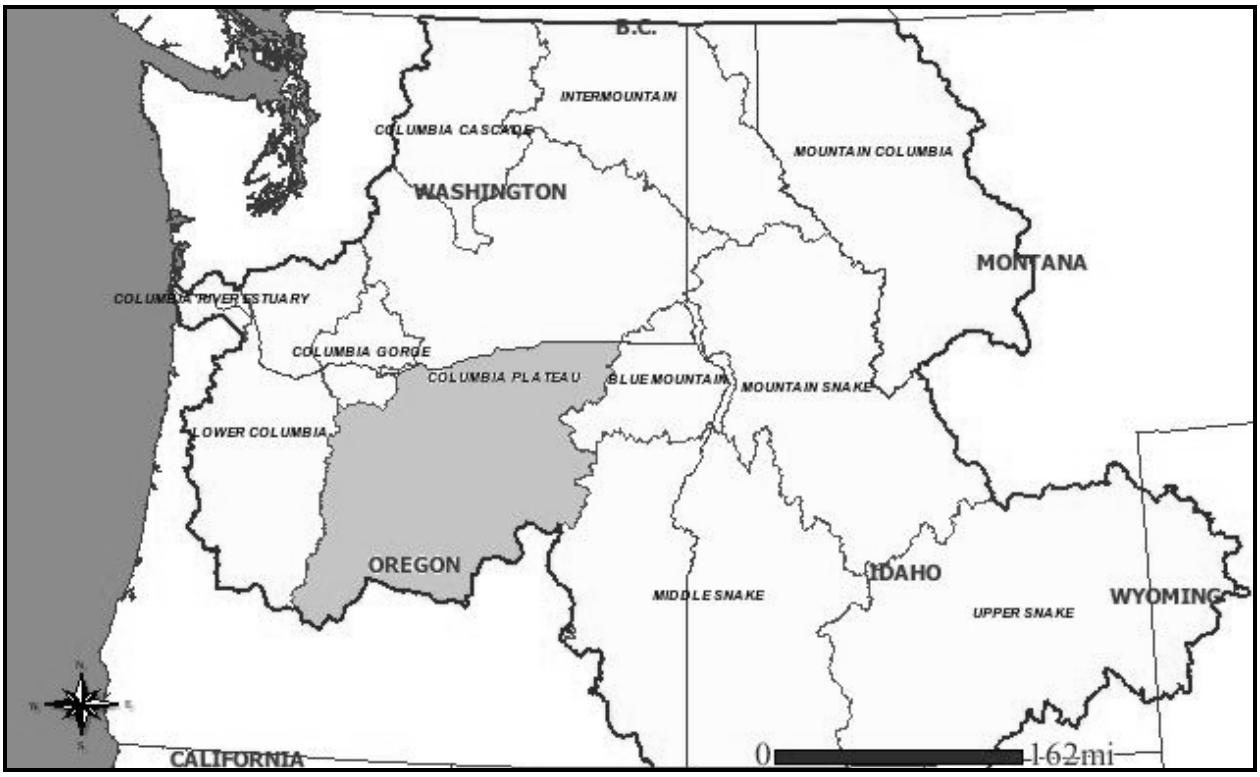
U.S. Fish and Wildlife Service

Pacific Region

Hatchery Review Team

Columbia River Basin
Columbia Plateau Province, Deschutes River Watershed



Warm Springs National Fish Hatchery

Assessments and Recommendations

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

May 2006

Warm Springs National Fish Hatchery Briefing Document

Note: This briefing document was created by a task team of the US Fish and Wildlife Service's Columbia Basin Hatchery Review Team (Review Team). It was developed as a support document that synthesizes information from the large number of briefing materials that the Review Team considered as part of the information-gathering phase of its review of the Warm Springs National Fish Hatchery (NFH) in the Columbia Plateau province/Deschutes River watershed in Oregon (see the Review Team's Warm Springs NFH Assessments and Recommendations *report for more detail). This document provides summaries of biological, ecological, and operational information considered by the Review Team in determining benefits and risks of this hatchery program. The Review Team received additional written information, as well as field tours and face-to-face meetings with federal, state and tribal personnel, after the initial version of this briefing document was assembled. Moreover, this Briefing Document is considered "dynamic" and will updated regularly by the Review Team as additional information is gathered and/or changes to the existing hatchery program are implemented. Although the Review Team has attempted to keep this document up-to-date, it is possible that it will contain some errors or inconsistencies with information found in the main body of the Review Team's Final Report for the Warm Springs NFH. The source documents for the summaries presented here can be found in the "Documents" section for the Warm Springs NFH on the Service's Hatchery Review website (www.fws.gov/pacific/fisheries/hatcheryreview/). The "WS" numbers in parenthesis throughout this Briefing Document (e.g., WS-006) refer to the accession numbers of the source documents on the Service's website.*

I. General Information[1]

1) Species and population (or stock) under propagation

- Warm Springs River spring Chinook salmon (*Oncorhynchus tshawytscha*),

2) ESA status of target stock and other stocks in the Basin

- Target stock (Warm Springs River spring Chinook salmon), unlisted.

Other key stocks of concern:

- Fall Chinook-unlisted
- Deschutes summer steelhead, listed as threatened by NOAA Fisheries within the Middle Columbia River ESU.
- Sockeye salmon – extirpated
- Bull trout – Threatened
- Rainbow trout - unlisted
- Pacific lamprey - unlisted

3) Primary Hatchery Contact

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[1] References are provided for source documents and page(s) for biological, ecological, and operational information described in briefing document. WS-numbering refers to specific reference information for WSNFH maintained on Review Team website (*http://pacific.fws.gov/Fisheries/hatcheryreview/*). See reference list for complete citation details.

4) Hatchery Evaluation Team (Evaluation Team) Contact

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5) Agencies, Tribes, and co-operators involved in the program (WS-006, P. 2-3)[1]

- Confederated Tribes of the Warm Springs Reservation of Oregon (CTWSRO), USFWS Columbia River Fisheries Program Office, Oregon Department of Fish and Wildlife.
- USFWS recognizes that CTWSRO have the principal management responsibility for fishery resources on the Warm Springs Reservation.
- The Service and the Tribe have a Memorandum of Understanding and an agreement that the operation of the hatchery is to be compatible with and compliment the Tribe's fishery management goals.

6) Funding source, staffing level, and annual hatchery program operational costs

- The Warm Springs National Fish Hatchery (NFH) is fully funded by the USFWS. The hatchery has a staff of six full time employees and has an annual operating budget of $538,000 *(WS-006, P. 3)*. An additional $400,000/year is spent on monitoring and evaluation activities associated with the hatchery.

7) Location(s) of hatchery and associated facilities

- Warm Springs NFH is located at rkm 16 of the Warm Springs River, within the Warm Springs Indian Reservation. The Warm Springs River enters the Deschutes River at rkm 135, which in turn enters the Columbia River at rkm 329. The hatchery site lies in Section 24, Township 8 South, Range 12 East, Willamette Meridian, Oregon. Shitike Creek enters the Deschutes River at rkm 155 after flowing approximately 61 km from its headwaters near Mt. Jefferson. *(WS-006, P. 3)*

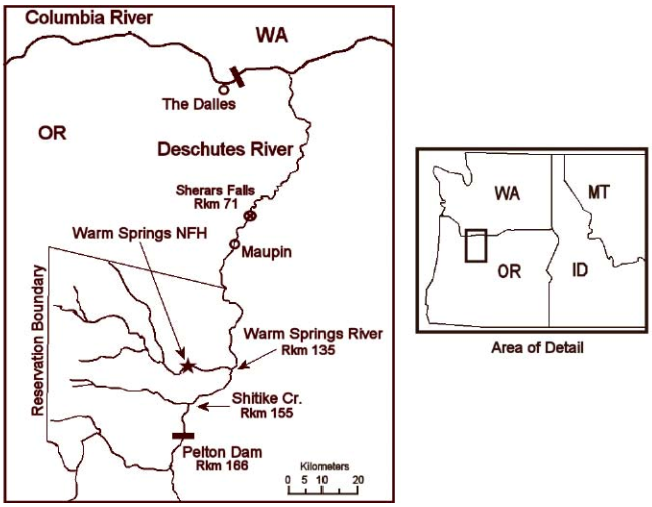

Figure 1--The lower 166 km of the Deschutes River watershed and location of Warm Springs NFH on the Warm Springs Indian Reservation, Oregon *(WS005, P. 3)*

II. Stock/Habitat/Harvest Program Goals and Purpose

1) Purpose of program

- harvest;
- conservation/recovery;
- research and/or education;
- cultural/socioeconomic.

2) Objective for achieving these purposes through this program include:

- The goals of the Warm Springs NFH (NFH) spring Chinook program are as follows: ***(WS008, P. 6)***
    - Produce spring chinook salmon that will contribute to fisheries in the Deschutes River while providing escapement for hatchery production.
    - Minimize negative effects of production of hatchery spring chinook salmon on indigenous fish species.
    - Monitor and evaluate the health of wild and cultured fish populations.
    - Monitor and evaluate the ecological effects attributable to the specific hatchery products following release.
    - Monitor and evaluate genetic effects of artificially propagated fish on wild and cultured populations.
    - Minimize disease impacts to indigenous fish by releasing healthy smolts.
    - Minimize competition/interactions between hatchery and indigenous fish.
    - Ensure that hatchery operations are compatible with the CTWSRO's fishery management goals.
    - Maintain close interagency communication and coordination between the CTWSRO, USFWS, and ODFW.

3) Type of program

- Integrated
- Although a primary objective is to produce fish for harvest, maintaining wild fish traits in the hatchery and stream environment (run timing, size, age, and broodstock composition) and managing affects on wild fish to very low, acceptable levels (as measured by escapement, straying, recruitment, spawning success, and fish health) are equally important. ***(WS-005, P. 3)***.

4) Size of hatchery program and production goals

- Warm Springs NFH (NFH) rearing units consist of 2 adult holding ponds, 3 catch ponds, 30 modified Burrows ponds, and 20 starter tanks ***(WS009, P. 1)***.
- Hatchery production has ranged from 200,000 to 1.2 million spring Chinook salmon, 1978–2004 ***(WS-005, P. 4)***.
- The current objective is to collect 630 adult broodstock for release of 750,000 juvenile fish, split as 10% fall subyearling and 90% spring yearling release into the Warm Springs River at the hatchery site ***(WS-005, P. 4)***.
- Broodstock and juvenile production goals are set to provide an adult return of 2,250 or more hatchery spring Chinook salmon to the mouth of the Deschutes River for harvest and escapement ***(WS-005, P. 4)***.
- The hatchery goal is to achieve a minimum 0.3% juvenile to adult survival rate of to the mouth of the Deschutes River ***(WS008, pages 8)***.

- The escapement objective for wild spring Chinook salmon is 1,300 or more adults upstream of Warm Springs NFH ***(WS-005, P. 4)***.
- The adult return goal is for at least 2,250 adults returning to the mouth of the Deschutes River ***(WS-005, P. 4)***.
- Ceremonial and subsistence goal is for surplus hatchery return adults distributed to the Confederated Tribes for ceremonial and subsistence use ***(WS-005, P. 6)***.

5) Justification for the program

- In 1959, USFWS, responding to a request by CTWSRO, began investigating salmon and steelhead enhancement possibilities on Warm Springs Reservation waters ***(WS-006, P. 3)***.
- In 1966, Congress authorized the construction of Warm Springs NFH in order to enhance anadromous fish runs in Reservation waters and meet the future needs of the resource as well as those of the Tribe ***(WS-006, P. 3)***.
- Full production at the hatchery began in 1978 ***(WS-006, P. 3)***.
- USFWS and CTWSRO have cooperatively managed the Warm Springs NFH in a manner that will provide harvest opportunities for hatchery spring Chinook salmon while protecting wild fish populations in the subbasin ***(WS-006, P. 3)***.

6) Alignment of the hatchery program with ESU-wide Plans

- Warm Springs NFH operates in compliance with the ODFW Lower Deschutes River Management Plan, the NPPC Deschutes River Salmon and Steelhead Plan, and the 1999 NMFS Biological Opinion on Columbia River Hatcheries. ***(WS-006, P. 22)***

7) ***Short-, Medium- and Long-Term*** *Goals for Stock and Habitat Status* ***(from WSNFH-descOct4.doc)***

Status and goals for target stock:			
○ = Low ◒ = Medium ● = High			
	Now	**Short-Term (10-15 years)**	**Long-Term (50-75 years)**
Biological Significance	●	●	●
Viability	◒	◒	●
Habitat	◒	◒	●

8) Habitat Description and Status

The Deschutes Subbasin encompasses over 10,700 square miles of land in central Oregon. The subbasin extends west to the crest of the Cascade Mountains, south to lava plateaus, east into the Ochoco Mountains and to the plateau between the Deschutes and John Day rivers, and north to its confluence with the Columbia River at rkm 330. The headwaters of the Deschutes River and most major tributaries receive large amounts of precipitation, but much of the subbasin lies in the rain shadow of the Cascades Mountains and is sheltered from western Oregon's heavy rainfall. Average annual precipitation amounts to more than 100 inches on the eastern slopes of the Cascades, mostly as snow, but drops to only 40 inches in the Ochoco Mountains and 10 inches at lower central locations.

Construction of the Pelton Round Butte Hydroelectric Complex in the late 1950's blocked anadromous fish from part of their historic spawning and rearing habitat above rkm 164. Major spawning and rearing areas that were blocked included Wychus Creek, the Metolius River, and the Crooked River. Major tributaries accessible to anadromous fish below the hydroelectric complex can be divided into two groupings based on topography, habitat similarity, and flow regimes. Eastside tributaries drain drier, lower-elevation areas than westside tributaries which flow off of the eastside of the Cascade Mountains. The eastside tributaries include Buck Hollow, Bakeoven, and Trout Creeks and provide spawning habitat for summer steelhead populations. The westside tributaries are composed of the Warm Springs River and Shitike Creek, which have populations of spring Chinook salmon as well as summer steelhead.

- Natural production of spring Chinook salmon now occurs in only two streams within the Deschutes River watershed, the Warm Springs River, and Shitike Creek (rkm 155 on the Deschutes River) ***(WS-005, P. 3)***.
- The CTWSRO are responsible for habitat protection and recovery strategies on the Warm Springs Reservation, including Warm Springs River and Shitike Creek. ***(WS-006, P. 23)***

Figure 2 – Warm Springs River habitat ***(picture from Review Team website)*.**

Warm Springs River

- More than 95% of the spring Chinook salmon natural production in the Deschutes River watershed occurs in the Warm Springs River ***(WS-005, P. 3)***.
- The Warm Springs River enters the Deschutes River at rkm 135, which enters the Columbia River 330 km from the Pacific Ocean. The Deschutes River is upstream of two

major dams on the Columbia River, Bonneville (rkm 235) and The Dalles (rkm 308) dams ***(WS-005, P. 3)***.

