
HATCHERY EVALUATION REPORT

Sawtooth Hatchery - Spring Chinook

September 1996

Integrated Hatchery Operations Team (IHOT)

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

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Executive Summary

This report presents the findings of the independent audit of the Sawtooth Hatchery - Spring Chinook program. The hatchery is located along the upper Salmon River near Stanley, Idaho. The hatchery is used for adult collection, incubation, and rearing of spring chinook and adult collection, spawning, and incubation of summer steelhead.

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.

Sawtooth Hatchery - Spring Chinook Results

The Sawtooth facility includes 3 adult holding pond, 28 concrete raceways, 12 outside early rearing raceways, 16 indoor early rearing vats, and incubation facilities. The Sawtooth Hatchery was constructed in 1984-85 as part of the Lower Snake River Compensation Plan (LSRCP) - a program to mitigate for anadromous fishery losses caused by the construction of four hydroelectric dams on the lower Snake River.

The Sawtooth 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, needed to improve its green-egg to eyed-egg survival and fry-to-smolt survival, and document its adult contribution. The audit found that the hatchery was not in compliance with the screen approach criteria, screen mesh criteria, acclimation pond requirements, and water quality monitoring criteria, which are all facilities requirements. The hatchery was not monitoring smoltification and needed to develop specific incubation and rearing standards for the IHOT Operations Plan. The hatchery needed to develop an approved Genetics Monitoring and Evaluation Program.

The specific areas in which the Sawtooth Hatchery - Spring Chinook 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:

- Construct acclimation ponds for off-station releases
- Develop approved genetics monitoring and evaluation program
- Develop smoltification goal and monitoring program
- Develop specific incubation standards for IHOT Operations Plan
- Document adult contribution
- Follow IHOT protocols for exterior and interior disinfection
- Improve fry-to-smolt survival
- Improve green-egg to eyed-egg survival
- Perform IHOT QA/QC feed tests
- Enlarge the headbox screen to meet current approach criteria and screen mesh criteria
- Review release strategy as it relates to overall program
- Run analysis for contaminants
- Run analysis for missing water chemistry parameters

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:	Sawtooth Hatchery
Stock/Species:	Spring Chinook Summer Steelhead
Operating Agency:	Idaho Department of Fish and Game
Funding Agency:	Lower Snake River Compensation Program
Location:	Located along the upper Salmon River near Stanley, Idaho. It is approximately 879 river miles from the mouth of the Columbia River at an elevation of 6,480 feet above sea level.
Address:	Idaho Department of Fish and Game Sawtooth Fish Hatchery HC 64, Box 9905 Stanley, ID 83278
Hatchery Manager:	Mr. Brent Snider
Phone:	(208) 774-3684
Fax:	
Purpose:	The Sawtooth Hatchery was constructed in 1984-85 as part of the Lower Snake River Compensation Plan (LSRCP) - a program to mitigate for anadromous fishery losses caused by the construction of four hydroelectric dams on the lower Snake River. The LSRCP mitigation goal is to return 19,445 spring chinook adults above Lower Granite Dam.
Production Goal:	Spring Chinook Produce 1.6 million smolts (80,000 lb) for on-station release Produce 700,000 smolts (35,000 lb) for release into the East Fork Salmon River. Summer Steelhead Trap and spawn adult steelhead to provide eggs to other hatcheries for LSRCP programs

Water Supply:

Water is supplied to the hatchery by gravity flow from the Salmon River and also pumped from three wells. Water from the river utilizes 15,709 gpm and wells produce 4,039 gpm for incubation and early rearing.

Facilities:

Adult Holding:	3 adult holding ponds - 10,200 cf each
Incubation:	100 stacks of vertical tray incubators (800 trays)
Early Rearing:	12 indoor rearing vats -391 cf each 12 outdoor fry raceways - 1395 cf each
Raceways:	28 raceways - 5,400 cf each
Rearing Ponds:	none
Satellite Facilities:	East Fork Salmon River Satellite 3 adult holding ponds and a spawning area.

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 basic 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. This process consisted of research and onsite visits. The site visit at the Sawtooth Hatchery was conducted on September 12, 1996.

