



NIAGARA SPRINGS FISH HATCHERY

2006 Steelhead Brood Year Report



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ABSTRACT

Niagara Springs Fish Hatchery (NSFH) received 2,128,002 steelhead (*Oncorhynchus mykiss*) eggs and fry during the 2006 brood year. A total of 1,211,622 Pahsimeroi stock eggs and fry (595,362 eggs and 616,260 swim-up fry) were received from Oxbow Hatchery. After spawning, Pahsimeroi stock eggs were shipped green to Oxbow Hatchery for incubation on chilled well water and then transferred to NSFH as eyed eggs or swim-up fry. Just over half (50.86%) of the Pahsimeroi egg lots were shipped to NSFH as first feeding fry. A total of 916,380 Hells Canyon stock eggs and fry (446,984 eggs and 469,396 swim-up fry) were received from Oxbow Hatchery. Approximately 50% of the earliest Hells Canyon egg lots were shipped to NSFH as first feeding fry.

Total production for the 2006 brood year at NSFH was 1,864,754 steelhead (384,850 lbs) for anadromous smolt releases. No excess fish were available to be stocked as fall releases.

A total of 1,864,754 steelhead smolts (384,850 lbs at 4.85 fish/lb) were released into the Snake and Salmon rivers from March 19 to April 26, 2007. A total of 830,447 smolts (181,300 lbs at 4.58 fish/lb) of Pahsimeroi stock were released in the Pahsimeroi River at the weir, and 266,738 smolts (52,200 lbs at 5.11 fish/lb) of Pahsimeroi stock were released in the Little Salmon River near Stinky Springs. A total of 527,700 smolts (105,850 lbs at 4.99 fish/lb) of Hells Canyon stock were released in the Snake River at Hells Canyon Dam, and 239,868 smolts (45,500 lbs at 5.27 fish/lb) of Hells Canyon stock were stocked in the Little Salmon River near Stinky Springs.

Mortalities from pathogens increased this year. For this brood year, the vaccine for furunculosis (*Aeromonas salmonicida*) was not available from Aqua Health Limited so none of the fish were vaccinated. A heavy outbreak of furunculosis in Chile, resulted in all vaccine (even vaccine ordered by NSFH 1 year in advance) going to Chile. No steelhead at NSFH were vaccinated for enteric redmouth disease (ERM-*Yersinia ruckerii*) during this brood year. ERM was not isolated during the 2006 brood year. Some of the Pahsimeroi and Hells Canyon eggs received came in with soft shell disease which decreased egg survival. Clinical bacterial coldwater disease, caused by *Flavobacterium psychrophilum*, was detected in June and again in July 2006 which caused high losses in the vats and the raceways. *F. psychrophilum* was detected again during preliberation sampling. Infectious Hematopoietic Necrosis Virus (IHNV) was not detected this brood year.

A total of 372,470 lbs of fish feed were fed (369,434 lbs of Rangen and 3,036 lbs of Skretting (formerly Moore-Clark)) at a cost of \$ 135,386.71 to produce 384,850 lbs of steelhead for a conversion rate of 0.968:1.

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INTRODUCTION

The NSFH is owned and financed by Idaho Power Company (IPC), and operated and staffed by the Idaho Department of Fish and Game (Department). It is located in the Snake River Canyon, ten miles south of Wendell, Idaho. The NSFH is one of four hatcheries IPC owns and which the Department staffs and operates that fulfill IPC's mitigation requirement under the Federal Energy Regulatory Commission license #1971. The goal of NSFH is to rear 400,000 pounds (lbs) of steelhead smolts annually. Originally, these smolts were used to relocate a portion of the Snake River steelhead run into the Salmon River. Since 1980, 200,000 lbs of production are used to sustain a steelhead run below Hells Canyon Dam in the Snake River, and 200,000 lbs are stocked in the Salmon River drainage.

