear for this fishery could consist of:

- rod and reel with bait or snag hook(s)
- scaffold or weir with dip net set in place
- dip net
- night drift fishing with a light and spear

A minimum adult return of 750 adults into the Clearwater River will be required before conducting a fishery. When escapement is 751 to 1250 fish, 75 percent of the escapement in excess of 750 fish may be harvested up to a maximum of 375 fish. When escapement exceeds 1251 fish, an option would be to harvest 375 fish plus 50 percent of the surplus.

Harvests of this type indicate a need for gear restriction, specifically dip nets only. This restriction would allow release of natural or hatchery fish in order to harvest the exact numbers of each type of fish. A fishery in the main river channels likely would require hook and line, snag hook, gaff or spear or set net (a dip net tied in place on a scaffold or a 'weir).

The recommended harvest level at maximum adult return would be' 50 percent (200 fish) of the maximum to protect the natural run from overharvest. Nez Perce Tribal Executive Committee (NPTEC) will represent the Tribe's fishermen and will 'manage and administer their fishery.

<u>Harvest Option A*</u>: When maximum escapement is exceeded, several options could be considered:

- Option 1 - Take all surplus fish for broodstock needs.
- Option 2 - Harvest 50 percent of the surplus regardless of production origin, either natural or hatchery.
- Option 3 - Harvest a greater percentage of the surplus, even to the point of 100 percent.

These management options **will be resolved** on an annual basis for each watershed. The ideal harvest would be to have an equal number of both hatchery and natural fish harvested. The balance of the natural escapement could spawn or they might be used as broodstock to support other restoration activities.

Monitoring of run development and areas inhabited by returning fish will be an important part of fall chinook harvest management. Harvest management may need to be refined at least every five years and **perhaps** on an annual basis.

CHAPTER VI COORDINATION ISSUES

Introduotion

Bonneville Power Administration (BPA) and the Northwest Power Planning Council (Council) are responsible under the Northwest Power Act For the Columbia Basin Fish and Wildlife Program (CBFWP). The Council has approved the Nez Perce Tribal Hatchery (NPTH) concept.

BPA has worked with a Core Group of management agencies to identify the scope of the NPTH program and appropriate biological and technical criteria. The Nez Perce Tribe, under contract to BPA, has taken the lead in developing the NPTH program. For the NPTH to proceed, the Council must approve a master plan and amend the CBFWP.

After the Council gives approves the NPTH master plan, BPA will:

- provide funding
- obtain environmental clearances and permits
- manage contracts to procure necessary services

Nez Perce Tribal Hatchery Management Structure

BPA and the fishery management agencies have established a viable adaptive management structure for the NPTH program (Figure VI-l). NPTH's management structure was taken from the Umatilla Hatchery Master Plan (Marcotte:2786W) and has been altered to fit NPTH's needs. Further changes also may be needed.

The goal of NPTH's management structure is to integrate two basic activities:

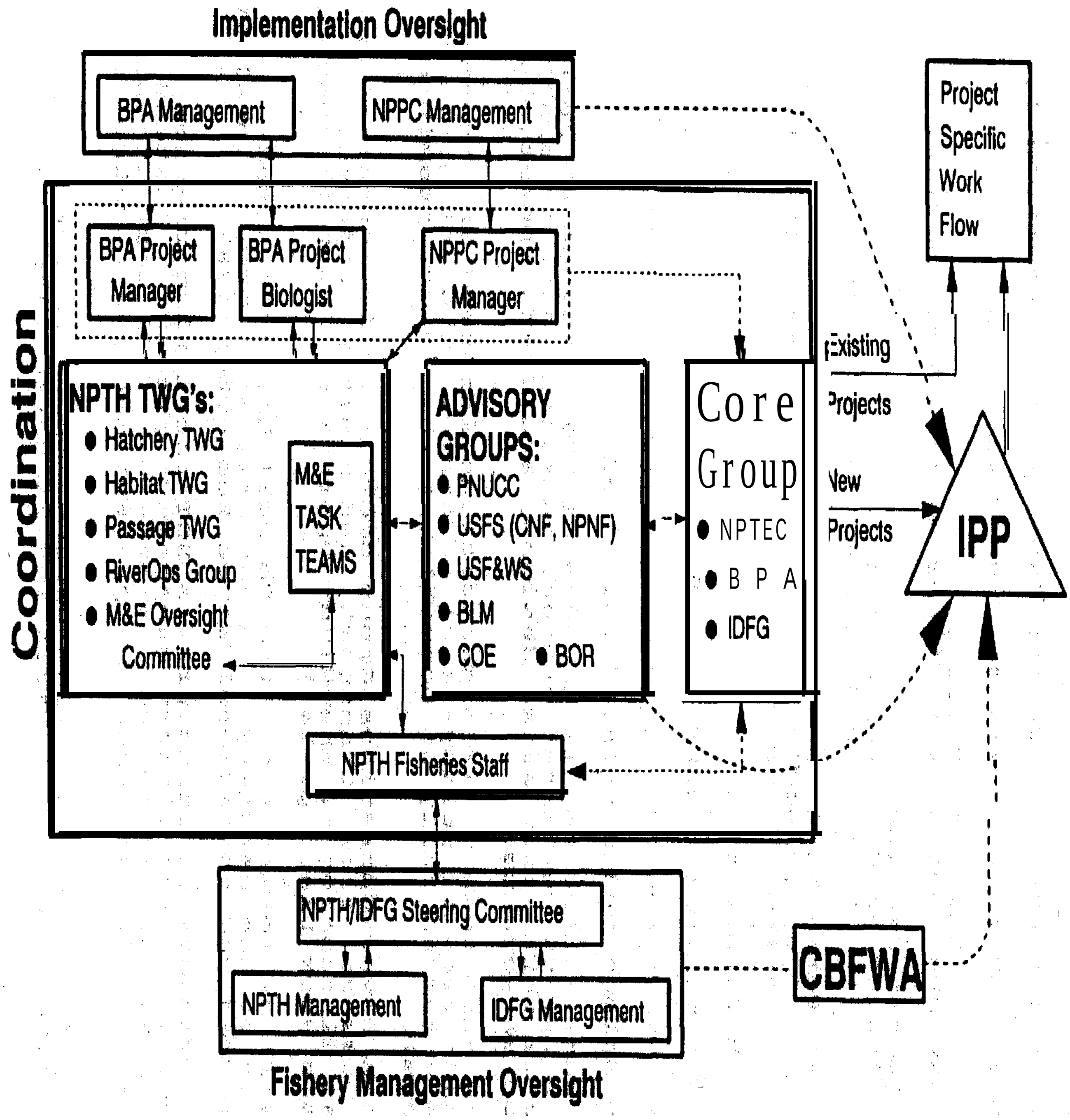
- implementation of the NPTH program
- fishery management oversight

Technical Work Groups - The Working Level

Since September 1987, various agencies and interested groups have taken part in meetings of Technical Work Groups (TWGs) to plan the proposed NPTH and support biological development. The TWGs are composed of:

- Bonneville Power Administration

Figure **VI-1.** Diagram of Nez **Perce Tribal** Hatchery Management Structure,



Legend:

TWG-Technical Work Group
M&E-Monitoring & Evaluation
COE-Corps of Engineers
BOR-Bureau of Reclamation
USFS-United States Forest Service
CNF-Clearwater National Forest
NPNF-Nez Perce National Forest
NPTH-Nez Perce Tribal Hatchery
IDFG-Idaho Dept. of Fish & Game
BLM-Bureau of Land Management
BPA-Bonneville Power Administration
IPP-Integrated Production Plan
NPPC-Northwest Power Planning Council
CBFWA-Columbia Basin Fish & Wildlife Authority
NPTEC-Nez Perce Tribal Executive Committee
PNUCC-Pacific NW Utilities Conference Committee
USF&WS-United States Fish & Wildlife Service

- Nez Perce Tribe
- Idaho Department of Fish and Game (Boise & Lewiston Offices)
- Columbia River Inter-Tribal Fish Commission
- U.S. Fish & Wildlife Service
  - Dworshak Hatchery & Fisheries Assistance Office
- U.S. Forest Service
  - Clearwater National Forest
    - (Supervisor's Office & Pierce District)
  - Nez Perce National Forest
    - (Supervisor's Office & Clearwater, Elk City, Salmon River Districts)
- Potlatch Corporation
- land and mineral rights owners
- Pacific Northwest Utilities Conference Committee
- Idaho Salmon and Steelhead Unlimited

TWGs have contributed to all aspects of NPTH program planning. TWG members review pertinent project material, such as draft statements of work, proposals, designs, and draft operations and maintenance agreements.

TWG members also keep their organizations informed and identify matters which require policy-level guidance. The intent is to work matters out as fully as possible at the lowest possible working level.

TWGs and the River Operations Group coordinate implementation of hatchery, passage, flow, transport, and habitat projects. (Additional discussion of the River Operations Group is contained in the Basin Work Plan, p. 14.)

The TWGS will be formed after the Council has authorized construction of the hatchery. An advisory and informational TWG has been formed and operational since September 1987.

The project management structure is NOT the implementation process, nor is it the fishery management process. Instead, it is the means to facilitate those processes. All participants are responsible to--make sure that the project management,structure works.

Although the TWGs are not policy groups, they are forums where policy decisions are communicated and factored into the management plans. Each entity has a distinct responsibility and process for dealing with policy matters.

public Advisory Consideration ,

Advice by'interested parties is critical to planning and implementing sound projects. The Pacific Northwest 'Utilities Conference Committee (PNUCC) and special fisheries interest groups (e.g., Idaho Salmon and Steelhead Unlimited and Oregon Trout) and implementing and managing entities want to be involved at the earliest practical phase.

Ideally, interest groups will participate as observers and commentors on particular TWGs. TWG participation affords the chance for early (pre-Integrated Production Plan [IPP]) involvement in project implementation. Other formal processes for public involvement also exist.

An advisory group will be established at the TWG level to consider interest group concerns. The.Core Group will seek input on such material as draft Statements of Work, draft operations and maintenance agreements, draft annual operating plan's, status reports, etc. Nevertheless, such a review process is not a substitute for TWG participation.

Operations and Maintenance

After a NPTH master plan is approved, the Tribal Fisheries staff will prepare 'a draft annual operations and maintenance plan. This plan will guide the day-to-day.bperations of all facets of the NPTH and satellite facilities. The plan will define:

- o annual production profiles".
- o release strategies
- o operating costs

The plan will be distributed for TWG review and will be subject to BPA and Council approval. BPA will define the requirements for hatchery operation in-i-contract 'with the Tribe.'

Monitoring and Evaluation

A NPTH-Monitoring and Evaluation Oversight Committee (NPTH-MEOC), will be formed to consider fishery management and biotechnical matters. It will coordinate research activities in the Snake, Clearwater, and Salmon River(g) subbasins related to hatchery and natural product&on and passage issues.

It is anticipated that NPTH-MEOC likely will develop recommendations for:

- o hatchery production
- o harvest
- o natural escapement
- o operation of hatchery
- o passage and'flow enhancement facilities
- o research

NPTH-MEOC will work to:*'

- o ensure minimal duplication of effort
- o maintain experimental design standards
- o coordinate research activities with Columbia Riversystem wide programs
- o provide peer review and input to the Tribe, BPA, and the Council about implementation procedures
- o recommend changes to the core group entities,,

Members of NPTH-MEOC will include the Nez Perce Tribe, Idaho. Department of Fish and Game (IDFG), BPA, PNUCC, and the Council's monitoring and evaluation group.

A NPTH Experimental Design Task Team (NPTH-EDTT) will be formed as a technical subgroup under the NPTH-MEOC to:

- o refine the hatchery monitoring and design of experiments
- o ensure consistency with the System-Wide Monitoring and , Evaluation Program.

Other Experimental Design Task Teams will be established to develop experimental procedures to monitor and evaluate passage, habitat, and flow. In some cases, the TWGs for these functions may simply take on this function and coordinate through the Umbrella Research Group (URG). The URG is'h group formed by the' Council to coordinate research throughout the Columbia River . . Basin.

The NPTH staff recognizes the need for a regional approach to resolving'uncertainties about supplementation. Progress of the Regional Assessment of Supplementation Projects (RASP) will be followed. The NPTH will be an integral part of the global experimental design emerging from that effort. The NPTH-EDTT will not'attempt to address questions that would be resolved more effectively elsewhere in the region';

BPA will fund and manage the contract for monitoring and evaluation. As new projects are developed, their hatchery monitoring and evaluation 'studies'will also be subject to the IPP process.

Habitat Restoration

NPTH satellite projects have been sited in watersheds where extensive instream and riparian habitat enhancement and passage development has occurred:

- Lo10 Creek
- Mill Creek
- Meadow Creek
- Newsome Creek
- Slate Creek
- South Fork Clearwater River
- Salmon River

Proposals by The Nez Perce Tribe, IDFG, and the U.S. Forest Service (USFS) have been submitted to the Council for funding under the Early Implementation Proposal programs,. Phases I,, II, and III for additional passage work in Eldorado, Slate, and Meadow Creek, Selway River. In each of these watersheds, the NPTH program would either support these new programs or be supported by their action.

Fishery Management Process

The Nez Per&Tribe is responsible, along with IDFG, U.S. Fish and Wildlife Service (USFWS), and other land and water management agencies, for managing fishery resources in Idaho subbasins, Development of harvest guidelines is the responsibility of the Tribe and State.

NPTH planning has'been included in both the Clearwater and Salmon River Subbasin Plans. Current production goals and objectives are in line with the biological goals and objectives established for chinook salmón above Lower Granite Dam in the September 1; 1990, plans.

The September 1989 Drafts of the Clearwater **and** Salmon River **Subbasin** Plans identified **NPTH as a component** for the **recommended** strategies for spring, summer, and 'fall chinook (Clearwater **Subbasin** Plan, page 85, 95, 105; Salmon River **Subbasin** Plan, page 105).

The **NPTH program** is included in **the Integrated** System Plan and the Early Implementation Programs scheduled for funding before 1998.

Recovery Plan for Endangered Species

NPTH production would support recovery programs for any species listed in Endangered Species Act (ESA) Recovery Plans. Spring chinook in the Salmon River have been proposed for listing, but not in the Clearwater River. Use of summer and fall chinook broodstock sources is the only potential conflict because their sources come from the Salmon and Snake Rivers where listing will occur. The outcome of the ESA listing will influence the freedom which NPTH will have to work with these stocks.

The goal of NPTH production is to promote natural selection and to prevent hatchery production from dominating or forcing to extinction natural production. Thus, NPTH production would aid ESA restoration in the Snake River Basin.

Other Production Projects

The Nez **Perce** Tribe, IDFG, and USFWS meet twice annually to plan production management for Dworshak, Kooskia, and Rapid River hatcheries. This planning coordinates putplanting **programs** for tribal as well as State programs. Brqodstock sources **and** disease management strategies also are discussed and coordinated at these meetings.

A new Tribal and State policy and Technical Memorandum of Agreement has been developed and was signed January 24, 1992, to facilitate future harvest and production management between the Tribe and State. This agreement covers both hatchery and wild salmonids throughout the Clear-water, Salmon and Snake River Basins.

NPTH **production** is a component of'the Idaho Salmon Supplementation research program which will begin in **1992.**

NPTH supplementation program will become a component of Regional Assessment of Supplementation Planning and will contribute to the **Council's region** wide assessment and coordination of supplementation projects.

The State, the Tribe, and the U.S. Forest Service also have entered into discussion to develop a Selway River restoration program.

Harvest

Harvest management will be developed by the **NPTH/IDFG** Steering Committee -consisting of the **Nez** Perce **Tribe technical** and policy **management** and counterparts from the State of Idaho. Nez Perce Fish and Wildlife will set **policy** and regulations for Tribal members. IDFG will set policy for sports fishermen. The Steering Committee will work with the Core Group to coordinate region&wide harvest issues.

LITERATURE CITED:

Bachen, B. 1990. Personal communication. Northern Southeast Regional Aguaculture Association, Sitka, Alaska.

Bugert, R., **LaRiviere,** P., **Marbach,** D., Martin, S., **Ross,L.,** . Geist, D. 1990. Lower Snake River compensation plan salmon hatchery **evaluation program** 1989 annual: report. **USFWS** Lower Snake River Compensation Plan Office. 145 pages.

Burnham, K.P. 1987, D.R. Anderson, G.C. White, C. Brownie, and K.H. Pollock. Design **and analysis** of **methods for** fish **survival experiments** based on **release-recapture.** American Fisheries Society Monograph 5, Bethesda, Mary&and. **437pp.**

Bowler, B. 1991. Personal Communication. Idaho Department of Fish and Game, **Lewiston** Office, Lewiston, Idaho.

Cates, B.C. 1981. **Instream** flow study of Lapwai Creek. Project Completion Report. U.S. Fish and Wildlife Service. Vancouver, Wash., 81 pages.

Chapman, D.W. 1981. Pristine production of anadromous salmonids **-** Clearwater River. Final report for Bureau of Indian Affairs, U.S. Department of Interior, Portland, Oregon.

Columbia Basin Fish and Wildlife Authority, 1990. Integrated system plan for salmon and steelhead production in the Columbia River basin. Columbia Basin System Planning. 449 pages.

Columbia Basin Fish and Wildlife Authority, 1990. Clearwater River **subbasin** salmon and steelhead production plan. Nez Perce Tribe of Idaho and Idaho Department of Fish and Game. 238 pages.

Columbia Basin -Fish and Wildlife Authority; 1990. Salmon River **subbasin** salmon and steelhead production plan. Nez Perce Tribe of Idaho and Idaho Department of Fish and Game. 238 pages. [reference for Salmon River subbasin]

Crone, R. A. 1982. Personal Communication. Northern Southeast Regional Aquaculture Association, Sitka, Alaska.

Crosthwaite, E.G. 1989. Results of testing exploratory wells, Nez Perce Reservation; Idaho. Nez Perce Tribe Special Subcontract Report under BPA Contract **83-350,** BPA agreement # **DE-AI79BP36809.** 63 pages.

DeLibero, F.E. 1986. A statistical assessment of 'the use of the coded wire tag for chinook (0.' tschawytscha) and who (0. kisutch). Ph.D. Dissertation, Univ. "of Wash, WA. 227 pages.

Espinosa, F.A. Jr. 1983. The Lolo Creek and upper Lochsa habitat enhancement projects., An annual report submitted to the Bonneville Power Administration; BPA Project No.' 83-522. Clearwater National Forest, Orofino, Idaho.

Halfmoon F.H. 1980. A Nez Perce fisheries study proposal presented to the Nez Perce Tribe. U.S. Fish and Wildlife Service, 'Fisheries Assistance Office. Olympia, 'Washington. 17 pages.

Harenberg, W.A., Jones, M.L., O'Dell I., Cordes, S.C., 1989. Water resources data, Idaho, Water Year 1989. US Geological-. Survey Water-Data Report ID-89-1. USGS, Boise, Idaho.

Hillman, T.W. 1986. Summer and winter habitat selection by juvenile chinook in a highly sedimented Idaho stream. Masters Thesis; Idaho State University. 40 pages,

Hillman, T.W. and Griffith, J.S. and Platts, W.S. 1987. Summer and winter Habitat selection by juvenile chinook salmon in a highly sedimented Idaho stream? Transactions of the American Fisheries Society 116:185-195.

Horher, N. and Bjornn, T.C. 1979. Status of upper Columbia and Snake River spring chinook salmon in relation to the Endangered Species Act. A report prepared for the US Fish and, Wildlife: Service. Idaho Cooperative Fishery Research Unit, University of Idaho; Moscow, Idaho. 60 pages.'

Idaho Department of Fish and Game. January 1991. Spring, summer, fall chinook, sockeye salmon distribution Clearwater, Salmon, Snake River drainages within Idaho. Potential smolt capacities extracted from the subbasin plans and presence/absence database. ESA Administrative Record, II.D.2.a. 20 pages.

Johnson, J.H. 1982. "Project Proposal; low' technology fisheries facilities for the enhancement of anadromous salmonid stocks on the Nez Perce Reservation. Nez Perce Tribe'of Idaho. 29 pages.

Koch, D.L., Lider, E.L. and Ferjancic, K.P. 1980. Feasibility evaluation of the fishery development potential on the Nez Perce Indian Reservation. 'Morrison-Maeirle, Inc., Helena, Montana. 50 pages.

Kucera, P.A., Johnson, J.H., and Bear, M.A. 1983. A biological and physical, inventory of the streams within the Nez Perce Reservation. A final report submitted to the Bonneville Power Administration. Fisheries Resource Management, Nez Perce Tribe, Lapwai, Idaho. 150 pages.

Larson, R.E. and Jose, J.R. 1988. .A report of fhe 1987-88 mid-winter water supply survey for the Nez Perce Tribe low capital/low technology anadromous salmonid hatchery project: 83-350 BPA agreement # DE-AI79BP36809. 21 pages.

Leitritz, E. and Lewis, R.C. 1980. Trout and salmon culture (hatchery methods). California Fish Bulletin No. 164. 197 pages.

Lichatowich, J and S. Cramer. 1979. Parameter selection and sample sizes in studies of anadromous salmonids, Oregon Dept.' of Fish and Wildlife Information Report Series, Fisheries Number 80-1, Portland, OR. 25pp.

Martinson, R.K. 1980. Anadromous fish production facility study on the Nez Perce Indian Reservation. United States Department of the Interior, Fish and wildlife Service, 75 pages.

McNeil, W.J. and Bailey, J.E. 1975. Salmon Rancher's Manual. Northwest Fisheries Center Auke Bay Fsheries Laboratory, National Marine Fisheries Service, NOAA, P.O. Box 155, Auke Bay, Alaska, 99821. 95 p-ages.

Mead, T.L., and Kenworthy, B.R. 1974. Denitrification in Water Re-use Systems. Proceedings 5th Annual Workshop of the World Mariculture Society, pp. 333-342.

Murphy, L.W. and Metsker, H.E. 1962. Inventory of streams containing anadromous fish including recommendations for improving production of salmon and steelhead. Part II--Clearwater River drainage. Idaho Department of Fish and Game, Boise, Idaho.

Murphy, P.K. and Johnson D.B. 1990. Nez Perce Tribal review of the Clearwater River. Lower Snake River Compensation Plan. Working Paper. 105 pages.

Murphy, P.K. 1989. Chinook salmon spawning ground surveys Selway River drainage, mainstem Clearwater Rive, Clearwater River Subbasin, Idaho, 1988. Technical Report 89-l. Department of Fisheries Management, Nez Perce Tribe, Lapwai, Idaho.

Northwest Power Planning Council. 1987. Columbia River basin fish and wildlife program. Amended February 11, 1987.

Northwest Power Planning Council. October 1987. Anadromous species presence/absence files for lower main Salmon basin. 12 pages. ,

Northwest Power Planning Council. October 1987. Anadromous species presence/absence files for mainstem Clearwater basin. 11 pages.,

Northwest Power Planning Counaii. September 1988. Anadromous species presence/absence files for S.F. Clearwater basin. 13 pages.

Northwest Power Planning Council. Monitoring and Evaluation Group. August 1989. Salmon and steelhead system planning documentation. 80 pages.

Northwest Power Planning Council. Monitoring and Evaluation Group. May 1991. ,A guide to genetic monitoring (a working draft, 5/11/91). Pages,l-18.

Olson, W.H. 1990. October 17, 1990 Memorandum. Dworshak Production Narrative September 1990. Spring Chinook Salmon. US Fish and Wildlife Service Dworshak-Kooskia National Fish Hatchery Complex, Ahsahka, Idaho. 6 pages.

