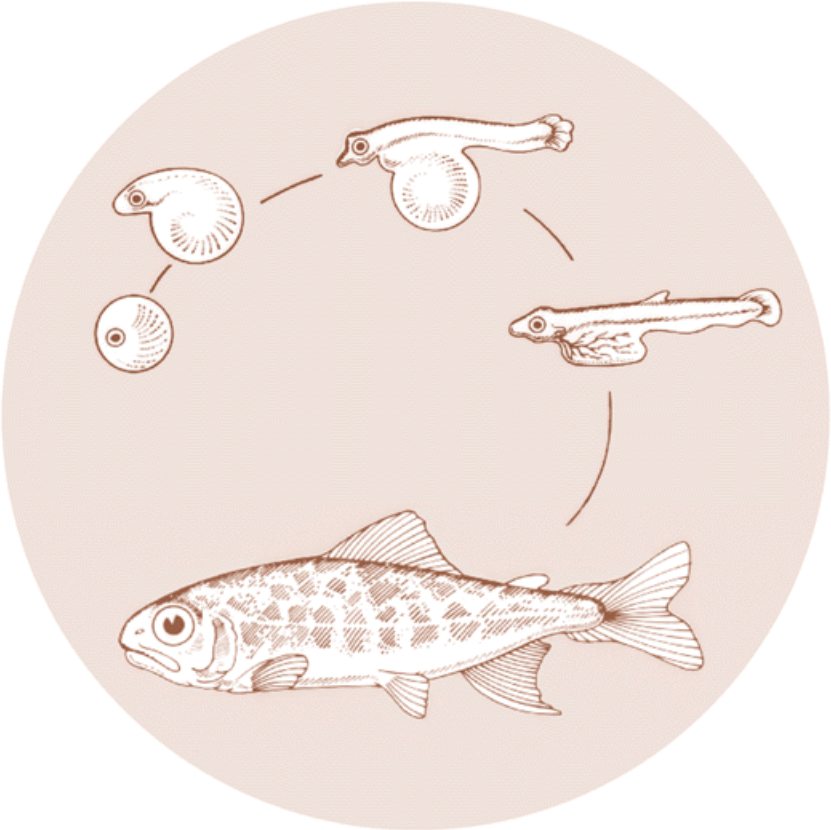
August 1993

INTEGRATED HATCHERY OPERATIONS TEAM
OPERATION PLANS FOR ANADROMOUS FISH PRODUCTION
FACILITIES IN THE COLUMBIA RIVER BASIN

Volume IV Addendum:
Rocky Reach Hatchery

Annual Report 1992



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INTEGRATED HATCHERY OPERATIONS TEAM

OPERATION PLANS FOR ANADROMOUS FISH PRODUCTION FACILITIES IN THE COLUMBIA RIVER BASIN VOLUME IV ADDENDUM:

ROCKY REACH HATCHERY

ANNUAL REPORT 1992

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Rocky Reach Salmon Hatchery

INTRODUCTION

Rocky Reach Hatchery is located along the Columbia River, just downstream from Rocky Reach Dam. Site elevation is 800 feet above sea level. The Turtle Rock Island facility, located 2 miles upstream, is operated as a satellite facility (shared with the Washington Department of Wildlife). The facility is staffed with 2.75 FTE's.

The hatchery was originally designed as a mile-long spawning channel at Turtle Rock Island. Rearing units consist of eight vinyl raceways at Rocky Reach and four rearing ponds at Turtle Rock.

Water rights are held by Chelan County PUD and total 3,613 gpm from the Columbia River. Water available for use in the Turtle Rock rearing ponds averages 12,000 gpm from the Columbia River.

PURPOSE

Rocky Reach Hatchery and the Turtle Rock satellite facility are owned by Chelan County PUD. They are operated as mitigation facilities for the fishery impacts caused by the construction and operation of Rocky Reach Dam. Rocky Reach Hatchery is used for incubation and early rearing of upriver bright (URB) fall chinook. Fingerlings are later transferred to the Turtle Rock facility for final rearing and release.

GOALS

The mitigation agreement with Chelan County PUD requires 54,400 pounds of total production. URB stock is not managed for escapement to this hatchery.

OBJECTIVES

Objective 1: Hatchery Production

Produce 200,000 yearling URB fall chinook for release from the Turtle Rock Island rearing facility.

Produce 1,600,000 subyearling URB fall chinook for release from the Turtle Rock Island rearing facility.

Objective 2: Minimize interactions with other fish populations through proper rearing and release strategies.

Objective 3: Maintain stock integrity and genetic diversity of each unique stock through proper management of genetic resources.

Objective 4: Maximize survival at all life stages using disease control and disease prevention techniques. Prevent introduction, spread or amplification of fish pathogens.

Objective 5: Conduct environmental monitoring to ensure that hatchery operations comply with water quality standards and to assist in managing fish health.

Objective 6: Communicate effectively with other salmon producers and managers in the Columbia River Basin.

CURRENT PRACTICES TO ACHIEVE OBJECTIVES

Objective 1: Hatchery Production

Adult Collection

There are no adult fish captured at this facility. Fall chinook eggs are transferred from Priest Rapids Hatchery for the yearling program and from Wells Hatchery for the subyearling program. Adult capture facilities are available and could be utilized in the future.

Objective 2: Minimize interactions with other fish populations through proper rearing and release strategies.

Rearing and Release Strategies

Two different URB fall chinook rearing programs are used at this facility:

- Transfer eyed eggs from Priest Rapids Hatchery; rear to fingerling size at Rocky Reach; transfer to Turtle Rock Island and rear to a size of 8 fish/pound; release on-station (acclimated) in April.

- Transfer green or eyed eggs from Wells Hatchery; start feeding at Rocky Reach; transfer to Turtle Rock Island and rear to a size of 50 fish/pound; release on-station (acclimated) in May/ June.

Objective 3: Maintain stock integrity and genetic diversity.

Adult Collection

There are no adults collected at this facility at this time.

Spawning Protocol

There is no spawning conducted at this facility.

Acceptable Stocks

Hatchery production goals at Rocky Reach are met by importing eggs from other facilities with acceptable stocks. The stocks approved for release from Rocky Reach and Turtle Rock Island are listed below.

URB Fall Chinook
Mainstem Columbia River upriver brights

Objective 4: Maximize survival at all life stages using disease control and disease prevention techniques. Prevent introduction, spread or amplification of fish pathogens.

Fish Health Management Programs-All Stocks

The primary objective of fish health management programs at WDF hatcheries is to produce healthy smolts that will contribute to the fisheries and natural spawning. Equally important is to prevent the introduction, amplification or spread of certain fish pathogens which might negatively affect the health of both hatchery and naturally reproducing stocks.

WDF has implemented both disease control and disease prevention programs at all of its facilities to try and achieve these objectives. These programs include the following standard elements:

Disease Control (Reactive)

- Perform necropsies of diseased and dead fish to diagnose the cause of loss.
- Prescribe appropriate treatments and remedies to disease.
- Use a disease control policy which dictates how specific disease problems will be addressed and what restrictions may be placed on movements of diseased stocks.
- Conduct applied research on new and existing techniques to control disease epizootics.

Disease Prevention (Proactive)

- Routinely perform necropsies of clinically healthy fish to assess health status and detect problems before they progress to clinical disease or mortality.
- Implement disease preventative strategies in all aspects of fish culture to produce a quality fish. This includes prescribing the optimal nutritional needs and environmental conditions in the hatchery rearing container based on historical disease events. It also involves the prophylactic use of vaccines in order to avoid a disease problem.
- Use a disease prevention policy which restricts the introduction of stocks into a facility which may result in the introduction of a new disease condition or mortality.
- Use sanitation procedures which prevent introduction of pathogens into and/or within a facility.

- Conduct applied research on new and existing disease prevention techniques.

- Utilize pond management strategies (e.g., Density Index and Flow Index) to help optimize the quality of the aquatic environment and minimize fish stress which can induce infectious and noninfectious diseases. For example, the Density Index is used to estimate the maximum number of fish (of a given length) that can occupy a rearing unit based on the rearing unit's size. The Flow Index is used to estimate the rearing unit's carrying capacity based on water flows.

Fish Health Activities at Rocky Reach Hatchery

Health Monitoring

- On at least a monthly basis, both healthy and clinically diseased fish from each fish lot at the hatchery are given a health exam. The sample includes a minimum of ten fish per lot. Findings are reported on WDF Form FH01.

- Prior to transfer or release, fish are given a health exam. This exam may be in conjunction with the routine monthly visit.

- Whenever abnormal behavior or mortality is observed, the fish health specialist will examine the affected fish, make a diagnosis and recommend the appropriate remedial or preventative measures.

- Reporting and control of selected fish pathogens are conducted in accordance with the Co-Managers Fish Disease Control Policy.

Fish and Egg Movements

- Movements of fish and eggs are conducted in accordance with the Co-Managers Fish Disease Control Policy.

Therapeutic and Prophylactic Treatments

- Juvenile fish are administered antibiotics orally when needed for the control of bacterial infections.

- Formalin (37% formaldehyde) is dispensed into water for control of parasites and fungus on eggs, juveniles and adult salmon. Treatment dosage and time of exposure varies with species, life-stage and condition being treated.

- Only therapeutants approved by the U.S. Food and Drug Administration are used for treatments.

Sanitation

- All eggs brought to the facility are surface-disinfected with iodophor (as per disease policy).

- All equipment (nets, tanks, rain gear) is disinfected with iodophor between different fish/egg lots.

- Different fish/egg lots are physically isolated from each other by separate ponds or incubation units. Incubation units are further isolated by plastic curtains. The intent of these activities is to prevent the horizontal spread of pathogens by splashing water.

- Tank trucks are disinfected between the hauling of different fish lots.

- Foot baths containing iodophor are strategically located on the hatchery grounds (i.e., entrance to hatchery building) to prevent spread of pathogens.

0 bjective 5: Conduct environmental monitoring.

Environmental Monitoring

Primarily, environmental monitoring is conducted at WDF facilities to ensure these facilities meet the requirements of the National Pollution Discharge Elimination Permit administered by the Washington Department of Ecology. It is also used in managing fish health. On a short-term basis, monitoring helps identify when changes to hatchery practices are required. Long-term monitoring provides the ability to quantify water quality impacts resulting from changes in the watershed (e.g., logging, road building and urbanization). The following parameters are currently monitored at this hatchery:

- *Total Suspended Solids (TSS)*—1 to 2 times per month on composite effluent, maximum effluent and influent samples. Once per month on pollution abatement pond influent and effluent samples.

- *Settleable Solids (SS)*—1 to 2 times per week on effluent and influent samples. Once per week on pollution abatement pond influent and effluent samples.

- *Upstream and* Downstream Temperatures-twice per month, June through September.

- *Upstream and* Downstream Dissolved Oxygen (DO)-twice per month, June through September.

- In-hatchery *Water* Temperatures-maximum and minimum daily.

- In-hatchery *Dissolved Oxygen-as* required by steam flow or weather conditions.

- Some facilities monitor rainfall and air temperature on a daily basis.

The following are additional parameters which should be monitored at WDF hatcheries:

- *Influent Water* Temperatures-continuous monitoring
- *Air* Temperatures-continuous monitoring
- *Influent/Effluent Dissolved* Oxygen-continuous monitoring
- *Influent pH/Conductivity*—continuous monitoring
- *Streambed Movement*
- *In-stream Flow/Current*
- *Daily Rainfall*

Objective 6: Communicate effectively with other salmon producers and managers.

Interagency Coordination/Communication

Production Advisory Committee (PAC): The Columbia River PAC is comprised of representatives from the regulatory management agencies and tribes. This group meets monthly to discuss anadromous fish production issues and to provide an opportunity for communication among the anadromous fish hatchery managers.

Technical Advisory Committee (TAC): The Columbia River TAC is comprised of regulatory fish harvest technicians. This group provides management direction used in establishing hatchery fish production goals. TAC meets monthly.

Integrated Hatchery Operations Team (IHOT): This group is comprised of representatives from fish management agencies and tribes. IHOT meets monthly and is currently developing a series of regional hatchery policies.

Pacific Northwest Fish Health Protection Committee (PNFHPC): This group is comprised of representatives from U.S. and Canadian fish management agencies, tribes, universities, and private fish operations. The groups meets twice a year to monitor regional fish health policies and to discuss current fish health issues in the Pacific Northwest.

In-River Agreements: State, federal and tribal representatives meet annually to set Columbia River harvests as part of the U.S. v. Oregon Agreement. Periodic meetings are also held throughout the year to assess if targets are being met.

In-Season Communications: Communication with PAC, the Columbia River Inter-Tribal Fish Commission, Oregon Department of Fish and Wildlife, Washington Department of Wildlife, U.S. Fish and Wildlife Service and Idaho Department of Fish and Game takes place each year to coordinate proper fish and egg transfers in an effort to meet basin-wide goals at all facilities, where applicable.

Record Keeping

Records are kept in a consistent manner employing standard formats to allow for documentation and monitoring. Future record keeping will be coordinated with the basin-wide Coordinated Information System (CIS) currently under development. It will be a system to access all necessary databases in the region. It is hoped that coordinated information collection and reporting will result in consistency between the various agencies.

Development and Review of Brood Documents

The three brood documents are reviewed and agreed to annually. The Eauilibrium Brood Document for the Columbia River and/or major tributaries has not yet been developed. It would document existing baseline production and current management. The Future Brood Document is a detailed listing of annual production goals. This is reviewed and updated each spring, and is finalized by July. The Current Brood Document reflects actual production relative to the annual production goals. It is developed in the spring after eggs are taken. It is usually finalized by March.

PERFORMANCE STANDARDS-ROCKY REACH HATCHERY

Objective 1

Measures	Species	Hatchery Goal	5-Year Average	Range	Constraints
Adult Capture	Fall Chinook	NA	NA	NA	1
Adult Prespawning Survival	Fall Chinook	NA	NA	NA	1
Egg-take	Fall Chinook	NA	NA	NA	1
Green Egg-to-Fry Survival	Fall Chinook	90%	91%	77-98%	
Fry-to-Smolt Survival	Fall Chinook	90%	92%	87-98%	
Fish Releases	Fall Chinook	1,800,000[1]	382,000	180K-900K	1,2
Transfers to Co-ops (Eggs/Fish)	Fall Chinook	0	--	--	
Other Transfers (Eggs/Fish)	Fall Chinook	0	--	--	
Adults Passed Upstream	Fall Chinook	NA	NA	NA	
Percent Survival	Fall Chinook	2.5%	1.92%	0.4-3.6%	2,3

NA=Not applicable.

[1] Releases involve 200,000 yearlings and 1,600,000 subyearlings.

Objective 2

Measures	Species	Hatchery Goal	5-Year Average	Range	Constraints
Release smol ts CV<10%	Fall Chinook	Yes	8.4%	7.8-10.0%	
Acclimation	Fall Chinook	Yes	Yes	--	
Volitional Release	Fall Chinook	No	No	--	

Objective 3

Measures	Species	Hatchery Goal	5-Year Average	Range	Constraints
Collect Adults Throughout Run	Fall Chinook	NA	NA	NA	1
Spawning Pop. >500	Fall Chinook	NA	NA	NA	1
Spawning Ratio Male:Female	Fall Chinook	NA	NA	NA	1

Objective 4

Measures	Species	Hatchery Goal	5-Year Average	Range	Constraints
Adhere to Disease Policy	Fall Chinook	Yes	Yes	--	

Objective 5

Measures	Species	Hatchery Goal	5-Year Average	Range	Constraints
TSS Effluent	All	5 mg/l	NA	NA	
TSS Max Effluent	All	15 mg/l	NA	NA	
SS Effluent	All	0.1 ml/l	NA	NA	
TSS PA Effluent	All	100 mg/l	NA	NA	
SS PA Effluent	All	1.0 ml/l	NA	NA	
Downstream Temp	All	Varies	NA	NA	
Downstream DO	All	Varies	NA	NA	
continuous monitoring of other parameters	All	Yes	NA	NA	

Objective 6

Measures	Species	Hatchery Goal	5-Year Average	Range	Constraints
Check Hatchery Records for Accuracy and Completeness	All	Yes	No	--	4
Develop and Review Comp. Basin-Wide Production Plan	All	Yes	No	--	5
Develop and Review Future Brood Doc.	All	Yes	Yes	--	4
Develop and Review Current Brood Doc.	All	Yes	Yes	--	4

Constraints/Comments-Rocky Reach Hatchery

1. No adults are collected at this facility. The rearing program is totally dependent upon obtaining surplus eggs from other facilities.

2. Survival may be decreased due to inadequate water flows, dam passage problems, high water temperatures in the reservoirs, or increased predation.

3. Lack of current, continuous tag data.

4. Insufficient funding to provide adequate support staff.

5. A comprehensive basin-wide production plan has not been completed at this time.

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Acronyms or Abbreviations Used in this Report

B PA: Bonneville Power Administration
cfs: Cubic feet per second.
CHF: Fall Chinook
CHS: Spring Chinook
CHR: Summer Chinook
CIS: Coordinated Information System
COH: Coho
CRITFC: Columbia River Inter-Tribal Fish Commission
ESA: Endangered Species Act
FERC: Federal Energy Regulatory Commission
IDFG: Idaho Department of Fish and Game
IHOT: Integrated Hatchery Operations Team
NMFS: National Marine Fisheries Service
ODFW: Oregon Department of Fish and Wildlife
PAC: Production Advisory Committee
PNFHPC: Pacific Northwest Fish Health Protection Committee
PP&L: Pacific Power and Light
PUD: Public Utility District
StS: Summer Steelhead
S tW: Winter Steehead
SOC: Sockeye
TAC: Technical Advisory Committee
USFWS: U.S. Fish and Wildlife Service
WDF: Washington Department of Fisheries
WD W: Washington Department of Wildlife

Cowlitz Salmon Hatchery

INTRODUCTION

Cowlitz Salmon Hatchery is located on the Cowlitz River (river mile 45) approximately 10 miles from Mossyrock, Washington. Elevation of the facility is 250 feet above sea level.

Cowlitz is a large hatchery that includes a fish ladder, adult return separation facility, 36 modified Burrows ponds (14 of which can be used for juvenile or adult holding), 18 kettles, hatchery building and maintenance facilities. The facility is staffed with 13.83 FTE's.

Water rights are held by Tacoma City Light and total 89,776 gpm (200 cfs) from the Cowlitz River and 1,000 gpm from wells. The hatchery is supplied from three sources, all pumped. The majority of water is supplied from the Cowlitz River with an average 68,800 gpm available to the rearing ponds. An additional 14,000 gpm is available for the fish separator and ladder. The remaining two sources are C-wells (500 gpm) and PW-wells (500 gpm). The wells are only used between September and March, normally for egg incubation and early fry rearing.

PURPOSE

The hatchery was built in 1967 and is owned and funded by Tacoma City Light as mitigation for the fishery impacts caused by Mossyrock and Mayfield dams. The facility is used for adult collection, egg incubation, and rearing of fall chinook, spring chinook and late (Type-N) coho. It also provides some eggs and fish for volunteer and/or educational fish rearing projects. Steelhead and cutthroat trout are also collected at this facility, with some fish shipped upstream and some downstream.

GOALS

The mitigation goal is established at 17,300 spring chinook adults, 8,300 fall chinook adults and 25,500 coho adults returning to Cowlitz River barrier dam.

OBJECTIVES

Objective 1: Hatchery Production

Fall Chinook
Produce 6,500,000 subyearlings for on-station release.

Provide 10,500 eggs/fish to co-op programs.

Provide eggs/fish (surplus to on-station needs) to other facilities.

Type-N Coho
Produce 4,700,000 yearlings for on-station release.

Produce 800,000 to 1,200,000 subyearlings for upstream resident coho fishery.

Provide 61,200 eggs/fish to co-op programs.

Provide eggs/fish (surplus to on-station needs) to other facilities.

Spring Chinook
Produce 1,752,000 yearlings and subyearlings for on-station release.

Provide 60,000 eggs/fish to co-op programs.

Provide eggs/fish (surplus to on-station needs) to other facilities.

Objective 2: Minimize interactions with other fish populations through proper rearing and release strategies.

Objective 3: Maintain stock integrity and genetic diversity of each unique stock through proper management of genetic resources.

Objective 4: Maximize survival at all life stages using disease control and disease prevention techniques. Prevent introduction, spread or amplification of fish pathogens.

Objective 5: Conduct environmental monitoring to ensure that hatchery operations comply with state and federal water quality standards.

Objective 6: Communicate effectively with other salmon producers and managers in the Columbia River Basin.

CURRENT PRACTICES TO ACHIEVE OBJECTIVES

Objective 1: Hatchery Production

Adult Collection

The primary intent of the adult collection procedures at Cowlitz Hatchery is to collect enough adults to 1) sustain the mitigation program through sufficient broodstock returns, 2) provide restocking of the upper Cowlitz watershed with coho, spring chinook and fall chinook adults, and 3) provide a limited number of eggs to other hatchery programs.

Fall Chinook: Adult fall chinook return from mid-August until November. Peak spawning usually occurs in mid-October. Broodstock are collected and separated at the hatchery.

Spring Chinook: Adults return to the Cowlitz River from March through July. Spawning occurs from August to September with a peak usually in September. Adults are collected and separated at the hatchery.

Tvpe-N Coho: Adults return from mid-September to February. Peak spawning occurs in late November and early December. Hatchery broodstock are collected and separated on-site.

Objective 2: Minimize interactions with other fish populations through proper rearing and release strategies.

Rearing and Release Strategies

Rearing and release strategies are designed to limit the amount of ecological interactions occurring between hatchery and naturally produced fish. Fish are reared to sufficient size that smoltification occurs within nearly the entire population, which will reduce retention time in downstream migration. Rearing on parent river water, or acclimation for several weeks to parent river water is used to ensure strong homing to the hatchery, thus reducing the stray rate to natural populations. Various release strategies are used to ensure that fish migrate from the hatchery with the least amount of interaction with native populations. The specific rearing and release strategies used at this hatchery are outlined below.

Fall Chinook: Rear 6.5 million fish to a size of SO-80 fish/pound and release on-station (acclimated) in May-June.

Type-N Coho: Rear 800,000 - 1.2 million coho to a size of 50 fish/pound and release into upper Cowlitz River tributaries and Riffe Lake in July-August. Rear 4.7 million coho to a size of 20 fish/pound and release on-station (acclimated) in May-June the following year.

Spring Chinook: Rear approximately 600,000 spring chinook to a size of 30-40 fish/pound and release on-station (acclimated) from May to July. Rear 1,152,000 fish to a size of 4 fish/pound and release on-station (acclimated) in March-April of the following year.

Objective 3: Maintain stock integrity and genetic diversity.

Broodstock Selection

Adults are collected throughout the entire run at the Cowlitz Salmon Hatchery adult fish separation facility to ensure that the run timing for these stocks is maintained. Any fish identified as non-Cowlitz origin are not used in spawning.

Spawning Protocol

The intent is to utilize a spawning population of at least 500 adults. When spawning fewer than 1 million eggs in a day, the male to female ratio will be 1:1 for all stocks. When spawning more than 1 million eggs in a day, the ratio will not be less than 1 male to 3 females. A portion of each day's egg-take is used for on-site hatchery production.

Acceptable Stocks

Spring chinook eggs for this facility were originally obtained from the Willamette River as well as the Cowlitz River. Tule fall chinook eggs were obtained from the Toutle River. Currently, importing eggs/fish from other facilities is not done at this hatchery and eggs from hatchery-returning adults are always given priority for station use. The stocks approved for use at the Cowlitz Hatchery are listed below.

Fall Chinook
1 Cowlitz River fall chinook

Type-N (Late) Coho
1 Cowlitz River Type-N (early, middle and late components)

Spring Chinook
1 Cowlitz River spring chinook

Objective 4: Maximize survival at all life stages using disease control and disease prevention techniques. Prevent introduction, spread or amplification of fish pathogens.

Fish Health Management Programs-All Stocks

The primary objective of fish health management programs at WDF hatcheries is to produce healthy smolts that will contribute to the fishery. Equally important is to prevent the introduction, amplification or spread of certain fish pathogens which might negatively affect the health of both hatchery and naturally reproducing stocks.

WDF has implemented both disease control and disease prevention programs at all of its facilities to try and achieve these objectives. These programs include the following standard elements:

Disease Control (Reactive)

- Perform necropsies of diseased and dead fish to diagnose the cause of loss.
- Prescribe appropriate treatments and remedies to disease.
- Use a disease control policy which dictates how specific disease problems will be addressed and what restrictions may be placed on movements of diseased stocks.
- Conduct applied research on new and existing techniques to control disease epizootics.

Disease Prevention (Proactive)

- Routinely perform necropsies of clinically healthy fish to assess health status and detect problems before they progress to clinical disease or mortality.
- Implement disease preventative strategies in all aspects of fish culture to produce a quality fish. This includes prescribing the optimal nutritional needs and environmental conditions in the hatchery rearing container based on historical disease events. It also involves the prophylactic use of vaccines in order to avoid a disease problem.
- Use a disease prevention policy which restricts the introduction of stocks into a facility which may result in the introduction of a new disease condition or mortality.
- Use sanitation procedures which prevent introduction of pathogens into and/or within a facility.
- Conduct applied research on new and existing disease prevention techniques.

- Utilize pond management strategies (e.g., Density Index and Flow Index) to help optimize the quality of the aquatic environment and minimize fish stress which can induce infectious and noninfectious diseases. For example, the Density Index is used to estimate the maximum number of fish (of a given length) that can occupy a rearing unit based on the rearing unit's size. The Flow Index is used to estimate the rearing unit's carrying capacity based on water flows.

Fish Health Activities at Cowlitz Hatchery

Health Monitoring

- On at least a monthly basis, both healthy and clinically diseased fish from each fish lot at the hatchery are given a health exam. The sample includes a minimum of ten fish per lot. Findings are reported on WDF Form FH01.

- At spawning, a minimum of 60 ovarian fluids and 60 kidney/spleens are examined for viral pathogens from each stock.

- At spawning, an Enzyme Link Immunosorbent Assay (ELISA) is conducted on kidney tissue samples from all spring chinook females. ELISA is used to detect the bacterium which causes kidney disease (*Renibacterium salmoninarum*).

- Prior to transfer or release, fish are given a health exam. This exam may be in conjunction with the routine monthly visit.

- Whenever abnormal behavior or mortality is observed, the fish health specialist will examine the affected fish, make a diagnosis and recommend the appropriate remedial or preventative measures.

- Reporting and control of selected fish pathogens are conducted in accordance with the Co-Managers Fish Disease Control Policy.

Fish and Egg Movements

- Movements of fish and eggs are conducted in accordance with the Co-Managers Fish Disease Control Policy.

Therapeutic and Prophylactic Treatments

- Adult fall chinook are injected with antibiotics for the control of bacterial diseases.

- At spawning, eggs are water-hardened in iodophor as a disinfectant.

- Juvenile fish are administered antibiotics orally when needed for the control of bacterial infections.

- **Formalin** (37% formaldehyde) is dispensed into water for control of parasites and fungus on eggs, juveniles and adult salmon. Treatment dosage and time of exposure varies with species, life-stage and condition being treated.

- Only therapeutants approved by the U.S. Food and Drug Administration are used for treatments.

Sanitation

- All eggs brought to the facility are surface-disinfected with iodophor (as per disease policy).

- All equipment (nets, tanks, rain gear) is disinfected with iodophor between different fish/egg lots.

- Different fish/egg lots are physically isolated from each other by separate ponds or incubation units. Incubation units are further isolated by plastic curtains. The intent of these activities is to prevent the horizontal spread of pathogens by splashing water.

- Tank trucks are disinfected between the hauling of different fish lots.

- Foot baths containing iodophor are strategically located on the hatchery grounds (i.e., entrance to hatchery building) to prevent spread of pathogens.

Objective 5: Conduct environmental monitoring.

Environmental Monitoring

Primarily, environmental monitoring is conducted at WDF facilities to ensure these facilities meet the requirements of the National Pollution Discharge Elimination Permit administered by the Washington Department of Ecology. It is also used in managing fish health. On a short-term basis, monitoring helps identify when changes to hatchery practices are required. Long-term monitoring provides the ability to quantify water quality impacts resulting from changes in the watershed (e.g., logging, road building and urbanization). The following parameters are currently monitored at this hatchery:

- Total Suspended *Solids (TSS)*—1 to 2 times per month on composite effluent, maximum effluent and influent samples. Once per month on pollution abatement pond influent and effluent samples.

- *Settleable Solids (SS)*—1 to 2 times per week on effluent and influent samples. Once per week on pollution abatement pond influent and effluent samples.

- *Upstream and Downstream* Temperatures-twice per month, June through September .

- Upstream *and Downstream Dissolved* Oxygen *(DO)*—twice per month, June through September.

- *In-hatchery Water Temperatures*-maximum and minimum daily.

- *In-hatchery Dissolved Oxygen*-as required by steam flow or weather conditions.

- Some facilities monitor rainfall and air temperature on a daily basis.

The following are additional parameters which should be monitored at WDF hatcheries:

- *Influent Water* Temperatures-continuous monitoring
- *Air Temperatures*—continuous monitoring
- *Influent/Effluent Dissolved* Oxygen-continuous monitoring
- *Influent* @Z/Conductivity-continuous monitoring
- *Streambed Movement*
- *In-stream Flow/Current*
- *Daily Rainfall*

Objective 6: Communicate effectively with other salmon producers and managers.

Interagency Coordination/Communication

Production Advisory Committee (PAC): The Columbia River PAC is comprised of representatives from the regulatory management agencies and tribes. This group meets monthly to discuss anadromous fish production issues and to provide an opportunity for communication among the anadromous fish hatchery managers.

Technical Advisory Committee (TAC): The Columbia River TAC is comprised of regulatory fish harvest technicians. This group provides management direction used in establishing hatchery fish production goals. TAC meets monthly.

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Pacific Northwest Fish Health Protection Committee (PNFHPC): This group is comprised of representatives from U.S. and Canadian fish management agencies, tribes, universities, and private fish operations. The groups meets twice a year to monitor regional fish health policies and to discuss current fish health issues in the Pacific Northwest.

In-River Agreements: State, federal and tribal representatives meet annually to set Columbia River harvests as part of the U.S. *v.* Oregon Agreement. Periodic meetings are also held throughout the year to assess if targets are being met.

In-Season Communications: Communication with PAC, the Columbia River Inter-Tribal Fish Commission, Oregon Department of Fish and Wildlife, Washington Department of Wildlife, U.S. Fish and Wildlife Service and Idaho Department of Fish and Game takes place each year to coordinate proper fish and egg transfers in an effort to meet basin-wide goals at all facilities, where applicable.

Record Keeping

Records are kept in a consistent manner employing standard formats to allow for documentation and monitoring. Future record keeping will be coordinated with the basin-wide Coordinated Information System (CIS) currently under development. It will be a system to access all necessary databases in the region. It is hoped that coordinated information collection and reporting will result in consistency between the various agencies.

Development and Review of Brood Documents

The three brood documents are reviewed and agreed to annually. The Equilibrium Brood Document for the Columbia River and/or major tributaries has-not yet been developed. It would document existing baseline production and current management. The Future Brood Document is a detailed listing of annual production goals. This is reviewed and updated each spring, and is finalized by July. The Current Brood Document reflects actual production relative to the annual production goals. It is developed in the spring after eggs are taken. It is usually finalized by March.

PERFORMANCE STANDARDS—COWLITZ HATCHERY

Objective 1

Measures	Species	Hatchery Goal	5-Year Average	Range	Constraints
Adult Capture	Spr. Chinook	17,300	7,595	4,642-13,212	1
	Fall Chinook	8,300	9,355	3,549-13,798	1
	Type-N Coho	23,500	28,918	13,009-46,559	1
Adult Prespawning Survival	Spr. Chinook	90%	92.3%	90.4-94.3%	
	Fall Chinook	90%	89.4%	81.9-94.2%	
	Type-N Coho	90%	95.3%	94.8-95.7%	2
Egg-take	Spr. Chinook	2,132,000	4,842,250	3,388K-6,134K	
	Fall Chinook	7,660,000	11665,000	6,911K-14,857K	
	Type-N Coho	7,010,000	12,031,000	9,892K-14,593K	
Green Egg- to-Fry Survival	Spr. Chinook	90%	89.7%	82.2-93.8%	3
	Fall Chinook	90%	90.8%	82.8-96.0%	3
	Type-N Coho	90%	90.7%	83.6-92.7%	3
Fry-to-Smolt Survival	Spr. Chinook	90%	92.2%'	91.0-96.8%[1]	
	Fall Chinook	90%	94.5%	92.7-95.9%	
	Type-N Coho	90%	72.4%	67.6-82.7%	2
Fish Releases	Spr. Chinook	1,752,000	1,052,143[2]	644K-1,252K	
	Fall Chinook	6,500,000	9,964,500[3]	6,280K-11,294K	
	Type-N Coho	5,900,000	4,402,025[4]	3,932K-4,686K	
Transfers to Co-ops (Eggs/Fish)	Spr. Chinook	60,000	57,258	2K-57K[5]	
	Fall Chinook	10,500	--		
	Type-N Coho	61,200	239,750	20K-870K	
Other Transfers (Eggs/Fish)	Spr. Chinook	300K-2,000K	--	--	
	Fall Chinook	300K-8,000K	526,000	526K	
	Type-N Coho	2,000K-8,000K	1,505,250	0-3,191K	
Adults Passed Upstream	Spr. Chinook	500[6]	466[7]	170-762	
	Fall Chinook	--	600[8]	600	
	Type-N Coho	10,000	12,527	O-28,916	

NA=Not applicable.
1 Average offourbroods, 1987-1990.
2 Does not include subyearling releases. Average of four broods, 1987-1990.
3 Includes fall releases.
4 Data from four broods, 1987-1990.
5 Two years of data. One year's transfer was 2,000 fish.
6 Passed downstream.
7 Two broods only, 1990 and 1991.
8 Oneyearly, 1988.

Objective 1 (continued)

Measures	Species	Hatchery Goal	5-Year Average	Range	Constraints
Percent Survival	Spr. Chinook	1.0%	2.70%	0.39-7.44%	4
	Fall Chinook	2.5%	1.09%	0.04-3.17%	
	Type-N Coho	3.0%	3.80%	1.66-7.32%	

Objective 2

Measures	Species	Hatchery Goal	5-Year Average	Range	Constraints
Release smolts CV<10%	Spr. Chinook	Yes	9.8%	9.3-10.4%	2
	Fall Chinook	Yes	10.4%	9.1-11.8%	2
	Type-N Coho	Yes	9.6%	lO.O-10.8%	2
Acclimation	Spr. Chinook	Yes	Yes	--	
	Fall Chinook	Yes	Yes	--	
	Type-N Coho	Yes	Yes	--	
Volitional Release	Spr. Chinook	Yes	No	--	
	Fall Chinook	Yes	No	--	
	Type-N Coho	Yes	No	--	

Objective 3

Measures	Species	Hatchery Goal	5-Year Average	Range	Constraints
Collect Adults Throughout Run	Spr. Chinook	Yes	Yes	Yes	
	Fall Chinook	Yes	Yes	Yes	
	Type-N Coho	Yes	Yes	Yes	
Spawning Pop. >500	Spr. Chinook	Yes	Yes	Yes	
	Fall Chinook	Yes	Yes	Yes	
	Type-N Coho	Yes	Yes	Yes	
Spawning Ratio Male:Female	Spr. Chinook	1:3[9]	0.86:1	0.72:1 - 1.02:1	
	Fall Chinook	1:3[9]	0.75:1	0.60:1 - 0.90:1	
	Type-N Coho	1:3[9]	0.70:1	0.53:1 - 0.82:1	

[9] Spawning guidelines require a 1 :1 male to female spawning ratio if less than 1 million eggs are spawned in a single day.

Objective 4

Measures	Species	Hatchery Goal	5-Year Average	Range	Constraints
Adhere to Disease Policy	Spr. Chinook	Yes	Yes	--	6
	Fall Chinook	Yes	Yes	--	6
	Type-N Coho	Yes	Yes	--	6

Objective 5

Measures	Species	Ha tchery Goal	5-Year Average	Range	Constraints
TSS Effluent	All	5 mg/l	3.6	nd-18	
TSS Max Effluent	All	15 mg/l	5.7	5-27	
SS Effluent	All	0.1 ml/l	Trace	Trace-O.1	
TSS PA Effluent	All	100 mg/l	NA	NA	
SS PA Effluent	All	1.0 ml/l	NA	NA	
Downstream Temp	All	<18.0°C	12.1	11.2-13.4	
Downstream DO	All	Varies	11.0 mg/l	10.0-12.5	
Continuous Monitoring of Other Parameters	All	Yes	NA	NA	

Objective 6

Measures	Species	Hatchery Goal	5-Year Average	Range	Constraints
Check Hatchery Records for Accuracy and Completeness	All	Yes	No	--	7
Develop and Review Comp. Basin-Wide Production Plan	All	Yes	No	--	8
Develop and Review Future Brood Doc.	All	Yes	Yes	--	7
Develop and Review Current Brood Doc.	All	Yes	Yes	--	7

Constraints/Comments—Cowlitz Hatchery

1. Harvest rates set on other tule stocks impact escapement to the hatchery. Lack of adequate broodstock results in failure to pass fish upstream. Poor survival of some broods of spring chinook or tule fall chinook results in lowered escapement. Disease transmission concerns have reduced or eliminated putting fall chinook upstream.

2. Poor pond design and excessive handling during the sorting process can increase adult mortalities. The poor pond design can also increase the size variation in juvenile populations and increase mortality due to increased disease problems. To counter the increased disease problems, numerous prophylactic and therapeutic drug treatments are used. because ponds operate at efficiency with large numbers of juvenile fish, several different egg-takes are often combined in one pond which can increase size variation.

3. Iron bacteria in the well water used for incubation can increase mortality.

4. Lack of current, continuous tag data.

5. Ponds are not designed for volitional release.

6. Leaky valves allow seepage of river water into well lines; therefore, well water is not pathogen free. Fish can move from one pond to the next because of faulty seals and submerged water inflow system. Leakage occurs between adjacent rearing ponds and kettles; therefore, water is exchanged freely.

7. Current hatchery system lacks the necessary infrastructure and mechanisms to ensure adequate monitoring and evaluation needed for efficient and effective hatchery rearing programs.

