## Executive Summary

### Plan Overview

The U.S. Fish and Wildlife Service (Service) has recognized the need for a comprehensive hatchery planning process to assist in meeting the challenge of changes to hatchery management as required by the conservation status of most Pacific salmon and other anadromous and freshwater fish species. The development of plans, such as this one, will help to: 1) integrate Service objectives and priorities with those of co-managers, other agencies, and resource programs; 2) fulfill our obligations under the Endangered Species Act (ESA) and relevant fisheries conservation, mitigation, and management programs; 3) identify and define in specifics what hatchery reforms we are implementing to achieve our objectives; and 4) provide a foundation for future program and budget development and review. This plan recognizes and complies with all management plans and Biological Opinions affecting the Columbia River Basin in general, and the Entiat River Basin in particular.

### Hatchery Purpose

Entiat NFH was authorized by the Grand Coulee Fish Maintenance Project, April 3, 1937 and reauthorized by the Mitchell Act (52 Stat. 345), May 11, 1938 to compensate for fish losses caused by the construction of Grand Coulee Dam. Original production consisted of Chinook salmon trapped at Rock Island Dam, but since then has included several resident and anadromous salmonids. The hatchery is currently used for adult collection, egg incubation and rearing of spring Chinook salmon. It also provides juveniles and/or adults, for re-establishing spring Chinook runs in other Columbia River tributaries, as needed.

The following Hatchery Management Goals were adapted from the Mitchell Act, Endangered Species Act (ESA) Biological Opinions, U.S. v. Oregon agreements, and the Integrated Hatchery Operations Team – Operation Plans for Anadromous Fish Production Facilities in the Columbia River Basin, Volume III – Washington, Annual Report for 1995 (IHOT 1996).

### Hatchery Goals[1]

Goal 1: Produce fish species and numbers commensurate with those lost/affected by the construction of Grand Coulee Dam. Assure that hatchery operations support Columbia River Fish Management Plan (U.S. v. Oregon) production and harvest objectives.

Goal 2: Minimize impacts to ESA listed and other native species, their habitat, and the environment.

Goal 3: Provide the public with quality aquatic interpretation and education, customer service and comprehensive outreach to enhance public understanding, participation and support of Service and Entiat NFH programs.

[1] Objectives, tasks, and current practices to achieve goals are described in Chapter 3.

**Attachment___ . Entiat NFH Physical Description of Rearing and Incubation Spaces**

| Type | Length (feet) | Width (feet) | Depth (feet) | Volume ($ft^3$) | No. | Material | Condition |
|---|---|---|---|---|---|---|---|
| **Adult Ponds** | 120 | 16 | 5 | 9500 | 2 | Concrete | Good |
| **Raceways** | 80 | 8 | 2.5 | 1460[1] | 30[2] | Concrete | Fair |
| **Starter Tanks** | 16 | 14.25 | 3.2 | 2.1 | 88[1] | Fiberglass | Good |
| **Incubation Troughs** | 15 | 1.25 | 1.25 | 23.4 | 4 | Fiberglass | Good |
| **Stacked Incubators** | | | | | 18 | Plastic | Good |
| **Coho Incubation Troughs** | 7.5 | 1.33 | 1.33 | 13.25 | 5 | Fiberglass | Good |

[1]Rearing space
[2]Up to seven ponds per Bank are used for rearing due to water supply.

**Attachment ___ - Hatchery Facilities – Descriptions, Primary Use, etc.**

| Asset | Description |
|---|---|
| Residence – Quarters #1 | Constructed in 1940, (1030 $ft^2$); attached garage, concrete driveway. |
| Residence – Quarters #3 | Constructed in 1940, (1030 $ft^2$); attached garage, concrete driveway. |
| Residence – Quarters #4 | Constructed in 1940, (1030 $ft^2$); attached garage, concrete driveway. |
| Hatchery Building; Office; Shop; Garage | Constructed in 1940, Reinforced concrete; includes break room, visitor area, chemical storage, incubation Room, shop, and a two stall garage. Used for facilities maintenance and egg incubation |
| Valve House | Constructed in 1940; Currently used as storage, maintained due to historical significance. |
| River Intake Dam | Constructed in 1940; Includes two water control valves, pole building, 155 linear feet concrete strip spanning the Entiat River. |
| River Supply Line | 36” Concrete water pipe; used to delivery surface water to Screen Chamber Building. |
| Domestic Water Reservoir | 15,000 gallon concrete storage tank; used for domestic water supply for hatchery and residences. |
| Well #1 | Ground water well, averages 350 GPM, 75 feet deep. Water used for fish production. |
| Well #2 | Ground water well, averages 320 GPM, 91 feet deep. Water used for fish production. |
| Well #3 | Ground water well, averages 250 GPM, 87 feet deep. Water used for fish production. |
| Well #4 | Ground water well, averages 225 GPM, |

# CHAPTER 1 - INTRODUCTION/BACKGROUND

## Purpose and Need

The Bureau of Reclamation plans for the construction of Grand Coulee Dam provided for a fish culture station to be located on the Entiat River. A suitable site was located about seven miles above the town of Entiat on the Entiat River. The site was selected and jointly approved by the Bureau of Reclamation and the Fish and Wildlife Service. Approximately 34 acres was purchased from P.B. Packwood by the Bureau of Reclamation on April 30th, 1940 for the sum of $7,495. A natural spring located on the property, Limekiln Spring, was a significant factor in selecting this site.

The Entiat National Fish Hatchery (NFH) was authorized by the Grand Coulee Fish Maintenance Project, dated April 3rd, 1937 and reauthorized by the Mitchell Act (52 Stat. 345) dated May 11th, 1938. The hatchery land was purchased and the original hatchery was constructed by the Bureau of Reclamation in 1940. Construction costs including the land purchase was $249,350. The facility was placed in limited operation on August 1, 1941. Full custody and jurisdiction was transferred to the U.S. Fish and Wildlife Service in March of 1949.

The hatchery was “re-modeled” in 1979. The original Foster-Lucas rearing ponds were replaced by 8’x 80’ raceways, a new adult holding pond, a fish ladder, a screen chamber; aeration building; an emergency generator building and three ground water wells were also constructed.

Over the years the Entiat NFH production program has included a variety of fish species: Rainbow trout, Brook trout, Coho salmon, Sockeye salmon and Kokanee, Spring and Fall Chinook. Since 1981 Entiat NFH has focused exclusively on Spring Chinook. Native to the Entiat River system, Spring Chinook adapted well to the Entiat NFH environment, and the resulting program is progressing. In the past, hatchery programs were allowed to evolve based on perceived needs and the capabilities of the facility. Today’s hatchery programs are still dynamic and the origin of change is driven by public appeal, legislative mandates, judicial decrees, and ESA. The need to develop thoughtful planning processes based on sound policy and scientific information has never been greater.

The U.S. Fish and Wildlife Service (Service) has recognized the need for a comprehensive hatchery planning process to assist in meeting the challenge of changes to hatchery management required by the conservation status of most Pacific salmon and other anadromous and freshwater fish species. The development of plans, such as this one, will help to: 1) integrate Service objectives and priorities with those of co-managers, other agencies, and resource programs; 2) fulfill our obligations under the Endangered Species Act and relevant fisheries conservation, mitigation, and management programs; 3) identify and define in specifics what hatchery reforms we are implementing to achieve our objectives; and, 4) provide a foundation for future program and budget development and review.

The Service is committed to developing and maintaining a sound scientific and management practices for its programs. The Service has participated with State, Tribal

and Federal partners in reviewing and assessing hatchery operations as they evolve to become, more than ever, part of the solution to fisheries restoration and recovery goals. The Service has involved our cooperators in defining and evaluating our respective roles, and the Service continues to reach out to the general public, individual constituent groups, and local governments to explain our programs and initiatives. The Service has put in place a system of program evaluations that utilize principles of adaptive management to integrate new information and expectations. All this and more are embodied in development of this plan. The journey of developing these plans, the research, analysis, thought, and outreach, is as important as the product itself. The Service looks into this process to stabilize and strengthen Service fish production programs in fisheries restoration and recovery efforts of the Nation.

## Description of Planning Process

The planning process began in August of 2003 with establishment of the Entiat CHMP Team, the core group responsible for drafting and revising the CHMP as it moves towards its anticipated completion in June 2004. The Team is composed of Service staff directly involved with the hatchery program. Additional coordination was provided by members from the Regional CHMP Steering Committee. The Steering Committee, composed of Service representatives from the Pacific Region, provided oversight to the CHMP process. In addition, the Steering Committee developed the general format and time line for completing the CHMP process, reviewed drafts of the Entiat CHMP to ensure consistency with both the approved format and other CHMPs under development in Region 1, and ensured consistency with Regional and National goals of the Service's Fishery Program.

## Composition of Planning Team

The planning team was made up of Service representatives from the following offices:

Entiat National Fish Hatchery
6970 Fish Hatchery Dr.
Entiat, WA 98822
Bill Edwards, Plan Co-Lead

Leavenworth National Fish Hatchery Complex
12790 Fish Hatchery Rd.
Leavenworth, WA 98826
Julie Collins, Plan Co-Lead
Corky Broaddus (I&E)

Mid-Columbia River Fisheries Resource Office
12790 Fish Hatchery Rd.
Leavenworth, WA 98826
Brian Cates – Steering Committee Liaison
Dave Carie, Plan Co-Lead

Olympia Fish Health Center
3859 Martin Way E.

Suite 101
Olympia, WA 98506
Ray Brunson
Dr. Joy Evered

Regional Office - Fishery Resources
Eastside Federal Complex
911 NE 11th Ave.
Portland, OR 97232-4181
Rich Johnson Steering Committee Liaison

## Review and Update of Plan

Because the biological, sociological, economic, and political environment is constantly changing, the role and responsibilities of Entiat NFH can also be expected to change. It was the intent from the beginning that the CHMP would itself be dynamic to reflect that nature. Therefore, it was necessary to include a process for reviewing and updating the plan on a periodic basis. Review and updating will take place at least once every five years and will be the responsibility of the HET.

## Fisheries Program Mission, Goals, and Priorities

Our National Fish Hatcheries have authority for construction, operation, and maintenance that is contained in a variety of specific and general statutes. The remainder of the Fisheries Program is guided by a variety of general statutory mandates and authorities. Without the specific direction that would come from organic legislation, the Service has continually adjusted the priorities of the entire Fisheries Program, at the national level, to guide the Program and ensure that each Region within the Service is focusing their limited resources on the highest priorities of the Nation (Attachment 1: Map of U.S. Fish and Wildlife Service Pacific Region).

To provide long-term management direction for fishery resources, the Service in January 1985, issued its most complete description of priorities to date for the Fisheries Program in a document entitled, "Statement of Responsibilities & Roles" (U. S. Fish and Wildlife Service Fishery Resources Program, January 31st, 1985). In May 1994, to incorporate those priorities within an ecosystem approach, the Service combined the fisheries resources and aquatic priorities of the Fisheries, Ecological Services and Refuges Programs into a single document titled, "Action Plan for Fishery Resource and Aquatic Ecosystems". This document included a comprehensive ecosystem and watershed based conservation, restoration, and enhancement program. As the Fisheries Program further evolved to include a conservation perspective to the management of natural populations, a revision to the Fisheries Program priorities was announced in November 1997. The Director approved and announced the following six priorities for the Service's Fishery

**Program:**

- Recovery of listed and candidate aquatic species
- Restoration of inter-jurisdictional fisheries and aquatic ecosystems

- Management of inter-jurisdictional fisheries
- Fulfilling mitigation obligations
- Restoring depleted aquatic populations to preclude listing under the ESA
- Providing fish and wildlife management assistance to tribes and on Fish and Wildlife Service land

Across the Nation, the Fisheries Program continues to be guided by these priorities, but there is an ongoing effort that may revise these priorities. At the request of Congress and the Office of Management and Budget, the Service began development of a strategic plan for the National Fish Hatchery System in 2000. In 2001, the Service began preparation of a strategic plan for the entire Fisheries Program. The completed plan entitled "Conserving America's Fisheries" sets the new direction for the Fisheries Program and the role of National Fish Hatcheries in implementing program priorities.

## National Fish Hatchery System - National/Regional Overview and Statutory Mandates/Authorities

The Service's stewardship of the Nation's varied and valuable fishery resources dates from the appointment of Spencer Baird as Commissioner of Fish and Fisheries by President Ulysses S. Grant in 1871. That initial Federal involvement was in response to concern over the widespread decline in domestic food fish supplies. In 1872, Congress provided the first appropriation for the Fisheries Program when it funded the introduction of shad, salmon, whitefish, and other food fishes into waters to which they were best adapted. A little later that year, "The propriety was strongly urged, at the Boston meeting, of sending some experienced fish-culturist to the west coast for the purpose of securing a large amount of spawn of the California salmon." Mr. Livingston Stone traveled to California and established a hatching-works on the McCloud River. This was the first salmon breeding unit in the United States, the first hatchery to be established with federal funds, and the beginning of the National Fish Hatchery System.

During the early years of the hatchery program, most National Fish Hatcheries were established under general authorizations for fisheries development as specified in appropriation acts. Then in the 1930's a series of acts provided authorizations for hatchery development. This permitted the National Fish Hatchery System to expand on a planned basis.

The Service has a 130-year history of leading Federal fishery conservation efforts in the Pacific Northwest. During this time, our Federal fishery resource involvement and responsibilities have grown, diversified, and undergone several modifications in response to continually changing needs. The program shifts and expansions evolved to address the circumstances of each era. Today, the Service is taking a holistic approach to fishery conservation. Present activities focus on a broad array of scientific fishery management and conservation efforts.

A historical background into the establishment and operation of National Fish Hatcheries in Region 1 is provided in Attachment 2 (Note: Region 1 is the Pacific Region and includes Washington, Oregon, Idaho, California, Nevada, Hawaii and the Pacific

Territories). Since the establishment of the first salmon hatchery on the McCloud River, 67 hatcheries or fish facilities have been established in California, Idaho, Oregon, and Washington. Only 19 of those hatcheries, 2 fish facilities, and 1 technology center are in operation today. The remainder have either been closed or transferred to State or other Federal agencies.

The development of a broad range of statutory mandates and authorities under which the Service conducts its hatchery program along with numerous other fishery related activities conducted in cooperation with other Federal, State, Tribal, and private entities is documented in Attachment 3. Vested with significant legal responsibilities under State and international agreements, treaties and laws, the Service conducts an extensive conservation effort in order to help protect and restore native aquatic species and their habitats with the goal of preempting severe declines and potential listings under the Endangered Species Act (ESA).

The Region 1 Fisheries Program consists of four major program activities: National Fish Hatcheries, Fish Health Centers, the Abernathy Fish Technology Center, and Fishery Resource Offices/Fish and Wildlife Offices. Successful implementation of the Service's hatchery activities requires close coordination and cooperation with the other three Fisheries Program activities. The Abernathy Salmon Technology Center provides state-of-the-art applied research in several fields including development of new fish diets for salmonid and sturgeon culture, use of genetic identification in the recovery and restoration of native stocks, and development of new and improved techniques to increase the efficiency of fish culture and captive brood stock operations. Fish Health Centers participate in Investigational New Animal Drug registration; provide diagnostic and veterinarian services on wild fish stocks and hatchery-reared fish, and supply health certifications for the export of fish and fish eggs. Fishery Resource Offices/Fish and Wildlife Offices participate in a wide variety of activities including coast-wide stock assessment and evaluation, coded-wire tagging of hatchery indicator stocks for the U.S./Canada Treaty, evaluation of hatchery production, and assessment of new approaches to produce "wild type" fish at culture facilities. These offices also participate in a broad range of other activities including habitat assessment and restoration, non-indigenous species coordination, natural production studies, harvest assessment, fish passage coordination, and endangered species listing and recovery activities.

## Regional Fishery Goals and Priorities

The Pacific Region Fisheries Program is committed to focusing its priorities and resources toward the conservation, recovery, and restoration of native resident and inter-jurisdictional species. The Fisheries Program works with State, Federal, Tribal and other partners, as well as on Service, Tribal, and other Federal lands, to ensure that its actions purposefully contribute to these objectives. Regional priorities are as follows:

**Implementing Hatchery Reform —** National Fish Hatcheries are reforming hatchery practices to conform to associated scientific foundations and management evaluations of those efforts. National Fish Hatcheries in the Pacific Region produce and release fish as identified in approved Hatchery Genetic Managements Plans (HGMPs).

**Implementing Comprehensive Hatchery Management Plans —** Implementation of the

Comprehensive Hatchery Management Plan is a significant Regional priority. Comprehensive plans incorporate the rationale, authorities and supportive documentation for operation and management of National Fish Hatchery programs.

**Hatchery Evaluations —** Monitoring and evaluation of hatchery production programs are a critical component of effective hatchery operations. Completion of hatchery management plans will help to identify research needs and assure quality.

**Hatchery Evaluation Teams —** To enhance communication in the hatchery production and evaluation process, active participation in Hatchery Evaluation Teams by Service programs, resource agencies, and public partners is a Fisheries Program priority.

**Habitat Restoration and Technical Assistance to Other Regional Programs —** Provide technical assistance to other Regional programs on Service lands with Partners for Fish and Wildlife and other Service habitat restoration efforts is a priority of the Fisheries Program.

**Tribal and Federal Lands —** Provide support to Tribal Governments and Federal land management agencies for fish and wildlife resources on their lands has always been and continues to be a high priority.

**Fish Passage Improvement —** A high priority is given to identifying and correcting fish passage problems at National Fish Hatcheries and on non-Service lands.

**Endangered Species Act —**The Fisheries Program promotes and initiates actions that ensure all Fisheries Stations in the Pacific Region are in compliance with the Endangered Species Act.

**Compliance with Court Agreements and Other Legal Obligations —** The Fisheries Program complies with court agreements and other legal obligations, and enhancement efforts that contribute to the mitigation, conservation, restoration, and recovery of listed, candidate and imperiled fish species, both anadromous native fish and resident native fish, such as, bull trout, cutthroat trout, desert fishes, and others.

**Mitigation —** The Fisheries Program implements artificial production to comply with mitigation responsibilities consistent with Congressional mandates and funding.

**Restoration and Recovery of Native Fishes —** Restoration and recovery of native fishes is a Regional priority. Healthy stocks of native fish are indicators of clean water and healthy aquatic ecosystems. Healthy stocks of native fish also provide harvest opportunities for recreational, commercial, and tribal fishers.

**Ecosystem and Cross-program Approach —** The Fisheries Program continues to work with an ecosystem and cross-program approach using the collective expertise of our employees and Programs in coordinated fashion.

**Make Full Use of Computer and Database Technology —** It is an ongoing Regional priority to strengthen our staff capabilities and make full use of computer and database technology in order to increase program effectiveness and efficiency, and meet the needs of resource management agencies, tribes, and other Federal agencies.

**Outreach —** Educational and outreach opportunities are pursued to enhance public understanding and appreciation of program responsibilities, capabilities, and

accomplishments. Outreach activities are an integral component of the Fisheries Program.

## Legal and Policy Guidance

National Fish Hatchery programs in the Columbia River Basin are shaped by various policies, regulations, laws, agreements and legislative mandates. National Fish Hatchery managers and policy makers are constantly challenged with the complex task of implementing a comprehensive state-of-the-art hatchery program while complying with legal, regulatory, and legislative mandates which have different and sometimes conflicting purposes. For example, the Mitchell Act and subsequent amendments; the Endangered Species Act and subsequent Biological Opinions; Treaty of 1855 with Columbia River Tribes; U.S. v Oregon court order of 1969; and subsequent Columbia River Fish Management Plan all guide production in the Columbia River. Chapters 2, 3 and 4 further discuss legal justification and operational guidance for Entiat National Fish Hatchery.

# CHAPTER 2 - HATCHERY AND RESOURCE DESCRIPTIONS

## Hatchery Overview

Entiat NFH is located six miles west of the town of Entiat, WA. at river mile seven on the Entiat River, a tributary of the Columbia River. The hatchery consists of 34.4 acres of land in a narrow valley on the banks of the Entiat River. Low mountains adjacent to the facility are covered with scattered evergreens, brush and grasses. The soil is primarily alluvial material consisting of granite, limestone, mica schist and gravel. The elevation is at approximately 1000 ft; average precipitation is about 30 inches, primarily in the form of snow. The hatchery is accesses via paved county road which connects to state highway 97A. The hatchery is 25 miles from the nearest medical facility.

Currently Entiat NFH operates with a staff of three full time employees (FTEs). This includes the Hatchery Manager and two Hatchery Maintenance Technicians. The hatchery also provides support to the Leavenworth National Fish Hatchery Complex Information and Education Office, located at the Leavenworth NFH. Volunteers are utilized to assist with outreach activities and station operations.

## Hatchery Purpose

The Entiat National Fish Hatchery (NFH) was authorized by the Grand Coulee Fish Maintenance Project, dated April 3rd, 1937 and reauthorized by the Mitchell Act (52 Stat. 345) dated May 11, 1938. The hatchery land was purchased and the original hatchery was constructed by the Bureau of Reclamation in 1940. Construction costs including the land purchase was $249,305. The facility was placed in limited operation on August 1st, 1941. Full custody and jurisdiction was transferred to the U.S. Fish and Wildlife Service in March of 1949.

The hatchery was “re-modeled” in 1979. The original Foster-Lucas rearing ponds were replaced by 8’x 80’ raceways, a new adult holding pond, a fish ladder, a screen chamber; aeration building; an emergency generator building and three ground water wells were also constructed.

This reconstruction was performed primarily to re-focus fish cultural activities towards the rearing of Spring Chinook salmon, as mitigation for the construction of Grand Coulee Dam. The facility is now used for adult collection, spawning, incubation, and rearing of Spring Chinook salmon. The current program is to release 400,000 smolts on-site into the Entiat River.

## Facility and Site Descriptions

The hatchery has numerous buildings involved in fish production, three residences, adult holding ponds, thirty raceways, (see Attachment 6 for physical measurements of holding incubation and rearing units) six wells, a spring, a pollution abatement pond, a river intake structure, a walk in freezer, a generator building, a screen chamber, and an aeration building. Currently, there are no plans for new buildings; however, the hatchery needs to

construct a heavy equipment storage building; covers over raceways and holding ponds; and public restrooms. A description of hatchery buildings, their primary use, and improvements are listed in Attachment 5.

The physical layout of the hatchery is diagramed in Attachment 7 and an aerial photograph shows the hatchery in relation to the Entiat River in Attachment 8.

## Archeology / Cultural Resources

The Entiat Indians, who were closely related to and share a similar lifestyle with the Indian tribes of the Chelan and Wenatchee, occupied villages near the mouth of the Entiat and upriver in the vicinity of Ardenvoir, WA. A trail used by the Native Americans is reported to have been located on the east bank of the Entiat River (Carter 1985:1). The 1883 Government Land Office survey map recorded the trail and the river as the En-ti-at-qua (GLO 1883). Ethonographic villages reported to be associated with the Entiat area include a small summer settlement near the mouth of Byrd Canyon …a small summer village on the Entiat River several miles above the mouth, and ...a permanent village near the mouth of the Entiat River (Ray 1974). No known village sites are within the boundaries of the Entiat NFH.

## Watershed/Ecosystem Setting

**General Description**[1] - The Entiat River Basin is located in north-central Washington, in Chelan County. The river flows southeasterly from the Cascade Mountains and joins the Columbia River near the town of Entiat. The town of Entiat is about 20 miles north of Wenatchee, WA. The drainage is about 266,500 acres. Topography is extremely steep and dissected. Vegetation cover is primarily forest. Eight-four percent of the Basin is in public ownership, primarily the National Forest. In the lower valley, are 1300 acres of prime agriculture land is predominately used as orchards. There are two major tributary drainages within the Entiat Basin. These are the North Fork which joins the Entiat at river mile 33 and the Mad River which enters at river mile 10.5. The watershed is nearly 42 miles in length and varies in width from 5 to 14 miles. It is bounded to the north by the Chelan Mountains and to the south by the Entiat Mountains. The basins highest elevation is the summit of Mt. Fernow (9,249 ft.) and the lowest is about 700 feet at the mouth of the Entiat River.

**Geomorphology** – In the North Cascades deformation processes have produced complex structural features. Extensive folding and faulting has occurred. A normal fault follows the west side of the Entiat Mountains. These mountains and the Chelan Mountains have been uplifted. The Entiat Basin is apparently a depression between two uplifts, and possibly a downwarped valley. The upper Entiat River descends in as series of steps and basins formed by the quarrying effect of the glaciers. The glacier's greatest erosive force is exerted near its terminus, thus the largest basin lies between Silver Creek and Potato Creek, the furthest point of glaciation. The stream gradient drops from an average of 2.3 percent to less than 0.3 percent. Several glacial lakes are in the watershed; these include Ice lakes, Larch Lakes, Myrtle Lake, Choral Lake and Fern Lake.

1 Adapted from the Entiat Co-Operative River Basin Study, April 1979, USDA

**Geology** – The Entiat River Basin is composed primarily of metamorphic schist and gneiss, intrusive granodiorite, and quartz diorite. The Chelan and Entiat Ranges consist of ragged angular forms indicative of hard rocks. Some areas are traversed by more resistant dikes of rhyolite porphyry. Mt Maude and Seven Fingered Jack are massive quartz diorite formations. Major geologic formations include Swakane Gneiss, Chiwaukum Schist, and Mt. Stewart Grandorite. Most of the area is covered with volcanic ash and pumice which was deposited by Glacier Peak Volcano at varying intervals within the past 12,000 years.

**Climate –** In the Entiat River Basin the climate can be characterized by arid grassland at the lowest elevation to moist alpine at the highest. Mean precipitation ranges from 90 inches to 10 inches due to the rain-shadow effect of the Cascades. Most precipitation falls as snow, the average snowfall ranges from less than 50 inches in the lower basin to nearly 400 inches on the mountain peaks. Approximately 50% of the mean precipitation falls between October and January. The driest months are July and August. The average growing season ranges from 150 days.

**Historical Development** – Non-Indian settlement of the area began in the late 1800's. With settlement came livestock which grazed in the area freely. By 1900 numerous herds of sheep were present in the valley. At the height of grazing, it has been estimated that 1000 head of cattle and 400 horses grazed nearly year long between the town of Entiat and Stormy Creek. Fire has also had significant impacts within the basin. Significant fires have been recorded since the 1880's followed by a fire in 1910 which burned 2,560 acres. Most recently the Tyee Creek fire swept through the valley on its way to burn over 140,000 acres. These fire events were typically followed by periods of serious flooding due to unrestricted runoff from rainfall and/or above average snowpac followed by rapid runoff. Runoff in the basin on June 10$^{th}$, 1972 caused serious landslides and took four lives.

**Fish and Wildlife —** Listed and candidate species which may occur in the area of the hatchery are included in Attachment 9.

Significant runs of Chinook salmon, Coho salmon and Steelhead trout occurred in the Entiat River prior to 1898. The last historical Chinook run prior to 1940 occurred in 1904. Very few fish remained by 1925. Stream surveys conducted in the 1930's found the river almost devoid of salmon. Pacific lampreys are also present in the basin. Both Steelhead and Pacific lampreys have been and are important fisheries to the Yakama Nation. Steelhead provided sport fishing opportunities for decades until recent declines in the early 1990's.

Entiat River Steelhead populations are depressed and are listed as Threatened under the Endangered Species Act (ESA), August 11$^{th}$, 1997. This stock is part of the Upper Columbia River steelhead Ecologically Significant Unit (ESU). Historical abundance throughout the ESU has been estimated at > 5000. At the time of listing the population was at 1400.

Bull trout in the Columbia River basin were listed as Threatened in 1998. The Entiat River Sub basin Summary (WDFW 2000) described the current status and distribution of bull trout in the Entiat River. Bull trout have been observed in the river below Box Canyon and in the Mad River.

Naturally spawning stocks of Summer Chinook, Rainbow trout, and Cutthroat trout are also indigenous to Entiat River but their population sizes are limited and largely unknown. Small populations of native trout and introduced brook trout are found throughout the Entiat River basin.