Olson, W.H. 1989. Spawning Report, Spring Chinook Salmon Broodyear 19889. US Fish and Wildllife Service, Dworshak-Kooskia National Fish Hatchery Complex, Ahsahka, Idaho. 6 pages..

Olson, W.H. 1988. Brood Year 1988 Spring Chinook Salmon Spawning Report. US Fish and Wildlife Service Dworshak-Kooskia National Fish Hatchery Complex, Ahsahka, Idaho. 6 pages.

Piper, R.G., McElwain, I.B., Orme, L.E., Mc Craven, J.P., Fowler, L.G., Leonard, J.R. 1982. Fish Hatchery Management. USDI Fish and Wildlife Service. Washington, D.C. 517 pages.

Poon, D.C. and Johnson, A.K. 1970. The effect of delayed fertilization-on transported salmon eggs., Prog. .Fish-Cult. 32:81-84.

Senn, H., Mack, J. and Rothfus, L. 1984. Compendium of low-cost pacific and steelhead trout production facilities and practices in the pacific northwest. U.S. Department of Energy, Bonneville Power Administration, Division of Fish and Wildlife. 488 pages.

Sprenke, K.F. and Associates. 1988. Sprenke, Geophysical **Evaluation** of **Potential Water Sources,** Nei' **Perce Reservation:** Proprietary Report for the **Nez Perce** Tribe, Lapwai, Idaho. Nez Perce Tribe Special Subcontract Report under BPA Contract **83-350,** BPA agreement # **DE-AI79BP36809.** 60 pages.

———, October 1990. Preliminary Hydrogeological Evaluation of **the Kerby** Farm site , Nez Perce Reservation, Idaho. Nez Peree Tribe Special **Subcontract Report** under BPA Contract **83-350,BPA** agreement **# DE-AI79BP36809.** 41 pages.

———, October 1990. Preliminary Hydrogeological Evaluation of **the** Stffes, Idaho site. **Nez Perce** Reservation, Idaho. Nez Perce Tribe- Special Subcontract Report under BPA Contract **83-350,** BPA agreement **#DE-AI79BP36809.** 24 pages;

——— February 1991. **Hydrogeologic Analysis** of the Cherry Lane Site Nez Perce Reservation, fdaho. Nez Perce Tribe Special Subcontract Report under BPA Contract 83-350, BPA agreement # **DE-AI79BP36809.** 63 pages.

———**, February 1991.** Hydrogeolugic Analysis of the Stites, **Idaho site** Nez **Perce** Reservation, **Idaho.** Nez Perce Tribe Special Subcontract Rsport under BPA Contract **83-350,** BPA agreement # **DE-AI79BP36809.** 48 pages.

———**,** June 1991. Reconnaissance Hydrogedlogic Evaluation of **the** Potential Water Well Locations **South** of Stites, **Idaho** Nez **Perce Reservation,** Idaho. Nez Perce Tribe Special Subcontract Report under BPA Contract **83-350,** BPA agreement # **DE-AI79BP36809.** 16 pages.

———**, January 1992.** Analysis of **aquifer** tests **and recommendations** for production well development at the **Cherylane** site, Nez **Perce** Reservation, Idaho. Special **SubcontractReport under BPA Contract** 83-350, **BPA** -agreement # **DE-AI79BP36809.** 90 **pages.**

———**,** January 1992. **Hydrgeological** analysis 'of the Luke's **Gulch** site, **Nez Perce** Reservation, Idaho. **Special** Subcontract Report under BPA Contract 83-350, BPA agreement # **DE-AI79BP36809.** 71 pages.

Taylor, 'L.R. and Hill, M.T. 1984. Site selection **report, low capital anadromous** fish propagation. A report **prepared for** the **Nez** Perce Tribe **of Idaho** by **CH_2M-Hill,** Boise **Office,** P.O. Box 8748, Boise, Idaho 83707, 88 pages.

——— 1984. Conceptual design 'report, low capital anadromous fish propagation. A report prepared for the Nez Perce Tribe of Idaho by CH_2M-Hill, se Office, P.O. Box 8748, Boise, Idaho 83707, 88 pages.

Thomas, C.D. 1990. What do real population dynamics tell us about minimum viable population sizes? Conservation Biology 4:3, 324-327.

Thompson, K. 1991. Lower main Slate Creek stream survey report (existing condition). Slate Creek Ranger District, HC01 Box 70, White Bird, ID 83554-9706. Nez Perce National Forest. 6 pages.

USF'WS Dworshak National Hatchery. 1984-85. Water quality sampling mainstem Clearwater River, above Carney Pole Yard. Clearwater River water analyses numbers 1 through 49.

Westin, D.T. 1974. Nitrate and nitrite toxicity to salmonoid fishes. The Progressive Fish-Culturist, vol. 23, no. 2, p. 86-89.

GLOSSARY OF TERMS

Acclimated presmolts: Age-O juvenile salmon that *are* held or raised in a particular stream for a period of time to adjust to survive and return to this specific location. They winter in the stream **prior** to **smolting.** The release site usually is different from'the incubation and rearing site.

Acclimated **smolts:** age **1+** juvenile salmon that are held or have been raised at a particular **place** for a period of time to adjust to 'local conditions thus improving survival and return to **this specific location.** The release site usually is different from the incubation and rearing site.

Adaptive **Management:** a scientific policy that seeks to improve management of biological resources, -particularly in areas of scientific uncertainty, by viewing program actions as vehicles for learning. Projects are designed and implemented as experiments so that **even** if they fail, they provide useful information for future 'actions. 'Monitoring and evaluation are emphasized so that the interaction of different elements of the system are better understood.

Adult passage survivals: survival rates of adults passing upstream through the dams on the Columbia and Snake Rivers.

Age-O acclimated **smolt:** juvenile fall chinook salmon that are held at a site prior to release for 2 to 6 weeks. The holding site is not the same as the site where they were incubated and. first reared.

Age-O smolt: juvenile salmon that change physiologically and emigrate from fresh water streams to the ocean in their first year of life. Fall chinook, pink salmon and chum salmon are species that commonly have Age-O **smolts.**

Age-l+ **smolt:** juvenile anadromous salmonids that have matured physiologically and are ready to emigrate to the ocean from fresh water after their first year of life.

Alevins: life stage of **salmonid fish** between hatching and feeding when the yolk sac is still outside the body wall and fish are not dependent on an external food source for nourishment.

Auxiliary Central Incubation and Rearing **Facility (CIRF):** secondary facility to the CIRF at Cherry Lane, Idaho. The auxiliary CIRF performs broodstock holding and age **1+** smolt rearing functions for the project.

Broodstook: Adult fish retained for spawning to produce the newt generation of fish.

Broodstock• ♦♍♋□♏❍□■♦♦ numbers of adults allowed to **survive** to spawn **in either** the stream or to be collected to produce eggs for incubation **in** a hatchery.

Broodstock sour&es: natural or hatchery adult fish that provide eggs to initiate the development of a 'new run or stock of fish . in a stream that either has no existing stock or where the population number is less than desired.

Carrying capacity: the number of juvenile fish, particularly, smolts that a stream can support during a specified time **(e.g.,** either summer or winter).

Caudal Peduncle: the most posterior part of a salmons body at the base of the tail fin.

Central Incubation **and** Rearing **Facility (CIRF):** a hatchery facility that incubates eggs and rears juvenile fish for distribution to other locations where they are released. The facility may also perform other functions but generally does not provide for all life stages to occur at this single site.

Cherry **Lane:** proposed site of the Nez **Perce Tribal Hatchery** Central Incubation and Rearing Facility, 21 miles east of **Lewiston,** Idaho on Highway 12, south of the Clearwater River on property owned by Cherry Lane Ranch, Inc. **(T37N, R3W,** Sections 34 **&** 35).

Complete temperature control: temperature is controlled at all times to predetermined specifications for incubation- of eggs **or the** rearing of fish (i.e., atmospheric or other conditions are not allowed to determine water temperatures).

Conditioning **of** fish: **subjecting fish** to conditions which would mimic those found in the natural environment in order to prepare them to survive when they are released into a stream or river. Examples are exposure'to swift currents, predators, woody debris, shading, insects for food, and gravel bottom ponds as opposed to concrete.

Controlled harvest: the number of adults harvested by fishermen is predetermined and restrictions are imposed on the numbers and types of fish harvested (e.g.; hatchery or natural adult fish).

Core Group: the management agencies (Nez Perce Tribe, Idaho Department of Fish and Game, Bonneville Power Administration, Northwest Power Planning Council) that identify the project scope and appropriate biotechnical criteria **for** short term and long term operation of the Nez Perce Tribal Hatchery (NPTH) facilities funded under the Columbia Basin Fish and Wildlife Act.

Council: Northwest Power Planning Council.

critical **assumptions:** assumptions which control or will have the greatest impact on the outcome of a project (e.g. life history parameters, habitat quantity and quality, passage, early marine and ocean survival, and factors limiting current production).

critical **uncertainties:** areas of knowledge that are not currently definable that must be discerned by monitoring and evaluation of the project and will determine the success or failure of the project.

critical **uncertainty analysis:** a logical and mathematical process of reviewing data gathered from the project to determine what has occurred and what management action will be taken..

Density **dependent mortality:** mortality in a population, that occurs due to the presence of too many individuals within a specified area. The rate of mortality can vary depending on density and environmental conditions.

Desired **Future Conditions (DFC):** a term used by the U.S. Forest **Service** to indicate a goal for various resource conditions at some future date (e.g., numbers of juvenile chinook salmon will achieve 80 percent of the **carrying capacity** of the stream).

Dip **nets:** as referenced in the Nez Perce Tribal Hatchery Master Plan, dip nets mean a type of net used by Nez Perce fishermen that has a release that allows the net to close around a salmon. Humane and efficient, the net allows a sure catch and no wounding of the fish occurs as with the use of gaff hooks, jigging, and spears.

Ecological interactions: a term denoting the interactions of various resources and climate that interact to either benefit' or deter the health of the environment in a geographical area **(e.g.,** interactions between timber harvest in a watershed and fish populations within a stream in that watershed).

Eggs: mature female germ cells, ovum, female gamete.

Emigrant **smolt:** a juvenile **salmonid** that is migrating from fresh water to **salt water** to **complete the portion** of **its life cycle** which occurs **in the** ocean.

Escapement: the number of fish that survive to return to'where they were born. A spawning escapement goal is the number of fish needed to return to each stream to produce the next generation of **fish in similar numbers.** .

Exacerbate: to aggravate, to intensify, or to make worse.

F_1: symbol for the first generation of returning adults.

F, returning adults: the **progeny (adults)** of the parent population.

Fecundity: the number of eggs in a female spawner (e.g., 4000 per adult female spring chinook).

Fed-fry for presmolt **production: juvenile** salmonids **raised** at the Nez Perce Tribal-Hatchery Central. **Incubation** and Rearing Facility for **outplanting** to **satellite facilities** for **rearing** and release into the streams or rivers.

Fifty/fifty (SO/SO) Rule: a rule **for** managing Nez **Perce** Tribal"" Hatchery operations which specifies that at **least one-half of** any **natural spawning population** are the progeny of fish that also spawned naturally.

Fingerling: juvenile anadromous **salmonid** fish generally between **1** to 3 inches in length prior to **obtaining** parr marks. Nevertheless, the absence of parr marks is not a'definitive criterion.

Fingerling capacity: the amount of' fish, **either** numbers or **weight,** that can be reared **under specified** conditions of space, temperature, water **flows and** water **chemistry.**

Fishery(ies): a term indicating either **singular or plural** conditions for **the science of fisheries management or the** act of conducting a harvest of fish.

Fish Management **Consultants (FMC):** a private business **firm that** consults to various agencies **owned and** operated by Harry **Senn,** 8137 Rainier Road, S.E., Olympia; WA **98503.**

Fry: a term used to describe juvenile **salmonid** fish-after they have absorbed the **yolk** sac and begin-feeding. They, **usually** are 1 to 2 inches long and generally'have not obtained parr marks yet.

Full-term smolts: juvenile anadromous salmonids that have reached a physical size and physiological maturity that enables them to migrate from fresh water to the **ocean.** Age is determined by species. Spring chinook are age **1+** and fall chinook are Age-O and sockeye are age **2+** at the time of migration.

Genetia **constraints:** those factors that shape genetic development and its nature within or between populations.

Genetic diversity: dissimilar characters found within the genetic character of individuals or populations.

Genetic identity: a term denoting **the** ability to identify an individual as being different from others within its population or a population as being distinct from other populations by either physical or physiological traits which are measurable.

Genetic management: management practices that control or shape the genetic character of a population (e.g., inbreeding **or** outbreeding, breeding **population** size, split gamete fertilization).

Genetic Resource Assessment: a process or document resulting from **reviewing** the history of stocks and their runs-into a watershed. The document is used to select management actions associated with broodstock development.

Genetic risks: four types **have been** specified by (NPPC May 1991): Risk 1, Extinction: Risk 2, Loss of Within Population Genetic Variability: Risk 3, Loss of Between-Population Genetic Variability; and Risk 4, Anthropogenic Effects.

Gravel to **gravel** management: a management philosophy which designates that fish must reproduce naturally generationafter generation in the gravels of **specified streams.**

Ground water capacity: the volume **of water** that can be obtained from a ground water source over time. This volume usually is measured **in** units of gallons per minute (gpm), cubic feet per second (cfs), or acre-feet (ac).

Ground **water** sources: water' found beneath the earth's surface that will be used for domestic, irrigation or other **uses (e.g.,** the operation of a salmon hatchery).

Harvest **management:** the management of harvest to control the numbers and species of fish taken for use by man.

Harvest opportunities: opportunities to **harvest** fish at a particular site by specified methods.

Hatchery **broodstock selection: the management** process by which adult fish are selected **for** development and maintenance of a stock of fish to be produced within a **hatchery environment.**

Hatchery **supplementation: the** manipulation of natural production of fish by using the artificial methods of incubation and rearing to increase survivals **and then** distributing those individuals to natural environments.

Husbandry **techniques:** 'the specific methods by which animals are managed in a controlled or semi-controlled **environment with** the intent of producing more animals with a specified genetic character.

Hatchery Transfer **Coefficient:** a cumulative measure of **survival** for both hatchery juveniles and adults which may be fixed or variable in one or more life stages.

Imprinted: the imposition of a behavior pattern in a young animal by exposure to a stimuli; exposure of young salmon to a specific stream for a period of time prior to release.

Incremental harvest: a process which increases or decreases harvest across the entire time span **of the** fish run in accordance with the total OF **accumulated numbers** of fish identified or predicted.

Indigenous spawning populations: a native or **wild** population whose reproduction has'not been altered **or changed as** a **result** of hatchery production or **management** -actions.

Interrogate: to expose fish to an electronic sensor which can **determine** if **they contain** either coded wire tags **(CWT)** or passive induced **transponders (PIT)** which gives them **a unique** identity and **origin.**

Introgressed population: a population that has received an **infiltration of** genes from another **stock or** population **into its** gene pool:

Juvenile carrying capacity: the number'of juvenile fish, **particularly smolts** that a stream can support during a , **specified time either, summer or winter).**

Long-term fitness: the ability of a population or stock **of** fish: to survive from generation to generation under **specific** environmental conditions **either natural or artificial.**

Low **density** rearing **($\leq$0.1 lb/ft^3/in):** a **management tool** specifying- **the density of a** group-of fish being reared under **artificial conditions based** on weight per.unit **volume** of space and the length of the fish. Rearing density for salmonids generally **ranges from** a value greater than zero to **0.5** lbs **ft^3/in.** Low density rearing-would be **considered a** value less than 0.1.

Lower **mainstem** Clearwater River: That portion of the Clearwater River between the confluence of the North Fork of the **Clearwater** and the confluence **with** the Snake River.

Lower **mainstem Salmon River:** that portion of the Salmon River between its confluence with the Snake River and its confluence with the Little Salmon River at **Riggins,** Idaho.

Minimum adult return:, the minimum size of an adult population over time that is not subjected to the risk of extinction.

Minimum **escapement goal: the minimum number** of fish. allowed, to escape all forms of harvest for the purpose of perpetuating the run or population.

Minimum **sustainable annual harvest:** the **minimum harvest** that a population or stock **can** sustain over time without causing a decline in the populations ability to avoid extinction.

Minimum viable population **(MVP):** a minimum size **in a population** which is considered to contain **all** the genetic character necessary to **continue the population** without subjecting the population to any of the four genetic risks.

Monitoring **facilities:** either portable equipment or permanent structures **that allow enumeration** and **identification** of. juvenile or adult fish migrating out of or into a stream or river.

Multiple recapture analysismethods: method of evaluating the actual numbers of fish migrating to or from a stream or river through repeated capture of fish in conjunction with marking procedures.

Native indigenous: those fish which are **not artificially** produced and have no history of being supplemented by hatchery production.

Natural **emergence timing:** a process where water temperatures **are** controlled.during incubation in a hatchery 'environment to match the incubation process that would occur in a specific natural stream.

Natural genetic base: the genetic composition of a stock or , population of fish derived from natural reproduction and survival in a stream or river regardless -of its association with hatchery production and supplementation practices.

Natural -habitat: habitat as it occurs in a stream or river, usually unaltered by man but in some cases it may have been artificially restored to match that which exizted previous to man's influence on the stream.

Naturalized biological maintenance: a favorable feature or character of a group or stock of fish resulting from successful reproduction and growth in a natural stream or river; a genetic benefit derived from natural selection process associated with reproduction, growth and survival in a stream or river.

Naturalized run: a group of fish which are part of a naturalized stock.

Naturalized stock: a stock which has been developed in a stream' or river as a result of hatchery supplementation; This may include the interaction with stock that are native to the stream or river.

Natural populations: a population of fish that lives in and reproduces naturally in streams, but has been. influenced by introductions of fish produced'in a hatchery.

Natural production: fish that are produced as a result of their parents spawning in the stream. and the progeny surviving : through the natural life cycle to return and reproduce in the natural environment.

Natural production management: a process for managing natural fish production in the stream by controlling harvest, supplementing the population, broodstock selection, monitoring and evaluation, or other techniques that will ensure a specified level of production;' .

Natural stocks: a stock of fish (i.e., fish that are genetically distinct) that reproduces in the natural environment which has a history of being derived from hatchery production through supplementation or introduction.

Natural Transfer Coefficient: a-cumulative measure of survival for both natural juveniles and adults which may be fixed or variable in one or more life stages.

Nez Perce Supplementation Modal (NPSM): a spread sheet model used to predict the response of supplemented or restored populations to hatchery production. The model also predicts the effects of harvest on populations.

Night drift spear fish: a traditional Nez Perce fishing method whereby stretches of river were drifted via rafts or boats outfitted with torches or lights thereby attracting salmon which were then speared.

Nonproductive summer habitats: portions of a steam or river where summer water temperatures prohibit use by juvenile salmonids.

NPTH Experimental Design Task Team (NPTH-EDTT): a group that will develop and evaluate the experimental design for NPTH production.

Other assumptions: assumptions that are known but are not considered critical to the monitoring and evaluation process.

Outplanted: the release of young hatchery-reared fish into streams away from the hatchery site.

Over-winter rearing strategies: management strategies based on release timing with respect to photoperiod, water temperature, location, and quantity of fish released within a watershed in anticipation of improving winter survival of the fish (natural and hatchery) in the stream or river.

Ozonation facility: a mechanical water supply treatment system that generates Ozone (O_3) a hyperactive form of oxygen and injects it into water to kill disease organisms.

Passive Integrated Transponder (PIT) tag: electronic transmitter device placed inside the body cavity of a fish which later responds to an electronic'signal and transmits identity, origin; and treatment.

Points of sustainability: see Figure I-2, Chapter I. The upper and lower limits of production relating natural and supplemented populations of juveniles and adults at two smolt-to-adult survival rates, 0.44 percent and 3.6 percent (see Sustainable Production).

Post-release survival (S_pr): survival of presmolts or smolts from the time of release until they reach Lower Granite Dam whether released in the fall or the spring.

Predator avoidance: the act of avoiding predators: a natural conditioned response in wild or natural fish, but hatchery fish are not considered to possess this trait and must be taught this response.

Pre-release conditioning: a process or series of processes taught **to fish** prior to'release from hatchery **facilities** whether taught inadvertently or through deliberate actions of management.

Presence and **absence files:** a file system cataloging the rivers and streams of **a subbasin** watershed showing **which anadromous** species are present and estimating summer smolt carrying capacity for each species present.

Present **stock condition:** the current and historical condition of a stock in terms of numbers of adults found to return each year.

Presmolt: a juvenile fish reared at satellite facility for release in the fall of the year to over winter in the stream or river prior to smolting and emigrating to the ocean..

Presmolts: plural of presmolt.

Production levels: numbers of juvenile or adult fish to be produced by a hatchery or at a satellite facility. The size of juvenile fish usually is predetermined (e.g., 20 fish per pound).

Produotion **model:** a mathematical computer model used to predict the results **of** multiple interactions. The model only estimates the outcome to some degree **of reliability. See the Nez Perce** Production Model and Appendix 1.00 for examples of production modeling.

Production parameters: mathematical measurements of survival for each life stage from egg through adulthood used to compare both hatchery and natural production- for the **Nez Perce** Tribal Hatchery (NPTH).

Recruitment to **Spawner** Transfer **Coefficient:** a tool used to compare natural and hatchery **survival** and to estimate advantages of using hatchery production as a tool to restore natural production.

Regional Assessment of Supplementation Project **(RASP)**: a process directed by a group of scientist& to evaluate supplementation activities occurring within the Columbia Basin as direoted by, the Columbia Basin Fish and Wildlife Act.

Release methods: methods of release for presmolts from satellite facilities and timed-release fed-fry; release methods may be volitional, forced and distributed off-site releases and' releases are timed according to temperature and photoperiod.

Remnant population: a small population, usually less than 25 adults per year, that, remain from indigenous stock or -naturalized stock resulting from supplementation **efforts.**

Re-naturalization of fish:. a process of exposing hatchery reared fish to rearing in streams and rivers to select for those most able to survive when subjected **to** natural **conditions.** Survival may depend on life stage (fry, **parr,** prasmolt, smolt, adult) and pre-release conditioning.

Reproduction **efficiency:** a measure of the effectiveness (percentage) of **adult** fish to reproduce. This measure is based on **total number of** returning fish and the number that **successfully** spawn **in** natural habitat which results in successive generations of progeny.

Reproductive success: the ability of adult fish-to spawn in a natural environment resulting **in the survival** of their progeny through subsequent generations.

Riparian: the plant community (trees, shrubs, grasses, etc.) found adjacent to a stream or river usually within an area denoted as the flood plain.

Risk containment: a process for minimizing genetic risk.' Harvest management, brood source, breeding practices, rearing and release practices and monitorjng and **evaluation practices are** the'areas **identified** for risk containment for **NPTH. Risk** containment describes-these **practices.**

Risk containment: **precautions** taken in developing the **experimental** design to control the results and to provide for analysis of the results of the experiment.

Risk containment monitoring: a process that **evaluates** the.. effectiveness of the experimental design with respect to determining if risk containment is effective.

Safe **Assumptions: assumptions in** the. experimental design that are not considered to be critical to the outcome of the experiment nor are they likely to confuse the results and analysis of the experiment.

Satellite facilities: extensions of the **Nez Perce Tribal** Hatchery **(NPTH)** located along streams where juveniles may be acclimated, conditioned, reared, and released and where adults will be captured, held, and spawned.

Scientific **Review Group (SRG):** a group of scientists that work for the Northwest Power Planning Council and evaluate the biology and scientific design of projects.