OBJECTIVES

The two major mitigation requirements that must be met at IPC's NSFH are to produce quality steelhead smolts to sustain steelhead trout runs in the Snake River below Hells Canyon Dam and in the Salmon River and its tributaries by successfully meeting these objectives:

1. Rear 200,000 lbs of quality steelhead smolts to be released in the Salmon River and its tributaries. The steelhead are to return as adults in sufficient numbers to provide quality sport fisheries in these waters and to supply sufficient broodstock (1,000 adults) to the Pahsimeroi Fish Hatchery for the collection of spawn for the next production cycle.
2. Rear 200,000 lbs of quality steelhead smolts to be released in the Snake River below Hells Canyon Dam. These are to return as adults in sufficient numbers to provide a quality sport fishery in the Snake River and to supply sufficient broodstock (1,000 adults) to the Hells Canyon Trap for the collection of spawn for the next production cycle.

IDAHO DEPARTMENT OF FISH AND GAME GOALS

1. Provide quality steelhead smolts to the Snake and Salmon rivers that will survive downstream migration and return as adults in sufficient numbers to provide a quality sport fishery in these waters and their tributaries.
2. Provide quality hatchery steelhead for supplementation where wild stocks of steelhead have diminished below desired levels and where managers feel quality hatchery steelhead would enhance the fisheries resource.
3. Enhance the genetic quality of hatchery stocks through management and hatchery practices that favor genetic variability.

FACILITY DESCRIPTION

Fish culture facilities at NSFH consist of an indoor nursery area, outdoor rearing raceways, and two flow-through settling ponds. The indoor nursery area consists of 42 upwelling incubators and 21 rectangular vats for the hatching and early rearing of fry. The nursery tanks provide 749.61 ft³ of hatching and early rearing space.

The outdoor rearing space consists of nineteen raceways (300-ft x 10-ft), (142,500 ft³) , which are supplied by constant temperature, gravity flow, spring water. This allows for the production of 400,000 lbs of steelhead at a density index of less than 0.35 lbs/ft³/in as recommended by Piper (1982).

Two flow-through settling ponds (150-ft x 60-ft) are provided to remove settleable solids from the NSFH effluent. The settling ponds handle all the flow from the raceways and meet Environmental Protection Agency (EPA) guidelines for aquaculture discharge.

Dissolved nutrients are monitored on a biweekly basis to comply with the terms of a consent order between IPC and the Idaho Division of Environmental Quality. Samples of inflow, raceway effluent, and settling pond discharges to Niagara Springs Creek and Rimview Trout Company are collected using Sigma automated water samplers and sent to Rangen Aquaculture Research Center for analysis. Additional water analysis is performed monthly in accordance with the EPA National Pollutant Discharge Elimination System permit. Samples are collected only on inflow and discharge water. The Rangen Aquaculture Research Center conducts nutrient analysis, and analysis for total suspended solids.

Swim-up fry are hand fed in all nursery areas with some supplementation from the use of Ziegler belt feeders. Once the fish reach approximately 75 fish per pound (fpp) they are transitioned to the automated feed delivery system. Two moveable bridges span the outdoor rearing area. A total of 19 Nielsen automatic feeders are mounted on the bridges. The fish are fed by moving the bridges down the length of the rearing area and energizing the individual feeders on the control panels. Bulk feed is dispensed to the feeders by a conveyor supplied by two 20,000-lb storage bins with an associated fines separator.

Raceway cleaning is accomplished with an automatic air blower system. Three blower motors supply approximately 10 psi of air to weighted, perforated, airlines on the bottom side corner of each raceway. The resulting bubble screen creates a vortex of water currents that keep waste material suspended along the length of the raceways. While this system saves many hours of labor sweeping raceways, it is not completely efficient. Raceways are broomed daily to augment the air blower system and a power scrubber is also employed on a regular basis to remove excessive algal growth.

Buildings on the NSFH grounds include five residences. Three are wood-frame houses, one is a doublewide modular home, and one is a 16-ft wide mobile home. A 32-ft x 80-ft metal building contains an office, two incubator rooms, garage, shop, and feed storage room. Additional buildings include: two screen storage buildings (14-ft x 24-ft and 10-ft x 12ft), an open front shed (10-ft x 30-ft), and a masonry block chiller building (70-ft x 45-ft) which contains the chiller and blower-electrical room, a heated shop, and garage.