- Currently all anadromous fish production is blocked at rkm 161 on the Deschutes River by the Pelton/Round Butte dams, mitigated by hatchery production of spring Chinook salmon and steelhead trout at Round Butte state fish hatchery ***(WS-005, P. 3)***.
- The Warm Springs River drainage encompasses 846 km^2. ***(WS-005, P. 3)***.
- Spring Chinook salmon redd surveys are conducted along the main spawning areas in the Warm Springs River and its tributaries. A total of 24 rkm on Beaver Creek, 10 rkm on Mill Creek, and 31 rkm on the Warm Springs River are surveyed ***(see Figure 3 below - WS-006, P. 102)***.
- Natural production in the Warm Springs River and Deschutes River is limited by the following: water quantity, water quality, consumptive water use, instream water rights, water diversion screening, sedimentation, stream substrate, cover, and barriers to fish passage. ***(WS-006, P. 23)***
- Habitat conditions in the Warm Springs River are considered to be fair to good. The CTWSRO have implemented various habitat restoration programs including riparian fencing, water diversion modifications, and placement of instream structures. ***(WS-006, P. 23)***

Shitike Creek

- Shitike Creek flows approximately 61 rkm from its headwaters on the eastside of Mt. Jefferson before it enters the Deschutes River at rkm 155. The Shitike Creek watershed is contained entirely within the Warm Springs Indian Reservation and is the uppermost tributary of the Deschutes River before the Pelton-Round Butte hydroelectric complex, which is located at rkm 164 ***(see Figure 3 below - WS-006, P. 102)***.
- The Shitike Creek drainage encompasses 122 km^2 ***(WS-005, P. 3)***.
- Habitat conditions in Shitike Creek are considered to be fair to good. The CTWSRO have implemented various habitat restoration programs including riparian fencing, water diversion modifications, and placement of instream structures. ***(WS-006, P. 23)***
- A water intake dam was built on Shitike Creek (rkm 11.5) in the mid-1960's that blocked upstream movement of adult salmon and restricted spring Chinook spawning to the lower section of the creek.
- The water intake dam was removed in 1983. Habitat improvements and fish passage projects have been ongoing in Shitike Creek since its removal.
- Despite these efforts, natural production of spring Chinook salmon in the drainage remained at relatively low levels.

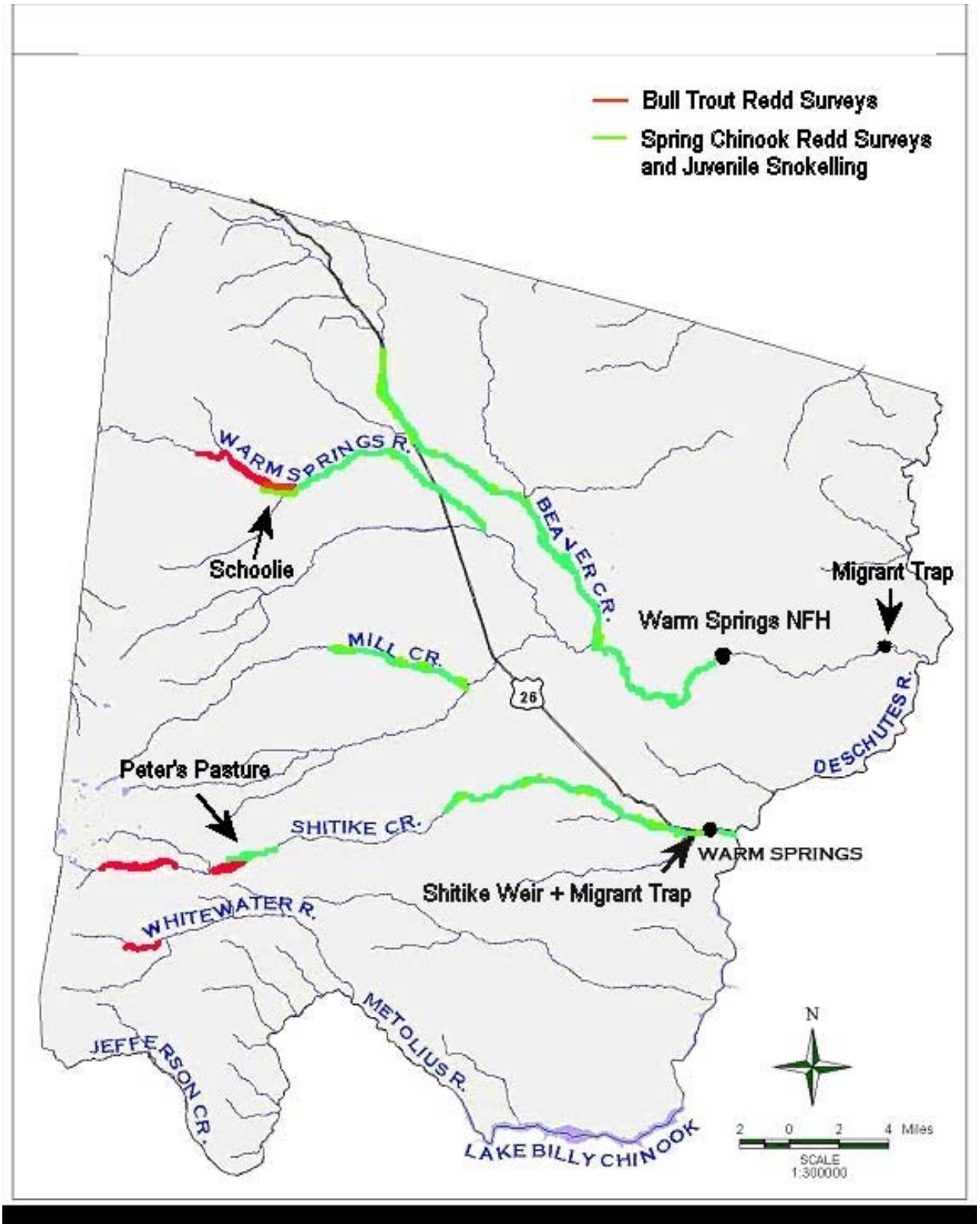

Figure 3. Map of spring Chinook monitoring activities on the Warm Springs River and Shitike Creek. Bull trout survey areas are from Brun and Dodson 2001 *(WS-006, P. 102)*.

9) Stock Description, History, and Status

- After passing through the fishery, fish return to the Warm Springs River to spawn ***(WS-005, P. 17)***.
- Wild spring Chinook returns have ranged from a low of less than 300 fish in 1995 and 1998 to more than 2,000 fish in 1975, 1976, 1978, 2000, and 2001 (Figure 4) ***(WS-005, P. 17)***.
- Hatchery returns have ranged from a low of 52 fish in 1994 to recent historic highs from 2,770 fish in 1999 to 6,891 fish in 2002 (Figure 4) ***(WS-005, P. 17)***.

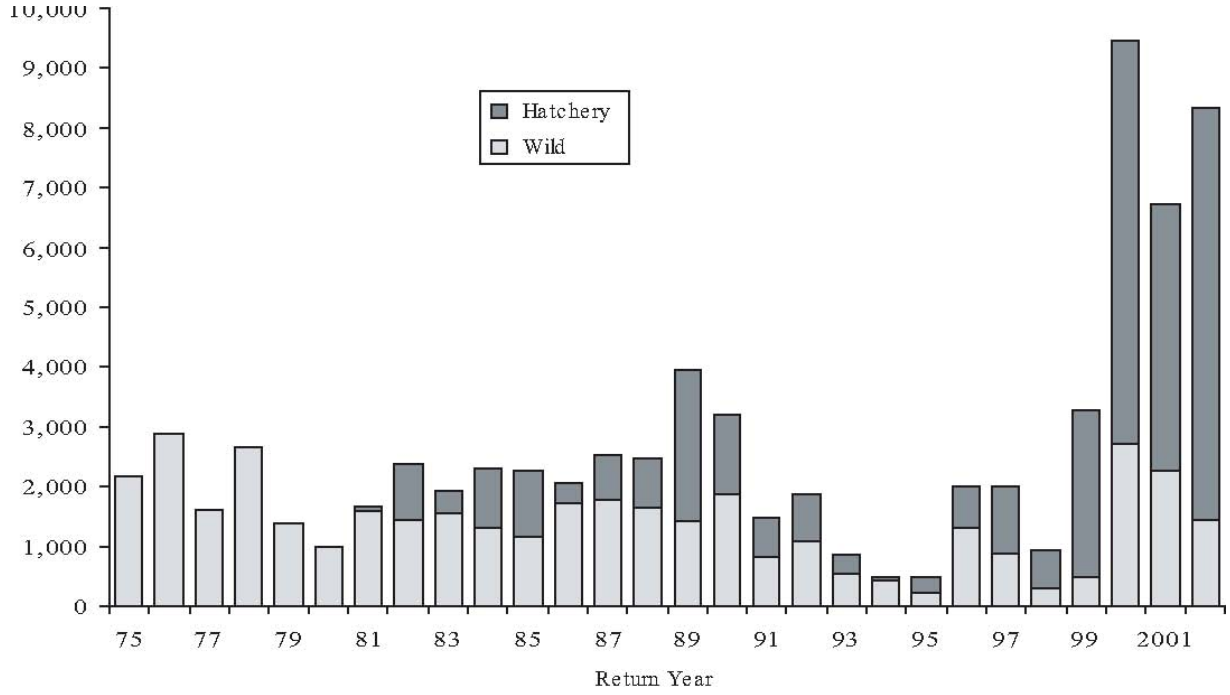

Figure 4 – Escapement of wild and hatchery spring Chinook salmon to the Warm Springs River, 1975-2002 ***(WS-005, P. 17, Figure 12)***.

Warm Springs River wild run Chinook status

- State and tribal co-managers consider the wild stock a relatively healthy and productive population, averaging 3.2 recruits per spawner (+1.9 SD) ***(WS-005, P. 14)***.
- Returns of wild spring Chinook salmon to a fish ladder located at Warm Springs NFH (rkm 16) from 1978 to 2002 have averaged 1,313 fish (SD=659, range of 237 to 2705) (Figure 4) ***(WS-005, P. 17)***.
- Wild fish return to the Warm Springs River from late April through September and spawn from late August through September. Most fish return to the Warm Springs River by late June ***(WS-005, P. 6)***.
- Both wild and hatchery stocks (80% and 82%, respectively) return predominately as age-4 adults (Figure 5). However, the wild stock has more fish returning at age 5 (16% for wild vs. 7% for hatchery fish) ***(WS-005, P. 7-8)*.**
- Based on redd surveys (see Figure 3 for survey areas), an average of 5 redds/km (range of 1 redd/km to 8.4 redd/km) have been counted between 1986 and 2004.

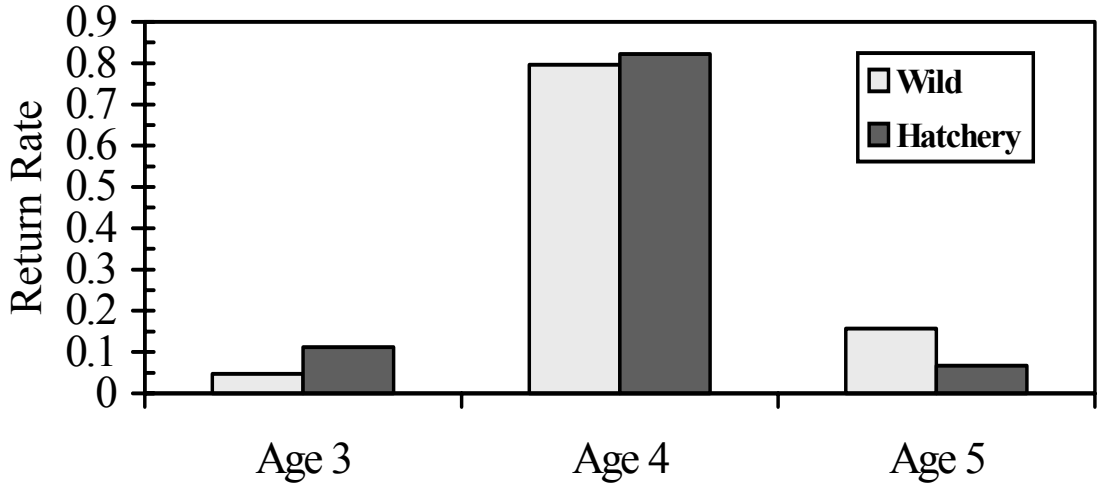

Figure 5. Comparison of age-class strength for wild and hatchery spring Chinook salmon returning to the Deschutes River, brood years 1978–1997 ***(WS-005, P. 8)***.

- Between 1995 and 2004, an average of 7% of the total annual run above Warm Springs NFH has been hatchery fish (range of 0% to 12%).
- Wild juvenile spring Chinook salmon exit the Warm Springs River in their first spring as subyearlings (7%), in the fall as subyearlings (57%), and in the spring as yearlings (36%), brood years 1983–1998 ***(WS-005, P. 13)***.
- There was a significant difference in mean fork length between wild and hatchery fish for both the fall ($P << 0.001$, $t = -50.0$) and spring out-migration periods ($P << 0.001$, $t = -17.5$). Specifically, hatchery fish averaged 167 mm (±2.4 mm, 95% confidence interval [CI]) in fall of 1996 ($n = 448$) and 149 mm (±1.8 mm, 95% CI) in spring of 1997 ($n = 851$), whereas wild fish averaged 98 mm (±1.2 mm, 95% CI) in fall of 1996 ($n = 305$) and 112 mm (±3.8 mm, 95% CI) in spring of 1997 ($n = 64$) ***(WS-005, P. 9)***.

Warm Springs hatchery Chinook status

- Return numbers from Warm Springs hatchery releases have increased in recent years (Figures 4 and 6).
- Hatchery fish return to the Warm Springs River from late April through September and spawn from late August through September. Most fish return to the Warm Springs River by late June ***(WS-005, P. 6)***.
- However, in the early part of the run, hatchery fish typically have a 1–2-week lag in their return when compared to wild fish ***(WS-005, P. 6)***.
- Both wild and hatchery stocks (80% and 82%, respectively), return predominately as age-4 adults (Figure 5). However, the hatchery stock has less fish returning at age 5 (7% for hatchery fish vs. 16% for wild) ***(WS-005, P. 7-8)***.
- Hatchery stock returns more age-3 fish, (5% for wild vs. 11% for hatchery fish) (Figure 5) ***(WS-005, P. 8)***.
- There is a difference of 1.1 cm in mean lengths between hatchery and wild age-4 females, with wild fish averaging 70.6 cm (±0.9, 95% CI) and hatchery fish averaging 69.5 cm (±0.3, 95% CI). Egg production of hatchery female adults at WSNFH is positively correlated to length ($y = -1{,}648 + 63.01x$) and has a significant linear relationship, $P <$

0.001. Based on this relationship, hatchery fish would produce fewer eggs per female than wild fish of the same age ***(WS-005, P. 11)***.

- For brood years 1983–1998, hatchery juvenile production included a fall subyearling (20%) and spring yearling release (80%) ***(WS-005, P. 13)***.
- There was a significant difference in mean fork length between hatchery and wild fish for both the fall ($P << 0.001$, $t = -50.0$) and spring out-migration periods ($P << 0.001$, $t = -17.5$). Specifically, hatchery fish averaged 167 mm (±2.4 mm, 95% confidence interval [CI]) in fall of 1996 ($n = 448$) and 149 mm (±1.8 mm, 95% CI) in spring of 1997 ($n = 851$), whereas wild fish averaged 98 mm (±1.2 mm, 95% CI) in fall of 1996 ($n = 305$) and 112 mm (±3.8 mm, 95% CI) in spring of 1997 ($n = 64$) ***(WS-005, P. 9)***.