The best anadromous spawning area in the Entiat occurs from the vicinity of Fox Creek (RM 27.7) downstream to the vicinity of Stormy Creek (RM 18.4), a distance of 9.3 river miles. The spawning gravel downstream of Fox Creek was severely silted during the flood in the spring of 1972. The tributary streams, Fox, Burns, McCree, Brennegan, and Preston Creeks deposit large amounts of debris into the Entiat River, degrading what was once suitable spawning habitat.

A variety of terrestrial wildlife inhabits the Basin, reflecting the diverse types of habitat. Chukar, grouse and various hawks are found in the arid grasslands and fields. Riparian and forest wildlife is typical of the eastern slopes of the Cascade Mountains. Large animals include badgers, black bears, coyotes and cougars. Mule deer are predominately the wild mammal of the Basin.

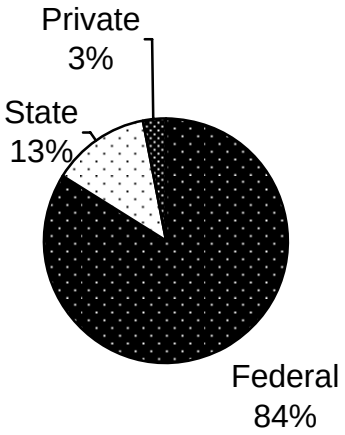
**Vegetation** - Listed and candidate species which may occur in the area of the hatchery are included in Attachment 9. Eighty seven percent of the Basin is comprised of forest land, 232,000 acres.

Presently, vegetation is approximately 90% Douglas fir, western hemlock and grand fir. Prior to European settlement, the forest of the Entiat River Basin contained either late-successional old growth or early-successional young growth. Currently, mid-successional stands dominate. Late- successional stands contain trees over 21 inches in diameter with multiple canopy layers. Mid-successional stands also contain trees with diameters over 21 inches but with a single canopy layer consisting of nine to 21 inch trees. Early-successional stands consist of trees from 0 to 9 inches. Circa 1850 was classified as follows: 6,700 acre non-forest, 40,700 acre early-successional, 12,485 acre mid-successional, and 83,556 acre late-successional. Current classification is: 9,887 acre non-forest, 34,118 acre early-successional, 67,628 acre mid-successional, and 31,816 acre late-successional.

**Habitat Condition** - Stream surveys, sub-basin assessments, and watershed analyses were used to evaluate factors limiting fish production in the Entiat River. All watershed assessments indicate that fish production in the Entiat River is primarily limited by habitat and water quality. Past riparian timber harvest, stream clean-outs, road building, and regeneration harvest within the rain on snow zone all have contributed to a decline in fish production. Many of these reaches were initially disturbed over one hundred years ago, habitat and water quality have recovered and in some cases are improving. Habitat problems noted in the sub basin plan are mainly related to timber harvesting practices which are now very limited. Throughout the sub basin there continues to be a need to restore riparian vegetation to reduce water temperatures and peak flows, reduce sediment delivery to streams, and ensure continuous recruitment of large woody debris into the system.

**Current and Future Development –**The Entiat River Sub basin is part of the Yakama Nation lands ceded to the United States in the Treaty of June 9, 1855. Within this area the tribe reserves the right to hunt and fish at all usual and accustomed places in common with

citizens of the territory. The upper portion of the basin is situated within the legislated boundary of the Wenatchee National Forest and federal ownership accounts for 127,682 acres (84%) of the watershed. Non-federal ownership includes Washington State Department of Natural Resources at 8,080 acres (3%), and private interests at 34,885 acres (13%).




The Entiat River drainage has traditionally been managed for timber production; however, under the Northwest Forest Plan, much of the drainage has been designated as late successional reserves, wilderness areas (wilderness areas pre-dated the Forest Plan), riparian reserves, or reserved through other means. In addition to WNF and DNR, there is limited amount of commercial timberland ownership the mid-valley. Urban development has been concentrated in Entiat, Washington which is located at RM 2 and Ardenvoir, WA (RM 11). There are individual dwellings throughout the first 22 miles of the river, with the majority located in the flood plain. In addition, a number of vacation cabins are situated throughout the valley. There is one moderately scaled industrial operation located in the city limits of Entiat. It is a small aluminum foundry. There is also a small scaled manufacturing plant that constructs wooden playground equipment.

## History of Hatchery

Grand Coulee Dam was one of the first dams constructed on the Columbia River (RM 597). Upon completion this impoundment blocked 1,140 miles of potential spawning and rearing habitat for anadromous salmonids. To compensate (mitigate) for this loss the Grand Coulee Fish Maintenance Project (GCFMP) was created. This project included the construction of three National fish hatcheries, Entiat, Leavenworth, and Winthrop.

To preserve the fish runs of salmon and steelhead trout, returning adults were trapped at Rock Island Dam (RM 453) and relocated to upstream tributaries and/or one of the three federal fish hatchery facilities. Initial goals of the GCFMP, was to maintain catch and escapement goals of approximately 79,700 Sockeye, 48,600 Chinook and 5,000 Steelhead in the Mid-Columbia. This was to be accomplished by enhancing returns of adults to the tributaries of the Columbia River between Rock Island and Grand Coulee Dam.

The Entiat National Fish Hatchery was authorized by the Grand Coulee Fish Maintenance Project on April 3rd, 1937 and re-authorized by the Mitchell Act (52 Stat. 345) on May 11th, 1938. It is important to note that funding for the Entiat NFH is provided through reimbursable funds from the Bureau of Reclamation (BOR) which began on October 1st, 1993.

Spring Chinook salmon (*Oncorhynchus tshawytscha*) and Steelhead trout (*O. mykiss*) were selected as the primary mitigation species. Spring Chinook salmon mitigation began in earnest in 1980.

In addition to the initial authorizations listed above, hatchery operations are authorized, sanctioned and influenced by the following treaties, judicial decisions and specific legislation:

Treaty with the Walla Walla, Cayuse, Umatilla Tribes, 06/09/1855;
Treaty with the Yakama, 06/09/1855;
Treaty with the Nez Perce, 06/11/1855;
Treaty with the Tribes of Middle Oregon, 06/25/1855;
Mitchell Act, 52 STAT. 345, 05/11/1938;
Mitchell Act (Amended), 60 STAT. 932, 08/08/1946;
U.S. v. Oregon (Sohappy v. Smith, "Belloni" decision:, Case 899), 07/08/1969;
Endangered Species Act of 1973, 87 STAT. 884, 12/28/1973;
Salmon and Steelhead Conservation and Enhancement Act, 94 STAT. 3299, 12/22/1980;
Pacific Salmon Treaty Act of 1985 (U.S./Canada Pacific Salmon Treaty), Public law 99-5, 16 U.S.C. 363, 03/15/1985.

**Production and Management** – Entiat National Fish Hatchery consists of 34.4 acres of land with an additional 0.8 acres of perpetual easements required for roads and access to the North end of the diversion (intake) dam. The hatchery is located on the Entiat River in a narrow valley approximately seven river miles from the confluence of the Entiat and Columbia rivers. The facility is reached by driving 18 miles north of Wenatchee, WA on Highway 97A then turning west onto the Entiat River Road and traveling six miles upriver.

Entiat NFH was authorized by the Grand Coulee Fish Maintenance Project on April 3rd, 1937 and re authorized by the Mitchell Act (52 Stat. 345) on May 11th, 1938. Construction of the original facility was initiated by the Bureau of Land Management in 1940.

Limited operation of the hatchery began on August 12th, 1941. Construction cost, including the original land purchase, was $249,305.11.

The original purpose of the hatchery was to mitigate the loss of salmon spawning grounds and rearing habitat resulting from the construction of Grand Coulee Dam. This mission continues today and is supported by the Service's Statement of Roles and Responsibilities which provide for "...mitigation of fishery resources impairment due to federal water-related development."

The responsibility of the hatchery, as stated in the Statement of Roles and Responsibilities, is to restore depleted Pacific Salmon stocks of national significance in accordance with statutory mandates.

Full custody, jurisdiction, and responsibility were transferred from the Bureau of Reclamation to the U.S. Fish & Wildlife Service in January of 1949. On March 15th, 1951, the Entiat NFH was transferred to the Branch of Fishery Biology to serve as a Salmon cultural laboratory headed by Roger E. Burrows. Feed trials, fish diversions, growth studies, and early salmon development tests were conducted. The hatchery returned to a production facility on March 1st, 1961. Rainbow trout and Chinook salmon became the primary production species.

The original Foster-Lucas rearing ponds were razed and replaced with 8' x 80' raceways in 1979. An adult pond/release pond, fish ladder, a screen chamber, water mixing chamber, spring cover with bird exclusion netting, and an emergency generator building have also been constructed within the last 20 years. Modifications to convert the adult holding pond from a single pond with a gravel bottom and sloped walls to two vertical walled ponds with concrete bottoms were completed in 1992.

Two additional ground water production wells have been installed and provide an additional 250 gallons per minute of pathogen (disease) free water for fish production. These wells began operation on December 6th, 1995.

This station works closely with the Mid-Columbia Fisheries Resource Office and the Olympia Fish Health Center striving to accomplish the goals of the U.S. Fish and Wildlife Service. Funding for these stations is from the Bureau of Reclamation via reimbursable funds. This funding responsibility was reestablished in 1994.

Spring Chinook salmon (*Oncorhynchus tshawytscha*) was identified as the primary mitigation species for the facility. Harvest of Chinook salmon from the Columbia River peaked at 2.3 million fish in 1883. Yield was about 1.3 million fish a year later through the period 1890-1920, followed by a steady decline to the present (Chapman et.al.1982). Spring Chinook reached their lowest counts from 1935 to 1942 (Dam construction) when the commercial catch in the lower river harvested 86% of the run. Following reductions in harvest and releases from the three GCFMP hatcheries returns increased at Rock Island dam. Naturally spawning adults remained stable from 1960 to 1987 (Mullan 1987). However a precipitous drop in naturally spawning adult returns in the early 1990s required that the Mid Columbia river stocks of Spring Chinook salmon be given protection under the Endangered Species Act along with summer steelhead trout and Bull Trout.

The Entiat NFH has released Spring Chinook that originated from commingled upriver stocks intercepted at Rock Island Dam in 1942 and 1944.

Annual reports dating from 1945-1974, indicate that the facility produced Summer Chinook, Spring Chinook, Sockeye, Coho, Rainbow and Steelhead trout either as smolts,

fry releases, catchable, and/or eyed egg transfers. Racks were installed across the river as a barrier to deflect returning adult salmonids into the facility. This practice of blocking the river began when water flows permitted work to be done in the river, typically late May early June. Racks were removed usually in November before ice became a problem.

On March 15th, 1951, the Entiat NFH was transferred to the Branch of Fishery Biology to serve as a salmon cultural laboratory headed by Roger E. Burrows. Both experimental and production operations were performed. Studies included feeding trials, pituitary, hydraulic, development, and incubation experiments.

In 1953 an electric weir was installed on an experimental basis across the Entiat River to block upstream migration and to ensure adult brood stock collection. The weir was designed similar to electric weirs used in the Great Lakes to control sea lampreys. It consisted of 50, 1.5" pipe electrodes, suspended vertically at 3 foot intervals at an angle across the river. A 1.5"pipe ground line was also installed 15 feet below the electrodes following the contour of the river and parallel to the electrode line. The weir was charged by 110 volt, 60 cycle alternating current. Steelhead, Dolly Varden and other trout were passed above the weir when captured in the holding pond. In 1954, due to the effectiveness of the electric weir at higher water flows some Spring Chinook were capture and spawned in August. Of the 903,410 Chinook eggs taken in 1954, 35% were derived from Spring Chinook. Sockeye eggs were also taken this year and subsequently shipped to Leavenworth NFH for further rearing. In 1954 the state of Washington negotiated an escapement of 50% for Chinook returning to the Entiat. In 1955 an estimated 200 adults reached spawning grounds above the facility. In 1956 escapement was believed to be over 1000 spring and summer Chinook. The goal at this time was to allow all returning spring Chinook to pass while retaining the summer run for artificial propagation.

On March 1st, 1961 the Entiat NFH was no longer a "Salmon Cultural Laboratory" and was returned to a production facility. The hatchery began to rear rainbow trout as well as Chinook salmon. Rainbow trout were distributed to areas on the Yakama Indian Reservation, Nason and Icicle Creeks, juvenile ponds in Cashmere, WA and the Entiat River. Planting areas expanded in 1963 to include areas on the Warm Springs Reservation, Peshastin Creek and Douglas creeks, and Lilly and Clear Lakes. Distributions of Cutthroat trout were also made. Annual reports do not specify whether or not the electric weir was in operation. Reports do state that the State of Washington was trapping Chinook at Rocky Reach Dam for the Chinook program at Turtle Rock. Releases of Coho salmon smolts began in 1965 and continued until 1970. It appears from the records that the eggs for the Coho program were shipped from Little White Salmon NFH. Records do not indicate why programs started and/or stopped. There were comments about significant trapping taking place at the newly constructed Rocky Reach Dam in the 60's.

In 1974, Spring Chinook salmon smolt production resumed with eggs from several locations; Cowlitz River (1974), Carson NFH (1975-1982), Little White Salmon NFH (1976, 1978, 1979, 1981), Leavenworth NFH (1979-1981, 1994) and Winthrop NFH (1988). Returning adults have voluntarily entered the fish trap at the facility and have

been the primary brood stock for the station in 1980, and from 1982 to 2002 (Cooper et. al. 2002).

The Columbia River Fish Management Plan under the U.S. V. Oregon decision of 1968 set fish production goal for the Entiat NFH. The initial Spring Chinook production goal was set at 800,000 smolts. However, subsequent fish health problems associated with using pathogen rich surface water prompted a renegotiation in 1991 to produce 400,000 yearling smolts and 400,000 spring released sub-yearlings. This number was determined based upon the availability of pathogen free ground water. Currently fish production is set at 400,000 yearling smolts; the sub-yearling program was discontinued, with the final release in May of 2000.

**Spring Chinook Production Summary (1983 - Present):** Prior to 1990, fish were raised to between 15 and 18 f/lb at release. Fish were also raised primarily on single pass surface water. A change in fish production began in 1990. Yearling fish production numbers were reduced to 400K and the release size increased to 13 f/lb. Pre and post 1990 fish production data was compared to try and evaluate changes in fish production. The results are significant (See Table 1). Post 1990 yearling smolts released were 33% larger; rearing densities were reduced by 37%; and, the rate of adult return tripled! The average return prior to 1990 was 606 adults, since 1990 the average has increased to 890 adults, a **47% increase!**

**Table 1:** Fish production comparison between pre 1990 and post 1990 fish production plans. Production plan changed in 1990 to rear fish on 100% ground water. Trend indicates an increase or decrease from pre 1990 fish program.

| | **Pre 1990** | **Post 1990** | **Trend** |
|---|---|---|---|
| **# Years** | 14 | 9 | n/a |
| **Avg. # Released** | 748,915 | 343,369 | - 54% |
| **Pounds of Fish** | 41,606 | 26,413 | - 36% |
| **Avg. # f/lb** | 18 | 13 | + 33% |
| **Total # Adults** | 8,479 | 8,894 | + 47.8[1] |
| **Avg. # Adults** | 606 | 889 | + 47% |
| **% Return** | 0.08 | 0.26 | + 225% |

**[1]Expanded total # adults to fourteen years for post 1990 returns.**

Beginning with brood year 2001, our size at release changed to between 18-20 FPP. These fish are released in the spring of 2003, jacks return in 2004, adults in 2005 and 2006. Brood 2002 is the second brood incubated on chilled water. Fish are on feed the first week in March. Fish are held in six raceways until mid-July and all fish are ad-clipped and 200K coded wire tags.

Adults return to the Columbia River in early April and begin to arrive at the facility as early as the first week in May. Adults are passively captured on station via a fish ladder and trap. Adults are held on station until they are ready to spawn in late August.

Water is mechanically chilled from $50^0$ F to an incubation temperature of $40^0$F. Hatching is completed by the end of December of each year. Fry are “ponded” directly outside into 8’x 80’ raceways the first week in March. Brood year 2001 was the first brood incubated

on chilled water. This program change occurred for several reasons. The service was contacted by the Yakama Nation for help their Mid-Columbia Coho Salmon Reintroduction Plan. The Yakama Nation needed a site to hold captured brood stock and a place to spawn and "eye-up" eggs. In order to help with this request, the Spring Chinook program had to be modified by slowing annual growth so that ponds normally used by Spring Chinook in the fall could be used to hold Coho salmon adults. The Chinook program was changed so that emergence would be delayed by three months. This is accomplished by chilling incubation water thereby slowing development.

Beginning with Coho brood year 2002, the adult holding ponds at the Entiat NFH are being used to hold adults. Adult Coho are trapped in the Wenatchee basin in September and are trucked to the Entiat NFH. Trapping can continue into December. Approximately 600 females are needed for a full program. Spawning takes place on site and eggs are trucked to Peshastin, WA or incubated at the Entiat NFH. Incubation at Entiat takes place in a modified shipping container, equipped with deep fiberglass troughs and a water chiller. Eggs are kept away from Spring Chinook for fish health reasons.

**Biological Risks and Ecological Interactions between Hatchery Spring Chinook salmon and ESA listed Summer Steelhead Trout in the Entiat River Basin**

All hatcheries must consider their potential for adversely affecting the aquatic community. To help assess potential impacts, the Service has developed several Biological Assessments (BA), and currently are in the "Phase II" portion of drafting Hatchery and Genetic Management Plans (HGMP) for fish hatcheries in the upper-Columbia River, including Entiat NFH. These management plans were drafted to assess our program and meet Endangered Species Act requirements identified by NOAA Fisheries and the Service. It is anticipated that the HGMP's will be updated regularly and re-submitted to NOAA Fisheries and the Service.

Whenever an aquatic species is ESA listed in the Columbia Basin, the Service must respond with an assessment of hatchery impacts on that species. In the upper-Columbia Basin, the initial BA (1994) covered potential hatchery impacts to listed Snake River sockeye and spring, summer, and fall Chinook salmon. Since this original BA, the Service has crafted BA's to cover listed upper-Columbia River summer steelhead (1997), listed and unlisted spring Chinook salmon (1999), and bull trout (1999). While these documents fulfilled the requirements under the ESA, they have recently been replaced with the HGMP's to better describe the programs and their potential impacts. These impacts include: water withdrawal and effluent discharge, broodstock collection, genetic introgression, juvenile fish releases, disease, competition, predation, residualism, and migration corridor and ocean impacts. NOAA Fisheries determination to date is that "the federal artificial propagation programs proposed for operation of funding by the USFWS and BPA in the UCR basin are not likely to jeopardize the continued existence of these listed ESU's or to destroy or adversely modify their habitat."

In addition to completing documentation to comply with our ESA responsibilities, we must also meet our mitigation responsibilities under the Mitchell Act as well as meet our Tribal Trust and U.S. v. Oregon obligations. In order to balance these sometimes conflicting mandates, we regularly meet with our co-managers to discuss operation and

management of the hatchery.

The following information was extracted primarily from our November 2002 Draft HGMP and summarizes biological risks and ecological interactions between hatchery (non-listed) spring Chinook salmon and wild (listed) summer steelhead, spring Chinook, and bull trout (USFWS 2002).

**Hatchery Water Withdrawals** - On July 18th, 1994, the U.S. Fish and Wildlife Service filed an application for a change in the Entiat NFH's Surface Water Certificate No. 3058. The service requested to change the point of diversion authorization under Certificate No. 3058 to six wells in continuity with the Entiat River.

The following water rights were acquired for the Entiat NFH **prior to Feb. 21, 1996**:

| **Certificate Number** | **Source** | **Priority Date** | **Amount** |
|---|---|---|---|
| **3058** | Entiat River | June 4, 1943 | 22.5 cfs<br>10098 GPM |
| **3059** | Limekiln Spring (a.k.a. Packwood Spring) | June 4, 1943 | 7.0 cfs<br>3142 GPM |
| Ground Water **4584-A** | Well #1 | August 25, 1960 | 800 AF/Yr<br>800 GPM<br>496 gpm[1] |
| Ground Water **G4-25874C** | Wells #2,#3 & #4 | April 19, 1978 | 699 AF/YR<br>1300GPM<br>433 GPM[1] |
| Ground Water | Wells #5 & #6 | See below | |

**CFS - Cubic feet per Second**

GPM - Gallons per Minute
[1] Continuous pumping rate

The Entiat NFH requested that all six production wells and the diversion of water from the Entiat River be within the scope of Certificate No. 3058 provided suitable measuring devices be installed and monitored on all diversionary sources. On February 21, 1996, the above request was approved by the State of Washington, Dept. of Ecology. The quantity of water under this change is for 22.5 cfs from six wells and the Entiat River for the purpose of fish propagation.

The following represents current water use rights for the ENFH.

| Certificate Number | Source | Priority Date | Amount |
|---|---|---|---|
| Surface & Ground Water **3058** | Entiat River and/or Wells #1 - #6 | June 4, 1943; Amended Feb. 21, 1996 | 22.5 cfs 10098 GPM |
| **3059** | Limekiln Spring (a.k.a. Packwood Spring) | June 4, 1943 | 7.0 cfs 3142 GPM |

As stated above, the fish production program at the Entiat NFH was changed in 1990. Fish were raised primarily on ground water throughout their rearing cycle. Surface water is used only for emergencies and for pre release acclimation. Ground water sources include six wells and a spring. The volume of water from these sites varies throughout the year due to weather and/or mechanical down time. The amount of water that is available is the limiting factor to fish production. Water is re-used via gravity flow between four banks of rearing units. The following graph depicts an annual average of available water for the past four years. The ability to accurately gage water flows has only recently been implemented.

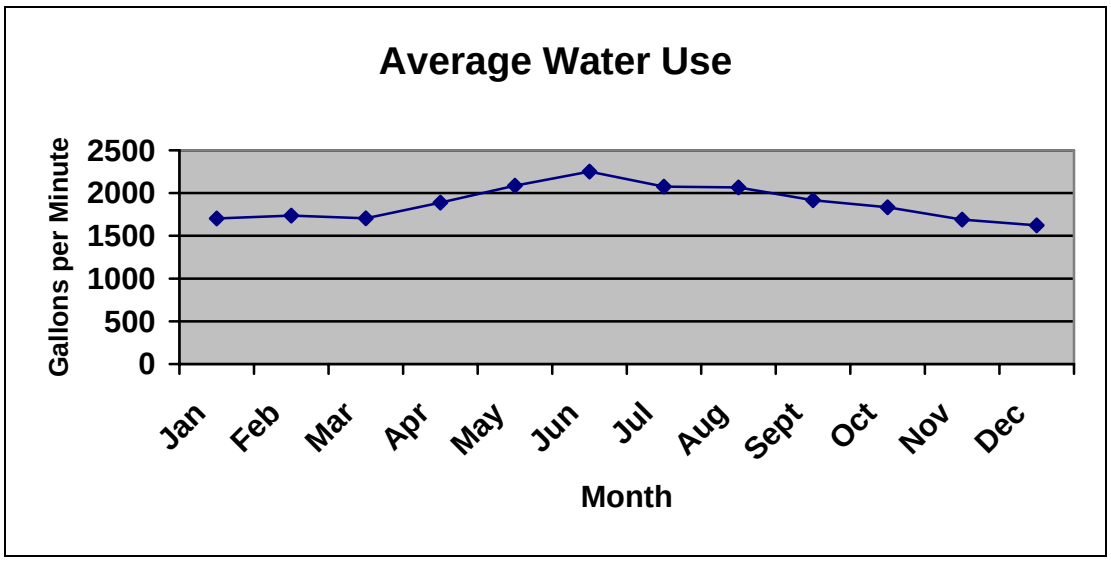



**Figure 1: Average ground water use for fish production (2000-2003). Annual amounts range from 1622 GPM to 2251 GPM. Flows are typically the lowest in the winter and peak during the end of spring. Fish production reaches its peak at release (April) when flows are beginning to increase.**

The surface water intake is located approximately 750m above the hatchery's effluent. The intake structure was built during the station's original construction in 1940. There is no screening at the point of diversion which leads into a 36" pipeline. The diverted wateer is screened 1000 feet later over inclined screens that do meet NOAA Fisheries screening requirements. The screened matter is returned to the river. Surface water is used just prior

to release for acclimation and during brood stock collection.

**Brood Stock Collection –** Returning adult Spring Chinook salmon begin to appear as early as the first week in May of every year. Surface water combined with groundwater is fed through the adult holding ponds to provide the necessary attraction and to operate the fish ladder. Adults enter the facility voluntarily via the fish ladder directly from the Entiat River. Adults enter a V-trap which has a one way swing gate that traps the fish in the holding ponds. This station has the capacity to hold 2000 Spring Chinook adults. This number is limited to available ground water in July and August. Only 300 adults of equal gender are needed for the current program. There is no barrier in the river that prohibits adults from passing by the facility. This allows for naturally spawning adults to return to their natal spawning grounds. Beginning with return year 2004, all returning hatchery adults will be ad-clipped. Any Spring Chinook adults with adipose fins will be returned to the river as well as any other non hatchery produced fish.

**Genetic Introgression -** Coded-wire tag recoveries indicate that returning adults of LNFH origin have a high fidelity to Icicle Creek. Few adults are recovered outside of Icicle Creek. Therefore, genetic introgression of spring Chinook released from Leavenworth NFH with other spring Chinook stocks is not considered a significant problem. The Service is currently marking 100% of the juveniles released from Leavenworth NFH to better quantify the degree of straying (potential genetic introgression) of our returning adults.

**Hatchery Production -** Entiat NFH Spring Chinook releases are small in magnitude relative to other Columbia River Spring Chinook production programs. Entiat NFH releases have been reduced from a previous program level of 800 thousand smolts to the current 400 thousand smolts. Production decreases are due to density dependent effects, virulent pathogen present in surface water and other potential ecological effects on other natural stocks.

Also, beginning with release year 2002, fish are being release at a smaller size for reasons similar to those stated above. Beginning with Brood year 1999, released in 2001, 60 thousand fish carried Passive Integrated transponders (Pit Tags). These tags will help determine downstream migration of released smolts as well as possible adult return time. Previous releases were made prior to 2001 with small numbers of tagged fish. The Service will continue to evaluate our release strategies and production numbers to minimize any negative effect upon the aquatic community, especially on listed species.

**Disease —** Hatchery programs are routinely monitored to prevent and subsequently treat fish in response to disease outbreaks that occur. Most pathogens now enter hatcheries through returning adult fish, surface water supplies, and other mechanisms involving direct contact with naturally spawning fish. Crowding and stress decrease the physiological resistance of salmonid fishes to disease and increase the likelihood of infection (Salonius and Iwama 1993; Schreck et al. 1993). Consequently, concern exists that the release of hatchery fish may increase the risk of disease in naturally spawning populations. Fish managers largely understand the kinds, abundance and virulence (epidemiology) of pathogens and parasites in hatchery fish. Recent studies suggest that the incidence of some pathogens in naturally spawning populations may be higher than in hatchery populations (Elliot and Pascho 1994). Indeed, the incidence of high ELISA titers

for *Renibacterium salmoninarum*, the causative agent of Bacterial Kidney Disease (BKD), appears, in general, to be significantly more prevalent among wild smolts of spring/summer Chinook salmon than hatchery smolts (Congleton et al. 1995; Elliot et al. 1997). For example, 95% versus 68% of wild and hatchery smolts, respectively, at Lower Granite Dam in 1995 had detectable levels of *R. salmoninarum* (Congleton et al. 1995). Although pathogens may cause significant post-release mortality among hatchery fish, there is little evidence that hatchery origin fish routinely infect naturally produced salmon and steelhead in the Pacific Northwest (Enhancement Planning Team 1986; Steward and Bjornn 1990). Many biologists believe disease-related losses often go undetected, and that the impact of disease on naturally spawning populations may be underestimated (Goede 1986; Steward and Bjornn 1990). Nevertheless, the Service is unaware of any studies or scientific literature that show hatchery fish infecting a naturally spawning population of salmon or steelhead in the Pacific Northwest, however more research is needed.

