



U.S. Fish and Wildlife Service - Pacific Region

Olympic Peninsula Hatchery Review Team

Olympic Peninsula

Big Quilcene, Quinault, Hoh, Sooes, and Waatch River Watersheds



**Quilcene, Quinault and Makah National Fish Hatcheries
Assessments and Recommendations**

**Final Report, Appendix A:
Briefing Document; Summary of Background Information**

May 2009

Please cite as:

U.S. Fish and Wildlife Service (USFWS). 2009. *Quilcene, Quinalt, and Makah National Fish Hatcheries: Assessments and Recommendations – Appendix A: Briefing Document; Summary of Background Information. Final Report, May 2009.* Hatchery Review Team, Pacific Region. U.S. Fish and Wildlife Service, Portland, Oregon. <<http://www.fws.gov/pacific/fisheries/Hatcheryreview/team.html>>.

USFWS Olympic Peninsula Hatchery Review Team
 Olympic Peninsula NFHs Assessments and Recommendations Report –May 2009



Figure 1. Fish Hatcheries on Olympic Peninsula (National Fish Hatcheries are in caps and underlined)¹

¹ Modified figure from Streamnet <<http://www.streamnet.org/>>.

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

Table of Contents

I. OLYMPIC PENINSULA	1
II. QUILCENE NATIONAL FISH HATCHERY	53
IIA. QUILCENE NFH COHO.....	75
IIB. QUILCENE NFH, HOOD CANAL STEELHEAD.....	101
III. QUINAULT NATIONAL FISH HATCHERY	103
IIIA. QUINAULT NFH STEELHEAD (COOK CREEK PROGRAM)	123
IIIB. QUINAULT NFH STEELHEAD (HOH RIVER PROGRAM)	144
IIIC. QUINAULT NFH COHO	152
IIID. QUINAULT NFH FALL CHINOOK	161
IIIE. QUINAULT NFH CHUM.....	169
IV. MAKAH NATIONAL FISH HATCHERY	177
IVA. MAKAH NFH STEELHEAD	198
IVB. MAKAH NFH COHO	219
IVC. MAKAH NFH FALL CHINOOK	228
IVD. MAKAH NFH OZETTE SOCKEYE	236
V. REFERENCES	239

I. Olympic Peninsula

A. Watersheds and geographic description

Big Quilcene River²

2.5.1 General Description - The Big Quilcene watershed is a diverse ecosystem encompassing 53,016 acres from Mt. Constance at an elevation of 7,747 feet in Olympic National Park to sea level at Quilcene Bay. Within the watershed, 41,734 acres of land (79% of the watershed) are administered by the U.S. Forest Service (USFS), 6,449 acres are owned by private or municipal interests, 3,676 acres are managed by the Washington State Department of Natural Resources, and 1,158 acres lie within the Olympic National Park.

The watershed displays a wide range of physical, biological, and social functions. Three main tributaries comprise the majority of the watershed: the mainstem Big Quilcene River, originating from Buckhorn Mountain; Tunnel Creek, originating from Mt. Constance; and Townsend Creek, originating from Mt. Townsend. Other tributaries to the Big Quilcene River include Penny Creek, Mile and a Half Creek, Three Mile Creek, and numerous unnamed streams. The watershed drains approximately 83 square miles of the eastern Olympic Peninsula via 117 miles of streams.

The two water sources most important to the operation of Quilcene NFH are the Big Quilcene River and its tributary, Penny Creek. Both provide water for fish cultural operations and originate from USFS lands. The Big Quilcene River, with approximately 20 miles of mainstem length, also provides salmon spawning and production habitat that varies from “poor” below RM 1, due to lack of pools, cover, large wood, side channels, and stable substrate to “good” between RM 9 and RM 10.6 [Zajac 2002].

2.5.2 Geology - The watershed was shaped by glacier activity 18,000-20,000 years ago. The upper watershed was also influenced by earlier alpine glaciations. Glacial damming of the Big Quilcene River resulted in sediment deposition up to 2,700 foot elevation in parts of Tunnel and Townsend Creek drainages. Bedrock is part of the Crescent Formation, consisting of folded marine basalts and volcanic breccia with interbeds of sedimentary and metasedimentary bedrock. Sandstones, shales, and conglomerates make up most of the sedimentary rocks. Soils on the lower slopes and ridges are mostly of glacial origin and tend to be gravelly textured in the upper horizons. Valley bottom soils tend to be finer material of alluvial origin [Geomax 1994].

2.5.3 Climate and Hydrology - The watershed has a mild maritime climate. Average annual precipitation recorded at the USFS Quilcene Ranger Station is 51 inches. Over 80% of the precipitation falls between October and April. Summers are relatively dry [Geomax 1994]. Precipitation occurs as rain below 2000 feet, rain and snow between 2000 and 4000 feet, and as snow above 4000 feet.

Most high river flows result from rain-on-snow events in the transitional snow zone between 2000 and 4000 feet. Monthly average flows in the Big Quilcene River as measured just below the Port Townsend City diversion from 1993 to 1999 ranged from a low of 37 cfs in September to a high

² QLNFH CHMP p. 12-14.

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

mean of 250 cfs in December. Stream gauging data collected by the USGS in 1927 indicated an instantaneous peak discharge of 1,620 cfs. Big Quilcene River water temperatures as measured at the Quilcene NFH from 1983 to 1993 ranged from a low mean of 39.6°F (4.2°C) in January to a high mean of 54.4°F (12.4°C) in August.

2.5.4 Fish and Wildlife - Terrestrial habitats in the watershed are used by blacktail deer, elk, marmot, black bear, bobcat, cougar, mountain goat, as well as smaller mammals. Bird species include pileated woodpeckers, neotropical birds, northern spotted owl, northern bald eagle, various hawks, band-tailed pigeon, and marbled murrelet. The northern spotted owl, northern bald eagle, and marbled murrelet are listed under the Endangered Species Act.

Aquatic habitats are used by coho, pink, fall and summer chum salmon, steelhead, rainbow, brook, and cutthroat trout, and sculpins. Bull trout/Dolly Varden char have been reported in the Big Quilcene River below RM 2.5 and in Penny Creek. Both summer chum salmon and bull trout are listed as federally threatened species under the Endangered Species Act. Various ducks, gulls, dippers, herons, kingfishers, beavers, raccoons, and otters frequent the streams as well.

2.5.5 Vegetation - Five vegetation zones are found in the Big Quilcene watershed: western hemlock, silver fir, mountain hemlock, subalpine fir, and Douglas fir. Understory vegetation includes sword fern, salal, Pacific rhododendron, white rhododendron, big huckleberry, Alaska huckleberry, blue leaf huckleberry, red heather, lupine, and various sedges, herbs, and lichens (USFS 1994).

Cook Creek (Quinault River)³

2.5.1 General Description - Cook Creek originates from Quinault Ridge on the west slope of the Olympic Mountains in the Olympic National Forest. The creek flows through a patchwork of USFS and Rayonier Timberlands Operating Company lands before leaving the USFS property and entering the Quinault Indian Reservation at about river mile (RM) 5.2 (Figure 2). Tribal and Rayonier Timberlands Operating Company lands are managed for timber harvest. Most USFS land in the Cook Creek watershed is designated as “Late-Successional Reserve” in order to protect and enhance old-growth forest ecosystem conditions. There is no harvest in stands older than 80 years. Younger stands may be thinned to create and maintain late-successional forest conditions. Minor portions of USFS land in the Cook Creek watershed are designated as “Adaptive Management Areas.” The goal of this designation is to develop and test technical and social approaches to land management that achieve desired ecological and economic objectives (Martha Krueger, USFS, per. comm., 2001).

Cook Creek main stem length is about 12.8 miles. There are also approximately 25 miles of tributaries entering Cook Creek. There are some known impasses to upstream fish migration. They include seasonally established beaver dams and log jams, possibly the culvert on the Moclips Highway at RM 10.3, the hatchery intake (which is fitted with a bypass ladder), and the hatchery weir when it is operating.

Historically, the Cook Creek watershed was intensively managed for timber production. Major logging occurred during the early 1930s. As a result of the earlier logging, and continued harvesting, pure stands of even-age single-story conifer trees make up 50 percent to 75 percent of

³ QNNFH CHMP draft, p. 13, 14.

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

the lowland land cover, with some alder stands adjacent to the creek itself. Artificially reforested stands range from 0 to 60 years in age and consist primarily of Douglas fir and western hemlock. Approximately 13 percent of the combined Cook/Boulder Creek watershed remains as late-mid-seral and late-seral forest [USFS et al. 1996].

2.5.2 Geology - Most of the Cook Creek stream system flows through a large plain of till and undifferentiated drift to the Quinault River. The drift consists of deposits from Olympic alpine glaciations, and the lowlands contain several hundred feet of the deposits [Moore 1965]. The drift generally consists of silt, sand, gravel, and cobbles derived from basalt and sedimentary rocks of the interior Olympic Mountains.

2.5.3 Climate and Hydrology - The watershed lies within the temperate rain-forest zone and has a high maritime influence. Precipitation primarily occurs as rain, and ranges from light rain to heavy downpours of up to six inches per day. Annual precipitation approaches eleven to twelve feet. Ninety percent of the rainfall occurs from September through May [Kirk and Franklin 1992].

2.5.4 Fish and Wildlife - Terrestrial habitats in the watershed are used by blacktail deer, elk, black bear, bobcat, and cougar, as well as smaller mammals. Some of the bird species include pileated woodpeckers, Neotropical birds, northern spotted owl, bald eagle, hawks, band-tailed pigeon, and marbled murrelet. The northern spotted owl, bald eagle, and marbled murrelet are listed under the Endangered Species Act.

Aquatic habitats are used by coho, fall Chinook, and fall chum salmon, steelhead, rainbow, and cutthroat trout, bull trout, Dolly Varden, and sculpins. The Olympic mud minnow is presumed to inhabit the area as well. Various ducks, dippers, herons, kingfishers, otters, beavers, and raccoons frequent Cook Creek as well.

2.5.5 Vegetation - The Cook Creek watershed is within the Western Hemlock, Pacific Silver Fir, and Sitka Spruce Zones that define the temperate rain forest ecosystem. The predominant conifer trees within the Hemlock and Spruce zones are western hemlock, Sitka spruce, and western red cedar in the low elevations, and western hemlock and western red cedar in the higher elevations. Red alder, black cottonwood, and vine maple frequent the lower elevation as well. Understory includes various ferns, berries, willows, and various wetland vegetation types, including skunk cabbage and slough sedge.

Hoh River⁴

2.5.1 General Description - The Hoh River lies in WRIA 20 and originates from Hoh glacier on Mount Olympus about 56 miles from the Pacific Ocean. Most the land base within this WRIA consists of private timberlands, Indian reservations, and Olympic National Park. The region is sparsely inhabited, with the City of Forks representing the largest population center. The region is characterized by a cool maritime climate with annual precipitation increasing as one moves either west or in an upward elevation. Annual precipitation typically ranges from 80-130 inches in the headwaters. This region is often exposed to high wind and heavy rainstorms, which play important roles in current habitat problems located in disturbed (logged or developed) areas. This WRIA has a significant portion of land that is located in the Olympic National Park, and this land has never been logged. The upper 60% of the Hoh River lies within the Park. In these undisturbed

⁴ QNNFH CHMP draft, p. 13, 14.

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

areas, temperate rainforest of coniferous old-growth forests are dominated by Sitka spruce in the lowlands and western hemlock with silver fir in the higher elevations. Bigleaf maple is also a component of the rainforests. The old-growth conifers can reach up to 200 feet in height, and are characterized by somewhat open canopies and low densities.

Sooes River⁵

2.5.1 General Description - The Sooes River originates in the foothills of the northwest slope of the Olympic Mountains. The river flows through timberlands owned by the Crown Pacific timber company until it reaches the Makah Indian Reservation boundary at about river mile (RM) 4.2 (Figure 1). All of the lands are managed for timber harvest.

The Sooes River mainstem length is about 16 miles. There are also approximately 39 miles of tributaries entering the Sooes River. However, there is an impassible water fall on the Sooes River at RM 13.8 and salmonids reportedly use only 14 miles of the tributaries. There are no other known impasses to fish migration except for the hatchery weir itself during operation.

The Sooes River watershed is intensively managed for timber production within all ownerships. Major logging occurred during the 1970s. Consequently, most stands are less than 30 years old. Forest conifer composition is about 60 percent hemlock, 30 percent spruce, and 10 percent fir (all in the Pinaceae family). Alder (Butulaceae) stands are common along the streams. The conifer harvest rotation period is 45 years, although thinning occurs between 25 and 30 years [Frank Silvernail, Crown Pacific Timber Company, per. comm., 2000].

2.5.2 Geology – Sixty million years ago the Pacific Ocean extended to the west slopes of the Cascades and the area which is now the Olympic Peninsula was submerged. Erosion from the Cascades carried sediment out into the ocean, where it accumulated in the shallow waters of the continental shelf. Some of these sediments were compressed under their own weight to form the sedimentary rocks, sandstones, siltstones, and shales of the Soleduck formation. Most of the Makah Reservation is composed of this formation [pers. comm. Gwen Bridge, Makah Nation, 2005].

2.5.3 Climate and Hydrology – The Makah NFH is about three miles from the Pacific Ocean and thus experiences a typical north coast climate with mild temperatures year-round. Winter months are often very windy with winds frequently exceeding 40 miles per hour while summer months sometimes bring cool foggy conditions. Average annual maximum temperature is 53°F while the average annual low temperature is 46°F [Renker, et al. 1990].

Seventy-five percent of the annual precipitation (over 100 inches) falls during the months of October through March mostly as rain. Generally, the period of June through August is relatively dry with only eight percent of the annual precipitation occurring [Makah Indian Tribe 2003].

2.5.4 Fish and Wildlife – Sooes watershed aquatic habitats are used by coho, fall Chinook, and fall chum salmon (*O. keta*), as well as steelhead and cutthroat trout (*O. clarki*). Various ducks (Anadidae), dippers (Cinclidae), herons (Ardeidae), kingfishers (Alcedinidae), otters (Mustelidae), beavers Castoridae, and raccoons (Procyonidae) frequent Sooes River as well.

⁵ MNFH CHMP draft, p. 24-26.

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

Terrestrial habitats in the Sooes watershed are used by blacktail deer (*Odocoileus hemionus*), elk (*Cervus sp.*), black bear (*Ursus americanus*), bobcat (*Lynx rufus*) and cougar (*Puma concolor*), as well as smaller mammals. Bird species include pileated woodpeckers (*Dryocopus pileatus*), Neotropical birds, northern spotted owl (*Strix occidentalis caurina*), bald eagle (*Haliaeetus leucocephalus*), hawks (*Accipitridae*), and marbled murrelet (*Brachyramphus marmoratus*). The northern spotted owl, bald eagle, and marbled murrelet are listed under the ESA

2.5.5 Vegetation – The Makah Reservation and hatchery lie in the “Sitka Spruce Zone.” Conifer forests in the area are composed mostly of hemlock followed by spruce and fir. Red alder is abundant in the riparian zone. Various other shrubs and plants include salal (*Gaultheria sp.*), salmonberry (*Rubus spectabilis*), black twinberry (*Lonicera sp.*), red elderberry (*Sambucus racemosa*), water parsley (*Oenanthe sarmentosa*), slough sledge (*Carex obnupta*), skunk cabbage (*Symplocarpus foetidus*), cow parsnip (*Haracleum maximum*), marsh hedgenettle (*Stachys palustris*), lady fern (*Athyrium filix-femina*), and sword fern (*Polystichum munitum*) [Fishman Environmental Services 2005].

Waatch River⁶

2.5.1 General Description - The Waatch River originates from a series of low peaks near the south border of the Makah Indian Reservation. The entire basin lies within the reservation boundaries. The main-stem is 7.8 miles long and tributaries add another 11.2 miles for a total of about 19 miles. Educket Creek flows into the Waatch at river mile 3.2 and is 3 miles long. Most of the Waatch basin is in timber production. Although there are some residential areas in the very lowest reach.

B. Historical anthropogenic impacts to salmonid populations in the region

1. Watershed impacts

Big Quilcene River⁷

2.5.6 Habitat Conditions -The Big Quilcene watershed has had an intense fire history compared to most of the Olympic Peninsula, except for the Dungeness and Elwha River drainages. The first fire for which evidence can be found occurred in 1308 and affected almost all of the watershed and much of the Olympic Peninsula. Beginning with the fire of 1308, natural fires occurred at about 200-year intervals with major fires evident in 1508, 1638, 1701, and 1860. Most fires since 1860 have been smaller and human-caused [USFS 1994].

The large natural fires usually resulted in stand replacement since the interval between fires allowed for accumulation of ground and ladder fuels resulting in hot crown fires that killed most of the trees [USFS 1994]. The prominence of Douglas fir in the landscape is a result of the watershed’s extensive fire history. Another result of these large fires was several years of

⁶ MNFH CHMP draft, p. 24-26.

⁷ QLNFH CHMP p. 14-16.

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

surface erosion and many more years of mass wasting. Sediment levels in nearby streams and aquatic populations were undoubtedly affected, and plant and wildlife communities may have taken years to return to pre-burn levels.

Before 1855, three known native communities used the Big Quilcene watershed: The Chemakum, Klallam (present day Port Gamble S'Klallam), and Twana (present-day Skokomish) [Righter 1978]. The Twana had at least one village near the present town of Quilcene, and the first reported homestead was established at the present site of Quilcene in 1860. The first major influx of settlers occurred between 1890 and 1895. Early settlers anticipated making a livelihood at farming. Generally, farming failed due to difficulty of getting the products to market. A second wave of settlers arrived between 1900 and 1910 intent on timber harvest and mining. During this early period only one logging company is known to have operated in the Big Quilcene watershed. Hundreds of mining claims were filed on Mt. Constance and Iron Mountain [Righter 1978]. The most successful mine was abandoned in 1920.

The population in the area continued to grow and the town of Quilcene was established near the mouth of the Big Quilcene River on the south side of the river. Quilcene was eventually moved upstream to its current location on the north side of the river to avoid recurring floods [pers. comm. Al Jakeway, 2001]. Flood control measures (diking) from Rodgers Street to the mouth of the Quilcene River have caused the river mouth to extend 1700 feet into Quilcene Bay. Flood control measures were initiated as early as the 1880s. Diking, filling, and excavation have altered about 26% of the historic Quilcene Bay delta [Jefferson County 1998].

In 1897, the Olympic National Forest was established. The USFS currently maintains two campgrounds and 30 miles of trails on National Forest lands within the Big Quilcene watershed. Recreational use in the watershed is estimated to be 8,000 to 20,000 visitor days each year [pers. comm.. Marc McHenry, US Forest Service, 2000].

In 1911, Quilcene NFH was constructed at the confluence of the Big Quilcene River and Penny Creek. Since then, the Service has acquired lands adjacent to the original hatchery site to construct and maintain other hatchery structures and to maintain water quality for fish production. Stream bank work, including barbs and revetments, has been installed on the Big Quilcene River mainstem to protect hatchery property from erosion.

In 1928, the City of Port Townsend constructed a timber crib diversion dam to meet its municipal and industrial water requirements. The dam is located above anadromous fish access on the Big Quilcene River just below its confluence with Tunnel Creek. The water is piped underground approximately 28 miles to Port Townsend. The intake is fitted with a trash rack but it is not screened to prevent fish entry.

Successful culturing of shellfish in the Quilcene area began in the 1930s with the introduction of Japanese seed oysters. Commercial harvest of oysters was fully underway by the mid-19th century. This in turn led to the eventual introduction of other exotic species of shellfish and the thriving shellfish seed industry which is seen today in the Quilcene area [USFS 1994].

In 1938, Olympic National Park was established to provide protection for Roosevelt elk and the old-growth rain forest ecological community. Tunnel Creek, a major tributary to the Big

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

Quilcene River, originates within the Olympic National Park. Habitat within Olympic National Park remains in pristine condition today.

In the mid 1950s, the Hiddendale community was established at about RM 3.8 on the south bank of the Big Quilcene River. Again, streambank work, including barbs and revetment, has been installed on the Big Quilcene River mainstem to protect private property at this community.

Timber harvest has been the most consistent and long-lived commercial venture in the watershed. Recorded acres clear cut ranged from a low of 21 during the 1920s to a high of 2,489 during the 1980s [USFS 1994].

Many agencies are currently addressing habitat deficiencies in the Big Quilcene River watershed. Active habitat improvements include land acquisition and dike setbacks in the lower river [pers. comm. Al Latham, Jefferson County, 2000]. Gravel traps are installed in the lower river, when funding is available [pers. comm. Ken Cook, Jefferson County, 2000], to reduce flooding impacts to land owners and to reduce gravel aggradations in spawning areas. The Skokomish Tribe has installed engineered log jams at about RM 2. The USFS has obliterated logging roads and added woody debris structures in some sections of the upper watershed to improve habitat for resident trout [pers. comm. Marc McHenry, USFS, 2000]. Passive habitat improvement is being implemented by the USFS, since it classified most of the watershed as “Late Successional Reserve” in 1994. This action is primarily aimed at promoting old-growth development by eliminating timber harvest after the stands reach the age of 80 years. Younger stands may be thinned, but no other harvest is scheduled by the USFS in the near-term [pers. com. Marc McHenry, USFS, 2000].

2.5.7 Current and Future Development - The population in the Big Quilcene River basin is expected to increase by about 50% in the next 20 years. Most of this growth will likely occur in the town of Quilcene and in shoreline areas near Point Whitney [Jefferson County 2000]. Increased population requires increased paved surfaces for homes, driveways, roads, and commercial infrastructure. This could potentially result in increased runoff, reduced groundwater recharge, and adverse impacts to groundwater and stream hydraulic continuity.

Population growth in general, both locally and regionally, will result in increased “visits” to the upper watershed areas as well. This could potentially lead to increased impacts and demands on plant, fish, and wildlife communities.

Cook Creek (Quinault River)⁸

2.5.6 *Habitat Condition* - Generally, habitat quality of Cook Creek is good. Large woody debris is common, and spawning gravels and riffles are abundant and interspersed with resting pools. Riparian vegetation consists of stands of alder and conifers, as well as areas of smaller plants such as vine maple and salmon berry. The creek is also connected to multiple tributaries and some additional wetland areas that would provide over-winter habitat for juvenile salmonids. Except for the headwaters, the creek gradient is less than 2 percent throughout its course and water temperatures at the hatchery generally average from 42° F (5.5° C) in

⁸ QNNFH CHMP draft, p. 14-15.

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

December to 54° F (12.2° C) in July. Summer low flows typically fall below 10 cfs at the hatchery [pers. comm. Glenn Green, USFWS, 2000].

The USFS reports 48 pieces of large woody debris (>12-inch diameter and 25-foot length) per 1,000 feet of stream length in the 3.5-mile reach from the hatchery intake to the Rayonier access road (RM 5.0 to 8.5) (Figure 2) [USFS et al. 1996]. The Washington Forest Practices Board rates this as fair for fish habitat [USFS et al. 1996]. The USFS also reports a pool area of 29% and substrate consisting of gravel (sizes 0.08-2.5 inches) and cobble (sizes 2.5-10 inches). This is a size range that serves well as spawning gravel.

During a site visit by Service staff to the same reach (RM 5.0 to 8.5) in September 2000, observations of gravel bar abundance, morphology, and sediment structure appeared to indicate substantial bedload sediment movement with concomitant tendencies for scour and bar instability [pers. comm. Paul Bakke, USFWS, 2000]. The reach most likely experiences a “flashy” hydrologic pattern, providing high sediment transport capacity over brief, but frequent, floods. Fresh hydraulic erosion on exposed cut banks in glacial outwash terraces provides ample gravel supply and currently, and much recruitment potential for moderately large wood (mostly red alder). Active cut bank erosion and large wood interactions are causing localized channel widening, scour pools, and development of secondary high-flow channels. Similar bar development is present in the creek from the hatchery to its confluence with the Quinault River. These conditions were not observed by Service staff in the reach between RM 8.5 to 9.3.

2.5.7 Current and Future Development - The closest established community in the area is Neilton which is located on Highway 101 and has about 100 residents. Most of the other landowners (Federal, state, private, and tribal) manage the Cook Creek watershed for timber production in conjunction with fish and wildlife habitat protections. Other uses of the surrounding landscape include activities such as hunting; fishing; berry, mushroom, and evergreen harvesting; and hiking. As such, future demands for residential, other agricultural, or other industrial uses, including land base and water appropriations, in the area are expected to be minimal.

Hoh River⁹

2.5.6 Habitat Condition - Habitat in the Hoh River basin has been largely protected since 60% of the upper river lies within Olympic National Park. However, habitat in other main-stem and tributary reaches in private timber lands have been compromised as a result of road building and timber harvesting practices.

In an effort to restore “at-risk” acres in the Hoh Basin the Hoh River Trust in partnership with Western Rivers Conservancy and the Wild Salmon Center has acquired nearly 50% of these acres. These acquisitions, in conjunction with lands protected within the Park represent 90% of the entire Hoh River basin (Hoh River Trust web site, 2009).

⁹ QNNFH CHMP draft, p. 14-15.

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

Sooes River¹⁰

2.5.6 Habitat Condition - Generally, habitat quality of the Sooes River and its tributaries is poor. Large woody debris is uncommon and immediate natural recruitment potential is low because of past intensive logging practices in riparian areas. However, spawning gravels and riffles are abundant and are interspersed with resting pools. Riparian vegetation and canopy consist of young stands of alder and conifers.

Observations made during a site visit by Service staff to the Sooes River watershed in October 2000 indicated a dynamic, mobile gravel bed with substantial bar development in some reaches [pers. comm. Paul Bakke, US Fish and Wildlife Service, 2000]. Observations of sediment structure in several spot-samples revealed a coarsened, but not embedded, gravel surface over a subsurface enriched with coarse sand but little or no fine sand or silt. This composition is generally easy for spawning fish to excavate and provides ample intra-gravel flow. However, it is also easily mobilized during high flows. Since there is little in-channel large wood to dissipate hydraulic energy, gravel bars are exposed to substantial hydraulic shear stress during floods, with concomitant scour and bar mobility. Also, the Sooes River probably experiences a “flashy” hydrologic pattern, providing high sediment transport capacity over brief, but frequent, floods. Mass wasting is also evident in some parts of the watershed, which results in substantial movement of fine and coarse sediment to downstream areas.

Except for the headwaters, the Sooes River gradient is less than 1 percent throughout its course, and water temperatures generally average from 42°F (5.5° C) in January to more than 65°F (18.3° C) in August at the hatchery. Tribal staff believes that water temperatures are generally cooling as a result of improving canopy cover and riparian conditions [pers. comm. Mike Haggerty, Makah Nation, 2000]. Summer low flows typically fall to about 9 cubic feet per second at the hatchery [pers comm. Al Jensen, US Fish and Wildlife Service, 2001].

Habitat deficiencies in the watershed are being addressed. Currently, the Makah Nation is working cooperatively with Crown Pacific Timber Company to identify and replace problem culverts. Together they are experimenting with adding large wood to the Sooes River. Also, streamside buffer protection should, after a number of years, provide a source of large wood for stream enhancement.

2.5.7 Current and Future Development - The closest established community in the area is Neah Bay which is located about seven miles north of the hatchery. The other landowners (private and tribal) manage the Sooes River watershed for timber production in conjunction with fish and wildlife habitat protections. Other uses of the surrounding landscape include activities such as berry, mushroom, and evergreen harvesting, hunting, fishing, and hiking. As such, future demands for residential, agricultural, or other industrial land uses, including water appropriations are expected to be minimal.

Waatch River¹¹

2.5.6 Habitat Conditions - The Waatch River basin is adjacent the Sooes River basin and thus shares the same climate, topography, gradient characteristics as well as similar land management practices (e.g. timber production) as the Sooes. Consequently, water

¹⁰ MNFH CHMP draft, p. 26-27.

¹¹ MNFH CHMP draft, p. 26-27.

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

temperature, erosion, sedimentation, and large wood features in the Waatch are similar to the Sooes River. The Waatch main-stem also has an impassible falls near river mile 4.0 further limiting its current capacity to support anadromous fish populations.

2. History of hatcheries in the region

(See chapter I, section G below)

C. ESUs identified by NMFS and current ESA status

Listed as *threatened* in 1999:

- Hood Canal Summer Chum
- Puget Sound Chinook
- Lake Ozette Sockeye
- Coastal/Puget Sound Bull Trout (DPS)

Listed as *threatened* in 2007:

- Puget Sound Steelhead.

D. Salmonid stocks in the region

1. Stocks identified by state and tribal comanagers¹²

HOOD CANAL

CHINOOK - SUMMER/FALL

Escapement -- 292 -- 5,234 (1968-1991). Escapement is generally strong in the Skokomish system but in the Dosewallips, Duckabush, Hamma Hamma, Dewatto, Tahuya and Union systems it has been extremely weak, given the available productive habitat.

Description -- Late September through October spawners. In the Skokomish system, a substantial segment of the naturally-spawning population is comprised of hatchery strays from two hatcheries in this system. For the other river systems, there have been releases of hatchery origin Chinook in those streams, however, the magnitude of genetic impacts is unknown.

Origin and Production Type -- A stock of mixed origin with composite production.

Status -- Healthy

¹² Washington Department of Fisheries et. al 1992.

USFWS Olympic Peninsula Hatchery Review Team
Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

CHUM – SUMMER (HOOD CANAL)

Escapement -- 200 -- 43,000 (1968-1991).

Description -- Mid-September through mid-October spawners in tributaries such as the Quilcene, Dosewallips, Duckabush, Hamma Hamma, Dewatto and Tahuya rivers. The Hood Canal summer chum are native fish that once numbered over 40,000 in the late 1960s. The latest escapement estimate for Hood Canal (1991) was 936. Origin and Production Type -- A native stock with wild production.

Status -- Critical due to chronically low escapements.

CHUM – SUMMER (UNION - HOOD CANAL)

Escapement -- 40 -- 2,000 (1968-1991).

Description -- September to early October spawners. The Union River native summer chum spawning run has an earlier timing than the rest of Hood Canal summer chum. Origin and Production Type -- A native stock with wild production.

Status – Healthy

CHUM – FALL (WEST HOOD CANAL)

Escapement -- 3,500 -- 37,000 (1968-1991).

Description -- November through early January spawners. The broad spawning season of the wild spawning chum have allowed these fish to remain a viable wild run. Egg box projects and hatchery plants have been made in most of these streams and have contributed to the wild run. Origin and Production Type -- A mixed stock of composite production.

Status – Healthy

CHUM – FALL (HAMMA HAMMA - LATE)

Escapement -- 900 -- 14,000 (1968-1991).

Description -- Often described as "late-falls," these chum spawn from late November through early January. Spawning takes place primarily in the lower mile of the river. The later-than normal timing of the wild spawning chum has allowed this stock to remain viable. Origin and Production Type -- A native stock with wild production.

Status – Healthy

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

CHUM – FALL (DUCKABUSH – LATE)

Escapement -- 74 -- 4,700 (1968-1991).

Description -- Often described as "late-falls," these chum spawn from late November through early January. Spawning takes place primarily in the lower mile of the river. The later-than normal timing of the wild spawning chum has allowed this stock to remain viable.

Origin and Production Type -- A native stock of wild production.

Status – Healthy

CHUM – FALL (DOSEWALLIPS – LATE)

Escapement -- 100 -- 7,300 (1968-1991).

Description -- Often described as "late-falls," these chum spawn from late November through early January. Spawning takes place primarily in the lower mile of the river. The later-than normal timing of the wild spawning chum has allowed this stock to remain viable. Origin and Production Type -- A native stock with wild spawning.

Status -- Healthy

CHUM – FALL (QUILCENE – LATE)

Escapement -- 50 -- 8,400 (1968-1991).

Description -- November through early January spawners. The majority of the spawning occurs in the Big Quilcene River. This run is supported by a federal hatchery located upriver (RM 2.3) on a tributary (Penny Creek). The wild escapement is the result of a combination of natural spawning and hatchery fish that spawn before reaching the hatchery. Spawning also takes place in the Little Quilcene River, the independent drainages of Jackson and Spencer creeks, and Wolcott Slough.

Origin and Production Type -- A mixed stock of composite production.

Status – Healthy

COHO (SOUTHWEST HOOD CANAL)

Escapement -- Unknown

Description -- Early November to late December spawners in independent drainages from the Skokomish to the Hamma Hamma River. There have been very limited introductions of hatchery origin coho in this area, however, the magnitude of genetic impact is unknown.

Origin and Production Type -- A mixed stock with wild production.

USFWS Olympic Peninsula Hatchery Review Team
Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

Status – Healthy

COHO (HAMMA HAMMA)

Escapement -- Unknown

Description -- Early November to late December spawners in the Hamma Hamma and tributaries. There have been very limited introductions of hatchery-origin coho in this area, however, the magnitude of genetic impacts is unknown.

Origin and Production Type -- A mixed stock with wild production.

Status – Healthy

COHO (DUCKABUSH)

Escapement -- Unknown

Description -- Early November to late December spawners in the Duckabush and its tributaries and Fulton Creek. There have been very limited introductions of hatchery-origin coho in this area, however, the magnitude of genetic impact is unknown. Origin and Production Type -- A mixed stock with wild production.

Status -- Depressed due to a short-term severe decline, based on escapement.

COHO (DOSEWALLIPS)

Escapement -- Unknown

Description -- Early November to late December spawners in the Dosewallips and tributaries and local independent drainages. There have been very limited introductions of hatchery-origin coho in this area, however, the magnitude of genetic impact is unknown.

Origin and Production Type -- A mixed stock with wild production.

Status – Healthy

COHO (QUILCENE/DABOB BAYS)

Escapement -- 200 -- 3,000 (1965-1992)

Description -- Spawning timing is widely variable between years, but when stronger returns are evident, spawning occurs over an extended period from early November to mid-January. This may also be the result of the composite return which includes strays from the Quilcene National Fish Hatchery (an early run) mixed with normal timed coho from natural and net pens production. Spawning occurs in all accessible tributaries to the Quilcene and Dabob bays.

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

There have been releases of Hood Canal and Dungeness coho into these streams, however, the magnitude of genetic impact is unknown.

Origin and Production Type -- A mixed stock of composite production.

Status -- Depressed based on chronically low escapement and run-size.

PINK (HAMMA HAMMA)

Escapement -- 2,000 -- 38,000 (1967-1991).

Description -- September through early October spawner. Most of the spawning takes place in the mainstem reaches. Pinks arrive in the river and hold in large pools until they are ready to spawn.

Origin and Production Type -- A native stock with wild production.

Status – Healthy

PINK (DUCKABUSH)

Escapement -- 2,300 -- 72,000 (1959-1967).

Description -- September through early October spawners. Most of the spawning takes place in the mainstem reaches. Pinks arrive in the river and hold in large pools until they are ready to spawn.

Origin and Production Type -- A native stock with wild production.

Status – Healthy

PINK (DOSEWALLIPS)

Escapement -- 1,700 -- 190,000 (1967-1991).

Description -- September through early October spawners. Most of the spawning takes place in the mainstem reaches. Pinks arrive in the river and hold in large pools until they are ready to spawn.

Origin and Production Type -- A native stock with wild production.

Status -- Depressed based on chronically low escapement levels.

SUMMER STEELHEAD (SKOKOMISH)

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

Escapement -- Unknown. Spawner escapement is not monitored for this stock, nor has an escapement goal been identified.

Description -- Spawning period is unknown but believed to be similar to other summer steelhead stocks in the Puget Sound region (February through April). A distinct stock based on the geographical isolation of the spawning population in the mainstem Skokomish, North Fork Skokomish, and South Fork Skokomish rivers and tributaries. Spawning believed to take place in upper reaches of river.

Origin and Production Type -- Unresolved by state and tribes.

Status -- Unknown, comprised of a historically small number of steelhead.

SUMMER STEELHEAD (DUCKABUSH)

Escapement -- Unknown. Spawner escapement is not monitored for this stock, nor has an escapement goal been identified.

Description -- Spawning believed to take place in upper reaches of river. Spawning period is unknown but believed to be similar to other summer steelhead stocks in Puget Sound region (February through April). A distinct stock based on the geographical isolation of the spawning population in the Duckabush River.

Origin and Production Type -- Unresolved by state and tribes.

Status -- Unknown, comprised of a historically small number of steelhead.

SUMMER STEELHEAD (DOSEWALLIPS)

Escapement -- Unknown. Spawner escapement is not monitored for this stock, nor has an escapement goal been identified.

Description -- Spawning period is unknown but believed to be similar to other summer steelhead stocks in Puget Sound region (February through April). A distinct stock based on the geographical isolation of the spawning population in the Dosewallips River and tributaries. Spawning believed to take place in upper reaches of river.

Origin and Production Type -- Unresolved by state and tribes.

Status -- Unknown, comprised of a historically small number of steelhead.

WINTER STEELHEAD (HAMMA HAMMA)

Escapement -- Unknown. Spawner escapement is not monitored for this stock nor has an escapement goal been identified.

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

Description -- Mid-February to early June spawning period. A distinct stock based on geographical isolation of the spawning population in the Hamma Hamma River.

Origin and Production Type -- A native stock sustained by wild production.

Status -- Unknown, comprised of a historically small number of steelhead.

WINTER STEELHEAD (DUCKABUSH)

Escapement -- Unknown. Spawner escapement is not monitored for this stock, nor has an escapement goal been identified.

Description -- Mid-February to early June spawning period. A distinct stock based on geographical isolation of the spawning population in the Duckabush River.

Origin and Production Type -- Unresolved by state and tribes.

Status -- Depressed based on short-term severe decline in sport harvest of wild steelhead.

WINTER STEELHEAD (DOSEWALLIPS)

Escapement -- Unknown. Spawner escapement is not monitored for this stock, nor has an escapement goal been identified.

Description -- Mid-February to early June spawning period. A distinct stock based on geographical isolation of the spawning population in the Dosewallips River.

Origin and Production Type -- Unresolved by state and tribes.

Status -- Depressed based on short-term severe decline in sport harvest of wild steelhead.

WINTER STEELHEAD (QUILCENE/DABOB BAYS)

Escapement -- Unknown. Spawner escapement is not monitored for this stock, nor has an escapement goal been identified.

Description -- Mid-February to early June spawning period. A distinct stock based on geographical isolation of the spawning population in tributaries to Quilcene and Dabob Bays, including Quilcene River, Little Quilcene River, and Tarboo Creek.

Origin and Production Type -- Unresolved by state and tribes.

Status -- Unknown, comprised of a historically small number of steelhead.

SOOES/OZETTE

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

FALL CHINOOK (SOOES)

Escapement -- Unknown

Description -- Spawning takes place late September through mid-November. The fish are removed from the river and spawned at the USFWS hatchery on the Sooes.

Origin and Production Type -- A native stock with cultured production.

Status – Unknown

FALL CHUM (SOOES)

Escapement -- Unknown

Description -- Spawning takes place throughout November. The fish are removed from the river and spawned at the USFWS hatchery on the Sooes. This stock is a Quilcene stock introduced from the Lake Quinault hatchery.

Origin and Production Type -- A non-native stock with cultured production.

Status – Unknown

FALL CHUM (OZETTE)

Escapement -- Unknown

Description -- Spawning takes place from late October to early December in the Ozette River below the lake and larger tributaries such as Big River, Umbrella Creek and Crooked Creek.

Origin and Production Type -- A native stock with wild production.

Status – Unknown

COHO (SOOES/WAATCH)

Escapement -- Unknown

Description -- Spawning takes place mid-October through January. For spawning distribution, 1,000 -- 2,000 coho are released above the weir at the USFWS hatchery on the Sooes.

Origin and Production Type -- A mixed stock with composite production.

Status – Unknown

COHO (OZETTE)

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

Escapement -- Unknown

Description -- Spawning takes place from late October through January in the tributaries to Lake Ozette and possibly in the lake outlet.

Origin and Production Type -- A native stock with wild production.

Status -- Unknown

SOCKEYE (OZETTE)

Escapement -- 263 -- 2,191(1977-1991).

Description -- The spawning distribution is in the lake, specifically at Olson's Landing and Allen's Bay near Umbrella Creek, and perhaps to a small degree in the Ozette River. Spawning is in December and January. This stock is supplemented with 40 -- 100,000 fry from sockeye caught off the spawning beds and reared at the Makah Tribal Hatchery on Umbrella Creek.

Origin and Production Type -- A native stock with wild production.

Status -- Depressed due to chronically low escapement levels.

WINTER STEELHEAD (SOOES/WAATCH)

Escapement -- Unknown. Spawner escapement is not monitored for this stock nor has an escapement goal been identified.

Description -- A distinct stock based on the geographical isolation of the spawning population in the Sooes River and Waatch River and tributaries. Spawning period is unknown but believed to be similar to other winter steelhead stocks along the coast (mid-February to early June).

Origin and Production Type -- A native stock sustained by wild production.

Status -- Unknown, comprised of a historically small number of steelhead.

WINTER STEELHEAD (OZETTE)

Escapement -- Unknown. Spawner escapement is not monitored for this stock, nor has an escapement goal been identified.

Description -- Spawning period is unknown but believed to be similar to other winter steelhead stocks along the coast (mid-February to early June). A distinct stock based on the geographical isolation of the spawning population in the Ozette River, Big River and tributaries.

USFWS Olympic Peninsula Hatchery Review Team
Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

Origin and Production Type -- A native stock sustained by wild production.

Status -- Unknown, comprised of a historically small number of steelhead.

QUILLAYUTE

SPRING CHINOOK (SOL DUC)

Escapement -- 100 -- 1,800 (1976-1992).

Description -- Spawning occurs late August to mid-September. Spawning takes place from the confluence with the Quillayute River up-stream into the headwaters (over 55 miles). Production is primarily from naturally-spawning hatchery fish.

Origin and Production Type -- A non-native stock with composite production.

Status -- Healthy

SUMMER CHINOOK (QUILLAYUTE/BOGACHIEL)

Escapement -- 35 -- 656 (1980-1992).

Description -- Late August to mid-October spawning, mostly in the mainstem Bogachiel, occasionally in the mainstem Quillayute.

Origin and Production Type -- A native stock with composite production.

Status -- Unknown

SUMMER CHINOOK (SOL DUC)

Escapement -- 250 -- 1,131 (1980-1992).

Description -- Late August to mid-October spawning, mostly in the mainstem Sol Duc River. In years with high late summer flows some spawning is observed in Beaver and Bear creeks.

Origin and Production Type -- A native stock with wild production.

Status -- Healthy

SUMMER CHINOOK (CALAWAH)

Escapement -- 85 -- 1,125 (1980-1992).

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

Description -- Late August to mid-October spawning, mostly in the mainstem and South Fork Calawah. In years with high late summer flows, some spawning is observed in the lower three miles of the Sitkum River and the lower three miles of the North Fork Calawah.

Origin and Production Type -- A native stock with wild production.

Status – Unknown

FALL CHINOOK (QUILLAYUTE/BOGACHIEL)

Escapement -- 308 -- 3,210 (1982-1992).

Description -- Late October to early December spawning, mostly in the mainstem Bogachiel. Redd densities are low in the mainstem Quillayute, except in low flow years. Some spawning occurs in Bear Creek.

Origin and Production Type -- A native stock with wild production.

Status – Healthy

FALL CHINOOK (DICKEY)

Escapement -- 78 -- 1,393 (1982-1991).

Description -- Late October to early December spawning in the mainstem, West Fork and East Fork. Coal Creek has high numbers of spawners some years, and other small to medium tributaries can also support small numbers of spawners.

Origin and Production Type -- A native stock with wild production.

Status – Healthy

FALL CHINOOK (SOL DUC)

Escapement -- 1,235 -- 7,658 (1982-1991).

Description -- Late October to early December spawning in both the mainstem and larger tributaries. In high flow years, large numbers of spawners can be found in Gunderson Lake, Beaver and Bear creeks and numerous small and medium tributaries.

Origin and Production Type -- A native stock with composite production.

Status – Healthy

FALL CHINOOK (CALAWAH)

USFWS Olympic Peninsula Hatchery Review Team
Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

Escapement -- 453 -- 4,947 (1982-1991).

Description -- Late October to early December spawning in the mainstem and lower South Fork Calawah; in some years spawning is observed in the lower three miles of the Sitkum River and the lower 11 miles of the North Fork Calawah.

Origin and Production Type -- A native stock with wild production.

Status – Healthy

FALL CHUM (QUILLAYUTE)

Escapement -- Unknown

Description -- Late October to Late December spawners. Chum are observed in low densities throughout the drainage. Spawning occurs in mainstem reaches of the Quillayute, Dickey, Sol Duc, and Calawah rivers and their accessible tributaries.

Origin and Production Type -- A native stock with wild production.

Status – Unknown

SUMMER COHO (SOL DUC)

Escapement -- 600 -- 1,573 (1976-1991).

Description -- Late October to early December spawning, mainly in the Sol Duc River from RM 61 to RM 63, above the Salmon Cascades; additional spawning in Bear, Camp, and Beaver creeks in years with larger run sizes.

Origin and Production Type -- A native stock with composite production.

Status – Healthy

FALL COHO (DICKY)

Escapement -- 438 -- 4,670 (1980-1991).

Description -- Mid-November to January spawning in most of the small- to medium-sized streams in this drainage.

Origin and Production Type -- A native stock with wild production.

Status – Healthy

FALL COHO (SOL DUC)

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

Escapement -- 1,348 -- 5,743 (1980-1991).

Description -- Mid-November to mid-January spawning in small- and medium-sized tributaries to the Sol Duc.

Origin and Production Type -- A native stock with composite production.

Status – Healthy

FALL COHO (BOGACHIEL)

Escapement -- 934 -- 1,918 (1980-1991).

Description -- Mid-November to mid-January spawning in small- to medium-sized tributaries and side channels of the upper mainstem.

Origin and Production Type -- A native stock with wild production.

Status – Healthy

FALL COHO (CALAWAH)

Escapement -- 709 -- 1,670 (1980-1991).

Description -- Mid-November to mid-January spawning in small- to moderate-sized tributaries.

Origin and Production Type -- A native stock with wild production.

Status – Healthy

SOCKEYE (LAKE PLEASANT)

Escapement -- Unknown

Description -- Late November to early January spawning, predominately on beaches, with little reproduction in tributaries.

Origin and Production Type -- A native stock with wild production

Status – Unknown

SUMMER STEELHEAD (SOL DUC)

Escapement -- Unknown. Spawner escapement is not monitored for this stock, nor has an escapement goal been identified.

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

Description -- Spawning period is unknown but believed to be similar to other summer steelhead stocks along the coast (February through April). A distinct stock based on the geographical isolation of the spawning population in the Sol Duc River and its forks. Distinct from wild winter steelhead in the Sol Duc based on run timing. Believed to spawn in the upper reaches of the river. This would geographically isolate the summer steelhead in the Sol Duc River from other summer steelhead stocks in the Quillayute River system.

Origin and Production Type -- Origin unresolved by state and tribes. Sustained by wild production.

Status -- Unknown, comprised of a historically small number of steelhead.

SUMMER STEELHEAD (BOGACHIEL)

Escapement -- Unknown. Spawner escapement is not monitored for this stock nor has an escapement goal been identified.

Description -- Spawning period is unknown but believed to be similar to other summer steelhead stocks along the coast (February through April). A distinct stock based on the geographical isolation of the spawning population in the Bogachiel River. Distinct from wild winter steelhead in the Bogachiel River based on run timing. Believed to spawn in the upper reaches of the river. This would geographically isolate the summer steelhead in the Bogachiel from other summer steelhead stocks in the Quillayute River system.

Origin and Production Type -- Origin unresolved by state and tribes. Sustained by wild production.

Status -- Unknown, comprised of a historically small number of steelhead.

SUMMER STEELHEAD (CALAWAH)

Escapement -- Unknown. Spawner escapement is not monitored for this stock, nor has an escapement goal been identified.

Description -- Spawning period is unknown but believed to be similar to other summer steelhead stocks along the coast (February through April). A distinct stock based on the geographical isolation of the spawning population in the Calawah River. Distinct from wild winter steelhead in the Calawah based on run timing. Believed to spawn in the upper reaches of the mainstem Calawah River, South Fork Calawah River, and Sitkum River. This would geographically isolate the summer steelhead in the Calawah from other summer steelhead stocks in the Quillayute River system.

Origin and Production Type -- Origin unresolved by state and tribes. Sustained by wild production.

Status -- Unknown, comprised of a historically small number of steelhead.

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

WINTER STEELHEAD (QUILLAYUTE/BOGACHIEL)

Escapement -- 973 -- 4,553 (1978-1992).

Description -- Mid-February to mid-June spawning period. A distinct stock based on geographical isolation of the spawning population in the mainstem Quillayute River, Bogachiel River, and tributaries.

Origin and Production Type -- A native stock sustained by wild production.

Status -- Healthy based on wild spawner escapement.

WINTER STEELHEAD (DICKY)

Escapement -- 179 -- 1,607 (1978-1992).

Description -- Mid-February to mid-June spawning period. A distinct stock based on geographical isolation of the spawning population in the Dickey River, its forks, and tributaries.

Origin and Production Type -- A native stock sustained by wild production.

Status -- Healthy based on wild spawner escapement.

WINTER STEELHEAD (SOL DUC)

Escapement -- 1,967 -- 5,333 (1978-1992).

Description -- Mid-February to mid-June spawning period. A distinct stock based on geographical isolation of the spawning population in the Sol Duc River and tributaries.

Origin and Production Type -- A native stock sustained by wild production.

Status -- Healthy based on wild spawner escapement.

WINTER STEELHEAD (CALAWAH)

Escapement -- 989 -- 4,526 (1978-1992).

Description -- Mid-February to mid-June spawning period. A distinct stock based on geographical isolation of the spawning population in the Calawah River and its forks, Sitkum River, and tributaries.

Origin and Production Type -- A native stock sustained by wild production.

Status -- Healthy based on wild spawner escapement.

USFWS Olympic Peninsula Hatchery Review Team
Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

HOH

SPRING/SUMMER CHINOOK (HOH)

Escapement -- 546 -- 4,721 (1973-1991).

Description -- Mid-August to mid-October spawning in North Fork, South Fork, mainstem, Mt. Tom Creek, and most larger tributaries.

Origin and Production Type -- A native stock with wild production.

Status – Healthy

FALL CHINOOK (HOH)

Escapement -- 1,420 -- 5,148 (1973-1992).

Description -- Mid-October to late December spawning in the mainstem, North Fork, South Fork, and larger tributaries.

Origin and Production Type -- A native stock with wild production.

Status – Healthy

FALL CHUM (HOH)

Escapement -- Unknown

Description -- November and December spawners in the mainstem Hoh and side channels upstream to the vicinity of Willoughby Creek. State managers believe this small population is likely a reproductively isolated stock. Tribal managers believe chum spawning in the Hoh River may be primarily produced from populations in other river systems.

Origin and Production Type -- A unknown stock with unknown production.

Status -- Unknown (unresolved by state and tribes - see Appendix Stock Report).

COHO (GOODMAN/MOSQUITO CREEKS)

Escapement -- Unknown

Description -- Spawning takes place from late October to mid-February. Spawning occurs throughout the Mosquito Creek drainage and most of the Goodman Creek drainage. Origin and Production Type -- A native stock with wild production.

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

Status – Unknown

COHO (HOH)

Escapement -- 1,700 -- 7,400 (1980-1992).

Description -- Late October through mid-February spawn timing in tributaries, spring-fed channels and river side-channels from the mouth to RM 48 on the North Fork and RM 10 on the South Fork.

Origin and Production Type -- A native stock with wild production.

Status – Healthy

SUMMER STEELHEAD (HOH)

Escapement -- Unknown. Spawner escapement is not monitored for this stock, nor has an escapement goal been identified.

Description -- Spawning period is unknown but believed to be similar to other summer steelhead stocks along the coast (February through April). A distinct stock based on the geographical isolation of the spawning population in the Hoh River, South Fork Hoh River, and tributaries. Distinct from wild winter steelhead in the Hoh River based on run-timing. Believed to spawn in the upper reaches of the river.

Origin and Production Type -- A native stock sustained by wild production.

Status – Unknown

WINTER STEELHEAD (GOODMAN CREEK)

Escapement -- Unknown. Spawner escapement is not monitored for this stock, nor has an escapement goal been identified.

Description -- Spawning period is unknown but believed to be similar to other winter steelhead stocks along the coast (Mid-February through early June). A distinct stock based on the geographical isolation of the spawning population in Goodman Creek.

Origin and Production Type -- A native stock sustained by wild production.

Status -- Unknown, comprised of a historically small number of steelhead.

WINTER STEELHEAD (MOSQUITO CREEK)

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

Escapement -- Unknown. Spawner escapement is not monitored for this stock, nor has an escapement goal been identified.

Description -- Spawning period is unknown but believed to be similar to other winter steelhead stocks along the coast (Mid-February through early June). A distinct stock based on the geographical isolation of the spawning population in Mosquito Creek.

Origin and Production Type -- A native stock sustained by wild production.

Status -- Unknown, comprised of a historically small number of steelhead.

WINTER STEELHEAD (HOH)

Escapement -- 1,290 -- 4,593 (1976-1992). WDFW escapement goal = 2,400

Description -- Mid-February to mid-June spawning period. A distinct stock based on geographical isolation of the spawning population in the Hoh River, South Fork Hoh River, and tributaries.

Origin and Production Type -- A native stock sustained by wild production.

Status -- Healthy based on wild spawner escapement.

KALALOCH

COHO (KALALOCH CREEK)

Escapement -- Unknown

Description -- November through December spawning period. Spawning distribution unknown but probably occurs throughout accessible areas of Kalaloch Creek and its tributaries.

Origin and Production Type -- A native stock of wild production type.

Status -- Unknown

WINTER STEELHEAD (KALALOCH CREEK)

Escapement -- Unknown. Spawner escapement is not monitored for this stock, nor has an escapement goal been identified.

Description -- Spawning period is unknown but believed to be similar to other winter steelhead stocks along the coast (mid-February to mid-June). A distinct stock based on the geographical isolation of the spawning population in Kalaloch Creek, its forks, and tributaries.

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

Origin and Production Type -- A native stock sustained by wild production.

Status -- Unknown, comprised of a historically small number of steelhead.

QUEETS

SPRING/SUMMER CHINOOK (QUEETS)

Escapement -- 525 -- 2,295 (1981-1991).

Description -- Spawning takes place from mid-September through mid-October. Distribution of the spawning grounds includes the mainstem Queets from RM 6 to RM 43. Additional spawning occurs in the lower reaches of Sams River and Matheny Creek. The recent two years low escapement followed well-above average escapement for the previous three years.

Origin and Production Type -- A native stock with wild production.

Status -- Depressed based on a short-term severe decline in escapement.

SPRING/SUMMER CHINOOK (CLEARWATER)

Escapement -- 38 -- 570 (1981-1991).

Description -- Spawning takes place from mid-September through mid-October. Distribution of the spawning grounds includes the mainstem Clearwater from the mouth, upstream approximately 24 river miles near the confluence with the Solleks River. The recent two years low escapement followed well-above average escapement for the previous three years.

Origin and Production Type -- A native stock with wild production.

Status -- Depressed based on a short-term severe decline in escapement.

FALL CHINOOK (QUEETS)

Escapement -- 1,688 -- 6,855 (1981-1991).

Description -- Spawning takes place from mid-October through mid-December. Distribution of the spawning grounds includes the mainstem Queets from RM 2 to RM 37. In addition, Sams River, Salmon River, and Matheny Creek each contain several miles of extensively utilized spawning habitat. Also, fall Chinook utilize spawning habitat in the lower reaches of several other smaller tributaries.

Origin and Production Type -- A native stock with wild production.

Status -- Healthy

USFWS Olympic Peninsula Hatchery Review Team
Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

FALL CHINOOK (CLEARWATER)

Escapement -- 799 -- 3,037 (1981-1991).

Description -- Spawning takes place from mid-October through mid-December. Distribution of the spawning grounds includes the mainstem Clearwater, upstream to RM 24, and major tributaries such as Miller Creek, Christmas Creek, Snahapish River, Solleks River and lower reaches of several smaller tributaries.