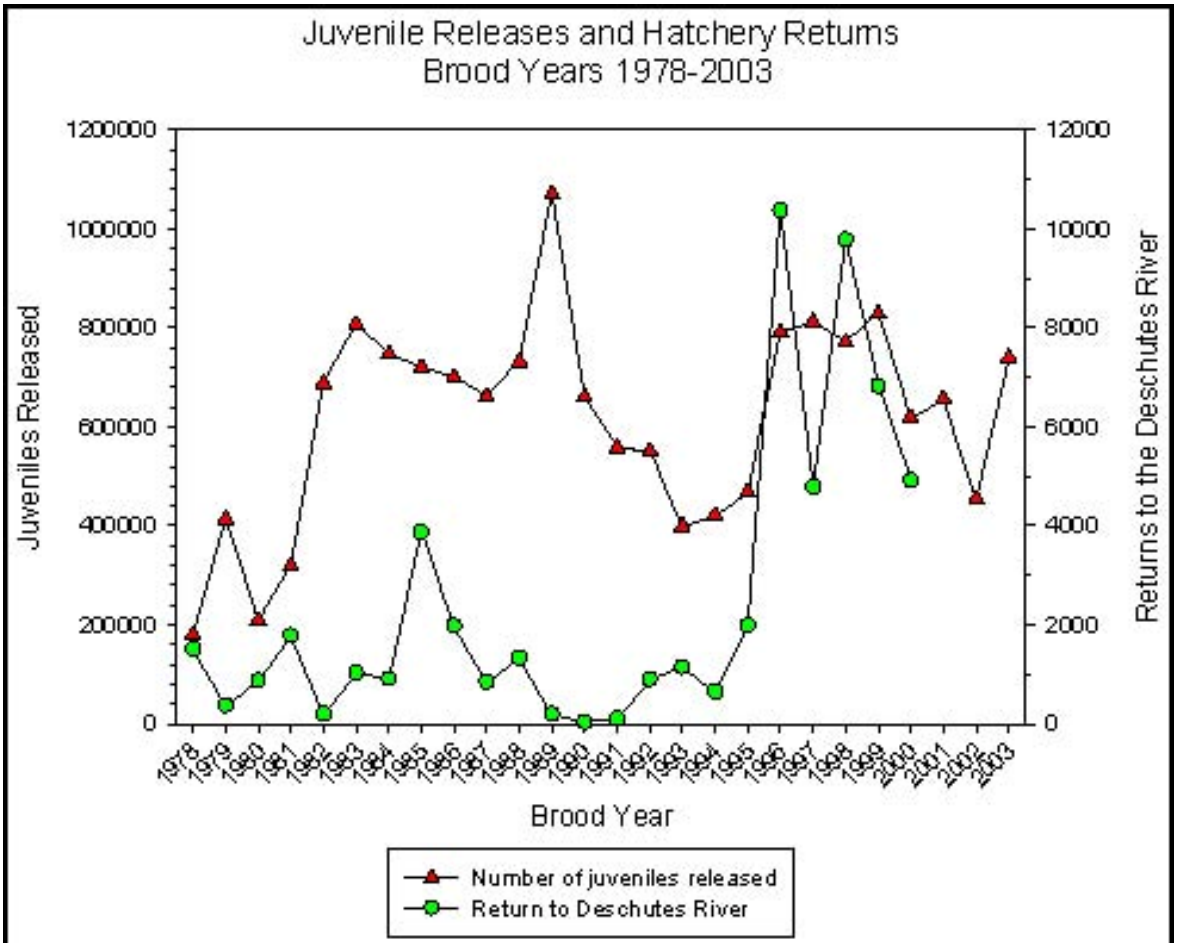

Figure 6. Juvenile releases and hatchery returns from WSHFH Chinook program (graph from ***WS007, P. 3***).

Shitike Creek Chinook status

- The density, or redds per mile, of spawning spring Chinook in Shitike Creek is much lower than in the Warm Springs River and it is thought that the habitat in Shitike Creek is under-seeded.
- Indexed redd counts in Shitike Creek, conducted annually since 1986 (see Figure 3 for survey areas), ranged from a low of six in 1996 to a high of 33 in 1997 ***(CTWSRO unpublished data)***.

- Outplanting of adult Chinook from WSNFH returns has increased redd abundance in recent years (Figure 7) ***(WS007, P. 3)***.
- It appears that a large proportion of juvenile Chinook migrate downstream into the Deschutes River during the fall of their first year (Table 1).

Table 1. Estimated downstream migration of juvenile spring Chinook salmon in Shitike Creek. Estimates are made from a rotary trap located at rkm 0.5.

	2001	2002	2003	2004
Spring Age 1+	6614	--	1947	3678
Fall Age 0+	21179	2484	6868	16395

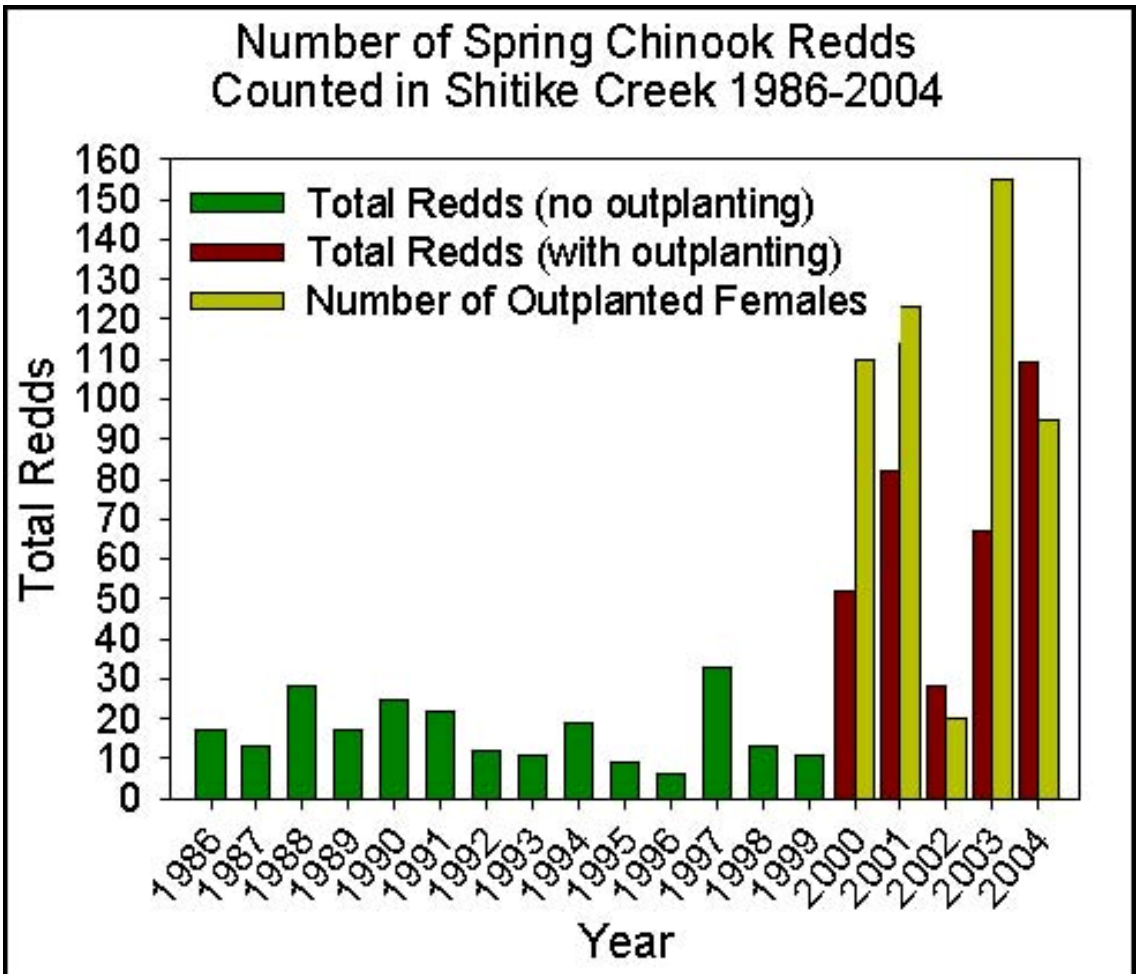

Figure 7 – Number of redds in Shitike Creek [graph from ***WS007, P. 3***). Redd surveys are conducted on the lower 20 rkm of the creek and a 1 rkm reach in the upper reach. Surveys are thought to encompass the majority of spawning area.

10. Stock Productivity

- Natural production of adult recruits per spawner (R/S) was cyclical for brood years 1978 through 1997 (Figure 8) ***(WS-005, P. 14)***.
- Low productivity was observed in the mid-1970s and early 1990s, with high productivity observed in the 1980s, and recently again in the mid to late 1990s ***(WS-005, P. 14)***.
- Wild fish had higher *R*/*S* ratios 13 out of 20 years, while hatchery fish had higher *R*/*S* ratios 7 out of 20 years; however, this difference was not significant ($P = 0.243$, Wilcoxon paired-sample test) ***(WS-005, P. 15)***.
- State and tribal co-managers consider the wild stock a relatively healthy and productive population, averaging 3.2 recruits per spawner (1.9 SD). [A *R*/*S* ratio greater than 1.0 indicates a population that has replaced itself over time, and the Warm Springs population, with a *R*/*S* ratio greater than 3.0, is considered healthy and robust.] ***(WS-005, P. 14-15)***.
- Hatchery production has been more variable, although it has increased recently, and has been, on average, comparable to the wild stock, averaging 3.3 recruits per spawner (3.9 SD; Figure 8) ***(WS-005, P. 14)***.

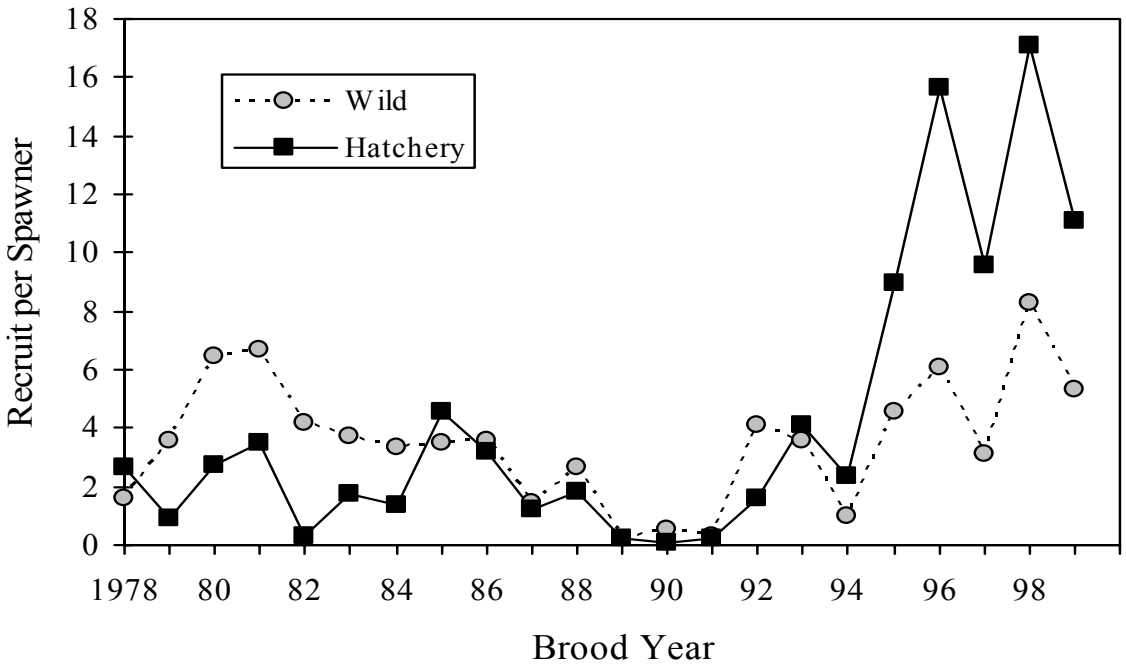

Figure 8 – Productivity of wild and hatchery spring Chinook as measured by adult recruit (harvest + escapement) per spawner, brood years 1978-1999 (through return year 2004) ***(WS-005, P. 16)***.

11) Harvest and Utilization (Description and Status)

- Fisheries benefiting from the Warm Springs NFH spring Chinook program include tribal ceremonial, tribal subsistence, and freshwater sport fisheries. Tribal fisheries also target wild Warm Springs River spring Chinook salmon. ***(WS-006, P. 22)***.
- The CTWSRO and the Oregon Department of Fish and Wildlife (ODFW) co-manage harvest in the Deschutes River Subbasin, while harvest in the Columbia River is managed by the parties to U.S. v. Oregon ***(WS-006, P. 22)***.

- Wild fish abundance drives fishery management decisions made by the CTWSRO and the ODFW ***(WS-006, P. 22)***.
- Spring Chinook salmon from the Deschutes River are harvested almost exclusively in freshwater fisheries and primarily within the Deschutes River ***(WS-005, P. 15)***.
- The primary fishing area for spring Chinook salmon in the Deschutes River is located at rkm 71 near Sherars Falls ***(WS-005, P. 15)***.
- Both wild and hatchery fish have contributed to harvest. More wild than hatchery fish from the Warm Springs River were often harvested, until recently (Figure 9) ***(WS-005, P. 15)***.
- Starting in 2000, the state implemented selective fisheries for spring Chinook salmon in the Deschutes River, where only adipose fin clipped hatchery fish could be retained and unmarked (wild) fish were to be released if caught. Improved survival of Warm Springs hatchery fish and restrictive regulations on sport fisheries has led to increased harvest on hatchery fish as compared to wild fish. For example, in return year 2000, almost 2,800 Warm Springs hatchery fish were harvested in tribal (17%) and sport (83%) fisheries, while only 339 wild fish were harvested (95% tribal) (Figure 9) ***(WS-005, P. 15)***.
- A typical breakdown of utilization of the hatchery return adults component is presented in Figure 10. ***(WS007, P. 2)***.
- In most years, more fish return to the hatchery than are needed for brood stock. Most of these surplus fish are still in very good condition and are distributed to the Confederated Tribes for ceremonial and subsistence use.
- Surplus fish or spawned carcasses are also used for stream enrichment. When surplus adults are used for nutrient outplanting, the fish are individually screened and decapitated/eviscerated to minimize concerns of disease transmission.

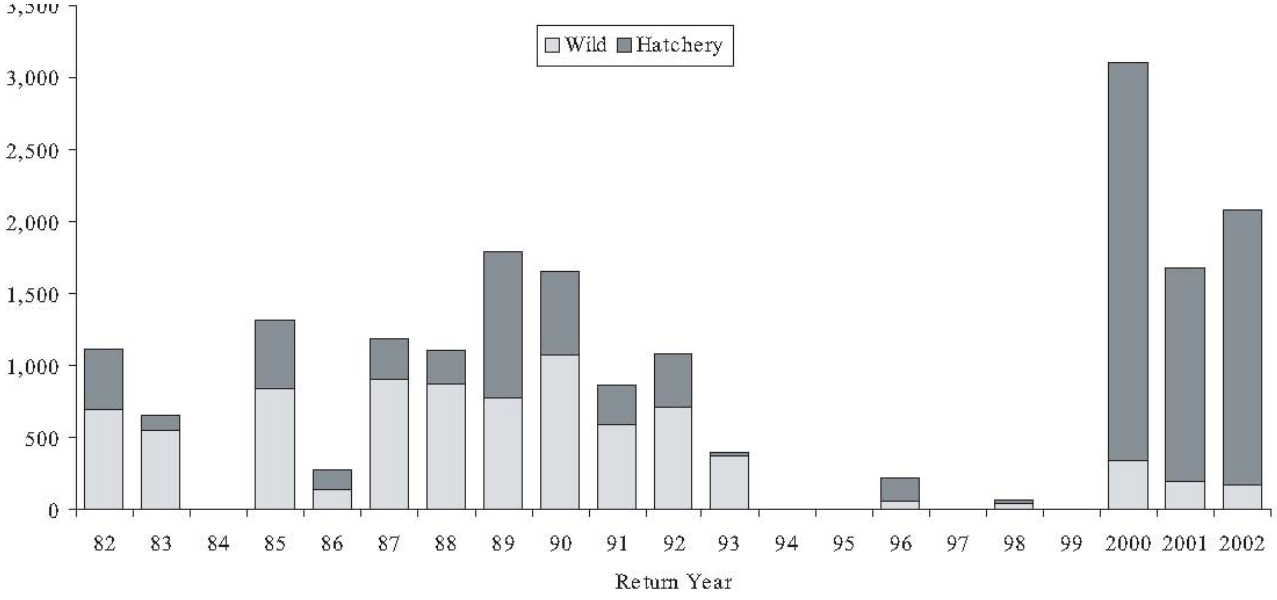

Figure 9. Estimated harvest of Warm Springs stock spring Chinook in the Deschutes River, 1982-2002 ***(WS-005, P. 15, Figure 11)***.