Selective harvest: a process whereby a specific stock or individdabs' from within a population are harvested from the run and other fish are released (e.g., marked hatchery fish are harvested and 'unmarked natural fish are released).

Self-sustained produotioa: the production of hatchery or natural population(s) that are able to successfully reproduce generation after generation as a result of supplementation or after supplementation has increased its population size above a threshold level.

self-sustaining populations: a population(s) that is able to successfully reproduce generation after generation without supplementation or after supplementation has increased its population size above a threshold level.

set nets: dip nets tied in place; a type of net used by Nez Perce fishermen that has a release that allows the net to close around a salmon. These pets are fished at night from scaffolds or weirs. Humane and efficient, the net allows a sure catch and no wounding of the fish.

Single-pass water supplies: water that is used only once for rearing fish held 'in a pond and is not recirculated'in part or whole through the pond.

Smolt: a juvenile salmonid that has physically and physiologically matured in the fresh water environment and can successfully transfer' from fresh water to 'sea water to complete its life to mature to adulthood.

Smolt-to-adult survival ($S_s a$): a measure of; survival for the smolt as it passes Lower Granite Dam until, it returns as an adult to its natal stream expressed in percent (0.2%) or as a whole number (0.002).

Specific pathogen **free (SPF):** a known disease causing organism is not present (e.g., in water, or animal, or population).

Specific tributary **watersheds:** the physical land area that,. drains waters into a particular river through a perennial or intermittent stream (e.g., Mill 'Creek of the South Fork of the Clear-water River).

Split-gamete fertilization: A method to maximize genotypes through division of the eggs and sperm and then selectively or randomly combining the gametes on a one-to-one ratio. Eggs might be sdparated into two or more parts to be mated with two or more males,

SPM: the Northwest Power Planning Council's System Planning Model **developed** in the **Subbasin** Planning and Integrated Planning **process.** This **model is used** to predict production interactions and responses **associated** with the Council's goal of increasing runs in the Columbia Basin.

S_sa: see Smelt-to-Adult Survival.

Stock: fish **that spawn** in **a** particular river system or portion of it at a particular season and do not interbreed to any substantial degree with any group spawning in **a** different place, or in the same place at a different season **(Ricker** 1973).

Stock isolation: a process which separates by physical means the stocks incubated, reared and **spawned** in **a** hatchery to insure that no mixing of the genetic material occurs and no exchange of disease occurs between stocks.

Summer carrying capacity: the number of juvenile fish or population size of **a** given species of fish that will remain in and rear in a stream during the' summer season. When the density or number exceeds a certain threshold, then either mortality occurs or excess fish migrate out of the stream.

Supplementation: the use of artificial propagation in the attempt to maintain or increase natural production while maintaining the long-term fitness of the target population, and keeping the ecological and genetic impacts on nontarget populations within specified biological limits.

supplementation **Products: the supplementation** products for the Nez **Perce** Tribal Hatchery (NPTH) are timed-release fed-fry, fed-fry and/or fingerlings, presmolts, Age-O smolts, age **1+** smolts.

Supplemented harvest opportunity: a harvest opportunity resulting from releases of one of the supplementation products, especially **age 1+** sniolts.

Supplemented natural production: a fish population that reproduces within the natural stream to which hatchery reared fish are added for the purpose of increasing the adult returns.

Supplementing harvest: a method **of** increasing harvest through the release of one of the hatchery supplementation products.

Survival **rates:** mathematical measurements of survival for any or all life stages as measured in percentage or whole numbers **(e.g.,** egg-to-smolt survival **(S_es)** of 72 percent or 0.72).

Sustainable produotioat the maximum level of production in numbers of adults **that** 'can occur as a **result of smolt-to-adult** survival **(S_sa).** Present **returns** of **adult** fish to upper Columbia River subbasins are **controlled** by this survival factor.

Sweetwater Spring: a spring with 2.0 cubic feet per **second** discharge of **50°** F water which is located approximately 8 miles southeast of **Lewiston, Idaho;** the auxiliary central incubation and rearing facility (CIRF) **site for** the Nez **Perce Tribal** Hatchery (NPTH).

system Planning: **the** process of planning fish restoration activities in the Columbia Basin through **Subbasin** Planning and **the** Integrated System Plan.

Technical Work 'Group. **(TWG):** a group of **representatives of** various Tribal, State, Federal and private **agencies which** meet periodically to learn, coordinate, and develop the Nez Perce Tribal Hatchery **(NPTH).**

III-ocean fish: adult salmon that have resided in the ocean for three summers prior to their return to fresh **water to** spawn.

Timed-Release Fed-Fry (TRFF): juvenile **salmonids in** the fry stage which have **incubated and reared** for **a short time in the** hatchery prior to"releas8 **into natural** habitat. 'The release of fry is timed to environmental conditions that will promote **their** survival and adaptation to life in the **stream.**

Transfer **coefficients: The curves in** Figure I-2 in Chapter I labeled **"Natural"** and **"Supplemented"** r&present spawner-to-smolt transfer **coefficients ("survivals") for** natural and supplemented populations **respectively.**

Tribal harvest: harvest of fish by Nez Perce Tribal fisherman in accordance with seasons administered by the Nez Perce Tribal Executive Committee.

II-Ocean Fish: adult salmon that have resided in the ocean for two summers prior to their -return to fresh water to spawn.

Uncertainty analysis: an analysis that accomplishes two things:

- o provides an overall **assessment** about the risk that the project will not meet its objectives
- o suggests where monitoring and evaluation investments will be most effective.

Watershed: a geographical 'area **that** drains water into **a** stream **beginning at the mouth** of the stream-or river and including. its tributaries. The watershed is'named according to the stream.

Weirs: structures (usually fence-like) placed in streams to divert and **capture** fish passing upstream or downstream.

Wild and **Scenic River Classification:** a federal designation that **protects and** prescribes the use of the stream or river. There are three classifications: wild, scenic, and recreational.

Wild **indigenous** broodstook: 'see wild stocks; a term, while some what redundant, that is used'to certify that the stock is unchanged through supplementation or hatchery influence. The stock is **the only** evolutionary and genetically original population which has never been changed through management.

Wild **stocks:** stocks **of fish** that have not beensupplemented or manipulated through hatchery production practices: other synonyms are indigenous, endemic.

Winter carrying **capacity:** the number of juvenile fish or population size of a given **species of** fish that will **remain in** and rear in a stream **during** the winter season. When the density or **number exceeds** a certain **threshold,** then either **mortality** occurs or **excess** fish migrate **out of** the stream.

YSR: Yolk sac **remaining** in fry when they emerge from incubation and begin feeding. It is expressed as a percentage of body weight and **has** been used **as** ,a **management** tool to **determine the** maturity of fry **incubated in hatcheries** in **comparison** with naturally **produced fry.**

Acronyms

AOP: annual operating plan

BPA: Bonneville Power Administration

CFS: cubic feet per second.

COE: U.S. Army Corps of Engineers

CRBFWP: Columbia River Basin Fish and Wildlife Plan

CRITFC: Columbia River Inter-Tribal Fish Commission

EDTT: Experimental Design Task Team

GPM: gallons per minute

GRA: Genetic Risk Assessment

IDFG: Idaho Department of Fish and Game

ISP: Integrated System Plan

ISSU: Idaho Salmon and Steelhead Unlimited

MEG: Monitoring and Evaluation Group of the Northwest Power Planning Council

NEDTT: Nez Perce Tribal Hatchery Experimental Design Task Team

NPSM: Nez Perce Supplementation Model

NPT: Nez Perce Tribe

NPTEC: Nez Perce Tribal Executive Committee

NPTH: Nez Perce Tribal Hatchery

NPTH-MEOC: Nez Perce Tribal Hatchery Monitoring & Evaluation Oversight Committee

OT: Oregon Trout

PIT: Passive integrated transponder

PNUCC: Pacific Northwest Utilities Conference Committee

RASP: Regional Assessment of Supplementation Project

SBP: Sub-Basin Plan

TRFF: timed-release fed-fry

TWG: Technical Working Group

USFS: United States Forest Service

USFWS: United States Fish and Wildlife Service

USFWS-FAO: United States Fish and Wildlife Service Fisheries Assistance Office

YSR: Yolk sac remaining

APPENDICES

APPENDIX I

BIOLOGICAL CRITERIA FOR ARTIFICIAL PRODUCTION

Introduction 1

Water Quality 1
Central Incubation and Rearing Facility 1
Satellite facility water quality 1
Aeration of groundwater 1
Specific pathogen free waters 2

Satellite Facilities 2
Water temperature and flow 2

Production Programming 5
Central Incubation and Rearing Facilities and Satellites 5

Description of Fish 13
Spring Chinook 13
Fall Chinook 14
Summer Chinook 14

Broodstock Management 15
Broodstock Capture 15
Broodstock Holding 15
Broodstock Maintenance 16
Spawning and Fertilization i7
Split gamete fertilization 17
Gamete Transport 18

Incubation 18
Egg size 20
Fry size 20
Egg-to-eyed egg survival 20
Egg-to-first feeding survival 20

Density 20
Egg eyeing 20
Fry and fingerlings 20
Presmolts and smolts 20
Adult 21

Technique of Delayed Fertilization 21

Rearing 22
Water quality 22

Flow 23
Density 23
Growth and Release 23
Food 23

Transportation 24

Broodstock Development from Natural Populations 24
Introduction 24
Natural Production Management 24
Restored Production Management 30

APPENDIX I I

NPTH SITE SELECTION PROCESS

Introduction 32

Central Incubation and Rearing Facility . . . . -32

Satellite Facility Development 33
Mainstem Clearwater River 34
Lo10 Creek Watershed 34
South Fork Clear-water River Tributaries 35
Meadow Creek 35
Mill Creek 39
Newsome Creek 39
Salmon River 40
Slate Creek 40
Selway River 40
Meadow Creek 40
Sweetwater Springs 41
Mann Lake Canal Dam Satellite Site 42

APPENDIX III

COST SUMMARY AND TIME LINE

Introduction 43
Time Line 46

APPENDIX IV

ASSUMPTIONS AND THE MODEL

Introduction 47
Safe Assumptions 47
Critical Assumptions 47
Other Assumptions 47

Uncertainty Analysis 49

Population Responses 51

Reproductive Success 53

Long-Term Fitness 54
Ecological Interactions 54
Experimental Design 54

APPENDIX V

SUPPORT DOCUMENTS 3.00, 6.00, 7.00 AND 8.00

Introduction 56

3.00: FACILITY CONCEPTUAL DESIGNS 57
Highlights 57

6.00: NPTH WATER SUPPLY DEVELOPMENT 58
Highlights 58
Water Quantity 58
Satellite Locations 58
Water Chemistry 59

7.00: RESOLUTIONS AND LETTERS OF SUPPORT 60
Highlights 60

8.00: NEZ PERCE HATCHERY PRODUCTION MODEL 61
Highlights 61

List of Tables

Table 1.11. Production estimator for NPTH CIRF facilities: Cherry Lane and Sweetwater Springs 7

Table 1.12. Production estimator for Lo10 Creek to predict the correlation of water resources and'production goals . . . . . . 8'

Table 1.13. **Production** estimator for S.F. Clearwater River tributaries; Meadow, Mill, and **Newsome** Creeks to predict the correlation of water resources and production goals 9

Table 1.14. Production estimator for Slate Creek to predict the correlation of water resources and production goals 10

Table 1.15. Production estimator for Meadow **Creek, Selway** River to predict the correlation of water resources and production goals 11

Table 1.16. Production estimator for Clear-water River to predict the correlation of water resources and production goals for fall chinook 12

Table 1.61. Estimate of natural production based on redd counts for Lo10 and **Newsome** Creeks used to estimate broodstock for NPTH to be taken from natural production. 25

Table 1.62. Survival parameters used to develop the recruitment per spawner ratios for both natural and hatchery fish in the supplementation of a an existing natural population while using the **50/50** rule for genetic integrity. 27

Table 1.63. Natural production restoration using a controlled ratio of hatchery broodstock recruitment from the anticipated Lo10 Creek natural run while adhering to the **50/50** rule for genetic management. . . . 29

Table 3.01 Cost summary for Nez Perce Tribal Hatchery Master Plan. 44

Table 3.02. Nez Perce Tribal Hatchery requirements for staff and salary budget. 45

Table 4.01. **Parameter** Values used in NPTH Planning. 48,

List of Figures

Figure 1.01 Rearing temperature requirements for, chinook salmon superimposed on water temperatures for Slate Creek, July and August 1990. 3

Figure 1.02 Spawning temperature requirements for chinook salmon superimposed on water temperatures for Yoosa Creek, September 1990. 4

Figure 2.11. Graph of water temperature and hours in excess of 16 °C per day in lower Eldorado Creek in July 1990. . 36

Figure 2.12. Graph of water temperature and hours in excess of 16 °C per day in lower Eldorado Creek in August 1990. 37

Figure 2.13. Graph of water temperatures in lower Eldorado Creek compared to Piper's (1982) spawning temperature range for chinook salmon during the summer of 1991. . . 38

Figure 3.01. Time Line for past and future events associated with Nez Perce Tribal Hatchery. 46

APPENDIX 1.00

BIOLOGICAL CRITERIA FOR ARTIFICIAL PRODUCTION

Introduction

In operating the Nez Perce Tribal Hatchery (NPTH), a variety of compatible techniques far artificial production and hatchery management (Piper et al. 1982, McNeil and Bailey 1975, Senn et al. 1984) will be used to:

- meet the needs of specific species or conditions, or
- produce the desired product at a specified time for a target date that will promote survival and return of the species.

Production will focus on generating a product that mimics natural production and promotes survival given the constraints imposed by changes in watershed management within the Columbia Basin and its subbasins.

Water Quality

Central Incubation and Rearing Facility (CIRF): Water chemistry and temperature for-the CIRF is reviewed and explained in Support Document[1] 6.00, Sections 6.19 through 6.21. Chemistry has been done by United States Department of' Interior Geological Survey Labs and other private labs-in checking 'and rechecking water quality. Drilling, pumping tests and well monitoring are being produced under other contracts which continue to monitor water chemistry and temperatures to insure that water quality will be adequate to rear fish.

Satellite facility water quality: is considered chemically adequate to rear and hold fish as salmonids are present in all streams where satellites are proposed.

Aeration of groundwater: at the CIRF will be required to produce saturated levels of oxygen and "removal-of carbon dioxide. This can be accomplished in several ways, possibly in conjunction with an aeration tower which could also be used to reduce temperature. Present ground water temperatures are 62 to 63 °F. An aeration tower will also aid in removing iron, sulfates and nitrates

[1] Support Document(s) information is too bulky to be included. It is available upon request: Department Fisheries Resource Management, Nez Perce Tribe.

present in low quantities in ground **waters** at the Cherry Lane site. Extensive research has been done on the ground waters to insure that **unaltered chemical** quality-is adequate for fish cultural purposes (Support Document'6.00).

Specific pathogen free waters: have been sought for the CIRF to reduce the hazards of disease.. **At** present, the Cherry Lane groundwater is known to be recharged from the **Clearwater** River. Thus, the probability of contamination from the outfall of hatcheries upstream of the site exists. **Transfer** time and geofiltration effectiveness are unknown (Support Document 6.30, Ralston 1991).

To compensate **for these** conditions, some form of water treatment to kill pathogens should be a part of facility operations. Depending upon water clarity, the recommended options for pathogen treatment would be ultraviolet exposure or ozoneation. The latter, in conjunction with a cooling tower, could aerate the water while sterilizing it.

Satellite Facilities

Water temperature and flow: Temperature requirements for **chinook** salmon rearing and spawning are shown in Figures 1.01 and 1.02 from Piper (1982). Temperatures recorded at two Satellite sites are superimposed to compare **Piper's** standards **with actual** conditions. Research and development of water resources for NPTH facilities has focused on-providing the optimum temperature for all life stages of fjsh **development** (spawning, incubation and rearing) to **produce** the desired product with the most potential to survive in each watershed selected in the Clearwater and Salmon subbasins.

Support Document 6.00 contains information on water temperatures and **flows at** all potential satellite facility sites for 1990 to present.

The average water temperatures shown in Support Document 6.01, 6.02, 6.08, 6.09, 6.14, 6.15 are near optimum for broodstock maintenance. Water temperatures,&, the satellite sites, Support Documents **6.01** through 6.15, **were** compared with Figures-l.91 and 1.02 to ensure that the water temperatures would provide a safe environment for NPTH production.

The temperatures in Support Documents 6.04 and 6.05 show highs greater than desired for juvenile production and adult holding. Thus, temperature information is being gathered at a site upstream that is more favorable for juvenile and adult production. The criteria which direct production are:

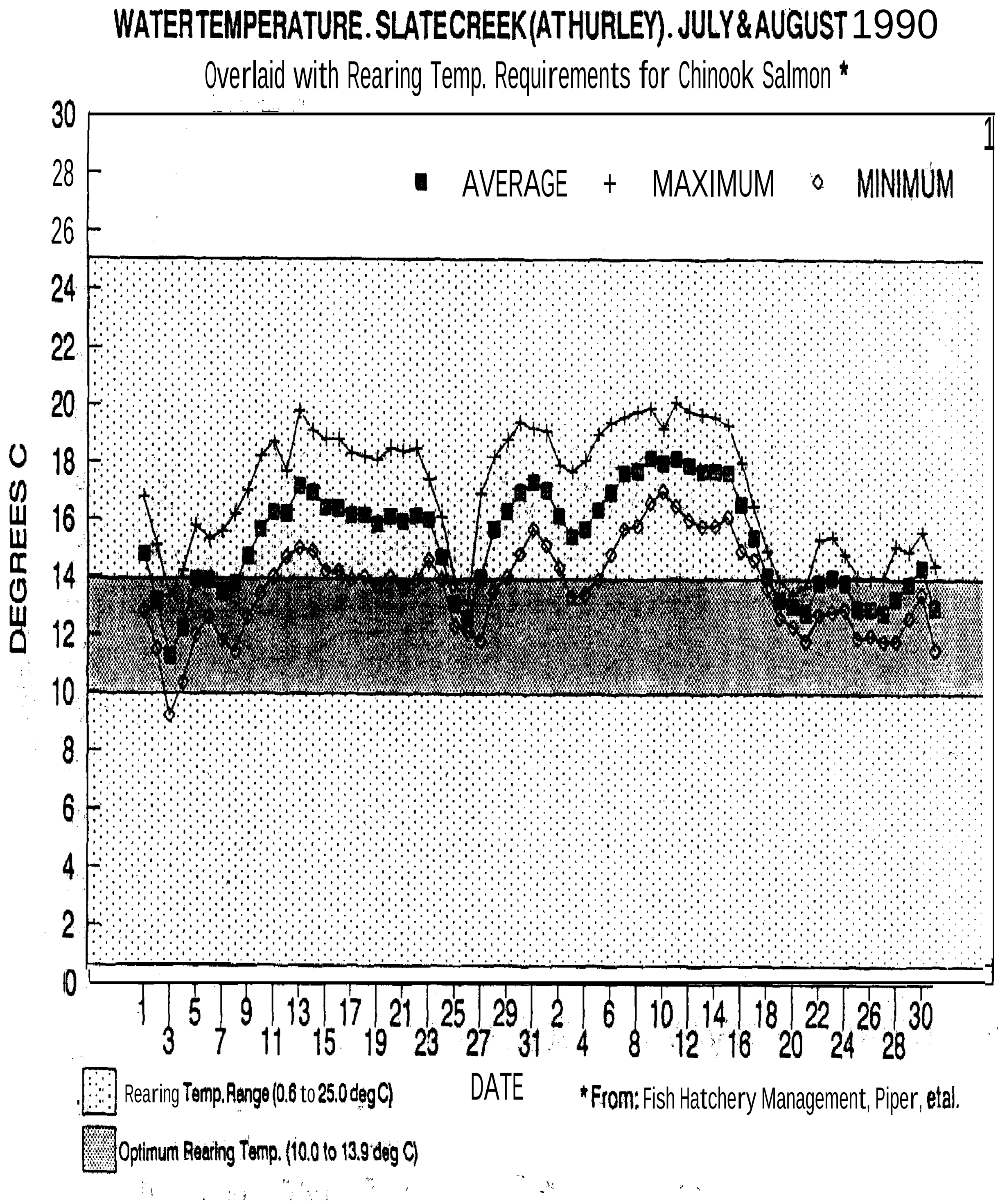


Figure 1.01 Rearing temperature requirements for chinook salmon superimposed on water temperatures for Slate Creek, July & August 1990.

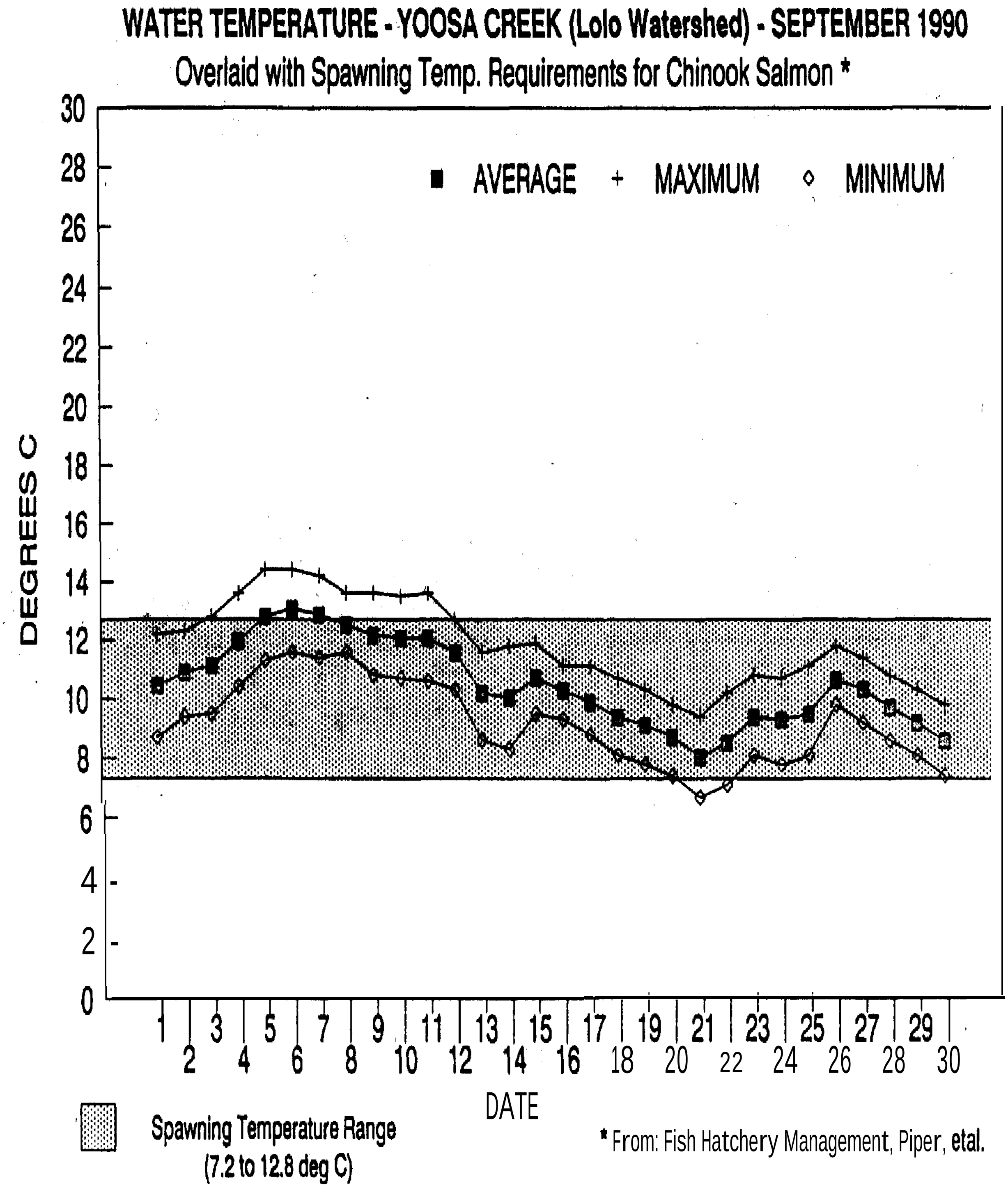


Figure 1.02 Spawning temperature requirements for chinook salmon superimposed on water temperatures for Yoosa Creek, September 1990,

- o low density for juveniles (less than (0.10 lbs/ft^3) and adults (10 to 20 ft^3 per fish).

