
HATCHERY EVALUATION REPORT

**Lookingglass Hatchery - Spring Chinook (Grande
Ronde Stock)**

September 1996

Integrated Hatchery Operations Team (IHOT)

HATCHERY EVALUATION REPORT

Lookingglass Hatchery - Spring Chinook, Grande Ronde Stock

**An Independent Audit Based on Integrated Hatchery Operations Team
(IHOT) Performance Measures**

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CONTENTS

Section 1 Executive Summary	1-1
Section 2 Facility Description	2-1
Section 3 Compliance Status.....	3-1
Section 4 Remedial Actions	4-1
Section 5 Hatchery Contribution to Fisheries, Spawning Grounds and Hatcheries	5-1
Section 6 Annual Operating Expenditures	6-1

List of Tables

Table

1	Summary Program Information for Lookingglass Hatchery - Spring Chinook (Grande Ronde Stock)
2	Compliance with Performance Measures : Lookingglass Hatchery - Spring Chinook (Grande Ronde Stock)
3	Remedial Actions Required at Lookingglass Hatchery - Spring Chinook (Grande Ronde Stock)
4	Adult Contribution to Fisheries, Spawning Grounds and Hatcheries: Lookingglass Hatchery - Spring Chinook (Grande Ronde Stock)
5	Annual Operating Expenses Lookingglass Hatchery - Spring Chinook (Grande Ronde Stock)
6	Annual Operating Expenses - Lookingglass Hatchery

Executive Summary

This report presents the findings of the independent audit of the Lookingglass Hatchery - Spring Chinook (Grande Ronde Stock) program. The hatchery is located along Lookingglass Creek, a tributary of the Grande Ronde River, 2 miles from Palmer Junction in northeast Oregon. The hatchery is used for adult collection, incubation, and rearing of spring chinook salmon.

The audit was conducted in 1996-1997 as part of a 2-year effort that will include 67 hatcheries and satellite facilities located on the Columbia and Snake River system in Idaho, Oregon, and Washington. The hatchery operating agencies include the U.S Fish and Wildlife Service, Idaho Department of Fish and Game, Oregon Department of Fish and Wildlife, and Washington Department of Fish and Wildlife.

Background

The audit is being conducted as a requirement of the Northwest Power Planning Council (NPPC) "Strategy for Salmon" and the Columbia River Basin Fish and Wildlife Program. Under the audit, the hatcheries are evaluated against policies and related performance measures developed by the Integrated Hatchery Operations Team (IHOT). IHOT is a multi-agency group established by the NPPC to direct the development of new basinwide standards for managing and operating fish hatcheries. The Bonneville Power Administration (BPA) contracted with Montgomery Watson to act as an independent contractor for the audit.

IHOT has established five basic policies that cover: (1) hatchery coordination, (2) hatchery performance standards, (3) fish health, (4) ecological interaction, and (5) genetics. The audit focuses on all these policies, with the exception of hatchery coordination. These policies are set forth in *Policies and Procedures for Columbia Basin Anadromous Salmonid Hatcheries (IHOT 1995)*. That document is the source for the performance measures that are the basis of this audit.

The Audit Process

The audit was based on the facility management's response to a 109-page questionnaire. This audit form was completed through a five-step process in which:

- Information was obtained from headquarters.
- The hatchery manager was asked to fill out and return the audit form.
- A 1-2 day site audit visit was conducted to inspect facilities, review hatchery records, discuss audit form responses, and develop remedial action plans.
- A compliance report was developed to document the compliance status of each performance measure. This report was then shared with the hatchery manager and IHOT representative.
- This hatchery evaluation report was written to document compliance with IHOT performance measures and develop cost estimates for remedial actions when needed.

Lookingglass Hatchery - Spring Chinook

(Grande Ronde Stock) Results

The Lookingglass facility includes one pond for adult holding, 32 Canadian troughs for early rearing, and 18 concrete raceways. The Imnaha Satellite Facility is operated as an adult collection and acclimation facility for the Imnaha Spring Chinook Stock. The hatchery was constructed in 1982 to mitigate for fish losses caused by construction of hydroelectric facilities on the lower Snake River.

The Lookingglass Hatchery was in general compliance with most of the performance measures. In the area of program objectives, the hatchery was not meeting its adult return goal. The audit found that the hatchery was not in compliance with the screen mesh opening criteria, adult holding facilities, temperature criteria, water quality monitoring criteria, and disease-free water criteria, which are all facilities requirements. If the current and captive broodstock program are continued, the hatchery will need more incubators, early rearing troughs, and outdoor raceways. The hatchery exceeds its loading for rearing and needs to develop specific standards for incubation and rearing for the IHOT operations plan. The hatchery was in compliance with all the genetics performance measures.

The specific areas in which the Lookingglass Hatchery - Spring Chinook (Grande Ronde Stock) program requires remedial actions based on the IHOT performance measures are listed below. These remedial actions are listed in alphabetical order without intent of ranking or otherwise assigning priority:

- Develop green-egg to eyed-egg survival goal
- Develop eyed-egg to fry survival goal
- Review temperature criteria for rearing; consider drilling additional wells
- Monitor DO and TGP
- Run analysis for chemistry parameters
- Run analysis for turbidity
- Run analysis for alkalinity and hardness
- Run analysis for nitrite
- Run analysis for contaminants
- Construct ozone system for influent and effluent disinfection (45 cfs)
- Check “other alarms” on a weekly basis
- Construct aeration system for adult holding
- Unclog smolt by-pass system
- Conduct IHOT feed QA/QC tests
- Develop specific incubation standards for IHOT
- Develop specific rearing and early rearing standards for IHOT
- Reduce loading of raceways
- Develop smoltification monitoring program and goals
- Follow IHOT transportation protocols

- Change traveling screens to 3/32"
- Construct 6 more raceways (needed if current and captive brood programs are retained)
- Install 11 additional Canadian troughs; enlarge building (needed if current and captive brood programs are retained)
- Install 288 additional tray incubator and replumb incubation piping (needed if current and captive brood programs are retained)
- Construct stripping tower to treat 2,000 gpm

Non-compliance issues resulting from items beyond human control or Performance Measures not relevant to this hatchery (Type 1 in Table 3, Section 4 of this report) were not listed above.

