
HATCHERY EVALUATION REPORT

Sandy Hatchery - Coho
December 1996

Integrated Hatchery Operations Team (IHOT)

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Sandy Hatchery - Coho

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 Sandy Hatchery - Coho program. Sandy Hatchery is located along Cedar Creek (a Sandy River tributary) near the town of Sandy, Oregon. The hatchery is used for adult collection, incubation, and rearing of coho.

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.

Sandy Hatchery - Coho Results

The Sandy facility includes one pond for adult holding, 20 concrete raceways, and incubation facilities. Marmot Pond is operated as satellite to Sandy Hatchery for the acclimation of Clackamas Hatchery Spring Chinook and Big Creek Hatchery Winter Steelhead. Sandy Hatchery began operation in 1951 as a state-funded facility. In 1959, the hatchery became part of the Columbia River Fisheries Development Program (Mitchell Act) -- a program to enhance declining runs in the Columbia River Basin.

The Sandy Hatchery - Coho program 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 and needed to develop a smolt-to-adult survival goal. The audit found that the hatchery was not in compliance with the disease-free water criteria, water quality monitoring requirements, and regional oversight of feed production criteria, which are all facilities requirements. The hatchery needed to develop specific incubation and rearing standards for the IHOT Operations Plan, exceeded its density criteria for rearing, was not following all of the transportation disinfection requirements, and did not have a smoltification goal or monitoring program. In the compliance area for fish health policy, the hatchery did not have foot baths in the incubation facilities. The hatchery did not have a Genetics Monitoring and Evaluation Program in place.

The specific areas in which the Sandy Hatchery - Coho 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 a genetics M&E program
- Develop smolt-to-adult survival goal for IHOT Operations Plan
- Develop smoltification goal and monitor
- Develop specific incubation and rearing standards for the IHOT Operations Plan
- Follow IHOT protocols for use of protective garments when handling fish eggs or cultural water
- Follow IHOT QA/QC for food preparation
- Follow IHOT recommendations for disinfection of the exteriors and interiors of transport vehicles
- Monitor TGP
- Provide disease-free water supply for incubation and early rearing
- Provide foot baths for incubation facilities
- Provide heating capability for incubation
- Review IHOT requirement for disease-free water for rearing
- Review IHOT temperature criteria for rearing
- Run analysis for water chemistry parameters, turbidity, alkalinity, hardness, nitrite, and contaminants

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:	Sandy Hatchery
Stock/Species:	Coho
Operating Agency:	Oregon Department of Fish & Wildlife
Funding Agency:	Mitchell Act
Location:	Sandy Hatchery is located along Cedar Creek (a Sandy River tributary) near the town of Sandy, Oregon.
Address:	Sandy Fish Hatchery Oregon Department of Fish & Wildlife 39800 SE Fish Hatchery Road Sandy, OR 97055
Hatchery Manager:	Mr. Ken Bourne
Phone:	(503) 668-4222
Fax:	(503) 668-4572
Purpose:	Sandy Hatchery began operation in 1951 as a state-funded facility. In 1959, the hatchery became part of the Columbia River Fisheries Development Program (Mitchell Act) -- a program to enhance declining runs in the Columbia River Basin.
Production Goal:	Coho Produce 1,000,000 coho smolts (66,7000) for on-station release Provide 2,000,000 green eggs to the Eagle Creek National Fish Hatchery as a backup to its program. Provide a total of 2,445,450 eyed coho eggs to McKenzie, Oxbow and Klamath hatcheries, Oregon's Salmon and Trout Enhancement Program, and Oregon State University.
Water Supply:	Water rights total 12,577 gpm from a spring and Cedar Creek. Water is supplied to the hatchery by gravity flow from Cedar Creek with a high flow of 8,000 gpm in March and a low flow of 1,800 gpm in July and August. A small amount of spring water is also used. Water is recirculated in the rearing ponds during the summer months. Adult

holding ponds are supplied with water from the rearing ponds.