- o flow rates of at least one complete water exchange per hour

These conditions ensure that life-support (oxygen) and sanitation conditions are optimal for juveniles and/or adults held at satellites. Flows for adults will exceed 1 gallon per minute (gpm) per adult. In most cases, the gpm will be at least 4 times the minimum recommended by Senn, et al (1984).

Present conceptual designs (Support Document 3.00 and 4.00, Figures 3.07 and 4.09) demonstrate the size of the ponds and operation on reuse. Single-use, single-pass us8 of water can become an option for adult broodstock maintenance rather than reuse of juvenile rearing water as was originally planned.

Production Programming

Central Incubation and Rearing Facilities and Satellites: A series of tables (1.11 through 1.16) illustrate production parameters and production projections for the CIRF and its associated satellite facilities. The tables are the product of a spread sheet model used to fit production toWater resources. These tables consider the following-and other factors for the purpose of predicting operation of the hatchery:

- o number of fish .
- o fish size
- o temperature
- o incubation
- o production timing
- o species
- o density
- o water-exchange rate
- o growth rate
- o mortality rates, etc.

These production models also help to assure that hatchery water needs do not impact the needs of resident and anadromous fish at the satellite sites. This modeling-effort is correlated with the flow data in Support Document 6.00 for each site to assure the adequacy of each site for both hatchery and resident populations of fish.

Water quantity is fitted to presmolt production and not to adult holding as juvenile production requires the greatest quantity of water. Adults can be maintained on water that has been previously used by juveniles; however, most sites have adequate water to provide adults with water not previously used.

Table 1.11 demonstrates a wide **range** of production options at the Cherry Lane CIRF for production of fish from 1 to 3.5 inches and at the Sweetwater auxiliary, **CIRF.** The primary purpose is to determine that water' supplies are adequate for producing the numbers of fish shown in Table **I-1** in **the Master** Plan. These estimates are conservative both in terms of density and water resources available.

Table **1.12** demonstrates the correlation of water resources and production goals for spring chinook in Lo10 Creek. 'The columns PC* for maximum numbers **of fish that** can be produced and AP* the actual production goal are'compafed 'to each other. This comparison determines if **the** quantity of water at the site sufficient to produce the desired number of fish. Other factors are displayed such as density, size, and actual water requirements. For Lo10 Creek the water resources are more than adequate as the numbers of fish will be divided between two sites with more than 3.0 cubic feet per second (cfs) available at each site.

Table 1.13 demonstrates the correlation **of water** resources for three sites on the **S.F. Clearwater** River; **Meadow, Mill** and **Newsome** Creeks; This **table** serves to predict **both presmolt** rearing for Mill and **Newsome** Creeks and smolt acclimation for Meadow Creek. In general, actual water resources available at each site exceed **actual needs** by 4 to 10 times depending on the seasonal flow.

Table **1.14** demonstrates the correlation of water resources for Slate Creek. In addition to presmolt production, age-l+ smolts will be acclimated and released in this stream.

Table 1.15 demonstrates the water resource and production relationship for producing 100,000 summer chinook presmolts. An additional 200,000 spring chinook timed-release fed-fry are planned for the upper basin. Stream water resources for fed-fry do not need to be planned as their habitat will **be** within the stream itself. However, **water resources** and production are shown for their production at the CIRF.

Table 1.16 demonstrates fall chinook production as if it **occurred** at the Cherry Lane CIRF. Other sites also have ability to rear fall chinook subyearling smolts which expands the production potential.

TABLE 1.11. Production estimator for groundwater at NPTH CIRF Facilities: Cherry Lane and Sweetwater Springs showing volumes of water correlated to specific fish sizes and densities.

DEFINITIONS:

- DENSITY INDEX: lbs./ft3/inch of length
- CUBIC FEET PER SECOND: 450 gallons per minute
- ONE CUBIC FOOT OF SPACE: 7.48 gallons of water
- CUBIC FEET OF REARING SPACE: Total gallons per hour divided by gallons per cubic foot.

TEMPERATURES: 50 - 54 Fahrenheit
WATER EXCHANGE RATE: 1X/hr.
WATER FLOW: single pass, single use
EGG TO FRY SURVIVAL: 0.81
FRY TO PRESMOLT MORTALITY: 0.0003/day

WATER REQUIREMENTS				POND REQUIREMENTS				PRODUCTION CAPACITY					ACTUAL PRODUCTION				
CUBIC FT/SEC WATER	GAL PER MINUTE	GAL PER HOUR	GAL PER CUBIC FT.	CUBIC FT. REARING SPACE	NUMBER PONDS	POND SIZE (FT3)	POND DIMENSIONS (W x L x D)	DENSITY INDEX (LBS/FT3/IN)	FISH LENGTH (INCH)	FISH SIZE (NO/LB)	TOTAL POUNDS	MAXIMUM NUMBER FISH	Am4 NUMBER FISH	ACTUAL POUNDS FISH	REQUIRED REARING SPACE	REQUIRED NUMBER PONDS	DENSITY INDEX (LBS/FT3/IN)
1	450	27,000	7.48	3,610	3.34	1,666	6 x 66 x 3	0.1	2.0	420	722	103,209					
1	450	27,000	7.48	3,610	3.34	1,080	6 x 66 x 3	0.2	2.0	426	1,444	606,417					
1	450	27,000	7.48	3,610	3.34	1,666	6 x 66 x 3	0.3	2.0	420	2,166	909,626					
1	450	27,000	7.48	3,610	3.34	1,666	6 x 66 x 3	0.3	3.5	16	3,790	165,161					
1.6	720	43,200	7.48	5,775	5.35	1,666	6 x 66 x 3	0.15	5.0	36	4,332	129,947					
2	900	54,000	7.48	1,119	6.68	1,666	6 x 60 x 3	0.15	5.0	30	5,414	162,433					
1.2	540	32,400	7.48	4,332	4.01	1,080	6 x 66 x 3	0.15	5.0	36	1,149	91,466					
3	1,356	81,000	7.48	10,829	10.03	1,080	6 x 60 x 3	0.1	2.0	420	2,166	909,626					
3	1,350	11,000	7.48	10,829	10.03	1,080	6 x 60 x 3	0.2	2.0	420	4,132	1,819,251					
3	1,350	81,000	7.48	10,829	10.03	1,666	6 x 60 x 3	0.3	2.0	420	6.497	2,728,877					
3	1,316	81,000	7.48	10,829	10.03	1,080	6 x 60 x 3	0.1	3.0	136	3,149	412,326					
3	1,350	81,000	7.48	10,829	10.03	1,660	6 x 60 x 3	0.2	3.0	136	6,497	844,652					
3	1,350	11,606	7.48	16,629	10.03	1,080	6 x 60 x 3	0.3	3.0	136	4,746	1,266,979					
5	2,250	135,000	7.48	18,048	16.71	1,666	6 x 60 x 3	0.1	3.0	136	5,414	103,817					
5	2,156	131,666	7.48	16,646	16.71	1,080	6 x 66 x 3	0.2	3.0	130	16,629	1,407,754					
5	2,250	135,000	7.48	18,048	16.71	1,066	6 x 66 x 3	0.3	3.0	136	16,243	2,111,631					
7	3,150	189,000	7.48	25,267	23.40	1,080	6 x 16 x 3	0.1	3.0	130	1,166	965,426					
7	3,150	189,000	7.48	25,267	23.40	1,080	6 x 60 x 3	0.2	3.0	130	15,160	1,970,856					
7	3,150	119,606	7.48	15,211	23.40	1,080	6 x 66 x 3	0.3	3.0	130	22,741	2,956,283					
9	4,050	243,000	7.48	32,487	30.08	1,080	6 x 60 x 3	0.1	3.0	130	9,166	1,266,979					
9	4,050	243,000	7.48	12,461	30.08	1,080	6 x 66 x 3	0.2	3.0	130	19,492	2,533,957					
9	4,050	243,000	7.48	11,411	30.08	1,080	6 x 60 x 3	0.3	3.0	130	29,231	3,800,936					
11	4,950	297,000	7.48	39,706	36.76	1,080	6 x 66' x 3	0.1	3.0	130	11,912	1,548,529					
11	4,950	297,000	7.48	39,706	36.76	1,066	6 x 60 x 3	0.2	3.0	130	11,824	3,097,059					
11	4,956	291,666	7.48	39,706	36.76	1,666	6 x 60 x 3	0.3	3.0	116	35,735	4,645,588					

TABLE 1.12. Productionestimator topredictthe correlation ofwaterresourcesand production goalsforspring chinook for LoloCreek: 116,006presmoltsforfallrelease, 1 Octobereachyear. CIRF incubation and rearing and satellilte rearing are shown. Production Capacity (PC*) is compared to Actual Production (AP*); as long as the value of AP* is less than PC*, no other facilities are required to meet production goals.

DEFINITIONS:

DENSITY INDEX: lbs./ft3/inch of length
CUBIC FEET PER SECOND: 450 gallons per minute
ONE CUBIC FOOT OF SPACE: 7.48 gallons of water
CUBIC FEET OF REARING SPACE: Total gallons per hour divided by gallons per cubic foot.

TEMPERATURE: 50-54 Fahrenheit
WATER EXCHANGE RATE: 1X/hr.
WATER FLOW: single pass, single use
EGG TO FRY SURVIVAL: 0.81
FRY TO PRESMOLT MORTALITY: 0.0003/day

SPRING CHINOOK: LOLO CREEK

Egg/Alevin incubation (1665TU): 211 days @ 39.9F (7.9TU/D); 1 SEPT to 1APR.
CIRF rearing 30 days (2APR-2MAY) @ 54F, 1.34" to 2.0". Growth rate; 0.0220"/day or 0.66"/mo.
Satellite rearing: 153 days (2MAY-1OCT), Size increase 2.0" to 5.5" = 3.5" (20/LB). Growth rate 0.0229"/day or 0.6863"/mo. Fry/presmolt survival: 0.9651

						POND REQUIREMENTS		PRODUCTION CAPACITY				PC'	AP*	ACTUAL PRODUCTION					
CUBIC FT/SEC	GAL PER MINUTE	GAL PER HOUR	GAL PER CUBIC FT.	CUBIC FT. REARING SPACE	NUMBER PONDS	POND SIZE (FT3)	POND DIMENSIONS (W x L x D)	DENSITY INDEX (LBS/FT3/IN)	FISH LENGTH (INCH)	FISH SIZE (NO/LB)	TOTAL POUNDS	MAXIUM NUMBER FISH	ACTUAL NUMBER FISH	ACTUAL POUNDS FISH	REQUIRED REARING SPACE	REQUIRED NUMBER PONDS	DENSITY INDEX (LBS/FT3/IN)	WATER GPM	WATER CFS
CIRF:																			
3	1,350	61,666	7.48	10,829	10.03	1,080	6 x 66 I 3	0.3	1.0	1666	1,249	3,248,663	187.500	188	625	0.6	0.3	78	0.17
3	1,350	61,666	7.48	16,629	10.03	1,666	6 x 66 I 3	0.3	1.6	960	1,196	4,678,075	187.500	208	434	0.4	0.3	54	0.12
3	1,350	81,000	7.48	10,829	10.03	1,666	6 x 66 I 3	0.25	2.0	420	5,414	2,274,064	187,500	446	893	0.8	0.25	135	0.30
3	1,350	61,666	7.48	16,629	4.23	2,566	I I 66 I 4	0.2	2.5	220	5,414	1,191,176	168.500	716	1,132	0.6	0.2	191	0.42
SATELLITE:																			
3	1,316	81,000	7.48	16,629	4.23	1,566	6 I 60 I I	0.1	3.0	130	1,249	422,326	168.500	1,296	4,321	2	0.1	539	1.20
4	1,666	166,606	7.48	14,439	5.64	2,560	8 I 66 x 4	0.1	5.0	25	7,219	180,481	150,000	1,666	12,666	5	0.1	1496	3.32

Footnote:

CIRF production is based on 3.0 cfs water supply; pump tests conducted in 1991 estimate groundwater production capacity of 5.0 to 11.0 cfs allowing other management options for production.
Water quantities allocated for production are 450 gpm (1.0 cfs); actual use shown specifies actual needs which allows other options or a margin of safety.
Satellite production will occur at two sites which are presently designed to produce up to 165,000 presmolts each, therefore production shown on botton line is actually divided between the two sites, Lolo and Eldorado Creeks.

TABLE 1.13. Production estimator to predict the correlation of water resources and production goals for spring chinook for S.F. Clearwater River tributaries, Meadow, Mill, Newsome Creeks of 90,000 presmolts for fall release, 1 October each year and up to 100,000 Age-1+ smolts for spring release. CIRF incubation and rearing and satellite rearing are shown. Production Capacity (PC*) is compared to Actual Production (AP*); as long as the value of AP* is less than PC*, no other facilities are required to meet production goals.

DEFINITIONS:
- DENSITY INDEX: lbs./ft3/inch of length
- CUBIC FEET PER SECOND: 450 gallons per minute
- ONE CUBIC FOOT OF SPACE: 7.48 gallons of water
- CUBIC FEET OF REARING SPACE: Total gallons per hour divided by gallons per cubic foot.

TEMPERATURE: 50-54 Fahrenheit
WATER EXCHANGE RATE: 1X/hr.
WATER FLOW: single pass, single use
EGG TO FRY SURVIVAL: 0.81
FRY TO PRESMOLT MORTALITY: 0.0003/day

SPRING CHINOOK: S.F. Clearwater River Tributaries, Meadow, Mill, Newsome Creeks.

Egg/Alevin incubation (1665TU); 181 days @ 41.2F (9.2TU/D); 1 SEPT to 1MAR.
CIRF rearing 30 days (2MAR-2APR) @ 54F. 1.34" to 2.0". Growth rate: 0.022"/day or 0.66"/mo.
Satellite rearing: 183 Days (1APR-1OCT), Size increase 2.0" to 5.5" = 3.5" (20/LB). Growth rate 0.0191"/D or 0.574"/mo. Fry/presmolt survival: 0.9561

POND REQUIREMENTS								PRODUCTION CAPACITY				PC*		AP*	ACTUAL PRODUCTION					
CUBIC FT/SEC	GAL PER MINUTE	GAL PER HOUR	GAL PER CUBIC FT.	CUBIC FT. REARING SPACE	NUMBER PONDS	POND SIZE (FT3)	POND DIMENSIONS (W x L x D)	DENSITY INDEX (LBS/FT3/IN)	FISH LENGTH (INCH)	FISH SIZE (NO/LB)	TOTAL POUNDS	MAXIMUM NUMBER FISH	ACTUAL NUMBER	ACTUAL FISH	POUNDS FISH	REQUIRED REARING SPACE	REQUIRED NUMBER PONDS	DENSITY INDEX (LBS/FT3/IN)	WATER GPM	WATER CFS
CIRF:																				
3	1,356	81,000	7.48	10,829	10.03	1,080	6 1.66 1 3	0.3	1.0	1000	3,249	3,248,663	251,000	251	837	0.8	0.3	104	0.23	
3	1,350	81,000	7.48	10,829	10.03	1,080	6 x 60 x 3	0.3	1.6	900	5,196	4,678,075	251,000	119	581	0.5	0.3	72	0.16	
3	1,316	61,066	7.48	10,829	10.03	1,080	6 x 66 x 3	0.25	2.0	420	5,414	2,274,064	225,000	536	1,071	1.0	0.25	135	0.30	
3	1,350	61,666	7.48	16,129	4.23	1,166	8 x 66 x 4	0.2	2.5	220	5,414	1,191,176	121,666	1,613	2,045	0.8	0.2	255	0.57	
SATELLITE: presmolts																				
2	900	54,000	7.48	7,219	2.82	2,560	8 x 80 x 4	0.1	3.0	136	2,166	261,551	166,666	169	2,564	1	0.1	316	0.71	
2	900	54,000	7.48	7,219	2.82	2,560	8 x 80 x 4	0.1	5.0	25	3,610	96,141	96,616	3,666	1,166	3	0.1	898	1.99	
SATELLITE: Age-1+ smolts																				
3	1,350	81,000	7.48	10,829	4.23	2,560	8 x 80 x 4	0.1	3.0	130	3,149	422,326	125,000	962	3,205	I	0.1	466	0.89	
3	1,350	61,666	7.48	10,829	4.23	2,560	8 x 80 x 4	0.1	5.5	20	5,956	119,118	100,000	1,666	9,091	4	0.1	1113	2.52	

Footnote:

CIRF production is based on 3.0 cfs water supply; pump tests conducted in 1991 estimate groundwater production capacity of 5.0 to 11.0 cfs allowing other management options for production.
Water quantities allocated for production are 450 gpm (1.0 cfs); actual use shown specifies actual needs which allows other options or a margin of safety.
Satellite production of presmolts will occur at two sites which are presently designed to produce up more than 100,000 presmolts each, therefore production shown on botten line is actually divided between the two sites, Mill and Newsome Creeks. Age-1+ smolts would be produced at the Sweetwater Auxillary CIRF site, acclimated and released in Meadow Creek.

TABLE 1.14. Production estimator to predict the correlation of water resources and production goals for spring chinook for Slate Creek, 250,000 presmolts for fall release, 1 October of each year and acclimated release of 100,000 Age-1+ smolts each spring. Production Capacity (PC*) is compared to Actual Production (AP*); as long as the value of AP* is less than PC*, no other facilities are required to meet production goals.

DEFINITIONS:

DENSITY INDEX: lbs./ft3/inch of length
CUBIC FEET PER SECOND: 450 gallons per minute
ONE CUBIC FOOT OF SPACE: 7.48 gallons of water
CUBIC FEET OF REARING SPACE: Total gallons per hour divided by gallons per cubic foot.

TEMPERATURE: 50-54 Fahrenheit
WATER EXCHANGE RATE: 1X/hr.
WATER FLOW: single pass, single use
EGG TO FRY SURVIVAL: 0.81
FRY TO PRESMOLT MORTALITY: 0.0003/day

SPRING CHINOOK: SLATE CREEK

Egg/Alevin incubation (1665TU): 153 days @ 42.9F (10.9TU/D): 1 SEPT to 1FEB.
CIRF rearing 30 days (1FEB-2MAR) @ 54F, 1.34" to 2.0". Growth rate: 0.022"/day or 0.66"/mo.
Satellite rearing: 212 days (2MAR-1OCT), Size increase 2.0" to 5.5" = 3.5" (20/LB). Growth rate 0.0165"/day or 0.4953"/mo. Fry/presmolt survival: 0.9474

WATER REQUIREMENTS				POND REQUIREMENTS				PRODUCTION CAPACITY				PC*	AP*	ACTUAL PRODUCTION					
CUBIC FT/SEC WATER	GAL PER MINUTE	GAL PER HOUR	GAL PER CUBIC FT.	CUBIC FT. REARING SPACE	NUMBER PONDS	POND SIZE (FT3)	POND DIMENSIONS (W x L x D)	DENSITY INDEX (LBS/FT3/IN)	FISH LENGTH (INCH)	FISH SIZE (NO/LB)	TOTAL POUNDS	MAXIUM NUMBER FISH	ACTUAL NUMBER FISH	ACTUAL POUNDS FISH	REQUIRED REARING SPACE	REQUIRED NUMBER PONDS	DENSITY INDEX (LBS/FT3/IN)	WATER GPM	WATER CFS
CIRF:																			
3	1,350	61,000	7.48	10,829	10.03	1,080	6 x 60 x 3	0.3	1.0	1000	3,249	3,248,663	250,000	250	833	0.6	0.3	104	0.23
3	1,350	81,000	7.48	10,829	10.03	1,080	6 x 60 x 3	0.3	1.6	900	5,198	4,678,075	250,000	278	579	0.5	0.3	72	0.16
3	1,350	81,000	7.48	10,819	10.03	1,080	6 x [illegible] x 3	0.25	2.0	420	5,414	2,274,064	250,000	595	1,190	1.1	0.25	135	0.30
3	1,358	81,000	7.48	10,829	4.23	2,560	8 x 80 x 4	0.2	2.5	220	5,414	1,191,176	250,000	1,136	2,273	0.9	0.2	283	0.63
SATELLITE: presmolt production																			
3	1.350	11,000	7.48	10,829	4.23	2.560	8 x 80 x 4	0.1	3.9	130	3.249	422.326	250,000	1,923	6,410	3	0.1	799	1.78
6	2.700	162,000	7.48	11,658	8.46	2,560	8 x 80 x [illegible]	0.1	5.0	25	10,829	270,722	250,000	10,000	20,000	8	0.1	2493	5.54
SATELLITE: Age-1+ smolts, acclimated/released.																			
3	1,350	81,000	7.48	10,829	4.23	2,560	8 x 80 x 4	0.1	5.0	25	5,414	135,361	100,000	4,000	8,000	3	0.1	997	2.22

Footnote:

CIRF production is based on 3.0 cfs water supply; pap tests conducted in 1991 estimate groundwater production capacity of 5.0 to 11.0 cfs allowing other management options for production.
Water quantities allocated for production are 450 gpm (1.0 cfs); actual use shown specifies actual needs which allows other options or a margin of safety.
Satellite production will occur at two sites which are presently designed to produce up to 250,000 presmolts each, therefore production shown on bottom line is actually divided between thr two sites, Hurley and Deadhorse Creeks.

TABLE 1.15. Production estimator to predict thr correlation of water resources and production goals for spring chinook salmon for Meadow Creek, Selway River; production of 100,000 summer chinook presmolts for fall release, 1 October each year and up to 200,000 Timed-release fed-fry spring chinook released in June of each year in the headwaters of the stream. CIRF incubation and rearing and satellite rearing are shown. Production Capacity (PC*) is compared to Actual Production (AP*); as long as the value of AP* is less than PC*, no other facilities are required to meet production goals.

DEFINITIONS:

- DENSITY INDEX: lbs./ft3/inch of length
- CUBIC FEET PER SECOND: 450 gallons per minute
- ONE CUBIC FOOT OF SPACE: 7.48 gallons of water
- CUBIC FEET OF REARING SPACE: Total gallons per hour divided by gallons per cubic foot.

TEMPERATURE: 50-54 Fahrenheit
WATER EXCHANGE RATE: 1X/hr.
WATER FLOW: single pass, single use
EGG TO FRY SURVIVAL: 0.81
FRY TO PRESMOLT MORTALITY: 0.0003/day

SUMMER AND SPRING CHINOOK: Meadow Creek, Selway River.