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

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 manager following the audit visit as a **Compliance Report**. That Compliance Report is Table 2 of this report.
5. 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 Sawtooth Hatchery - Spring Chinook

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 Sawtooth Hatchery - Spring Chinook 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 Sawtooth Hatchery - Spring Chinook

Component	Location of Adult Holding, Spawning, Incubation, and Rearing					
	Sawtooth Hatchery	Various Locations	East Fork Satellite			
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, LSRCP, IDFG 5-Year Plan, and ESA	
is the hatchery operating under a current hatchery operational plan?		✓			IHOT Operations Plan and Hatchery Operations and Maintenance Plan	
is it understood by staff?		✓				
is it being followed?		✓				
is a hatchery monitoring and evaluation plan in place?					LSRCP Fish Hatchery Evaluation - Idaho	
do you have a written monitoring and evaluation plan?		✓				
What is the hatchery's contribution to fisheries, spawning grounds, and hatchery production?			✓		Only have partial information on Idaho returns	Document adult returns
How does the hatchery's contribution to fisheries, spawning grounds, and hatchery production compare to established goals?		✓			Review of records; in compliance 5 out of last 5 years	
How does the hatchery's contribution to fisheries, spawning grounds, and hatchery production compare to established goals?				✓	Review of records; in compliance 0 out of last 5 years	Improve adult returns
How does the hatchery's contribution to fisheries, spawning grounds, and hatchery production compare to established goals?				✓	Review of records; in compliance 3 out of last 4 years	Improve green-egg to eyed-egg survival
How does the hatchery's contribution to fisheries, spawning grounds, and hatchery production compare to established goals?		✓			Review of records; in compliance 4 out of last 4 years	
How does the hatchery's contribution to fisheries, spawning grounds, and hatchery production compare to established goals?				✓	Review of records; in compliance 2 out of last 3 years	Improve fry-to-smolt survival
How does the hatchery's contribution to fisheries, spawning grounds, and hatchery production compare to established goals?				✓	Review of records; in compliance 0 out of last 4 years	Improve adult returns
How does the hatchery's contribution to fisheries, spawning grounds, and hatchery production compare to established goals?				✓	Review of records; in compliance 0 out of last 4 years	Improve adult returns
How does the hatchery's contribution to fisheries, spawning grounds, and hatchery production compare to established goals?	✓				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		
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	
Dissolved gases						
Is the oxygen level near saturation?		✓			Review of records/Discussion	
Is the dissolved nitrogen level less than saturation?		✓			Review of records/Discussion	
Chemistry						
Ammonia (un-ionized)			✓		No data	Run analysis
Carbon Dioxide			✓		No data	Run analysis
Chlorine			✓		No data	Run analysis
Hardness		✓			Review of records/Discussion	
Copper			✓		No data	Run analysis
Hydrogen Sulfide			✓		No data	Run analysis
Iron			✓		No data	Run analysis
Manganese			✓		No data	Run analysis
Turbidity						
Does your turbidity meet the criteria?		✓			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		
Alarm Systems						
Do the following areas have alarms?						
Intake		✓			Inspection of facilities/ Discussion	None
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				✓	Not a problem at this hatchery	
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?		✓			Discussion	
Is there a log of alarms for emergencies, tests, and maintenance requirements?		✓			Review of records/Discussion	
Are telephone pagers used?		✓			Discussion	
Adult collection and holding facilities						
Do you meet the adult holding criteria?		✓			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		
Incubation facilities Type 1: Vertical Stack Incubators Do you have an adequate number of units for the overall program?		✓			Inspection of facilities/Discussion	
Rearing facilities Type 1: Inside Vats Do you have an adequate number of units for the overall program? Type 2: Small Outside Raceways Do you have an adequate number of units for the overall program? Type 3: Raceways Do you have an adequate number of units for the overall program?		✓ ✓ ✓			Inspection of facilities/Discussion Inspection of facilities/Discussion Inspection of facilities/Discussion	
Screening 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 Not needed for this stock	Rebuild intake to meet current approach velocity and screen mesh criteria Rebuild intake to meet current approach velocity and screen mesh criteria
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?		✓			Inspection of facilities/Discussion	
Does a regional quality control officer oversee production procedures and monitor:						
Verification by feed manufacturer that ingredients meet specifications?				✓	Discussion	Perform IHOT QA/QC feed tests
Ensure feed does not contain unwanted drugs or other additives?				✓	Discussion	Perform IHOT QA/QC feed tests
Analyze ingredients contained in the final food product to ensure that feed specifications have been met?				✓	Discussion	Perform IHOT QA/QC feed 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 1 to 2 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	

Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
	N/A	Yes	?	No		
Release facilities						
Do the release facilities ensure that fish are not subjected to adverse conditions?		✓			Inspection of Sawtooth Hatchery facilities/Discussion	
Pollution abatement facilities						
Do the pollution abatement facilities meet all federal and state regulations (or good engineering practice)?		✓			Inspection of facilities/Discussion	
Are pollution abatement facilities operated correctly?		✓			Discussion	
Transportation facilities						
Are the transport systems adequate to meet IHOT performance measures for transportation practices?		✓			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		
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?	✓				Existing program; does not apply	
Refer to PM #40 in Genetics Section						
Spawning practices						
Were the appropriate number of spawners, male/female ratios, and fertilization protocols used?				✓	Adult returns too low	Improve adult returns
Refer to PM #42 in Genetics Section						
Incubation practices						
Are specific incubation standards listed in the hatchery operations plan?		✓			Reviewed Hatchery Operations and Maintenance Manual	Develop specific incubation standards for IHOT Operations Plan
Are incubation practices written?		✓				
Incubation Type 1: <u>Vertical Stack</u> (see PM #8) do you meet the loading and flow criteria?		✓			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		
rearing practices						
specific rearing standards listed in the hatchery operations plan?		✓			Review of Hatchery Operations Plan	
rearing practices written?		✓				
rearing Unit Type 1: Indoor Vats (see PM #9)						
Do you meet the density and DI criteria?		✓			Review of records/Discussion	
Do you meet the Loading and FI criteria?		✓			Review of records/Discussion	
rearing Unit Type 2: Small Outdoor Raceways (see #9)						
Do you meet the density and DI criteria?		✓			Review of records/Discussion	
Do you meet the Loading and FI criteria?		✓			Review of records/Discussion	
rearing Unit Type 3: Raceways (see PM #9)						
Do you meet the density and DI criteria?		✓			Review of records/Discussion	
Do you meet the Loading and FI criteria?		✓			Review of records/Discussion	
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)		✓			Review of records/Discussion	
Are the following water quality parameters within criteria? (PM #5a-5h)						
Water temperature		✓			Review of records/Discussion	
Dissolved gases		✓			Review of records/Discussion	
Chemistry			✓		Review of records/Discussion	Run analysis for missing chemistry parameters
Turbidity		✓			Review of records/Discussion	
Alkalinity and hardness		✓			Review of records/Discussion	
Nitrite		✓			Review of records/Discussion	
Contaminants			✓		Review of records/Discussion	Run analysis for contaminants
Are rearing standards being followed? (PM #19)		✓			Review of records/Discussion	
Are egg and fish transfer/release requirements met? (PM #31)		✓			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>Do hatchery performance meet requirements defined in the regional hatchery policies and in basin and hatchery plans for the following areas?</p> <p>Percent smoltification</p> <p>Do you measure percent smoltification?</p> <p>Did you meet the smoltification criteria?</p>				✓	Discussion	Develop smoltification goal and monitoring program
			✓		Discussion	
<p>Rearing density (prior to release)</p> <p>Did you meet the rearing density criteria just prior to release?</p>		✓			Review of records/Discussion	
<p>Disease condition (at release)</p> <p>Did you meet all disease regulations just prior to release?</p>		✓			Review of records/Discussion	
<p>Release number (at release)</p> <p>Did you meet the release number goal?</p>				✓	Review of records/Discussion	Improve adult returns
<p>Release size (at release)</p> <p>Did you meet the size goal?</p>		✓			Review of records/Discussion	
<p>Release dates of release</p> <p>Did you meet the release date goal?</p>		✓			Review of records/Discussion	
<p>Release location of release</p> <p>Did you release the fish at the specified location?</p>		✓			Review of records/Discussion	
<p>Acclimation of fish reared in the subbasin or acclimated in the basin?</p> <p>Station Releases Are the fish reared in the subbasin?</p> <p>Station Releases Are the fish acclimated in the subbasin?</p>		✓		✓	Discussion	Construct acclimation ponds for off-station releases
				✓	Discussion	
<p>Is the release strategy appropriate for the program?</p>			✓		Discussion	Review release strategy as it relates to overall program

Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
	N/A	Yes	?	No		
Transportation 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 protocols for exterior and interior disinfection
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 protocols for exterior and interior disinfection
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	

Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
	N/A	Yes	?	No		
Transportation facilities						
Does the fish transport unit receive an inspection prior to loading?		✓			Discussion	
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?						
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	

Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
	N/A	Yes	?	No		
ining 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		
monthly hatchery monitoring visits being conducted by a qualified fish health specialist as described below?						
Conduct visit at least monthly		✓			Review of records/Discussion	
Monitoring conducted by qualified fish health specialist		✓			Review of records/Discussion	
Examine a representative sample of healthy and moribund fish from each lot.		✓			Review of records/Discussion	
Review fish culture practices with hatchery manager.		✓			Review of records/Discussion	
Report finding and results of necropsies on standard form.		✓			Review of records/Discussion	
Recommend appropriate drug or chemical treatment.		✓			Review of records/Discussion	
Summarize fish health status or stock prior to release or transfer to another facility.		✓			Review of records/Discussion	
all of the functions of the hatchery yearly monitoring visits being completed as described below?						
Annually examine each broodstock for the presence of reportable viral pathogens.		✓			Review of records/Discussion	
Annually screen each salmon broodstock for the presence of <i>Renibacterium salmoninarum</i> .		✓			Review of records/Discussion	
Conduct inspection by or under the supervision of qualified fish health specialist.		✓			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		
Are hatchery sanitation procedures accepted?						
Are there any sources of pathogen-free water, especially for incubation and early rearing?		✓			Discussion	
Are the hatchery sanitation procedures understood and being followed as described below?						
Disinfect/water harden eggs in iodophor?		✓			Inspection of facilities/ Discussion	
Are foot baths containing disinfectant placed at the incubation facility's entrance and exit?		✓			Inspection of facilities/ Discussion	
Is equipment and rain gear utilized in broodstock handling or spawning sanitized prior to its use elsewhere in the hatchery?		✓			Inspection of facilities/ Discussion	
Is equipment used to collect dead fish sanitized prior its use in another pond and/or lot of fish?		✓			Inspection of facilities/ Discussion	
Is equipment, including vehicles used to transfer fish between facilities, disinfected prior to use with any other fish lots or at any other location?		✓			Inspection of facilities/ Discussion	
Are rearing vessels sanitized after fish are removed and prior to introducing a new fish lot or stock?		✓			Inspection of facilities/ Discussion	
Are dead fish properly disposed of?		✓			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		
water quality parameters being followed?						
Are the following water quality parameters within criteria? (PM #5a-5h)						
Water temperature		✓			Review of records/Discussion	
Dissolved gases		✓			Review of records/Discussion	
Chemistry			✓		Review of records/Discussion	Run analysis for missing parameters
Turbidity		✓			Review of records/Discussion	
Alkalinity and hardness		✓			Review of records/Discussion	
Nitrite		✓			Review of records/Discussion	
Contaminants			✓		Review of records/Discussion	Run analysis for contaminants
io to PM #21						
incubation and rearing standards being followed?						
Are the incubation practices following the IHOT incubation criteria? (PM #18)		✓			Review of records/Discussion	
Are the rearing practices following the IHOT criteria? (PM #19)		✓			Review of records/Discussion	
io to rearing practices PM #18-PM #19						
egg and fish transfer/release requirements met?		✓			Discussion	

Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
	N/A	Yes	?	No		
<p>Is the hatchery's program outlined in a subbasin management plan?</p> <p>Refer to subbasin plan PM #1</p>		✓			Columbia Basin System Planning Production Plan, LSRCP, IDFG 5-Year Plan, and ESA	
<p>Is the hatchery operating under a current hatchery operational plan?</p> <p>Refer to operational plan PM #2</p>		✓			IHOT Operations Plan and Hatchery Operations and Maintenance Plan	
<p>Is a hatchery monitoring and evaluation plan in place?</p> <p>Refer to hatchery monitoring and evaluation plan PM #3</p>		✓			LSRCP Fish Hatchery Evaluation - Idaho	

Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
	N/A	Yes	?	No		
<p>Does the hatchery program meet requirements established in the regional hatchery policies and basin planning documents in the following areas: species, stock, broodstock collection location, broodstock numbers, broodstock collection strategy, spawning and egg-take protocols?</p> <p>Does the hatchery program meet the requirements for the following?</p>						
Species protocols (PM #4a)		✓			Review of records/Discussion	
Stock protocols (PM #4a)		✓			Review of records/Discussion	
Broodstock collection location protocols (PM #41)		✓			Review of records/Discussion	
Broodstock numbers protocols (PM #42)		✓			Review of records/Discussion	
Broodstock collection strategy protocols (PM #41)		✓			Review of records/Discussion	
Spawning protocols (PM #42)				✓	Too few adults	Improve adult returns
Egg-take protocols (PM #42)		✓			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			
Do the hatchery's performance meet requirements defined in the regional hatchery policies and in the basin and hatchery plans for the following areas: percent smoltification, rearing density, disease condition, and the number, size date(s), and location of release?							
Percent smoltification (PM #22a1)				✓	Review of records/Discussion	Develop smoltification goal and monitoring program	
Rearing density (PM #22a2)		✓			Review of records/Discussion		
Disease condition (PM #22a3)		✓			Review of records/Discussion		
Number at release (PM #22a4)				✓	Review of records/Discussion		Improve adult returns
Size at release (PM #22a5)		✓			Review of records/Discussion		
Date of release (PM #22a6)		✓			Review of records/Discussion		
Location of release (PM #22a7)		✓			Review of records/Discussion		
Are fish reared in the subbasin or acclimated in the basin?					Discussion		
Station releases		✓				Construct acclimation ponds for off-station releases	
Off-station releases				✓			
PM #22b							
Is the release strategy appropriate for the program?			✓		Discussion	See PM #22c	
PM #22c							

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

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 procedures 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>✓</p> <p></p>	<p>Review broodstock collection plan</p> <p>Discussion</p> <p>Discussion</p> <p>Discussion</p> <p>Discussion</p>	<p>Improve adult returns</p>

Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
	N/A	Yes	?	No		
Are the appropriate number of spawners, male/female ratios, and fertilization protocols used?						
Are the spawning protocols written?		✓			Review of spawning protocols	
Are daily or weekly spawning logs available?		✓			Review of records	
Was the appropriate number of spawners used?				✓	Adult returns very low	Improve adult returns
Did you attempt to spawn all collected broodstock and randomize mating with respect to age class, and other traits?		✓			Discussion	
Was the sex-ratio within the limits given in the performance standards?		✓			Discussion	
Were the fertilization protocols followed?		✓			Discussion	
If the hatchery needed to reduce the number of eggs retained, was this done by representative sampling of each male/female cross?	✓				Discussion	

Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
	N/A	Yes	?	No		
<p>Is 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 HOT:</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>None supplied to team</p> <p>Discussion</p> <p>Discussion</p> <p>Discussion</p> <p>Discussion</p>	<p>Develop approved genetics monitoring and evaluation program</p>

Section 4

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 Sawtooth Hatchery - Spring Chinook

This section presents the corrective actions required to bring the Sawtooth Hatchery - Spring Chinook program into compliance with 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 Sawtooth Hatchery - Spring Chinook

Remedial Action Required	Cost	PMS¹
<p>Type 1 - Non-compliance issues resulting from items beyond human control or Performance Measures not relevant for this hatchery</p> <p>Improve adult returns; passage conditions from estuary to facility</p>	----	4c, 4g, 4h, 22a4, 41, 42
<p>Type 2 - Remedial actions requiring changes in agency policies or procedures</p> <p>Document adult contribution</p> <p>Perform IHOT QA/QC feed tests</p> <p>Develop specific incubation standards for IHOT Operations Plan</p> <p>Develop smoltification goal and monitoring program</p> <p>Review release strategy as it relates to overall program</p> <p>Follow IHOT protocols for exterior and interior disinfection</p> <p>Develop approved genetics monitoring and evaluation program</p>	----	4a 12 18 22a1 22c 23
<p>Type 3 - Remedial actions requiring changes in monitoring coverage or interval</p> <p>Run analysis for missing water chemistry parameters</p> <p>Run analysis for contaminants</p>	----	5c 5g