Facilities:

Adult Holding:	1 concrete adult holding pond - 8,190 cf
Incubation:	24 concrete troughs - 23 cf each
Early Rearing:	24 concrete troughs - 23 cf each
Raceways:	20 concrete raceways - 5,600 cf each
Rearing Ponds:	None
Satellite Facilities:	Marmot Pond (used to acclimate Clackamas Spring Chinook and Big Creek Winter Steelhead)

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

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

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 Sandy Hatchery was conducted on October 24, 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 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 Sandy Hatchery - Coho

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 Sandy Hatchery - Coho 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 Sandy Hatchery - Coho

Component	Location of Adult Holding, Spawning, Incubation, and Rearing					
	Sandy Hatchery	Eagle Creek NFH	McKenzie, Oxbow, Klamath hatcheries	Oregon's Salmon and Trout Enhancement Program	Oregon State University	
Adult Collection	✓					
Adult Holding	✓					
Spawning	✓					
Fertilization	✓					
Incubation						
green-to-eyed	✓	Green eggs transferred	Eyed eggs transferred	Eyed eggs transferred	Eyed eggs transferred	
eyed-to-hatch	✓					
Rearing						
fry	✓					
fingerlings	✓					
smolts	✓					
Acclimation/release	✓					

PM #	Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
		N/A	Yes	?	No		
#1	Are the hatchery programs outlined in a subbasin management plan?		✓			Columbia Basin System Planning Production Plan and Sandy River Subbasin Management Plan	
#2	Is the hatchery operating under a current hatchery operational plan? Is it understood by staff? Is it being followed?		✓ ✓ ✓			IHOT Operations Plan and Sandy Hatchery O&M manual	
#3	Is a hatchery monitoring and evaluation plan in place? Do you have a written monitoring and evaluation plan?		✓			IHOT Operation Plan cover CWT program	
#4a	Adult contribution to fisheries, spawning grounds, and hatchery		✓			Review of records	
#4b	Adult pre-spawning survival as compared with established goal				✓	Review of records; in compliance 3 out of last 4 years. Low returns and high male mortality in 1 year.	None
#4c	Egg-take as compared with established hatchery goal				✓	Review of records; in compliance 3 out of last 4 years	None
#4d	Green-egg to eyed-egg survival as compared with established goal		✓			Review of records; in compliance 4 out of last 4 years	
#4e	Eyed-egg to fry survival as compared with established goal		✓			Review of records; in compliance 4 out of last 4 years	
#4f	Fry to smolt survival as compared with established goal		✓			Review of records; in compliance 3 out of last 3 years	
#4g	Production as compared with established goal				✓	Review of records; in compliance 2 out of last 3 years	Improve adult returns
#4h	Percent survival (smolt to adult) as compared with established goal				✓	No goal	Develop smolt-to-adult survival IHOT Operations Plan
#4i	Number of eggs, fry, fingerlings, smolts, and/or adults to meet basinwide needs	✓				Review of records/Discussion	

PM #	Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
		N/A	Yes	?	No		
#5a	<p>Temperature</p> <p>Does your water temperature meet the criteria for spawning?</p> <p>Does your water temperature meet the criteria for incubation?</p> <p>Does your water temperature meet the criteria for rearing?</p>		✓			<p>Review of records/Discussion</p> <p>Review of records/Discussion. December and January temperatures care below criteria</p> <p>Review of records/Discussion. Temperature varies from 32-72°F over rearing cycle</p>	<p>Provide heating capability for</p> <p>Review IHOT temperature or rearing</p>
#5b	<p>Dissolved gases</p> <p>Is the oxygen level near saturation?</p> <p>Is the dissolved nitrogen level less than saturation?</p>		✓	✓		<p>Measure this periodically. Never < 7 mg/L</p> <p>No data</p>	<p>Monitor TGP</p>
#5c	<p>Chemistry</p> <p>Ammonia (un-ionized)</p> <p>Carbon Dioxide</p> <p>Chlorine</p> <p>pH</p> <p>Copper</p> <p>Hydrogen Sulfide</p> <p>Iron</p> <p>Zinc</p>			✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓		<p>No data</p>	<p>Run analysis for chemistry parameters</p> <p>See above</p>
#5d	<p>Turbidity</p> <p>Does your turbidity meet the criteria?</p>			✓		<p>No data</p>	<p>Run analysis for turbidity</p>