Egg/Alevin incubation (1665TU): 231 days @ 39.0F (7.0TU/D); 1 SEPT to 21 APRIL.
CIRF rearing 45 days (20 API-W @ 54F, 1.34" to 2.35". Growth rate: 0.0220"/day or 0.66"/mo.
Satellite rearing: 111 days (5JUN-10CT), Size increase 2.5" to LO' = 2.5" (25/LB). Growth rate 0.0212"/day or 0.636"/mo. Fry/presmolt survival: 0.9650

	POND REQUIREMENTS							PRODUCTION CAPACITY				PC*	AP*	ACTUAL		PRODUCTION			
CUBIC FT/SEC	GAL PER MINUTE	GAL PER HOUR	GAL PER CUBIC FT.	CUBIC FT. REARING SPACE	NUMBER PONDS	POND SIZE (FT3)	POND DIMENSIONS (W x L x D)	DENSITY INDEX (LBS/FT3/IN)	FISH LENGTH (INCH)	FISH SIZE (NO/LB)	TOTAL POUNDS	MAXIUM NUMBER FISH	ACTUAL NUMBER FISH	ACTUAL POUNDS FISH	REQUIRED REARING SPACE	REQUIRED NUMBER PONDS	DENSITY INDEX (LBS/FT3/IN)	WATER GPM	WATER CFS
CIRF:																			
3	1,350	81,000	7.48	10,129	10.03	1,080	6 x 60 x 3	0.3	1.0	1000	3,249'	3,248,663	333,000	333	1,110	1.0	0.3	138	0.31
3	1,350	111,000	7.48	10,829	10.03	1,080	6 x 60 x 3	0.3	1.6	900	5,198	4,678,075	333,000	370	771	0.7	0.3	96	0.21
3	1,350	11,000	7.48	10,829	10.03	1,080	6 x 60 x 3	0.25	2.0	420	5,414	2,274,064	311,000	740	1,481	1.4	0.25	135	0.30
3	1,350	81,000	7.48	10,829	4.23	2,560	8 x 80 x 4	0.2	2.5	220	1,414	1,191,176	311,000	1,414	2,827	1.1	0.2	352	0.78
SATELLITE: presmolts on lower Meadow Creek																			
2	900	54,000	7.48	7,219	2.82	2,560	8 x 80 x 4	0.1	3.0	130	2,166	281,551	111,000	854	1,846	1	0.1	355	0.79
3	1,350	81,000	7.48	10,829	4.23	2,560	8 x 80 x 4	0.1	5.0	25	5,414	135,361	100,000	4,000	1,000	3	0.1	997	2.22
DIRECT RELEASE OF TIMED-RELEASE FED-FRY:																			
3	1,350	81,000	7.48	10,829	4.23	2,560	8 x 80 x 4	0.25	2.0	410	5,414	2,274,064	100,000	476	952	0	0.25	119	0.26
3	1,350	81,000	7.48	10,829	4.23	2,560	8 x 80 x 4	0.2	2.5	220	5,414	1,191,176	200,000	909	1,818	1	0.2	227	0.50

Footnote:

CIRF production is based on 3.0 cfs water supply; pump tests conducted in 1991 estimate groundwater production capacity of 5.0 to 11.0 cfs allowing other management 'options for production.
Water quantities allocated for production are 450 gpm (1.0 cfs); actual use shorn specifies actual needs which allows other options or a margin of safety.
Satellite production of presmolts will occur at one site which will be designed to produce more thu 100,000 presmolts; Timed-release Fed-fry are distributed throughout the streams headwaters.

TABLE 1.16. Production estimator to predict the correlation of water resources and production goals for fall chinook salmon at two levels of production, 250,000 and 500,000 Age-0 smolts. Model predicts allocating up to 3.0 cfs of water at the Cherry Lane CIRF to produce up to 265,000 smolts for off site release, satellite facility production and release of 88,000 smolts at Lake's Gulch and 132,000 smolts at North Lapwai Valley. Total production 485,000 Age-0 smolts.

DEFINITI DENSITY INDEX: lbs./ft3/inch of length
CUBIC FEET PER SECOND: 450 gallons per minute
ONE CUBIC FOOT OF SPACE: 7.48 gallons of water
CUBIC FEET OF REARING SPACE: Total gallons per hour divided by gallons per cubic foot.

WATER EXCHANGE RATE: 1X/hr.
WATER FLOW: single pass, single use
EGG TO FRY SURVIVAL: 0.81
FRY TO PRESMOLT MORTALITY: 0.0003/day

FALL CHINOOK:

Egg Incubation (900TU): 50F, 30 days @ 18TU/day = 540TU and 54F. 17 days @ 22TU/day = 360TU.
Alevin Incubation (765TU): 54F, 35 days @ 22TU/day = 765TU. Total Incubation time 82 days, 1NOV to 21JAN.
CIRF rearing 10 days (21JAN-31JAN) @54F, 1.43" to 1.6". Growth rate; 0.017"/day or 0.51"/mo.
Satellite rearing: 96 days (1FEB-7MAY), 1.6" to 3.54" (70/LB). Growth rate 0.0202"/day or 0.6"/mo. Fry/presmolt survival: 0.9712

WATER REQUIREMENTS					POND REQUIREMENTS				PRODUCTION CAPACITY				PC*	AP*	ACTUAL PRODUCTION				
CUBIC FT/SEC SECOND	GAL PER a	GAL PER m	GAL PER HOUR	CUBIC FT. REARING CUBIC FT.	NUMBER PONDS SPACE	POND SIZE (FT3)	POND DIMENSIONS (W | L | D)	DENSITY INDEX (LBS/FT3/IN)	FISH LENGTH (INCH)	FISH SIZE (NO/LB)	TOTAL POUNDS	MAXIUM NUMBER FISH	ACTUAL NUMBER FISH	ACTUAL POUNDS FISH	REQUIRED REARING SPACE	REQUIRED NUMBER PONDS	DENSITY INDEX (LBS/FT3/IN)	WATER GPM	WATER CFS
CIRF:																			
3	1,350	81,000	7.48	10,829	10.03	1,080	6 x 60 x 3	0.3	1.6	900	5,198	4,678,075	250,000	278	579	0.54	0.3	72	0.16
3	1,350	81,000	7.48	10,829	10.03	1,080	6 x 60 x 3	0.3	2.0	420	6,497	2,728,877	250,000	595	992	0.92	0.3	124	0.27
3	1,350	81,000	7.48	10,829	10.03	1,080	6 x 60 x 3	0.25	2.5	220	6,768	1,488,971	250,000	1,136	1,818	1.68	0.25	227	0.50
3	1,350	81,000	7.48	10,829	4.23	2,560	8 x 80 x 4	0.2	3.0	130	6,497	844,652	250,000	1,923	3,205	1.25	0.2	400	0.89
6	2,700	162,000	7.48	21,658	8.46	2,560	8 x 80 x 4	0.1	3.5	70	7,580	530,615	485,000	6,929	19,796	7.73	0.1	2468	5.48
CHERRY LANE PRODUCTION:																			
3	1,350	81,000	7.48	10,829	4.23	2,560	8 x 80 x 4	0.1	3.5	70	3,790	265,307	265,000	3,786	10,816	4.23	0.1	1348	3.00
SATELLITE: Lake's Gulch, S.F. Clearwater River.																			
1	450	27,000	7.48	3,610	3.34	1,080	6 x 60 x 3	0.3	2.0	420	2,166	909,626	88,000	210	349	0.32	0.3	44	0.10
1	450	27,000	7.48	3,610	1.41	2,560	8 x 80 x 4	0.1	3.5	70	1,263	88,436	88,000	1,257	3,592	1.40	0.3	448	1.00
SATELLITE: North Lapwai Valley, l.a. Clearwater River.																			
1.5	675	40,500	7.48	5,414	5.01	1,080	6 x 60 x 3	0.25	2.0	220	2,707	595,588	132,000	600	1,200	1.11	0.25	150	0.33
1.5	675	40,500	7.48	5,414	2.12	2,560	8 x |0 x |	0.1	3.5	70	1,895	132,654	132,000	1,886	5,388	2.10	0.1	672	1.49

Footnote:

CIRF production is based on 3.0 cfs water supply; pump tests conducted in 1991 estimate groundwater production capacity of 5.0 to 11.0 cfs allowing other management options for production.
Water quantities allocated for production are 1350 gpm (3.0 cfs); actual use shows specifies actual needs which allow other options or a margin of safety.
Satellite production will occur at two sites which will be designed to produce up to the number of smolts indicated. Off site releases of smolts would occur at Lolo Creek and/or Fenn, Selway River.

Luke's Gulch production is conservatively estimated; recent pump tests show that approximately 1.0 cfs of ground water is available at the site. Because of ground water temperature is 62 °F, riverwater will be used to cool temperature and will expand the production potential at the site. Serial reuse would also offer an option to increase production by up to 150,000 smolts. ,

North Lapwai Valley water resources are still being developed. Additional'potential may exist at this site which could make it a juvenile rearing site which could expand' fall chinook production up to 500,000 smolts.

The use of these modeling tools shown in Tables 1.11 through 1.16 provides immediate utilization of adaptive management for NPTH production. As more is learned these tools wili be used to support NPTH production. . .

- quality: initial,, reuse,, etc
- flow: per deep trough, raceway, pond,. fish

Description of Fish

Spring Chinook: Clearwater River Stock

Adult weight: Probably ranges from 10 to 20 pounds. Age grouping shows that III-ocean fish have dominated the returns (50 to 80+%) to Kooskia and Dworshak Hatcheries from 1972 to 1990.

Kooskja returns from 1972 to 1982 (USFWS 1972-1985) show a range of 2% to 53% III-wean fish. In., eight of the ten years, III-Ocean fish exceeded 26% of the age group returns. From 1987 to 1990, III-Ocean fish comprise less than 16% of the returns in three out of four years (Olsen 1988-90).

The reasons for this type of age grouping are unknown. Possible reasons are:

- genetics
- hatchery management practices . .
- down-river harvest,, or
- environmental changes.-

The age grouping generally matches the age grouping for Rapid River stocks.

Male:Female ratio: In general, they are considered to be 1:1. In actuality, females often dominate slightly with a ratio of 1.0 male to 1:2 female.

Capture to Sbawnina Survival.' S = 0.85: The goal is to achieve adult pre-spawning survival of at least 85%. Spawning survival in recent years at the Dworshak-Kooskia Hatchery complex have achieved pre-spawning survival of 89.7% (mortality of 10.3%) in 1989; 91% (mortality of 9%) in 1988; and 83.4% (mortality of 16.6%) in 1987 (Olsen 1989).

Fecundity (eggs/female): Fecundity is estimated at 4,000 eggs per female (Table I-1, Chapter I Master Plan.) A review of reports from Dworshak-Kooskia Hatchery 'show Clearwater stock'average fecundity ranging from 3760 to 4600, depending upon the age group composition. When II-Ocean. fish dominate the run, then fecundity drops to less than 4,000 egg average per female.

Fall Chinook: Bugert et al (1990) reported that fall chinook returned to Lyons Ferry hatchery from 6 September to 4 December in 1989. Fish were spawned from 21 October to 16 December: prespawning survival was 94.25% (mortality of 5.75%).

The predominant age classes in 1989 were 3- and 4-year old as determined from scale samples,; age ranged from 2 to 6 years. The ratio of females to males for all age classes in 1989 was 0.57:1.0. The average female:male ratio since 1977 has beeh 1.03:1.00. Average fecundity and egg size for 1989 was 4,315 eggs/female 1,574 eggs/pound (0.28 grams/egg).

Broodstock sources are from adults trapped at Lyons Ferry, Ice Harbor Dam and eyed eggs from Kalama Falls Fish Hatchery a part of Snake River Egg Bank Program completed in 198'6. Sub yearling smolts are released when 67 to 85 fish per pound in the first two weeks of June and yearling releases are 8 fish per pound in mid April.

Summer Chinook: South Fork Salmon River summer chinook adults return to the Snake River from 1 June to July 31 and the Salmon River June through September (Subbasin Plan 1989). Age composition ranges from I-Ocean to III-Ocean fish. Males dominate the younger age composition and females dominate the older age composition. In recent years, fecundity has ranged from approximately 3500 to 5255.

Broodstock Management: at satellite facilities

Broodstock Capture: Two types of structures are likely to be used for NPTH broodstock capture:

1. a permanent weir used, to capture adults and monitor juveniles during all seasonal flows (e.g. at the mouth of Lo10 Creek)

2. temporary seasonal weirs constructed of tripods, aluminum channel, and electrical conduit as described in the Compendium of Low-cost Pacific Salmon and Steelhead, Trout production Facilities and Practices in the Pacific Northwest (her8 after called NPPC Compendium) (Senn et al, 198.4).

A combination of techniques probably will be used to fit the stream channel and flow conditions for each site and watershed (e.g., velocity barrier on the main channel and pipe weir on a side channel to provide protection in floods and yet promote adult capture as fish move through the side channel under relatively controlled flow).

Prior to release, juveniles will b8 imprinted to a chemical such as morphaline, Imprinting, in combination with groundwater, will. be used to attract returning adults. Pump generated flows of 10 to 15 cfs should entice the future returning adults to enter an adult capture facility (e.g. capture of fall chinook at either Lapwai Creek or Luke's Gulch on the S.F. Clearwater River.)

In all cases, it should be possible to capture adults through direct water-to-water transfer and either hold them at the site or move them to another site for maturing and spawning.

For spring chinook, a "trap and haul" operation will be required to preserve broodstock and monitor natural versus hatchery escapement. This will be needed to manage harvest and protect adults by moving them to a site where water temperatures are conducive to. their survival; 55-60 °F (X2.5 to 15 °C).

NPTH staff collected water temperature and flow data during 1989-91 to select sites and develpp conceptual designs for adult facilities (Support Document 2.00, Site Selection and Evaluation Process, Support Documents 3.00, Facility Conceptual Designs; and 6.00, NPTH Water Supply Development).

Broodstock Holding: Broodstock holding facilities are conceptualized in Support Document 3.00, Figures 3.07, 3.12, 3.13, 3.16. Conceptual design for these structures will be up-graded in fiscal year 1992 in accordance with the recommendations given in Support Document 2.00, Site Selection and Evaluation Process.

Broodstock holding facilities are conceptualized as gravel-lined earthen-ponds as shown in Support Document 3.00, Figure 3.07. These holding facilities are generally sited as far up in the watershed as possible to tak8 advantage 'of water temperatures of approximately 55 °F.

Broodstock pond space and flow requirements were developed from the NPPC Compendium Chapter 2, Table 2. A minimum of 1 gpm of 50 °F water and at least 8 ft^3 of space per adult is recommended for holding spring and fall chinook broodstock. NPTH broodstock facility design criteria exceed these recommendations by a factor of at least two. A central vertical pond wall may need to be installed in each pond to help:

- segregate fish by sex as they mature
- seine and check fish for spawning maturity

<u>Broodstock Maintenance:</u> Adults will be captured, examined and, if needed, treated. Injections with antibiotics will be used when needed. Adults also will be treated for any external diseases and then transported as quickly as possible to their holding site in the respective watershed. If water temperature and fish condition do not require health supporting action, handling and treatment will be kept to a minimum.

Transport will require a truck and tank with full life support and temperature maintenance equipment. Anesthesia and/or physiological buffering may also be used to support adults during transport and to reduce post-handling stress (Senn et al 1984). Three transport units would be required, one each for Lo10 Creek, S.F. Clearwater River tributaries, and Slate Creek for spring chinook. Slate Creek and Meadow Creek,. Selway River facilities water temperature could sustain adults at the capture site. The same transport units could be used for juvenile transport and fall chinook transport as required.

Shading and over-spray of adult pond surfaces will be used to prevent stress and the jumping response of adults. Adjustment of pond design may be necessary to mimic adult prespawning behavior in a stream environment by providing removable in-pond habitat and/or change of flows at various times. Many broodstock holding facilities, primarily raceways, have problems with adults injured as a result of excessive jumping.

NPTH's holding facilities for adults will either provide an environment which does not entice the jumping syndrome or which will not cause injury when jumping occurs.

Spawning and Fertilization: Spawning will-take place at each satellite holding site. Adults will be sorted by sex and segregated as soon as they mature sufficiently to identify males and females. At spawning, gametes (eggs and sperm) will be collected and kept separately in sealable plastic bags, placed in a refrigerated environment and transported to the CIRF for delayed fertilization.

This technique is based on methodology supplied by McNeil and Bailey (1975) (Poon 1970) and experience of the author while developing two salmon hatcheries for Northern Southeast Regional Aguaculture at Sitka and Juneau, Alaska (1980-84). This method reduces mortality associated with post-fertilization transportation.

Split gamete fertilization: will be necessary to increase diversity of small populations (i.e., to provide single male-to-female mating by mating each female or male with more than one male or female). With this type of technique, one female may mate with multiple males and vice versa. This means that the mating of one female can be equivalent to having mated with four to eight different males and/or a male mated with four to eight females.

All matings are single pairings to a&d fertilization dominance by on8 male as occurs when male and female gametes are pooled at fertilization. The genetic -diversity of stocks within the Columbia River" subbasins will depend upon:

- preserving the genetic base that exists within the remaining stocks
- developing stocks through selection that can survive the present and future environmental conditions.

Individual adult fish will be identified to:

- provide purposeful pairing of mates at spawning
- track genetic diversity development
- identify diseased lots of gametes
- control or prevent disease
- protect genetic traits of remnant populations

Gamete Transport: 'Eggs are taken from the female without the incorporation of water or other external, non-maternal fluids and:

- placed in individual plastic bags
- sealed and placed in an ice chest suspended above a layer of 2-4 inch layer of ice
- separated from direct exposure to ice in an environment of 38 to 46 °F.

Semen (sperm) is take from a direct-stream, non-contaminated collection expressed from the male and caught in Whirl-Paks (2"x7"), sealed with ambient air through whirling and placed' directly on crushed ice. Care must be taken to not incorporate water from any source into the gametes because it would activate them and render them infertile in less than a minute.

Transport is completed as rapidly as possible, preferably within four to eight hours to the incubation facility where mating and fertilization take place. Transit time from satellites to the CIRF at Cherry Lane will be 2.0 to 2.5 hours. Eggs will be water-hardened in Iodophor or other chemical as appropriate for disease control.

Incubation

Incubation will occur at a CIRF (Cherry Lane or Sweetwater Springs). Stock isolation will occur for each satellite site on a watershed by watershed basis. In the Lo10 Creek watershed, two isolation groups are expected - naturalized stock of Lola Creek and the stock introduced to Eldorado Creek from the Dworshak-Kooskia stock.

While these two groups of fish may be incubated in a single isolation unit, they will be kept on separate incubators and water supplies. The natural Lo10 Creek stock will be incubated in individual incubators on either a female basis or as units containing split-gamete matings.

The advantage of this type of identification is to provide fish health management for tracking or preventing disease and to make genetic identification possible in order to track genetic diversity.

Individual one gallon incubators (Senn et al 1984) would be used when the broodstock population is small (less than 50 mated pairs). Where larger numbers of broodstock (more than 50 mated pairs) are available, stack tray incubators and Heath Trays will be used to incubate eggs and alevins.

Substrate will be used for alevin incubation to promote conditioning of fry and to prevent early emergence that occurs without substrate. Plastic netting or plastic bio-rings will be used as substrate for alevin incubation.

Exclusion of light from incubators will be mandatory for both eyeing eggs and alevin incubation,- This will be done by designing the building to exclude light or by using black plastic drapes over incubators.

For each stock incubated, temperature control will be selected on the basis of mimicking natural production in the mother watershed- or tributary. A range of-temperatures from 32 to 53 °F (0 to 11.67 °C) will be used to match natural stream production or to provide a product. Nevertheless., in the case of fall chinook, incubation will be accelerated to produce fish that could emigrate in mid-May or early June while a water budget would support their passage through the dams.

The CIRF's mechanical refrigeration and heat exchange systems (Support Document 3.00, Figures 3.02, 3.04, 3.05) are designed to provide incubation water of selected temperatures. Inreality, a hatchery incubation system should mimic the annual winter temperatureprofile as demonstrated in the thermograph recording partially shown in Support Document 6.00, Figures 6.09 and 6.16.

For example, Table 1.41 lists the daily temperatures for Slate Creek in conjunction with accumulated temperature units (TU's) for spring chinook (Senn et al 1984) which- is listed at 1660 to first feeding.': Figure 1.41 demonstrates the anticipated time of- , emergence and feeding based on accumulated temperature units. Emergence-and feeding under natural'conditions would be on approximately 1 May of the following year.

Winter water temperatures are being recorded at selected satellite sites and will continue to be recorded over the next two years. This will enable NPTH staff to program CIRF incubation temperatures to mimic natural conditions required for each stock. This type of incubation management will make the rearing management of fish at the CIRF easier because it avoids having all stocks of fish being reared simultaneously.

Many hatcheries that produce spring chinook spawn their fish in August and September which is near the natural spawning time and then incubate eggs at relatively warm temperatures, 50 to 54 °F (Olsen 1988, 1989).

This promotes early emergence of fry (Olsen 1989) which forces feeding to begin in November and December of the current year rather than in March through May-of-the following year when natural emergence would occur (Olsen 1988, 1989, 1990).

Emergence in December at the hatchery along with the size of smolts at release, may have a negative effect on the age group distribution of returning adults. NPTH staff would prefer to follow natural production characteristics as closely as possible. Reduced growth period may also influence the prevalence of disease in stocks (e.g. Bacterial, Kidney Disease).

Egg size: will be a function of biology (i.e. the age of fish spawned and stock character). In general, 5,000 eggs are recommended for alevin incubation for chinook in Heath Tray incubators (Senn.et al 1984).

Fry size: will be a function of biology (i.e. the age of fish spawned and stock character). In general, substrate will be used during incubation to promote; maximum size and vigor of emerging fry from an incubation of 5,000 chinook eggs per tray as recommended for alevin incubation for chinook (Senn et al 1984).

Egg-to-eyed egg survival. S_{ge} = 0.95: NPTH production parameters have set green-to-eyed egg survival at 90%. The goal of /NPTH/ operations will be to work toward achieving 95% survival during this stage of development.

Egg-to-first feeding survival, S_{fp} = 0.95: NPTH production parameters (Table I-2 Master Plan) have set eyed egg to swim-up or first feeding fry at 90%. The goal of NPTH operations will be to work toward achieving 95% survival during this stage of development.

Density

Egg eyeing densities vary with the species, temperature, flow and style of incubator (Senn et al 1984). For the purposes of this hatchery, up to 8,000 spring chinook can be eyed in Heath Trays and 5,000 eggs in one gallon jug incubators.
Fry and fingerlings will be held to 0.3 lbs/ft^3 for fingerlings up to 2.5 inches in size given a minimum pond exchange rate of no less than 1 time per hour.

Presmolts and smolts densities index'will not exceed 0.1 lbs/ft^3 with a minimum pond exchange rate of 1 time per hour.

Adult density will be 10 ft^3 per fish. Current pond design provides up to 4 times this amount of space for adults, The additional space provides protection for jumping and provides space for other purposes such as acclimation of smolts prior to release.

Technique of Delayed Fertilization

when performed- properly, this method reduces mortality associated with post-fertilization transportation. The gametes must be taken from the fish without incorporating water or other external non-maternal fluids. This is needed to assure a hiqh quality product yielding a high percentage of eye-up in excess of 90%.

This technique is based on a method developed by Poon (1970) and McNeil and Bailey (1975) and the experience of the author while developing two salmon hatcheries for Northern Southeast Regional Aquaculture at Sitka and Juneau, Alaska (1980-83). The following description gives the rudiments of the method.

