
HATCHERY EVALUATION REPORT

Kooskia NFH - Spring Chinook

September 1996

Integrated Hatchery Operations Team (IHOT)

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Kooskia NFH - Spring Chinook

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 Kooskia National Fish hatchery (NFH) - Spring Chinook program. The hatchery is located in north-central Idaho, approximately 75 miles southeast of Lewiston in northwest Idaho County. The hatchery is used for adult collection, incubation, and rearing of spring chinook and operated as satellite of Dworshak NFH.

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.

Kooskia NFH - Spring Chinook Results

The Kooskia facility includes one pond for adult holding, 12 concrete raceways, 6 Burrow's ponds, 42 circular starter tanks, 32 rectangular starter tanks, and incubation facilities. The purpose of the hatchery is to service and enhance the stocks of chinook salmon in Middle Fork Snake River Basin.

The Kooskia NFH 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 survival goals for eye-egg to fry and fry-to-smolt. The audit found that the hatchery was not in compliance with the screen approach criteria, temperature criteria, alarm facilities, water quality and contaminant criteria, food storage facilities, release facilities, and adult holding facilities, which are all facilities requirements. The hatchery did not have any information on loading and density for early rearing and rearing. In the compliance area for fish health policy, the hatchery was not conducting the monthly fish health visits and did not meet the foot bath requirement or disinfection of equipment and rain gear. In the area of genetics policy, the hatchery did not have a broodstock collection plan or a Genetics Monitoring and Evaluation Program in place.

The specific areas in which the Kooskia NFH - 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:

- Conduct monthly fish health monitoring visits
- Develop a genetics monitoring and evaluation program
- Develop additional well supply, develop water supply from Middle Fork, or add more chiller capacity
- Develop broodstock collect plan
- Develop eye-egg to fry survival goal
- Develop fry-to-smolt goal
- Develop information on density and loading for early rearing and rearing
- Develop smoltification goal and monitoring program
- Develop written rearing standards for IHOT Operations Plan
- Disinfect equipment and rain gear utilized in broodstock handling or spawning prior to its use elsewhere in the hatchery
- Document summary of all diagnostic cases by fish lot
- Follow IHOT criteria for checking alarms
- Follow IHOT disinfection protocols for vehicle cab
- Follow IHOT protocols for checking proper functioning of pure oxygen aeration system
- Follow IHOT recommendations for moist pellets
- Follow IHOT temperature criteria for transportation
- Follow manufacturer's recommendation for storage of feeds

- Install alarm for headboxes
- Install foot bath in incubation facility
- Install logging system for alarms
- Rebuild release line to reduce stress
- Run analysis for alkalinity and hardness
- Run analysis for chemistry parameters
- Run analysis for contaminants
- Run analysis for turbidity

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:	Kooskia NFH (A satellite of Dworshak NFH)
Stock/Species:	Spring Chinook
Operating Agency:	U.S. Fish and Wildlife Service
Funding Agency:	Lower Snake Compensation Program
Location:	Located in north-central Idaho, approximately 75 miles southeast of Lewiston in northwest Idaho County. The hatchery is situated in a narrow valley of Clear Creek, just upstream of the confluence with the Middle Fork Clearwater River.
Address:	Dworshak/Kooskia National Fish Hatchery U.S. Fish and Wildlife Service P.O. Box 18, State Highway 7 Ahsahka, ID 83520-0018
Hatchery Manager:	Mr. William Miller (complex manager) Mr. Richard "Kip" Bottomly (on-site hatchery manager)
Phone:	(208) 476-4591
Fax:	
Purpose:	The hatchery was authorized in 1961 to facilitate restoration of depleted, national significant fishery resources. Its first year of operation was 1969. It is currently used for adult collection and rearing of spring chinook. The purpose of the hatchery is to service and enhance the stocks of chinook salmon in Middle Fork Snake River Basin.
Production Goal:	Spring Chinook 800,000 yearling spring chinook (20/lb) for on-station release Total production: 40,000 lb
Water Supply:	Water rights total 13,456 gpm from six wells and Clear Creek. Just over half the water is from Clear Creek. Water available for hatchery use ranges from 4,389 to 8,527 gpm, with the majority supplied from Clear Creek. The hatchery is operated with a water re-use system that incorporates biofilters between uses.