PM #	Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
		N/A	Yes	?	No		
#5e	Alkalinity and hardness Does your alkalinity and hardness meet the criteria?			✓		No data	Run analysis for alkalinity and hardness
#5f	Nitrite Does your nitrite meet the criteria?			✓		No data	Run analysis for nitrite
#5g	Contaminants Aldrin Endrin Dieldrin Heptachlor Chlordane Methoxychlor Lindane Malathion Guthion			✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓		No data No data No data No data No data No data No data No data No data No data	Run analyses See above See above See above See above See above See above See above See above See above
#5h	Pathogens What portions of the hatchery have disease-free water? Adult holding Incubation Early rearing Rearing Others				✓ ✓ ✓ ✓ ✓	Inspection of facilities/Discussion. Have up to 60 gpm from spring for incubation use. Need more water Inspection of facilities/Discussion Inspection of facilities/Discussion Inspection of facilities/Discussion	None Provide disease-free water suitable for incubation and early rearing. this is currently being developed Review IHOT requirement for disease-free water for rearing See above See above

PM #	Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
		N/A	Yes	?	No		
#6	<p>Alarm Systems</p> <p>Do the following areas have alarms?</p> <p>Intake</p> <p>Large rearing ponds and adult holding ponds</p> <p>Raceway headboxes and rearing ponds</p> <p>Incubation facilities</p> <p>Quarantine areas and facilities</p> <p>Water treatment systems</p> <p>Security</p> <p>Are there outside systems and buzzers in onsite residences?</p> <p>Are water flow alarms checked daily?</p> <p>Are all other alarms checked weekly?</p> <p>Is there a log of alarms for emergencies, tests, and maintenance requirements?</p> <p>Are telephone pagers used?</p>		<p>✓</p>			<p>Inspection of facilities/Discussion</p> <p>Inspection of facilities/Discussion</p> <p>Inspection of facilities/Discussion</p> <p>Inspection of facilities/Discussion</p> <p>None on station</p> <p>None on station</p> <p>Security provided by onsite residences</p> <p>Discussion</p> <p>Review of records/Discussion</p> <p>Discussion</p> <p>Review of records/Discussion</p> <p>Discussion</p>	<p>Install security alarms</p>
#7	<p>Adult collection and holding facilities</p> <p>Do you meet the adult holding criteria?</p>		<p>✓</p>			<p>Review of records/Discussion</p>	

PM #	Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
		N/A	Yes	?	No		
#8	<p>Incubation facilities</p> <p>Type 1: Trough Do you have an adequate number of units for the overall program?</p> <p>Type 2: N/A Do you have an adequate number of units for the overall program?</p>		✓			Inspection of facilities/Discussion	
#9	<p>Rearing facilities</p> <p>Type 1: Raceways Do you have an adequate number of units for the overall program?</p> <p>Type 2: _____ Do you have an adequate number of units for the overall program?</p> <p>Type 3: _____ Do you have an adequate number of units for the overall program?</p>		✓			Inspection of facilities/Discussion	
#10	<p>Screening facilities</p> <p>Do you meet the approach velocity criteria?</p> <p>Are the fish screens regularly cleaned?</p> <p>Does the screen mesh meet screen opening criteria?</p> <p>Are rearing containers double screened for fish that should not be released to adjacent water?</p>		✓			Inspection of facilities/Discussion	
#11	<p>Predator control facilities</p> <p>Are your predation control facilities effective?</p>		✓			Inspection of facilities/Discussion	