A four foot 3ength of 10" to 12" diameter schedule 80 plastic pipe is cut in half on the long axis to form a trough. One end is shaped to allow a one gallon, sealable, plastic bag to be slipped over the end of the pipe. A small block is attached to the opposite end of the trough to form an incline plane with an angle of about 18 to 15 degrees,

This part of the operation can alleviate back stress when supported on a simple table above waist height. A holding rack constructed from 2x4's with twenty penny nails driven through a 2x4 cross member and sharpened with a file to form a three or four sided

trocar-type. point is used to pierce the caudal peduncle and support the fish while awaiting removal of the eggs or sperm.

Ripe adults are killed and the gill arches on one side are removed. The adults are then-hung by the tail to bleed and drain excess surface fluid. Holding fish-in this inverted posit-ion prevents the loss of gametes that often occurs when fish are-laid on their side or hung tail down.-

Prior to being placed in the spawning chute and while Still hanging, the female is wiped dry with a paper towel which is inserted under the opercle to insure that no blood becomes mixed with the eggs at the time of spawning. The female is laid at the upper end of the chute, and a Zak knife is used to incise the ventral body wall from the vent to the anterior body cavity.

By holding the head and tail of the fish simultaneously, the technician can then gently shake the fish to remove eggs which slide down the chute **into** the sealable plastic bag. A second technician then **labels** the-bag, seals it, and places it in an ice chest with **2-4"** of ice in the bottom.

Bags containing eggs are separated from direct contact with the ice by a partition floor of waxed cardboard or other water proof light-weight material serving the same purpose. Ice chests are generally loaded with ice several hours before spawning to reduce temperature to 36 to 42 degrees. Even if large numbers of females are spawned, eggs should not be pooled in large canisters because temperature would not controlled sufficiently to prevent suffocation. Suffocation would result in a low percentage of egg survival to eye-up.

Males are killed and hung by the **caudal** peduncle the same as females unless it is desired to keep them alive. In either case, one person would take semen (sperm) from a direct-stream, non-contaminated collection expressed from the male via a stripping motion anterior to posterior along the abdomen. If a second person is not available, the male may be resuspended by the head and a single person can strip the sperm into the bags.

When additional staff is available, a second person catches the sperm in mid-air in Whirl-Paks **(2"x7")** that have been gently blown open by mouth without introducing moisture. The Whirl-Pak is then sealed with ambient air through whirling and placed directly on a bed **of** crushed ice as-opposed to egg bags which are protected from direct **contact** with'the ice. Care must be taken not to incorporate water from any source into the gametes because it will activate and render them infertile in less than a minute.

Transport is completed in sealed ice chests as rapidly as possible, preferably **within** four to eight hours to the incubation facility where mating and fertilization occur. Transit time from satellites to the CIRF will be 2.0 to 2.5 hours. Delayed fertilization has been successfully performed as long as 20 -26 hours post-spawning **(Connor** 1990, personal communication).

This method usually results in more than 90 percent survival to eye-up and often achieves survivals in excess of 95%.

Rearing

Water **quality** at satellite sites currently sustains both resident salmonids and anadromous salmonids. **Water** chemistry has not been examined to determine the exact chemical composition. Ground waters at Cherry Dane have been repeatedly examined to insure chemical quality (Support Document 6.00, Sections 6.19 through 6.21).

Flow: All-rearing facilities have been developed to have a minimum. flow which causes the water in the rearing container to be exchanged at least once per hour.- Opportunity exists to achieve periodic exchanges of as great as four times per hour. This is not needed forrearing at the densities prescribed, but it would be useful for conditioning smolts and presmolts prior to release.

Density: Two Density Index(es) (DI), defined as pounds per cubic foot per inch of body length (lbs/ft^3/in), have been selected.,

For fish under 2.5 inches, the maximum DI will be 0.3 lbs/ft^3/in. For fish longer than 2.5 inches, the maximum DI will be 0.1 lbs/ft^3/in regardless of the container type.

Growth an-ease:. Fry from incubators will be ponded when Yolk Sack Remaining (YSR) is 5% to 7% of total, body weight; chinook fry should be approximately 1.1 to 1.2 inches in length (28 to 30 mm.) Pry rearing to fingerling size 2 to 3 inches will occur in ponds at the Cherry Lane CIRF.:

Fingerlings will be moved to satellites for final rearing and release; size change being from 2 to approximately 3 inches- or 400 to 25 to the pound.

Presmolts will be released in the fall of the year. At present it appears that declining temperature will probably guide releases. Natural fish are currently showing migration patterns as water temperatures drop from 15 to 7 °C and from 7 to 4 °C (Kiefer 1991).

Fall chinook Age-0 smolts, 3 to 3.5 inches at 60 to 70/lb will be released between 15 May and 1 June of each year. Sprfng chinook Age-l+ smolts will be acclimated from 14 to 28 days and released on approximately 15 April-to 1 May each year. Out migration will. be monitored to determine survival in relation to release timing.

Food: A variety of feeds is available for salmon production. The author's experience has been primarily with-the Oregon Moist Pellet and Bio-Diet. The advantage of Bio-Diet for NPTH satellite facilities is that is- can be stored without having to maihtain a freezer. The feed of choice should be the diet that produces fish that survive to adults.

Transportation

Chapter 6, Compendium of Low-Cost Pacific Salmon and Steelhead Trout Production Facilities and Practices in the Pacific Northwest (Senn et al. 1984) describes the basic guidelines for fish transportation. Other document& also describe methods for transporting fish under various conditions ((Piper et al. 1982, McNeil and Bailey 1975; Leitritz
Gamete (sperm and egg) transportation are described in previous sections in thie'document.

In transporting fry, fingerlings, presmolts, and adults, NPTH staff will follow guidelines and'best management practices previously documented.

Releases of fish into natural environment will -be staged arid timed to promote survival with respect to each life stage; fry, presmolt, or adult. Timed-release fed-fry will be distributed throughout habitats rather than massive dumps at single points. Presmolt releases will be evaluated to compare: volitional, distributed and forced releases with respect to photo period and water temperatures. Adults transported into habitat which they are not able to reach above barriers will be randomly distributed in habitat typed as suitable for spawning.

Broodstock Development from Natural Populations

Introduction

NPTH production involves managing:

1. an existing natural population, called Natural Production Management

2. the re-introduction of a population into unused habitat, called-Restored Production Management

The operation of both methods is quite similar.

Natural Produotion Management

NPTH supplementation activities in watersheds with existing natural populations of chinook salmon pose a question of how to protect the natural population while using existing natural fish for hatchery broodstock. This is the case in the Lolo Creek watershed.'

In these'cages, **conservation supplementation** will be used, **This** form of supplementation means that, rather than take a majority of the natural run for broodstock, NPTH management will control hatchery recruitment of natural broodstock.

In watersheds where natural **populations** of chinook salmon are present and sufficiently large (greater than 10 pairs of adults), the goal is to supplement the population using a portion of the natural population as hatchery broodstock. **Lolo** Creek and **Newsome** Creek have resident populations of **naturally spawning** chinook (Table 1.61) that meet these criteria.

The goal is to build natural production to a level where it comprises at least **50%** of **the spawning** population and does not allow hatchery **production** to out-compete natural production in **terms of carrying** capacity and genetic modification of the overall population.

Determination of hatchery versus natural production for the **Lolo** Creek watershed is based on an estimate of the natural run in Lo10 Creek of approximately 80 fish (Table 1.61).

Table **1.61.** Estimate of natural production **based** on **redd** counts for **Lolo and Newsome Creeks** used to estimate broodstock for NPTH to be taken from natural production.

STREAM:	YEAR:'	**NUMBER REDDS OBSERVED:**	**ESTIMATE** OF **NATURAL POPULATION: A/**
Lolo Creek	**1990**	**27**	79.78 (IDFG)
n n	1989	i o	59.10 (IDFG)
" "	**1988**	**31**	91.60 **(IDFG)**
" n	**1987**	**31**	91.60 (IDFG)
Newsome Creek:	**1983-** 87	**7**	**20.68 (CSBP)**
" "	**1974-78**	**12**	**35.46 (CSBP)**

A/ Number of redds counted divided by percent of total spawning area monitored divided by probability of observing total number of redds times 2.4 fish per redd divided by prespawning survival factor of 0.95.

The number of hatchery broodstock **("X")** to be taken from the natural population while maintaining a ratio of 50% natural fish in the resulting spawning population is determined by the following process:

$$X \times \frac{R_H}{S_H} = (100-X) \times \frac{R_N}{S_N}$$

Where **"X"** is the unknown portion of hatchery broodstock to be selected from the natural population, N = 80 fish in the natural population.

The value of **"X"** representing the hatchery broodstock taken from the natural population in this example has a range **of 32.88** to 48.48 percent of the'natural population. The range is a function of the variation in the survival of each life stage within the natural population.

In reality, while the survival for hatchery life stages appear to be precise, they too are subject to variation that can affect selection of the broodstock from a natural population; For the time being, they are 'the best values available and will be subject to change with monitoring and evaluation.

- recruitment to spawner transfer. coefficients
- natural transfer coefficient

The values for the hatchery and natural recruitment per spawner ratios (R_H/S_H and R_N/S_N, respectively) in the above equation are derived in Table 1.62.

The solutions for the first generation **broodstock's "X"** in the equation range from 32.88 to 48.48 percent; i.e., from **0.3288*N** to **0.4848*N** of natural-origin'returns will be **used for** hatchery broodstock in the first generation, the remainder contributing to the natural-spawning broodstock. The range in **"X"** is a function of the variation in the survival of each life stage within the natural population.

While the survival parameter values presented in Table 1.62 for hatchery life stages are treated as known values in this discussion, they are actually subject to variation that can affect the actual number of hatchery broodstock selected from a natural population. However, for the time being, these are the best values available and will be subject to change with monitoring and evaluation.

Table 1.62. Survival parameters used to develop the recruitment per spawner ratios for 40th natural and hatchery fish in the supplementation of a an existing natural population while using the 50/50 rule for genetic integrity.

SURVIVAL FACTORS:	Recruits per Spawner	
	Natural	Hatchery
Prespawning Survival	0.9	0.85
Eggs per Spawner	2000	2000
Egg to Fry Survival	0.2923 - 0.4 A/	0.72
Fry to Presmolt Survival	0.60 - 0.72 A/	0.9
Presmolt Post Release Survival	n/a B/	0.5
Presmolt to Smolt Survival	0.72 C/	0.72 C/
Smolt to Adult Survival	0.0044	0.0044
RECRUITS per SPAWNER (R/S) at low winter rearing density:	1.000 - 1.642	1.745

A/ Egg to presmolt survival for natural fish is anticipated to vary depending upon a variety of habitat conditions.

B/ Presmolt post-release survival affects only hatchery reared fish; the value is taken from hatchery smolt release survivals from Dworshak Hatchery to Lower Granite Dam.

C/ Presmolt to smolt survival is assumed to be the same for hatchery fish (after post-r&& mortality) and natural fish. This survival is assumed to vary with the population density. The recruit per spawner ratios in the table assume low densities. Note that the relative R/S ratios of hatchery fish to natural fish is not affected by this assumption.

The hatchery recruitment (R_H) per hatchery spawner (S_L) ratio R_H/S_H as derived from survival parameters estimates in Table 1.62 is:

$$\frac{R_H}{S_H} = 1.745$$

The natural transfer coefficient R_N/S_N with natural recruitment (R_N) and spawners recruitment (S_N) are derived from survival parameters estimates in Table 1.62 is as follows:

$$\frac{R_N}{S_N} = 1.000 - 1.642$$

The following is the estimated range in the relative R/S ratios of hatchery natural fish in the Lo10 Creek watershed:

$$\frac{\frac{R_H}{S_H}}{\frac{R_N}{S_N}} = 1.063 - 1.745$$

The preceding equation demonstrates **the** relationship between supplemented recruitment **(R_H)** and spawners **(S_H)** and natural **recruitment (R_N)** and spawners (S,) in the Lo10 Creek watershed.

Hatchery supplementation is anticipated to survive 1.063 to 1.745 times better than natural production. This ratio is valid assuming that the natural spawner to recruitment ratio is **1:1** and the survival parameters in Table 1.62 are valid.

Table 1.63 demonstrates the restoration process predicted for the Lo10 Creek natural population through conservation supplementation given a hatchery and natural spawner/recruitment ratios range of **1.063:1** and **1.745:1.**

Table 1.63 demonstrates roughly the rebuilding schedule that would be predicted for the Lo10 Creek natural population through conservation supplementation if the hatchery to natural spawner/recruitment ratio is in the range of **1.063:1** to **1.745:1.**

Numbers of natural broodstock available within the watershed will be a major constraint to this **or** any other type of supplementation. The key is to remember that the restoration process appears to take at least four generations to show progress in terms of generating a harvestable surplus (Table 1.63).

Table 1.63. Natural production restoration using a controlled ratio of hatchery broodstock recruitment from the anticipated Lolo Creek natural run while adhering to the- 50/50 rule for genetic management4

YEAR:	TOTAL RETURN:	BROODSTOCK: Hatchery	Natural	HARVEST:
1 (1993)	80.00	26	54	0
6 (1998)	99 - 134	45	54 - 89	0
11 (2003)	167 - 224	78	89 - 146	0
16 (2008)	282 - 375	136	146 - 239	20
21 (2015)	476 - 629	237	239 - 392	51 - 222
26 (2020)	805 - 1056	413	392 - 643	215 - 640
31 (2025)	1363 - 1776	720	643 - 1056	495 - 1360

Genetic Risk Assessment (GRA) and conservation is also a concern and an uncertainty. At present, the numbers of many natural populations are depressed which limits broodstock availability. With broodstock limitations, maintenance of the genetic base of a natural population is a major concern.

The NPTH model provides a method to select the proportion of natural broodstock usurped by a hatchery given the survival:' parameters determined for the subbasin.

Survival parameters that could have a major effect on NPTH operations are:

- o hatchery presmolt post-release survival (S_{pr})
- o hatchery and natural smolt-to-adult survival ($S_,$)

These and other survival'parameters *are* shown in Table I-l, Chapter 1.

All survival parameters 'for either natural or hatchery production are only estimates and are subject to changes in watershed management (e.g., logging, mining, road construction, fish passage survival, etc.). Recent Subbasin Basin Plans, Integrated System Plans, and Endangered Species Act activities are anticipated to'provide better overall resource management that will sustain or increase the survival parameters.

NPTH presmolt post-release survival (S_{pr}) is the same as smolt survival from Dworshak Hatchery to Lower Granite Dam, approximately 50%. S_{pr} is used to anticipate the worst survival response from rearing and releasing presmolts into natural waters.

NPTH staff anticipates that post-release survival can be increased by:

- o lowering density
- o providing higher water exchange rates in ponds
- o conditioning fish to adapt to the natural environment (e.g., shade, velocity, in-stream structures, predator avoidance, release timing, eto.

Stream water quality and habitat also are expected to influence survival of hatchery presmolts.

Smolt-to-adult survival(S_{sa}) for presmolts is anticipated to be equal to that of natural smolts while within the subbasin. Hatchery presmolts over-wintered in the stream are expected to be conditioned to survive in equal numbers as natural fish. Provided that hatchery and natural smolts are equal in condition, then smolt-to-adult survival is- expected to be equal throughout the remainder of the life cycle.

NPTH production of presmolts is modeled to consider carrying capacity and to prevent hatchery fish from having a negative interaction with natural fish through release methods and release timing. If density-dependent mortality does not exceed the carrying capacity of the watershed, then some positive survival traits may be learned by hatchery presmolts from natural presmolts.

Restored Production Management

In the case where the population is being re-established (restored), the concern is to generate new natural production.

In a conservation supplementation mode for restoration, the goal is to establish a natural spawning population using the 50/50 rule (e.g., **Meadow** Creek, **Selway River).** A **harvest** supplementation mode may manage for some lesser level of natural production; e.g., less than **50% in Slate Creek,** Salmon River) where harvest supplementation would reduce the natural production.

The harvest supplementation mode would require a selective harvest if the **50/50 rule** were to **be maintained:**

> Differentially marked acclimated **smolts would be** released and the returning adults would selectively harvested to the desired hatchery and natural **production ratio of 50/50.**

APPENDIX 2.00

NPTH SITE SELECTION PROCESS

Introduction

This appendix discusses how and why the sites for the Central Incubation and Rearing Facility (CIRF) and how its associated satellite facilities were chosen.

The Nez Perce Tribal Hatchery (NPTH) study team has worked since September 1987 to develop a water quality and quantity data base to support and predict salmonid production. Water temperatures and flows have been monitored since August, 1989 (Support Document 6.00) to refine site selection as aspects of production were developed through the Subbasin Plan, Integrated System Planning and NPTH Production Modeling.

Water resources for two types of hatchery sites have been developed:

- a Central Incubation and Rearing Facility (CIRF) to incubate eggs and rear fry on disease free ground water
- satellite production sites to rear and release juveniles into natural habitat using stream surface flow]

In 1987, Larson and Jose reviewed previous efforts to develop the NPTH (Halfmoon 1980, Koch et al 1980, Martinson 1980, Johnson 1982, Taylor and Hill 1984) and then conducted a water resource survey of the Nez Perce Reservation and its surrounding Ceded Territory (Larson and Jose 1988).

The report by Larson and Jose recommended developing:

- a CIRF using pathogen-free ground water with a flow of at least 3.0 cubic feet per second (cfs) (1350 gallons per minute) to incubate eggs and rear fry
- satellite facilities where ambient temperatures and natural stream flow would support anadromous salmonid production

Central Incubation and Rearing Facility

In 1988, geohydrologist, E.G.Crosthwaite and geophysicist, K.F. Sprenke reviewed regional hydrological and geological data and recommended geophysical evaluation of 13 sites for a CIRF.

This work **identified potential** ground water sources at eleven of the thirteen **sites (Sprenke 1988).** After consulting with Crosthwaite, the Net **Perce Tribal Council** selected five sites for exploratory drilling. Tribal council review eliminated the cultural conflict that was described in the 1984 **CH2M** HILL report and directed the project to follow the *gravel-to-gravel*@ management position of the **Nez** Perce Tribe (NPT).,

In 1989, E.G. **Crosthwaite's** report **identified** three potential CIRF sites, based on drilling and pump-testing for ground water. The site at Cherry Lane had the greatest potential for providing the minimum 3.0 cfs of water without conflict with domestic or commercial wells. Since then, extensive geophysical and hydrologic tests have been conducted at Cherry Lane to determine the suitability of this ground water source to supply the quantity and quality of water needed and recommended by Larson and José (1988) for a CIRF.

In 1990 and 1991 consultants Senn and **Mack surveyed the** Cherry Lane site and provided conceptual designs, cost **estimates,** and schematics of how the facility would function. These detailed documents are found in Support Documents 3.00 and **4.00.**

In August 1991, a ninety day pump test will be concluded at the site. Present results of this test as found in Support Document 6.30 confirm that the aquifer is capable **of** continued production. of at least 3.0 cfs with a potential of 'producing up to 10.0 to 11.0 cfs as it is continuously **recharged by** the Clearwater River (Ralston and Sprenke 1992).

To confirm water quality for fish rearing, the chemistry has been tested **extensively** to verify **its suitability** for **salmonid** aquiculture and **a 60 day** bioassay **using spring chinook** fry was conducted to verify that fish could-be **reared** using the Cherry Lane ground water source (Support Document 6.00).

Satellite Facility Development

Selection of NPTH satellite sites was based on three principles:

- history or presence of anadromous salmonids, primarily salmon

- habitat and passage restoration projects completed or actively pursued in the watershed

- o water quality (primarily temperature) and water quantity sufficient to support satellite production without hampering natural production of anadromous or resident species

The absence of commercial support facilities, such as electricity and potable water, did not determine site selection; seasonal access to sites and stream gradient and **site size** were the initial criteria used to select sites. Later water temperature and flow data determined the final selection of each site.

Biological support for fisheries production were the criteria used in evaluating sites. These criteria included:

- o gravity flow of water
- o water quality and'quantity
- o physical space for-juvenile production and adult capture, holding, and spawning

In addition to exploration and monitoring, the recommendations about where to site satellite facilities were based on:

- o consultations
- o NPTH Production Modeling

In 1988 and 1989, Larson and Jose, assisted by consultants Harry Senn and John **Mack,** explored potential satellite sites on streams recommended by biologists from the Idaho Department of Fish and Game (IDFG) and U.S. Forest Service (USFS).

Senn and **Mack** completed the satellite surveys in 1990 and 1991. The drawings and cost estimates that were developed for each site are found in Support Documents '3.00 and 4.00. These documents provide the information from which the cost summary found Appendix 3.00. and Chapter I were developed.

<u>**Mainstem** Clearwater River</u>

Lo10 **Creek** Watershed

Facility and site recommendations for the **Lolo** Creek watershed are:

1. **Yoosa/Camp/Lolo** Creek juvenile production and adult holding/spawning facility

2. **Snow/Eldorado/Lolo** Creek juvenile production site
3. Bradford **Bridge/Lolo** Creek adult trap and haul site

4. lower **Eldorado/Lolo** Creek adult trap and haul site

5. mouth of Lo10 Creek/Clearwater River permanent adult and juvenile monitoring facility

An alternate program to be considered would be relocation of the Snow/Eldorado/Lolo Creek juvenile production and adult holding sites farther upstream to obtain cooler water -to hold Eldorado Creek adults in that watershed. Figures 2.11, 2.12 and 2.13 demonstrate the high summer water conditions. Temperature in hours greater than 16 °C per day are shown in figures 2.11 and 2.12. Figure 2.13 compares Piper's (1982) temperatures for spawning with temperatures in lower Eldorado Creek in 1991. Numbers of juveniles and adult broodstock and estimated costs are shown in Table-I-2 in Chapter 1.

For future expansion, an alternate juvenile production site has been selected on Musselshell Creek near the USFS work center. Development of this site is conditional upon habitat quality being improved and maintained.