Entiat NFH follows Integrated Hatchery Operations Team (IHOT 1995) and Pacific Northwest Fish Health Protection Committee protocols for disease sampling and treatment. The Olympia Fish Health Center is located in Olympia, WA. Fish health sampling, diagnosis, and treatment are performed monthly and are available as fish health issues arise. Chapter 3 provides more detail on Fish Health practices. The fish health goal for Entiat NFH is to release healthy fish that are physiologically ready to migrate. Entiat Spring Chinook are released directly into the Entiat River at the hatchery site and navigate eight Columbia River dams en route to the ocean. Entiat NFH Spring Chinook have an increased potential for suffering from disease due to impacts and stresses of collection for transport and/or diversion through multiple bypass systems. Disease transmission is believed to be triggered by increased population density and unusual changes in environment such as would occur at transport collection facilities and juvenile bypass systems.

Our general conclusion at this time is that the Entiat NFH is, as are all federal hatcheries in the Columbia River Basin, currently taking extensive measures to control disease and the release of diseased fish. As a consequence, infection of natural fish by hatchery fish is being minimized. Based on the relative prevalence of BKD among hatchery and wild Chinook salmon (Elliot et al. 1997; Congleton et al. 1995), the crowding and handling of fish at transportation dams at the time of barging or bypass may have a greater likelihood of increasing the incidence of disease among naturally produced fish than direct infection from hatchery fish.

**Competition -** The impacts from competition are assumed to be greatest in the spawning and nursery areas at points of highest density (release areas) and diminish as hatchery smolts disperse (USFWS 1994). Salmon and steelhead smolts actively feed during their downstream migration (Becker 1973; Muir and Emmett 1988; Sager and Glova 1988). Competition in reservoirs could occur where food supplies are inadequate for migrating salmon and steelhead. However, the degree to which smolt performance and survival are affected by insufficient food supplies is unknown (Muir et. al. 1994). On the other hand, the available data are more consistent with the alternative hypothesis that hatchery-produced smolts are at a competitive disadvantage relative to naturally produced fish in tributaries and free-flowing main stem sections (Steward and Bjornn 1990). Although

limited information exists, available data reveal no significant relationship between level of crowding and condition of fish at main stem dams. Consequently, survival of natural smolts during passage at main stem dams does not appear to be affected directly by the number (or density) of hatchery smolts passing through the system at present population levels. While smolts may be delayed at main stem dams, the general consensus is that smolts do not normally compete for space when swimming through the bypass facilities (Enhancement Planning Team 1986). The main factor causing mortality during bypass appears to be confinement and handling in the bypass facilities, not the number of fish being bypassed.

Juvenile salmon and steelhead, of both natural and hatchery origin, rear for varying lengths of time in the Columbia River estuary and pre-estuary before moving out to sea. The intensity and magnitude of competition in the area depends on location and duration of estuarine residence for the various species of fish. Research suggests, for some species, a negative correlation between size of fish and residence time in the estuary (Simenstad et. al. 1982).

While competition may occur between natural and hatchery juvenile salmonids in, or immediately above the Columbia River estuary, few studies have been conducted to evaluate the extent of this potential problem (Dawley et. al. 1986). The general conclusion is that competition may occur between natural and hatchery salmonid juveniles in the Columbia River estuary, particularly in years when ocean productivity is low. Competition may affect survival and growth of juveniles and thus affect subsequent abundance of returning adults. However, these are postulated effects that have not been quantified or well documented.

The release of hatchery smolts that are physiologically ready to migrate is expected to minimize competitive interactions as they should quickly migrate from the release site. Entiat NFH Spring Chinook are released into the Entiat River at the hatchery site and migrate quickly into the main stem Columbia River migration corridor en route to the ocean based on juvenile out-migrant trapping and PIT tag monitoring at McNary Dam (see Chapter 3), reducing potential competitive interactions within the Entiat River basin.

**Predation -** The Service presented information that salmonid predators are generally thought to prey on fish approximately one-third or less their size (USFWS 1994). Depending on species and population, hatchery smolts are often released at a size that is greater than their naturally-produced counterparts. In addition, for species that typically smolt at one year of age or older (e.g. Steelhead and Spring Chinook salmon), hatchery-origin smolts may displace younger year classes of naturally-produced fish from their territorial feeding areas. Both factors could lead to predation by hatchery fish on naturally produced fish, but these effects have not been extensively documented, nor are the effects consistent (Steward and Bjornn 1990). A primary concern is the potential impact of predation by residualized hatchery steelhead on naturally-spawning populations.

In general, the extent to which salmon and steelhead smolts of hatchery origin prey on fry from naturally reproducing populations is not known, particularly in the Columbia River basin. The available information, while limited, is consistent with the hypothesis that predation by hatchery-origin fish is, most likely, not a major source of mortality to naturally reproducing populations, at least in freshwater environments of the Columbia

River basin (Enhancement Planning Team 1986). However, virtually no information exists regarding the potential for such interactions in the marine environment.

There is little potential for Entiat Spring Chinook to prey on natural steelhead fry or parr in the Entiat River. Based on time of spawning, steelhead fry would be emerging from the gravel after Entiat Chinook had exited the river. In addition, much of the spawning and early rearing stage (egg to parr) production areas for natural populations of Entiat River steelhead are in the tributaries and upper basin areas above the Entiat NFH. However, the life history rearing stage for steelhead, age-1 parr to age-2 smolt, does occur below the hatchery with the parr moving into the area as smolts vacate the area during their annual migration which peaks from May 10-15 (Dan Rawding, WDFW, personal communication). Mr. Rawding indicated that age-1 parr typically range in size from 80-100mm and age-2 smolts from 140-200mm so neither life history stage would be at a size susceptible to Entiat Spring Chinook predation. Available data indicate that Entiat Spring Chinook smolts exit the Entiat River very quickly and that potential negative impacts on listed steelhead within the basin are likely to be negligible.

Entiat Spring Chinook releases may contribute to indirect predation effects on listed stocks by attracting predators (birds, fish, pinnipeds) and/or by providing a large forage base to sustain predator populations. Releasing large numbers of hatchery fish may lead to a shift in the density or behavior of non-salmonid predators, thus increasing predation on naturally reproducing populations. Conversely, large numbers of hatchery fish may mask or buffer the presence of naturally produced fish, thus providing sufficient distraction to allow natural juveniles to escape (Park 1993). Prey densities at which consumption rates are highest, such as northern pikeminnow in the tailraces of main stem dams (Beamesderfer et. al. 1996; Isaak and Bjornn 1996), have the greatest potential for adversely affecting the viability of naturally reproducing populations, similar to the effects of mixed fisheries on hatchery and wild fish. However, hatchery fish may be substantially more susceptible to predation than naturally produced fish, particularly at the juvenile and smolt stages (Piggins and Mills 1985; Olla et. al. 1993).

Predation by birds and marine mammals (e.g. seals and sea lions) may also be significant source of mortality to juvenile salmonid fishes, but functional relationships between the abundance of smolts and rates of predation have not been demonstrated. Nevertheless, shorebirds, marine fish, and marine mammals (NMFS 1997) can be significant predators of hatchery fish immediately below dams and in estuaries (Bayer 1986; Ruggerone 1986; Beamish et al. 1992; Park 1993; Collis et al. 2001). Unfortunately, the degree to which adding large numbers of hatchery smolts affects predation on naturally produced fish in the Columbia River estuary and marine environments is unknown, although many of the caveats associated with predation by northern pikeminnow in freshwater are true also for marine predators in saltwater.

**Residualism -** Entiat Spring Chinook releases are not known to residualize in the Entiat River. Available out-migrant trap and PIT tag monitoring information indicate a rapid exit of Entiat Spring Chinook from the Entiat River (see Chapter 3 Monitoring and Evaluation discussion).

**Migration Corridor/Ocean –** The Columbia River hatchery production ceiling called for in the Proposed Recovery Plan for Snake River Salmon of approximately 197.4 million

fish (1994 release levels) has been incorporated by NOAA Fisheries into their recent hatchery biological opinions to address potential main stem corridor and ocean effects as well as other potential ecological effects from hatchery fish. Although hatchery releases occur throughout the year, approximately 80 percent occur from April to June (NMFS 1999a) and Columbia River out-migration occurs primarily from April through August. Entiat's Spring Chinook production is released in April at the beginning of the normal hatchery and natural stock out-migration season. The total number of hatchery fish released in the Columbia River basin has declined by about 26 percent since 1994 (NMFS 1999c) reducing potential ecological interactions throughout the basin.

Ocean rearing conditions are dynamic. Consequently, fish culture programs might cause density-dependent effects during years of low ocean productivity, especially in near shore areas affected by upwelling (Chapman and Witty 1993). To date, research has not demonstrated that hatchery and naturally produced salmonids compete directly in the ocean, or that the survival and return rates of naturally produced and hatchery origin fish are inversely related to the number of hatchery origin smolts entering the ocean (Enhancement Planning Team 1986). If competition occurs, it most likely occurs in near shore areas when (a) upwelling is suppressed due to warm ocean temperatures and/or (b) when the abundance or concentration of smolts entering the ocean is relatively high. However, we are only beginning to understand the food-chain effects of cyclic, warm ocean conditions in the northeastern part of the Pacific Ocean and associated impacts on salmon survival and productivity (Beamish 1995; Mantua et al. 1997). Consequently, the potential for competition effects in the ocean cannot be discounted (Emlen et. al. 1990).

Alternatively, the hatchery program may be filling an ecological niche in the freshwater and marine ecosystem. A large number of species are known to utilize juvenile and adult salmon as a nutrient and food base (Groot and Margolis 1991; and McNeil and Himsworth 1980). Pacific salmon carcasses are also important for nutrient input back to freshwater streams (Cederholm et. al. 1999). Reductions and extinctions of wild populations of salmon could reduce overall ecosystem productivity. Because of this, hatchery production has the potential for playing an important role in population dynamics of predator-prey relationships and community ecology. The Service speculates that these relationships may be particularly important (as either ecological risks or benefits) in years of low productivity and shifting climactic cycles.

**Harvest -** Biological Assessments are completed by the management agencies to ensure risks to listed species are not jeopardized (NMFS 1999c).

**Sea Run Cutthroat Trout -** Since there is likely a very small breeding population of sea run cutthroat trout in the Entiat River, program fish from the Entiat NFH could potentially encounter out-migrants of sea-run cutthroat in the Entiat and/or Columbia rivers. Time of out-migration of the sea-run cutthroat in the Columbia River may begin as early as March and peaks in mid-May (Trotter 1997) similar in time to the release of hatchery smolts. The size of the sea-run cutthroat trout smolts observed in other lower Columbia River tributaries, 100mm-260mm (USFWS Columbia River Fisheries Program Office, Vancouver, WA unpublished data), are similar to the size of the yearling hatchery smolts released from Entiat NFH. Instances of predation by hatchery smolts are thought to be low.

**Public Uses -** An annual Kid's Fishing Day Event and Open House began in 1989 in the hopes of increasing both hatchery visibility within the local community and use by visiting public**.** Also, an annual Open House event is held where visitors can view hatchery salmon spawning operations and Kid's can fish in Brock Memorial Pond or walk the Red Willow Nature Trail.

**Harvest Contribution -** Spring Chinook salmon from Entiat NFH have not, over the years, supported successful sport and tribal fisheries in the Columbia and Entiat rivers. Fisheries occur almost exclusively in the Lower Columbia with the majority of fish harvested in the freshwater sport fishery, followed by tribal treaty and Columbia River gill net fisheries (Refer to Chapter 3 for more discussion on harvest). Not until 1999 did the adult returns to the Entiat NFH exceed brood stock needs. Surplus adults were transferred to the Colville Confederated Tribes via the Bureau of Indian Affairs. Since 1999, there have been surplus fish available to the Native Americans.

**Economic Benefit -**When attempting to estimate the benefits of an anadromous fish hatchery, environmental conditions outside the hatchery are cyclic and beyond the control of hatchery administrators (e.g. ocean conditions). This environmental variability can subsequently affect post-release survival of juveniles and number of adult returns. During times of "good ocean and river conditions" that result in healthy adult returns, significant economic activity is generated through harvest of Entiat NFH Spring Chinook salmon.

In addition, the role of a Federal mitigation hatchery is to compensate for natural habitat lost to Federal hydro-projects. It follows then, that the economic benefit of the mitigation hatchery is interwoven into the economic benefit of the hydro-power project/s being mitigated for and that the hatchery can be characterized as an operating expense of the hydro-power project. The Service recognizes that mitigation hatcheries are extremely important in supporting economically important fisheries.

**Cultural Values -** The Yakama Nation shares the in-river harvest of spring Chinook salmon returning to Entiat NFH and is the primary beneficiary of surplus spring Chinook salmon which entered the hatchery holding ponds. However, since the Yakama Nation's needs are met by lower river fisheries, a platform fishery at the Leavenworth NFH, and surplus adults from the Leavenworth NFH, surplus adults from the Entiat NFH are generally transferred to members of the Colville Confederated Tribes. However, the Yakama Nation has received fish from Entiat NFH in the past. The cultural significance of these fish to the tribes can be characterized by the following quotations:

*"For the Yakama people salmon is seen as one of the gifts from the Creator. Since the beginning of time the Yakama people have relied upon salmon as well as the roots, berries, deer, elk and herbal medicines still important today. When the Yakama people were placed on this part of Mother Earth they were told by the Creator that He was going to give us some gifts. Those gifts came in the form of salmon and other natural resources.*

*He also instructed the Yakama people on how to care for the resources and warned that if any of the resources disappear, then we too as people, would disappear. That is why the Yakama people continually care for the salmon, the deer, the elk, the roots, the berries and the herbal medicines. We are also taught at a very young age that we are not here on Mother Earth to live and go away. Our Yakama elders tell us that we are only borrowing*

*the water, the salmon, the Yakama language and everything else as we are preparing for the up and coming generations, it's like remembering the future."* (Carol Craig; Yakama Nation Fisheries Resource Management; Public Information Officer; personal communication.)

*"Salmon was presented to me and my family through our religion as our brother, the same with the deer. And our sisters are the roots and berries. And you would treat them as such. Their life to you is just as important as another person would be."* (Margeret Saluskin; Yakama Nation; Columbia River Inter-Tribal Fish Commission Web-Page.)

Other tribes benefiting from surplus adults are the Colville Confederated Tribes, Spokane Tribe, Kalispel Tribe, and the Snoqualmie Tribe.

# CHAPTER 3 - HATCHERY AND RESOURCE MANAGEMENT

## Hatchery Goals, Objectives, and Tasks [1]

The following Hatchery Management Goals were adapted from the Mitchell Act, Endangered Species Act (ESA) Biological Opinions, U.S. v. Oregon agreements, and the Integrated Hatchery Operations Team - Operation Plans for Anadromous Fish Production Facilities in the Columbia River Basin Volume III - Washington, Annual Report for 1995 (IHOT 1996):

**Goal 1:** Conserve Columbia River spring Chinook salmon in the area upstream of Bonneville Dam (as defined in the Mitchell Act of 1937).

Objective 1: Successfully maintain a brood stock of spring Chinook salmon at Entiat NFH without the need for out-of-basin egg or fish transfers to the hatchery (achieve a minimum 0.1% smolt to adult return back to the hatchery)

Task 1: Implement measures to efficiently manage and conserve water use at the hatchery.

Task 2: Implement measures for brood stock management to maintain integrity and genetic diversity of Entiat hatchery stock, as identified in the HGMP.

Task 3: Implement management practices for incubation strategies and procedures at the hatchery.

Task 4: Implement management practices for hatchery rearing strategies.

Task 5: Implement management practices for release strategies at the hatchery.

Task 6: Maximize survival at all life stages using disease control and prevention techniques. Prevent introduction, spread or amplification of fish pathogens.

Objective 2: Conduct monitoring and evaluation to ensure goal #1 is achieved.

Task 1: Conduct hatchery evaluation studies to investigate alternative strategies to improve water management, brood stock management, incubation, rearing and release strategies. Support

[1]Tasks and current practices to achieve objectives are described in this chapter.

research on physiology, diet, fish health, and genetics, and other Columbia River projects.

Task 2: Bio-sample returning adults

Task 3: Hold Hatchery Evaluation Team meetings each spring and fall to review progress

Task 4: Complete a Station Development Plan (Engineering) to identify facility needs in addressing the needs of hatchery conservation goals (unfunded).

Task 5: Monitor health and disease status of fish, following the Service Fish Health Policy and Integrated Hatchery Operation Team (IHOT) Guidelines.

## Goal 2: Assure that hatchery operations support Columbia River Fish Management Plan

(U.S. v Oregon) production and harvest objectives

Objective 1: Collect sufficient brood stock to produce 0.4 million smolts for on-station release into the Entiat River.

Task 1: Collect between 300 to 350 brood stock, depending on pre-spawning mortality, fecundity and sex ratio

Task 2: Work with co-managers to manage adult fish returning in excess of brood stock need

Objective 2: Contribute to a meaningful harvest for sport, tribal and commercial fisheries from March through July of each year in the Columbia and Entiat Rivers (achieve a 10-year average of 0.5% smolt to adult survival, harvest plus escapement).

Task 1: Work with states and tribes to establish meaningful fisheries (through U.S. v. Oregon forums)

Task 2: Mass mark juvenile hatchery fish prior to release to enable state agencies to implement selective fisheries upon return of adults

Objective 3: Meet tribal trust responsibilities.

Task 1: Follow pertinent Laws, Agreements, Policies and Executive Orders on Consultation and Coordination with Native American Tribal Governments

Task 2: Hold an annual coordination meeting between the Service and Yakama Nation to identify and report on issues of interest and coordinate management

Objective 4: Communicate and coordinate effectively with co-managers in the Columbia River Basin.

Task 1: Participate in U.S. v Oregon Production Advisory Committee (PAC) and Technical Advisory Committee (TAC) meetings.

Task 2: Develop technical reports for PAC and TAC.

Task 3: Discuss management issues for Entiat NFH at an annual coordination meeting each February between the Service, WDFW, NOAA Fisheries, and Yakama Nation.

Task 4: Hold Hatchery Evaluation Team meetings each spring and fall to review progress

Objective 5: Conduct monitoring and evaluation to ensure goal #2 is achieved.

Task 1: Coded-Wire-Tag production lots of fish to represent unique rearing units

Task 2: Bio-sample returning adults

Task 3: Produce an annual report on stock assessment and contribution to fisheries

Task 4: Compare survival, life history, fisheries contribution, and fish health parameters at Entiat NFH to other National Fish Hatcheries producing spring Chinook salmon in the Columbia River.

Task 5: Determine natural production potential for spring Chinook salmon in the Entiat River (unfunded).

## Goal 3: Minimize impacts to listed (ESA) and other native species, their habitat, and the environment.

Objective 1: Minimize interactions with other fish populations by implementing state-of-the-art fish culture technology.

Task 1: Draft and implement actions identified in a Hatchery and Genetic Management Plan

Task 2: Release juvenile fish that are ready to migrate (smolts)

Task 3: Mass mark all production fish to identify them from naturally produced fish

Task 4: Support projects for restoration of ESA listed steelhead (threatened), Bull trout (listed) in the Entiat River (unfunded)

Task 5: Investigate the hatchery's role in recovery of ESA listed steelhead (threatened) and bull trout in the Entiat River (unfunded)

Task 6: Upgrade hatchery intake to meet NOAA Fisheries screening criteria for listed salmonids the Entiat River (unfunded)

Task 7: Manage hatchery ladder within acceptable impacts to listed and native fish

Task 8: Monitor interactions between hatchery and wild fish in the Entiat River (see Objective 2 below)

Objective 2: Conduct monitoring and evaluation to ensure goal #3 is achieved.

Task 1: Conduct environmental monitoring to ensure that hatchery operations comply with water quality standards and to assist in managing fish health

Task 2: Develop a study plan for in-stream evaluation of hatchery and wild fish interactions and reproductive success (unfunded)

Task 3: Develop a study plan to assess physiological status of juveniles prior to release (unfunded) and determine downstream migration rates (PIT tagging)

Task 4: Assess straying (rates and where) of hatchery fish from Entiat NFH (funds pending per HGMP development)

Task 5: Monitor health and disease status of fish, following the Service Fish Health Policy and IHOT guidelines

## Goal 4: Develop outreach to enhance public understanding, participation and support of Service and Entiat NFH programs.

Objective 1: Increase visibility of Entiat NFH.

Task 1: Coordinate with other federal, state, and local information/public affairs offices to incorporate information about Entiat NFH.

Task 2: Facilitate interagency cooperation with existing and new programs in the Mid-Columbia River Recreation Area.

Task 3: Continue to nurture the existing partnership relationship with the USFS, Entiat Ranger District, Chelan County Soil Conservation District, and the local area service club to promote outdoor education and recreational activities

Task 4: Interact with Regional Office, MCFRO, and Leavenworth NFHC Fisheries outreach coordinators and actively seek to integrate Mid Columbia River fisheries outreach activities with the Regional and National Outreach Strategies.

Task 5: Increase public use of the hatchery facilities by inviting special interest groups to tour the hatchery and to host non-profit fund raising event.

Objective 2: Provide information and education about the Service programs and Entiat NFH to internal and external audiences.

Task 1: Continue existing and develop new cooperative agreements and partnerships with public, private, and home school groups

Task 2: Maintain website for the Entiat NFH to inform cyber-visitors of the Entiat NFH programs, history and general information

Task 3: Ensure that hatchery staff is present weekends to give tours, answer questions, and disseminate general information

Task 4: Develop a strong working relationship with the local media (newspaper & radio) and provide regular news releases and articles regarding agency issues and station activities

Objective 3: Develop forums for public participation (or input) into Entiat NFH issues.

Task 1: Regularly participate in Entiat River Watershed Technical Advisory and Council meetings

Task 2: Hold an annual meeting with local conservation groups each spring to discuss Entiat NFH, Entiat River, and other issues of concern

Objective 4: Conduct monitoring and evaluation to ensure goal #4 is achieved.

Task 1: Evaluate use and/or exposure of program materials and exhibits as they help support goals of the Information and Education program

Task 2: Distribute teacher evaluations of our education programs to assure education goals are met

## Current Practices to Achieve Goals, Objectives, and Tasks

Water Use and Management: The following represents current water use rights for the ENFH.

| Certificate Number | Source | Priority Date | Amount |
|---|---|---|---|
| Surface & Ground Water 3058 | Entiat River and/or Wells #1 - #6 | June 4, 1943; Amended Feb. 21, 1996 | 22.5 CFS<br>10098 GPM |
| 3059 | Limekiln Spring (a.k.a. Packwood Spring) | June 4, 1943 | 7.0 CFS<br>3142 GPM |

The main water source for the fish production is groundwater, while the Entiat River is used as a secondary supply and for adult trapping. Domestic water is provided by Limekiln Springs. Water is supplied by gravity flow from the spring and by mechanical means from six wells. Rearing units are designed for serial re-use of water. Entiat NFH does not have a mechanical water reuse system. Water for fish production is re-used up to three times.

Limekiln Springs (also known as Packwood Springs) is located northwest of the hatchery building and is used for fish production and drinking water. This is a critical water supply due to the nature of its delivery to the facility. In the event of a catastrophic power loss, gravity fed water from Limekiln spring provides the minimum amount of water needed to protect fish production. This gives hatchery personnel time to remedy the power loss situation or switch to surface water.

Domestic water and water to the nursery do not share a common pipeline from the spring to the hatchery. Domestic water is pumped to a 10,000 gallon reservoir to create pressure for the domestic water supply.

Limekiln Spring flows year-round, although water volume fluctuates seasonally with the greatest flow in the winter and the lowest flow in late summer. The spring water remains clear, oxygen saturated, and between $44^{o}$ and $50^{o}$ F. The water is also relatively pathogen free, with the biggest concern coming from occasional ducks wintering on the pond. Netting and a wooden structure seems to have corrected this problem.

The Entiat NFH also has six production wells that deliver pathogen free water at a constant water temperature, $48\text{-}50^{o}$ F. The first well was built in 1961, followed by three more in 1979 and finally by two more in 1994. Wells need significant annual repairs such as redeveloping, rebuilt pumps and motors, and electrical repairs.

In contrast to Limekiln Spring and the production wells, the temperature of Entiat River water fluctuates from freezing in the winter to the upper-sixties during the late summer months, and has a tendency to become turbid at high flows. It is suspected of harboring a much higher organic and pathogen load than the groundwater sources due to the presence of adult spring Chinook from May to August, steelhead, other resident fish populations, and cattle present upriver. The Entiat River water is used as early as the first of May until mid to late July for brood stock collection. There are insufficient amounts of ground water to operate the fish ladder.

**Screening.—**The Entiat River intake structure is located approximately one-half mile upstream of the hatchery. The Entiat River intake itself is not in direct compliance with NOAA Fisheries fish screening criteria. However three 3/32" mesh incline screens are located in the screen chamber building where debris and downstream migrants are deflected back into the Entiat River. There are steel racks at the main river intake that deters large debris and spawned out adults from entering the hatchery's surface water pipeline. The racks are removed each winter and replaced each summer and require constant attention to ensure that the openings do not clog with leaves, trees, and small rocks. There are plans to permanently replace the intake structure and bring it into compliance with the ESA screening criteria.

**Conveyance System to Hatchery and Ponds.—**Entiat River water flows to the hatchery through a 36" pipeline and then to the screen chamber building where the water is screen then allowed to pre-settle suspended solids prior to entering the surface water supply line. The route of the water is determined by manipulating valves and canal gates.

The configuration of the water conveyance is such that it is possible to send first pass surface water to any of the four rearing units. Surface water can only enter the nursery if it enters the Aeration Building.

Ground water is delivered from the spring via gravity in a 14" pipe to a water treatment building called the Aeration Building. The other six ground water sources, wells, also enter this building via mechanical means, pumps. Well water is aerated through stack columns and venture nozzles to dissipate excess gasses. Wells are drilled from 75 to 125 feet in rocky to sandy areas. Sand causes premature wear to the moving parts.

**Effluent Treatment and Monitoring**.—Raceway cleaning effluent is sent to a pollution abatement pond via gravity flow where solids are passively settle out prior to discharge to the Entiat River. Raceways are typically cleaned twice a week by removing a stand pipe and drawing the pond down while brushing unwanted debris out of the pond. Cleaning effluent and total discharge (normal operation) effluent are monitored weekly for suspended and settle able solids. Environmental Protection Agency standards have never been exceeded for either cleaning effluent discharge or total discharge since monitoring began in the early 1980s. This is primarily due to the use of ground water. Even during high surface water flows and turbid conditions, settle able solids failed to exceed NPDES thresholds.

The twin holding ponds are used to hold returning adult Chinook and Coho Salmon from May until early December. If necessary the pond is vacuumed with a 4" trash pump to remove excess debris. From December to mid April, the ponds are used to hold spring Chinook yearlings prior to release. The ponds are cleaned at least bi-weekly using the

same vacuum method. This method allows for the debris to be removed via a 25hp lift pump to the pollution abatement pond. The equipment to perform this task is noisy and expensive. The commercial grade vacuum head costs over $400. We intend to design an electrical venturi type vacuum system in the near future.

## Brood Stock Management

The following performance measures have been established at the hatchery for spring Chinook salmon:

| Performance Measure | Hatchery Goal | 5-Year Average | Range |
|---|---|---|---|
| Spawning Population[1] | 350 | 350 | |
| Fish release (millions)[2] | 400K | | |
| Egg transfers (thousands)[2] | 0 | 0 | N/A |
| Fish transfers (thousands)[2] | 0 | 0 | N/A |
| Adults passed upstream[3] | 0 | Unknown | Unknown |
| Percent survival juvenile to adult[4] | 0.50 | | |
| Smolt size at release (fish/lb)[2] | 19 | 19 | 18-20 |

[1]females plus males (including jacks) spawned, five year average and range from calendar years 1997-2001

[2]five year average and range from calendar years 1998-2002
[3]volitional passage upstream and into hatchery
[4]includes all adult recoveries (fisheries plus hatchery), five year average and range from completed brood years 1992-1996

Entiat NFH is currently a single species facility rearing only Entiat (Carson) strain spring Chinook salmon. Brood stock collection at the hatchery is managed to maintain the genetic integrity of the stock. The Service ensures that adult brood stock is randomly collected for spawning across the run in proportion to the rate at which they return. To accomplish this, two adult holding ponds are utilized. The east pond (HP1) is designated as the “keep” pond and the west pond (HP2) is designated as the “excess” pond. Fish are trapped weekly into the “keep” pond at the historical rate of return for that week. For example, if records indicate that 10% of the total run returns the second week of May, then 10% of the number needed to meet the spawning goal is trapped that week. The “keep” pond is then closed and subsequently returning adults are trapped into the excess pond. This process is repeated throughout the run. Adjustments are made as the season progresses indicated by shifts in return rate.