PM #	Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
		N/A	Yes	?	No		
#12	<p>Food storage facilities and quality control</p> <p>Does the storage of dry/semi-moist/moist foods (dry<12%; semi-moist 12-20%; moist >20% moisture) follow food manufacturer's recommendations?</p> <p>Does a regional quality control officer oversee production procedures and monitor:</p> <p>Verification by feed manufacturer that ingredients meet specifications?</p> <p>Ensure feed does not contain unwanted drugs or other additives?</p> <p>Analyze ingredients contained in the final food product to ensure that feed specifications have been met?</p> <p>Are the foods stored and handled according to the following criteria?</p> <p>Moist pellets should not exceed 10°F at point of delivery.</p> <p>Moist pellets should be removed from freezer just prior to feeding.</p> <p>Do not leave buckets of feed or feed containers outside exposed to light or heat.</p> <p>Open bags of feed should be fed within 1 to 2 days except when feeding small groups of fish.</p> <p>Automatic feeder hoppers and bulk storage facilities should be insulated against excessive temperatures (80°F and above).</p>		✓			<p>Inspection of facilities/Discussion. Dry/Semi-moist only. No moist</p> <p>Discussion with regional QC officer</p> <p>Discussion with regional QC officer</p> <p>Discussion with regional QC officer</p> <p>Discussion. No moist food on station</p> <p>Discussion. No moist food on station</p> <p>Discussion</p> <p>Discussion</p> <p>Discussion. No automatic feeders. Bulk storage is in the freezer</p>	<p>Follow IHOT recommendation production monitoring at regi</p> <p>See above</p> <p>See above</p>

PM #	Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
		N/A	Yes	?	No		
#13	<p>Release facilities</p> <p>Do the release facilities ensure that fish are not subjected to adverse conditions?</p>		✓			Inspection of facilities/Discussion	
#14	<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>Inspection of facilities/Discussion</p> <p>Discussion</p>	
#15	<p>Transportation facilities</p> <p>Are the transport systems adequate to meet IHOT performance measures for transportation practices?</p>		✓			Inspection of facilities/Discussion	

PM #	Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
		N/A	Yes	?	No		
#16	Broodstock selection practices						
	Is the donor selection process document attached? (PM #40a)	✓				Existing program; does not apply	
	Was the donor selection outline followed in selecting the hatchery broodstock? (PM #40b-c)	✓				Existing program; does not apply	
#17	Spawning practices						
	Were the appropriate number of spawners, male/female ratios, and fertilization protocols used? (PM #42c-g)		✓			Review of records/Discussion	
#18	Incubation practices						
	Are specific incubation standards listed in the hatchery operations plan?		✓			Review of IHOT Operations Plan and Sandy Hatchery O&M manual	Develop specific incubation standards in the IHOT Operations Plan
	Are incubation practices written?		✓			See above	
	Incubation Type 1: Trough (see PM #8) Do you meet the loading and flow criteria?		✓			Review of records/Discussion	
Incubation Type 2: N/A/ (see PM #8) Do you meet the loading and flow criteria?	✓						

PM #	Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
		N/A	Yes	?	No		
#19	<p>Rearing practices</p> <p>Are specific rearing standards listed in the hatchery operations plan?</p> <p>Are rearing practices written?</p> <p>Rearing Unit Type 1: Raceways (see PM #9)</p> <p>Do you meet the density and DI criteria?</p> <p>Do you meet the Loading and FI criteria?</p> <p>Rearing Unit Type 2: N/A (see PM #9)</p> <p>Do you meet the density and DI criteria?</p> <p>Do you meet the Loading and FI criteria?</p> <p>Rearing Unit Type 3: N/A (see PM #9)</p> <p>Do you meet the density and DI criteria?</p> <p>Do you meet the Loading and FI criteria?</p>				<p>✓</p> <p>✓</p> <p>✓</p> <p>✓</p> <p>✓</p> <p>✓</p> <p>✓</p> <p>✓</p>	<p>Review of IHOT Hatchery Operations Plan and Sandy Hatchery O&M manual</p> <p>Review of Hatchery Operations Plan</p> <p>Density and loading based on successful culture practices. No problems observed</p> <p>See above</p>	<p>Develop written rearing criteria, Operations Plan and Sandy Hatchery O&M manual</p> <p>See above</p> <p>see above</p>
#20	<p>Smolt quality</p> <p>Do you produce a high quality smolt?</p>		✓			Discussion	