Facility Description

Name:	Lookingglass Hatchery
Stock/Species:	Spring Chinook, Grande Ronde Stock Spring Chinook, Imnaha Stock
Operating Agency:	Oregon Department of Fish & Wildlife
Funding Agency:	Lower Snake River Compensation Program
Location:	Along Lookingglass Creek, a tributary of the Grande Ronde River, 2 miles from Palmer Junction in northeast Oregon
Address:	Lookingglass Fish Hatchery 76657 Lookingglass Road Elgin, OR 97827
Hatchery Manager:	Mr. Robert Lund
Phone:	(541) 437-9723
Fax:	(541) 437-1919
Purpose:	Lookingglass Hatchery was constructed in 1982 as part of the Lower Snake River Compensation Program (LSRCP) - a program to mitigate for spring chinook and summer steelhead losses caused by the four federal dams constructed on the lower Snake River. Lookingglass is used to raise spring chinook for ocean and river fisheries.
Production Goal:	Chinook Salmon (Grande Ronde Stock) 900,000 smolts (48,335 lb) for on-station release Chinook Salmon (Imnaha Stock) 490,000 smolts (19,470 lb) for release from the Imnaha Acclimation pond
Water Supply:	Water rights for the hatchery total 38,782 gpm from Lookingglass Creek and wells. Water rights for Lookingglass Creek include 22,442 gpm for fish propagation an additional 13,462 for operation of a fishway.

Facilities:

Adult Holding:	1 concrete holding pond - 6400 cf
Incubation:	36 8-tray vertical stacks (252 trays useable)
Early Rearing:	32 Canadian troughs - 60 cf each
Raceways:	18 concrete raceways - 3,500 cf each
Rearing Ponds:	None
Satellite Facilities:	Imnaha Acclimation Pond (Gumboot Weir)

Compliance Status

The hatchery audits are based on compliance with written IHOT performance measures. These performance measures are documented in *Policies and Procedures for Columbia Basin Anadromous Salmonid Hatcheries* (referred to as *IHOT 1995* in this report).¹ The purpose of the performance measures is to implement new basinwide policies that provide regional guidelines for operating anadromous hatcheries in the Columbia Basin.

The audit focuses on performance measures for IHOT policies that cover (1) hatchery performance standards, (2) fish health, (3) ecological interaction, and (4) genetics. These performance measures are intended to guide hatchery operations once production is established. For that reason, the hatchery operations audit included broodstock collection, spawning, incubation of eggs, fish rearing and feeding, fish release, equipment maintenance and operations, and personnel training. Production priorities are beyond the scope of this audit.

Based on *IHOT 1995*, a detailed 109-page audit form was developed. The audit form divided the performance measures into six major sections along major program and technical criteria areas. Two additional sections (sections 1 and 8) include general information and expenditure information needed for this Hatchery Evaluation Report and blank forms for additional comments. The following is the structure of the IHOT audit form:

Section 1	Performance Measures for General Information and Expenditure Information (PMs General 1-2)
Section 2	Performance Measures for Program Objectives (PMs 1-4)
Section 3	Performance Measures for Facility Requirements (PMs 5-15)
Section 4	Performance Measures for Hatchery Practices (PMs 16-25)
Section 5	Performance Measures for Fish Health Policy (PMs 26-34)
Section 6	Performance Measures for Ecological Interactions (PMs 35-38)
Section 7	Performance Measures for Genetics Policy (PMs 39-43)
Section 8	Blank Forms for Additional Comments

Several performance measures are repeated in various sections of the audit form. These performance measures overlap in *IHOT 1995* and were retained to allow individuals interested in specific portions of the audit (such as Genetics or Fish Health) to determine the compliance status of all performance measures for a given topic in one location. A repeated performance measure is indicated by shaded text.

The Hatchery Audit Process

The hatchery audit will be conducted over a 2-year period that concludes in 1997. At each hatchery, a five-step process was used to complete the overall hatchery audit.

¹Integrated Hatchery Operations Team (IHOT) 1995. *Policies and Procedures for Columbia Basin Anadromous Salmonid Hatcheries*, Bonneville Power Administration, Portland, Oregon.

This process consisted of research and onsite visits. The site visit at the Lookingglass Hatchery was conducted on September 11, 1996.

The following is the five-step audit process:

1. Information was obtained from headquarters.
2. The hatchery manager was asked to fill out and return the **Audit Form**.
3. A 1-2 day site audit visit was conducted at each hatchery. During that visit an audit team inspected facilities, reviewed hatchery records, discussed audit form responses, and developed remedial action plans when appropriate.
4. During the site visit, the compliance status of each performance measure was discussed with the hatchery manager and IHOT representative. A portion of the Hatchery Evaluation Report was sent to the hatchery managers following the audit visit as a **Compliance Report**. That Compliance Report is Table 2 of this report.
5. The information from steps 1-4 was used to prepare a draft **Hatchery Evaluation Report**. This draft report was submitted to the operating agencies for review of the information used to determine compliance. Based on review and comments, a final Hatchery Evaluation Report was developed. The final report documents the compliance of a particular hatchery with the IHOT performance measures and presents cost estimates to correct any deficiencies.

Compliance Status of Lookingglass Hatchery - Spring Chinook (Grande Ronde Stock)

The following table includes information on life-stages that are held on this facility for some portion of their rearing cycle (Table 1). For multi-facility programs, summary cost and contribution data is presented at the facility where rearing occurs. For the compliance status relating to performance measures that do not occur at this hatchery, please refer to the Hatchery Evaluation Reports for the hatcheries and stocks listed in Table 1. A check mark (✓) indicates that the specific life-stage is held at this facility.