Origin and Production Type -- A native stock with wild production.

Status – Healthy

FALL CHUM (QUEETS)

Escapement -- Unknown

Description -- Spawning takes place from early November through mid-December. Distribution of the spawning grounds is not well understood, but some spawning in the lower Queets and Clearwater Rivers does occur. The lower reaches of Salmon River and Matheny Creek are also used by chum for spawning. State managers believe this small population is likely a reproductively isolated stock. Tribal managers believe chum spawning in the Queets River may be primarily produced from populations in the Quinault River and perhaps the Grays Harbor drainage.

Origin and Production Type -- An unknown stock from unknown production.

Status -- Unknown (unresolved by state and tribes - see Appendix Stock Report).

COHO (QUEETS)

Escapement -- 1,500 -- 5,400 (1979-1991).

Description -- Spawning takes place from mid-November through the end of January. Distribution of the spawning grounds includes the mainstem Queets from approximately RM 2 upstream to RM 37, significant reaches in the Sams and Salmon rivers, Matheny Creek, and all other accessible tributaries to the Queets. Tribal managers believe that improved production is achieved through supplementation. Continued evaluation of this stock's production potential is planned by state and tribal managers.

Origin and Production Type -- A native stock from composite production.

Status – Healthy

COHO (CLEARWATER)

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

Escapement -- 700 -- 3,900 (1979-1991).

Description -- Spawning takes place from mid-November through the end of January. Distribution of the spawning grounds includes the mainstem Clearwater, upstream to RM 34, and major tributaries such as Miller Creek, Christmas Creek, Snahapish River, Solleks River and all other accessible tributaries to the Clearwater. Tribal managers believe that improved production is achieved through supplementation. Continued evaluation of this stock's production potential is planned by state and tribal managers.

Origin and Production Type -- A native stock from composite production.

Status – Healthy

COHO (SALMON RIVER)

Escapement -- 1,100 -- 8,700 (1983-1991).

Description -- Spawning takes place from mid-October through mid-November. Spawning grounds are located throughout the Salmon River basin and in neighboring tributaries near the Salmon River.

Origin and Production Type -- A non-native stock from composite production.

Status – Healthy

SUMMER STEELHEAD (QUEETS)

Escapement -- Unknown. Spawner escapement is not monitored for this stock, nor has an escapement goal been identified.

Description -- Spawning period is unknown but believed to be similar to other summer steelhead stocks along the coast (February through April). A distinct stock based on the geographical isolation of the spawning population in the Queets River. Distinct from wild winter steelhead in the Queets based on run timing. Believed to spawn in the upper reaches of the river.

Origin and Production Type -- A native stock sustained by wild production.

Status -- Healthy based on combined sport and tribal harvest of wild steelhead.

SUMMER STEELHEAD (CLEARWATER)

Escapement -- Unknown. Spawner escapement is not monitored for this stock, nor has an escapement goal been identified.

Description -- Spawning period is unknown but believed to be similar to other summer steelhead stocks along the coast (February through April). A distinct stock based on the

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

geographical isolation of the spawning population in the Clearwater River. Distinct from wild winter steelhead in the Clearwater River based on run-timing. Believed to spawn in the upper reaches of the river.

Origin and Production Type -- A native stock sustained by wild production.

Status -- Unknown, comprised of a historically small number of steelhead.

WINTER STEELHEAD (QUEETS)

Escapement -- 2,248 -- 4,841 (1980-1992).

Description -- Mid-February through June spawning period. A distinct stock based on geographical isolation of the spawning population in the Queets River, Salmon River, Sams River, Matheny Creek and tributaries.

Origin and Production Type -- A native stock sustained by wild production.

Status -- Healthy based on wild spawner escapement.

WINTER STEELHEAD (CLEARWATER)

Escapement -- 1,638 -- 2,662 (1982-1992).

Description -- Mid-February through June spawning period. A distinct stock based on geographical isolation of the spawning population in the Clearwater River, Solleks River, Miller Creek, Christmas Creek, Snahapish River, and tributaries.

Origin and Production Type -- A native stock sustained by wild production.

Status -- Healthy based on wild spawner escapement.

RAFT

FALL CHINOOK (RAFT)

Escapement -- Unknown

Description -- Spawning is thought to occur mid-October through mid-November. Spawning distribution is unknown.

Origin and Production Type -- A native stock with wild production.

Status -- Unknown

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

COHO (RAFT)

Escapement -- Unknown

Description -- Spawning is thought to occur throughout the basin from mid-November through mid-January. Spawning locations are unknown.

Origin and Production Type -- A native stock with wild production.

Status – Unknown

WINTER STEELHEAD (RAFT)

Escapement -- Unknown. Spawner escapement is not monitored for this stock, nor has an escapement goal been identified.

Description -- Spawning period is unknown but believed to be similar to other coastal winter stocks (mid-February to early June). A distinct stock based on the geographical isolation of the spawning population in the Raft River and tributaries. Extensive stocking of Quinault Indian Nation Hatchery and Quinault National Fish Hatchery (Cook Creek) steelhead fry has occurred.

Origin and Production Type -- A mixed stock sustained by composite production.

Status -- Unknown.

QUINAULT

SPRING/SUMMER CHINOOK (QUINAULT)

Escapement -- 298 -- 1,685 (1987-1992).

Description -- Spawning takes place from early September through mid-October. Distribution of the spawning grounds includes the mainstem Quinault from approximately RM 9 upstream to Lake Quinault and from the North end of the lake, upstream to RM 53. Additional spawning occurs in the lower eight miles of the North Fork. The recent two years low escapement followed well-above average escapement for the previous three years.

Origin and Production Type -- A native stock with wild production.

Status -- Depressed based on a short-term severe decline in escapement.

FALL CHINOOK (QUINAULT)

Escapement -- 3,078 -- 4,630 (1987-1992).

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

Description -- Spawning takes place from mid-October through mid-December. Distribution of the spawning grounds includes the mainstem Quinault, from approximately RM 3, upstream to Lake Quinault, and from the North end of the lake, upstream to RM 53. Additional spawning occurs in the lower eight miles of the North Fork and lower reaches on several tributaries.

Origin and Production Type -- A native stock with wild production.

Status – Healthy

FALL CHINOOK (COOK CREEK)

Escapement -- 2,140 -- 4,736 (1986-1991).

Description -- Spawning takes place from mid-October through mid-December. Distribution of the spawning grounds includes the mainstem Quinault, from approximately RM 3, upstream to Lake Quinault, and the four mile reach below the hatchery on Cook Creek. Additional spawning occurs in the lower reaches of several tributaries.

Origin and Production Type -- A mixed stock with composite production.

Status – Healthy

FALL CHUM (QUINAULT)

Escapement -- 1,860 -- 12,155 (1977-1991).

Description -- Spawning takes place from late October through early December. Distribution of the spawning grounds include the mainstem Quinault, from approximately RM 3, upstream to Lake Quinault, and from the North end of the lake, upstream to RM 47 and in major tributaries.

Origin and Production Type -- A mixed stock with composite production.

Status – Healthy

COHO (QUINAULT)

Escapement -- 1,194 -- 9,250 (1986-1991).

Description -- Spawning takes place from early November through mid-February. Distribution of the spawning grounds include the mainstem Quinault, from approximately RM 3, upstream to Lake Quinault, and from the North end of the lake, upstream to RM 53. Additional spawning occurs in the lower eight miles of the North Fork and all accessible tributaries.

Origin and Production Type -- A mixed stock with composite production.

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

Status – Unknown

COHO (COOK CREEK)

Escapement -- 1,431 -- 22,531(1986-1991).

Description -- Spawning takes place from mid-October through late November. Distribution of the spawning grounds include the mainstem Quinault, from approximately RM 3, upstream to Lake Quinault, and from the North end of the lake, to approximately RM 41 near the confluence of Big Creek. Additional spawning occurs in accessible tributaries downstream of the lake.

Origin and Production Type -- A mixed stock with composite production.

Status – Healthy

SOCKEYE (QUINAULT)

Escapement -- 11,546 -- 64,172 (1972-1992).

Description -- Spawning takes place from mid-October through end of February. Distribution of the spawning grounds include the mainstem Quinault above Lake Quinault to RM 53. Primary spawning habitat is located in the mainstem Quinault between the lake and the confluence of the North and East forks and the major tributaries in that reach.

Origin and Production Type -- A native stock with wild production.

Status – Healthy

SUMMER STEELHEAD (QUINAULT)

Escapement -- Unknown. Spawner escapement is not monitored for this stock, nor has an escapement goal been identified.

Description -- Spawning period unknown but believed to be similar to other summer steelhead stocks (February through April). A distinct stock based on the geographical isolation of the spawning population in the Quinault River. Distinct from winter steelhead stock in the Quinault River based on run-timing. Spawning believed to take place in the upper reaches of river.

Origin and Production Type -- A native stock sustained by wild production.

Status -- Unknown, comprised of a historically small number of steelhead.

WINTER STEELHEAD (QUINAULT/LAKE QUINAULT)

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

Escapement -- (1978-1992) 1,716 -- 3,646

Description -- A distinct stock based on the geographical isolation of the spawning population in the Quinault River primarily downstream of Lake Quinault. Hatchery broodstock collected at Quinault Indian Nation Lake Quinault net pens includes some wild winter steelhead each year which are spawned through March. Mid-February through June spawning period.

Origin and Production Type -- A mixed stock sustained by wild production.

Status -- Healthy based on spawner escapement.

WINTER STEELHEAD (QUINAULT)

Escapement -- 772 -- 2,722 (1978-1992). Escapement goal = 1,200

Description -- Mid-February through June spawning period. A distinct stock based on the geographical isolation of the spawning population in the upper Quinault River.

Origin and Production Type -- A native stock sustained by wild production.

Status -- Healthy based on wild spawner escapement.

MOCLIPS/COPALIS

FALL CHINOOK (MOCLIPS)

Escapement -- Unknown

Description -- Spawning is thought to occur mid-October through mid-November. Spawning distribution is unknown.

Origin and Production Type -- A native stock with wild production.

Status – Unknown

FALL CHINOOK (COPALIS)

Escapement -- Unknown

Description -- Spawning is thought to occur mid-October through mid-November. Spawning distribution is unknown.

Origin and Production Type -- A native stock with wild production.

Status – Unknown

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

COHO (MOCLIPS)

Escapement -- Unknown

Description -- Spawning is thought to occur throughout the basin, from mid-November through mid-January.

Origin and Production Type -- A mixed stock with composite production.

Status -- Unknown.

COHO (COPALIS)

Escapement -- Unknown

Description -- Spawning is thought to occur throughout the basin from mid-November through mid-January.

Origin and Production Type -- A mixed stock with composite production.

Status -- Unknown

WINTER STEELHEAD (MOCLIPS)

Escapement -- 130 -- 250 (1988-1992). No escapement goal has been identified for this stock.

Description -- Mid-February to early June spawning period. A distinct stock based on geographical isolation of the spawning population in the Moclips River and tributaries.

Origin and Production Type -- A native stock sustained by wild production.

Status -- Healthy based on wild spawner escapement.

WINTER STEELHEAD (COPALIS)

Escapement -- Unknown. Spawner escapement is not monitored for this stock, nor has an escapement goal been identified.

Description -- Mid-February to early June spawning period. A distinct stock based on the geographical isolation of the spawning population in the Copalis River and tributaries.

Origin and Production Type -- A native stock sustained by wild production.

Status -- Unknown, comprised of a historically small number of steelhead.

E. Current state, federal, and tribal hatchery programs/facilities in the region

1. Federal

a) Quilcene NFH¹³

2.1 Hatchery Overview - Quilcene NFH is in northwestern Washington State, at the confluence of the Big Quilcene River and Penny Creek, on the east side of the Olympic Peninsula in Jefferson County (Figure 2). Quilcene NFH has been operated continuously since 1911 by the Service and its predecessor agency, the Bureau of Fisheries. The hatchery is located along U.S. Highway 101, 2 miles south of the town of Quilcene and 75 miles northwest of Olympia, Washington. The hatchery facilities lie in a narrow valley approximately three miles upstream from Quilcene Bay, an arm of Hood Canal. The valley runs southwest to northeast in the foothills of the Olympic Mountains.

The Walcott Slough Trapping Facility, the station's satellite facility for capturing and spawning chum salmon, is located 10 miles south of Quilcene NFH adjacent to U.S. Highway 101 on Brinnon Flats near the confluence of the Dosewallips River and Dabob Bay. The facility is used only intermittently at this time. Another satellite station was operated on the Duckabush River, and weirs and traps were operated annually on the Dosewallips and Little Quilcene Rivers to capture adult salmon until 1942.

2.2 Hatchery Purpose - Quilcene NFH was authorized by 35 Stat. 589 on June 29, 1909. This statute authorized the Secretary of Commerce and Labor to establish "two or more fish cultural stations on Puget Sound, or its tributaries in the State of Washington, for the propagation of salmon and other food fishes." The station was constructed in 1911 at a cost of \$16,700. The Act contains no specific language concerning the species the station was to rear or the specific waters to be stocked by the hatchery. We currently propagate coho salmon only. Hatchery operations are conducted as an element of the Hood Canal Salmon Management Plan, which is a part of the Puget Sound Salmon Management Plan, resulting from U.S. v. Washington (the Boldt Decision).

2.6.2 Production and Management History - In 2000, stock histories for the various species as recorded in handwritten hatchery logbooks dating back to 1911 were entered into a computer database [Kane and Moore 2001]. While the historic record of fish production is incomplete due to missing logbooks for some years, data exist to confirm the source and destination of various stocks that have been raised at Quilcene NFH. Known stock dynamics for currently raised species are detailed below. The database is available from WWFOW - Division of Fisheries or is accessible at the WWFOW on the shared network drive as G:\AR\FRED\QuilLogs\Quillolog.dbf.

Species historically reared at Quilcene NFH include coho salmon (*Oncorhynchus kisutch*), fall Chinook salmon and spring Chinook salmon (*O. tshawytscha*), fall chum salmon and summer chum salmon (*O. keta*), sockeye salmon and kokanee (*O. nerka*), pink salmon (*O.*

¹³ QLNFH CHMP p. 8, 17 - 19.

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

gorbuscha), winter steelhead and rainbow trout (*O. mykiss*), brook trout (*Salvelinus malma*), cutthroat trout (*O. clarki*), and Montana blackspot trout (cutthroat) (*O. clarki*).

The earliest records of Quilcene NFH operation indicate that chum salmon, coho salmon, pink salmon, Chinook salmon, and steelhead trout were propagated and distributed into local streams and other rivers tributary to Hood Canal and the Strait of Juan de Fuca. A satellite station operated on the Duckabush River, and weirs and traps operated annually on the Dosewallips and Little Quilcene Rivers and at Walcott Slough to capture adult salmon, were phased out as salmon runs declined or the station's priorities changed.

Specifically, sockeye salmon were added to the Quilcene NFH rearing program in 1927. In 1930, a trout rearing and stocking program was begun at the Quilcene NFH to provide cutthroat trout and brook trout primarily for waters in the Olympic and Mt. Rainier National Parks, military reservations, and McNeil Island Penitentiary. Rainbow trout were added to the program in 1933. Once initiated, trout production proved to be a major segment of the Quilcene NFH program for over 40 years.

In 1978 production of spring Chinook salmon was begun at the hatchery, in accord with the Puget Sound Salmon Management Plan, to preserve and enhance depressed spring Chinook stocks in Puget Sound. Concurrently, the trout program was discontinued to provide rearing space for the spring Chinook salmon. By this time, the sockeye and pink salmon and steelhead trout programs had been discontinued. As indicated above, the fall Chinook salmon program was discontinued in 1979 after coded-wire tagging indicated the program was not showing favorable survival rates and because of difficulties in getting broodstock into the hatchery. Similarly, in 1993, the spring Chinook salmon program was discontinued because of poor returns and low fishery contributions.

The hatchery currently raises coho salmon only. Hatchery records indicate that coho salmon are largely a local stock, with some importation of Dungeness, Eagle Creek (Clackamas River), Sultan Station (Skykomish River), and University of Washington stocks. Coho salmon have been raised continuously since 1911.

Fall chum salmon and summer chum salmon originated from local stocks, with no documentation of outside imports. Fall chum salmon production in the Big Quilcene River was de-emphasized in favor of production at Walcott Slough Trapping Facility. The Walcott Slough program exported many eggs to chum salmon programs throughout Puget Sound. However, due to harvest management concerns over winter steelhead trout, the Walcott Slough production program was ended in 1989 and the program was moved back in total to Quilcene NFH and the Big Quilcene River where it was terminated in 2003 due to limited harvest. Summer chum salmon were originally produced until 1938.

In 1991, the State of Washington and Treaty Indian Tribes identified Hood Canal summer chum salmon as a critically depressed stock in a statewide inventory of salmon and steelhead populations [Washington Department of Fisheries et al. 1993]. In response to this decline, Quilcene NFH and the Service's Western Washington Fishery Resource Office initiated a summer chum salmon recovery program on the Big Quilcene River in 1992, in cooperation with WDFW and the Point-No-Point Treaty Council. The species was subsequently listed as federally threatened throughout Hood Canal and the eastern Strait of Juan de Fuca in 1999.

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report –May 2009

Adult summer chum salmon were collected in Quilcene Bay during August and September from a commercial beach seine fishery targeting coho salmon. Up to 389,000 fry annually were produced at Quilcene NFH and released into Big Quilcene River. Returns of summer chum salmon to the Big Quilcene River have increased since inception of this program. In addition to enhancing the summer chum salmon run in the Big Quilcene River, Quilcene NFH also began transferring eyed eggs to Big Beef Creek Hatchery in 1996, as part of an effort to re-establish a summer chum salmon run in Big Beef Creek, where the species had been extirpated. The program was deemed a success and terminated in 2004, as planned. Escapement will be monitored in the event that further assistance is needed.



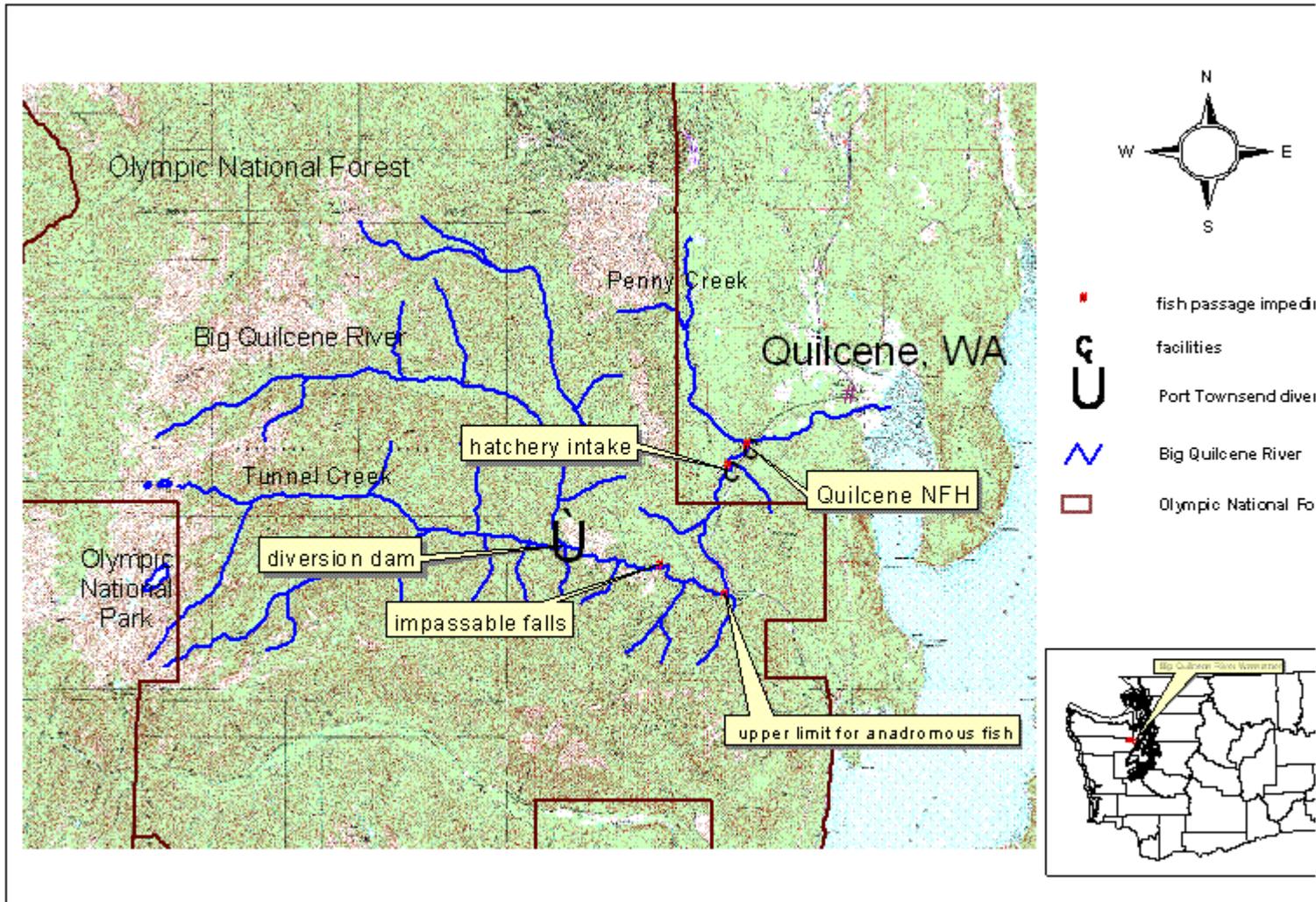


Figure 2. Quilcene NFH and Big Quilcene River watershed.

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

b) Quinault NFH¹⁴

2.1 Hatchery Overview - The Quinault NFH is located on Cook Creek 4.5 miles above its confluence with the Quinault River (Figure 2). The Quinault River then flows approximately 16.5 miles before entering the Pacific Ocean. The property includes about 79 acres on Indian allotment 204 within the boundaries of the Quinault Indian reservation located about 30 miles north-northwest of Aberdeen, Washington. The hatchery also includes an easement with the USFS for access, maintenance, and operation of the Cook Creek water intake and access road (Attachment 3). Fish production is guided by agreements with the Quinault Nation (Attachments 4 and 5).

2.2 Hatchery Purpose - The hatchery was authorized on July 7, 1964 by Appropriation Act (78 Stat.283) and Fish and Wildlife Act of 1956 (70 Stat. 1119) and began operations in 1968 “. . . to restore and enhance depleted runs of salmon and steelhead on the Quinault Indian Reservation and adjacent federal lands . . .” The hatchery currently produces fall Chinook, chum, and coho salmon and winter steelhead trout for release into Cook Creek. Steelhead are also released to the Hoh River.

Initial hatchery operations were funded by the Bureau of Sport Fisheries and Wildlife and coordinated via a Memorandum of Agreement with the Quinault Nation. However, from 1984 to 1988 funding was provided by the Bureau of Indian Affairs and hatchery operations were coordinated by the Quinault Nation (Attachment 7). Funding responsibility was transferred back to the Service around 1989 and hatchery operations have been coordinated with the Quinault Nation via a Cooperative Agreement since 1991.

2.6.2 Production and Management History - Since beginning operations in 1968, Quinault NFH has produced a variety of local indigenous salmonids, in a variety of life history phases. Current production emphasizes the production of migratory smolts to minimize detrimental impacts of hatchery releases on local populations of salmon and trout. Steelhead were founded from the local Quinault River/Cook Creek stock. Chum salmon stock development included use of Willapa and Walcott Slough (Quilcene) stocks, and coho salmon stock development included use of Willapa, Skagit, and Green River stocks in the early 1970s. Fall Chinook salmon were founded from the local Quinault River stock, but were augmented with stock imported from a variety of Washington state sources in the early 1970s; including University of Washington, Nemah, Green River, Willapa, Hoh, Hoodsport, and Deschutes stocks. Chinook returns to Quinault NFH continually fall below the number needed to sustain the program, so the program is regularly augmented by eggs from the tribal Chinook program conducted at Quinault Lake. Further historical information can be found in a Service report, Quinault National Fish Hatchery Salmon and Steelhead Coded Wire Tagging Results, 1984.

The Quinault NFH was originally established to restore fisheries to the Quinault Reservation and to adjacent Federal lands. As part of this commitment a Quinault NFH steelhead pre-smolt transfer to the Hoh Reservation and a smolt release into the Hoh River were initiated in the mid-1980s. Specifically, approximately 50,000 pre-smolts are transferred to the Hoh Tribe’s Chalaat Creek rearing facility in February and 50,000

¹⁴ QNNFHCHMP draft p. 9, 16,17.

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

smolts are released into the Hoh River at Allen's Bar each year. The Chalaat Creek facility is a small acclimation facility adjacent to the lower Hoh River and is the only fish culture facility in the Hoh basin. This program is referred to as the Hoh Program, or the Hoh River Steelhead Program throughout this document. The program goal is to support a winter steelhead fishery that could not be maintained with the Hoh River native steelhead population.

The Quinault and Hoh watersheds lie in different fish health management zones as defined in the Co-Manager's Fish Health Policy. The Hoh Program violates specific restrictions defined in the Policy. Consequently, an annual exemption from the Policy must be proposed by the Hoh Tribe and approved by Co-Managers.

In 2004, the HSRG recommended that the Hoh program via Quinault NFH be discontinued. The reasons included a secondary recommendation to allow adult fish passage above Quinault NFH in Cook Creek. The HSRG also viewed using an out of Hoh basin stock (e.g., Quinault) as potentially detrimental to the continued existence of the Hoh River native steelhead population. Finally, the HSRG recommended initiating an integrated Hoh River steelhead program using an in-basin location and native stock. Currently there is an exemption to the fish health policy due to the intentional passage of steelhead (and other fish) above the hatchery which creates a water supply that is no longer pathogen free as for transfer and releases between fish health management zones

The HSRG recommendations were consistent with previous recommendations. The Hoh Tribe and WDFW completed a feasibility study in 1988 regarding construction of a facility at Owl Creek that would use native stocks, and the Service delineated fish passage options at Quinault NFH in 2004.

Currently, the Hoh Tribe is seeking grants to expand the feasibility study, with the goal being construction of a hatchery in the Hoh watershed.

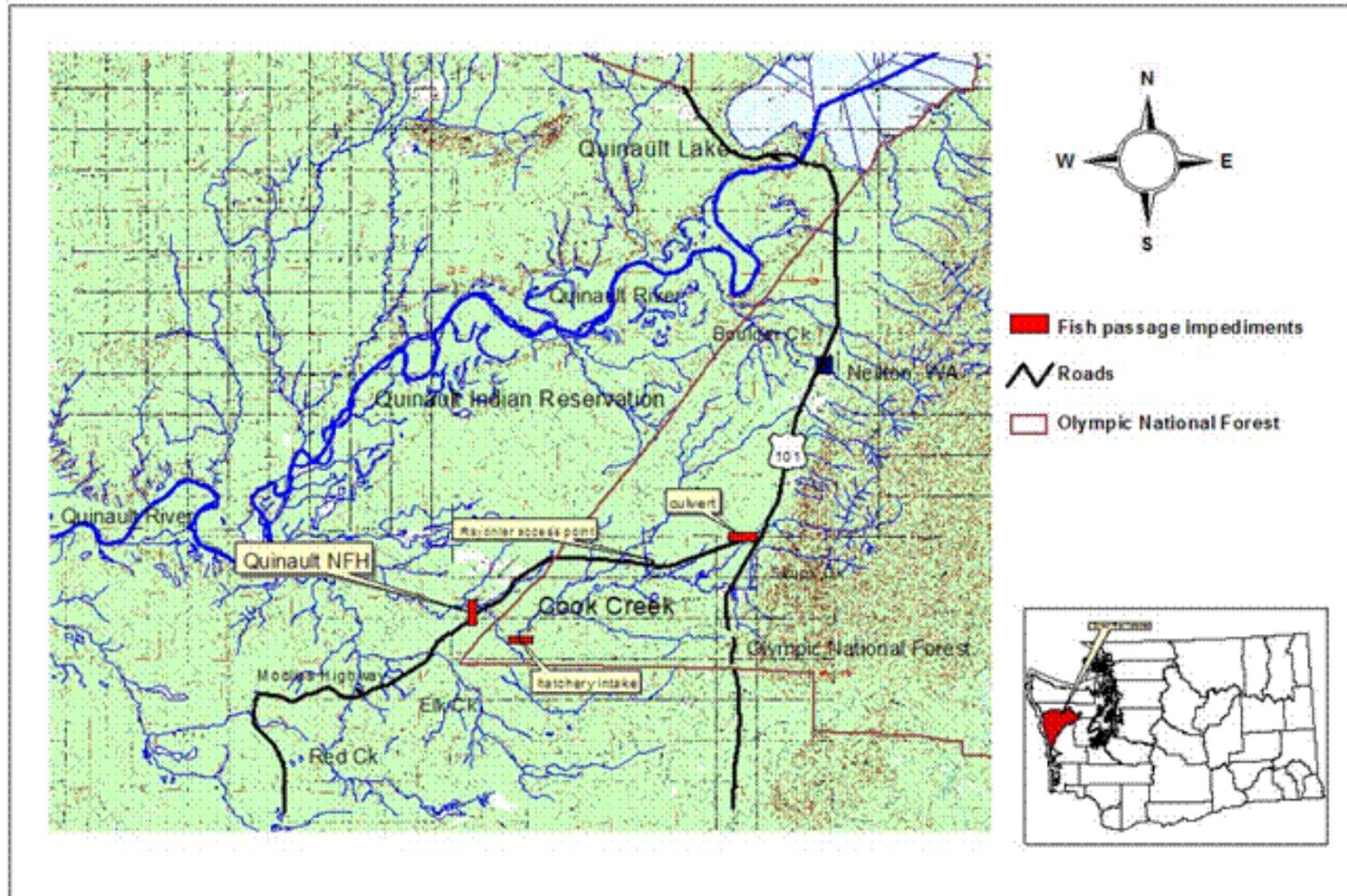


Figure x. Quinault NFH and Cook Creek drainage

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

c) Makah NFH¹⁵

2.1 Hatchery Overview - The Makah NFH is located within the Makah Indian Reservation boundary on the Sooes River three miles above its entrance to the Pacific Ocean (Figure 2). The Makah NFH was established in 1981 to restore salmon resources of the Makah Indian Reservation and nearby watersheds on the north Washington coast and the Strait of Juan de Fuca.

The current fish production program at Makah NFH is consistent with several cooperative agreements with the Makah Nation. Modifications to the fish production program are discussed as needed with Makah Tribal representatives. The WDFW is not involved with on-reservation fish production. Agreement between the Makah Nation and the Service is required before a change in production can be implemented, as required by the aforementioned plans and management agreements.

2.2 Hatchery Purpose - The hatchery was authorized to begin operations due to the October 4, 1973, Appropriation Act (87 Stat. 436), the Fish and Wildlife Act of 1956 (70 Stat. 1119), and the Anadromous Fish Conservation Act (79 Stat. 1125). The Makah NFH began operations in 1981 to restore and enhance depleted runs of salmon and steelhead on the Makah Indian Reservation. The hatchery currently produces fall Chinook and coho salmon, and winter steelhead trout for release into Sooes River. Chinook, coho, and steelhead are also transferred to the Tribal Educket Creek facility for subsequent release into the Waatch River. Threatened Lake Ozette sockeye (*O. nerka*) eggs are incubated for a short period at the hatchery as well.

2.6.2 Production and Management History - Since 1981, the Makah NFH has produced a variety of local indigenous salmonids. The current program emphasizes the production of migratory smolts to minimize detrimental impacts of hatchery releases on local populations of salmon and trout. Additionally, the program contributes to river and ocean commercial and sport fisheries.

Native Sooes River salmon and steelhead stocks were depressed, so efforts to enhance runs prior to the construction of the Makah NFH included sporadic fish planting of Quilcene coho, Walcott Slough chum, and various fall Chinook stocks. Post hatchery construction stock development included Quinault NFH coho and steelhead, and Walcott Slough chum. Fall Chinook salmon were developed from returns to the Sooes River.

A Viral Hemorrhagic Septicemia (VHS) detection in 1988 precipitated the complete depopulation of juvenile salmonids at the Makah NFH in 1989. Replacement coho and steelhead stock came from the Quinault NFH. Chum and Chinook were not replaced and were expected to recover naturally since both species return at multiple ages.

Hatchery operations have been modified over the years to help foster development of different stocks. Specifically, for several years early returning coho, presumed to be descendants of Quilcene NFH coho, were excluded from spawning in order to further develop the coastal Quinault NFH stock. Also, weir operations during the steelhead return were modified to direct early returning hatchery stock into the hatchery and allow later

¹⁵ MNFH CHMP draft p. 21, 22, 28.

USFWS Olympic Peninsula Hatchery Review Team

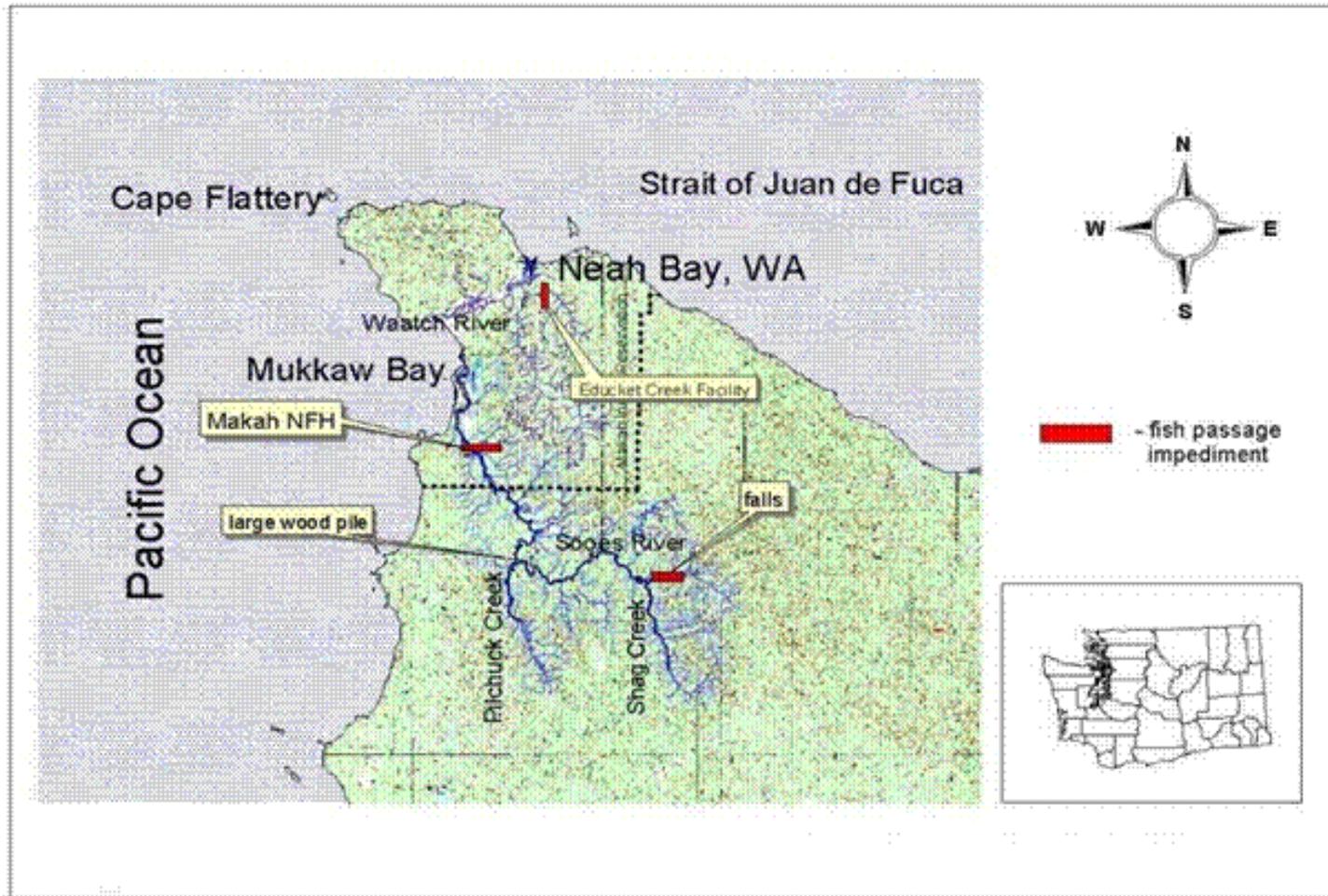
Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

returning wild stock to continue upstream. The chum program was discontinued in 1997 after years of failed attempts at establishing a run.

Historically, Makah NFH has produced fish for release into nearby streams such as the Sail River and Village Creek. The hatchery also temporarily reared Hoko fall Chinook. Those programs have been discontinued. A new program was started during the early 2000's that is designed to help recover Lake Ozette Sockeye. Specifically, sockeye eggs are temporarily incubated in the isolation/quarantine unit and then returned to Lake Ozette tributaries. Today the hatchery produces steelhead, coho, and fall Chinook for both the Sooes and Waatch rivers.

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009



USFWS Olympic Peninsula Hatchery Review Team
Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

2. *State*¹⁶

a) Hoodspport Hatchery

Hoodspport Hatchery is located at the mouth of Finch Creek (16.0222), which flows into Hood Canal in the town of Hoodspport, Washington in Hood Canal. Location: Section 12, Township 22, Range 4W Address: North 24350 Hwy 101, Hoodspport, WA 98548 Mailing: P.O. Box 606, Hoodspport, WA 98548 Approximate size (acres): 4.32 Buildings: Main hatchery building consists of incubation room with 84 vertical-stack incubators and 4 concrete shallow troughs used for egg sorting, office, store room, feed room, freezer, and garage.

b) George Adams Hatchery

George Adams Hatchery is owned and operated by the Washington Department of Fish and Wildlife. It is located at RM 1.0 on Purdy Creek, a tributary of the Skokomish River that flows into Hood Canal in southwestern Puget Sound near Union, Washington. The Skokomish River drains a region of about 246 square miles, originating in the Olympic National Park and the Olympic National Forest. The hatchery site is located at the junction of Highway 101 and the Skokomish Valley Road.

c) McKernan Hatchery

McKernan Hatchery is owned and operated by the Washington Department of Fish and Wildlife. It is located at RM 1.0 on Weaver Creek, a tributary of the lower Skokomish River which flows into Hood Canal in southwestern Puget Sound near Union, Washington. The Skokomish River drains a region of about 246 square miles, originating in the Olympic National Park and the Olympic National Forest. The hatchery site is located on Deyette Road, 1.5 miles west of George Adams Hatchery.

d) Eells Springs Hatchery

Address: 7570 W Eells Hill Road, Shelton, WA 98584 Eells Springs Hatchery is located on Hunter Creek, a tributary of the Skokomish River approximately ten miles north of Shelton and four miles west off of Highway 101. The hatchery was constructed in 1947 and is operated by WDFW and funded through State Wildlife funds. The hatchery site is 42 acres and consists of a hatchery building with 112 shallow trough incubators with an eyeing capacity of 2,800,000 eggs. Eight concrete raceways (10'x85'), 12 round concrete ponds (40' diameter), one large (1.75 acre) and one medium (1.25 acre) earthen pond. A single family residence and duplex are available for on station personnel. Eells Springs Hatchery is staffed with 4 full-time employees.

e) Sol Duc Hatchery

Sol Duc Hatchery is located on the Sol Duc River RM 30, 12.5 miles north of Forks, Washington off highway 101. It is owned and operated by the Washington Department of

¹⁶ HSRG 2004.

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

Fish and Wildlife. The property spans 43 acres and consists of an incubation building with office, shop and freezer, a four bay storage building, interpretive center, a pump building and three residences.

f) Bogachiel Rearing Ponds

The Bogachiel Rearing Ponds are located approximately two and half miles south west of the town of Forks, WA. WDFW owns approximately thirty-eight acres of property adjacent to the Bogachiel River. The two main land owners to each side of the property are Richard Miller and Rayonier Timber Company. WDFW also leases approximately 12 acres from Rayonier Timber Company for the South Calawah and North Calawah Ponds near the Bogachiel facility. The department has right of way access through their property to access the ponds. On department property there is a duplex residence with a small office. Set within the duplex are two one car garages. A twenty by sixty foot shop, garage and feed storage building is adjacent the duplex. Approximately 150 yards from the shop is a small hatchery building used for incubation of eggs and initial rearing of summer and winter steelhead. One section of the property has a public boat launch for fisherman to access the Bogachiel River. The boat launch is gated at night for security purposes. This facility is funded through Wildlife funds.

3. Tribal¹⁷

a) Enetai Hatchery (Skokomish Tribe)

Hatchery is located at mouth of Enetai Creek (WRIA 16.0217) just north of the Skokomish River in southern Hood Canal. Facilities include a fish weir and adult collection pond at the mouth of the creek, fish incubation and rearing facilities just upstream on the west side of Highway 101, and a water intake and supply system with the intake located in Enetai Creek approximately 200 yards upstream

b) Port Gamble (Bay) Net Pens (Port Gamble S’Klallam Tribe)

There are two net pens, 50’ square by 25’ deep with ½” mesh. The pens are hung from a stainless steel framework that is supported by foam-filled plastic floats and anchored to the bottom of the bay. A bird net, to protect against bird predators, is suspended above each net pen. Walkways on the framework and along the periphery of the net pens accommodate fish feeding, equipment maintenance, and periodic coho weight and fish health sampling. A solar-powered, photocell controlled navigation light is placed on the pens to meet U.S. Coast Guard requirements

c) Quilcene Bay Net Pens (Skokomish Tribe)

The net pen is 50’ square by 30’ deep with ½” mesh. The pen is hung from a stainless steel framework that is supported by foam-filled plastic floats and anchored to the bottom of the bay. A bird net, to protect against bird predators, is suspended above the net pen. Walkways on the framework, along the periphery of the net pen, accommodate fish

¹⁷ HSRG 2004.

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

feeding, equipment maintenance, and periodic coho weight and fish health sampling. A solar-powered, photocell controlled navigation light is placed on the pens to meet U.S. Coast Guard requirements.

d) Lake Quinault Pens Rearing (Quinault Nation)

Lake Quinault Tribal Hatchery (Pen Rearing), is owned and operated by the Quinault Indian Nation. The facility is located on the Southwest shore of Lake Quinault (WRIA number 21.0398) on the Olympic Peninsula. Lake Quinault is part of the mainstem Quinault River at river mile 33. There are 3 buildings on the site with a net pen complex approximately 1000 feet off shore of the hatchery/office complex.

e) Salmon River Hatchery (Quinault Nation)

The Salmon River Fish Culture Facility is owned and operated by the Quinault Indian Nation. The facility is sited at river mile 4.0 on the Salmon River (WRIA 21.0139), a lower main tributary to the Queets River (WRIA 21.0016). The Queets River is located near the middle of Washington States north coast. There are two buildings on the site housing feed storage, office space, employee quarters and hatchery incubation units.

f) Chalaat Creek Hatchery (Hoh Tribe)

This facility is located on the Hoh reservation and has some incubation capacity and some limited above ground small rectangular tanks. Chalaat Creek can be “fenced” to create an imprint area for the transfer, rearing, and release of Quinault NFH steelhead.

g) Lonesome Creek Hatchery (Quileute Tribe)

Property is located at 13380 La Push Road (approximately milepost 13 on SR 113) and is owned by the Quileute Tribe. The facility, in general, is situated on approximately 3 acres, with the hatchery proper taking up a little more than one acre of that total. Six buildings are distributed on the site and the site is bisected by Lonesome Creek.

h) Educket Creek Pond (Makah Nation)

Located just south of Neah Bay on the “haul back” road on Educket Creek (tributary to the Waatch River). Has some incubation capacity and a small impoundment on the creek for fish imprint and release.

i) Umbrella Creek Hatchery (Makah Nation)

(The program also utilizes the MNFH quarantine incubation facility for initial incubation. See USFWS-MNFH documentation for facility description for MNFH. Worthy of note is that the Umbrella Creek and Elk Lake facilities are located in remote areas classified as commercial forest and have few available amenities such as electricity or land line phone service.)

Hatchery name: Umbrella Creek Hatchery, Elk Lake RSI, Stony Creek RSI

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

Hatchery location: Umbrella Creek, Big River State: Washington

Hatchery operator: Makah Tribal Council Water source: Umbrella Creek (WRIA 20.0056)

Year(s) when constructed: 1982 Year operations began: 1983

Authorization(s) and funding sources(s) for hatchery construction: Makah Tribe; BIA; Washington Department of Fish and Wildlife; Crown Pacific Timber

Estimated total investment in all hatchery facilities and equipment: \$140,000

Current operations funding source(s): BIA Self Governance

Ownership status of hatchery and land upon which hatchery is situated: Lease from Crown Pacific Ltd., granted permission for Stony Creek RSI by Robert Stevens (private land owner)

j) Hoko Falls Hatchery (Makah Nation)

Hatchery name: Hoko Falls Hatchery

Hatchery location: Hoko River (river mile 10.0) State: Washington

Hatchery operator: Makah Tribal Council Water source: Rights Creek (WRIA 19.0174) & Brownes Creek (WRIA 19.0170) secondary system currently inoperable due to break dam flood

Year(s) when constructed: 1982-1991 Year operations began: 1984

Authorization(s) and funding sources(s) for hatchery construction: Makah Tribe; BIA

Estimated total investment in all hatchery facilities and equipment: \$370,000

Includes Incubation building, hatchery office, shop/garage, 2 covered concrete block raceways, subdivided ½ acre asphalt rearing pond. On-site housing privately owned.

Current operations funding source(s): BIA Self Governance

Ownership status of hatchery and land upon which hatchery is situated: 10 acre leased from Rayonier Timberlands Operating Co. (renewable lease which expires August 20, 2015)

Number of tribes whose members derive benefits from hatchery products 2; Makah, Lower Elwha.

4. Other¹⁸

a) Lilliwaup Hatchery (Long Live the Kings)

Lilliwaup Hatchery is located in Mason County along the east side of Lilliwaup Creek – which drains into Hood Canal on the west side of the Canal, north of Hoodport. The property is owned by the Lilliwaup Falls Generating Company. The hatchery site covers 3 acres. The hatchery building has meeting and office space upstairs, incubation and early rearing (24 – 4ft. circular tanks) downstairs. Outside there are 16 – 20 ft. circular tanks, 12

¹⁸ HSRG 2004.

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

– 10 ft. circular tanks and a storage building. Additionally, there is a spring fed gravity flow intake, a small stream utilized for natural spawning, a wetland for coho rearing and a settling pond for hatchery effluent.

b) Big Beef Creek

The Big Beef Creek Project is located at a man-made hatchery, pond and experimental channel complex on the north side of Big Beef Creek, river kilometer 0.1, in the Hood Canal Basin, in Washington State. The project is located in Section 15, T25N, R1W. Hatchery facilities are physiographically and hydrologically isolated from the natural stretches of Big Beef Creek; water used in the hatchery facilities for incubation and tank flow is from a 350= freshwater production well. The property is owned by the University of Washington.

F. Special considerations in region (e.g., ESA listings, Habitat Conservation Plans, Fishery Management Plans, FERC relicensing, etc.)

- Bull Trout were listed as threatened in Coastal Washington and Puget Sound in 1999. They are known to occupy Cook Creek (Quinalt NFH) and suspected to move through marine waters near Quilcene NFH. Since encounters in the hatcheries during routine fall adult fish handling operations have or may occur we have requested handling authorization for all three hatcheries via subpermit number FWSWWFWO-11 of blanket permit number TE-702631. The permit was granted and expires on December 31, 2010. Specific permitted procedures include pelvis fin tissue samples and the return of sampled fish to the stream above the hatchery.
- **Hood Canal Dead Zone** (report KCTS/Seattle News) - Hood Canal began to suffer from major fish kills in 2003. Studies concluded that oxygen levels were dangerously low rendering sections of the canal “dead zones”. Dead zones are defined as areas of water containing low levels of oxygen in which fish, plants, and other aquatic life find it difficult or impossible to survive. The oxygen levels have been depleted by the rapid population growth and development in the region.
- **Japanese Knotweed** - Knotweed is a noxious weed introduced from Japan. It is found along and near water sources. It can form dense thickets to exclude native vegetation especially in riparian habitats.
- Cushman Dam on the Skokomish is currently undergoing FERC relicensing negotiations.
- The Elwha Dams are scheduled to be removed in the near future.

II. Quilcene National Fish Hatchery

A. Description of hatchery¹⁹

2.3 Facility and Site Description - The Quilcene NFH occupies approximately 47.4 acres. Its main facilities consist of 39 8-foot x 80-foot raceways, three water intake structures (two on the Big Quilcene River and one on Penny Creek), a pre-settling pond, a pollution abatement pond, a hatchery building (containing the office, laboratory, and tank room), an isolation/quarantine building, and a shop building, all of which are located on the west bank of the Big Quilcene River at RM 2.8. One residence, a small cabin, and a log house are on the hatchery grounds proper, and two other residences for hatchery staff are situated on a hill just north of the hatchery. The hatchery diverts returning adult salmon to holding facilities by means of a graduated-field electrical weir and fish ladder at RM 2.8. Figure 3 shows the principal features of Quilcene NFH.

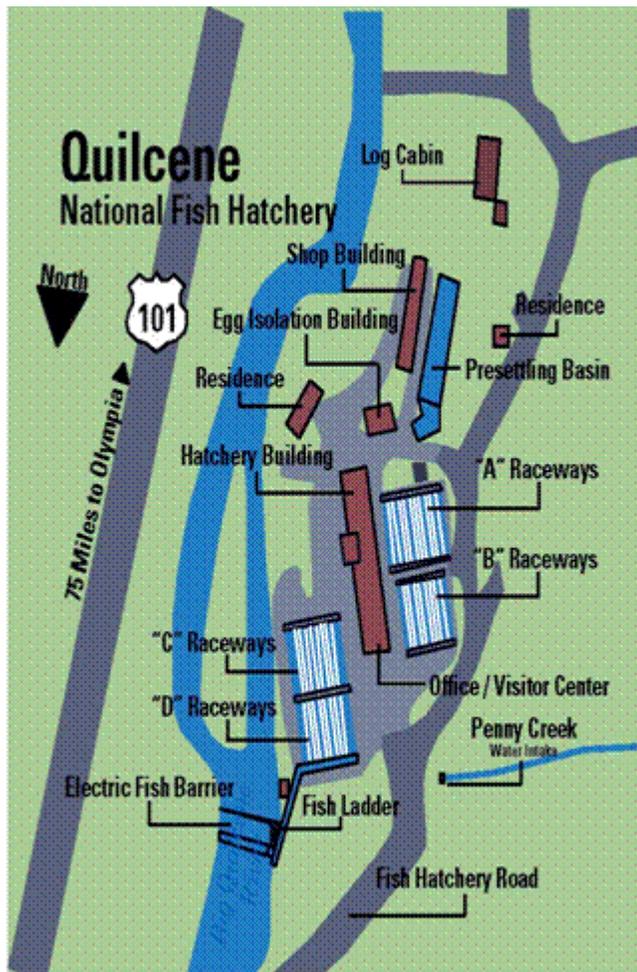


Figure 3. Quilcene NFH site map.

¹⁹ QLNFH CHMP p. 8, 11, and 12.

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

2.3.1 Isolation/Quarantine Building - The isolation/quarantine building was constructed to allow for flexibility in management of depressed or endangered fish stocks or other aquatic species. Any aquatic organisms brought in could be isolated from the production fish on station to prevent transmission of any potential diseases.

Construction of the isolation/quarantine building at Quilcene NFH was completed in the summer of 1999. The building has eight vertical incubators (half stack) with eight drawers each; two deep egg troughs that can incubate to the eyed egg stage; an egg working trough; water chillers to mark otoliths; and a packed column to remove nitrogen gas from water. The effluent can be treated with chlorine, routed to a 1500 gallon contact chamber (30 minutes) and then dechlorinated prior to entering the Big Quilcene River. Chlorine monitors are located in the chlorine contact chamber and at the outfall from the dechlorinator. These monitors are connected to the station's alarm system.

The water source is Well #1, which has redundant 50 gallon per minute pumps. A back-up propane generator serves the isolation/quarantine building, Well #1, and the drum screens/lights at the settling pond for Big Quilcene River water.

2.4.1 Historical Buildings at Quilcene NFH - With authorization of Quilcene NFH in 1909, most of the original hatchery property was acquired by condemnation, but some property was also acquired by donation in 1911. Many modifications to the hatchery structures have occurred over the years. When the first foreman arrived there was a 40 ft x 86 ft hatchery building and a foreman's cottage. The only building still dating from that time is the hatchery building, which has had several modifications and additions. The original part of this building is referred to as the "north tank room." A brief recount of further structural and facility changes at Quilcene NFH follows (see Figure 3 for present-day hatchery facilities):

- 1914 -** Additional residences were added, including a frame garage and paint storage building, which have since been removed.
- 1930s** A shop building was added.
-
- 1940s** Penny Creek water supply system was re-constructed.
-
- 1950s** The hatchery building was enlarged and reconditioned, and heating and refrigeration were installed. Thirty 6 ft x 60 ft raceways were built, as well as an adult holding pond, three new residences, and a service building.
-
- 1960s** The service building was enlarged and two new residences were constructed.
- Eighteen 8 foot x 80 foot raceways, a fish ladder, and a new domestic well with associated pipeline were constructed. The office and visitor center with aquaria

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

and a laboratory were completed. The Penny Creek water supply was expanded.

- 1980s** - Twenty-one 8 ft x 80 ft raceways were constructed to replace the 6 foot x 60 foot raceways, and a pollution abatement facility was constructed.
- 1990s** - The raceway system was connected via pipeline to the pollution abatement facility. The suspended-electrode weir was replaced with a graduated field fish barrier in 1990.
- 1998** - A 24 ft x 200 ft pre-settling pond was constructed to reduce turbidity and sediment load of Big Quilcene River water before it enters the raceways. Property purchased for this project had an old inn and restaurant dating to the 1920s. After inspection, the Service Regional Archeologist concluded that the building had been altered too many times and too recently to be considered for “historic” status. Future disposition of these buildings is uncertain. An isolation/quarantine building was constructed to aid in the restoration of depleted aquatic species from watersheds outside of the basin.
- 2000** - A major office remodel was accomplished which provided much-needed space but eliminated the visitor center and aquaria. Handicapped visitor access to the office and restrooms was improved considerably with the remodel.
- 2001** - The service/shop building, which failed its 1999 seismic inspection, was severely damaged during the Nisqually earthquake on February 28, 2001. The “C” raceway deck was renovated to address a settling problem, and the Penny Creek water intake system was renovated for safety purposes.
- 2003** - A replacement shop building was constructed to the east of the pre-settling pond and put into use in July 2003. A new electrical service (main breakers and meters) was placed east of the isolation/quarantine building. The old service/shop building, old electrical main breaker service (located in the old service/shop building) and paint shed were demolished in October 2003.

B. Hatchery water sources²⁰

3.1 Water Use and Management - Quilcene NFH holds the following certificates of water right:

Source	Certificate or Permit Number	Priority Date	Amount
Penny Creek	C101	10/14/1924	10 cfs
Big Quilcene River	C4189	9/3/1946	15 cfs
Penny Creek	C4453	4/7/1951	15 cfs
Walcott Slough	C8184	5/4/1956	5 cfs
Well No. 1	C38767A	4/23/1958	0.71 cfs (320 gpm)
Well No. 3	C7275	7/29/1964	0.044 cfs (20 gpm)

²⁰ QLNFH CHMP p. 28-32.