PM #	Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
		N/A	Yes	?	No		
#21	Fish health management practices						
	Are the monthly hatchery monitoring visits being conducted? (PM #26)		✓			Review of records/Discussion. Pathologist's report on visits to regional labs	
	Are the annual broodstock inspections being conducted? (PM #27)		✓			Review of records/Discussion. Pathologist's report on visits to regional labs	
	Is there pathogen-free water and are the sanitation procedures being followed? (PM #28)				✓	Review of records/Discussion. No pathogen-free water for incubation/early rearing	See PM #5h
	Are the following water quality parameters within criteria? (PM #5a-5g)						
	Water temperature				✓	Outside criteria for incubation/rearing	See PM #5a
	Dissolved gases			✓		No data for nitrogen	See PM #5b
Chemistry			✓		No data	See PM #5c	
Turbidity			✓		No data	See PM #5d	
Alkalinity and hardness			✓		No data	See PM #5e	
Nitrite			✓		No data	See PM #5f	
Contaminants			✓		No data	See PM #5g	
Are rearing standards being followed? (PM #19)					✓	No written standards	See PM # 19
Are egg and fish transfer/release requirements met? (PM #31)			✓			Review of records/Discussion	

PM #	Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
		N/A	Yes	?	No		
#22a	Does hatchery performance meet requirements outlined in the regional hatchery policies and in subbasin and hatchery plans for the following areas?						
#22a1	Percent smoltification Do you measure percent smoltification? Did you meet the smoltification criteria?				✓ ✓	Discussion Discussion	Develop criteria for IHOT and smoltification measurement procedure See above
#22a2	Rearing density (prior to release) Did you meet the rearing density criteria just prior to release?				✓	Review of records/Discussion. Density slightly above 1.0 lb/cf	Develop written rearing density criteria
#22a3	Disease condition (at release) Did you meet all disease regulations just prior to release?		✓			Review of records/Discussion	
#22a4	Number (at release) Did you meet the release number goal?				✓	Review of records/Discussion. Met goal in 1995 but not in 1996. Goal set annually	None
#22a5	Size at release Did you meet the size goal?		✓			Review of records/Discussion	
#22a6	Dates of release Did you meet the release date goal?		✓			Review of records/Discussion	
#22a7	Location of release Did you release the fish at the specified location?		✓			Review of records/Discussion	
#22b	Are fish reared in the subbasin or acclimated in the subbasin? Are the fish reared in the subbasin? Are the fish acclimated in the subbasin?		✓ ✓			Discussion Discussion	
#22c	Is the release strategy appropriate for the program?		✓			Discussion	

PM #	Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
		N/A	Yes	?	No		
#23	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 recommendation for disinfection of the exteriors of transport vehicles
	Is the fish transport vehicle (cab) disinfected using 600 ppm quaternary ammonia compounds (1.5 ml of 50% stock solution/liter water)?				✓	Discussion	See above
	Is other equipment disinfected including fish pumps, nets, egg sorters, waders, boots, rain gear, hoses and other equipment using one of the following solutions?		✓			Discussion	
	200 ppm chlorine for 30 minutes		✓				
	600 ppm quaternary ammonia compound for 30 minutes		✓				
	200 ppm iodophor solution for 10 minutes		✓				
	Do personnel wear protective garments when handling fish eggs or cultural water?				✓	Discussion	Follow IHOT protocols for use of protective garments when handling fish eggs or cultural water
	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	