8. A comprehensive basin-wide production plan has not been completed at this time.

Elokomin Salmon Hatchery

INTRODUCTION

Elokomin Hatchery is located on the Elokomin River, 7 miles upstream from the river mouth. The Elokomin River is a north bank tributary of the lower Columbia River below Bonneville Dam. It enters the Columbia at river mile 38, just downstream of Cathlamet, Washington. It is staffed with 4.25 FTE's.

The facility consists of 20 raceway, 3 large ponds and a hatchery building with 6 shallow troughs, 12 deep troughs, 36 stacks of vertical incubators and 9 freestyle incubators.

Water rights total 20,583 gpm from four sources: the Elokomin River, one well, a small, unnamed stream and Clear Creek. Well water is used for domestic use only. The Elokomin River supplies the majority (94 percent of average flow) of the water used for fish rearing. Water from Clear Creek and an unnamed stream is used for incubation. Actual water available to the hatchery averages 10,100 gpm (range: 8,310 gpm - 12,200 gpm).

PURPOSE

Elokomin Hatchery was authorized under the Mitchell Act and began operating in 1954 as part of the Columbia River Fisheries Development Program-a program to mitigate for fishery losses caused by human impacts such as hydroelectric system development. Funds for the program are administered by the National Marine Fisheries Service. The facility is used for adult collection, egg incubation and rearing of lower river fall chinook and coho (Type-S and Type-N). The hatchery is currently operating at maximum production. Tule fall chinook and Type-N coho stocks produced from Mitchell Act hatcheries are managed as species aggregates; therefore, adequate escapement of appropriate species/stocks for each hatchery's egg-take needs is not critical. Mitchell Act hatcheries with insufficient broodstock can receive eggs of appropriate species/stocks from any other Mitchell Act facility with surplus eggs.

GOALS

Produce lower river fall chinook and coho that will contribute to NE Pacific and Columbia River Basin commercial and sport fisheries.

OBJECTIVES

Objective 1: Hatchery Production

Tule Fall Chinook
Produce 4 million subyearlings for on-station release.

Provide 325,000 eggs/fish to co-op programs.

Provide eggs/fish (surplus to on-station needs) to other facilities.

Type-S Coho
Produce 500,000 yearlings for on-station release.

Type-N Coho
Produce 1,200,000 yearlings for on-station release.

Provide eggs/fish (surplus to on-station needs) to other facilities.

Objective 2: Minimize interactions with other fish populations through proper rearing and release strategies.

Objective 3: Maintain stock integrity and genetic diversity of each unique stock through proper management of genetic resources.

Objective 4: Maximize survival at all life stages using disease control and disease prevention techniques. Prevent introduction, spread or amplification of fish pathogens.

Objective 5: Conduct environmental monitoring to ensure that hatchery operations comply with water quality standards and to assist in managing fish health.

Objective 6: Communicate effectively with other salmon producers and managers in the Columbia River Basin.

CURRENT PRACTICES TO ACHIEVE OBJECTIVES

Objective 1: Hatchery Production

Adult Collection

The intent of the adult collection procedures at Elokomin Hatchery is to collect as many adults as possible to maintain the hatchery production program and to provide for upstream escapement.

Tule Fall Chinook: Entry of adults into the subbasin occurs from early September to October. Spawning occurs from late September to early November with a peak usually in mid-October. Adults are captured in the lower Elokomin River at a temporary fish collection barrier, then hauled by truck upstream to the hatchery. Low stream flows in September and October prohibit adults from reaching the hatchery site. Production shortfalls are made up with imports from other hatcheries with excess eggs.

Type-S and Type-N Coho: Type-S coho begin entering the Elokomin River in early September. Spawning activity peaks in late October. Type-N coho begin entering the Elokomin River in late October and November. Peak spawning occurs in late November and early December. Adults are captured at a permanent fish collection barrier located at the hatchery site. Stocks are separated based on return timing. Type-S coho are the first to return. When the number of newly arriving adults decreases, the trap is temporarily closed and all captured adults are spawned. The trap is then re-opened and all adults entering after that date are considered Type-N stock. Production shortfalls are made up with imports from other hatcheries with excess eggs.

Objective 2: Minimize interactions with other fish populations through proper rearing and release strategies.

Rearing and Release Strategies

Rearing and release strategies are designed to limit the amount of ecological interactions occurring between hatchery and naturally produced fish. Fish are reared to sufficient size that smoltification occurs within nearly the entire population, which will reduce retention time in downstream migration. Rearing on parent river water, or acclimation for several weeks to parent river water is used to ensure strong homing to the hatchery, thus reducing the stray rate to natural populations. Various release strategies are used to ensure that fish migrate from the hatchery with the least amount of interaction with native populations. The specific rearing and release strategies used at this hatchery are outlined below.

Tule Fall Chinook: Rear 4 million fish to a size of 50-80 fish/pound and release on-station into the Elokomin River (acclimated) in June.

Type-S Coho: Rear 500,000 fish to a size of 17 fish/pound and release on-station into the Elokomin River (acclimated) in May-June.

Type-N Coho: Rear 1,200,000 fish to a size of 17 fish/pound and release on-station into the Elokomin River (acclimated) in April-June. Some fish are volitionally released for two weeks before the space is needed for chinook rearing.

Objective 3: Maintain stock integrity and genetic diversity.

Broodstock Selection-All Stocks

Adults are collected throughout the entire run to ensure that the run timing for these stocks is maintained. Any fin-marked fish or fish otherwise identified as non-Elokomin origin are not used in spawning.

Spawning Protocol-All Stocks

The intent is to utilize a spawning population of at least 500 adults. When spawning fewer than 1 million eggs in a day, the male to female ratio will be 1:1 for all stocks. For these stocks, gametes are pooled and the effective male to female ratio may not be 1:1. When spawning more than 1 million eggs in a day, the ratio will not be less than 1 male to 3 females. A portion of each day's egg-take is used for on-site hatchery production.

Acceptable Stocks

Importing eggs/fish from other facilities with acceptable stocks is done to achieve production goals while maintaining regional genetic integrity in times of inadequate hatchery returns. Eggs from hatchery-returning adults are always given priority for station use.

The stocks approved for use at the Elokomin Hatchery have been prioritized and are listed below. Stocks with the number 1 adjacent to their title are most desirable. Stocks with higher numbers are considered to be progressively less well suited.

Tule Fall Chinook
1 Elokomin fall chinook
1 Any other lower Columbia River tule stock

Historically, Kalama Falls and Spring Creek tule stocks have been major donor stocks for Elokomin. However, in each year, releases have included at least some progeny from adults returning to Elokomin hatchery.

Type-S (Early) Coho
1 Elokomin River Type-S
2 Any other Columbia River Type-S stock

All Type-S coho runs were started with Toutle River stock. Since the eruption of Mt. St. Helens, this stock has been maintained at Grays River Hatchery. Grays River has been the major donor since that time.

Type-N (Late) Coho
1 Elokomin River Type-N
2 Any other Columbia River Type-N stock

The Type-N coho run at Elokomin was started with both Elokomin and Cowlitz Hatchery Type-N stock.

Objective 4: Maximize survival at all life stages using disease control and disease prevention techniques. Prevent introduction, spread or amplification of fish pathogens.

Fish Health Management Programs-All Stocks

The primary objective of fish health management programs at WDF hatcheries is to produce healthy smolts that will contribute to the fishery. Equally important is to prevent the introduction, amplification or spread of certain fish pathogens which might negatively affect the health of both hatchery and naturally reproducing stocks.

WDF has implemented both disease control and disease prevention programs at all of its facilities to try and achieve these objectives. These programs include the following standard elements:

Disease Control (Reactive)

- Perform necropsies of diseased and dead fish to diagnose the cause of loss.
- Prescribe appropriate treatments and remedies to disease.
- Use a disease control policy which dictates how specific disease problems will be addressed and what restrictions may be placed on movements of diseased stocks.
- Conduct applied research on new and existing techniques to control disease epizootics.

Disease Prevention (Proactive)

- Routinely perform necropsies of clinically healthy fish to assess health status and detect problems before they progress to clinical disease or mortality.
- Implement disease preventative strategies in all aspects of fish culture to produce a quality fish. This includes prescribing the optimal nutritional needs and environmental conditions in the hatchery rearing container based on historical disease events. It also involves the prophylactic use of vaccines in order to avoid a disease problem.
- Use a disease prevention policy which restricts the introduction of stocks into a facility which may result in the introduction of a new disease condition or mortality.
- Use sanitation procedures which prevent introduction of pathogens into and/or within a facility.
- Conduct applied research on new and existing disease prevention techniques.

- Utilize pond management strategies (e.g., Density Index and Flow Index) to help optimize the quality of the aquatic environment and minimize fish stress which can induce infectious and noninfectious diseases. For example, the Density Index is used to estimate the maximum number of fish (of a given length) that can occupy a rearing unit based on the rearing unit's size. The Flow Index is used to estimate the rearing unit's carrying capacity based on water flows.

Fish Health Activities at Elokomin Hatchery

Health Monitoring

- On at least a monthly basis, both healthy and clinically diseased fish from each fish lot at the hatchery are given a health exam. The sample includes a minimum of ten fish per lot. Findings are reported on WDF Form FH01.

- At spawning, a minimum of 60 ovarian fluids and 60 kidney/spleens are examined for viral pathogens from each fish lot.

- Prior to transfer or release, fish are given a health exam. This exam may be in conjunction with the routine monthly visit.

- Whenever abnormal behavior or mortality is observed, the fish health specialist will examine the affected fish, make a diagnosis and recommend the appropriate remedial or preventative measures.

- Reporting and control of selected fish pathogens are conducted in accordance with the Co-Managers Fish Disease Control Policy.

Fish and Egg Movements

- Movements of fish and eggs are conducted in accordance with the Co-Managers Fish Disease Control Policy.

Therapeutic and Prophylactic Treatments

- At spawning, eggs are water-hardened in iodophor as a disinfectant.

- Juvenile fish are administered antibiotics orally when needed for the control of bacterial infections.

- **Formalin** (37% formaldehyde) is dispensed into water for control of parasites and fungus on eggs, juveniles and adult salmon. Treatment dosage and time of exposure varies with species, life-stage and condition being treated.

- Only therapeutants approved by the U.S. Food and Drug Administration are used for treatments.

Sanitation

- All eggs brought to the facility are surface-disinfected with iodophor (as per disease policy).

- All equipment (nets, tanks, rain gear) is disinfected with iodophor between different fish/egg lots.

- Different fish/egg lots are physically isolated from each other by separate ponds or incubation units. Incubation units are further isolated by plastic curtains. The intent of these activities is to prevent the horizontal spread of pathogens by splashing water.

- Tank trucks are disinfected between the hauling of different fish lots.

- Foot baths containing iodophor are strategically located on the hatchery grounds (i.e., entrance to hatchery building) to prevent spread of pathogens.

Objective 5: Conduct environmental monitoring.

Environmental Monitoring

Primarily, environmental monitoring is conducted at WDF facilities to ensure these facilities meet the requirements of the National Pollution Discharge Elimination Permit administered by the Washington Department of Ecology. It is also used in managing fish health. On a short-term basis, monitoring helps identify when changes to hatchery practices are required. Long-term monitoring provides the ability to quantify water quality impacts resulting from changes in the watershed (e.g., logging, road building and urbanization). The following parameters are currently monitored at this hatchery:

- *Total* Suspended Solids *(TSS)*—1 to 2 times per month on composite effluent, maximum effluent and influent samples. Once per month on pollution abatement pond influent and effluent samples.

- *Settleable* Solids *(SS)*—1 to 2 times per week on effluent and influent samples. Once per week on pollution abatement pond influent and effluent samples.

- *In-hatchery Water Temperatures*-maximum and minimum daily.

- *In-hatchery Dissolved Oxygen*—as required by steam flow or weather conditions.

- Some facilities monitor rainfall and air temperature on a daily basis.

The following are additional parameters which should be monitored at WDF hatcheries:

- *Influent Wafer Temperatures*—continuous monitoring
- *Air Temperatures*—continuous monitoring
- *Influent/Effluent Dissolved* Oxygen-continuous monitoring
- *Influent pH/Conductivity*—continuous monitoring
- *Streambed Movemenf*
- *In-stream Flow/Current*
- *Daily Rainfall*

Objective 6: Communicate effectively with other salmon producers and managers.

Interagency Coordination/Communication

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PERFORMANCE STANDARDS-ELOKOMIN HATCHERY

Objective 1

Measures	Species	Hatchery Goal	5-Year Average	Range	Constraints
Adult Capture	Fall Chinook	2,500	3,074	1,498-4,705	1
	Type-S Coho'	590	3,689	0-7,313	1
	Type-N Coho	1,435	5,616	1,267-9,700	1
Adult Prespawning Survival	Fall Chinook	90%	70.0%	58.9-77.5%	2
	Type-S Coho	90%	90.8%	78.7-100%	2
	Type-N Coho	90%	95.1%	91.9-97.5%	2
Egg-take	Fall Chinook	5,000,000	5,374,779	2,253K-10,456K	
	Type-S Coho[2]	590,000	2,586,250	1,832K-3,340K	
	Type-N Coho	1,435,000	2,083,393	1,356K-3,733K	
Green Egg-to-Fry Survival	Fall Chinook	90%	90.2%	85.5-96.1%	
	Type-S Coho	90%	97.9%[3]	95.8-100%	
	Type-N Coho	90%	85.0%	78.6-89.7%	3
Fry-to-Smolt Survival	Fall Chinook	90%	90.8%	77.7-98.3%	
	Type-S Coho[1]	90%	83.0%[4]	83.0%	
	Type-N Coho	90%	86.3%	66.2-97.8%	4
Fish Releases	Fall Chinook	4,000,000	3,950,000	1,840K-4,712K	1,2,3,4
	Type-S Coho[5]	500,000	475,000[4]	475K	1,2,3,4
	Type-N Coho	1,200,00	971,933[6]	737K-1,687K	1,2,3,4

NA=Not applicable.

[1] Based on three broods only. In 1990, Type-S coho were combined with Type-N coho and could not be differentiated.

[2] Eggs taken from two broods only.

[3] Average of two broods.

[4] One brood only, 1988.

[5] Based on three broods. Fish transferred from other hatcheries to make up shortfalls from insufficient egg-takes.

[6] Average of four broods, 1987-1990.

Ob'ective 1 (continued)

Measures	Species	Hatchery Goal	5-Year Average	Range	Constraints
Transfers to Co-ops (Eggs/Fish)	Fall Chinook	325,000	124,000[7]	124,000	
	Type-S Coho	0	111[8]	111	
	Type-N Coho	0	102,600[9]	102,600	
Other Transfers (Eggs/Fish)	Fall Chinook	0-5,400,000	4,270K[7]	4,270K	
	Type-S Coho	0	--		
	Type-N Coho	0-2,100,000	--	--	
Adults Passed Upstream	Fall Chinook	256	0	0	1
	Type-S Coho	500	3,941[8]	3,941	
	Type-N Coho	500	1,004	O-2,722	
Percent Survival	Fall Chinook	1.0%	unknown	unknown	5
	Type-S Coho	3.0%	unknown	unknown	5
	Type-N Coho	3.0%	2.89%	0.69-4.49%	5

Objective 2

Measures	Species	Hatchet-y Goal	S-Year Average	Range	Constraints
Release smolts CV<10%	Fall Chinook	Yes	6.5%	3.8-8.5%	
	Type-S Coho	Yes	7.5%	7.2-10.1%	
	Type-N Coho	Yes	7.5%	7.2-10.1%	
Acclimation	Fall Chinook	Yes	Yes	--	
	Type-S Coho	Yes	Yes	--	
	Type-N Coho	Yes	Yes	--	
Volitional Release	Fall Chinook	No	No	--	6
	Type-S Coho	Yes	No	--	6
	Type-N Coho	Yes	Partial	--	6

[7] One year only, 1988.
[8] One brood only, 1991.
[9] One year only, 1989.

Ob'ective 3

Measures	Species	Hatchery Goal	5-Year Average	Range	Constraints
Collect Adults Throughout Run	Fall Chinook	Yes	Yes	Yes	1
	Type-S Coho	Yes	Yes	Yes	1
	Type-N Coho	Yes	No	No	1
Spawning Pop. >500	Fall Chinook	Yes	Yes	Yes	
	Type-S Coho	Yes	No	No	7
	Type-N Coho	Yes	Yes	Yes	
Spawning Ratio Male:Female	Fall Chinook	1:3[10]	0.81:1	0.62:1 - 1.01:1	
	Type-S Coho	1:3[10]	0.63:1	0.51:1 - 0.75:1	
	Type-N Coho	1:3[10]	0.90:1	0.75:1 - 1.04:1	

Objective 4

Measures	Species	Hatchery Goal	5-Year Averaee	Range	Constraints
Adhere to Disease Policy	Fall Chinook	Yes	Yes	--	
	Type-S Coho	Yes	Yes	--	
	Type-N Coho	Yes	Yes	--	

[10] Spawning guidelines require a 1:1 male to female spawning ratio if less than 1 million eggs are spawned in a single day.

Objective 5

Measures	Species	Hatchery Goal	5-Year Average	Range	Constraints
TSS Effluent	All	5 mg/l	NA	NA	
TSS Max Effluent	All	15 mg/l	NA	NA	
SS Effluent	All	0.1 ml/l	NA	NA	
TSS PA Effluent	All	100 mg/l	NA	NA	
SS PA Effluent	All	1.0 ml/l	NA	NA	
Downstream Temp	All	Varies	NA	NA	
Downstream DO	All	Varies	NA	NA	
Continuous Monitoring of Other Parameters	All	Yes	NA	NA	

Objective 6

Measures	Species	Hatchery Goal	5-Year Average	Ranee	Constraints
Check Hatchery Records for Accuracy and Completeness	All	Yes	No	--	8
Develop and Review Comp. Basin-Wide Production Plan	All	Yes	No	--	9
Develop and Review Future Brood Doc.	All	Yes	Yes	--	8
Develop and Review Current Brood Doc.	All	Yes	Yes	--	8

Constraints/Comments-Elokomin Hatchery

1. Tule fall chinook and Type-N coho are not managed for escapement to individual hatcheries. Lack of adequate broodstock is made up by importing eggs from other facilities which have a surplus. The lower river trap captures non-tule stocks which must be removed from the population prior to spawning. In years when water flows are high, coho escape over the dam at the hatchery and are not captured. Survival of tule fall chinook has been low at this facility. Harvest and river flows can influence the sex ratio of returning adults.

2. Transportation of adults and the poorly designed holding pond (uses re-use water) increases stress on the adult fish and increases mortality. High water temperatures in the early fall increase the incidence of furunculosis disease.

3. There are not enough vertical incubators to incubate all of the coho eggs. This results in higher mortalities for those eggs incubated in trough incubators.

4. Poor design of large rearing ponds (use of reuse water and poor flow characteristics) increases disease-related mortalities.

5. Lack of current, continuous tag data.

6. Designs of ponds 21 and 22 preclude use of volitional release until funding can be obtained to modify the outlet structures. Fish reared in pond 23 can be volitionally released for only two weeks before the pond space is needed to rear other species.

7. Type-S and Type-N coho cannot be held separately. Therefore, determining escapement and spawning of Type-S coho is difficult.

8. Current hatchery system lacks the necessary infrastructure and mechanisms to ensure adequate monitoring and evaluation needed for efficient and effective hatchery rearing programs.

9. A comprehensive basin-wide production plan has not been completed at this time.

Grays River Salmon Hatchery

INTRODUCTION

Grays River Hatchery is located at about river mile 2 of the West Fork Grays River, a lower Columbia River tributary. The Washington Department of Fisheries acquired the land on which hatchery is sited from the Weyerhauser Corporation. The buildings and hatchery facilities are owned by the federal government. Weyco Pond, an off-station rearing site, was operated as a satellite facility in the past, but is currently not being used. The facility is staffed with 3.5 FTE's.

The facility includes 10 raceways, 1 earthen rearing pond, and 2 concrete adult-holding ponds (also used for juvenile rearing). Water rights total 22,488 gpm from three sources: the West Fork Grays River, an unnamed stream and wells. Most of the water is supplied by gravity flow from an intake located approximately 0.5 miles upstream from the hatchery. During the summer and fall months, virtually the entire river flow is diverted for hatchery use.

PURPOSE

The hatchery was authorized under the Mitchell Act and began operating in 1961 as part of the Columbia River Fisheries Development Program-a program to mitigate for fishery losses caused by hydroelectric system development. Funds for the program are administered by the National Marine Fisheries Service. The facility is used for adult collection, egg incubation, and rearing of lower river tule fall chinook and early (Type-S) coho. The hatchery is currently operating at maximum production (based on deliverable water). Tule fall chinook and Type-N coho stocks produced from Mitchell Act hatcheries are managed as species aggregates; therefore, adequate escapement of appropriate species/stocks for each hatchery's egg-take needs is not critical. Mitchell Act hatcheries with insufficient broodstock can receive eggs of appropriate species/stocks from any other Mitchell Act facility with surplus eggs.

GOALS

Produce lower river fall chinook and coho that will contribute to NE Pacific and Columbia River Basin commercial and sport fisheries while providing adequate escapement for hatchery production.

OBJECTIVES

Objective 1: Hatchery Production

Fall Chinook
Produce 1,200,000 subyearlings for on-station release.

Incubate 2,875,000 eggs for the Toutle River Hatchery.

Provide eggs/fish (surplus to on-station needs) to other facilities.

Type-S Coho
Produce 350,000 yearlings for on-station release.

Produce 350,000 subyearlings for transfer to the Toutle Hatchery.

Provide eggs/fish (surplus to on-station needs) to other facilities.

Objective 2: Minimize interactions with other fish populations through proper rearing and release strategies.

Objective 3: Maintain stock integrity and genetic diversity of each unique stock through proper management of genetic resources.

Objective 4: Maximize survival at all life stages using disease control and disease prevention techniques. Prevent introduction, spread or amplification of fish pathogens.

Objective 5: Conduct environmental monitoring to ensure that hatchery operations comply with water quality standards and to assist in managing fish health.

Objective 6: Communicate effectively with other salmon producers and managers in the Columbia River Basin.

CURRENT PRACTICES TO ACHIEVE OBJECTIVES

Objective 1: Hatchery Production

Adult Collection

The intent of the adult collection procedures at Grays River Hatchery is to collect as many adults as possible to maintain the hatchery production program and to provide upstream escapement. Eggs from acceptable donor stocks are used to supplement hatchery shortfalls. Excess adults to hatchery needs are allowed to pass upstream for natural spawning.

Tule Fall Chinook: Adult fall chinook return in September and October. Spawning occurs from September to November. Adults are captured using a temporary weir located at the hatchery. Low river flows make it very difficult for adults to make it to the hatchery in many years.

Type-S Coho: Adult coho return in September and October. Spawning occurs from October to November with a peak in late October. Adults are also captured using a temporary weir located at the hatchery.

Objective 2: Minimize interactions with other fish populations through proper rearing and release strategies.

Rearing and Release Strategies

Rearing and release strategies are designed to limit the amount of ecological interactions occurring between hatchery and naturally produced fish. Fish are reared to sufficient size that smoltification occurs within nearly the entire population, which will reduce retention time in downstream migration. Rearing on parent river water, or acclimation for several weeks to parent river water is used to ensure strong homing to the hatchery, thus reducing the stray rate to natural populations. Various release strategies are used to ensure that fish migrate from the hatchery with the least amount of interaction with native populations. The specific rearing and release strategies used at this hatchery are outlined below.

Tule Fall Chinook: Rear 1.2 million fish to a size of approximately 75 fish/pound and release on-station (acclimated) in late May or June. Rear 75,000 fish to a size of 25 fish/pound and release on-station (acclimated) in September or October.

Type-S Coho: Rear 350,000 fish to a size of 12-18 fish/pound; acclimate to parent river water for a minimum of six weeks; release one group of fish in April and the second group in May.

Objective 3: Maintain stock integrity and **genetic diversity.**

Broodstock Selection-A/l Stocks

Adults are collected throughout the entire run to ensure that the run timing for these stocks is maintained.

Spawning Protocol-Ail Stocks

The intent is to utilize a spawning population of at least 500 adults. When spawning fewer than 1 million eggs in a day, the male to female ratio will be 1:1 for all stocks. For these situations, gametes are pooled and the effective male to female ratio may not be 1:1. When spawning more than 1 million eggs in a day, the ratio will not be less than 1 male to 3 females. A portion of each day's egg-take is used for on-site hatchery production.

Acceptable Stocks

Importing eggs/fish from other facilities with acceptable stocks is done to achieve production goals while maintaining regional genetic integrity in times of inadequate hatchery returns. Eggs from hatchery-returning adults are always given priority for station use. The stocks approved for use at the Grays River Hatchery have been prioritized and are listed below. Stocks with the number 1 adjacent to their title are the most desirable. Stocks with higher numbers are considered to be progressively less well suited.

Tule Fall Chinook
1 Grays River fall chinook
1 Any lower Columbia River tule stock

Type S (Early) Coho
1 Grays River Type-S
2 Toutle River Type-S

The Type-S coho run was started with Toutle River stock.

Objective 4: Maximize survival at all life stages using disease control and disease prevention techniques. Prevent introduction, spread or amplification of fish pathogens.

Fish Health Management Programs-All Stocks

The primary objective of fish health management programs at WDF hatcheries is to produce healthy smolts that will contribute to the fisheries and natural spawning. Equally important is to prevent the introduction, amplification or spread of certain fish pathogens which might negatively affect the health of both hatchery and naturally reproducing stocks.

WDF has implemented both disease control and disease prevention programs at all of its facilities to try and achieve these objectives. These programs include the following standard elements:

Disease Control (Reactive)

- Perform necropsies of diseased and dead fish to diagnose the cause of loss.
- Prescribe appropriate treatments and remedies to disease.
- Use a disease control policy which dictates how specific disease problems will be addressed and what restrictions may be placed on movements of diseased stocks.
- Conduct applied research on new and existing techniques to control disease epizootics.

Disease Prevention (Proactive)

- Routinely perform necropsies of clinically healthy fish to assess health status and detect problems before they progress to clinical disease or mortality.
- Implement disease preventative strategies in all aspects of fish culture to produce a quality fish. This includes prescribing the optimal nutritional needs and environmental conditions in the hatchery rearing container based on historical disease events. It also involves the prophylactic use of vaccines in order to prevent a disease problem.
- Use a disease prevention policy which restricts the introduction of stocks into a facility which may result in the introduction of a new disease condition or mortality.
- Use sanitation procedures which prevent introduction of pathogens into and/or within a facility.
- Conduct applied research on new and existing disease prevention techniques.

- Utilize pond management strategies (e.g., Density Index and Flow Index) to help optimize the quality of the aquatic environment and minimize fish stress which can induce infectious and noninfectious diseases. For example, the Density Index is used to estimate the maximum number of fish (of a given length) that can occupy a rearing unit based on the rearing unit's size. The Flow Index is used to estimate the rearing unit's carrying capacity based on water flows.

Fish Health Activities at Grays River Hatchery

Health Monitoring

- On at least a monthly basis, both healthy and clinically diseased fish from each fish lot at the hatchery are given a health exam. The sample includes a minimum of ten fish per lot. Findings are reported on WDF Form FH01.

- At spawning, a minimum of 60 ovarian fluids and 60 kidney/spleens are examined for viral pathogens from each stock.

- Prior to transfer or release, fish are given a health exam. This exam may be in conjunction with the routine monthly visit.

- Whenever abnormal behavior or mortality is observed, the fish health specialist will examine the affected fish, make a diagnosis and recommend the appropriate remedial or preventative measures.

- Reporting and control of selected fish pathogens are conducted in accordance with the Co-Managers Fish Disease Control Policy.

Fish and Egg Movements

- Movements of fish and eggs are conducted in accordance with the Co-Managers Fish Disease Control Policy.

Therapeutic and Prophylactic Treatments

- At spawning, eggs are water-hardened in iodophor as a disinfectant.

- Juvenile fish are administered antibiotics orally when needed for the control of bacterial infections.

- Formalin (37% formaldehyde) is dispensed into water for control of parasites and fungus on eggs, juveniles and adult salmon. Treatment dosage and time of exposure varies with species, life-stage and condition being treated.

- Only therapeutants approved by the U.S. Food and Drug Administration are used for treatments.

Sanitation

- All eggs brought to the facility are surface-disinfected with iodophor (as per disease policy).

- All equipment (nets, tanks, rain gear) is disinfected with iodophor between different fish/egg lots.

- Different fish/egg lots are physically isolated from each other by separate ponds or incubation units. Incubation units are further isolated by plastic curtains. The intent of these activities is to prevent the horizontal spread of pathogens by splashing water.

- Tank trucks are disinfected between the hauling of different fish lots.

- Foot baths containing iodophor are strategically located on the hatchery grounds (i.e., entrance to hatchery building) to prevent spread of pathogens.

Objective 5: Conduct environmental monitoring.

Environmental Monitoring

Primarily, environmental monitoring is conducted at WDF facilities to ensure these facilities meet the requirements of the National Pollution Discharge Elimination Permit administered by the Washington Department of Ecology (WDOE). It is also used in managing fish health. On a short-term basis, monitoring helps identify when changes to hatchery practices are required. Long-term monitoring provides the ability to quantify water quality impacts resulting from changes in the watershed (e.g., logging, road building and urbanization). The following parameters are currently monitored at this hatchery:

- *Total* Suspended Solids *(TSS)*—1 to 2 times per month on composite effluent, maximum effluent and influent samples. Once per month on pollution abatement pond influent and effluent samples.

- *Settleable Solids (SS)*—1 to 2 times per week on effluent and influent samples. Once per week on pollution abatement pond influent and effluent samples.

- *Upstream* and Downstream Temperatures-twice per month, June through September. This requirement may be waived by WDOE if no water violations occur.

- Upstream and Downstream Dissolved Oxygen *(DO)*—twice per month, June through September. This requirement may be waived by WDOE if no water violations occur.

- *In-hatchery Water Temperatures*-maximum and minimum daily.

- *In-hatchery Dissolved Oxygen*-as required by steam flow or weather conditions.

- Some facilities monitor rainfall and air temperature on a daily basis.

The following are additional parameters which should be monitored at WDF hatcheries:

- *Influent* Water Temperatures-continuous monitoring
- *Air Temperatures*—continuous monitoring
- *Influent/Effluent Dissolved* Oxygen-continuous monitoring
- *Influent pH/Conductivity*—continuous monitoring
- *Streambed Movement*
- *In-stream Flow/Current*
- *Daily Rainfall*

Objective 6: Communicate effectively with other salmon producers and managers.

Interagency Coordination/Communication

Production Advisory Committee (PAC): The Columbia River PAC is comprised of representatives from the regulatory management agencies and tribes. This group meets monthly to discuss anadromous fish production issues and to provide an opportunity for communication among the anadromous fish hatchery managers.

Technical Advisory Committee (TAC): The Columbia River TAC is comprised of regulatory fish harvest technicians. This group provides management direction used in establishing hatchery fish production goals. TAC meets monthly.

Integrated Hatchery Operations Team (IHOT): This group is comprised of representatives from fish management agencies and tribes. IHOT meets monthly and is currently developing a series of regional hatchery policies.

Pacific Northwest Fish Health Protection Committee (PNFHPC): This group is comprised of representatives from U.S. and Canadian fish management agencies, tribes, universities, and private fish operations. The groups meets twice a year to monitor regional fish health policies and to discuss current fish health issues in the Pacific Northwest.

In-River Agreements: State, federal and tribal representatives meet annually to set Columbia River harvests as part of the U.S. v. *Oregon* Agreement. Periodic meetings are also held throughout the year to assess if targets are being met.

In-Season Communications: Communication with PAC, the Columbia River Inter-Tribal Fish Commission, Oregon Department of Fish and Wildlife, Washington Department of Wildlife, U.S. Fish and Wildlife Service and Idaho Department of Fish and Game takes place each year to coordinate proper fish and egg transfers in an effort to meet basin-wide goals at all facilities, where applicable.

Record Keeping

Records are kept in a consistent manner employing standard formats to allow for documentation and monitoring. Future record keeping will be coordinated with the basin-wide Coordinated Information System (CIS) currently under development. It will be a system to access all necessary databases in the region. It is hoped that coordinated information collection and reporting will result in consistency between the various agencies.

Development and Review of Brood Documents

The three brood documents are reviewed and agreed to annually. The Eouilibrium Brood Document for the Columbia River and/or major tributaries has not yet been developed. It would document existing baseline production and current management. The Future Brood Document is a detailed listing of annual production goals. This is reviewed and updated each spring, and is finalized by July. The Current Brood Document reflects actual production relative to the annual production goals. It is developed in the spring after eggs are taken. It is usually finalized by March.

PERFORMANCE STANDARDS-GRAYS RIVER HATCHERY

Objective 1

Measures	Species	Hatchery Goal	5-Year Averaee	Range	Constraints
Adult Capture	Fall Chinook	706	650	243-1,357	1
	Type-S Coho	415	2,369	376-3,739	1
Adult Prespawning Survival	Fall Chinook	90%	87.7%	78.0-94.0%	2
	Type-S Coho	90%	91.5%	87.0-97.1%	2
Egg-take	Fall Chinook	1,425,000	1,429,360	184K-3,355K	1
	Type-S Coho	415,000	1,865,140	455K-3,282K	1
Green Egg-to-Fry Survival	Fall Chinook	90%	91.3%	85.4-95.6%	3
	Type-S Coho	90%	90.0%	85.1-98.3%	3
Fry-to-Smolt Survival	Fall Chinook	90%	86.9%	77.3-96.1%	
	Type-S Coho	90%	75.0%'	59.3-93.2%	
Fish Releases	Fall Chinook	1,200,000	847,700	159K-1,394K	1,5
	Type-S Coho	350,000	246,395	132K-375K	1,5
Transfers to Co-ops (Eggs/Fish)	Fall Chinook	0	--	--	
	Type-S Coho	0	34,300[2]	34,300	
Other Transfers (Eggs/Fish)	Fall Chinook	0-1,930,000	1,532,900[3]	1,532,900	
	Type-S Coho	O-2,667,000	1,146,350[1]	219K-2,256K	
Adults Passed Upstream	Fall Chinook	50	24	O-118	1
	Type-S Coho	150	365	O-I 526	1
Percent Survival	Fall Chinook	1.0%	0.76%	0.04-2.73%	4,6
	F. Chinook (fall rel.)	2.5%	2.84%	0.49-2.96%	4,6
	Type-S Coho	2.5%	1.71%	1.81-4.07%	4,6

NA=Not applicable.
1 Average of four broods, 1987-1990.
2 One year only, 1989.
3 One year only, 1988.

Objective 2

Measures	Species	Hatchery Goal	5-Year Average	Range	Constraints
Release smolts	Fall Chinook	Yes	8.6%	6.5-11.2%	7
CV<10%	Type-S Coho	Yes	6.8%	6.5-7.0%	7
Acclimation	Fall Chinook	Yes	Yes	--	
	Type-S Coho	Yes	Yes	--	
Volitional Release	Fall Chinook	Yes	No	--	
	Type-S Coho	Yes	No	--	8

Objective 3

Measures	Species	Hatchery Goal	5-Year Average	Range	Constraints
Collect Adults	Fall Chinook	Yes	No	--	1
Throughout Run	Type-S Coho	Yes	Yes	--	
Spawning Pop.	Fall Chinook	Yes	Yes	--	1
>500	Type-S Coho	Yes	Yes	--	1
Spawning Ratio	Fall Chinook	1:3[4]	0.78:1	0.71:1 - 0.91:1	1
Male:Female	Type-S Coho	1:3[4]	0.91:1	0.83:1 - 0.91:1	1

Objective 4

Measures	Species	Hatchery Goal	5-Year Average	Range	Constraints
Adhere to	Fall Chinook	Yes	Yes	--	3
Disease Policy	Type-S Coho	Yes	Yes	--	3

[4] Spawning guidelines require a 1:1 male to female spawning ratio if less than 1 million eggs are spawned in a single day.

Objective 5

Measures	Species	Hatchery Goal	5-Year Average	Range	Constraints
TSS Effluent	All	5 mg/l	NA	NA	
TSS Max Effluent	All	15 mg/l	NA	NA	
SS Effluent	All	0.1 ml/l	NA	NA	
TSS PA Effluent	All	100 mg/l	NA	NA	
SS PA Effluent	All	1.0 ml/l	NA	NA	
Downstream Temp	All	Varies	NA	NA	
Downstream DO	All	Varies	NA	NA	
Continuous Monitoring of Other Parameters	All	Yes	NA	NA	

Objective 6

Measures	Species	Hatchery Goal	5-Year Average	Range	Constraints
Check Hatchery Records for Accuracy and Completeness	All	Yes	No	--	9
Develop and Review Comp. Basin-Wide Production Plan	All	Yes	No	--	9
Develop and Review Future Brood Doc.	All	Yes	Yes	--	10
Develop and Review Current Brood Doc.	All	Yes	Yes	--	9

Constraints/Comments-Grays River Hatchery

1. Tule fall chinook and Type-S coho are not managed for escapement to individual hatcheries. Lack of adequate broodstock is made up with importation of eggs from other facilities which have a surplus. Low river flows during the spawning migration coupled with no lower river weir prevents the hatchery from obtaining sufficient broodstock during years where adequate numbers of adult fish are present. However, coho returning during high water events may be able to bypass the temporary weir. Also, in some years there is low survival of chinook or coho from this facility. Harvest levels and migration impedance may result in unequal sex ratios at the hatchery.

2. Inadequate flows and high water temperatures in some years result in overcrowding and higher stress-related mortalities. Pipeline needs cleaning to remove the debris that is restricting water flow to the holding ponds. However, there has not been sufficient funds to accomplish this needed maintenance.

3. Hatchery relies on outdated trough incubators that are minimally supplied with pathogen-free groundwater from a shallow well. These incubators cause higher mortalities, especially in coho. They also splash and leak which can result in a transfer of pathogens.

4. Because of funding shortfalls, a portion of the fall chinook has not been reared until fall for release. The fall releases have historically had the highest survival rates at this hatchery.

5. One of the large rearing ponds has a porous bottom which reduces the amount of rearing water. This creates increased rearing densities and higher mortalities.