Facilities:

Adult Holding:	1 adult holding pond
Incubation:	
Early Rearing:	42 circular starter tanks 32 rectangular starter tanks
Raceways:	12 raceways 6 Burrow's ponds
Rearing Ponds:	None
Satellite Facilities:	None

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 Kooskia NFH was conducted on September 2, 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 site visit as a **Compliance Report**. That Compliance Report is Table 2 of this report.
5. This information 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 Kooskia NFH - Spring Chinook

The following 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 Kooskia NFH - 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 Kooskia NFH - Spring Chinook

Component	Location of Adult Holding, Spawning, Incubation, and Rearing					
	Kooskia NFH	Dworshak NFH				
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 and U.S. v Oregon	
is the hatchery operating under a current hatchery management plan?		✓			IHOT Operations Plan and Dworshak-Kooskia NFH Goals and Responsibilities	
is it understood by staff?		✓				
is it being followed?		✓				
is a hatchery monitoring and evaluation plan in place?						
do you have a written monitoring and evaluation plan?		✓			At the Fisheries Research Office (FRO) Office; none supplied to team	
is there a plan for adult contribution to fisheries, spawning grounds, and hatchery		✓			Review of records	
is adult pre-spawning survival as compared with established goal	✓				At Dworshak NFH	
is fry take as compared with established hatchery goal	✓				At Dworshak NFH	
is eyed-egg to eyed-egg survival as compared with established goal	✓				At Dworshak NFH	
is eyed-egg to fry survival as compared with established goal			✓		No goal	Develop eyed-egg to fry survival goal
is fry to smolt survival as compared with established goal			✓		No goal	Develop fry-to-smolt survival goal
is adult production as compared with established goal				✓	Review of records; In compliance 0 out of last 4 years	Improve adult returns
is percent survival (smolt to adult) as compared with established goal				✓	Little information supplied to team	Improve adult returns
is the number of eggs, fry, fingerlings, smolts, and/or adults meet basinwide needs	✓				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	Develop additional well supply, develop water supply from middle Fork, or add more chillers
Does your water temperature meet the criteria for rearing?				✓	Review of records/Discussion	Develop additional well supply, develop water supply from middle Fork, or add more chillers
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 supplied to team	Run analysis on wells, creek water, and reuse system
Carbon Dioxide			✓		No data supplied to team	
Chlorine			✓		No data supplied to team	
H			✓		No data supplied to team	
Copper			✓		No data supplied to team	
Hydrogen Sulfide			✓		No data supplied to team	
Iron			✓		No data supplied to team	
Zinc			✓		No data supplied to team	
Turbidity						
Does your turbidity meet the criteria?			✓		No data supplied to team	Run analysis for turbidity

Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
	N/A	Yes	?	No		
Alkalinity and hardness						
Does your alkalinity and hardness meet the criteria?			✓		No data supplied to team	Run analysis for alkalinity and hardness
Nitrite						
Does your nitrite meet the criteria?		✓			Review of records/Discussion	
Contaminants						
Aldrin			✓		No data supplied to team	Run analysis for contaminants
Dieldrin			✓		No data supplied to team	
Diieldrin			✓		No data supplied to team	
Heptachlor			✓		No data supplied to team	
Chlordane			✓		No data supplied to team	
Methoxychlor			✓		No data supplied to team	
Endosulfan			✓		No data supplied to team	
Malathion			✓		No data supplied to team	
Parathion			✓		No data supplied to team	
Diseases						
What portions of the hatchery have disease-free water?						
Adult holding	✓				Adult holding at Dworshak	
Incubation		✓			Inspection of facilities/ Discussion	
Early rearing		✓			Inspection of facilities/ Discussion	
Rearing		✓			Inspection of facilities/ Discussion	
Others						

Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
	N/A	Yes	?	No		
Alarm Systems						
Do the following areas have alarms?						
Intake		✓			Inspection of facilities/ Discussion	
Large rearing ponds and adult holding ponds	✓				At Dworshak	
Raceway headboxes and rearing ponds				✓	Inspection of facilities/ Discussion	Install alarm for headboxes
Incubation facilities		✓			Inspection of facilities/ Discussion	
Quarantine areas and facilities	✓				Inspection of facilities/ Discussion	
Water treatment systems		✓			Inspection of facilities/ Discussion	
Security				✓	Inspection of facilities/ Discussion	No a problem at this facility
Are there outside systems and buzzers in on-site residences?		✓			Discussion	
Are water flow alarms checked daily?				✓	Review of records/Discussion	Follow IHOT criteria for checking flow alarms
Are all other alarms checked weekly?		✓			Discussion	
Is there a log of alarms for emergencies, tests, and maintenance requirements?				✓	Review of records/Discussion	Install logging systems for alarms
Are telephone pagers used?		✓			Discussion	
Adult collection and holding facilities						
Do you meet the adult holding criteria?	✓				At Dworshak	

Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
	N/A	Yes	?	No		
Abatement facilities Type 1: Vertical Tray Do you have an adequate number of units for the overall program?		✓			Inspection of facilities/Discussion	
Filtering facilities Type 1: Burrow's Ponds Do you have an adequate number of units for the overall program? Type 2: Raceways Do you have an adequate number of units for the overall program? Type 3: Rec. Tanks Do you have an adequate number of units for the overall program? Type 4: Circular Tanks Do you have an adequate number of units for the overall program?		✓ ✓ ✓ ✓			Inspection of facilities/Discussion Inspection of facilities/Discussion Inspection of facilities/Discussion okay now; but will need replacement soon	
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 Inspection of facilities/Discussion	
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	Follow manufacturers recommendation for storage of feeds
Does a regional quality control officer oversee production procedures and monitor:						
Verification by feed manufacturer that ingredients meet specifications?		✓			Discussion	
Ensure feed does not contain unwanted drugs or other additives?		✓			Discussion	
Analyze ingredients contained in the final food product to ensure that feed specifications have been met?		✓			Discussion	
Are the foods stored and handled according to the following criteria?						
Moist pellets should not exceed 10°F at point of delivery.				✓	Discussion	
Moist pellets should be removed from freezer just prior to feeding.		✓			Discussion	
Do not leave buckets of feed or feed containers outside exposed to light or heat.		✓			Discussion	
Open bags of feed should be fed within one to two days except when feeding small groups of fish.		✓			Discussion	
Automatic feeder hoppers and bulk storage facilities should be insulated against excessive temperatures (80°F and above).	✓				Discussion	

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?				✓	Several valves and sharp corners are encountered	Rebuild release line to reduce stress
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? Refer to PM #40 in Genetics Section	✓				Existing program; does not apply	
Spawning practices						
Were the appropriate number of spawners, male/female ratios, and fertilization protocols used? Refer to PM #42 in Genetics Section	✓				Spawning at Dworshak NFH	
Incubation practices						
Are specific incubation standards listed in the hatchery operations plan?		✓				
Are incubation practices written?		✓				
Do incubation Type 1: Vertical Tray (see PM #8) 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 rearing plan?				✓	No information supplied to team	Develop written rearing standards
rearing practices written?				✓	Review Hatchery Operations Plan	
Rearing Unit Type 1: <u>Burrow's Ponds</u> (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: <u>Raceways</u> (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 3: <u>Rec. Tanks</u> (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 3: <u>Circular Tanks</u> (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	Conduct monthly fish health monitoring visits
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	Develop new water supply
Dissolved gases		✓			Review of records/Discussion	
Chemistry			✓		Review of records/Discussion	Run analysis for parameters
Turbidity			✓		Review of records/Discussion	Run analysis for parameter
Alkalinity and hardness			✓		Review of records/Discussion	Run analysis for parameters
Nitrite		✓			Review of records/Discussion	
Contaminants			✓		Review of records/Discussion	Run analysis for parameters
Are rearing standards being followed? (PM #19)			✓		Review of records/Discussion	Develop goal and document density and loading
Are egg and fish transfer/release requirements met? (PM #31)				✓	Review of records/Discussion	Document summary of all diagnostic cases by fish lot

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>			✓		No information supplied to team	Document density prior to release
<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 (at release)</p> <p>Did you meet the release date goal?</p>		✓			Review of records/Discussion	
<p>Release location (at release)</p> <p>Did you release the fish at the specified location?</p>		✓			Review of records/Discussion	
<p>Subbasin acclimation (at release)</p> <p>Were the fish reared in the subbasin?</p> <p>Were the fish acclimated in the subbasin?</p>		✓			Discussion	
		✓			Discussion	
<p>Release strategy appropriate for the program?</p>		✓			Discussion	