PM #	Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
		N/A	Yes	?	No		
#24	<p>Evaluation practices</p> <p>Has the hatchery conducted fishery contribution studies to:</p> <p>Determine the requirements for evaluating and improving management programs?</p> <p>Develop guidelines that define the geographical area and identify component stocks (hatchery and/or wild) that comprise the management unit?</p> <p>Develop guidelines that define if the proper stocks of fish are currently being used?</p> <p>Determine which management units contribute to a specific fishery and the time periods of those contributions?</p> <p>Determine the relative contributions of the various management units to a specific fishery over the different time periods?</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>	

PM #	Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
		N/A	Yes	?	No		
#25	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	

PM #	Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
		N/A	Yes	?	No		
#26	<p>Are 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. Pathologist's report from visit to regional labs</p> <p>See above</p> <p>See above</p> <p>See above</p> <p>See above</p> <p>See above</p> <p>See above</p>	
#27	<p>Are all of the functions of the hatchery yearly monitoring visits being completed as described below?</p> <p>Annually examine each broodstock for the presence of reportable viral pathogens.</p> <p>Annually screen each salmon broodstock for the presence of <i>Renibacterium salmoninarum</i>.</p> <p>Conduct inspection by or under the supervision of qualified fish health specialist.</p>		<p>✓</p> <p>✓</p> <p>✓</p>			<p>Review of records/Discussion. Pathologist's report from visit to regional labs</p> <p>See above</p> <p>See above</p>	

PM #	Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
		N/A	Yes	?	No		
#28	<p>Is the hatchery following accepted sanitation procedures?</p> <p>Are there any sources of pathogen-free water, especially for incubation and early rearing?</p> <p>Are the hatchery sanitation procedures understood and being followed as described 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></p> <p></p> <p>✓</p> <p></p> <p></p> <p></p> <p>✓</p> <p></p> <p>✓</p> <p></p> <p>✓</p> <p></p> <p>✓</p>	<p>Discussion. Springs provide about 60 gpm; need more for 100% incubation requirement</p> <p>Inspection of facilities/Discussion</p>	<p>Provide disease-free water su incubation and early rearing</p> <p>Provide foot baths</p>

PM #	Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
		N/A	Yes	?	No		
#29	<p>Are water quality parameters being followed?</p> <p>Are the following water quality parameters within criteria? (PM #5a-5g)</p> <p>Water temperature</p> <p>Dissolved gases</p> <p>Chemistry</p> <p>Turbidity</p> <p>Alkalinity and hardness</p> <p>Nitrite</p> <p>Contaminants</p> <p>Go to PM #21</p>			<p>✓</p> <p>✓</p> <p>✓</p> <p>✓</p> <p>✓</p> <p>✓</p>	<p>✓</p>	<p>Incubation and rearing outside criteria</p> <p>Review of records/Discussion. No data for nitrogen</p> <p>No data</p> <p>No data</p> <p>No data</p> <p>No data</p> <p>No data</p>	<p>See PM #5a</p> <p>See PM #5b</p> <p>See PM #5c</p> <p>See PM #5d</p> <p>See PM #5e</p> <p>See PM #5f</p> <p>See PM #5g</p>
#30	<p>Are 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? (PM #19)</p> <p>Go to rearing practices PM #18-PM #19</p>		<p>✓</p>		<p>✓</p>	<p>Review of records/Discussion</p> <p>Review of records/Discussion. Need to develop written practices</p>	<p>See PM #19</p>
#31	<p>Are egg and fish transfer/release requirements met?</p>		<p>✓</p>			<p>Discussion</p>	

PM #	Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
		N/A	Yes	?	No		
#32	Is the hatchery's program outlined in a subbasin management plan? Go to subbasin plan PM #1		✓			Columbia Basin System Planning Production Plan and Sandy River Subbasin Management Plan	
#33	Is the hatchery operating under a current hatchery operational plan? Go to operational plan PM #2		✓			Review IHOT Operations Plan and Sandy Hatchery O&M Manual	
#34	Is a hatchery monitoring and evaluation plan in place? Go to hatchery monitoring and evaluation plan PM #3		✓			M&E program described in IHOT Operations Plan	