Adult spring Chinook return to the hatchery from May through July. The ladder is kept open throughout the return, typically until the 1st of August. In the 2003 Biological Opinion NOAA Fisheries requests the USFWS maintain the Entiat NFH ladder and trapping facility open through the entire duration of the Carson-lineage spring Chinook

salmon adult return period to maximize removal of the fish from critical habitat for listed spring Chinook salmon.

The adult brood stock remains in the east holding pond (HP1) until removed for spawning. The first spawn date is usually scheduled for late-August and all spawning is usually completed by the second week in September. The holding ponds are supplied with ground water so the temperature remains at 49- 50°F. The volume of the pond is such that density is not a concern. However, pond loading is managed to meet or exceed one gallon of inflow per fish and a minimum 8 $ft^3$ per adult in HP1. Holding capacity for each holding pond is about 950 adults, 350 are needed for brood stock. The adults are injected with erythromycin 60 days prior to spawning and again 30 days prior to spawning to control bacterial kidney disease. The adults are also treated three times weekly with formalin to control external parasites.

Recently our first egg take occurs the last Saturday in August in conjunction with our annual Open House, followed by takes on Thursdays until 150 females are spawned. The adults are crowded with manually operated crowders. Partitions are set up in the holding pond to separate ripe females and males. Unripe fish are returned to the holding pond and held there until the following week. Ripe fish are killed with a club and are not bled prior to spawning.

**Surplus Adult Returns -** More fish enter the hatchery than are needed for brood stock. Brood stock excess to hatchery needs are transferred to the Bureau of Indian Affairs for distribution to either the Yakama Nation or the Colville Confederated Tribes for Ceremonial and Subsistence (C&S) use, other tribes for C&S use, or the Bureau of Federal Prisons for inmate rations. Surplus fish or spawned carcasses may also be available for stream enrichment. Adult spring Chinook held for brood stock must be treated (injected) with erythromycin to control bacterial kidney disease infection. Erythromycin has not been cleared for use on food fish by the Federal Drug Administration; therefore, carcasses previously injected with erythromycin cannot be used for human consumption and must be buried on site. Pre-spawn mortalities are unfit for human consumption and, in accordance with the Pacific Northwest Fish Health Protection Committee's draft Salmon and Steelhead Carcass Distribution Protocols, cannot be used for stream enrichment out-plants and must be buried on site as well.

**Spawning Protocol -** The goal mentioned earlier of maintaining the genetic integrity of the Entiat (Carson) strain by applying as much randomness to brood stock collection and selection as possible is continued through the spawning process. Fish are randomly selected and randomly mated as close to a 1:1 male/female spawning ratio as possible. It is nearly impossible to attain a strict 1:1 ratio, however, because the sex ratio of returning adults is typically skewed 60/40 in favor of the females. There are times when, simply by chance, insufficient numbers of males come across the spawning table to exactly match the desired 1:1 spawning ratio. The actual ratio attained is usually 1.0 male: 1.1 females (i.e. some males are used more than once). Jack size fish (age 3 males) are randomly included in the spawning population. Should an extraordinary number of jacks return, the number included in the spawning population will be limited to 5% of the total number of males used per our Regional genetics guidelines.

To achieve a spawning population of 300 fish, up to 350 spring Chinook brood stock are retained based on the following assumptions:

- 400,000 smolt release
- 15% green egg to smolt mortality
- 10-20% BKD cull
- 4000 green eggs per female
- 5% pre-spawn mortality
- 60:40; female to male return ratio

**Other Acceptable Stocks -** If brood stock numbers are insufficient to meet hatchery production objectives, the hatchery will rear fewer fish. In case of a natural or man-made disaster no provisions have been made to replenish the hatchery stock. Eggs from Leavenworth NFH have been transferred in the distant pass.

**Upstream Passage -** Since there is no barrier dam at the hatchery, fish are not prevented from passing upstream of the hatchery. Hatchery fish volitionally enter the hatchery, attracted by a mixture of Limekiln spring and ground water. Wild Steelhead can pass upstream of the hatchery. Very few Steelhead trout enter the facility, trapping operations for salmon are performed prior to the steelhead return.

**Special Concerns over Brood Stock Management -** Co-managers are involved in brood stock management decisions through participation in Hatchery Evaluation Team meetings, through direct contact with the Columbia River Fisheries Program Office, or through other regional forums.

## Incubation Strategies and Procedures

The eggs from each female are individually incubated in trays until the eyed stage at which time dead eggs are removed. Viable eggs are counted and returned into vertical stack incubators for hatching and larval development. All incubation takes place in 40-$50^0$ F ground water. Eggs from females with moderate to high levels of Bacterial Kidney Disease are discarded. Beginning with Brood year 2001, incubation temperatures were reduced to $40^0$ F to delay development and emergence until late February. This program change had to occur in order to hold Coho adults in our holding ponds. In the past, yearling Chinook needed the holding ponds for rearing space due to growth and because raceways were needed for the new brood. Chilling incubation water delays growth and the need for space so there is a brief window where the holding ponds can be used to hold Coho adults. All takes are incubated at variable temperature so that “ponding” can occur at the same time for all takes.

## Rearing Strategies

Fry are moved directly outside to the upper bank of 6 raceways for first feeding in early March. The remaining 12 raceways and two holding ponds contain yearling fish at this time. All fish are fed moist feed from BioOregon. Dry feeds have been tried in the past with anecdotal evidence that dry feeds amplify losses due to BKD. Fish are fed several times a day when first on feed to once a day when they reach fingerling size. We have to balance growth with limited space and water to ensure the best possible fish health.

In July, 100% of the fish receive adipose fin-clip and a portion receive a coded- wire tag., and a total count of the fish on hand is made. Marked fish are loaded directly into one of the 18 raceways where most will remain until release in April; the exception is fish from A-bank are moved to the holding ponds in December where they will remain until release in April. The number of fish per pond is: A-bank, six ponds at 29,000; B-bank, six ponds at 20,000; C-bank, six ponds at 18,000; and, holding ponds, two ponds at 87,000 each. Slight changes to these loadings may occur in the future given adult return results and fish health examinations. Fish from each bank of ponds and each holding pond are represented by unique tag codes.

Entiat NFH does not have enough water of adequate quality to supply each rearing unit with first pass water therefore water is reused. The current water management scheme is to provide first pass water to A-bank; B-bank receives water from A-bank (second pass); and C-bank receives water from B-bank (third pass). The holding ponds generally receive water from C-bank. When fish are not in A-bank first pass water is provided to B-bank and is then reused by lower banks. Pond loading considers water reuse; ponds on reuse water have lower pond densities.

Beginning with brood year 1997, rearing space has been managed so that density indices (the ratio of weight of fish to rearing unit volume and fish length) at no time exceed 0.15 In order to achieve the low indices, total production was reduced from 800 thousand to 400 thousand smolts. The results have been very encouraging. Erythromycin treatments to control BKD have been reduced and are administered on a brood by brood basis.

The raceways are brushed every other day from first “ponding” until the fish are “split” in July. Then raceways are then brushed once every three days until the fish are released. The adult pond is also vacuumed once every three days until release.

## Release Strategies

Smolts are released directly into the Entiat River at 19 fish per pound or smaller to minimize interaction with other fish populations. As discussed in Chapter 2, there are feral spring Chinook stocks in the Entiat River above the hatchery as well as listed a steelhead and Bull trout populations as defined by the Endangered Species Act. Releasing fish at 19 fish/pound or smaller helps ensure that the released fish are functional smolts which actively migrate through the Entiat River corridor, reducing competition with listed steelhead. Rearing the smolts almost exclusively on Limekiln Spring and ground water minimizes straying of adults, further reducing competition with native steelhead. All fish are marked and roughly 50% have coded wire tags at release.

Smolts are released around the 15$^{th}$ April to coincide with normal spring migration and spill at Rocky Reach Dam. It is likely that the fish are functional or near functional smolts at this time as evidenced by their rapid migration to detection at Rocky Reach Dam. Detecting PIT tagged fish at McNary Dam bypass facilities provide an indication of travel time for releases from Entiat NFH.

## Fish Health Management Program

The primary objective of fish health management programs at Service hatcheries is to produce healthy smolts that will contribute to the program goals of that particular stock.

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.

**Fish Health Policy -**The Olympia Fish Health Center (FHC) in Olympia, WA provides fish health care for Entiat NFH under the auspices of the published policy 713 FW in the Fish and Wildlife Service Manual (FWM). In addition to this policy, the 1994 annual report "Policies and Procedures for Columbia Basin Anadromous Salmonid Hatcheries", by the Integrated Hatchery Operations Team (IHOT 1995) provide further fish health guidelines as approved by northwestern state, federal, and tribal entities. The directives of these two documents more than meet the requirements of Washington's state and tribal fish health entities which follow the directives in the Co-Managers' Salmonid Disease Control Policy of 1998.

The documents mentioned above provide guidance for preventing or minimizing diseases within and outside of the hatchery. In general, movements of live fish into or out of the hatchery must be approved in the U.S. v Oregon Production Advisory Committee forum (Objective 6) and be noted on the State of Washington Brood Document for the hatchery. If a fish transfer or release is not on the Brood Document, permits from the Washington Department of Fish and Wildlife, the Service, and any other states through which the fish travel must be obtained and approved by co-managers. Fish health exam and certification must be done prior to any releases or transfers from the hatchery to minimize risks from possible disease transmittance.

**Fish Health Examinations -** Monthly examination: A pathologist from the FHC visits once per month to examine fish at the hatchery. From each stock and brood year of juveniles, fish are randomly sampled to ascertain general health. Based on pathological signs, age of fish, concerns of hatchery personnel, and the history of the facility, the examining pathologist determines the appropriate tests. This usually includes a necropsy with an external and internal exam of skin, gills, and internal organs. Kidneys (and other tissues, if necessary) will be checked for the common bacterial pathogens by culture and by a specific test for bacterial kidney disease (BKD). Blood is checked for signs of anemia or other infections, including viral anemia. Additional tests for virus or parasites are done if warranted. The pathologist will also examine fish which are moribund or freshly dead to ascertain potential disease problems in the stocks.

Diagnostic Examination: This is done on an as-needed basis as determined by the pathologist or requested by hatchery personnel. Moribund, freshly dead fish or fish with unusual signs or behavior are examined for disease using necropsy and appropriate diagnostic tests. A pathologist will normally check symptomatic fish during a monthly examination.

Ponding Examination: The first health exam of newly hatched fish occurs when approximately 50% of the animals are beyond the yolk sac stage and begin feeding. Sixty fish will be sampled and tested for virus.

Pre-release Examination: At two to four weeks prior to a release or transfer from the hatchery, 60 fish from the stock of concern are necropsied and tissues taken for testing of listed pathogens. The listed pathogens, defined in Service policy 713 FW (Fish and Wildlife Service Manual) include infectious hematopoietic necrosis virus (IHNV),

infectious pancreatic necrosis virus (IPNV), viral hemorrhagic septicemia virus (VHSV), *Renibacterium salmoninarum, Aeromonas salmonicida, Yersinia ruckeri,* and *Myxobolus cerebralis*.

Adult Certification Examination: At spawning, tissues from adult fish are collected to ascertain viral, bacterial, and parasite infections and to provide a brood health profile for the progeny. The FHC tests for all of the listed pathogens, except *Myxobolus cerebralis*, and including *Ceratomyxa shasta*. The minimum number of samples collected is defined by 713 FW. At Entiat NFH, all brood females are tested for *R. salmoninarum* (causative agent of BKD), with an identifying fish health number corresponding to each female's eggs so that selective culling and/or segregation is possible. This is done to reduce/control BKD, a vertically-transmitted disease. Progeny from females with high levels of BKD are culled (if not needed to make production goals) or segregated from progeny at lower risk. The FHC provides results from testing within four weeks to allow management decisions.

**Chemotherapeutant Use**.—Erythromycin injections for brood stock are critical to the control of bacterial kidney disease which is caused by a vertically transmitted bacterium (*Renibacterium salmoninarum*) that can reside in the ovarian and seminal fluids. In addition, erythromycin injections control the mortality and reduce horizontal transmission of BKD between adults in the brood pond. The injection schedule is set to maximize the number of adults injected, with a goal of two injections for the early arriving adults and one injection for the later arrivals. To reduce bacterial numbers in the reproductive fluids and to deposit the drug inside the ova, erythromycin must be injected at a dosage of 20 mg drug/kg of fish at 30 days prior to spawning. At Entiat NFH, the first injection is scheduled on about June 25$^{th}$ and the second injection on about July 25$^{th}$. All spring Chinook salmon adult females kept for brood stock will be injected. Injections were done under the INAD 6430 (Investigational New Animal Drug regulation) but now require a prescription from a veterinarian. The injected drug is Erythro-200 or Erythro-100 (200 mg/ml or 100 mg/ml, respectively, of active erythromycin base in PEG, ethl-actate and ethyl alcohol), to be injected in the dorsal sinus at 20 mg drug/kg of body weight.

Since 1998 (brood year 97 juveniles) prophylactic medicated feedings to control BKD in juveniles has been deemed unnecessary. The reduced levels of BKD in the juveniles is attributed to lowered densities ($\leq$ 0.25 density index and < 1.0 flow index) during rearing, regular cleaning and maintenance of individual equipment (nets, etc.) for each pond, erythromycin injection of the adults, culling/segregation of progeny from highly infected females. Should prophylactic feeding be necessary, as determined by the FHC, juveniles are to be fed at a daily dosage of 100 mg/kg of fish for a minimum of 14 days unless contraindicated by drug toxicity or needed feeding rate adjustments. The time and number of treatments will be dictated by circumstances. As of 2001, there is a temporary INAD 4333 that allows feeding of Aquamycin 100 (erythromycin thiocyanate in a wheat flour base) and prescription by a veterinarian is not required.

Formalin treatments on adults held for brood stock are used to control external pathogens three times per week prior to spawning.

Salmonid egg hardening and disinfection treatment with a polyvinylpyrrolidone iodine compound (approximately 1% iodine) is required by 713 FW Policy to minimize/prevent transmittance of viral and bacterial pathogens. The eggs shall be disinfected in 50 ppm iodine in water buffered by sodium bicarbonate (at 0.01%) for 30 minutes during the water-hardening process. Eggs received at the hatchery must be disinfected before they are allowed to come in contact with the station's water, rearing units or equipment. Specifics are provided in 713 FW Policy.

**Other Fish Health Precautions -** Unless knowledge regarding vertical transmittance of BKD proves otherwise, eggs from female brood stock with high levels of BKD (a cut-off point selected by the NFH and FHC managers based on results from the Enzyme-Linked Immunosorbent Assay or ELISA) will not be used in production unless egg production is low. If the number of brood females is low, progeny from highly infected females shall be segregated into rearing units apart from the rest of the production and absolute fastidiousness maintained as to using equipment that is disinfected and/or dedicated to these rearing units.

Returning spring Chinook salmon in the Entiat River upstream of the hatchery can serve as a reservoir of pathogens for the fish in the hatchery. Because of this, the standard practice is to rear juveniles on spring/ground water. Returning spring Chinook salmon have a relatively high incidence of infectious hematopoietic necrosis virus (IHNV), ranging from 41 to 88%. The risk from bacterial kidney disease in the juveniles is also enhanced, with evidence from this and other hatcheries that horizontal transmission occurs when infected adults are in the water supply. Since 1990 Entiat River water is no longer used for rearing, there have been no isolations of IHNV, no detection of furunculosis, and a reduced incidence of BKD in the juveniles.

Drugs and chemicals for treating fish are used on an "as needed" basis. Formalin treatments for adult brood stock are given to control external parasites and as a fungicide on eggs. Tank trucks and tagging trailers are disinfected before being brought onto the station and after use at the hatchery.

Abernathy Fish Technology Center provides quarterly feed quality analysis to prevent disease and meet nutritional requirements of fish.

## Monitoring, Evaluation, and Coordination

The Mid-Columbia Fisheries Resource Office (MCFRO) provides monitoring, evaluation, and coordination services concerning Entiat NFH production. The MCFRO staff monitors hatchery returns, biological characteristics of the hatchery stock, fish marking, tag recovery, and other aspects of the hatchery program. They maintain the database that stores this information and serve as a link to databases maintained by other entities. The MCFRO also cooperates with the hatchery, fish health center, Abernathy Fish Technology Center, and co-managers to evaluate fish culture practices, assess impacts to native species, and coordinate hatchery programs both locally and regionally. These activities are described in the following section:

**Database Management.—**The Fisheries Information System (FIS) is a national database system for the Service's Fisheries Program. Each Service field office contributes to this database. The FIS consists of five different databases, two of which, Fish and Egg

Distribution databases document production accomplishments from all National Fish Hatcheries. This database is discussed further in Chapter 4.

Information from and about Entiat NFH is connected to the broader fisheries community of the West Coast of the North American Continent through the U.S. Fish & Wildlife Service Columbia River (information) System (CRiS). The following information is recorded in files that are components of the CRiS database: adult, jack and mini-jack returns to the hatchery; age, sex, length, mark and coded-wire tag information for returning fish that are sampled; egg development and disposition; the origin of fish raised at the hatchery; and fish transfers and releases. Entiat NFH maintains files containing information generated at the hatchery (brood stock management, incubation, rearing, and release). Staff from MCFRO maintains files containing information on marked juvenile fish and on sampled adult fish (adult bio-samples).

Use of CRiS database files and programs achieves the following multiple purposes: 1) reduces the amount of effort expended to meet reporting requirements, 2) increases the quality and consistency of data, 3) facilitates development of software usable at all stations, 4) provides a platform on which to build effective evaluation tools which can be used by hatcheries, fisheries management and regional offices, and 5) facilitates the exchange of information with other agencies. For example, release and recovery information is reported to both the Regional Mark Information Center and the StreamNet databases.

Computer programs that are components of the CRiS database are used to transform data into formats required by other agencies. These formats can be either electronic or printed. Other CRiS programs combine data from the hatchery, CRFPO, and from databases maintained by other agencies into other formats to accomplish reporting, monitoring, and evaluation.

**Marking/Tagging Program**.—Juvenile fish are fin clipped, coded-wire tagged and/or PIT tagged at Entiat NFH by CRFPO to monitor and evaluate fish cultural techniques, survival and fishery contribution. Presently all spring Chinook salmon are fin clipped at Entiat NFH to identify hatchery fish in selective fisheries and to measure the impact on wild anadromous and resident stocks of fish in Entiat River. This action is in compliance with recommendations of the Biological Opinions of NMFS's 1999 Artificial Propagation in the Columbia River Basin and the 2000 Reinitiating of Consultation on Operation of the Federal Columbia River Power System, under the Endangered Species Act-Section 7 Consultation.

**Bio-sampling and Reporting**.—State and tribal coast-wide sampling of sport, tribal, and commercial fisheries and hatchery rack return sampling, by MCFRO and the hatchery staff, provides total recovery and survival estimates for each brood year released.

Coded-wire tag recovery information is used to evaluate the relative success of individual brood stocks and compare performance between years and hatcheries. This information is used by salmon harvest managers to develop plans to allow the harvest of excess hatchery fish while protecting threatened, endangered, or other stocks of concern.

Until 2001, snouts were removed from all adipose fin-clipped fish to recover coded-wire tags. A percentage of unmarked fish were sampled for length, sex, and scales (age). The

percentage of fish sampled was set high enough that at least 500 fish were sampled. These samples, and a subset of fish sampled for coded-wire tags, were used to determine the age composition of fish returning to the hatchery (Attachment 15). Starting with brood year 2000 all production fish were adipose fin clipped. All returning fish are now checked for coded-wire tags by passing them through a tag detection unit. Mass marking will allow selective fisheries and will help us determine production of wild or feral spring Chinook salmon in the Entiat River.

**Hatchery Evaluation Studies**.—Hatchery evaluation is the use of replicable, statistically defensible studies to guide management decisions. The hatchery evaluation vision action plan developed in 1993 for Region 1 Fisheries describes hatchery evaluation in greater detail (USFWS 1993). The purpose of hatchery evaluation is to simply determine what works and doesn't work through planning, implementing, documenting, monitoring, analyzing, and reporting.

Past studies include National Marine Fisheries Service's (NOAA Fisheries) coded-wire tagging of Willard stock coho and Carson stock spring Chinook salmon reared at Carson NFH in the late 1970's and early 80's. This study evaluated imprinting and homing mechanisms of fish released at various locations in the Columbia River basin (Slatick 1988). Abernathy Fish Technology Center has also conducted hatchery evaluation studies at the hatchery. For example, brood years 1982 to 1985 spring Chinook from Carson were marked and coded-wire tagged for a rearing density study (Banks 1994). As a result of this study, rearing densities in hatchery raceways were reduced. The guidelines being implemented as a result of the density study are to keep the rearing density index at 0.25 or lower with a flow index greater than 1.0. The present production goal at Carson NFH is 1.42 million smolts.

A study to evaluate survival of spring Chinook from the effects of fin clipping and coded-wire tagging was completed as part of a three brood year (1989-91), three hatchery investigation (Carson NFH, Oregon's South Santiam, and Washington's Cowlitz hatcheries). The results and conclusions of this study are forthcoming.

**Stock Assessment and Contribution to Fisheries -**

**Juvenile Monitoring.—**Juvenile fish at Entiat NFH are monitored on a routine basis by the hatchery staff to determine the condition factor of fry, fingerling and yearling fish. Samples are taken monthly for Bio-analysis by the Olympia Fish Health Center (OFHC) to determine the health condition of fry, fingerling, yearling and smolts prior to release. Sampling of fingerling fish for tag retention and fin mark quality, prior to release, is conducted by MCFRO. Length measurements are recorded for all PIT tagged fish by CRFPO.

Use of passive integrated transponder (PIT) tags began with brood year 2000 fish at Entiat NFH. PIT tagging at Entiat NFH is part of a larger comparative survival study conducted by the Fish Passage Center, Portland, Oregon.

**ESA Assessments, Ecological Interactions, and Natural Production Studies -** The Service completes Biological Assessments and Hatchery and Genetic Management Plans

to comply with the Endangered Species Act (ESA). These assessments and plans help guide production, considering the potential impacts on the biological community.

To comply with ESA, the Service initiated a Biological Assessment for the hatchery back in 1993 and subsequently initiated a Hatchery and Genetic Management Plan (HGMP) for Entiat NFH in 1999 (USFWS 1999). This initial draft HGMP followed an older format and was produced under consultation with NOAA Fisheries to meet our ESA Section 7 obligations. The Service and NOAA Fisheries agreed that we would complete a more thorough HGMP once the format was finalized by NOAA Fisheries and the Service. The Service is now in the process of completing this more detailed HGMP and anticipates having it completed by fall of 2004. This document, considered a "phase I draft", will describe current operations at the hatchery and will comply with ESA obligations, covering both NOAA Fisheries and Service trust species. It is anticipated that the phase I drafts for all hatcheries, including Entiat, will be distributed to the co-managers and other interested parties and will serve as the focus for a collaborative, phase II part of the process. Collaboration meetings should begin in late 2002 and continue through the first half of 2003. Drafts for any proposed new project/programs will be developed by appropriate proponents and also discussed and reconciled during phase II. This process will produce phase II draft plans which will be provided to sub basin planning processes and the appropriate technical recovery team (TRT) for consideration and interaction with those groups. For HGMPs that involve unreconcilable differences, the phase II options could create "scenarios" that can be presented to the TRT for consideration and advice. The phase II draft plans will be completed and set aside (parked) until all HGMPs relevant to an Evolutionarily Significant Unit (ESU) are completed, allowing for ESU-wide considerations and feedback with the TRT/Recovery Planning processes. The HGMP collaborators will incorporate TRT advice as appropriate to ensure consistency with broader recovery objectives. This step culminates in Phase III drafts, which become final and ready to implement after approval by NOAA Fisheries and the Service.

Of special concern in the Entiat River is wild (listed) summer steelhead trout production. Natural production of juvenile, smolt and adult steelhead is monitored by WDFW, USFS and USFWS. The Service is developing study proposals to assess the effects of hatchery spring Chinook salmon on the aquatic community in the Entiat River, especially on the listed summer steelhead population. The Olympia Fish Health Center can also help assess the status of wild fish health in the watershed.

Additional monitoring needs have also been identified in the Draft Entiat River Sub basin Summary (WDFW 2000). These fish and wildlife needs are: 1) determine abundance, distribution, survival and status of fish and wildlife native to the watershed including steelhead, coastal cutthroat, fall Chinook, bull trout, coho, lamprey, and crawfish; 2) determine genetic and life history types of native fish and wildlife and the strength of their current expression relative to historical and desired future conditions; 3) assess effect of natural escapement of hatchery spring Chinook and feral brook trout on natural production of steelhead; 4) determine the effectiveness of habitat restoration projects on achieving the desired physical change and measure response of wild steelhead populations to these changes; 5) assess effect of operations of Rocky Reach and Rock Island dams on the fish and wildlife production capacity and migration corridor of the

portion of the Entiat River that is inundated with the impounded waters; 6) assess straying (rates and where) of hatchery fish from Entiat NFH.

**Environmental Monitoring -** Environmental monitoring is conducted at Service facilities to ensure these facilities meet the requirements of the National Pollution Discharge Elimination System (NPDES) permit and 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 for our cooperators 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) - Once per week on composite effluent, maximum effluent and inflow samples. Once per month on pollution abatement pond inflow and effluent samples.
- Settable Solids (SS) - Once per week on inflow samples. Once per week on pollution abatement pond outflow and effluent samples.
- In-hatchery Water Temperatures – maximum, minimum daily and monthly average.
- Entiat River water Temperatures – monthly maximum, minimum and average
- In-hatchery Dissolved Oxygen - as required by stream flow, weather conditions and/or pond loadings.
- Quarterly domestic water sampling; Annual Nitrate sampling of domestic water
- Water quality sampling – minimum once every six years

**Coordination/Communication -**The hatchery holds Hatchery Evaluation Team (HET) meetings each spring and fall. These meetings include representatives from Entiat NFH, MCFRO and OFHC. Topics of concern include reports on current activities and accomplishments, present management programs, and future plans or studies that might affect, or be affected by hatchery operations. Other aspects include survival, life history, fisheries contribution, and fish health parameters at Entiat NFH and how it compares to other National Fish Hatcheries producing spring Chinook salmon in the Columbia River. These meetings have evolved into combination HET/Coordination meetings. Cooperators (NOAA Fisheries, WDFW, YN) are invited to all HET meetings and are especially encouraged to attend when significant hatchery management decisions are scheduled. The fall HET meeting reviews adult returns with emphasis on production decisions for the next year. Production is also coordinated with the co-managers through the Production Advisory Committee (see below) and with concurrence of the Regional Office and NOAA Fisheries.

**Fish and Egg Transfers -** All fish and egg requests and transfers are coordinated through Entiat NFH, OFHC, and MCFRO. Any request for fish and/or eggs, either in or out of Entiat NFH, will be in writing and a National Fish Hatchery Planned Release or Transfer Schedule will be prepared by the requester. All transfers of fish and/or eggs require a fish health certification from OFHC prior to transfer. All fish and egg transfers are made in accordance with the co-managers fish disease control policy and the Service's fish health policy and implementation guidelines. If the fish and/or eggs are determined to be healthy the OFHC arranges for all appropriate state permits involving the transport. The transfer schedule is signed by the Entiat NFH manager and OFHC and sends the

document and permits to the MCFRO for approval. These requests and permits are kept on file at the MCFRO for future reference.