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	
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 disinfection protocols for vehicle cab
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	Follow IHOT protocols for checking proper functioning of pure oxygen aeration system
Is water temperature in the transportation unit maintained within the 42-48 °F range?				✓	Discussion	Follow IHOT temperature criteria for transportation
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		
<p>monthly hatchery monitoring visits being conducted by a qualified fish health specialist as described below?</p> <p>Conduct visit at least monthly</p> <p>Monitoring conducted by qualified fish health specialist</p> <p>Examine a representative sample of healthy and moribund fish from each lot.</p> <p>Review fish culture practices with hatchery manager.</p> <p>Report finding and results of necropsies on standard form.</p> <p>Recommend appropriate drug or chemical treatment.</p> <p>Summarize fish health status or stock prior to release or transfer to another facility.</p>		<p>✓</p> <p>✓</p> <p>✓</p> <p>✓</p> <p>✓</p> <p>✓</p>		<p>✓</p>	<p>Review of records/Discussion</p>	<p>Conduct monthly fish health monitoring visits</p>
<p>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</p> <p>Review of records/Discussion</p> <p>Review of records/Discussion</p>	

Description of Performance Measure	Compliance Status				Basis for Compliance or Non-Compliance	Remedial Action Needed for Compliance
	N/A	Yes	?	No		
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	Install foot baths in incubation facility
Is equipment and rain gear utilized in broodstock handling or spawning sanitized prior to its use elsewhere in the hatchery?				✓	Inspection of facilities/ Discussion	Disinfect equipment and rain gear utilized in broodstock handling or spawning prior to its use elsewhere in the hatchery
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	Develop new water supply/add more chilling
Dissolved gases		✓			Review of records/Discussion	Run analysis
Chemistry			✓		Review of records/Discussion	Run analysis
Turbidity			✓		Review of records/Discussion	Run analysis
Alkalinity and hardness			✓		Review of records/Discussion	Run analysis
Nitrite		✓			Review of records/Discussion	
Contaminants			✓		Review of records/Discussion	Run analysis
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)			✓		No information supplied to team	Document density and loading for early rearing and rearing
io to rearing practices PM #18-PM #19						
egg and fish transfer/release requirements met?				✓	Discussion	Provide summary of all diagnostic cases by fish lot

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 and U.S. v Oregon	
<p>Is the hatchery operating under a current hatchery operational plan?</p> <p>Refer to operational plan PM #2</p>		✓			IHOT Operations Plan and Dworshak-Kooskia NFH Goals and Responsibilities	
<p>Is a hatchery monitoring and evaluation plan in place?</p> <p>Refer to hatchery monitoring and evaluation plan PM #3</p>		✓			At the FRO Office; none supplied to team	

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	Develop broodstock collection plan
Spawning protocols (PM #42)	✓				Occurs at Dworshak NFH	
Egg-take protocols (PM #42)	✓				Occurs at Dworshak NFH	

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 goal and monitoring program
Rearing density (PM #22a2)			✓		Review of records/Discussion	Document density and loading for early rearing and rearing
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	
PM #22b						
Is the release strategy appropriate for the program?		✓			Discussion	
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>None provide to team</p> <p>Discussion</p> <p>Discussion</p> <p>Discussion</p> <p>Discussion</p>	<p>Develop broodstock collection plan</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?	✓				Spawning at Dworshak NFH	
Are daily or weekly spawning logs available?	✓				Spawning at Dworshak NFH	
Was the appropriate number of spawners used?	✓				Spawning at Dworshak NFH	
Did you attempt to spawn all collected broodstock and randomize mating with respect to age class, and other traits?	✓				Spawning at Dworshak NFH	
Was the sex-ratio within the limits given in the performance standards?	✓				Spawning at Dworshak NFH	
Were the fertilization protocols followed?	✓				Spawning at Dworshak NFH	
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>✓</p> <p>✓</p> <p>✓</p> <p>✓</p>	<p>None supplied to team</p> <p>Discussion</p> <p>Discussion</p> <p>Discussion</p> <p>Discussion</p>	<p>Develop a genetics monitoring and evaluation program</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 Kooskia NFH - Spring Chinook

This section presents the corrective actions required to bring the Kooskia NFH - 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 Kooskia NFH - Spring Chinook

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, 4h, 22a4, 41
Type 2 - Remedial actions requiring changes in agency policies or procedures		
Develop eye-egg to fry survival goal	----	4e
Develop fry-to-smolt goal	----	4f
Install security alarm	----	6
Follow manufacturer's recommendation for storage of feeds	----	12
Follow IHOT recommendations for moist pellets	----	12
Develop written rearing standards for IHOT Operations Plan	----	19
Develop information on density and loading for early rearing and rearing	----	19, 22a2
Conduct monthly fish health monitoring visits	----	21, 26
Document summary of all diagnostic cases by fish lot	----	21,31
Develop smoltification goal and monitoring program	----	22a1
Follow IHOT disinfection protocols for vehicle cab	----	23
Follow IHOT protocols for checking proper functioning of pure oxygen aeration system	----	23
Follow IHOT temperature criteria for transportation	----	23
Install foot bath in incubation facility	----	28
Disinfect equipment and rain gear utilized in broodstock handling or spawning prior to its use elsewhere in the hatchery	----	28
Develop broodstock collect plan	----	35,41
Develop a genetics monitoring and evaluation program	----	43