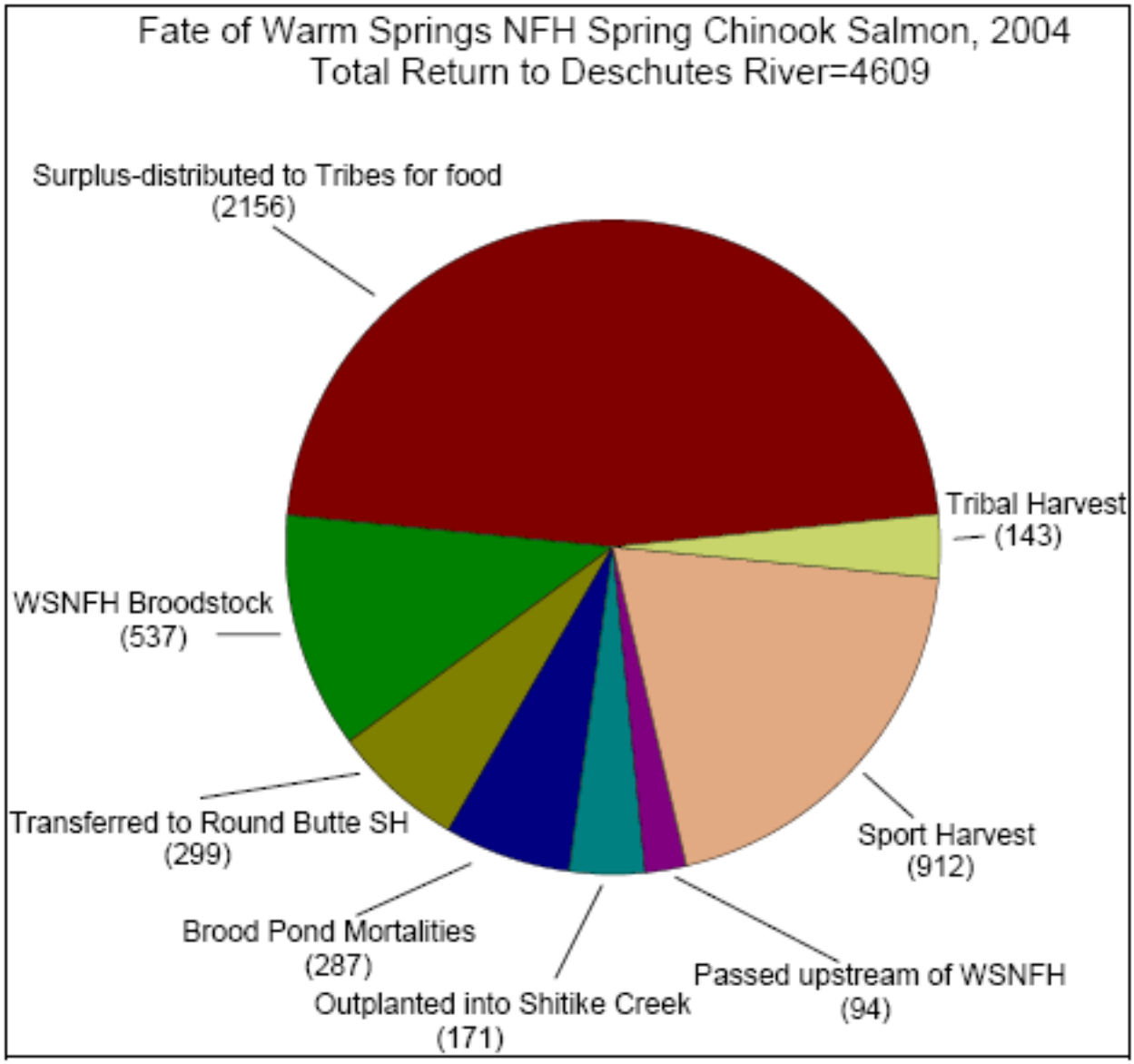

Figure 10. Distribution of returning hatchery-origin adults from the Warm Springs NFH in 2004. Approximately 50% of the returning adults were provided directly to the CTWSRO, either through direct tribal harvest or by transfer to the tribe of surplus adults trapped at the hatchery.

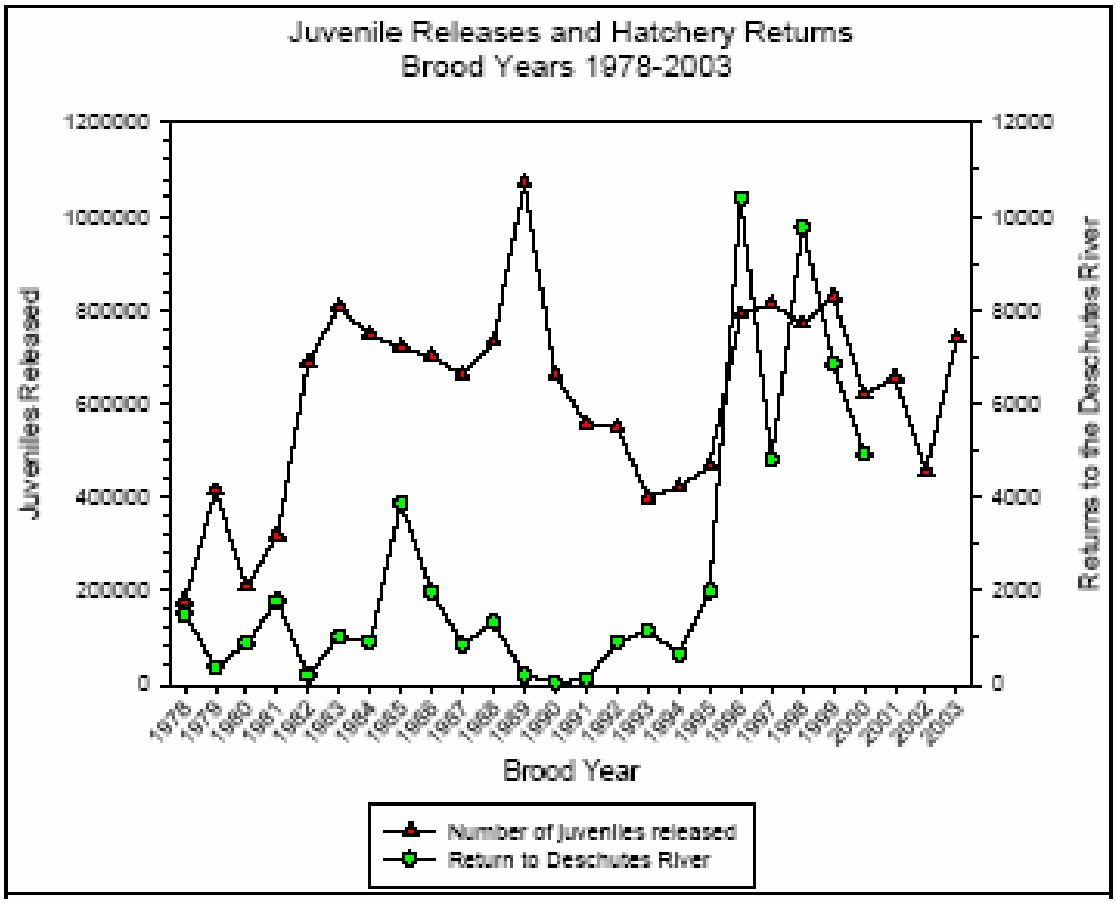

Figure 11. Juvenile Releases and Hatchery Returns, Brood Years 1978-2003 ***(WS-007, P. 2,)***.

12) Current regional management objectives for spring chinook populations

- Deschutes River spring chinook were identified by NOAA as a part of the Mid-Columbia River spring-run chinook ESU that comprises spring chinook populations in the Columbia River and its tributaries from the Klickitat River upstream to the Yakima River and were considered not warranted for listing under the ESA ***(WS015, P. 32)***.
- Within the Deschutes River, spring chinook salmon are managed for two populations, (mainstem Deschutes River including Shitike Creek and Warms Springs River) ***(WS015, P. 31-32)***.
- Current minimum escapement for Warm Springs River is 1,300 adult wild spring chinook above the barrier dam at Warm Springs NFH ***(WS015, P. 34)***.
- Current management objective for the Pelton Round Butte mitigation project is an escapement of 1,200 spring chinook adults to the Pelton trap ***(WS015 P. 34-35)***.
- Short term regional management objectives - restoration work will focus on developing effective passage for downstream migrants through the project reservoirs and at the Pelton-Round Butte Hydroelectric Project ***(WS015, P. 39)***.
- Hatchery supplementation will be used to assist in meeting sustainability goals until a naturally self-sustaining population is achieved ***(WS015, P. 39)***.

- Preferred spring chinook parental stocks for reintroduction include Warm Springs wild origin and hatchery origin if available, and/or Round Butte hatchery origin *(WS015, P. 39)*.
- Long term regional management objectives - actions will focus on habitat deficiencies associated with riparian and stream channel enhancement including instream flow requirements *(WS015, P. 40)*.

III. Description of Facilities (WS-006, except as noted)

Figure 12 – Warm Springs NFH *(from review team website)*.

1) Description of hatchery (information provided by WSNFH Evaluation Team)

Warm Springs NFH is located on the north bank of the Warm Springs River, approximately 14 miles north of Warm Springs, Oregon. The hatchery site is leased by the federal government from the Confederated Tribes of the warm Springs Reservation of Oregon. Site elevation is 1,525 feet above sea level.

The hatchery has four buildings involved in fish production and three residences (Table 1). Currently there are no plans for new buildings. All buildings are the property of the U. S. Fish and Wildlife Service.

Rearing units consist of 2 adult holding ponds, 3 adult catch ponds, 20 starter tanks, vertical stack incubator trays, an egg isolation building, and 30 Burrows ponds which have been modified into u-shaped ponds by placing a divider at the head end (Table 2).

Table 2. Hatchery buildings, primary use of buildings, size, and construction type. ***(provided by WSNFH personnel)***.

Building	Sq. Ft.	Construction Type
Hatchery Building (includes shop, garage, incubation room, spawning area, mechanical room, and visitor center)	34,500	Concrete/slump block
Feed Building	2,048	Slump Block
Egg Isolation Unit	1,296	Metal
Chlorination Building	72	Wood Frame
Quarters #2	2,400	Wood Frame
Quarters #3	2,400	Wood Frame
Quarters #4	2,400	Wood Frame

Table 3. Physical description of incubation and rearing facilities. ***(provided by WSNFH personnel)***.

Unit Type	Size	Volume (cu ft)	Number	Material	Age	Condition
Catch pond	28'x8'x3'	672	3	Concrete	18	Good
Brood Pond	48'x26'x6'	7,488	1	Concrete	15	Good
Brood Pond	50'x26'x6'	7,800	1	Concrete	15	Good
Burrows Ponds (modified)	75'x17'x4'	5,100	30	Concrete	25	Good
Vertical Stacked Incubators			32 Stacks 218 Trays	Plastic	25	Fair
Starter Tanks	13'x3'x3'	117	20	Fiberglass	25	Good

2) Hatchery water source

- The water source for the hatchery is the Warm Springs River. All water rights on the Warm Springs River are the property of the CTWSRO ***(WS-006, P. 27)***. A business lease with the CTWSRO allows the hatchery to divert up to 100 cfs of water from the Warm Springs River.
- New hatchery water supply intake screens were installed in 2004 to meet NOAA Fisheries and Service screen specifications.

- Hatchery use of water has ranged between 20 and 40 cfs. Average daily streamflow during the lowest flow period (July-October) is 264 cfs, meaning a hatchery withdrawal of 40 cfs constitutes around 15% of the total streamflow.
- The intake structure and pumps are located at the hatchery site just upstream of the barrier dam. Prior to being pumped, water is passed through a trash rack and traveling screen. In front of the traveling screen is a fish bypass that deposits small fish below the barrier dam ***(WS-006, P. 27)***.
- Water temperature ranges from lows in the upper 30°F in winter to highs in the mid 60°F in summer (Table 4). ***(provided by WSNFH personnel)***.
- Figure 13 provides a schematic of water flow use at WSNFH ***(provided by WSNFH manager)***.
- Warm Springs NFH is equipped with backup generators and pumps that provide power in case of power failures. An automated alarm system alerts on-call staff members of potential problems at the hatchery during non-work hours. ***(WS-006, P. 30)***.

3) Broodstock collection facilities

- All fish passing upstream are blocked by a barrier dam and are directed to a fish ladder at Warm Springs NFH. All fish must use the fish ladder in order to pass upstream of the hatchery ***(WS-006, P. 28)***.
- A volitional passage system was installed in 1996 to assist with brood stock management and reduce handling of wild fish passed upstream. The passage system includes a magnetic tag detection gate to separate tagged hatchery and non-tagged wild fish as well as an underwater video to monitor fish passed upstream.
- During the spring Chinook salmon migration period (April 16- September 30), the automated fish passage system is used to pass wild (unmarked) fish upstream of the barrier dam. Because of operational constraints, it is used approximately 50% of the time during the upstream migration. ***(WS-006, P. 28)***.
- Fish that are not passed upstream are directed into a catch pond. The catch pond measures 28ft x 8ft, with a water depth of 3ft ***(WS-006, P. 28)***.
- Fish are then moved from the catch ponds into holding ponds at the hatchery. Fish are held in the holding ponds until spawning ***(WS-006, P. 28)***.

Table 4a. Rearing and incubation temperature profiles of ambient water in outside ponds at WSNFH. ***(provided by WSNFH personnel)***.