PM #	Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
		N/A	Yes	?	No		
#35	<p>Does the hatchery program meet requirements established in the regional hatchery policies and subbasin planning documents in the following areas: species, stock, broodstock collection location, broodstock numbers, broodstock collection strategy, and 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 #41b)		✓			Review of records/Discussion	
	Broodstock numbers protocols (PM #42c)		✓			Review of records/Discussion	
	Broodstock collection strategy protocols (PM #41b-d)		✓			Review of records/Discussion	
	Spawning protocols (PM #42d-e)		✓			Review of records/Discussion	
	Egg-take protocols (PM #42f-g)		✓			Review of records/Discussion	

PM #	Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
		N/A	Yes	?	No		
#36	Does the hatchery's performance meet requirements outlined in the regional hatchery policies and in subbasin 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. No data; not done	See PM #22a1
	Rearing density (PM #22a2)				✓	Review of records/Discussion. No written goals	See PM #22a2
	Disease condition (PM #22a3)		✓			Review of records/Discussion	
	Number at release (PM #22a4)				✓	Review of records/Discussion. Goal set annually	None
	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		
#37	Are fish reared in the subbasin or acclimated in the subbasin?		✓			Discussion	
	See PM #22b						
#38	Is the release strategy appropriate for the program?		✓			Discussion	
	See PM #22c						

PM #	Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
		N/A	Yes	?	No		
#39	For new programs, has a broodstock collection plan been developed?						
	Is the broodstock collection plan written?	✓				Existing Program; does not apply	
	For a non-captive broodstock program:	✓				Existing Program; does not apply	
	Was an unbiased, representative sample collected?						
	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	
#40	For a new program, was the donor selection outline followed in selecting the hatchery broodstock?						
#40a	Is a donor selection plan written?	✓				Existing Program; does not apply	
#40b	Was the donor selection outline followed in selecting the broodstock?	✓				Existing Program; does not apply	
#40c	Was the target stock recommended in the donor selection process actually used?	✓				Existing Program; does not apply	

PM #	Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
		N/A	Yes	?	No		
#41	For existing programs, were the broodstock collection procedures followed?						
#41a	Is the broodstock collection plan written?		✓			Discussion/Document review	
	Does the broodstock collection plan follow the guideline:						
#41b	Was an unbiased, representative sample collected?		✓			Discussion	
#41c	Was the recommended number of broodstock collected?		✓			Discussion	
#41d	Were the broodstock collection procedures in hatchery operation plan understood and followed?		✓			Discussion	

PM #	Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
		N/A	Yes	?	No		
#42	Was the appropriate number of spawners, male/female ratios, and fertilization protocols used?						
#42a	Are the spawning protocols written?		✓			Discussion/Document Review	
#42b	Are daily or weekly spawning logs available?		✓			Review of records	
#42c	Was the appropriate number of spawners used?		✓			Discussion	
#42d	Did you attempt to spawn all collected broodstock and randomize mating with respect to age class, and other traits?		✓			Discussion	
#42e	Was the sex-ratio within the limits given in the performance standards?		✓			Discussion	
#42f	Were the fertilization protocols followed?		✓			Discussion	
#42g	If the hatchery needed to reduce the number of eggs retained, was this done by representative sampling of each male/female cross?		✓			Discussion	

PM #	Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
		N/A	Yes	?	No		
#43	<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 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>✓</p>	<p>Discussion</p> <p>Discussion</p> <p>Discussion</p> <p>Discussion</p>	<p>Develop a genetics M&E pro</p> <p>See above</p> <p>See above</p> <p>See above</p> <p>See above</p> <p>See above</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 Sandy Hatchery - Coho

This section presents the corrective actions required to bring the Sandy Hatchery - Coho 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 Sandy Hatchery - Coho