**Interagency Coordination/Communication -** As part of the U.S. v Oregon Columbia River Management Plan, the Technical Advisory and Production Advisory Committees are comprised of harvest and production assessment biologists, including representatives from the Service, Tribes, NMFS, and states of Oregon, Washington and Idaho. These groups provide management direction used in establishing hatchery fish production goals and harvest rates.

The Integrated Hatchery Operations Team (IHOT) was comprised of representatives from fish management agencies, including CRFPO, MCFRO, and tribes. IHOT developed a series of regional hatchery policies and operational plans. The IHOT group has since been replaced by the Artificial Production Review process funded by the Northwest Power Planning Council. The Service is represented by our Regional Office staff.

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

**Ocean Fisheries Management.—**Entiat NFH spring Chinook salmon are not recovered in ocean fisheries in significant numbers and do not influence ocean fishery management decisions.

**Freshwater Fisheries Management**.—Washington, Oregon, and the four treaty tribes (Yakama, Warm Springs, Umatilla and Nez Perce), that are parties to the Columbia River Fish Management Plan (U.S. v. Oregon) prepare harvest strategies based on run size predictions made by their respective fishery agencies. They then jointly present their findings to the Columbia River Compact through the Technical Advisory Committee (TAC). The Columbia River Compact, created by Congress, has the authority to approve or reject sport and commercial fishery proposals for the main stem Columbia River. In their deliberations, the Compact will consider the findings of the TAC. If those findings are in compliance with the management plan, brood stock goals and ESA guidelines, and the run size prediction shows a harvestable surplus, the Compact will set seasons for non-tribal and/or tribal fisheries in the main stem Columbia River.

If a harvestable surplus is predicted for the Entiat River, the State of Washington and Yakama Nation will set regulations for terminal area non-tribal sport and/or tribal subsistence fisheries. Fishing regulations are established to also provide adequate escapement for hatchery production and meet ESA guidelines.

## Public Outreach Activities

The Leavenworth National Fish Hatchery Complex (I&E) office services the Entiat, Winthrop, and Leavenworth National Fish Hatcheries. The Office shares/distributes its time and staffing between these stations.

The goal of the I&E Office outreach program is to increase the visibility of the Fish and Wildlife Service facilities in the Mid-Columbia River and to provide information about

Service programs to internal and external audiences. Staff and volunteers show how Service programs benefit the public and the environment in keeping with the Service's mission "To conserve, protect, and enhance the Nation's fish and wildlife and their habitats for the continuing benefit of people."

Recognizing that it is increasingly important for all staff to be involved in gaining or retaining public support for our programs; the I&E program will strive to insure that hatchery staff is well-informed about policies, procedures, and issues; and that staff are willing and able to interact with our various publics. Program efforts will include providing information to staff, partners, and volunteers and, through them, to members of the community and other publics. Outreach will be used as a management tool, providing support to the Service, the public, and our hatchery programs.

**On Station -** On station activities include tours of the facility to predominantly local schools. Some special interest groups schedule special tours to better understand hatchery operations. Students from both Entiat Elementary and Mission View Elementary care for spring Chinook salmon in their classrooms and visit the hatchery annually to release their fish and tour the facility. Annual festivals include a Kid's Fishing Day each June and an Open House Fishing Day each August.

**Off station -** Outreach efforts include an array of activities that occur throughout the Pacific Region. Examples include various festivals, classroom participation at local schools, stream adoption, participation in other National Fish Hatchery events, county fairs, and the Wenatchee River Salmon Festival.

Visitors can visit Entiat NFH through the World Wide Web at:
http://leavenworth.fws.gov/evisit.htm

**Partnerships/Cooperators -** A bulleted list of particular events and partnerships follows:

- Entiat Elementary School - Entiat NFH provides spring Chinook salmon for Salmon-In-The- Classroom activities annually, classes tour the hatchery and release their fish in April each year.
- Chelan County Soil Conservation District – participate in on-site outdoor education activities with high schools students from Entiat.
- Mission View Elementary – Salmon in the classroom and fish anatomy dissection.
- Friends of Northwest Hatcheries - continue to strengthen and expand the partnership with the Friends of Northwest Hatcheries. Entiat NFH signed an official MOU with the Friends Group and the Regional Director in fall 2000.
- U.S. Forest Service, Entiat Ranger District - cooperative effort with outreach activities including fishing day events, fishing day camp activities.
- Entiat River Watershed Council. NOAA Fisheries - funding agency via Mitchell Act and ESA trust responsibilities.
- Bonneville Power Administration.
- Columbia River Inter-Tribal Fisheries Commission - provides coordination and technical assistance to Columbia River treaty tribes.
- Private land owners in Entiat River watershed.

- Washington Department of Ecology and U.S. Environmental Protection Agency - water quality and effluent discharge permits.
- U.S. *v* Oregon parties - co-managers of Columbia River fisheries, including Yakama Nation, Confederated Tribes of the Umatilla Indian Reservation, Nez Perce Tribe, Confederated Tribes of the Warm Springs Reservation of Oregon, Washington Department of Fish and Wildlife, Oregon Department of Fish and Wildlife, Idaho Fish and Wildlife, NOAA Fisheries, U.S. Fish and Wildlife Service.
- Yakama Nation – Coho Reintroduction Project
- Washington Department of Fish and Wildlife - co-managers of Entiat River fisheries.
- Entiat Service Club – Partners in hosting Kid's Fishing Days and Open House events

## Special Concerns

**Planning Issues -** Several federal, state and tribal entities share responsibilities for development of sub basin plans, hatchery production, harvest management, and ESA considerations. Recent actions have centered a round factors contributing to the decline of Entiat River's aquatic resources. The agencies involved include the U.S. Forest Service, U.S. Fish and Wildlife Service, NOAA Fisheries, U.S. Geological Survey, Chelan County Conservation District, the Washington Department of Fish and Wildlife, Washington Department of Fish and Wildlife, Bureau of Land Management, Bureau of Reclamation and the Yakama Nation. As previously mentioned, private land owners, the public and watershed groups play an important role in managing the Entiat River watershed.

This plan will recognize and comply with all management plans and Biological Opinions affecting the Columbia River Basin in general and the Entiat River in particular. Operations at Entiat NFH pose a number of potential issues in the watershed. The primary issues center around marking, water use, juvenile distribution and production numbers, surplus adult distribution, impacts to ESA listed species and other aquatic resources, actions being taken to help recover listed and depressed populations, and funding for operations, maintenance and evaluation.

**Marking -** To help protect wild and naturally produced fish, the states of Washington, Oregon and Idaho are implementing selective sport and commercial fisheries (non-tribal) on marked hatchery fish. This selective fisheries management strategy requires that all hatchery produced fish targeted for harvest be mass marked. Mass marking of hatchery fish is being implemented for steelhead trout and coho salmon and most recently for spring Chinook salmon. Mass marking of fall Chinook salmon has not yet been implemented because of technical, logistic, and funding limitations, except for special cases.

Tribal managers generally disagree with the management strategy for mass marking and selective fisheries.

> The Service has not made any unilateral decisions on marking but has undertaken actions to comply with ESA Biological Opinions. The Service will continue to coordinate actions with the states and tribes through U.S. v Oregon and NOAA Fisheries to comply with ESA actions and coordinate with the Pacific States Marine Fisheries Commission mark committee. In addition, the federal agencies are

beginning discussion of a comprehensive marking strategy for the Columbia River Basin as identified by Action 174-1in the Federal Columbia River Power System Biological Opinion. The federal agencies (NOAA Fisheries lead) are meeting with the states and tribes to begin this effort.

This comprehensive marking plan should:

- Improve our ability to assess and monitor the status of naturally-producing (especially ESA listed) populations
- Monitor and evaluate hatchery programs, including hatchery reforms and stray rates
- Maintain critical harvest management and stock assessment information
- Monitor mark-selective fishery regimes established by the states
- Improve regional and watershed based marking decisions
- Be consistent with recovery plan goals
- Be coordinated through U.S. v Oregon, Pacific States Marine Fisheries Commission and U.S. - Canada forums

**Juvenile Salmon Distribution and Production Numbers -** Juvenile salmon are to be released from the hatchery in the spring as yearling smolts to promote quick downstream migration from the hatchery, through the Entiat and Columbia Rivers to the estuary and ocean. This release strategy is agreed to by the WDFW, Service and NOAA Fisheries.

**Water Use (Drought) -** In summer of 2001, a drought year, we anticipated having extremely low and insufficient water supply for raising 4 million juveniles to full-term smolts. An interim plan by Service, NOAA Fisheries, WDFW, and YN was to have an emergency release of juveniles into the lower Entiat River, if the hatchery water supply dropped to critically low levels during summer. Although this plan was agreed to by the fisheries managers, some conservation groups were highly concerned about this potential action and its impact to listed steelhead and resident cutthroat trout. Fortunately water supply was adequate and an emergency early release was not necessary. A written plan is in place to address potential or realized low water conditions and is revisited particularly in years of expected drought like conditions.

**Surplus Adult Salmon Distribution -** In most years more fish return to the hatchery than are needed for brood stock. Most of these surplus fish are still in very good condition and are distributed to Native Americans for ceremonial and subsistence use. Fish not suitable for food are buried. Plans are underway to determine the number, if any, suitable for stream enrichment.

**Fish Passage and Ladder Management -** Negative Impacts to Listed and Other Aquatic Resources and What Actions are taken to Help Recover Listed and Depressed Populations - All hatcheries must consider their potential for adversely affecting the aquatic community and Entiat NFH is no exception. Of particular concern is the potential impact to the Mid Columbia River Ecologically Significant Unit (ESU) of threatened steelhead and spring Chinook. To meet our ESA obligations, we are proceeding to

comply with the March 1999 Biological Opinion on hatcheries. These actions are identified in Chapter 4. The Service is developing a Hatchery and Genetic Management Plan (HGMP) to help assess our impacts from hatchery operations. More in-stream research is also needed to assess the impacts of both hatchery releases and naturally spawning spring Chinook on listed steelhead in the Entiat River. We will work towards going beyond the assessment stage and work towards taking actions which help recover listed and depressed populations; including identification of actions the hatchery can take (hatchery reform). Implementing measures identified by the HGMP, this CHMP, and in Biological Opinions will require additional resources. The following chapter identifies these projects and funding needs.

**Operations and Maintenance Funding through the Bureau of Reclamation –** The Entiat NFH is funded via the Leavenworth National Fish Hatchery Complex from reimbursable funds to the Service by the Bureau of Reclamation. Current funding also includes operational costs relating to Entiat, Leavenworth, and Winthrop National Fish Hatcheries for the Olympia Fish Health Center, Mid-Columbia Fisheries Resource Office and Regional Office overhead. The annual budget for 2004 was $2.2 million.

# CHAPTER 4 IMPLEMENTATION

Implementation of the Entiat NFH program requires input to reimbursable and Service budget processes, as well as compliance with Service policies, legal mandates, and other environmental and human resource laws. This chapter intends to outline these processes and discuss the policy and planning documents which provide guidance to Entiat NFH in regards to policy, budget, safety, grounds and facilities maintenance.

## Budget Overview

Entiat National Fish Hatchery receives 100% of its operation budget from reimbursable Bureau of Reclamation (BOR) funds, which are administered by the Region One Fisheries. Operation budget needs are identified each year and negotiated with BOR to determine the final fiscal year allocation. Deferred Maintenance and construction funding is also funded via the BOR. Some funding for special studies can also be derived from reimbursable sources other than Mitchell Act. Current budget and number of full-time personnel for the Entiat NFH are provided in Attachment 18. Additional BOR funding is provided to the MCFRO and the OFHC for support services to the hatchery

**Budgetary Needs and Strategies -** Funding for unmet needs such as construction, program changes, and housing maintenance is identified through the Maintenance Management System (MMS), the Fisheries Operational Needs System (FONS), and Regional Quarters Overhead funds and allocated through a competitive process. Access to FONS and MMS files is through the Fisheries Information System (FIS) database. The FIS database consists of five modules which address out-year budgeting (FONS), resource oriented accomplishments that occurred over a fiscal year (Accomplishments Module), Congressionally mandated reporting requirements that describe yearly production at NFH (Fish and Egg Module), activities related to endangered species (Imperiled Species Module), and deferred maintenance needs (Maintenance Management System).

**Fisheries Operational Needs System (FONS) -** The FONS was established in 1999 as a planning, budgeting, and communication tool to enhance identification of funding and staffing needs for the fishery program. FONS projects are used in budget requests to the Department of Interior and the Office of Management and Budget. Attachment 19 outlines the Regional and National budget formulation, and provides a time step through the process. In FY 2002, an additional project will be submitted to evaluate ecological interactions between wild steelhead and hatchery spring Chinook salmon in the Entiat River (Attachment 20). Additional projects will be submitted as needs arise. Several other Service field offices support Entiat NFH. Those include Mid-Columbia Fisheries Resource Office (Leavenworth, Washington), Olympia Fish Health Center, and the Abernathy Fish Technology Center. Projects included in the FY 2002 FONS database by these stations that support Entiat NFH resource needs are listed in Attachment 21.

**Maintenance Management System (MMS) -** The Maintenance Management System (MMS) is an inventory of deferred maintenance projects, which are maintenance projects that can be put off or do not occur on an annual basis. The MMS is the primary vehicle used to address

maintenance requirements above $5,000. The database is updated annually then forwarded to the WO for consolidation and submission into the budgetary process. Projects submitted for consideration are too numerous to list here and can be found in Attachment 22. Recent MMS funding has been directed toward correcting Health and Safety discrepancies.

**Five-Year Construction Plan -** Fisheries Construction projects are entered into the RMIS, the same web-based database, developed for Refuges, as is used for the RPI. Scores and Regional priorities are assigned and the information is used in the WO to develop the Five-year Construction Plan. This plan, after it has been approved by the Department and OMB, is submitted as part of the Service Budget to Congress. The out-years of this plan are subject to revision each year.

Construction funds are similar to MMS funds but are reserved for new construction and maintenance to existing buildings above $100,000.

**Five-Year Maintenance Plan -**The Deferred Maintenance projects entered into the database are prioritized by the WO, at least partially, based on the priority established by the Field Office and Regional Office priorities. This plan is reviewed by the Department and the approved plan is part of the basis of our MMS budget request to Congress (see previous discussion on MMS).

**ESA Compliance and Needs**.—The 1999 NOAA Fisheries Biological Opinion on Artificial Propagation in the Columbia River Basin lists a host of measures which either must, in the case of Reasonable and Prudent Alternatives, be complied with or, in the case of Conservation Recommendations, should be implemented (NMFS 1999b). Several actions require additional resources. Two of the Conservation Recommendations (CRs) discussed below have work proposals developed but are not currently funded.

CR 4. Evaluate NATURES type rearing strategies. A proposal to evaluate NATURES type rearing strategies on a production level has been submitted by the NOAA Northwest Fisheries Science Center Resource Enhancement and Utilization Technologies Division and is being considered for funding by the Northwest Power Planning Council. Should this study receive funding, nearly all raceway rearing units at Entiat NFH will be involved. Variables to be looked at are: substrate, in water structure (suspended Christmas trees), shade, and possibly predator avoidance training.

CR 6. Monitor and evaluate ecological interaction. Little data describing the ecological interaction of hatchery Chinook smolts with Endangered Species Act listed Entiat River summer steelhead trout are available. To procure funding to fill this data gap will be pursued via the FONS system will be initiated with the FY 2002 FONS submissions. This will be a shared project with the Mid-Columbia Fisheries Resource Office.

Additional Conservation Recommendations are: minimize inter-basin stock transfers, emphasize juveniles that are ready to migrate to the ocean and spend a minimum amount of time in the freshwater environment, improve homing and reduce straying, assess carrying capacity and density-dependent effects (unfunded), monitor and evaluate predation (unfunded), conduct spawning ground surveys, assess use of hatchery carcasses for nutrient input (needs

development), use most appropriate brood stock for reintroduction into historic or vacant habitats, develop cost-effective externally distinguishable marks to identify hatchery origin fish, modify hatchery programs to conservation / enhancement role (to be identified in HGMP), adopt strategies to separate returning hatchery fish from listed naturally spawning fish, continue adaptive management to improve smolt quality, and continue to coordinate hatchery programs to meet ESA concerns. In addition, a host of measures are associated with an Incidental Take Statement. Reasonable and Prudent Measures are: provide projected hatchery releases to NOAA Fisheries annually, manage programs to minimize potential inbreeding of hatchery and listed fish, monitor and evaluate artificial propagation programs (partially funded), reduce potential negative impacts to listed salmon and steelhead from hatchery operations, and NOAA Fisheries shall conduct the proposed actions in such a way as to minimize adverse genetic and demographic effects on naturally-produced listed steelhead (to be identified in HGMP). Terms and Conditions include: provide to NOAA Fisheries projected hatchery releases and annual report of releases and returns, mark a representative sample of hatchery salmon and steelhead released to allow M&E (partially funded), develop protocols for fishery augmentation/mitigation programs to reduce potential for interbreeding and genetic introgression (to be identified in HGMP), insure water intakes are properly screened and comply with NOAA Fisheries intake structure criteria (unfunded), implement PNFHPC and IHOT guidelines, monitor effluent for compliance with NPDES permits, and the NOAA Fisheries shall minimize the number of hatchery adults remaining to potentially spawn with wild fish through removal of hatchery fish at sufficiently high harvest and/or trapping.

## Service and Station Guidance

Each Service hatchery operates under a variety of guidance and policies. This section is provided to describe some of the more important policy and guidance documents that are available at the hatchery.

**Quarters Policy -**The Service administers a variety of field offices and National Fish Hatcheries. At many of these hatcheries, including Entiat NFH, government owned residences are available to employees on a required occupancy basis. The determination of whether an employee must occupy government furnished quarters as a condition of employment is made on a station-by-station, position-by-position basis. In making a determination, supervisors will consider: the dependability of the water supply, adequacy of the alarm and call back systems, response time needed to take emergency corrective actions, and the adequacy of the security provided to protect fish, facilities, and equipment. Attachment 23 is a copy of the current housing policy.

**Required On-Station Housing -** The current Quarters Plan for Entiat NFH is dated November 20, 2001 (Attachment 24). The intent of having personnel living in government quarters at Entiat NFH is to provide station security and operations during non-duty hours. Mechanical systems to regulate water flows must be maintained immediately to prevent loss of valuable fish stocks. Additional security protection of government owned property is provided by occupants especially when anadromous brood stock is present. The isolated setting of Entiat NFH combined with potential inaccessibility during severe snowstorms precludes adequate protection by other than required housing.

**Overtime/Compensatory Time/Standby -** Regulations governing overtime, compensatory time, and standby are described in the U. S. Fish and Wildlife Service Administrative Manual. Premium pay is discussed in Part 225 FW of the Manual with specific discussions on overtime regulations in Chapter 7.8, callback overtime in Chapter 7.13, Compensatory time in Chapter 7.18, and standby in Chapter 7.22.

**Distribution of Surplus Fish/Eggs -** Guidance was provided in a July 2001 memorandum from the Regional Director (Attachment 25). The guidance states: "Live fish entering a National Fish Hatchery (Hatchery), whole fish carcasses or their parts, are Government property and cannot be converted for personal use, even temporarily on loan. Misuse of Government property may result in disciplinary action ranging from a written reprimand to removal from the Service. The attached Standards of Ethical Conduct for Employees of the Executive Branch, contained in 5 CFR 2635.704, specifically address use of Government property. Please review and be acquainted with these standards. Also, please ensure that all your employees read and understand this memorandum.

It is important that you first consider all possible uses of hatchery fish that are consistent with the Service Mission. Surplus fish must be disposed of using prescribed government contracting procedures. Furthermore, you must comply with other Service and FDA policies related to the disposition of carcasses and parts that have been treated with chemicals making them unfit for human consumption."

**Drugs and Anesthetics -** Guidance on the use of anesthetics, drugs and other chemicals was provided in a November 9, 2000 memorandum from the Assistant Regional Director for Fisheries in Region 1 (Attachment 26). Hatcheries and other Fisheries offices within Region 1 may at times have legitimate and necessary reasons to use certain drugs and chemicals to achieve their goals and complete the mission and objectives of the Service. During the capture, rearing, or monitoring of fish species, several drugs and chemicals are used for anesthesia, disease treatments, or to increase the survival of the animals. Some of these compounds are already registered and labeled for fisheries use. Others may be legally used under the prescription and supervision of a veterinarian, or within the protocols of an existing Investigational New Animal Drug (INAD) exemption permit issued by the Food and Drug Administration (FDA). The Service has existing correspondence from the FDA concerning the use of compounds in the recovery of threatened and endangered species, but there are strict considerations and limits even in those situations. Region 1, working closely with the National INAD Office and through appropriate consultation with FDA, will fully comply with all regulations and agreements for the use of aquatic drugs and chemicals. The inappropriate use of compounds on fish or aquatic animals intended for human or animal consumption is prohibited. If you have questions regarding the use of chemicals or drugs, please contact your servicing Fish Health Center, or your supervisor.

**Employee Training -** Regulations governing employee training are described in the U. S. Fish and Wildlife Service Administrative Manual. Career development is discussed starting in Part 230 FW of the Manual.

## Service Required Planning Documents

Daily operations of Entiat NFH are guided by a number of plans and reports designed to promote health and safety, station development, emergency situations, employee training, and other actions. Some of the more significant ones are described in the following section:

**Safety and Health Plan -** Regulations safety are described in the U. S. Fish and Wildlife Service Administrative Manual. Safety program discussions start in Part 240 FW of the Manual.

**Fire Management Plan -** Department and Service policy require that "every area with burnable vegetation must have an approved Fire Management Plan" and field stations cannot conduct prescribed fire operations, including trash burning, without an approved Fire Management Plan that includes such activities. All Service facilities developed plans and had them approved in FY2001, but they must be amended before any controlled burning can be conducted.

**Integrated Pesticide Management Plan -** It is Service policy to eliminate unnecessary use of pesticides by implementing integrated pest management techniques and by selecting crops and other vegetation that are beneficial to fish and wildlife but do not require pesticides. The ultimate goal is to eliminate pesticide use on Service lands and facilities and to encourage pest management programs that benefit trust resources and provide long-term, environmentally sound solutions to pest management problems on sites which are off Service lands (Attachment 27).

When pesticides are used, they must be part of a pest management program that includes strategies to reduce and eventually eliminate their use. The program must be set forth in an Integrated Pest Management Plan which must include consideration of target specificity of the pesticide (insecticide, fungicide, herbicide, etc.), risk to non-target organisms, and incidental reduction of food resources for trust species, persistence, control and prevention of the spread of fish and wildlife diseases, and other environmental hazards.

**Station Development Plan -** The Station Development Plan considers future growth and construction needs of the facility that are necessary to meet goals and objectives. The plan is an opportunity to work with the Service's Engineering Department to thoughtfully lay out a course of action to maintain the facility in proper operating condition. It is also a necessary precursor to get construction projects on the five-year construction list (see previous discussion).

Station Development Plans were completed for many stations in the early to mid-80s. Most are in need of revision and 1 to 3 stations will be updated each year as funds and personnel availability allow. The Entiat NFH Station Development Plan was written in 1981. A new plan needs to be written to include new and much needed station improvements.

**Monitoring and Evaluation Plan -** Monitoring and evaluation of production programs are outlined in Hatchery and Genetic Management Plans (HGMPs) which can be found at the hatchery, the Columbia River Fishery Program Office, or through the Fishery Program Office in Portland. A more detailed discussion of this plan can be found in Chapter 3.

**Distribution of Surplus Fish Plan -** In this exercise the hatchery works cooperatively with the Mid-Columbia Fisheries Resource Office, Olympia Fish Health Center, and co-managers to plan beneficial uses of fish surplus to hatchery needs in years of large adult returns. The plan should consider all possible uses of adult carcasses and live fish in excess of hatchery needs, and should be coordinated with co-managers when necessary to achieve mutually satisfying solutions. A plan should be developed in years where surpluses are anticipated, and should be developed well in advance of spawning operations. These plans can be obtained from the hatchery, the Mid-Columbia Fisheries Resource Office (Leavenworth, Washington), or through the Fishery Program Office in Portland

**Small Water Systems Management Plan (Drinking Water) -** The Safe Drinking Water Act (SDWA) became an issue in the spring of 2002. The Act delegated safe drinking water control to the states and we must meet state requirements to provide drinking water to the public as well as our employees and their families. The EPA recently indicated that they believe that a significant number of the Service's systems do not fully comply with the SDWA. They have requested that we audit our compliance with state regulation. This process has already been started using the services of a contractor. Facilities in the State of Washington have been surveyed and the other states will be done in the next one to two years. Deficiencies discovered in water systems will be corrected as they are detected.

**Continuity of Operation Plan -**The continuity of Operations Plan provides guidance for Entiat NFH staff to ensure that essential operations and activities continue during and after an emergency situation. The plan is developed in accordance with DOI, MRPS Bulletin 98-01, Continuity of Operations Planning - Guidance and Schedules, dated March 27, 1998, and 380 DM 6, Vital Records Program. This plan is current and located at the hatchery in the administrative files.

**Spill Prevention, Control and Counter Measure Plan -** A Spill Prevention, Control, and Countermeasure Plan (SPCC) is prepared in accordance with the provisions of Title 40 of the Code of Federal Regulations, Part 112. An SPCC plan establishes procedures, methods, and equipment used at the Entiat hatchery to comply with U. S. Environmental Protection Agency (EPA) oil spill prevention control and countermeasures standards, and inspection reporting, training and record keeping requirements. An SPCC is required at Entiat NFH because it stores petroleum fuel in above ground storage tanks greater than 660 gallons. The CCC for Entiat is current (April 1999) and can be located in the hatchery administrative files, or the Fisheries Program Regional Office in Portland.

**Outreach Plan -** An outreach plan (see Chapter 3) describes the hatchery's strategy for telling the Service, Entiat National Fish Hatchery, and the Mid-Columbia River Basin resource story to the public. Furthermore, this plan describes outreach tools and facilities needed to implement this strategy. The plan should be cited when describing unmet outreach needs in the FONS database (see Fish and Wildlife Service Budgeting Process).

**Watershed/Sub-basin Plan -** These documents are part of the Northwest Power Planning Council process to address fisheries and aquatic issues related to sub basin and recovery planning in the Columbia River basin and in facilitating implementation of recovery actions.

National attention has been focused on the Columbia River basin with listings of salmon and steelhead, bull trout, and other aquatic species. Endangered Species Act (ESA) consultations and recovery planning for listed species are having a major impact on management of fishery resources, the economy and cultural values in the basin. Consultations include the operation of the Federal Columbia River Power System, hatchery operations, harvest actions, habitat planning and project specific activities. Planning processes include the development of an All H Paper which is a conceptual recovery plan for salmon, steelhead and other aquatic species in the Columbia River basin, and various state and local government recovery planning efforts in Washington, Oregon, Idaho and Montana. The Pacific Northwest Electric Power Planning and Conservation Act resulted in the establishment of the Northwest Power Planning Council and ultimately the development of its Columbia Basin Fish and Wildlife Program, a comprehensive program to enhance and restore the salmon and steelhead runs and other fish and wildlife resources of the Columbia River basin. The Northwest Power Planning Council is leading a major sub basin assessment and planning effort which will provide key building blocks for aquatic species restoration in the basin. At the same time the Service has initiated recovery planning for bull trout and NOAA Fisheries for salmon and steelhead. Each of these recovery plans will rely on sub basin planning as major building blocks for recovery of listed species. In addition, Implementation Plans have been developed by the Corps of Engineers, Bonneville power Administration, and the Bureau of Reclamation that require implementation of significant habitat actions for listed salmon.

There are over 30 different agencies, Indian tribes, councils or commissions with fisheries responsibilities or interests operating in the Columbia River basin. The effective management and restoration of Columbia River basin salmon and steelhead and other aquatic resources depends to a large extent on the ability of these agencies to communicate effectively, resolve differences, develop unified sub basin plans, and work together in a spirit of cooperation in various interagency forums to solve regional and river basin problems.