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

Big Quilcene River	S2-28179	5/16/1991	25 cfs
Well No. 6 (domestic water)	G2-29679	5/19/1998	0.044 cfs (20 gpm)

3.1.1 Penny Creek Water Rights - The hatchery has two water rights on Penny Creek. One dated 1/14/1924 for 10 cfs, and the other dated 4/7/1951 for 15 cfs. Water diverted from Penny Creek is the only supply of production water to the hatchery building for fish egg incubation and early rearing. Quality water is essential to the entire production program. Penny Creek water is very reliable although flows drop off in the late summer months. The quality of water from Penny Creek has degraded in recent years due to logging and development in the watershed. Another threat to Penny Creek water quality for egg incubation is allowing anadromous fish upstream of the hatchery's water intake. If this is allowed, the hatchery will have to reconstruct the water intake structure, install a filtration/sterilization system, and provide a means to allow adult fish passage. This topic is gaining interest with some tribes and other interest groups.

3.1.2 Big Quilcene River Water Rights - Water diverted from the Big Quilcene River is the primary source of water for the hatchery's production raceways. The hatchery has two water rights (1946 and 1991) on the Big Quilcene River. Although the Port Townsend Paper Corporation and the City of Port Townsend own a water right on the Big Quilcene River with a priority date which precedes the hatchery's 1946 water right for 15 cfs, there is generally sufficient water to satisfy the hatchery rights. The Port Townsend Paper Corporation and the City of Port Townsend divert water out of the watershed for the drinking water of several towns and the operation of a pulp mill. This diversion is located upstream of the hatchery's water intakes. The mill has voluntarily agreed to leave at least 27 cfs in the stream during low flow periods for fish. A work group of local, state, municipal, tribal, and private entities formed a partnership to address any water problems at the hatchery, instream flow, municipal drinking water needs, and operation of the pulp mill and meets once a year at a minimum.

The second hatchery water right, obtained in 1991, is for 25 cfs. This right is seasonally limited when instream flows fall below 50 cfs (July through February) and 83 cfs (March through June). However, the hatchery's senior water right for 15 cfs is not subject to this restriction.

3.1.3 Durdle Creek Water Rights - Because of poor quality and low flows during the summer months, this domestic water supply was abandoned in 1964. We relinquished this water right in 2005.

3.1.4 Walcott Slough Water Rights - This water right covers operation of the fish trap within the tidewaters of Walcott Slough and is used only periodically. An auxiliary well used for wash-down purposes was also drilled at this site in 1977, but no water right exists for its use. (*Dave Z. note: Note: This well will be sealed as a result of decommissioning Walcott Slough*)

3.1.5 Well No. 1 - The original water right from 4/23/1958 for Well #1 was for 320 gallons per minute. This well was originally used for fish production and was renovated in 1998, supplying water only to the isolation/quarantine building for fish egg incubation. Two 50 gallon per minute pumps and motors were installed into the existing well casing during the renovation. The redundant pumps were installed to insure that if one pump failed the other pump could be immediately started, without endangering the incubating fish eggs. In case of power outages, a propane generator automatically starts up to operate the isolation/quarantine building, well #1, and the pre-settling pond drum screens.

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

There is an old connection from Well #1 to the Penny Creek water supply which enters the north tank room in the hatchery building. A new valve was installed in 1998 where the well head separates the water sources. A connection from Well #2 to the same pipeline was disconnected during the construction of the pre-settling pond in 1997.

3.1.6 Well No. 2 - This artesian well has high salt content and was drilled a number of times to different depths. A 1998 water right permit allowed withdrawal of 185 gallons per minute which, after passing through a nitrogen gas removal device (packed column), could be introduced to water supplying the raceways. This well provided a small amount of water relative to the total amount of water used in the raceways. The ground water permit for this well was cancelled in 2001 and it is not listed in the water rights table above. This well should be sealed according to Washington State standards.

3.1.7 Well No. 3 - This domestic water well was originally drilled in 1964 and served as the potable drinking water source until 1993 when it was abandoned due to iron scale plugging the casing perforations. The new well was drilled approximately 20 feet west of the original well in 1993. There were continual problems with the supply line from the original well breaking as it ran under the Big Quilcene River. The buried pipeline broke in 1995 and 1997 due to scouring of the gravel around the pipeline. In 1998, Well #6 was drilled and became the main water source for domestic water use. Well #3 has a faucet connection near the well head for domestic use but is not connected to the hatchery's water filtration/sterilization system.

3.1.8 Well No. 4 - This well is undeveloped. It was drilled and capped around the time the pollution abatement pond was originally constructed. It is located just east of the pollution abatement pond.

3.1.9 Well No. 5 - This water right was obtained when the hatchery purchased the vice-Kearney property in 1991. Very little appears to be known about this well (originally residential) as it has not been used by the Service since it was purchased.

3.1.10 Well No. 6 - This well was drilled in 1997 and is currently the main source of potable water for the hatchery. In 2002, installation of a filtration, sterilization, and water softening system began in order to meet Washington State drinking water standards for a public water system.

3.1.11 Water Systems Coordination - Water quantity and quality are inextricably intertwined at Quilcene NFH. Availability of water at Quilcene NFH is a highly seasonal prospect. While water quality from the Big Quilcene River and Penny Creek is excellent, there are extensive periods of high turbidity. Ironically, as the quantity of available water rises, turbidity also rises, so Quilcene NFH must restrict the amount of water it diverts in order to avoid entraining too much sediment. The hatchery's pre-settling pond that was constructed in 1999 has helped to reduce the sediment problem. The pre-settling pond has freed up the entire "A" bank of raceways for more rearing space, which allows the hatchery to make much lighter initial loadings of coho salmon.



City of Port Townsend water diversion

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

The most important partnership affecting hatchery operations is a water-sharing arrangement between the Service and the City of Port Townsend. The city currently has an unconditional year-round right to 30 cfs from the Big Quilcene River to meet its municipal and industrial needs. The city withdraws water from the Big Quilcene River about six miles upstream of the hatchery. If the city fully exercised its water right, it could effectively “dry up” the river during the low flow periods in late summer and early fall. Realizing the consequences to hatchery operations and in-stream aquatic life, the city voluntarily leaves a minimum instream flow of 27 cfs below its diversion. The city uses conservation techniques and other stored water for municipal needs when the river approaches this critical low flow. The city water system does not have a filtration system and draws water from the Big Quilcene River when the water is clear. During high winter flows, the city does not withdraw turbid water.

3.1.12 Screening - The screening on the Big Quilcene River intake system consists of 2-inch “grizzly” bars at 3-inch spacing. The intake system supplies a single 30-inch line that leads to the pre-settling basin (Figure 3). There are two rotary drums with 0.25-inch screening in front of the channels to the raceway valves in the pre-settling basin. The current screens are not compliant with NMFS criteria, which specify 0.125-inch. Big Quilcene River water is not used in the hatchery rooms.

Two intakes are located on Penny Creek, one for the raceways and one for the hatchery rooms, each screened with 0.125-inch wedge-wire panels. The Penny Creek intakes are also screened from adult fish with large “grizzly” bars and woven metal screens. However, the sheer steepness of Penny Creek reduces the likelihood that adult fish will be present in the vicinity of the intakes.

3.1.13 Conveyance System to Hatchery and Ponds - The hatchery relies on two surface water sources for supply to the raceways. There are two intakes on the Big Quilcene River located approximately ½ mile upstream of the hatchery proper. River water enters the system valves and pipes and passes through a 200-foot-long x 24-foot-wide presettling pond and two drum screens before it enters the raceways through a series of valves. There are supply valves to all four raceway decks. Reused water is routinely used from “A” deck to “B” deck and eventually to “D” deck and finally through the outfall channel of “D” deck which also acts as a receiving channel for returning adult fish. Only fresh water can be introduced into “C” deck and oftentimes “C” deck water will be reused into “D” deck.

Penny Creek water enters through the screened intake located across the road from the entrance to the hatchery. It can be used in the raceways and is the exclusive water source for the hatchery building. It enters the raceways through a separate piping system from the river water.

The isolation/quarantine facility is supplied exclusively from Well No. 1. Water is pumped from the well immediately outside of the building and passes through aspirators and a packed column to both aerate the low dissolved oxygen water and strip all of the excess nitrogen from the raw water. After the water passes through the incubation troughs or incubators, it is chlorinated and then dechlorinated before it is released to the river.

C. Adult broodstock collection facilities²¹

Quilcene NFH is currently a single species facility rearing only Quilcene strain coho 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 collected for spawning across the spectrum of the run in proportion to the rate at which they return. Adults to be held for spawning are collected throughout the return period on a schedule approximating a Normal distribution.

Adult coho return to the hatchery from mid-August through November. Brood fish enter the hatchery via a fish ladder associated with a graduated-field electric weir that spans the river. Adults ascend the ladder and enter a collection channel, which is the outflow channel for the lowermost bank of raceways (D bank). Two of these raceways are used for adult holding of segregated males and females. The held adults are treated three times weekly with 250 ppm hydrogen peroxide to control fungus.

D. Broodstock holding and spawning facilities²²

Typically, spawning is conducted each Tuesday during the season to accommodate sampling by OFHC. Ripe females are sorted the previous day to expedite spawning. Unripe females are returned to the holding pond and held there until mature. Males and jacks are crowded, sorted for ripeness, and killed on spawning day in numbers to match the number of ripe females. Ripe fish are killed by concussion. Spawning is conducted under a portable garage frame-and-cover structure.

E. Incubation facilities²³

The eggs are placed into wire baskets that are suspended in a stainless steel trough in the nursery building with 75 ppm iodine solution for 30 minutes. Each wire basket holds eggs from twelve females. The eggs are then placed in deep egg troughs for incubation at 10 gpm of Penny Creek water.

F. Indoor rearing facilities²⁴

The nursery building (tank room) contains 28 2.5' x 15' 85 cu ft fiberglass start tanks. The tanks are supplied with Penny Creek water. However, the tanks are not currently being used since the coho are started in the outdoor raceways.

G. Outdoor rearing facilities²⁵

²¹ *QLNFH CHMP p. 33.*

²² *ibid.*

²³ *ibid.*

²⁴ *ibid.*

²⁵ *ibid.*

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

The hatchery has 39 8' x 80' raceways distributed amongst four “banks”. A bank situated on the southwest side of the property has 11 raceways, B bank situated on the northwest side of the property has 10 raceways and both C and D banks situated on the southeast and northeast side of the property have 9 raceways each. The water supply flows from a headbox through boards drilled with 8 2 inch holes and exits by spilling over a similar array of solid boards. A bank can be reused through B bank and then through D bank.

H. Release locations and facilities²⁶

3.5 Release Strategies - Quilcene NFH currently produces only coho salmon. Release goals for fish produced at Quilcene NFH are reviewed annually by the Quilcene Hatchery Evaluation Team (HET), a standing committee of Service staff that regularly reviews and plans the fish production programs at the hatchery. Formal production goals are then established in cooperation with the co-managers (WDFW and the Point-No-Point Treaty tribes) under guidelines in the Hood Canal Salmon Management Plan, which is a part of the Puget Sound Salmon Management Plan - subsequent to the decision rendered in *U.S. v Washington* (“The Boldt Decision”). Production goals are documented through the Future Brood Document process, which establishes salmon hatchery production levels for all agencies throughout Washington. Target size for coho salmon release is between 15 and 20 fish/lb (23-30g) around May 1. Table 3 shows current production goals by species and life stage for Quilcene NFH.

Table 3. Fish production goals for Quilcene NFH.

Number	Life stage	Fish size		Release site/Destination
		No./lb.	g/fish	
Coho salmon				
450,000	Eyed eggs	-	-	George Adams SFH – transferred to Port Gamble Tribal net pens
200,000	Pre-smolt	25	18	Skokomish Tribal net pens, Quilcene Bay
400,000	Smolts	15-20	23-30	On-station, Big Quilcene River

I. Outmigrant monitoring facilities

None.

J. Additional or special facilities²⁷

2.3.1 Isolation/Quarantine Building -The isolation/quarantine building was constructed to allow for flexibility in management of depressed or endangered fish stocks or other aquatic species. Any aquatic organisms brought in could be isolated from the production fish on station to prevent transmission of any potential diseases.

²⁶ QLNFH CHMP p. 36.

²⁷ QLNFH CHMP p. 11, 20.

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

Construction of the isolation/quarantine building at Quilcene NFH was completed in the summer of 1999. The building has eight vertical incubators (half stack) with eight drawers each; an egg working trough; water chillers to mark otoliths; and a packed column to remove nitrogen gas from water. The effluent can be treated with chlorine, routed to a 1500 gallon contact chamber (30 minutes) and then dechlorinated prior to entering the Big Quilcene River. Chlorine monitors are located in the chlorine contact chamber and at the outfall from the dechlorinator. These monitors are connected to the station's alarm system.

The water source is Well #1, which has redundant 50 gallon per minute pumps. A back-up propane generator serves the isolation/quarantine building, Well #1, and the drum screens/lights at the settling pond for Big Quilcene River water.

2.6.4 Hatchery Water Intake and Use - Water withdrawn from the Big Quilcene River is pre-settled in a concrete basin to reduce sediments entering the raceways. A rotating drum screen system prevents naturally produced fish (primarily trout) from entering the rearing system and shunts them to piping that returns them to the river.

Hatchery effluents are settled in a concrete basin and the solids are removed as needed (about every other year). Quilcene effluent discharges meet established water quality standards.

Walcott Slough - Walcott Slough satellite facility located in Brinnon WA was operated as a fall chum spawning facility for many years. A small building, access road, concrete channel, and crowder were located on leased land. Resulting eggs were transported to Quilcene NFH to support their chum program as well as some other historic transfers. The program was moved to Quilcene NFH in the mid 1980s. However, we maintained the lease and property. The HET eventually decided that maintaining the property for no fish cultural purpose was an environmental liability and decided to recommend decommissioning and restoration of the property.

STATEMENT OF WORK [USFWS and HCSEG 2007]

A. Project Summary and Objectives

Six species of salmonids occur within this estuary located within a large portion of the estuarine complex of the Dosewallips River in Jefferson County adjacent to the town of Brinnon. Under this proposal, the Hood Canal Salmon Enhancement Group will remove existing storage and hatchery facilities including concrete slabs, remove ~ 600 cu yards of fill and debris, remove 80 cu yards of concrete raceways and restore the native vegetation. This work continues a highly successful partnership between the HCSEG, Hood Canal Coordinating Council (HCCC), Port Gamble S'Klallam Tribe (PGST), Washington Department of Fish and Wildlife (WDFW), the USFWS and Brinnon-area residents.

Reconnecting isolated wetland habitats is a cost-effective and functionally effective approach for restoring wetland habitats, especially in coastal areas. This project proposes to completely remove Concrete raceways, storage facilities, fences, rip rap and all man made structures. As a part of restoring the natural tidal channel network, an enhanced channel will be designed to provide natural passage.

This project will address the disconnection of a significant estuarine marsh/ tidal channel area. The habitat functions (tidal inundation) conducive to forming natural estuarine marsh/ tidal channel

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

conditions will once again be allowed to exist. We hypothesize that removal of the structures will allow full tidal inundation, resulting in increases in tidal channel density and size, as well as complete re-colonization of salt marsh communities.

Historic tidal channels still persist within the diked area, although they have partially filled in with sediment and vegetation from the years of isolation from tidal action. The restored channels will provide for natural processes to form additional tidal channels on the 10-acre restoration site.

B. Project Description and Need

Western Washington's Puget Sound is a very large, complex system of estuaries that support tremendous biological productivity and diversity. The plankton-rich waters, kelp forests, eelgrass beds, and salt marshes sustain a vast array of wildlife species. Puget Sound is home to at least 7,000 species of invertebrates, 200 species of fish, 100 species of sea birds, and 26 species of marine mammals (Seattle District USACE 2004; PSAT 2005). Although the Sound still supports the largest area of remaining estuarine wetlands on the west coast, 73 percent of its salt marsh habitat has been lost since the 1800's (PSAT 2004). Many species that depend on nearshore and marine habitats, such as salmon, forage fish, marine birds, and orcas, have declined in numbers.

Hood Canal is a natural, glacier-carved fjord more than 60-miles long, which forms the westernmost waterway of the Puget Sound basin. Hood Canal is one of the most scenic marine environments of Puget Sound; it was also once one of the most productive. However, habitat loss and low dissolved oxygen levels threaten Hood Canal's health. The vital role estuaries play in summer chum salmon recovery is a basic tenant of salmon biology (Walters et al. 1978; Healy 1987; Levy and Northcote 1982). Properly functioning estuaries are recognized as a critical environment relating to the salmon lifecycle. The ability of estuaries to provide abundant food supply, wide salinity gradients, and diverse habitats is particularly important to anadromous fish in terms of rearing, feeding and osmoregulatory acclimatization (Macdonal et al 1987). The project area is located in the estuary of the Dosewallips River, the second largest tributary to Hood Canal, lying in south Jefferson County. The headwaters of the Dosewallips watershed are protected within Olympic National Park and Olympic National Forest, while the lower river reaches are mostly in private ownership. The Dosewallips estuary supports extensive mudflat, eelgrass, and emergent marsh habitats important to varied fish, wildlife, and shellfish populations. Numerous recent planning efforts have highlighted the Dosewallips as among the most pristine riverine-estuarine systems in Hood Canal, offering one of the best chances for effective salmon habitat protection and recovery (Frissell et al. 2000, WDFW & PNPTT 2000, May and Peterson 2003). As a result, the Hood Canal Coordinating Council has designated the Dosewallips as one of eight Tier 1 watersheds in its Salmon Recovery Strategy (HCCC 2004).

The project area includes critical freshwater and estuarine habitat for two salmon stocks listed as threatened under the ESA, Puget Sound Chinook and Hood Canal summer chum. In addition, the river harbors a diversity of other fish species: fall chum, pink, coho, winter steelhead, rainbow, cutthroat, and sculpin populations. Harboring at least eight distinct stocks. In response to an identified lack of aquatic habitat information for the Dosewallips (USFS 1999, WDFW & PNPTT 2000) in 2001 the Port Gamble S'Klallam Tribe with support from the BIA initiated an assessment of riverine-floodplain habitat, coupling ground and remote sensing surveys (LIDAR and high-resolution digital photography). This work highlights important restoration opportunities in the watershed (including work outlined under this proposal), and provides data which will be essential to future project planning.

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

This property is currently under easement to the USFWS for the purpose of collecting adult spawners for brood stock at the Quilcene hatchery. The easement stipulates the USFWS must collect salmon at least once every 4 years. However at this time they have no need to collect at this site and would like to remove all vestiges of their presence and return the site to its original condition. This project will remove the man made structure and reopen the Northern Dosewallips estuary to estuary biological functions.

C. Final Products

There are many estuaries on Hood Canal which have been similarly impacted by development such as this. Ecological lessons will be learned of the effects of removing long-existing impacts which over time have increased dramatically. There will be more reliability in predicting the effects of removals on more land-sensitive river systems. Moreover, this is a very certain project in allowing fairly immediate access to areas where obstacles have prevented salmonid migration for many decades. It is a cost effective and efficient method to achieve success in one season. All project activities will be timed to minimize disturbance to salmonids.

Estuaries are becoming better known for their importance to the life stages of juvenile salmon and for the successful return of spawning adults. This project will affect adult and juvenile salmonids which includes ESA-listed summer chum and Puget Sound Chinook. Army Corps of Engineer standards and directives will apply for removing and re-deploying material inside and outside the flood plain.

There is very little uncertainty about the results of this project. It is straight forward and we are removing human impact on the site. The USFWS has been consulted for comparisons and their input.

D. Partner Justification

The Hood Canal Salmon Enhancement Group (HCSEG) is one of 14 regional salmon enhancement groups in the state of Washington. The HCSEG is involved in various projects ranging from habitat restoration work, supplementation, research, and education/outreach. With eight years of notable outcomes and accomplishments the HCSEG has released 2.5 million fish. The fish species released include: Coho, Summer Chum, Fall Chum, Chinook and Steelhead. Over 55 fish passage barriers have been removed, repaired or replaced opening up 88 miles of streams and over 250,000 acres of spawning and rearing habitat. Additionally, the group has dispersed over 35,000 salmon carcasses supplementing nutrients to the aquatic and terrestrial habitat ecosystems. Over 405 projects have been completed, including revegetation, surveys, assessments, estuary restorations, research, monitoring, evaluation, nitrification evaluation, stewardship and educational programs.

Hood Canal Coordinating Council (HCCC) is a Watershed-Based Council of Governments. It was established in 1985 in response to community concerns about water quality problems and related natural resource issues in the watershed. The Council currently operates under a variety of authorities in Hood Canal. It is a Public Benefit Corporation (RCW 24.03); a Non-profit Corporation {IRS Code 501(c)3}; the “Management Board” for aquatic rehabilitation {RCW 90.88.030(1)}; the “Lead Entity” and “Regional Recovery Organization” for salmon recovery {RCW 90.88.030(1)(a)}, and the “Inter-WRIA Coordinator” for watershed planning. Port Gamble S’Klallam Tribe - with support from the BIA initiated an assessment of riverine-floodplain habitat, coupling ground and remote sensing surveys (LIDAR and high-resolution digital photography).

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

This work highlights important restoration opportunities in the watershed (including work outlined under this proposal), and provides data which will be essential to future project planning.

WDFW - Randy Johnson is a Fish & Habitat biologist for region 6 and assists in establishing priorities for nearshore restoration work.

USFWS - Ron Wong is the manager for the Quilcene Hatchery and has been instrumental in recommending and authorizing the removal of the man-made structures central to this project. Additionally, Rich Carlson has been instrumental in obtaining the permits necessary to accomplish this project.

Contractors for this project will be selected from bids received from local contractors on the HCSEG's small contractor work list through a sealed bid process.

K. Outreach and public education facilities/programs²⁸

3.9 Public Outreach - In 2001, the visitor center and displays were displaced by the office space expansion. Visitor information is currently very limited due to confined space in the entrance vestibule to the office. A new visitor center has been identified for future construction.

The Quilcene NFH partners with local schools to provide learning experiences for students ranging from pre-school to high school ages. The local schools have a standing invitation to participate in scientific sampling and activities at the hatchery. The hatchery also partners with the Service's Regional Office in Portland, Oregon, to provide training opportunities for foreign fisheries professionals as well as students interested in fisheries careers.

L. Special issues or problems (e.g. water and property rights issues, law suits, etc.)

- **Quilcene is authorized to discharge effluent under NPDES permit number WA-000187-2.** The permit has expired and a renewal application has been submitted.
- **Quilcene Electric Weir and bypass ladder [pers comm. D. Zajac USFWS 2008]** – Since the construction of the new electric weir gravel movement, scouring, and aggradation have been a problem. Currently, barbs both above and below the weir that are meant to direct/deflect river flows and protect banks have eroded and a large gravel bar and plug have rendered the weir bypass ladder inoperable.
- **3.10.3 Water Use (Drought) [QLNFH CHMP page 47]** - In spring of 2001, an anticipated drought year, we developed options regarding fish releases commensurate with expected declines in water availability for fish culture. The options ranged from the preferred option of an early on-station release of some production to unpreferred options including releases to other watersheds or euthanasia. Fortunately, adequate water was available and no options had to be exercised. The options are still viable with the current production if drought conditions are anticipated in the future (Attachment 8).

²⁸ QLNFH CHMP p. 46.

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

- **3.10.6 Culvert Assessment Project [QLNFH CHMP page 48]** - In 2003, the WWFOW received Fisheries Operations Needs System (FONS) funding to assess culverts on federal property (fish hatcheries and refuges). The assessment (Tschaekofske et al. 2004) identified barriers to both adult and juvenile salmonids and included hatchery structures such as intake dams and weirs as well as culverts. Two Quilcene NFH structures, both on Penny Creek, were identified as complete year-round barriers. A feasibility study has been proposed to assess the biological potential of allowing fish access up Penny Creek and construction alternatives.
- **Coho Over-escapement to the Hatchery [pers comm. D. Zajac USFWS 2008]** - Quilcene coho historically made significant contributions to Canadian troll fisheries. However, when those fisheries were reduced or eliminated more than 10 years ago we saw a dramatic increased escapement to the hatchery. My expectation was that those fisheries would be temporarily reduced, new harvest methods would be applied for coho that were co-mingled with depressed summer chum in Quilcene Bay, and the sport fisheries in both Quil Bay and the Quil River would increase and effectively harvest any realized over-escapement. And, besides excess could be distributed for subsistence and direct terminal Tribal fisheries could be executed at the hatchery weir. So, I was a proponent for a continued static production level. Well, two or three years ago I called a Canadian assessment biologist and asked her opinion about ever resurrecting the Canadian coho troll fleet? Bottom line – no chance. At this time I believe the Quil Bay and River fisheries have increased to their capacity as well as the terminal fishery and we still realize a significant escapement. The only other harvest potential I see is the de-listing of summer chum to allow directed harvest of the co-mingled summer chum and coho. However, that may be years down the road. Is it time to consider a coho production reduction to reduce under-harvested/over-escaped coho?

Also, excess fish for distribution to the tribes or to the food bank program are moved from the channel to totes via the Pescolator. The tote is then covered and the fish suffocate. No anesthesia system is used.

- **Penny Creek Coho Access [pers comm. D. Zajac USFWS 2008]** - Several years ago a Tribal habitat biologist suggested that coho should have access to Penny Creek above the hatchery. To our knowledge (or lack thereof) coho may never have had access to the creek. One old photo, hatchery intake placement, and numerous cascades and waterfalls that exist on west-side Hood Canal streams suggest to some of us that the creek may have been inaccessible. Never-the-less, we funded a Penny Creek feasibility study to research historic access, impacts to existing trout populations and hatchery populations if access was constructed. Not to mention broodstock management and – don't forget – fish health concerns/management.

Statement Of Work: Fish Passage Study Penny Creek June 4, 2007

GENERAL: The U.S. Fish & Wildlife Service (USFWS), Quilcene National Fish Hatchery (NFH), located at 281 Fish Hatchery Road, Quilcene, Washington 98376, has a project to conduct a feasibility study to look at a fish passage issue on Penny Creek at the confluence to the Big Quilcene River. Quilcene NFH is located in Jefferson County, on the east side of the Olympic peninsula in the state of Washington. A fish barrier has been identified on Penny Creek on Quilcene NFH property.

There is also a separate fish barrier upstream of the Quilcene NFH fish barrier that is managed by Jefferson County.

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

The completed assessment should be sufficiently detailed and in-depth to permit management to use this information to decide if fish passage on federal property should be reestablished or if the status quo should be maintained.

SCOPE: This is a feasibility study to assess and evaluate:

- (1) The purpose of allowing coho fish passage on Penny Creek.
- (2) If there is any historical evidence that Penny Creek was ever accessible to coho salmon.
- (3) Impacts to salmonid populations.
- (4) What fish species currently are and historically were present in Penny Creek.
- (5) Potential disease risks to the hatchery, if fish passage were allowed on Penny Creek.
- (6) Potential impacts to the Big Quilcene River fish if Brook Trout were able to move downstream from Penny Creek into the Big Quilcene River.
- (7) Impacts that the continued presence of the fish barrier would have in contrast to impacts that removal of the fish barrier would have.
- (8) Historical fish plantings on Penny Creek.
- (9) Potential coho production on Penny Creek.
- (10) Impacts of the fish barrier removal to the hatchery facility.
- (11) Potential of trying to provide habitat for wild coho in Penny Creek, while also managing for the Quilcene NFH coho stock.
- (12) The biological impacts that the fish barrier has historically had.

The contractor will provide a final report that should be sufficiently detailed and in-depth to permit management to use this information to decide if fish passage on federal property should be reestablished or if the status quo should be maintained.

Contractor will meet with the USFWS to:

- discuss the scope of the project and address any questions
- review a preliminary draft to verify that, the contractor's work is in line with the objectives of the study
- verify that the contractor has finalized the assessment in an acceptable report form and provided the USFWS staff copies

PLACE/DELIVERY AND PERIOD OF PERFORMANCE: Written report should be sent to U.S. Fish & Wildlife Service (USFWS), Quilcene National Fish Hatchery, 281 Fish Hatchery Road, Quilcene, Washington 98376. Reports shall be completed by September 30, 2007 with five copies distributed to Quilcene National Fish Hatchery. If the September 30, 2007 due date is not achievable, contractor can discuss matter with the government representative, Ron Wong to come up with a due date agreeable to both parties.

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

GOVERNMENT FURNISHED EQUIPMENT OR MATERIALS/INFORMATION: There are hatchery records that are pertinent to this study which the contractor can obtain copies from Larry Telles, Assistant Manager Quilcene NFH.

PROCEDURES FOR ISSUING ORDERS: This is an Indefinite Delivery, indefinite Quantity contract

TECHNICAL COORDINATOR: Contact Ron Wong, manager at Quilcene National Fish Hatchery, Monday thru Friday (7:30 AM to 4:00 PM). Phone: 360-765-3334 or 3330

- **3.10.2 Hatchery Reform** [QLNFH CHMP page 47]- The Hatchery Reform Project of Puget Sound and Coastal Washington has the twin goals of recovering wild salmon and also providing for sustainable fisheries [LLTK and HSRG 2000]. As part of the hatchery reform project, fish passage protocols at Quilcene NFH were re-assessed to optimize natural and hatchery salmon production in the Quilcene River system [Zajac 2002]. A historical review of Quilcene NFH fish production was also completed as part of the hatchery reform project [Kane and Moore 2001] to better understand the genetic makeup of fish reared at Quilcene NFH as well as the hatchery's historical influence on regional salmon production.

The Hatchery Reform Project resulted in hatchery-specific as well as area-wide recommendations regarding fish hatcheries. These recommendations were developed by an independent scientist panel with informational input from various agency personnel.

Recommendations specific to Quilcene included increasing the percentage of jack coho spawned, reducing coho production, eliminating chum production, and continuing mass marking. We have implemented all of these recommendations. An additional recommendation was made to replace the existing Quilcene coho stock with Big Beef Creek stock to alleviate perceived genetic impacts to neighboring wild coho stocks. The Service is cooperatively conducting a genetic profiling study of coho stocks in Hood Canal [Ardren et al. 2006] to provide the best science available to make a decision regarding the appropriate coho salmon stock to use at Quilcene NFH (this was accomplished and led to the following internal recommendation).

Summary/Interpretation of (internal USFWS) Quilcene Coho Genetics Discussion May 21, 2007

Assumptions based on "snapshot in time" tissue collections and genetic analysis

The Quilcene NFH coho stock consists of three reproductively distinct broodlines that have evolved over time *likely due* to the historical exclusion of jacks (2-year old males) from the broodstock. The three broodlines exhibit three characteristic return times (early, middle, late) that are approximately 3-4 weeks earlier than the mean return times for wild populations in north Hood Canal.

Two of the three Quilcene coho broodlines have significantly *less genetic diversity* than neighboring wild stocks at five of 10 loci based on measures of allelic richness (Fig 2; Table 1). The early (BY 01/04) and middle (BY 02/05) broodlines exhibited approximately 13.1 and 16.4% less allelic richness than the mean for the wild populations. The mean allelic richness for the late timed broodline (BY 00/03) and wild populations were approximately equal (6.0 and 6.1, respectively), and did not differ significantly at any locus. The early (BY 2001) and

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

middle (BY2002) broodlines also diverged genetically from natural populations to a much greater extent than did the late (BY 2000) broodline (Fig. 3).

The lower genetic diversity in Quilcene coho was *likely caused* by selectively breeding for earlier return timing by excluding late returning fish from the broodstock. Historical exclusion of jacks from the broodstock until 1992 is expected to have also contributed to reduced allelic richness by allowing each broodline to reproduce independently of the other two broodlines, but this latter practice most likely had only a minor effect compared to deliberate selective breeding and reduced effective population size.

There have been no *obvious* deleterious phenotypic effects to the Quilcene coho stock as a result of lower diversity.

There have been no *obvious or identified* deleterious genetic effects to neighboring wild populations of coho in Hood Canal. Genetic analyses performed to date do not indicate homogenization of wild stocks by hatchery strays nor do they indicate reduced genetic diversity in wild Hood Canal stocks relative to coho stocks elsewhere. Important limitations to the presently available data are that they 1) do not allow us to distinguish shared ancestry of hatchery and wild stocks from contemporary gene flow between these groups, and 2) focus strictly on neutral variation, which does not necessarily reflect selective differences between hatchery and wild coho stocks in Hood Canal.

Management Implications/Benefits/Risks if:

1. Quilcene NFH maintains its current broodstock –

Benefits:

- Easily cultured in the hatchery environment.
- Successfully providing adults for harvest.
- Timing separation from wild stocks reduces risk of “genetic interactions” with wild stocks.

Risks:

- Reduced genetic diversity may reduce genetic resiliency and the ability to respond physiologically to episodic environmental challenges or stress.
- Timing overlap with summer chum creates harvest constraints.

2. Quilcene NFH changes broodstock to a local wild stock (via replacement or infusion) –

Benefits:

- Reduces return timing overlap with summer chum and reduces harvest constraints.
- Reduces potential genetic risks to naturally spawning populations.

Risks:

- Increases potential interbreeding between hatchery and natural-origin coho assuming similar stray rates.

USFWS Olympic Peninsula Hatchery Review Team
Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

Proposed management actions/direction

Maintain the current coho broodstock at Quilcene NFH.

Increase use of two year old males to 20% of males spawned for two generations (six years) beginning in 2007. This strategy will result in 10% gene flow among broodlines for two full generations, thus reducing genetic divergence among the three broodlines. There may be a slight increase in percent jacks after one generation, but this increase is expected to be minimal based on the relatively low heritability (% phenotypic variance due to genetic variation among males) of “jacking” compared to the environmental effects of freshwater growth rate and size at smoltification.

Continue tissue collections and genetic analysis and comparisons of hatchery and wild stocks. Annual collection goals will be 100 random samples from each targeted population per Abernathy sampling protocol and analysis.

Discussion/Explanation

Generally, we (Quilcene NFH HET) feel there is a greater genetic risk to local wild coho populations in Quilcene Bay and adjacent tributaries if Quilcene coho were replaced or modified with a wild stock than there is to the local wild populations if the current stock is maintained.

We also feel that the lower genetic diversity in Quilcene coho relative to wild stocks (13-16% decrease for two of three broodlines) is not a significant concern as previously discussed. Of greater concern for this reproductively segregated hatchery stock is the historical absence of gene flow among year classes (brood years) and the resulting development of three genetically distinct broodlines. Consequently, we propose to increase the use of two year old males (jacks) during spawning and monitoring potential changes in percent jacks and genetic diversity among returning adults in future generations. The continued tissue sampling and analysis will provide a measure to track genetic changes in the Quilcene stock as a result of this practice.

Dave Zajac – May 22, 2007. Modified May 24, 2007 with edits from attendees.

Attendance: Christian Smith, Don Campton – Abernathy FTC, Sonia Mumford – Olympia FHC, Ron Wong, Larry Telles, Dave Knox, Paul Kaiser – Quilcene NFH, Yvonne Dettlaff, Dave Zajac – Western Washington FWO

Note: Point No Point Treaty Council and WDFW generally agree with our management recommendation (Chris Weller, PNPTC, per. comm., 2008). However, Skokomish Tribe may not. They may prefer use of a later timed stock for Quilcene coho production (Dave Herrera, Skokomish Tribe, per. comm., 2008).

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

Attachment 7: Recommendations of HSRG Specific to Quilcene NFH [OLNFH CHMP pages 87-91, HSRG 2004, pages 28-30,35,36]

Big Quilcene Hatchery Coho

US Fish and Wildlife Service

Stock Goals:	Current	Short-Term	Long-Term
<i>Biological Significance</i>	Intermediate	Intermediate	Intermediate
<i>Population Viability¹²</i>	High	High	High
<i>Habitat</i>	Limiting	Limiting	Limiting
<i>Harvest Opportunity</i>	Each Year	Each Year	Each Year
Hatchery Program:			
<i>Purpose</i>	Harvest		
<i>Type</i>	Segregated		

¹²In the case of a segregated harvest program, population viability ratings are low, medium and high and refer to the stock's ability to sustain itself in the culture environment.

PROGRAM DESCRIPTION

This stock has been artificially propagated since 1911 and currently exhibits a run timing that is slightly earlier than other stocks of Hood Canal coho. Eggs have been provided from Hoodsport Hatchery, the Skokomish, Duckabush, Skagit (Skagit region), Skykomish (Stillaguamish/ Snohomish region), Dungeness (Eastern Straits region), Quinalt (North Coast region) and Clackamas (Oregon) rivers, and Lake Washington (Lake Washington sub-region of Central Puget Sound). The last eggs were imported in 1973. 450,000 yearlings are released on-station at Quilcene National Fish Hatchery (NFH). Adult collection, incubation and rearing occur on-station.

OPERATIONAL CONSIDERATIONS

- The last import of eggs for this program was in 1973.
- The hatchery stock has an extensive tagging history, with the stock currently serving as a double index indicator stock under the Pacific Salmon Treaty.
- The remainder of the hatchery release is marked with an adipose fin clip.
- Total survival rates for the program have been very consistent, averaging approximately 4.8% for brood years 1987–98.
- The stock displays earlier run timing than other coho stocks in Hood Canal. This is thought to be a result of past artificial selection at the hatchery.
- Strays from the program contribute to the high occurrence (40-50%) of hatchery fish in natural spawning populations in northern Hood Canal streams.

BENEFITS AND RISKS

A. Consistent with short-term and long-term goals?

The program provides annual harvest opportunity consistent with the short- and long-term goals for the stock.

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

B. Likelihood of attaining goals?

The contribution of the program to harvest has changed dramatically since brood year 1994, with returns from the program currently underused. Prior to that time, the program contributed approximately 26,000 fish annually to all fisheries. Brood years 1995-98, however, have only contributed approximately 4,400 fish per year to all fisheries. Hatchery escapement during the same period has averaged approximately 15,000 fish per year, well in excess of the broodstock needs. Terminal area catches in Quilcene Bay and the Big Quilcene River (attributed to this program and the Quilcene Bay Net Pens) have averaged only 2,000 and 300 fish, respectively, from 1996–2001.

C. Consistent with goals for other stocks?

The program presents a risk to summer chum through predation at the juvenile stage and through by catch in fisheries directed at returning coho adults. The predation risk is mitigated to some extent by release timing consistent with the Summer Chum Salmon Conservation Initiative (SCSCI). The program poses genetic risks from straying to naturally produced coho in Hood Canal. It also poses potential competition risks with other natural coho stocks in Hood Canal. The program presents a predation risk to fall chum, pink and Chinook stocks.

RECOMMENDATIONS

Replace the current hatchery brood stock with a normal-timed, in-region brood stock to improve harvest opportunity and reduce incidental harvest on summer chum.

- Adjust the program's size to control straying and to be consistent with harvest goals and goals for other stocks, including summer chum conservation. Since the program consistently produces unharvested returns that exceed escapement needs, it should either be reduced or additional harvest options should be explored that take full advantage of harvest opportunities.
- Select Big Beef Creek coho as the broodstock source, if the program is to provide fish for the Port Gamble Net Pen, as recommended by the HSRG for that program. Maintain its integration with Big Beef coho by introducing an annual average of 10–20% natural spawning fish of Big Beef Creek origin.
- Increase the use of jacks to ten percent of the males used for spawning.
- Mark and continue to tag hatchery releases to evaluate their contribution to natural spawning populations and to harvest.
- Devise and implement a strategy to transition from the current stock to the new one.

COMMENTS

Modification of the program's size should prevent underutilization of returns from the program.

- The program should also be sized and designed to provide freshwater rearing support for the Port Gamble Bay Net Pens. Development of an integrated broodstock program will reduce the straying risks from this program and the Port Gamble Bay Net Pens.
- The managers identified a single coho stock for naturally-spawning populations in Hood Canal. Part of the rationale for recommending replacement of the existing coho hatchery

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

stock at Quilcene NFH is its long history of artificial propagation (since the early 1900s) as a segregated stock, and the potential domestication and genetic risks this stock poses to naturally-spawning stocks in Hood Canal due to straying. Net pen releases from Quilcene Bay and Port Gamble Bay significantly increase this straying risk, thus warranting a different hatchery stock if those net pen releases are to continue.

MANAGERS RESPONSE

The HSRG recommends replacing the coho brood stock and selecting Big Beef as the source, if the Quilcene NFH continues to support the Port Gamble Net Pen program. However, the co-managers believe it would be prudent to develop more information upon which to base such a decision. The tribes believe a genetic assessment and straying study of north Hood Canal coho populations should be done, to provide better evaluation of the risks, help the co-managers decide on program objectives, and help decide what hatchery programs should continue and what stock the continuing programs should use.

Surplus coho returns to the hatchery are occurring at the current program size. While in recent years, harvest opportunity has been compromised by harvest limitations to protect summer chum, new fishing opportunities have been developed (an in-river recreational fishery and tribal dip net fishery). The tribes plan to explore additional fishing opportunities and, if the co-managers decide to change to a brood stock of later timing, the constraints associated with protecting summer chum may be removed, thus increasing harvest opportunity. Furthermore, the tribes and others are fully utilizing the current coho surpluses at the hatchery; there is no waste of these fish.

See also Appendix A: US Fish and Wildlife Service Response to HSRG Recommendations.

Quilcene Bay Net Pen Coho

Skokomish Tribe and US Fish and Wildlife Service

Stock Goals:	Current	Short-Term	Long-Term
<i>Biological Significance</i>	Low	Intermediate	Intermediate
<i>Population Viability¹⁵</i>	High	High	High
<i>Habitat</i>	Limiting	Limiting	Limiting
<i>Harvest Opportunity</i>	Each Year	Each Year	Each Year
Hatchery Program:			
<i>Purpose</i>	Harvest		
<i>Type</i>	Segregated		

¹⁵In the case of a segregated harvest program, population viability ratings are low, medium and high and refer to the stock's ability to sustain itself in the culture environment.

PROGRAM DESCRIPTION

Quilcene Bay net pen coho are of Quilcene National Fish Hatchery (NFH) stock. 190,000 yearlings are released on-site at the net pens. Adult collection, incubation and rearing prior to saltwater transfer occur at Quilcene.

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

OPERATIONAL CONSIDERATIONS

- Smolts are transported to the net pens in January for release in May at 15 fish per pound.
- Since broodyear 1996, a portion of the fish from this program has received a double index tag prior to saltwater transfer. Previous tagging was limited and inconsistent. The remainder of the hatchery release is unmarked.
- Total survival rates for the program have averaged approximately 3.8%.
- The program has been reduced from a planned release of 400,000 fish to its current size.
- The stock displays earlier run timing than other coho stocks in Hood Canal. This is thought to be a result of past artificial selection at Quilcene NFH.
- Smolts are immersed in a *Vibrio anguillarum* vaccine during transport to the net pens.
- The program has had occasional mortality problems from noxious phytoplankton (1987, 1989, and 2003).
- Strays from the program contribute to the high occurrence (40–50%) of hatchery fish in natural spawning populations in northern Hood Canal streams.

BENEFITS AND RISKS

A. Consistent with short-term and long-term goals?

The program is providing some harvest benefits, but appears to contribute minimal benefits to the terminal area fishery in Quilcene Bay relative to the contribution of the Big Quilcene Hatchery coho program. For return years 1991–96, this contribution generally ranged from 30–900 fish.

B. Likelihood of attaining goals? □

Terminal area catches in Quilcene Bay and the Big Quilcene River (attributed to both this program and the Big Quilcene Hatchery coho) have averaged only 2,000 and 300 fish, respectively, from 1996–2001. This is likely due to the current depressed market for salmon and to harvest limitations caused by conservation concerns for summer chum.

C. Consistent with goals for other stocks?

The program poses genetic risks from straying and potential competition risks to naturally produced coho in Hood Canal. The genetic risk is compounded in this case by the inability to remove uncaught hatchery fish at a broodstock collection site. It also poses potential predation risks to summer and fall chum, pink and Chinook. The risk to summer chum is mitigated by release timing consistent with the *Summer Chum Salmon Conservation Initiative (SCSCI)*. The program also poses a risk to Quilcene River summer chum from fishery-induced mortality, because of the significant overlap in timing with that stock.

RECOMMENDATIONS

Discontinue the program, because of limited harvest benefits and high genetic risks.

COMMENTS

Discontinuing this program would also provide Quilcene NFH with the capacity to meet rearing needs for the Big Quilcene hatchery coho and the Port Gamble Net Pen programs.

MANAGERS RESPONSE

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

The Skokomish Tribe supports the joint comments made by the state and the Point-No-Point Treaty Council Tribes regarding the Quilcene Hatchery coho, since the net pen program is basically an extension of it. The Tribe is interested in exploring the use of a later-timed coho stock of local origin, because it may provide greater harvest opportunity for coho and reduced harvest-related mortality on summer chum. This could address the concerns identified in the Benefits and Risks section. No major changes should be made to the current program until after the assessments and studies referred to in the WDFW/Tribal joint comments (Quilcene Hatchery section) are completed.

The Skokomish Tribe also reports that the tribal, state and federal hatchery staff members involved have agreed to move the transfer date to early March, to minimize mortality related to noxious phytoplankton.

IIA. Quilcene NFH Coho

A. General information

Quilcene NFH was authorized by 35 Stat. 589 on June 29, 1909. This statute authorized the Secretary of Commerce and Labor to establish "two or more fish cultural stations on Puget Sound, or its tributaries in the State of Washington, for the propagation of salmon and other food fishes." The station was constructed in 1911 at a cost of \$16, 700. The Act contains no specific language concerning the species the station was to rear or the specific waters to be stocked by the hatchery. We currently propagate coho salmon only. Hatchery operations are conducted as an element of the Hood Canal Salmon Management Plan, which is a part of the Puget Sound Salmon Management Plan, resulting from *U.S. v. Washington* (the Boldt Decision)[QLNFH CHMP page 8].

B. Stock/Habitat/Harvest Program Goals and Purpose

*1. Purpose and justification of program*²⁹

Quilcene National Fish Hatchery was authorized by 35 Stat.589 on June 29, 1909. This statute authorized the Secretary of Commerce and Labor to establish "two or more fish cultural stations on Puget Sound, or its tributaries in the State of Washington, for the propagation of salmon and other food fishes." The Act contains no specific language concerning the species the station was to rear or the specific waters to be stocked by the hatchery.

The Hood Canal Salmon Management Plan (HCSMP), under which the Quilcene NFH program operates, was established to provide guidelines for the harvest, protection, rehabilitation and enhancement of salmon resources originating from or passing through Hood Canal waters from the mouth of Hood Canal southward. The HCSMP is intended to comply with and address all regional issues required by the Puget Sound Salmon Management Plan and meet guidelines for Regional plans as suggested by the Salmon and Steelhead Conservation and Enhancement Act. The primary goal of the HCSMP is to maximize the long term net benefits from the salmon resources in a manner that provides clear policy and technical guidelines, minimizes disagreements, and improves coordination between parties.

Hatchery operations are influenced by the following authorities, policies, and agreements.

- Policies:*
- Secretarial Order #3206, American Indian Tribal Rights, Federal- Tribal Trust Responsibilities, and the Endangered Species Act
 - Viable Salmon Populations Strategy, NMFS
 - Fish and Wildlife Service Recreational Fisheries Policy, NPI #89-25

²⁹QLNFH CHMP p. 16, 17.

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

- Case Law:*
- U.S. v Washington*, 384 F. Supp. 312, 1974
 - Hoh v. Baldrige Framework Management Plan
- Agreements:*
- Memorandum of Agreement with Quinault Nation, 1965
 - Cooperative Agreement with Quinault Nation, 1991
 - Cooperative Agreements with Makah Tribe, 1994, 1996
 - MOU – BIA, carcass disposition to tribes
 - MOU – DOJ, carcass disposition to Federal Prison System
 - Puget Sound Salmon Management Plan, 1985. *U.S. v Washington*, 384 F. supp. 312, sub no. 85-2 (W.D. Wash.)
 - Hood Canal Salmon Management Plan, 1986
 - Stipulation and Order Concerning Co-Management and Mass Marking, April 28, 1997, U.S. District Court, Seattle, WA
 - Salmonid Disease Control Policy of the Fisheries Co-Managers of Washington State, revised October 1997
- Legislative Authorities:*
- Magnuson Fishery Conservation and Management Act (16 USC 1801-1882)
 - Quilcene NFH Authorization 35 Stat. 589, dated June 29, 1909
 - National Invasive Species Act of 1996
 - Omnibus Appropriation Bill of 2003 (Mass Marking Law)
- Regulations:*
- Endangered Species Act
 - Biological Opinion on Artificial Propagation of Summer Chum Salmon in Hood Canal/Strait of Juan de Fuca, NMFS
 - Clean Water Act

USFWS Olympic Peninsula Hatchery Review Team
Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

2. Goals and objectives of program³⁰

- Goal 1: Support recovery and conservation of local endangered and threatened species and species at risk. [3.1]
- Objective 1.1: Successfully maintain a summer chum salmon monitoring program at Quilcene NFH in accordance with the co-managers' Summer Chum Salmon Conservation Initiative (CI) and NOAA-Fisheries' Biological Opinion. [3.1.5]
- Task 1.1.1: Biosample and mark sample returning adults. [3.1.4]
- Task 1.1.2: Communicate program planning and progress annually within the hatchery evaluation team and to co-managers and cooperators under the CI. [5.2.8]
- Objective 1.2: Minimize negative impacts to ESA-listed and other native species, their habitats, and the environment by implementing state-of-the-art fish culture technology, hatchery operation, and hatchery maintenance. [5.2.1]
- Task 1.2.1: Update completed HGMPs to address listed species. [5.2.4]
- Task 1.2.2: Release only juvenile fish that are ready to migrate downstream (smolts), in the appropriate timeframes to avoid impacting listed or vulnerable species. [3.2.4]
- Task 1.2.3: Mass mark all coho salmon to identify them from naturally produced fish. [3.2.4, 5.2.2, 5.2.6]
- Task 1.2.4: Upgrade the hatchery intakes to meet NOAA-Fisheries screening criteria for fish in the Big Quilcene River (unfunded). [10.2.7]
- Task 1.2.5: Manage the hatchery weir and ladder within acceptable impacts to listed and native fish. [5.2.8]
- Task 1.2.6: Implement a Hazard Analysis and Critical Control Point (HACCP) plan. (Attachment 5) [4.1.2]
- Task 1.2.7: Conduct environmental monitoring to ensure that hatchery operations comply with water quality standards and to assist in managing fish health. [10.4.1, 10.4.2]
- Task 1.2.8: Comply with all environmental permit (including ESA consultation) requirements for hatchery operation, construction, and maintenance. [10.4.1, 10.4.2]

³⁰ QLNFH CHMP p. 50-53

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

- Objective 1.3: Seek other opportunities to contribute to the recovery and conservation of ESA-listed species and other species at risk. [5.1.4]
- Task 1.3.1: Communicate with all partners and forums in order to stay informed of other recovery and conservation needs that may be accommodated at Quilcene NFH. [1.4, 5.2.8]
- Task 1.3.2: Develop processes for isolated steelhead incubation to accommodate the developing Hood Canal steelhead supplementation study (NOAA-Fisheries lead). [1.4, 5.2.8]
- Goal 2: Assure that hatchery operations support the Hood Canal Salmon Management Plan, the Puget Sound Salmon Management Plan (*U.S. v Washington*), and Pacific Salmon Treaty objectives. [5.1]
- Objective 2.1: Collect sufficient coho salmon brood stock to produce 400,000 smolts for on-station release into the Big Quilcene River, 200,000 pre-smolts for the Quilcene Bay net pens, and 450,000 eyed eggs for the Port Gamble net pen program. [6.2.1, 8.2.3]
- Task 2.1.1: Collect and successfully hold about 600 pairs of coho to maturity.
- Objective 2.2: Contribute to a meaningful harvest for sport, tribal, and commercial fisheries from Canada to the Big Quilcene River (achieve a 10-year-average survival from smolt to adult of 5.0% for coho salmon, harvest plus escapement). [6.1.1, 6.2.1]
- Task 2.2.1: Work with states and tribes to establish meaningful fisheries (through *U.S. v. Washington* and Pacific Salmon Commission forums). [5.1.1, 5.1.4]
- Task 2.2.2: Mass mark juvenile hatchery coho salmon to facilitate harvest and related conservation and assessment efforts for hatchery, wild, and ESA-listed stocks. [3.2.4]
- Objective 2.3: Meet tribal trust responsibilities. [8.1, 8.2, 8.3]
- Task 2.3.1: Follow pertinent Laws, Agreements, Policies, and Executive Orders on consultation and coordination with Native American Tribal Governments. [8.1, 8.2, 8.3]
- Objective 2.4: Maximize survival at all life stages by working with the appropriate fish health center to maintain a comprehensive fish health program, focusing on prevention of diseases rather than treatment. [5.2.7]

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

- Task 2.4.1: Maintain hatchery operations that are consistent with the Service Manual (Part 713); State of Washington, Aquaculture and Disease Control (RCW 75.58); and the Salmonid Disease Control Policy of the Fisheries Co-Managers of Washington State. Any exceptions to this task would be negotiated on a case-by-case basis with the fish health co-managers. [5.2.7]
- Objective 2.5: Communicate and coordinate effectively with co-managers in Hood Canal. [2.3, 5.2.8]
 - Task 2.5.1: Participate in *U.S. v Washington* production planning processes. [5.1.4, 5.2.8]
 - Task 2.5.2: Hold semi-annual Hatchery Evaluation Team meetings to plan and review progress toward meeting hatchery goals.
- Objective 2.6: Ensure goals are achieved by working with the appropriate Fishery Resource Office to conduct monitoring and evaluation. [3.2.4]
 - Task 2.6.1: Coded-wire-tag production lots of coho salmon for Pacific Salmon Treaty indicator stock purposes. [5.2.2]
 - Task 2.6.2: Double-index tag and mass mark production lots of coho salmon to evaluate mark-selective fisheries. [5.2.2, 5.2.6]
 - Task 2.6.3: Biosample and mark sample returning adults. [5.2.3]
 - Task 2.6.4: Produce an annual report on stock assessment, survival, fish health, and fisheries contribution. [2.3.2]
 - Task 2.6.5: Provide data as needed for co-managers and for internal management needs. [5.2.8]
- Goal 3: Promote understanding, participation, and support of Service and Quilcene NFH programs.
 - Objective 3.1: Increase awareness of Quilcene NFH programs. [2.1.4]
 - Task 3.1.1: Coordinate with state, other federal, tribal and local information/public offices to incorporate information about Quilcene NFH. [1.4, 2.1.4]
 - Task 3.1.2: Facilitate interagency cooperation with existing and new programs in fisheries management [5.2.8]
 - Task 3.1.3: Coordinate with other federal offices to participate in special events, such as National Fishing and Boating Week. [6.2.2]

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

- Task 3.1.4: Interact with Service, tribal, other federal agencies, Fisheries outreach coordinators and actively seek to integrate Fisheries outreach activities with the Regional and National Outreach Strategies. [2.1.4]
- Task 3.1.5: Distribute the annual Quilcene NFH Focus Report (prepared by the WWFWO) to the public and to our cooperators. [2.3.2]
- Objective 3.2: Provide information and education about Service programs and Quilcene NFH to internal and external audiences. [2.3.2, 3.1.7, 6.3]
 - Task 3.2.1: Continue existing and develop new cooperative agreements and partnerships with public, private, and home school groups. [1.2]
 - Task 3.2.2: Create and maintain a website for the Quilcene NFH to inform cyber-visitors of the hatchery's programs and history, and to provide general information about the hatchery. [2.3.1]
 - Task 3.2.3: Develop a volunteer program to give tours, answer questions, and disseminate general information. [2.1.4]
 - Task 3.2.4: Develop a strong working relationship with the local media (newspaper, radio, and other Puget Sound area publications) and provide news releases and articles regarding agency issues and station activities. [2.1.4]
 - Task 3.2.5: Increase public use of the hatchery facilities by inviting special interest groups to tour the hatchery. [2.1.4]
 - Task 3.2.6: Loan Service-developed educational material to teachers (fish kit, migratory bird kit). [2.1.4]
- Goal 4: Support the principles of hatchery reform.
 - Objective 4.1: Maintain scientifically defensible production programs. [5.2.1]
 - Task 4.1.1: Increase the use of coho jacks in spawning to 10% of the males spawned. [5.2.1]
 - Task 4.1.2: Reduce the number of unharvested adults that exceed escapement needs or may stray to nearby streams.
 - Sub-Task 4.1.2.1: Work with the co-managers (WDFW, PNPTC, Hood Canal U&A Tribes) to expand harvest on returning adults OR to identify reductions in production that do not jeopardize harvest opportunities. [5.1.4, 5.2.8, 8.2.2]

USFWS Olympic Peninsula Hatchery Review Team
Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

- Task 4.1.3: Investigate back-selection of coho salmon for later return timing to temporally separate returning summer chum and coho salmon adults. [3.2.4, 5.2.8]

- Objective 4.2: Use informed decision making to manage the hatchery program. [5.1.5]
 - Task 4.2.1: Measure the genetic profiles of northern Hood Canal coho populations to assess the impacts of Quilcene stock coho strays on natural coho. [3.2.1, 3.2.4, 5.2.8, 9.3.2]

 - Task 4.2.2: Work with the co-managers (WDFW, PNPTC, Hood Canal U&A Tribes) to review results of recent straying and genetics studies, working towards a decision on future broodstock selection at Quilcene NFH. [5.1.4, 5.2.9, 9.3.2]

3. Type of program (Integrated or Segregated)

Segregated.