Warm Springs NFH
Water Temperatures
Ambient/Outside Ponds
Temperature in Fahrenheit

estimated
upstream spill

Estimated temp
Shade structure caved in
couldn't reach temp sensor

	1992/1993	1993/1994	1994/1995	1995/1996	1996/1997	1997/1998	1998/1999	1999/2000	2000/2001	2001/2002	2002/2003	2003/2004	2004/2005	2005/2006
	Max	Max	Max	Max	Max	Max	Max	Max	Max	Max	Max	Max	Max	Max
July	68	64	71	67	66	64	67	69	71	70	73	73	72	72
August	68	66	68	63	64	65	69	69	70	71	68	69	71	71
September	61	62	61	62	58	55	62	60	64	66	67	64	62	63
October	55	54	55	54	54	53	52	55	53	56	56	56	57	54
November	47	45	44	48	45	48	46	52	50	51	47	47	50	48
December	42	44	43	45	40	42	44	46	44	42	46	44	47	37
January	49	43	43	43	41	41	42	55	43	42	46	37	43	41
February	41	45	43	49	43	42	45	44	46	47	46	44	46	
March	45	51	46	45	47	49		51	52	47	49	50	52	
April	51	58	53	52	50	56	54	54	61	50	42	56	55	
May	61	63	61	56	57	57	54	62	67	55	47	62	65	
June	64	66	64	62	63	64	64	68	70	70	54	71	69	
	Min	Min	Min	Min	Min	Min	Min	Min	Min	Min	Min	Min	Min	Min
July	59	58	59	59	56	55	61	54	55	55	56	57	57	58
August	58	55	58	55	57	57	58	51	51	56	55	57	55	55
September	51	53	54	51	49	48	52	46	46	48	46	50	49	46
October	45	43	42	40	42	43	41	42	42	43	33	34	42	42
November	37	38	34	36	36	42	39	41	35	36	33	35	34	33
December	34	36	31	35	34	35	32	37	33	34	35	32	35	31
January	33	36	31	33	33	31	35	33	34	34	37	32	32	36
February	33	33	33	36	37	39	34	37	36	36	34	36	34	
March	39	40	38	36	40	43		39	38	40	40	41	40	
April	44	46	46	44	44	45	41	41	41	43	55	42	44	
May	48	52	48	47	47	48	50	45	46	44	65	50	50	
June	54	55	51	58	54	55	47	52	51	50	69	52	53	
	Avg	Avg	Avg	Avg	Avg	Avg	Avg	Avg	Avg	Avg	Avg	Avg	Avg	Avg
July	64	60	66	63	63	61	64	61	61	64	65	67	65	66
August	62	60	66	59	60	61	62	62	59	61	62	63	63	63
September	56	55	57	56	53	51	56	54	55	57	55	57	54	55
October	50	48	48	48	48	47	46	47	48	48	47	49	54	49
November	43	42	39	44	41	44	43	45	37	42	41	40	41	39
December	36	41	37	39	38	38	37	40	39	38	39	39	40	32
January	39	40	37	39	38	37	38	37	39	36	41	36	39	38
February	37	39	40	43	40	40	38	40	40	40	40	40	36	
March	42	44	43	43	43	46		45	45	43	45	45	45	
April	47	51	49	47	47	49	47	47	48	46	49	49	48	
May	55	57	54	52	53	52	52	53	56	53	55	54	56	
June	58	60	58	53	57	59	56	60	59	61	62	61	60	

Table 4b. Rearing and incubation temperature profiles of ambient water in incubators and indoor tanks at WSNFH. ***(provided by WSNFH personnel)***.

	Incubators/Indoor Tanks			
	2002/2003 Max	2003/2004 Max	2004/2005 Max	2005/2006 Max
September	56	61	56	57
October	57	60	58	55
November	50	47	49	51
December	49	45	48	42
January	50	44	48	43
February	49	46	50	
March	50	51	54	
April	55	58	56	
	Min	Min	Min	Min
September	45	45	44	46
October	41	41	43	45
November	35	37	37	36
December	38	34	38	35
January	38	34	34	37
February	40	39	41	
March	43	43	42	
April	44	46	47	
	Avg	Avg	Avg	Avg
September	48	52	49	50
October	48	52	50	51
November	45	42	44	42
December	44	41	42	37
January	45	39	41	40
February	45	44	46	
March	47	47	47	
April	50	52	49	

4) Broodstock holding and spawning facilities

- Two oval shaped ponds, each 50ft x 26ft with approximately a 6ft water depth are used to hold broodstock until spawning ***(WS-006, P. 29)***.
- Each pond is fully enclosed at the top and sides above the water surface by nylon netting. The netting prevents fish from jumping out of the holding ponds and prevents predators from gaining entry ***(WS-006, P. 29)***.
- The Broodstock ponds are plumbed to supply chilled water as summer water temperatures increase ***(WS-006, P. 29)***. They program for a temperature of 55^{o}F, but do not always achieve that temperature.

5) Incubation facilities

- Incubation facilities consist of 16 stacks of 15 Heath incubator trays ***(WS-006, P. 29)***.
- Egg taking begins in late August. TU's necessary for eye-up average 550, hatch 850, and emergence 1500 ***(information provided by WSNFH personnel)***.

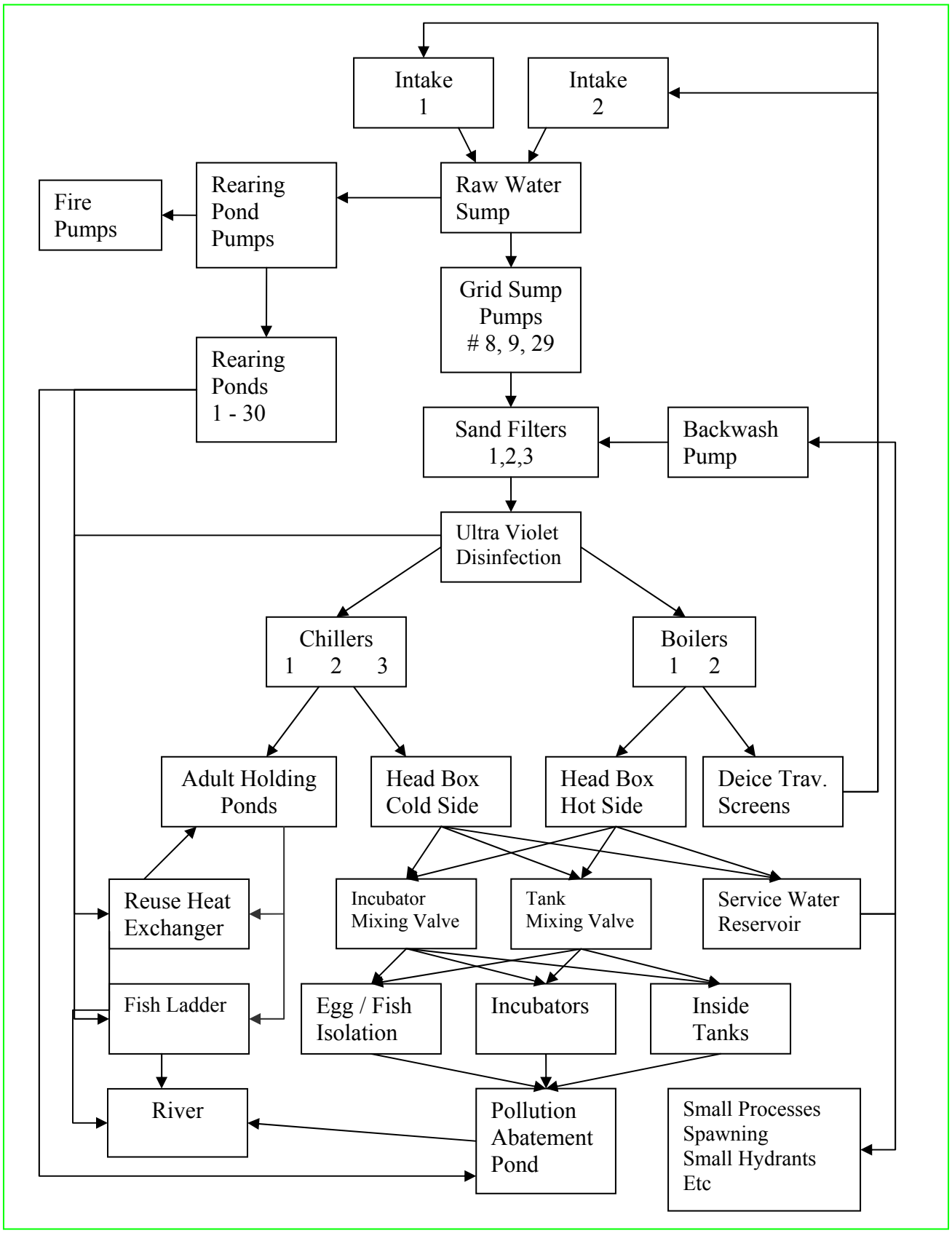

Figure 13. Schematic of water flow use at WSNFH *(provided by WSNFH manager)*.

6) Starter tanks in building

- Indoor starter tanks consist of 20 tanks that are 13 feet long X 3 feet wide X 2 ft depth. Additional tanks are needed to reduce early rearing densities.

7) Rearing facilities

- Rearing facilities at Warm Springs NFH consist of 30 modified rectangular Burrows ponds measuring 75ft x 16ft with a water depth of 1.7ft ***(WS-006, P. 29)***.
- Shade cloth was placed over ponds in 2001 to provide protection from the sun ***(WS-006, P. 40)***.
- In 2003, ten of 30 production ponds were coated with Lifelast[4] polyurethane and colored to approximate the Warm Springs River substrate ***(WS-006, P. 11)***.

8) Release locations

- There is no off-station transport of spring Chinook salmon eggs, fingerlings or smolts at the present time ***(WS-006, P. 28-29)***.
- Approximately 200 hatchery adult spring Chinook salmon are outplanted into Shitike Creek from May through early September ***(WS-006, P. 28)***.

9) Trap facilities

1) A rotary screw trap, located at approximately rkm 5 of the Warm Springs River, is operated by the CTWSRO in order to gather outmigration timing and population estimates for juvenile spring Chinook salmon. The trap is typically operated from mid-March through mid-November.

10) Isolation facilities

- An egg isolation building constructed in 2003 allows for the quarantine and segregation of fish for special studies or supplementation projects in the Deschutes River Basin ***(WS-017, P. 5)***.

IV. Description of Program Operations

1) Broodstock goal

- Broodstock goal of 630 adult spring Chinook salmon, assuming 90% pre-spawning survival and a return that is 60% female. Fish that are 60 cm in length or longer are considered adults ***(WS-005, P. 4-5)***.

2) Broodstock Source

- The Warm Springs NFH spring Chinook salmon program uses hatchery and wild Warm Springs River spring Chinook salmon in its broodstock program.
- During the first four years of broodstock collection (1978-1981), 100% of the broodstock was collected from wild Warm Springs River spring Chinook salmon ***(WS-006, P. 31)***.
- Since 1981, the majority of broodstock has been of Warm Springs NFH origin ***(WS-006, P. 31)***.
- In the 10 years between 1993–2002, the percentage of wild fish in the broodstock only averaged 3% (Figure 14). This is because of low wild fish escapement (<1,300 adults) in most years. ***(WS-005, P. 4)***.

- In order to maintain wild characteristics in the hatchery program, the Warm Springs NFH Operation and Implementation Plan 2002-2006 sets a goal of having an average of 10% of the hatchery broodstock of wild origin ***(WS-006, P. 31)***.
- To accomplish this, a sliding scale for incorporating wild fish into the broodstock was established based on total wild fish returns (Table 4). In years with less than 800 returning wild adult fish, no wild fish are taken into the hatchery for broodstock and all wild fish are passed upstream for natural production. If escapement of wild fish exceeds 800, an increasing proportion of the hatchery broodstock may be wild, based on the sliding scale. For example, if between 1,300 and 1,399 wild fish are predicted to return to the Warm Springs River, then 10% of the total broodstock (63 fish) can be wild fish. The sliding scale goes up to 20% wild fish only if escapement exceeds 2,300 wild fish ***(WS-005, P. 4)***.
- The total number of wild fish utilized for broodstock does not exceed 5% of the wild fish in the natural spawning population (Table 5) ***(WS-005, P. 4)***.

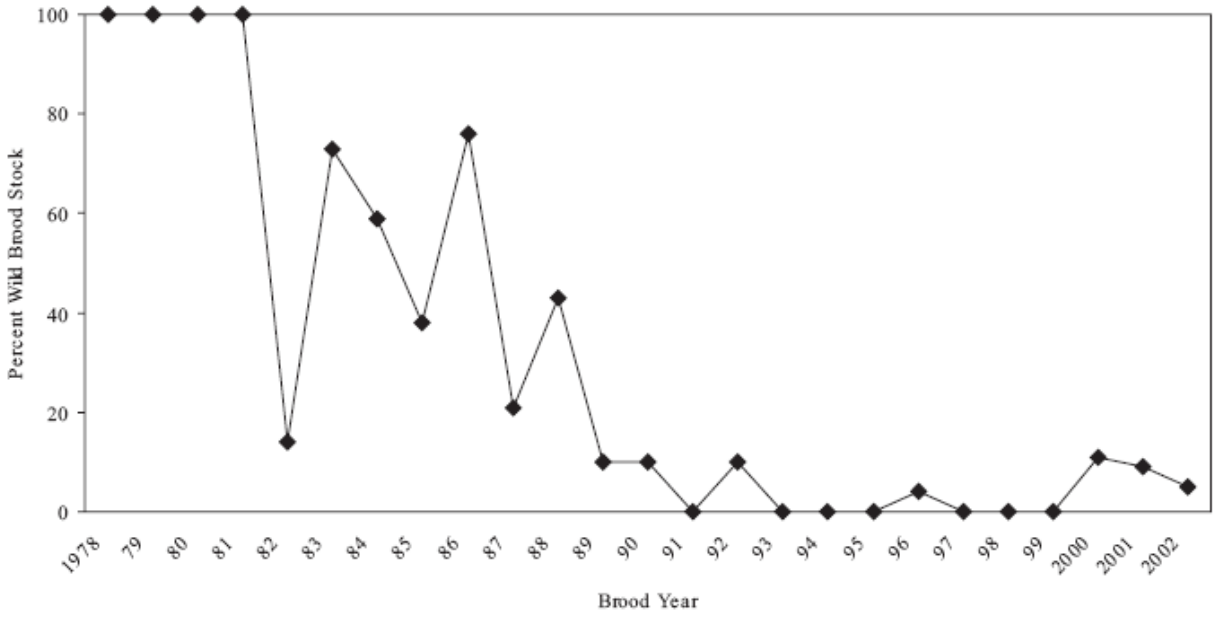

Figure 14. Percent of the Chinook broodstock at the Warm Springs NFH composed of wild (unmarked) adults each year.

3) Adult holding

- The spring Chinook salmon adults are taken into the hatchery throughout the adult return, starting in mid-April. Due to the lengthy holding time before spawning in late August, the held adults can require formalin treatment three to five times weekly at a rate of 167 ppm to control external fungus and parasites ***(WS-017, P. 3)***.
- All adults held for broodstock and for live out-planting are injected with erythromycin to prevent pre-spawning mortality by bacterial kidney disease (BKD) and to reduce vertical transmission of its causative agent to their progeny. Fish are injected, at about 60 days and 30 days before spawning, with a dosage of 10-20 mg erythromycin /kg body weight ***(WS-017, P. 3)***.
- Erythromycin injections are done under the INAD 6430 or by veterinarian prescription ***(WS-017, P. 3)***.

Table 5. Sliding-scale for incorporating wild spring Chinook salmon into the hatchery brood stock at Warm Springs NFH. This sliding scale was developed in 2002 to increase the proportion of broodstock composed of wild (unmarked) fish ***(WS-005, P. 5)***.

Projected wild escapement	Number of wild fish for broodstock	Percent of hatchery brood contributed by wild fish
<800	0	0
800–899	31	5
900–999	38	6
1,000–1,099	45	7
1,100–1,199	50	8
1,200–1,299	57	9
1,300–1,399	63	10
1,400–1,499	69	11
1,500–1,599	76	12
1,600–1,699	82	13
1,700–1,799	88	14
1,800–1,899	95	15
1,900–1,999	100	16
2,000–2,099	107	17
2,100–2,199	113	18
2,200–2,299	120	19
>2,300	126	20

4) Spawning

- Spawners are randomly collected over the entire run and randomly spawned from ripe fish over a three to four week period ***(WS-006, P. 35)***.
- Approximately 40% of the adults collected are males ***(WS-006, P. 35)***.
- For the actual spawning protocol, the intent is to utilize a spawning population of 630 fish and to use a 1:1 male to female spawning ratio ***(WS-005, P. 4)***.
- When the number of returning males is less than the number of females, the male to female ratio may become 1:2 ***(WS-005, P. 4)***.
- When less than 400 broodstock are available, in order to increase effective population size, the number of eggs taken from each female is divided in half and each half fertilized with gametes from a different male ***(WS-005, P. 4)***.
- Males are used with more than one female only as often as necessary to fertilize the eggs of all females ***(WS-005, P. 4)***.
- Fish that are 60 cm or longer fork length are considered adults and fish less than 60 cm fork length are considered jacks ***(WS-005, P. 5)***.
- Between 2% and 5% of the broodstock are fish less than 60 cm fork length, based on the percentage of jacks in the wild population and their estimated contribution during spawning ***(WS-005, P. 5)***.
- The objective is to maintain life history characteristics of the hatchery stock similar to that of the wild fish ***(WS-005, P. 5-6)***.