6. Lack of current, continuous tag data to assess survival.

7. Combining progeny from more than one egg-take into a single rearing pond or disease problems during early rearing.

8. Design of rearing pond outlet structures is not conducive to volitional release.

9. Current hatchery system lacks the necessary infrastructure and mechanisms to ensure adequate monitoring and evaluation needed for efficient and effective hatchery rearing programs.

10. A comprehensive basin-wide production plan has not been completed at this time.

Kalama Falls Salmon Hatchery

INTRODUCTION

Kalama Falls Hatchery is located along the Kalama River at about river mile 10. The nearest town is Kalama, Washington located approximately 12 miles south of the hatchery. Site elevation is 100 feet above sea level. The facility is staffed with 5 FTE's.

The rearing units consist of 12 raceways and 6 rearing ponds. The rearing ponds are also used for holding adults. The fish ladder was originally constructed to pass fish around Kalama Falls, but was later modified to trap adults for the hatchery when the facility was built.

Adult fish cannot enter the adult holding ponds directly from the fishway. They are trapped and lifted into trucks and then transported to the holding ponds a few hundred feet away.

Facility water rights total 8,055 gpm from four sources: Kalama River, two unnamed creeks and a well (domestic water). The majority of water is supplied from the Kalama River with the two unnamed creeks providing seasonal water.

PURPOSE

The hatchery was authorized under the Mitchell Act and began operating in 1958 as part of the Columbia River Fisheries Development Program-a program to mitigate for fishery losses caused by hydroelectric system development. Funds for the program are administered by the National Marine Fisheries Service. The facility is used for adult collection, egg incubation and rearing of fall chinook, spring chinook and late (Type-N) coho. It has also been used in the past as an egg collection facility for early (Type-S) coho. The hatchery is currently operating at maximum production. Tule fall chinook and Type-N coho stocks produced from Mitchell Act hatcheries are managed as species aggregates; therefore, adequate escapement of appropriate species/stocks for each hatchery's egg-take needs is not critical. Mitchell Act hatcheries with insufficient broodstock can receive eggs of appropriate species/stocks from any other Mitchell Act facility with surplus eggs,

GOALS

Produce lower river fall chinook, spring chinook and coho that will contribute to NE Pacific and Columbia River Basin commercial and sport fisheries while providing adequate escapement for hatchery production.

OBJECTIVES

Objective 1: Hatchery Production

Spring Chinook
Produce 550,000 yearlings for transfer to the Lower Kalama Hatchery for extended rearing and release.

Pass 400 adult males upstream.

Fall Chinook
Produce 3,500,000 subyearlings for on-station release.

Provide eggs/fish (surplus to on-station needs) to other facilities.

Pass 250 adults upstream for natural production.

Type-N Coho
Produce 900,000 yearlings for on-station release.

Objective 2: Minimize interactions with other fish populations through proper rearing and release strategies.

Objective 3: Maintain stock integrity and genetic diversity of each unique stock through proper management of genetic resources.

Objective 4: Maximize survival at all life stages using disease control and disease prevention techniques. Prevent introduction, spread or amplification of fish pathogens.

Objective 5: Conduct environmental monitoring to ensure that hatchery operations comply with water quality standards and to assist in managing fish health.

Objective 6: Communicate effectively with other salmon producers and managers in the Columbia River Basin.

CURRENT PRACTICES TO ACHIEVE OBJECTIVES

Objective 1: Hatchery Production

Adult Collection

The intent of the adult collection procedures at Kalama Falls Hatchery is to collect as many adults as possible to maintain the hatchery production program and to provide for upstream escapement.

Spring Chinook: Adults are collected at the hatchery from May through September and are spawned from early September to early October.

Fall Chinook: Entry of adults into the Kalama River occurs from August to November. Spawning occurs from September to November with a peak in October. Most adults are captured at Modrow Trap in the lower Kalama River and trucked to the hatchery.

Tvpe-N Coho: Type-N coho begin entering the Kalama River in late October and November. Peak spawning occurs in late November and early December. Adults are trapped at the hatchery.

Objective 2: Minimize interactions with other fish populations through proper rearing and release strategies.

Rearing and Release Strategies

Rearing and release strategies are designed to limit the amount of ecological interactions occurring between hatchery and naturally produced fish. Fish are reared to sufficient size that smoltification occurs within nearly the entire population, which will reduce retention time in downstream migration. Rearing on parent river water, or acclimation for several weeks to parent river water is used to ensure strong homing to the hatchery, thus reducing the stray rate to natural populations. Various release strategies are used to ensure that fish migrate from the hatchery with the least amount of interaction with native populations. The specific rearing and release strategies used at this hatchery are outlined below.

Spring Chinook: Rear 550,000 fish to a size of 200 fish/pound and transfer to the Lower Kalama Hatchery in April-May for final rearing and release.

Fall Chinook: Rear 3.5 million fish to a size of 50-80 fish/pound and release on-station (acclimated) in June.

Type-N Coho: Rear 900,000 fish to a size of 17 fish/pound and release on-station (acclimated) in June.

Objective 3: Maintain stock integrity and genetic diversity.

Broodstock Selection-All Stocks

Adults are collected throughout the entire run to ensure that the run timing for these stocks is maintained.

Spawning Protocol-All Stocks

The intent is to utilize a spawning population of at least 500 adults. When spawning fewer than 1 million eggs in a day, the male to female ratio will be 1:1 for all stocks. When spawning more than 1 million eggs in a day, the ratio will not be less than 1 male to 3 females. A portion of each day's egg-take is used for on-site hatchery production.

Acceptable Stocks

Importing eggs/fish from other facilities with acceptable stocks is done to achieve production goals while maintaining regional genetic integrity in times of inadequate hatchery returns. Eggs from hatchery-returning adults are always given priority for station use. The stocks approved for release from the Kalama Falls Hatchery are listed below.

Spring: Chinook
Kalama Falls spring chinook

Fall Chinook
Kalama River fall chinook

Type-N Coho
Any Columbia River Type-N

Objective 4: Maximize survival at all life stages using disease control and disease prevention techniques. Prevent introduction, spread or amplification of fish pathogens.

Fish Health Management Programs-All Stocks

The primary objective of fish health management programs at WDF hatcheries is to produce healthy smolts that will contribute to the fisheries and natural spawning. Equally important is to prevent the introduction, amplification or spread of certain fish pathogens which might negatively affect the health of both hatchery and naturally reproducing stocks.

WDF has implemented both disease control and disease prevention programs at all of its facilities to try and achieve these objectives. These programs include the following standard elements:

Disease Control (Reactive)

- Perform necropsies of diseased and dead fish to diagnose the cause of loss.
- Prescribe appropriate treatments and remedies to disease.
- Use a disease control policy which dictates how specific disease problems will be addressed and what restrictions may be placed on movements of diseased stocks.
- Conduct applied research on new and existing techniques to control disease epizootics.

Disease Prevention (Proactive)

- Routinely perform necropsies of clinically healthy fish to assess health status and detect problems before they progress to clinical disease or mortality.
- Implement disease preventative strategies in all aspects of fish culture to produce a quality fish. This includes prescribing the optimal nutritional needs and environmental conditions in the hatchery rearing container based on historical disease events. It also involves the prophylactic use of vaccines in order to prevent a disease problem.
- Use a disease prevention policy which restricts the introduction of stocks into a facility which may result in the introduction of a new disease condition or mortality.
- Use sanitation procedures which prevent introduction of pathogens into and/or within a facility.
- Conduct applied research on new and existing disease prevention techniques.

- Utilize pond management strategies (e.g., Density Index and Flow Index) to help optimize the quality of the aquatic environment and minimize fish stress which can induce infectious and noninfectious diseases. For example, the Density Index is used to estimate the maximum number of fish (of a given length) that can occupy a rearing unit based on the rearing unit's size. The Flow Index is used to estimate the rearing unit's carrying capacity based on water flows.

Fish Health Activities at Kalama Falls Hatchery

Health Monitoring

- On at least a monthly basis, both healthy and clinically diseased fish from each fish lot at the hatchery are given a health exam. The sample includes a minimum of ten fish per lot. Findings are reported on WDF Form FH01.

- At spawning, a minimum of 60 ovarian fluids and 60 kidney/spleens are examined for viral pathogens from each species.

- Prior to transfer or release, fish are given a health exam. This exam may be in conjunction with the routine monthly visit.

- Whenever abnormal behavior or mortality is observed, the fish health specialist will examine the affected fish, make a diagnosis and recommend the appropriate remedial or preventative measures.

- Reporting and control of selected fish pathogens are conducted in accordance with the Co-Managers Fish Disease Control Policy.

Fish and Egg Movements

- Movements of fish and eggs are conducted in accordance with the Co-Managers Fish Disease Control Policy.

Therapeutic and Prophylactic Treatments

- Adult spring and fall chinook are injected with antibiotics for the control of bacterial diseases.

- At spawning, eggs are water-hardened in iodophor as a disinfectant.

- Juvenile fish are administered antibiotics orally when needed for the control of bacterial infections.

- **Formalin** (37% formaldehyde) is dispensed into water for control of parasites and fungus on eggs, juveniles and adult salmon. Treatment dosage and time of exposure varies with species, life-stage and condition being treated.

- Only therapeutants approved by the U.S. Food and Drug Administration are used for treatments.

Sanitation

- All eggs brought to the facility are surface-disinfected with iodophor (as per disease policy).

- All equipment (nets, tanks, rain gear) is disinfected with iodophor between different fish/egg lots.

- Different fish/egg lots are physically isolated from each other by separate ponds or incubation units. Incubation units are further isolated by plastic curtains. The intent of these activities is to prevent the horizontal spread of pathogens by splashing water.

- Tank trucks are disinfected between the hauling of different fish lots.

- Foot baths containing iodophor are strategically located on the hatchery grounds (i.e., entrance to hatchery building) to prevent spread of pathogens.

Objective 5: Conduct environmental monitoring.

Environmental Monitoring

Primarily, environmental monitoring is conducted at WDF facilities to ensure these facilities meet the requirements of the National Pollution Discharge Elimination Permit administered by the Washington Department of Ecology. It is also used in managing fish health. On a short-term basis, monitoring helps identify when changes to hatchery practices are required. Long-term monitoring provides the ability to quantify water quality impacts resulting from changes in the watershed (e.g., logging, road building and urbanization). The following parameters are currently monitored at this hatchery:

- *Total Suspended Solids (TSS)*—1 to 2 times per month on composite effluent, maximum effluent and influent samples. Once per month on pollution abatement pond influent and effluent samples.

- *Settleable Solids (SS)*—1 to 2 times per week on effluent and influent samples. Once per week on pollution abatement pond influent and effluent samples.

- Upstream *and* Downstream Temperatures-twice per month, June through September.

- Upstream *and Downstream Dissolved* Oxygen *(DO)*—twice per month, June through September.

- *In-hatchery Water Temperatures*-maximum and minimum daily.

- *In-hatchery Dissolved* Oxygen-as required by steam flow or weather conditions.

- Some facilities monitor rainfall and air temperature on a daily basis.

The following are additional parameters which should be monitored at WDF hatcheries:

- *Influent Water* Temperatures-continuous monitoring
- *Air Temperatures*—continuous monitoring
- *Influent/Effluent Dissolved* Oxygen-continuous monitoring
- *Influent pH/Conductivity*—continuous monitoring
- *Streambed Movement*
- *In-stream Flow/Current*
- *Daily Rainfall*

Objective 6: Communicate effectively with other salmon producers and managers.

Interagency Coordination/Communication

Production Advisory Committee (PAC): The Columbia River PAC is comprised of representatives from the regulatory management agencies and tribes. This group meets monthly to discuss anadromous fish production issues and to provide an opportunity for communication among the anadromous fish hatchery managers.

Technical Advisory Committee (TAC): The Columbia River TAC is comprised of regulatory fish harvest technicians. This group provides management direction used in establishing hatchery fish production goals. TAC meets monthly.

Integrated Hatchery Operations Team (IHOT): This group is comprised of representatives from fish management agencies and tribes. IHOT meets monthly and is currently developing a series of regional hatchery policies.

Pacific Northwest Fish Health Protection Committee (PNFHPC): This group is comprised of representatives from U.S. and Canadian fish management agencies, tribes, universities, and private fish operations. The groups meets twice a year to monitor regional fish health policies and to discuss current fish health issues in the Pacific Northwest.

In-River Agreements: State, federal and tribal representatives meet annually to set Columbia River harvests as part of the U.S. *v.* Oregon Agreement. Periodic meetings are also held throughout the year to assess if targets are being met.

In-Season Communications: Communication with PAC, the Columbia River Inter-Tribal Fish Commission, Oregon Department of Fish and Wildlife, Washington Department of Wildlife, U.S. Fish and Wildlife Service and Idaho Department of Fish and Game takes place each year to coordinate proper fish and egg transfers in an effort to meet basin-wide goals at all facilities, where applicable.

Record Keeping

Records are kept in a consistent manner employing standard formats to allow for documentation and monitoring. Future record keeping will be coordinated with the basin-wide Coordinated Information System (CIS) currently under development. It will be a system to access all necessary databases in the region. It is hoped that coordinated information collection and reporting will result in consistency between the various agencies.

Development and Review of Brood Documents

The three brood documents are reviewed and agreed to annually. The Equilibrium Brood Document for the Columbia River and/or major tributaries has not yet been developed. It would document existing baseline production and current management. The Future Brood Document is a detailed listing of annual production goals. This is reviewed and updated each spring, and is finalized by July. The Current Brood Document reflects actual production relative to the annual production goals. It is developed in the spring after eggs are taken. It is usually finalized by March.

PERFORMANCE STANDARDS-KALAMA FALLS HATCHERY

Objective 1

Measures	Species	Hatchery Goal	5-Year Average	Range	Constraints
Adult Capture	Fall Chinook	3,000	3,264	2,280-4,220	
	Spr. Chinook	450	953	701-1,066	
	Type-S Coho	NA	1,871	294-4,877	
	Type-N Coho	1,100	2,330	1,150-3,073	
Adult Prespawning Survival	Fall Chinook	90%	78.2%	65.7-92.2%	1
	Spr. Chinook	90%	74.6%	60.9-85.7%	1
	Type-S Coho	90%	90.1%	67.2-97.3%	
	. Type-N Coho	90%	95.9%	89.4-98.2%	
Egg-take	Fall Chinook	4,120,000	7,174,060	5,547K-11,306K	
	Spring Chinook	589,000	773,767	334K-1,352K	
	Type-S Coho	NA	466,620	32K-985K	
	Type-N Coho	1,060,000	1,087,350	327K-1,251K	2
Green Egg-to-Fry Survival	Fall Chinook	90%	93.6%	81-96%	3
	Spring Chinook	90%	87.5%	80-89%	3
	Type-S Coho	90%	96.6%'	96.6	3
	Type-N Coho	90%	90.2	85.5-94.9	
Fry-to-Smolt Survival	Fall Chinook	90%	95.9%	94.5-96.7%	
	Spring Chinook	90%	89.4%[2]	83.5-96.6%	4
	Type-S Coho	NA	NA	NA	
	Type-N Coho	90%	90.2%	85.5-94.9%	
Fish Releases	Fall Chinook	3,500,000	3,752,222[3]	3,538K-4,448K	
	Spr. Chinook	--[4]	NA	NA	
	Type-S Coho	--[4]	NA	NA	
	Type-N Coho	900,000	854,180	600K-952K	2

NA=Not applicable.

1 One year of data; eggs are shipped out.

2 Three broods only; fish rearing was switched to Lower Kalama Hatchery.

3 On average, 308,040 fry are planted.

4 Transported and released at Lower Kalama Hatchery.

Objective 1 (continued)

Measures	Species	Hatchery Goal	5-Year Average	Range	Constraints
Transfers to Co-ops (Eggs/Fish)	Fall Chinook	0	222,800[5]	222,800	
	Spr. Chinook	0	--		
	Type-S Coho	NA	NA	NA	
	Type-N Coho	0	--		
Other Transfers (Eggs/Fish)	Fall Chinook	500K-6,700K	2,597,000	300K-6,595K	
	Spr. Chinook	0	166,900[6]	157K-177K	
	Type-S Coho	NA	415,900	32K-985K	
	Type-N Coho	0	548,800[5]	548,800	
Adults Passed Upstream	Fall Chinook	250	171	o-435	1
	Spr. Chinook	400	231	O-555 (males)	1
	Type-S Coho	NA	558	0-1,778	
	Type-N Coho	1,500	284	111-514	2
Percent Survival	Fall Chinook	1.0%	Unknown	Unknown	5
	Spr. Chinook	5.0%	Unknown	Unknown	5
	Type-S Coho	NA	NA	NA	
	Type-N Coho	5.0%	4.8%	1.1-6.9%	

Objective 2

Measures	Species	Hatchery Goal	5-Year Average	Range	Constraints
Release smolts CV<10%	Fall Chinook	Yes	NA	NA	5
	Spr. Chinook	NA	NA	NA	5
	Type-S Coho	Yes	NA	NA	5
	Type-N Coho	Yes	NA	NA	5
Acclimation	Fall Chinook	Yes	Yes	--	
	Spr. Chinook	NA	NA	NA	
	Type-S Coho	Yes	Yes	--	
	Type-N Coho	Yes	Yes	--	
Volitional Release	Fall Chinook	Yes	No	--	1
	Spr. Chinook	NA	NA	NA	
	Type-S Coho	Yes	No	--	1
	Type-N Coho	Yes	No	2 years	1

[5] One year only.

[6] Two years of data.

Objective 3

Measures	Species	Hatchery Goal	5-Year Average	Range	Constraints
Collect Adults Throughout Run	Fall Chinook	Yes	Yes	Yes	1
	Spr. Chinook	Yes	Yes	Yes	1
	Type-S Coho	Yes	Yes	Yes	
	Type-N Coho	Yes	Yes	Yes	
Spawning Pop. >500	Fall Chinook	Yes	Yes	Yes	
	Spr. Chinook	Yes	Yes	Yes	
	Type-S Coho	Yes	Yes	Yes	
	Type-N Coho	Yes	Yes	Yes	
Spawning Ratio Male:Female	Fall Chinook	1:3[7]	0.63:1	0.33:1 - 0.89:1	
	Spr. Chinook	1:1	0.93:1	0.72:1 -1.10:1	
	Type-S Coho	1:3[7]	0.90:1	0.70:1 -1.05:1	
	Type-N Coho	1:3[7]	1.50:1	0.49:1 - 3.70:1	

Objective 4

Measures	Species	Hatcher-v Goal	5-Year Average	Range	Constraints
Adhere to Disease Policy	All	Yes	Yes	--	

[7] Spawning guidelines require a 1:1 male to female spawning ratio if less than 1 million eggs are spawned in a single day.

Objective 5

Measures	Species	Hatchery Goal	5-Year Average	Range	Constraints
TSS Effluent	All	5 mg/l	NA	NA	
TSS Max Effluent	All	15 mg/l	NA	NA	
SS Effluent	All	0.1 ml/l	NA	NA	
TSS PA Effluent	All	100 mg/l	NA	NA	
SS PA Effluent	All	1.0 ml/l	NA	NA	
Downstream Temp	All	Varies	NA	NA	
Downstream DO	All	Varies	NA	NA	
Continuous Monitoring of Other Parameters	All	Yes	NA	NA	

Objective 6

Measures	Species	Hatchery Goal	5-Year Average	Range	Constraints
Check Hatchery Records for Accuracy and Completeness	All	Yes	No		6
Develop and Review Comp. Basin-Wide Production Plan	All	Yes	No	--	7
Develop and Review Future Brood Doc.	All	Yes	Yes	--	6
Develop and Review Current Brood Doc.	All	Yes	Yes	--	6

Constraints/Comments-Kalama Falls Hatchery

1. Poorly designed rearing ponds are also used for adult holding. These ponds have poor water flow, poor circulation, and use 100 percent re-use water. During the summer and fall adult holding periods, the combination of poor design and warm water increases prespawning mortality of spring and fall chinook. This reduces the number of fish available for passage upstream and reduces egg availability from all run timing segments.

   Because this station supplies tule fall chinook eggs to other hatcheries, increased mortality reduces the number of fish that can be passed upstream. During the spring juvenile rearing period, the poor water quality and inadequate flows reduce the hatchery production capacity. The existing pond design makes it difficult to use volitional release and there are currently no funds available to make improvements.

2. Columbia River Type-N coho are not managed to provide adequate escapement to the individual hatcheries.

3. Warm water during early incubation and muddy water during the fall rainy periods reduce the egg-to-fry survival of spring and fall chinook, and Type-S coho.

4. Transfer of juvenile spring chinook to Lower Kalama Hatchery results in additional stress on the fish.

5. Lack of current, continuous tag data. Only tagged fish are measured for mean length and coefficient of variation (CV).

6. Current hatchery system lacks the necessary infrastructure and mechanisms to ensure adequate monitoring and evaluation needed for efficient and effective hatchery rearing programs.

7. A comprehensive basin-wide production plan has not been completed at this time.

Klickitat Salmon Hatchery

INTRODUCTION

Klickitat Hatchery is located in a remote area on the Klickitat River at river mile 42, near the town of Glenwood, Washington. The facility includes a hatchery building, 34 raceways (12 of which are hypalon-lined, above-ground raceways), an adult holding pond and 3 rearing/release ponds.

Water rights total 28,338 gpm from four sources: Indian Ford Springs, an unnamed spring (designated Indian Ford "B"), Wonder Springs and the Klickitat River. The facility is staffed with 6.0 FTE's.

PURPOSE

Klickitat Hatchery was authorized and constructed under the Mitchell Act. It began operation in 1949 as part of the Columbia River Fisheries Development Program-a program to mitigate for fishery losses caused by hydroelectric system development. Funds for the program are administered by the National Marine Fisheries Service. The facility is currently used for adult collection, egg incubation, and rearing of spring chinook, upriver bright (URB) fall chinook and late (Type-N) coho. The hatchery is currently operated at maximum production. Tule fall chinook and Type-N coho stocks produced from Mitchell Act hatcheries are managed as species aggregates; therefore, adequate escapement of appropriate species/stocks for each hatchery's egg-take needs is not critical. Mitchell Act hatcheries with insufficient broodstock can receive eggs of appropriate species/stocks from any other Mitchell Act facility with surplus eggs.

GOALS

Produce adult fall chinook, Type-N coho and spring chinook that will contribute to NE Pacific and Columbia River Basin commercial and sport fisheries.

OBJECTIVES

Objective 1: Hatchery Production

URB Fall Chinook
Produce 4,000,000 subyearlings for on-station release.

Type-N Coho
Produce 1,350,000 yearlings for on-station release.

Spring Chinook
Produce 1,200,000 subyearlings for release into the upper Klickitat River.

Produce 600,000 yearlings for on-station release.

Objective 2: Minimize interactions with other fish populations through proper rearing and release strategies.

Objective 3: Maintain stock integrity and genetic diversity of each unique stock through proper management of genetic resources.

Objective 4: Maximize survival at all life stages using disease control and disease prevention techniques. Prevent introduction, spread or amplification of fish pathogens.

Objective 5: Conduct environmental monitoring to ensure that hatchery operations comply with water quality standards and to assist in managing fish health.

Objective 6: Communicate effectively with other salmon producers and managers in the Columbia River Basin.

CURRENT PRACTICES TO ACHIEVE OBJECTIVES

Objective 1: Hatchery Production

Adult Collection

The intent of the adult collection procedures at Klickitat Hatchery is to collect enough spring chinook adults to maintain the hatchery production program. Neither URB fall chinook or coho are managed for escapement to the hatchery; therefore, most eggs for these rearing programs come from other Columbia Basin hatcheries that have surplus eggs.

Spring; Chinook: Adults return to the hatchery from May through September. Peak spawning occurs in mid-September. There-is usually sufficient adult returns to maintain the spring chinook production goals.

URB Fall Chinook: This stock is not managed to provide adequate escapement to the hatchery. This hatchery depends on eggs collected at other Columbia Basin facilities to supply eggs for this program.

Type-N Coho: This stock is not managed to provide adequate escapement to the hatchery. Coho eggs are imported from lower river hatcheries in most years.

Objective 2: Minimize interactions with other fish populations through proper rearing and release strategies.

Rearing and Release Strategies

Rearing and release strategies are designed to limit the amount of ecological interactions occurring between hatchery and naturally produced fish. Fish are reared to sufficient size that smoltification occurs within nearly the entire population, which will reduce retention time in downstream migration. Rearing on parent river water, or acclimation for several weeks to parent river water is used to ensure strong homing to the hatchery, thus reducing the stray rate to natural populations. Various release strategies are used to ensure that fish migrate from the hatchery with the least amount of interaction with native populations. The specific rearing and release strategies used at this hatchery are outlined below.

URB Fall Chinook: Rear to a size of 80 fish/pound and release at the hatchery in March-May. For the past two years, approximately 45 percent of the fall chinook production has had exposure to partial river water for three weeks or more prior to release. Approximately 6 percent of the production has been acclimated to 100 percent river water for at least three weeks prior to release. This acclimation will likely continue in the years ahead.

Twe-N Coho: Rear 1,350,000 fish to a size of 20 fish/pound and volitionally release at the hatchery in April-June. Fish are acclimated to parent river water for six months or more prior to release.

Spring Chinook: Rear 1,200,000 fish to a size of 50 fish/pound and release into the upper Klickitat River in June. Rear 600,000 fish to a size of 7-10 fish/pound and release at the hatchery in March-May. A portion of the releases is acclimated to parent river water for 3-6 weeks as part of an experiment. Program changes can be made to acclimate up to 50 percent of the programmed production if the experiment demonstrates that fish survival is enhanced.

Objective 3: Maintain stock integrity and genetic diversity.

Broodstock Selection-All Stocks

Adults are collected throughout the entire run to ensure that the run timing for these stocks is maintained.

Spawning Protocol-All Stocks

The intent is to utilize a spawning population of at least 500 adults. When spawning fewer than 1 million eggs in a day, the male to female ratio will be 1:1 for all stocks. When spawning more than 1 million eggs in a day, the ratio will not be less than 1 male to 3 females. A portion of each day's egg-take is used for on-site hatchery production.

Acceptable Stocks

Importing eggs/fish from other facilities with acceptable stocks is done to achieve production goals while maintaining regional genetic integrity in times of inadequate hatchery returns. Eggs from hatchery-returning adults are always given priority for station use.

The stocks approved for release from the Klickitat Hatchery have been prioritized and are listed below. Stocks with the number 1 adjacent to their title are the most desirable. Stocks with higher numbers are considered to be progressively less well suited.

Fall Chinook
1 Upriver bright (Priest Rapids fall chinook)
2 Mid-Columbia River, Snake River mix fall chinook

Type-N (Late) Coho
1 Any Columbia River Type-N coho

Spring Chinook
1 Klickitat River spring chinook

Objective 4: Maximize survival at all life stages using disease control and disease prevention techniques. Prevent introduction, spread or amplification of fish pathogens.

Fish Health Managemerit Programs-All Stocks

The primary objective of fish health management programs at WDF hatcheries is to produce healthy smolts that will contribute to the fisheries and natural spawning. Equally important is to prevent the introduction, amplification or spread of certain fish pathogens which might negatively affect the health of both hatchery and naturally reproducing stocks.

WDF has implemented both disease control and disease prevention programs at all of its facilities to try and achieve these objectives. These programs include the following standard elements:

Disease Control (Reactive)

- Perform necropsies of diseased and dead fish to diagnose the cause of loss.
- Prescribe appropriate treatments and remedies to disease.
- Use a disease control policy which dictates how specific disease problems will be addressed and what restrictions may be placed on movements of diseased stocks.
- Conduct applied research on new and existing techniques to control disease epizootics.

Disease Prevention (Proactive)

- Routinely perform necropsies of clinically healthy fish to assess health status and detect problems before they progress to clinical disease or mortality.
- Implement disease preventative strategies in all aspects of fish culture to produce a quality fish. This includes prescribing the optimal nutritional needs and environmental conditions in the hatchery rearing container based on historical disease events. It also involves the prophylactic use of vaccines in order to avoid a disease problem.
- Use a disease prevention policy which restricts the introduction of stocks into a facility which may result in the introduction of a new disease condition or mortality.
- Use sanitation procedures which prevent introduction of pathogens into and/or within a facility.

- Conduct applied research on new and existing disease prevention techniques.

- Utilize pond management strategies (e.g., Density Index and Flow Index) to help optimize the quality of the aquatic environment and minimize fish stress which can induce infectious and noninfectious diseases. For example, the Density Index is used to estimate the maximum number of fish (of a given length) that can occupy a rearing unit based on the rearing unit's size. The Flow Index is used to estimate the rearing unit's carrying capacity based on water flows.

Fish Health Activities at Klickitat Hatchery

Health Monitoring

- On at least a monthly basis, both healthy and clinically diseased fish from each fish lot at the hatchery are given a health exam. The sample includes a minimum of ten fish per lot. Findings are reported on WDF Form FHOI.

- At spawning, a minimum of 60 ovarian fluids and 60 kidney/spleens are examined for viral pathogens from each stock.

- At spawning, an Enzyme Link Immunosorbent Assay (ELISA) is conducted on kidney tissue samples from all spring chinook females. ELISA is used to detect the bacterium which causes kidney disease (*Renibacterium salmoninarum*). Progeny from females with similar ELISA levels are grouped and reared together to reduce the horizontal transmission of this disease.

- Prior to transfer or release, fish are given a health exam. This exam may be in conjunction with the routine monthly visit.

- Whenever abnormal behavior or mortality is observed, the fish health specialist will examine the affected fish, make a diagnosis and recommend the appropriate remedial or preventative measures.

- Reporting and control of selected fish pathogens are conducted in accordance with the Co-Managers Fish Disease Control Policy.

Fish and Egg Movements

- Movements of fish and eggs are conducted in accordance with the Co-Managers Fish Disease Control Policy.

Therapeutic and Prophylactic Treatments

- Adult spring chinook are injected with antibiotics for the control of bacterial diseases.

- At spawning, eggs are water-hardened in iodophor or hyamine as a disinfectant.

- Juvenile fish are administered antibiotics orally when needed for the control of bacterial infections.

- Formalin (37% formaldehyde) is dispensed into water for control of parasites and fungus on eggs, juveniles and adult salmon. Treatment dosage and time of exposure varies with species, life-stage and condition being treated.

- Only therapeutants approved by the U.S. Food and Drug Administration are used for treatments.

Sanitation

- All eggs brought to the facility are surface-disinfected with iodophor or hyamine (as per disease policy).

- All equipment (nets, tanks, rain gear) is disinfected with iodophor between different fish/egg lots.

- Different fish/egg lots are physically isolated from each other by separate ponds or incubation units. Incubation units are further isolated by plastic curtains. The intent of these activities is to prevent the horizontal spread of pathogens by splashing water.

- Tank trucks are disinfected between the hauling of different fish lots.

- Foot baths containing iodophor are strategically located on the hatchery grounds (i.e., entrance to hatchery building) to prevent spread of pathogens.

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Primarily, environmental monitoring is conducted at WDF facilities to ensure these facilities meet the requirements of the National Pollution Discharge Elimination Permit administered by the Washington Department of Ecology. It is also used in managing fish health. On a short-term basis, monitoring helps identify when changes to hatchery practices are required. Long-term monitoring provides the ability to quantify water quality impacts resulting from changes in the watershed (e.g., logging, road building and urbanization). The following parameters are currently monitored at this hatchery:

- *Total* Suspended *Solids (TSS)*—1 to 2 times per month on composite effluent, maximum effluent and influent samples. Once per month on pollution abatement pond influent and effluent samples.

- *Settleable Solids (SS)*—1 to 2 times per week on effluent and influent samples. Once per week on pollution abatement pond influent and effluent samples.

- *Upstream* and *Downstream* Temperatures-twice per month, June through September .

- *Upstream* and *Downstream* Dissolved Oxygen (DO&twice per month, June through September.

- In-hatchery *Water* Temperatures-maximum and minimum daily.

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- Some facilities monitor rainfall and air temperature on a daily basis.

The following are additional parameters which should be monitored at WDF hatcheries:

- *Influent Water* Temperfzfures-continuous monitoring
- *Air Temperatures*—continuous monitoring
- *Influent/Effluent Dissolved* Oxygen-continuous monitoring
- *Influent pH/Conductivity*—continuous monitoring
- *Streambed Movement*
- *In-stream Flow/Current*
- *Daily Rainfall*

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PERFORMANCE STANDARDS-KLICKITAT HATCHERY

Objective 1

Measures	Species	Hatchery Goal	5-Year Average	Range	Constraints
Adult Capture	Fall Chinook	2,500	39'	36-41	1
	Spr. Chinook[2]	1,060	767	375-1,419	2
	Type-N Coho	1,600	0	0	1
Adult Prespawning Survival	Fall Chinook	90%	68.9%'	67.4-70.3%	
	Spr. Chinook	90%	89.4%	75.0-98.6%	
	Type-N Coho	90%	0	0	
Egg-take	Fall Chinook	5,000,000	56,250'	34K-78K	1
	Spr. Chinook	2,120,000	1,522,950	373K-3,224K	2
	Type-N Coho	1,600,000	0	0	1
Green Egg-to-Fry Survival	Fall Chinook	90%	83.2%	73.8-96.2%	3
	Spr. Chinook	90%	93.7%	91.0-95.9%	
	Type-N Coho	90%	95.4%	88.2-96.7%	
Fry-to-Smolt Survival	Fall Chinook	90%	93.3%	82.9-98.0%	
	Spr. Chinook	90%	89.6%	82.3-95.5%	
	Type-N Coho	90%	74.1%	70.7-77.2%[3]	4
Fish Releases	Fall Chinook[4]	4,000,000	4,301,360	4,191K-4,467K	1
	Spr. Chinook	600,000	643,400	310K-783K	2
	Type-N Coho[4]	1,350,000	1,271,233[5]	1,250K-1,354K	1
Transfers to Co-ops (Eggs/Fish)	Fall Chinook	0	--	--	
	Spr. Chinook	0	--	--	
	Type-N Coho	0	--	--	

NA=Not applicable.

1 Only the last two years have had any adult returns.

2 Data for Klickitat stock spring chinook only. Wind River spring chinook were captured in 1989 and 1990.

3 Average of three broods, 1987-1990.

4 Production figures are the result of transferred eggs.

5 Average of three broods, 1987-1990.

Ob'ective 1 (continued)

Measures	Species	Hatchery Goal	5-Year Average	Range	Constraints
Other Transfers (Eggs/Fish)	Fall Chinook	0	--	--	
	Spr. Chinook	1,200,000[6]	1,197,800[7]	1,197,800	
	Type-N Coho	0		--	
Adults Passed Upstream	Fall Chinook	0	0	0	1
	Spr. Chinook	0	60	0-300	2
	Type-N Coho	0	0	0	1
Percent Survival	Fall Chinook	1.0%	Unknown	Unknown	5
	Spr. Chinook	2.5%	Unknown	unknown	5
	Type-N Coho	3.0%	Unknown	Unknown	5

Objective 2

Measures	Species	Hatchery Goal	5-Year Average	Range	Constraints
Release smolts CV<10%	Fall Chinook	Yes	NA	NA	6
	Spr. Chinook	Yes	NA	NA	6
	Type-N Coho	Yes	NA	NA	6
Acclimation	Fall Chinook	Yes	Partial	--	7
	Spr. Chinook	Yes	Experimental	--	7
	Type-N Coho	Yes	Yes	--	
Volitional Release	Fall Chinook	No	No	--	7
	Spr. Chinook	Partial	Partial	--	7
	Type-N Coho	Yes	Yes	--	

[6] Klickitat River programmed fingerling production; usually not achieved.
[7] One brood only, 1988.

Objective 3

Measures	Species	Hatchery Goal	5-Year Average	Range	Constraints
Collect Adults Throughout Run	Fall Chinook	Yes	No	No	1
	Spr. Chinook	Yes	Yes	Yes	
	Type-N Coho	Yes	No	No	1
Spawning Pop. >500	Fall Chinook	Yes	No	No	1
	Spr. Chinook	Yes	Yes	Yes	1
	Type-N Coho	Yes	No	No	1
Spawning Ratio Male:Female	Fall Chinook	1:3[8]	1.1:1	1:1.1	
	Spr. Chinook	1:3[8]	0.8:1	0.62:1 - 1:1	
	Type-N Coho	1:3[8]	No adults	No adults	1

Objective 4

Measures	Species	Hatchery Goal	5-Year Average	Range	Constraints
Adhere to Disease Policy	Fall Chinook	Yes	Yes	--	
	Spr. Chinook	Yes	Yes	--	
	Type-N Coho	Yes	Yes	--	

[8] Spawning guidelines require a 1:1 male to female spawning ratio if less than 1 million eggs are spawned in a single day.

Objective 5

Measures	Species	Ha tchery Goal	5-Year Average	Range	Constraints
TSS Effluent	All	5 mg/l	NA	NA	
TSS Max Effluent	All	15 mg/l	NA	NA	
SS Effluent	All	0.1 ml/l	NA	NA	
TSS PA Effluent	All	100 mg/l	NA	NA	
SS PA Effluent	All	1.0 ml/l	NA	NA	
Downstream Temp	All	Varies	NA	NA	
Downstream DO	All	Varies	NA	NA	
Continuous Monitoring of Other Parameters	All	Yes	NA	NA	

Objective 6

Measures	Species	Hatchery Goal	5-Year Average	Range	Constraints
Check Hatchery Records for Accuracy and Completeness	All	Yes	No	--	8
Develop and Review Comp. Basin-Wide Production Plan	All	Yes	No	--	8
Develop and Review Future Brood Doc.	All	Yes	No	--	9
Develop and Review Current Brood Doc.	All	Yes	No		8

Constraints/Comments—Klickitat Hatchery

1. Both URB fall chinook and Type-N coho fisheries are not managed to provide adequate escapement to this hatchery. Egg shortfalls are made up by importing eggs from other hatcheries that have surplus eggs. Because of inadequate adult returns to the hatchery, fish are not passed upstream.

2. Poor survival has reduced the number of returning adults. This poor survival may be the result of 1) rearing fish in spring water (which delays the migratory response), 2) mortality associated with passage over one dam, or 3) mortality associated with bacterial kidney disease.

3. Eggs are imported from either Priest Rapids or Lyons Ferry hatcheries. Eggs from Lyons Ferry hatchery suffer from softshell disease.

4. Lack of vertical incubators increases juvenile fish mortality due to cold water disease.

5. Lack of current and continuous tag data.

6. Ponding of progeny from numerous egg-takes into single ponds can cause size variations. Rearing of fish in warm spring water causes fast growth rates which requires feeding at ration levels that are too low to promote keeping fish in-size.