The NPT Fisheries staff and USFS personnel identified more than sixteen sites in the, Lolo Creek watershed:

- two on Mussellshell/Lolo Creek
- seven on Lolo/Yoosa/Camp Creeks
- seven on Eldorado/Lolo Creek

Consultation with USFS personnel and review by consultants Senn and Mack refined the site selections based on production estimates originally developed during Subbasin Planning to:

- two sites on Lolo/Yoosa/Camp Creeks (Yoosa/Camp Creek site and upper Lolo Creek site)
- two sites on Eldorado/Lolo Creek (lower Eldorado Creek and, Snow/Eldorado Creek site

South Fork Clearwater River Tributaries

Meadow Creek

Facility and site recommendations for the Meadow Creek watershed are:

1. Age-f+ smolt acclimation and release facility at Camp 58 site
2. Seasonal monitoring of adults and juveniles at the stream mouth

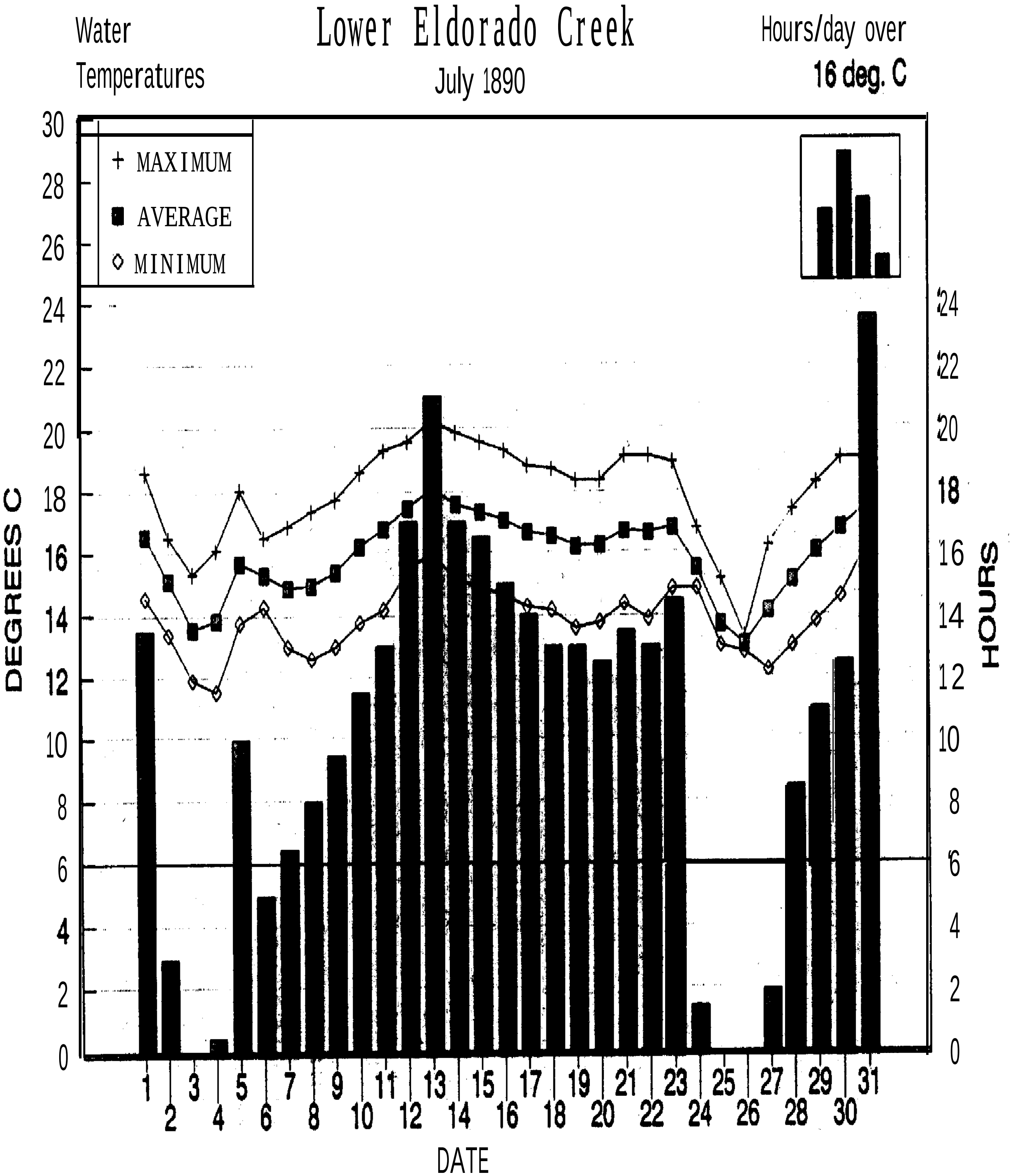


Figure 2.11. Graph of water temperature and hours in excess of 16 °C per day in lower Eldorado Creek in July 1990.

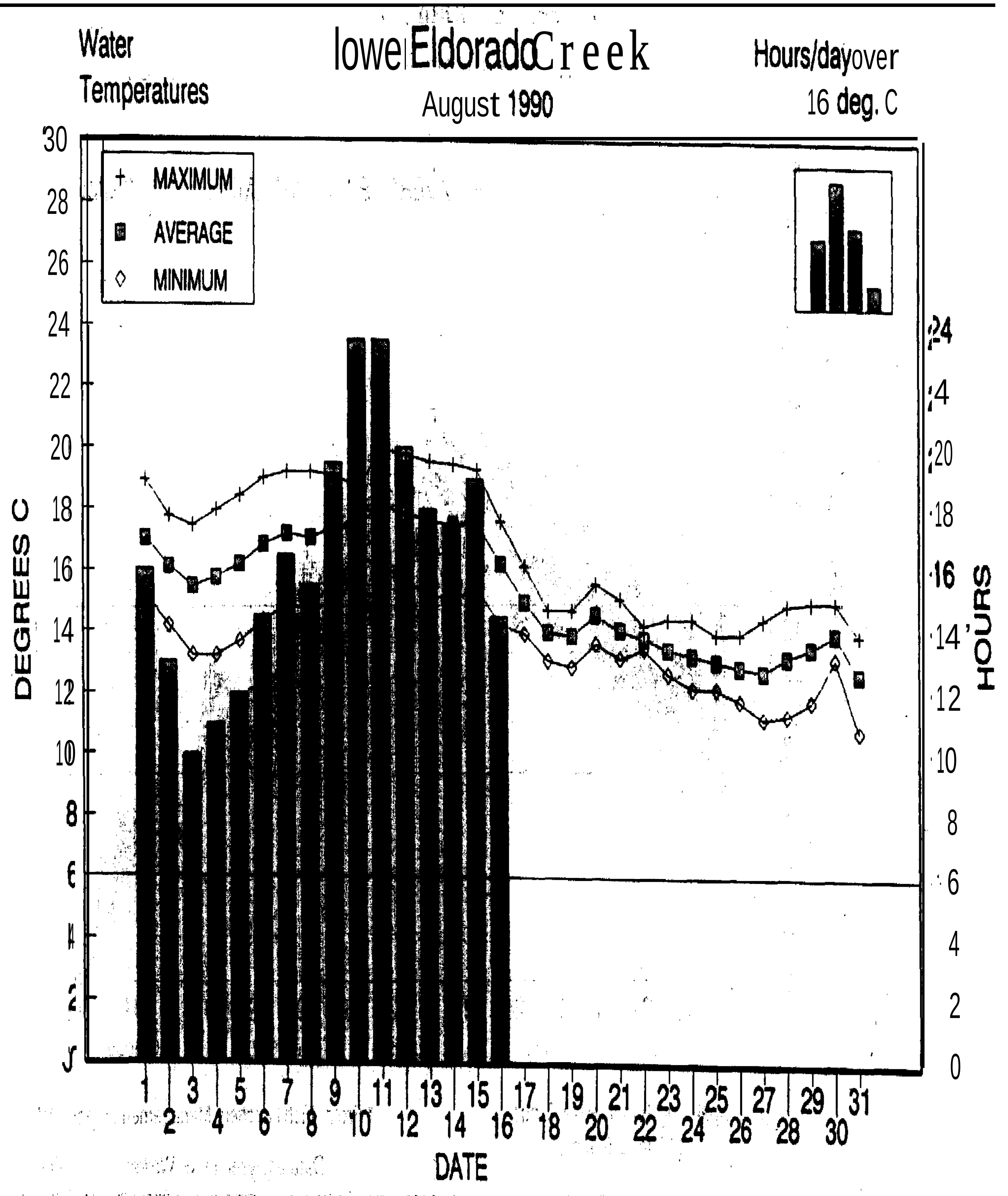


Figure 2.12. Graph of water temperature and hours in excess of 16 °C per day in lower Eldorado Creek in August 1990.

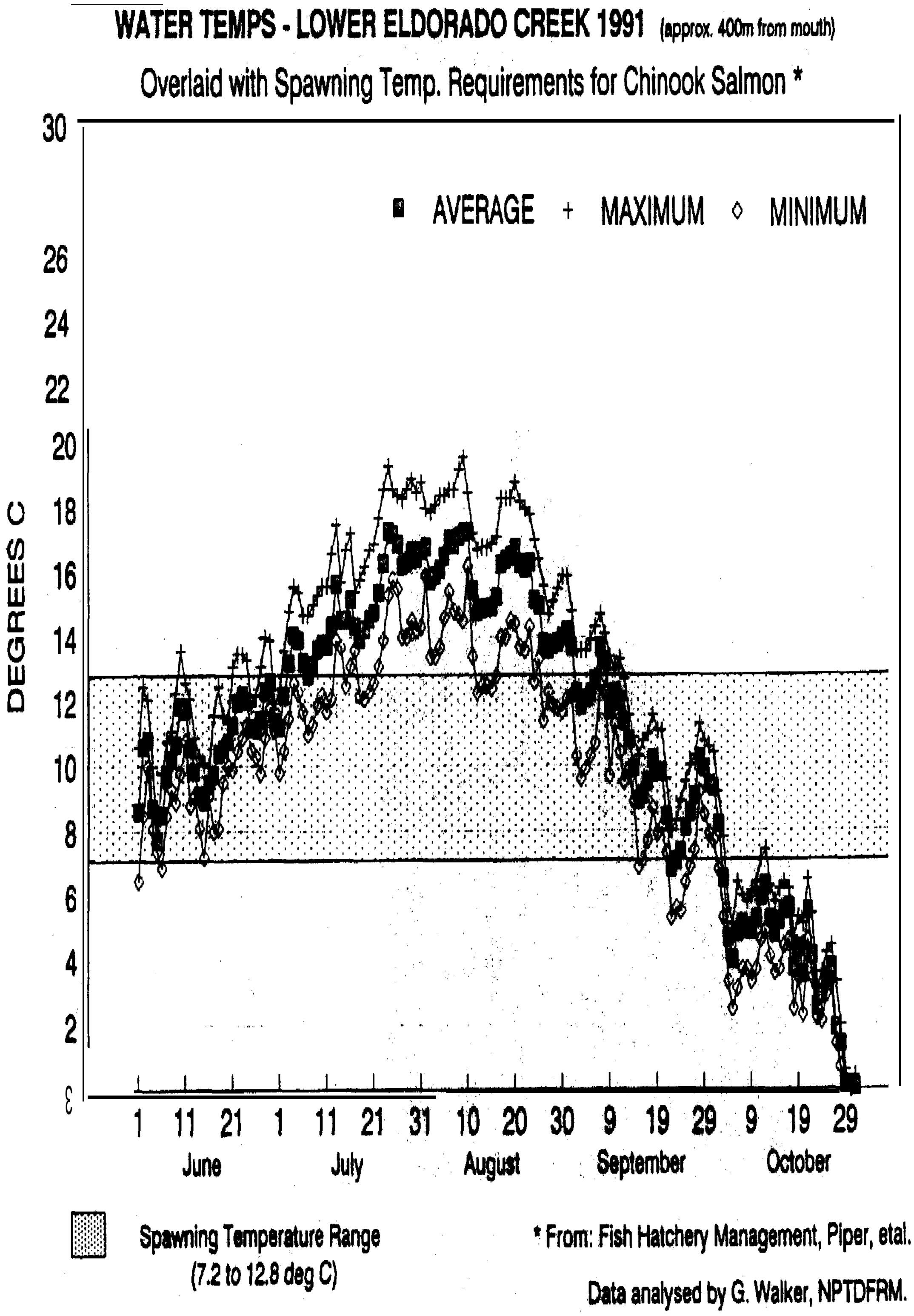


Figure 2.13. Graph of water temperatures in lower Eldorado Creek compared to Piper's (1982) spawning temperature range for chinook salmon during the summer of 1991.

Initial investigation identified three potential juvenile rearing sites:

- Camp 58
- Space Creek
- 'upper Meadow Creek
- an adult and juvenile monitoring site near the mouth of Meadow Creek upstream of the Highway 14 bridge

Water temperatures in Meadow Creek are not conducive to natural production due to lack of riparian habitat in the McComas Meadow portion of the stream. Until habitat is restored and summer water temperatures are reduced to acceptable levels, a long-term investment in'natural production is not recommended; The USFS is working to negotiate land ownership exchange. This would be followed by habitat restoration and water quality improvements.

Mill Creek

Facility and site recommendations for the Mill Creek watershed. are:

1. Juvenile rearing and adult holding facility -located approximately 0.75 miles upstream from the mouth.

2. Seasonal adult and juvenile monitoring facility near the stream mouth.

Initial investigation identified two potential juvenile rearing/adult holding sites between 0.5 and 1.0 miles upstream from the stream mouth. One of these sites was selected,- A : seasonal adult and juvenile monitoring site also should be developed'near the mouth of Mill Creek.

Newsome Creek

Facility and site recommendations for the Newsome Creek watershed are:

1. Juvenile rearing and adult holding facility located either downstream or upstream of the confluence of Beaver and Newsome Creek

2. Seasonal adult and juvenile monitoring facility upstream of the Highway 14 bridge at the mouth of Newsome Creek

Initial investigation identified two potential juvenile rearing/adult holding sites near the confluence of Beaver and Newsome Creeks.

salmon **River: lower mainstem**

Slate Creek

Facility and site recommendations for the Slate Creek watershed are:

1. Juvenile rearing and adult trap and haul at Hurley Creek

2. Juvenile rearing and adult holding at Dead Horse/Little Slate Creek

3. Seasonal monitoring of juvenile out-migration at Hurley Creek

An alternate monitoring site at or near the mouth of Slate Creek should be investigated and, if possible, developed for both adults and juveniles. This action will require development on private lands which has not been investigated as yet. This facility would replace the adult trap and haul proposed at Hurley Creek site four miles up from the stream mouth and would provide a biological advantage to evaluating NPTH production and harvest. in the system.

Initial investigation identified five potential juvenile rearing and two adult holding sites on Slate Creek:

- Hurley Creek
- Willow Creek
- Lee Creek
- confluence of upper Slate and Little Slate Creek .
- confluence of Dead Horse/Little Slate Creek confluence

Selwav River: above Selwav Falls

Meadow Creek

Facility and site recommendations for the Slate Creek watershed are:

1. Seasonal or semi-permanent monitoring facility for adults and juveniles at or near the stream mouth.

2. Temporary presmolt or Age-l+ smolt rearing, acclimation and release facility along the lower stream accessed by road.

The nature of the terrain and access to this stream limit the number of sites available for satellite facility development.

Approximately 98 percent or more of the watershed has no road access.

Production species for Meadow Creek/Selway River is, anticipated to be summer chinook in the lower stream and spring chinook in the upper basin: broodstock is expected to be limited for either species. Spring chinook for the upper basin will be released as Timed-Release Fed-Fry (TRFF).

If TRFF production were the only, type of supplementation, then only a monitoring facility would be needed at the mouth for juveniles and adults.

South Fork Clearwater River, near Stites, Idaho; Fall Chinook Production

Facility and site recommendations for fall chinook production are:

1. Complete the design for a fall chinook Age-0 rearing/acclimation/release facility at Luke's Gulch.'

2. A juvenile acclimation/release facility at Luke's Gulch (Smolts will be reared at Sweetwater Springs.).

The facility will mix the available ground water with . river water to rear fall chinook smolts on site and to later attract'adubts for broodstock capture. The ground water source will provide 300 to 450 gallons per minute (gpm) at 61°F (see "Hydrogeological Analysis of the Luke's Gulch Site", Ralston et al, 1992, Support -Document 6.31) which will be mixed with surface water from the South Fork Clearwater River. This will provide 50°F water for rearing and acclimation. The facility will be operated for up to. four months beginning as early as February and for a short time in the fall for adult capture.

Sweetwater Springs: Sweetwater/Lapwai Creek.

Facility and site recommendations for Sweetwater Springs watershed are:

1. Supplemental incubation site for either expansion or isolation purposes.

2. Smolt production for either/or Age-O fall chinook and Age-l+ spring chinook.'

3. Broodstock holding for fall chinook if they cannot be held at the South Fork Clearwater River satellite.

4. Future production of A-type steelhead

Sweetwater Springs is a constant 50°F (10 °C) and has a discharge of 2.0 cubic feet per second (cfs) or greater (Support Document 6.17).
A facility at this site could be operated on gravity flow and access to the site would not be prohibited by weather.

A facility developed at this site should be equipped to provide incubation as well as rearing. Such a facility could be developed and operational within three to nine months. Smolt rearing could be limited to single pass of water or multiple reuse for expansion of production which is limited by the volume of discharge, 2.0 cfs.

Mann Lake Canal Dam Satellite Site: Sweetwater/Lapwai Creek

The study team investigated an additional rearing facility approximately 1.5 miles downstream of Sweetwater Spring (Support Document 3.18 and 4.18). This is known as the Mann Lake Canal Dam satellite facility. Water temperature and flow data are shown in
Support Document 6.19.

It is difficult to reach this site, but it could be used to rear Age-l+ smolts. This is important because the opportunity for NPTH to economically produce Age-14 smolts is limited to sweetwater Springs and this site. Spring or summer chinook smolts could be reared here and "A-type" summer steelhead are particularly adapted to these waters (Kucera et al 1983, Cates 1981). NPT Fisheries staff and Lewiston Orchards Irrigation District staff saw adult steelhead ascending the falls at the diversion dam in 1990 and 1991.

APPENDIX XII

COST SUMMARY AND TIME LINE

Introduatioa

Cost summary (Table 3.01) was developed from conceptual designs provided by Harry Senn and John Mack for all sites with the exception of Sweetwater Springs and monitoring and evaluation sites (Appendix 4.00 from Master Plan Draft 1; September 1991, unpublished). The latter were estimated by Ed Larson, project leader for the Nez Perce Tribe; on the basis of his experiences. These cost estimates will be reviewed by an other consulting firm in 1992 and an updated version produced which will include all facilities.

Table 3.02 estimates future staffing and operations for Nez Perce Tribal Hatchery. NPTH covers a large geographic area and requires a much diffetent staff organization than a conventional hatchery. Seasonal staff for satellite operations comprises a majority of annual expenses: two persons are required to operate each facility 24 hours per day. At the satellites each person serves a.10 hour day for four days each week. Remoteness of the sites requires field foremen to check on the sites two times each week to assure successful operation, In addition to rearing fish technicians will participate in spawning ground survey, adult capture, 'spawning, habitat evaluation and monitoring and evaluation as well as seasonal maintenance and mobilization activities.

Figure 3.01 is an estimate of time for specific activities. The actual time for 'each action may change do to various factors;. e.g. NEPA or ESA processes.

Table 3.01 Cost summary for Nez Perce Tribal Hatchery Master Plan. Costs as anticipated from facilities planned from Support Document 4.00, February 1992 and NPTH92\BUDGET\O&MSLRYS. wk1 .

	PERSONNEL (K = $1,000)	CONSTRUCTION (KK = $1,000,000)	ANNUAL OPERATING (K = $1,000)	MAINTENANCE AND REPLACEMENT (K = $1,000)
NPTH HATCHERY - Permanent Personnel - Seasonal Personnel permanent benef i ts (33%) seasonal benefits (33%) - Administration (35%)	$817K ($213K) ($242K) ($70K) ($80K) ($212K)	$3.3KK CIRF $2.65KK Satellites $0.25KK Equipment: vehicles, fish tanks, fish trailer, computers, thermographs, etc.	$175K CIRF: utilities, supplies, fish food, vehicle, office, grounds, fish health, repair, services, etc. $50K Satellites: same as above.	$50K vehicles, computers, other equipment
MONITORING AND EVALUATION - Permanent Personnel - Seasonal Personnel Benefits(33%) Administration (35%)	$155 (60) (22) (33) (40)	$1.0KK Permanent Weirs (2) $0.2KK Mobile Traps (10) $0.05KK Equipment: vehicles, computers, stream survey equipment, etc.	$50K Office and field	$20K vehicles, traps, tags, computers, other equipment.
TOTAL ANNUAL PERSONNEL COSTS:	$972,000			
TOTAL CAPITAL CONSTRUCTION:		$7,425,000		
TOTAL ANNUAL UTILITIES AND OPERATING COST:			$275,000	
TOTAL REPAIRS AND REPLACEMENT:				$70,000
TOTAL ANNUAL OPERATION COST:	$1,317,000			

Table 3.02. Nez Perce Tribal Hatchery requirements for staff and salary budget.

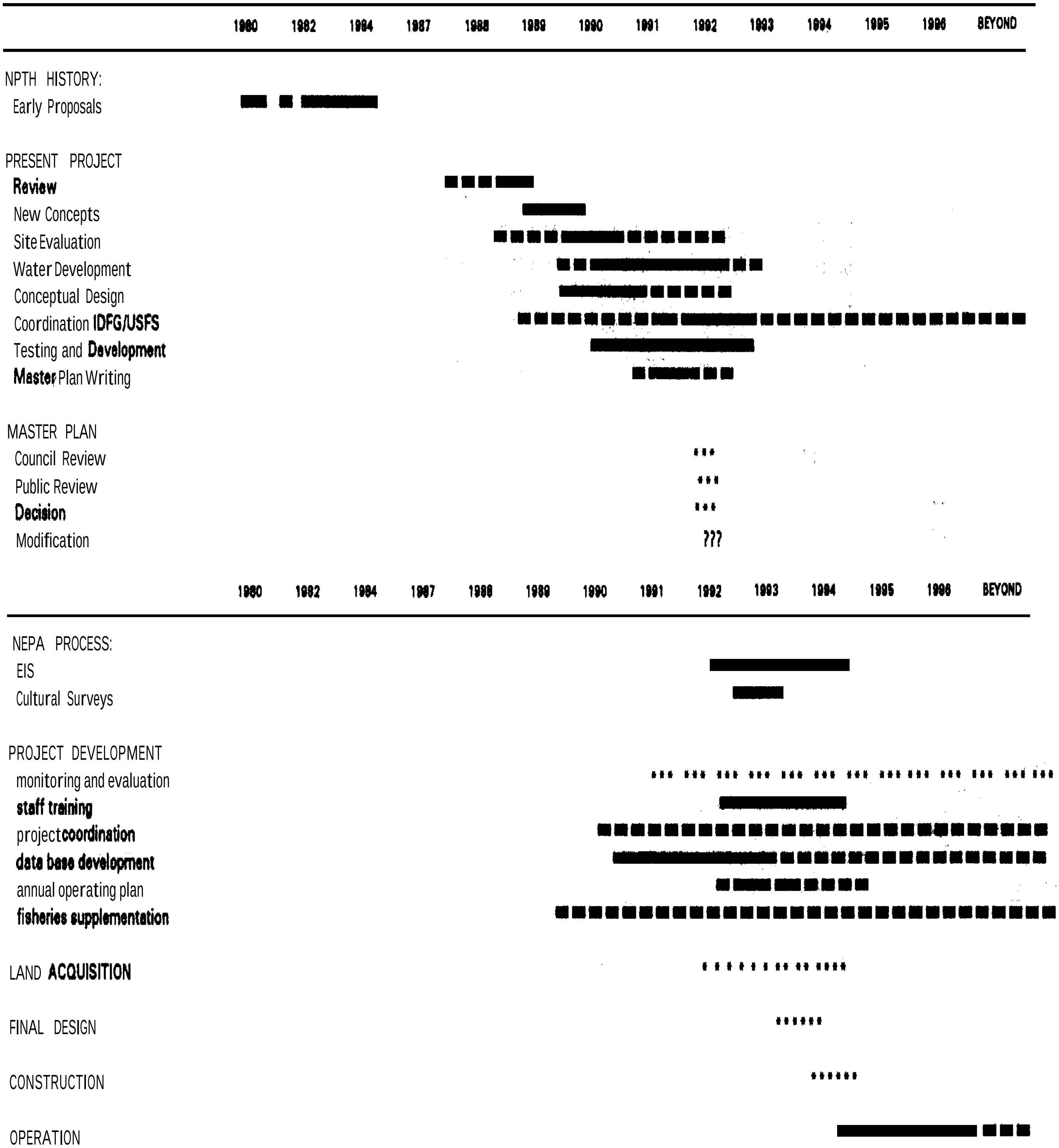
STAFFING REQUIREMENTS AND SALARY BUDGET - NEZ PERCE TRIBAL HATCHERY

POSITION:	Director Hatchery Operations $39,000	Hatchery Manager $34,000	Assistant Hatchery Manager $31,000	Satellite Operations Foremen $31,000	Hatchery Technicians $22,000	Satellite Technicians (part-time) $11,000	Satellite Technicians (full-time) $22,000	TOTALS
FACILITY:								
Cherrylane-CIRF	0.5	1	1		1	1	1	5.5
Sweetwater Springs-CIRF						2	1	3
Yoosa/Camp (upper Lolo)				0.2		2		2.2
Snow/Dollar (w. Eldorado)				0.2		2		2.2
Meadow + Mill (s.f. Clrwtr.)				0.2		2		2.2
Newsome Creek (s.f. Clrwtr.)				0.2		2		2.2
Slate + Little Slate				0.2		2		2.2
Meadow Creek + Fenn (Selway)				0.2		2		2.2
Stites/Lukes Gulch				0.2		2		2.2
N. Lapwai Valley				0.2		1		1.2
Mouth of Lolo Creek				0.2		2		2.2
Mann L. Headgate (Swtwtr Crk)				0.2		2		2.2
TOTAL POSITIONS:	0.5	1	1	2	1	22	2	29.5
	$19,500	$34,000	$31,000	111,000'	$22,000	$242,000	$44,000	$454,500

Fringe Benefits:	33%	$149,985
Admin. Costs:	35.1%	$212,174
OVERALL TOTAL:		$816,659

A:\NPTH92\BUDGET\O&MSLRYS.WK1
GWN, 2-19-92

Figure 3.01. Time Line for past and future events associated with Nez Perce Tribal Hatchery.