The NSFH staff is also responsible for care of the IPC-owned two-acre park adjacent to Niagara Springs Creek. It has a public, handicapped-accessible restroom, picnic tables, BBQ grills, and refuse containers.

WATER SUPPLY

In addition to NSFH, Niagara Springs supplies water to Rimview Trout Company, Niagara Springs Wildlife Management Area, and Idaho State's Pugmire Park. Niagara Springs' total flow is 220 cubic feet per second (cfs), which is divided into water rights by the four users.

The IPC has entered into an agreement with the three other users of Niagara Springs water whereby NSFH will receive water according to a stepped flow chart (Appendix 1). The NSFH has a water right of 132 cfs. A diversion canal was built by IPC in 2001, allowing up to 75 cfs of water to be discharged to Rimview Trout Company from November through April. This canal crosses onto Rimview property and attaches at their second-use head-ditch. Three slide gates located in the east and west settling basins regulate the volume of water discharged to Rimview. The volume of water discharged to Rimview this season is summarized by month in Appendix 2.

Water from Niagara Springs is a constant 59°F and flows by gravity to the incubators, nursery vats, outdoor raceways, fire hydrants, and irrigation system. Water quality is checked annually during the spring at the NSFH for herbicides, pesticides, heavy metal contaminants and normal water chemistry parameters (Appendix 3).

STAFFING

Four permanent personnel staff the NSFH. Jerry Chapman, Fish Hatchery Manager II, Jarrett Page, Fish Hatchery Assistant Manager, Doug Young, and Kevin Yelton, Fish Culturists, handle most operational duties. During peak work activities there are several Bio Aides throughout the year: Mike Anderson, Alissa Bosscher, Lonnie Medina, Zak Welch, Lachel Taylor, and Erik Kvale who assist the permanent staff with fish culture, maintenance, and other assignments.

FISH PRODUCTION

Egg Shipments and Early Rearing

Eggs and fry received at NSFH originate from broodstock trapping and spawning operations at IPC's Oxbow and Pahsimeroi hatcheries. To retard embryonic development, steelhead eggs spawned at Pahsimeroi Hatchery were transported by aircraft to Oxbow Hatchery for incubation in chilled wellwater (43°F) prior to delivery to NSFH. This procedure was done to control smolt size while minimizing the need to take fish off feed during the rearing cycle at NSFH. At the Oxbow Hatchery, a 70 horsepower chiller unit was utilized to chill 52°F wellwater to 43°F for incubation. Pahsimeroi Hatchery does not have a chiller unit for this

purpose. The NSFH received both eggs and fry for the 2006 brood year (Appendix 4). Of the Pahsimeroi stock eggs incubated at Oxbow Hatchery and destined for NSFH, approximately one-half (49.14%) were delivered to NSFH as eyed eggs while the remaining (50.86%) were delivered as first feeding fry. Eyed eggs were transported in conventional coolers while fry were transported in specially designed, perforated fry transport tubes; and placed inside a 500-gallon fish-stocking tank acquired by NSFH from Hagerman State Fish Hatchery (HSFH).

The 500-gallon tank is mounted to a trailer and towed by a 3/4-ton hatchery vehicle. The tank is equipped with Point-4 ceramic air stones and bottled oxygen. This tank and trailer design was created in 2002 to help prevent the possible transmission of disease pathogens between hatcheries. This tank/trailer configuration also eliminated the transportation bottleneck created when NSFH wanted to use HSFH transport trucks during their busy "catchable" stocking season.

The NSFH received 595,362 eyed-eggs of Pahsimeroi stock between June 8 and June 16, 2006. This was the same week as the prior brood year and came from lots 6-10. A total of 616,260 Pahsimeroi stock swim-up fry from egg lots 1-5, and 8 were received from June 26 through July 18. The first of the fry were received 10 days earlier than the prior brood year. A total of 1,211,622 eggs and fry of the Pahsimeroi stock were received at NSFH for the 2006 brood year.