7. Use of spring water to rear fish does not promote a strong migratory response in smolts. Therefore, it does not promote volitional release. Without acclimation to ambient river water, the migratory urge is reduced and fish survival may decrease.

8. Current hatchery system lacks the necessary infrastructure and mechanisms to ensure adequate monitoring and evaluation needed for efficient and effective hatchery rearing programs.

9. A comprehensive basin-wide production plan has not been completed at this time.

Lewis River and Speelyai Salmon Hatcheries

INTRODUCTION

Lewis River Hatchery is located adjacent to the Lewis River, 3 miles downstream from Merwin Dam, about 8 miles east of Woodland, Washington. Elevation of the facility is 64 feet above sea level.

The hatchery began operation in 1932. Currently 68 percent of the funding is provided by WDF and 32 percent from Pacific Power and Light (PP&L). The facility is staffed with 5.5 FTE's which is shared with Speelyai Hatchery. This staffing level will be changing as a result of the existing and proposed budget cuts.

Rearing units consist of 12 raceways and four 0.5-acre ponds. Facility water rights total 38,613 gpm from three sources: the Lewis River, an unnamed stream and Colvin Creek. Only the Lewis River is currently used for hatchery operations.

Speelyai Hatchery is operated as a satellite facility to the Lewis River Hatchery. It is located in a mountainous area at the upper end of Lake Merwin on the Lewis River, approximately 21 miles east of Woodland. Site elevation is approximately 500 feet above sea level.

Speelyai began operation in I954 and is owned and funded jointly by PP&L and Cowlitz County PUD. The facility has 12 concrete raceways, a 0.14-acre rearing pond, and an adult holding pond (also used to rear fish). It is staffed with 3.2 FTE's which is shared with Lewis River Hatchery when needed. Water rights total 6,732 gpm from Speelyai Creek. All raceways and ponds receive single-pass water.

PURPOSE

Lewis River and Speelyai hatcheries were originally constructed to provide mitigation for hydroelectric system development in the Lewis River System. An almost total remodel and upgrade of all rearing ponds and infrastructure at Lewis River Hatchery was funded with state enhancement funds in 1979 and 1980. The Lewis River Hatchery is used for adult collection, egg incubation and rearing of early (Type-S) and late (Type-N) coho. It is also used for final rearing of spring chinook. Speelyai Hatchery is used for adult holding, egg incubation and rearing of spring chinook and Type-N coho. Spring chinook are managed to provide adequate escapement to the hatcheries, Type-N coho are not.

GOALS

Produce adult coho and spring chinook that will contribute to NE Pacific and Columbia River Basin sport and commercial fisheries while providing- adequate escapement for hatchery production.

OBJECTIVES

Objective 1: Hatchery Production

Lewis River Hatchery
Produce 900,000 yearling spring-chinook for on-station release.

Produce 3,552,000 yearling Type-N coho for on-station release.

Produce 870,000 yearling Type-S coho (from Speelyai) for on-station release.

Provide 1,000 Type-S coho eggs/fish to co-op programs.

Provide Type-N and Type-S coho eggs/fish (surplus to on-station needs) to other facilities.

Speelvai Hatcherv
Rear 315,000 spring chinook yearlings for transfer to the Lewis River Hatchery.

Produce 300,000 Type-S coho yearlings for release into Lake Merwin.

Provide 31,000 Type-S coho eggs/fish to co-op programs.

Objective 2: Minimize interactions with other fish populations through proper rearing and release strategies.

Objective 3: Maintain stock integrity and genetic diversity of each unique stock through proper management of genetic resources.

Objective 4: Maximize survival at all life stages using disease control and disease prevention techniques. Prevent introduction, spread or amplification of fish pathogens.

Objective 5: Conduct environmental monitoring to ensure that hatchery operations comply with water quality standards and to assist in managing fish health.

Objective 6: Communicate effectively with other salmon producers and managers in the Columbia River Basin.

CURRENT PRACTICES TO ACHIEVE OBJECTIVES

Objective 1: Hatchery Production

Adult Collection

The intent of the adult collection procedures at Lewis River Hatchery is to collect as many adults as possible to maintain the hatchery production/mitigation program.

Spring Chinook: Adults return to the hatchery and are also trapped at Merwin Dam. Fish are trapped from April to July. They are sorted, inoculated and then transported to Speelyai Hatchery for holding and spawning.

Type-S Coho: Adults return to the hatchery from mid-September to mid-November with peak spawning in early to mid-January.

Type-N Coho: Adults return to the hatchery from mid-October to late December with peak spawning in early to mid-December.

Both early and late coho return to the hatchery or are trapped at Merwin Dam.

Objective 2: Minimize interactions with other fish populations through proper rearing and release strategies.

Rearing and Release Strategies

Rearing and release strategies are designed to limit the amount of ecological interactions occurring between hatchery and naturally produced fish. Fish are reared to sufficient size that smoltification occurs within nearly the entire population, which will reduce retention time in downstream migration. Rearing on parent river water, or acclimation for several weeks to parent river water is used to ensure strong homing to the hatchery, thus reducing the stray rate to natural populations. Various release strategies are used to ensure that fish migrate from the hatchery with the least amount of interaction with native populations. The specific rearing and release strategies used at this hatchery are outlined below.

Spring Chinook

- Incubate eggs at Speelyai and transfer 930,000 fish to the Lewis River Hatchery in April. Rear these fish to a size of 7 fish/pound and volitionally release on-station (acclimated) in March-April the following year.

- Keep approximately 315,000 fish at Speelyai; rear to a size of 10 fish/pound and transfer to Lewis River Hatchery in early January.

Type-S Coho

- Incubate all early coho eggs at Speelyai until eyed and then ship to Lewis River Hatchery. Rear 300,000 fish to a size of 20 fish/pound and release into Lake Merwin in June the following year.

- Rear approximately 870,000 fish to a size of 30 fish/pound and transfer to the Lewis River Hatchery in January; volitionally release on-station (acclimated) in April-June at a size of 17 fish/pound.

Type-N Coho: Rear 3,552,000 fish at Lewis River Hatchery to a size 17 fish/pound; volitionally release on-station (acclimated) in April-June.

Objective 3: Maintain stock integrity and genetic diversity.

Broodstock Selection-All Stocks

Adults are collected throughout the entire run to ensure that the run timing for these stocks is maintained.

Spawning Protocol-All Stocks

The intent is to utilize a spawning population of at least 500 adults. When spawning fewer than 1 million eggs in a day, the male to female ratio will be 1:1 for all stocks. When spawning more than 1 million eggs in a day, the ratio will not be less than 1 male to 3 females. A portion of each day's egg-take is used for on-site hatchery production.

Acceptable Stocks

Importing eggs/fish from other facilities with acceptable stocks is done to achieve production goals while maintaining regional genetic integrity in times of inadequate hatchery returns. Eggs from hatchery-returning adults are always given priority for station use. The stocks approved for release from the Lewis River and Speelyai hatcheries have been prioritized and are listed below. Stocks with the number 1

adjacent to their title are the most desirable. Stocks with higher numbers are considered to be progressively less well suited.

Spring Chinook
1 Lewis River spring chinook
2 Cowlitz River spring chinook
2 Kalama River spring chinook

Type-S Coho
1 Lewis River Type-S
2 Any Columbia River Type-S

Type-N Coho
1 Lewis River Type-N
2 Any Columbia River Type-N

Fall Chinook
1 Lewis River fall chinook

Objective 4: Maximize survival at all life stages using disease control and disease prevention techniques. Prevent introduction, spread or amplification of fish pathogens.

Fish Health Management Programs-All Stocks

The primary objective of fish health management programs at WDF hatcheries is to produce healthy smolts that will contribute to the fisheries and natural spawning. Equally important is to prevent the introduction, amplification or spread of certain fish pathogens which might negatively affect the health of both hatchery and naturally reproducing stocks.

WDF has implemented both disease control and disease prevention programs at all of its facilities to try and achieve these objectives. These programs include the following standard elements:

Disease Control (Reactive)

- Perform necropsies of diseased and dead fish to diagnose the cause of loss.
- Prescribe appropriate treatments and remedies to disease.
- Use a disease control policy which dictates how specific disease problems will be addressed and what restrictions may be placed on movements of diseased stocks.
- Conduct applied research on new and existing techniques to control disease epizootics.

Disease Prevention (Proactive)

- Routinely perform necropsies of clinically healthy fish to assess health status and detect problems before they progress to clinical disease or mortality.
- Implement disease preventative strategies in all aspects of fish culture to produce a quality fish. This includes prescribing the optimal nutritional needs and environmental conditions in the hatchery rearing container based on historical disease events. It also involves the prophylactic use of vaccines in order to avoid a disease problem.
- Use a disease prevention policy which restricts the introduction of stocks into a facility which may result in the introduction of a new disease condition or mortality.
- Use sanitation procedures which prevent introduction of pathogens into and/or within a facility.

- Conduct applied research on new and existing disease prevention techniques.

- Utilize pond management strategies (e.g., Density Index and Flow Index) to help optimize the quality of the aquatic environment and minimize fish stress which can induce infectious and noninfectious diseases. For example, the Density Index is used to estimate the maximum number of fish (of a given length) that can occupy a rearing unit based on the rearing unit's size. The Flow Index is used to estimate the rearing unit's carrying capacity based on water flows.

Fish Health Activities at Lewis/Speelyai Hatcheries

Health Monitoring

- On at least a monthly basis, both healthy and clinically diseased fish from each fish lot at the hatchery are given a health exam. The sample includes a minimum of ten fish per lot. Findings are reported on WDF Form FH01.

- At spawning, a minimum of 60 ovarian fluids and 60 kidney/spleens are examined for viral pathogens from each stock.

- Prior to transfer or release, fish are given a health exam. This exam may be in conjunction with the routine monthly visit.

- Whenever abnormal behavior or mortality is observed, the fish health specialist will examine the affected fish, make a diagnosis and recommend the appropriate remedial or preventative measures.

- Reporting and control of selected fish pathogens are conducted in accordance with the Co-Managers Fish Disease Control Policy.

Fish and Egg Movements

- Movements of fish and eggs are conducted in accordance with the Co-Managers Fish Disease Control Policy.

Therapeutic and Prophylactic Treatments

- Adult spring chinook and Type-S coho are injected with antibiotics for the control of bacterial diseases.

- At spawning, eggs are water-hardened in iodophor as a disinfectant.

- Juvenile fish are administered antibiotics orally when needed for the control of bacterial infections.

- Formalin (37% formaldehyde) is dispensed into water for control of parasites and fungus on eggs, juveniles and adult salmon. Treatment dosage and time of exposure varies with species, life-stage and condition being treated.

- Only therapeutants approved by the U.S. Food and Drug Administration are used for treatments.

Sanitation

- All eggs brought to the facility are surface-disinfected with iodophor (as per disease policy).

- All equipment (nets, tanks, rain gear) is disinfected with iodophor between different fish/egg lots.

- Different fish/egg lots are physically isolated from each other by separate ponds or incubation units. Incubation units are further isolated by plastic curtains. The intent of these activities is to prevent the horizontal spread of pathogens by splashing water.

- Tank trucks are disinfected between the hauling of different fish lots.

- Foot baths containing iodophor are strategically located on the hatchery grounds (i.e., entrance to hatchery building) to prevent spread of pathogens.

Objective 5: Conduct environmental monitoring.

Environmental Monitoring

Primarily, environmental monitoring is conducted at WDF facilities to ensure these facilities meet the requirements of the National Pollution Discharge Elimination Permit administered by the Washington Department of Ecology. It is also used in managing fish health. On a short-term basis, monitoring helps identify when changes to hatchery practices are required. Long-term monitoring provides the ability to quantify water quality impacts resulting from changes in the watershed (e.g., logging, road building and urbanization). The following parameters are currently monitored at this hatchery:

- *Total* Suspended Solids *(TSS)*—1 to 2 times per month on composite effluent, maximum effluent and influent samples. Once per month on pollution abatement pond influent and effluent samples.

- *Settleable* Solids *(SS)*—1 to 2 times per week on effluent and influent samples. Once per week on pollution abatement pond influent and effluent samples.

- Upstream and Downstream Temperatures-twice per month, June through September.

- *Upstream* and Downstream Dissolved Oxygen *(DO)*—twice per month, June through September.

- In-hatchery Wafer Temperatures-maximum and minimum daily.

- *In-hatchery Dissolved Oxygen*—as required by steam flow or weather conditions.

- Some facilities monitor rainfall and air temperature on a daily basis.

The following are additional parameters which should be monitored at WDF hatcheries:

- *Influent Wafer* Temperatures-continuous monitoring
- *Air Temperatures*—continuous monitoring
- *Influent/Effluent Dissolved* Oxygen-continuous monitoring
- *Influent* @-I/Conductivity-continuous monitoring
- *Streambed Movement*
- *In-stream Flow/Current*
- *Daily Rainfall*

Objective 6: Communicate effectively with other salmon producers and managers.

Interagency Coordination/Communication

Production Advisory Committee (PAC): The Columbia River PAC is comprised of representatives from the regulatory management agencies and tribes. This group meets monthly to discuss anadromous fish production issues and to provide an opportunity for communication among the anadromous fish hatchery managers.

Technical Advisory Committee (TAC): The Columbia River TAC is comprised of regulatory fish harvest technicians. This group provides management direction used in establishing hatchery fish production goals. TAC meets monthly.

Integrated Hatchery Operations Team (IHOT): This group is comprised of representatives from fish management agencies and tribes. IHOT meets monthly and is currently developing a series of regional hatchery policies.

Pacific Northwest Fish Health Protection Committee (PNFHPC): This group is comprised of representatives from U.S. and Canadian fish management agencies, tribes, universities, and private fish operations. The groups meets twice a year to monitor regional fish health policies and to discuss current fish health issues in the Pacific Northwest.

In-River Agreements: State, federal and tribal representatives meet annually to set Columbia River harvests as part of the U.S. v. Oregon Agreement. Periodic meetings are also held throughout the year to assess if targets are being met.

In-Season Communications: Communication with PAC, the Columbia River Inter-Tribal Fish Commission, Oregon Department of Fish and Wildlife, Washington Department of Wildlife, U.S. Fish and Wildlife Service and Idaho Department of Fish and Game takes place each year to coordinate proper fish and egg transfers in an effort to meet basin-wide goals at all facilities, where applicable.

Record Keeping

Records are kept in a consistent manner employing standard formats to allow for documentation and monitoring. Future record keeping will be coordinated with the basin-wide Coordinated Information System (CIS) currently under development. It will be a system to access all necessary databases in the region. It is hoped that coordinated information collection and reporting will result in consistency between the various agencies.

Development and Review of Brood Documents

The three brood documents are reviewed and agreed to annually. The Eauilibrium Brood Document for the Columbia River and/or major tributaries has not yet been developed. It would document existing baseline production and current management. The Future Brood Document is a detailed listing of annual production goals. This is reviewed and updated each spring, and is finalized by July. The Current Brood Document reflects actual production relative to the annual production goals. It is developed in the spring after eggs are taken. It is usually finalized by March.

PERFORMANCE STANDARDS-LEWIS RIVER/SPEELYAI HATCHERIES

Objective I

Measures	Species	Hatcher-v Goal	5-Year Average	Range	Constraints
Adult Capture	Spr. Chinook	618	525	164-794	1
	Type-S Coho	1,950	11,208	3,388-29,561	
	Type-N Coho	5,205	27,798	9,036-46,220	
Adult Prespawning Survival	Spr. Chinook	90%	83.2%	74.9-95.1%	2
	Type-S Coho[1]	90%	94.6%	83.1-98.9%	
	Type-N Coho	90%	98.0%	96.6-99.3%	
Egg-take	Spr. Chinook	1,600,000	1,083,000	365K-1,672K	
	Type-S Coho	1,950,000	2,138,897	1,303K-2,916K	3
	Type-N Coho	5,205,000	11,370,100	7,791K-13,097K	
Green Egg-to-Fry Survival	Spr. Chinook	90%	90.3%	86.9-93.3%	2
	Type-S Coho	90%	87.5%	73.8-90.9%	2
	Type-N Coho	90%	93.1%	86.5-95.4%	
Fry-to-Smolt Survival	Spr. Chinook[2]	90%	96.4%	95.3-97.2%	
	Type-S Coho[2]	90%	86.6%	79.8-93.7%	
	Type-N Coho[2]	90%	91.3%	87.0-94.6%	
Fish Releases	Spr. Chinook'	900,000	597,825	314K-970K	1,2,4
	Type-S Coho[1]	900,000[3]	933,300[4]	684K-1,071K	
	Type-N Coho'	4,200,000[5]	3,890,525	2,248K-4,541K	
Transfers to Co-ops (Eggs/Fish)	Spr. Chinook	0	--		
	Type-S Coho	32,000	30,650[6]	30,650	
	Type-N Coho	0	5,400'	5,400	

NA=Not applicable.
1 Combined totals for Lewis River and Speeiyai hatcheries,
2 Average of four broods, 1987-1990.
3 1992 Type-S coho planting goal reduced to 870,000.
4 An additional average of 817,450 Type-S coho are planted into Lake Merwin from Speelyai Hatchery.
5 1992 Type-N coho planting goal reduced to 3,552,000.
6 Two years data, 1989 and 1990.
7 One year only, 1990.

Objective 1 (continued)

Measures	Species	Hatchery Goal	5-Year Average	Range	Constraints
Other Transfers (Eggs/Fish)	Spr. Chinook	0	--	--	
	Type-S Coho	300,000[8]	947,425[9]	687K-1,112K	
	Type-N Coho	0-1,000,000	3,443,742[10]	1,766K-6,735K	
Adults Passed Upstream	Spr. Chinook	0	0	0	
	Type-S Coho	0	4,847	0-20,306	
	Type-N Coho	0	6,800	0-25,125	
Percent Survival	Spr. Chinook	2.5%	unknown	unknown	5
	Type-S Coho	2.5%	5.0%	4.2-5.4%"	
	Type-N Coho	2.5%	8.0%	7.1-8.8%[11]	

Objective 2

Measures	Species	Hatchery Goal	5-Year Average	Range	Constraints
Release smolts CV<10%	Spr. Chinook	Yes	15.0%	12.0-19.0%	6
	Type-S Coho	Yes	6.8%	4.8-8.7%	6
	Type-N Coho	Yes	6.9%	4.5-9.0%	6
Acclimation	Spr. Chinook	Yes	Yes	--	
	Type-S Coho	Yes	Yes	--	
	Type-N Coho	Yes	Yes	--	
Volitional Release	Spr. Chinook	Partial	Partial	--	7
	Type-S Coho	Partial	Partial		
	Type-N Coho	Partial	Partial		

[8] Transferred to Lake Merwin.
[9] From Speelyai Hatchery only.
[10] Most are egg transfers to other stations.
[11] Data is based on two broods.

Objective 3

Measures	Species	Hatchery Goal	5-Year Average	Range	Constraints
Collect Adults Throughout Run	Spr. Chinook	Yes	Yes	Yes	1
	Type-S Coho	Yes	Yes	Yes	
	Type-N Coho	Yes	Yes	Yes	
Spawning Pop. >500	Spr. Chinook	Yes	Yes	Yes	
	Type-S Coho	Yes	Yes	Yes	
	Type-N Coho	Yes	Yes	Yes	
Spawning Ratio Male:Female	Spr. Chinook	1:3[12]	1:1.5	1.1:1 - 1:1.6	
	Type-S Coho	1:3[12]	1:1	1.2:1 - 1:1.1	
	Type-N Coho	1:3[12]	1:1.1	1:1 - 1:1.6	

Objective 4

Measures	Species	Hatchery Goal	5-Year Average	Range	Constraints
Adhere to Disease Policy	Spr. Chinook	Yes	Yes	--	
	Type-S Coho	Yes	Yes	--	
	Type-N Coho	Yes	Yes	--	

[12] Spawning guidelines require a 1 :1 male to female spawning ratio if less than 1 million eggs are spawned in a single day.

Objective 5

Measures	Species	Ha tchery Goal	5-Year Average	Range	Constraints
TSS Effluent	All	5 mg/l	NA	NA	8
TSS Max Effluent	All	15 mg/l	NA	NA	8
SS Effluent	All	0.1 ml/l	NA	NA	8
TSS PA Effluent	All	100 mg/l	NA	NA	8
SS PA Effluent	All	1.0 ml/l	NA	NA	8
Downstream Temp	All	Varies	NA	NA	8
Downstream DO	All	Varies	NA	NA	
Continuous Monitoring of Other Parameters	All	Yes	NA	NA	

Objective 6

Measures	Species	Hatchery Goal	5-Year Average	Range	Constraints
Check Hatchery Records for Accuracy and Complctcncss	All	Yes	No	--	9
Develop and Review Comp. Basin-Wide Production Plan	All	Yes	No	--	10
Develop and Review Future Brood Doc.	All	Yes	Yes	--	9
Develop and Review Current Brood Doc.	All	Yes	Yes	--	9

Constraints/Comments-Lewis River/Speelyai Hatcheries

1. Mouth of the fish ladder needs to be dredged because shallow bar area discourages spring chinook from entering the ladder. In addition, spring chinook are not well attracted to the ladder mouth because they were reared on a different water source.

2. High water temperatures during the fall causes increased mortality of spring chinook and Type-S coho. It also increases egg mortality from adults held in warm water for long periods of time. Hauling of spring chinook to Speelyai Hatchery increases stress and mortality, but decreases subsequent adult and egg mortality.

3. Lack of sufficient brood due to poor survival years or high harvest rates in the Columbia River commercial fisheries. Higher survival of male fish can skew the sex ratio of returning adult, thus making it difficult to obtain adequate number of eggs.

4. Low flows can reduce production capability and increase loadings in Davis Creek pond.

5. Lack of continuous, current tag data.

6. Combining progeny of many different egg-takes increases size variation in the large rearing ponds.

7. Location of Speelyai Hatchery precludes volitional release.

8. Pollution abatement pond is too small to accommodate the hatchery cleaning schedule, particularly for the large rearing ponds. In addition, the Davis Creek pond is not plumbed into the abatement pond. As a result, this hatchery is in frequent violation of the pollution abatement requirement. An abatement pond is in the planning stage at Speelyai Hatchery.

9. Current hatchery system lacks the necessary infrastructure and mechanisms to ensure adequate monitoring and evaluation needed for efficient and effective hatchery rearing programs.

10. A comprehensive basin-wide production plan has not been completed at this time.

Lower Kalama Salmon Hatchery

INTRODUCTION

Lower Kalama Hatchery is located along the Kalama River, 5 miles north of Kalama, Washington. The facility is 53 feet above sea level and is located in relatively steep terrain. It is staffed with 3.25 FTE's.

The rearing units consist of 8 raceways, 1 asphalt rearing pond (also used for adult holding), and 1 gravel rearing pond. Total rearing area is 161,200 cubic feet.

Facility water rights total 15,112 gpm from-two sources: Kalama River and Fallert Creek. The hatchery water supply comes from the Kalama River by pumping and from Fallert Creek by gravity flow.

Water from Fallert Creek is used for incubation and some fish rearing. This creek is not used during summer months because of low water flows.

PURPOSE

Lower Kalama Hatchery began operation in 1895 and is one of the oldest hatcheries in the Columbia River Basin. Facility operations are funded as part of the Mitchell Act-a program to mitigate for fishery losses caused by hydroelectric system development. Funds for this program are administered by the National Marine Fisheries Service.

This facility is used for spawning, egg incubation, and rearing of tule fall chinook and early (Type-S) coho. It is also used for final rearing and release of yearling spring chinook transferred in from the Kalama Falls Hatchery. The hatchery is currently operating at maximum production. Tule fall chinook and Type-N coho stocks produced from Mitchell Act hatcheries are managed as species aggregates; therefore, adequate escapement of appropriate species/stocks for each hatchery's egg-take needs is not critical. Mitchell Act hatcheries with insufficient broodstock can receive eggs of appropriate species/stocks from any other Mitchell Act facility with surplus eggs (see Kalama Falls Hatchery Plan).

GOALS

Produce lower river fall chinook, spring chinook and coho that will contribute to NE Pacific and Columbia River Basin commercial and sport fisheries while providing adequate escapement for hatchery production.

OBJECTIVES

Objective 1: Hatchery Production

Spring Chinook
Produce 500,000 yearlings for on-station release.

Fall Chinook
Produce 2,000,000 subyearlings for on-station release.

Provide eggs/fish (surplus to on-station needs) to other facilities.

Type-S Coho
Produce 525,000 yearlings for on-station release.

Provide eggs/fish (surplus to on-station needs) to other facilities.

Objective 2: Minimize interactions with other fish populations through proper rearing and release strategies.

Objective 3: Maintain stock integrity and genetic diversity of each unique stock through proper management of genetic resources.

Objective 4: Maximize survival at all life stages using disease control and disease prevention techniques. Prevent introduction, spread or amplification of fish pathogens.

Objective 5: Conduct environmental monitoring to ensure that hatchery operations comply with water quality standards and to assist in managing fish health.

Objective 6: Communicate effectively with other salmon producers and managers in the Columbia River Basin.

CURRENT PRACTICES TO ACHIEVE OBJECTIVES

Objective 1: Hatchery Production

Adult Collection

The intent of the adult collection procedures at Lower Kalama Hatchery is to collect as many adults as possible to maintain the hatchery production program.

Spring Chinook: There is no adult spring chinook collection program at this hatchery. Spring chinook are transferred from the Kalama Falls Hatchery as fingerlings.

Tule Fall Chinook: Entry of adults into the subbasin occurs from August to November. Spawning occurs from September to November with a peak in October. Adults are captured at Modrow Trap in the lower Kalama River and trucked to Kalama Falls Hatchery. When the holding ponds at Kalama Falls are full, Lower Kalama Hatchery becomes the alternate location for holding adults. Adults also return to Fallert Creek, which supplies additional eggs for the hatchery.

Type-S Coho: Type-S coho begin entering the Kalama River in September. Spawning occurs from October to November with a peak in late October to early November. Adults are captured at the hatchery site as they migrate up Fallert Creek.

Objective 2: Minimize interactions with other fish populations through proper rearing and release strategies.

Rearing and Release Strategies

Rearing and release strategies are designed to limit the amount of ecological interactions occurring between hatchery and naturally produced fish. Fish are reared to sufficient size that smoltification occurs within nearly the entire population, which will reduce retention time in downstream migration. Rearing on parent river water, or acclimation for several weeks to parent river water is used to ensure strong homing to the hatchery, thus reducing the stray rate to natural populations. Various release strategies are used to ensure that fish migrate from the hatchery with the least amount of interaction with native populations. The specific rearing and release strategies used at this hatchery are outlined below.

Spring Chinook: Rear 500,000 fish to a size of 7 fish/pound and release on-station (acclimated) in April.

Fall Chinook: Rear 2 million fish to a size of SO-80 fish/pound and release on-station (acclimated) in June.

Type-S Coho: Rear 525,000 fish to a size of 18 fish/pound and release on-station (acclimated) in May.

Objective 3: Maintain stock integrity and genetic diversity.

Broodstock Selection-All Stocks

Adults are collected throughout the entire run to ensure that the run timing for these stocks is maintained.

Spawning Protocol-All Stocks

The intent is to utilize a spawning population of at least 500 adults. When spawning fewer than 1 million eggs in a day, the male to female ratio will be 1:1 for all stocks. When spawning more than 1 million eggs in a day, the ratio will not be less than 1 male to 3 females. A portion of each day's egg-take is used for on-site hatchery production.

Acceptable Stocks

Importing eggs/fish from other facilities with acceptable stocks is done to achieve production goals while maintaining regional genetic integrity in times of inadequate hatchery returns. Eggs from hatchery-returning adults are always given priority for station use. The stocks approved for release from the Lower Kalama Hatchery are listed below. Stocks with the number 1 adjacent to their title are the most desirable. Stocks with higher numbers are considered to be progressively less well suited.

Spring Chinook
1 Kalama Falls spring chinook

Fall Chinook
1 Kalama River fall chinook

Type-S Coho
1 Grays River Type-S
2 Toutle River Type-S

Objective 4: Maximize survival at all life stages using disease control and disease prevention techniques. Prevent introduction, spread or amplification of fish pathogens.

Fish Health Management Programs-All Stocks

The primary objective of fish health management programs at WDF hatcheries is to produce healthy smolts that will contribute to the fisheries and natural spawning. Equally important is to prevent the introduction, amplification or spread of certain fish pathogens which might negatively affect the health of both hatchery and naturally reproducing stocks.

WDF has implemented both disease control and disease prevention programs at all of its facilities to try and achieve these objectives. These programs include the following standard elements:

Disease Control (Reactive)

- Perform necropsies of diseased and dead fish to diagnose the cause of loss.
- Prescribe appropriate treatments and remedies to disease.
- Use a disease control policy which dictates how specific disease problems will be addressed and what restrictions may be placed on movements of diseased stocks.
- Conduct applied research on new and existing techniques to control disease epizootics.

Disease Prevention (Proactive)

- Routinely perform necropsies of clinically healthy fish to assess health status and detect problems before they progress to clinical disease or mortality.
- Implement disease preventative strategies in all aspects of fish culture to produce a quality fish. This includes prescribing the optimal nutritional needs and environmental conditions in the hatchery rearing container based on historical disease events. It also involves the prophylactic use of vaccines in order to avoid a disease problem.
- Use a disease prevention policy which restricts the introduction of stocks into a facility which may result in the introduction of a new disease condition or mortality.
- Use sanitation procedures which prevent introduction of pathogens into and/or within a facility.

- Conduct applied research on new and existing disease prevention techniques.

- Utilize pond management strategies (e.g., Density Index and Flow Index) to help optimize the quality of the aquatic environment and minimize fish stress which can induce infectious and noninfectious diseases. For example, the Density Index is used to estimate the maximum number of fish (of a given length) that can occupy a rearing unit based on the rearing unit's size. The Flow Index is used to estimate the rearing unit's carrying capacity based on water flows.

Fish Health Activities at Lower Kalama Hatchery

Health Monitoring

- On at least a monthly basis, both healthy and clinically diseased fish from each fish lot at the hatchery are given a health exam. The sample includes a minimum of ten fish per lot. Findings are reported on WDF Form FH01.

- At spawning, a minimum of 60 ovarian fluids and 60 kidney/spleens are examined for viral pathogens from each stock.

- Prior to transfer or release, fish are given a health exam. This exam may be in conjunction with the routine monthly visit.

- Whenever abnormal behavior or mortality is observed, the fish health specialist will examine the affected fish, make a diagnosis and recommend the appropriate remedial or preventative measures.

- Reporting and control of selected fish pathogens are conducted in accordance with the Co-Managers Fish Disease Control Policy.

Fish and Egg Movements

- Movements of fish and eggs are conducted in accordance with the Co-Managers Fish Disease Control Policy.

Therapeutic and Prophylactic Treatments

- At spawning, eggs are water-hardened in iodophor as a disinfectant.

- Juvenile fish are administered antibiotics orally when needed for the control of bacterial infections.

- **Formalin** (37% formaldehyde) is dispensed into water for control of parasites and fungus on eggs, juveniles and adult salmon. Treatment dosage and time of exposure varies with species, life-stage and condition being treated.

- Only therapeutants approved by the U.S. Food and Drug Administration are used for treatments.

Sanitation

- All eggs brought to the facility are surface-disinfected with iodophor (as per disease policy).

- All equipment (nets, tanks, rain gear) is disinfected with iodophor between different fish/egg lots.

- Different fish/egg lots are physically isolated from each other by separate ponds or incubation units. Incubation units are further isolated by plastic curtains. The intent of these activities is to prevent the horizontal spread of pathogens by splashing water.

- Tank trucks are disinfected between the hauling of different fish lots.

- Foot baths containing iodophor are strategically located on the hatchery grounds (i.e., entrance to hatchery building) to prevent spread of pathogens.

Objective 5: Conduct environmental monitoring.

Environmental Monitoring

Primarily, environmental monitoring is conducted at WDF facilities to ensure these facilities meet the requirements of the National Pollution Discharge Elimination Permit administered by the Washington Department of Ecology. It is also used in managing fish health. On a short-term basis, monitoring helps identify when changes to hatchery practices are required. Long-term monitoring provides the ability to quantify water quality impacts resulting from changes in the watershed (e.g., logging, road building and urbanization). The following parameters are currently monitored at this hatchery:

- *Total* Suspended Solids *(TSS)*—1 to 2 times per month on composite effluent, maximum effluent and influent samples. Once per month on pollution abatement pond influent and effluent samples.

- *Settleable* Solids *(SS)*—1 to 2 times per week on effluent and influent samples. Once per week on pollution abatement pond influent and effluent samples.

- Upstream and Downstream Temperatures-twice per month, June through September.

- Upstream and Downstream Dissolved Oxygen *(DO)*—twice per month, June through September.

- In-hatchery Wafer Temperatures-maximum and minimum daily.

- *In-hatchery Dissolved Oxygen* - a s required by steam flow or weather conditions.

- Some facilities monitor rainfall and air temperature on a daily basis.

The following are additional parameters which should be monitored at WDF hatcheries:

- *Influent* Water Temperatures-continuous monitoring
- *Air* Temperatures-continuous monitoring
- *Influent/Effluent Dissolved* Oxygen-continuous monitoring
- *Influent pH/Conductivity*—continuous monitoring
- *Streambed Movement*
- *In-stream Flow/Current*
- *Daily* Rainfall

Objective 6: Communicate effectively with other salmon producers and managers.

Interagency Coordination/Communication

Production Advisorv Committee (PAC): The Columbia River PAC is comprised of representatives from the regulatory management agencies and tribes. This group meets monthly to discuss anadromous fish production issues and to provide an opportunity for communication among the anadromous fish hatchery managers.

Technical Advisorv Committee (TAC): The Columbia River TAC is comprised of regulatory fish harvest technicians. This group provides management direction used in establishing hatchery fish production goals. TAC meets monthly.

Integrated Hatchery Operations Team (IHOT): This group is comprised of representatives from fish management agencies and tribes. IHOT meets monthly and is currently developing a series of regional hatchery policies.

Pacific Northwest Fish Health Protection Committee (PNFHPC): This group is comprised of representatives from U.S. and Canadian fish management agencies, tribes, universities, and private fish operations. The groups meets twice a year to monitor regional fish health policies and to discuss current fish health issues in the Pacific Northwest.

In-River Agreements: State, federal and tribal representatives meet annually to set Columbia River harvests as part of the U.S. v. Oregon Agreement. Periodic meetings are also held throughout the year to assess if targets are being met.

In-Season Communications: Communication with PAC, the Columbia River Inter-Tribal Fish Commission, Oregon Department of Fish and Wildlife, Washington Department of Wildlife, U.S. Fish and Wildlife Service and Idaho Department of Fish and Game takes place each year to coordinate proper fish and egg transfers in an effort to meet basin-wide goals at all facilities, where applicable.

Record Keeping

Records are kept in a consistent manner employing standard formats to allow for documentation and monitoring. Future record keeping will be coordinated with the basin-wide Coordinated Information System (CIS) currently under development. It will be a system to access all necessary databases in the region. It is hoped that coordinated information collection and reporting will result in consistency between the various agencies.

Development and Review of Brood Documents

The three brood documents are reviewed and agreed to annually. The Eouilibrium Brood Document for the Columbia River and/or major tributaries has not yet been developed. It would document existing baseline production and current management. The Future Brood Document is a detailed listing of annual production goals. This is reviewed and updated each spring, and is finalized by July. The Current Brood Document reflects actual production relative to the annual production goals. It is developed in the spring after eggs are taken. It is usually finalized by March.

PERFORMANCE STANDARDS-LOWER KALAMA HATCHERY

Objective 1

Measures	Species	Ha tcherv Goal	5-Year Average	Range	Constraints
Adult Capture	Fall Chinook	1,425	1,432	658-2,407	1
	Type-S Coho	880	1,763	1504,108	
Adult Prespawning Survival	Fall Chinook	90%	82.0%	72.5-91.3%	2
	Type-S Coho	90%	98.6%	95.9-100%	
Egg-take	Fall Chinook	2,360,000	2,400,960	860K-4,231K	
	Type-S Coho	1,200,000	2,057,825[1]	888K-3,833K	
Green Egg-to-Fry Survival	Fall Chinook	90%	93.8%	86.9-96.7%	
	Type-S Coho	90%	91.8%	84.0-97.2%	2
Fry-to-Smol t Survival	Fall Chinook	90%	97.2%	95.2-99.5%	
	Type-S Coho	90%	92.4%	84.5-99.2%	
Fish Releases	Fall Chinook	2,000,000	2,324,581	2,040K-3,087K	1
	Spr. Chinook	500,000	473,638[2]	282K-547K	
	Type-S Coho	525,000	550,507[2]	527K-587K	
Transfers to Co-ops (Eggs/Fish)	Fall Chinook	0	700,000[3]	--	
	Spr. Chinook	0	--	--	
	Type-S Coho	0	550,000[4]	--	
Other Transfers (Eggs/Fish)	Fall Chinook	0-1,500,000	1,025,000[5]	--	
	Spr. Chinook	0	435,694[6]	--	
	Type-S Coho	550,000'	--	270K-1,200K	

NA=Not applicable.
1 Average of four broods, 1988-1991.
2 Average of four broods, 1987-1990.
3 One year only , 1987.
4 One year only (1990, egg transfer).
5 Two years only (egg transfers).
6 Three years of egg transfers and two years of fish transfers.
7 Rocky Reach program.