4. Alignment of program with ESU-wide plans

HGMPs have been developed and accepted regarding Quilcene coho (and previously summer chum) and Hood Canal steelhead.

5. Habitat description and status where fish are released³¹

Please fill out the table below for each stock using the general definitions provided:

(Provided by Dave Zajac, USFWS)

	Spawning Habitat		Freshwater Rearing Habitat		Migration Habitat		Estuarine Habitat
	Hatchery	Wild	Hatchery	Wild	Hatchery	Wild	
Rating (H/M/L)	M	M	L	L	M	M	M

(Provided by Doris Small, WDFW)

	Spawning Habitat		Freshwater Rearing Habitat		Migration Habitat		Estuarine Habitat
	Hatchery	Wild	Hatchery	Wild	Hatchery	Wild	
Rating (H/M/L)			L		L		M

These habitat ratings are:

1. High (H) = Healthy: Productivity of the target stock is high and the population is capable of growth and supporting significant terminal harvest.

³¹HSRG 2004 – corrected 2008, Zajac.

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

2. *Medium (M) = Limiting: The target stock is productive enough for the population to sustain itself at a low level terminal harvest.*
3. *Low (L) = Inadequate: The target stock is unproductive and the population will go extinct, even without terminal harvest.*

Habitat Conditions

Are there exceptions or “islands” of habitat that are in better or worse condition and do not correspond with the rating given in question?

Spawning habitat is not consistent. The lower river gravels (quantity) and gradient/flow are better. Accessible upriver areas lack appropriate spawning substrate and are higher gradient. The entire stream lacks large wood and off-channel habitat preferred by coho. (However, cooperators are now experimenting with engineered log structures in the lower river).

Habitat Improvement

What habitat improvement projects could elevate the rating for this sub-region or the “islands” of inferior production? If so, please list them and indicate if they are in the proposed or planning stages.

Projects to add LWD to the Big Quilcene to assist in restoring sediment transport are underway and additional restoration project is in the initial planning stages. (Provided by Dave Zajac, USFWS) Land acquisition and subsequent dike removal/setbacks/breaches. Addition of large wood. Currently, the Hood Canal Coordinating Council (HCCC) is reviewing habitat improvement options (from the SCSCI) and is in the early discussion/planning stages regarding implementation.

Future Expectations

Do you see the quality of the habitat in this region become better or worse in the next ten to twelve years? Fifty years? What are the long-term goals for habitat in this sub-region?

Ecosystem restoration will be a long, difficult process but initial steps are underway toward habitat improvement. (Provided by Dave Zajac, USFWS) Better with time. USFS land management practices in the watershed above RM 4 (USFS boundary) include a road obliteration program and identification of the watershed as late-successional reserve. This action is primarily aimed at promoting old-growth development by regulating harvest. Also, some land acquisition and dike setbacks have occurred in the lower river. Long term goals are likely being discussed by the HCCC planning process identified in 3.

Additional Information

What other habitat information should the Scientific Group consider (for example, salmonid or non-salmonid stocks not native to the watershed)? Please describe

The city of Port Townsend has a water right to 30cfs at their diversion at RM 9. Flows in the river are sometimes lower than that during late summer months. However, the city has a verbal arrangement with the USFWS to cease withdrawals so that 27 cfs remain in the river at all times. Flows in this low range may not be optimum for spawning and migration.

6. *Size of program and production goals (No. of spawners and smolt release goals)*³²

³² QLNFH CHMP p. 33, 36.

USFWS Olympic Peninsula Hatchery Review Team
Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

Measure	Goal	Five-year ¹ mean	Five-year ¹ range
Spawned population	1,200	1,079	948 – 1,303
Smolts released	400,000	410,888	361,891 – 488,080
Eggs transferred	450,000	450,220	450,000 – 450,400
Pre-smolts transferred	200,000	216,499	180,187 – 307,191
Spawners passed upstream	600	537	500 – 589
Percent survival from smolt	5.0%	4.61%	3.78% - 6.03%
Smolt size at release (fish/lb)	15 – 20	21.7	20.3 – 22.3

Number	Life stage	Fish size		Release site/Destination
		No./lb.	g/fish	
Coho salmon				
450,000	Eyed eggs	-	-	George Adams SFH – transferred to Port Gamble Tribal net pens
200,000	Pre-smolt	25	18	Skokomish Tribal net pens, Quilcene Bay
400,000	Smolts	15-20	23-30	On-station, Big Quilcene River

C. Description of program and operations

1. Broodstock goal and source

Collect and successfully spawn 600 pairs (600 females, 540 males, and 60 jacks) from coho returning to the hatchery. However, we are increasing the percentage of jacks used from 10 % (60) to 20% (120) for two generations (six years 2007-2012)(see L. Special Issues.. section).

Known importation of outside stocks, by broodyear:

1922, 1924 - Skykomish

1923 – Skagit

1925 - unspecified WA Dept. Fisheries

1927-1930 – Quinault

(The production program from 1911 through 1934 broods focused on fry and sub-yearling releases, with limited success. Beginning with the 1935 brood, production focused on yearling releases)

1965, 1968 - Quinault

1962 - Dungeness SFH

1959 - Eagle Creek (OR)

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

1942 - unspecified WA Dept. Fisheries

1973 - George Adams SFH

2. Adult collection procedures and holding³³

- Quilcene NFH is currently a single species facility rearing only Quilcene strain coho 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 collected for spawning across the spectrum of the run in proportion to the rate at which they return. Adults to be held for spawning are collected throughout the return period on a schedule approximating a Normal distribution.
- Adult coho return to the hatchery from mid-August through November. Brood fish enter the hatchery via a fish ladder associated with a graduated-field electric weir that spans the river. Adults ascend the ladder and enter a collection channel, which is the outflow channel for the lowermost bank of raceways (D bank). Two of these raceways are used for adult holding of segregated males and females. The held adults are treated three times weekly with 250 ppm hydrogen peroxide to control fungus.
- Approximately 600 adults are passed upstream to use the available habitat (Zajac 2002).

3. Adult spawning

a) Spawning protocols³⁴

3.2.2 Spawning Protocol -Potential spawners are randomly selected from the receiving channel on a set schedule, e.g., 50 pairs the first week, 100 pairs the next, etc., so that an approximately Normal distribution curve is described over a six-week period. Healthy appearing fish without external wounds are held for up to 6 weeks before they are ripe for spawning. At spawning, all ripe fish are killed and spawning selection is randomized. That is to say, large fish are not matched with large fish, etc. Up to 10% of the spawned males are jacks, per HSRG recommendation. Eggs from one female are placed into a three gallon stainless steel bucket and sperm from one male is immediately added. Penny Creek water is added to the eggs and milt and gently swirled and set aside for at least one minute. Eggs are then pooled (eggs from six females) into one stainless steel bucket and taken to the hatchery building for washing. Washing consists of adding Penny Creek water and pouring off any fish tissues, blood, debris, etc. This procedure is repeated until the eggs are clean. All spawning equipment is rinsed in iodine solution before use on other fish. The last egg rinse is with a 75 ppm solution of iodine. The eggs are then placed into wire baskets that are suspended in a stainless steel trough with 75 ppm iodine solution for 30 minutes. Each wire basket holds eggs from twelve females. The eggs are then placed in deep egg troughs for incubation at 10 gpm of Penny Creek water. Enough eggs are taken on each spawning day to allow culling and/or removal of unneeded eggs and still allow for a representation of that spawning day in the timing of the run.

³³ QLNFH CHMP p. 33.

³⁴ QLNFH CHMP p. 34.

USFWS Olympic Peninsula Hatchery Review Team
Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

b) No. of males and females spawned each year over past 10 years³⁵

YEAR	FEMALES	MALES	JACKS	% JACKS
2006	518	477	50	9.5
2005	473	449	26	5.5
2004	515	464	56	10.8
2003	568	553	11	2.0
2002	650	634	19	2.9
2001	480	471	11	2.3
2000	550	534	32	5.7
1999	704	689	15	2.1
1998	676	644	33	4.9
1997	683	675	18	2.6
AVERAGE	582	559	27	4.6

4. Fertilization

a) Protocols³⁶

Eggs from one female are placed into a three gallon stainless steel bucket and sperm from one male is immediately added. Penny Creek water is added to the eggs and milt and gently swirled and set aside for at least one minute. Eggs are then pooled (eggs from six females) into one stainless steel bucket and taken to the hatchery building for washing. Washing consists of adding Penny Creek water and pouring off any fish tissues, blood, debris, etc. This procedure is repeated until the eggs are clean.

b) Number of eggs collected and fertilized each year over past 10 years³⁷

Broodyear	Eggs taken	Number eyed	% eyed
1991	787,158	684,600	87.0%
1992	824,990	591,361	71.7%
1993	1,421,107	1,243,085	87.5%
1994	1,456,978	1,445,604	99.2%
1995	1,633,461	1,515,250	92.8%
1996	1,365,566	1,238,075	90.7%
1997	1,293,758	1,172,625	90.6%
1998	1,741,222	1,614,994	92.8%
1999	1,842,283	1,725,100	93.6%
2000	1,545,681	1,437,841	93.0%
2001	1,295,653	1,231,905	95.1%
2002	1,805,121	1,638,359	90.8%
2003	1,415,150	1,287,058	90.9

³⁵ USFWS 1991.

³⁶ QLNFH CHMP p. 34.

³⁷ Section text from QLNFH HGMP p. 12.

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

2004	1,638,831	1,474,652	90.0
2005	1,107,765	1,021,152	92.2
2006	1,481,653	1,361,325	91.9

5. Incubation³⁸

The eggs are placed into wire baskets that are suspended in a stainless steel trough with 75 ppm iodine solution for 30 minutes. Each wire basket holds eggs from twelve females. The eggs are then placed in deep egg troughs for incubation at 10 gpm of Penny Creek water. Eggs are kept in baskets in deep troughs until development to the eyed stage (eye-up) at which time the eggs are shocked, sorted, and placed into vertical stack incubators. Eggs are treated for fungus control with formalin three times a week until the eyed stage. Formalin is introduced at the head of the trough and again at the mid-point to maintain a full concentration level of 167 ppm.

6. Ponding³⁹

a) Protocols

- After hatched fry have absorbed their yolk sac (“buttoned up”), they are placed directly into outdoor 8-foot x 80-foot concrete raceways. Fish remain in these raceways until release. Every attempt is made to split raceways in advance of the density index reaching 0.20, in consideration of the total weight of fish in the rearing vessel, the vessel’s rearing volume, and oxygen intake of the fish as related to their size [Piper et al. 1982]. Availability of water can be a constraint in this regard. Inevitably, a large number of fish must be reared in re-used water for much of their hatchery residence, but regular cleaning, improved feeds, and regular diagnostic checks by OFHC prevent or minimize the onset of disease.
- Also, the specific raceway populations are reduced by 10% for each reuse (e.g. B bank is 10 % lighter than A bank and D bank is 10% lighter than B bank).

b) Number of fry ponded each year, including % hatch each year

See section 4b). Fry are ponded at approximately 70,000 per raceway.

7. Rearing/feeding protocols⁴⁰

Fry are started in raceways at about 70,000 each and fed initially five times per day. Raceways are cleaned and fed daily except on weekends. The raceway flows are 500 gpm. When the fish reach 300 fpp they are fed 4 times a day. When they reach 150 fpp they are fed three times a day. Sample counts are done several times a month throughout rearing. Inventories are also done several times a year with a new fish counting system and also with the tag trailer

³⁸ QLNFH CHMP p. 34, 35.

³⁹ QLNFH CHMP p. 3.

⁴⁰ pers. comm. Dan Magnuson, US Fish and Wildlife Service 2008.

USFWS Olympic Peninsula Hatchery Review Team
Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

counting system. Also, all pond brushes, brooms, and nets are disinfected in iodophore solution between ponds.

8. Fish growth profiles⁴¹

Average size at end of month – (Broods 1979-2001)

Month	Size (fpp)
January	1310
February	1034
March	514
April	278
May	152
June	94
July	60
August	43
September	36
October	33
November	30
December	29
January	26
February	24
March	21
April	19
May	18

9. Fish health protocols and issues⁴²

3.6.1 Fish Health Policy - The OFHC provides the fish health care for Quilcene NFH under the auspices of the published policy 713 FW in the FWS Manual (FWM). In addition, other fish health measures may be adopted after consideration by the HET. Fish health exams must be done prior to releases. Fish health inspections as defined by the FWS Handbook/AFS Blue Book must be performed approximately 6 weeks before any transfer. The fish health management programs at Quilcene NFH meet or exceed the Co-managers' Salmonid Disease Control Policy of 1998.

⁴¹ pers. comm. Dan Magnuson, US Fish and Wildlife Service, 2008.

⁴² QLNFH CHMP p. 36-38.

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

In general, movements of live fish into or out of the hatchery must be noted in the State of Washington Future Brood Document for the hatchery. If a fish transfer or release is not in the Future Brood Document, permits from the Service, WDFW, and any other states through which the fish travel must be obtained and approved by the co-managers. Fish health exam or certification must be done prior to any releases or transfers from the hatchery to minimize risks from possible disease transmittance.

3.6.2 Management Changes Affecting Fish Health since 1993 - In 1993, the hatchery's spring Chinook program was discontinued due to poor adult returns and significant mortality of juveniles resulting from Bacterial Kidney Disease (BKD). Termination of this program reduced the amount of BKD on station, thus reducing the risk to the other species on station.

Prior to 1997, epizootics (defined as average daily mortality of at least 0.1% daily for 5 consecutive days) of Bacterial Coldwater Disease occurred on a regular basis in coho salmon and required treatment with antibiotics. Starting in 1997, densities were reduced, in particular initial ponding densities, which has reduced mortality such that antibiotic treatment has not been required for approximately 8 years. Prior to this time, the initial pondings resulted in densities that exceeded 0.33 lb/ (inch x ft³) before the first split. The current density goal is not to exceed 0.20 lb/ (inch x ft³). An iodine pre-rinse prior to water hardening was instituted to decrease transfer of bacteria from ovarian fluid to the eggs. Flow rates in the vertical incubator stacks were increased to 4 gpm. In addition, when eggs were treated with formalin for fungus control, hatchery staff instituted the introduction of formalin at the head and midway down the trough to help insure consistent therapeutic levels. This change in protocol also likely resulted in reduced Bacterial Coldwater Disease.

While decreasing densities and other management changes have dramatically reduced the amount of Bacterial Coldwater Disease on station, this disease continues to cause sporadic mortality. BKD is also associated with low level mortalities. In an effort to continue to improve fish health, the co-managers agreed by consensus to lower coho production in 2005 from 450,000 to 400,000 on-station release.

Based on the evolving information on best management practices for fish culture, the Quilcene HET continually evaluates and adapts to optimize fish health within the limits of budget and the facility itself.

Note: The OFHC also recommends that flow indices not exceed 1.0 and pond turnover intervals should be every 30 minutes.

3.6.3 Fish Health Examinations - Monthly examination: A fish health biologist (FHB) from OFHC visits at least monthly to examine fish at the hatchery. Based on observations of fish, input from the hatchery staff, and hatchery records, the FHB will determine numbers and distribution of the fish to be tested, as well as what tests will be employed.

Diagnostic Examination: Additional fish health exams are performed as determined by the FHB and/or when requested by hatchery or WWFWO personnel.

Broodstock Health Evaluation: The number of broodstock sampled will meet or exceed the minimum requirements in the USFWS Handbook/AFS Bluebook and the Washington Co-managers' Salmonid Disease Control Policy of 1998. The number and type of fish samples taken is based on programs and disease history.

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

The Service’s Abernathy Fish Technology Center provides feed quality analysis to insure that feed manufacturers are meeting nutrient specifications to avoid nutritional diseases and contribute to healthy fish.

10. Chemotherapeutant use⁴³

3.6.4 Chemotherapeutic Use - It has been, and will continue to be, the philosophy of the HET to minimize treatment of fish/eggs with drugs by practicing sound fish culture and disinfection practices. However, in some cases, medications must be used:

- Treatment of Eggs: Polyvinylpyrrolidone (PVP) iodine at 75 ppm for 30 minutes during water hardening is used to disinfect eggs. Formalin at 1:6000 (167 ppm) for 15 minutes beginning one day after fertilization is used to control fungus on the eggs and is currently applied three times per week for approximately eight weeks.
- Treatment of Adults: Adults are treated with 250-500 ppm of hydrogen peroxide for 1 hour, 3 days per week, for the duration of holding.
- Treatment of Juveniles: Treatment of juveniles does not occur on a regular basis. If a treatment is indicated, the FHB will make recommendations to the HET and collaboratively determine a treatment plan.
- Pond brooms, mortality pickers, boots, and crowders are disinfected with iodine solution between ponds. Spawning knives and buckets are disinfected with iodine solution between each group of fish handled.
- Tank trucks, fish pumps, and tagging trailers are disinfected before being brought onto the station and after use in the hatchery, as warranted, during operations at the hatchery. More specific fish health guidelines regarding marking and tagging are found in Attachment 4.

11. Tagging and marking of juveniles⁴⁴

This section briefly describes current juvenile marking and adult sampling, both mark-related and genetic, that provides data for estimation of short- and long-term post-release survival, fishery contribution estimates, and changes in genetic profiles. Coded-wire tagging [Jefferts et al. 1963] is the primary identification system used for generation of these estimates. Tagging and sampling goals are presented in Table 4. These goals were developed based on statistical accuracy of the final survival and contribution estimates. Tag groups are replicated as recommended by the “PSC Workshop on Hatchery CWT Methodology” [Sands 1995]. Current Quilcene NFH tag program costs are summarized in a document entitled “Hatchery Support Activities Costs Review” [USFWS 2001].

Table 4. Current Quilcene NFH tagging and sampling goals.

⁴³ QLNFH CHMP p. 38.

⁴⁴ QLNFH CHMP p. 38, 39.

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

Species	Juveniles			Adults		
	Production goal	Mark/tag	Number	Mark/tag sample rate	Scale sample rate	Number of genetic samples
Coho, on-station	400,000	Tag/clip	48,000	50%	n/a	100
		Tag/no clip	48,000	50%	n/a	
		Clip only	304,000	50%	n/a	
Coho, pen transfer	200,000	Tag/clip	45,000	50%	n/a	
		Clip only	155,000	50%	n/a	

The on-station production occupies about 15 raceways in B and D banks. Four unique coded-wire tag groups of 10,000 each and four more unique groups (DITs) of 10,000 each are tagged into four separate raceways (one pair of clipped and tagged and tagged only (DIT)). Usually three in B bank and one in D bank. The ponds are selected so that as many spawn takes as possible are represented by the tags. The remaining fish are adipose clipped (mass marked).

The Quilcene Bay Pen fish occupy seven raceways in A bank. In this case since the fish are ultimately going to be moved to a single saltwater pen, one unique code and adipose clip is applied to 40,000 fish in two of the raceways. No DIT is applied. The remaining fish are adipose clipped (mass marked).

3.7.1 Mass Marking Law - The FY 2003 appropriations language (House bill, Conference Committee and Omnibus Appropriations) requires the FWS to “implement a system of mass marking of salmonid stocks released from federally operated or federally financed hatcheries including but not limited to fish releases of the coho, Chinook, and steelhead species. The requirements of this section shall not be applicable when the hatchery fish are produced for conservation purposes.” The House Report further states that the FWS is expected to be a “full participant in this effort by ensuring that hatchery fish that are suitable/available for selective fisheries are visually marked to assist in the identification and recovery of wild salmonid stocks.”

The mass marking law did not affect Quilcene in that coho mass marking was implemented in 1997 for the very same reasons as stipulated in the law. However, it does guide the future of the marking program regardless of future fish production changes.

USFWS Olympic Peninsula Hatchery Review Team
Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

12. Fish Release

a) Protocols

The fish are force released from the raceways usually late in the day and coordinated with expected high marine tides. Target date is about May 1 at between 15-20 fpp.

The fish destined for the Quilcene Bay net pen program are trucked and barged to the pens. A target size of 25 fpp has been the standard measure which historically has triggered the transfer to occur in February. However, in recent years the transfer has occurred in March to avoid as many marine algal blooms as possible. Logistics regarding trucks, barges, and especially weather complicate this transfer.

b) Number of fish released each year⁴⁵

Quilcene NFH On-Station Releases

Date	Stage	Number	Size(fpp)
5/2/1997	Yearling	425,971	15.7
5/4/1998	Yearling	452,203	18.6
5/7/1999	Yearling	437,222	17.7
5/10/2000	Yearling	343,725	18.9
5/1/2001	Yearling	428,994	19.6
4/25/2002	Yearling	411,674	20.3
5/5/2003	Yearling	388,212	22.3
4/30/2004	Yearling	404,582	21.1
4/28/2005	Yearling	361,891	22.3
5/3/2006	Yearling	488,080	22.3

Quilcene Bay Net Pen Transfers

Date	Stage	Number	Size (fpp)
2/18/1997	Yearling	225,288	19.6
2/23/1998	Yearling	239,730	24.0
2/11/1999	Yearling	190,006	25.4
2/20/2000	Yearling	208,908	27.8
2/14/2001	Yearling	211,165	22.8
2/7/2002	Yearling	212,200	25.6
2/13/2003	Yearling	180,187	24.2
3/8/2004	Yearling	202,335	29.5
3/17/2005	Yearling	180,582	28.1
2/9/2006	Yearling	199,191	25.7

⁴⁵ USFWS 1991

D. Program benefits and performance

1. *Adult returns*⁴⁶

a) Numbers of adult returns, SARs, etc.

Quilcene NFH coho adults (3 year), from CWT recoveries				
Broodyear	smolt:adult survival	total adults produced	escapement to hatchery rack	harvested adults
1989	2.57%	9,071	2,066	7,005
1990	4.03%	20,178	7,511	12,667
1991	9.39%	37,338	13,055	24,283
1992	5.32%	21,322	12,183	9,139
1993	3.60%	15,300	6,248	9,052
1994	4.74%	24,834	19,072	5,762
1995	2.83%	12,050	7,898	4,152
1996	1.04%	4,804	4,253	551
1997	3.89%	16,580	11,312	5,268
1998	4.40%	16,971	10,448	6,523
1999	4.50%	19,166	15,436	3,730
2000	3.70%	16,480	10,777	5,703
Mean	4.17%	17,841	10,022	7,820

b) Return timing and age-class structure of adults⁴⁷

Age range 2-3 years and average 2.9 (1985-2006). Entry date range July – December and mean entry September 25.

2. *Contributions to harvest and utilization (e.g. food banks)*

- For Quilcene NFH coho released at the hatchery, the program confers significant sport, tribal, and commercial harvest benefits as well as returns to the hatchery that are used for broodstock and subsistence. For broods 1993-2002, on average approximately 16,500 coho are recovered annually. The distribution of those recoveries is: 62% (10,200) recovered at the Quilcene NFH; 2% (300) from US commercial fisheries; 15% (2,500) from US sport fisheries; 19.0% (3,100) from treaty tribal fisheries; 1% (150) from Canada commercial fisheries; 1% (150) from Canada sport fisheries; 0.2% (30) from spawning ground surveys; and 0.03% (5) recovered from research type activities. [RMIS 2008]
- For Quilcene NFH coho released at the Port Gamble net pens, the program confers significant sport, tribal, and commercial harvest benefits. For broods 1993-2002, on average approximately 5,900 coho are recovered annually. The distribution of those recoveries is: 4% (235) recovered at various hatcheries; 6% (350) from US commercial fisheries; 30% (1775) from US sport fisheries; 50% (2950) from treaty tribal fisheries;

⁴⁶ QLNFH HGMP.

⁴⁷ USFWS 2006a.

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

0.6% (35) from Canada commercial fisheries; 2% (100) from Canada sport fisheries; 8% (475) from spawning ground surveys; and 0.03% (2) recovered from research type activities. [RMIS 2008]

- For Quilcene NFH coho released at the Quilcene Bay net pen, the program confers significant sport, tribal, and commercial harvest benefits. For broods 1993-2002, on average approximately 4,000 coho are recovered annually. The distribution of those recoveries is: 54% (2,200) from Quilcene NFH; 1% (40) from US commercial fisheries; 21% (850) from US sport fisheries; 23% (900) from treaty tribal fisheries; 0.3% (10) from Canada sport fisheries; 0.5% (20) from spawning ground surveys; 0.05% (2) recovered at various hatcheries other than Quilcene; and 0.07% (3) recovered from research type activities. Brood years 1989 – 2000 averaged 10,022 adults to the rack and 7,820 to harvest (or about 56% to the rack and 44% to harvest-see section a) above). Most of the rack return is distributed to Tribes for subsistence purposes. The remainder, excluding those held for spawning and treated with fungus control drugs, are picked up by a commercial processor according to our Oregon Food Bank cooperative agreement. [RMIS 2008]
- The returns to the Quilcene NFH rack have ranged from 1,415 to 28,882 coho between 1986 and 2006. The rack returns averaged 3,359 fish between 1986 and 1993. The average rack returns averaged 11,492 between 1994 and 2006. Closure to the West Coast Vancouver Island Canadian Fishery occurred in the mid 1990's. The average surplus return between 2001 and 2005 was 13,217 adult coho salmon. 54% of the surplus returns were distributed to area tribes for subsistence, 42.6% were sent to processors, and 1.9% were released above the weir [pers. comm. D. Zajac, USFWS, 2008]

Table: Disposition of Excess Quilcene NFH Coho, return years 1990-2005 [pers. comm. D. Zajac, USFWS, 2008]

Year	Total Excess	% Pushed Back into River	% Subsistence	% Processor	% Buried
1990	2,094	0.0	100.0	0.0	0.0
1991	2,054	0.0	96.3	0.0	3.7
1992	1,649	0.0	79.4	0.0	20.6
1993	6,002	1.8	95.5	0.0	2.7
1994	12,850	0.0	100.0	0.0	0.0
1995	18,595	0.0	55.4	44.6	0.0
1996	6,757	0.0	70.3	28.7	1.0
1997	24,136	1.7	71.8	26.5	0.0
1998	9,662	0.0	79.6	20.4	0.0
1999	5,602	0.0	85.6	14.4	Few
2000	14,286	0.0	38.2	61.8	0.0
2001	15,575	2.4	62.1	35.4	Few
2002	12,214	0.0	46.2	53.8	Few
2003	14,592	2.1	34.4	63.5	Few
2004	11,141	2.7	71.7	20.6	4.9
2005	12,561	2.4	61.7	35.9	Few
Average	10,610	1.0	65.0	33.3	0.7

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

3. Contributions to conservation

None identified.

4. Other benefits

In the past Quilcene coho have been taken to the raptor rehabilitation center in Sequim and also used for educational presentations at local schools.

E. Research, monitoring, and evaluation programs

- Current production survival and contribution are monitored using coded-wire tags as previously described in section C.10.
- Historically, Quilcene NFH coho salmon releases have been tagged for survival and contribution monitoring and for coast-wide harvest management from brood 1977 to 1981 and continuously from brood 1987 to present. Also, some specific off-station releases were tagged as early as brood 1974. Early survival estimates were reported to range between 5.87% to 10.49% for on-station releases and 0.63% to 5.65% for off-station releases [Knudsen et al. 1989][QLNFH CHMP page 86].
- Quilcene is currently involved in the Hood Canal steelhead supplementation study. Quilcene's involvement began in 2007 and is planned through 2014.
- Also, tissues are collected as standard operation procedure annually to track long term trends and changes regarding the genetic profile of Quilcene coho.

F. Program conflicts

1. Biological conflicts (e.g. propagated stock maladapted to hatchery water source)

None identified.

2. Harvest conflicts (e.g. mixed stock fishery on hatchery and wild fish limits harvest opportunities on hatchery fish)

Quilcene NFH hatchery coho co-mingle with listed summer chum at return. Most of the fishery is conducted with beach seines and generally incidental harvest of chum is regulated. There are some additional scheduled gill net openings later in the return.

USFWS Olympic Peninsula Hatchery Review Team
Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

3. Conservation conflicts and risks

a) Genetic conflicts associated with straying and natural spawning of hatchery fish (Stray rates, proportion of hatchery-origin fish on natural spawning grounds, etc. Provide tables or figures where appropriate)

- As noted in previous sections there is a potential for straying to occur from the saltwater net pen programs in Quilcene and Port Gamble Bays. However, the genetic analyses would suggest that there has been little impact to local wild stocks.
- The following are tables describing the extent that Quilcene NFH stock coho stray from each of the three release locations (Port Gamble Bay net pens, Quilcene Bay net pen, and Quilcene NFH. Data extracted from the Regional Mark Information System, [RMPC 2008 - www.rmhc.org, compiled by USFWS staff].

Table. Quilcene NFH stray recoveries

Brood Year	Brood Source	Approximate Number Released	Recovery Location	Estimated Number Recovered	Estimated Total Harvest
1993	Quilcene	425,000	Big Beef	91	9,250
1994	Quilcene	524,000	Grovers	12	5,900
			Jorsted Creek	1	
1995	Quilcene	426,000	Big Beef	84	4,475
			Little Quilcene River	9	
1996	Quilcene	452,000	Big Beef	10	500
1997	Quilcene	437,000	Big Beef	5	5,775
1998	Quilcene	344,000	Big Beef	78	6,600
			Johnson Creek	4	
1999	Quilcene	429,000			3,350
2000	Quilcene	412,000	Big Beef	92	4,400
			Fulton Creek	1	
			Lilliwaup Creek	1	
2001	Quilcene	388,000	Big Quilcene River	4	11,800
			Duckabush River	1	
			Fulton Creek	1	
			Garrison Hatchery	4	
			George Adams	8	
			John	5	

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

			Creek		
			Johnson Creek	4	
			Lilliwaup Creek	1	
			Walcott Slough	1	
2002	Quilcene	404,000	Big Quilcene River	3	12,900
			Little Quilcene River	2	

Table. Stray rates of Quilcene NFH coho to Big Beef Creek from Quilcene NFH as a % of harvest and release

Brood Year	Approximate Number Released	Recovery Location	Estimated Number Recovered	Estimated Total Harvest	% of harvest	% of release
1993	425,000	Big Beef	91	9,250	0.98%	0.02%
1995	426,000	Big Beef	84	4,475	1.88%	0.02%
1996	452,000	Big Beef	10	500	2.00%	0.00%
1997	437,000	Big Beef	5	5,775	0.09%	0.00%
1998	344,000	Big Beef	78	6,600	1.18%	0.02%
2000	412,000	Big Beef	92	4,400	2.09%	0.02%
					1.37%	0.01%

Table. Quilcene Bay net pen stray recoveries

Brood Year	Brood Source	Approximate Number Released	Recovery Location	Estimated Number Recovered	Estimated Total Harvest
1996	Quilcene	240,000	Big Beef	8	335
1997	Quilcene	190,000	Big Beef	42	3,100
			Big Quilcene River	2	
1998	Quilcene	209,000	Minter Creek Hatchery	4	6,350
2000	Quilcene	212,000	Big Beef	93	2,800
			Eagle Creek	2	
			George Adams	6	
			Johnson	4	

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

			Creek		
			Pierce Creek	2	
			Seabeck Creek	2	
2001	Quilcene	180,000	Big Beef	18	1,655
			Johnson Creek	8	
2002	Quilcene	202,000	Big Quilcene River	10	1,600
			Hamma	3	
			John Creek	10	
			Little Quilcene	13	
			Minter Creek Hatchery	5	
			Rocky Brook	3	

Table. Stray rates of Quilcene NFH coho to Big Beef Creek from Quilcene Bay net pen as a % of harvest and release

Brood Year	Approximate Number Released	Recovery Location	Estimated Number Recovered	Estimated Total Harvest	% of harvest	% of release
1996	240,000	Big Beef	8	335	2.39%	0.00%
1997	190,000	Big Beef	42	3,100	1.35%	0.02%
2000	212,000	Big Beef	93	2,800	3.32%	0.04%
2001	180,000	Big Beef	18	1,655	1.09%	0.01%
2002	202,000	Big Quilcene River	10	1,600	0.63%	0.00%
					1.76%	0.02%

Table. Port Gamble Bay net pens stray recoveries

Brood Year	Brood Source	Approximate Number Released	Recovery Location	Estimated Number Recovered	Estimated Total Harvest
1993	Quilcene	272,000	Big Beef	150	870
			George	5	

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

			Adams		
			Hoodsport	10	
			Portage Bay	5	
1994	Quilcene	230,000	Big Beef	53	3,250
			Hoodsport	14	
			Lilliwaup Creek	1	
			Queets	5	
			Seabeck Creek	5	
1995	Quilcene	342,000	George Adams	7	1,350
			Hoodsport	52	
			Minter	7	
1996	Quilcene	440,000	Big Beef	277	3,500
			George Adams	9	
			Hoodsport	30	
			Minter	3	
1997	Quilcene	103,000	Big Beef	1	250
			Minter	1	
1998	Quilcene	390,000	Big Beef	1,100	12,500
			Cowling	4	
			Dogfish Creek	4	
			Gamble Creek	47	
			Garrison	14	
			George Adams	195	
			Grovers	4	
			Hoodsport	716	
			Lower Elwha	4	
			Martha John Creek	3	
			Portage Bay	4	
			Quilcene	30	
			Steele Creek	1	
			Creek	1	
1999	Quilcene	47,000	Big Beef	142	1,000
			Gamble Creek	30	
			George Adams	38	
			Hoodsport	31	
			Lilliwaup Creek	1	
			Minter	5	
			NF Skok	1	
			Creek	1	
2000	Quilcene	432,000	Big Beef	245	4,500

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

			Gamble Creek	1	
			George Adams	26	
			Hoodsport	10	
			Martha John Creek	4	
			Minter	5	
2001	Quilcene	409,000	Big Beef	108	1,600
			George Adams	56	
			Hoodsport	36	
2002	Quilcene	45,000	Big Beef	192	2,500
			Blackjack Creek	1	
			Dewatto River	1	
			George Adams	12	
			Hoodsport	3	
			Lilliwaup Creek	1	
			McTaggart Creek	1	
			Minter	4	

Table. Stray rates of Quilcene NFH coho to Big Beef Creek from Port Gamble Bay net pens as a % of harvest and release

Brood Year	Approximate Number Released	Recovery Location	Estimated Number Recovered	Estimated Total Harvest	% of harvest	% of release
1993	272,000	Big Beef	150	870	17.24%	0.06%
1994	230,000	Big Beef	53	3,250	1.63%	0.02%
1995	342,000	George Adams	7	1,350	0.52%	0.00%
1996	440,000	Big Beef	277	3,500	7.91%	0.06%
1997	103,000	Big Beef	1	250	0.40%	0.00%
1998	390,000	Big Beef	1,100	12,500	8.80%	0.28%
1999	47,000	Big Beef	142	1,000	14.20%	0.30%
2000	432,000	Big Beef	245	4,500	5.44%	0.06%
2001	409,000	Big Beef	108	1,600	6.75%	0.03%
2002	45,000	Big Beef	192	2,500	7.68%	0.43%
					7.06%	0.12%

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

b) Ecological conflicts (e.g. competition between hatchery fish and wild fish, predation,)

- There is the potential for coho yearling releases to prey on summer chum. However, there is about a two month separation in outmigrant times between the two species.

4. Other conflicts between the hatchery program, or fish produced by the program, and other non-hatchery issues

None identified.

G. Other information

Table. Assessment of coho harvest and surplus and production options [Review Team, 2008]

Table 4. Estimated total and adjusted natural escapement of coho salmon to marine area 12A streams, 1986 through 2005

Return year	QNFH + QNP	QNFH rack escapement	"Off Station" Stray rate	OffStat strays to QNFH	Total 12A nat escape	OffSt strays other streams	Adj QNFH escapement	Harvest only	Harvest + Rack estimated	SAR	Adj 12A nat escape	Off station escapemnt
1986		2,055		0	500		2,055					
1987		2,621	0.1511	396	500	76	2,225				424	472
1988		3,357	0.0955	321	300	29	3,036				271	349
1989		7,397	0.0955	706	500	48	6,691				452	754
1990		2,569	0.0955	245	250	24	2,324				226	269
1991		2,121	0.0745	158	600	45	1,963				555	203
1992		1,664	0.1496	249	300	45	1,415				255	294
1993	600000	7,698	0.0698	537	400	28	7,161	3,069	10,230	0.017	372	565
1994	600000	14,326	0.0955	1,368	600	57	12,958	5,553	18,511	0.031	543	1,425
1995	600000	16,001	0.0955	1,528	1,300	124	14,473	6,203	20,676	0.034	1,176	1,652
1996	600000	7,938	0.0325	258	900	29	7,680	3,291	10,971	0.018	871	287
1997	600000	28,882	0.0000	0	400	0	28,882	12,378	41,260	0.069	400	0
1998	600000	10,497	0.2166	2,274	1,300	282	8,223	3,524	11,748	0.020	1,018	2,555
1999	600000	6,620	0.2843	1,882	250	71	4,738	2,031	6,768	0.011	179	1,953
2000	600000	15,225	0.2947	4,487	670	197	10,738	4,602	15,340	0.026	473	4,684
2001	600000	16,205	0.2634	4,269	190	50	11,936	5,115	17,051	0.028	140	4,319
2002	600000	14,112	0.0000	0	650	0	14,112	6,048	20,160	0.034	650	0
2003	600000	16,341	0.2952	4,824	490	145	11,517	4,936	16,453	0.027	345	4,969
2004	600000	11,712	0.0363	425	1,030	37	11,287	4,837	16,124	0.027	993	462
2005	600000	13,977	0.2063	2,884	710	147	11,093	4,754	15,847	0.026	563	3,031
2006	600000	1,909	0.0795	152	430	34	1,757	753	2,510	0.004	396	186
2007	600000	0	0.0000	0	310	0	11,183	4,793	15,975	0.027	310	0

Average from Quilcene Bay Net pens from 1993-2002 fr

Total from QB and QNFH

2200 1800 4000
13,383 6,593 19,975 0.033

Smolt production 432,000 400,000 375,000 350,000

Total return at 3.3% SAR 14,382 13,317 12,484 11,652

Needed for broodstock + release 1,800 1,800 1,800 1,800

Mean harvest 6,593 6,593 6,593 6,593

Surplus 5,990 4,924 4,092 3,260

Broodstock need 1,800

Surplus 9,383

Smolts needed to produce broodstock 54,068

Smolts needed to produce surplus 347,501

Smolts needed to produce harvest 143,955

IIB. Quilcene NFH, Hood Canal Steelhead

A. General information

- This program contributes to the conservation and recovery of listed Puget Sound steelhead.
- We are supporting the incubation of eyed eggs brought in from the Dewatto and Duckabush Rivers. The resulting fry are then transported to Lilliwaup Hatchery (LLTK) pending negative fish health findings from pre-release sampling. We began our involvement in 2007 and expect to be involved through 2014.
- See Hood Canal Steelhead Supplementation Project HGMP (2006) and Hood Canal Steelhead Supplementation Project Study Plan (2006) for the entire description of the project.

B. Description of program and operations

1. Incubation

- Eyed eggs pumped from steelhead redds in the Dewatto and Duckabush are brought to the I/Q unit about weekly, disinfected in iodophore, and placed one redd per Heath tray. Stack flows are maintained at 4 gpm. The different stocks are maintained in separate stacks. Chillers are used to “equalize” hatch dates to the extent possible in order to create as few “batches” as possible. This is done so that pre-release fish health inspections require as few sacrificed fish as possible. Resulting disease free fry are transported to Lilliwaup for extended rearing. Details of I/Q unit operation follow:
- The isolation/quarantine building was constructed to allow for flexibility in management of depressed or endangered fish stocks or other aquatic species. Any aquatic organisms brought in could be isolated from the production fish on station to prevent transmission of any potential diseases.
- Construction of the isolation/quarantine building at Quilcene NFH was completed in the summer of 1999. The building has eight vertical incubators (half stack) with eight drawers each; two deep egg troughs that can incubate to the eyed egg stage; an egg working trough; water chillers to mark otoliths; and a packed column to remove nitrogen gas from water. The effluent can be treated with chlorine, routed to a 1500 gallon contact chamber (30 minutes) and then dechlorinated prior to entering the Big Quilcene River. Chlorine monitors are located in the chlorine contact chamber and at the outfall from the dechlorinator. These monitors are connected to the station’s alarm system.
- The water source is Well #1, which has redundant 50 gallon per minute pumps. A back-up propane generator serves the isolation/quarantine building, Well #1, and the drum screens/lights at the settling pond for Big Quilcene River water.

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

- The resulting fry are temporarily reared in oval start tanks with conical bottoms with flows set at 2 gpm. There are 20 tanks available in two lines. The two stocks are reared in separate lines. Tank volume is 6.28 cubic feet. Each tank has its own dedicated cleaning equipment (brush, net).

III. Quinault National Fish Hatchery

A. Description of hatchery⁴⁸

2.3 Facility and Site Descriptions - The Quinault NFH occupies 79.45 acres. Its main facilities consist of thirty-six, 16-foot-wide by 80-foot-long raceways (converted Burrows), two water re-use pumps, a pollution abatement pond, and three water intake structures. The main intake structure is located on Cook Creek, and a smaller one on Hatchery Creek. A third intake structure siphons water from a large pond adjacent to the Moclips Highway approximately 2 miles northeast of the facility. The hatchery diverts returning adult salmon to holding facilities by means of an electrical fish barrier and fish ladder. The facility also includes an administration building, which houses the main office, a conference room and a visitor's center with interpretational information and displays. A separate hatchery building contains a room that holds the incubation trays and fry start tanks, a lunch room and a gear locker room. Additionally, the facility has an electric weir control building, an egg isolation/quarantine building, a service/shop/feed building, a welding-metal craft/vehicle and equipment storage building that also houses the emergency power generator room, a hazardous materials storage, and domestic water pumps. All buildings are situated on the north side of Cook Creek. There are three permanent government residences and five temporary residential trailer pads. Permanent residences are reserved for required-occupancy staff. Temporary residential pads are used by camp-host volunteers and non-required occupancy staff. All residences are located adjacent to the north portion of the facility (figure 3).

⁴⁸ QNNFH CHMP draft p. 9, 11-13.

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

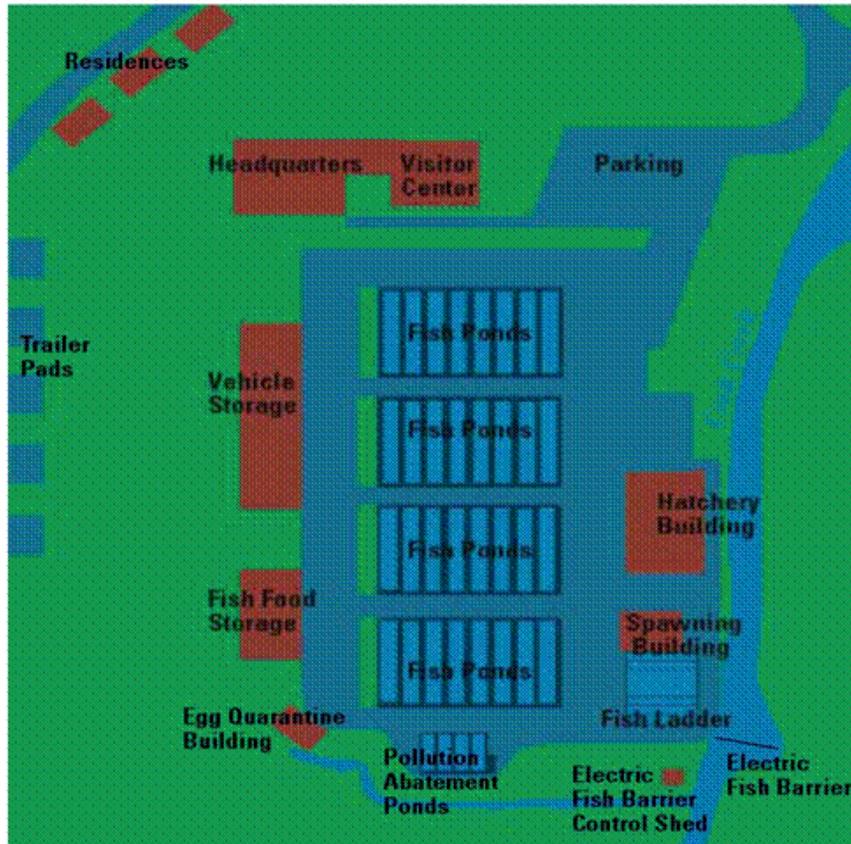


Figure 3. Quinault NFH Site Map.

2.3.1 Isolation/Quarantine Building – The isolation/quarantine building was constructed to allow for flexibility in management of depressed or endangered fish stocks or other aquatic species. Any aquatic organisms brought in can be isolated from the production fish on station to prevent transmission of potential diseases.

Construction of the isolation/quarantine building at Quinault NFH was completed in the summer of 2003. The building has twenty half stack vertical incubators with seven trays available for incubation. The effluent can be treated with chlorine, routed to a contact chamber for 30 minutes and de-chlorinated prior to entering the station's pollution abatement pond, from where it eventually is discharged into Cook Creek. One chlorine monitor is located in the chlorine contact chamber and one at the outfall from the de-chlorinator. These monitors are connected to the

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

station's alarm system. The monitors check for enough chlorine in the contact chamber and the lack of chlorine in the water that is returned to the creek.

The water can be drawn from either one of two sources, or the two may be mixed. The preferred source originates from siphon-pumped water in a pond approximately 2 miles northeast of the hatchery. The other source is delivered from Hatchery Creek and is more susceptible to turbid water flows from November through mid-December.

2.4 Archeology/Cultural Resources - Historically, two Quinault Indian villages were located at the mouth of Cook Creek, which the Quinault Indians locally referred to as Salmon River. According to Justin James of the Quinault Indian Nation, the name indicates that the local Indians fished in the creek, probably hunted in the area, and used the spring for drinking water (Justine James, per. comm., 2005). A spring adjacent to the Cook Creek intake road is used for hatchery domestic water supply. This spring is also currently used by local Tribal members for drinking water.

Historically, two Quinault Indian villages were located at the mouth of Cook Creek, which the Quinault Indians locally referred to as Salmon River. According to Justin James of the Quinault Indian Nation, the name indicates that the local Indians fished in the creek, probably hunted in the area, and used the spring for drinking water (Justine James, per. comm., 2005). A spring adjacent to the Cook Creek intake road is used for hatchery domestic water supply. This spring is also currently used by local Tribal members for drinking water.

2.4.1 Historical Site Development at Quinault NFH - With authorization of Quinault NFH in 1964, most of the original hatchery property was acquired by lease and purchase from members of the Quinault Indian Nation. Additional property was purchased from Rayonier Incorporated.

Additional access to hatchery water structures on USFS land was obtained via a MOA and "Road Use Permit" with the USFS.

A brief account of further structural and facility changes at Quinault NFH follows (see Figure 3 for present-day hatchery facilities):

- 1967-68** Cook Creek, Hatchery Creek intakes installed. Residences 1, 2, and 3 constructed.
- 1968-72** Vertical egg incubators and fiberglass troughs installed.
- 1969** Hatchery building constructed.
- 1970** Original fish weir constructed.
- 1972** Construction completed for administration building and visitors' center, equipment storage building, fire house, 24 Burrows ponds, and 6 adult holding ponds.
- 1974** Construction completed on pollution abatement pond.
- 1976** Construction completed on spawning building, and feed storage building.
- 1996** Burrows ponds in A, B, C, D banks converted to flow-through raceways.
- 1998** Installation of re-use pumps and associated conveyance system.
- 2002** Electric fish barrier replaced with a graduated electric field model.
- 2003** Egg isolation/quarantine unit constructed, and one residence building was rebuilt.
- 2006** A 15-foot physical barrier installed on the upstream edge of the main deck of the electric weir to improve operations during low flows.

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

B. Hatchery water sources⁴⁹

3.1 Water Use and Management - Cook Creek provides the primary source of water for fish production at Quinault NFH. In addition to the 5,000 - 31,000 gpm flow available from Cook Creek, water from Hatchery Creek (500 - 1,500 gpm.) and a spring-fed pond (0-1,200 gpm) is used for incubation and fish production. Water from A – D bank ponds can be reused in E bank via pump.

Quinault NFH holds the following certificates of water:

Certificate No.	Permit No.	Source	Purpose of Use	Priority Date	Amt CFS
S2-00875C	14826	Cook Creek	Fish propagation	7-13-1966	50.0
S2-00876C	14827	Hatchery Creek	Fish propagation	7-13-1966	5.0
S2-00747C	N/A	Unnamed spring	Domestic supply	3-14-1971	0.23

3.1.1 Cook Creek Water Rights – Quinault NFH has water rights on Cook Creek established on July 13, 1966, for an allotment of 50 cfs. Water diverted from Cook Creek is the main supply of production water to the outside raceways and adult collection facility. Water quality and quantity is essential to the entire production program. Cook Creek water is reliable although flows decline in the late summer months. The quality of water from Cook Creek is good although it does contain varying amounts of tannin and sediment. Water quality does degrade during high creek flows, elevating sediment loads during and after prolonged periods of intense precipitation.

3.1.2 Hatchery Creek Water Rights - Quinault NFH holds water rights on Hatchery Creek for up to 5 cfs as established on July 13, 1966. Diversion from this source supplements hatchery production reared in outside raceways and is the main source for incubation and fry rearing indoor tanks. It is also a source available for use in the egg isolation/quarantine unit. Flow from this source is relatively stable and quality is affected by prolonged and intense precipitation activity.

3.1.3 Hatchery Domestic Water Supply – Because it is located on Quinault Indian Reservation, Quinault NFH’s drinking water system is not subject to monitoring under the Washington State Department of Health (Chapter 246-291 WAC). However, samples of domestic water from four source points (two on-station, one off-station and one from quarters) are submitted monthly to Grays Harbor County Health Department for precautionary pathogen tests. An unnamed spring is used by local Tribal members for drinking water also.

3.1.5 Screening – At Cook Creek, intake water passes over screened wire panels that meet NOAA Fisheries mesh requirements of 3/32 inch (Glenn Green, USFWS, pers. comm., 2000) [Photo 2]. At Hatchery Creek, intake chamber water also passes over screened wire panels. Below the screened panels, water mixes with water collected from a larger spring-fed collection pond located

⁴⁹ QNNFH CHMP draft p. 30-32.

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

approximately 2 miles east of the hatchery (Photo 3). This blending occurs in the mixing box before the water is fed into a line that travels to the nursery building and the isolation/quarantine unit when operating.

3.1.6 Conveyance System to Hatchery and Ponds - The hatchery can rely on three water sources: Cook Creek, Hatchery Creek, and an unnamed, spring-fed pond. All sources use some type of a conveyance system to transport water to the hatchery.

3.1.7 Cook Creek Conveyance System -

Water delivered to Quinault NFH is collected through a bar raked intake chamber (Photo 4). The intake chamber is located on the north bank of Cook Creek. A motorized diversion gate (powered via portable electrical generator) controls the water flow from Cook Creek to the hatchery. During periods of high and turbid flows, this gate remains open to allow gravel and sediment to pass through a by-pass channel. An inner gate controls water to the main supply line. Failure to raise the diversion gate during high water will result in the buildup of materials that may clog the main intake line. A clogged intake line would stop the water flow into the hatchery.



Photo 4. Cook Creek main intake diversion control gate.

The inner gate valve is operated manually, which allows for precise control of water to the hatchery. A 48-inch main supply line from Cook Creek is buried approximately 3 feet under the intake road. From the valve pit the Cook Creek intake chamber and diversion gate are located 4,144 feet upstream, on Cook Creek. From the intake chamber the water flows 900 feet through the 48-inch line to the screen chamber and adjoining head box. The 48-inch main line enters the chamber roughly at a 45-degree angle at the northeast corner of an inclined screen chamber. The inclined screen chamber carries and empties water to a slot from which the water pours over a series of inclined screens (see Photo 2). As water spills over the inclined screens, excess water continues over the screens and into an outfall slot. Water destined for hatchery production continues to descend into a pre-settling basin. This pre-settling basin allows for removal of some settleable solids during normal flow periods. Two gate valves are present on the south side of the screen chamber, which allows for the removal of settled-out solids. Water that passes through the pre-settling basin exits on the west end and is collected back into the 48-inch main line before arriving at the valve pit. The valve pit allows available water to be distributed throughout the station. The valve pit is located adjacent to the visitor parking lot between the entrance and exit of the main hatchery buildings. In the valve pit are accessible sections of the 48-inch water line, a crossover tee, and a corresponding valve that connects the Cook and Hatchery Creek supply lines.

3.1.8 Hatchery Creek Conveyance System - The Hatchery Creek intake and diversion structure is located 1,050 feet upstream from the valve pit, on Hatchery Creek. The Hatchery Creek water supply line begins as a 20-inch pipe and runs 950 feet before it tees to a 12-inch line for 100 feet and arrives at the valve pit. Water continues in a 12-inch line that runs another 850 feet before ending at the hatchery building. The Hatchery Creek intake chamber also has a mixing box for incoming water from the spring pond

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

3.1.9 Unnamed Spring Pond

Conveyance System - . The unnamed spring pond is located 1.4 miles east of the hatchery on the Moclips Highway. This third source of water is based on a siphon system (Photo 5). This siphon system must remain air-free in order to convey water continuously. The system begins with 10-foot-high and 16-foot-wide, screened collection chamber that penetrates the surface of the spring pond and extends well below the surface. A centrifugal sump pump is suspended next



Photo 5. Unnamed spring pond water collection structure.



Photo 7. Siphon system priming structure.

to this intake structure and is connected to the main line by a 4-inch line. This entire influent structure is encased in a circular metal housing. There are risers that join a tee that connects to a 12-inch line below a walkway bridge. This 12-inch line connects to a siphon priming structure and an air removal structure. Both the siphon priming and air removal structures are enclosed in a metal box that can remove any air that builds up in the system (Photo 6 and 7).

Water is carried adjacent to Moclips Highway near milepost 13 to the mixing box located at the Hatchery Creek intake structure. This water source can be isolated from Hatchery Creek water by removing dam boards, which allows for the diversion of Hatchery Creek. By being able to

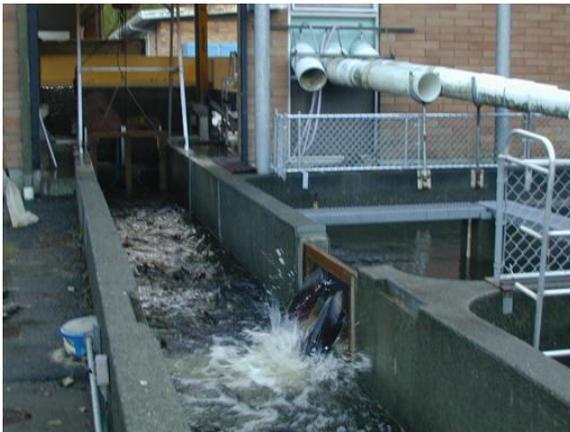
isolate water coming from the spring pond, which is considered a cleaner source of water than either Hatchery Creek or Cook Creek, the spring pond water can be used in the Isolation/Quarantine Unit, thus reducing necessary filtration system cleaning and filtration bag changes.