APPENDIX 4.00

ASSUMPTIONS AND THE MODEL

Introduction

Critical uncertainties can not be identified unless clear and specific objectives and strategies are stated. Chapter III, Objectives and Strategies presented., goals, objectives and strategies for each stream in terms of juvenile production and adult returns. This section describes the assumptions behind the objectives and strategies in Chapter III and Chapter IV, Monitoring and Evaluation.

Safe **Assumptions:** Those we have reasonable confidence in from local observations or from applicable literature. These assumptions generally concern parameters that are fairly certain or have little impact on the choice (or outcome) of strategy.

Critical Assumptions: Those we are uncertain about and that are critical to the choice of strategy, but can likely be resolved through experimentation.

Other Assumptions: Those that cannot be resolved through studies and may affect-the outcome significantly, and must be dealt with through risk containment monitoring.

To better understand the implications of uncertainties the NPTH study team developed a simple life cycle model (the Nez Perce Supplementation Model - NPSM) (Support Document 8.00, Nez Peree Supplementation Model). 'The NPSM computes adult production numbers on the basis of a sgt of assumed transfer coefficient? between the various life stages.

An effort was made to construct the model in such a way that the base parameters used in the Northwest Power Planning Council System Planning Model (SPM) would apply.; The SPM was judged inadequate for simulatinq presmolt supplementation strategies and was rejected (fgr this application) in favor of a n&spreadsheet model that has more detail in the production phase but simplifies the smolt-to-adult life stages to a single survival parameter. Nevertheless,, compatibility with the SPM is important because it allowed the NPTH study team to take advantage of the considerable progress achieved in the recently completed subbasin planning effort.

Table 4.01 shows the base parameter values used in the NPSM. Conclusions stated below about uncertainties are based mainly on modeling exercises 'using the NPSM.

Table 4.01. Parameter Values used in NPTH Planning. Production parameters; survival rates, production levels, fecundity, sex ratios, reproduction efficiency, broodstock sources (native/imported) used to determine satellite production for smolts, presmolts and timed-release fed-fry.

Parameters	Stream: Species:	Lolo Creek Clearwater R. (SC)	Slate Creek, Salmon R. (SC)	Newsome Creek SF Clearwater R. (SC)	Mill Creek, SF Clearwater R. (SC)	Meadow Creek, Selway R. (SC/SH)	SF Clearwater, Stites/Luke's Gulch (FC)	Meadow Creek, SF Clearwater R. (SC)
Carrying Capacity	summer winter	332,312 (1) 586,158 (2)	166,251 (1) 467,374 (2)	71,367 (1) 237,802 (2)	44,908 (1) 211,343 (2)	497,375 (1) 944,750 (2)	500,000 (7)	30,000 (8)
Pre-spawning Survival	hatchery: natural:	85% (3) 90% (6)	85% (3) 90% (6)	85% (3) 90% (6)	85% (3) 90% (6)	85% (3) 90% (6)	85% (3) 90% (6)	85% (3) 90% (6)
% Females (all Ages)	hatchery & natural	50% (6)	50% (6)	50% (6)	50% (6)	50% (6)	50% (6)	50% (6)
Eggs/Female (all ages)	hatchery & natural	4,000 (6)	4,000 (6)	4,000 (6)	4,000 (6)	5,000 (6)	4,315	4,000 (6)
Egg to Fry Survival	hatchery: natural:	72% (6) 40% (4)	72% (6) 40% (4)	72% (6) 40% (4)	72% (6) 40% (4)	72% (6) 40% (4)	85% 40%	72% (6) 40% (4)
Fry to Fall Presmolt Survival at low Dens.	hatchery: natural:	90% (6) 72% (4)	90% (6) 72% (4)	90% (6) 72% (4)	90% (6) 72% (4)	90% (6) 72% (4)	NA	90% (6) 72% (4)
Presmolt to Smolt Survival at low Density	hatchery & natural	72% (4)	72% (4)	72% (4)	72% (4)	72% (4)	95%	72% (4)
Post-release Survival *	hatchery	50% (3)	50% (3)	50% (3)	50% (3)	50% (3)	NA	50% (3)
Smolt to Adult Survival	hatchery & natural	0.44% (5)	0.44% (5)	0.44% (5)	0.44% (5)	0.44% (5)	0.25%	0.44% (5)
Natural Reproductive Efficiency	hatchery: natural:	80% (3) 100% (3)	80% (3) 100% (3)	80% (3) 100% (3)	80% (3) 100% (3)	80% (3) 100% (3)	80% UNKNOWN	80% (3) 100% (3)
% of Broodstock Imported	hatchery	0%	100%	0%	0%	0%	100%	100%

* Most critical uncertainty.

1. Standard method used in subbasin planning. 2. See Appendix I.
3. Salmon and Steelhead System Planning Documentation. Prepared by Monitoring and Evaluation Group, Northwest Power Planning Council.
4. System Planning assumed a 20.8% low density survival from egg to smolt. This rate used here is (.4x.72x.72=.207). Density dependent mortality is assumed (Beverton-Holt) for both fry to presmolt and presmolt to smolt.
5. System Planning assumed equal smolt to adult survival for natural and hatchery after a 50% post release loss for the latter.
6. Clearwater subbasin plan.
7. Age-0 smolts (age-0 migrants. 8. See Harvest Management.

Perhaps the key assumption of the NPSM is the form of the survival functions used to convert fry to presmolt (defined here as the juvenile stage entered in the fall) and presmolt to smolt.The NPSM assumes these survivals to be affected by the numbers of fish present (i.e., density-dependent mortality). The survival is presumed to increase with the quantity of habitat (expressed as summer or winter carrying capacity for fry and presmolt respectively) and with the quality of habitat (reflected in the low density survival rates). The SPM makes a similar assumption (Monitoring and Evaluation Group, 1989).

The main difference betweenthe SPM and, the NPSM is that the latter assumes two survival "bottlenecks" (summer and winter carrying capacity) in the juvenile rearing phase, whereas the SPM uses only one. All other transfer coefficients are simple, constant rates with definitions and in common with the SPM.

The supplementation strategies (detailed in Chapter III) prescribe the procedures for brood'stock selection, adult. holding, mating, incubation, rearing of fish *in* the hatchery, and release (time,, method,- location etc.). Modifications of these treatments may well be in order if fish behavioral, physiological, or genetic responses fail to meet expectations. These assumed responses are manifested in the parameter values in Table 4.01.

The effect of hatchery treatment on the transfer coefficients of out-planted fish and their offspring is a topic receiving attention by the Regional Assessment of Supplementation Project ((RASP), draft report expected August 1991). This subject is also covered by the Artificial Environment Team of the Yakima/Klickitat Fisheries Project, work plan in preparation.

The NPSM was used for two separate purposes. First, it was used to refine the-supplementation strategy, primarily by manipulating the numbers of fish planted and their source. In this modeling phase,' the presumed "best" available parameter values were always used (see Table 4.01). The purpose for this exercise was to find strategies that could (according to the model) achieve the stated objectives. The strategies proposed in Chapter III should achieve their objectives according to the model.

Uncertainty Analysis

Secondly, the model was used to-explore the sensitivity of the. strategy choice to several model assumptions. This was done by varying transfer coefficients and noting if the chosen strategy would meet the objectives. This constitutes part of the uncertainty analysis.

Those coefficients (model parameters) that significantly affected the outcomes of the chosen strategies were then examined from two perspectives:

1. Would the coefficients respond to or be sensitive to aspects of the supplementation treatment - might success of the project hinge on the ability to condition fish to some optimal migratory response?) and

2. Would the uncertainties about the coefficients lend themselves to experimental resolution (i.e., can changes in experimental response variables be measured with statistical power)?

Affirmative answers to these questions suggested experimental priority.

Other uncertainties, (i.e., those where experimentation [within NPTH] was judged unlikely to lead to successful resolution), also were identified. For example, smolt-to-adult survival (Ssa) is critical to project success (and to the choice of strategy). Nevertheless, because this survival is so low, the sample sizes of adult returns from experimental groups prohibit statistically powerful experiments. A frequently quoted rule of thumb for comparative survival studies is to plan experiments large enough so that a minimum of 35 adult recoveries is expected from each of three replicates per treatment group in order to detect a 50 percent difference in survival (DeLibero 1986).

Given the estimated survival rates for presmolt releases and realistic sampling rates of returning adults, this would require in excess of 200,000 marked presmolts per treatment. Since a minimum of two treatments are needed, the smallest justifiable experiment would require almost half a million marked juveniles. Releasing that'many fish to compete with natural populations, within any of the chosen tributaries 'does not seem wise. NPSM has shown that level of production would be defeated by density-dependent mortality as the presmolt releases exceed the stream carrying capacity. For this reason experiments are not proposed that rely on comparison of survival to adulthood.

The study team also recognizes that performance beyond the smolt stage is critically important. Indicators of population health and survival-must be identified and monitored. Such indicators should be less variable than molt-to-adult survival (see Lichatowich and Cramer, 1979). This type of routine risk containment monitoring should be efficient and moderate in cost. [NOTE: Risk containment monitoring is expected to be recommended by RASP.}, Population responses are emerging in the region as. standards for expressing supplementation objectives. They are described briefly in the next section. The objectives used in Chapter III are 'consistent.with these standards. They are discussed here in the context, of monitoring and evaluation to emphasize the potential relevance of NPTH discover&es to the region.

Population Responses

In postulating that the supplementation strategy will meet the objectives, the study team assumed that the population will respond in a certain way based on past experience. Since the team hopes to benefit from results reported elsewhere in the Basin, and vice versa, consistency in the definition of terms is important-(e.g., the "currency" or yardsticks whereby objectives are expressed and evaluated). The Scientific Review Group (SRG) called for clearly defined objectives in order to allow meaningful evaluation. RASP is also responding to this call.

Thus, population responses are'grouped into'four categories corresponding to four sets of yardsticks. They are:

1. Post-release survival, survival of outplanted fish to returning adults

2. Reproductive success of the supplemented populations

3. Long-term fitness of the supplemented population

4. Ecological interactions with other populations

Two central hypotheses of the NPTH supplementation efforts are:

1. Eggs brought to the hatchery for incubation, rearing, and then release an pre-smolts into a target stream will survive (to returning adult) at a rate greater 'than eggs deposited in the spawning grounds by natural spawners.

2. The mixture, of natural and hatchery fish will reproduce successfully without adverse genetic effects and that undesired 'interactions with other populations will not occur.

These hypotheses are discussed below and related to the four population responses. Also, specific variables used to express objectives are proposed - the "currency" whereby performance is valued.

Post-release **survival** (Spr) refers to the rate of survival of hatchery-reared fish from the point of release to their return to the **subbasin** as adults. One condition for successful supplementation is that **a** spawner that donates its eggs to the hatchery contributes more offspring (suwiving to adults) than a natural **spawner.**[2]

Thus, the survival of hatchery fish relative to natural fish must be evaluated. We know that fish while in the custody of the artificial environment, survive at a rate several times greater than the corresponding survival in nature. Nevertheless, after being liberated, the opposite is true. The survival of hatchery fish is typically between 10 percent and 50 percent of the natural rate.

A condition for success of the **NPTH** (derived from modeling) is:

> a 36 percent survival rate for outplanted fish from the time of their release as presmolts into the stream until they reach at Lower Granite Dam as smolts.

For comparison, the survival rate of natural fish during the same life stages is 72 percent.

Modeling results show that success is critical to this' relative survival rate. It is reasonable to assume that this post-release survival is **affected** by the supplementation treatment (i.e., by the manner in which fish are released, conditioned prior to release, and/or otherwise treated in the artificial environment).

Analyses using the NPSM suggest that, if the basic survival assumptions approximate natural survival, a necessary requirement for success (as measured along the post-release survival yardstick) is that the supplemented fish survive at least half as well as the naturally reproduced fish. The handicaps associated with artificial rearing are expected-to be most severe during the first months after release. If this is **true,** then experimental opportunities may indeed exist to evaluate post-release survival success for selected supplementation strategies.

We can identify some response variables (e.g., relative presmolt to out-migrant smolt survival) that can be measured with high precision and used to construct powerful experiments.

---

[2] This condition is not necessary in reintroduction cases, or in some cases where imported brood stock is used.

The proposed. experimental program is designed primarily to address the question of relative post-release survival in the juvenile stages.

Reproductive Success

For natural spawning to make its expected contribution toward production goals,, the supplemented population must be able to reproduce. Enough adults must return to the tributaries where they were released, mate, and produce viable offspring, Aspects of the supplementation treatment, including brood stock selection, may affect homing, reproductive behavior and site selection, etc.

Reproductive success in this context means that the introgressed populations produce surviving offspring. Successful reproduction is difficult to evaluate. The study team's analyses assumed that a first generation returning adult would produce at least 80 percent as many surviving offspring as a

naturally reproduced fish. Second generation supplementation fish (i.e., naturally produce4 fish whose parents were supplementation fish) were assumed equivalent to natural fish.. Powerful experiments to study reproductive success would be difficult to design within the NPTH program alone. As a component of a larger more global experiment, NPTH observations may be of value, Experiments of this kind are contemplated as a part of the -proposed Idaho Fish and Game supplementation study (Personal Communication, Ed Bowles 1991). The NPTH staff hopes to contribute to the value of this work and to benefit from its results.

Risk containment monitoring also will provide feedback on reproductive success. The feasible measurements include:

- proportions of supplementation origin fish found among returning adults
- the subsequent parr production index
- fecundity
- age at return
- sex ratios

Long-Term Fitness

Genetic consequences must be taken into consideration to assure that supplementation benefits can be sustained in the long term. The NPTH has adopted, the 50:50 Rule, which says, "that the spawning population must consist of at least 50 percent natural origin fish."

This guideline limits the level of supplementation (i.e., numbers of fish released), and may necessitate' selective harvest. While this provides no assurance of long-term fitness, it constrains potential genetic impacts. The Oregon Department of Fish and Wildlife (ODFW) has adopted a similar guideline for supplementation.

Long-term fitness of the supplemented population is a goal of the project, the defined objective of the NPTH is the 50:50 Rule (see also Chapter III). This objective will be measured.

It probably is not feasible for the NPTH project to 'resolve uncertainties about the effectiveness of the 50:50 Rule through designed experiments, Nevertheless, NPTH projects should be components of a broader regional study. Also, as was the case with reproductive success, 'risk containment monitoring will be used to evaluate and measure long-term fitness.

Genetics issues are discussed in more detail in 'Chapter II of this document. The NPTH program will continue to.follow regional initiatives by traoking progress of the Columbia Basin Monitoring and Evaluation Group in developing guidelines for genetics risk assessment and monitoring.

Ecological Interactions

Interactions may occur to varying degrees between the target species and other fish stocks sharing the habitat.

Interactions of supplementation fish with the target population is covered in the population dynamics model of the Nez Perce Supplementation Model (NPSM) and under reproductive success.

Experimental Design

Hypotheses and experimental protocols are being developed and will continue to be developed as treatments evolve.

These experiments will involve the release of marked lots of supplementation presmolts and trapping'and marking of wild presmolts for comparative survival studies.

Hypotheses under consideration include:

H_0: The proportion of presmolts present in an upper tributary in the fall, that leave the tributary before January, is the same for natural fish and supplementation fish.

H_0: Supplementation fish that-pass the monitoring station in a lower tributary before January, survive (to Lower Granite Dam) at the same rate as natural fish migrating before January.

H_0: Natural and supplementation spring migrants survive at the same rate to Lower Granite Dam.

Similar comparisons would be made between different supplementation treatment groups.

All marked groups would be replicated within the tributaries; These experiments will be repeated for a minimum of five years to account for between-year interaction effects. The numbers of test fish per group depends upon sampling efficiencies yet to be determined. We expect to be able to operate traps at or near tributary mouths that can interrogate between 50 and 100 percent of the outmigrants.

Sampling rates and biases at existing stations in the Salmon, Clearwater, and Snake Rivers are a concern that needs to be addressed.

APPENDIX 5.00

SUPPORT DOCUMENTS 3.00, 8.00. 7.00 AND 8.00

Introduction

Various support documents used to develop the Nez Perce Tribal Hatchery Master Plan are available. These documents were appendices to the Draft 1 of the Master Plan and contain detailed information about data collected over the previous three years; e.g. water temperatures and flow data at all facility sites and conceptual designs. These documents were considered to be of little interest to most readers and due to their bulk, they were not included as appendices.

Highlights from these documents are given on-subsequent pages. To get a copy of any of these documents, write or call:

Nez Perce Tribal Fisheries Resource Management
P.O. Box 365
Lapwai, Idaho 83540

(208) 843-2253

support **Document** 3.00

3.00: FACILITY CONCEPTUAL DESIGNS

These support documents contain drawings and descriptions of all **of** the proposed facilities for the **Nez Perce Tribal Hatchery (NPTH)** with the exception of **Sweetwater** Springs CIRF and monitoring facilities. These documents were **Appendix** 3.06 in Draft 1 of the Master Plan, September 1991.

Highlights

Ground water used at the Cherry Lane Central Incubation and Rearing Facility will be routed through sterilization, aeration, cooling, and distribution devices: The ground water is recharged by the Clear-water River. The volume **of water** allocated for use is 5.33 cubic feet per second (cfs) **[2250** gallons per minute]. The **total** volume. available is **11.00 cfs** (4950 gpm). Water efficient methods of **incubating** eggs will be used.

All stocks will be physically isolated to provide genetic integrity to prevent or control disease.

Multiple stock rearing will occur in a single set of raceways by controlling emergence with different **temperatures**

A potential rearing facility upstream of Mann Lake **Headgate** could be developed to rear Age **1+** smoltg.

Aluminum raceways could be more an economical choice in some locations.

No preliminary engineering cost estimates have been **made** of sny monitoring facilities.

Support boaument'6.00~

6.00: NPTH WATER SUPPLY DEVELOPMENT

These support documents contain the results of water development studies related to developing the proposed facilities for the Nez Perce Tribal Hatchery (NPTH). These documents were Appendix 6.00 in Draft 1 of the Master Plan, September 1991.

Highlights

Water Quantity: Central Incubation and Satellite Locations

Water development studies have focused on:

1. 'identifying at least 3.0 cubic feet per second (cfs) (1350 gallons per minute (gpm) of ground water at the Cherry Lane Central Incubation and Rearing Facility (CIRF). Eleven (11.0) cfs was identified.
2. testing the stability of the aquifer to produce that quantity of water over at least 50 years
3. identifying satellite facilities where temperature and flow (cfs) could support juvenile production and adult holding and spawning
4. bioassay using spring chinook fry and rearing them for 60 days and doing a complete health exam on these fish.

The importance of water temperature information is to determine:

1. mimic conditions for natural production
2. controlled incubation
3. release timing
4. programming production of presmolt growth
5. broodstock development and maintenance
6. health management practices

NPTH staff has set a goal of using no more than 33 percent of the minimum stream flow at satellite production ponds while achieving at least one complete water exchange per pond per hour.

Stream flow gauging is useful in determining:

1. if higher flows can be used to condition fish to swim in higher velocity by exchanging pond volumes up to four times an hour and/or lowering the pond level in addition to increasing flows

2. when to expect adverse silting conditions
3. arrival of adults
4. release of juveniles corresponding with emigration stimuli

water Chemistry

Ground water and stream water quality information developed to date shows that it is sufficient to support salmonid production.

Detailed water quality tests have been conducted at the proposed CIRF sites. All water quality parameters, except for nitrate-nitrogen, were within limits suggested by Fish Hatchery Management Manual, Piper,, et al 1982. This condition occurred at Cherry Lane wells.

Consultation with Mr. Piper about the elevated nitrate-nitrogen levels found in a well at Cherry Lane revealed it was "only an indication of pollution and not a level inhibiting salmonid production".

Support **Document** 7.00

7.00: RESOLUTIONS AND LETTERS OF SUPPORT

These support documents describe some of the formal and informal decision that have been made about the Nez Perce Tribal Hatchery **(NPTH).** These documents were Appendix 7.00 in Draft 1 of the Master Plan, September 1991.

Highlights

The Nez Perce Tribe adopted these resolutions:

1. In rebuilding the Columbia River Basin fish runs, the following species priority should apply:

    1. spring and summer chinook
    2. summer steelhead and fall chinook
    3. sockeye and **coho**

2. Develop cooperative strategies with the State of Idaho for the:

    - supply of **salmonid** eggs
    - rearing and outplanting of **salmonid** juveniles
    - recapture of **salmonid** adults for spawning purposes

The Idaho Department of Fish and Game (IDFG) expressed support for the concept of a NPTH.

A Memorandum of Agreement was signed in 24 January 1992 by IDFG and the Nez Perce Tribe. The two parties will meet at least twice per year to resolve issues and to explore ways to cooperatively work together.

Treaties between the United States and the Nez Perce Tribe provide the legal basis for fisheries management and production in the Nez Perce ceded territory.

Informal Decisions and Agreements made by Interested Parties

- Pursue building a NPTH rather than use the surplus capacity available at other fish culture facilities in the Clearwater River Basin.

- If the NPTH supplementation program does not increase survival from egg-to-adult, then brood fish should be left to spawn and rear naturally or be diverted to a proven supplementation program.

Support Document 8.00

8.00: NEZ PERCE HATCHERY PRODUCTION MODEL

These support documents contain simulations of production levels and potential impacts of hatchery supplementation. These documents were Appendix 8.00 in Draft 1 of the Master Plan, September 1991.

Eleven tables show how the Nez Perce Tribal Hatchery (NPTH) production model applies to NPTH spring chinook production at the various satellite sites.

Highlights

The goals of the simulations are to select strategies that:

1. Maintain natural production at a level of at least 50 percent for the first generation of returning adults (F1)
2. Maintain genetic integrity/diversity of the stock(s).
3. Promote long-term fitness of the stock (i.e., the ability of returning adults regardless of their F1 origin, either hatchery or natural, to reproduce in the stream.
4. Achieve natural production and harvest objectives.
5. Facilitate future monitoring and evaluation programs.

Production was modeled using the survival parameters identified in Subbasin Planning and the Integrated System -Planning (Table I-l. The effects of these parameters on natural production were simulated through thirteen life,cycles.