Objective 1 (continued)

Measures	Species	Hatchery Goal	5-Year Average	Range	Constraints
Adults Passed Upstream	Fall Chinook	0	0	0	
	Spr. Chinook	0	0	0	
	Type-S Coho	0	89	o-211	1
Percent Survival	Fall Chinook	1.0%	Unknown	Unknown	3
	Spr. Chinook	5.0%	Unknown	Unknown	3
	Type-S Coho	3.0%	Unknown	Unknown	3

Objecfive 2

Measures	Species	Hatchery Goal	5-Year Averaee	Range	Constraints
Release smol ts CV<10%	Fall Chinook	Yes	NA	NA	3
	Spr. Chinook	Yes	NA	NA	3
	Type-S Coho	Yes	NA	NA	3
Acclimation	Fall Chinook	Yes	Yes	--	
	Spr. Chinook	Yes	Yes	--	
	Type-S Coho	Yes	Yes	--	
Volitional Release	Fall Chinook	Yes	No	--	4
	Spring chinook	Yes	No	--	4
	Type-S Coho	Yes	No	--	4

Objective 3

Measures	Species	Hatchery Goal	5-Year Average	Range	Constraints
Collect Adults Throughout Run	Fall Chinook	Yes	No	--	1
	Type-S Coho	Yes	Yes	--	
Spawning Pop. >500	Fall Chinook	Yes	Yes	600-2,400	
	Type-S Coho	Yes	Yes	15-4,000	
Spawning Ratio Male:Female	Fall Chinook	1:1	1.6:1	0.6:1 - 3.6:1	
	Type-S Coho	1:3[8]	1.1:1	0.7:1 - 1.4:1	

[8] Spawning guidelines require a 1 :1 male to female spawning ratio if less than 1 million eggs are spawned in a single day.

Objective 4

Measures	Species	Hatchery Goal	5-Year Average	Range	Constraints
Adhere to Disease Policy	Fall Chinook	Yes	Yes	- -	
	Type-S Coho	Yes	Yes	- -	

Objective 5

Measures	Species	Hatchery Goal	5-Year Average	Range	Constraints
TSS Effluent	All	5 mg/l	NA	NA	5
TSS Max Effluent	All	15 mg/l	NA	NA	5
SS Effluent	All	0.1 ml/l	NA	NA	5
TSS PA Effluent	All	100 mg/l	NA	NA	5
SS PA Effluent	All	1.0 ml/l	NA	NA	5
Downstream Temp	All	Varies	NA	NA	
Downstream DO	All	Varies	NA	NA	
Continuous Monitoring of Other Parameters	All	Yes	NA	NA	

Ob'ective 6

Measures	Species	Hatchery Goal	5-Year Average	Range	Constraints
Check Hatchery Records for Accuracy and Completeness	All	Yes	No	--	6
Develop and Review Comp. Basin-Wide Production Plan	All	Yes	No	--	7
Develop and Review Future Brood Doc.	All	Yes	Yes	--	6
Develop and Review Current Brood Doc.	All	Yes	Yes	--	6

Constraints/Comments-Lower Kalama Hatchery

1. Kalama River tule fall chinook are managed to provide adequate escapement to the Kalama hatcheries because these hatcheries provide eggs to-other lower Columbia River hatcheries with shortfalls. Type-S coho are not managed to provide adequate escapement to the hatchery. Because of the lower river trap at Modrow, this facility does not receive tule fall chinook from all segments of the run.

2. Hauling fish increases prespawning mortality, particularly during years when high water temperatures are present. High water temperatures during holding increases the egg-to-fry mortality, particularly with Type-S coho.

3. Lack of current, continuous tag data. Only marked fish are measured to determine mean length and coefficient of variation (CV).

4. Outlet structures on rearing ponds are not designed to allow volitional release.

5. There is no pollution abatement pond; effluent discharges into Fallert Creek. The hatchery has been in violation of water quality standards during pond drawdowns. Funds are not currently available for construction of an abatement pond.

6. Current hatchery system lacks the necessary infrastructure and mechanisms to ensure adequate monitoring and evaluation needed for efficient and effective hatchery rearing programs.

7. A comprehensive basin-wide production plan has not been completed at this time.

Lyons Ferry Salmon Hatchery

INTRODUCTION

Lyons Ferry Salmon Hatchery is located downstream of the confluence of the Palouse and Snake rivers, about 7 miles west of Starbuck, Washington. This facility is part of a complex operated jointly with the Washington Department of Wildlife (WDW) which rears trout and steelhead in one portion of the hatchery complex. The spring chinook acclimation pond and adult trap at Tucannon Hatchery (WDW facility) is operated as a satellite facility. The hatchery is staffed with 6.5 FTE's.

Rearing units at the salmon hatchery consist of 28 raceways and 4 rearing ponds. The raceways were not designed to allow direct release of fish into the Snake River. Therefore, smolts must be pumped to either the river or barges which transport them downriver.

Water rights total 53,200 gpm from wells and are held jointly with the WDW hatchery. Water temperatures range from 54°-56°F. No river water is currently being utilized.

On June 27, 1991 the National Marine Fisheries Service proposed a determination that Snake River spring and summer chinook salmon be included as a threatened species under the Endangered Species Act (ESA).

PURPOSE

The hatchery began operation in 1984. It was constructed under the Lower Snake River Compensation Program as partial mitigation for federal dams constructed on the lower Snake River. The facility is used for adult collection, egg incubation and rearing of fall chinook and spring chinook salmon.

GOALS

The original mitigation goal for the hatchery was 1,152 adult Tucannon spring chinook and 18,300 adult Snake River fall chinook salmon. Additional hatchery goals are to 1) maintain genetic integrity of these stocks, 2) manage the hatchery operations in accordance with the listing of both stocks as “threatened” under the Endangered Species Act, 3) gather information on short- and long-term effects of hatchery supplementation on an indigenous wild salmon stock, and 4) minimize impacts on other fish stocks.

OBJECTIVES

Objective 1: Hatchery Production

Produce 800,000 yearling fall chinook for on-station release.

Produce 132,000 spring chinook (8,800 pounds) to be transferred to the WDW Tucannon Hatchery for final rearing, acclimation and release.

(Note: Hatchery production objectives are subject to change under ESA considerations.)

Objective 2: Minimize interactions with other fish populations through proper rearing and release strategies.

Objective 3: Maintain stock integrity and genetic diversity of each unique stock through proper management of genetic resources.

Objective 4: Maximize survival at all life stages using disease control and disease prevention techniques. Prevent introduction, spread or amplification of fish pathogens.

Objective 5: Conduct environmental monitoring to ensure that hatchery operations comply with water quality standards and to assist in managing fish health.

Objective 6: Communicate effectively with other salmon producers and managers in the Columbia River Basin.

CURRENT PRACTICES TO ACHIEVE OBJECTIVES

Objective 1: Hatchery Production

Adult Collection

The intent of the adult collection procedures at Lyons Ferry Hatchery is to collect enough adults of the appropriate stock to maintain the hatchery production program while minimizing adverse impacts on wild or native populations. These stocks are listed as "threatened" under the Endangered Species Act.

Spring Chinook: Spring chinook from the Tucannon River are trapped at the WDW Tucannon Hatchery throughout the run (mid-April to October). A maximum of 50 hatchery and 50 wild fish are used. The objectives are to 1) allow as many wild fish upstream for natural spawning as possible, and 2) ensure proportional genetic contribution from both wild and hatchery fish. Adults are transferred to Lyons Ferry Hatchery for holding and spawning.

Fall Chinook: Fall chinook adults either return to the hatchery or are trapped at Ice Harbor and Lower Granite dams. Only marked hatchery fish are trapped at the dams.

Objective 2: Minimize interactions with other fish populations through proper rearing and release strategies.

Rearing and Release Strategies

Rearing and release strategies are designed to limit the amount of ecological interactions occurring between hatchery and naturally produced fish. Fish are reared to sufficient size that smoltification occurs within nearly the entire population, which will reduce retention time in downstream migration. Rearing on parent river water, or acclimation for several weeks to parent river water is used to ensure strong homing to the hatchery, thus reducing the stray rate to natural populations. Various release strategies are used to ensure that fish migrate from the hatchery with the least amount of interaction with native populations. The specific rearing and release strategies used at this hatchery are outlined below.

Spring Chinook: Rear 130,000 fish to a size of 35 fish/pound; transfer back to Tucannon Hatchery in November for final rearing and acclimation; volitionally release from the Tucannon acclimation pond in April at a size of 15 fish/pound. These activities are done in conformance with the ESA Salmon Recovery Plan and tribal agreements.

Fall Chinook: Rear 800,000 fish to a size of 8 fish/pound and release at the hatchery in April the following year. Fall chinook are reared on spring water; therefore, they are not acclimated to parent river water prior to release. Approximately one-half of

the on-station production is barged downstream. These activities are done in conformance with the ESA Salmon Recovery Plan and tribal agreements.

Objective 3: Maintain stock integrity and genetic diversity.

Broodstock Selection-All Stocks

Adults are collected throughout the entire run to ensure that the run timing for these stocks is maintained and appropriate stocks are utilized in the hatchery. Adults and "jacks" are collected in proportion to their prevalence in the run.

Spawning Protocol-Al/ Stocks

The intent of the spawning protocols used for fall and spring chinook is to maintain genetic diversity of these stocks. Male to female spawning ratios will always be 1:1 for each spawning. In cases where sex ratios on a given spawning day are unequal, gametes will be split into subsets for cross-matings. The use of live-spawned males is a viable alternative as well. Prior to spawning, coded-wire tags are read to ensure that only parent stocks are used in matings. Eggs originating from non-Lyons Ferry fall chinook are shipped off-station for use in other Columbia River upriver bright fall chinook programs.

Acceptable Stocks

The stocks approved for release from Lyons Ferry and Tucannon hatcheries are listed below.

Fall Chinook
Snake River fall chinook (confirmed by CWT analysis)

Spring Chinook
Tucannon River spring chinook (confirmed by CWT analysis)

Monitoring

Tucannon River spring chinook salmon are a discrete, genetically isolated population within the Snake River Basin that has received limited, historical hatchery enhancement. Maintenance of the the genetic integrity of wild spring chinook salmon stocks is a priority in the Tucannon River.

Approximately 80 gene loci in the Tucannon River spring chinook salmon are currently being monitored through electrophoretic analysis. In addition, a four-year study was initiated in 1990 to determine if measurable genetic differences occur in incubation and rearing performance, and smolt-to-adult survival rates as a result of one generation of hatchery rearing.

Objective 4: Maximize survival at all life stages using disease control and disease prevention techniques. Prevent introduction, spread or amplification of fish pathogens.

Fish Health Management Programs-AH Stocks

The primary objective of fish health management programs at WDF hatcheries is to produce healthy smolts that will contribute to the fisheries and natural spawning. Equally important is to prevent the introduction, amplification or spread of certain fish pathogens which might negatively affect the health of both hatchery and naturally reproducing stocks.

WDF has implemented both disease control and disease prevention programs at all of its facilities to try and achieve these objectives. These programs include the following standard elements:

Disease Control (Reactive)

- Perform necropsies of diseased and dead fish to diagnose the cause of loss.
- Prescribe appropriate treatments and remedies to disease.
- Use a disease control policy which dictates how specific disease problems will be addressed and what restrictions may be placed on movements of diseased stocks.
- Conduct applied research on new and existing techniques to control disease epizootics.

Disease Prevention (Proactive)

- Routinely perform necropsies of clinically healthy fish to assess health status and detect problems before they progress to clinical disease or mortality.
- Implement disease preventative strategies in all aspects of fish culture to produce a quality fish. This includes prescribing the optimal nutritional needs and environmental conditions in the hatchery rearing container based on historical disease events. It also involves the prophylactic use of vaccines in order to avoid a disease problem.
- Use a disease prevention policy which restricts the introduction of stocks into a facility which may result in the introduction of a new disease condition or mortality.
- Use sanitation procedures which prevent introduction of pathogens into and/or within a facility.

- Conduct applied research on new and existing disease prevention techniques.

- Utilize pond management strategies (e.g., Density Index and Flow Index) to help optimize the quality of the aquatic environment and minimize fish stress which can induce infectious and noninfectious diseases. For example, the Density Index is used to estimate the maximum number of fish (of a given length) that can occupy a rearing unit based on the rearing unit's size. The Flow Index is used to estimate the rearing unit's carrying capacity based on water flows.

Fish Health Activities at Lyons Ferry Hatchery

Health Monitoring

- On at least a monthly basis, both healthy and clinically diseased fish from each fish lot at the hatchery are given a health exam. The sample includes a minimum of ten fish per lot. Findings are reported on WDF Form FH01.

- At spawning, a minimum of 60 ovarian fluids and 60 kidney/spleens are examined for viral pathogens from each fish stock.

- At spawning, an Enzyme Link Immunosorbent Assay (ELISA) is conducted on kidney tissue samples from all spawned females. ELISA is used to detect the bacterium which causes kidney disease (*Renibacterium salmoninarum*). Progeny from females with similar ELISA levels are grouped and reared together to reduce the horizontal transmission of this disease.

- Prior to transfer or release, fish are given a health exam. This exam may be in conjunction with the routine monthly visit.

- Whenever abnormal behavior or mortality is observed, the fish health specialist will examine the affected fish, make a diagnosis and recommend the appropriate remedial or preventative measures.

- Reporting and control of selected fish pathogens are conducted in accordance with the Co-Managers Fish Disease Control Policy.

Fish and Egg Movements

- Movements of fish and eggs are conducted in accordance with the Co-Managers Fish Disease Control Policy.

Therapeutic and Prophylactic Treatments

- Adult fall and spring chinook are injected with antibiotics for the control of bacterial diseases.

- At spawning, eggs are water-hardened in iodophor as a disinfectant.

- Juvenile fish are administered antibiotics orally when needed for the control of bacterial infections.

- **Formalin** (37% formaldehyde) is dispensed into water for control of parasites and fungus on eggs, juveniles and adult salmon. Treatment dosage and time of exposure varies with species, life-stage and condition being treated.

- Only therapeutants approved by the U.S. Food and Drug Administration are used for treatments.

Sanitation

- All equipment (nets, tanks, rain gear) is disinfected with iodophor between different fish/egg lots.

- Different fish/egg lots are physically isolated from each other by separate ponds or incubation units. Incubation units are further isolated by plastic curtains. The intent of these activities is to prevent the horizontal spread of pathogens by splashing water.

- Tank trucks are disinfected between the hauling of different fish lots.

- Foot baths containing ivory soap are strategically located on the hatchery grounds (i.e., entrance to hatchery building) to prevent spread of pathogens.

Objective 5: Conduct environmental monitoring.

Environmental Monitoring

Primarily, environmental monitoring is conducted at WDF facilities to ensure these facilities meet the requirements of the National Pollution Discharge Elimination Permit administered by the Washington Department of Ecology. It is also used in managing fish health. On a short-term basis, monitoring helps identify when changes to hatchery practices are required. Long-term monitoring provides the ability to quantify water quality impacts resulting from changes in the watershed (e.g., logging, road building and urbanization). The following parameters are currently monitored at this hatchery:

- *Total Suspended Solids (TSS)*—1 to 2 times per month on composite effluent, maximum effluent and influent samples. Once per month on pollution abatement pond influent and effluent samples.

- *Settleable Solids (SS)*—1 to 2 times per week on effluent and influent samples. Once per week on pollution abatement pond influent and effluent samples.

- *Upstream and* Downstream *Temperatures*—twice per month, June through September.

- *Upstream and Downstream Dissolved* Oxygen *(DO)*—twice per month, June through September.

- *In-hafchery Wafer Temperatures*—maximum and minimum daily.

- *In-hatchery Dissolved Oxygen*—as required by steam flow or weather conditions.

- Some facilities monitor rainfall and air temperature on a daily basis.

The following are additional parameters which should be monitored at WDF hatcheries:

- *Influent Wafer* Temperatures-continuous monitoring
- *Air Temperatures*—continuous monitoring
- *Influent/Effluent Dissolved* Oxygen-continuous monitoring
- *Influent pH/Conductivity*—continuous monitoring
- *Streambed Movement*
- *In-stream Flow/Current*
- *Daily Rainfall*

Objective 6: Communicate effectively with other salmon producers and managers.

Interagency Coordination/Communication

Production Advisorv Committee (PAC): The Columbia River PAC is comprised of representatives from the regulatory management agencies and tribes. This group meets monthly to discuss anadromous fish production issues and to provide an opportunity for communication among the anadromous fish hatchery managers.

Technical Advisorv Committee (TAC): The Columbia River TAC is comprised of regulatory fish harvest technicians. This group provides management direction used in establishing hatchery fish production goals. TAC meets monthly.

Integrated Hatcher-v Operations Team (IHOT): This group is comprised of representatives from fish management agencies and tribes. MOT meets monthly and is currently developing a series of regional hatchery policies.

Pacific Northwest Fish Health Protection Committee (PNFHPC): This group is comprised of representatives from U.S. and Canadian fish management agencies, tribes, universities, and private fish operations. The groups meets twice a year to monitor regional fish health policies and to discuss current fish health issues in the Pacific Northwest.

In-River Agreements: State, federal and tribal representatives meet annually to set Columbia River harvests as part of the U.S. v. Oregon Agreement. Periodic meetings are also held throughout the year to assess if targets are being met.

In-Season Communications: Communication with PAC, the Columbia River Inter-Tribal Fish Commission, Oregon Department of Fish and Wildlife, Washington Department of Wildlife, US. Fish and Wildlife Service and Idaho Department of Fish and Game takes place each year to coordinate proper fish and egg transfers in an effort to meet basin-wide goals at all facilities, where applicable.

Record Keeping

Records are kept in a consistent manner employing standard formats to allow for documentation and monitoring. Future record keeping will be coordinated with the basin-wide Coordinated Information System (CIS) currently under development. It will be a system to access all necessary databases in the region. It is hoped that coordinated information collection and reporting will result in consistency between the various agencies.

Development and Review of Brood Documents

The three brood documents are reviewed and agreed to annually. The Eauilibrium Brood Document for the Columbia River and/or major tributaries has not yet been developed. It would document existing baseline production and current management. The Future Brood Document is a detailed listing of annual production goals. This is reviewed and updated each spring, and is finalized by July. The Current Brood Document reflects actual production relative to the annual production goals. It is developed in the spring after eggs are taken. It is usually finalized by March.

PERFORMANCE STANDARDS—LYONS FERRY HATCHERY

Objective 1

Measures	Species	Ha tcherv Goal	5-Year Average	Range	Constraints
Adult Capture	Fall Chinook	4,000	1.918	1,413-3,267	1
	Spr. Chinook	100	105[1]	101-168	1
Adult Prespawning Survival	Fall Chinook	90%	79.0%	72.5-84.3%	1,2
	Spr. Chinook	90%	67.4%	55.8-82.2%	1,2
Egg-take	Fall Chinook	3,530,000	3,977,162	2,926K-5,958K	1
	Spr. Chinook	136,000	165,317	91K-196K	
Green Egg-to-Fry Survival	Fall Chinook	90%	94.8%	91.7-97.0%	
	Spr. Chinook	90%	78.6%	64.9-87.2%	3
Fry-to-Smolt Survival	Fall Chinook	90%	87.5%[2]	80.4-91.7%	
	Spr. Chinook	90%	91.7%[2]	89.6-95.1%	
Fish Releases	Fall Chinook	3,000,000	2,806,516	914K-4,986K	1,3
	Spr. Chinook	88,000	120,541	86K-152K	1,3
Transfers to Co-ops (Eggs/Fish)	Fall Chinook	0	--	--	
	Spr. Chinook	0	—	--	
Other Transfers (Eggs/Fish)	Fall Chinook	0	2,028,377[3]	--	
	Spr. Chinook	0	--	--	
Adults Passed Upstream	Fall Chinook	0	0	0	
	Spr. Chinook	--[4]	171	100-327	
Percent Survival	Fall Chinook	1.0%	0.23%	--	
	Spr. Chinook	2.5%	0.29%[5]	--	

NA=Not applicable.

1 On average, an additional 171 adults are passed upstream every year.

2 Average of four broods, 1987-1990. Fall chinook include both yearling and subyearling releases.

3 Average of three broods. Includes eggs of non-Lyons Ferry origin adults and fry reared for other programs.

4 By agreement, a minimum of 60% of the wild-origin fish will be passed upstream, or 1,052 total fish.

5 1986 brood year.

Objective 2

Measures	Species	Hatcherv Goal	5-Year Average	Range	Constraints
Release smolts	Fall Chinook	Yes	9.8%	7.3-12.0%	4
CV<10%	Spr. Chinook	Yes	11.1%	8.5-13.6%	4
Acclimation	Fall Chinook	Yes	No	--	5
	Spr. Chinook	Yes	Yes	--	
Volitional Release	Fall Chinook	No	No	--	5
	Spr. Chinook	Yes	Yes	--	5

Objective 3

Measures	Species	Hatcherv Goal	5-Year Averaee	Range	Constraints
Collect Adults	Fall Chinook	Yes	Yes	Yes	
Throughout Run	Spr. Chinook	Yes	Yes	Yes	
Spawning Population	Fall Chinook	Yes	1,599	1,082-2,798	1,2
>500	Spr. Chinook	Yes	78	180-327	
Spawning Ratio	Fall Chinook	1:1	0.50:1	0.40:1 - 0.83:1	3
Male:Female	Spr. Chinook	1:1	0.90:1	0.70:1 - 1.24:1	3

Objective 4

Measures	Species	Hatcherv Goal	5-Year Average	Range	Constraints
Adhere to	Fall Chinook	Yes	Yes	--	
Disease Policy	Spr. Chinook	Yes	Yes	--	

Objective 5

Measures	Species	Hatcher-v Goal	5-Year Average	Range	Constraints
TSS Effluent	All	5 mg/l	NA	NA	6
TSS Max Effluent	All	15 mg/l	NA	NA	6
SS Effluent	All	0.1 ml/l	NA	NA	6
TSS PA Effluent	All	100 mg/l	NA	NA	6
SS PA Effluent	All	1.0 ml/l	NA	NA	6
Downstream Temp	All	Varies	NA	NA	6
Downstream DO	All	Varies	NA	NA	
Continuous Monitoring of Other Parameters	All	Yes	NA	NA	

Objective 6

Measures	Species	Hatchery Goal	5-Year Average	Range	Constraints
Check Hatchery Records for Accuracy and Completeness	All	Yes	No		7
Develop and Review Comp. Basin-Wide Production Plan	All	Yes	No	--	8
Develop and Review Future Brood Doc.	All	Yes	Yes	--	7
Develop and Review Current Brood Doc.	All	Yes	Yes	--	7

Constraints/Comments-Lyons Ferry Hatchery

1. Low survival due to dam passage or water flow Constraints. Higher mortality due to high water temperatures in the reservoirs or in the Tucannon River during adult migration period. High predation losses in the reservoirs. High harvest rate of Lyons Ferry fall chinook. Section 10 of the Endangered Species Act requires a permit to trap spring chinook, which constrains trapping these fish for broodstock.

2. High river temperatures during adult return increase both egg and adult mortalities. Hauling adults to the hatchery also increases stress-related mortalities.

3. The spawning protocol requires that the origin of each fish be determined before eggs are fertilized. As a result, eggs are not fertilized immediately, which in warm temperature conditions, can reduce egg and sperm viability. In addition, some egg lots are shipped to the hatchery prior to fertilization. Softshell disease causes higher mortalities. Warm temperatures during incubation accelerate development requiring fish to be held back during rearing. This can increase the susceptibility to some pathogens. Spawning protocol may eliminate candidate males for spawning (i.e., improper stock) and thus skew the sex ratio from 1:1.

4. Combining progeny of different egg-takes into single ponds increases size variation as does feeding fish at low rations.

5. At Lyons Ferry, the pond design does not allow for direct river release or the use of river water for acclimation. Volitional release may be truncated to coordinate fish outmigration with timing of water spills.

6. Operations are administered by Washington Department of Wildlife.

7. Current hatchery system lacks the necessary infrastructure and mechanisms to ensure adequate monitoring and evaluation needed for efficient and effective hatchery rearing programs.

8. A comprehensive basin-wide production plan has not been completed at this time.

Methow Salmon Hatchery

INTRODUCTION

Methow Hatchery is located on the Methow River, 3 miles upstream from the confluence with the Chewuch River in Winthrop, Washington. It is also approximately 1 mile upstream of Winthrop National Fish Hatchery. Site elevation is 1,770 feet above sea level.

The facility is funded by Douglas County PUD and is staffed with 3.5 FTE's. The hatchery has satellite acclimation ponds and upstream migrant traps on the Twisp and Chewuch rivers.

Rearing units include 12 rearing ponds, 24 starter troughs, 3 adult ponds and 3 lined release ponds. The hatchery uses well water to incubate eggs, and well and river water for fish rearing.

PURPOSE

Methow Hatchery began operating in 1992 to replace the fish killed by the Wells Project. The mitigation agreement requires that the hatchery production be consistent with guidelines and procedures developed under the Northwest Power Planning Council's Fish and Wildlife Program.

The central hatchery is used for adult holding, incubation, and rearing of three separate populations of spring chinook salmon. Each population is treated as a separate stock. Two of these stocks are eventually released via the off-station acclimation ponds. Adult fish are collected from the Twisp and Chewuch rivers, and transported to Methow where they are held and spawned. Following egg incubation and early rearing, juvenile fish are transported to acclimation ponds at the parent river for final rearing and release.

GOALS

Increase the number of naturally spawning spring chinook salmon adults in the Methow, Twisp and Chewuch rivers.

OBJECTIVES

Objective 1: Hatchery Production

Produce up to 246,000 yearling spring chinook smolts for on-station release into the Methow River.

Produce up to 246,000 yearling spring chinook smolts for release into the Twisp River from the Twisp River acclimation pond.

Produce up to 246,000 yearling spring chinook smolts for release into the Chewuch River from the Chewuch River acclimation pond.

Objective 2: Minimize interactions with other fish populations through proper rearing and release strategies.

Objective 3: Maintain stock integrity and genetic diversity of each unique stock through proper management of genetic resources.

Objective 4: Maximize survival at all life stages using disease control and disease prevention techniques. Prevent introduction, spread or amplification of fish pathogens.

Objective 5: Conduct environmental monitoring to ensure that hatchery operations comply with water quality standards and to assist in managing fish health.

Objective 6: Communicate effectively with other salmon producers and managers in the Columbia River Basin.

CURRENT PRACTICES TO ACHIEVE OBJECTIVES

Objective 1: Hatchery Production

Adult Collection

Methow Spring Chinook: Adults return from May to August and spawn from August to September. Fish will be trapped at the Foghorn Diversion Dam.

Twisp Spring Chinook: Adults return from May to August and spawn from August to September. Adults are collected via a Japanese-style weir. Adult collection protocols will be developed each year.

Chewuch Spring Chinook: Adults return from May to August and spawn from August to September. Adults will be collected at the Fulton Irrigation Diversion Dam ladder. Adult collection protocols will be developed each year.

Objective 2: Minimize interactions with other fish populations through proper rearing and release strategies.

Rearing and Release Strategies

The release strategies established for this hatchery are intended to acclimate and imprint the hatchery fish so that returning hatchery adults do not stray into the spawning areas of other distinct stocks. The release procedures are also intended to 1) imprint the fish so that returning hatchery adults spawn with the donor stock, and 2) minimize adverse interactions (i.e., competition for food and habitat) between hatchery releases and naturally produced fish. The specific rearing and release strategies are outlined below.

Methow Spring Chinook: Rear fish to a size of 15 fish/pound; acclimate to the Methow River water for minimum of six week; volitionally release on-station in April-May.

Twisp Spring Chinook: Incubate and provide early rearing at Methow Hatchery; transport to Twisp acclimation pond for final rearing; volitionally release into the Twisp River in April-May at a size of 15 fish/pound.

Chewuch Spring Chinook: Incubate and provide early rearing at Methow Hatchery; transport to Chewuch acclimation pond for final rearing; volitionally release into the Chewuch River in April-May at a size of 15 fish/pound.

Objective 3: Maintain stock integrity and genetic diversity.

Broodstock Selection and Spawning

Adults will be collected throughout the duration of the run, in as much as possible, to ensure representation from the entire population. For both the Twisp and Chewuch facilities, no more than 30 percent of salmon trapped should be retained for broodstock. This percentage may be adjusted in subsequent years, depending upon hatchery performance, estimates of run strength and broodstock collection efficiency.

The guidelines for mating Methow Complex spring chinook are as follows:

1. Matings will be single-pair, with individual family incubation and rearing for each population.

2. Live-spawn the males and mark them after their use.

3. Cryopreserve milt for successive years. Priority will be placed upon freezing gametes from age-5 males (identified by size).

These methods are used regardless of the number of fish collected for broodstock. A genetic monitoring program is underway to test whether the broodstock and mating procedures are conserving the genetic diversity of the donor stocks.

All salmon released from the Methow Fish Hatchery Complex will be marked (coded-wire tag and adipose clip). This mark is required for assessing survival rates, straying rates and for broodstock management. The tentative plan in ensuing years is to allow all marked salmon to pass upstream and spawn naturally. An external mark may be required to distinguish Methow Complex fish from those released from Winthrop NFH.

Objective 4: Maximize survival at all life stages using disease control and disease prevention techniques. Prevent introduction, spread or amplification of fish pathogens.

Fish Health Management Programs-All Stocks

The primary objective of fish health management programs at WDF hatcheries is to produce healthy smolts that will contribute to the fisheries and natural spawning. Equally important is to prevent the introduction, amplification or spread of certain fish pathogens which might negatively affect the health of both hatchery and naturally reproducing stocks.

WDF has implemented both disease control and disease prevention programs at all of its facilities to try and achieve these objectives. These programs include the following standard elements:

Disease Control (Reactive)

- Perform necropsies of diseased and dead fish to diagnose the cause of loss.
- Prescribe appropriate treatments and remedies to disease.
- Use a disease control policy which dictates how specific disease problems will be addressed and what restrictions may be placed on movements of diseased stocks.
- Conduct applied research on new and existing techniques to control disease epizootics.

Disease Prevention (Proactive)

- Routinely perform necropsies of clinically healthy fish to assess health status and detect problems before they progress to clinical disease or mortality.
- Implement disease preventative strategies in all aspects of fish culture to produce a quality fish. This includes prescribing the optimal nutritional needs and environmental conditions in the hatchery rearing container based on historical disease events. It also involves the prophylactic use of vaccines in order to avoid a disease problem.
- Use a disease prevention policy which restricts the introduction of stocks into a facility which may result in the introduction of a new disease condition or mortality.
- Use sanitation procedures which prevent introduction of pathogens into and/or within a facility.

- Conduct applied research on new and existing disease prevention techniques.

- Utilize pond management strategies (e.g., Density Index and Flow Index) to help optimize the quality of the aquatic environment and minimize fish stress which can induce infectious and noninfectious diseases. For example, the Density Index is used to estimate the maximum number of fish (of a given length) that can occupy a rearing unit based on the rearing unit's size. The Flow Index is used to estimate the rearing unit's carrying capacity based on water flows.

Fish Health Activities at Methow Hatchery

Health Monitoring

- On at least a monthly basis, both healthy and clinically diseased fish from each fish lot at the hatchery are given a health exam. The sample includes a minimum of ten fish per lot. Findings are reported on WDF Form FH01.

- At spawning, a minimum of 60 ovarian fluids and 60 kidney/spleens are examined for viral pathogens from each fish lot.

- At spawning, an Enzyme Link Immunosorbent Assay (ELISA) is conducted on kidney tissue samples from each spawned female (Methow, Twisp and Chewuch spring chinook). ELISA is used to detect the bacterium which causes kidney disease (*Renibacterium salmoninarum*). Progeny from females with similar ELISA levels are grouped and reared together to reduce the horizontal transmission of this disease.

- Prior to transfer or release, fish are given a health exam. This exam may be in conjunction with the routine monthly visit.

- Whenever abnormal behavior or mortality is observed, the fish health specialist will examine the affected fish, make a diagnosis and recommend the appropriate remedial or preventative measures.

- Reporting and control of selected fish pathogens are conducted in accordance with the Co-Managers Fish Disease Control Policy.

Fish and Egg Movements

- Movements of fish and eggs are conducted in accordance with the Co-Managers Fish Disease Control Policy. Fish and egg movements outside the subbasin are not appropriate for these facilities.

Therapeutic and Prophylactic Treatments

- At spawning, eggs are water-hardened in iodophor as a disinfectant.
- Juvenile fish are administered antibiotics orally when needed for the control of bacterial infections.
- Formalin (37% formaldehyde) is dispensed into water for control of parasites and fungus on eggs, juveniles and adult salmon. Treatment dosage and time of exposure varies with species, life-stage and condition being treated.
- Only therapeutants approved by the U.S. Food and Drug Administration are used for treatments.

Sanitation

- All eggs brought to the facility are surface-disinfected with iodophor (as per disease policy).
- All equipment (nets, tanks, rain gear) is disinfected with iodophor between different fish/egg lots.
- Different fish/egg lots are physically isolated from each other by separate ponds or incubation units. Incubation units are further isolated by separate rooms. The intent of these activities is to prevent the horizontal spread of pathogens by splashing water.
- Tank trucks are disinfected between the hauling of different fish lots.
- Foot baths containing iodophor are strategically located on the hatchery grounds (i.e., entrance to hatchery building) to prevent spread of pathogens.

Objective 5: Conduct environmental monitoring.

Environmental Monitoring

Primarily, environmental monitoring is conducted at WDF facilities to ensure these facilities meet the requirements of the National Pollution Discharge Elimination Permit administered by the Washington Department of Ecology. It is also used in managing fish health. On a short-term basis, monitoring helps identify when changes to hatchery practices are required. Long-term monitoring provides the ability to quantify water quality impacts resulting from changes in the watershed (e.g., logging, road building and urbanization). The following parameters are currently monitored at all WDF hatcheries:

- *Total* Suspended Solids *(TSS)*—1 to 2 times per month on composite effluent, maximum effluent and influent samples. Once per month on pollution abatement pond influent and effluent samples.

- *Settleable* Solids *(SS)*—1 to 2 times per week on effluent and influent samples. Once per week on pollution abatement pond influent and effluent samples.

- *Upstream* and *Downstream* Temperatures-twice per month, June through September .

- Upstream *and Downstream Dissolved Oxygen (DO)*—twice per month, June through September.

- *In-hatchery Wafer Temperatures*-maximum and minimum daily.

- *In-hatchery* Dissolved *Oxygen*- a s required by steam flow or weather conditions.

- Some facilities monitor rainfall and air temperature on a daily basis.

The following are additional parameters which should be monitored at WDF hatcheries:

- *Influent Wafer* Temperatures-continuous monitoring
- *Air Temperatures*—continuous monitoring
- *Influent/Effluent Dissolved* Oxygen-continuous monitoring
- *Influent* @!/Conductivity-continuous monitoring
- *Streambed Movement*
- *In-stream Flow/Current*
- *Daily Rainfall*

Objective 6: Communicate effectively with other salmon producers and managers.

Interagency Coordination/Communication

Production Advisory Committee (PAC): The Columbia River PAC is comprised of representatives from the regulatory management agencies and tribes. This group meets monthly to discuss anadromous fish production issues and to provide an opportunity for communication among the anadromous fish hatchery managers.

Technical Advisory Committee (TAC): The Columbia River TAC is comprised of regulatory fish harvest technicians. This group provides management direction used in establishing hatchery fish production goals. TAC meets monthly.

Integrated Hatchery Operations Team (IHOT): This group is comprised of representatives from fish management agencies and tribes. IHOT meets monthly and is currently developing a series of regional hatchery policies.

Pacific Northwest Fish Health Protection Committee (PNFHPC): This group is comprised of representatives from U.S. and Canadian fish management agencies, tribes, universities, and private fish operations. The groups meets twice a year to monitor regional fish health policies and to discuss current fish health issues in the Pacific Northwest.

In-River Agreements: State, federal and tribal representatives meet annually to set Columbia River harvests as part of the U.S. *v.* Oregon Agreement. Periodic meetings are also held throughout the year to assess if targets are being met.

In-Season Communications: Communication with PAC, the Columbia River Inter-Tribal Fish Commission, Oregon Department of Fish and Wildlife, Washington Department of Wildlife, U.S. Fish and Wildlife Service and Idaho Department of Fish and Game takes place each year to coordinate proper fish and egg transfers in an effort to meet basin-wide goals at all facilities, where applicable.

Record Keeping

Records are kept in a consistent manner employing standard formats to allow for documentation and monitoring. Future record keeping will be coordinated with the basin-wide Coordinated Information System (CIS) currently under development. It will be a system to access all necessary databases in the region. It is hoped that coordinated information collection and reporting will result in consistency between the various agencies.

Development and Review of Brood Documents

The three brood documents are reviewed and agreed to annually. The Eauilibrium Brood Document for the Columbia River and/or major tributaries has not yet been developed. It would document existing baseline production and current management. The Future Brood Document is a detailed listing of annual production goals. This is reviewed and updated each spring, and is finalized by July. The Current Brood Document reflects actual production relative to the annual production goals. It is developed in the spring after eggs are taken. It is usually finalized by March.

PERFORMANCE STANDARDS-METHOW HATCHERY AND SATELLITES

Objective 1

Measures	Species	Hatchery Goal	5-Year Average	Range	Constraints
Adult Capture	Methow CHS	238	NA	NA	
	Twisp CHS	238	NA	NA	
	Chewuch CHS	238	NA	NA	
Adult Prespawning Survival[1]	Methow CHS	80%	NA	NA	
	Twisp CHS	80%	NA	NA	
	Chewuch CHS	80%	NA	NA	
Egg-take	Methow CHS	350,000	NA	NA	
	Twisp CHS	350,000	NA	NA	
	Chewuch Cl-IS	350,000	NA	NA	
Green Egg-to-Fry Survival'	Methow CHS	85%	NA	NA	
	Twisp CHS	85%	NA	NA	
	Chewuch CHS	85%	NA	NA	
Fry-to-Smol t Survival'	Methow CHS	70%	NA	NA	
	Twisp CHS	70%	NA	NA	
	Chewuch CHS	70%	NA	NA	
Fish Releases	Methow CHS	225,000	NA	NA	
	Twisp CHS	225,000	NA	NA	
	Chewuch CHS	225,000	NA	NA	
Transfers to Co-ops (Eggs/Fish)	Methow CHS	0	NA	NA	
	Twisp CHS	0	NA	NA	
	Chewuch CHS	0	NA	NA	
Other Transfers (Eggs/Fish)	Methow CHS	0	NA	NA	
	Twisp CHS	0	NA	NA	
	Chewuch CHS	0	NA	NA	
Adults Passed Upstream	Methow CHS	2/3 of run	NA	NA	
	Twisp CHS	2/3 of run	NA	NA	
	Chewuch CHS	2/3 of run	NA	NA	
Percent Survival	Methow CHS	1.0%	unknown	unknown	
	Twisp CHS	1.0%	unknown	unknown	
	Chewuch CHS	1.0%	unknown	unknown	

NA=Not applicable.

[1] Goals are assigned by FERC agreement and do not reflect hatchery expectations.