3.1.10 Isolation/Quarantine Unit Operation - Water to the egg isolation/quarantine unit can be supplied from Hatchery Creek or the unnamed spring pond (Photo 8). Either water source can be isolated or blended. When the isolation/quarantine unit is used, water from the Spring Pond is isolated to reduce the need for filtration bag replacement, as Hatchery Creek water is susceptible to turbid water flows. Water is pumped through a series of two filtration canisters, each equipped with micron-measured filtration bags. These filtration canisters remove the majority of suspended particulate and organic matter before the water passes through an ultra-violet light sterilizer. Water is then distributed to ten vertical-tray incubator units, which house the incubating eggs. After the water passes through the incubation trays, it is chlorinated, and then de-chlorinated before it is released to the facility's pollution abatement pond.

C. Adult broodstock collection facilities⁵⁰

Adult coho return to the hatchery from mid-September through early-January. Winter steelhead start returning in early October and cease by mid-March. Fall Chinook return from mid-October through December. Chum returns are comparatively brief, usually lasting two to three weeks during November. Brood fish enter the hatchery via a fish ladder. The fish ladder is associated with a graduated-field electric weir that spans Cook creek. Adult fish ascend the ladder and enter a collection channel. The collection channel is the outflow channel for the “E” bank of raceways. Two of the six “E” bank raceways are used for adult collection. Two ponds are used during fish returns, one for actual adult return access, and another for holding unripe, post-sorted returning fish.

D. Broodstock holding and spawning facilities⁵¹



Typically, spawning is conducted each Wednesday during the season when fish are returning. The WWFWO, the hatchery, and OFHC coordinate to sample and monitor returning fish. Non-segregated brood fish are crowded (one pond at a time) into the effluent channel. The manual grate is used to crowd the fish from the channel into a basket/hoist apparatus.

Photo 9. Fish crowding prior to sorting and spawning.

The hoist lifts fish into an anesthetic tank where regulated carbon dioxide and oxygen are introduced. When fish are sufficiently anesthetized, they are lifted and deposited onto the sorting table with a hydraulic-controlled basket lift system (Photo 10). Fish slide down the delivery chute onto a sorting table. Depending on egg needs, ripe fish are sorted and then killed using a blunt instrument or a pneumatic device that is powered by compressed air. This pneumatic device is called the M-3 Fish Stunner which is specially designed to quickly dispatch adult fish. Unripe fish are either returned to the holding pond where they are held until mature or surplused if they exceed holding needs and egg-take quota has been fulfilled.



Photo 10. Removing adult salmon from anesthetic bath and loading to sort table.

⁵⁰ QNNFH CHMP draft p. 36.

⁵¹ *Ibid.*

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

Spawning is conducted in an unheated enclosed building.

E. Incubation facilities⁵²

Incubation takes place in vertical tray incubation units (Marisource stacks). The eggs are kept in trays until development reaches the eyed stage (eye-up) at which time the eggs are shocked, sorted, and inventoried into Marisource Tray incubators. The amount of eggs per tray are species dependent as chum have 5000 to 6000 eggs per tray, coho and Chinook have 5000 eggs per tray, and steelhead have 10,000 eggs per tray. Water delivery flows to each stack are set between 3 to 5 gpm during egg development and 4 gpm from hatching to ponding.

F. Indoor rearing facilities

The nursery building contains 18, 115 cubic foot, start tanks that use 25-35 gpm duck pond water. The water flows through six inch diameter pack columns. These tanks are used to start steelhead.

G. Outdoor rearing facilities

- A – D banks contain 6 modified burrows ponds each. The ponds have been modified into pairs of 8 foot x 80 foot flow through raceways that are connected at the head end. Estimated volume is 3500 cubic feet. Incoming water from Cook Creek and Hatchery Creek is supplied through aluminum headers in the upper corner of each raceway. Flow ranges from 440 to 650 gpm.
- Flow from A – D banks can be reused through the E bank burrows ponds. There are 6 of these ponds with estimated volumes of 3900 cubic feet and flows around 600 gpm. This bank is used for rearing steelhead and holding adults.

H. Release locations and facilities⁵³

3.5 Release/Distribution Strategies- Release and distribution goals for fish produced at Quinault NFH are reviewed annually by the Quinault HET. The HET is a standing committee of Service staff that regularly reviews and plans for the fish production programs at the hatchery. Formal production goals are then established in cooperation with fisheries co-managers from Washington State and the Quinault Indian Nation. Production goals follow guidelines subsequent to the decision rendered in *U.S. v Washington* (“The Boldt Decision”). Production goals are documented through the WDFW’s Future Brood Document process, which establishes salmon hatchery production levels throughout Washington.

Fish are generally released at a time, size, and physiological condition that provide a low likelihood of residualization, and promote a rapid migration to marine waters. As an example, Chinook are released during July when they reach 50 fish per pound. These subyearling fish are

⁵² QNNFH CHMP draft p. 39.

⁵³ QNNFH CHMP draft p. 41, 42.

USFWS Olympic Peninsula Hatchery Review Team
Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

released at a time and size when they are fully smolted, and thereby unlikely to residualize, and expected to move rapidly to marine waters.

The target size to release chum is about 500 fish per pound and the target release date is around April 5. The target size to release coho salmon is between 15 and 20 fish per pound and the target release date around April 20. The release of steelhead commences when 5.5 fish per pound is achieved, usually between April and May (Photo 15). Chinook are released when they are at least 50 fish per pound from mid to late July (Table 5). Often declining water flows in Cook Creek dictates a late July release regardless of size.



Photo 15. Steelhead smolts being released in Hoh River at Allen's Bar.

Table 5. Fish production goals for Quinault NFH.

Number	Life stage	Fish size		Release site/Destination
		No./lb.	g/fish	
Coho salmon				
660,000	Smolt	15-20	23-30	On-station, Cook Creek
Fall Chinook salmon				
600,000	Smolt	40	11	On-station, Cook Creek
Chum salmon				
1,500,000	Fry	500	0.9	On-station, Cook Creek
Winter Steelhead				
50,000	Pre-smolt	15	30	Hoh Tribe- Chalaat Creek Acclimation Pond
50,000	Smolt	5.5	82	Hoh Tribe- Allen's Bar Release Site
190,000	Smolt	5.5	82	On-station, Cook Creek

I. Outmigrant monitoring facilities

None.

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

J. Additional or special facilities⁵⁴

2.3.1 Isolation/Quarantine Building – The isolation/quarantine building was constructed to allow for flexibility in management of depressed or endangered fish stocks or other aquatic species. Any aquatic organisms brought in can be isolated from the production fish on station to prevent transmission of potential diseases.

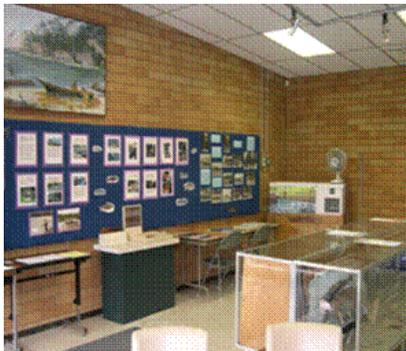
Construction of the isolation/quarantine building at Quinault NFH was completed in the summer of 2003. The building has twenty half stack vertical incubators with seven trays available for incubation. The effluent can be treated with chlorine, routed to a contact chamber for 30 minutes and de-chlorinated prior to entering the station’s pollution abatement pond, from where it eventually is discharged into Cook Creek. One chlorine monitor is located in the chlorine contact chamber and one at the outfall from the de-chlorinator. These monitors are connected to the station’s alarm system. The monitors check for enough chlorine in the contact chamber and the lack of chlorine in the water that is returned to the creek.

The water can be drawn from either one of two sources, or the two may be mixed. The preferred source originates from siphon-pumped water in a pond approximately 2 miles northeast of the hatchery. The other source is delivered from Hatchery Creek and is more susceptible to turbid water flows from November through mid-December.

K. Outreach and public education facilities/programs⁵⁵

3.9 Public Outreach Activities- Funding for outreach activities is part of the hatchery’s operating budget. The amount spent annually for outreach is at the Project Leader’s discretion.

Quinault NFH is fortunate to have a rather large and well-furnished visitor center. The visitor center contains interpretive materials pertaining not only to the station, but to agency programs as well (Photo 17). Visitors can enjoy a video presentation outlining the purpose and necessity of fish culture in fisheries management. Visitors can view any salmonid lifestages from eyed egg up to smolt. Taxidermist-prepared fish mounts of adult salmonid species cultured at this station are also displayed. A guest sign-in book allows the hatchery to monitor visitation trends, frequency, and place of residence. The guest book allows for comments and suggestions by the public.



⁵⁴ QNNFH CHMP draft p. 11, 12.

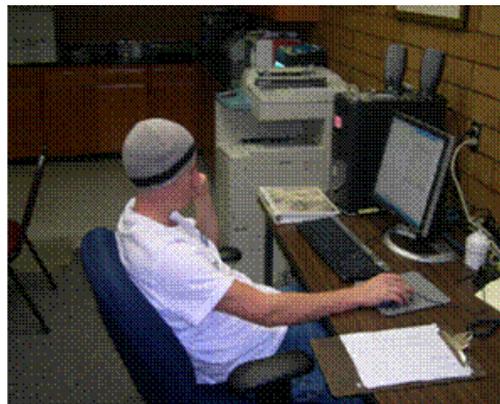
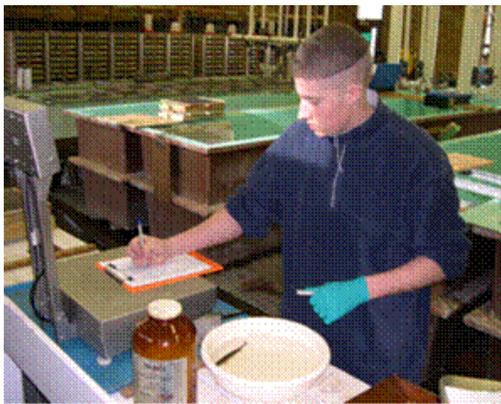
⁵⁵ *Ibid.*

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

In 2002, a “Camp Host” program was initiated in which selected applicants serve as volunteer hosts. These hosts provide valuable services such as providing facility tours, helping distribute the interpretive and visitors’ center literature, and assisting with landscaping and spawning activities. In return, camp hosts are provided space to park their recreational vehicle (Photo 18). These spaces are complete with water, electric, and sewage hookups. The station currently has three such sites available throughout the year.

Quinalt NFH partners with local schools to provide learning experiences for students ranging from pre-school to high school ages. In September 2004, Quinalt NFH, in cooperation with Quinalt Unified School District, added a Junior Fisheries Biologist student volunteer to its staff (Photo 19). The student biologist designed, gathered data, summarized, and presented findings of a study on length-weight frequencies present in a population of winter steelhead fingerling. The student also assisted staff with daily fish culture and maintenance duties until completion of the fall, 2004 semester.



L. Special issues or problems (e.g. water and property rights issues, law suits, etc.)

- Quinalt is authorized to discharge effluent under NPDES permit number WA-0001911. The permit has expired and a renewal application has been submitted.
- Cooperative Agreement or Memorandum of Understanding regarding co-management of the Quinalt NFH between the USFWS and Quinalt Nation: [pers. comm. D. Zajac, US Fish and Wildlife Service, 2008] - Two agreements regarding hatchery management exist (MOA 1965, CA 1991). They are redundant to each other. In 1996 we attempted to consolidate the two into one with no success. Note: Circa 1984-88, the Quinalt NFH was managed by the Quinalt Nation and funded by BIA. However, the employees remained USFWS. Not clear why this change was initiated or why it was terminated.
- **Hoh River Steelhead Program Support using Quinalt NFH Steelhead:** - The HSRG recommended terminating this program and replacing with a more appropriate stock (Hoh). The Hoh Tribe would like to but lack funding to construct their own hatchery program. There

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

was a feasibility study done for hatchery placement on Owl Creek (upper Hoh). Grant funding has been secured to resurrect and expand that feasibility study. The program has been in place for more than 20 years. And, supports the most lucrative Tribal commercial fishery in the Hoh. The fish are mass marked to offer selective harvest opportunities to sport fishers. However, flow conditions during the return limit the success of sport fishing. I agree with the HSRG. However, I also realize that it may take many more years to establish a program of their own that could support the current commercial fishery. Grant money has now been received by the ONP and Hoh Tribe to collect tissues and do genetic analyses. I think this is needed and could lead to a “transitional phase out” of our support from Quinault NFH. Also, the WWFOW has “conditioned” USFWS support for a Hoh River hatchery upon assessments of the Bull Trout population and impacts expected from hatchery operation and operating the hatchery as an integrated program with all stocks cultured. [pers. comm. D. Zajac, US Fish and Wildlife Service, 2008]

- **Fall Chinook Program Support from Quinault Lake Pen Program** - The Quinault NFH Chinook program is relatively successful regarding contribution to harvest (see section 111C.D.). However, returning adults prefer to stay and spawn in the mainstem Quinault River and few ascend Cook Creek to the hatchery. Consequently, we have to rely on adults spawned and gametes transferred from the Lake Pen program to attempt to meet our production goal. This requires 100% adult pathogen sampling, transport of gametes via coolers and ice, etc and use of the I/Q unit. Discussions have occurred regarding maintaining the entire Quinault River hatchery program at the Lake Pens and moving it away from the Quinault NFH. [pers. comm. D. Zajac, US Fish and Wildlife Service, 2008]
- **3.10.6 Fish Passage and Ladder Management** – The Quinault NFH has an electric fish barrier located along a weir across the breadth of Cook Creek beside the entrance to a fish ladder. The weir consists of a low water bypass channel and a main deck modified (Photos 23 and 24). When in operation the by-pass is always energized and the main deck can be automatically or manually engaged. Fish passage can occur when the barrier is turned off, during extreme high water events, or during the transition from low water to high water when the main deck is not energized due to safety concerns.

The Quinault NFH hanging probe electric weir was replaced with a Smith/Root graduated electric field weir in 2002. However, to date, the weir has not operated correctly. Problems noted include unintentional adult fish passage, mortality of adult fish, lampreys, and other animals, and gravel accumulation in the bypass channel and downstream of the weir.

Hatchery management has communicated with Smith/Root frequently regarding these problems. Smith/Root has attempted to correct the problems through computer and electrical adjustments, and weir structural modifications. Physical modifications were made by hatchery staff in September 2006, which has significantly improved the way the weir operates. Improved sensors and computer software has been installed to further improve the behavior of the electric fish barrier. Additional fencing and danger signs have been installed to improve human safety.

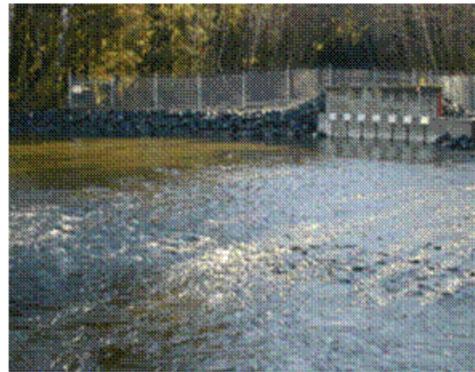
[QNNFH CHMP draft pages 56,57]

The Service has shared weir operational information with the Quinault Nation since the new weir was constructed in 2002. The Nation has been concerned with fish and wildlife mortality and especially human safety.

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

In response to both the Quinault Nation's and the Service's concern over the weir's operational integrity the Service has contracted Montgomery/Watson/Harza (MWH, Inc.) to evaluate the current structure and to propose alternative fish barriers. MWH, Inc. submitted a draft technical memorandum in 2006 as part of that contract. They were awarded an additional contract in 2007 to model the system and prepare a feasibility design.



- **3.10.1 Hatchery Reform**⁵⁶The Hatchery Reform Project for Puget Sound and Coastal Washington has goals of recovering wild salmon and also providing for sustainable fisheries [LLTK and HSRG 2000]. As part of the hatchery reform project the fish passage potential at Quinault NFH was assessed to optimize natural and hatchery salmon production in Cook Creek [Zajac 2004].-

ATTACHMENT 12: Recommendations of HSRG Specific to Quinault NFH⁵⁷

Quinault River Fall Chinook

Quinault Indian Nation and US Fish and Wildlife Service

STOCK GOALS: Current, Short-Term, Long-Term

Biological Significance: Intermediate, Intermediate, Intermediate

Population Viability: At Risk, At Risk, At Risk

Habitat: Limiting/Healthy, Limiting/Healthy, Limiting/Healthy

Harvest Opportunity: Each Year, Each Year, Each Year

Purpose: Harvest

Type: Integrated

PROGRAM DESCRIPTION

This is a native stock with wild production. Multiple stocks were used to begin the Quinault River fall Chinook program including Quinault, Queets and Hoh river stocks, as well as introductions from Puget Sound (Green, Deschutes and Samish rivers and Finch Creek) and Willapa Bay (Willapa and Nemah rivers.) This stock is one of 13 stocks in the North Coast Fall Chinook GDU. Broodstock is collected from adults returning to Quinault National Fish Hatchery (NFH) and by gillnet in Lake Quinault (up to 300 adults). For the Lake Quinault Hatchery portion of the program, the egg-take goal is 1.3 million. For the Quinault NFH portion, the egg-take goal is 700,000. Up to 450,000 eyed eggs are transferred to Quinault

⁵⁶ QNNFH CHMP draft p. 53, 139-144.

⁵⁷ HSRG 2004, p. 138, 139, 157, 158, 165, 166, 187, 188.

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

NFH from Lake Quinault, to make up for shortfalls at Quinault NFH. Spawning, incubation, rearing and release take place at each facility. The program's release goals are 600,000 at 40 fish per pound in July from Quinault NFH, and 400,000 at 15 fish per pound from Lake Quinault. Another 100,000 are released from pens at Lake Quinault in September.

OPERATIONAL CONSIDERATIONS

- Coded wire tag analysis indicates that the broodstock is approximately 75% hatchery-origin and
- 25% natural-origin.
- Hatchery-origin recruits make up 30% or less of the natural spawning population.
- The mating scheme at Quinault NFH uses single family pairing.
- The mating scheme for the Lake Quinault program uses modified factorial mating.
- 200,000 fish from Quinault NFH are adipose fin clipped and coded wire tagged.
- 40,000 fish are marked and coded wire tagged for in-river management.
- Total survival for the Quinault NFH program has averaged approximately 0.75% for broodyears 1973–96, and 0.25% for broodyears 1990–96.
- The average catch contribution for the Quinault NFH program has been approximately 2,800 fish per year for broodyears 1973–96, and approximately 900 fish per year for broodyears 1990–96.

BENEFITS AND RISKS

A. Consistent with short-term and long-term goals?

The program is making consistent contributions to harvest, although it has not appeared to be as successful in recent years as it has historically. The composition of the natural spawning component, as well as the composition of fish collected for hatchery broodstock, is consistent with a properly integrated program.

B. Likelihood of attaining goals?

Both the harvest and conservation goals for the stock are currently being met.

C. Consistent with goals for other stocks?

The program appears to be consistent with goals for other stocks.

RECOMMENDATIONS

Maintain the current proportion of hatchery- and natural-origin fish in the broodstock and on the spawning grounds, to maintain proper integration with the natural stock.

COMMENTS

Like all integrated hatchery programs, success will depend on good habitat being available to both the hatchery- and natural-origin components of the integrated population (see HSRG system wide recommendation about productive habitat).

MANAGERS RESPONSE

The Quinault Indian Nation generally agrees with the HSRG recommendation. See also Appendix A: US Fish and Wildlife Service Response to HSRG Recommendations.

USFWS Olympic Peninsula Hatchery Review Team
Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

Quinault River Hatchery Coho

Quinault Indian Nation and US Fish and Wildlife Service

STOCK GOALS: Current, Short-Term, Long-Term

Biological Significance: Low, Low, Low

Population Viability: High, High, High

Habitat: Limiting/Healthy, Limiting/Healthy, Healthy

Harvest: Opportunity Each Year, Each Year, Each Year

Purpose: Harvest

Type: Segregated

PROGRAM DESCRIPTION

Skagit River gametes were crossed with local stock in 1975, and Queets River stock was released with the 1983 brood. The egg take goal is 700,000. Spawning, incubation and rearing are at Quinault National Fish Hatchery (NFH). The program goal is 600,000 fish released as yearlings, on-station at 15–20 fish per pound, and 60,000 released from Camp 7 Pond adjacent to the Quinault River.

OPERATIONAL CONSIDERATIONS

This is a US/Canada double index stock.

BENEFITS AND RISKS

A. Consistent with short-term and long-term goals?

There is a harvest benefit.

B. Likelihood of attaining goals?

The program is providing harvest.

C. Consistent with goals for other stocks?

Hatchery adults returning to the tribal hatchery on Lake Quinault may have contributed to some wild production above and around Lake Quinault. Interbreeding between the native and non-native stocks is thought to have occurred, creating a biological and genetic risk from straying. However, the managers indicate that the biological significance of this natural stock is low, and they have specified no conservation goals for that stock.

RECOMMENDATIONS

- Monitor and evaluate the contribution of hatchery-origin spawners to natural coho spawning in the river.
- Use HSRG guidelines for properly segregated programs if the goal for the natural Quinault coho stock is to maintain its current viability.
- Increase the use of jacks to ten percent of the males used for spawning.
- Mark the hatchery fish to evaluate stray rates.

COMMENTS

- Long-term goals might be more readily achieved by developing a viable, naturally-spawning coho stock in the Quinault River as a resource to be used as habitat improves in the future. This could be accomplished by: 1) operating a segregated program that controls

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

straying, so that the hatchery stock does not drive adaptation of the naturally spawning stock (see HSRG System- Wide Recommendations), or 2) operating an integrated program. Both of these options need not be in conflict with maintaining the full harvest benefit from the hatchery program.

- If the natural stock in this watershed is determined to be of higher significance, it will be necessary to ensure that straying from this program is kept within the levels required for a properly segregated program.

MANAGERS RESPONSE

The Quinault Indian Nation generally agrees with the HSRG's recommendations. Currently, QIN is unable to monitor the natural coho due to fiscal constraints. QIN will review options for the operation of the hatchery to meet HSRG guidelines. Hatchery fish are currently marked and could be used for evaluating stray rates, but QIN is unable to do so, due to fiscal constraints. See also Appendix A: US Fish and Wildlife Service Response to HSRG Recommendations.

Quinault River Hatchery Chum

Quinault Indian Nation and US Fish and Wildlife Service

STOCK GOALS: Current, Short-Term, Long-Term

Biological Significance: Intermediate, Intermediate, Intermediate

Population Viability: High, High, High

Habitat: Limiting, Limiting, Limiting/Healthy

Harvest: Opportunity Each Year, Each Year, Each Year

Purpose: Harvest

Type: Segregated

PROGRAM DESCRIPTION

The founding broodstock was native to the local area near the Quinault National Fish Hatchery (NFH) over 30 years ago, but there have been introductions, particularly from Walcott Slough (Hood Canal). The genetic persistence of these introductions is unknown. This stock is one of five stocks within the North Coast Washington Fall Chum GDU. For this program, fall chum adults are collected at Quinault NFH from rack returns. Eggs are spawned, incubated, reared and released on site. The egg take goal is 1.8 million and the planting goal is 1.5 million at 500 fish per pound in April.

OPERATIONAL CONSIDERATIONS

- The program's goal is to support harvest on a hatchery stock segregated from wild chum in other watersheds.
- 900 pairs of mostly age-three and age-four chum are spawned as they return to the rack (effective population size approaches 1,000).
- Spawning is via the random pairing of adults and one-to-one matings; they are pooled only after activation.
- Silt in the incubation water is a major operational problem.

USFWS Olympic Peninsula Hatchery Review Team
Olympic Peninsula NFHs Assessments and Recommendations Report –May 2009

BENEFITS AND RISKS

A. Consistent with short-term and long-term goals?

The harvest goal is being met, as there are 1,000–3,000 fish for harvest each year. It is not known

how many hatchery- versus natural-origin chums are in that harvest.

B. Likelihood of attaining goals?

Annual harvest is, and probably will continue to be, achieved.

C. Consistent with goals for other stocks?

There is a possibility of genetic and ecological interactions with the natural population. However, the managers indicate that the biological significance of this natural stock is low, and they have specified no conservation goals for the stock. Straying to other watersheds is unknown, but probably not significant.

RECOMMENDATIONS

- Monitor and evaluate this program’s contribution to harvest.
- Monitor and evaluate straying of program adults into neighboring watersheds.

COMMENTS

- If the natural stock in this watershed is determined to be of higher significance, it will be necessary to ensure that straying from this program is kept within acceptable levels for a properly segregated program (see HSRG System-Wide Recommendations).
- Briefing information provided to the HSRG states that this stock’s, “... traits appear to be typical of other wild stocks within the GDU.” However, management staff reports that return timing for this stock is a month earlier. If true, this could be because the natural Quinault River stock has an earlier timing. Or it could be that hatchery practices have encouraged earlier run timing.

MANAGERS RESPONSE

The Quinault Indian Nation generally agrees with the HSRG’s recommendations, but due to fiscal constraints is unable to implement a monitoring program. See also Appendix A: US Fish and Wildlife Service Response to HSRG Recommendations.

Quinault River Hatchery Winter Steelhead

Quinault Indian Nation and US Fish and Wildlife Service

STOCK GOALS: Current, Short-Term, Long-Term

Biological Significance: Low ,Low,Low

Population Viability: High ,High ,High

Habitat: Healthy: Healthy ,Healthy

Harvest Opportunity: Each Year ,Each Year ,Each Year

Purpose: Harvest

Type: Segregated

PROGRAM DESCRIPTION

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

This is an early returning hatchery stock of uncertain origin. From 1969 through the present, only fish returning to Quinalt National Fish Hatchery (NFH) have been used for broodstock. Spawning incubation and rearing take place on-station. 190,000 are released on-station at five fish per pound in May.

OPERATIONAL CONSIDERATIONS

- Fish are released at 4.5–6.5 per pound from late April to mid-May.
- Releases are not adipose fin clipped.
- Single pair matings are used.
- 25,000 fish are coded wire tagged each year.
- This facility supports the Hoh River steelhead program, which lacks adult collection facilities.
- 6,000 fish are maintained on-station for a fishing derby in June.
- No adult fish passage is available above the hatchery rack.

BENEFITS AND RISKS

A. Consistent with short-term and long-term goals?

The program is being operated in a manner consistent with its short- and long-term goals. It is providing harvest opportunity. Interbreeding of the hatchery stock with the naturally-spawning stock is minimized by the differences in spawn time and adult removal capability, except for Hoh River releases.

B. Likelihood of attaining goals?

There is likelihood that program goals will continue to be met. Coastal steelhead stocks have experienced relatively good survival in recent years.

C. Consistent with goals for other stocks?

There is the potential for genetic interaction with naturally-spawning winter steelhead, but this is likely to be minimized for the reason stated in A, above. The Hoh River program represents a risk to other stocks because of the need to prevent adult fish passage above hatchery rack to maintain a “specific pathogen free” water supply. This results in a loss of 18 miles of good habitat for wild fish.

RECOMMENDATIONS

- Implement System-Wide Recommendations regarding establishing a regional system of wild steelhead management zones, where streams are not planted with hatchery fish and are instead managed for native stocks. Fishing for steelhead in these zones would not be incompatible with this approach, but no hatchery-produced steelhead should be introduced. Such zones would reduce the risk of naturally spawning fish interbreeding with hatchery fish, and provide native stocks for future fisheries programs. To meet harvest goals, hatchery releases may be increased in those streams selected for hatchery production.
- Select both wild and hatchery streams based on stock status and a balance of large and small streams and habitat types.
- Use locally-adapted hatchery stock for those streams. Decrease reliance on other facilities to backfill shortages in locally adapting hatchery stock. Actions such as harvest restrictions should be implemented to achieve 100% local broodstock if necessary.

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

- Manage the hatchery stock to maintain its early spawn timing and reduce the likelihood of interaction with naturally spawning steelhead.
- Include adult collection capability wherever steelhead are released, to capture as many adults from the returning segregated population as possible. Discontinue releases where adults cannot be collected at return.
- Size the hatchery program in a manner that achieves harvest goals with minimal impact on wild populations.
- Release hatchery yearling steelhead smolts between April 15 and May 15 at target size of six fish to the pound, and a condition factor of less than 1.0.
- Conduct a workshop to implement this wild steelhead management zones concept.
- Implement monitoring and evaluation as a basic component, of both wild steelhead management zones and hatchery harvest streams.
- Discontinue egg collection and rearing of Hoh River steelhead and allow passage of wild stocks upstream of the hatchery weir (see Hoh River hatchery winter steelhead).
- Increase volitional release timing prior to forced release.

COMMENTS

Establishment of wild steelhead management zones should reduce the chances of ecological and genetic interactions with hatchery steelhead and help to ensure the availability of founding stocks for hatchery purposes should the need for such stocks arise.

MANAGERS RESPONSE

The Quinault Indian Nation general agrees with the HSRG's recommendations. QIN is willing to participate in regional discussions with appropriate co-managers regarding steelhead management. See also Appendix A: US Fish and Wildlife Service Response to HSRG Recommendations.

Facility and Regional Recommendations

Assembled below are the Hatchery Scientific Review Group's recommendations that involve capital improvements at hatchery facilities in the North Coast region.

ALL FACILITIES

- Improved rearing and incubation facilities across the region, as needed based on reprogramming decisions resulting from implementing HSRG recommendations
- Additional investment may be necessary to establish new steelhead adult collection sites across the region
- In order to maximize benefits from hatchery production, take into account facility water and space availability in determining the optimum species mix.
- Provide the needed equipment for fish culture and biological sampling (fish pumps, crowders, sorting facilities, abatement ponds, etc.).
- In order for hatcheries to adequately follow the general principles of scientific defensibility and informed decision making, the HSRG supports the need for increased

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

monitoring and evaluation capabilities. This would include the acquisition of the equipment necessary for these activities. Examples would include the following:

- Equipment for adult handling to improve both the recovery of evaluation data and to facilitate safe passage upstream of natural-origin fish.
- Equipment to facilitate adult collection for inclusion in integrated hatchery brood stock population management.
- Equipment for monitoring and evaluating the population status of integrated hatchery stocks and associated natural spawning populations.
- Equipment for improving hatchery inventory, monitoring and predator control.
- Opportunities to process data collections such as otolith reading, genetic sampling and mark recovery activities.

QUINAULT NATIONAL FISH HATCHERY

- Provide fish pumps.
- Install pre-settling chambers.
- Improve adult spawning and holding facilities.
- Expand the hatchery building for early rearing.
- Provide a water chiller to resolve temperature problems.
- Modify raceways to allow volitional release.

IIIA. Quinault NFH Steelhead (Cook Creek Program)

A. General information⁵⁸

The hatchery was authorized on July 7, 1964 by Appropriation Act (78 Stat.283) and Fish and Wildlife Act of 1956 (70 Stat. 1119) and began operations in 1968 “. . . to restore and enhance depleted runs of salmon and steelhead on the Quinault Indian Reservation and adjacent federal lands . . .” The hatchery currently produces fall Chinook, chum, and coho salmon and winter steelhead trout for release into Cook Creek. Steelhead are also released to the Hoh River.

Initial hatchery operations were funded by the Bureau of Sport Fisheries and Wildlife and coordinated via a Memorandum of Agreement with the Quinault Nation. However, from 1984 to 1988 funding was provided by the Bureau of Indian Affairs and hatchery operations were coordinated by the Quinault Nation. Funding responsibility was transferred back to the Service around 1989 and hatchery operations have been coordinated with the Quinault Nation via a Cooperative Agreement since 1991.

B. Stock/Habitat/Harvest Program Goals and Purpose

1. Purpose and justification of program⁵⁹ []

The hatchery was authorized on July 7, 1964, by appropriation Act (78 stat.23) and Fish and Wildlife Act of 1956 (70 Stat. 1119) “. . . to restore and enhance depleted runs of salmon and steelhead on the Quinault Indian Reservation and adjacent federal lands . . .” Hatchery operations are also influenced by the following authorities, policies, and agreements.

Policies:

- Secretarial Order #3206, American Indian Tribal Rights, Federal-Tribal Trust Responsibilities, and the Endangered Species Act
- Viable Salmon Populations Strategy, NMFS
- Fish and Wildlife Service Recreational Fisheries Policy, NPI #89-25
- Executive Order #12962 of June 7, 1995 - Recreational Fisheries

Case Law:

- U.S. v Washington*, 384 F. Supp. 312, 1974
- Hoh v. Baldrige Framework Management Plan*

Agreements

- Memorandum of Agreement with Quinault Nation, 1965
- :
- Cooperative Agreement with Quinault Nation, 1991
- MOU – BIA, carcass disposition to tribes
- Stipulation and Order Concerning Co-Management and Mass Marking, April 28, 1997, U.S. District Court, Seattle, Washington
- Salmonid Disease Control Policy of the Fisheries Co-Managers of

⁵⁸ QNNFH CHMP Draft p. 9.

⁵⁹ QNNFH CHMP Draft p. 15, 16

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

	Washington State, revised October 1997
<i>Legislative Authorities</i>	-Magnuson Fishery Conservation and Management Act (16 USC 1801-1882)
:	
	-National Invasive Species Act of 1996
	-Omnibus Appropriation Bill of 2003 (Mass Marking Law)
<i>Regulations:</i>	-Endangered Species Act
	-Clean Water Act

2. Goals and Objectives of program⁶⁰

Goal 1: Support recovery and conservation of local endangered and threatened species and species at risk. [3.1]

- Objective 1.1: Minimize negative impacts to ESA-listed and other native species, their habitats, and the environment by implementing state-of-the-art fish culture technology, hatchery operation, and hatchery maintenance (hatchery reform). [5.2.1]
- Task 1.1.1: Release only juvenile fish that are ready to migrate downstream (smolts), in the appropriate timeframes to avoid impacting listed or vulnerable species. [3.2.4]
- Task 1.1.2: Mass mark all coho and Chinook salmon to identify them from naturally produced fish. [3.2.4, 5.2.2, 5.2.6]
- Task 1.1.3: Manage the hatchery weir and ladder within acceptable impacts to listed and native fish. [5.2.8]
- Task 1.1.4: Implement a HACCP (Attachment 10) [4.1.2].
- Task 1.1.5: Conduct environmental monitoring to ensure that hatchery operations comply with water quality standards and to assist in managing fish health. [10.4.1, 10.4.2]
- Task 1.1.6: Comply with all environmental permits (including ESA consultation) requirements for hatchery operation, construction, and maintenance. [10.4.1, 10.4.2]
- Objective 1.2: Seek other opportunities to contribute to the recovery and conservation of ESA-listed species and other species at risk. [5.1.4]

⁶⁰ QNNFH CHMP Draft p. 59-63.

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

- Task 1.2.1: Communicate with all partners and forums in order to stay informed of other recovery and conservation needs that may be accommodated at Quinault NFH. [1.4, 5.2.8]
- Objective 1.3: Maintain Isolation/Quarantine unit to industry standards.
- Task 1.3.1: Maintain inflow and outflow disinfection systems.
- Goal 2: Assure that hatchery operations support the cooperative agreement between the Service, the Quinault Indian Nation, and Pacific Salmon Treaty objectives. [5.1]
 - Objective 2.1: Collect sufficient steelhead broodstock to produce 50,000 smolts for release into the Hoh River and 50,000 pre-smolts for transfer to Chalaat Creek [6.2.1, 8.2.3]. This should be viewed as a short term or interim objective until a facility can be constructed in the Hoh Basin to assume this program [2.6.6].
 - Task 2.1.1: Collect, hold, and spawn about 85 pairs of returning adult steelhead for the Hoh program fish production.
 - Task 2.1.2: Participate in future Hoh River hatchery construction proposals as a member of the ad hoc committee [2.6.6, and 4.1.2]
 - Objective 2.2: Collect sufficient broodstock to produce: 660,000 coho salmon smolts for release into Cook Creek; 600,000 Chinook salmon smolts for release into Cook Creek; 1,500,000 chum salmon smolts for release into Cook Creek;
 - Task 2.2.1: Collect and successfully hold returning adult salmonids for fish production: about 400 pairs of coho, 150 pairs of Chinook, 650 pairs of chum, and 250 pairs of steelhead to maturity.
 - Objective 2.3: Contribute to a meaningful harvest for tribal, sport, and commercial fisheries from Alaska to the Quinault and Hoh rivers (achieve a 10-year-average survival from smolt to adult of 2.0% for coho, 1.0% for Chinook, 1.0% for chum, and 2.0% for steelhead, harvest plus escapement). [6.1.1, 6.2.1]
 - Task 2.2.1: Mass mark juvenile hatchery coho and Chinook salmon to facilitate harvest and related conservation and assessment efforts for hatchery, wild, and ESA-listed stocks. [3.2.4]
 - Objective 2.4: Meet tribal trust responsibilities. [8.1, 8.2, 8.3]

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

- Task 2.4.1: Follow pertinent Laws, Agreements, Policies, and Executive Orders on consultation and coordination with Native American Tribal Governments. [8.1, 8.2, 8.3]
- Task 2.4.2: Work with the Quinault Nation to develop operational guidelines that support the operation of Tribal fish culture programs in addition to the National Fish Hatchery fish culture programs.
- Objective 2.5: Maximize survival at all life stages by working with the appropriate fish health center to maintain a comprehensive fish health program, which focuses on prevention rather than treatment of diseases. [5.2.7]
 - Task 2.5.1: Maintain hatchery operations that are consistent with the Service Manual (Part 713); State of Washington, Aquaculture and Disease Control (RCW 75.58); and the Salmonid Disease Control Policy of the Fisheries Co-Managers of Washington State. Any exceptions to this task would be negotiated on a case by case basis, with the fish health co-managers. [5.2.7]
- Objective 2.6: Communicate and coordinate effectively with the Quinault Indian Nation Fisheries staff. [2.3, 5.2.8]
 - Task 2.6.1: Participate in *U.S. v Washington* production planning processes. [5.1.4, 5.2.8]
 - Task 2.6.2: Hold annual Technical Work Group meetings with the Quinault Indian Nation to plan, report, and review progress toward meeting hatchery goals.
- Objective 2.7: Ensure goals are achieved by working with WWFOW to conduct monitoring and evaluation. [3.2.4]
 - Task 2.7.1: Double-index tag and mass mark production lots of coho salmon to evaluate selective fisheries. [5.2.2, 5.2.6]
 - Task 2.7.2: Biosample and mark sample returning adults. [5.2.3]
 - Task 2.7.3: Produce an annual report on stock assessment, survival, fish health, and fisheries contribution. [2.3.2]
 - Task 2.7.4: Provide data as needed for co-managers and for internal management needs. [5.2.8]
- Goal 3: Promote understanding, participation, and support of Service and Quinault NFH programs.
 - Objective 3.1: Increase awareness of Quinault NFH programs. [2.1.4]

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

- Task 3.1.1: Coordinate with state, other Federal, tribal and local information/public offices to incorporate information about Quinault NFH. [1.4, 2.1.4]
- Task 3.1.2: Facilitate interagency cooperation with existing and new programs in fisheries management. [5.2.8]
- Task 3.1.3: Coordinate with other Federal offices to participate in special events, such as National Fishing and Boating Week. [6.2.2]
- Task 3.1.4: Interact with Service, Tribal, other Federal agencies, Fisheries outreach coordinators and actively seek to integrate Fisheries outreach activities with the Regional and National Outreach Strategies. [2.1.4]
- Task 3.1.5: Distribute the annual Quinault NFH Focus Report (prepared by the Western Washington FWO) to the public and our cooperators. [2.3.2]
- Objective 3.2: Provide information and education about Service programs and Quinault NFH to internal and external audiences. [2.3.2, 3.1.7, 6.3]
 - Task 3.2.1: Continue to develop and implement new cooperative agreements with partnerships from the public and private groups. [1.2]
 - Task 3.2.2: Create and maintain a website for the Quinault NFH to inform cyber-visitors of the hatchery's programs and history. The website also provides general information about the hatchery. [2.3.1]
 - Task 3.2.3: Maintain a volunteer (camp host) program to give tours, answer questions, and disseminate general information. [2.1.4]
 - Task 3.2.4: Develop a strong working relationship with the local media (newspaper, radio, and other coastal area publications), and provide news releases and articles regarding agency issues and station activities. [2.1.4]
 - Task 3.2.5: Increase public use of the hatchery facilities by inviting special interest groups to tour the hatchery. [2.1.4]
 - Task 3.2.6: Loan Service-developed educational materials (such as the fish kit, and the migratory bird kit) to teachers. [2.1.4]
- Goal 4: Support the principles and recommendations of hatchery reform.

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

- Objective 4.1: Maintain scientifically defensible production programs. [5.2.1]
- Task 4.1.1: Increase the use of coho jacks in spawning to 10% of the males spawned. [5.2.1] (Implemented in 2005)
- Task 4.1.2: Work with the Hoh Tribe (lead organizer), Quinault Nation and WDFW to replace the current release and transfer of Quinault NFH winter steelhead to the Hoh River with a more locally adapted stock. The Hoh Tribe has not set any timelines.
- Task 4.1.3: Meet and communicate annually with the Hoh staff to monitor progress regarding the feasibility of a hatchery program and facility on Owl Creek.
- Objective 4.2: Use informed decision making to manage the hatchery program. [5.1.5]

3. Type of program (Integrated or Segregated)

Segregated.

4. Alignment of program with ESU-wide plans

There are no NOAA jurisdictional listed species in the area.

5. Habitat description and status where fish are released⁶¹

	<i>Habitat</i>				<i>Habitat</i>		
	<i>Hatchery</i>	<i>Wild</i>	<i>Hatchery</i>	<i>Wild</i>	<i>Hatchery</i>	<i>Wild</i>	
<i>Rating (H/M/L)</i>	<i>N/A</i>		<i>N/A</i>		<i>H</i>		<i>H</i>

(Provided by Tom Kane, USFWS)

	<i>Spawning Habitat</i>		<i>Freshwater Rearing Habitat</i>		<i>Migration Habitat</i>		<i>Estuarine Habitat</i>
	<i>Hatchery</i>	<i>Wild</i>	<i>Hatchery</i>	<i>Wild</i>	<i>Hatchery</i>	<i>Wild</i>	
<i>Rating (H/M/L)</i>	<i>M</i>	<i>M</i>	<i>M</i>	<i>M</i>	<i>M</i>	<i>M</i>	<i>H</i>

Three categories of habitat are defined in terms of conditions that support the target stocks, with the assumption that these conditions would also provide for the needs of other native stocks of salmonids (assume that pre-terminal harvest is part of the environment during the fish's whole life cycle).

⁶¹ HSRG 2004 p. 734.

USFWS Olympic Peninsula Hatchery Review Team
Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

These habitat ratings are:

1. *High (H) = Healthy: Productivity of the target stock is high and the population is capable of growth and supporting significant terminal harvest.*
2. *Medium (M) = Limiting: The target stock is productive enough for the population to sustain itself at a low level terminal harvest.*
3. *Low (L) = Inadequate: The target stock is unproductive and the population will go extinct, even without terminal harvest.*

Habitat Conditions

Are there exceptions or “islands” of habitat that are in better or worse condition and do not correspond with the rating given in question?

Yes. The Moclips Highway culvert crossing on Cook Creek at river mile 10.3 is an impasse and has also caused creek channel scour for some distance below the culvert. This section contains no large wood.

Habitat Improvement

What habitat improvement projects could elevate the rating for this sub-region or the “islands” of inferior production? If so, please list them and indicate if they are in the proposed or planning stages.

Culvert removal and bridge construction. Not planned or funded.

Future Expectations

Do you see the quality of the habitat in this region become better or worse in the next ten to twelve years? Fifty years? What are the long-term goals for habitat in this sub-region?

The quality of the habitat should gradually improve as a result of timber harvest regulations and identification of much of the U.S. Forest Service lands as “Late Successional Reserve”.

Note: The WRIA 21 Technical Review Group actively seeks “Salmon Recovery Board” funding for habitat recovery projects in WRIA 21. Projects are proposed by various agencies and other participating parties and are prioritized by the Technical Review Group. The “Lead Entity” is the Quinault Nation.

6. *Size of program and production goals*⁶²

Measure	Goal	Five-year ¹ mean	Five-year ¹ range
<i>Winter Steelhead</i>			
Spawned population	550	673	407 – 1,367
Smolts released (Cook)	190,000	200,085	182,352 - 217,583
Smolt size at release	6	6.0	5.2 – 7.3
Percent survival from smolt ⁴	2	> 2.00%	> 1.57% - > 2.64%
Smolts released (Hoh River)	50,000	53,265	46,058 – 65,351
Smolt size at release	6	6.5	5.4 – 7.9

Number	Life stage	Fish size	
--------	------------	-----------	--

⁶² QNNFH CHMP Draft p. 35, 42.

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

		No./lb.	g/fish	Release site/Destination
Winter Steelhead				
50,000	Pre-smolt	15	30	Hoh Tribe- Chalaat Creek Acclimation Pond
50,000	Smolt	5.5	82	Hoh Tribe- Allen's Bar Release Site
190,000	Smolt	5.5	82	On-station, Cook Creek

C. Description of program and operations⁶³

1. Broodstock goal and source

Collect and successfully spawn 225 pairs (225 females and 225 males) from steelhead returning to the hatchery.

2. Adult collection procedures and holding

- Winter steelhead start returning in early October and cease by mid-March. Fish are collected throughout the return and spawned proportional to the magnitude and timing of the return. Brood fish enter the hatchery via a fish ladder. The fish ladder is associated with a graduated-field electric weir that spans Cook creek. Adult fish ascend the ladder and enter a collection channel. The collection channel is the outflow channel for the “E” bank of raceways. Two of the six “E” bank raceways are used for adult collection. Two ponds are used during fish returns, one for actual adult return access, and another for holding unripe, post-sorted returning fish.
- No adult salmon and steelhead are intentionally passed upstream [Zajac 2004].

3. Adult spawning

a) Spawning protocols

- Brood fish are crowded (one pond at a time) into the effluent channel. The manual grate is used to crowd the fish from the channel into a basket/hoist apparatus. The hoist lifts fish into an anesthetic tank where regulated carbon dioxide and oxygen are introduced. When fish are sufficiently anesthetized, they are lifted and deposited onto the sorting table with a hydraulic-controlled basket lift system. Fish slide down the delivery chute onto a sorting table. Depending on egg needs, ripe fish are sorted and then killed using a blunt instrument or a pneumatic device that is powered by compressed air. This pneumatic device is called the M-3 Fish Stunner which is specially designed to quickly dispatch adult fish. Unripe fish are either returned to the holding pond where they are held until mature or surplus if they exceed holding needs and egg-take quota has been fulfilled. Spawning is conducted in an unheated enclosed building.

⁶³ Unless otherwise specified, section text from QNNFH CHMP Draft p. 35-46.

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

- All ripe fish are killed and spawning selection is randomized. Eggs from one female are placed into a three gallon stainless steel bucket and mixed with sperm from one male. Cook Creek water is added to the eggs and milt and gently swirled and set aside for at least one minute. With coho and steelhead an additional step is taken, in which a 1.4 percent solution of sodium bicarbonate and water is poured over the unfertilized eggs. Eggs are then pooled (eggs from 3 females) into one stainless steel bucket and rinsed prior to delivery to the hatchery building. Rinsing removes any fish tissues, blood, debris, and other materials from the fertilized eggs. Rinsed eggs are placed in incubation trays with iodophor solution (75 ppm – 100 ppm) to disinfect the exterior of the eggs. Eggs remain in the iodophor solution between 30 and 60 minutes. Egg rinsing improves the disinfection process.
- The eggs are incubated with water from Hatchery Creek and/or spring water at a flow of 3 to 5 gpm. Enough eggs are taken on each spawning day to allow culling and/or removal of unneeded eggs and still allow for a representation of that spawning day in the timing of the run. All spawning equipment is rinsed in iodine solution before use on other fish.

b) No. of males and females spawned each year over past 10 years⁶⁴

YEAR	FEMALES	MALES	JACKS	% JACKS
2006/07	342	264	0	
2005/06	217	211	0	
2004/05	298	283	1	
2003/04	260	258	0	
2002/03	255	255	2	
2001/02	274	285	0	
2000/01	199	208	0	
1999/00	706	658	3	
1998/99	834	849	1	
1997/98	603	617	2	
AVERAGE	264 ¹	211 ¹		

¹ Last seven years only.

4. Fertilization

a) Protocols

All ripe fish are killed and spawning selection is randomized. Eggs from one female are placed into a three gallon stainless steel bucket and mixed with sperm from one male. Cook Creek water is added to the eggs and milt and gently swirled and set aside for at least one minute. With coho and steelhead an additional step is taken, in which a 1.4 percent solution of sodium bicarbonate and water is poured over the unfertilized eggs.

⁶⁴ USFWS 1991.

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

Eggs are then pooled (eggs from 3 females) into one stainless steel bucket and rinsed prior to delivery to the hatchery building. Rinsing removes any fish tissues, blood, debris, and other materials from the fertilized eggs. Rinsed eggs are placed in incubation trays with iodophor solution (75 ppm – 100 ppm) to disinfect the exterior of the eggs. Eggs remain in the iodophor solution between 30 and 60 minutes. Egg rinsing improves the disinfection process.

b) Number of steelhead eggs collected and fertilized ⁶⁵

Brood Year	Number Green	Number Eyed	% to Eye
1998	2,402,176	1,984,201	82.6
1999	3,265,997	2,576,134	78.9
2000	2,508,864	2,053,463	81.8
2001	858,704	710,500	82.7
2002	1,124,099	620,509	55.2
2003	907,142	492,633	54.3
2004	1,018,952	722,727	70.9
2005	637,794	429,917	67.4
2006	843,200	595,600	70.6
2007	1,284,387	1,108,989	86.3

5. Incubation

Incubation takes place in vertical tray incubation units (Marisource stacks). The eggs are kept in trays until development reaches the eyed stage (eye-up) at which time the eggs are shocked, sorted, and inventoried into Marisource Tray incubators. The amount of eggs per tray are species dependent as chum have 5000 to 6000 eggs per tray, coho and Chinook have 5000 eggs per tray, and steelhead have 10,000 eggs per tray. Water delivery flows to each stack are set between 3 to 5 gpm during egg development and 4 gpm from hatching to ponding.

Eggs are emptied into fine-wire mesh baskets approximately 30 days after fertilization. Eggs are given a physical shock by personnel holding an egg-filled basket at shoulder height and emptying that basket into a water-filled basket. Shocked eggs remain undisturbed for 12 to 24 hours before any dead eggs are removed.

6. Ponding

a) Protocols

After hatched fry have absorbed their yolk sac (buttoned up), they are placed either in a 16-foot-long by 3-foot-wide, and 3-foot-deep fiberglass tank or in an outdoor 16-foot-wide by 80-foot-long concrete raceway. Winter steelhead fry are always placed in a fiberglass tanks. Winter steelhead remain in the tank until they attain a size of at least 700 fish per pound.

⁶⁵ pers. comm. Bill Edwards, US Fish and Wildlife Service, 2008.

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report –May 2009

Every attempt is made to split the raceways in advance of the density index reaching 0.20 or flow index of 1.00, in consideration of the total weight of fish in the rearing vessel, the vessel's rearing volume, and oxygen intake of the fish as related to their size (Piper et al. 1982). Availability of water can restrict this process, all steelhead destined for release into Cook Creek are moved to the E-bank raceways in the summer. The E-bank raceways can be supplemented by the re-use of water from ponds in A-, B-, C-, and D-bank raceways. Raceways are brushed clean daily and fish fed accordingly. Production fish receive regular diagnostic checks by OFHC.

b) Number of fry ponded each year, including % hatch each year

From brood year 1998 to 2007 the number of fry ponded has ranged from a little over 400,000 to nearly 2,000,000. The yearling production goal is 290,000. Excess to program needs are generally discarded as eggs. However, on occasion fry have been buried or some are programmed to be released upstream [Zajac 2004].

7. Rearing/feeding protocols

- Generally, tanks and raceways are cleaned daily (exception would be Wednesday spawn days or turbid water conditions). Fish are fed six times a day at 3% body weight until they reach a size of 100 fpp. Then feed frequency is reduced to three times a day and to .8% body weight. All fish are fed at least six days per week.
- Sample counts are done monthly. All species are inventoried initially as eggs. Post egg inventories occur manually or through the tag trailer for all but chum. Chum population estimation is egg count minus mortality.

8. Fish growth profiles

2007 Brood Quinault NFH steelhead

End of Month	Size (fpp)
February	2150
March	1012
April	403
May	290
June	201
July	117
August	87.5
September	47
October	33
November	22
December	18.5
January	16
February	14

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

9. Fish health protocols and issues

The OFHC in Olympia, Washington, provides the fish health care for Quinault NFH under the auspices of the published policy 713 FW in the Service Manual (FWM). In addition, other fish health measures may be adopted after consideration by the HET. Fish health exams must be done prior to releases. Fish health inspections, as defined by the Service Handbook/AFS Blue Book, must be performed approximately 6 weeks prior to any fish transfers. The fish health management programs at Quinault NFH meet or exceed the Co-Managers' Salmonid Disease Control Policy of 2006.

In general, movements of live fish into or out of the hatchery must 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 WDFW, the Service, and any other states through which the fish travel must be obtained and approved. Fish health exams and certifications must be done prior to any releases or transfers from the hatchery to minimize risks from possible disease transmittance.

3.6.2 Fish Health Examinations - A fish health biologist, (FHB) from OFHC visits at least monthly to examine fish at the hatchery. Based on observations of fish, input from the hatchery staff, and hatchery records, the FHB will determine numbers and distribution of the fish to be tested, as well as what tests will be employed.

Diagnostic examinations are performed as determined by the FHB and/or when requested by hatchery or WWFOW personnel.

3.6.3 Broodstock Health Evaluation - The number of broodstock sampled will meet or exceed the minimum requirements described in the Service's Handbook/AFS Blue Book and in the Washington Co-Managers' Salmonid Disease Control Policy document. The number and type of fish samples are based on programs and disease history.

3.6.5 Other Management Practices - Cleaning practices are used to minimize bacterial and virus infections. Such as:

- Tank trucks and tagging trailers are disinfected before and after being used at the hatchery. More specific fish health guidelines regarding marking and tagging are found in Attachment 9.
- Raceways are pressure washed and disinfected with chlorine prior to being used.
- Fish screens are checked twice a day. Screens are cleaned when needed.
- The intake settling basin is cleaned annually. Accumulated sediments are removed mechanically

The Abernathy Fish Technology Center provides feed quality analyses to ensure that feed manufacturers are meeting nutrient specifications to avoid nutritional diseases and contribute to healthy fish.

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

Fish health recommendations in addition to those already addressed in other parts of the CHMP for hatchery production operations and environmental parameters for Quinault NFH include the following:

1. Flow index (Piper 1982) should never exceed 1.0 for any period during the rearing cycle of any species.
2. Density index (Piper 1982) should not exceed 0.20 during early phases of rearing.
3. Pond water exchange rate (turn over) should be at least 2 per hour (Wedemeyer 1996).
4. Fish feed storage should not exceed 90 days post-manufacture.
5. Mortalities should be removed from all ponds, disposed properly, and recorded on a daily basis.