A total of 446,984 eyed-eggs of Hells Canyon stock (lots 10-15) were shipped to NSFH from May 19 through May 26, 2006. Egg lots 1-9 were transported to NSFH as swim-up fry (469,396) between June 13 and June 30, 2006, and placed directly into outdoor nursery raceways. The timing of the fry shipments coincided with the swim-up timing of fish from the eyed-eggs that were received earlier at NSFH, and was approximately the same as the prior brood year. A total of 916,380 eggs and fry of Hells Canyon stock were received at NSFH for the 2006 brood year. NSFH's steelhead egg to smolt survival for brood year 2006 was 87.63% (Appendix 4.)

Upon arrival at NSFH, all eggs were tempered and disinfected with iodine at 100-ppm for 30 minutes and placed in upwelling incubators (26,059 per incubator average) inside the vats. All fry shipping containers were disinfected prior to shipping. Upon arrival at the hatchery, fry were tempered in their shipping containers before ponding.

Fry were not inventoried from the nursery vats to the nursery raceways this brood year. Consequently, hatching success and mortality could only be estimated. The NSFH staff observed elevated mortality of eyed eggs during the early rearing cycle. Many of the incoming egg lots showed signs of soft-shell disease. Survival of fry to fingerling was 92.61% in Pahsimeroi steelhead and 88.54% in Hells Canyon steelhead. Overall, fry to fingerling survival was 90.85%.

As was done last year, nursery sections were screened at both ends and remained expanded from 20-ft to 35-ft in length. This effectively prevented fry and fingerlings from getting into the headrace, and allowed the fry to be reared at lower starting densities. As densities increased, fry were given more rearing volume by relocating screens to 50-ft, 75-ft, and finally, to the end of the first section at 100-ft. In 2001, additional screen brackets were placed at 75-ft and 150-ft allowing for greater flexibility than the standard keyway distances of 100, 200, and 300-ft. This methodology reduces wasted feed and reduces cleaning times created by using the standard keyway distances, yet still allows densities to be lowered and greater management of inventories. This practice was expanded even more, during the 2003 brood year, by creating

screen brackets at 250-ft for the Coded-Wire-Tag (CWT) raceways. The CWT raceways have approximately 30,000 to 78,000 untagged steelhead per pond, depending on tagging requests. In the production cycle, these 30,000 to 78,000 fish require less or more than the normal 100-ft key-way sections depending on the number. This allows for better cleaning, feeding and density control. Fish are given more room before they attain a density index of 0.30. All of these fish culture practices will continue in future brood years.

Throughout the entire early rearing period, steelhead at NSFH was fed Rangen dry feeds. Feed was dispensed by hand feeding and supplemented with Ziegler belt feeders in the indoor and outdoor nursery areas. When the fingerlings reached approximately 275 fish/lb 50% of the population was fed Skretting's "Clarks Fry" (ProActive) dry feeds for 14 days. The purpose of feeding Skretting's ProActive feed was to stimulate the fry's immune system prior to the vaccination program. When they reached 75 fish/lb, all NSFH fish were switched to a Rangen extruded diet. The switch to Rangen bulk extruded feed allowed NSFH staff to utilize the bulk tanks, feed conveyor system, fines separator, and bridge feeders.

Final Production Rearing

Adipose fin-clipping operations are used to split the fish into even-numbered and odd-numbered raceway sections. During this program, fish are crowded to the lower 100-ft section of each odd-numbered raceway. Half the fish are clipped and put into the upper two-thirds of the raceway, while the other half is clipped into the adjacent even-numbered raceway. Fin-clipping operations started on September 18 and were completed by October 24, 2006.

Fish were given the final 100-ft of rearing space in early January. Hells Canyon fish were placed in raceways 1 through 8, while Pahsimeroi fish were placed in raceways 9 through 19. Normal fish culture techniques during this time include: feeding fish with the bridge, sweeping raceways, conducting sample counts, cleaning screens and air lines, removing mortalities, equipment maintenance, record keeping, nutrient sampling, pond scrubbing, supervising and running the adipose-marking trailer, length frequency and fin quality collection and reporting, assisting with CWT and passive integrated transponder (PIT) tagging operations, and conducting tag and mark retention checks.