Ob'ective 2

Measures	Species	Hatchery Goal	5-Year Average	Range	Constraints
Release smol ts CV<10%	Methow CHS	Yes	NA	NA	
	Twisp U-IS	Yes	NA	NA	
	Chewuch CHS	Yes	NA	NA	
Acclimation	Methow CHS	Yes	NA	NA	
	Twisp CHS	Yes	NA	NA	
	Chewuch CHS	Yes	NA	NA	
Volitional Release	Methow CHS	Yes	NA	NA	
	Twisp U-IS	Yes	NA	NA	
	Chewuch CHS	Yes	NA	NA	

Ob'ective 3

Measures	Species	Hatchery Goal	5-Year Average	Range	Constraints
Collect Adults Throughout Run	Methow CHS	Yes	NA	NA	
	Twisp CHS	Yes	NA	NA	
	Chewuch CHS	Yes	NA	NA	
Spawning Pop. >500	Methow CHS	Yes	NA	NA	
	Twisp CHS	Yes	NA	NA	
	Chewuch CHS	Yes	NA	NA	
Spawning Ratio Male:Female	Methow CHS	1:3[1]	NA	NA	
	Twisp CHS	1:3[1]	NA	NA	
	Chewuch CHS	1:3[1]	NA	NA	

Objective 4

Measures	Species	Hatchery Goal	5-Year Average	Range	Constraints
Adhere to Disease Policy	Methow CHS	Yes	NA	NA	
	Twisp CHS	Yes	NA	NA	
	Chewuch CHS	Yes	NA	NA	

[1] Spawning guidelines require a 1 :1 male to female spawning ratio if less than 1 million eggs are spawned in a single day.

Objective 5

Measures	Species	Hatchery Goal	5-Year Average	Range	Constraints
TSS Effluent	All	5 mg/l	NA	NA	
TSS Max Effluent	All	15 mg/l	NA	NA	
SS Effluent	All	0.1 ml/l	NA	NA	
TSS PA Effluent	All	100 mg/l	NA	NA	
SS PA Effluent	All	1 .O ml/l	NA	NA	
Downstream Temp	All	Varies	NA	NA	
Downstream DO	All	Varies	NA	NA	
Continuous Monitoring of Other Parameters	All	Yes	NA	NA	

Objective 6

Measures	Species	Hatcher-v Goal	5-Year Averaee	Range	Constraints
Check Hatchery Records for Accuracy and Completeness	All	Yes	NA	NA	
Develop and Review Comp. Basin-Wide Production Plan	All	Yes	NA	NA	1
Develop and Review Future Brood Doc.	All	Yes	NA	NA	
Develop and Review Current Brood Doc.	All	Yes	NA	NA	

Constraints/Comments-Methow Hatchery and Satellites

1. A comprehensive basin-wide production plan has not been completed at this time.

Priest Rapids Salmon Hatchery

INTRODUCTION

Priest Rapids Hatchery is located just below Priest Rapids Dam along the Columbia River. Elevation of the facility is 445 feet above sea level. It is funded by the Grant County PUD and is staffed with 5.25 FTE's.

The hatchery began operation in 1963 and was originally designed and constructed as a mile-long spawning channel. The upper portion has since been converted into six large rearing ponds. The remainder of the channel is currently unused except for volunteer broodstock trapping and collection.

The facility rears only fall chinook. The rearing units consist of 6 rearing ponds and 12 vinyl raceways. Four of the rearing ponds are used only for smolt production. Two of the ponds are used for adult holding or fry rearing.

Water is supplied to the hatchery from the Columbia River and wells. The majority of the water is supplied by gravity flow from the Columbia River (44,883 gpm) with the wells supplying 8,000 gpm. Both river water and well water are used for adult holding, incubation and rearing.

PURPOSE

Priest Rapids Hatchery is operated as mitigation facility for fishery impacts caused by the Priest Rapids Project (i.e., Priest Rapids and Wanapum dams). It is used for adult collection, egg incubation, rearing and release of upriver bright (URB) fall chinook. The hatchery also supplies eggs to other hatcheries within the basin, and is therefore managed to allow for adequate escapement.

GOALS

The mitigation agreement with Grant County PUD requires an annual production level of 100,000 pounds of URB chinook.

OBJECTIVES

Objective 1: Hatchery Production

Produce 100,000 pounds of subyearling URB fall chinook for on-station release.

Provide URB chinook eggs (surplus to on-station needs) to other facilities which rear this stock.

Objective 2: Minimize interactions with other fish populations through proper rearing and release strategies.

Objective 3: Maintain stock integrity and genetic diversity of each unique stock through proper management of genetic resources.

Objective 4: Maximize survival at all life stages using disease control and disease prevention techniques. Prevent introduction, spread or amplification of fish pathogens.

Objective 5: Conduct environmental monitoring to ensure that hatchery operations comply with water quality standards and to assist in managing fish health.

Objective 6: Communicate effectively with other salmon producers and managers in the Columbia River Basin.

CURRENT PRACTICES TO ACHIEVE OBJECTIVES

Objective 1: Hatchery Production

Adult Collection

The intent of the adult collection procedures at Priest Rapids Hatchery is to collect enough adults to maintain the hatchery production program. Surplus eggs are supplied to other hatcheries when available.

Adult URB fall chinook return to the hatchery from September 1 through November and are collected as volunteers to the channel. Adults are also collected from a trap at the dam ladder but these fish are usually surplus to the hatchery's on-station production needs.. There is usually a sufficient number of eggs taken to meet the hatchery production goals and supply other hatcheries.

Objective 2: Minimize interactions with other fish populations through proper rearing and release strategies.

Rearing and Release Strategies

Rearing and release strategies are designed to limit the amount of ecological interactions occurring between hatchery and naturally produced fish. Fish are reared to sufficient size that smoltification occurs within nearly the entire population, which will reduce retention time in downstream migration. Rearing on parent river water, or acclimation for several weeks to parent river water is used to ensure strong homing to the hatchery, thus reducing the stray rate to natural populations. Various release strategies are used to ensure that fish migrate from the hatchery with the least amount of interaction with native populations.

Fall chinook is the only species reared at this facility. The goal is to rear fish to a size of 50 fish/pound, acclimate to parent river and release on-station in mid-June.

Objective 3: Maintain stock integrity and genetic diversity.

Broods tock Selection

Adults are collected throughcut the entire run to ensure that the run timing for these stocks is maintained.

Spawning Protocol

The intent is to utilize a spawning population of at least 500 adults. When spawning fewer than 1 million eggs in a day, the male to female ratio will be 1:1 for all stocks. When spawning more than 1 million eggs in a day, the ratio will not be less than 1 male to 3 females. A portion of each day's egg-take is used for on-site hatchery production.

Acceptable Stocks

Importing eggs/fish from other facilities with acceptable stocks is done to achieve production goals while maintaining regional genetic integrity in times of inadequate hatchery returns. Eggs from hatchery-returning adults are always given priority for station use.

The stocks approved for release from the Priest Rapids Hatchery have been prioritized and are listed below. Stocks with the number 1 adjacent to their title are the most desirable. Stocks with higher numbers are considered to be progressively less well suited.

Fall Chinook
1 Priest Rapids fall chinook
2 Mainstem Columbia River upriver brights

Objective 4: Maximize survival at all life stages using disease control and disease prevention techniques. Prevent introduction, spread or amplification of fish pathogens.

Fish Health Management Programs-A/l Stocks

The primary objective of fish health management programs at WDF hatcheries is to produce healthy smolts that will contribute to the fisheries and natural spawning. Equally important is to prevent the introduction, amplification or spread of certain fish pathogens which might negatively affect the health of both hatchery and naturally reproducing stocks.

WDF has implemented both disease control and disease prevention programs at all of its facilities to try and achieve these objectives. These programs include the following standard elements:

Disease Control (Reactive)

- Perform necropsies of diseased and dead fish to diagnose the cause of loss.
- Prescribe appropriate treatments and remedies to disease.
- Use a disease control policy which dictates how specific disease problems will be addressed and what restrictions may be placed on movements of diseased stocks.
- Conduct applied research on new and existing techniques to control disease epizootics.

Disease Prevention (Proactive)

- Routinely perform necropsies of clinically healthy fish to assess health status and detect problems before they progress to clinical disease or mortality.
- Implement disease preventative strategies in all aspects of fish culture to produce a quality fish. This includes prescribing the optimal nutritional needs and environmental conditions in the hatchery rearing container based on historical disease events. It also involves the prophylactic use of vaccines in order to avoid a disease problem.
- Use a disease prevention policy which restricts the introduction of stocks into a facility which may result in the introduction of a new disease condition or mortality.
- Use sanitation procedures which prevent introduction of pathogens into and/or within a facility.

- Conduct applied research on new and existing disease prevention techniques.

- Utilize pond management strategies (e.g., Density Index and Flow Index) to help optimize the quality of the aquatic environment and minimize fish stress which can induce infectious and noninfectious diseases. For example, the Density Index is used to estimate the maximum number of fish (of a given length) that can occupy a rearing unit based on the rearing unit's size. The Flow Index is used to estimate the rearing unit's carrying capacity based on water flows.

Fish Health Activities at Priest Rapids Hatchery

Health Monitoring

- On at least a monthly basis, both healthy and clinically diseased fish from each fish lot at the hatchery are given a health exam. The sample includes a minimum of ten fish per lot. Findings are reported on WDF Form FH01.

- At spawning, a minimum of 60 ovarian fluids and 60 kidney/spleens are examined for viral pathogens.

- Prior to transfer or release, fish are given a health exam. This exam may be in conjunction with the routine monthly visit.

- Whenever abnormal behavior or mortality is observed, the fish health specialist will examine the affected fish, make a diagnosis and recommend the appropriate remedial or preventative measures.

- Reporting and control of selected fish pathogens are conducted in accordance with the Co-Managers Fish Disease Control Policy.

Fish and Egg Movements

- Movements of fish and eggs are conducted in accordance with the Co-Managers Fish Disease Control Policy.

Therapeutic and Prophylactic Treatments

- At spawning, eggs are water-hardened in iodophor as a disinfectant.

- Juvenile fish are administered antibiotics orally when needed for the control of bacterial infections.

- **Formalin** (37% formaldehyde) is dispensed into water for control of parasites and fungus on eggs, juveniles and adult salmon. Treatment dosage and time of exposure varies with species, life-stage and condition being treated.

- Only therapeutants approved by the U.S. Food and Drug Administration are used for treatments.

Sanitation

- All eggs brought to the facility are surface-disinfected with iodophor (as per disease policy).

- All equipment (nets, tanks, rain gear) is disinfected with iodophor between different fish/egg lots.

- Different fish/egg lots are physically isolated from each other by separate ponds or incubation units. Incubation units are further isolated by plastic curtains. The intent of these activities is to prevent the horizontal spread of pathogens by splashing water.

- Tank trucks are disinfected between the hauling of different fish lots.

- Foot baths containing iodophor are strategically located on the hatchery grounds (i.e., entrance to “clean” or isolated areas of the incubation room) to prevent spread of pathogens.

Objective 5: Conduct environmental monitoring.

Environmental Monitoring

Primarily, environmental monitoring is conducted at WDF facilities to ensure these facilities meet the requirements of the National Pollution Discharge Elimination Permit administered by the Washington Department of Ecology. It is also used in managing fish health. On a short-term basis, monitoring helps identify when changes to hatchery practices are required. Long-term monitoring provides the ability to quantify water quality impacts resulting from changes in the watershed (e.g., logging, road building and urbanization). The following parameters are currently monitored at this hatchery:

- Total Suspended Solids *(TSS)*—1 to 2 times per month on composite effluent, maximum effluent and influent samples. Once per month on pollution abatement pond influent and effluent samples.

- *Settleable Solids (SS)*—1 to 2 times per week on effluent and influent samples. Once per week on pollution abatement pond influent and effluent samples.

- Upstream *and Downstream* Temperatures-twice per month, June through September.

- *Upstream and Downstream Dissolved Oxygen* (DO&twice per month, June through September.

- *In-hatchery Water* Temperafures-maximum and minimum daily.

- *In-hatchery Dissolved Oxygen*—as required by steam flow or weather conditions.

- Some facilities monitor rainfall and air temperature on a daily basis.

The following are additional parameters which should be monitored at WDF hatcheries:

- *Influent Water* Temperatures-continuous monitoring
- *Air Temperatures*—continuous monitoring
- *Influent/Effluent Dissolved* Oxygen-continuous monitoring
- *Influent pH/Conductivity*—continuous monitoring
- *Streambed Movement*
- *In-stream Flow/Current*
- *Daily Rainfall*

Objective 6: Communicate effectively with other salmon producers and managers.

Interagency Coordination/Communication

Production Advisory Committee (PAC): The Columbia River PAC is comprised of representatives from the regulatory management agencies and tribes. This group meets monthly to discuss anadromous fish production issues and to provide an opportunity for communication among the anadromous fish hatchery managers.

Technical Advisory Committee (TAC): The Columbia River TAC is comprised of regulatory fish harvest technicians. This group provides management direction used in establishing hatchery fish production goals. TAC meets monthly.

Integrated Hatchery Operations Team (IHOT): This group is comprised of representatives from fish management agencies and tribes. MOT meets monthly and is currently developing a series of regional hatchery policies.

Pacific Northwest Fish Health Protection Committee (PNFHPC): This group is comprised of representatives from U.S. and Canadian fish management agencies, tribes, universities, and private fish operations. The groups meets twice a year to monitor regional fish health policies and to discuss current fish health issues in the Pacific Northwest.

In-River Agreements: State, federal and tribal representatives meet annually to set Columbia River harvests as part of the U.S. v. Oregon Agreement. Periodic meetings are also held throughout the year to assess if targets are being met.

In-Season Communications: Communication with PAC, the Columbia River Inter-Tribal Fish Commission, Oregon Department of Fish and Wildlife, Washington Department of Wildlife, U.S. Fish and Wildlife Service and Idaho Department of Fish and Game takes place each year to coordinate proper fish and egg transfers in an effort to meet basin-wide goals at all facilities, where applicable.

Record Keeping

Records are kept in a consistent manner employing standard formats to allow for documentation and monitoring. Future record keeping will be coordinated with the basin-wide Coordinated Information System (CIS) currently under development. It will be a system to access all necessary databases in the region. It is hoped that coordinated information collection and reporting will result in consistency between the various agencies.

Development and Review of Brood Documents

The three brood documents are reviewed and agreed to annually. The Eouilibrium Brood Document for the Columbia River and/or major tributaries has not yet been developed. It would document existing baseline production and current management. The Future Brood Document is a detailed listing of annual production goals. This is reviewed and updated each spring, and is finalized by July. The Current Brood Document reflects actual production relative to the annual production goals. It is developed in the spring after eggs are taken. It is usually finalized by March.

PERFORMANCE STANDARDS—PRIEST RAPIDS HATCHERY

Objective 1

Measures	Species	Hatchery Goal	5-Year Average	Range	Constraints
Adult Capture	Fall Chinook	6,102	8,150	2,636-l 8,171	1
Adult Prespawning Survival	Fall Chinook	90%	93.3%	87.6-97.7%	
Egg-take	Fall Chinook	5,900,000	14,120,900	6.3-24.1 million	
Green Egg-to-Fry Survival	Fall Chinook	90%	93.2%	91.4-94.8%	2
Fry-to-Smolt Survival	Fall Chinook	90%	94.6%	89.1-98.0%	
Fish Releases	Fall Chinook	5,000,000	5,988,610	5,159K-7,709K	2
Transfers to Co-ops (Eggs/Fish)	Fall Chinook	0	1,935,600	0-6,937K	
Other Transfers (Eggs/Fish)	Fall Chinook	1 00K-17,500K[1]	3,788,700	705K-7,639K	
Adults Passed Upstream	Fall Chinook	195	195	O-620	
Percent Survival	Fall Chinook	1.0%	1.17%	0.29-2.44%	1

NA=Not applicable.

[1] Klickitat, Rocky Reach and other URB programs.

Objective 2

Measures	Species	Hatchery Goal	5-Year Average	Range	Constraints
Release smol ts CV<10%	Fall Chinook	Yes	7.2%[2]	4.8-9.5%	3
Acclimation	Fall Chinook	Yes	Yes	--	
Volitional Release	Fall Chinook	Yes	No	--	1,4

Objective 3

Measures	Species	Hatchery Goal	5-Year Averaee	Range	Constraints
Collect Adults Throughout Run	Fall Chinook	Yes	Yes	Yes	
Spawning Pop. >500	Fall Chinook	Yes	Yes	Yes	
Spawning Ratio Male:Female	Fall Chinook	1:3[3]	0:5:1	0.4:1 - 0.7:1	

Objective 4

Measures	Species	Hatchery Goal	5-Year Average	Range	Constraints
Adhere to Disease Policy	Fall Chinook	Yes	Yes	--	

[2] Average of four broods, 1984-1987.
[3] Spawning guidelines require a 1:1 male to female spawning ratio if less than 1 million eggs are spawned in a single day.

Objective 5

Measures	Species	Hatchery Goal	5-Year Average	Range	Constraints
TSS Effluent	All	5 mg/l	NA	NA	5
TSS Max Effluent	All	15 mg/l	NA	NA	5
SS Effluent	All	0.1 ml/l	NA	NA	5
TSS PA Effluent	All	100 mg/l	NA	NA	5
SS PA Effluent	All	1.0 ml/l	NA	NA	5
Downstream Temp	All	Varies	NA	NA	
Downstream DO	All	Varies	NA	NA	
Continuous Monitoring of Other Parameters	All	Yes	NA	NA	

Objective 6

Measures	Species	Hatchery Goal	5-Year Average	Range	Constraints
Check Hatchery Records for Accuracy and Completeness	All	Yes	No	--	6
Develop and Review Comp. Basin-Wide Production Plan	All	Yes	No	--	7
Develop and Review Future Brood Doc.	All	Yes	Yes	--	6
Develop and Review Current Brood Doc.	All	Yes	Yes	--	6

Constraints/Comments-Priest Rapids Hatchery

1. High water temperatures in the reservoirs during late summer and early fall can increase stress-related mortality of returning adults. It can also increase mortalities due to columnaris disease and increase egg mortality from the spawned adults. To minimize interactions with naturally spawned populations downstream at Hanford Reach, fish releases are often delayed until after the spill window period. This can delay outmigration time which make smolts more susceptible to predation. Delaying fish releases beyond the optimum release date can also cause additional fish stress related to smoltification and creates a situation in which all fish are released into the river during a short period of time.

2. Soft shell disease decreases egg-to-fry survival. In severe years, this disease can make it difficult to reach on-station program goals or program goals at other hatcheries.

3. Combining juvenile fish from different spawnings into a single pond can increase the proportion of out-sized fish, particularly if the initial rearing temperatures are too cold.

4. Pond design does not allow for simultaneous and extended volitional release from all hatchery ponds.

5. This facility lacks a pollution abatement pond. Effluent is discharged to a drain field.

6. Current hatchery system lacks the necessary infrastructure and mechanisms to ensure adequate monitoring and evaluation needed for efficient and effective hatchery rearing programs.

7. A comprehensive basin-wide production plan has not been completed at this time.

Ringold Springs Salmon Pond

INTRODUCTION

Ringold Springs Salmon Pond is located adjacent to the Columbia River about 17 miles west of Mesa, Washington. Site elevation is 275 feet above sea level.

Facility rearing units include an earthen rearing pond (9 acres) and 14 vinyl raceways. The raceways are only used for early rearing. All smolt releases occur from the large rearing pond. There is no incubation facility because of past problems with high water temperatures. This problem needs to be investigated to further determine if the water source could be used for egg incubation.

Water rights total 31,417 gpm from Ringold Springs. About 13,464 gpm of this water right is shared with the Washington Department of Wildlife's Ringold Springs Steelhead Pond. The facility is staffed with 3 FTE's.

PURPOSE

The facility began operation in 1963 as part of the Columbia River Fisheries Development Program—a program to mitigate for fishery loses caused by hydroelectric system development in the Columbia River Basin. Funds for the program are administered by the National Marine Fisheries Service. The facility has been used in the past for rearing fall chinook and some coho on an interim basis. It is currently used for adult collection and rearing of spring chinook.

GOALS

Produce spring chinook that will contribute to NE Pacific and Columbia River Basin commercial and sport fisheries while providing adequate escapement for hatchery production.

OBJECTIVES

Objective 1: Hatchery Production

Produce 1,100,000 yearling spring chinook for on-station release.

Objective 2: Minimize interactions with other fish populations through proper rearing and release strategies.

Objective 3: Maintain stock integrity and genetic diversity of each unique stock through proper management of-genetic resources.

Objective 4: Maximize survival at all life stages using disease control and disease prevention techniques. Prevent introduction, spread or amplification of fish pathogens.

Objective 5: Conduct environmental monitoring to ensure that hatchery operations comply with water quality standards and to assist in managing fish health.

Objective 6: Communicate effectively with other salmon producers and managers in the Columbia River Basin.

CURRENT PRACTICES TO ACHIEVE OBJECTIVES

Objective 1: Hatchery Production

Adult Collection

The intent of the adult collection procedures at Ringold Hatchery is to collect as many adults as possible to maintain the hatchery production program. Spring chinook adults return to the hatchery from April through June. Adults are collected at Ringold and transferred to Lyons Ferry for holding and spawning. After the eggs hatch, the fry are returned to Ringold Hatchery for rearing.

Objective 2: Minimize interactions with other fish populations through proper rearing and release strategies.

Rearing and Release Strategies

Rearing and release strategies are designed to limit the amount of ecological interactions occurring between hatchery and naturally produced fish. Fish are reared to sufficient size that smoltification occurs within nearly the entire population, which will reduce retention time in downstream migration. Rearing on parent river water, or acclimation for several weeks to parent river water is used to ensure strong homing to the hatchery, thus reducing the stray rate to natural populations. Various release strategies are used to ensure that fish migrate from the hatchery with the least amount of interaction with native populations.

Spring chinook is the only fish stock currently reared at this facility. The strategy is to rear 1,100,000 fish to a size of 7 fish/pound and release on-station on April 1. A pump was recently installed in the Columbia River to supply water to the rearing pond, allowing fish to be acclimated prior to release. This will help increase migratory readiness and decrease the residence time in the river during outmigration, thus lessening possible adverse impacts with naturally produced smolts.

Objective 3: Maintain stock integrity and genetic diversity.

Broodstock Selection

Adults are collected throughout the entire run to ensure that the run timing for these stocks is maintained.

Spawning Protocol

The intent is to utilize a spawning population of at least 500 adults. When spawning fewer than 1 million eggs in a day, the male to female ratio will be 1:1 for all stocks. When spawning more than 1 million eggs in a day, the ratio will not be less than 1 male to 3 females. A portion of each day's egg-take is used for on-site hatchery production.

Acceptable Stocks

Importing eggs/fish from other facilities with acceptable stocks is done to achieve production goals while maintaining regional genetic integrity in times of inadequate hatchery returns. Eggs from hatchery-returning adults are always given priority for station use.

The stocks approved for release from the Ringold Springs facility have been prioritized and are listed below. Stocks with the number 1 adjacent to their title are the most desirable. Stocks with higher numbers are considered to be progressively less well suited.

Fall Chinook
1 Upriver bright fall chinook

Spring Chinook
1 Mid-Columbia River spring chinook
2 Cowlitz River spring chinook

Objective 4: Maximize survival at all life stages using disease control and disease prevention techniques. Prevent introduction, spread or amplification of fish pathogens.

Fish Health Management Programs-All Stocks

The primary objective of fish health management programs at WDF hatcheries is to produce healthy smolts that will contribute to the fisheries and natural spawning. Equally important is to prevent the introduction, amplification or spread of certain fish pathogens which might negatively affect the health of both hatchery and naturally reproducing stocks.

WDF has implemented both disease control and disease prevention programs at all of its facilities to try and achieve these objectives. These programs include the following standard elements:

Disease Control (Reactive)

- Perform necropsies of diseased and dead fish to diagnose the cause of loss.
- Prescribe appropriate treatments and remedies to disease.
- Use a disease control policy which dictates how specific disease problems will be addressed and what restrictions may be placed on movements of diseased stocks.
- Conduct applied research on new and existing techniques to control disease epizootics.

Disease Prevention (Proactive)

- Routinely perform necropsies of clinically healthy fish to assess health status and detect problems before they progress to clinical disease or mortality.
- Implement disease preventative strategies in all aspects of fish culture to produce a quality fish. This includes prescribing the optimal nutritional needs and environmental conditions in the hatchery rearing container based on historical disease events. It also involves the prophylactic use of vaccines in order to avoid a disease problem.
- Use a disease prevention policy which restricts the introduction of stocks into a facility which may result in the introduction of a new disease condition or mortality.
- Use sanitation procedures which prevent introduction of pathogens into and/or within a facility.

- Conduct applied research on new and existing disease prevention techniques.

- Utilize pond management strategies (e.g., Density Index and Flow Index) to help optimize the quality of the aquatic environment and minimize fish stress which can induce infectious and noninfectious diseases. For example, the Density Index is used to estimate the maximum number of fish (of a given length) that can occupy a rearing unit based on the rearing unit's size. The Flow Index is used to estimate the rearing unit's carrying capacity based on water flows.

Fish Health Activities at Ringold Hatchery

Health Monitoring

- On at least a monthly basis, both healthy and clinically diseased fish from each fish lot at the hatchery are given a health exam. The sample includes a minimum of ten fish per lot. Findings are reported on WDF Form FH01.

- At spawning, a minimum of 60 ovarian fluids and 60 kidney/spleens are examined for viral pathogens from each fish lot. This is done at Lyons Ferry Hatchery.

- Prior to transfer or release, fish are given a health exam. This exam may be in conjunction with the routine monthly visit.

- Whenever abnormal behavior or mortality is observed, the fish health specialist will examine the affected fish, make a diagnosis and recommend the appropriate remedial or preventative measures.

- Reporting and control of selected fish pathogens are conducted in accordance with the Co-Managers Fish Disease Control Policy.

Fish and Egg Movements

- Movements of fish and eggs are conducted in accordance with the Co-Managers Fish Disease Control Policy.

Therapeutic and Prophylactic Treatments

- Juvenile fish are administered antibiotics orally when needed for the control of bacterial infections.

- **Formalin** (37% formaldehyde) is dispensed into water for control of parasites and fungus on juvenile salmon. Treatment dosage and time of exposure varies with species, life-stage and condition being treated.

- Only therapeutants approved by the U.S. Food and Drug Administration are used for treatments.

Sanitation

- All equipment (nets, tanks, rain gear) is disinfected with iodophor between different fish/egg lots.

- Tank trucks are disinfected between the hauling of different fish lots.

Objective 5: Conduct environmental monitoring.

Environmental Monitoring

Primarily, environmental monitoring is conducted at WDF facilities to ensure these facilities meet the requirements of the National Pollution Discharge Elimination Permit administered by the Washington Department of Ecology. It is also used in managing fish health. On a short-term basis, monitoring helps identify when changes to hatchery practices are required. Long-term monitoring provides the ability to quantify water quality impacts resulting from changes in the watershed (e.g., logging, road building and urbanization). The following parameters are currently monitored at this hatchery:

- *Total* Suspended *Solids (TSS)*—1 to 2 times per month on composite effluent, maximum effluent and influent samples. Once per month on pollution abatement pond influent and effluent samples.

- *Settleable Solids (SS)*—1 to 2 times per week on effluent and influent samples. Once per week on pollution abatement pond influent and effluent samples.

- Upstream and Downstream *Temperatures*—twice per month, June through September.

- Upstream and Downstream Dissolved Oxygen *(DO)*—twice per month, June through September.

- In-hatchery *Water* Temperatures-maximum and minimum daily.

- *In-hatchery Dissolved Oxygen*—as required by steam flow or weather conditions.

- Some facilities monitor rainfall and air temperature on a daily basis.

The following are additional parameters which should be monitored at WDF hatcheries:

- *Influent Water* Temperatures-continuous monitoring
- *Air Temperatures*—continuous monitoring
- *Influent/Effluent Dissolved* Oxygen-continuous monitoring
- *Influent pH/Conductivity*—continuous monitoring
- *Streambed Movement*
- *In-stream Flow/Current*
- *Daily Rainfall*

Objective 6: Communicate effectively with other salmon producers and managers.

Interagency Coordination/Communication

Production Advisorv Committee (PAC): The Columbia River PAC is comprised of representatives from the regulatory management agencies and tribes. This group meets monthly to discuss anadromous fish production issues and to provide an opportunity for communication among the anadromous fish hatchery managers.

Technical Advisorv Committee (TAC): The Columbia River TAC is comprised of regulatory fish harvest technicians. This group provides management direction used in establishing hatchery fish production goals. TAC meets monthly.

Integrated Hatchery Ouerations Team (IHOT): This group is comprised of representatives from fish management agencies and tribes. MOT meets monthly and is currently developing a series of regional hatchery policies.

Pacific Northwest Fish Health Protection Committee (PNFHPC): This group is comprised of representatives from U.S. and Canadian fish management agencies, tribes, universities, and private fish operations. The groups meets twice a year to monitor regional fish health policies and to discuss current fish health issues in the Pacific Northwest.

In-River Agreements: State, federal and tribal representatives meet annually to set Columbia River harvests as part of the U.S. v. *Oregon* Agreement. Periodic meetings are also held throughout the year to assess if targets are being met.

In-Season Communications: Communication with PAC, the Columbia River Inter-Tribal Fish Commission, Oregon Department of Fish and Wildlife, Washington Department of Wildlife, U.S. Fish and Wildlife Service and Idaho Department of Fish and Game takes place each year to coordinate proper fish and egg transfers in an effort to meet basin-wide goals at all facilities, where applicable.

Record Keeping

Records are kept in a consistent manner employing standard formats to allow for documentation and monitoring. Future record keeping will be coordinated with the basin-wide Coordinated Information System (CIS) currently under development. It will be a system to access all necessary databases in the region. It is hoped that coordinated information collection and reporting will result in consistency between the various agencies.

Development and Review of Brood Documents

The three brood documents are reviewed and agreed to annually. The Equilibrium Brood Document for the Columbia River and/or major tributaries has not yet been developed. It would document existing baseline production and current management. The Future Brood Document is a detailed listing of annual production goals. This is reviewed and updated each spring, and is finalized by July. The Current Brood Document reflects actual production relative to the annual production goals. It is developed in the spring titer eggs are taken. It is usually finalized by March.

PERFORMANCE STANDARDS-RINGOLD SPRINGS SALMON POND

Objective 1

Measures	Species	Hatchery Goal	5-Year Average	Range	Constraints
Adult Capture	Spr. Chinook	300	796'	222-1,750	1
Adult Prespawning Survival	Spr. Chinook	NA	NA	NA	1
Egg-take	Spr. Chinook	N A	NA	NA	2
Green Egg-to-Fry Survival	Spr. Chinook	NA	NA	NA	2
Fry-to-Smol t Survival	Spr. Chinook	90%	82.5%'	72-90%	3
Fish Releases	Spr. Chinook	1,100,000	1,040,000	870K-1,200K	3,4
Transfers to Co-ops (Eggs/Fish)	Spr. Chinook	0	--	--	
Other Transfers (Eggs/Fish)	Spr. Chinook	0	--	--	
Adults Passed Upstream	Spr. Chinook	NA	NA	NA	
Percent Survival	Spr. Chinook	2.5%	unknown	unknown	5

NA=Not applicable.
1 Average of three broods, 1988-1990.

Objective 2

Measures	Species	Hatchery Goal	5-Year Average	Range	Constraints
Release smolts CV<10%	Spr. Chinook	Yes	Unknown	Unknown	5
Acclimation	Spr. Chinook	Yes	Yes	--	1
Volitional Release	Spr. Chinook	Yes	No	--	1

Objective 3

Measures	Species	Hatchery Goal	5-Year Average	Range	Constraints
Collect Adults Throughout Run	Spr. Chinook	Yes	NA	NA	1
Spawning Pop. >500	Spr. Chinook	Yes	NA	NA	1
Spawning Ratio Male:Female	Spr. Chinook	1:3[2]	NA	NA	

Objective 4

Measures	Species	Hatchery Goal	5-Year Averaee	Range	Constraints
Adhere to Disease Policy	Spr. Chinook	Yes	Yes	--	

[2] Spawning guidelines require a 1 :1 male to female spawning ratio if less than 1 million eggs are spawned in a single day.

Objective 5

Measures	Species	Hatchery Goal	5-Year Average	Range	Constraints
TSS Effluent	All	5 mg/l	NA	NA	
TSS Max Effluent	All	15 mg/l	NA	NA	
SS Effluent	All	0.1 ml/l	NA	NA	
TSS PA Effluent	All	100 mg/l	NA	NA	
SS PA Effluent	All	1.0 ml/l	NA	NA	
Downstream Temp	All	Varies	NA	NA	
Downstream DO	All	Varies	NA	NA	
Continuous Monitoring of Other Parameters	All	Yes	NA	NA	

Objective 6

Measures	Species	Hatchery Goal	5-Year Average	Range	Constraints
Check Hatchery Records for Accuracy and Completeness	All	Yes	No	--	6
Develop and Review Equil. Brood Doc.	All	Yes	No	--	7
Develop and Review Future Brood Doc.	All	Yes	Yes	--	6
Develop and Review Current Brood Doc.	All	Yes	Yes	--	6

Constrain ts/Comments—Ringold Springs

1. Inadequate adult holding and spawning facilities. Smolts are only -partially acclimated to river water prior to release. This can reduce the migratory urge and extend the outmigration period. Lack of acclimation precludes use of volitional release. A newly installed river pump may allow for acclimation in the future.

2. No incubation facilities at the hatchery site.

3. High chemical content of the rearing water (ammonia-nitrates) is caused by irrigation runoff. This increases fish mortalities because of additional disease problems.

4. Fish in the large rearing pond cannot be adequately protected from avian predators.

5. Lack of current, continuous tag data. Only tagged fish are measured to determine mean length and coefficient of variation (CV).

6. Current hatchery system lacks the necessary infrastructure and mechanisms to ensure adequate monitoring and evaluation needed for efficient and effective hatchery rearing programs.

7. A comprehensive basin-wide production plan has not been completed at this time.

Rock Island Hatchery Complex (Eastbank and Satellites)

INTRODUCTION

The Rock Island Hatchery Complex consists of a central hatchery (Eastbank) and five satellite rearing facilities. The five satellite facilities are located on four different rivers (Wenatchee, Chiwawa, Methow and Similkameen). The Eastbank facility is located on the mainstem Columbia River just above Rocky Reach Dam, approximately 10 miles north of East Wenatchee, Washington. The hatchery was built to mitigate for smolt losses at Rock Island Dam and serves as a hub for the five satellite facilities. The hatchery began operation in 1989. Hatchery funding is provided by Chelan County PUD. The facility is jointly operated by WDF and the Washington Department of Wildlife. WDF provides 5.5 FTE's and Washington Department of Wildlife provides 2 FTE's.

The facility consists of two (15 ft x 120 ft) adult salmon holding ponds, eight (10 ft x 100 ft) raceways, and five (20 ft x 185 ft) raceways. There is one (10 ft x 70 ft) adult steelhead holding pond and two (1/2 acre) steelhead rearing ponds. A hatchery building houses shallow troughs and numerous double stacks of vertical incubators.

Four deep aquifer wells provide up to 53 cfs of water at a relatively constant temperature. The hatchery has chillers to cool the incubation water and retard egg and alevin development. Satellite facilities associated with Eastbank Hatchery include the Lake Wenatchee net pens, and the Chiwawa, Dryden, Similkameen and Methow rearing ponds. As an aggregate, these facilities are supplied with approximately 85 cfs of river water.

The Chiwawa/lake Wenatchee complex has a rearing site located on the Chiwawa River approximately one mile upstream of the confluence with the Wenatchee River. The hatchery has an office, two large rearing ponds, a removable, picket diffuser weir and trap. The facility rears only spring chinook. The facility has two water sources: the Chiwawa River (21 cfs, pumped) or the Wenatchee River (12 cfs, pumped). The latter water source is used only in December when ice forms in the Chiwawa River. In addition to rearing spring chinook, sockeye juveniles are reared in six floating net cages on Lake Wenatchee. Two additional floating cages are used for holding adult sockeye until spawning. These two cages are kept separate from the remaining six cages to prevent disease transmittal. The remaining six cages are used for rearing juvenile sockeye until their release into Lake Wenatchee in the fall. This facility is staffed with 2.75 FTE's.

The Dryden rearing facility consists of a large, lined rearing pond located adjacent to the Wenatchee River in Dryden, Washington. It is used to acclimate Wenatchee summer chinook. The water supply (16 cfs) originates from an irrigation canal that

takes water from the Wenatchee River at Dryden Dam. The intake is located less than a mile upstream of the pond. There are no buildings at this site.

The Similkameen rearing facility is located on the Similkameen River-near Oroville, Washington. The facility has an office, small shop and a large rearing pond used for rearing Okanogan summer chinook. The water supply (21 cfs) is pumped from the Similkameen River. An aeration system was recently installed to supply oxygen to the pond during periods when water flow is shut off, due to ice formation or toxic spills in the river. The facility is staffed with 1.75 FTE's.

The Methow facility consists of a large, lined rearing pond located on the Methow River near Twisp, Washington. There is a also a small office on site. This facility is used to acclimate Methow summer chinook. -Water (15 cfs) is pumped from the Methow River.

PURPOSE

Eastbank Hatchery and the various satellite facilities began operating in 1989. The hatchery complex is one of three components of the mitigation agreement relating to the construction of Rock Island Dam. The mitigation agreement requires that hatchery production be equivalent to the number of naturally produced adults lost due to smolt mortality at Rock Island Dam. Furthermore, the mitigation agreement requires that the hatchery program be consistent with maintenance of genetically distinct stocks or populations.

The satellite facilities serve two functions: 1) collection of native salmon for broodstock, and 2) a site to rear and release salmon progeny from each river's respective broodstock. Broodstock selection and spawning protocols reflect the need to maintain genetic diversity of these separate populations.

GOALS

Use artificial propagation to replace adult production lost due to smolt mortality at the Rock Island Project, while not reducing the natural production or long-term fitness of salmon and steelhead populations in the mid-Columbia River. The Rock Island Settlement Agreement has specific goals for meeting the mitigation agreement. The specific goals for hatchery production are to trap sufficient broodstock to meet programmed release numbers, and use fish cultural methods that result in 1) maintenance of the genetic integrity of the native stock, and 2) the release of high quality smolts from the facility.