This section documents the compliance status of the Lookingglass Hatchery - Spring Chinook (Grande Ronde Stock) program. Each performance measure is presented in a table taken from the audit form (Table 2). The compliance status is identified by the following categories:

- **N/A** (not applicable)
- **Yes** (in compliance)
- **?** (unknown; generally due to unavailability of information to determine compliance)
- **No** (not in compliance).

Remedial actions are suggested for performance measures not in compliance. These remedial actions are grouped into categories and listed in Section 4 of this report, where the cost of the required remedial actions is also presented.

Table 1 Summary Program Information for Lookingglass Hatchery - Spring Chinook (Grande Ronde Stock)

Component	Location of Adult Holding, Spawning, Incubation, and Rearing					
	Lower Granite Dam	Lookingglass Hatchery				
Adult Collection	✓	✓				
Adult Holding		✓				
Spawning		✓				
Fertilization		✓				
Incubation		✓				
green-to-eyed		✓				
eyed-to-hatch		✓				
Rearing		✓				
fry		✓				
fingerlings		✓				
smolts		✓				
Acclimation/release		✓				

Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
	N/A	Yes	?	No		
the hatchery programs outlined in a subbasin management plan?		✓			Columbia Basin System Planning Production Plan, U.S. v Oregon, and LSRCP Annual Operation Plan	
<p>the hatchery operating under a current hatchery operational plan?</p> <p>Is it understood by staff?</p> <p>Is it being followed?</p>		<p>✓</p> <p>✓</p> <p>✓</p>			IHOT Operations Plan, Lookingglass Creek Fish Hatchery Operations and Maintenance Manual, and LSRCP Annual Operation Plan	
<p>hatchery monitoring and evaluation plan in place?</p> <p>Do you have a written monitoring and evaluation plan?</p>		<p>✓</p> <p>✓</p>			LSRCP Annual Operation Plan	
<p>hatchery contribution to fisheries, spawning grounds, and hatchery</p>		✓			Missing Production Groups Report	
<p>hatchery pre-spawning survival as compared with established goal</p>				✓	In compliance 4 out of last 5 years Reused males	Build aeration system for adult holding ponds.
<p>hatchery smolt take as compared with established hatchery goal</p>				✓	In compliance 1 out of last 4 years	Build aeration system for adult holding ponds.
<p>hatchery green-egg to eyed-egg survival as compared with established goal</p>				✓	In compliance 3 out of last 4 years; No IHOT goal	Problem at Umatilla Hatchery in past program Develop green-egg to eyed-egg goal
<p>hatchery eyed-egg to fry survival as compared with established goal</p>			✓		In compliance 4 out of last 4 years No IHOT goal	Develop eyed-egg to fry survival goal
<p>hatchery smolt to smolt survival as compared with established goal</p>		✓			In compliance 5 out of last 5 years	
<p>hatchery production as compared with established goal</p>				✓	In compliance 2 out of last 5 years	See PM #4b
<p>hatchery percent survival (smolt to adult) as compared with established goal</p>				✓	In compliance 0 out of last 5 years	See PM #4b
<p>hatchery number of eggs, fry, fingerlings, smolts, and/or adults meet basinwide needs</p>	✓					

Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
	N/A	Yes	?	No		
Temperature						
Does your water temperature meet the criteria for spawning?		✓			Review of records/Discussion	
Does your water temperature meet the criteria for incubation?		✓			Review of records/Discussion	
Does your water temperature meet the criteria for rearing?				✓	Review of records/Discussion; water temperature below criteria 6-7 months/year	Review temperature criteria for rearing; consider drilling additional wells
Dissolved gases						
Is the oxygen level near saturation?			✓		Review of records/Discussion	Monitor DO and TGP
Is the dissolved nitrogen level less than saturation?				✓	Review of records/Discussion; stripping tower is flooded at 2,000 gpm	Redesign stripping tower to treat 2,000 gpm
Chemistry						
Ammonia (un-ionized)			✓		No data provided to team	Run analysis for chemistry parameters
Carbon Dioxide			✓		No data provided to team	
Chlorine			✓		No data provided to team	
pH			✓		No data provided to team	
Copper			✓		No data provided to team	
Hydrogen Sulfide			✓		No data provided to team	
Iron			✓		No data provided to team	
Zinc			✓		No data provided to team	
Turbidity						
Does your turbidity meet the criteria?			✓		No data provided to team	Run analysis for turbidity
Alkalinity and hardness						
Does your alkalinity and hardness meet the criteria?			✓		No data provided to team	Run analysis for alkalinity and hardness
Nitrite						
Does your nitrite meet the criteria?			✓		No data provided to team	Run analysis for nitrite

Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
	N/A	Yes	?	No		
Alarm Systems						
Do the following areas have alarms?						
Intake		✓			Inspection of facilities/ Discussion	
Large rearing ponds and adult holding ponds		✓			Inspection of facilities/ Discussion	
Raceway headboxes and rearing ponds		✓			Inspection of facilities/ Discussion	
Incubation facilities		✓			Inspection of facilities/ Discussion	
Quarantine areas and facilities	✓	✓			Inspection of facilities/ Discussion	
Water treatment systems	✓				Inspection of facilities/ Discussion	
Security	✓				Inspection of facilities/ Discussion	
Are there outside systems and buzzers in on-site residences?		✓			Discussion	
Are water flow alarms checked daily?		✓			Review of records /Discussion	
Are all other alarms checked weekly?	✓				Review of records /Discussion	Check "other alarms" on a weekly basis
Is there a log of alarms for emergencies, tests, and maintenance requirements?		✓			Review of records/Discussion	
Are telephone pagers used?		✓			Discussion	
Adult holding facilities						
Do you meet the adult holding criteria?				✓	Review of records/Discussion; water shortage during drought years (2-3 weeks)	Build aeration system for adult holding system at the hatchery
Incubation facilities						
Type 1: Vertical Tray						
Do you have an adequate number of units for the overall program?				✓	Inspection of facilities/Discussion	Need 288 more trays to replace trays taken by captive program; no more floor space needed; redesign of water supply to incubators needed.

Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
	N/A	Yes	?	No		
ring facilities Type 1: Canadian Troughs Do you have an adequate number of units for the overall program? Type 2: Raceways Do you have an adequate number of units for the overall program?				✓ ✓	Inspection of facilities/Discussion Inspection of facilities/Discussion	Need 11 more Canadian troughs to replace troughs taken by captive brood program; the building would have to be enlarged. Need 6 more raceways to replace raceways taken by captive brood; also need pure oxygen supplementation system because water supply is limited.
rearing facilities Do you meet the approach velocity criteria? Are the fish screens regularly cleaned? Does the screen mesh meet screen opening criteria? Are rearing containers double screened for fish that should not be released to adjacent water?		✓ ✓ ✓		✓	Inspection of facilities/Discussion Inspection of facilities/Discussion Inspection of facilities/Discussion; Opening criteria changed under ESA; smolt by-pass system clogged	Change traveling screens to 3/32" Unclog smolt by-pass system
predator control facilities Are your predation control facilities effective?		✓			Inspection of facilities/Discussion	

Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
	N/A	Yes	?	No		
d storage facilities and quality control						
Does the storage of dry/semi-moist/moist foods (dry<12%; semi-moist 12-20%; moist >20% moisture) follow food manufacturer's recommendations?		✓			Discussion	
Does a regional quality control officer oversee production procedures and monitor:						
Verification by feed manufacturer that ingredients meet specifications?				✓	Discussion	Conduct IHOT feed QA/QC tests
Ensure feed does not contain unwanted drugs or other additives?				✓	Discussion	Conduct IHOT feed QA/QC tests
Analyze ingredients contained in the final food product to ensure that feed specifications have been met?				✓	Discussion	Conduct IHOT feed QA/QC tests
Are the foods stored and handled according to the following criteria?						
Moist pellets should not exceed 10 °F at point of delivery.		✓			Discussion	
Moist pellets should be removed from freezer just prior to feeding.		✓			Discussion	
Do not leave buckets of feed or feed containers outside exposed to light or heat.		✓			Discussion	
Open bags of feed should be fed within one to two days except when feeding small groups of fish.		✓			Discussion	
Automatic feeder hoppers and bulk storage facilities should be insulated against excessive temperatures (80°F and above).		✓			Discussion	
Release facilities						
Do the release facilities ensure that fish are not subjected to adverse conditions?		✓			Inspection of facilities/Discussion	Need to modify 90° turn in open channel where it transitions to the discharge pipe

Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
	N/A	Yes	?	No		
<p>pollution abatement facilities</p> <p>Do the pollution abatement facilities meet all federal and state regulations (or good engineering practice)?</p> <p>Are pollution abatement facilities operated correctly?</p>		<p>✓</p> <p>✓</p>			<p>Inspection of facilities/Discussion</p> <p>Discussion</p>	
<p>transportation facilities</p> <p>Are the transport systems adequate to meet IHOT performance measures for transportation practices?</p>		<p>✓</p>			<p>Inspection of facilities/Discussion</p>	

Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
	N/A	Yes	?	No		
Broodstock selection practices						
Is the donor selection process document attached?	✓				Existing program; does not apply	
Was the donor selection outline followed in selecting the hatchery broodstock? to PM #40 in Genetics	✓				Existing program; does not apply	
Spawning practices						
Were the appropriate number of spawners, male/female ratios, and fertilization protocols used? to PM #42 in Genetics Section		✓			Review of records/Discussion	
Incubation practices						
Are specific incubation standards listed in the hatchery operations plan?				✓		Develop specific incubation standards
Are incubation practices written?				✓		
Incubation Type 1: Vertical tray Do you meet the loading and flow criteria?				✓	Review of records/Discussion; only use 4 gpm/stack	Not a problem due to reduced loading of trays
Rearing practices						
Are specific rearing standards listed in the hatchery operations plan?		✓			In hatchery Operations Plan; not in IHOT	Develop specify rearing standards for IHOT Operations Plan
Are rearing practices written?		✓			Review of rearing standards	
Rearing Unit Type 1: Canadian Troughs Do you meet the density and DI criteria? Do you meet the Loading and FI criteria?		✓ ✓			Review of records/Discussion Review of records/Discussion	
Rearing Unit Type 2: Raceways Do you meet the density and DI criteria? Do you meet the Loading and FI criteria?		✓		✓	Review of records/Discussion Review of records/Discussion	Do not meet loading criteria under full program; reduce loadings
Smolt quality						
Do you produce a high quality smolt?		✓			Discussion	

Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
	N/A	Yes	?	No		
Health management practices						
Are the monthly hatchery monitoring visits being conducted? (PM #26)		✓			Review of records/Discussion	
Are the annual broodstock inspections being conducted? (PM #27)		✓			Review of records/Discussion	
Is there pathogen-free water and are the sanitation procedures being followed? (PM #28)				✓	Do not have enough pathogen-free water for early rearing	Develop pathogen-free water supply for early rearing
Are the following water quality parameters within criteria? (PM #5a-5h)						
Water temperature				✓	Review of records/Discussion	Review criteria; develop additional groundwater supply
Dissolved gases					Review of records/Discussion	
Chemistry				✓	Review of records/Discussion	
Turbidity				✓	Review of records/Discussion	
Alkalinity and hardness				✓	Review of records/Discussion	
Nitrite				✓	Review of records/Discussion	
Contaminants				✓	Review of records/Discussion	
Are rearing standards being followed? (PM #19)				✓	Review of records/Discussion	Do not meet loading criteria under full program; reduce loadings
Are egg and fish transfer/release requirements met? (PM #31)		✓			Review of records/Discussion	
Do hatchery performance meet requirements outlined in the regional hatchery policies and in basin and hatchery plans for the following areas?						
Percent smoltification						
Do you measure percent smoltification?				✓		Develop smoltification monitoring program
Did you meet the smoltification criteria?				✓		Develop smoltification goal for IHOT

Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
	N/A	Yes	?	No		
ring density (prior to release) Did you meet the rearing density criteria just prior to release?		✓			Review of records/Discussion	
ease condition (at release) Did you meet all disease regulations just prior to release?		✓			Review of records/Discussion	
number (at release) Did you meet the release number goal?				✓	Review of records/Discussion. In compliance 0 out of 2 years.	Improved adult return needed. See also PM #4b.
size (at release) Did you meet the size goal?		✓			Review of records/Discussion	
release dates (at release) Did you meet the release date goal?		✓			Review of records/Discussion; can be delayed by NMFS regulations	
location of release Did you release the fish at the specified location?		✓			Review of records/Discussion	
fish reared in the subbasin or acclimated in the basin? Are the fish reared in the subbasin? Are the fish acclimated in the subbasin?		✓ ✓			Discussion Discussion	
release strategy appropriate for the program?		✓			Discussion	

Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
	N/A	Yes	?	No		
nsportation facilities						
Do transportation equipment and personnel receive disinfection before and after use?		✓			Discussion	
Is the fish tank interior disinfected using a solution of 200 ppm active chlorine for 30 minutes minimum or formaldehyde gas generation method (relative humidity of 60% for 2 hrs)?		✓			Discussion	
Is the exterior of the fish transport vehicle disinfected using high pressure steam (115-130°C), high temperature acid, or with 200 ppm chlorine for 30 minutes?				✓	Discussion	Follow IHOT transportation protocols
Is the fish transport vehicle (cab) disinfected using 600 ppm quaternary ammonia compounds (1.5 ml of 50% stock solution/liter water)?				✓	Discussion	Follow IHOT transportation protocols
Is other equipment disinfected including fish pumps, nets, egg sorters, waders, boots, rain gear, hoses and other equipment using one of the following solutions? 200 ppm chlorine for 30 minutes 600 ppm quaternary ammonia compound for 30 minutes 200 ppm iodophor solution for 10 minutes		✓			Discussion	
Do personnel wear protective garments when handling fish eggs or cultural water?		✓			Discussion	
Do the fish transport truck/chassis and tank/unit receive an inspection and service prior to the release season?		✓			Discussion	
Is a daily service inspection completed before starting up and leaving for the day?		✓			Discussion	
Does the fish transport unit receive an inspection prior to loading?		✓			Discussion	
		✓			Discussion	

Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
	N/A	Yes	?	No		
nsportation facilities						
Does a pre-loading inspection covering: tank water level, pumps or aerators, oxygen injection system settings, displacement gauge, and truck loading/hauling density tables checked and reviewed occur prior to loading fish in the transport unit?		✓			Discussion	
Do hauling criteria include checking the fish 45 minutes to 1 hour after loading?		✓			Discussion	
When fish are active and systems are functioning properly, is the oxygen concentration reduced and maintained at approximately 8 ppm?		✓			Discussion	
Is water temperature in the transportation unit maintained within the 42-48 °F range?		✓			Discussion	
Do fish releasing procedures include the following criteria?						
Releasing the fish at the correct release site or into the correct water body.		✓			Discussion	
Tempering or the difference between the liberation tank and the target water body should not exceed 10°F.		✓			Discussion	
The liberation hose should be angled so that fish gently hit the water. Using a tripod is a method of ensuring the hose will stay at the proper angle.		✓			Discussion	

Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
	N/A	Yes	?	No		
Evaluation practices						
Has the hatchery conducted fishery contribution studies to:						
Determine the requirements for evaluating and improving management programs?		✓			Discussion	
Develop guidelines that define the geographical area and identify component stocks (hatchery and/or wild) that comprise the management unit?		✓			Discussion	
Develop guidelines that define if the proper stocks of fish are currently being used?		✓			Discussion	
Determine which management units contribute to a specific fishery and the time periods of those contributions?		✓			Discussion	
Determine the relative contributions of the various management units to a specific fishery over the different time periods?		✓			Discussion	
Training practices						
Does the hatchery have a training schedule for its staff?		✓			Review of records/Discussion	
Does each staff member have a personal training plan approved by a supervisor and reviewed annually?		✓			Review of records/Discussion	
Does the hatchery routinely exchange training details between other hatcheries and agencies?		✓			Review of records/Discussion	
Does the hatchery encourage and reward off-duty training of staff?		✓			Review of records/Discussion	
Does the hatchery conduct monthly staff meetings?		✓			Review of records/Discussion	

Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
	N/A	Yes	?	No		
<p>monthly hatchery monitoring visits being conducted by a qualified fish health specialist as described below?</p> <p>Conduct visit at least monthly</p> <p>Monitoring conducted by qualified fish health specialist</p> <p>Examine a representative sample of healthy and moribund fish from each lot.</p> <p>Review fish culture practices with hatchery manager.</p> <p>Report finding and results of necropsies on standard form.</p> <p>Recommend appropriate drug or chemical treatment.</p> <p>Summarize fish health status or stock prior to release or transfer to another facility.</p>		<p>✓</p> <p>✓</p> <p>✓</p> <p>✓</p> <p>✓</p> <p>✓</p> <p>✓</p>			<p>Review of records/Discussion</p>	
<p>all of the functions of the hatchery yearly monitoring visits being completed as described below?</p> <p>usually examine each broodstock for the presence of portable viral pathogens.</p> <p>usually screen each salmon broodstock for the presence of <i>Aeromonas salmonicida</i>.</p> <p>conduct inspection by or under the supervision of qualified health specialist.</p>		<p>✓</p> <p>✓</p> <p>✓</p>			<p>Review of records/Discussion</p> <p>Review of records/Discussion</p> <p>Review of records/Discussion</p>	

Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
	N/A	Yes	?	No		
<p>Are there any sources of pathogen-free water, especially for early rearing?</p> <p>Are there any sources of pathogen-free water, especially for early rearing?</p> <p>Are the hatchery sanitation procedures understood and being followed as describe below?</p> <p>Disinfect/water harden eggs in iodophor?</p> <p>Are foot baths containing disinfectant placed at the incubation facility's entrance and exit?</p> <p>Is equipment and rain gear utilized in broodstock handling or spawning sanitized prior to its use elsewhere in the hatchery?</p> <p>Is equipment used to collect dead fish sanitized prior its use in another pond and/or lot of fish?</p> <p>Is equipment, including vehicles used to transfer fish between facilities, disinfected prior to use with any other fish lots or at any other location?</p> <p>Are rearing vessels sanitized after fish are removed and prior to introducing a new fish lot or stock?</p> <p>Are dead fish properly disposed of?</p>				<p>✓</p>	<p>Not enough pathogen-free water for early rearing</p> <p>Inspection of facilities/Discussion.</p> <p>Inspection of facilities/Discussion</p>	<p>Develop pathogen-free water supply for early rearing</p>

Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
	N/A	Yes	?	No		
<p>water quality parameters being followed?</p> <p>Are the following water quality parameters within criteria? (PM #5a-5h)</p> <p>Water temperature</p> <p>Dissolved gases Chemistry Turbidity Alkalinity and hardness Nitrite Contaminants</p> <p>to PM #21</p>			✓ ✓ ✓ ✓ ✓ ✓ ✓	✓	<p>Review of records/Discussion</p> <p>Review of records/Discussion Review of records/Discussion Review of records/Discussion Review of records/Discussion Review of records/Discussion Review of records/Discussion</p>	<p>Review criteria; develop additional groundwater supply</p> <p>Run analysis for parameters Run analysis for parameters</p>
<p>incubation and rearing standards being followed?</p> <p>Are the incubation practices following the IHOT incubation criteria? (PM #18)</p> <p>Are the rearing practices following the IHOT criteria? (see PM #19)</p> <p>to rearing practices PM #18-PM #19</p>				<p>✓</p> <p>✓</p>	<p>Review of records/Discussion</p> <p>Review of records/Discussion</p>	<p>Exceed water flow criteria; probably not a problem due to reduce loading</p> <p>Exceed loading criteria</p>
<p>egg and fish transfer/release requirements met?</p>		✓			<p>Discussion</p>	

Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
	N/A	Yes	?	No		
<p>Do the hatchery's performance meet requirements defined in the regional hatchery policies and in basin and hatchery plans for the following areas: percent smoltification, rearing density, disease condition, and the number, size date(s), and location of release?</p> <p>Percent smoltification (PM #22a1)</p> <p>Rearing density (PM #22a2)</p> <p>Disease condition (PM #22a3)</p> <p>Number at release (PM #22a4)</p> <p>Size at release (PM #22a5)</p> <p>Date of release (PM #22a6)</p> <p>Location of release (PM #22a7)</p>		<p>✓</p> <p>✓</p> <p>✓</p> <p>✓</p> <p>✓</p> <p>✓</p> <p>✓</p>		<p>✓</p> <p>✓</p> <p>✓</p>	<p>Review of records/Discussion</p>	<p>Develop smoltification monitoring program and IHOT goal</p> <p>See PM #22a4</p>
<p>Are fish reared in the subbasin or acclimated in the basin?</p> <p>PM #22b</p>		<p>✓</p>			<p>Discussion</p>	
<p>Is the release strategy appropriate for the program?</p> <p>PM #22c</p>		<p>✓</p>			<p>Discussion</p>	

Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
	N/A	Yes	?	No		
<p>new programs, has a broodstock collection plan developed?</p> <p>Is the broodstock collection plan written?</p> <p>For a non-captive broodstock program:</p> <p>Was an unbiased, representative sample collected?</p> <p>Was the recommended number of broodstock collected?</p> <p>For a captive broodstock program:</p> <p>Were captive brood progeny excluded as donors for propagating the next generation of the captive broodstock program?</p> <p>Were full-sib crosses avoided?</p> <p>Is the broodstock collection plan understood and being followed by staff?</p>	<p>✓</p> <p>✓</p> <p>✓</p> <p>✓</p> <p>✓</p> <p>✓</p> <p>✓</p>				<p>Existing Program; does not apply</p>	
<p>a new program, was the donor selection outlined in selecting the hatchery broodstock?</p> <p>Is a donor selection plan written?</p> <p>Was the donor selection outline followed in selecting the broodstock?</p> <p>Was the target stock recommended in the donor selection process actually used?</p>	<p>✓</p> <p>✓</p> <p>✓</p>				<p>Existing Program; does not apply</p> <p>Existing Program; does not apply</p> <p>Existing Program; does not apply</p>	

Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
	N/A	Yes	?	No		
<p>existing programs, were the broodstock collection cedures followed?</p> <p>Is the broodstock collection plan written?</p> <p>Does the broodstock collection plan follow the guideline:</p> <p> Was an unbiased, representative sample collected?</p> <p> Was the recommended number of broodstock collected?</p> <p> Were the broodstock collection procedures in hatchery operation plan understood and followed?</p> <p> Were the broodstock collection procedures in hatchery operation plan understood and followed?</p>		<p>✓</p> <p>✓</p> <p>✓</p> <p>✓</p> <p>✓</p> <p>✓</p>			<p>Review broodstock collection plan</p> <p>Discussion</p> <p>Discussion</p> <p>Discussion</p> <p>Discussion</p>	
<p>s the appropriate number of spawners, male/female os, and fertilization protocols used?</p> <p>Are the spawning protocols written?</p> <p>Are daily or weekly spawning logs available?</p> <p>Was the appropriate number of spawners used?</p> <p>Did you attempt to spawn all collected broodstock and randomize mating with respect to age class, and other traits?</p> <p>Was the sex-ratio within the limits given in the performance standards?</p> <p>Were the fertilization protocols followed?</p> <p>If the hatchery needed to reduce the number of eggs retained, was this done by representative sampling of each male/female cross?</p>		<p>✓</p> <p>✓</p> <p>✓</p> <p>✓</p> <p>✓</p> <p>✓</p> <p>✓</p>			<p>Review spawning protocols</p> <p>Review of records</p> <p>Review of records</p> <p>Discussion</p> <p>Discussion</p> <p>Discussion</p> <p>Discussion</p>	

Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
	N/A	Yes	?	No		
<p>Are there a genetics monitoring and evaluation program in place?</p> <p>Is a genetics monitoring and evaluation program available?</p> <p>Does the plan address the following elements listed in IHOT:</p> <p>Does the program have elements needed to meet evaluation goals 1-4?</p> <p>Has a qualified geneticist reviewed and endorsed the program (goal 5)?</p> <p>Will the program collect the data and maintain the records needed to evaluate compliance on an ongoing basis (goal 5)?</p> <p>Is the program understood and followed by staff?</p>		<p>✓</p> <p>✓</p> <p>✓</p> <p>✓</p> <p>✓</p>			<p>Discussion</p> <p>Discussion</p> <p>Discussion</p> <p>Discussion</p> <p>Discussion</p>	

Remedial Actions

Based on the compliance status for each performance measure, remedial actions were developed. The required remedial actions are organized into five categories. The types of categories range across a spectrum from those actions that are beyond human control, to those that require a change in agency policy or procedures, to those that involve a significant capital cost to put in place. The following are the five types of remedial actions identified under phase 1 of the audit:

The Five Types of Remedial Actions

Type	Description
1	Non-compliance issues resulting from items beyond human control or Performance Measures not relevant for this hatchery
2	Remedial actions requiring changes in agency policies or procedures
3	Remedial actions requiring changes in monitoring coverage or interval
4	Remedial actions requiring significant capital expenditures
5	Remedial actions that may require significant capital expenditures but are not clearly definable at this time

Remedial Actions at Lookingglass Hatchery - Spring Chinook (Grande Ronde Stock)

This section presents the corrective actions required to bring Lookingglass Hatchery - Spring Chinook (Grande Ronde Stock) program into compliance with the IHOT performance measures. The remedial actions suggested here are just that, suggestions developed by the Montgomery Watson Audit Team. For some non-compliance areas, other remedial actions could be proposed. The required remedial actions are cross-referenced to each IHOT performance measure that was not in compliance. Where appropriate, the costs associated with the remedial actions are also presented (Table 3).

The cost estimates presented in this section are based on professional experience from similar projects. In most cases, only a lump-sum figure is presented, and detailed take-off lists have not been prepared. The cost estimates are essentially order of magnitude estimates ($\pm 40\%$).

More importantly, the suggested remedial activities may also present several levels of action. Optional actions have been listed for several problems. These optional actions are desirable for either operational or safety considerations.

Table 3. Remedial Actions Required at Lookingglass Hatchery - Spring Chinook (Grande Ronde Stock)

Remedial Action Required	Cost	PMs ¹
Type 1 - Non-compliance issues resulting from items beyond human control or Performance Measures not relevant for this hatchery		
Need better adult survival	----	22a4
Type 2 - Remedial actions requiring changes in agency policies or procedures		
Develop green-egg to eyed-egg survival goal	----	4d
Develop eyed-egg to fry survival goal	----	4e
Develop specific incubation standards for IHOT	----	18
Incubation flows less than IHOT criteria; not a problem due to reduced loading	----	18
Develop specific rearing and early rearing standards for IHOT	----	19
Reduce loading of raceways	----	19
Develop smoltification monitoring program and goals	----	22a1
Follow IHOT transportation protocols	----	23
Type 3 - Remedial actions requiring changes in monitoring coverage or interval		
Monitor DO and TGP	----	5b
Run analysis for chemistry parameters	----	5c
Run analysis for turbidity	----	5d
Run analysis for alkalinity and hardness	----	5e
Run analysis for nitrite	----	5f
Run analysis for contaminants	----	5g
Check "other alarms" on a weekly basis	----	6
Conduct IHOT feed QA/QC tests	----	12

¹ PMs are performance measures that were extracted from the IHOT 1995 report. The IHOT performance measures are listed in Table 2 (Section 3 of this report) in numerical order.

Remedial Action Required	Cost	PMS¹
Type 4 - Remedial actions requiring significant capital expenditures		
Construct stripping tower to treat 2,000 gpm	\$5,000	5b
Construct aeration system for adult holding	\$5,000 to \$10,000	4b, 4c, 4g, 4h, 7, 22a4
Install 288 additional tray incubator and replumb incubation piping (needed if current and captive brood programs are retained)	\$32,500	8
Install 11 additional Canadian troughs; enlarge building (needed if current and captive brood programs are retained)	\$250,000	9
Construct 6 more raceways (needed if current and captive brood programs are retained)	\$500,000	9
Unclog smolt by-pass system	\$5,000 to \$10,000	10
Type 5 - Remedial actions that may require significant capital expenditures but are not clearly definable at this time		
Review temperature criteria for rearing; consider drilling additional wells	---	5a
Construct ozone system for influent and effluent disinfection (45 cfs)	---	5h,28
Change traveling screens to 3/32"	---	10

¹ PMS are performance measures that were extracted from the IHOT 1995 report. The IHOT performance measures are listed in Table 2 (Section 3 of this report) in numerical order.