Pahsimeroi steelhead were held off feed for 20 days for fish culture reasons. Hells Canyon steelhead were off feed for 16 days for fish culture reasons. These reasons include; monthly sample counts, adipose fin clipping, CWT and PIT-tagging programs, and off feed prior to shipping. This is a dramatic decrease from prior years, since it was not uncommon to have fish off feed for up to 45 days. Although early growth rates exceeded 0.033 inches per day, growth rates were slowed to 0.026 inches per day. Slowing the growth rates has been accomplished through feeding practices and reducing the amount of feed fed per raceway per day, but still continually feeding the fish. Past practices reduced growth rates by holding fish off feed for 5 days at a time.

A total of 369,434 lbs of Rangen and 3,036 lbs of Skretting were fed over the course of the brood year (Appendix 5). The Rangen feed total includes 28,100 lbs of Oxytetracycline (OTC) medicated feed used for three medicated feed treatment during this brood year. OTC was fed allowing for a 21-day withdrawal time prior to stocking, meeting Food and Drug Administration (FDA) requirements.

The total cost of the OTC feed was \$14,644.04. The total cost of regular feed was \$120,742.67. A total of 384,850 lbs of fish were produced on 372,470 lbs of feed for a conversion rate of 0.9678:1. Total NSFH production costs incurred by IPC during the 2006 brood year were \$994,671.57, which includes IPC overhead, fish feed, smolt hauling, and shop expenditures, but do not include capital outlay expenditures. The cost/lb of fish produced was \$ 2.58 (Appendix 7).

Fin quality was assessed in February for Hells Canyon stock, and in March for Pahsimeroi stock using methods developed by the NSFH personnel. NSFH personnel had previously performed fin quality measurements in March and April. However, alterations to the stocking schedule dictated that all fin quality measurements be taken at least 21 days prior to shipping to allow NSFH staff time to meet the FDA required guidelines for withdrawal periods on fish treated with MS-222 anesthetic.

Fins of steelhead reared at NSFH were compared to fins of wild, outmigrating steelhead collected from the Salmon and Pahsimeroi Rivers over a two-year period. The resulting fin index (0.1185) will be used for all fin quality measurements at NSFH.

A total of 80 steelhead from all four of the CWT-tagged raceways, was used for this comparison. After measuring the lengths of the dorsal and pectoral fins, a fork length was taken from each fish. By comparing the average fin length to the average fork length, a fin quality index was calculated. This index was then compared to that of wild steelhead. Results indicate that the fin quality index from fish raised at NSFH was 60% of that of wild fish (Appendix 8). This was a 10% decrease from the 2005 releases using the fin index based on wild steelhead. An increase in fin erosion was likely due to ad-clipping numbers nearly 100,000 fish less than actual fish numbers. This elevated actual densities resulting in the increased fin erosion.

A target smolt size of 170 to 250 mm fork length has been established by NOAA Fisheries to maximize smolt out-migration and minimize the potential for predation by hatchery steelhead on wild salmon. To demonstrate compliance with these criteria, length frequency data were collected prior to shipping to determine fish size at the time of release (Appendix 9). The average length of CWT tagged fish sampled from four raceways one month prior to shipping was 182.84 mm (7.2 inches).

Fish Distribution

The IPC contracted with Neil Ring Trucking of Buhl, Idaho, to transport steelhead smolts to release sites using three IPC tank trailers. Transport of steelhead from NSFH began on March 29 and ended on April 26, 2007. Eighty loads of steelhead (384,850 lbs at 4.85 fish/lb) were transported to the Snake and Salmon rivers (Appendix 6). The first fish were transported to Hells Canyon (Hells Canyon stock), then to the Little Salmon River near Stinky Springs (Hells Canyon stock and then Pahsimeroi stock), then to the Pahsimeroi River below the weir, and finally back to the Little Salmon River to meet requests. Department biologists feel that Pahsimeroi fish do better if stocked after the second week in April (Kent Ball, personal communication 1999).