5) Fertilization

- Eggs from each female are placed in separate numbered buckets and sperm from each male is placed in numbered baggies ***(WS-006, P. 36)***.
- Sperm is added to the eggs with approximately 16 ounces of water/sperm extender mix ***(WS-006, P. 36)***.
- No cryopreserved gametes are used ***(WS-006, P. 36)***.

- The female number and male number is written on the bucket used to hold the egg/sperm mixture ***(WS-006, P. 36)***.
- Eggs are water-hardened in a solution of polyvinylpyrrolidone iodine compound at 75 ppm iodine in water buffered by sodium bicarbonate (at 0.01%) for 20 minutes during the water-hardening process ***(WS-017, P. 3)***.
- The bucket of fertilized eggs is poured into the water/iodophor mixture and allowed to sit for 20 minutes. After the 20 minute waiting period fresh water is turned on the eggs ***(WS-006, P. 36)***.
- Ovarian fluid is taken from each female, and carcasses of both males and females are checked by the fish health staff for signs of BKD. If signs of gross BKD are detected, the fish health staff informs the hatchery and the spawn products of those fish are removed from production ***(WS-006, P. 36)***.

6) Incubation

- Eggs from individual females are held separate in incubation containers located in the starter tanks.
- At the eyed egg stage, eggs are moved to Heath tray and incubated at 5,000 eggs/tray ***(WS-006, P. 37)***.
- Formalin (27% formaldehyde) is dispensed into water if necessary for the control of fungus on eggs or to reduce parasite loads on juvenile fish ***(WS-017, P. 3)***.
- Eggs are kept at 50 degrees F, left undisturbed until eye-up, and then electronically counted ***(WS-006, P. 37)***.
- Survival to eye-up averaged 91% from 1992-2001 (range 78-97%) ***(WS-006, P. 36-37)***.

7) Ponding

- At complete button-up (1,600 temperature units, 1,100 fish per pound) fry are moved into tanks ***(WS-006, P. 38)***.
- Ponding usually begins near the end of January and is completed by the end of February ***(WS-006, P. 38)***.
- Pond densities range from a density index of 0.08 (approximately 0.44 lbs fish/ft3) to a density index of 0.16 (approximately 0.88 lbs fish/ft3), based on an average fish size of 20 fish/lb ***(WS-006, P. 38)***.
- Density and loading criteria vary with annual production goals. Current production goals allow for density indices to be kept at or below 0.5 and flow indices to be within accepted standards for spring Chinook salmon ***(WS-006, P. 38)***.

8) Fish rearing conditions

- Temperatures in the rearing ponds are monitored daily. Temperatures during the rearing cycle range from a low of 32 degrees F in the winter to a high of 72 degrees F in the summer ***(WS-006, P. 39)***.
- Dissolved oxygen levels are monitored on a monthly, weekly, or daily basis as needed ***(WS-006, P. 39)***.
- Ponds are cleaned by brush twice a week during the summer ***(WS-006, P. 39)***.
- Biomoist grower and Biomoist feed is used during rearing ***(WS-006, P. 40)***.
- Feeding rates range from 1.5% to 3% B.W./day (Conversion rates averaged 1.62 for BY 1999). ***(WS-006, P. 40)***.

- Erythromycin feed (21 days) is used in May and September *(WS-006, P. 40)*. Initial information shows this feeding protocol produces higher adult returns (Figure 15).

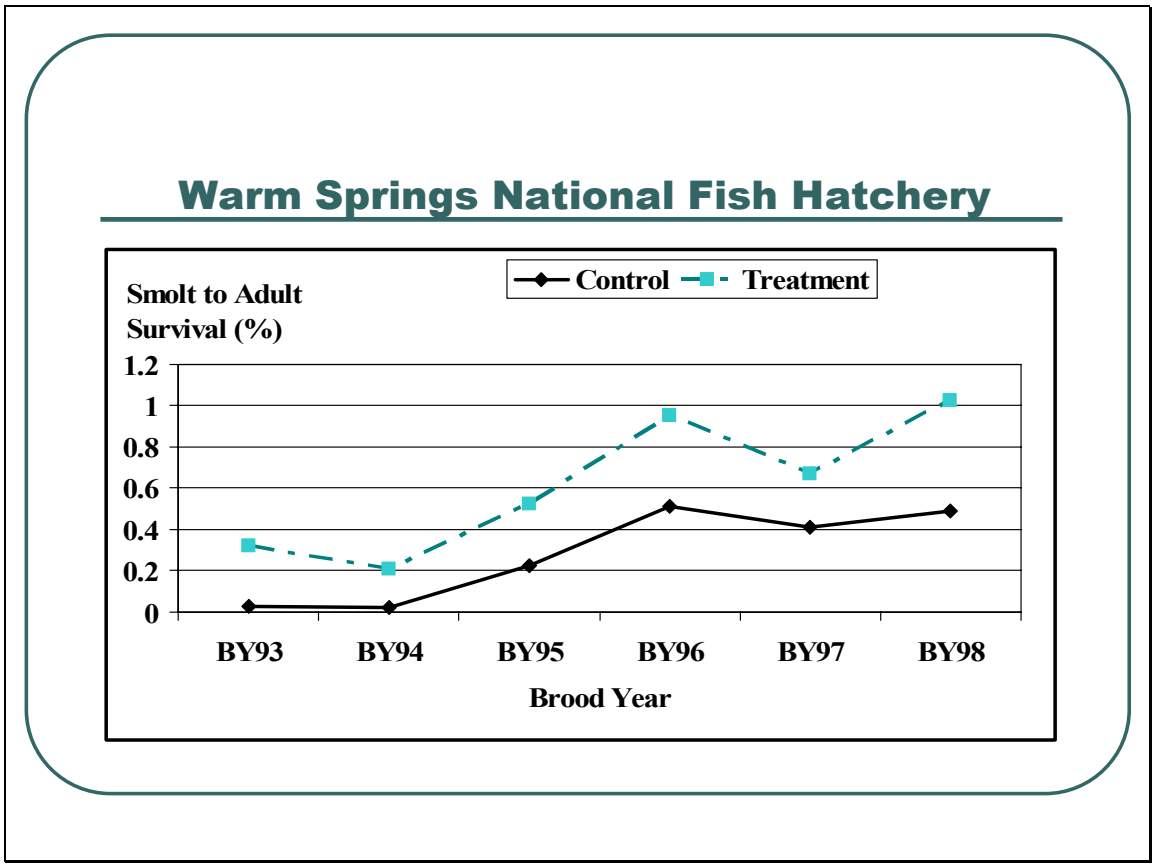

Figure 15. Percent survival from release to recovery at the hatchery for control (solid black line) and erythromycin feed treatment (broken blue line) groups, brood years 1993 through 1998. *(Figure provided by WSNFH Evaluation Team)*.

9) Fish growth profiles

- Over the years, the size of the fish at release has been reduced in order to improve health, survival, and to mimic wild fish characteristics in the hatchery population. These changes are monitored for effects on fish health, survival, run timing, and age/size at return.
- The original target was to release fish at a size between 26 and 33 fish/kg (12 and 15 fish/lb) and greater than 140 mm average fork length *(WS-005, P. 10)*.
- Recently, however, we have experimented with smaller fish at release at 55 fish/kg (25 fish/lb) and 118 mm average fork length *(WS-005, P. 10)*.
- Evaluations will be pursued to effect growth rate in the hatchery environment to match wild fish in the stream, including feeding regimes, diet, and reduced summer water temperatures in the hatchery rearing ponds *(WS-005, P. 10)*. This will be accomplished by investigating increased/decreased rations, diet composition, and/or feeding rates. Figure 16 shows past data on differences between fish size of wild and hatchery juvenile fish.
- Table 6 shows typical monthly fish growth data for the hatchery program *(WS-006, P. 40)*.

Table 6. Monthly fish growth information for Brood Year 1999 *(WS-006, P. 39)*.

Month	Length (in.)	#/lb	CF[A]	Conversion Rate[B]	DI [C]	FI [D]
Jan '00	1.41	1098		0	0.47	1.55
Feb '00	1.90	448		0.3	0.83	2.72
Mar '00	1.99	389		6.89	0.30	0.89
Apr '00	2.38	228		1.95	0.03	0.10
May '00	2.93	122		1.60	0.05	0.15
Jun '00	3.90	52		0.80	0.09	0.27
Jul '00	4.41	36		1.49	0.12	0.35
Aug '00	4.41	36		-	0.12	0.35
Sep '00	4.41	36		-	0.12	0.35
Oct '00	5.02	24		0.65	0.15	0.45
Nov '00	5.02	24		1.11	0.15	0.45
Dec '00	5.36	20		0.19	0.17	0.52
Jan '01	5.36	20		-1.06	0.16	0.49
Feb '01	5.36	20		-	0.16	0.49
Mar '01	5.46	19		3.86	0.17	0.50

[A]CF(Condition Factor)=standard spring Chinook CF of 3.24 taken from Piper et al. 1992 [B]Conversion Rate=lbs of monthly feed/lbs of monthly fish growth. [C]DI (Density Index)=(weight of fish)/(fish length x volume) [D]FI (Flow Index)=(fish weight)/(fish length x water inflow)

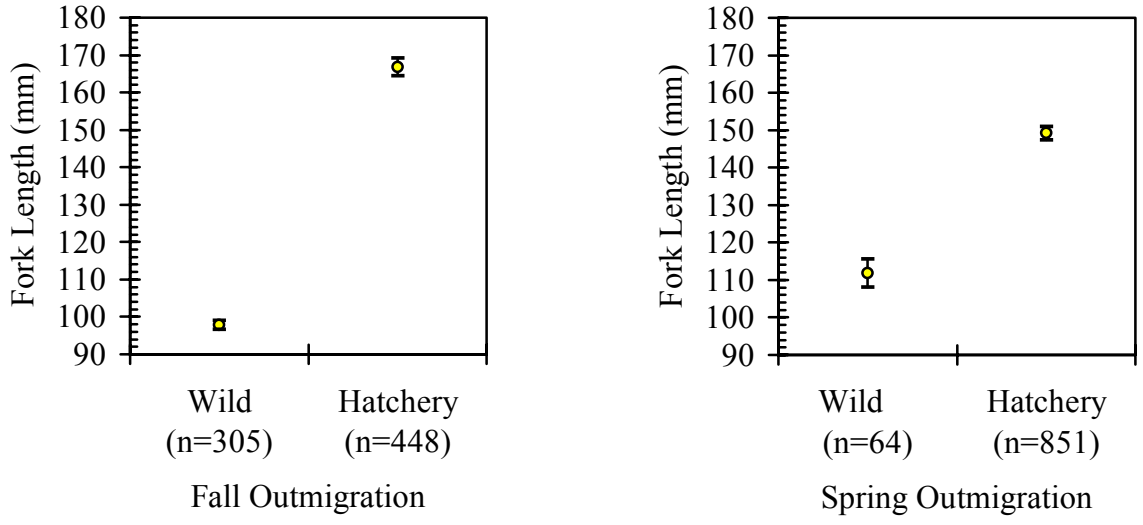

Figure 16. Comparison of fork length (mean and 95% CI) between wild and hatchery juvenile spring Chinook salmon during the fall of 1996 and spring of 1997 (brood year 1995) out-migration periods from the Warm Springs River *(WS-005, P. 10)*.

10) Fish Health

- Fish health is monitored daily by hatchery staff ***(WS-006, P. 40)***.
- The Lower Columbia River Fish Health Center (FHC) in Willard, WA provides fish health care for the Warm Springs NFH under the auspices of the published policy 713 FW in the Fish and Wildlife Service Manual.
- A fish health specialist visits at least once per month to examine fish in each lot, checking both healthy and symptomatic fish in the rearing ponds ***(WS-006, P. 40)***.
- If necessary, the appropriate chemotherapy or cultural changes are administered after consultation with the fish health specialist ***(WS-006, P. 40)***.
- Sanitation procedures follow guidelines established by the Fish Hatchery Management manual ***(WS-006, P. 40)***.
- The first health exam of newly hatched fish occurs when approximately 50% of the animals are beyond the yolk sac stage and begin feeding. Sixty fish are sampled and tested for virus ***(WS-017, P. 2)***.
- At two to four weeks prior to a release or transfer from the hatchery, 60 fish from the stock are necropsied and tissues are taken for testing of listed pathogens ***(WS-017, P. 2)***.
- At spawning, tissues from adult fish are collected to assay viral, bacterial and parasite infections and to provide a health profile ***(WS-017, P. 2)***.
- 100% of the adult fish are tested for infectious hematopoietic necrosis virus and for *Renibacterium salmoninarum (causative agent of BKD)*. Eggs from female broodstock with high levels of BKD are not used unless egg production is low ***(WS-017, P. 3)***.
- The Enzyme-linked Immunosorbent Assay or ELISA is used to measure BKD levels in 100% of the spring Chinook adults. Returning adult numbers permitting, eggs from females measuring greater than 0.199 optical density (O.D.) in this test will be culled to reduce/control BKD ***(WS-017, P. 3)***.
- If the number of brood females is low, progeny from highly infected females are segregated into rearing units apart from the rest of the production and absolute fastidiousness maintained as to using equipment that is disinfected and/or dedicated to these rearing units ***(WS-017, P. 3-4)***.
- Carcasses of the spawned adults are numbered for identification, decapitated, eviscerated and frozen until results from disease testing has been completed. Carcasses with high levels of BKD and virus are not used for nutrient out-planting.
- Also of concern are the non-endemic hatchery steelhead which are infected with the parasite *Myxobolus cerebralis*, the agent of whirling disease. To this date, the parasite has not been found in the Warm Springs fish stocks ***(WS-017, P. 4)***.

11) Chemotherapeutant Use

<u>Hatchery Adults</u>

- The spring Chinook salmon adults are taken into the hatchery in mid-April, and due to the lengthy holding time before spawning in late August, can require formalin treatment three to five times weekly at a rate of 167 ppm to control external fungus and parasites ***(WS-017, P. 3)***.
- All adults held for broodstock and for live out-planting are injected with erythromycin to prevent pre-spawning mortality by BKD and to reduce vertical transmission of its causative agent to their progeny. Fish are injected with erythromycin at about 60 days and 30 days before spawning, with a dosage of 10-20 mg/kg body weight ***(WS-017, P. 3)***.

- Erythromycin injections are done under the INAD 6430 or by veterinarian prescription ***(WS-017, P. 3)***.
- If necessary, adult fish are injected with oxytetracycline (10 mg/kg body weight) to reduce pre-spawn mortality from furunculosis. In 2005 at 60 days pre-spawn, all adult fish were injected with erythromycin (intraperitoneally) and oxytetracycline (in the dorsal sinus). This protocol is under consideration for use in future years.

Wild Adults

- When the automatic passage system is not operational for either mechanical or biological reasons, the wild fish are separated by hand. When this happens, to reduce the possibility of pre-spawning mortality from BKD, the wild fish handled in the hatchery receive an injection of erythromycin prior to release above the hatchery. In addition, no wild fish are injected when water temperatures exceed 60^{o}F or within 30 days of spawning.
- Erythromycin injections are done under the INAD 6430 or by veterinarian prescription ***(WS-017, P. 3)***.