OBJECTIVES

Objective 1: Hatchery Production

Produce 672,000 yearling spring chinook for release into the Chiwawa River from the Chiwawa rearing facility to replace 1,750 adults.

Produce 864,000 yearling summer chinook for release into the Wenatchee River from the Dryden rearing pond to replace 1,990 adults.

Produce 200,000 subyearling sockeye for release into Lake Wenatchee from the Lake Wenatchee net pens to replace 1,800 adults.

Produce 400,000 yearling summer chinook for release into the Methow River from the Methow rearing pond to replace 600 adults.

Produce 576,000 yearling summer chinook for release into the Similkameen River from the Similkameen rearing pond to replace 864 adults.

Objective 2: Minimize interactions with other fish populations through proper rearing and release strategies.

Objective 3: Maintain stock integrity and genetic diversity of each unique stock through proper management of genetic resources.

Objective 4: Maximize survival at all life stages using disease control and disease prevention techniques. Prevent introduction, spread or amplification of fish pathogens.

Objective 5: Conduct environmental monitoring to ensure that hatchery operations comply with water quality standards and to assist in managing fish health.

Objective 6: Communicate effectively with other salmon producers and managers in the Columbia River Basin, and with the spill coordination subcommittee.

CURRENT PRACTICES TO ACHIEVE OBJECTIVES

Objective 1: Hatchery Production

Adult Collection

Chiwawa Spring Chinook: There have been insufficient numbers of broodstock collected every year since this facility began operating. The picket diffuser floating weir has not been effective in trapping adults. In 1992, the weir was washed out prior to the arrival of adults. Because of the ineffectiveness of the trap, gaffing or seining adult fish in the river spawning beds has been necessary to obtain eggs. Unripe adults are transported to Eastbank Hatchery for holding and subsequent spawning. Eggs taken from ripe females at the gaffing/seining sites are also taken to Eastbank Hatchery. If the weir is operating as designed, no more than one-third of the trapped adults are kept for broodstock and the remaining fish are allowed to pass upstream. Protocols for each year's adult collection are developed in the year of return.

Wenatchee Summer Chinook: Insufficient numbers of adults have been collected each year of operation. Temporary modifications at Dryden Dam in 1992 were largely successful in increasing the number of fish trapped. Permanent modifications were completed in the summer of 1992. When insufficient numbers of broodstock are captured at Dryden Dam, up to 25 percent of the needed broodstock can be trapped at Tumwater Dam. Unripe females are transported to Eastbank Hatchery for holding and subsequent spawning.

Lake Wenatchee Sockeye: Sufficient numbers of adults are captured at Tumwater Dam on the mainstem Wenatchee River. Adults are transported to Lake Wenatchee net pens until maturity. Unfertilized eggs are transported to the Eastbank Hatchery for incubation. Fry are then returned to the net pen complex and reared until the fall when they are released into the lake. On occasion, females excess to program needs are inadvertently retained because of the difficulty in sexing the fish at the time of capture. Beginning in 1993, these excess adults will be released into Lake Wenatchee to spawn naturally in the tributaries.

Methow/Okanogan Summer Chinook: Adults are captured at the fish ladder at Wells Dam or as volunteers to the Wells Hatchery collection channel. The fish are held at Wells Hatchery until maturity and then spawned. The eggs are transported to Eastbank.

Objective 2: Minimize interactions with other fish populations through proper rearing and release strategies.

Rearing and Release Strategies

Fish production at Rock Island Hatchery Complex is intended to replace fishery losses caused by Rock Island Dam while maintaining genetically distinct populations or stocks. To accomplish this goal, hatchery rearing and release procedures include acclimation to parent river water for a minimum of six weeks prior to release. This imprinting is expected to reduce the staying of these stocks into other areas that contain different stocks of fish and reduce interbreeding. The rearing and release strategies are specifically designed to 1) imprint the hatchery fish so that returning hatchery adults will spawn with the donor stock, and 2) minimize adverse interactions (i.e., competition for food and-habitat) between hatchery-released and naturally produced smolts. All spring/summer chinook stocks are reared as yearlings to increase survival and reduce river residence time. The specific rearing and release strategies for each satellite facility are outlined below.

Chiwawa Spring Chinook: Transfer 700,000 subyearlings from Eastbank Hatchery to the Chiwawa Pond in September; rear and acclimate on parent river water to a size of approximately 12 fish/pound; allow fish to volitionally migrate in April-May.

Lake Wenatchee Sockeye: Transfer 230,000 fry from Eastbank Hatchery to the Lake Wenatchee net pens in March; rear fish to a size of approximately 24 fish/pound and release fish to the lake in October. The fish will reside in the lake for several months before migrating.

Wenatchee River Summer Chinook: Transfer 900,000 yearling fish from Eastbank Hatchery to Dryden Pond in February; rear and acclimate on parent river water to a size of approximately 12 fish/pound; allow fish to volitionally migrate in April-May.

Okanogan and Methow Summer Chinook: Transfer 600,000 subyearlings from Eastbank Hatchery to the Similkameen Pond in October; rear and acclimate on parent river water to a size of approximately 10 fish/pound; allow fish to volitionally migrate in April-May. Transfer 425,000 yearling fish from Eastbank Hatchery to the Methow Pond in February; rear and acclimate to parent river water until release. These fish are volitionally released in April-May at a size of 10 fish/pound.

Objective 3: Maintain stock integrity and genetic diversity.

Broodstock Selection and Spawning

The hatchery practices established for broodstock selection and spawning are critical for maintaining the genetic diversity of each unique population or stock. Broodstock trapping is designed to remove representative members from the donor population in a random manner, and in a way to ensure that all segments (age and return timing) of the run are represented. The specific broodstock selection and spawning protocols for Rock Island Hatchery Complex are outlined below.

Chiwawa Spring Chinook: The trap used at Chiwawa serves three functions: 1) it collects all sizes and ages of returning adults, 2) it allows for segregation of hatchery- or natural-origin fish, and 3) when not collecting broodstock, the trap passes fish upstream with minimal delay. The broodstock selection strategy for Chiwawa spring chinook is to retain no more than 30 percent of the naturally produced adults returning to the river and pass all hatchery-origin fish upstream. The mating guidelines include the splitting of gametes of each sex into subsets for cross mating, spitting of eggs into sufficient numbers of subsets to accommodate 1:1 matings with males (particularly if there are more males), live spawning of individual males, and cryopreservation of milt for use in successive years.

Lake Wenatchee Sockeye: The strategy is to trap only enough adults to meet hatchery needs and spawn at 1:1 male to female ratio using two female and two male pools of gametes. Only Wenatchee River sockeye are used for broodstock.

Wenatchee River Summer Chinook: The broodstock section strategy is to collect only naturally produced salmon for broodstock. In 1992, both hatchery and wild fish were retained. The fish are spawned at a 1:1 male to female ratio. Gametes of the least numerous sex are split into subsets and these are crossed with gametes from a different individual of the more numerous sex. Males are also live-spawned when necessary.

Okanogan and Methow Summer Chinook: Broodstock collection for the Similkameen and Methow facilities is done concurrently with broodstock collection for the Wells Hatchery. Fish trapped at the east fishway of Wells Dam are used for the Similkameen and Methow programs, and fish volunteering into Wells Hatchery are used primarily for the Wells program although shortfalls in the Similkameen/Methow needs can be made up with volunteer fish. To prevent inclusion of fall chinook stock into the summer chinook gene pool, broodstock collection at both capture sites is curtailed on August 28. Also, gametes from fish with coded-wire tags are held separately until the origin of fish is determined. Only summer chinook are used in these programs. A 1:1 mating scheme is employed.

Objective 4: Maximize survival at all life stages using disease control and disease prevention techniques. Prevent introduction, spread or amplification of fish pathogens.

Fish Health Management Programs-All Stocks

The primary objective of fish health management programs at WDF hatcheries is to produce healthy smolts that will contribute to the fisheries and natural production. Equally important is to prevent the introduction, amplification or spread of certain fish pathogens which might negatively affect the health of both hatchery and naturally reproducing stocks.

WDF has implemented both disease control and disease prevention programs at all of its facilities to try and achieve these objectives. These programs include the following standard elements:

Disease Control (Reactive)

- Perform necropsies of diseased and dead fish to diagnose the cause of loss.
- Prescribe appropriate treatments and remedies to disease.
- Use a disease control policy which dictates how specific disease problems will be addressed and what restrictions may be placed on movements of diseased stocks.
- Conduct applied research on new and existing techniques to control disease epizootics.

Disease Prevention (Proactive)

- Routinely perform necropsies of clinically healthy fish to assess health status and detect problems before they progress to clinical disease or mortality.
- Implement disease preventative strategies in all aspects of fish culture to produce a quality fish. This includes prescribing the optimal nutritional needs and environmental conditions in the hatchery rearing container based on historical disease events. It also involves the prophylactic use of vaccines in order to avoid a disease problem.
- Use a disease prevention policy which restricts the introduction of stocks into a facility which may result in the introduction of a new disease condition or mortality.
- Use sanitation procedures which prevent introduction of pathogens into and/or within a facility.

- Conduct applied research on new and existing disease prevention techniques.

- Utilize pond management strategies (e.g., Density Index and Flow Index) to help optimize the quality of the aquatic environment and minimize fish stress which can induce infectious and noninfectious diseases. For example, the Density Index is used to estimate the maximum number of fish (of a given length) that can occupy a rearing unit based on the rearing unit's size. The Flow Index is used to estimate the rearing unit's carrying capacity based on water flows. Roper feeding practices are used to discourage over-feeding of the fish and over-accumulation of uneaten food or feces. Ponds or raceways are vacuumed to maintain cleanliness and reduce stress caused by other cleaning methods.

Fish Health Activities at Rock Island Hatchery Complex

Health Monitoring

- On at least a monthly basis, both healthy and clinically diseased fish from each fish lot at the hatchery are given a health exam. The sample includes a minimum of ten fish per lot. Findings are reported on WDF Form FH01.

- At spawning, a minimum of 60 ovarian fluids and 60 kidney/spleens are examined for viral pathogens from each fish lot.

- At spawning, an Enzyme Link Immunosorbent Assay (ELISA) is conducted on kidney tissue samples from spawned females (Chiwawa spring chinook, Wenatchee sockeye, and Wenatchee, Similkameen and Methow summer chinook). ELISA is used to detect the bacterium which causes kidney disease (*Renibacterium salmoninarum*). Progeny from females with similar ELISA levels are grouped and reared together to reduce the horizontal transmission of this disease.

- Prior to transfer or release, fish are given a health exam. This exam may be in conjunction with the routine monthly visit.

- Whenever abnormal behavior or mortality is observed, the fish health specialist will examine the affected fish, make a diagnosis and recommend the appropriate remedial or preventative measures.

- Reporting and control of selected fish pathogens are conducted in accordance with the Co-Managers Fish Disease Control Policy.

Fish and Egg Movements

- Movements of fish and eggs are conducted in accordance with the Co-Managers Fish Disease Control Policy.

Therapeutic and Prophylactic Treatments

- Adult fall chinook are injected with antibiotics for the control of bacterial diseases.

- At spawning, eggs are water-hardened in iodophor as a disinfectant.

- Juvenile fish are administered antibiotics orally when needed for the control of bacterial infections.

- Formalin (37% formaldehyde) is dispensed into water for control of parasites and fungus on eggs, juveniles and adult salmon. Treatment dosage and time of exposure varies with species, life-stage and condition being treated.

- Only therapeutants approved by the U.S. Food and Drug Administration are used for treatments.

Sanitation

- All eggs brought to the facility are surface-disinfected with iodophor (as per disease policy).

- All equipment (nets, tanks, rain gear) is disinfected with iodophor between different fish/egg lots.

- Different fish/egg lots are physically isolated from each other by separate ponds or incubation units. Incubation units are further isolated by plastic curtains. The intent of these activities is to prevent the horizontal spread of pathogens by splashing water.

- Tank trucks are disinfected between the hauling of different fish lots.

- Foot baths containing iodophor are strategically located on the hatchery grounds (i.e., entrance to hatchery building) to prevent spread of pathogens.

Objective 5: Conduct environmental monitoring.

Environmental Monitoring

Primarily, environmental monitoring is conducted at WDF facilities to ensure these facilities meet the requirements of the National Pollution Discharge Elimination Permit administered by the Washington Department of Ecology. It is also used in managing fish health. On a short-term basis, monitoring helps identify when changes to hatchery practices are required. Long-term monitoring provides the ability to quantify water quality impacts resulting from changes in the watershed (e.g., logging, road building and urbanization). The following parameters are currently monitored at this hatchery:

- *Total* Suspended Solids *(TSS)*—1 to 2 times per month on composite effluent, maximum effluent and influent samples. Once per month on pollution abatement pond influent and effluent samples.

- *Settleable Solids (SS)*—1 to 2 times per week on effluent and influent samples. Once per week on pollution abatement pond influent and effluent samples.

- Upstream *and* Downstream Temperatures-twice per month, June through September.

- Upstream *and* Downstream *Dissolved* Oxygen *(D0)*—twice per month, June through September.

- In-hatchery Water Temperatures-maximum and minimum daily.

- *In-hatchery Dissolved Oxygen*—as required by steam flow or weather conditions.

- Some facilities monitor rainfall and air temperature on a daily basis.

The following are additional parameters which should be monitored at WDF hatcheries:

- *Influent Water* Temperatures-continuous monitoring
- *Air Temperatures*—continuous monitoring
- *Influent/Effluent Dissolved* Oxygen-continuous monitoring
- *Influent pH/Conductivity*—continuous monitoring
- *Streambed Movement*
- *In-stream Flow/Current*
- *Daily Rainfall*

Objective 6: Communicate effectively with other salmon producers and managers.

Interagency Coordination/Communication

Production Advisory Committee (PAC): The Columbia River PAC is comprised of representatives from the regulatory management agencies and tribes. This group meets monthly to discuss anadromous fish production issues and to provide an opportunity for communication among the anadromous fish hatchery managers.

Technical Advisory Committee (TAC): The Columbia River TAC is comprised of regulatory fish harvest technicians. This group provides management direction used in establishing hatchery fish production goals. TAC meets monthly.

Integrated Hatchery Operations Team (IHOT): This group is comprised of representatives from fish management agencies and tribes. IHOT meets monthly and is currently developing a series of regional hatchery policies.

Pacific Northwest Fish Health Protection Committee (PNFHPC): This group is comprised of representatives from U.S. and Canadian fish management agencies, tribes, universities, and private fish operations. The groups meets twice a year to monitor regional fish health policies and to discuss current fish health issues in the Pacific Northwest.

In-River Agreements: State, federal and tribal representatives meet annually to set Columbia River harvests as part of the U.S. v. *Oregon* Agreement. Periodic meetings are also held throughout the year to assess if targets are being met.

In-Season Communications: Communication with PAC, the Columbia River Inter-Tribal Fish Commission, Oregon Department of Fish and Wildlife, Washington Department of Wildlife, U.S. Fish and Wildlife Service and Idaho Department of Fish and Game takes place each year to coordinate proper fish and egg transfers in an effort to meet basin-wide goals at all facilities, where applicable.

Record Keeping

Records are kept in a consistent manner employing standard formats to allow for documentation and monitoring. Future record keeping will be coordinated with the basin-wide Coordinated Information System (CIS) currently under development. It will be a system to access all necessary databases in the region. It is hoped that coordinated information collection and reporting will result in consistency between the various agencies.

Development and Review of Brood Documents

The three brood documents are reviewed and agreed to annually. The Equilibrium Brood Document for the Columbia River and/or major tributaries has not yet been developed. It would document existing baseline production and current management. The Future Brood Document is a detailed listing of annual production goals. This is reviewed and updated each spring, and is finalized by July. The Current Brood Document reflects actual production relative to the annual production goals. It is developed in the spring after eggs are taken. It is usually finalized by March.

Evaluation Program

The first phase of the Rock Island Hatchery Complex evaluation program was implemented in 1992. Future areas of evaluation will be developed over time. Annual reports will include genetic monitoring results, disease history, survival estimates, pre-release physiology, and interactions with natural production at the time of fish release and during spawning when adults return.

PERFORMANCE STANDARDS-ROCK ISLAND HATCHERY COMPLEX

Objective 1

Measures	Species	Hatchery Goal	5-Year Average	Range	Constraints
Adult Capture	Chiwawa CHS	400	35	19-53'	1
	Wenatchee CHR	512	182	81-336	1
	Wenatchee SOC	300	466	231-455	
	Similkameen CHR	400	NA	NA	1
	Methow CHR	291	NA	NA	1
Adult Prespawning Survival[2]	Chiwawa CHS	80%	91.2%	74.0-100%	
	Wenatchee CHR	80%	90.7%	90.0-91.0%	
	Wenatchee SOC	80%	84.7%	55.0-100%	
	Similkameen CHR	80%	92.0%	NA	
	Methow CHR	80%	92.0%	NA	
Egg-take	Chiwawa CHS	830,000	56,504	45K-73K	1
	Wenatchee CHR	1,070,000	408,190	161K-828K	1
	Wenatchee SOC	250,000	237,226	139K-333K	
	Similkameen CHR	711,000	1,267,533[3]	1,145K-1,450K	1
	Methow CHR	525,000	1,267,533[3]	1,145K-1,450K	1
Green Egg-to-Fry Survival[2]	Chiwawa CHS	90%	94.6%	95.1-98.0%	
	Wenatchee CHR	90%	86.1%	81.7-88.0%	2
	Wenatchee SOC	90%	84.3%	79.9-87.0%	
	Similkameen CHR	90%	87.5%	84.7-89.8%	2
	Methow CHR	90%	87.5%	84.7-89.8%	2
Fry-to-Smolt Survival[2]	Chiwawa CHS	72%	96.5%'	96.0-98.0%	
	Wenatchee CHR	72%	95.5%'	88.7-98.7%	
	Wenatchee SOC	72%	94.6%'	93.7-98.5%	
	Similkameen CHR	72%	96.3%'	57.4-98.6%	3
	Methow CHR	72%	96.3%'	NA	
Fiih Releases	Chiwawa CHS	672,000	53,170'		1,2
	Wenatchee CHR	864,000	422,200'	124K-648K	1,2
	Wenatchee SOC	200,000	266,675'	168K-372K	
	Similkameen CHR	576,000	447,300'	353K-542K	1,2,3
	Methow CHR	400,000	0[4]	NA	1,2
Transfers to Co-ops (Eggs/Fish)	Chiwawa CHS	0		–	
	Wenatchee CHR	0		–	
	Wenatchee SOC	0		–	
	Similkameen CHR	0		–	
	Methow CHR	0		–	

1 Data is based on two broods.
2 Goals are assigned by FERC agreement and do not reflect hatchery expectations.
3 Three year average. Eggs are taken at Wells Hatchery.
4 First brood not yet released.

Objective 1- Continued

Measures	Species	Hatchery Goal	$-Year Average	Range	Constraints
Other Transfers (Eggs/Fish)	Chiwawa CHS	0	–	–	
	Wenatchee CHR	0	–	–	
	Wenatchee SOC	0	–	–	
	Similkameen CHR	0	–	–	
	Methow CHR	0	–	–	
Adults Passed Upstream	Chiwawa CHS	–	19	One year only	
	Wenatchee CHR	–	–	fish get by trap	
	Wenatchee SOC	–	1,265[4]	31-3,296	
	Similkameen CHR	–			
	Methow CHR	–			
Percent Survival*	Chiwawa CHS	0.26%	*unknown*	Unknown	1,4
	Wenatchee CHR	0.23%	Unknown	unknown	1,4
	Wenatchee SOC	0.90%	unknown	Unknown	1.4
	Simikameen CHR	0.15%	unknown	Unknown	1.4
	Methow CHR	0.15%	unknown	unknown	1.4

Objective 2

Measures	Species	Hatchery Goal	5-Year Average	Range	Constraints
Release smolts CV<10%	Chiwawa CHS	Yes	Unknown	4.4%	5
	Wenatchee CHR	Yes	Unknown	13.7%	5
	Wenatchee SOC	Yes	unknown	NA	5
	Similkameen CHR	Yes	unknown	9.5%	5
	Methow CHR	Yes	unknown	16.0%	5
Acclimation	Chiwawa CHS	Yes	NA	NA	
	Wenatchee CHR	Yes	NA	NA	
	Wenatchee SOC	No	NA	NA	
	Similkameen CHR	Yes	NA	NA	
	Methow CHR	Yes	NA	NA	
Volitional Release	Chiwawa CHS	Yes	NA	NA	
	Wenatchee CI-IR	Yes	NA	NA	
	Wenatchee SOC	No	NA	NA	
	Similkameen CHR	Yes	NA	NA	
	Methow CHR	Yes	NA	NA	

Objective 3

Measures	Species	Hatchery Goal	5-Year Average	Range	Constraints
Collect Adults Throughout Run	Chiwawa CHS	Yes	NA	NA	1
	Wenatchee CHR	Yes	NA	NA	1
	Wenatchee SOC	Yes	NA	NA	
	Similkameen CHR	Yes	NA	NA	
	Methow CHR	Yes	NA	NA	
Spawning Pop. >500	Chiwawa CHS	Yes	NA	NA	1
	Wenatchee CHR	Yes	NA	NA	1
	Wenatchee SOC	No	NA	NA	
	Similkameen CHR	Yes	NA	NA	1
	Methow CHR	Yes	NA	NA	1
Spawning Ratio Male:Female	Chiwawa CHS	1:1	0.46: 1	0.16:1 - 0.65:1	
	Wenatchee CHR	1:1	0.81:1	0.73: 1 - 0.90: 1	
	Wenatchee SOC	1:1	1.00:1	1.00:1	
	Similkameen CHR	1:1	0.76: 1	0.65:1 - 1.00:1	
	Methow CHR	1:1	0.76: 1	0.65:1 - 1.00:1	

Objective 4

Measures	Species	Hatchery Goal	5-Year Average	Range	Constraints
Adhere to Disease Policy	Chiwawa CHS	Yes	NA	NA	
	Wenatchee CHR	Yes	NA	NA	
	Wenatchee SOC	Yes	NA	NA	
	Similkameen CHR	Yes	NA	NA	
	Methow CHR	Yes	NA	NA	

Objective 5

Measures	Species	Hatchery Goal	5-Year Average	Range	Constrainy
TSS Effluent	All	5 mg/l	NA	NA	
TSS Max Effluent	All	15 mgfl	NA	NA	
SS Effluent	All	0.1 ml/l	NA	NA	
TSS PA Effluent	All	100 mg/l	NA	NA	
SS PA Effluent	All	1.0 ml/l	NA	NA	
Downstream Temp	All	Varies	NA	NA	
Downstream DO	All	Varies	NA	NA	
Continuous Monitoring of Other Parameters	All	Yes	NA	NA	

Objective 6

Measures	Species	Hatchery Goal	5-Year Average	Range	Constraints
Check Hatchery Records for Accuracy and Completeness	All	Yes	No		
Develop and Review Comp. Basin-wide Production Plan	All	Yes	No		8
Develop and Review Future Brood Doc.	All	Yes	Yes	--	
Develop and Review Current Brood Doc.	All	Yes	Yes	--	

Constraints/Comments-Rock Island Hatchery Complex

1. Trap inefficiencies at some sites result in capturing inadequate numbers of broodstock, particularly during heavy spring runoff. This results in fish spawning upstream of the trap and prevents sampling of fish from the entire run. Poor survival of juveniles or adults may be caused by inadequate water flows, dam passage problems, higher reservoir water temperatures or predation in the reservoirs. Transporting adults to Eastbank may also increase mortality due to handling stress.

2. Softshell disease in eggs may reduce egg-to-fry survival. Unexplained poor fertilization occurs in some egg lots.

3. Thick ice or anchor ice at Similkameen rearing pond can restrict pond flows or kill fish directly.

4. Lack of current, continuous tag data. Only tagged fish are measured to determine mean length and coefficient of variation (CV).

5. Combining progeny of many egg-takes into single rearing ponds can cause size variations in the population. Dropout syndrome in some chinook stocks can also cause size variation problems.

6. Volitional release may be truncated if fish movement does not correspond with timing of water spills on the Columbia River,

7. Fish cannot be volitionally released from net pens. In addition, fish are not outmigrating when released. They reside in the lake over the winter and outmigrate the following spring.

8. A comprehensive basin-wide production plan has not been completed at this time.

Toutle Salmon Hatchery

INTRODUCTION

The Toutle Hatchery site is located along the Green River about 23 miles east of Castle Rock, Washington. It is situated in a hilly location approximately 770 feet above sea level. The hatchery began operating in 1956 but was destroyed in the 1980 eruption of Mount St. Helens. Hatchery operations were reestablished in 1985.

Two large rearing ponds (Beaver Slough Rearing Ponds) near the hatchery site were only slightly damaged by the eruption. These ponds were cleaned and have been operating since 1985. Six raceways have been dredged out and placed into temporary operation to evaluate water quality for summer rearing. The facility is currently staffed with 2.5 FTE's. Water rights for the Toutle Hatchery total 26,031 gpm from the Green River.

PURPOSE

The hatchery was authorized under the Mitchell Act and began operation as part of the Columbia River Fisheries Development Program-a program to mitigate for fishery losses caused by hydroelectric system development. Funds for the program are administered by the National Marine Fisheries Service.

The facility is used for adult collection, limited incubation and rearing of tule fall chinook and early (Type-S) coho. The hatchery is currently operating at maximum production given the existing facility Constraints. Tule fall chinook stocks produced from Mitchell Act hatcheries are managed as species aggregates; therefore, adequate escapement of appropriate species/stocks for each hatchery's egg-take needs is not critical. Mitchell Act hatcheries with insufficient broodstock can receive eggs of appropriate species/stocks from any other Mitchell Act facility with surplus eggs

GOALS

Produce adult fall chinook and coho that will contribute to NE Pacific and Columbia River Basin commercial and sport fisheries while providing adequate escapement for hatchery production.

OBJECTIVES

Objective 1: Hatchery Production

Produce 2,500,000 subyearling tule fall chinook for on-station release.

Produce 1,100,000 yearling Type-S coho for on-station release.

Objective 2: Minimize interactions with other fish populations through proper rearing and release strategies.

Objective 3: Maintain stock integrity and genetic diversity of each unique stock through proper management of genetic resources.

Objective 4: Maximize survival at all life stages using disease control and disease prevention techniques. Prevent introduction, spread or amplification of fish pathogens.

Objective 5: Conduct environmental monitoring to ensure that hatchery operations comply with water quality standards and to assist in managing fish health.

Objective 6: Communicate effectively with other salmon producers and managers in the Columbia River Basin.

CURRENT PRACTICES TO ACHIEVE OBJECTIVES

Objective 1: Hatchery Production

Adult Collection

The intent of the adult collection procedures at Toutle Hatchery is to collect as many adults as possible to maintain the hatchery program. Because tule stocks are not managed to provide adequate escapement to individual hatcheries, shortfalls are made up with imports from other facilities which have surplus eggs.

Tule Fall Chinook: Entry of adults into the subbasin occurs from late August to November. Spawning occurs from late September to November with a peak in October. Adults are captured at a temporary weir which diverts fish into the holding pond. Eggs are taken to Grays River Hatchery for incubation.

Type-S Coho: Entry of adults in the subbasin begins in early September and runs through November. Spawning peaks in October. Adults are diverted into the holding pond by a temporary weir. Gametes are taken to other Columbia River facilities for incubation, hatching and early rearing. Fingerlings are later returned to Toutle Hatchery for rearing and eventual release. A test incubation program was tried in 1991 using 500,000 eggs.

Objective 2: Minimize interactions with other fish populations through proper rearing and release strategies.

Rearing and Release Strategies

Rearing and release strategies are designed to limit the amount of ecological interactions occurring between hatchery and naturally produced fish. Fish are reared to sufficient size that smoltification occurs within nearly the entire population, which will reduce retention time in downstream migration. Rearing on parent river water, or acclimation for several weeks to parent river water is used to ensure strong homing to the hatchery, thus reducing the stray rate to natural populations. Various release strategies are used to ensure that fish migrate from the hatchery with the least amount of interaction with native populations. The specific rearing and release strategies used at this hatchery are outlined below.

Tule Fall Chinook: Transfer 2,500,000 fish from Grays River Hatchery in January; rear to a size of at least 80 fish/pound; release on-station (acclimated) in June.

Type-S Coho: Transfer 1,100,000 fingerlings from Grays River, Elokomin and Lewis River hatcheries in January; rear to a size of 17 fish/pound; release on-station (acclimated) in May.

Objective 3: **Maintain stock integrity and genetic diversity.**

Broodstock Selection-All Stocks

Adults are collected throughout the entire run to ensure that the run timing for these stocks is maintained.

Spawning Protocol-AN Stocks

The intent is to utilize a spawning population of at least 500 adults. When spawning fewer than 1 million eggs in a day, the male to female ratio will be 1:1 for all stocks. When spawning more than 1 million eggs in a day, the ratio will not be less than 1 male to 3 females. A portion of each day's egg-take is used for on-site hatchery production.

Acceptable Stocks

The stocks approved for release from the Toutle Hatchery are listed below.

Tule Fall Chinook
Any tule stock

Type-S (Early) Coho
Toutle River Type-S

Objective 4: Maximize survival at all life stages using disease control and disease prevention techniques. Prevent introduction, spread or amplification of fish pathogens.

Fish Health Management Programs-All Stocks

The primary objective of fish health management programs at WDF hatcheries is to produce healthy smolts that will contribute to the fisheries and natural spawning. Equally important is to prevent the introduction, amplification or spread of certain fish pathogens which might negatively affect the health of both hatchery and naturally reproducing stocks.

WDF has implemented both disease control and disease prevention programs at all of its facilities to try and achieve these objectives. These programs include the following standard elements:

Disease Control (Reactive)

- Perform necropsies of diseased and dead fish to diagnose the cause of loss.
- Prescribe appropriate treatments and remedies to disease.
- Use a disease control policy which dictates how specific disease problems will be addressed and what restrictions may be placed on movements of diseased stocks.
- Conduct applied research on new and existing techniques to control disease epizootics.

Disease Prevention (Proactive)

- Routinely perform necropsies of clinically healthy fish to assess health status and detect problems before they progress to clinical disease or mortality.
- Implement disease preventative strategies in all aspects of fish culture to produce a quality fish. This includes prescribing the optimal nutritional needs and environmental conditions in the hatchery rearing container based on historical disease events. It also involves the prophylactic use of vaccines in order to avoid a disease problem.
- Use a disease prevention policy which restricts the introduction of stocks into a facility which may result in the introduction of a new disease condition or mortality.
- Use sanitation procedures which prevent introduction of pathogens into and/or within a facility.

- Conduct applied research on new and existing disease prevention techniques.

- Utilize pond management strategies (e.g., Density Index and Flow Index) to help optimize the quality of the aquatic environment and minimize fish stress which can induce infectious and noninfectious diseases. For example, the Density Index is used to estimate the maximum number of fish (of a given length) that can occupy a rearing unit based on the rearing unit's size. The Flow Index is used to estimate the rearing unit's carrying capacity based on water flows.

Fish Health Activities at Toutle Hatchery

Health Monitoring

- On at least a monthly basis, both healthy and clinically diseased fish from each fish lot at the hatchery are given a health exam. The sample includes a minimum of ten fish per lot. Findings are reported on WDF Form FH01.

- At spawning, a minimum of 60 ovarian fluids and 60 kidney/spleens are examined for viral pathogens from each fish lot.

- Prior to transfer or release, fish are given a health exam. This exam may be in conjunction with the routine monthly visit.

- Whenever abnormal behavior or mortality is observed, the fish health specialist will examine the affected fish, make a diagnosis and recommend the appropriate remedial or preventative measures.

- Reporting and control of selected fish pathogens are conducted in accordance with the Co-Managers Fish Disease Control Policy.

Fish and Egg Movements

- Movements of fish and eggs are conducted in accordance with the Co-Managers Fish Disease Control Policy.

Therapeutic and Prophylactic Treatments

- At spawning, eggs are water-hardened in iodophor as a disinfectant.

- Juvenile fish are administered antibiotics orally when needed for the control of bacterial infections.

- **Formalin** (37% formaldehyde) is dispensed into water for control of parasites and fungus on eggs, juveniles and adult salmon as needed. Treatment dosage and time of exposure varies with species, life-stage and condition being treated.

- Only therapeutants approved by the U.S. Food and Drug Administration are used for treatments.

Sanitation

- All eggs brought to the facility are surface-disinfected with iodophor (as per disease policy).

- All equipment (nets, tanks, rain gear) is disinfected with iodophor between different fish/egg lots.

- Different fish/egg lots are physically isolated from each other by separate ponds or incubation units. Incubation units are further isolated by plastic curtains. The intent of these activities is to prevent the horizontal spread of pathogens by splashing water.

- Tank trucks are disinfected between the hauling of different fish lots.

- Foot baths containing iodophor are strategically located on the hatchery grounds (i.e., entrance to hatchery building) to prevent spread of pathogens.

Objective 5: Conduct environmental monitoring.

Environmental Monitoring

Primarily, environmental monitoring is conducted at WDF facilities to ensure these facilities meet the requirements of the National Pollution Discharge Elimination Permit administered by the Washington Department of Ecology. It is also used in managing fish health. On a short-term basis, monitoring helps identify when changes to hatchery practices are required. Long-term monitoring provides the ability to quantify water quality impacts resulting from changes in the watershed (e.g., logging, road building and urbanization). The following parameters are currently monitored at this hatchery:

- *Total* Suspended Solids *(TSS)*—1 to 2 times per month on composite effluent, maximum effluent and influent samples. Once per month on pollution abatement pond influent and effluent samples.

- *Settleable Solids (SS)*—1 to 2 times per week on effluent and influent samples. Once per week on pollution abatement pond influent and effluent samples.

- *Upstream and* Downstream *Temperatures*—twice per month, June through September.

- Upstream *and* Downstream *Dissolved Oxygen* (DO)-twice per month, June through September.

- In-hatchery Water *Temperatures*—maximum and minimum daily.

- *In-hatchery Dissolved* Oxygen-as required by steam flow or weather conditions.

- Some facilities monitor rainfall and air temperature on a daily basis.

The following are additional parameters which should be monitored at WDF hatcheries:

- *Influent Wafer* Temperufures-continuous monitoring
- *Air Temperatures*—continuous monitoring
- *Influent/Effluent Dissolved* Oxygen-continuous monitoring
- *Influent pH/Conductivity*—continuous monitoring
- *Stream bed Movement*
- *In-st ream Flow/Curren t*
- *Daily Rainfall*

Objective 6: Communicate effectively with other salmon producers and managers.

Interagency Coordination/Communication

Production Advisorv Committee (PAC): The Columbia River PAC is comprised of representatives from the regulatory management agencies and tribes. This group meets monthly to discuss anadromous fish production issues and to provide an opportunity for communication among the anadromous fish hatchery managers.

Technical Advisorv Committee (TAC): The Columbia River TAC is comprised of regulatory fish harvest technicians. This group provides management direction used in establishing hatchery fish production goals. TAC meets monthly.

Integrated Hatchery Operations Team (IHOT): This group is comprised of representatives from fish management agencies and tribes. MOT meets monthly and is currently developing a series of regional hatchery policies.

Pacific Northwest Fish Health Protection Committee (PNFHPC): This group is comprised of representatives from U.S. and Canadian fish management agencies, tribes, universities, and private fish operations. The groups meets twice a year to monitor regional fish health policies and to discuss current fish health issues in the Pacific Northwest.

In-River Agreements: State, federal and tribal representatives meet annually to set Columbia River harvests as part of the U.S. v. Oregon Agreement. Periodic meetings are also held throughout the year to assess if targets are being met.

In-Season Communications: Communication with PAC, the Columbia River Inter-Tribal Fish Commission, Oregon Department of Fish and Wildlife, Washington Department of Wildlife, U.S. Fish and Wildlife Service and Idaho Department of Fish and Game takes place each year to coordinate proper fish and egg transfers in an effort to meet basin-wide goals at all facilities, where applicable.

Record Keeping

Records are kept in a consistent manner employing standard formats to allow for documentation and monitoring. Future record keeping will be coordinated with the basin-wide Coordinated Information System (CIS) currently under development. It will be a system to access all necessary databases in the region. It is hoped that coordinated information collection and reporting will result in consistency between the various agencies.

Development and Review of Brood Documents

The three brood documents are reviewed and agreed to annually. The Eauilibrium Brood Document for the Columbia River and/or major tributaries has not yet been developed. It would document existing baseline production and current management. The Future Brood Document is a detailed listing of annual production goals. This is reviewed and updated each spring, and is finalized by July. The Current Brood Document reflects actual production relative to the annual production goals. It is developed in the spring after eggs are taken. It is usually finalized by March.

PERFORMANCE STANDARDS-TOUTLE HATCHERY

Objec tive 1

Measures	Species	Hatcher-v Goal	5-Year Average	Range	Constraints
Adult Capture	Fall Chinook	1,524	307'	253-360	1
	Type-S Coho	1,350	6,310'	2,745-9,874	1
Adult Prespawning Survival	Fall Chinook	90%	95.3%'	95.0-95.6%	
	Type-S Coho	90%	99.5%'	99.4-99.5%	
Egg-take	Fall Chinook	2,875,000	587,800	463K-712K	1
	Type-S Coho	2,700,000	2,400,000	1,855K-2,945K	1
Green Egg-to-Fry Survival	Fall Chinook	90%	NA	NA	2
	Type-S Coho	90%	NA	NA	2
Fry-to-Smol t Survival	Fall Chinook	90%	98.8%	98.3-99.6%	
	Type-S Coho	90%	99.2%.	99.0-99.7%	
Fish Releases	Fall Chinook	2,500,000	3,364,800	2,387K-4,714K	
	Type-S Coho	2,300,000	760,775[2]	740K-1,293K	1
Transfers to Co-ops (Eggs/Fry)	Fall Chinook	0	--	--	
	Type-S Coho	0	--	--	
Other Transfers (Eggs/Fry)	Fall Chinook	0	--	--	
	Type-S Coho	0	--	--	
Adults Passed Upstream	Fall Chinook	150	30[1]	43-17	1
	Type-S Coho	1,300	5,831'	2,378-9,283	
Percent Survival	Fall Chinook	1.0%	Unknown	unknown	3
	Type-S Coho	2.5%	4.3%[3]	unknown	3

NA=Not applicable.
[1] Average of two broods, 1990-l 991.
[2] Based on average of four broods, 1987-l 990.
[3] Average of three broods, 1986-1988.