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	PMs ¹
Type 4 - Remedial actions requiring significant capital expenditures Enlarge the headbox screen to meet current approach criteria and screen mesh criteria Construct acclimation ponds for off-station releases 3 acclimation ponds @\$1,000,000 per pond	\$50,000-\$100,000 \$3,000,000	10 22b
Type 5 - Remedial actions that may require significant capital expenditures but are not clearly definable at this time Improve green-egg to eye-egg survival Improve fry-to-smolt survival	---- ----	4d 4f

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 Sawtooth Hatchery - Spring Chinook 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:
Sawtooth Hatchery - Spring Chinook**

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					
1985					
1986					
1987					
1988	unknown	344	700		0.055
1989	unknown	50	100		0.023
1990	unknown	33	65		0.008
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 Sawtooth Hatchery - Spring Chinook 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 facility is presented in a separate table (Table 5a).

Table 5. Annual Operating Expenses: Sawtooth Hatchery - Spring Chinook

Hatchery	1994	1995	1996
1. Sawtooth Hatchery	\$385,439	\$379,816	\$249,675
2.			
3.			
4.			
5.			
Total Program Costs	\$385,439	\$379,816	\$249,675

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

Table 6. Annual Operating Expenses - Sawtooth Hatchery

Program	1994	1995	1996
1. Spring Chinook	\$385,439	\$379,816	\$249,675
2. Summer Steelhead	\$290,770	\$119,942	\$78,845
3.			
4.			
5.			
Total Hatchery Costs	\$676,209	\$499,758	\$328,520

**Table 5a. Annual Operating Expenses: Sawtooth Hatchery - Spring Chinook
Expenditure Occurring at Sawtooth Hatchery**

Component	1994	1995	1996
Personnel Costs	\$214,873	\$232,218	\$166,108
Operational Costs	\$243,561	\$169,972	\$110,890
Capital Costs	\$133,880	\$27,970	\$18,303
Indirect Costs	\$83,895	\$69,598	\$51,522
Lumped Hatchery Costs ¹			
Lumped Third-Party Costs			
Total Hatchery Costs	\$676,209	\$499,758	\$328,520
Source of Funds			
LSRCP			
Program Production (lb)	---	---	---
Total Production (lb)	---	---	---
Program as Percent of Total	57%	76%	76%
Program Costs	\$385,439	\$379,816	\$249,675

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 Sawtooth Hatchery by Program

Spring Chinook

Component	1994	1995	1996
Personnel Costs	\$214,873	\$232,218	\$166,108
Operational Costs	\$243,561	\$169,972	\$110,890
Capital Costs	\$133,880	\$27,970	\$18,303
Indirect Costs	\$83,895	\$69,598	\$51,522
Lumped Hatchery Costs ¹			
Lumped Third-Party Costs			
Total Hatchery Costs	\$676,209	\$499,758	\$328,520
Source of Funds			
Program Production (lb)	---	---	---
Total Production (lb)	---	---	---
Program as Percent of Total	57%	76%	76%
Program Costs	\$385,439	\$379,816	\$249,675

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 Sawtooth Hatchery by Program

Summer Steelhead

Component	1994	1995	1996
Personnel Costs	\$214,873	\$232,218	\$166,108
Operational Costs	\$243,561	\$169,972	\$110,890
Capital Costs	\$133,880	\$27,970	\$18,303
Indirect Costs	\$83,895	\$69,598	\$51,522
Lumped Hatchery Costs ¹			
Lumped Third-Party Costs			
Total Hatchery Costs	\$676,209	\$499,758	\$328,520
Source of Funds			
Program Production (lb)	---	---	---
Total Production (lb)	---	---	---
Program as Percent of Total	43%	24%	24%
Program Costs	\$290,770	\$119,942	\$78,845

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