Hatchery Contribution to Fisheries, Spawning Grounds, and Hatcheries

This section presents the audit findings for the Lookingglass Hatchery - Spring Chinook (Grande Ronde Stock) program contribution of adult fish to fisheries, local fisheries, spawning grounds, and hatcheries. Data is reported by broodyear. A broodyear refers to the adult contribution from the eggs produced from a single group of spawning adults. For some species, this may include fish caught as 2-, 3-, 4-, 5-, and 6-year old fish. Because of the return distribution and data processing delays, the complete adult contribution for a given broodyear may not be available until 4 to 5 years after the fish have been released from the hatchery.

Table 4. Adult Contribution to Fisheries, Spawning Grounds, and Hatcheries: Lookingglass Hatchery - Spring Chinook (Grande Ronde Stock)

Year	Fisheries ¹ (Broodyear)	Spawning Grounds ¹ (Broodyear)	Hatchery ¹ (Broodyear)	Total Combined Contribution ² (Broodyear)	Smolt to Adult Survival (percent)
1981					
1982					
1983					
1984				52	0.11
1985				480	0.052
1986				406	0.092
1987				144	0.040
1988				2355	0.38
1989					
1990					
1991					
1992					

¹ Data obtained from Missing Production Groups Annual Report or from the Regional Mark Information System database.

² Total combined adult contribution; presented when it is not possible to subdivide the contribution into fisheries, spawning grounds, and hatchery contributions.

Annual Operating Expenditures

The level and detail of annual operating expenditures varies widely depending on hatchery, operating agency, and funding source. When provided, expenditures were presented in terms of personnel costs, operating costs (power, feed, supplies), capital costs, indirect costs charged to the Federal government, third-party costs, and other costs. These cost components were summed to determine a total hatchery annual cost. Based on discussion with the hatchery manager, the percent of total hatchery costs allocated to a given program was estimated. The total hatchery costs and the percent of hatchery costs allocated to a given program were used to compute the cost of a given program. Table 5 shows the annual operating expenses for the overall Lookingglass Hatchery - Spring Chinook (Grande Ronde Stock) program. For programs that occur at more than one facility (as shown on Table 1 in Section 3 of this report), the cost breakdown for the component(s) at each hatchery is presented in a separate table (Table 5a).

**Table 5. Annual Operating Expenses: Lookingglass Hatchery -
Spring Chinook (Grande Ronde Stock)**

Hatchery	1994	1995	1996
1. Lookingglass	\$643,873	\$339,434	\$250,198
2.			
3.			
4.			
5.			
Total Program Costs	\$643,873	\$339,434	\$250,198

The total expenditures for the Lookingglass Hatchery are presented in Table 6 by program. The detailed breakdown of program expenditures at this hatchery is presented in separate tables (Table 6a and 6b).

Table 6. Annual Operating Expenses - Lookingglass Hatchery

Program	1994	1995	1996
1. Chinook Salmon (Grande Ronde Stock)	\$643,873	\$339,434	\$250,198
2. Chinook Salmon (Imnaha Stock)	\$127,232	\$339,434	\$250,198
3.			
4.			
5.			
Total Hatchery Costs	\$771,105	\$678,868	\$500,396

**Table 5a. Annual Operating Expenses: Lookingglass Hatchery -
Spring Chinook (Grande Ronde Stock)
Expenditure Occurring at Lookingglass Hatchery**

Component	1994	1995	1996
Personnel Costs	\$231,924	\$206,448	\$191,769
Operational Costs	\$362,215	\$341,093	\$222,807
Capital Costs	\$60,214	\$20,577	\$0
Indirect Costs	\$116,752	\$110,750	\$86,320
Lumped Hatchery Costs ¹			
Lumped Third-Party Costs	\$0	\$0	\$0
Total Hatchery Costs	\$771,105	\$678,868	\$500,396
Source of Funds			
LSRCP	100%	100%	100%
Program Production (lb)	44,819	30,078	6,955
Total Production (lb)	53,014	36,576	11,897
Program as Percent of Total	83.5%	50%	50%
Program Costs	\$643,873	\$339,434	\$250,198

¹ When it was not possible to obtain a detailed cost breakdown from an agency or third party, the undivided costs were entered here.

**Table 6a. Detailed Expenditures at Lookingglass Hatchery by Program
Spring Chinook, Grande Ronde Stock**

Component	1994	1995	1996
Personnel Costs	\$231,924	\$206,448	\$191,769
Operational Costs	\$362,215	\$341,093	\$222,807
Capital Costs	\$60,214	\$20,577	\$0
Indirect Costs	\$116,752	\$110,750	\$86,320
Lumped Hatchery Costs ¹			
Lumped Third-Party Costs	\$0	\$0	\$0
Total Hatchery Costs	\$771,105	\$678,868	\$500,396
Source of Funds			
	100%	100%	100%
Program Production (lb)	44,819	30,078	6,955
Total Production (lb)	53,014	36,576	11,897
Program as Percent of Total	83.5%	50%	50%
Program Costs	\$643,873	\$339,434	\$250,198

¹ When it was not possible to obtain a detailed cost breakdown from an agency or third party, the undivided costs were entered here.

**Table 6b. Detailed Expenditures at Lookingglass Hatchery by Program
Spring Chinook, Imnaha Stock**

Component	1994	1995	1996
Personnel Costs	\$231,924	\$206,448	\$191,769
Operational Costs	\$362,215	\$341,093	\$222,807
Capital Costs	\$60,214	\$20,577	\$0
Indirect Costs	\$116,752	\$110,750	\$86,320
Lumped Hatchery Costs ¹			
Lumped Third-Party Costs	\$0	\$0	\$0
Total Hatchery Costs	\$771,105	\$678,868	\$500,396
Source of Funds			
	100%	100%	100%
Program Production (lb)	8,195	6,498	4,942
Total Production (lb)	53,014	36,576	11,897
Program as Percent of Total	16.5%	50%	50%
Program Costs	\$127,232	\$339,434	\$250,198

¹ When it was not possible to obtain a detailed cost breakdown from an agency or third party, the undivided costs were entered here.