10. Chemotherapeutant use

- It has been, and will continue to be, the philosophy of the HET to minimize drug treatment to fish and eggs. By practicing sound fish culture and disinfection practices drug treatments are minimized. However, in some cases, medications must be used and follow formulations listed below:
- Treatment of Fish Eggs - PVP iodine at 75 ppm for 30 minutes is used during water hardening to disinfect eggs. Formalin 1:6000 (167 ppm) for 15 minutes starting at least 24 hours after fertilization is used to control fungus on eggs. Formalin is applied three to seven days a week depending on the species being treated. Treatments continue until eggs are inventoried.
- Treatment of Adult Fish: Holding adult fish are not routinely treated at the hatchery. If a treatment is indicated, the FHB will make recommendations to the HET and collaboratively determine a treatment plan.
- Treatment of Juvenile Fish: Treatment of juvenile fish does not occur on a regular basis. If a treatment is indicated, the FHB will make recommendations to the HET and collaboratively determine a treatment plan.

11. Tagging and marking of juveniles⁶⁶

This section briefly describes marking methods, and how this marking provides data for short and long-term post-release survival estimates, fishery contribution estimates, and changes in genetic profiles. Fish marking is done using a coded-wire-tagging system. Fish tagging and sampling goals are presented in Table 6. These goals were developed based on statistical analysis of fish survival and contribution estimates. Tag groups are replicated as recommended by the “PSC Workshop on Hatchery CWT Methodology” [Sands 1995]. Current Quinault NFH tag program costs are summarized in a document entitled “Hatchery

⁶⁶ QNNFH CHMP Draft p. 44-46.

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

Support Activities Costs Review” [USFWS 2001]. Past evaluations are listed in Attachment 11.

Other short-term, pre-release evaluations are conducted. These are usually directed towards fish health problems during juvenile rearing. Generally, fish health and mortality tracking are used to evaluate these treatments instead of using the coded-wire-tag system.

Hatchery data are routinely collected and stored in the Fisheries Resource Evaluation Database (FRED), maintained by the WWFVO. Data stored in FRED include adult return numbers and their fates, egg production, fry production, released and transferred fish production, tagging and marking activities, tag and mark recovery, and sampling activities. The database serves as an information system that is used to provide current and historical data to fisheries agencies and fisheries managers.

Specifically, 20,000 coded-wire tags of a single code and an adipose clip are applied to about half of the raceways that the production group occupies.

3.7.1 Mass Marking Law - The FY 2003 appropriations language (House bill, Conference Committee and Omnibus Appropriations) requires the Service to implement a system of mass marking of salmonid stocks released from federally operated or federally financed hatcheries including but not limited to fish releases of the coho, Chinook, and steelhead species. The requirements of this section shall not be applicable when the hatchery fish are produced for conservation purposes.” The House report further states that the Service is expected to be a full participant in this effort by ensuring that hatchery fish that are suitable/available for selective fisheries are visually marked to assist in the identification and recovery of wild salmonid stocks.”

The mass mark law did not cause any changes in the Quinault coho program since mass marking was already implemented in 1997 for the very same reasons stipulated in the law. However, the mass marking law did require the Service to mark all of the steelhead and Chinook production as well. However, steelhead mass marking was discontinued since they are not subject to selective harvest and because funding was reduced. The mass mark law will guide future marking regardless of fish production changes.

USFWS Olympic Peninsula Hatchery Review Team
Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

Table 6. *Current Quinault NFH marking, tagging, and sampling goals.*

Species	Juveniles			Adults	
	Production goal	Mark/tag	Number	Mark/tag sample rate	Scale sample rate
Fall Chinook	600,000	Tag/clip	200,000	100%	100%
”		Clip only	400,000	100%	100%
Coho, on-station	660,000	Tag/clip	80,000	50%	n/a
”		Tag/no clip	80,000	50%	n/a
		Clip only	500,000	50%	n/a
Chum	1,500,000	None	n/a	n/a	25%
Steelhead, on-station	190,000	Tag/clip	20,000	100%	25%
		Clip only ¹	170,000	100%	25%
Steelhead, Hoh River	100,000	Tag/clip	20,000	n/a	n/a
”		Clip only	80,000	n/a	n/a

¹ For release year 2007 (brood 2005-06), due to funding and appropriation constraints these fish were not clipped.

12. Fish Release

a) Protocols

- All species are force released through outflow channels and pipes. Generally, raceway screens and boards are removed late in the day and then remaining fish are forced out the next day.
- Fish are generally released at a time, size, and physiological condition that provide a low likelihood of residualization, and promote a rapid migration to marine waters.
- The release of steelhead commences when 5.5 fish per pound is achieved, usually between April and May.

b) Number of fish released each year

Quinault NFH On-Station Steelhead Releases

Date	Stage	Number	Size (fpp)
5/13/1997	Yearling	198,101	5.1
5/15/1998	Yearling	169,474	5.9
5/13/1999	Yearling	252,647	6.2
5/3/2000	Yearling	217,583	5.2
5/8/2001	Yearling	214,846	5.2

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

4/16/2002	Yearling	189,707	5.8
5/12/2003	Yearling	182,352	6.3
5/3/2004	Yearling	195,937	7.3
5/23/2005	Yearling	210,208	6.9
5/10/2006	Yearling	248,688	9.7

D. Program benefits and performance

1. Adult returns

a) Numbers of adult returns and average SAR

Rack and River Combined [USFWS 2006b]

Return Year	Age at Return					Total Per Year
	2	3	4	5	6	
1996-97	3	1,562	1,138	0	0	2,703
1997-98	2	1,020	1,206	0	0	2,228
1998-99	1	2,061	901	0	0	2,963
1999-00	0	1,004	582	0	0	1,586
2000-01	2	1,233	1,377	0	0	2,612
2001-02	0	6,166	2,066	0	0	8,232
2002-03	4	1,288	864	8	0	2,164
2003-04	4	2,348	1,230	16	0	3,598
2004-05	49	1,290	926	0	0	2,265
2005-06	1	751	716	13	0	1,481

The number of adult returns indicates a successful program. Total survival rate exceeds 1.7 percent. Broods 2004 and 2005 were mass marked.

USFWS Olympic Peninsula Hatchery Review Team
Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

Table: Cook Creek Steelhead Escapement History [pers. comm. D. Zajac, USFWS, 2008]

Year	Total Adult Escapement		Total
	Wild	Hatchery	
1996	50	na	
1997	23	na	
1998	78	na	
1999	18	na	
2000	62	na	
2001	48	na	
2002	16	na	
2003	20	na	
2004	19	na	
2005	45		69
2006	63		52
2007	47		21
2008	130		44

na = no hatchery surveys conducted

March 15th is the separation date used for hatchery/wild.

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

*Table: Basin-Wide Quinault Winter Steelhead Harvest and Escapement Estimates-
Natural Stock [pers. comm. L. Gilbertson, Quinault Indian Nation, 2008]*

Run Year	Lower River Stock		Upper River Stock			Total
	Catch	Escapement	Total	Catch	Escapement	
1978	3,023	2,234	5,257	1,690	1,061	2,751
1979	2,309	2,436	4,745	1,083	892	1,975
1980	534	3,646	4,180	354	1,294	1,648
1981	2,734	3,592	6,326	1,096	1,192	2,288
1982	2,536	2,972	5,508	1,100	1,070	2,170
1983	1,882	1,716	3,598	1,383	772	2,155
1984	707	3,052	3,759	630	2,722	3,352
1985	3,902	2,162	6,064	2,417	1,218	3,635
1986	1,963	2,354	4,317	2,682	2,644	5,326
1987	1,942	1,764	3,706	1,657	1,227	2,884
1988	3,100	3,002	6,102	1,508	1,264	2,772
1989	2,537	2,910	5,447	1,263	1,430	2,693
1990	1,976	2,682	4,658	1,518	1,832	3,350
1991	1,424	1,745	3,169	1,528	1,719	3,247
1992	2,854	2,192	5,046	1,706	1,192	2,898
1993	2,281	1,557	3,838	1,858	1,156	3,014
1994	1,076	1,755	2,831	969	1,299	2,268
1995	889	1,352	2,241	1,272	1,346	2,618
1996	1,279	1,282	2,561	1,404	1,177	2,581
1997	1,159	1,903	3,062	1,392	1,745	3,137
1998	1,174	1,091	2,265	1,417	1,307	2,724
1999	581	734	1,315	1,075	1,162	2,237
2000	854	1,136	1,990	1,362	1,470	2,832
2001	1,384	956	2,340	2,914	1,846	4,760
2002	850	897	1,747	1,654	1,303	2,957
2003	523	462	985	2,020	1,571	3,591
2004	1,274	859	2,133	2,338	1,269	3,607
2005	569	867	1,436	1,906	2,877	4,783

Note: "Run Year" refers to the spawning year, so 1978 refers to winter 77'-78'

USFWS Olympic Peninsula Hatchery Review Team
Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

Table: Basin-Wide Quinault Hatchery Winter Steelhead Harvest and Escapement Estimates (Quinault NFH and Lake Quinault Pen Rearing programs) [pers. comm. L. Gilbertson, Quinault Indian Nation, 2008]

Run	Total Catch	Total Escapement	Total Hatchery Run Size
1978	2,917	2,638	5,555
1979	2,067	2,835	4,902
1980	1,127	2,670	3,797
1981	5,764	7,576	13,340
1982	7,303	7,928	15,231
1983	5,539	4,357	9,896
1984	10,975	5,979	16,954
1985	16,512	2,857	19,369
1986	9,593	2,423	12,016
1987	16,436	3,360	19,796
1988	16,202	2,641	18,843
1989	10,679	2,443	13,122
1990	5,973	2,292	8,265
1991	6,221	2,615	8,836
1992	5,866	5,258	11,124
1993	10,753	5,865	16,618
1994	3,416	3,186	6,602
1995	7,722	6,388	14,110
1996	8,979	5,115	14,094
1997	7,590	4,684	12,274
1998	7,156	4,098	11,254
1999	11,297	5,566	16,863
2000	6,698	2,485	9,183
2001	6,357	3,042	9,399
2002	6,227	8,278	14,505
2003	4,971	3,605	8,576
2004	4,789	4,952	9,741
2005	4,474	4,026	8,500

Notes:

* "Run Year" refers to the spawning year, so 1978 refers to winter 77'-78'

* Includes hatchery returns from both Quinault NFH (USFWS) and Lake Quinault Pen Rearing (Quinault Nation)

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

b) Return timing and age-class structure of adults

Age range 2 -6 years and average 3.4 (1985-2003). Entry date range September – February and mean entry December 14. [USFWS 2006b]

2. Contributions to harvest and utilization (e.g. food banks)

- See section a) above. Sport harvest in Cook Creek not enumerated. However, it is substantial since fisherman gain access through hatchery proper and many fish are observed as they leave.
- Also, nearly all excess fish and spawned fish as well are distributed as subsistence to local residents.

3. Contributions to conservation

None identified.

4. Other benefits

None identified.

E. Research, monitoring, and evaluation programs

- Current production survival and contribution is monitored using coded-wire tags as described in section C 11.
- Also, tissue are collected annually for long term trend genetic analysis regarding the genetic profile of the Quinault NFH steelhead.

F. Program conflicts

1. Biological conflicts (e.g. propagated stock maladapted to hatchery water source)

None identified.

2. Harvest conflicts (e.g. mixed stock fishery on hatchery and wild fish limits harvest opportunities on hatchery fish)

None identified.

3. *Conservation conflicts and risks*

- a) Genetic conflicts associated with straying and natural spawning of hatchery fish (Stray rates, proportion of hatchery-origin fish on natural spawning grounds, etc. Provide tables or figures where appropriate)**

None identified.

- b) Ecological conflicts (e.g. competition between hatchery fish and wild fish, predation,)**

- The rearing and release strategies for Quinault steelhead are designed to promote rapid outmigration. However, the potential still exists for ecological interactions to occur between the hatchery steelhead and all other stocks.

4. *Other conflicts between the hatchery program, or fish produced by the program, and other non-hatchery issues*

None identified.

IIIB. Quinault NFH Steelhead (Hoh River Program)

A. General information⁶⁷

The Quinault NFH was originally established to restore fisheries to the Quinault Reservation and to adjacent Federal lands. As part of this general commitment a Quinault NFH steelhead pre-smolt transfer to the Hoh Reservation and a smolt release into the Hoh River was initiated in the mid-1980s in consultation with the Hoh Tribe, the Quinault Indian Nation, and the state of Washington. 50,000 steelhead smolts are reared for release into Hoh River, and 50,000 pre-smolts for transfer, imprint, and subsequent release from Chalaat Creek hatchery (Hoh River).

B. Stock/Habitat/Harvest Program Goals and Purpose

1. Purpose and justification of program⁶⁸

See Quinault NFH Steelhead (On-station release) section.

2. Goals and Objectives of program⁶⁹

See Quinault NFH Steelhead (On-station release) section.

3. Type of program (*Integrated or Segregated*)

Segregated.

4. Alignment of program with ESU-wide plans

There are no NOAA jurisdictional listed species in the area.

5. Habitat description and status where fish are released⁷⁰

⁶⁷ QNNFH CHMP Draft p. 9.

⁶⁸ QNNFH CHMP Draft p. 15, 16

⁶⁹ QNNFH CHMP Draft p. 59-63.

⁷⁰ HSRG 2004 p. 734.

USFWS Olympic Peninsula Hatchery Review Team
Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

Please fill out the table below for each stock using the general definitions provided:

	Spawning Habitat		Freshwater Rearing Habitat		Migration Habitat		Estuarine Habitat
	Hatchery	Wild	Hatchery	Wild	Hatchery	Wild	
Rating (H/M/L)	N/A	M	N/A	M	N/A	M	M

Three categories of habitat are defined in terms of conditions that support the target stocks, with the assumption that these conditions would also provide for the needs of other native stocks of salmonids (assume that pre-terminal harvest is part of the environment during the fish's whole life cycle).

These habitat ratings are:

1. **High (H) = Healthy:** Productivity of the target stock is high and the population is capable of growth and supporting significant terminal harvest.
2. **Medium (M) = Limiting:** The target stock is productive enough for the population to sustain itself at a low level terminal harvest.
3. **Low (L) = Inadequate:** The target stock is unproductive and the population will go extinct, even without terminal harvest.

6. Size of program and production goals⁷¹

See Quinault NFH Steelhead (On-station release) section.

C. Description of program and operations⁷²

1. Broodstock goal and source

See Quinault NFH Steelhead (On-station release) section.

2. Adult collection procedures and holding

See Quinault NFH Steelhead (On-station release) section.

3. Adult spawning

See Quinault NFH Steelhead (On-station release) section. Spawning is conducted as per usual production spawning methods and protocols. However, specific eggs for this program are taken during two takes during late December and early January. The intention is to select a segment of the run that would return to the Hoh River between wild coho and wild steelhead runtimes and allow targeted harvest.

⁷¹ QNNFH CHMP Draft p. 35, 42.

⁷² Unless otherwise specified, section text from QNNFH CHMP Draft p. 35-46.

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

4. Fertilization

See Quinault NFH Steelhead (On-station release) section.

5. Incubation

See Quinault NFH Steelhead (On-station release) section.

6. Ponding

See Quinault NFH Steelhead (On-station release) section.

7. Rearing/feeding protocols

See Quinault NFH Steelhead (On-station release) section.

8. Fish growth profiles

See Quinault NFH Steelhead (On-station release) section.

9. Fish health protocols and issues

See Quinault NFH Steelhead (On-station release) section. This program requires an exemption request from the co-manager's fish health policy since the Hoh is in a different fish health zone and the juveniles are not reared in regulated pathogen free water as a result of some adult salmon and steelhead passing above the hatchery. Also, the adults spawned for this program are sample at a 100% level for reportable pathogens.

10. Chemotherapeutant use

See Quinault NFH Steelhead (On-station release) section.

11. Tagging and marking of juveniles⁷³

100% of the juveniles are adipose clipped and the Allen's Bar release and the Chalaat Creek transfer receive 10,000 coded-wire tags each.

12. Fish Release

a) Protocols

See Quinault NFH Steelhead (On-station release) section.

⁷³ QNNFH CHMP Draft p. 44-46.

USFWS Olympic Peninsula Hatchery Review Team
Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

b) Number of fish released each year

Releases into Hoh River at Allen’s Bar

Date	Stage	Number	Size (fpp)
5/7/1997	Yearling	58,970	7.4
5/15/1998	Yearling	49,102	5.8
5/14/1999	Yearling	49,372	9.7
5/11/2000	Yearling	46,058	5.4
5/8/2001	Yearling	49,939	6.3
4/19/2002	Yearling	65,351	6.4
5/14/2003	Yearling	53,583	6.3
5/19/2004	Yearling	51,396	7.9
5/20/2005	Yearling	55,115	8.5
5/10/2006	Yearling	59,926	7.4

Transfers to Chalaat Creek Hatchery

Date	Stage	Number	Size (fpp)
2/25/1997	Yearling	49,975	9.2
2/27/1998	Yearling	44,998	10.0
2/19/1999	Yearling	49,126	14.9
2/24/2000	Yearling	49,144	11.2
2/12/2001	Yearling	51,803	11.1
1/17/2002	Yearling	53,571	10.4
2/13/2003	Yearling	51,596	11.4
3/4/2004	Yearling	53,292	18.4
2/23/2005	Yearling	48,625	13.1
2/15/2006	Yearling	50,381	16.4

D. Program benefits and performance

1. Adult returns

a) Numbers of adult returns and average SAR

Table: Hoh River Winter Steelhead Run Reconstruction [pers. comm. T. Jurasin, Hoh River Tribe, 2008]

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

Hoh River Winter Steelhead Run Reconstructions (pers. comm. T. Jurasin, HOI)

Season	Run Size		Escapement		Harvest							
	Wild	Hatchery	Wild	Hatchery	Wild			Hatchery				
					Treaty	NT	TOTAL	Treaty	NT	TOTAL		
											Commercial	C & S
1990-91	4,206		2783		832	20	571	1,423	1865		273	2138
1991-92	4,515		2061		1,131	20	1,303	2,454	1587		571	2158
1992-93	4,144		2053		862	20	1,209	2,091	2188		1016	3204
1993-94	3,988		2239		871	30	848	1,749	821		328	1149
1994-95	3,571		2204		538	30	799	1,367	888		1075	1963
1995-96	4,097		2340		963	30	764	1,757	1344		548	1892
1996-97	4,152		3008		815	50	279	1,144	2296		783	3079
1997-98	3,977		3689		258	20	10	288	1344		387	1731
1998-99	4,123		3095		579	33	416	1,028	3067		505	3572
1999-00	4,468		3162		724	40	542	1,306	1223		734	1957
2000-01	5,351		2,767		1,909	39	636	2,584	2,082		968	3050
2001-02	5,125		2,811		1,603	12	699	2,314	2,229		1,518	3747
2002-03	3,583		1,616		1,399	30	538	1,967	1,016		650	1666
2003-04	4,053		2,268		1,051	30	704	1,785	842		211	1053
2004-05	2,539		1,480		833	18	208	1,059	738		437	1175
2005-06	3,984		3,547		294	27	116	437	1,001		427	1428
2006-07	3,914		3,026		692	30	166	888	840		76	916
average	4,105		2,597		903	28	577	1,508	1,492		618	2,110
min	2,539		1,480		258	12	10	288	738		76	916
max	5,351		3,689		1,909	50	1,303	2,584	3,067		1,518	3,747

Notes:

- * The Hoh River sport fishery was closed to the retention of wild steelhead during the 1997/98 season.
- * Hatchery run sizes are estimates based on return rates to the Quinault River system of Cook Creek NFH releases in the Quinault River system and Hoh River yearling releases.
- * Hatchery/wild proportions for sport catches reflect Catch Record Card estimates from the 1991/92 season through the 02/03 season.
- * Creel surveys do not include SF Hoh or ONP but CRC numbers do. Non-retention of wild above Oxbow Campground.
- * 03/04 estimates are from a creel survey. The comparable CRC numbers are 760 unmarked and 488 marked.
- * 04/05 estimates are from a creel survey. The comparable CRC numbers are 243 unmarked and 705 marked.
- * 05/06 estimates are from a creel survey. The comparable CRC numbers are 135 unmarked and 676 marked.
- * 06/07 estimates are from a creel survey. The comparable CRC numbers are 97 unmarked and 188 marked (draft).
- * Hatchery/wild proportions for the tribal gill net fishery from 1993/94 to present reflect scale pattern analysis. Proportions in earlier years were determined from the presence of marks or stubbed dorsals.
- * Tribal commercial hatchery catch includes hatchery dip-in steelhead from other systems.
- * Tribal C&S are separately scheduled ceremonial or subsistence fisheries and do not include personal use fish kept during commercial openers
- * Separately scheduled C&S fisheries generally occur in late March and in April where commercial fishing is limited or unscheduled
- * No adult collection facility exists in the Hoh Basin for annual rack return

USFWS Olympic Peninsula Hatchery Review Team
Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

b) Return timing and age-class structure of adults

See Quinault NFH Steelhead (On-station release) section.

2. Contributions to harvest and utilization (e.g. food banks)

- See section D,1a) above

Table. Contributions to harvest (Hoh River): [HSRG Briefing Book, Internal Document, 2004]

HOH RIVER WINTER STEELHEAD								
Year	HARVEST				ESCAPEMENT		TERMINAL RUNSIZE	
	Treaty		NonTreaty		Natural	Hatchery	Natural	Hatchery
	Natural	Hatchery	Natural	Hatchery				
1981	1,067	2,213	787	1,156	2,224	N/A	4,078	N/A
1982	1,326	1,384	473	696	3,984	N/A	5,783	N/A
1983	765	1,196	385	566	4,593	N/A	5,743	N/A
1984	1,064	4,406	582	1,789	3,670	N/A	5,316	N/A
1985	1,888	7,142	605	3,817	3,228	N/A	5,721	N/A
1986	1,726	4,672	368	1,000	3,000	N/A	5,094	N/A
1987	1,242	5,152	357	1,945	2,908	N/A	4,507	N/A
1988	1,927	4,099	873	1,257	2,906	N/A	5,706	N/A
1989	974	2,526	608	990	2,808	N/A	4,390	N/A
1990	1,419	2,224	696	558	2,390	N/A	4,505	N/A
1991	832	1,865	571	273	2,783	N/A	4,186	N/A
1992	1,131	1,587	970	897	2,061	N/A	4,162	N/A
1993	862	2,188	891	1,334	2,053	N/A	3,806	N/A
1994	871	821	623	472	2,239	136	3,733	1,429
1995	538	888	799	1,074	2,204	1,728	3,541	3,690
1996	963	1,344	764	820	2,340	2,288	4,067	4,452
1997	815	2,296	263	942	3,008	840	4,086	4,078
1998	258	1,344	10	387	3,689	1,205	3,957	2,936
1999	579	3,067	416	517	3,095	2,120	4,090	5,704
2000	724	1,223	542	726	3,162	635	4,428	2,584
2001	1,909	2,082	583	923	2,767	294	5,259	3,299
2002	1,603	2,229	643	1,579	2,811	N/A	5,057	N/A

3. Contributions to conservation

None identified.

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

4. Other benefits

None identified.

E. Research, monitoring, and evaluation programs

- See Quinault NFH Steelhead (On-station release) section.
- The Hoh Tribe and Olympic Nation Park received funding in 2007 to collect Hoh River steelhead tissues for subsequent genetic analysis and comparison the Quinault NFH steelhead. Results not available yet

F. Program conflicts

1. Biological conflicts (e.g. propagated stock maladapted to hatchery water source)

None identified.

2. Harvest conflicts (e.g. mixed stock fishery on hatchery and wild fish limits harvest opportunities on hatchery fish)

There is the potential for harvest conflicts to occur with both Hoh River wild coho and wild steelhead. However, the fish are mass marked for stock identification and harvest management. There is also the potential for genetic conflicts with Hoh wild steelhead via interbreeding. Ecological conflicts could occur as well with juvenile wild steelhead.

3. Conservation conflicts and risks

a) Genetic conflicts associated with straying and natural spawning of hatchery fish (Stray rates, proportion of hatchery-origin fish on natural spawning grounds, etc. Provide tables or figures where appropriate)

There are no terminal recovery areas for Quinault steelhead returning to the Hoh River, posing a genetic risk to the natural-origin Hoh River steelhead population depending upon the relative abundance of hatchery and natural origin steelhead and the extent to which hatchery steelhead stray into tributaries where natural spawning occurs. Genetic samples have been collected to help assess this risk. Results are pending⁷⁴.

b) Ecological conflicts (e.g. competition between hatchery fish and wild fish, predation,)

⁷⁴ pers. comm. Tyler Jurasin, Hoh Tribe, 2008

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

- The rearing and release strategies for Quinault steelhead are designed to promote rapid outmigration. However, the potential still exists for ecological interactions to occur between the hatchery steelhead and all other stocks.

4. Other conflicts between the hatchery program, or fish produced by the program, and other non-hatchery issues

None identified.

IIIC. Quinault NFH Coho

A. General information

See section IIIA,A.

B. Stock/Habitat/Harvest Program Goals and Purpose

1. Purpose and justification of program

See section IIIA,B.

2. Goals of program

See section IIIA,B.

3. Objectives of program

See section IIIA,B.

4. Type of program (*Integrated or Segregated*)

Segregated.

5. Alignment of program with ESU-wide plans

There are no NOAA jurisdictional listed species in the area.

6. Habitat description and status where fish are released.

See section IIIA,B,5.

7. Size of program and production goals (*No. of spawners and smolt release goals*)⁷⁵

<i>Coho</i>			
Spawned population	900	898	752 – 1,081
Smolts released (Cook Creek)	660,000	577,486	552,274 – 595,314
Smolt size at release (fish/lb)	17	16.8	15.5 – 17.8

⁷⁵ QNNFH CHMP Draft p. 35, 42.

USFWS Olympic Peninsula Hatchery Review Team
Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

Percent survival from smolt	3.00%	4.62%	3.58% - 6.47%
Pre-smolt size at release (fish/lb)	20	19.0	13.9 – 25.4

Number	Life stage	Fish size		Release site/Destination
		No./lb.	g/fish	
Coho salmon				
660,000	Smolt	15-20	23-30	On-station, Cook Creek

C. Description of program and operations

1. Broodstock goal and source

Collect and successfully spawn 450 pairs (450 females, 405 males, and 45 jacks) from coho returning to the hatchery.

2. Adult collection procedures and holding⁷⁶

Adult coho return to the hatchery from mid-September through early-January. Brood fish enter the hatchery via a fish ladder. The fish ladder is associated with a graduated-field electric weir that spans Cook creek. Adult fish ascend the ladder and enter a collection channel. The collection channel is the outflow channel for the “E” bank of raceways. Two of the six “E” bank raceways are used for adult collection. Two ponds are used during fish returns, one for actual adult return access, and another for holding unripe, post-sorted returning fish.

3. Adult spawning

a) Spawning protocols

See section IIIA,C,3,a.

b) No. of males and females spawned each year over past 10 years⁷⁷

Year	Females	Males	Jacks	% Jacks
1997	359	265	23	8.0
1998	612	578	22	3.7
1999	722	729	8	1.1
2000	462	470	3	.6

⁷⁶ QNNFH CHMP Draft p. 36.

⁷⁷ USFWS 1991.

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

2001	386	374	1	.3
2002	585	481	15	3.2
2003	498	464	0	0
2004	377	342	33	8.8
2005	380	336	28	7.8
2006	472	402	37	8.4
AVERAGE	485	444	17	3.7

4. Fertilization

a) Protocols

See section IIIA,C,4a.

b) Number of coho eggs collected and fertilized each year⁷⁸

Brood Year	Number Green	Number Eyed	% Eyed
1998	1,949,821	1,230,664	63.1
1999	2,059,922	1,654,664	80.3
2000	1,313,743	1,055,529	80.3
2001	1,179,801	770,788	65.3
2002	1,699,761	1,376,913	81.0
2003	1,428,661	1,043,652	73.1
2004	1,283,468	976,856	76.1
2005	1,236,905	1,002,677	81.1
2006	1,661,834	1,486,382	89.4
2007	1,245,947	1,134,212	91.0

5. Incubation

See section IIIA,C5.

6. Ponding

a) Protocols

See section IIIA,C6a.

⁷⁸ pers. comm. Bill Edwards, US Fish and Wildlife Service, 2008.

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

b) Number of fry ponded each year, including % hatch each year

The number of fry ponded from 1998 to 2007 has ranged from about 750,000 to 1,500,000. The yearling production goal is 660,000. Eggs excess to program needs are generally discarded. However, some fry can be planted upstream [Zajac 2004].

7. Rearing/feeding protocols

See section IIIA.C.7.

8. Fish growth profiles

Brood 2006 Quinault NFH coho

End of Month	Size (fpp)
February	1250
March	616
April	318
May	192
June	162
July	99
August	69
September	40
October	33
November	28
December	25
January	23.5
February	20

9. Fish health protocols and issues

See section IIIA,C,9.

10. Chemotherapeutant use

See section IIIA, C, 10.

11. Tagging and marking of juveniles

See section IIIA, C, 11. Specific tagging protocols include application of four uniquely coded tagged and adipose clipped groups of 20,000 and matching uniquely coded unclipped groups (DITs) to four of the 10 ponds in A and B banks that the fish occupy. The ponds are selected so that the tags represent as many as the spawn takes as possible. The remaining fish are adipose clipped (mass marked).

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

12. Fish Release

a) Protocols

See section IIIA, C, 12a.

b) Number of fish released each year

Quinault On-Station Coho Releases [USFWS 1991]

Date	Stage	Number	Size (fpp)
5/1/1997	Yearling	625,040	16.6
4/29/1998	Yearling	688,204	15.5
4/16/1999	Yearling	528,533	14.0
4/19/2000	Yearling	551,409	12.8
4/20/2001	Yearling	595,314	16.4
4/22/2002	Yearling	575,892	17.0
4/23/2003	Yearling	552,274	17.1
4/19/2004	Yearling	592,876	17.8
4/18/2005	Yearling	169,919	15.1
4/22/2005	Yearling	124,991	15.5
4/26/2005	Yearling	276,165	15.8
4/26/2006	Yearling	649,573	15.1

Camp 7 Pond Releases [USFWS 1991]

Date	Stage	Number	Size (fpp)
3/25/1999	Yearling	20,016	16.8
3/8/2000	Yearling	58,544	13.5
2/15/2001	Yearling	64,059	25.4
3/14/2002	Yearling	55,437	13.9
3/11/2003	Yearling	61,470	19.2
3/26/2004	Yearling	64,141	17.4
4/27/2005	Yearling	43,871	19.0

Note: The Camp 7 was discontinued due to poor performance and poor access.

D. Program benefits and performance

1. Adult returns []

a) Numbers of adult returns

USFWS Olympic Peninsula Hatchery Review Team
Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

Number of Returning Adults [USFWS 2006b]

Return Year	Age at Return		Total per Year
	2	3	
1996	411	3,885	4,296
1997	109	6,446	6,555
1998	167	698	865
1999	844	2,526	3,370
2000	1,461	11,550	13,011
2001	2,413	7,550	9,963
2002	240	24,551	24,791
2003	416	9,476	9,892
2004	1,212	8,601	9,813
2005	378	8,787	9,165

The number of adult returns indicates a successful coho program. Total survival rate averages 2.2 percent. A density study to determine the effects of three production levels on adult survival rates is in progress. Coho are mass marked to support selective fisheries.

Table: Basin-Wide Quinault Fall Coho harvest and Escapement Estimates (hatchery and wild) [pers. comm. L. Gilbertson, Quinault Indian Nation. 2008]

Year	Natural Stock Catch	Hatchery Stock Catch	Natural Stock Natural Spawning	Natural Stock in Hatchery Rack	Hatchery Stock Natural Spawning	Hatchery Stock Rack Return	Total Natural Spawners	%Hatch in Natural Spawners
1936	32,958							
1937	14,118							
1938	22,549							
1939	32,329							
1940	7,595							
1941	44,444							
1942	7,538							
1943	26,735							
1944	10,695							
1945	28,212							
1946	8,475							
1947	18,704							
1948	6,691							
1949	13,373							
1950	29,482							
1951	19,316							
1952	24,117							
1953	16,477							
1954	11,543							

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

1955	11,384								
1956	14,987								
1957	11,808								
1958	10,756								
1959	11,360								
1960	9,081								
1961	9,491								
1962	9,943								
1963	7,179								
1964	8,299								
1965	7,000								
1966	6,900								
1967	6,000								
1968	5,900								
1969	6,530								
1970	6,000								
1971	5,900								
1972	5,700								
1973	5,800	200							
1974	4,950	250							
1975	4,100	736							
1976	4,000	1,583							
1977	968	300	1500		300		1,800	0.166667	
1978	3,520	2,600	2500		1,600		4,100	0.390244	
1979	3,541	7,000	7200	2,141	751	3,003	7,951	0.094425	
1980	3,752	8,229	2,499	2,782	462	1,849	2,961	0.1561	
1981	2,264	7,951	2,217	407	959	3,837	3,176	0.302007	
1982	2,538	8,487	2,241	1,495	276	1,103	2,517	0.109566	
1983	1,954	1,679	7,045	1,934	316	1,265	7,361	0.042961	
1984	5,257	15,737	3,160	5,687	725	2,901	3,885	0.186668	
1985	1,810	5,464	1,524	3,435	164	657	1,688	0.09729	
1986	9,761	16,425	5,136	919	544	2,174	5,680	0.095695	
1987	6,242	7,341	1,849	2,989	179	716	2,028	0.088264	
1988	1,084	10,426	1,194	1,498	814	3,256	2,008	0.405378	
1989	3,544	4,562	4,443	47	564	2,257	5,007	0.112687	
1990	2,025	6,049	3,301	2,292	610	2,440	3,911	0.15597	
1991	3,951	15,986	9,250	1,149	2,249	8,997	11,499	0.1956	
1992	2,064	2,916	4,616	0	874	3,494	5,490	0.159122	
1993	1,134	4,369	1,940	44	347	1,386	2,287	0.151542	
1994	458	748	820	352	24	94	844	0.02786	
1995	2,082	2,638	3,249	786	775	3,099	4,024	0.192594	
1996	3,996	4,560	4,679	2,039	1,102	4,407	5,781	0.190624	
1997	137	160	636	329	137	548	773	0.177232	
1998	3,420	2,194	3,042	453	518	2,073	3,560	0.145506	
1999	4,773	9,194	2,191	4,199	1,838	7,351	4,029	0.456193	
2000	5,402	9,859	3,491	1,491	1,515	6,059	5,006	0.302637	
2001	6,809	18,222	7,372	8,481	4,017	16,070	11,389	0.352709	
2002	4,869	12,719	2,045	5,489	1,996	7,984	4,041	0.493937	
2003	7,476	15,878	12,515	265	2,303	9,211	14,818	0.155419	
2004	6,792	10,171	7,373	8,481	2,017	8,070	9,390	0.214803	
2005	9,048	15,537	5,429	989	2,007	8,027	7,436	0.269903	
Mean %Hatch in Nat Spawn=									0.20309

USFWS Olympic Peninsula Hatchery Review Team
Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

b) Return timing and age-class structure of adults

The age at return for broods 1985-2005 includes 2 and 3 year olds with an average of 2.9. The entry timing for broods 1988-2004 is September through December with a mean entry of October 31.

2. Contributions to harvest and utilization (e.g. food banks)

- The catch of coho from broods 1988 – 2002 shows 44% contribute to U.S. sport, 29% to Tribal fisheries, 15% to Canada commercial, and 6% each to U.S. commercial and Canada sport.
- Many of the excess fish and the spawned adults are distributed to local residents. The rest are picked up by a processor under the Oregon Food Bank agreement.

3. Contributions to conservation

None identified.

4. Other benefits

None identified.

E. Research, monitoring, and evaluation programs

- Generally, coded-wire tagging is conducted as annually standard operating procedure to track survival and contribution. However, recent specific studies were conducted to assess the success of the Camp 7 program (discontinued due to poor performance) and to compare relative rearing densities (report in progress).
- Also, tissues are collected on an annual basis for long term trend genetic analysis regarding the genetic profile of Quinault coho.

F. Program conflicts

None identified.

1. Biological conflicts (e.g. propagated stock maladapted to hatchery water source)

None identified.

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

2. Harvest conflicts (e.g. mixed stock fishery on hatchery and wild fish limits harvest opportunities on hatchery fish)

None identified.

3. Conservation conflicts and risks

a) Genetic conflicts associated with straying and natural spawning of hatchery fish (Stray rates, proportion of hatchery-origin fish on natural spawning grounds, etc. Provide tables or figures where appropriate)

None identified.

b) Ecological conflicts (e.g. competition between hatchery fish and wild fish, predation,)

- Rearing and release strategies are designed to minimize the potential for adverse effects to other salmonid stocks. However, we do realize that the potential exists for ecological impacts.

4. Other conflicts between the hatchery program, or fish produced by the program, and other non-hatchery issues

None identified.

IIID. Quinault NFH Fall Chinook

A. General information

See section IIIA.A.

B. Stock/Habitat/Harvest Program Goals and Purpose

1. Purpose and justification of program

See section IIIA.B.

2. Goals of program

See section IIIA.B.

3. Objectives of program

See section IIIA.B.

4. Type of program (Integrated or Segregated)

Integrated.

5. Alignment of program with ESU-wide plans

There are no NOAA jurisdictional listed species in the area.

6. Habitat description and status where fish are released.

See section IIIA.B.5.

7. Size of program and production goals⁷⁹

Fall Chinook ²			
Spawned population	330	59	2 – 129
Smolts released	600,000	282,211 ³	204,363 – 344,665
Percent survival from smolt	0.50%	0.14%	0.07% - 0.19%
Smolt size at release (fish/lb)	40	70	55 – 104

⁷⁹ QNNFH CHMP Draft p. 35, 42.

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

² Results from composite Cook Creek and Quinault Lake broodstocks.

³ Production is consistently lower than goals as fall Chinook generally choose to stay in the mainstem, and not migrate into Cook Creek.

Number	Life stage	Fish size		Release site/Destination
		No./lb.	g/fish	
Fall Chinook salmon				
600,000	Smolt	40	11	On-station, Cook Creek

C. Description of program and operations

1. Broodstock goal and source

Collect as many brood fish from returning Chinook to the Quinault NFH. However, supplement shortage from adults (gametes) taken from Quinault Lake Pen program. Total goal is 165 pairs. The most recent agreed to number of adults spawned at the Lake to supplement Quinault NFH is 80-100 pair.

2. Adult collection procedures and holding⁸⁰

Fall Chinook return from mid-October through December. Brood fish enter the hatchery via a fish ladder. The fish ladder is associated with a graduated-field electric weir that spans Cook creek. Adult fish ascend the ladder and enter a collection channel. The collection channel is the outflow channel for the “E” bank of raceways. Two of the six “E” bank raceways are used for adult collection. Two ponds are used during fish returns, one for actual adult return access, and another for holding unripe, post-sorted returning fish.

3. Adult spawning

a) Spawning protocols

See section IIIA.C,3a.

b) No. of males and female fall Chinook spawned each year over past 10 years⁸¹

Year	Females	Males	Jacks	% Jacks

⁸⁰ QNNFH CHMP Draft p. 36

⁸¹ USFWS 1991

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

1997	55	55	0	0
1998	28	14	3	17.6
1999	29	19	0	0
2000	19	7	0	0
2001	9	8	2	20.0
2002	1	1	0	0
2003	74	45	0	0
2004	86	42	1	2.3
2005	27	18	2	10.0
2006	6	3	1	25.0
AVERAGE	33	21	1	4.5

4. *Fertilization*

a) **Protocols**

See section IIIA.C,4a. Eggs and milt from adults at the Lake are collected into zip-lock plastic bags, kept separately, transported in coolers on ice from the Lake to the Quinault NFH I/Q unit. Here they are fertilized per our standard operating procedures.

b) **Number of eggs collected and fertilized⁸²**

From Quinault NFH Returns

Brood Year	Number Green	Number Eyed	% Eyed
1998	317,503	294,519	92.8
1999	367,189	330,592	90.0
2000	81,701	66,201	81.0
2001	452,715	370,947	81.9
2003	337,808	295,898	87.6
2004	395,860	359,683	90.9
2005	337,853	279,769	82.8
2006	27,583	25,845	93.7
2007	7,767	6,575	84.7

From Eggs taken at Quinault Lake Pens

Brood Year	Number Green	Number Eyed	% Eyed
2000	208,847	159,569	76.4
2004	393,048	341,089	86.8

⁸² pers. comm. Bill Edwards, US Fish and Wildlife Service, 2008.

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

2006	360,483	308,062	85.5
2007	432,775	362,275	83.7

5. Incubation

See section IIIA.C.5.

6. Ponding

a) Protocols

See section IIIA.C.6a.

b) Number of fry ponded each year, including % hatch each year

The number of fry ponded from broods 1998-2007 have ranged from less than 100,000 to more than 600,000. The production goal is 600,000. No adults or fry are planted upstream [Zajac 2004].

7. Rearing/feeding protocols

See section IIIA.C.7.

8. Fish growth profiles

Brood 2006 Quinault NFH Chinook

End of Month	Size (fpp)
February	800
March	751
April	517
May	201
June	135.5
July	60

9. Fish health protocols and issues

See section IIIA.C.9.

10. Chemotherapeutant use

See section IIIA.C.10.

USFWS Olympic Peninsula Hatchery Review Team
Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

11. Tagging and marking of juveniles

See section IIIA.C.11. Specific tagging protocols include application of four unique tag codes of 50,000 each and adipose clip to each of four of the ponds. Generally, this means that at least one tag group is located in each of the rearing ponds. The remaining fish are adipose clipped (mass marked).

12. Fish Release

a) Protocols

See section IIIA.C.12a.

b) Number of fish released each year [USFWS 1991]

Fall Chinook Releases

Date	Stage	Number	Size (fpp)
7/15/1997	Subyearling	509,358	63.6
7/1/1998	Subyearling	550,408	61.0
7/14/1999	Subyearling	239,809	74.7
7/28/2000	Subyearling	334,483	55.3
7/13/2001	Subyearling	204,363	57.3
7/18/2002	Subyearling	344,665	58.4
7/16/2004	Subyearling	287,734	103.9
7/19/2005	Subyearling	647,005	68.0
7/27/2006	Subyearling	251,887	58.9

D. Program benefits and performance

1. Adult returns

a) Numbers of adult returns

Table. Number of Returning Adults [USFWS 1991]

Return Year	Age at Return					Total Per Year
	2	3	4	5	6	
1996	3	7	55	25	5	95
1997	2	32	93	38	3	168
1998	1	6	19	34	1	61
1999	0	7	42	30	0	79
2000	0	2	28	13	0	43

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

2001	4	2	26	8	0	40
2002	0	0	9	0	0	9
2003	1	40	122	4	0	167
2004	5	27	54	77	0	163
2005	2	0	39	28	0	69

The FCS program is augmented by a successful Quinault Lake broodstock capture program. Increased production is not desired because of considerable natural production in Cook Creek and the Quinault River. Total fishery harvest and hatchery return averages 1 percent of releases. 100 percent Chinook mass marking was initiated in 2004.

Table: History of Basin-Wide Quinault Fall Chinook Harvest and Escapement Estimates [pers. comm.. L. Gilbertson, Quinault Indian Nation. 2008]

Year	Natural Stock Harvest	Hatchery Catch	Natural Escapement	Year	Natural Stock Harvest	Hatchery Catch	Natural Escapement
1936	3,334			1971	1,916		
1937	1,579			1972	2,481		
1938	2,931			1973	1,676		
1939	2,637			1974	2,073	400	
1940	1,579			1975	1,400	200	
1941	1,448			1976	2,100	1,363	
1942	994			1977	3,646	2,500	
1943	2,755			1978	4,541	2,500	
1944	1,069			1979	4,098	3,000	
1945	7,318			1980	2,454	2,875	2,147
1946	1,850			1981	3,716	1,665	2,553
1947	617			1982	3,523	1,969	2,886
1948	1,719			1983	2,125	2,279	2,200
1949	1,504			1984	3,179	2,358	2,620
1950	5,182			1985	2,945	1,795	2,809
1951	1,939			1986	4,095	2,513	3,577
1952	5,280			1987	7,168	5,018	5,070
1953	1,297			1988	5,486	4,317	1,616
1954	1,909			1989	6,861	3,195	7,403
1955	1,186			1990	3,366	1,877	8,415
1956	2,507			1991	3,940	2,328	7,045
1957	2,344			1992	4,016	3,486	4,483
1958	3,180			1993	3,098	3,573	7,063
1959	1,815			1994	3,147	3,712	4,782
1960	2,537			1995	1,860	2,213	5,780
1961	1,883			1996	2,412	2,806	9,390
1962	1,799			1997	1,151	1,474	3,434
1963	2,853			1998	3,713	2,412	4,144

USFWS Olympic Peninsula Hatchery Review Team
Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

1964	1,394	1999	1,608	3,220	2,188
1965	3,655	2000	1,610	1,810	1,413
1966	3,762	2001	1,616	2,419	1,820
1967	2,063	2002	1,307	3,235	4,929
1968	1,852	2003	1,796	5,219	11,013
1969	948	2004	5,738	4,852	4,797
1970	1,734	2005	3,181	3,080	6,860

b) Return timing and age-class structure of adults

Age at return for broods 1985-2005 ranged from 2-6 years old with an average age of 4.3. Adults from broods 1988-2004 enter the hatchery from September to November with the mean entry date of November 6.

2. Contributions to harvest and utilization (e.g. food banks)

- Broods 1984-2001 averaged harvest was 55% to Tribal fisheries, 24% to U.S. commercial, 15% to Canadian commercial, and 3% each to the U.S. and Canada sport fisheries.
- Spent carcasses are distributed to local residents or to the Oregon Food Bank processor via the cooperative agreement.

3. Contributions to conservation

None identified.

4. Other benefits

None identified.

E. Research, monitoring, and evaluation programs

- Coded-wire tagging is performed annually to track survival and contributions.
- Also, tissue are collected annually for long term trend genetic analysis regarding the genetic profile of the Quinault NFH Chinook.

F. Program conflicts

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

1. Biological conflicts (e.g. propagated stock maladapted to hatchery water source)

See section III L (special issues). Adult Chinook prefer to stay in the mainstem Quinault River to spawn. Consequently, production goals are not met from returning adults and we must rely on eggs from Quinault Lake Pens.

2. Harvest conflicts (e.g. mixed stock fishery on hatchery and wild fish limits harvest opportunities on hatchery fish)

None identified.

3. Conservation conflicts and risks

a) Genetic conflicts associated with straying and natural spawning of hatchery fish (Stray rates, proportion of hatchery-origin fish on natural spawning grounds, etc. Provide tables or figures where appropriate)

None identified – integrated program.

b) Ecological conflicts (e.g. competition between hatchery fish and wild fish, predation,)

None identified.

4. Other conflicts between the hatchery program, or fish produced by the program, and other non-hatchery issues

None identified.

IIIE. Quinault NFH Chum

A. General information

See section IIIA.A.

B. Stock/Habitat/Harvest Program Goals and Purpose

1. Purpose and justification of program

See section IIIA.B.1.

2. Goals and objectives of program

See section IIIA.B.2.

3. Type of program (Integrated or Segregated)

Segregated.

4. Alignment of program with ESU-wide plans

There are no NOAA jurisdictional listed species in the area.

5. Habitat description and status where fish are released.

See section IIIA.B.5.

6. Size of program and production goals⁸³

Measure	Goal	Five-year ¹ mean	Five-year ¹ range
<i>Chum</i>			
Spawmed population	1,200	1,178	157 – 2,052
Fed fry released	1,500,000	1,022,191	176,761 - 1,691,824
Size at release (fish/lb)	550	494	440 – 563

⁸³ QNNFH CHMP draft p. 35, 42.

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

Number	Life stage	Fish size		Release site/Destination
		No./lb.	g/fish	
Chum salmon				
1,500,000	Fry	500	0.9	On-station, Cook Creek

C. Description of program and operations

1. Broodstock goal and source

Collect and spawn 600 pairs of chum returning to the hatchery.

2. Adult collection procedures and holding ⁸⁴

- Chum returns are brief, usually lasting two to three weeks during November. Brood fish enter the hatchery via a fish ladder. The fish ladder is associated with a graduated-field electric weir that spans Cook creek. Adult fish ascend the ladder and enter a collection channel. The collection channel is the outflow channel for the “E” bank of raceways. Two of the six “E” bank raceways are used for adult collection. Two ponds are used during fish returns, one for actual adult return access, and another for holding unripe, post-sorted returning fish.
- No adults are intentionally passed upstream [Zajac 2004].

3. Adult spawning

a) Spawning protocols

See section IIIA.C.3 a.

b) No. of males and females spawned each year over past 10 years ⁸⁵

Year	Females	Males	Jacks	% Jacks
1997	221	208	0	
1998	840	881	0	
1999	234	196	0	
2000	84	73	0	
2001	973	926	0	
2002	1034	1018	0	
2003	398	364	0	

⁸⁴ QNNFH CHMP draft p. 35.

⁸⁵ USFWS 1991.

USFWS Olympic Peninsula Hatchery Review Team
Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

2004	532	489	0	
2005	486	302	0	
2006	830	725	0	
AVERAGE	563	518		

4. Fertilization

a) Protocols

See section IIIA.C.4a.

b) Number of eggs collected and fertilized each year⁸⁶

Brood Year	Number Green	Number Eyed	% Eyed
1998	2,232,131	1,941,703	87.0
1999	516,634	436,617	84.5
2000	217,095	190,035	87.5
2001	2,281,053	1,623,761	71.2
2002	2,756,097	2,454,800	89.1
2003	854,062	628,750	73.6
2004	1,207,884	1,026,206	85.0
2005	1,074,531	1,065,649	99.2
2006	2,085,023	1,928,373	92.5
2007	601,159	546,552	90.9

5. Incubation

See section IIIA.C5.

6. Ponding

a) Protocols

See section IIIA.C6a.

b) Number of fry ponded each year, including % hatch each year

The number of fry ponded from 1998 to 2007 has ranged from about 190,000 to nearly 2,000,000. The production goal is 1,500,000. Eggs excess to program goals are discarded.

⁸⁶ pers. comm. Bill Edwards, US Fish and Wildlife Service, 2008

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

7. Rearing/feeding protocols

See section IIIA.C.7.

8. Fish growth profiles

Brood 2006 Quinault NFH chum

February 28 1056 fpp

March 31 910 fpp

April 30 395 fpp

9. Fish health protocols and issues

See section IIIA.C.9.

10. Chemotherapeutant use

See section IIIA.C.10.

11. Tagging and marking of juveniles

The chum are not marked or tagged.

12. Fish Release

a) Protocols

See section IIIA.C.12a.

b) Number of fish released each year⁸⁷

Date	Stage	Number	Size (fpp)
4/22/1997	Fry	97,468	407.8
4/19/1998	Fry	356,235	254.8
4/13/1999	Fry	1,540,032	348.7
4/12/2000	Fry	438,905	438.5
4/4/2001	Fry	176,761	535.6
4/10/2002	Fry	1,605,185	562.6
4/7/2003	Fry	1,691,824	442.5
4/12/2004	Fry	641,026	440.0

⁸⁷ USFWS 1991.

USFWS Olympic Peninsula Hatchery Review Team
Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

4/7/2005	Fry	966,157	490.4
4/19/2006	Fry	1,027,187	447.0

D. Program benefits and performance

1. Adult returns

a) Numbers of adult returns

Number of Returning Adults [USFWS 2006b]

Return Year	Age at Return				Total Per Year
	3	4	5	6	
1996	55	47	25	0	127
1997	365	207	5	0	577
1998	10	2,464	19	0	2,493
1999	37	170	303	0	510
2000	115	93	11	0	219
2001	1,922	949	25	0	2,896
2002	397	2,276	409	0	3,082
2003	406	1,024	33	0	1,463
2004	778	356	11	0	1,145
2005	105	424	281	0	810

Table. History of Basin-Wide Quinault Chum Harvest and Escapement Estimates [pers. comm. L. Gilbertson, Quinault Indian Nation, 2008]

Year	Harvest	Natural Escapement	Year	Harvest	Natural Escapement
1936	89,062		1971	944	
1937	18,625		1972	2,311	
1938	24,909		1973	1,221	
1939	8,667		1974	3,869	
1940	17,354		1975	1,872	
1941	46,836		1976	7,320	
1942	20,509		1977	3,759	6792
1943	5,991		1978	13,640	12158
1944	898		1979	3,241	3404
1945	3,890		1980	11901	5756
1946	31,146		1981	4,459	3486

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

1947	2,090	1982	7,390	6279
1948	2,368	1983	3,694	3549
1949	5,742	1984	4,257	2312
1950	11,520	1985	3,737	3797
1951	13,595	1986	7,112	5191
1952	12,844	1987	3,486	1860
1953	4,698	1988	8,623	8901
1954	12,762	1989	2,563	3673
1955	6,639	1990	1,656	2938
1956	4,786	1991	2,565	6136
1957	4,291	1992	2,566	6905
1958	5,426	1993	5,258	9805
1959	10,057	1994	1,449	4522
1960	4,300	1995	687	2782
1961	1,678	1996	594	3098
1962	3,662	1997	1,033	3099
1963	1,427	1998	4,691	5873
1964	1,642	1999	583	2710
1965	422	2000	755	2162
1966	2,941	2001	2007	III41
1967	542	2002	1,148	5235
1968	1,356	2003	3739	11486
1969	215	2004	2,916	3343
1970	503	2005	1283	1404

b) Return timing and age-class structure of adults⁸⁸

Age range is 3-5 years and average 4.2 (1985-2005). Entry date range October to December and mean entry November 9 (1988-2004).

2. Contributions to harvest and utilization⁸⁹

Calendar Year	Number Caught Quinault River
1995	690
1996	595
1997	1,037
1998	4,727
1999	594
2000	754
2001	2,005
2002	1,178

⁸⁸USFWS 2006b.

⁸⁹Ibid.

USFWS Olympic Peninsula Hatchery Review Team
Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

2003	3,450
2004	2,914
2005	1,283

Nearly all excess fish and spawned fish are distributed as subsistence to local residents.

3. *Contributions to conservation*

None identified.

4. *Other benefits*

None identified.

E. Research, monitoring, and evaluation programs

Tissues are collected annually for long term trend genetic analysis regarding the genetic profile of the Quinault NFH chum.

F. Program conflicts

None identified.

1. *Biological conflicts (e.g. propagated stock maladapted to hatchery water source)*

None identified.

2. *Harvest conflicts (e.g. mixed stock fishery on hatchery and wild fish limits harvest opportunities on hatchery fish)*

None identified.

3. *Conservation conflicts and risks*

a) Genetic conflicts associated with straying and natural spawning of hatchery fish (Stray rates, proportion of hatchery-origin fish on natural spawning grounds, etc. Provide tables or figures where appropriate)

A significant number of chum salmon spawn below the hatchery in Cook Creek. Source (hatchery vs. natural) is unknown.

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

b) Ecological conflicts (e.g. competition between hatchery fish and wild fish, predation,)

- None identified.

4. *Other conflicts between the hatchery program, or fish produced by the program, and other non-hatchery issues*

None identified.

IV. Makah National Fish Hatchery

A. Description of hatchery⁹⁰

2.3 Facility and Site Descriptions - The Makah NFH is located, approximately 8 miles southwest of the town of Neah Bay, Washington on the northwest tip of the Olympic Peninsula. The facility is situated on approximately 80 acres that are leased from the Makah Nation, on the west shore of the Sooes River. Its main facilities consist of twenty-nine 11-foot-wide by 80-foot-long raceways, four 4-foot-wide by 40-foot-long raceways, a pump house building, and a two-story hatchery building. The pump house building is equipped with traveling screens, an aeration/sedimentation pond, a pollution control pond, and a 1.2-mile-long serpentine abatement channel. The upper level of the two-story hatchery building houses administrative offices and a visitor's center. The lower level of the two-story building includes a crew break room, gear locker room, trough and egg incubation tray nursery, feed storage room, metal shop, general shop, sand filters, and a generator room. Directly attached to the hatchery building is the recently enclosed spawning facility, which contains five adult holding ponds, hydraulic crowders, a pescalator, two anesthetic tanks, a sorting table and a series of connecting pipes to relocate acquired fish. A separate building includes parking stalls for Service vehicles, a hazardous materials room, tool storage facilities and a woodworking shop. There are three permanent government residences for required-occupancy staff (two quarters for residences and one that serves as a bunkhouse). Other satellite structures include storage buildings, a fire shed, a sewage treatment plant and an egg isolation/quarantine building.