Objective 2

Measures	Species	Hatchery Goal	5-Year Average	Range	Constraints
Release smolts	Fall Chinook	Yes	Unknown	Unknown	3
CV<10%	Type-S Coho	Yes	Unknown	Unknown	3
Acclimation	Fall Chinook	Yes	Yes	--	
	Type-S Coho	Yes	Yes	--	
Volitional Release	Fall Chinook	Yes	No	--	4
	Type-S Coho	Yes	Partial	--	4

Objective 3

Measure	Species	Hatchery Goal	5-Year Average	Range	Constraints
Collect Adults	Fall Chinook	Yes	Yes	Yes	1
Throughout Run	Type-S Coho	Yes	Yes	Yes	1
Spawning Pop.	Fall Chinook	Yes	No	No	1
>500	Type-S Coho	Yes	Yes	Yes	
Spawning Ratio	Fall Chinook	1:3[4]	0.85:1[1]	--	
Male:Female	Type-S Coho	1:3[4]	1.1:1[1]	--	1

Objective 4

Measures	Species	Hatchery Goal	5-Year Average	Ranee	Constraints
Adhere to	Fall Chinook	Yes	Yes	--	
Disease Policy	Type-S Coho	Yes	Yes	--	

[4] Spawning guidelines require a 1 :1 male to female spawning ratio if less than 1 million eggs are spawned in a single day.

Objective 5

Measures	Species	Hatchery Goal	5-Year Average	Range	Constraints
TSS Effluent	All	5 mg/l	NA	NA	
TSS Max Effluent	All	15 mg/l	NA	NA	
SS Effluent	All	0.1 ml/l	NA	NA	
TSS PA Effluent	All	100 mg/l	NA	NA	
SS PA Effluent	All	1.0 ml/l	NA	NA	
Downstream Temp	All	Varies	NA	NA	
Downstream DO	All	Varies	NA	NA	
Continuous Monitoring of Other Parameters	All	Yes	NA	NA	

Objective 6

Measures	Species	Hatchery Goal	5-Year Average	Ranee	Constraints
Check Hatchery Records for Accuracy and Completeness	All	Yes	No	--	5
Develop and Review Comp. Basin-Wide Production Man	All	Yes	No	--	6
Develop and Review Future Brood Doc.	All	Yes	Yes	--	5
Develop and Review Current Brood Doc.	All	Yes	Yes	--	5

Constraints/Comments-Tout/e Hatchery

1. Tule fall chinook and Type-S coho stocks are not managed for escapement to individual hatcheries. Lack of adequate broodstock is made up by importing eggs or fingerlings from other facilities which have a surplus. Low river flows during the spawning migration prevent the hatchery from obtaining sufficient broodstock during years when adequate fish numbers are present. Coho returning during high flow periods may be able to bypass the weir. The eruption of Mt. St. Helens severely damaged the river environment which may affect the survival of outmigrating juvenile fish. Harvest levels and migration obstacles may affect sex ratio of returning adults.

2. This facility has no electricity. Therefore, incubation is limited to only a few vessels utilizing a marginal water source. Most eggs taken at this facility are transported to other facilities; this could increase egg mortality.

3. Lack of current, continuous tag data. Only marked fish are sampled for mean length and coefficient of variation (CV).

4. Because there is only one rearing pond, coho must be released in order to rear chinook. This reduces the time available to volitionally release coho. Because river flows decline in June, chinook must be forced out of the pond to take advantage of the available flow.

5. Current hatchery system lacks the necessary infrastructure and mechanisms to ensure adequate monitoring and evaluation needed for efficient and effective hatchery rearing programs.

6. A comprehensive basin-wide production plan has not been completed at this time.

Washougal Salmon Hatchery

INTRODUCTION

The Washougal Salmon Hatchery is located along the Washougal River about 16 miles north of the town of Washougal, Washington. Hatchery site elevation is 120 feet above sea level.

The facility has 24 raceways and 3 earthen rearing ponds. There is also an asphalt-lined adult holding pond which is not used for fish rearing. The facility is staffed with 5.25 FTE's.

Water rights total 15,061 gpm from four sources: Washougal River, Bob Creek, Boyle Creek and C-Creek.

PURPOSE

The Washougal Hatchery was authorized under the Mitchell Act and began operating in 1959 as part of the Columbia River Fisheries Development Program-a program to mitigate for fishery losses caused by hydroelectric system development. Funds for the program are administered by the National Marine Fisheries Service. The facility is used for adult collection, egg incubation and rearing of lower river fall chinook and late (Type-N) coho. It also supplies coho for release into the Klickitat River and provides coho to various sports/educational cooperative groups. Tule fall chinook and Type-N coho stocks produced from Mitchell Act hatcheries are managed as species aggregates; therefore, adequate escapement of appropriate species/stocks for each hatchery's egg-take needs is not critical. Mitchell Act hatcheries with insufficient broodstock can receive eggs of appropriate species/stocks from any other Mitchell Act facility with surplus eggs.

GOALS

Produce lower river fall chinook and coho that will contribute to NE Pacific and Columbia River Basin commercial and sport fisheries while providing adequate escapement for hatchery production.

OBJECTIVES

Objective 1: Hatchery Production

Tule Fall Chinook
Produce 6 million subyearlings for on-station release.

Provide 500 eggs/fish to co-op programs.

Provide eggs/fish (surplus to on-station needs) to other facilities.

Type-N Coho
Produce 500,000 yearlings for on-station release.

Provide 220,000 eggs/fish to co-op programs.

Produce 2.5 million yearlings for release into the Klickitat River as per U.S. *v.* Oregon Agreement.

Objective 2: Minimize interactions with other fish populations through proper rearing and release strategies.

Objective 3: Maintain stock integrity and genetic diversity of each unique stock through proper management of genetic resources.

Objective 4: Maximize survival at all life stages using disease control and disease prevention techniques. Prevent introduction, spread or amplification of fish pathogens.

Objective 5: Conduct environmental monitoring to ensure that hatchery operations comply with water quality standards and to assist in managing fish health.

Objective 6: Communicate effectively with other salmon producers and managers in the Columbia River Basin.

CURRENT PRACTICES TO ACHIEVE OBJECTIVES

Objective 1: Hatchery Production

Adult Collection

The intent of the adult collection procedures at Washougal Hatchery is to collect as many adults as possible to maintain the hatchery production program. Tule fall chinook and Type-N coho stocks produced from Mitchell Act hatcheries are managed as an aggregate; therefore, adequate escapement for each hatchery's egg-take needs is not considered. Hatcheries with insufficient broodstock receive eggs from any other Mitchell Act facility that has a surplus.

Fall Chinook: Entry of adults into the subbasin occurs from early September to November. Spawning occurs from late September to mid-November with a peak usually in mid-October. Adults are captured at the hatchery site.

Type-N Coho: Adults begin entering the Washougal River in late October and November. Peak spawning occurs in late November and early December. Adults are captured at the hatchery site.

Objective 2: Minimize interactions with other fish populations through proper rearing and release strategies.

Rearing and Release Strategies

Rearing and release strategies are designed to limit the amount of ecological interactions occurring between hatchery and naturally produced fish. Fish are reared to sufficient size that smoltification occurs within nearly the entire population, which will reduce retention time in downstream migration. Rearing on parent river water, or acclimation for several weeks to parent river water is used to ensure strong homing to the hatchery, thus reducing the stray rate to natural populations. Various release strategies are used to ensure that fish migrate from the hatchery with the least amount of interaction with native populations. The specific rearing and release strategies used at this hatchery are outlined below.

Fall Chinook: Rear 5.5 million fish to a size of 80-100 fish/pound; acclimate in parent river water for a minimum of four weeks; release at the hatchery in June. Rear 500,000 fish to a size of 40 fish/pound; acclimate and release at the hatchery in August.

Type-N Coho: Rear 2.5 million fish to a size of 20 fish/pound; truck and release these fish into the Klickitat River (nonacclimated) in April. Rear 500,000 fish to a size of 17 fish/pound; acclimate to parent river water for a minimum of 4 weeks; release at the hatchery in May-June.

Objective 3: Maintain stock integrity and genetic diversity.

Broodstock Selection-AH Stocks

Adults are collected throughout the entire run to ensure that the run timing for these stocks is maintained.

Spawning Protocol-All Stocks

The intent is to utilize a spawning population of at least 500 adults. When spawning fewer than 1 million eggs in a day, the male to female ratio will be 1:1 for all stocks. When spawning more than 1 million eggs in a day, the ratio will not be less than 1 male to 3 females. A portion of each day's egg-take is used for on-site hatchery production.

Acceptable Stocks

Importing eggs/fish from other facilities with acceptable stocks is done to achieve production goals while maintaining regional genetic integrity in times of inadequate hatchery returns. Eggs from hatchery-returning adults are always given priority for station use.

The stocks approved for release from the Washougal Hatchery have been prioritized and are listed below. Stocks with the number 1 adjacent to their title are the most desirable. Stocks with higher numbers are considered to be progressively less well suited.

Fall Chinook
1 Washougal fall chinook
1 Any lower Columbia River tule stock

Twe-N (Late) Coho
1 Washougal River Type-N
2 Any Columbia River Type-N stock

Objective 4: Maximize survival at all life stages using disease control and disease prevention techniques. Prevent introduction, spread or amplification of fish pathogens.

Fish Health Management Programs-All Stocks

The primary objective of fish health management programs at WDF hatcheries is to produce healthy smolts that will contribute to the fisheries and natural spawning. Equally important is to prevent the introduction, amplification or spread of certain fish pathogens which might negatively affect the health of both hatchery and naturally reproducing stocks.

WDF has implemented both disease control and disease prevention programs at all of its facilities to try and achieve these objectives. These programs include the following standard elements:

Disease Control (Reactive)

- Perform necropsies of diseased and dead fish to diagnose the cause of loss.
- Prescribe appropriate treatments and remedies to disease.
- Use a disease control policy which dictates how specific disease problems will be addressed and what restrictions may be placed on movements of diseased stocks.
- Conduct applied research on new and existing techniques to control disease epizootics.

Disease Prevention (Proactive)

- Routinely perform necropsies of clinically healthy fish to assess health status and detect problems before they progress to clinical disease or mortality.
- Implement disease preventative strategies in all aspects of fish culture to produce a quality fish. This includes prescribing the optimal nutritional needs and environmental conditions in the hatchery rearing container based on historical disease events. It also involves the prophylactic use of vaccines in order to avoid a disease problem.
- Use a disease prevention policy which restricts the introduction of stocks into a facility which may result in the introduction of a new disease condition or mortality.
- Use sanitation procedures which prevent introduction of pathogens into and/or within a facility.

- Conduct applied research on new and existing disease prevention techniques.

- Utilize pond management strategies (e.g., Density Index and Flow Index) to help optimize the quality of the aquatic environment and minimize fish stress which can induce infectious and noninfectious diseases. For example, the Density Index is used to estimate the maximum number of fish (of a given length) that can occupy a rearing unit based on the rearing unit's size. The Flow Index is used to estimate the rearing unit's carrying capacity based on water flows.

Fish Health Activities at Washougal Hatchery

Health Monitoring

- On at least a monthly basis, both healthy and clinically diseased fish from each fish lot at the hatchery are given a health exam. The sample includes a minimum of ten fish per lot. Findings are reported on WDF Form FH01.

- At spawning, a minimum of 60 ovarian fluids and 60 kidney/spleens are examined for viral pathogens from each stock.

- Prior to transfer or release, fish are given a health exam. This exam may be in conjunction with the routine monthly visit.

- Whenever abnormal behavior or mortality is observed, the fish health specialist will examine the affected fish, make a diagnosis and recommend the appropriate remedial or preventative measures.

- Reporting and control of selected fish pathogens are conducted in accordance with the Co-Managers Fish Disease Control Policy.

Fish and Egg; Movements

- Movements of fish and eggs are conducted in accordance with the Co-Managers Fish Disease Control Policy.

Therapeutic and Prophylactic Treatments

- At spawning, eggs are water-hardened in iodophor as a disinfectant.

- Juvenile fish are administered antibiotics orally when needed for the control of bacterial infections.

- **Formalin** (37% formaldehyde) is dispensed into water for control of parasites and fungus on eggs, juveniles and adult salmon. Treatment dosage and time of exposure varies with species, life-stage and condition being treated.

- Only therapeutants approved by the U.S. Food and Drug Administration are used for treatments.

Sanitation

- All eggs brought to the facility are surface-disinfected with iodophor (as per disease policy).

- All equipment (nets, tanks, rain gear) is disinfected with iodophor between different fish/egg lots.

- Different fish/egg lots are physically isolated from each other by separate ponds or incubation units. Incubation units are further isolated by plastic curtains. The intent of these activities is to prevent the horizontal spread of pathogens by splashing water.

- Tank trucks are disinfected between the hauling of different fish lots.

- Foot baths containing iodophor are strategically located on the hatchery grounds (i.e., entrance to hatchery building) to prevent spread of pathogens.

Objective 5: Conduct environmental monitoring.

Environmental Monitoring

Primarily, environmental monitoring is conducted at WDF facilities to ensure these facilities meet the requirements of the National Pollution Discharge Elimination Permit administered by the Washington Department of Ecology. It is also used in managing fish health. On a short-term basis, monitoring helps identify when changes to hatchery practices are required. Long-term monitoring provides the ability to quantify water quality impacts resulting from changes in the watershed (e.g., logging, road building and urbanization). The following parameters are currently monitored at this hatchery:

- *Total Suspended Solids (TSS)*—1 to 2 times per month on composite effluent, maximum effluent and influent samples. Once per month on pollution abatement pond influent and effluent samples.

- *Settleable Solids (SS)*—1 to 2 times per week on effluent and influent samples. Once per week on pollution abatement pond influent and effluent samples.

- *Upstream and* Downstream Temperatures-twice per month, June through September.

- *Upstream and Downstream Dissolved* Oxygen *(DO)*—twice per month, June through September.

- In-hatchery Water Temperatures-maximum and minimum daily.

- *In-hatchery Dissolved Oxygen*- a s required by steam flow or weather conditions.

- Some facilities monitor rainfall and air temperature on a daily basis.

The following are additional parameters which should be monitored at WDF hatcheries:

- *Influent Water* Temperatures-continuous monitoring
- *Air Temperatures*—continuous monitoring
- *Influent/Effluent Dissolved* Oxygen-continuous monitoring
- *Influent pH/Conductivity*—continuous monitoring
- *Streambed Movement*
- *In-stream Flow/Current*
- *Daily Rainfall*

Objective 6: Communicate effectively with other salmon producers and managers.

Interagency Coordination/Communication

Production Advisory Committee (PAC): The Columbia River PAC is comprised of representatives from the regulatory management agencies and tribes. This group meets monthly to discuss anadromous fish production issues and to provide an opportunity for communication among the anadromous fish hatchery managers.

Technical Advisory Committee (TAC): The Columbia River TAC is comprised of regulatory fish harvest technicians. This group provides management direction used in establishing hatchery fish production goals. TAC meets monthly.

Integrated Hatchery Operations Team (IHOT): This group is comprised of representatives from fish management agencies and tribes. MOT meets monthly and is currently developing a series of regional hatchery policies.

Pacific Northwest Fish Health Protection Committee (PNFHPC): This group is comprised of representatives from U.S. and Canadian fish management agencies, tribes, universities, and private fish operations. The groups meets twice a year to monitor regional fish health policies and to discuss current fish health issues in the Pacific Northwest.

In-River Agreements: State, federal and tribal representatives meet annually to set Columbia River harvests as part of the U.S. v. *Oregon* Agreement. Periodic meetings are also held throughout the year to assess if targets are being met.

In-Season Communications: Communication with PAC, the Columbia River Inter-Tribal Fish Commission, Oregon Department of Fish and Wildlife, Washington Department of Wildlife, U.S. Fish and Wildlife Service and Idaho Department of Fish and Game takes place each year to coordinate proper fish and egg transfers in an effort to meet basin-wide goals at all facilities, where applicable.

Record Keeping

Records are kept in a consistent manner employing standard formats to allow for documentation and monitoring. Future record keeping will be coordinated with the basin-wide Coordinated Information System (CIS) currently under development. It will be a system to access all necessary databases in the region. It is hoped that coordinated information collection and reporting will result in consistency between the various agencies.

Development and Review of Brood Documents

The three brood documents are reviewed and agreed to annually. The Eauilibrium Brood Document for the Columbia River and/or major tributaries has not yet been developed. It would document existing baseline production and current management. The Future Brood Document is a detailed listing of annual production goals. This is reviewed and updated each spring, and is finalized by July. The Current Brood Document reflects actual production relative to the annual production goals. It is developed in the spring after eggs are taken. It is usually finalized by March.

PERFORMANCE STANDARDS—WASHOUGAL HATCHERY

Objective 1

Measures	Species	Hatchery Goal	S-Year Average	Range	Constraints
Adult Capture	Fall Chinook	3,530	5,266	3,877-6,719	
	Type-N Coho	4,100	4,624	2,042-9,316	1
Adult Prespawning Survival	Fall Chinook	90%	94.3%	92.2-95.8%	
	Type-N Coho	90%	97.7%	95.8-99.5%	
Egg-take	Fall Chinook	7,060,000	8,331,620	5,671K-12,212K	
	Type-N Coho	4,100,000	1,724,975	1,120K-4,267K	
Green Egg-to-Fry Survival	Fall Chinook	90%	93.9%	91.8-95.1%	
	Type-N Coho	90%	94.1%	90.5-95.0%	
Fry-to-Smolt Survival	Fall Chinook	90%	96.0%	91.0-98.8%	
	Type-N Coho	90%	90.2%'	84.9-99.4%	2
Fish Releases	Fall Chinook	6,000,000	5,691,000	4,631 K-6,425K	3
	Type-N Coho	500,000	1,249,021	934K-1,612K	2,3
Transfers to Co-ops (Eggs/Fish)	Fall Chinook	500	528,000[2]	--	
	Type-N Coho	220,000	90,000	20K-145K	
Other Transfers (Eggs/Fish)	Fall Chinook	O-5 million	716,460	263K-2,900K	
	Type-N Coho	2,530,000[3]	1,725,875	837K-2,195K	
Adults Passed Upstream	Fall Chinook	0	888[4]	--	4
	Type-N Coho	0	697	0-2,660	4
Percent Survival	Fall Chinook	1.0%	0.83%	0.2-2.1%	
	Type-N Coho	3.5%	unknown	unknown	5

NA=Not applicable.
1 Based on average of four broods,1987-1990.
2 One brood only.
3 Klickitat River smolt plant and Duncan Creek mitigation.
4 One brood only, 1987.

Objective 2

Measures	Species	Hatchery Goal	5-Year Average	Range	Constraints
Release smol ts	Fall Chinook	Yes	7.0%	6.4-7.5%	5
CV<10%	Type-N Coho	Yes	Unknown	Unknown	5
Acclimation	Fall Chinook	Yes	Yes	--	
	Type-N Coho	Yes	Partial	--	6
Volitional Release	Fall Chinook	No	No	--	
	Type-N Coho	No	No	--	7

Objective 3

Measures	Species	Hatchery Goal	5-Year Average	Range	Constraints
Collect Adults	Fall Chinook	Yes	Yes	Yes	3
Throughout Run	Type-N Coho	Yes	Yes	Yes	3
Spawning Pop.	Fall Chinook	Yes	Yes	Yes	
>500	Type-N Coho	Yes	Yes	Yes	
Spawning Ratio	Fall Chinook	1:3[5]	0.83:1	0.67:1 - 1.0:1	
Male:Female	Type-N Coho	1:3[5]	1.0:1	0.91:1 - 1.2:1	

Objective 4

Measures	Species	Hatchery Goal	5-Year Averaee	Range	Constraints
Adhere to	Fall Chinook	Yes	Yes	--	
Disease Policy	Type-N Coho	Yes	Yes	--	

[5] Spawning guidelines require a 1:1 male to female spawning ratio if less than 1 million eggs are spawned in a single day.

Objective 5

Measures	Species	Hatchery Goal	5-Year Average	Range	Constraints
TSS Effluent	All	5 mg/l	NA	NA	8
TSS Max Effluent	All	15 mg/l	NA	NA	8
SS Effluent	All	0.1 ml/l	NA	NA	8
TSS PA Effluent	All	100 mg/l	NA	NA	8
SS PA Effluent	All	1.0 ml/l	NA	NA	8
Downstream Temp	All	Varies	NA	NA	
Downstream DO	All	Varies	NA	NA	
Continuous Monitoring of Other Parameters	All	Yes	NA	NA	

Objective 6

Measures	Species	Hatchery Goal	5-Year Average	Range	Constraints
Check Hatchery Records for Accuracy and Completeness	All	Yes	No	--	9
Develop and Review Comp. Basin-Wide Production Plan	All	Yes	No	--	10
Develop and Review Future Brood Doc.	All	Yes	Yes	--	9
Develop and Review Current Brood Doc.	All	Yes	Yes	--	9

Constraints/Comments-Washougal Hatchery

1. Tule fall chinook and Type-S coho are not managed for escapement to individual hatcheries. Shortfalls are made up with surplus eggs from other hatcheries.

2. Transporting fish to the Klickitat River result in excessive handling and stress. No acclimation prior to release into the Klickitat River likely increases mortality even more.

3. Low flows in the spring cause overloading in some ponds. Low flows in the fall may preclude some portions of the run from reaching the hatchery. High flows in the fall result in coho escaping above-the racks. Bird predation in large rearing ponds can be high.

4. Impassable falls located 1/2 mile above the hatchery limits the area available for natural rearing and thus reduces the number of adults to pass upstream.

5. Lack of current continuous tag data. Only tagged fish are measured for mean length or coefficient of variation (CV). Warm water temperatures in the summer make rearing and release until the fall very difficult.

6. Water used for rearing coho is from the Washougal River and a creek. Coho released into the Klickitat River are not acclimated.

7. Design of pond outfall will not facilitate volitional release.

8. Abatement pond is inadequate which can cause violation of water quality standards. No funds are currently available to improve the pond.

9. Current hatchery system lacks the necessary infrastructure and mechanisms to ensure adequate monitoring and evaluation needed for efficient and effective hatchery rearing programs.

10. A comprehensive basin-wide production plan has not been completed at this time.

Wells Salmon Hatchery

INTRODUCTION

Wells Salmon Hatchery is located along the Columbia River just below Wells Dam. Site elevation is 750 feet above sea level. The facility is funded by the Douglas County PUD. The site, facilities and water are shared with the Washington Department of Wildlife's Wells Hatchery. The facility is staffed with 3.7 FTE's.

The rearing units consist of 12 raceways and 4 rearing ponds of varying sizes. Water to the rearing facilities is supplied from 13 wells and the Columbia River. Average flows available to the hatchery are 78,000 gpm from the Columbia River and 9,000 gpm from the wells.

PURPOSE

The hatchery is situated on 30 acres owned by Douglas County PUD and is operated as mitigation facility for fishery impacts caused by the Wells Dam.The facility is used for adult collection, egg incubation and rearing of fall chinook and summer chinook. It is also used to trap and spawn summer chinook for the Methow and Similkameen programs as part of the Rock Island Dam mitigation program at Eastbank Hatchery.

GOALS

The mitigation agreement with Douglas County PUD requires an annual production level of 56,200 pounds of summer chinook. Upriver bright (URB) fall chinook are not managed to provide adequate escapement to this hatchery.

OBJECTIVES

Objective 1: Hatchery Production

Summer Chinook
Produce 320,000 yearlings and 434,000 subyearlings for on-station release.

Trap, hold and spawn adult summer chinook for transfer of 1,300,000 green eggs to Eastbank Hatchery.

Provide 2,000 eggs to co-op programs for educational purposes.

Fall Chinook
Produce 100,000 subyearlings for transfer to the Lake Chelan net pens.

Objective 2: Minimize interactions with other fish populations through proper rearing and release strategies.

Objective 3: Maintain stock integrity and genetic diversity of each unique stock through proper management of genetic resources.

Objective 4: Maximize survival at all life stages using disease control and disease prevention techniques. Prevent introduction, spread or amplification of fish pathogens.

Objective 5: Conduct environmental monitoring to ensure that hatchery operations comply with water quality standards and to assist in managing fish health.

Objective 6: Communicate effectively with other salmon producers and managers in the Columbia River Basin.

CURRENT PRACTICES TO ACHIEVE OBJECTIVES

Objective 1: Hatchery Production

Adult Collection

The intent of the adult collection procedures at Wells Hatchery is to collect enough adults to maintain the hatchery production program and provide sufficient escapement to the Methow, Similkameen and Okanogan rivers. An additional goal is to provide fall chinook to other hatcheries in the basin. Adults are trapped at both the east and west ladders of the dam and at the hatchery.

Summer Chinook: Adults return from July to September and spawn from October to November. Peak spawning occurs in October. Adults are captured at the channel outfall or the east ladder of Wells Dam. Summer chinook are separated from fall chinook at the hatchery using coded-wire tags and a cut-off date of August 28. Fish spawned after this date are considered fall chinook.

Fall Chinook: Adults return from September through November. Peak spawning occurs in November. Adults are captured in the channel outfall.

Objective 2: Minimize interactions with other fish populations through proper rearing and release strategies.

Rearing and Release Strategies

The rearing and release strategies developed for this facility are designed to minimize adverse interactions (i.e., competition for food or habitat) between hatchery-released and naturally produced smolts. A large size at release increases smolt migration speed, thus reducing the residence time in the river. The specific rearing and release strategies used at this facility are outlined below.

Summer Chinook: Rear 484,000 fish to a size of 20 fish/pound and release on-station in June. Rear 320,000 fish to a size of 10 fish/pound; acclimate to parent river water for several months; release on-station in April.

Fall Chinook: Rear 100,000 fish to a size of 50 fish/pound and transfer to the Lake Chelan net pen in May.

Objective 3: Maintain stock integrity and genetic diversity.

Broodstock Selection-All Stocks

Adults are collected throughout the entire run to ensure that the run timing for these stocks is maintained. Summer chinook collection is terminated by August 28 to ensure that this stock does not overlap with fall chinook. Adult collection is managed throughout the season in response to fish counts at Rocky Reach Dam to ensure adequate escapement above Wells Dam. Most fish used for broodstock are volunteers with a component coming from the traps at the dam.

Spawning Protocol-All Stocks

Adult fish are spawned at 1:1 male to female spawning ratio. A portion of each day's egg-take is used for on-site hatchery production. Gametes from adults spawned in November are incubated separately until coded-wire tags from the spawned adults are read. If fish are identified as Priest Rapids fall chinook, the eggs may be transferred to that station, or used in the Lake Chelan program.

Acceptable Stocks

There are no stocks imported to achieve production goals for summer chinook. Fall chinook broodstock can be any mid-Columbia URB.

Objective 4: Maximize survival at all life stages using disease control and disease prevention techniques. Prevent introduction, spread or amplification of fish pathogens.

Fish Health Management Programs-All Stocks

The primary objective of fish health management programs at WDF hatcheries is to produce healthy smolts that will contribute to the fisheries and natural spawning. Equally important is to prevent the introduction, amplification or spread of certain fish pathogens which might negatively affect the health of both hatchery and naturally reproducing stocks.

WDF has implemented both disease control and disease prevention programs at all of its facilities to try and achieve these objectives. These programs include the following standard elements:

Disease Control (Reactive)

- Perform necropsies of diseased and dead fish to diagnose the cause of loss.
- Prescribe appropriate treatments and remedies to disease.
- Use a disease control policy which dictates how specific disease problems will be addressed and what restrictions may be placed on movements of diseased stocks.
- Conduct applied research on new and existing techniques to control disease epizootics.

Disease Prevention (Proactive)

- Routinely perform necropsies of clinically healthy fish to assess health status and detect problems before they progress to clinical disease or mortality.
- Implement disease preventative strategies in all aspects of fish culture to produce a quality fish. This includes prescribing the optimal nutritional needs and environmental conditions in the hatchery rearing container based on historical disease events. It also involves the prophylactic use of vaccines in order to avoid a disease problem.
- Use a disease prevention policy which restricts the introduction of stocks into a facility which may result in the introduction of a new disease condition or mortality.
- Use sanitation procedures which prevent introduction of pathogens into and/or within a facility.

- Conduct applied research on new and existing disease prevention techniques.

- Utilize pond management strategies (e.g., Density Index and Flow Index) to help optimize the quality of the aquatic environment and minimize fish stress which can induce infectious and noninfectious diseases. For example, the Density Index is used to estimate the maximum number of fish (of a given length) that can occupy a rearing unit based on the rearing unit's size. The Flow Index is used to estimate the rearing unit's carrying capacity based on water flows.

Fish Health Activities at Wells Hatchery

Health Monitoring

- On at least a monthly basis, both healthy and clinically diseased fish from each fish lot at the hatchery are given a health exam. The sample includes a minimum of ten fish per lot. Findings are reported on WDF Form FH01.

- At spawning, a minimum of 60 ovarian fluids and 60 kidney/spleens are examined for viral pathogens from each stock.

- At spawning, an Enzyme Link Immunosorbent Assay (ELISA) is conducted on kidney tissue samples from all summer chinook females. ELISA is used to detect the bacterium which causes kidney disease (*Renibacterium salmoninarum*). Progeny from females with similar ELISA levels are grouped and reared together to reduce the horizontal transmission of this disease.

- Prior to transfer or release, fish are given a health exam. This exam may be in conjunction with the routine monthly visit.

- Whenever abnormal behavior or mortality is observed, the fish health specialist will examine the affected fish, make a diagnosis and recommend the appropriate remedial or preventative measures.

- Reporting and control of selected fish pathogens are conducted in accordance with the Co-Managers Fish Disease Control Policy.

Fish and Egg Movements

- Movements of fish and eggs are conducted in accordance with the Co-Managers Fish Disease Control Policy.

Therapeutic and Prophylactic Treatments

- Adult summer chinook are injected with antibiotics for the control of bacterial diseases.

- At spawning, eggs are water-hardened in iodophor as a disinfectant.

- Juvenile fish are administered antibiotics orally when needed for the control of bacterial infections.

- Formalin (37% formaldehyde) is dispensed into water for control of parasites and fungus on eggs, juveniles and adult salmon. Treatment dosage and time of exposure varies with species, life-stage and condition being treated.

- Only therapeutants approved by the U.S. Food and Drug Administration are used for treatments.

Sanitation

- All eggs brought to the facility are surface-disinfected with iodophor (as per disease policy).

- All equipment (nets, tanks, rain gear) is disinfected with iodophor between different fish/egg lots.

- Different fish/egg lots are physically isolated from each other by separate ponds or incubation units. Incubation units are further isolated by plastic curtains. The intent of these activities is to prevent the horizontal spread of pathogens by splashing water.

- Tank trucks are disinfected between the hauling of different fish lots.

- Foot baths containing iodophor are strategically located on the hatchery grounds (i.e., entrance to hatchery building) to prevent spread of pathogens.

Objective 5: Conduct environmental monitoring.

Environmental Monitoring

Primarily, environmental monitoring is conducted at WDF facilities to ensure these facilities meet the requirements of the National Pollution Discharge Elimination Permit administered by the Washington Department of Ecology. It is also used in managing fish health. On a short-term basis, monitoring helps identify when changes to hatchery practices are required. Long-term monitoring provides the ability to quantify water quality impacts resulting from changes in the watershed (e.g., logging, road building and urbanization). The following parameters are currently monitored at this hatchery:

- *Total Suspended Solids (TSS)*—1 to 2 times per month on composite effluent, maximum effluent and influent samples. Once per month on pollution abatement pond influent and effluent samples.

- *Settleable Solids (SS)*—1 to 2 times per week on effluent and influent samples. Once per week on pollution abatement pond influent and effluent samples.

- *Upstream and* Downstream Temperatures-twice per month, June through September.

- *Upstream and Downstream Dissolved* Oxygen (DO&twice per month, June through September.

- *In-hatchery Water* Temperatures-maximum and minimum daily.

- *In-hatchery Dissolved Oxygen*-as required by steam flow or weather conditions.

- Some facilities monitor rainfall and air temperature on a daily basis.

The following are additional parameters which should be monitored at WDF hatcheries:

- *Influent Water* Temperatures-continuous monitoring
- Air *Temperatures*—continuous monitoring
- *Influent/Effluent Dissolved* Oxygen-continuous monitoring
- *Influent pH/Conductivity*—continuous monitoring
- *Streambed Movement*
- *In-stream Flow/Current*
- *Daily Rainfall*

Objective 6: Communicate effectively with other salmon producers and managers.

Interagency Coordination/Communication

Production Advisory Committee (PAC): The Columbia River PAC is comprised of representatives from the regulatory management agencies and tribes. This group meets monthly to discuss anadromous fish production issues and to provide an opportunity for communication among the anadromous fish hatchery managers.

Technical Advisory Committee (TAC): The Columbia River TAC is comprised of regulatory fish harvest technicians. This group provides management direction used in establishing hatchery fish production goals. TAC meets monthly.

Integrated Hatchery Operations Team (IHOT): This group is comprised of representatives from fish management agencies and tribes. MOT meets monthly and is currently developing a series of regional hatchery policies.

Pacific Northwest Fish Health Protection Committee (PNFHPC): This group is comprised of representatives from U.S. and Canadian fish management agencies, tribes, universities, and private fish operations. The groups meets twice a year to monitor regional fish health policies and to discuss current fish health issues in the Pacific Northwest.

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PERFORMANCE STANDARDS-WELLS HATCHERY

Objective 1

Measures	Species	Hatcher-v Goal	5-Year Average	Range	Constraints
Adult Capture	Fall Chinook	59	174	117-383	
	Sum. Chincok	1,125	1,220	997-1,642	
Adult Prespawning Survival	Fall Chinook	90%	97.5%	92.7-100%	
	Sum. Chinook	90%	92.0%	87.6-96.5%	
Egg-take	Fall Chinook	118,000	--	--	
	Sum. Chinook	2,250,000	3,284,501	2,555K-3,727K	
Green Egg-to-Fry Survival	Fall Chinook	90%	90.4%	One year data	
	Sum. Chinook	90%	88.9%	84.0-93.6%	2
Fry-to-Smolt Survival	Fall Chinook	90%	91.7%	One year data	3
	Sum. Chinook	90%	91.7%	77.7-96.9%	
Fish Releases	Fall Chinook	--	--	--	
	Sum. Chinook 1+	320,000	452,667'	385K-602K	2
	Sum. Chinook 0+	484,000	1,404,567		
Transfers to Co-ops (Eggs/Fish)	Fall Chinook	100,000	--	--	
	Sum. Chinook	2,000	--		
Other Transfers (Eggs/Fish)	Fall Chinook	0	--	--	
	Sum. Chinook	1,300,000[2]	--		
Adults Passed Upstream	Fall Chinook	0	0	0	
	Sum. Chinook	0	0	0	
Percent Survival	Fall Chinook	No data since no release			
	Sum. Chinook (0 age)	1%	0.06%	0.02-0.15%	1
	Sum. Chinook (yrl)	1%	0.25%	0.13-0.48%	1

NA=Not applicable.
1 Four years of release data.
2 Methow and Similkameen programs, part of the Rock Island Hatchery Complex.

Objective 2

Measures	Species	Hatchery Goal	5-Year Average	Range	Constraints
Release smolts	Fall Chinook	Yes	--	--	
CV<10%	Sum. Chinook	Yes	11.1%[3]	9.8-12.5%[3]	3,4
Acclimation	Fall Chinook	No	--	--	
	Sum. Chinook	Yes	Yes	--	
Volitional Release	Fall Chinook	No	No	--	
	Sum. Chinook	No	No	--	

Objective 3

Measures	Species	Hatchery Goal	5-Year Average	Range	Constraints
Collect Adults	Fall Chinook	Yes	Yes	--	
Throughout Run	Sum. Chinook	Yes	Yes	--	
Spawning Pop.	Fall Chinook	Yes	174	O-383	1
>500	Sum. Chinook	Yes	1,220	1,000-1,642	
Spawning Ratio	Fall Chinook	1:3[4]	0.75:1	0.75:1	
Male:Female	Sum. Chinook	1:1	0.76:1	0.65:1 - 1:1	

Objective 4

Measures	Species	Hatchery Goal	5-Year Averaee	Range	Constraints
Adhere to	Fall Chinook	Yes	Yes	--	
Disease Policy	Sum. Chinook	Yes	Yes	--	

[3] Two years of data.
[4] Spawning guidelines require a 1 :1 male to female spawning ratio if less than 1 million eggs are spawned in a single day.

Objective 5

Measures	Species	Hatchery Goal	5-Year Average	Ranae	Constraints
TSS Effluent	All	5 mg/l	NA	NA	5
TSS Max Effluent	All	15 mg/l	NA	NA	5
SS Effluent	All	0.1 ml/l	NA	NA	5
TSS PA Effluent	All	100 mg/l	NA	NA	5
SS PA Effluent	All	1.0 ml/l	NA	NA	5
Downstream Temp	All	Varies	NA	NA	
Downstream DO	All	Varies	NA	NA	
Continuous Monitoring of Other Parameters	All	Yes	NA	NA	

Objec tive 6

Measures	Species	Hatchery Goal	5-Year Average	Range	Constraints
Check Hatchery Records for Accuracy and Completeness	All	Yes	No	--	6
Develop and Review Comp. Basin-Wide Production Elan	All	Yes	No	--	7
Develop and Review Future Brood Doc.	All	Yes	Yes	--	6
Develop and Review Current Brood Doc.	All	Yes	Yes	--	6

Constraints/Comments- Wells Hatchery

1. Poor fish survival caused by a number of factors including dam passage problems, water flow Constraints which delay migrations, high river water temperatures, or high levels of predation in the reservoirs.

2. Egg survival may decrease due to softshell disease problems.

3. Because of inadequate amounts of well water, it is occasionally necessary to re-use the rearing water. This can increase the effective rearing densities and decrease survival. Inadequate number of ponds for yearling program has also resulted in an increased density index and increased incidence of bacterial kidney disease.

4. Ponding of progeny from different egg-takes can increase size variation.

5. Program administered by the Washington Department of Wildlife.

6. Insufficient funding to provide adequate support staff to review all hatchery records.

7. A comprehensive basin-wide production plan has not been completed at this time.