**National Pollution Discharge Elimination System -** Entiat NFH is currently in compliance with required National Pollution Discharge Elimination System (NPDES) permit requirements for discharge from the hatchery.

**Hazardous Waste -** Entiat NFH is currently, to the best of our knowledge, in compliance with all hazardous waste treatment and control regulations. Efforts have been made to reduce dependence on products resulting in hazardous waste to the greatest extent possible.

**Investigative New Animal Drugs (INAD) –** Erythromycin treatments require an Investigative New Animal Drug use permit. Erythromycin is used to combat bacterial kidney disease and have been used nearly every year. The INAD coordinator is assigned to the Olympia Fish Health Center.

## Monitoring and Reporting

**Fisheries Information System (FIS) -** The FIS is a multifaceted database system consisting of five modules which address unmet management needs (out-year budgeting), accomplishments, deferred maintenance, and other national reporting requirements. This system was previously

referenced in “Budgetary Needs and Strategies section. The following paragraphs provide a more detailed description of the modules and their reporting requirements.

**Fisheries Operational Needs System (FONS) -** FONS was described earlier in this Chapter under “Fish and Wildlife Service Budgeting Process”. This database is available through the hatchery or the Fisheries Program Regional Office in Portland.

**Accomplishment Module -** The Fisheries Accomplishment Module was established as a planning, budgeting, and communication tool to enhance identification of Fisheries Program accomplishments. These data are used in budget documents presented to the Department, OMB, and Congress. The data structure is a "flip-side" of the FONS Module data structure (see previous Fish and Wildlife Service Budgeting Process). This module is used to describe all accomplishments, regardless of funding source. This database is available through the hatchery or the Fisheries Program Regional Office in Portland.

**Fish and Egg Distribution -**This information is used in the Fish and Egg Distribution Report. The report describes the mission of the National Fish Hatchery System, a component of the Fisheries Program of the Fish and Wildlife Service, and its varied accomplishments. The report contains detailed information regarding species, numbers, and pounds of fish produced. It also describes the general purpose of the production program and if it involves listed species. Copies of the report can be obtained by writing the Division of Fish Hatcheries, U. S. Fish and Wildlife Service, 4401 N. Fairfax Drive, Room 810, Arlington, Virginia 22203.

**Imperiled Species Module -** The Imperiled Species Module was designed to capture and report on imperiled species work performed by any Fisheries office. For the purpose of this database an imperiled species is any species or population that is 1) Federally listed under the ESA as threatened or endangered, 2) petition, proposed, or a candidate for Federal listing, or 3) a State listed or species of special concern. Reporting occurs annually, generally in November.

**Maintenance Management System (MMS) -** MMS was described earlier in this Chapter under “Fish and Wildlife Service Budgeting Process”. This database is available through the hatchery or the Fisheries Program Regional Office in Portland.

**Station Guides -** The Station Guide provides an overview of the hatchery program and layout. It describes the station location, layout plan, easements or permits in place, water supply, quarters, office and other buildings. The Guide also provides a brief history of the hatchery. This summary document is useful for providing a quick snap-shot to Service employees and parties interested the hatchery program and facility layout. The Guide is kept current and generally updated annually. Copies can be obtained from the hatchery or the Fisheries Program Regional Office in Portland.

**Real Property Inventory -** The Real Property Inventory (RPI) provides an annual update on Service real property. The RPI was maintained by the Realty Branch until automated in the spring of 1999. The update function was “pen-and ink changes to a paper file”. This was changed to an automated system using FileMaker Pro software in FY1999. It was converted to a web-based data base in FY2001. This method of updating the database is expected to continue

until FY2003 or FY2004 when it will probably be converted to Maximo/SAMMS, also a web-based database.

**Columbia River information System (CRiS) Reports -** This database is used at Columbia River Basin hatcheries to record information related to hatchery operations, marking and tagging, juvenile releases, adult returns, etc. The CRiS also is useful in providing summary reports of this data. The utility and purpose of this database is described in greater detail in Chapter 3 under Monitoring, Evaluation and Coordination.

**Energy Use Report -** This is an annual report that summarizes electricity, heating and cooling energy, and gasoline used at the hatchery.

## REFERENCES


Banks, J.L. 1994. Raceway density and water flow as factors affecting spring Chinook salmon (*Oncorhynchus tshawytscha*) during rearing and after release. Aquaculture 119:201-217.

Bayer, R.D. 1986. Seabirds near an Oregon estuarine salmon hatchery in 1982 and during the 1983 El Nino. Fish. Bull. 84: 279_286.

Beamesderfer, R.C.P., D.L. Ward, and A.A. Nigro. 1996. Evaluation of the biological basis for a predator control program on northern squawfish (*Ptychocheilus oregonensis*) in the Columbia and Snake rivers. Canadian Journal of Fisheries and Aquatic Sciences 53: 2898_2908.

Beamish, R.J. (ed.). 1995. Climate Change and Northern Fish Populations; National Research Council of Canada. Ottawa, Canada.

Beamish, R.J., B.L. Thomson, and G.A. McFarlane 1992. Spiny Dogfish Predation on Chinook and Coho Salmon and the Potential Effects on Hatchery Produced Salmon. Transactions of the American Fisheries Society 121: 444_455.

Becker, C.D. 1973. Food and growth parameters of juvenile Chinook salmon, *Oncorhynchus tshawytscha*, in central Columbia River. Fish. Bull. 71: 387_400.

Campton, D.E. 2000 (Draft). Genetic comparisons among hatchery and wild populations of spring Chinook salmon in the Methow River Basin: ESA controversies in the Columbia River Basin. U.S. Fish and Wildlife Service, Abernathy Fish Technology Center, Longview, Washington.

Cederholm, C.J. et al. 1999. Pacific salmon carcasses: Essential contributions of nutrients and energy for aquatic and terrestrial ecosystems. Fisheries 24 (10): 6-15.

Chapman, D., and K. Witty. 1993. Habitat of weak salmon stocks in the Snake River basin and feasible recovery measures. Report to the Bonneville Power Administration, DOE/BP-99654-1, Portland, Oregon.

Collis, K., Roby, D.D., Craig, D.P., Ryan, B.A., and R.D. Ledgerwood. 2001. Colonial waterbird predation on juvenile salmonids tagged with passive integrated transponders in the Columbia River estuary: Vulnerability of different salmonid species, stocks, and rearing types. Transactions of the American Fisheries Society 130:385-396.

Congleton, J.L., and 10 coauthors. 1995. Evaluation procedures for collection, bypass, and downstream passage of out migrating salmonids. Draft annual report for 1995, MPE-96-10.

Dawley, E.M., R.D. Ledgerwood, T.H. Blahm, C.W. Sims, J.T. Durkin, R.A. Kirn, A.E. Rankis, G.E. Monan, and F.J. Ossiander. 1986. Migration characteristics, biological observations, and relative survival of juvenile salmonids entering the Columbia River estuary, 1966-1983. 1985

Final Report. Bonneville Power Administration and National Marine Fisheries Service, Portland, Oregon.

Elliott, D.G., and R. Pascho. 1994. Juvenile fish transportation: impact of bacterial kidney disease on survival of spring/summer Chinook salmon stocks. 1992. Annual report of the National Biological Survey to the U.S. Army Corps of Engineers, Walla Walla, Washington.

Elliot D.G., R.J. Pascho, L.M. Jackson, G.M. Mathews, and J.R. Harmon. 1997. *Renibacterium salmoninarum* in spring-summer Chinook salmon smolts at dams on the Columbia and Snake River. Aquatic Animal Health 9: 114-126.

Emlen, J.M., R.R. Reisenbichler, A.M. McGie, and T.E. Nickelson. 1990. Density dependence at sea for Coho salmon (*Oncorhynchus kisutch*). Can. J. Fish. Aquatic Sci. 47: 1765_1772.

Enhancement Planning Team. 1986. Salmon and steelhead enhancement plan for the Washington and Columbia River conservation area. Vol. 1. Preliminary review draft.

Goede, R. 1986. Management considerations in stocking of diseased or carrier fish. Pages 349-356 *in* R.H. Stroud, editor. Fish Culture in fisheries management. American Fisheries Society, Bethesda, Maryland.

Groot, C. and L. Margolis. 1991. Pacific salmon life histories. UBC Press, University of British Columbia, Vancouver B.C.

IHOT (Integrated Hatchery Operations Team). 1995. Policy and procedures for Columbia Basin anadromous salmonid hatcheries. Annual report 1994 to the Bonneville Power Administration, Portland Oregon. Project # 92-043.

IHOT (Integrated Hatchery Operations Team). 1996. Operation plans for anadromous fish production facilities in the Columbia River Basin, Volume III-Washington. Annual report 1995 to the Bonneville Power Administration, Portland, Oregon. Project 92-043.

Isaak, D.J., and T.C. Bjornn. 1996. Movement of northern squawfish in the tailrace of a lower Snake River dam relative to the migration of juvenile anadromous salmonids. Transactions of the American Fisheries Society 125: 780_793.

Mantua, N.J., S.R. Hare, Y. Zhang, J.M. Wallace, and R.C. Francis. 1997. A Pacific interdecadal climate oscillation with impacts on salmon production. Bull. Am. Meterol. Soc. 78: 1069_ 1079.

McNeil, W.J. and D.C. Himsworth. 1980. Salmonid ecosystems of the North Pacific. Oregon State University Press and Oregon State University Sea Grant College Program, Corvallis, Oregon.

Muir, W.D., and R.L. Emmett. 1988. Food habits of migrating salmonid smolts passing Bonneville Dam in the Columbia River, 1984. Regulated River 2: 1_10.

Muir, W.D., A.E. Giorgi, and T.C. Coley. 1994. Behavioral and Physiological Changes in Yearling Chinook Salmon During Hatchery Residence and Downstream Migration. Aquaculture 127: 69_82.

Myers, J.M., R.G. Kope, G.J. Bryant, D. Teel, L.J. Lierheimer, T.C. Wainwright, W.S. Grant, F.W. Waknitz, K. Neely, S.T. Lindley, and R.S. Waples. 1998. Status review of Chinook salmon from Washington, Idaho, Oregon, and California. U.S. Dept. Commer., NOAA Technical Memo. NMFS-NWFSC-35, 443p.

NMFS (National Marine Fisheries Service). 1999a. Biological Assessment for Mitchell Act Hatchery Operations. Hatcheries and Inland Fisheries Branch, Portland, Oregon.

NMFS (National Marine Fisheries Service). 1999b. Biological Opinion on Artificial Propagation in the Columbia River Basin, Endangered Species Act - Section 7 Consultations.

NMFS (National Marine Fisheries Service). 1999c. Biological Opinion on Harvest in the Columbia River Basin, Endangered Species Act - Section 7 Consultations.

NMFS (National Marine Fisheries Service). 1997. Investigation of Scientific Information on the Impacts of California Sea Lions and Pacific Harbor Seals on Salmonids and on the Coastal Ecosystems of Washington, Oregon, and California. U.S. Dep. Commer., NOAA Tech. Memo. NMFS_NWFSC_28, 172 p.

Olla, B.L., M.W. Davis and C.H. Ryer. 1993. Behavioral deficits of hatchery reared Pacific salmon: potential effects on survival following release, p. 19. *In* D.S. Danielssen and E. Moksness [ed.] Proc. Int. Symp. on Sea Ranching of Cod and Other Marine Animals, held in Bergen, Norway, June 15_18, 1993. Institute of Marine Research, Bergen, Norway.

Park, D.L. 1993. Effects of marine mammals on Columbia River salmon listed under the Endangered Species Act, DOE/BP_99654_3. Bonneville Power Administration. Portland, Oregon.

Pastor, S.M. 1999. Annual coded wire program. Annual report 1998 to the Bonneville Power Administration, project 89-065, U.S. Fish and Wildlife Service, Vancouver, Washington.

Pettit, R. 1999a. Escapement database for spring Chinook in Washington tributaries between Bonneville and McNary Dams, 1970-1998. Columbia River Progress Report 99-2. Washington Department of Fish and Wildlife, Vancouver, Washington

Pettit, R. 1999b. Escapement estimates for adult spring Chinook in Washington tributaries between Bonneville and McNary Dams, 1998. Columbia River Progress Report 99-3. Washington Department of Fish and Wildlife, Vancouver, Washington

Piggins, D.J., and C.P.R. Mills. 1985. Comparative aspects of the biology of naturally produced and hatchery reared Atlantic salmon smolts *Salmo salar*. Aquaculture 45: 321_334.

Ruggerone, G.T. 1986. Consumption of migrating juvenile salmonids by gull foraging below a Columbia River dam. Trans. Am. Fish. Soc. 115: 736_742.
Sager, P.M., and G.J. Glova. 1988. Diet feeding periodicity, daily ration and prey selection of a riverine population of juvenile Chinook salmon, *Oncorhynchus tshawytscha*. J. Fish Biol. 33: 643_653.

Salonius, K., and G.K. Iwama. 1993. Effects of Early Rearing Environment on Stress Response, Immune Function, and Disease Resistance in Juvenile Coho (*Oncorhynchus kisutch*) and Chinook Salmon (*O. tshawytscha*). Canadian Journal of Fisheries and Aquatic Sciences 50: 759_766.

Schreck, C.B., A.G. Maule and S.L. Kaattari. 1993. Stress and disease resistance, p. 170_175. *In* J.F. Muir and R.J. Roberts [ed.] Recent Advances in Aquaculture, Vol. 4. Blackwell Scientific Publications, Oxford, UK.

Simenstad, C., K. Fresh, and E. Salo. 1982. The role of Puget Sound and Washington coastal estuaries in the life history of Pacific Salmon: an unappreciated function. Pages 343-364 *in* V. Kennedy, editor. Estuarine comparisons. Academic Press, New York.

Slatick, E., L.G. Gilbreath, J.R. Harmon, T.C. Bjornn, R.R. Ringe, K.A. Walch, A.J. Novotny, and W.S. Zaugg. 1988. Imprinting hatchery reared salmon and steelhead trout for homing, 1978 - 1983. Final report of research by NOAA Fisheries, Seattle, Washington. Bonneville Power Administration Project No. 78-1, Portland, Oregon.

Smith. S.D. 1995. Wind River summer run steelhead: An evaluation to determine the feasibility of rearing steelhead to enhance natural production. U.S. Department of the Interior, National Biological Service, Columbia River Research Laboratory, Cook, Washington.

Steward, R., and T. Bjornn. 1990. Supplementation of salmon and steelhead stocks with hatchery fish: a synthesis of published literature. Tech. Report 90-1. Part 2 *in* W.H. Miller, editor. Analysis of Salmon and Steelhead Supplementation. Bonneville Power Administration, Portland, Oregon. U.S. Fish and Wildlife, Dworshak Fisheries Assistance Office, Idaho.

Trotter, P.C. 1997. Sea-run cutthroat trout: life history profile. Pages 7-15 *in* J.D. Hall, P.A. Bisson, and R.E. Gresswell, editors. Sea-run cutthroat trout: biology, management, and future conservation. Oregon Chapter, American Fisheries Society, Corvallis, Oregon.

USFWS (U.S. Fish and Wildlife Service). 1993. Hatchery Evaluation Vision Action Plan. Draft planning report, May 14, 1993 by Region 1 Fisheries, Portland, Oregon.

USFWS (U.S. Fish and Wildlife Service). 1994. Biological Assessments for operation of U.S. Fish and Wildlife Service operated or funded hatcheries in the Columbia River Basin in 1995-1998. Submitted to National Marine Fisheries Service under cover letter, dated August 2, 1994, from Bill Shake Acting USFWS Regional Director to Brian Brown, NMFS.

USFWS (U.S. Fish and Wildlife Service). 1999. Hatchery and Genetic Management Plan, spring Chinook salmon, Entiat National Fish Hatchery, December 14, 1999 Draft. Columbia River Fisheries Program Office, Vancouver, Washington.

Washington Conservation Commission. 1999. Salmon and steelhead habitat limiting factors in Water Resource Inventory Area (WRIA) 29.

WDFW (Washington Department of Fish and Wildlife) 2000. Wind River Subbasin Summary (Draft). Prepared for the Northwest Power Planning Council, Portland, Oregon.

## LIST OF ATTACHMENTS

Attachment 1.—Map of U.S. Fish and Wildlife Service Pacific Region including Location of Entiat National Fish Hatchery and associated field offices.

Attachment 2.—Historical Background of National Fish Hatcheries in the Pacific Region. http://www.r1.fws.gov/crfpo

Attachment 3.—Statutory Mandates and Authorities**.**

Attachment 4.—Map of Entiat River Watershed in North Central Washington and Location Map of Entiat National Fish Hatchery.

Attachment 5.— Hatchery Buildings, Primary Use, and Improvements.

Attachment 6.— Entiat NFH Physical Description of Holding, Incubation, and Rearing Units.

Attachment 7.—Layout Diagram of Entiat National Fish Hatchery.

Attachment 8.—Aerial Photographs of Entiat National Fish Hatchery.

Attachment 9.—Listed and Candidate Species under the Endangered Species Act.

Attachment 10.—Spawning Ground Survey Data for Spring Chinook Salmon in the Entiat River, 1970 - 2001.

Attachment 11.—Special Use Permit from the U.S.D.A. Forest Service, Circa 1937.

Attachment 12.—Historical Releases from Entiat National Fish Hatchery, 1938-1980.

Attachment 13.—Releases of Juvenile Spring Chinook Salmon from Entiat National Fish Hatchery into the Entiat River since 1990.

Attachment 14.—Entiat National Fish Hatchery Spring Chinook Return Data, 1980-2001.

Attachment 15.—Age at Return of Entiat National Fish Hatchery Spring Chinook Salmon.

Attachment 16.—Smolt to Adult Survival of Entiat National Fish Hatchery Spring Chinook Salmon, 1980-1996 Broods.

Attachment 17.—Fisheries Contribution of Spring Chinook Salmon from Entiat National Fish Hatchery.

Attachment 18.—Budget by Funding Source and Full Time Equivalent (FTE) Personnel for Fiscal Years (FY) 2000 through 2002.

Attachment 19.—Regional and National Calender for the Budget Formulation Process.

Attachment 20.—Projects Submitted as of Fiscal Year 2001 which are Linked to Entiat NFH Goals and Objectives.

Attachment 21.—Projects Submitted to FONS in 2001 by the Service's Columbia River Fisheries Program Office (Vancouver, Washington), Lower Columbia River Fish Health Center and Abernathy Fish Technology Center to Support Entiat NFH which are Linked to Entiat NFH Goals and Objectives.

Attachment 22.—MMS.

Attachment 23.—Quarters Policy.

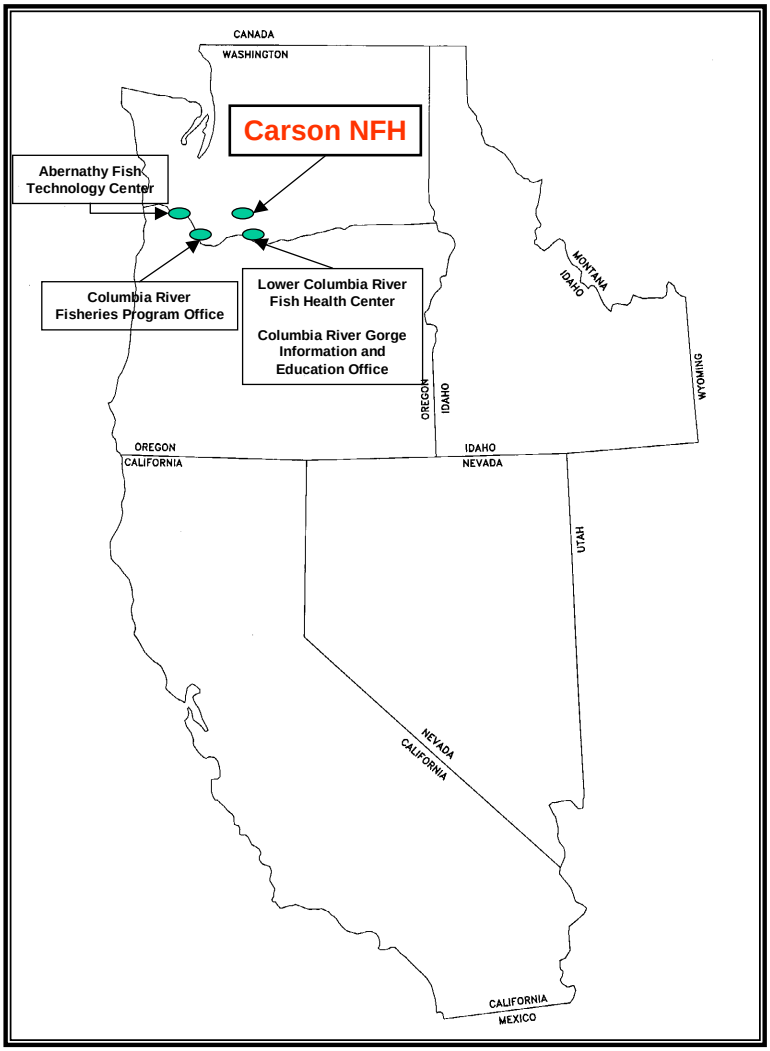
Attachment 24.—Quarters Plan.

Attachment 25.—Surplus Fish as Government Property.

Attachment 26.—Drugs and Anesthetics.

Attachment 27.—Fisheries Pest Management Policy.

## Pacific Region and Location of Carson NFH




The Pacific Region of the U. S. Fish and Wildlife Service and location of Carson National Fish Hatchery, Abernathy Fish Technology Center, Lower Columbia River Fish Health Center, Columbia River Gorge Information and Education Office, and Columbia River Fisheries Program Office.

Attachment 1.—Map of Pacific Region including location of Entiat National Fish Hatchery.

UPDATE MAP

Attachment 2 - Historical Background of National Fish Hatcheries in Region 1.

| Station | Year Established | Final Year | Disposition |
|---|---|---|---|
| McCloud River, CA | 1872 | 1882 | Closed |
| Crooks Creek, CA | 1879 | 1887 | Moved to McCloud River, CA |
| Baird (formerly McCloud | 1888 | 1937 | Transferred to BOR |
| Clackamas, OR | 1888 | 1943 | Transferred to State of Oregon |
| Fort Gaston, CA | 1889 | 1898 | Replaced by Willamette Falls, OR |
| Korbel, CA | 1893 | 1896 | Closed |
| Redwood Lake, CA | 1893 | 1898 | Closed |
| Sandy River, OR | 1895 | 1925 | Closed |
| Battle Creek, CA | 1896 | 1946 | Closed |
| Olema (Bear Valley), CA | 1897 | 1898 | Closed |
| Salmon River, OR | 1897 | 1900 | Transferred to State of Oregon |
| Upper Clackamas, OR | 1897 | 1931 | Transferred to State of Oregon |
| Roque River, OR | 1897 | 1932 | Closed |
| Mill Creek, CA | 1898 | 1948 | Transferred to FWS Div. of Research |
| Little White Salmon, WA | 1898 | ---------- | Operating |
| Willamette Falls, OR | 1899 | 1942 | Closed |
| Baker Lake, WA | 1899 | 1942 | Transferred to US Forest Service |
| Spring Creek, WA | 1901 | ---------- | Operating |
| Grants Pass, OR | 1904 | 1906 | Moved to Applegate Creek, OR |
| Phinney Creek, WA | 1907 | 1918 | Closed |
| Applegate, OR | 1907 | 1959 | Transferred to FWS Div. of Research |

| | | | |
|---|---|---|---|
| Cazadero, OR | 1908 | 1913 | Closed |
| Illabot Creek, WA | 1909 | 1927 | Closed |
| Duckabush, WA | 1911 | 1943 | Transferred to US Forest Service |
| Quilcene, WA | 1911 | ---------- | Operating |
| Darrington, WA | 1912 | 1919 | Closed |
| Brinnon, WA | 1913 | 1923 | Closed - egg collection |
| Sultan, WA | 1913 | 1933 | Closed |
| Birdsview, WA | 1913 | 1947 | Transferred to State of Washington |
| Day Creek, WA | 1914 | 1919 | Closed |
| Quinault (Old), WA | 1914 | 1947 | Transferred to US Forest Service |
| St. Helens, OR | 1917 | 1919 | Closed |
| Paris, ID | 1918 | 1921 | Closed |
| Washougal River, WA | 1919 | 1923 | Closed |
| Salmon, ID | 1921 | 1946 | Transferred to Bureau of Land Management |
| Phalon, WA | 1922 | * | Authorized, but never operated |
| Snake River, OR | 1924 | 1925 | Moved to Salmon, ID |
| Ozette, WA | 1926 | 1927 | Closed |
| Wind River, WA | 1926 | 1936 | Transferred to State of Washington |
| Mt. Rainer, WA | 1931 | 1942 | Transferred to National Park Service |
| Hagerman, ID | 1931 | -------- | Operating |
| Butte Falls, OR | 1932 | 1943 | Transferred ½ to State of Oregon; ½ to Bureau of Reclamation |
| Deschutes, OR | 1932 | * | Never operated |
| Spokane, WA | 1935 | 1942 | Transferred to State of Washington |
| Yakima Fish Screen, WA | 1935 | 1986 | Closed |
| Delph Creek (Estacada, OR) | 1936 | 1954 | Transferred to State of Oregon |
| Entiat, WA | 1937 | ---------- | Operating |
| Leavenworth, WA | 1938 | ---------- | Operating |

| | | | |
|---|---|---|---|
| Clark Fork, ID | 1939 | 1942 | Transferred to State of Idaho |
| Sun Valley, ID | 1940 | 1941 | Closed |
| Warm River, ID | 1940 | 1951 | Transferred to State of Idaho |
| Entiat, WA | 1940 | ---------- | Operating |
| Winthrop, WA | 1940 | ---------- | Operating |
| Coleman, CA | 1942 | ---------- | Operating |
| Willard, WA | 1951 | ---------- | Operating |
| Eagle Creek, OR | 1953 | ---------- | Operating |
| Abernathy, WA | 1957 | ---------- | Operating |
| Lahontan, NV | 1964 | ---------- | Operating |
| Tehama-Colusa Spawning Channels, CA | 1967 | 1989 | Caretaker status |
| Quinault, WA | 1969 | ---------- | Operating |
| Dworshak, ID | 1969 | ---------- | Operating |
| Kooskia, ID | 1970 | ---------- | Operating |
| Marble Bluff Fishway, NV | 1974 | ---------- | Operating |
| Warm Springs, OR | 1974 | ---------- | Operating |
| Makah, WA | 1981 | ---------- | Operating |
| Nisqually, WA | 1991 | ---------- | Operating |
| Livingston Stone, CA | 1992 | ---------- | Operating |

Attachment 3.—Statutory Mandates and Authorities**.**

General Authorizations

1. Anadromous Fish Conservation Act, as amended (16 U.S.C. 757a-757f).
2. Department of Transportation Act (16 U.S.C. 1653f).
3. Estuary Protection Act (16 U.S.C. 1221-1226).
4. Federal Aid in Sport Fish Restoration Act of August 9, 1950, as amended (16 U.S.C. 777k).
5. Federal Water Pollution Control Act Amendments, as amended (33 U.S.C. 1251-1365, 1281-1292, 1311-1328, 1341-1345, 1361-1376).
6. Fish and Wildlife Act of 1956, as amended (16 U.S.C. 742a-742j).
7. Fish and Wildlife Conservation Act of 1980 (16 U.S.C. 2901-2911).
8. Indian Self-Determination and Education Assistance Act of 1976 (25 U.S.C. 450-450n).
9. Magnuson Fishery Conservation and Management Act of 1976 (16 U.S.C. 1801-1882).
10. National Aquaculture Act of 1980, as amended (16 U.S.C. 2801-2810).
11. Reorganization Plan No. 4 of 1970 (5 U.S.C. Appendix).
12. Rivers and Harbors Act of 1899, as amended (33 U.S.C. 401 et seq.).
13. Recreation Use of Conservation Areas Act (16 U.S.C. 460k-460k-4).
14. Sikes Act, as amended (16 U.S.C. 670a-670o).
15. Watershed Protection and Flood Prevention Act, as amended (16 U.S.C. 1001-1009).
16. Code of Federal Regulation, Wildlife and Fisheries, Title 50, Parts 1 to 199.
17. Endangered Species Act of 1973 (16 U.S.C. 1531-1544, 87 stat. 884) as amended.
18. Federal Power Act (16 U.S.C. 791-828c; Chapter 285, June 10, 1920; 41 Stat. 1063) as amended.
19. Federal Water Project Recreation Act (16 U.S.C. 460 (L) (12) - 460 (L) (21); P.L. 89-72.
20. Fish and Wildlife Coordination Act (16 U.S.C. 661-667e; 48 Stat. 401) as amended.
21. Fish and Wildlife Improvement Act (16 U.S.C. 7421; 92 Stat. 3110)
22. Lacy Act Amendments of 1981 (P.L. 97-79; 95 Stat. 1073, 16 U.S.C. 3371-3378)
23. Non-indigenous Aquatic Nuisance Prevention and Control Act of 1990 [Title I of P.L. 101-646 (104 Stat. 4761].
24. Oil Pollution Act of 1990 [Public Law 101-380 33 U.S.C. 2701 et seq; 104 Stat. 484].
25. Comprehensive Environmental Response Compensation and Liability Act (Superfund) (26 U.S.C. 4611-4682; P.L. 96-510, December 11, 1980; 94 Stat. 2797).
26. National Environmental Policy Act of 1969 (P.L. 91-190, 42 U.S.C. 4321-4347, January1, 1970, 83 Stat. 852) as amended by P.L. 94-52.
27. National Wildlife Refuge System Administration Act of 1966 (16 U.S.C. 668dd-668ee) as amended.
28. Emergency Relief Appropriations Act (49 Stat. 115).
29. Reclamation Laws (54 Stat. 1198, 1199).
30. Flood Control Act of 1962 (76 Stat. 1193).
31. White Act (46 Stat. 371).
32. Flood Control Act of 1944, as amended 1950 (58 Stat. 887).