⁹⁰ Unless otherwise cited, section text from MNFH CHMP draft p. 22-24.

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

Figure. Aerial View of Makah National Fish Hatchery Facility

2.3.1 Isolation/Quarantine Building - The isolation/quarantine building was constructed to allow for flexibility in management of depressed or endangered fish stocks or other aquatic species. Any aquatic organisms brought in can be isolated from the production fish on station to prevent transmission of any potential diseases.

2.4 Archeology/Cultural Resources - There were five Makah villages in pre-contact times; Waatch, Sooes, Deah, Ozette, and Bahaada, whose combined population in the early 1800s numbered up to four thousand, almost double what it is today (www.makah.com/history.htm). The Sooes village is believed to have been near the present day hatchery location but closer to the Pacific Ocean [pers. comm. Rebecca Monette, Makah Nation, 2005]. In 1972 Edward Friedman conducted an archaeological survey of the hatchery site prior to construction. No cultural resources were identified in the survey. [pers. comm. Anan Raymond, US Fish and Wildlife Service, 2005]. In 1995 a road widening project near the hatchery (it is unclear exactly where) damaged six burial sites assumed to be part of the Sooes village [pers. comm. Rebecca Monette, Makah Nation, 2005 and pers. comm. Anan Raymond, US Fish and Wildlife Service, 2005]. More of the Sooes archaeological site probably occurs on and near the hatchery (pers. comm. Anan Raymond, US Fish and Wildlife Service, 2005). Consequently, additional hatchery construction projects, such as the sediment removal project scheduled for 2006, will be reviewed under Section 106 of the National Historic Preservation Act [pers. comm. Rebecca Monette, Makah Nation, 2005].

2.4.1 Historical Site Development at Makah NFH - Following congressional authorization for the Makah NFH in 1973, most of the original hatchery property was acquired by lease from the Makah Indian Nation. Actual construction on the hatchery began in 1976 and initial fish production in 1982. Further structural and facility changes at Makah NFH are summarized below:

- 1989** Incubation / Isolation building was constructed.
- 1994** Two pump water reuse system was constructed to supply raceways.
- 1996** Ozone / Storage building was constructed.
- 1999** Hatchery grounds paved.
- 2000** Spawning facility constructed. Construction included building, Pescolator, pond and weir modifications, sorting area, and anesthetic tanks.
- 2001** Original feed silo was demolished.
- 2002** Isolation/Quarantine building was equipped for Lake Ozette Sockeye recovery program.
- 2002** New domestic water well was drilled on west side of Sooes River.
- 2002** Hatchery alarm system updated.
- 2002** 4.5 mile entry road was paved.
- 2002** Sooes River bridge span widening project.
- 2005** Hatchery alarm/radio system was upgraded from analog to digital.
- 2006** Dike and levee system updated.

B. Hatchery water sources⁹¹

3.1 Water Use and Management – The Makah NFH has water rights that are outlined in a lease agreement between the Bureau of Indian Affairs and U.S. Department of Interior (Attachment 3) The Makah NFH is allowed 50 cubic feet per second from the Sooes River for fish culture and domestic purposes.

3.1.2 Screening – All water collected from the Sooes River is passed through screens, located in the pump house. Two separate chambers allow water to pass through a 3/16 inch stainless steel mesh traveling screen. Screens are monitored and cleaned as required by water demand and season.

3.1.3 Conveyance System to Hatchery and Ponds - The Sooes River provides the only water used at the Makah NFH (for fish production, not domestic use) [Photo 2]. Hatchery water is pumped from the river directly to a sedimentation pond. From that point, water is gravity fed for the many uses of the hatchery. When eggs and fry are present in the hatchery building and incubation/isolation facility, water is passed through a series of five sand filters, each containing 44.2 sq. ft of filter media and rated at 663 gallons per minute (gpm) [Photo 3]. When water levels in the river drop during the summer months, a water reuse channel can be utilized. This system allows discharged water to pass through the abatement system, mix with incoming river water, and be used again in the hatchery.

3.1.4 Isolation/Quarantine Unit Operation - For the past 3 years, the Makah NFH, has assisted the Makah Nation with their Lake Ozette sockeye recovery efforts. Eggs and milt are brought to the Hatchery's Isolation/Quarantine facility for fertilization and incubation (Photo 4). This facility receives water from the Sooes River via a series of sand filters located in the hatchery building. Incoming water is then passed through a bank of micron-measured filtration bags and a high intensity UV sterilizer before being delivered to the individual egg isolation buckets and the incubation trays. All effluent water is passed through a chlorine contact chamber to prevent non-endemic fish pathogens from entering the Sooes River watershed. Eggs are held until the eye up stage, when they are thermally marked for identification purposes. Developing eggs are then transferred back to the Makah Nation for final development and hatching



⁹¹ MNFH CHMP draft p. 40, 41.

C. Adult broodstock collection facilities⁹²

Adult salmon typically enter the river system in mid to late August. However, due to water constraints and proximity to the ocean, returning fish may not approach the hatchery until much later. For this reason, the hatchery ladder is not opened until late September/early October. Hatchery winter steelhead begin to return to in the river during October, but the majority of fish enter the river from late November to the end of January. Brood fish enter the hatchery via a fish ladder associated with a suspended-electrode electric weir that spans the Sooes River. Adults ascend the ladder and enter a holding pond. All five of the adult holding ponds are used for adult collection and holding purposes

D. Broodstock holding and spawning facilities⁹³

Typically, spawning is conducted each Wednesday during the season to facilitate sampling by the OFHC. Non-segregated brood fish are crowded out one pond at a time into the effluent channel. Another hydraulic gate is used to crowd the fish from the channel for delivery into a mechanical pescalator (fish lift). The pescalator lifts fish and water onto a delivery chute. Two hydraulic gates can be activated independently to guide fish into one of two anesthetic tanks. If both gates are closed, fish continue down the chute into a conduit leading upstream of the barrier dam. Limited numbers of fish are passed upriver for natural spawning. When fish are sufficiently anesthetized, they are lifted and deposited onto the sorting table, via a hydraulic-controlled basket lift system (Photo 5). Depending on egg take needs, ripe females, males and jacks are sorted and dispatched via concussion with a blunt instrument. Unripe fish are either returned to the holding pond, where they are held until mature or needed, or surplused, if numbers handled exceed egg-take and holding needs. Spawning is conducted in an enclosed building.

E. Incubation facilities⁹⁴

The eggs are placed into vertical-tray (Heath) incubators. The hatchery building is equipped with 6 rows of 15 stacks.

F. Indoor rearing facilities⁹⁵

The hatchery building is equipped with 22 troughs with dimensions 2'x3'x16'.

G. Outdoor rearing facilities⁹⁶

The hatchery has 4 5 foot x 40 foot raceways and 29 11 foot x 80 foot raceways.

⁹² MNFH CHMP draft p. 42.

⁹³ MNFH CHMP draft p. 43.

⁹⁴ *Ibid.*

⁹⁵ *Ibid.*

⁹⁶ *Ibid.*

H. Release locations and facilities⁹⁷

3.5 Release/Distribution Strategies - Release and distribution goals for fish produced at the Makah NFH are reviewed annually by the HETs that regularly reviews and plans the fish production programs at the hatchery. Formal production goals are then established in cooperation with the fisheries co-managers from the WDFW and the Makah Indian Nation. Production goals follow guidelines subsequent to the decision rendered in *U.S. v Washington* (“The Boldt Decision”). Production goals are documented through the WDFW’s Future Brood Document process, which establishes salmon hatchery production levels throughout Washington.

Release is by size, seasonality, and environmental conditions determined most optimum by the members of the HET. Any deviations due to disease is discussed and documented by the Makah NFH, OFHC, and Fisheries Resource Office. Conditions of release due to disease would depend on drug withdrawal requirements, severity of disease, and potential impacts on survival and to wild populations. Unscheduled releases are very rare, but may occur if water flows are disrupted or fish exceed recommended loading parameters.

Table 4 outlines fish production goals and their optimum size at release. Target size for coho salmon release is between 15 and 20 fish per pound, and Chinook are released when the fish are at least 75 fish per pound. Release of steelhead commences when a size of 5.5 fish per pound is achieved (release timing is usually a function of raceway loading, flows, and water temps). Coho and steelhead are released as yearlings in May after approximately 18 months on station, whereas Chinook salmon are released after 5 or 6 months post hatch as juvenile smolts.

Fish are generally released at a time, size, and physiological condition that provide a low likelihood of residualization, and promote a rapid migration to marine waters. As an example, Chinook are released between May and June when they reach 75 fish per pound. These subyearling fish are released at a time and size when they are fully smolted, and thereby unlikely to residualize, and expected to move rapidly to marine waters.

I. Outmigrant monitoring facilities

None.

J. Additional or special facilities⁹⁸

3.1.4 Isolation/Quarantine Unit Operation - For the past 3 years, the Makah NFH, has assisted the Makah Nation with their Lake Ozette sockeye recovery efforts. Eggs and milt are brought to the Hatchery’s Isolation/Quarantine facility for fertilization and incubation (Photo 4). This facility receives water from the Sooes River via a series of sand filters located in the hatchery building. Incoming water is then passed through a bank of micron-measured filtration bags and a high intensity UV sterilizer before being delivered to the individual egg isolation buckets and the incubation trays. All effluent water is passed through a chlorine contact chamber to prevent non-endemic fish pathogens from entering the Sooes River watershed. Eggs are held until the eye up

⁹⁷ MNFH CHMP draft p. 48, 49.

⁹⁸ MNFH CHMP draft p. 40, 41.

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

stage, when they are thermally marked for identification purposes. Developing eggs are then transferred back to the Makah Nation for final development and hatching



Photo 4. Isolation/Quarantine facility.

K. Outreach and public education facilities/programs⁹⁹

3.9 Public Outreach Activities - The majority of visitors stop by during the summer months. Local school groups regularly come out to visit the hatchery during the spawning months of October through January. Within the last year, a renewed effort has been placed on improving the hatchery Visitor's Center through interpretive displays and better signs to guide people to and around the hatchery. Several handouts are available to the general public, from fish tagging and marking techniques to annual reports. The public can also access the Service's website at http://www.fws.gov/westwafwo/fisheries/wwfish_pub1.htm for publications and reports.

L. Special issues or problems (e.g. water and property rights issues, law suits, etc.)

- **Makah is authorized to discharge effluent under NPDES permit number WA-0025682.** The permit has expired and a renewal application has been submitted.
- **3.10.1 Hatchery Reform¹⁰⁰** - The Hatchery Reform Project for Puget Sound and Coastal Washington has the twin goals of recovering wild salmon and also providing for sustainable fisheries [LLTH and HSRG 2000]. As part of the hatchery reform project, fish passage potential at the Makah NFH was assessed to optimize natural and hatchery salmon production in the Sooes River [Zajac 2004].
<http://www.fws.gov/westwafwo/fisheries/Publications/FP065.pdf>

The Hatchery Reform Project resulted in hatchery specific as well as area-wide recommendations regarding fish hatcheries. These recommendations were developed by an

⁹⁹ *Ibid.*

¹⁰⁰ *MNFH CHMP draft p. 59, 60.*

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

independent panel of scientists with informational input from various agency personnel. Recommendations are outlined in the Hatchery Reform Recommendations Hood Canal, Willapa Bay, North Coast Grays Harbor prepared by the Hatchery Scientific Review Group March 2004. Recommendations specific to the Makah NFH for Sooes River fall Chinook, coho, and steelhead are outlined below (Attachment 11).

Recommendations specific to the Makah NFH for Chinook as outlined in the Hatchery Reform Recommendations, 2004, include:

- Reduce program size to meet agency flow and density index recommendations.
- Employ volitional releases to increase the success of the hatchery program and reduce the number of fish occupying limited receiving habitat during a limited time frame. This will require structural modifications of pond outlets.
- Dispose of mortalities in a manner that reduces the likelihood of pathogen transmission to the receiving watershed; for example, by burying them.

Recommendations specific to the Makah NFH for coho as outlined in the Hatchery Reform Recommendations, 2004, include:

Develop and execute a management plan to create a naturally spawning population capable of supporting a properly integrated hatchery program. Once established, take steps to integrate this population into the hatchery broodstock and maintain proper integration using Hatchery Scientific Review Group guidelines.

- Increase the use of jacks to ten percent of the males used for spawning.
- Reduce the program's size to meet flow and density indices.
- Dispose of mortalities off-site, to reduce disease risk.
- Quantify the contribution of this program to terminal harvest (including subsistence harvest).
- Release fish volitionally.

Recommendations specific to the Makah NFH for steelhead as outlined in the Hatchery Reform Recommendations, 2004, include:

- Implement System-Wide Recommendations regarding establishing a regional system of wild steelhead management zones, where streams are not planted with hatchery fish and are instead managed for native stocks. Fishing for steelhead in these zones would not be incompatible with this approach, but no hatchery-produced steelhead should be introduced. Such zones would reduce the risk of naturally spawning fish interbreeding with hatchery fish, and provide native stocks for future fisheries programs. To meet harvest goals, hatchery releases may be increased in those streams selected for hatchery production.
- Select both wild and hatchery streams based on stock status and a balance of large and small streams and habitat types.
- Use locally-adapted hatchery stock for these streams. Decrease reliance on other facilities to backfill shortages in locally adapting hatchery stock. Actions such as harvest restrictions should be implemented to achieve 100 percent local broodstock if necessary.

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

- Manage the hatchery stock to maintain its early spawn timing and reduce the likelihood of interaction with naturally spawning steelhead.
- Include adult collection capability wherever steelhead are released, to capture as many adults from the returning segregated population as possible. Discontinue releases where adults cannot be collected at return.
- Adipose mark releases to maximize harvest opportunity and monitor stray rates.
- Size the hatchery program in a manner that achieves harvest goals with minimal impact on wild populations.
- Release hatchery yearling steelhead smolts between April 15 and May 15 at target size of six fish to the pound, and a condition factor of less than 1.0.
- Conduct a workshop to implement this wild steelhead management zones concept.
- Implement monitoring and evaluation as a basic component, of both wild steelhead management zones and hatchery harvest streams.
- Increase volitional release time period prior to forced release.

Attachment 11: Recommendations of HSRG Specific to Makah NFH¹⁰¹

Educket Creek Hatchery Fall Chinook

Makah Tribe

Stock Goals:	Current	Short-Term	Long-Term
<i>Biological Significance</i>	Low	Low	Low
<i>Population Viability³⁴</i>	Medium	Medium	Medium
<i>Habitat</i>	Limiting	Limiting	Limiting
<i>Harvest Opportunity</i>	Each Year	Each Year	Each Year
Purpose			
	Harvest		
Type			
	Segregated		

³⁴ In the case of a segregated harvest program, population viability ratings are low, medium and high and refer to the stock's ability to sustain itself in the culture environment.

PROGRAM DESCRIPTION

This program started in 1995 and operates only in years when the fall Chinook production needs at the Makah National Fish Hatchery (NFH) are met (to date this includes 1995, 1998, 1999 and 2002). The program uses a Sooes River fall Chinook stock obtained from the Makah NFH. In each year of operation, 100,000 fish at 500 fish per pound are transferred to Educket Creek Hatchery in March. The fish are reared at Educket Creek until June, at which point they are released at a size of 55 fish per pound.

OPERATIONAL CONSIDERATIONS

- Releases are volitional, but are not marked or tagged.

¹⁰¹HSRG 2004.

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

- Initial rearing at Educket Creek is in a fiberglass container, but final rearing is under natural conditions in an enclosure within the creek.
- Returning adults that escape the fisheries are not removed from the system at Educket Creek.
- There is apparently no natural fall Chinook population in the Educket/Waatch drainage.

BENEFITS AND RISKS

A. Consistent with short-term and long-term goals?

The program is being operated in a manner consistent with its short- and long-term goals.

B. Likelihood of attaining goals?

The program is providing both tribal and non-tribal harvest benefits, but data on the actual size of the harvest are lacking.

C. Consistent with goals for other stocks?

There is a risk of competition with other juvenile salmon in the drainage but, considering then umbers of fish released and their size at release, the risk of significant predation is likely low. The absence of a natural fall Chinook population in the drainage means that the program does not pose a genetic risk in the drainage.

RECOMMENDATIONS

Continue the program, but monitor the unmarked/untagged Chinook catch in the Educket/Waatch drainage, to evaluate benefits from the program.

COMMENTS

Normally, in a segregated program, one would use tagged fish to provide a means of evaluating the degree to which unwanted interactions with other stocks might be occurring and to quantify benefits of the program. However, in the present program, in which natural populations of Chinook are not thought to occur in the Educket/Waatch drainage, this requirement can be dispensed with because of the unlikelihood of any genetic introgression with another Chinook stock. In addition, under these conditions, reasonably accurate estimates of the program's harvest benefit should be possible by simply counting untagged Chinook harvested in the Educket/ Waatch drainage. Straying to other drainages, if it occurs, would most likely be to the nearby Sooes River, the original source of this fall Chinook stock.

MANAGERS RESPONSE

The Makah Tribe supports the recommendations of the HSRG, with the notation that if current monitoring needs to be expanded to accommodate this recommendation, additional funding may be needed

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

Sooes River Fall Chinook

Makah Tribe and US Fish and Wildlife Service

Stock Goals:	Current	Short-Term	Long-Term
<i>Biological Significance</i>	Intermediate	Intermediate	Intermediate
<i>Population Viability</i>	Critical	Critical	Critical
<i>Habitat</i>	Inadequate/ Limiting	Inadequate/ Limiting	Inadequate/ Limiting
<i>Harvest Opportunity</i>	Each Year	Each Year	Each Year
Purpose			
<i>Purpose</i>	Harvest		
Type			
<i>Type</i>	Integrated		

PROGRAM DESCRIPTION

This is a native stock, with hatchery and wild production. Deschutes River and Soos Creek stocks were released for one or two years in the 1960s; Minter Creek stock was released for one year in the 1970s; Quinault stock was released for one year in the 1980s (there is some uncertainty about these releases). This stock is one of 13 stocks in the North Coast Fall Chinook GDU. Broodstock is collected from rack returns to the Makah National Fish Hatchery (NFH). Adult collection, spawning, incubation and rearing occur on-station. The egg take goal is 3.85 million. 100,000 fish are transferred to Educket Creek Hatchery in March at 500 fish per pound. On-station releases are 3.2 million at 70 fish per pound.

OPERATIONAL CONSIDERATIONS

- When available, approximately 300 adults are passed upstream of the hatchery rack for natural spawning.
- Approximately 260,000 fish are adipose fin clipped and coded wire tagged, as a US/Canada indicator stock.
- The composition of hatchery returns and natural escapement is unknown, since the level of marking does Not allow identification of the stock components.
- Total survival for the Makah NFH portion of the program has averaged 0.14% for brood years 1985–97.
- The average catch contribution for the Quinault NFH portion of the program has been approximately 720 fish per year for brood years 1985–97.
- During rearing, the flow index exceeds recommended guidelines by approximately 30%, and the density index exceeds recommended guidelines by approximately 50%.
- Fish are force-released at approximately 75 fish per pound, similar in size to naturally produced fall Chinook.

BENEFITS AND RISKS

A. Consistent with short-term and long-term goals?

The program is making a relatively small contribution to harvest, given its size. Total survival has been poor, leading to small contributions to harvest and difficulties in meeting escapement goals for the program. Returns in 2001 and 2002, however, provided the

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

opportunity for more harvest than actually occurred. The program is not being operated consistent with the HSRG's guidelines for integrated programs (see System-Wide Recommendations).

B. Likelihood of attaining goals?

Limited capacity and current conditions make the Sooes unsuitable to support a large Chinook core population. Therefore, it appears unlikely that the system can support a properly integrated program at this program's current size. It is unclear why contribution to harvest has been poor. Operational changes suggested below may improve overall survival. However, the possibility also exists that the program is oversized for the quantity and quality of the receiving habitat. If this is the case, harvest goals might be achieved by reducing the size of the program.

C. Consistent with goals for other stocks?

Since there appears to be no sustained natural fall Chinook population in the watershed, the fish released by this program pose no significant ecological or genetic risks. The segregated approach described below would be consistent with the goal of rebuilding a naturally spawning Chinook population in the Sooes River.

RECOMMENDATIONS

- Reduce program size to meet agency flow and density index recommendations.
- Employ volitional releases to increase the success of the hatchery program and reduce the number of fish occupying limited receiving habitat during a limited time frame. This will require structural modifications of pond outlets.
- Dispose of mortalities in a manner that reduces the likelihood of pathogen transmission to the receiving watershed; for example, by burying them.

COMMENTS

- The actions recommended may improve survival enough for the program to make an important contribution to cultural and fishery needs in the North Coast region. Despite improvements, however, the success of this program may be limited by water quality and quantity problems.
- The program could be maintained near its present size (and therefore provide the current harvest benefit) if it were managed as a segregated harvest program using its capacity to remove excess hatchery adults from the system when necessary.
- Like all integrated hatchery programs, success will depend on good habitat being available to both the hatchery- and natural-origin components of the integrated population (see HSRG system-wide recommendation about productive habitat).

MANAGERS RESPONSE

The Makah Tribe understands the importance of adjusting rearing conditions to optimize the productivity of the hatchery stock and looks forward to meeting with USFWS to discuss production. See also Appendix A: US Fish and Wildlife Service Response to HSRG Recommendations.

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

Educket Creek Hatchery Coho

Makah Tribe and US Fish and Wildlife Service

Stock Goals:	Current	Short-Term	Long-Term
<i>Biological Significance</i>	Low	Low	Low
<i>Population Viability</i> ³⁶	Medium	Medium	Medium
<i>Habitat</i>	Limiting	Limiting	Limiting
<i>Harvest Opportunity</i>	Each Year	Each Year	Each Year
Purpose			
Harvest			
Type			
Segregated			

³⁶ In the case of a segregated harvest program, population viability ratings are low, medium and high and refer to the stock's ability to sustain itself in the culture environment.

PROGRAM DESCRIPTION

This program started in 1988. It uses a Sooes River coho stock obtained from Makah National Fish Hatchery (NFH). Each year, 50,000 fish at 18 fish per pound are transferred to Educket Creek Hatchery in March. The fish are reared at Educket Creek until April, at which point they are released at a size of 15 fish per pound.

OPERATIONAL CONSIDERATIONS

- Releases are forced in some years (to make room for fall Chinook) and are adipose fin clipped, but not coded-wire tagged.
- Rearing at Educket Creek is in an enclosure within the creek, under natural conditions.
- Returning adults that escape the fisheries are not removed from the system at Educket Creek.
- There is apparently no natural coho population in the Educket/Waatch drainage.

BENEFITS AND RISKS

A. Consistent with short-term and long-term goals?

The program is being operated in a manner consistent with its short- and long-term goals.

B. Likelihood of achieving goals.

The program is providing both tribal and non-tribal harvest benefits, but no data on harvest size were provided.

C. Consistent with goals for other stocks?

There is a risk of competition with other juvenile salmon in the drainage, but, considering the numbers of fish released and their size at release, the risk of significant predation is likely low. The absence of a natural coho population in the drainage means that the program does not pose a genetic risk in the drainage.

RECOMMENDATIONS

Monitor coho catches in the Educket/Waatch drainage in order to evaluate harvest benefits.

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

COMMENTS

Normally, in a segregated program, one would use tagged fish to provide a means of evaluating the degree to which unwanted interactions with other stocks might be occurring and to quantify benefits of the program. However, in the present program, in which natural populations of coho do not occur in the Educket/Waatch drainage, this requirement can be dispensed with because of the unlikelihood of any genetic introgression with another coho stock. In addition, under these conditions, reasonably accurate estimates of the program's harvest benefit should be possible by simply counting the untagged (but adipose fin clipped) coho harvested in the Educket/Waatch drainage. Any straying that occurs is likely to be to the nearby Sooes River, the original source of this coho stock.

MANAGERS RESPONSE

The Makah Tribe supports the recommendations of the HSRG, with the notation that if current monitoring needs to be expanded to accommodate this recommendation that additional funding may be needed.

Sooes River Coho

Makah Tribe and US Fish and Wildlife Service

Stock Goals:	Current	Short-Term	Long-Term
<i>Biological Significance</i>	Low	Low	Low
<i>Population Viability</i>	Critical	Critical	Critical
<i>Habitat</i>	Inadequate/ Limiting	Inadequate/ Limiting	Limiting
<i>Harvest Opportunity</i>	Each Year	Each Year	Each Year
Purpose			
<i>Purpose</i>	Harvest		
Type			
<i>Type</i>	Integrated		

PROGRAM DESCRIPTION

Broodstock from this program was derived from natural spawners in the Sooes River. The program has an egg take goal 450,000 from returns to Makah National Fish Hatchery (NFH). Spawning, incubation, rearing and release take place on-station. The program goal is for 50,000 fish to be transferred to Educket Creek Hatchery at 18 fish per pound in March and 250,000 released on-station at 15–20 fish per pound in April.

OPERATIONAL CONSIDERATIONS

- Outplants into the Sooes River from Quilcene and Quinault NFHs occurred during the 1970s and 1980s, prior to the operation of the Makah NFH.
- Fish from this program are all adipose fin clipped.
- Fish in excess of the program's needs are released on-station as fry.

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

BENEFITS AND RISKS

A. Consistent with short-term and long-term goals?

There is a harvest benefit. There is a genetic risk associated with improper stock integration management.

B. Likelihood of attaining goals?

The program's size is exceeding flow and density indices at the hatchery.

C. Consistent with goals for other stocks?

Yes.

RECOMMENDATIONS

- Develop and execute a management plan to create a naturally spawning population capable of supporting a properly integrated hatchery program. Once established, take steps to integrate this population into the hatchery broodstock and maintain proper integration using HSRG guidelines.
- Increase the use of jacks to ten percent of the males used for spawning.
- Reduce the program's size to meet flow and density indices.
- Dispose of mortalities off-site, to reduce disease risk.
- Quantify the contribution of this program to terminal harvest (including subsistence harvest).
- Release fish volitionally.

COMMENTS

Like all integrated hatchery programs, success will depend on good habitat being available to both the hatchery- and natural-origin components of the integrated population (see HSRG system-wide recommendation about productive habitat).

MANAGERS RESPONSE

The Makah Tribe understands the importance of adjusting rearing conditions to optimize the productivity of hatchery stock, and looks forward to meeting with USFWS to discuss production capacity, operational considerations and options for future changes and improvements. Scheduling for this meeting is currently in progress.

See also Appendix A: US Fish and Wildlife Service Response to HSRG Recommendations.

Lake Ozette Sockeye

Makah Tribe and US Fish and Wildlife Service

Stock Goals:	Current	Short-Term	Long-Term
<i>Biological Significance</i>	High	High	High
<i>Population Viability</i>	At Risk	At Risk	Healthy
<i>Habitat</i>	Inadequate	Inadequate	Limiting

USFWS Olympic Peninsula Hatchery Review Team
Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

<i>Harvest Opportunity</i>	None	None	Occasional
<i>Purpose</i>	Conservation		
<i>Type</i>	Integrated		

PROGRAM DESCRIPTION

This is a native stock with little or no history of fish transfers into the basin, and no evidence of interbreeding. Artificial production has occurred to some extent, but has involved small egg takes and limited broodstock collection (an average of 98 fish per year). This is the only stock within the Ozette Sockeye GDU. Adults are captured in a trap located at river mile one on Umbrella Creek. They are transported to Umbrella Creek hatchery at river mile 4.6 and held there until ripe. Ripe adults are taken to the Makah Tribal “staging building” in Neah Bay to be spawned. Unfertilized gametes are taken to Makah NFH. The egg take goal is 305,000. Incubation and otolith marking occur at Makah NFH. Eyed eggs are taken to Umbrella Creek (122,000) and to Stony Creek Hatchery (183,000 in remote site incubators, or RSI, plus fiberglass troughs). Planting goals are 122,000 at 450 fish per pound into Umbrella Creek (Elk Lake RSI), 91,500 at 900 fish per pound and 91,500 at 450 fish per pound into Stony Creek.

OPERATIONAL CONSIDERATIONS

- This stock is listed as endangered under the Endangered Species Act (ESA). The purpose of the program is to: 1) augment the river spawner component of the population to increase the life history diversity and productivity of the lake system; 2) establish self-sustaining river runs in Lake Ozette tributaries; and 3) de-list the population.
- Genetics studies indicate no evidence of interbreeding of native stocks with any planted stocks.
- The fish are too small at release to be coded wire tagged and are therefore 100% otolith marked.
- The stock is not harvested in any known fishery.
- The spawning protocol is to use a four-by-four factorial process.
- The Umbrella Creek program is operated under a Lake Ozette Sockeye Hatchery and Genetic Management Plan (HGMP) prepared by the Makah Tribe in 2000.

BENEFITS AND RISKS

A. Consistent with short-term and long-term goals?

Recent stock reintroductions into underused habitat in Lake Ozette tributaries have been increasingly successful in reestablishing tributary spawning aggregations. Domestication selection risk is reduced by the small size and early life history stage at which the fish are released from the Hatchery. There is an increased potential for predation on the juvenile hatchery fish by native cutthroat as the sockeye population expands.

B. Likelihood of attaining goals?

Overall, there is a significant conservation benefit to this ESA-listed stock, insofar as the riverine life history has been re-established and the size of the spawner population appears to be increasing. Whether the population will become self-sustaining remains to be seen.

C. Consistent with goals for other stocks?

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

There are no detectable negative effects to the natural population from the increased run size.

RECOMMENDATIONS

Continue the program as designed.

COMMENTS

The HSRG commends the project managers on this well-designed and efficiently-operated program.

The HSRG recognizes that sockeye salmon propagated through the Umbrella Creek program are included as part of the Ozette Lake sockeye salmon ESU, but juvenile and first generation adult fish produced by the program are not. In its ESA listing determination for the ESU, NMFS determined that the tributary sockeye salmon aggregation propagated under the HGMP is not essential for recovery, but if conditions warrant, the stock is not precluded from playing a role in recovery of the beach spawning component. Like all integrated hatchery programs, success will depend on good habitat being available to both the hatchery- and natural-origin components of the integrated population.

MANAGERS RESPONSE

The Makah Tribe agrees with the recommendations of the HSRG and appreciates the complimentary remarks on this program.

Educket Creek Hatchery Winter Steelhead

Makah Tribe

Stock Goals:	Current	Short-Term	Long-Term
<i>Biological Significance</i>	Low	Low	Low
<i>Population Viability⁴⁰</i>	Medium	Medium	Medium
<i>Habitat</i>	Limiting	Limiting	Limiting
<i>Harvest Opportunity</i>	Each Year	Each Year	Each Year
Purpose			
	Harvest		
Type	Segregated		

⁴⁰ In the case of a segregated harvest program, population viability ratings are low, medium and high and refer to the stock's ability to sustain itself in the culture environment.

PROGRAM DESCRIPTION

This is a hatchery stock originating from the Makah National Fish Hatchery (NFH) on the Sooes River. 25,000 Sooes River smolts are transferred in March from Makah NFH at seven fish per pound. Fish are released on-station from mid-April to mid-May at six fish per pound.

OPERATIONAL CONSIDERATIONS

- Releases are not adipose fin clipped.

USFWS Olympic Peninsula Hatchery Review Team
Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

- Single pair matings are used.
- The program has no adult collection capability.

BENEFITS AND RISKS

A. Consistent with short-term and long-term goals?

The program is being operated in a manner consistent with its short- and long-term goals. It is providing a valuable harvest opportunity.

B. Likelihood of attaining goals?

There is a strong likelihood that the harvest goals will continue to be met. Coastal steelhead stocks have experienced relatively good survival in recent years.

C. Consistent with goals for other stocks?

Since no viable wild stock is present, lack of an adult collection facility does not pose a risk to other steelhead stocks.

RECOMMENDATIONS

- Implement System-Wide Recommendations regarding establishing a regional system of wild steelhead management zones, where streams are not planted with hatchery fish and are instead managed for native stocks. Fishing for steelhead in these zones would not be incompatible with this approach, but no hatchery-produced steelhead should be introduced. Such zones would reduce the risk of naturally spawning fish interbreeding with hatchery fish, and provide native stocks for future fisheries programs.
- Select both wild and hatchery streams based on stock status and a balance of large and small streams and habitat types.
- Use locally-adapted hatchery stocks for those streams. Actions such as harvest restrictions should be implemented to achieve 100% local broodstock if necessary.
- Manage the hatchery stock to maintain its early spawn timing and reduce the likelihood of interaction with naturally spawning steelhead.
- Size the hatchery program in a manner that achieves harvest goals with minimal impact on wild populations.
- Adipose mark releases to maximize harvest opportunity and monitor stray rates.
- Release hatchery yearling steelhead smolts between April 15 and May 15 at target size of six fish to the pound, and a condition factor of less than 1.0.
- Conduct a workshop to implement this wild steelhead management zones concept.
- Implement monitoring and evaluation as a basic component, of both wild steelhead management zones and hatchery harvest streams.

COMMENTS

Establishment of wild steelhead management zones should reduce the chances of ecological and genetic interactions with hatchery steelhead and help to ensure the availability of founding stocks for hatchery purposes should the need for such stocks arise.

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

MANAGERS RESPONSE

The Makah Tribe supports the philosophy and general recommendations of the HSRG for management of hatchery and wild steelhead stocks. The Tribe agrees with the principle of maintaining wild steelhead management zones. However, the Tribe feels that it is extremely important that the zones be established in a manner consistent with the co-managers harvest, stock and habitat goals.

The Makah Tribe supports the development and holding of a workshop to implement the wild steelhead management zone concept. The Tribe also supports monitoring and evaluation of wild stock status in regional watersheds prior to designation as wild steelhead management zones. The Tribe notes, however, that additional survey and monitoring efforts may be required to achieve this and that additional funding will be needed to support this activity.

Sooes River Hatchery Winter Steelhead

Makah Tribe and United States Fish and Wildlife Service

Stock Goals:	Current	Short-Term	Long-Term
<i>Biological Significance</i>	Low	Low	Low
<i>Population Viability⁴⁸</i>	Medium	Medium	Medium
<i>Habitat</i>	Limiting	Limiting	Limiting
<i>Harvest Opportunity</i>	Each Year	Each Year	Each Year
<hr/>			
<i>Purpose</i>	Harvest		
<i>Type</i>	Segregated		

⁴⁸ In the case of a segregated harvest program, population viability ratings are low, medium and high and refer to the stock's ability to sustain itself in the culture environment.

PROGRAM DESCRIPTION

This is an early-timed, hatchery stock originating from Quinault River stock. The program's egg take goal is 250,000 from rack returns at Makah National Fish Hatchery (NFH). Spawning, incubation, rearing and release take place on-station. The transfer goal is 25,000 fish to Educket Creek in April at seven fish per pound. The planting goal is 175,000 into the Sooes River at 5.5 fish per pound in May.

OPERATIONAL CONSIDERATIONS

- The broodstock for this program is self-sustaining and locally-adapted.
- Releases are not adipose fin clipped or coded wire tagged, except for a recent, two-year diet study.
- Single pair matings are used.
- The program does include adult removal capability.

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

BENEFITS AND RISKS

A. Consistent with short-term and long-term goals?

The program is being operated in a manner consistent with its short- and long-term goals. It is providing harvest opportunity. Interbreeding of the hatchery stock with the naturally-spawning stock is minimized by the differences in spawn time and adult removal capability.

B. Likelihood of attaining goals?

There is a strong likelihood that program goals will continue to be met. Coastal steelhead have experienced relatively good survival in recent years.

C. Consistent with goals for other stocks?

There is the potential for genetic interactions with naturally-spawning winter steelhead, but this is likely to be minimized for the reason stated in A, above.

RECOMMENDATIONS

- Implement System-Wide Recommendations regarding establishing a regional system of wild steelhead management zones, where streams are not planted with hatchery fish and are instead managed for native stocks. Fishing for steelhead in these zones would not be incompatible with this approach, but no hatchery-produced steelhead should be introduced. Such zones would reduce the risk of naturally spawning fish interbreeding with hatchery fish, and provide native stocks for future fisheries programs. To meet harvest goals, hatchery releases may be increased in those streams selected for hatchery production.
- Select both wild and hatchery streams based on stock status and a balance of large and small streams and habitat types.
- Use locally-adapted hatchery stock for those streams. Decrease reliance on other facilities to backfill shortages in locally adapting hatchery stock. Actions such as harvest restrictions should be implemented to achieve 100% local broodstock if necessary.
- Manage the hatchery stock to maintain its early spawn timing and reduce the likelihood of interaction with naturally spawning steelhead.
- Include adult collection capability wherever steelhead are released, to capture as many adults from the returning segregated population as possible. Discontinue releases where adults cannot be collected at return.
- Adipose mark releases to maximize harvest opportunity and monitor stray rates.
- Size the hatchery program in a manner that achieves harvest goals with minimal impact on wild populations.
- Release hatchery yearling steelhead smolts between April 15 and May 15 at target size of six fish to the pound, and a condition factor of less than 1.0.
- Conduct a workshop to implement this wild steelhead management zones concept.
- Implement monitoring and evaluation as a basic component, of both wild steelhead management zones and hatchery harvest streams.
- Increase volitional release time period prior to forced release.

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

COMMENTS

Establishment of wild steelhead management zones should reduce the chances of ecological and genetic interactions with hatchery steelhead and help to ensure the availability of founding stocks for hatchery purposes should the need for such stocks arise.

MANAGERS RESPONSE

The Makah Tribe generally supports the recommendations of the HSRG. The Tribe agrees with the principle of maintaining wild steelhead management zones which exclude hatchery releases, however, it is extremely important that the zones be established in a manner consistent with the co-managers' harvest, stock and habitat goals.

See also Appendix A: US Fish and Wildlife Service Response to HSRG Recommendations.

Facility and Regional Recommendations

Below are the Hatchery Scientific Review Group's recommendations that involve capital improvements at hatchery facilities in the North Coast region.

Makah National Fish Hatchery

- Reconstruct the fish release system.
- Provide a water chiller to resolve temperature problems.
- Provide fish pumps.
- Install pre-settling chambers.
- Improve adult spawning and holding facilities.
- Expand the hatchery building for early rearing.
- Provide a water chiller to resolve temperature problems.
- Modify raceways to allow volitional release.

All Facilities

- Improved rearing and incubation facilities across the region, as needed based on reprogramming decisions resulting from implementing HSRG recommendations
- Additional investment may be necessary to establish new steelhead adult collection sites across the region
- In order to maximize benefits from hatchery production, take into account facility water and □ space availability in determining the optimum species mix □ Provide the needed equipment for fish culture and biological sampling (fish pumps, crowders □ sorting facilities, abatement ponds, etc.)
- In order for hatcheries to adequately follow the general principles of scientific defensibility and informed decision making, the HSRG supports the need for increased monitoring and evaluation capabilities. This would include the acquisition of the equipment necessary for these activities. Examples would include the following:
 - Equipment for adult handling to improve both the recovery of evaluation data and to facilitate safe passage upstream of natural-origin fish.

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

- Equipment to facilitate adult collection for inclusion in integrated hatchery brood stock population management.
- Equipment for monitoring and evaluating the population status of integrated hatchery stocks and associated natural spawning populations.
- Equipment for improving hatchery inventory, monitoring and predator control.
- Opportunities to process data collections such as otolith reading, genetic sampling and mark recovery activities.

IVA. Makah NFH Steelhead

A. General information¹⁰²

The hatchery was authorized to begin operations due to the October 4, 1973, Appropriation Act (87 Stat. 436), the Fish and Wildlife Act of 1956 (70 Stat. III9), and the Anadromous Fish Conservation Act (79 Stat. 1125). The Makah NFH began operations in 1981 to restore and enhance depleted runs of salmon and steelhead on the Makah Indian Reservation. The hatchery currently produces fall Chinook and coho salmon, and winter steelhead trout for release into Sooes River. Chinook, coho, and steelhead are also transferred to the Tribal Educket Creek facility for subsequent release into the Waatch River. Threatened Lake Ozette sockeye (*O. nerka*) eggs are incubated for a short period at the hatchery as well.

B. Stock/Habitat/Harvest Program Goals and Purpose

1. Purpose and justification of program¹⁰³

The hatchery was authorized to begin operations on October 4, 1973 by the Appropriation Act (87 Stat. 436), the Fish and Wildlife Act of 1956 (70 Stat. III9), and the Anadromous Fish Conservation Act (79 Stat. 1125). The Makah NFH began operations in 1981 to restore and enhance depleted runs of salmon and steelhead on the Makah Indian Reservation.

- Policies:*
- Secretarial Order #3206, American Indian Tribal Rights, Federal-Tribal Trust Responsibilities, and the Endangered Species Act
 - Viable Salmon Populations Strategy, NMFS
 - Fish and Wildlife Service Recreational Fisheries Policy, NPI #89-25
 - Executive Order #12962 of June 7, 1995 - Recreational Fisheries
 - Fisheries Pest Management, 2001
- Case Law:*
- U.S. v Washington*, 384 F. Supp. 312, 1974
 - Hoh v. Baldrige Framework Management Plan
- Agreements:*
- Memorandum of Agreement with Quinault Nation, 1965
 - Cooperative Agreement with BIA, 1982
 - Cooperative Agreement with Quinault Nation, 1991
 - Cooperative Agreements with Makah Tribe, 1994, 1996
 - Stipulation and Order Concerning Co-Management and Mass Marking, April 28, 1997, U.S. District Court, Seattle, WA
 - Salmonid Disease Control Policy of the Fisheries Co-Managers of Washington State, revised October 1997
 - Lease Agreement, 2000
 - Memorandum of Agreement Surplus Fish, 2001
 - Memorandum of Understanding between the Service and the U.S. Department of Justice, 2006

¹⁰² MNFH CHMP Draft p. 22.

¹⁰³ MNFH CHMP Draft p. 27,28.

USFWS Olympic Peninsula Hatchery Review Team
Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

-Memorandum of Understanding Salmon Carcass, 2006

- Legislative Authorities:* -Magnuson Fishery Conservation and Management Act
(16 USC 1801-1882)
- Regulations:* -National Invasive Species Act of 1996
-Omnibus Appropriation Bill of 2003 (Mass Marking Law)
-Endangered Species Act
-Clean Water Act
-Lacey Act
-Migratory Bird Treaty Act
-Bald and Golden Eagle Protection Act

2. Goals and objectives of program¹⁰⁴

Goal 1: Support recovery and conservation of local endangered and threatened species and species at risk.

Objective 1.1: Minimize negative impacts to ESA listed and other native species, their habitats, and the environment by implementing state-of-the-art fish culture technology, hatchery operation, and hatchery maintenance (hatchery reform). [1.7, 2.6, 2.7, 3.2, 3.10, 5.3]

Task 1.1.1: Release only juvenile fish that are ready to migrate downstream (smolts), in the appropriate timeframes to avoid impacting listed or vulnerable species. [2.8, 3.5]

Task 1.1.2: Mass mark all coho and Chinook salmon and steelhead trout to identify them from naturally produced fish. [1.7, 3.7]

Task 1.1.3: Manage the hatchery weir and ladder within acceptable impacts to listed and native fish. [1.7.7, 3.2.2, 3.10.7]

Task 1.1.4: Implement HACCPs. (Attachment 9) [3.6.6]

Task 1.1.5: Conduct environmental monitoring to ensure that hatchery operations comply with water quality standards and to assist in managing fish health. [3.1, 3.10.9]

Task 1.1.6: Comply with all environmental permits (including ESA consultation) requirements for hatchery operation, construction, and maintenance. [2.7]

¹⁰⁴ MFNH CHMP Draft p. 64-68.

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

- Objective 1.2: Seek other opportunities to contribute to the recovery and conservation of ESA-listed species and other species at risk. [1.7, 2.7, 2.8, 2.9, 3.5, 3.6, 3.7, 3.8, 3.9, 3.10]
 - Task 1.2.1: Communicate with all partners and forums in order to stay informed of other recovery and conservation needs that may be accommodated at Makah NFH. [1.1, 1.2, 1.3, 1.4, 1.5, 1.6, 1.7, 1.8, 2.6.3, 2.7, 2.8, 3.2.3, 3.7, 3.8, 3.10]
- Objective 1.3: Maintain Isolation/Quarantine unit to industry standards. [3.1, 3.6]
 - Task 1.3.1: Maintain inflow and outflow disinfection systems. [3.6]
- Goal 2: Assure that hatchery operations support the cooperative and lease agreements between the Service and the Makah Indian Nation, and Pacific Salmon Treaty objectives.
 - Objective 2.1: Collect sufficient coho salmon adults to produce 250,000 smolts for release into Sooes River and 50,000 pre-smolts to Educket Creek, sufficient Chinook salmon adults to produce 2,200,000 smolts for release into Sooes River and 100,000 pre-smolts to Educket Creek, and sufficient steelhead trout adults to produce 175,000 smolts for release into Sooes River and 25,000 pre-smolts for transfer to Educket Creek. [2.6, 3]
 - Task 2.1.1: Collect and successfully spawn about 225 pairs of coho, 550 pairs of Chinook, and 150 pairs of steelhead. [2.6, 3]
 - Objective 2.2: Contribute to a meaningful harvest for tribal, sport, and commercial fisheries from Alaska to the Sooes and Waatch rivers (achieve a 10-year-average survival from smolt to adult of 2.0 percent for coho, 1.0 percent for Chinook, and 2.0 percent for steelhead, harvest plus escapement). [1, 2, 3, 4, 5]
 - Task 2.2.1: Work with states and tribes to establish meaningful fisheries (through *U.S. v. Washington* and Pacific Salmon Commission forums). [1.7, 1.8, 2.6, 3.6, 3.7, 3.8, 3.10]
 - Task 2.2.2: Mass mark juvenile hatchery coho and Chinook salmon and steelhead trout to facilitate harvest and related conservation and assessment efforts for hatchery, wild, and ESA-listed stocks. [3.7]
 - Objective 2.3: Meet tribal trust responsibilities. [1, 2, 3, 4, 5]

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

- Task 2.3.1: Follow pertinent Laws, Agreements, Policies, and Executive Orders on consultation and coordination with Native American Tribal Governments. [1, 2, 3, 4, 5]
- Objective 2.4: Maximize survival at all life stages by working with the appropriate fish health center to maintain a comprehensive fish health program, which focuses on prevention of diseases rather than treatment. [3.2.4, 3.6, 3.1.4]
 - Task 2.4.1: Maintain hatchery operations that are consistent with the Service Manual (Part 713); State of Washington, Aquaculture and Disease Control (RCW 75.58); and the Salmonid Disease Control Policy of the Fisheries Co-Managers of Washington State. Any exceptions to this task would be negotiated on a case-by-case basis, with the fish health co-managers. [1, 2, 3, 4, 5]
- Objective 2.5: Communicate and coordinate effectively with the Makah Indian Nation Fisheries staff. [1, 2, 3, 4, 5]
 - Task 2.5.1: Participate in *U.S. v Washington* production planning processes. [1, 2, 3, 4, 5]
 - Task 2.5.2: Hold semi-annual Steering Committee meetings to plan, report, and review progress toward meeting hatchery goals. [1.8, 2.6, 3]
- Objective 2.6: Ensure goals are achieved by working with the WWFWO to conduct monitoring and evaluation. [1, 2, 3, 4, 5]
 - Task 2.6.1: Double-index tag and mass mark production lots of coho salmon to evaluate selective fisheries. [3.7]
 - Task 2.6.2: Biosample and mark sample returning adults. [3.7]
 - Task 2.6.3: Produce an annual report on stock assessment, survival, fish health, and fisheries contribution. [3.7, 5.4.8]
 - Task 2.6.4: Provide data as needed for co-managers and for internal management needs. [3.7, 5.4.8]
- Goal 3: Promote understanding, participation, and support of Service and Makah NFH programs.
 - Objective 3.1: Increase awareness of Makah NFH programs. [3.9]
 - Task 3.1.1: Coordinate with state, other Federal, tribal and local information/public offices to incorporate information about Makah NFH. [1, 2.6, 2.9, 3]

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

- Task 3.1.2: Facilitate interagency cooperation with existing and new programs in fisheries management. [1, 2.6, 2.9, 3]
- Task 3.1.3: Coordinate with other Federal offices to participate in special events, such as National Fishing and Boating Week. [3.9]
- Task 3.1.4: Interact with Service, tribal, other Federal agencies, Fisheries outreach coordinators and actively seek to integrate Fisheries outreach activities with the Regional and National Outreach Strategies. [1, 2, 3, 4, 5]
- Task 3.1.5: Distribute the annual Makah NFH Focus Report (prepared by the Western Washington FWO) to the public and our cooperators. [3.9]
- Objective 3.2: Provide information and education about Service programs and Makah NFH to internal and external audiences. [3.9]
 - Task 3.2.1: Continue to develop and implement new cooperative agreements with partnerships from the public and private groups. [3.9]
 - Task 3.2.2: Create and maintain a website for the Makah NFH to inform cyber-visitors of the hatchery's programs and history. The website also provides general information about the hatchery. [3.9]
 - Task 3.2.3: Develop a volunteer (camp host) program to give tours, answer questions, and disseminate general information. [3.9]
 - Task 3.2.4: Develop a strong working relationship with the local media (newspaper, radio, and other coastal area publications) and provide news releases and articles regarding agency issues and station activities. [3.9]
 - Task 3.2.5: Increase public use of the hatchery facilities by inviting special interest groups to tour the hatchery. [3.9]
 - Task 3.2.6: Loan Service-developed educational materials (such as the fish kit, and the migratory bird kit) to teachers. [3.9]
- Goal 4: Support the principles of hatchery reform.
 - Objective 4.1: Maintain scientifically defensible production programs. [2, 3]
 - Task 4.1.1: Increase the use of coho jacks in spawning to 10 percent of the males spawned. [3.10]
 - Objective 4.2: Use informed decision making to manage the hatchery program. [1, 2, 3, 4, 5]

USFWS Olympic Peninsula Hatchery Review Team
 Olympic Peninsula NFHs Assessments and Recommendations Report –May 2009

3. Type of program (Integrated or Segregated)

Segregated.

4. Alignment of program with ESU-wide plans

There are no NOAA jurisdictional listed species in Sooes River.

5. Habitat description and status where fish are released¹⁰⁵

Rating (H/M/L)	Spawning Habitat		Freshwater Rearing Habitat		Migration Habitat		Estuarine Habitat
	Hatchery	Wild	Hatchery	Wild	Hatchery	Wild	
	N/A		N/A		H		H

Rating (H/M/L)	Spawning Habitat		Freshwater Rearing Habitat		Migration Habitat		Estuarine Habitat
	Hatchery	Wild	Hatchery	Wild	Hatchery	Wild	
	L/M	L/M	L/M	L/M	M	M	H

Three categories of habitat are defined in terms of conditions that support the target stocks, with the assumption that these conditions would also provide for the needs of other native stocks of salmonids (assume that pre-terminal harvest is part of the environment during the fish’s whole life cycle).

These habitat ratings are:

1. High (H) = Healthy: Productivity of the target stock is high and the population is capable of growth and supporting significant terminal harvest
2. Medium (M) = Limiting: The target stock is productive enough for the population to sustain itself at a low level terminal harvest
3. Low (L) = Inadequate: The target stock is unproductive and the population will go extinct, even without terminal harvest.

Habitat Conditions

Are there exceptions or “islands” of habitat that are in better or worse condition and do not correspond with the rating given in question?

No

¹⁰⁵ HSRG Briefing Book, Internal Document, p.2004 p. 799,800.

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

Habitat Improvement

What habitat improvement projects could elevate the rating for this sub-region or the “islands” of inferior production? If so, please list them and indicate if they are in the proposed or planning stages.

Habitat deficiencies in the watershed are being addressed. Currently, the Makah Nation is working cooperatively with Crown Pacific Timber Company to identify and replace problem culverts. Together they are experimenting with adding large wood to the Sooes River. Also, streamside buffer protection should, after a number of years, provide a source of large wood for stream enhancement.

Future Expectations

Do you see the quality of the habitat in this region become better or worse in the next ten to twelve years? Fifty years? What are the long-term goals for habitat in this sub-region?

The quality of the habitat is gradually improving. However, significant improvement should not be expected in the short term. For example, it will likely be fifty years before natural recruitment of large wood can occur. The long term goals include improved riparian conditions, associated large wood recruitment, and stream-bed stability.

Additional Information

What other habitat information should the Scientific Group consider (for example, salmonid or non-salmonid stocks not native to the watershed)? Please describe.

While riparian area improvement should be expected due to stream buffer restrictions, it should be recognized that the most of the watershed is subject to intense timber harvest management and associated road construction/maintenance and therefore siltation and culvert issues.

6. Size of program and production goals¹⁰⁶

Measure	Goal	Five-year ¹ mean	Five-year ¹ range
Winter Steelhead			
Spawned population	270	327	261 – 432
Smolts released – Sooes	158,000	157,682	142,540 – 180,010
Smolt size at release	5.5	6.9	5.7 – 7.6
Pre-smolts transferred –	22,000	25,981	48,900 - 19,100
Pre-smolt size at transfer	8.0	8.0	6.1 – 9.8

Number	Life stage	Fish size		Release site/Destination
		No./lb.	g/fish	
Winter Steelhead				
22,000	Pre-smolt	8.0	57	Educket Creek facility
158,000	Smolts	5.5	82	On-station, Sooes River

¹⁰⁶ MNFH CHMP Draft p. 42,49 - corrected by Zajac 2008.

C. Description of program and operations

1. Broodstock goal and source

- The stated goal of 135 pairs results in more eggs taken than needed for production. However, the goal is to meet a genetic minimum effective population size. Eggs excess to program needs are discarded. The broodstock source are hatchery adults returning to Makah NFH up to March 1. Adults returning after March 1 are wild adults and are allowed to move upstream past the hatchery.
- Note: The Makah NFH and Sooes River were de-populated in the late 1980s when VHS was discovered at the hatchery. Replacement stock was from Quinault NFH.

2. Adult collection procedures and holding¹⁰⁷

- Adult salmon typically enter the river system in mid to late August. However, due to water constraints and proximity to the ocean, returning fish may not approach the hatchery until much later. For this reason, the hatchery ladder is not opened until late September/early October. Hatchery winter steelhead begin to return to in the river during October, but the majority of fish enter the river from late November to the end of January. Brood fish enter the hatchery via a fish ladder associated with a suspended-electrode electric weir that spans the Sooes River. Adults ascend the ladder and enter a holding pond. All five of the adult holding ponds are used for adult collection and holding purposes.
- The pescalator lifts fish and water onto a delivery chute. Two hydraulic gates can be activated independently to guide fish into one of two anesthetic tanks. If both gates are closed, fish continue down the chute into a conduit leading upstream of the barrier dam. Limited numbers of fish are passed upriver for natural spawning. When fish are sufficiently anesthetized, they are lifted and deposited onto the sorting table, via a hydraulic-controlled basket lift system (Photo 5). Depending on egg take needs, ripe females, males and jacks are sorted and dispatched via concussion with a blunt instrument. Unripe fish are either returned to the holding pond, where they are held until mature or needed, or surplused, if numbers handled exceed egg-take and holding needs. Spawning is conducted in an enclosed building.
- No hatchery steelhead are passed upstream All wild fish are passed. [Zajac 2002].

3. Adult spawning

a) Spawning protocols¹⁰⁸

- Typically, spawning is conducted each Wednesday during the season to facilitate sampling by the OFHC. Non-segregated brood fish are crowded out one pond at a

¹⁰⁷ Unless otherwise sited, section text from MNFH CHMP Draft p. 42,43.

¹⁰⁸ MNFH CHMP Draft p. 42,44.

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

time into the effluent channel. Another hydraulic gate is used to crowd the fish from the channel for delivery into a mechanical pescalator (fish lift).