12) Tagging (marks/tags applied and strategies for marking/tagging)

- Since 1990, all juvenile fish at the hatchery have been externally marked with an adipose fin clip and 100% coded-wire tagged ***(WS-005, P. 11)***.
- All juvenile hatchery spring Chinook salmon released from Warm Springs NFH are externally marked for visual identification ***(WS-006, P. 22)***.
- All spring Chinook salmon juveniles released from Warm Springs NFH are coded-wire tagged (the tag retention goal is 95%) ***(WS-006, P. 42)***.
- Some juvenile spring Chinook salmon may be implanted with radio-tags and/or PIT tags in order to monitor their migration behavior in the Deschutes River

13) Fish Release

- Hatchery production is typically split into fall and spring release periods, with approximately 10% to 30% of total production volitionally leaving during the fall migration period, mid-October to mid-November ***(WS-005, P. 12)*** *(see* Table 7).

Table 7. Juvenile release information for Warm Springs NFH by release year. Release dates are the last day of release during the release period *(WS-006, P. 41)*.

Release Year	Spring Release Dates	Number Released	Avg. Fish/lb	Fall Release Dates*	Number Released	Avg. Fish/lb
1990	04/11, 04/16	563,581	17.5	09/26, 11/01	254,513	10.7
1991	04/17, 04/22	816,420	14.8	11/04	8,521	6
1992	04/22	650,986	12	10/01, 11/16	47,257	21
1993	04/22	509,757	17	11/15	23,099	21
1994	04/20	527,565	16	11/16	16,497	13
1995	03/31	381,645	11	11/22	53,001	14
1996	04/10	367,885	11	11/13	30,394	12
1997	04/16	437,033	9	11/14	90,809	16
1998	04/15	699,613	22	11/09	35,718	20
1999	03/04	775,852	19	11/17	91,377	18
2000	04/19	679,042	15	11/15	42,921	22
2001	04/18	784,744	19	11/14	57,975	22
2002	04/24	560,847	19	11/20	36,395	20
2003	04/16	619,345	25	11/13	10,643	25
2004	04/21	443,669	23	-	-	-

*Fall release is a volitional release of age 0+ spring Chinook salmon (see section 3.5). The number released is based on either on smolt trapping estimates made during the first year of fall release and pond estimates of the total number of fish placed into ponds. Fall released fish are from the same brood year as fish released in the spring of the following year (e.g., fish released in fall '90 and spring '91 are both from BY '89).

- This fall/spring hatchery release technique has been found to be a more successful strategy in returning adults as compared to the former practice of only releasing spring yearling juveniles.
- 75,000 fingerlings are planned for on-station release in fall (early October-late November) *(WS-006, P. 40)*.
    - Size of fish released are 18-28 fpp (16-25 grams). Size range is similar to spring release, with the larger fish having a higher propensity to outmigrate in the fall.
    - Gates are opened at the end of each raceway that allow fish to leave the hatchery via a pipe that enters the Warm Springs River, just downstream of the adult barrier dam.

  - All fall release fish are allowed to outmigrate volitionally during a six-week window, then the ponds are closed until the spring.
  - Preliminary results indicate that many of the hatchery fish released in the fall, overwinter in the Deschutes River. This migration behavior is similar to their wild counterparts, which also have a fall and spring out-migration period from the Warm Springs River. Wild juveniles leaving the Warm Springs River in the fall also predominately overwintering in the Deschutes River ***(WS-006, P. 12)***.
- 675,000 smolts are planned for on-station release in spring (March-April) ***(from WSNFH-descOct4.doc)***
  - Size of fish released are 18-28 fpp (16-25 grams).
  - Gates are opened at the end of each raceway that allow fish to leave the hatchery via a pipe that enters the Warm Springs River, just downstream of the adult barrier dam.
  - All fish are allowed to outmigrate volitionally for two weeks in the spring then at the end of two weeks the remainder are crowded out to make room for the next year's brood.
  - Hatchery fish from the spring release migrate quickly to the Columbia River, with median passage time to The Dalles Dam and the Columbia River Estuary measured at 3–4 weeks after release from the hatchery ***(WS-005, P. 12)***.
- Approximately 200 hatchery adult spring Chinook salmon are outplanted into Shitike Creek during late August and early September ***(WS-006, P. 12-13)***.
  - Staff from the CTWSRO use a tank truck to transport fish from the adult holding ponds to five release sites along Shitike Creek.

V. Research, Monitoring, and Evaluation Programs Connected to WSNFH.

A) List of program "Performance Indicators *(from Hatchery and Genetic Management Plan, August 2004)*.

Benefits **Performance Standards**	**Performance Indicators**	**Monitoring and Evaluation**
1) Life history characteristics of wild and hatchery fish do not significantly diverge.	Age composition, body size, sex ratio, juvenile migration timing, adult run timing, and spawn timing of wild and hatchery fish are similar.	A subsample of wild and hatchery fish are biosampled in order to collect length, age, sex, and coded-wire tag information for adult fish. The USFWS operates a fish barrier dam and adult fish ladder adjacent to the fish hatchery on the Warm Springs River. Approximately 10% of the wild run and 40% of the hatchery run are sampled at the hatchery. The CTWSRO operates a migrant traps downstream of the hatchery on the Warm Springs River and near the mouth of Shitike Creek that monitor juvenile outmigration timing of wild and hatchery fish.
2) Broodstock collection methods maintain the run timing of wild and hatchery spring Chinook salmon.	Adults collected for broodstock are collected proportionately throughout the run based on wild stock run timing.	Run timing of wild spring Chinook salmon is monitored at the hatchery fish ladder. Broodstock for the hatchery program are collected based on historical run timing averages of the wild run.
3) Produce spring Chinook salmon for harvest in treaty and non-treaty fisheries (U.S. v Oregon).	Contribution of Warm Springs NFH spring Chinook salmon to fisheries in the Deschutes and Warm Springs rivers.	Creel surveys conducted by the CTWSRO and the Oregon Department of Fish and Wildlife (ODFW), coded-wire tag recoveries, and hatchery returns are used to estimate the contribution of Warm Springs NFH spring Chinook salmon to various fisheries.
4) Surplus hatchery spring Chinook salmon are available for outplanting in underseeded habitat on the Warm Springs Reservation.	An average of 200 adult Warm Springs NFH spring Chinook salmon are outplanted into Shitike Creek annually. Outplanting was initiated in 2001.	Adults are selected for outplanting in Shitike Creek at spawn time in the hatchery. Redd surveys, radio-telemetry, genetic surveys, and juvenile monitoring will be used to evaluate the contribution of Warm Spring NFH spring Chinook salmon to natural production in Shitike Creek.

Benefits Performance Standards	Performance Indicators	Monitoring and Evaluation
5) Maximize survival of hatchery spring Chinook salmon at all life stages using disease control and disease prevention techniques.	Hatchery operations comply with USFWS Fish Health Policy and Implementation Guidelines as well as the Integrated Hatchery Operation Team's fish policy.	Specialists from the Lower Columbia River Fish Health Center (LCRFHC) will inspect adult broodstock yearly and monitor juvenile fish on a monthly basis to assess health and detect potential disease problems. As necessary, the LCRFHC will recommend remedial or preventative measures to prevent or treat disease, with administration of therapeutic and prophylactic treatments as deemed necessary.
6) Release healthy, functional smolts from Warm Springs NFH.	Annually release up to 750,000 marked smolts from Warm Springs NFH.	Three to six weeks prior to release or transfer, 60 fish from each lot will be given a health exam by fish health specialists from the LCRFHC. All juvenile fish at the hatchery are externally marked and coded-wire tagged (CWT) prior to release. Juvenile fish are sampled by the USFWS for mark quality and tag retention prior to release. The tag retention goal at release is a minimum of 95%.
7) Juvenile releases from Warm Springs NFH survive and return to the hatchery in sufficient numbers to sustain the hatchery program.	The adult production goal from the 750,000 smolts released from Warm Springs NFH is at least 2,250 adults returning to the mouth of the Deschutes River. The production goal allows for a harvest in the Deschutes River and a broodstock collection goal of 630 hatchery adults at Warm Springs NFH.	Smolt to adult survival rates are estimated for each brood year. Creel surveys conducted by CTWSRO and ODFW sample fish caught in fisheries in the Deschutes River. A subsample of hatchery spring Chinook salmon returning to the hatchery are biosampled. Coded-wire tag recoveries are used to estimate the age structure of returning fish.
8) Fully seed available spring Chinook salmon habitat above Warm Springs NFH.	Maintain a minimum escapement goal for wild spring Chinook salmon above Warm Springs NFH of 1,300 adults (60 cm or greater).	Wild spring Chinook salmon abundance is monitored as fish pass through the fish ladder at Warm Springs NFH. The CTWSRO and USFWS will conduct redd surveys in order to estimate spawning abundance.

Benefits Performance Standards	Performance Indicators	Monitoring and Evaluation
9) Maintain the genetic characteristics and stock integrity of wild summer steelhead in the Warm Springs River above Warm Springs NFH.	Intentionally pass only wild (unmarked) steelhead above the barrier dam at Warm Springs NFH.	During the steelhead migration period all fish are sorted by hand. All hatchery steelhead, identified as having missing or deformed fins, are killed at the hatchery and distributed to the CTWSRO. All wild steelhead are passed upstream. The disposition of each fish handled is recorded in fish removal database files maintained by the USFWS Columbia River Fisheries Program Office.
10) Maintain the genetic characteristics and stock integrity of indigenous fish populations in the Warm Springs River.	Only known indigenous fish species will be intentionally passed above the barrier dam at Warm Springs NFH.	Fish passed upstream are monitored either manually or through a video-monitor system.
11) Warm Springs NFH enhances stream enrichment opportunities in the Warm Springs River.	Carcasses from hatchery broodstock are available for outplanting into the Warm Springs River after spawning.	All carcasses are screened by the fish health center for disease prior to being outplanted into the stream. Carcasses are treated (by evisceration and heat-baking) to prevent potential disease transmission.
12) Design and implement projects to improve the quality of fish production at Warm Springs NFH.	Projects are identified, reviewed, and implemented that will increase survival of program fish while minimizing impacts on wild populations.	Monitoring programs will be incorporated into project designs. Examples of project designs include diet studies, rearing density studies, and rearing environment projects.
13) Effectively communicate with other salmon producers, managers, and the public in the Columbia River Basin.	A yearly meeting with all cooperators and policy level personnel will be held annually in March. Quarterly meetings with the hatchery evaluation team will include hatchery, management, fish health, and tribal representatives.	Effectively communicate with other salmon producers, managers, and the public in the Columbia River Basin.

Risks Performance Standards	Performance Indicators	Monitoring and Evaluation
1) Hatchery operations comply with ESA responsibilities.	Hatchery conducts Section 7 consultations and completes an HGMP. Section 10 permits are issued when applicable.	Refer to M&E Section in this document.
2) Hatchery operations comply with water quality standards.	Hatchery meets the requirements of the National Pollution Discharge Elimination Permit.	Environmental monitoring of total suspended solids, settleable solids, in-hatchery water temperatures, in hatchery dissolved oxygen, nitrogen, ammonia, and pH is conducted annually at the hatchery.
3) Handling of wild spring Chinook salmon is minimized.	An automated fish passage system is used that passively separates coded-wire tagged hatchery spring Chinook from wild fish. The minimum operating standards for the system are removal of 95% of the fish with coded-wire tags and 95% accuracy in counting upstream-bound fish.	Trapping efficiency is evaluated on a regular basis. During efficiency testing upstream bound fish will be held overnight and then manually examined for fin clips and the presence of coded-wire tags. Video monitoring is used to estimate wild fish passage above the hatchery.
4) Harvest of hatchery produced fish minimizes impacts to wild fish populations.	Number of non-target or wild fish caught in tribal and non-tribal fisheries.	The CTWSRO and USFWS formulate a pre-season run prediction for Warm Springs River stocks returning to the Deschutes River. The CTWSRO and ODFW co-manage and monitor the fishery in order to ensure that impacts to wild fish are minimized.
5) Juvenile hatchery releases minimize interactions with wild fish species.	a) All juvenile releases will be at Warm Springs NFH except to meet CTWSRO requests. b) Juvenile releases do not negatively impact wild populations in the Warm Springs River and Deschutes River.	A juvenile trap located downstream of Warm Springs NFH monitors the outmigration of hatchery and wild fish. Juvenile releases may also be monitored using radio telemetry, PIT tagging, snorkeling, trapping, or other techniques.
6) Straying of hatchery fish is minimized.	Recovery of Warm Springs NFH produced fish in non-target watersheds. Stray hatchery steelhead are collected at Warm Springs NFH (see Benefit 9).	Coded-wire tag recoveries throughout the Columbia basin are recorded and summarized in order to estimate the amount of straying of Warm Springs NFH spring Chinook salmon.
7) The water intake system minimizes impacts to wild fish populations.	Water intake screens are replaced in order to meet NMFS Hatchery Biological Opinion criteria.	Screens are monitored by hatchery personnel on a regular basis.

Risks Performance Standards	Performance Indicators	Monitoring and Evaluation
8) Minimize disease risk to wild fish.	Hatchery operations comply with USFWS Fish Health Policy and Implementation Guidelines as well as the Integrated Hatchery Operation Team's fish policy. The USFWS wild fish health survey protocols are followed.	Juvenile fish health is monitored on at least a monthly basis at the hatchery in order to detect potential disease problems. A fish health specialist will examine affected fish and make recommendations on remedial or preventative measures. Therapeutic and prophylactic treatments will be administered upon consultation with the fish health specialist and in accordance with USFWS and the Integrated Hatchery Operation Team's policies. Wild fish used in the broodstock are checked for disease. Wild fish juveniles in the stream are periodically checked, as identified in the hatchery operations plan.

B. Examples of individual specific RM&E research:

Note: this section provides synopsis of relevant research associated with the hatchery.

a. What is the effect of feeding Erythromycin to juvenile salmon for control of BKD at Warm Springs NFH? ***(WS009, P. 5-6)***

- Spring chinook salmon reared at Warm Springs NFH, as well as wild juveniles and adults in the Warm Springs River itself, are infected to varying extent with *R. salmoninarum*.
- The objectives of the study are to determine the potential benefits of oral erythromycin treatment on the survival of juveniles in the hatchery, the levels of soluble antigen produced by *R. salmoninarum* in juveniles in the hatchery as an indirect measure of the level of infection, and survival to adult.
- This study was undertaken under Investigative New Animal Drug 4333.
- Drug concentrations in the diet and feeding regimes provided a daily dosage of 100 mg/kg body weight. Control and treatment fish were fed erythromycin thiocyanate (Aquamycin 100) three times daily. Feeding rates were calculated based on feeding 2% body weight of fish per day. Erythromycin therapy was administered for 21 days for each of two treatments in spring and summer.
- We see substantial difference in survival to adult between the control and treatment groups. The groups from the medicated feed survived better than the standard spring yearling release and fall/spring split volitional release groups.