Area-Specific Authorizations

33. U. S. v. Oregon, “Belloni Decision” [302 F. Supp. 899 (1969); affirmed, 529 F. 2d 570 (1976)].
34. U. S. v. Washington, “Boldt Decision” [384 F. Supp. 312 (1974); affirmed, 520 F. 2d 676 (1975); cert. denied, 423 U.S. 1086 (1976)].
35. Water Resources Development Act of 1976 [Lower Snake River Compensation Plan (90 Stat. 2921)].
36. Pacific Salmon Treaty Act of 1985, “U.S./Canada Pacific Salmon Treaty” (P.L. 99-5, 16 U.S.C. 3631, 03/15/1985).
37. Salmon and Steelhead Conservation and Enhancement Act (16 U.S.C. 3301-3325).
38. Yakima Fishery Enhancement Project (P.L. 98-360, P.L. 98-381, P.L. 98-386).
39. Grand Coulee Dam Project (49 Stat. 1028).
40. Grand Coulee Fish Management Project [Columbia Basin (Grand Coulee Dam) Act] - April 3, 1937.
41. Chief Joseph Dam Project - [Oroville-Tonasket Unit, Washington (76 stat. 761) Section 3 of the Act of October 9, 1962] [Whitestone Coulee Unit, Washington (43 U.S.C. 616uu, 616vv-1-6163; 78 Stat. 704], as amended.
42. Columbia Basin Project Act (16 U.S.C. 835 et seq., 57 Stat. 140) as amended.
43. Chehalis River Fishery Resources Study and Restoration Act [Public Law 101-454 (104 Stat. 1054].
44. Mitchell Act (16 U.S.C. 755-757; 52 Stat. 345).
45. Pacific Northwest Electric Power Planning and Conservation (16 U.S.C. 839, P.L. 96-501, 94 Stat. 2697) as amended.
46. First Deficiency Appropriation Act, “Central Valley Project” (49 Stat. 1622).
47. Reclamation Projects Authorization and Adjustment Act of 1992, “Central Valley Project Improvement Act (106 Stat. 4714-4731).
48. Washoe Project Act (70 Stat. 775-777).

UPDATE MAP

Attachment 4.—Map of Entiat River Watershed in Central Washington and Location Map of Entiat National Fish Hatchery http://www.cbfwf.org/files/province/gorge/map.gif.

Attachment 5 - Hatchery Buildings, Primary Use, and Improvements.

| **Building** | **Construction type** |
|---|---|
| Nursery Building<br>4141 sq. ft. | Wood frame, constructed 1937. Used to incubate eggs and fry. |
| Shop<br>2118 sq.ft | Wood frame, constructed 1937. Expanded 1994. |
| Residences<br>Residence-1, 192 $ft^2$<br>Residence-2 1,500 $ft^2$<br>Residence-3 1,500 $ft^2$ | Residences at Entiat NFH consist of three wood frame houses constructed circa 1937 and two concrete block three bedroom duplex units constructed in 1955. A third duplex unit was declared excess to hatchery needs and razed in FY 1996. |
| Service/Administration<br>3,537 $ft^2$ | Brick/ceramic block, constructed 1955. Includes office space for Project Leader, Assistant Manager and Administrative Assistant plus storage for three vehicles, fish food storage freezer, feed prep room and production crew office. |
| Oil and Paint Storage<br>339 $ft^2$ | Brick, constructed 1955. Used to store gas powered equipment, oil, and paint. |
| Pond Cover<br>17,170 $ft^2$ | Galvanized steel cover constructed over the middle bank of raceways in 2000 to replace a cover which had collapsed during heavy snow. This structure is made of very heavy steel posts and trusses designed to carry up to 1,000,000 pounds of snow. |
| Hazardous Material Storage<br>69 $ft^2$ | Prefabricated 9' x 12' metal hazardous material storage building purchased in 2001 to store formalin. |

Attachment 6.— Entiat NFH Physical Description of Holding, Incubation, and Rearing Units.

| Unit type | Length (ft) | Width (ft) | Depth (ft) | Volume ($ft^3$) | No. | Material | Age | Condition |
|---|---|---|---|---|---|---|---|---|
| Brood pond | 146 | 40 | 4 | 23,360 | 2 | concrete | 42 | fair |
| Lower earth pond | 270 | 78 | 3 | 63,180 | 1 | dirt | 42 | good |
| Upper earth pond | 170.0 | 45.0 | 2.3 | 17,212 | 1 | dirt | 42 | good |
| Raceways[1] | 80 | 8 | 2 | 1,280 | 46 | concrete | 42 | good |
| Incubator troughs | 20.0 | 1.5 | 1.5 | 45 | 8 | fiberglass | 20 | good |
| Vertical stack incubators | | | | 7 | 21 | fiberglass | 5 | good |
| Starter tanks | 15.0 | 3.5 | 2.0 | 105 | 24 | fiberglass | 20 | good |

[1] Raceways lined with polyurethane in 2002.

Attachment 7.—Layout Diagram of Entiat National Fish Hatchery.

Attachment 8.—Aerial Photographs of Entiat National Fish Hatchery.

Attachment 9.—Listed and Candidate Species under the Endangered Species Act.

Comment [1]: DON'T EDIT OR DELETE ABOVE THIS COMMENT

Western Washington Fish and Wildlife Office
510 Desmond Drive SE, Suite 102
Lacey,Washington 98503
Phone: (360) 753-9440 Fax: (360) 534-9331

Dear Species List Requester:

We are providing the information you requested to assist your determination of possible impacts of a proposed project to species of Federal concern. Attachment A includes the listed threatened and endangered species, species proposed for listing, candidate species, and/or species of concern that may be within the area of your proposed project.

Any Federal agency, currently or in the future, that provides funding, permitting, licensing, or other authorization for this project must assure that its responsibilities section 7(a)(2) of the Endangered Species Act of 1973, as amended (Act), are met. Attachment B outlines the responsibilities of Federal agencies for consulting or conferencing with us (U.S. Fish and Wildlife Service).

If both listed and proposed species occur in the vicinity of a project that meets the requirements of a major Federal action (i.e., "major construction activity"), impacts to both listed and proposed species must be considered in a biological assessment (BA) (section 7(c); see Attachment B). Although the Federal agency is not required, under section 7(c), to address impacts to proposed species if listed species are not known to occur in the project area, it may be in the Federal agency's best interest to address impacts to proposed species. The listing process may be completed within a year, and information gathered on a proposed species could be used to address consultation needs should the species be listed. However, if the proposed action is likely to jeopardize the continued existence of a proposed species, or result in the destruction or adverse modification of proposed critical habitat, a formal conference with us is required by the Act (section 7(a)(4)). The results of the BA will determine if conferencing is required.

The Federal agency is responsible for making a determination of the effects of the project on listed species and/or critical habitat. For a Federal agency determination that a listed species or critical habitat is likely to be affected (adversely or beneficially) by the project, you should request section 7 consultation through this office. For a "not likely to adversely affect" determination, you should request our concurrence through the informal consultation process.

Candidate species and species of concern are those species whose conservation status is of concern to us, but for which additional information is needed. Candidate species are included as an advance notice to Federal agencies of species that may be proposed and listed in the future. Conservation measures for candidate species and species of concern are voluntary but

recommended. Protection provided to these species now may preclude possible listing in the future.

For other federally listed species that may occur in the vicinity of your project, contact the National Marine Fisheries Service at (360) 753-9530 to request a list of species under their jurisdiction. For wetland permit requirements, contact the Seattle District of the U.S. Army Corps of Engineers for Federal permit requirements and the Washington State Department of Ecology for State permit requirements.

Thank you for your assistance in protecting listed threatened and endangered species and other species of Federal concern. If you have additional questions, please contact Yvonne Dettlaff (360) 753-9582.

Sincerely,

Ken S. Berg, Manager
Western Washington Fish and Wildlife Office

Enclosure(s)

**ATTACHMENT A** **July 2, 2002**

# LISTED AND PROPOSED ENDANGERED AND THREATENED SPECIES, CRITICAL HABITAT, CANDIDATE SPECIES, AND SPECIES OF CONCERN THAT MAY OCCUR IN THE VICINITY OF THE ENTIAT NATIONAL FISH HATCHERY IN CHELAN COUNTY, WASHINGTON

**(T5N R7E S32)**

**FWS REF: 1-3-02-SP-1530**

## LISTED

Wintering bald eagles (*Haliaeetus leucocephalus*) may occur in the vicinity of the project. Wintering activities occur from October 31 through March 31.

Bull trout (*Salvelinus confluentus*) may occur in the vicinity of the project.

Northern spotted owl (*Strix occidentalis caurina*) occurs in the vicinity of the project. Nesting activities occur from March 1 through September 30.

Major concerns that should be addressed in your biological assessment of the project impacts to listed species include:

1. Level of use of the project area by listed species,

2. Effect of the project on listed species' primary food stocks, prey species, and foraging areas in all areas influenced by the project, and

3. Impacts from project construction (i.e., habitat loss, increased noise levels, increased human activity) that may result in disturbance to listed species and/or their avoidance of the project area.

## PROPOSED

None

## CANDIDATE

None

## CRITICAL HABITAT

Critical habitat for the northern spotted owl has been designated in the vicinity of the project.

## SPECIES OF CONCERN

The following species of concern have been documented in the county where the project is located. These species or their habitat could be located on or near the project site. Species in **bold** were specific occurrences located on the database within a 1 mile radius of the project site.

California wolverine (*Gulo gulo luteus*)
Cascades frog (*Rana cascadae*)
Larch Mountain salamander (*Plethodon larselli*)
Long-eared myotis (*Myotis evotis*)
Long-legged myotis (*Myotis volans*)
**Northern goshawk (*Accipiter gentilis*)**
Northwestern pond turtle (*Clemmys marmorata marmorata*)
Olive-sided flycatcher (*Contopus cooperi*)
Pacific Townsend's big-eared bat (*Corynorhinus townsendii townsendii*)
Pacific lamprey (*Lampetra tridentata*)
Peregrine falcon (*Falco peregrinus*)
River lamprey (*Lampetra ayresi*)
**Tailed frog (*Ascaphus truei*)**
Western toad (*Bufo boreas*)
*Penstemon barrettiae* (Barrett's beardtongue)
*Rorippa columbiae* (Columbia yellow-cress)
*Sisyrinchium sarmentosum* (pale blue-eyed grass)

**ATTACHMENT B**

## FEDERAL AGENCIES' RESPONSIBILITIES UNDER SECTIONS 7(a) AND 7(c) OF THE ENDANGERED SPECIES ACT OF 1973, AS AMENDED

SECTION 7(a) - Consultation/Conference

Requires: 1. Federal agencies to utilize their authorities to carry out programs to conserve endangered and threatened species;

2. Consultation with the U.S. Fish and Wildlife Service (FWS) when a Federal action may affect a listed endangered or threatened species to ensure that any action authorized, funded, or carried out by a Federal agency is not likely to jeopardize the continued existence of listed species or result in the destruction or adverse modification of critical habitat. The process is initiated by the Federal agency after it has determined if its action may affect (adversely or beneficially) a listed species; and

3. Conference with the FWS when a Federal action is likely to jeopardize the continued existence of a proposed species or result in destruction or an adverse modification of proposed critical habitat.

SECTION 7(c) - Biological Assessment for Construction Projects *

Requires Federal agencies or their designees to prepare a Biological Assessment (BA) for construction projects only. The purpose of the BA is to identify any proposed and/or listed species that is/are likely to be affected by a construction project. The process is initiated by a Federal agency in requesting a list of proposed and listed threatened and endangered species (list attached). The BA should be completed within 180 days after its initiation (or within such a time period as is mutually agreeable). If the BA is not initiated within 90 days of receipt of the species list, please verify the accuracy of the list with the Service. No irreversible commitment of resources is to be made during the BA process which would result in violation of the requirements under Section 7(a) of the Act. Planning, design, and administrative actions may be taken; however, no construction may begin.

To complete the BA, your agency or its designee should (1) conduct an onsite inspection of the area to be affected by the proposal, which may include a detailed survey of the area to determine if the species is present and whether suitable habitat exists for either expanding the existing population or potential reintroduction of the species; (2) review literature and scientific data to determine species distribution, habitat needs, and other biological requirements; (3) interview experts including those within the FWS, National Marine Fisheries Service, state conservation department, universities, and others who may have data not yet published in scientific literature; (4) review and analyze the effects of the proposal on the species in terms of individuals and populations, including consideration of cumulative effects of the proposal on the species and its habitat; (5) analyze alternative actions that may provide conservation measures; and (6) prepare a report documenting the results, including a discussion of study methods used, any problems encountered, and other relevant information. Upon completion, the report should be forwarded to our Endangered Species Division, 510 Desmond Drive SE, Suite 102, Lacey, WA 98503-1273.

---

* "Construction project" means any major Federal action which significantly affects the quality of the human environment (requiring an EIS), designed primarily to result in the building or erection of human-made structures such as dams, buildings, roads, pipelines, channels, and the like. This includes Federal action such as permits, grants, licenses, or other forms of Federal authorization or approval which may result in construction.

Attachment 10.—Spawning Ground Survey Data for Spring Chinook Salmon in the Entiat River, 1970 - 2001.
Data from Washington Department of Fish and Wildlife, Vancouver Washington.

| Return Year | Adult | Jack | Total |
|---|---|---|---|

Attachment 11.—Special Use Permit from the U.S.D.A. Forest Service, Circa 1937.

Attachment 12.—Historical Releases from Entiat National Fish Hatchery, 1938-1980.

| Date | BY | Species | Size | Number | Water |
|---|---|---|---|---|---|

++Planted by Forest Service.
*Reared cooperatively with the Washington Dept. of Game
+Reared as part of the Lower Columbia River Salmon Development Program

BBS= Blueback Salmon
BKT= Brook Trout
BST= Black-spotted Trout
CH= Chinook Salmon
COS= Coho Salmon
SIS= Silver Salmon
CUT= Cutthroat Trout
FCS= Fall Chinook Salmon
FKS= Fall King Salmon
KMT= Kamloops Trout
KOK= Kokanes
RBT= Rainbow Trout
SCS= Spring Chinook Salmon
SES= Sockeye Salmon
SHT= Steelhead Trout

Fry = up to time yolk sac absorbed & feeding begins
Advanced fry = end of fry to 1 inch
Fingerlings = between 1" and yearling, No.1 were 1", up to 2", No. 2 were up to 3", etc.
Yearling = one year old, but less than 2 from date of hatching, could call them No. 1, etc, as well.

Attachment 13.—Releases of Juvenile Spring Chinook Salmon from Entiat National Fish Hatchery into the Entiat River since 1980.

Attachment 14.—Entiat National Fish Hatchery Spring Chinook Return Data, 1980-2001.

Attachment 15.—Age at Return of Entiat National Fish Hatchery Spring Chinook Salmon.

Attachment 16.—Smolt to Adult Survival of Entiat National Fish Hatchery Spring Chinook Salmon, includes all Reported Recoveries (hatchery plus harvest), 1980-1996 Broods.

Attachment 17.—Fisheries Contribution of Spring Chinook Salmon from Entiat National Fish Hatchery.

Attachment 18.—Budget by Funding Source and Full Time Equivalent (FTE) Personnel for Fiscal Years (FY) 2000 through 2002.

| | FY 2000<br>Actual<br>($1,000) | FY 2001<br>Actual<br>($1,000) | FY 2002<br>Estimated<br>($1,000) |
|---|---|---|---|
| NOAA Fisheries<br>USFWS<br>Operations | 424.1<br>23.6<br>447.7 | 470.5<br>23.7<br>494.2 | 564.7<br>0.0<br>564.7 |
| Cyclical<br>Quarters<br>Flood<br>Spill control<br>MMS project list<br>Maintenance | 5.2<br>10.5<br>474.5<br>8.3<br>0.0<br>498.5 | 5.2<br>8.9<br>0.0<br>4.0<br>115.0<br>133.1 | 0.0<br>8.9<br>0.0<br>0.0<br>328.0<br>336.9 |
| Cost recoverables | 424.1 | 470.5 | 564.7 |

| | FY 2000 | FY 2001 | FY 2002 |
|---|---|---|---|
| FTE | 6.75 | 7 | 7 |

Attachment 19.—Regional and National Calender for the Budget Formulation Process.

| **Regional Formulation Process** | |
|---|---|
| November | Project Leaders complete FONS submissions, emphasizing projects related to ecoregion priorities, and forward to the Regional FONS Coordinator.<br>Submissions are reviewed for completeness and clarity. Projects are then submitted to the relevant supervisors for ranking.<br><br>ARD, Fisheries incorporate supervisor rankings and input, plus regional and national priorities to develop regional ranking recommendations.<br><br>Regional Director reviews and approves/modifies regional ranking recommendations. |
| **National Formulation Process** | |
| February | Regional FONS submission to Service's Washington Office. |
| Mar/Apr | Assistant Director, Fisheries and Habitat Conservation and ARD, Fisheries review regional submissions and identify themes.<br><br>Themes communicated to ARD, Fisheries, Regional Directors, and Director. |
| May/June | Regions use themes in the development of regional budget requests. Using FONS, project lists will be developed for each theme to be forwarded in the Regional Request. |
| June | The Service Budget Committee considers the Regional Requests in setting priorities for the Service's Budget Request to the Department. |
| June➜Jan | As the Service's Budget Request moves through the approval process (Department of Interior and OMB review), ARD, Fisheries will be consulted to ensure that FONS lists still represent the highest priorities of the regions. |
| February | Presidents budget submitted to Congress including FONS projects for Fisheries Program increases. |

Attachment 20.—Projects Submitted as of Fiscal Year 2001 which are Linked to Entiat NFH Goals and Objectives.

| Goal | Objective | Intended accomplishment | FONS project # | Cost ($1,000) |
|---|---|---|---|---|
| 1 | 2 | Most efficient use of fish rearing facilities to enhance unique spring Chinook in river fishing opportunities. | 1999-001 | 35 |
| 4 | 1 & 2 | Increase public use of hatchery facilities while informing visiting publics of Fish and Wildlife Service activities. | 1999-002 | 110 |
| 3 | 1 | Enhanced survival and abundance of listed salmon in Washington. | 1999-003 | 21 |
| 3 | 1 | Restoration of ESA listed steelhead (threatened) in the Wind River. | 2000-001 | 10 |
| 1<br>2 | 1<br>2 & 3 | Development of a Station Development Plan which will make Entiat NFH more effective in addressing the needs of fishers reaching conservation hatchery goals. | 2001-02 | 25 |
| 1 | 2 | Evaluate the energetic costs of passage and migration delay, resulting from hydropower projects, on Columbia river adult spring Chinook salmon. | 2002-001 | 4 |
| 1 | 1 & 2 | Determine the effects of electrical anesthesia used during spawning activities on adult spawners, eggs, and juveniles | 2002-002 | 4 |
| 1<br>(All) | 1<br>(All) | Maximizing efforts of fisheries managers and biologists on resource issues by minimizing computer down time which is estimated at 2000 hours (50 weeks) per year for 6 stations | 2002-003 | 18 |
| 3 | 1 | Provide information to assist with the recovery of wild and listed fish in the Wind River. | 2002-004 | 15 |
| | | | | |
| | | | Total: | 242 |

Attachment 21.—Projects Submitted to FONS in 2001 by the Service's Columbia River Fisheries Program Office (Vancouver, Washington), Lower Columbia River Fish Health Center and Abernathy Fish Technology Center to Support Entiat NFH which are Linked to Entiat NFH Goals and Objectives.

| Goal | Objective | Intended accomplishment | FONS project # | Cost ($1,000) |
|---|---|---|---|---|
| **Columbia River Fisheries Program Office (Vancouver, Washington)** | | | | |
| 3 | 1 | Evaluate four National Fish Hatcheries to Improve Efficiency and Reduce Impacts to Wild Fish | 1999-005 | 110 |
| 3 | 1 | Ecological Interactions Between Hatchery and Wild fish in the Wind River, Washington | 2002-001 | 150 |
| 3 | 1 | Comprehensive Hatchery and Genetic Management Plans for National Fish Hatcheries | 1999-006 | 20 |
| | | | Total: | 280 |
| **Lower Columbia River Fish Health Center** | | | | |
| 3 | 1 | Restoration of Endangered Steelhead in the Wind River, Washington | 2000-002 | 51 |
| 1 | 1 | Fisheries Resources Computer Management | 2000-006 | 18 |
| 3 | 1 | Ecological Interactions Between Hatchery and Wild fish in the Wind River, Washington | 2002-002 | 18 |
| | | | Total: | 87 |
| **Abernathy Fish Technology Center** | | | | |
| 1 | 1&2 | Evaluate Electro Anesthesia Used in Sorting Fish During Spawning Activities | 2001-009 | 66 |
| 3 | 1 | Ecological Interactions Between Hatchery and Wild fish in the Wind River, Washington | 2002-002 | 40 |
| 1 | 2 | Energetic Costs of Spawning Migration and Reproductive Maturation in Columbia River Chinook salmon | 2001-006 | 184 |
| | | | Total: | 290 |

Attachment 22.—MMS.

Attachment 23.—Quarters Policy.

Attachment 24.—Quarters Plan.

**Quarters Plan**
**Entiat National Fish Hatchery**
November 20, 2001

General Information

The housing at Entiat NFH consists of three circa 1937 wood frame, three bedroom houses designated as Q 1, 2, &3 and two circa 1955 block construction, three bedroom duplex units designated as Q 37-1 & 2 and Q 39-1 & 2. Quarters 1, 2, and 39-1 & 2 are generally reserved for station personnel. Quarters 2 and 37-1 & 2 are currently excess to station needs. However, Quarters 2 has been designated as historically significant by Cultural Resources and an attempt to have it removed was thwarted. It is currently rented to a US Geological Survey Willard Laboratory employee. Quarters 37-1 has been used in recent years to provide housing for student and other volunteers. This program has been very successful providing much needed volunteer help in the busy summer months and, most recently, during the winter months. The savings to the government have more than offset the costs of maintaining the unit.

The intent of having personnel living in government quarters at Entiat NFH is to provide station security and operations during non-duty hours. Mechanical systems to regulate water flows must be maintained immediately to prevent loss of valuable fish stocks. Additional security protection of government owned property is provided by occupants especially when anadromous broodstock are present. The isolated setting of Entiat NFH combined with potential inaccessibility during sever snowstorms precludes adequate protection by other than required housing.

Required housing at present is limited to the station manager, the assistant station manager, and a fish culturist. The job descriptions of the required tenants are less critical to the safety of fish stocks than is the number of tenants required to live on station. Under the Fair Labor Standards Act, employees cannot be required to be at home in government owned quarters without compensation. Since there is no viable mechanism for compensating the employees, the presence of someone at home in government owned quarters and available to respond immediately to a water alarm or other emergency is left to chance. Increasing the number of people living on station increases the probability that someone will be available for emergency response. Therefore, the minimum number required to provide a reasonable prospect of protection is three. Whether the person is management, maintenance, or production personnel is not critical. Most alarm situations at Entiat NFH can be managed with a leaf rake. In the event the problem cannot be solved by the responder, maintenance or other staff can be called in for assistance.

Assignment of Quarters

The assignment of quarters shall be done in accordance with Chapter 8, Department of the Interior Departmental Quarters Handbook (DQM)(400 DM Addition to IPMR 06/02/94).

Assignment Priorities: Assignment of quarters shall follow the priorities in the order listed below.

1. Required Occupants.

2. Other Station Personnel, including contractors and essential cooperators.

3. Volunteers. Must meet requirements of paragraph 8.1C DQH 400 DM.

4. Other Bureaus. Employees of other Interior bureaus.

5. Other Agencies. Employees of other Federal Agencies.

6. Non-Federal Tenants. See paragraph 5.2 DQH.

## Maintenance

The station manager has final approval authority over all quarters maintenance. Quarters maintenance needs are reported to the station manger for inclusion into the prioritization process. Quarters deficiencies affecting safety or health are given top priority, followed by weatherization and structural needs. The station manager meets with the assistant manager and maintenance personnel at the beginning of the fiscal year to determine major deficiencies and prioritize repairs.

Attachment 25.—Surplus Fish as Government Property.

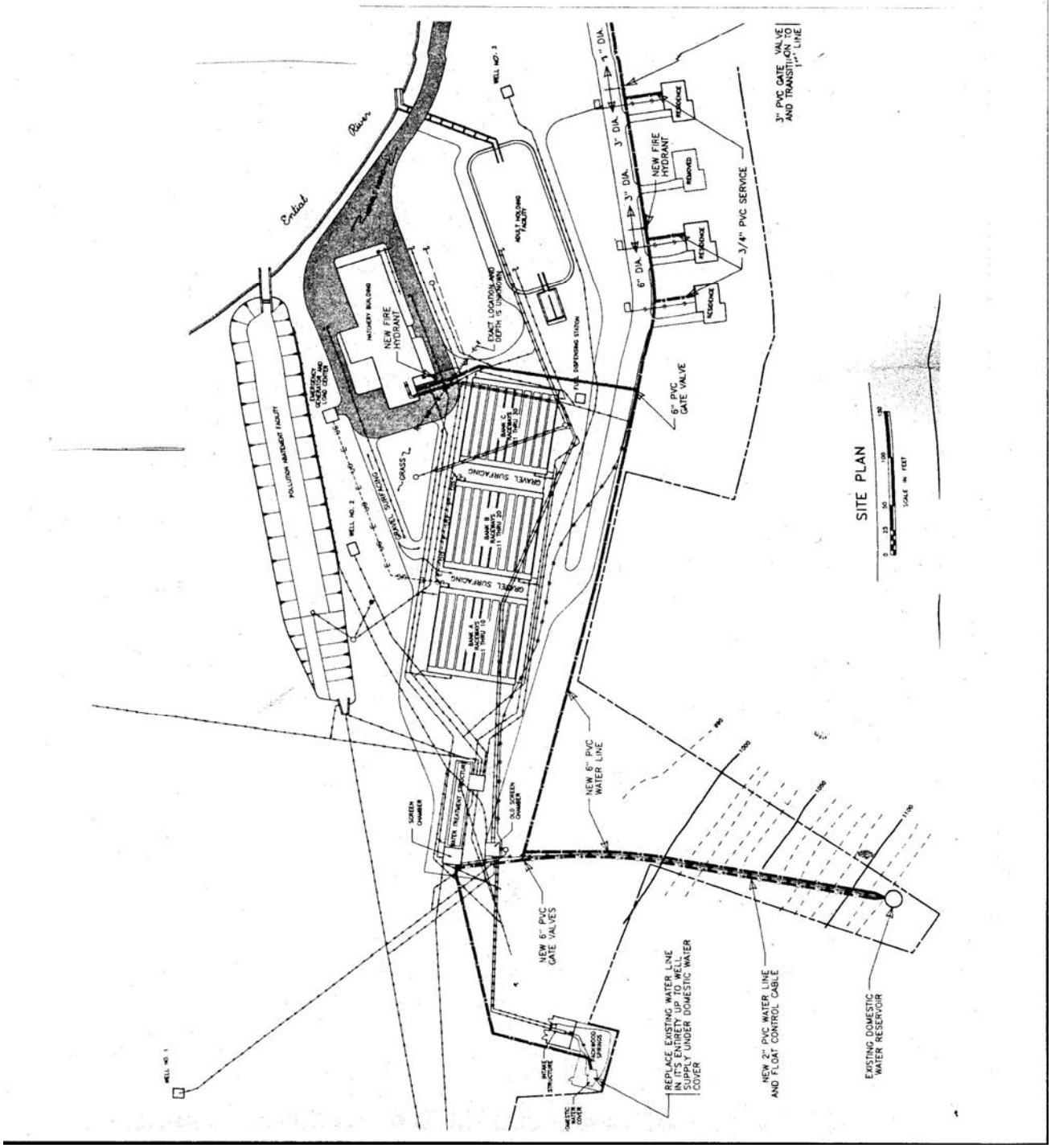
Attachment 26.—Drugs and Anesthetics.