- The Makah NFH has a full-blockage electric weir which directs returning salmonid adults to the fish ladder and receiving ponds. Although adult fish are able to pass or circumvent the weir during high river flows. At spawning, all ripe fish are killed and spawning selection is randomized. That is to say, large fish are not matched with large fish, etc. To ensure this, different tasks are assigned to different people. The person spawning a female is not the person adding milt. Eggs from one female are deposited into a colander and rinsed with a bicarbonate solution, and then poured into a dry bucket with sperm from one male added immediately. The sperm and egg mixture is gently stirred with more bicarbonate solution being added. This process of egg stripping and fertilization takes about 5 minutes. For Chinook, eggs are then rinsed several times with filtered Sooes River water. For coho and steelhead, the eggs from three females are combined into one bucket prior to rinsing with fresh water.

b) No. of males and females spawned each year over past 10 years

Table. Returns to hatchery [pers. comm. C. Peterschmidt, USFWS, 2008]

Return Year	females			males			jacks			total to hatchery			
	spawned	morts/XS	passed	spawned	morts/XS	passed	spawned	morts/XS	passed	females	males	jacks	total
1997													
1998													
1999	173	161	0	189	108	0	1	1	0	334	297	2	633
2000	206	85	0	158	58	0	26	75	0	291	216	101	608
2001	199	756	0	233	590	0	0	2	0	955	823	2	1780
2002	144	81	0	167	121	0	1	2	0	225	288	3	516
2003	130	88	0	128	164	0	3	61	0	218	292	64	574
2004	151	314	0	172	275	0	0	1	0	465	447	1	913
2005	144	155	0	159	232	0	1	21	0	299	391	22	712
2006	215	236	0	297	263	0	30	33	0	451	560	63	1074
2007	202	150	0	193	74	0	0	14	0	352	267	14	633
2008													
min	130	81	0	128	58	0	0	1	0	218	216	1	516
max	215	756	0	297	590	0	30	75	0	955	823	101	1780
avg	174	225	0	188	209	0	7	23	0	399	398	30	827

4. Fertilization

a) Protocols¹⁰⁹

- At spawning, all ripe fish are killed and spawning selection is randomized. That is to say, large fish are not matched with large fish, etc. To ensure this, different tasks are assigned to different people. The person spawning a female is not the person adding milt. Eggs from one female are deposited into a colander and rinsed with a bicarbonate solution, and then poured into a dry bucket with sperm from one male added immediately. The sperm and egg mixture is gently stirred with more

¹⁰⁹MNFH CHMP Draft p. 44.

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report –May 2009

bicarbonate solution being added. This process of egg stripping and fertilization takes about 5 minutes. For Chinook, eggs are then rinsed several times with filtered Sooes River water. For coho and steelhead, the eggs from three females are combined into one bucket prior to rinsing with fresh water.

- Bicarbonate solution: Empty a 1 lb box of Baking soda into the 10 gallon plastic can. Add hatchery water up to the line indicating approximately 8.75 gallons. Stir until baking soda is completely dissolved. Fill garden sprinkler can with this rinse solution. Set up plastic buckets and colanders provided (colander should fit loosely over bucket lip).
- Rinsing process: Spawn female into colander (this helps drain ovarian fluid and proteins/shell fragments from broken or damaged eggs). Sprinkle the eggs with the rinse solution (use about 1 cup of solution per female or sprinkle for about 5 seconds). Gently transfer eggs to a clean, dry spawning bucket. Add milt (from fish or cup). Add another 0.5 cup of baking soda solution to activate sperm. Stir gently to mix completely. Let mixture stand for 30 to 60 seconds to complete fertilization. Gently rinse eggs in hatchery water until clean
- Eggs are then pooled (eggs from three females-coho and steelhead only) into one stainless steel bucket and taken for washing. Washing consists of adding Sooes River water and pouring off any tissues, blood, etc., to reduce dead organic matter that hasten the development and spread of fungus (*Saprolegnia* spp.) This is done several times until the eggs appear clean.

b) Number of eggs collected and fertilized each year over past 10 years¹¹⁰

Brood Year	Number Green	Number Eyed	% Eyed
2000	621,000	411,000	66.2
2001	994,784	743,003	74.7
2002	781,828	599,730	76.7
2003	548,700	408,000	74.4
2004	590,084	426,174	72.2
2005	505,274	428,599	84.8
2006	507,479	428,528	84.4
2007	807,089	531,453	65.8
2008	807,666	731,379	90.6

5. Incubation¹¹¹

- Incubation takes place in vertical tray incubation units known as Heath Stacks. Egg loadings per tray are species dependent; coho at 8,000 eggs per tray, Chinook at 5,000 eggs per tray, and steelhead at 10,000 eggs per tray. Water delivery flows to each stack are set between 4 to 5 gpm during egg development and 4 to 5 gpm from hatching to ponding.

¹¹⁰ Pers. comm. C. Peterschmidt, US Fish and Wildlife Service, 2008.

¹¹¹[MNFH CHMP Draft p. 46,47.

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

The eggs are kept in trays until development to the eyed stage (eye-up) at which time the eggs are shocked, sorted, and placed back into Heath Tray incubators along with vexar substrate.

- Shocking takes place approximately 30 days after fertilization. Eggs from a ready take-date are emptied from their respective trays into fine-wire mesh baskets suspended in a shallow trough. Eggs are then shocked by personnel holding an egg-filled basket at shoulder height and emptying that basket into a water-filled basket. Shocked eggs remain undisturbed for 12 to 24 hours before picking (cleaning out sterile eggs).
- Picking commences shortly after shocking by sorting eggs through automated egg sorting machines. Machines must be calibrated for each species. Since this process is not 100 percent effective and some eggs are shocked during this sorting, a supplemental manual pick is done. Dead eggs are then inventoried and disposed of in a burial pit. Live eggs are inventoried and trayed into Heath Stacks along with dual-folded panels of Vexar plastic screen to facilitate development and lessen the incidence of coagulated-yolk syndrome. The eggs remain in this setup, undisturbed, until hatching.

6. *Ponding*¹¹²

a) Protocols

After hatched fry have absorbed their yolk sac (buttoned up), winter steelhead fry are ponded in 16-foot-long by 3-foot-wide and 2-foot-deep (96 cu.ft.) fiberglass tanks at 20,000 each. Fall Chinook and coho fry are placed directly into 11-foot-wide by 80-foot-long outdoor concrete raceway at 130,000 coho each or 170,000 fall Chinook each. Winter steelhead remain in tanks until they attain a size of 500 per lb or bigger as outlet raceway screen may impede newly buttoned up steelhead fry. Once placed in the outdoor raceways, fish remain there until release.

b) Number of fry ponded each year, including % hatch each year

The number of fry ponded for brood years 2000-2007 has ranged from about 400,000 to about 600,000. Excess to program needs may be planted as fry at the hatchery.

7. *Rearing/feeding protocols*¹¹³

- Once placed in the outdoor raceways, fish remain there until release. Every attempt is made to split raceways in advance of the density index reaching 0.20 or flow index of 1.00, in consideration of the total weight of fish in the rearing vessel, the vessel's rearing volume, and oxygen intake of the fish as related to their size (Piper et al. 1982, Evered et al. 2005). Availability of water can be a constraint in this regard. Coho salmon and steelhead trout, which are held over the summer, are ponded in specific raceways which allows for implementation of a water re-use system, if needed. With frequent cleaning,

¹¹² MNFH CHMP Draft p. 47.

¹¹³ MNFH CHMP Draft p. 47, 48.

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

improved feeds, and regular diagnostic checks by OFHC, onset of disease can be minimized or eliminated.

- General pond cleaning is done every three days. Fish are fed three times a day. Sample counts are done at the end of each month. Fish are inventoried with an electronic counter during pond movements and coho and Chinook are inventoried again with electronic counters during marking and tagging.

8. *Fish growth profiles*¹¹⁴

Example – Brood year 2007 Steelhead

March	1445 fpp
April	415
May	223
June	119
July	51.8
August	31.4
September	27.8
October	19.5
November	15.1
December	13.4
January	11.6

9. *Fish health protocols and issues*¹¹⁵

The OFHC in Olympia, Washington, provides the fish health care for Makah NFH under the auspices of the published policy 713 FW in the Fish and Wildlife Service Manual. In addition, other fish health measures may be adopted after consideration by the HET. Fish health exams must be done prior to releases. Fish health inspections, as defined by the USFWS Handbook/AFS Blue Book, must be performed approximately 6 weeks prior to any transfers. The fish health management programs at Makah NFH meet or exceed the Co-Managers' Salmonid Disease Control Policy of 1998.

In general, movements of live fish into or out of the hatchery must 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 WDFW, the Service, and any other states through which the fish travel must be obtained and approved by the 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.

¹¹⁴*Ibid.*

¹¹⁵MFNH CHMP Draft p. 49-52.

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

3.6.2 Fish Health Examinations -: A fish health biologist (FHB) from the OFHC visits at least monthly to examine fish at the hatchery. Based on observations of fish, input from the hatchery staff, and hatchery records, the FHB will determine numbers and distribution of the fish to be tested, as well as what tests will be employed.

Diagnostic examinations are performed as determined by the FHB and/or when requested by hatchery or Western Washington Fish and Wildlife Office (WWFWO) personnel.

3.6.3 Broodstock Health Evaluation - The number of broodstock sampled will meet or exceed the minimum requirements described in the USFWS Handbook/AFS Blue Book and in the Washington Co-Managers' Salmonid Disease Control Policy of 1998. The number and type of fish samples taken is based on programs and disease history.

3.6.5 Other Management Practices - Cleaning practices are used to minimize bacterial and virus infections. Such as:

- Tank trucks and tagging trailers are disinfected before and after being used at the hatchery. More specific fish health guidelines regarding marking and tagging are found in Attachment 8.
- Raceways are pressure washed and disinfected with chlorine prior to being used.
- Fish screens are checked twice a day. Screens are cleaned when needed.
- The intake settling basin is cleaned annually. Accumulated sediments are removed mechanically

The Abernathy Fish Technology Center provides feed quality analyses to ensure that feed manufacturers are meeting nutrient specifications to avoid nutritional diseases and contribute to healthy high quality smolts.

Fish health recommendations in addition to those already addressed in other parts of the CHMP for hatchery production operations and environmental parameters for Makah NFH include the following:

- Flow index [Piper 1982] should never exceed 1.0 for any period during the rearing cycle of any species.
- Density index [Piper 1982] should never exceed 0.2 for any period during the rearing cycle.
- Pond water exchange rate (turn over) should be at least 2 per hour (Wedemeyer 1996).
- Fish feed freshness should not exceed 90 days post manufacture.
- Mortalities should be removed from all ponds and recorded on a daily basis.

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

10. Chemotherapeutant use¹¹⁶

It has been, and will continue to be, the philosophy of the HET to minimize drug treatment to fish and eggs. By practicing sound fish culture and disinfection practices drug treatment are minimized. However, in some cases, medications must be used and follow formulations listed below (Photo 9):

Treatment of Fish Eggs - PVP iodine at 75 to 100 ppm for 30 to 60 minutes is used during water hardening to disinfect eggs. Formalin 1:600 (1670 ppm) for 15 minutes starting at least 24 hours after fertilization is used to control fungus on the eggs. Depending on the species being treated formalin is applied three to seven days a week for about 8 weeks then discontinued before hatching.

Treatment of Adult Fish: Holding adult fish are not routinely treated at the hatchery. If a treatment is indicated, the FHB will make recommendations to the HET and collaboratively determine a treatment plan.

Treatment of Juvenile Fish:

- Furunculosis caused by the bacterium *Aeromonas salmonicida* is a significant recurring problem in juvenile coho when water temperatures are elevated in the summer. This strain of bacteria has been resistant to oxytetracycline for many years and is intermittently resistant to Romet thus leaving no approved antibiotic for treatment. Amoxicillin and Florfenicol have been used under the Investigational New Drug Approval process and have been effective in reducing mortality although generally two or more medicated feed treatments are required per broodyear until water temperatures fall below 60°F in the fall. Furunculosis occasionally causes mortality in the juvenile steelhead but treatment is rarely required. Fall Chinook are released prior to elevations in the water temperature to prevent an epizootic from occurring in that stock.
- Coldwater disease caused by the bacterium *Flavobacterium psychrophilum* has been isolated from juvenile coho, Chinook, and steelhead and has been treated in both coho and steelhead by oral administration of oxytetracycline or florfenicol under the Investigational New Animal Drug (INAD) permit.
- Formalin bath treatments to control external parasites on all species of fish are common. Depending on the parasite and the water temperature, this may be a one time treatment or it may be performed on multiple days either consecutively or alternately. Baths are generally one hour long at 1:6000 to 1:4000 (167 – 250 ppm) and conform to the Food and Drug Administration (FDA) and EPA guidelines and labels. The parasites which cause the most significant problems are *Ichthyophthirius*, *Ichthyobodo*, and *Trichodina*.
- Vaccination of coho and steelhead have been performed for several years and have not provided any significant reduction in mortality.
- Nutritional immune system modulators are currently being evaluated as part of the prevention and control of furunculosis but so far have not been associated with much reduction in mortality.

¹¹⁶MNFH CHMP Draft p. 50, 51.

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

11. Tagging and marking of juveniles¹¹⁷

This section briefly describes marking methods, and how this marking provides data for short and long-term post-release survival estimates, fishery contribution estimates, and changes in genetic profiles. Fish marking is done using a coded-wire-tagging system. Fish tagging and sampling goals are presented in Table 6. These goals were developed based on statistical analysis of fish survival and contribution estimates. Tag groups are replicated as recommended by the “PSC Workshop on Hatchery CWT Methodology” [Sands 1995].

Other short-term, pre-release evaluations are conducted. These are usually directed towards fish health problems during juvenile rearing. Generally, fish health and mortality tracking are used to evaluate these treatments instead of using the coded-wire-tag system.

Table 6. Current Makah NFH marking, tagging, and sampling goals (updated)

Species	Juveniles			Adults	
	Production goal	Mark/tag	Number	Mark/tag sample rate	Scale sample rate
Fall Chinook, on-station	2,200,000	Tag/clip	260,000	100%	25%
”		Clip only	1,940,000	100%	25%
Fall Chinook, Educket	100,000	Clip only	100,000	n/a	n/a
Coho, on-station	200,000	Tag/clip	40,000	50%	n/a
”		Tag/no clip	40,000	50%	n/a
		Clip only	120,000	50%	n/a
Coho, Educket	40,000	Clip only	40,000	n/a	n/a
Steelhead, on-station	158,000	None	0	0%	25%
Steelhead, Educket	22,000	None	0	n/a	n/a

3.7.1 Mass Marking Law - The FY 2003 appropriations language (House bill, Conference Committee and Omnibus Appropriations) requires the Service to implement a system of mass marking of salmonid stocks released from federally operated or federally financed hatcheries including but not limited to fish releases of the coho, Chinook, and steelhead species. The requirements of this section shall not be applicable when the hatchery fish are produced for conservation purposes.” The House report further states that the Service is expected to be a full participant in this effort by ensuring that hatchery fish that are

¹¹⁷ MNFH CHMP Draft p. 52-54.

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

suitable/available for selective fisheries are visually marked to assist in the identification and recovery of wild salmonid stocks.”

The mass mark law did not cause any changes in the Makah coho program since mass marking was implemented in 1997 for the very same reasons stipulated in the law. However, the mass marking law now requires the Makah NFH to mark all of the steelhead and Chinook production as well. The law will also guide future marking regardless of fish production changes.

Note: Makah NFH steelhead mass marking was discontinued with brood year 2006 due to lack of funds.

12. Fish Release

a) Protocols¹¹⁸

Table 5 outlines fish production goals and their optimum size at release. Target size for coho salmon release is between 15 and 20 fish per pound, and Chinook are released when the fish are at least 75 fish per pound. Release of steelhead commences when a size of 5.5 fish per pound is achieved (release timing is usually a function of raceway loading, flows, and water temps). Coho and steelhead are released as yearlings in May after approximately 18 months on station, whereas Chinook salmon are released after 5 or 6 months post hatch as juvenile smolts.

Fish are generally released at a time, size, and physiological condition that provide a low likelihood of residualization, and promote a rapid migration to marine waters. As an example, Chinook are released between May and June when they reach 75 fish per pound. These subyearling fish are released at a time and size when they are fully smolted, and thereby unlikely to residualize, and expected to move rapidly to marine waters.

Table 5. Fish production goals for Makah NFH.(updated)

Number	Life stage	Fish size		Release site/Destination
		No./lb.	g/fish	
Winter Steelhead				
22,000	Pre-smolt	8.0	57	Educket Creek facility
158,000	Smolts	5.5	82	On-station, Sooes River

¹¹⁸ MNFH CHMP Draft p. 48, 49.

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

a) Number of fish released each year-on station ¹¹⁹

Date	Stage	Number	Size (fpp)
4/11/1997	Yearling	184,376	6.5
5/19/1997	Subyearling	384,000	1,097.1
4/23/1998	Yearling	164,580	7.1
5/21/1998	Subyearling	176,000	1,230.8
4/29/1999	Yearling	135,940	6.7
4/13/2000	Yearling	145,470	5.7
4/18/2001	Yearling	135,517	6.2
5/1/2002	Yearling	178,050	7.4
4/21/2003	Yearling	169,830	6.2
4/30/2003	Subyearling	34,500	425.9
4/19/2004	Yearling	142,540	7.6
4/27/2005	Yearling	153,010	7.4
4/10/2006	Yearling	143,020	5.7

Steelhead Transfers to Educket Creek Pond

Date	Stage	Number	Size (fpp)
4/16/1997	Yearling	25,000	7.2
4/2/1998	Yearling	25,185	7.0
4/14/1999	Yearling	20,000	7.7
4/11/2000	Yearling	17,280	6.4
4/13/2001	Yearling	19,980	7.4
3/6/2002	Yearling	48,900	9.7
4/4/2003	Yearling	20,300	6.1
3/31/2004	Yearling	19,100	7.8
4/1/2005	Yearling	21,090	9.8
3/30/2006	Yearling	20,516	6.6

¹¹⁹ USFWS 1991.

D. Program benefits and performance

1. *Adult returns*

a) **Numbers of adult returns/harvest/age at return**

Table. Number of Adults Harvested [USFWS 1991]

Catch Year	Number Caught	
	Sooes River	Waatch River
1995/96	1,857	143
1996/97	2,133	20
1997/98	1,539	166
1998/99	2,967	50
1999/00	963	31
2000/01	1,406	74
2001/02	2,220	90
2002/03	446	22
2003/04	1,895	2
2004/05	3,516	6
2005/06	2,413	107

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

Table. Returns to hatchery and harvest [pers. comm. C. Peterschmidt, USFWS, 2008]

Return Year	total to hatchery				Harvest					Total to River
	females	males	jacks	total	Sooes	Wa'atch	Sport Sooes	Sport Wa'atch	Total	
1997					1163	25			1188	1188
1998					2753	201			2954	2954
1999	334	297	2	633	1257	23			1280	1913
2000	291	216	101	608	1416	53			1469	2077
2001	955	823	2	1780	4274	99			4373	6153
2002	225	288	3	516	1990	49			2039	2555
2003	218	292	64	574	2435				2435	3009
2004	465	447	1	913	4362	26			4388	5301
2005	299	391	22	712	2364	144			2508	3220
2006	451	560	63	1074	3243	74			3317	4391
2007	352	267	14	633	2941	301			3242	3875
2008					40				40	40
min	218	216	1	516	40	23	0	0	40	40
max	955	823	101	1780	4362	301	0	0	4388	6153
avg	399	398	30	827	2353	100	0	0	2436	3056

Table. Number of Returning Adults by Age at Return [USFWS 1991]

Return Year	Age at Return to rack and river					Total Per Year
	2	3	4	5	6	
1996-97	0	345	131	5	0	481
1997-98	2	248	194	1	0	445
1998-99	5	2,261	726	5	0	2,997
1999-00	6	510	118	5	0	639
2000-01	0	299	289	2	0	590
2001-02	19	1,213	516	34	0	1,782
2002-03	6	441	73	0	0	520
2003-04	163	169	249	0	0	581
2004-05	1	818	94	0	0	913
2005-06	22	499	202	0	0	723

Table. Catch Numbers By Year [TFT and SoftData Reports, NWIFC, May 20, 2008]

Catch Year	Sooes Steelhead	Waatch Steelhead
1997	1163	25
1998	2753	201
1999	1257	23
2000	1416	53
2001	4274	99
2002	1990	49
2003	2435	
2004	4362	26
2005	2364	144
2006	3243	74
2007	2941	301
2008	40	

USFWS Olympic Peninsula Hatchery Review Team
Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

- The hatchery fish entry date range is September – February with a mean date of January 8. The age at return ranges from 2-6 with an average age of 3.3.
- Survival of broods 2001-03 averaged between about 1.0 to 1.5 percent [Tipping and Zajac 2007].

2. *Contributions to harvest and utilization (e.g. food banks)*

- See tables in section D,1a) above.
- All carcasses are available to local residents.

3. *Contributions to conservation*

None identified.

4. *Other benefits*

None identified.

E. Research, monitoring, and evaluation programs

Tissues are collected annually for long term genetic analysis.

F. Program conflicts

1. *Biological conflicts (e.g. propagated stock maladapted to hatchery water source)*

None identified.

2. *Harvest conflicts (e.g. mixed stock fishery on hatchery and wild fish limits harvest opportunities on hatchery fish)*

None identified.

3. *Conservation conflicts and risks*

- a) **Genetic conflicts associated with straying and natural spawning of hatchery fish (Stray rates, proportion of hatchery-origin fish on natural spawning grounds, etc. Provide tables or figures where appropriate)**

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

- There is a definite timing difference between wild and hatchery steelhead. Therefore, the weir is operated to exclude upstream movement of hatchery steelhead.
- Potential strays: Steelhead encounter records at Umbrella Creek (Lake Ozette tributary) weir:

2007: no steelhead

2006: 2 steelhead, no marks

2005: 3 steelhead with ad-marks out of a total of 18 steelhead encountered

2004: 8 steelhead, no marks

2003: 2 steelhead, no marks

2002: 4 steelhead, one noted as "double ventral clip" - per further conversation with Joe, we suspect this was really a pelvic fin "clip", and more likely to be nasty raceway fin erosion than an intentional fin clip

2001: no steelhead

The Umbrella Creek weir is targeted at capturing sockeye broodstock and operates in the window of late October to the week after New Year's. During that "heavy" steelhead showing in '05, all fish showed up in December. So now the question is whether any other coastal hatcheries were ad-marking steelhead in the '02 or '03 window that might have contributed to those marked fish encountered in '05? Proximity leads one to believe that MNFH is a likely contributor, but does not guarantee that we have the only fish with faulty GPS. [pers. comm. C. Peterschmidt, USFWS, 2008]

b) Ecological conflicts (e.g. competition between hatchery fish and wild fish, predation,)

- The rearing and release strategies for Makah steelhead are designed to promote rapid outmigration. However, the potential still exists for ecological interactions to occur between the hatchery steelhead and all other stocks.

4. Other conflicts between the hatchery program, or fish produced by the program, and other non-hatchery issues

None identified.

IVB. Makah NFH Coho

A. General information

See section IVA.A.

B. Stock/Habitat/Harvest Program Goals and Purpose

1. Purpose and justification of program

See section IVA.B.1.

2. Goals and objectives of program

See section IVA.B.2.

3. Type of program (Integrated or Segregated)

Integrated.

4. Alignment of program with ESU-wide plans

There are no NOAA jurisdictional species in the Sooes River.

5. Habitat description and status where fish are released.

See section IVA.B.5.

6. Size of program and production goals¹²⁰

¹²⁰ MFNH (CHMP Draft p. 42, 49).

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

Measure	Goal	Five-year ¹ mean	Five-year ¹ range
<i>Coho</i>			
Spawned population	450	434	336 – 519
Upstream passage		3,621	1,769 – 5,635
Smolts released – Sooes	200,000	219,473	181,256 – 251,300
Smolt size at release (fish/lb)	15 – 20	17.8	16.5 – 19.2
Percent survival from smolt	3.0%	3.19%	2.00% - 4.78%
Pre-smolts transferred –	40,000	42,541	28,861 – 53,000
Pre-smolt size at release	25	21.3	18.5 – 28.0

Number	Life stage	Fish size		Release site/Destination
		No./lb.	g/fish	
Coho salmon				
40,000	Pre-smolt	25	18	Educket Creek facility
200,000	Smolts	15 - 20	23 - 30	On-station, Sooes River

C. Description of program and operations

1. Broodstock goal and source

- The goal is to spawn 225 females with 203 males and 22 jacks (10%) from coho returning to the Makah NFH.
- Note: The hatchery and Sooes River were de-populated in the late 1980s when VHS was discovered at the hatchery. Replacement stock was from Quinault NFH.

2. Adult collection procedures and holding

See section IVA.C.2. Also up to 1,610 coho are passed upstream to use available habitat [Zajac 2002].

3. Adult spawning

a) Spawning protocols

See section IVA.C.3a.

USFWS Olympic Peninsula Hatchery Review Team
Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

b) No. of males and females spawned each year over past 10 years (includes number of coho passed upstream)¹²¹

COHO	females			males			jacks			total to hatchery				
	Return Year	spawned	morts/XS	passed	spawned	morts/XS	passed	spawned	morts/XS	passed	females	males	jacks	total
	1997	313			286			14						
	1998	301			289			8						
	1999	291	659	3450	288	468	2675	16	66	410	4400	3431	492	8323
	2000	292	552	1467	315	609	1166	27	197	280	2311	2090	504	4905
	2001	254	378	2860	260	231	2405	5	79	354	3492	2896	438	6826
	2002	269	182	2769	239	87	2426	14	28	440	3220	2752	482	6454
	2003	178	929	738	185	595	756	10	78	284	1845	1536	372	3753
	2004	209	796	928	219	587	874	14	363	391	1933	1680	768	4381
	2005	164	980	1484	163	852	1339	9	31	67	2628	2354	107	5089
	2006	212	78	226	156	44	221	18	6	41	516	421	65	1002
	2007	222	60	31	212	52	19	45	46	15	313	283	106	702
	2008													0
	min	164	60	31	156	44	19	5	6	15	313	283	65	0
	max	313	980	3450	315	852	2675	45	363	440	4400	3431	768	8323
	avg	246	513	1550	237	392	1320	16	99	254	2295	1938	370	4144

4. Fertilization

a) Protocols

See section IVA.C.4a.

b) Number of eggs collected and fertilized each year over past 10 years¹²²

Brood Year	Number Green	Number Eyed	% Eyed
1999	1,029,090	855,602	83.1
2000	1,024,224	851,848	83.2
2001	862,697	700,102	81.2
2002	917,189	548,351	59.8
2003	543,561	433,169	79.7
2004	733,916	660,054	89.9
2005	326,388	280,403	85.9
2006	563,915	482,712	85.6
2007	617,086	470,212	76.2

5. Incubation

See section IVA.C.5.

¹²¹ Pers. comm. C. Peterschmidt, USFWS, 2008. w/ additions from USFWS 1991c.

¹²² Ibid.

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

6. Ponding

a) Protocols

See section IVA.C.6a.

b) Number of fry ponded each year, including % hatch each year

The number of fry ponded for brood years 1999-2006 ranged from about 300,000 to almost 900,000. Excess to program needs may be released into the Sooes River at the hatchery.

7. Rearing/feeding protocols

See section IVA.C.7.

8. Fish growth profiles¹²³

Example – Brood year 2006 coho.

March	233 fpp
April	195
May	97
June	77
July	50.6
August	33.5
September	28.4
October	22.7
November	20.5
December	22.2
January	21.1

9. Fish health protocols and issues

See section IVA.C.9.

10. Chemotherapeutant use

See section IVA.C.10.

¹²³ *Ibid.*

USFWS Olympic Peninsula Hatchery Review Team
Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

11. Tagging and marking of juveniles

- See section IVA.C.11. Also, specific tagging protocols include application of four uniquely coded tagged and adipose clipped groups of 10,000 and matching uniquely coded unclipped groups (DITs) to four of the 6 ponds that the fish occupy. The ponds are selected so that the tags represent as many as the spawn takes as possible. The remaining fish are adipose clipped (mass marked).
- The Educket Creek coho are adipose clipped (mass marked).

12. Fish Release

a) Protocols

See section IVA.C.12.

b) Number of fish released each year¹²⁴

Table. On-station releases into the Sooes river

Date	Stage	Number	Size (fpp)
4/22/1997	Yearling	232,301	13.6
3/10/1997	Subyearling	448,000	1,103.4
4/15/1998	Yearling	234,999	14.4
2/17/1998	Subyearling	375,000	1,010.8
4/27/1999	Yearling	187,391	17.4
4/19/2000	Yearling	236,798	16.4
4/25/2001	Yearling	182,494	15.6
4/16/2002	Yearling	251,300	16.5
4/16/2003	Yearling	232,901	17.1
4/15/2004	Yearling	231,500	18.2
5/12/2004	Subyearling	54,473	179.2
4/15/2005	Yearling	200,409	19.2
4/14/2006	Yearling	181,256	18.2

Table. Coho Transfers to Educket Creek Pond

Date	Stage	Number	Size (fpp)
3/4/1997	Yearling	45,646	19.0
3/11/1998	Yearling	42,390	18.9
3/11/1999	Yearling	30,075	28.6
3/9/2000	Yearling	43,340	22.0

¹²⁴ *Ibid.*

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

3/28/2001	Yearling	34,986	23.8
4/11/2002	Yearling	53,000	18.5
2/26/2003	Yearling	42,383	20.1
3/3/2004	Yearling	53,000	28.0
3/8/2005	Yearling	35,462	19.8
3/7/2006	Yearling	28,861	20.0

D. Program benefits and performance

1. Adult returns

a) Numbers of adult returns

Table. Total to hatchery, including fish passed upstream, and harvest [pers. comm. C. Peterschmidt, USFWS, 2008]

COHO	total to hatchery				Harvest					Total to River	
	Return Year	females	males	jacks	total	Sooes	Wa'atch	Sport Sooes	Sport Wa'atch		Total
1997						260	632			892	892
1998						3489	1198			4687	4687
1999	4400	3431	492	8323	4514	1718			6232	14555	
2000	2311	2090	504	4905	35	104			139	5044	
2001	3492	2896	438	6826	4433	893			5326	12152	
2002	3220	2752	482	6454	7199	441			7640	14094	
2003	1845	1536	372	3753	5794	1552			7346	11099	
2004	1933	1680	768	4381	6476	562			7038	11419	
2005	2628	2354	107	5089	10610	142			10752	15841	
2006	516	421	65	1002	1903	31			1934	2936	
2007	313	283	106	702	739	81			820	1522	
2008				0					0	0	
min	313	283	65	0	35	31	0	0	0	892	
max	4400	3431	768	8323	10610	1718	0	0	10752	15841	
avg	2295	1938	370	4144	4132	669	0	0	4801	8567	

b) Return timing and age-class structure of adults¹²⁵

The entry timing ranges from September to January with the mean entry date of October 26 (1988-2005). Age at return is 2 or 3 with the average being 2.8 (1985-2005).

Return Year	Age at Return		Total per Year
	2	3	

¹²⁵ USFWS 2006c.

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

1996	200	5,395	5,595
1997	492	2,193	2,685
1998	446	2,969	3,415
1999	492	7,842	8,334
2000	504	4,401	4,905
2001	438	6,388	6,826
2002	485	5,972	6,457
2002	372	3,781	4,153
2004	768	3,613	4,381
2005	107	4,982	5,089
The current coho program contributes to various fisheries and is very successful. Average survival is 4 percent. A coho mass marking program was initiated in the fall/winter of 1997/98 to support selective fisheries.			

2. Contributions to harvest and utilization¹²⁶

- Catch for broods 1988 – 2002 averaged 29% to U.S. sport, 27% to Canada commercial, 26% to U.S. commercial, 11% to Tribal fisheries, and 7% to Canada sport.
- Carcasses from spawning or excess to production needs are distributed to local residents.

Table: Catch Numbers By Year [TFT and SoftData Reports, NWIFC, May 20, 2008]

Catch Year	Sooes Coho	Waatch Coho
1997	261	632
1998	3489	1198
1999	4514	1718
2000	35	104
2001	4433	893
2002	7199	441
2003	5794	1552
2004	6476	562
2005	10610	142
2006	1903	31
2007	739	81
2008		

3. Contributions to conservation

None identified.

¹²⁶ Unless otherwise cited, section text from USFWS 2006c.

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

4. Other benefits

None identified.

E. Research, monitoring, and evaluation programs

- Coded-wire tagging including DITs are applied annually to track program success and to evaluate the effects of selective fishing.
- Tissues are collected annually for long term trend genetic analysis.

F. Program conflicts

None identified.

1. Biological conflicts (e.g. propagated stock maladapted to hatchery water source)

None identified.

2. Harvest conflicts (e.g. mixed stock fishery on hatchery and wild fish limits harvest opportunities on hatchery fish)

None identified.

3. Conservation conflicts and risks

a) Genetic conflicts associated with straying and natural spawning of hatchery fish (Stray rates, proportion of hatchery-origin fish on natural spawning grounds, etc. Provide tables or figures where appropriate)

None identified.

b) Ecological conflicts (e.g. competition between hatchery fish and wild fish, predation,)

The rearing and release strategies for Makah NFH coho are designed to promote rapid outmigration. However, the potential still exists for ecological interactions to occur between the hatchery coho and other fish populations.

4. Other conflicts between the hatchery program, or fish produced by the program, and other non-hatchery issues

USFWS Olympic Peninsula Hatchery Review Team
Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

None identified.

IVC. Makah NFH Fall Chinook

A. General information

See section IVA.A.

B. Stock/Habitat/Harvest Program Goals and Purpose

1. Purpose and justification of program

See section IVA.B.1.

2. Goals and objectives of program

See section IVA.B.2.

3. Type of program (*Integrated or Segregated*)

Integrated.

4. Alignment of program with ESU-wide plans

There are no NOAA jurisdictional fish in the Sooes River.

5. Habitat description and status where fish are released.

See section IVA.B.5.

6. Size of program and production goals¹²⁷

Measure	Goal	Five-year mean	Five-year range
Fall Chinook			
Spawned population	1,100	1,337	1,186 – 1,573
Upstream passage	500	2,101	1,037 – 3,420
Smolts released – Sooes	2,200,000	2,580,845	2,209,722 –
Smolt size at release	75	72.0	69.7 – 79.2
Percent survival from	0.75%	0.24%	0.03% - 0.50%
Pre-smolts transferred –	100,000	59,200	0 – 100,000

¹²⁷ MNFH CHMP Draft p. 42, 49.

USFWS Olympic Peninsula Hatchery Review Team
Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

Measure	Goal	Five-year mean	Five-year range
Pre-smolt size at transfer	350	406	280 - 480

Number	Life stage	Fish size		Release site/Destination
		No./lb.	g/fish	
Fall Chinook salmon				
100,000	Pre-smolt	350	1.3	Educket Creek facility
2,200,000	Smolt	75	6	On-station, Sooes River

C. Description of program and operations

1. Broodstock goal and source

The broodstock goal is to spawn 550 females and 550 males from Chinook returning to the hatchery.

2. Adult collection procedures and holding

- See section IVA.C.2.
- Up to 499 adult Chinook may be passed to use upstream habitat [Zajac 2002].

3. Adult spawning

a) Spawning protocols

See section IVA.C.3a.

b) No. of males and females spawned each year over past 10 years (includes number of Chinook passed upstream)¹²⁸

¹²⁸ Pers. comm. C. Peterschmidt, USFWS, 2008. 1997 and 1998 data from USFWS FRED database, 2008.

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

CHINOOK	females			males			jacks			total to hatchery				
	Return Year	spawned	morts/XS	passed	spawned	morts/XS	passed	spawned	morts/XS	passed	females	males	jacks	total
1997	889			665			23							
1998	782			696			39							
1999	568	11	2	530	29	22	21	14	114		581	581	149	1311
2000	475	19	2	454	29	110	91	66	139		496	593	296	1385
2001	748	25	594	653	22	2243	74	1	463		1367	2918	538	4823
2002	766	16	1162	750	3	1638	57	35	620		1944	2391	712	5047
2003	592	348	333	610	953	728	56	126	177		1273	2291	359	3923
2004	606	879	742	560	1722	719	29	133	48		2227	3001	210	5438
2005	589	94	566	572	79	459	25	4	12		1249	1110	41	2400
2006	511	230	14	340	44	8	15	0	0		755	392	15	1162
2007	131	11	1	110	19	4	27	196	4		143	133	227	503
2008														
min	131	11	1	110	3	4	15	0	0		143	133	15	503
max	889	879	1162	750	1722	2243	91	196	620		2227	3001	712	5438
avg	605	181	380	540	322	659	42	64	175		1115	1490	283	2888

4. Fertilization

a) Protocols

See section IVA.C.4a.

b) Number of eggs collected and fertilized each year over past 10 years¹²⁹

Brood Year	Number Green	Number Eyed	% Eyed
1999	2,643,641	2,366,282	89.5
2000	2,345,568	2,127,760	90.7
2001	3,883,464	3,449,779	88.8
2002	3,928,250	3,282,250	83.6
2003	2,976,108	2,402,389	80.7
2004	2,866,657	2,522,365	88.0
2005	2,779,794	2,416,512	86.9
2006	2,305,485	1,859,002	80.6
2007	597,993	465,495	77.8

5. Incubation

See section IVA.C.5.

6. Ponding

¹²⁹ pers. comm. C. Peterschmidt, US Fish and Wildlife Service, 2008.

USFWS Olympic Peninsula Hatchery Review Team
Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

a) Protocols

See section IVA.C.6.

b) Number of fry ponded each year, including % hatch each year

The number of fry ponded for brood years 1999-2006 ranged from about 2,000,000 to about 3,500,000.

7. Rearing/feeding protocols

See section IVA.C.7.

8. Fish growth profiles

Example – Brood year 2005.

January	728 fpp
February	455
March	212
April	110
May	79.6

9. Fish health protocols and issues

See section IVA.C. 9.

10. Chemotherapeutant use

See section IVA.C.10.

11. Tagging and marking of juveniles

See section IVA.C.11. Also, specific tagging protocols include application of four uniquely coded tagged and adipose clipped groups of 65,000 to four of the 15 ponds that the fish occupy. The ponds are selected so that the tags represent as many as the spawn takes as possible. The remaining fish are adipose clipped (mass marked).

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

12. Fish Release

a) Protocols

See section IVA.C.12.

b) Number of fish released each year

- *Table. On-station fall Chinook releases (Date in this case is the last release date) [USFWS 1991]*

Date	Stage	Number	Size (fpp)
6/5/1997	Subyearling	2,466,427	71.8
5/27/1998	Subyearling	3,149,700	71.8
6/12/1999	Subyearling	3,081,900	70.2
6/2/2000	Subyearling	2,240,730	60.1
6/4/2001	Subyearling	1,979,850	64.1
6/3/2002	Subyearling	3,070,100	65.2
5/28/2003	Subyearling	3,172,636	74.1
5/19/2004	Subyearling	2,212,801	71.9
5/24/2005	Subyearling	2,209,722	69.7
5/18/2006	Subyearling	2,238,967	79.2

- *Table. Transfers to Educket Creek Pond [USFWS 1991]*

Date	Stage	Number	Size (fpp)
2/18/1995	Fry	101,083	513.1
2/19-4/29/1998	Fry	321,135	123-327
3/2/1999	Fry	95,900	383.6
4/2/2002	Fry	100,000	280.1
4/4/2005	Fry	96,000	480.0

USFWS Olympic Peninsula Hatchery Review Team
 Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

D. Program benefits and performance

1. Adult returns

a) Numbers of adult returns

Table. Total to hatchery, including fish passed upstream, and harvest [pers. comm. C. Peterschmidt, USFWS, 2008 and 1998 data from USFWS FRED database, 2008]

Return Year	total to hatchery				Harvest					Total to River
	females	males	jacks	total	Sooes	Wa'atch	Sport Sooes	Sport Wa'atch	Total	
1997					1441	30			1471	
1998					613	6			619	
1999	581	581	149	1311	93	5			98	1409
2000	496	593	296	1385	1				1	1386
2001	1367	2918	538	4823	80	16			96	4919
2002	1944	2391	712	5047	2017	43			2060	7107
2003	1273	2291	359	3923	1555	2			1557	5480
2004	2227	3001	210	5438	8349	648			8997	14435
2005	1249	1110	41	2400	4264	1			4265	6665
2006	755	392	15	1162	2528				2528	3690
2007	143	133	227	503	330	2			332	835
2008					1				1	1
min	143	133	15	503	1	1	0	0	1	835
max	2227	3001	712	5438	8349	648	0	0	8997	14435
avg	1115	1490	283	2888	1773	84	#DIV/0!	#DIV/0!	1835	5103

b) Return timing and age-class structure of adults

- Fall Chinook entry timing ranges from September to November with a mean entry date of October 8. Age at return ranges from 2-6 years with an average of 3.7 [USFWS 2006c, broods 1985-2005].
- Table. Combined hatchery rack and in-river harvest [USFWS 1991]

Return Year	Age at Return					Total Per Year
	2	3	4	5	6	
1997	88	231	3,826	171	0	4,316
1998	77	394	926	1,323	0	2,720
1999	168	353	538	357	24	1,440
2000	301	425	553	138	10	1,427
2001	604	1,553	2,496	222	14	4,889
2002	712	1,126	5,522	405	0	7,765

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

2003	359	1,796	2,679	644	0	5,478
2004	210	5,935	6,358	975	0	13,478
2005	41	61	3,528	1,656	0	5,286

c) Smolt-to-adult return rates

Survival ranges from .03 - .50 percent [MNFH CHMP draft page 42].

2. Contributions to harvest and utilization (e.g. food banks)

- See table in section D,1a) above.
- Commercial fisheries account for 83% of all fish captures. Of the FCS produced by Makah NFH, 41% are caught in Canadian waters, 53% in Alaska, 7% in Washington waters. The portion caught in Washington will increase as the run builds and directed fisheries in the Sooes River occur [USFWS 2006c – brood years 1985-2001].
- *Table: Chinook Catch By Year [TFT and SoftData Reports, NWIFC, May 20, 2008]*

Catch Year	Sooes Chinook	Waatch Chinook
1997	1441	30
1998	613	6
1999	93	5
2000	1	
2001	80	16
2002	2017	43
2003	1555	2
2004	8349	648
2005	4264	1
2006	2528	
2007	330	2
2008	1	

3. Contributions to conservation

The original brood source was taken from the Sooes River. Therefore it is assumed that the genetic profile of the Makah NFH fall Chinook is similar to the historic wild run.

4. Other benefits

None identified.

E. Research, monitoring, and evaluation programs

Tissues are collected annually for long term genetic analysis.

F. Program conflicts

1. *Biological conflicts (e.g. propagated stock maladapted to hatchery water source)*

None identified.

2. *Harvest conflicts (e.g. mixed stock fishery on hatchery and wild fish limits harvest opportunities on hatchery fish)*

None identified.

3. *Conservation conflicts and risks*

a) *Genetic conflicts associated with straying and natural spawning of hatchery fish (Stray rates, proportion of hatchery-origin fish on natural spawning grounds, etc. Provide tables or figures where appropriate)*

None identified.

b) *Ecological conflicts (e.g. competition between hatchery fish and wild fish, predation,)*

None identified.

4. *Other conflicts between the hatchery program, or fish produced by the program, and other non-hatchery issues*

None identified.

IVD. Makah NFH Ozette Sockeye¹³⁰

Lake Ozette Sockeye

Makah Tribe and US Fish and Wildlife Service

Stock Goals:	Current	Short-Term	Long-Term
<i>Biological Significance</i>	High	High	High
<i>Population Viability</i>	At Risk	At Risk	Healthy
<i>Habitat</i>	Inadequate	Inadequate	Limiting
<i>Harvest Opportunity</i>	None	None	Occasional
Purpose			
<i>Purpose</i>	Conservation		
Type			
<i>Type</i>	Integrated		

PROGRAM DESCRIPTION

This is a native stock with little or no history of fish transfers into the basin, and no evidence of interbreeding. Artificial production has occurred to some extent, but has involved small egg takes and limited broodstock collection (an average of 98 fish per year). This is the only stock within the Ozette Sockeye GDU. Adults are captured in a trap located at river mile one on Umbrella Creek. They are transported to Umbrella Creek hatchery at river mile 4.6 and held there until ripe. Ripe adults are taken to the Makah Tribal “staging building” in Neah Bay to be spawned. Unfertilized gametes are taken to Makah NFH. The egg take goal is 305,000. Incubation and otolith marking occur at Makah NFH. Eyed eggs are taken to Umbrella Creek (122,000) and to Stony Creek Hatchery (183,000 in remote site incubators, or RSI, plus fiberglass troughs). Planting goals are 122,000 at 450 fish per pound into Umbrella Creek (Elk Lake RSI), 91,500 at 900 fish per pound and 91,500 at 450 fish per pound into Stony Creek.

OPERATIONAL CONSIDERATIONS

- This stock is listed as endangered under the Endangered Species Act (ESA). The purpose of the program is to: 1) augment the river spawner component of the population to increase the life history diversity and productivity of the lake system; 2) establish self-sustaining river runs in Lake Ozette tributaries; and 3) de-list the population.
- Genetics studies indicate no evidence of interbreeding of native stocks with any planted stocks.
- The fish are too small at release to be coded wire tagged and are therefore 100% otolith marked.
- The stock is not harvested in any known fishery.
- The spawning protocol is to use a four-by-four factorial process.
- The Umbrella Creek program is operated under a Lake Ozette Sockeye Hatchery and Genetic Management Plan (HGMP) prepared by the Makah Tribe in 2000.

BENEFITS AND RISKS

B. Consistent with short-term and long-term goals?

¹³⁰ HSRG 2004.

USFWS Olympic Peninsula Hatchery Review Team
Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

Recent stock reintroductions into underused habitat in Lake Ozette tributaries have been increasingly successful in reestablishing tributary spawning aggregations. Domestication selection risk is reduced by the small size and early life history stage at which the fish are released from the Hatchery. There is an increased potential for predation on the juvenile hatchery fish by native cutthroat as the sockeye population expands.

B. Likelihood of attaining goals?

Overall, there is a significant conservation benefit to this ESA-listed stock, insofar as the riverine life history has been re-established and the size of the spawner population appears to be increasing. Whether the population will become self-sustaining remains to be seen.

C. Consistent with goals for other stocks?

There are no detectable negative effects to the natural population from the increased run size.

RECOMMENDATIONS

Continue the program as designed.

COMMENTS

The HSRG commends the project managers on this well-designed and efficiently-operated program.

The HSRG recognizes that sockeye salmon propagated through the Umbrella Creek program are included as part of the Ozette Lake sockeye salmon ESU, but juvenile and first generation adult fish produced by the program are not. In its ESA listing determination for the ESU, NMFS determined that the tributary sockeye salmon aggregation propagated under the HGMP is not essential for recovery, but if conditions warrant, the stock is not precluded from playing a role in recovery of the beach spawning component. Like all integrated hatchery programs, success will depend on good habitat being available to both the hatchery- and natural-origin components of the integrated population.

MANAGERS RESPONSE

The Makah Tribe agrees with the recommendations of the HSRG and appreciates the complimentary remarks on this program.

V. References

Reference/supporting documents can be found at the Columbia River Basin Hatchery Review website <<http://www.fws.gov/pacific/Fisheries/Hatcheryreview/index.html>> under “Reports & Publications”.

- Ardren, William. et al. 2006. Genetic Analyses of Coho Salmon Populations in Hood Canal: How similar genetically are hatchery and natural populations? U.S. Fish and Wildlife Service, Abernathy Fish Technology Center, Longview, WA.
- Fishman Environmental Services. 2005. U.S. Fish and Wildlife Service Makah National Fish Hatchery Dike Repair and Sediment Removal Project-Final Environmental Assessment. Portland, OR.
- Frissell, C, P. Morrison, J. Kramer, and M. Mentor. 2000. Conservation priorities: an assessment of freshwater habitat for Puget Sound Salmon. Trust for Public Land, Seattle, WA.
- Geomax. 1994. Comprehensive Flood Management Plan for the Big Quilcene and Dosewallips Rivers. Jefferson County Public Works. Port Townsend, WA
- Hatchery Scientific Review Group (HSRG)-Lars Mobrand (chair), John Barr, Lee Blankenship, Don Campton, Trevor Evelyn, Conrad Mahnken, Paul Seidel, Lisa Seeb, and Bill Smoker. 2004. Hatchery Reform Recommendations for the Puget Sound and Coastal Washington Hatchery Reform Project. Long Live the Kings. Seattle, WA.
- Jefferson County. 1998. Lower Big Quilcene River Comprehensive Flood Hazard Management Plan. Jefferson County Department of Public Works, Port Townsend, WA.
- Jefferson County. 2000. Land use data for WRIA 17 sub-basins. Unpublished data from Jefferson County, Port Townsend, WA.
- Jefferts, K. B., P. K. Bergman, and H. F. Fiscus. 1963. A Coded-Wire Identification System for Macro-Organisms. Washington Department of Fisheries. Seattle, WA.
- Kane, T. and L. Moore. 2001. Quilcene National Fish Hatchery Historic Logbook Database Project. U.S. Fish and Wildlife Service, Western Washington Office, Lacey, WA.
- Kirk, R., and J. Franklin. 1992. The Olympic Rain Forest, An Ecological Web. University of Washington Press, Seattle, WA.
- Knudsen, E. E., D. P. Zajac, and B. Kenworthy. 1989. Quilcene National Fish Hatchery Coded Wire Tagging Results: Coho - Brood Years 1974 - 81; Fall Chinook - Brood Years 1972 - 75. U.S. Fish and Wildlife Service. Olympia, WA.
- Levy, DA, T.G. Northcote. 1982. Juvenile Salmon Residency n a Marsh Area of the Fraser River Estuary. Canadian Journal of Fisheries and Aquatic Sciences. Vol. 39, no. 2, p270-276. 1982. Tronto, Ontario, Canada
- Long Live the Kings (LLTK) and the Hatchery Scientific Review Group. 2000. Hatchery Reform in Puget Sound and Coastal Washington: Managing Hatchery Programs to Help Recover Wild

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

Salmon and Support Sustainable Fisheries. A Joint Report to Congress on the Hatchery Reform Project dated June 29, 2000. Long Live the Kings. Seattle, WA.

Makah Indian Tribe. 2003. Sooes Basin Anadromous Barrier Elimination. Neah Bay, WA.

Moore, James L. 1965. Surficial Geology of the Southwestern Olympic Peninsula. Masters Thesis, University of Washington, Seattle, WA.

NOAA. 2006. (Draft) Hood Canal Steelhead Project Study Plan. Manchester, Washington.

Parametrix, Inc., Pacific Groundwater Group, Inc., Montgomery Water Group Inc., Caldwell and Associates. 2000. Stage 1 technical Assessment as of February 2000 Water Resource Inventory Area 17. Kirkland, WA

Piper et al. 1982. Fish Hatchery Management. USFWS, Washington D.C.

Renker, A., M.E Gunther. 1990. The Makah. In the Handbook of North American Indians. Smithsonian Institution, Vol. 7:422-430. Washington D.C.

Regional Mark Processing Center (RMPC). www.rmhc.org.

Righter, E. 1978. Cultural resource overview of the Olympic National Forest, Washington. Vol. 1. Jack McCormick and Associates, Inc. Washington, D.C.

Sands, N.J. 1995. Minutes from PSC Workshop on Hatchery CWT Methodology. Seattle, WA

Tipping, J.M., and D. Zajac. 2007 (Draft). Manipulating Diet in the Last Month of Juvenile Rearing did not Enhance Adult Steelhead Survival at Makah National Fish Hatchery.

Tschaekofske, H. D., L. B. Peck. 2004. Fish Passage Inventory and Barrier Assessment on U.S. Fish and Wildlife Service Lands: Watershed Resource Inventory Areas 1-23. U.S. Fish and Wildlife Service. Lacey, WA.

U.S. Fish and Wildlife Service (USFWS). 1991. Fisheries Resources Evaluation Database (FRED).

USFWS. 2001. Hatchery Support Activities Costs Review. Western Washington Office, Lacey, WA.

USFWS. 2005. (Draft) Hatchery and Genetic Management Plan – Quilcene Coho. Quilcene National Fish Hatchery (QLNFH). Quilcene, WA.

USFWS. 2006A. Quilcene NFH FOCUS Report. Western Washington Fish and Wildlife Office. Lacey, WA.

USFWS. 2006B. Quinault NFH FOCUS Report. Western Washington Fish and Wildlife Office. Lacey, WA.

USFWS. 2006C. Makah NFH FOCUS Report. Western Washington Fish and Wildlife Office. Lacey, WA.

USFWS. 2007. Quilcene National Fish Hatchery Comprehensive Hatchery Management Plan. Quilcene National Fish Hatchery (QLNFH). Quilcene, WA.

USFWS Olympic Peninsula Hatchery Review Team

Olympic Peninsula NFHs Assessments and Recommendations Report – May 2009

- USFWS. 2007. Quinault National Fish Hatchery Comprehensive Hatchery Management Plan (draft). Quinault National Fish Hatchery (QNNFH). Humptulips, WA.
- USFWS. 2008. Makah National Fish Hatchery Comprehensive Hatchery Management Plan (draft). Makah National Fish Hatchery (MNFH). Neah Bay, WA.
- USFWS and Hood Canal Salmon Enhancement Group (HCSEG). 2007. Dosewallips River, Walcott Slough Habitat Restoration Agreement. Cooperative Agreement No. 13245-07-J001 Western Washington Fish and Wildlife Office. Lacey, WA
- U.S. Forest Service. 1994. Big Quilcene Watershed Analysis; An Ecological Report at the Watershed Level. Quilcene Ranger District. Quilcene, WA.
- U.S. Forest Service, U.S. Geological Survey, U.S. Fish and Wildlife Service, U.S. Bureau of Indian Affairs, Quinault Indian Nation Business Council, Washington Department of Natural Resources, and Rayonier. 1996. Boulder and Cook Watershed Analysis. US Forest Service. Quinault, WA.
- Washington Department of Fish and Wildlife (WDFW) and LLTK. 2006. Hatchery and Genetic Management Plan (Hood Canal Steelhead Supplementation Project). Seattle, WA.
- WDFW and Point-No-Point Treaty Tribes. 2000. Summer Chum Salmon Conservation Initiative (An Implementation Plan to Recover Summer Chum in the Hood Canal and Strait of Juan de Fuca Region). Olympia, WA.
- Washington Department of Fisheries, Washington Department of Wildlife, and Western Washington Treaty Indian Tribes. 1993. 1992 Washington State Salmon and Steelhead Stock Inventory. Olympia, WA.
- Zajac, Dave. 2002A. An Assessment of Anadromous Fish Habitat Use Above Quilcene National Fish Hatchery in the Big Quilcene River. U.S. Fish and Wildlife Service, Western Washington Office, Lacey, WA.
- Zajac, Dave. 2002B. An Assessment of Potential Anadromous Fish Habitat Use and Fish Passage Above Makah National Fish Hatchery in the Sooes River. U.S. Fish and Wildlife Service, Western Washington Fish and Wildlife Office, Lacey, WA.
<http://www.fws.gov/westwafwo/fisheries/Publications/FP065.pdf>
- Zajac, Dave. 2004. An Assessment of Potential Anadromous Fish Habitat Use and Fish Passage Above Quinault National Fish Hatchery in Cook Creek. U.S. Fish and Wildlife Service, Western Washington Fish and Wildlife Office, Lacey, WA.

Pacific Region Fishery Resources
911 NE 11th Avenue
Portland, OR 97232
503/872.2763
E-Mail: Douglas_dehart@fws.gov

U.S. Fish and Wildlife Service
www.fws.gov

For Pacific Region Hatchery Review Information
www.fws.gov/pacific/Fisheries/Hatcheryreview/

The mission of the U.S. Fish and Wildlife Service is working with others to conserve, protect and enhance fish, wildlife, plants and their habitats for the continuing benefit of the American people.

May 2009