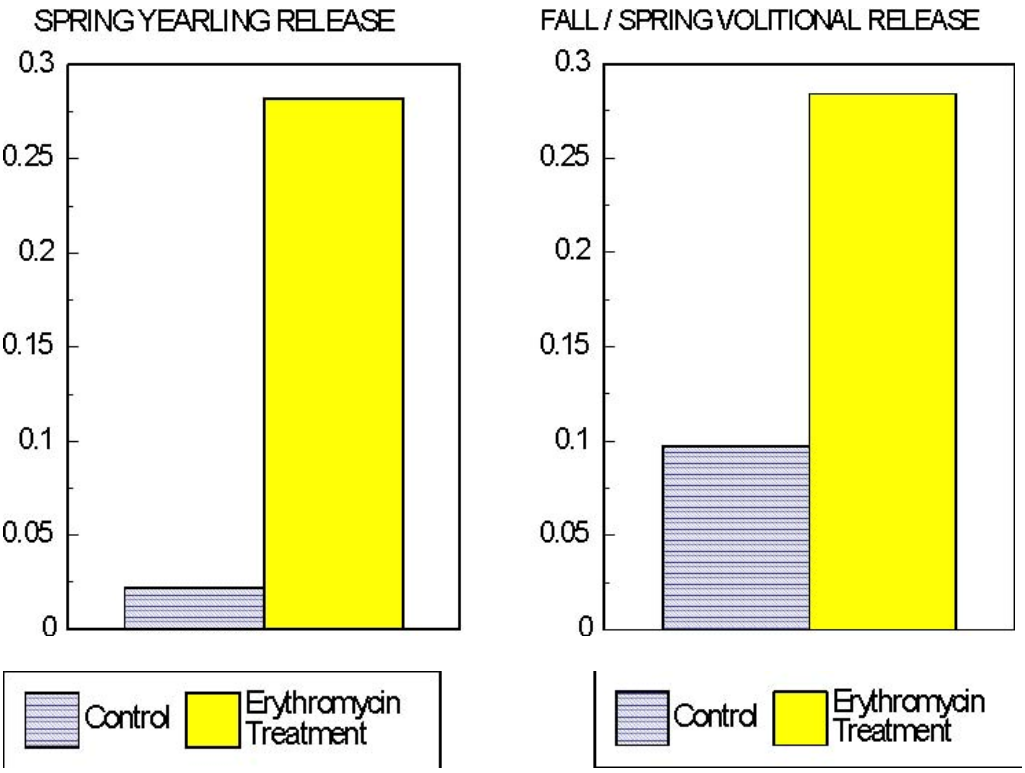

Figure 17. Hatchery adult recoveries (%) for medicated feed study
RELEASE TO RECOVERY (%)

b) Do fall releases contribute to adult returns? ***(WS009, P. 2-3)***

- The objective was to determine if fish released in the fall survive and contribute to adult returns.
- The fall release fish did survive to adult and in four out of nine years, the larger fall released fish returned to the hatchery at a higher rate than the spring releases, but the larger fish released in the fall also produced a higher percentage of age 3 jacks relative to the age 4 and 5 adult return

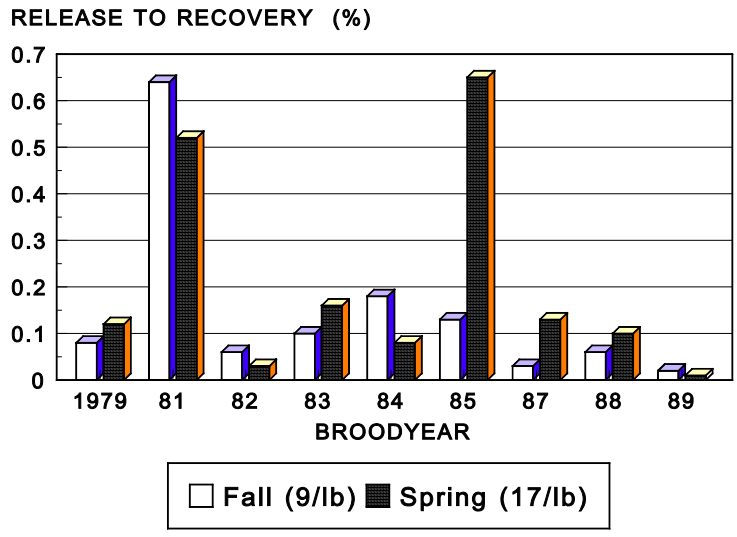

Figure 18. Survival of fall and spring releases.

c) Does rearing density affect adult yield? ***(WS009, P. 3-4)***

- The hatchery has also looked at reduced rearing densities at 20,000 to 30,000 per pond compared to 50,000 to 60,000 per pond after the fall graded release.
- Prior to broodyear 1987, it was standard practice to grade out the larger fish and release them in the fall, then combine the ponds of remaining smaller fish.
- Approximately 60,000 per pond of the smaller fish were reared overwinter until the spring release = High Overwinter Rearing Density.
- Approximately 30,000 per pond of the smaller fish were reared overwinter until the spring release = Low Overwinter Rearing Density.
- What we see is that percent survival and adult yield per pond was higher for the lower density groups.

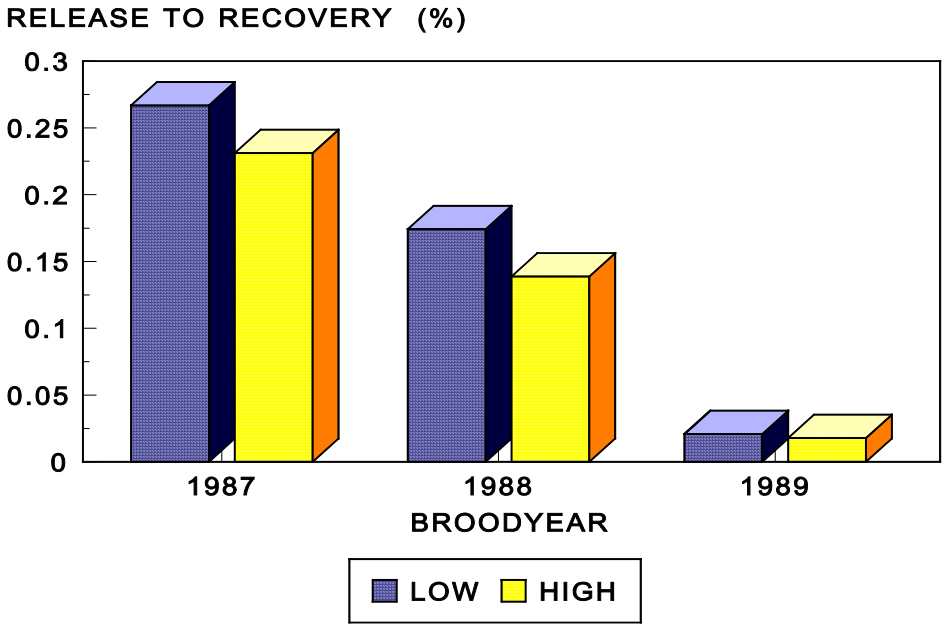

Figure 19. Overwinter rearing density and survival at 20K-30K fish/pond (low density) and 50K-60K fish/pond (high density).

- Rearing density experiments, similar to Banks (1994) are currently being conducted at Warm Springs hatchery to examine the balance between maximum survival rates and adult returns to determine if fewer fish can be released and still achieve the adult returns desired for broodstock maintenance and harvest contribution ***(WS-005, P.12)***.
- Depending on results of our 3-year study conducted on brood years 2000 through 2002, hatchery production could potentially be reduced from the current juvenile production goal of 750,000 to less than 500,000 total smolt production. Reduced rearing densities at the hatchery should also help in fish health management. The fish are being reared at 16,000 per pond, 24,000 per pond and 32,000 per pond ***(WS-005, P. 12)***.

d) Enhanced hatchery rearing environments

- These new investigations involve natural colored rearing environments, live-feed enhancements, variable flow environments, and water temperature adjustments to match the stream temperature profile ***(WS-005, P. 12)***.

- Growth rates, condition factor, body coloration, skin reflectance, physiology, and fish health will be monitored, as well as the standard survival parameters at the hatchery ***(WS-005, P. 12)***.
- Monitoring the biological characteristics of both hatchery and wild fish biological characteristics are planned. Behavioral observations may include use of underwater video, direct observations by snorkeling, radio telemetry, passive integrated transponder tagging and possibly controlled tank observations ***(WS-005, P. 12)***.
- The USGS is investigating differences in skin coloration, reflectance, and physiology between hatchery and wild juvenile fish and between hatchery fish in camouflaged-painted vs. standard raceways (publication in progress).

e) Genetic studies ***(information provided by WSNFH Evaluation Team)***

- The performance of wild and hatchery spring Chinook salmon at Warm Springs NFH was examined by USGS-Seattle under a Bonneville Power Administration contract. Survival and growth was examined in three crosses in two environments.
- The three crosses were wild x wild, wild x hatchery, and hatchery x hatchery. The two environments were the hatchery and a stream.
- The various studies were conducted over three brood years (1992, 1996, and 2000). Reisenbichler and Rubin (1999) reported that the survival of fish planted in the stream in January 1997 as button-up fry to August 1997 summer rearing period was 0.86 for the hatchery x hatchery cross relative to 1.0 for wild x wild cross. Results were indicated as preliminary.
- Results for the hatchery rearing environment and evaluation of domestication selection were recently presented at the 2005 Northwest Fish Culture Conference by Mike Hayes[2] et al., USGS. Their abstract stated "although juvenile performance [e.g. growth, survival] was generally similar among the three crosses, migration timing differences were apparent. Smolt sampling showed the HH cross was 2-3 times more abundant than expected and indicated that greater numbers of the WW cross migrated during a volitional fall release with the HW cross intermediate."

f) Ecological interactions studies ***(information provided by WSNFH Evaluation Team)***

- In 2000 and in 2002 through 2005, the USFWS provided funding to USGS-Columbia River Lab through an interagency agreement to conduct research associated with our program at the hatchery and to investigate ecological interactions between hatchery and wild fish.
- As reported in annual progress reports, between 24 and 75 juvenile fish were trapped and radio-tagged each year in the Warm Spring River for three years to evaluate the behavior and distribution of fall-release fish from the hatchery.
- Between 5% to 36% of the fall-release, radio-tagged fish migrated downstream from the Warm Springs River and exited the Deschutes River, with a median travel time of two to five days to the mouth of the Deschutes River.
- The remainder of the fish were tracked and remained in the Deschutes River over the two-month study period.

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[2] **Michael C. Hayes*,** Reginald R. Reisenbichler, Stephen P. Rubin, and Lisa A. Wetzel

Western Fisheries Research Center, Biological Resources Division, U.S. Geological Survey, 6505 NE 65th St., Seattle, WA 98115. Phone: 206-526-6282 326x. FAX: 206-526-6654. Email: mhayes@usgs.gov

- It is believed that fish that have not left within the two-month study period, will over-winter in the Deschutes River and exit the following spring.
- Fall-release fish that remained in the Deschutes River preferred slow water, pool-eddy habitat.
- A literature review was also conducted by USGS to summarize studies on behavioral interactions between juvenile salmonids in artificial streams and stream enclosures, focusing on study design and enclosure specifications.
- One of the conclusions of this review was: "Perhaps an ideal way to study species interactions relevant to the Warm Springs-Deschutes River project is to conduct detailed research in artificial stream environments followed by direct observation, and even telemetry, of fishes in the natural stream."[3]

VI. Program Conflicts *(from WS006, except as noted)*

- Listed populations that may be incidentally affected by the spring Chinook salmon program include species utilizing habitat in the Warm Springs River, Shitike Creek, Deschutes River, and the Columbia River downstream of the confluence of the Deschutes River (see Table 5 for list of potentially affected species).
- Of particular concern to the Warm Springs NFH is the population of threatened summer steelhead (*Oncorhynchus mykiss*).
- Incidental take of summer steelhead could occur through activities associated with the Warm Springs NFH adult collection facility.
- The removal of identifiable hatchery steelhead from the population at Warm Spring NFH has likely reduced the potential transmission of non-endemic diseases into the Warm Springs River. Currently, wild steelhead in the Warm Springs River are free of whirling disease and IHNV. Tests conducted on stray hatchery steelhead removed from the population indicate that at least some of the strays are positive for *M. cerebralis*, the causative agent for whirling disease. Removal of hatchery strays has also reduced the potential for genetic hybridization with the wild steelhead population.
- A small number of bull trout migrate up through the hatchery ladder each year, presumably on spawning runs to the upper watershed. The number of bull trout migrating up the fish ladder has increased each year since 1997, from 7 to 41.
- Operational Constraints and Considerations (mitigation, co-manager agreements, legal requirements, etc.
- The operation of Warm Springs NFH is guided by an Operational and Implementation Plan that is updated every five years. The plan is developed cooperatively with the CTWSRO and signed by both parties. During development and updating of the plan, legal and policy issues are addressed.

VII. ESA Status of salmonid stocks

- Target stock (Warm Springs River spring Chinook salmon), unlisted.

[3] Reagan, R.E., P.J. Connolly, N.S. Adams, M.G. Mesa, and D.W. Rondorf (USGS); G. Fitzgerald and R. Spateholts (CTWSRO); T. Hoffman, and D.E. Olson (USFWS). 2004. Distribution, migration behavior, habitat use, and species interactions of fall-released juvenile hatchery spring Chinook salmon on the Deschutes River, Oregon, 2002. Annual report of research to the U.S. Fish and Wildlife Service, Vancouver, Washington.

Other key stocks of concern:

- Deschutes summer steelhead, listed as threatened by NOAA Fisheries within the Middle Columbia River ESU.
    - NOAA Fisheries' ICTRT has identified two demographically independent population groups for summer-run steelhead in the Deschutes River Basin: those associated with "west-side" tributaries (and adjacent mainstem regions) and those associated with "east-side" tributaries (and adjacent mainstem regions). These distinctions are based primarily on "dramatic habitat and life history differences, although the boundary is uncertain due to continuous spawning via the mainstem.

VIII. Statue of wildlife species

- Federal and Oregon listing status of wildlife species in the lower Deschutes River subbasin below Pelton Dam (ODFW 2001) ***(WS-006, P. 87)***.

Species	Federal Listing Status	Oregon Listing Status
Amphibians		
Cascade frog *Rana cascadae*	Species of Concern	Sensitive
Northern leopard frog *Rana pipiens*		Sensitive
Northern red-legged frog *Rana aurora aurora*	Species of Concern	Sensitive
Oregon spotted frog *Rana prettosa*	Proposed Threatened	Sensitive
Western toad *Bufo boreas*		Sensitive
Reptiles		
Northern sagebrush lizard *Sceloporus graciosus graciosus*	Species of Concern	
Western pond turtle	Species of Concern	Sensitive
Birds		
American Peregrine falcon *Falco peregrinus anatum*	Endangered	Endangered
Bald eagle *Haltaeetus leucocephalus*	Threatened	Threatened
Bank swallow *Riparia riparia*		Sensitive
Ferruginous hawk *Buteo regalis*	Species of Concern	Sensitive
Harlequin duck *Histrionicus histrionicus*	Species of Concern	Sensitive

Species	Federal Listing Status	Oregon Listing Status
Mountain quail *Oreortyx pictus*	Proposed threatened	
Northern goshawk *Acipiter gentilis*	Species of Concern	Sensitive
Northern spotted owl *Strix occidentalis caurina*	Threatened	Threatened
Olive-sided flycatcher *Contopus cooperi*	Species of Concern	
Tricolored blackbird *Agelaius tricolor*	Species of Concern	Sensitive
Western barrowing owl *Speotyto cunicularia hypagea*	Species of Concern	Sensitive
Mammals		
California bighorn *Ovis Canadensis californiana*	Species of concern	
California wolverine *Gulo gulo luteus*	Species of Concern	Threatened
Pacific fisher *Mertes pennanti pacifica*	Species of Concern	Sensitive
Long-eared myotis *Myotis evotis*	Species of Concern	Sensitive
Long-legged myotis *Myotis volans*	Species of Concern	Sensitive
Pale western big-eared bat *Plecotus townsendii pallescens*	Species of Concern	Sensitive
Pygmy rabbit *Brachlagus idahoensis*	Species of Concern	Sensitive
Small-footed myotis *Myotis cilolabrum*	Sepcies of Concern	Sensitive
Yuma myotis *Myotis yumanensis*	Species of Concern	Sensitive

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503/872.2763
E-Mail: Douglas_dehart@fws.gov

U.S. Fish and Wildlife Service
www.fws.gov

For Columbia River Basin 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 2006