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

Remedial Action Required	Cost	PMS¹
Type 3 - Remedial actions requiring changes in monitoring coverage or interval		
Run analysis for chemistry parameters	----	5c
Run analysis for turbidity	----	5d
Run analysis for alkalinity and hardness	----	5e
Run analysis for contaminants	----	5g
Follow IHOT criteria for checking alarms	----	6
Type 4 - Remedial actions requiring significant capital expenditures		
Install alarm for headboxes	\$5,000	6
Install logging system for alarms	\$5,000	6
Rebuild release line to reduce stress	\$75,000	13
Type 5 - Remedial actions that may require significant capital expenditures but are not clearly definable at this time		
Develop additional well supply, develop water supply from Middle Fork, or add more chiller capacity	----	5a

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 Kooskia NFH - Spring Chinook 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:
Kooskia NFH - Spring Chinook**

Year	Fisheries ¹ (Broodyear)	Spawning Grounds ¹ (Broodyear)	Hatchery ¹ (Broodyear)	Total Combined Contribution ² (Broodyear)	Smolt to Adult Survival (percent)
1983					
1984					
1985					
1986					
1987					
1988	173	0	907		0.27
1989					
1990					
1991					
1992					

Only one year data is listed in the Missing Production Groups (1994); other calendar year data provided by hatchery but not presented.

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 Kooskia NFH - 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 separate tables (Tables 5a and 5b).

Table 5. Annual Operating Expenses: Kooskia NFH - Spring Chinook

Hatchery	1994	1995	1996
1. Kooskia NFH	Information not provided	\$224,000	\$227,000
2. Dworshak	Information not provided	Information not provided	Information not provided
3.			
4.			
5.			
Total Program Costs	N/A	\$224,000	\$227,000

The total expenditures for the Kooskia NFH are presented in Table 6 by program. The detailed breakdown of program expenditures at this hatchery is presented in a separate table (Table 6a).

Table 6. Annual Operating Expenses - Kooskia NFH

Program	1994	1995	1996
1. Spring Chinook	N/A	\$224,000	\$227,000
2.			
3.			
4.			
5.			
Total Hatchery Costs	N/A	\$224,000	\$227,000

**Table 5a. Annual Operating Expenses: Kooskia NFH - Spring Chinook
Expenditure Occurring at Kooskia NFH**

Component	1994	1995	1996
Personnel Costs		\$137,000	\$142,000
Operational Costs		\$84,000	\$80,000
Capital Costs		\$3,000	\$5,000
Indirect Costs			
Lumped Hatchery Costs ¹			
Lumped Third-Party Costs			
Total Hatchery Costs	N/A	\$224,000	\$227,000
Source of Funds			
Program Production (lb)			
Total Production (lb)			
Program as Percent of Total	100%	100%	100%
Program Costs	N/A	\$224,000	\$227,000

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 5b. Annual Operating Expenses: Kooskia NFH - Spring Chinook
Expenditure Occurring at Dworshak NFH**

Component	1994	1995	1996
Personnel Costs			
Operational Costs			
Capital Costs			
Indirect Costs			
Lumped Hatchery Costs ¹			
Lumped Third-Party Costs			
Total Hatchery Costs			
Source of Funds			
Program Production (lb)			
Total Production (lb)			
Program as Percent of Total			
Program Costs			

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 Kooskia NFH by Program
Spring Chinook

Component	1994	1995	1996
Personnel Costs		\$137,000	\$142,000
Operational Costs		\$84,000	\$80,000
Capital Costs		\$3,000	\$5,000
Indirect Costs			
Lumped Hatchery Costs ¹			
Lumped Third-Party Costs			
Total Hatchery Costs	N/A	\$224,000	\$227,000
Source of Funds			
Program Production (lb)			
Total Production (lb)			
Program as Percent of Total	100%	100%	100%
Program Costs	N/A	\$224,000	\$227,000

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