Remedial Action Required	Cost	PMS¹
Type 1 - Non-compliance issues resulting from items beyond human control or Performance Measures not relevant for this hatchery		
Improve adult returns	----	4g
Install security alarms	----	6
Type 2 - Remedial actions requiring changes in agency policies or procedures		
Develop smolt-to-adult survival goal for IHOT Operations Plan	----	4h
Review IHOT temperature criteria for rearing	----	
Review IHOT requirement for disease-free water for rearing	----	
Follow IHOT QA/QC for food preparation		12
Develop specific incubation and rearing standards for the IHOT Operations Plan	----	18-19, 22a2
Develop smoltification goal and monitor	----	22a1
Follow IHOT recommendations for disinfection of the exteriors and interiors of transport vehicles	----	23
Follow IHOT protocols for use of protective garments when handling fish eggs or cultural water	----	23
Provide foot baths for incubation facilities	----	28
Develop a genetics M&E program	----	
Type 3 - Remedial actions requiring changes in monitoring coverage or interval		
Monitor TGP	----	5b
Run analysis for water chemistry parameters, turbidity, alkalinity, hardness, nitrite, and contaminants	----	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 Provide heating capability for incubation (144 gpm) Provide disease-free water supply for incubation and early rearing (9 cfs)	\$50,000 \$2.3 Million	5a 5h
Type 5 - Remedial actions that may require significant capital expenditures but are not clearly definable at this time None	----	

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 Sandy Hatchery - Coho 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:
Sandy Hatchery - Coho**

Year	Fisheries ¹ (Broodyear)	Spawning Grounds ¹ (Broodyear)	Hatchery ¹ (Broodyear)	Total Combined Contribution ² (Broodyear)	Smolt to Adult Survival (percent)
1982					
1983					
1984					
1985					
1986					
1987				25,029	2.36%
1988				39,456	4.13%
1989				32,684	3.11%
1990				726	0.07%
1991				9,207	0.90%
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 Sandy Hatchery - Coho 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 separate tables (Table 5a).

Table 5. Annual Operating Expenses: Sandy Hatchery - Coho

Hatchery	1994	1995	1996
1. Sandy	\$309,438	\$329,347	\$315,434
2.			
3.			
4.			
5.			
Total Program Costs	\$309,438	\$329,347	\$315,434

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

Table 6. Annual Operating Expenses - Sandy Hatchery

Program	1994	1995	1996
1. Coho	\$309,438	\$329,347	\$315,434
2.			
3.			
4.			
5.			
Total Hatchery Costs	\$309,438	\$329,347	\$315,434

Table 5a. Annual Operating Expenses: Sandy Hatchery - Coho
Expenditure Occurring at Sandy Hatchery

Component	1994	1995	1996
Personnel Costs	\$168,017	\$178,177	\$166,866
Operational Costs	\$89,788	\$96,241	\$90,894
Capital Costs			\$6,095
Indirect Costs	\$51,633	\$54,989	\$51,579
Lumped Hatchery Costs ¹			
Lumped Third-Party Costs			
Total Hatchery Costs	\$309,438	\$329,347	\$315,434
Source of Funds			
Mitchell Act			
Program Production (lb)			
Total Production (lb)			
Program as Percent of Total	100%	100%	100%
Program Costs	\$309,438	\$329,347	\$315,434

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 Sandy Hatchery by Program

Coho

Component	1994	1995	1996
Personnel Costs	\$168,017	\$178,177	\$166,866
Operational Costs	\$89,788	\$96,241	\$90,894
Capital Costs			\$6,095
Indirect Costs	\$51,633	\$54,989	\$51,579
Lumped Hatchery Costs ¹			
Lumped Third-Party Costs			
Total Hatchery Costs	\$309,438	\$329,347	\$315,434
Source of Funds			
Mitchell Act			
Program Production (lb)			
Total Production (lb)			
Program as Percent of Total	100%	100%	100%
Program Costs	\$309,438	\$329,347	\$315,434

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