Attachment 27.—Fisheries Pest Management Policy.

## GLOSSARY OF ABBREVIATIONS AND ACRONYMS

BOR ..... Bureau of Reclamation
BPA ..... Bonneville Power Administration
CHMP ..... Comprehensive Hatchery Management Plan
COE ..... Corps of Engineers
CRIS ..... Columbia River information System
CRITFC ..... Columbia River Inter-Tribal Fish Commission
CRFPO ..... Columbia River Fisheries Program Office
CWT ..... Coded-Wire Tag
DNR ..... Department of Natural Resources
ESA ..... Endangered Species Act
ESU ..... Ecologically Significant Unit
FIS ..... Fisheries Information System
FONS ..... Fisheries Operations Needs System
FTE ..... Full Time Equivalent
HGMP ..... Hatchery and Genetic Management Plan
IHOT ..... Integrated Hatchery Operations Team
MMS ..... Maintenance Management System
NFH ..... National Fish Hatchery
NMFS ..... National Marine Fisheries Service
NOAA Fisheries ..... also known as NMFS or National Marine Fisheries Service
..... National Oceanic and Atmospheric Administration, U.S. Department of Commerce
ODFW ..... Oregon Department of Fish and Wildlife
PAC ..... Production Advisory Committee
PIT ..... Passive Integrated Transponder
PNFHPC ..... Pacific Northwest Fish Health Protection Committee
Service ..... United States Fish and Wildlife Service (USFWS)
TAC ..... Technical Advisory Committee
USFWS ..... United States Fish and Wildlife Service (Service)
WDFW ..... Washington Department of Fish and Wildlife
YN ..... Yakama Nation

Attachment ___- Entiat National Fish Hatchery Site Plan – c.2004



**Attachment___ . Entiat NFH Physical Description of Rearing and Incubation Spaces**

| Type | Length (feet) | Width (feet) | Depth (feet) | Volume ($ft^3$) | No. | Material | Condition |
|---|---|---|---|---|---|---|---|
| **Adult Ponds** | 120 | 16 | 5 | 9500 | 2 | Concrete | Good |
| **Raceways** | 80 | 8 | 2.5 | 1460[1] | 30[2] | Concrete | Fair |
| **Starter Tanks** | 16 | 14.25 | 3.2 | 2.1 | 88[1] | Fiberglass | Good |
| **Incubation Troughs** | 15 | 1.25 | 1.25 | 23.4 | 4 | Fiberglass | Good |
| **Stacked Incubators** | | | | | 18 | Plastic | Good |
| **Coho Incubation Troughs** | 7.5 | 1.33 | 1.33 | 13.25 | 5 | Fiberglass | Good |

[1]Rearing space
[2]Up to seven ponds per Bank are used for rearing due to water supply.

**Attachment ___ - Hatchery Facilities – Descriptions, Primary Use, etc.**

| Asset | Description |
|---|---|
| Residence – Quarters #1 | Constructed in 1940, (1030 $ft^2$); attached garage, concrete driveway. |
| Residence – Quarters #3 | Constructed in 1940, (1030 $ft^2$); attached garage, concrete driveway. |
| Residence – Quarters #4 | Constructed in 1940, (1030 $ft^2$); attached garage, concrete driveway. |
| Hatchery Building; Office; Shop; Garage | Constructed in 1940, Reinforced concrete; includes break room, visitor area, chemical storage, incubation Room, shop, and a two stall garage. Used for facilities maintenance and egg incubation |
| Valve House | Constructed in 1940; Currently used as storage, maintained due to historical significance. |
| River Intake Dam | Constructed in 1940; Includes two water control valves, pole building, 155 linear feet concrete strip spanning the Entiat River. |
| River Supply Line | 36” Concrete water pipe; used to delivery surface water to Screen Chamber Building. |
| Domestic Water Reservoir | 15,000 gallon concrete storage tank; used for domestic water supply for hatchery and residences. |
| Well #1 | Ground water well, averages 350 GPM, 75 feet deep. Water used for fish production. |
| Well #2 | Ground water well, averages 320 GPM, 91 feet deep. Water used for fish production. |
| Well #3 | Ground water well, averages 250 GPM, 87 feet deep. Water used for fish production. |
| Well #4 | Ground water well, averages 225 GPM, |

| | |
|---|---|
| | 129 feet deep. Water used for fish production. |
| Well #5 | Ground water well, averages 120 GPM, 130 feet deep. Water used for fish production. |
| Well #6 | Ground water well, needs to be re-developed. 120 feet deep. |
| Limkiln Spring | Spring water source; water used for domestic and fish production. Includes avian exclusion grid and pole building. |
| Surface Water Screen Chamber Bldg. | Concrete block construction; 3/32” stainless steel sloped screens; Houses domestic water supply pumps. Screens surface water. |
| Aeration Building | Concrete block construction; contains venturi type aerators as well as two stacked columns. De-gasses ground water from 6 wells. |
| Seasonal Storage Building | Wooden framed building; Currently used by FRO as a sampling station. |
| Pre-Settling Basin | Concrete sloped structure used to pre-settle settleable solids from surface water. |
| Raceways | Concrete rearing ponds; 8’ x 80’s; Includes six canal gates and seven water control valves. |
| Holding Ponds | Two concrete multi-purpose ponds; 16’ x 120’; Ponds used to hold Spring Chinook and Coho salmon adults; Also used for juvenile Spring Chinook rearing. |
| Fish Ladder | Concrete construction; connects holding ponds to Entiat river. |
| Pollution Abatement Pond | Earthen pond with rip-rapped sides; Used for pre-settling effluent |

| | |
|---|---|
| Isolation Incubation Unit | Insulated shipping container; modified with electrical and water chiller. Used to isolate Coho eggs from Spring Chinook eggs. |
| Spawning Building | Wooden framed construction; un-insulated and poorly heated. Used for spawning if Spring Chinook and Coho salmon. |
| Emergency Power Generator Bldg. | Concrete block construction; houses 125KW generator and diesel engine; also main power panels. |
| Fish Food Storage Freezer Bldg. | Insulated cold storage building – $18^0$F; Includes exterior roof structure made of wood. Holds up to 18,000 lbs of feed. |
| Fuel Tanks | Tandem 500 gallon above ground fuel tanks; diesel and unleaded gas. |
| Hatchery Water Re-Use Pumps | Two 7.5hp pumps located in the front of the hatchery building; used to re-circulate water from the nursery to raceways and/or screen chamber building. Also used to pump cleaning effluent to Pollution Abatement Pond. |
| Marking Trailer Power Supply | 100 amp, single phase, 220V power supply; used by marking trailers. |
| Red Willow Trail | 0.38 miles of constructed gravel trail along the Entiat river. Used for tours and outdoor education. |
| Housing Septic Systems | Constructed in 2005; Each house has two 1000 gallon tanks and 10’ x 30’ drain fields. |

Attachment ____ . – Historical Salmon Fish Releases (1980 – 2004).

| DATE | BY | HC | LN | SPE | NUMBER | PERLB |
|---|---|---|---|---|---|---|
| 3/5/1976 | 74 | LW | | SCS | 436634 | 12.58 |
| 9/23/1976 | 75 | CA | | SCS | 25275 | 17.3 |
| 7/6/1977 | 76 | LW | | SCS | 400000 | 70 |
| 4/14/1978 | 76 | CA | | SCS | 39237 | 15.69 |
| 4/25/1978 | 76 | CA | | SCS | 217798 | 17.12 |
| 4/25/1978 | 76 | LW | | SCS | 165710 | 27.09 |
| 5/1/1978 | 76 | LW | | SCS | 31730 | 23.38 |
| 5/2/1978 | 76 | LW | | SCS | 16568 | 23.4 |
| 5/15/1978 | 76 | LW | | SCS | 33034 | 24.2 |
| 5/16/1978 | 76 | LW | | SCS | 17020 | 24 |
| 5/25/1978 | 76 | LW | | SCS | 17550 | 22.1 |
| 4/23/1979 | 77 | CA | | SCS | 448238 | 16.17 |
| 4/16/1980 | 78 | LW | | SCS | 596162 | 17.47 |
| 4/16/1980 | 78 | CA | | SCS | 61936 | 27.8 |
| 4/13/1981 | 79 | LW | 01 | SCS | 326844 | 17 |
| 4/13/1981 | 79 | CA | 02 | SCS | 247963 | 16 |
| 4/13/1981 | 79 | LE | 03 | SCS | 48566 | 16 |
| 4/15/1982 | 80 | ET | 04 | SCS | 481302 | 19 |
| 4/15/1982 | 80 | CA | 05 | SCS | 380577 | 20 |
| 4/15/1982 | 80 | LE | 06 | SCS | 135962 | 20 |
| 4/18/1983 | 81 | ET | 07 | SCS | 197935 | 15 |
| 4/18/1983 | 81 | LE | 08 | SCS | 621844 | 18 |
| 4/18/1983 | 81 | CA | 09 | SCS | 136191 | 20 |
| 10/19/1983 | 82 | CA | 02 | SCS | 25000 | 44 |
| 10/31/1983 | 82 | CA | 02 | SCS | 25530 | 44 |
| 11/17/1983 | 82 | ET | 01 | SCS | 3000 | 25 |
| 2/28/1984 | 83 | ET | 03 | SCS | 150000 | 761 |
| 4/9/1984 | 82 | CA | 02 | SCS | 42552 | 24 |
| 4/23/1984 | 82 | ET | 01 | SCS | 386436 | 16.5 |
| 4/23/1984 | 82 | CA | 02 | SCS | 259022 | 21.3 |
| 4/15/1985 | 83 | ET | 03 | SCS | 894631 | 18.7 |
| 4/22/1986 | 84 | ET | 04 | SCS | 835090 | 19.5 |
| 4/21/1987 | 85 | ET | 07 | SCS | 925000 | 17.1 |
| 2/2/1988 | 87 | ET | 07 | SCS | 263018 | 541 |
| 2/8/1988 | 87 | ET | 07 | SCS | 24942 | 320 |
| 4/21/1988 | 86 | ET | 06 | SCS | 838940 | 21 |
| 5/12/1988 | 87 | ET | 07 | SCS | 10800 | 101 |
| 11/14/1988 | 87 | ET | 07 | SCS | 56493 | 26 |
| 1/4/1989 | 88 | WT | 09 | SCS | 49605 | 615 |
| 2/14/1989 | 88 | ET | 08 | SCS | 66540 | 296 |
| 4/20/1989 | 87 | ET | 07 | SCS | 791263 | 20.6 |

| DATE | BY | HC | LN | SPE | NUMBER | PERLB |
|---|---|---|---|---|---|---|
| 4/19/1990 | 88 | ET | 08 | SCS | 338900 | 19.4 |
| 4/19/1990 | 88 | WT | 09 | SCS | 246944 | 19.4 |
| 12/1/1990 | 89 | ET | 01 | SCS | 34426 | 27.5 |
| 4/4/1991 | 89 | ET | 01 | SCS | 55862 | 20.38 |
| 4/4/1991 | 89 | ET | 01 | SCS | 47074 | 20.38 |
| 4/4/1991 | 89 | ET | 01 | SCS | 49585 | 20.38 |
| 4/4/1991 | 89 | ET | 01 | SCS | 159426 | 20.38 |
| 4/4/1991 | 89 | ET | 01 | SCS | 158170 | 20.38 |
| 4/4/1991 | 89 | ET | 01 | SCS | 157543 | 20.38 |
| 4/4/1991 | 89 | ET | 02 | SCS | 15176 | 19.97 |
| 4/4/1991 | 89 | ET | 02 | SCS | 48218 | 19.97 |
| 4/4/1991 | 89 | ET | 02 | SCS | 14408 | 19.97 |
| 4/4/1991 | 89 | ET | 02 | SCS | 17097 | 19.97 |
| 4/4/1991 | 89 | ET | 02 | SCS | 48410 | 19.97 |
| 4/4/1991 | 89 | ET | 02 | SCS | 48795 | 19.97 |
| 5/24/1991 | 90 | ET | 03 | SCS | 134938 | 81.9 |
| 5/28/1991 | 90 | ET | 03 | SCS | 243008 | 78.2 |
| 4/7/1992 | 90 | ET | 03 | SCS | 600 | 14 |
| 4/15/1992 | 90 | ET | 03 | SCS | 92164 | 14 |
| 4/15/1992 | 90 | ET | 03 | SCS | 82982 | 16 |
| 4/15/1992 | 90 | ET | 03 | SCS | 83662 | 16 |
| 4/15/1992 | 90 | ET | 03 | SCS | 84342 | 14 |
| 4/21/1992 | 91 | ET | 04 | SCS | 3750 | 75 |
| 5/15/1992 | 91 | ET | 04 | SCS | 90479 | 52.6 |
| 5/15/1992 | 91 | ET | 04 | SCS | 90334 | 52.6 |
| 5/15/1992 | 91 | ET | 04 | SCS | 90262 | 52.6 |
| 5/15/1992 | 91 | ET | 04 | SCS | 90515 | 52.6 |
| 4/1/1993 | 91 | ET | 04 | SCS | 86298 | 14.4 |
| 4/1/1993 | 91 | ET | 04 | SCS | 88991 | 14.7 |
| 4/1/1993 | 91 | ET | 05 | SCS | 12344 | 15.3 |
| 4/1/1993 | 91 | ET | 05 | SCS | 13540 | 13.5 |
| 4/1/1993 | 91 | ET | 04 | SCS | 86179 | 14.4 |
| 4/1/1993 | 91 | ET | 04 | SCS | 89110 | 14.7 |
| 5/14/1993 | 92 | ET | 07 | SCS | 83044 | 42 |
| 5/14/1993 | 92 | ET | 07 | SCS | 84041 | 42 |
| 5/14/1993 | 92 | ET | 07 | SCS | 3500 | 42 |
| 5/14/1993 | 92 | ET | 07 | SCS | 80055 | 42 |
| 5/14/1993 | 92 | ET | 07 | SCS | 85038 | 42 |
| 1/14/1994 | 92 | ET | 06 | SCS | 2000 | 18.86 |
| 3/29/1994 | 92 | ET | 06 | SCS | 60 | 14 |
| 4/1/1994 | 92 | ET | 06 | SCS | 191679 | 14.28 |
| 4/1/1994 | 92 | ET | 06 | SCS | 187050 | 13.09 |
| 5/6/1994 | 93 | ET | 09 | SCS | 2000 | 40 |

| DATE | BY | HC | LN | SPE | NUMBER | PERLB |
|---|---|---|---|---|---|---|
| 4/1/1995 | 93 | ET | 08 | SCS | 392011 | 13.5 |
| 5/15/1995 | 94 | ET | 11 | SCS | 186817 | 50.85 |
| 4/1/1996 | 94 | ET | 10 | SCS | 84651 | 13.2 |
| 4/1/1996 | 94 | LE | 12 | SCS | 116975 | 13.5 |
| 4/1/1996 | 94 | ET | 10 | SCS | 41085 | 13.5 |
| 4/1/1996 | 94 | LE | 12 | SCS | 89882 | 13.2 |
| 4/1/1997 | 95 | ET | 13 | SCS | 36247 | 9.8 |
| 4/1/1997 | 95 | ET | 13 | SCS | 17587 | 9.8 |
| 4/1/1997 | 95 | ET | 13 | SCS | 59971 | 9.6 |
| 4/1/1997 | 95 | ET | 13 | SCS | 61510 | 9.6 |
| 4/1/1997 | 95 | ET | 13 | SCS | 7585 | 9.1 |
| 4/1/1997 | 95 | ET | 13 | SCS | 17586 | 9.8 |
| 4/1/1998 | 96 | ET | 14 | SCS | 76901 | 10.3 |
| 4/1/1998 | 96 | ET | 14 | SCS | 177563 | 11.4 |
| 4/1/1998 | 96 | ET | 14 | SCS | 16364 | 10.1 |
| 4/1/1998 | 96 | ET | 14 | SCS | 39972 | 10.3 |
| 4/1/1998 | 96 | ET | 14 | SCS | 39984 | 10.2 |
| 5/28/1998 | 97 | ET | 16 | SCS | 164999 | 41.3 |
| 4/7/1999 | 97 | ET | 15 | SCS | 224097 | 11.4 |
| 4/7/1999 | 97 | ET | 15 | SCS | 84957 | 11.2 |
| 4/7/1999 | 97 | ET | 15 | SCS | 45184 | 11.2 |
| 4/4/2000 | 98 | ET | 17 | SCS | 123962 | 12 |
| 4/4/2000 | 98 | ET | 17 | SCS | 123273 | 12 |
| 4/4/2000 | 98 | ET | 17 | SCS | 69240 | 11.9 |
| 4/4/2000 | 98 | ET | 17 | SCS | 43192 | 12 |
| 5/14/2000 | 99 | ET | 18 | SCS | 421126 | 43.8 |
| 4/3/2001 | 99 | ET | 19 | SCS | 101285 | 12.6 |
| 4/3/2001 | 99 | ET | 19 | SCS | 196448 | 12.9 |
| 4/3/2001 | 99 | ET | 19 | SCS | 100122 | 12.8 |
| 4/7/2002 | 00 | ET | 20 | SCS | 131155 | 22.3 |
| 4/7/2002 | 00 | ET | 20 | SCS | 2400 | 16 |
| 4/8/2002 | 00 | ET | 20 | SCS | 65446 | 16.1 |
| 4/8/2002 | 00 | ET | 21 | SCS | 50504 | 32.7 |
| 4/8/2002 | 00 | ET | 20 | SCS | 184090 | 17.4 |
| 4/8/2002 | 00 | ET | 20 | SCS | 102525 | 15.8 |
| 4/15/2003 | 01 | Et | 22 | SCS | 119499 | 19.7 |
| 4/15/2003 | 01 | Et | 22 | SCS | 99100 | 19.6 |
| 4/15/2003 | 01 | Et | 22 | SCS | 88114 | 19.8 |
| 4/15/2003 | 01 | Et | 22 | SCS | 88976 | 19.8 |
| 4/14/2004 | 02 | Et | 23 | SCS | 120352 | 17 |
| 4/14/2004 | 02 | Et | 23 | SCS | 109884 | 17.4 |
| 4/14/2004 | 02 | Et | 23 | SCS | 77558 | 17.3 |
| 4/14/2004 | 02 | Et | 23 | SCS | 79039 | 17.6 |

## References


Andonaegui, C. 2001. Salmon, steelhead, and bull trout habitat limiting factors for the Wenatchee Basin (Water Resource Inventory Area 45) and Portions of WRIA 40 within Chelan County. Final draft report. WA State Conservation Commission.

Beamish, R.J. (ed). 1995. Climate Change and Northern Fish Populations. National Research Council of Canada. Ottawa, Canada.

Cederholm, C.J. et al. 1999. Pacific salmon carcasses: Essential contributions of nutrients and energy for aquatic and terrestrial ecosystems. Fisheries 24 (10): 6-15.

CCCD (Chelan County Conservation District). 1996. Draft Wenatchee River watershed ranking report addendum, Technical Supplement 1. Wenatchee, WA.

CCCD 1998. Wenatchee River watershed action plan; a plan containing non-point pollution source control and implementation strategies. Wenatchee, WA.

Chapman, D., and K. Witty. 1993. Habitat of weak salmon stocks in the Snake River Basin and feasible recovery measures. Report to Bonneville Power Administration, DOE/BP-99654-1. Portland, OR.

Chapman, D., and C. Peven, T. Hillman, A. Giorgi, and F. Utter. 1994. Status of Summer Steelhead in the Mid-Columbia Region. Don Chapman Consultants Inc. Boise, ID.

Congleton, J.L., and 10 co-authors. 1995. Evaluation procedures for collection, bypass, and downstream passage of out-migrating salmonids. Draft annual report for 1995, MPE-96-10.

Economic and Engineering Services, Inc. and Golder Associate, Inc. 1998. Public Utility District No. 1 of Chelan County, Lake Wenatchee groundwater assessment. Wenatchee, WA.

Elliot, D.G., and R. Pascho. 1994. Juvenile fish transportation: impact of bacterial kidney disease on survival of spring/summer Chinook salmon stocks. 1992. Annual report of the National Biological Survey to the U.S. Army Corps of Engineers, Walla Walla, WA.

Elliot, D.G., R.J. Pascho, L.M. Jackson, G.M. Mathews, and J.R. Harmon. 1997. *Renibacterium salmoninarum* in spring-summer Chinook salmon smolts at dams on the Columbia and Snake River. Aquat. Animal Health 9: 114-126.

Emlen, J.M., R.R. Reisenbichler, A.M. McGie, and T.E. Nickelson. 1990. Density-dependence at sea for coho salmon *(Oncorhynchus kisutch)*. Can. J. Fish. Aquat. Sci. 47:1765-1772.

Enhancement Planning Team. 1986. Salmon and steelhead enhancement plan for the Washington and Columbia River conservation area. Vol. 1. Preliminary review draft.

Goede, R. 1986. Management considerations in stocking of diseased or carrier fish. Pages 349-356 *in* R.H. Stroud, editor. Fish Culture in fisheries management. American Fisheries Society, Bethesda, MD.

Groot, C., and L. Margolis. 1991. Pacific salmon life histories. UBC Press, University of British Columbia, Vancouver, B.C.

Hindes, R. 1994. Watershed characterization and ranking report, Wenatchee River watershed ranking project. Chelan County Conservation District.

IHOT (Integrated Hatchery Operations Team). 1995. Policy and procedures for Columbia Basin anadromous salmonid hatcheries. Annual report 1994 to the Bonneville Power Administration, Portland Oregon. Project # 92-043. Chapters xx and 5.

IHOT (Integrated Hatchery Operations Team). 1996. Operation plans for anadromous fish production facilities in the Columbia River Basin, Volume III-Washington. Annual report 1995 to the Bonneville Power Administration, Portland, Oregon. Project 92-043.

Mantua, N.J., S.R. Hare, Y. Zhang, J.M. Wallace, and R.C. Francis. 1997. A Pacific interdecadal climate oscillation with impacts on salmon production. Bull. Am. Meterol. Soc. 78: 1069- 1079.

McNeil, W.J. and D.C. Himsworth. 1980. Salmonid ecosystems of the North Pacific. Oregon State University Press and Oregon State University Sea Grant College Program, Corvallis, Oregon.

Montgomery Water Group, Adolfson Associates, Hong West and Associates, R2 Resource Consultants, Marshall and Associates, and Washington Department od Ecology. 1995. Draft Initial Watershed Assessment Water Resources Inventory Area 45, Wenatchee River Watershed. Open file report 95-12. Kirkland, WA.

Mullan, J.W., K.R. Williams, G. Rhodus, T.W. Hillman, and J.D. McIntyre. 1992. Production and habitat of salmonids in mid-Columbia River tributary streams. Monograph I, USFWS, Leavenworth, WA.

Nielsen, C.J., 1940. The Snow Lake Tunnel: Migratory Fish Control, Columbia Basin Project, *The Reclamation Era*, March 1940: 72-76.

NMFS (National Marine Fisheries Service). 1999a. Biological Assessment for Mitchell Act Hatchery Operations. Hatcheries and Inland Fisheries Branch, Portland, Oregon.

NMFS (National Marine Fisheries Service). 1999b. Biological Opinion on Artificial Propagation in the Columbia River Basin, Endangered Species Act - Section 7 Consultation.

NMFS (National Marine Fisheries Service). 1999c. Biological Opinion on Harvest in the Columbia River Basin, Endangered Species Act - Section 7 Consultation.

NMFS (National Marine Fisheries Service). 2001. Biological Opinion on Artificial Propagation in the Upper Columbia River Basin. NMFS, Northwest Region.

Peven, C.M. 1990. The life history of naturally produced steelhead trout from the mid-Columbia River Basin. M.S. thesis. University of Washington, Seattle, WA.

SIWG (Species Interactions Work Group). 1984. Evaluation of potential interaction effects in the planning and selection of salmonid enhancement projects. Report prepared for the Enhancement Planning Team for the implementation of the Salmon and Steelhead Conservation and Enhancement Act of 1980. Washington Department of Fish and Wildlife. Olympia, WA.

Salonius, K., and G.K. Iwama. 1993. Effects of Early Rearing Environment on Stress Response, Immune Function, and Disease Resistance in Juvenile Coho (*Oncorhynchus kisutch*) and Chinook Salmon (*O. tshawytscha*). Canadian Journal of Fisheries and Aquatic Sciences 50: 759-766.

Schreck, C.B., A.G. Maule and S.L. Kaattari. 1993. Stress and disease resistance, p. 170-175. *In* J.F. Muir and R.J. Roberts [ed.] Recent Advances in Aquaculture, Vol. 4. Blackwell Scientific Publications, Oxford, UK.

Steward, R., and T. Bjornn. 1990. Supplementation of salmon and steelhead stocks with hatchery fish: a synthesis of published literature. Tech. Report 90-1. Part 2 *in* W.H. Miller, editor. Analysis of Salmon and Steelhead Supplementation. BPA, Portland, OR. USFWS, Dworshak Fisheries Assistance Office, ID.

USFWS (U.S. Fish and Wildlife Service). 1993. Hatchery Evaluation Vision Action Plan. Draft planning report, May 14, 1993 by Region 1 Fisheries, Portland, OR.

USFWS (U.S. Fish and Wildlife Service). 1999. Hatchery and Genetic Management Plan, spring Chinook salmon, Spring Creek National Fish Hatchery, October 2002. Columbia River Fisheries Program Office, Vancouver, Washington.

USFS (U.S. Forest Service). 1994. Icicle Creek stream survey report by: Jones, Gower, and Rickel. Wenatchee National Forest, Leavenworth Ranger District.

USFS (U.S. Forest Service). 1995. Icicle Creek Watershed- Watershed Assessment. USDA Forest Service, Wenatchee National Forest, Leavenworth Ranger District.

Washington State Conservation Commission. 1999. Salmon and steelhead habitat limiting factors in Water Resource Inventory Area (WRIA) 29.

WDF/WDW (Washington Department of Fish and Washington Department of Wildlife). 1993. 1992 Washington State salmon and steelhead stock inventory; Appendix Three, Columbia River stocks. Olympia, WA.

WDFW (Washington Department of Fish and Wildlife) 2001. Wenatchee River Subbasin Summary (Draft). Prepared for the Northwest Power Planning Council, Portland, OR.