Steelhead smolt release figures are as follows; Snake River at Hells Canyon Dam (Hells Canyon stock): 527,701 fish (105,850 lbs at 4.99 fish/lb); Little Salmon near Stinky Springs (Hells Canyon stock): 239,868 fish (45,500 lbs at 5.27 fish/lb); Pahsimeroi River below the weir

(Pahsimeroi stock): 830,447 fish (181,300 lbs at 4.58 fish/lb); and the Little Salmon near Stinky Springs (Pahsimeroi stock): 266,738 fish (52,200 lbs at 5.11 fish/lb) (Appendix 6). Total Pahsimeroi production was 233,500 lbs, or 1,097,184 steelhead smolts at 4.7 fish/lb, and total Hells Canyon production was 151,350 lbs, or 767,568 steelhead smolts at 5.07 fish/lb. Total NSFH production for the year was 384,850 lbs, or 1,864,754 fish.

Total survival to release was 90.55% for Pahsimeroi steelhead, while total survival to release for Hells Canyon steelhead was 83.76%. Overall, combined survival to release for NSFH steelhead smolts was 87.63.% (Appendix 4).

FISH HEALTH

Fish health is always a concern at NSFH. The location of NSFH, in the heart of the commercial trout industry, makes it vulnerable to the horizontal transmission of many etiologic agents. Disease problems from IHNV, bacterial furunculosis, ERM, and bacterial coldwater disease (CWD) have caused significant losses in years past (Munson, 1996). In addition, the NSFH and its spring-water source are located directly below agricultural land, exposing both to toxic drift and runoff from chemical application to fields above NSFH. Stringent sanitation programs and fish culture practices are implemented to facilitate disease control.

This brood year none of the fish were vaccinated for furunculosis. NSFH ordered enough vaccine to inoculate 50% of the fish on station. A heavy outbreak of furunculosis in the Chilean commercial fish industry resulted in all vaccine (even vaccine ordered by NSFH 1 year in advance) going to Chile. Vaccinations at NSFH typically begin the third week of August and conclude the second week of September. Aqua Health Limited did not notify NSFH of the vaccine shortage until the first week of August 2006. Aqua Health Limited is the sole supplier for the furunculosis vaccine.

Mortality for the year was above normal. Egg mortality increased this year due to eggs arriving to NSFH infected with soft shell disease. Acute losses due to bacterial cold water disease (CWD) caused by *Flavobacterium psychrophilum* were limited to fry of Hells Canyon stock inside the vats at NSFH. Other losses to CWD were chronic. Clinical CWD was detected in July 2006 in two raceways and 4 vats of Pahsimeroi steelhead. Treatment with OTC-medicated feed was administered with good results. Sub acute losses to furunculosis *Aeromonas salmonicida* were limited to raceways 5 and 6 during early March. This was the first detection of furunculosis at NSFH since 1999 (Burton 2007). An application of OTC - medicated feed was administered prior to release to reduce mortality due to CWD being detected earlier in the rearing cycle. Fish were treated for 10 days with 4% OTC incorporated into the feed in accordance with FDA Investigational New Animal Drug #9332 requirements.

The organosomatic index showed normal values in all categories for both Pahsimeroi and Hells Canyon stocks. Blood work was also taken on both stocks of steelhead at NSFH. Parameter levels for leukocrit and serum protein were normal for the Hells Canyon stock. Mean hematocrit levels and serum protein for the Hells Canyon raceway sampled were 43.95% and 3.845% respectively (Burton 2007).

Mean hematocrit levels and serum protein for the Pahsimeroi raceway sampled were 41.35% and 3.34% respectively (Burton 2007). The condition of fish from both Hells Canyon and Pahsimeroi stocks at liberation was good.

ERM was not isolated again at this facility during the 2006 brood year. A continuing aggressive disease management program at this facility has been effective in controlling mortality due to this etiological agent. During the first 31 years of production at NSFH, (1966-1997), the yearly mortality averaged 30.70%. During the last 6 years of production at NSFH, the average yearly mortality has declined to 11.91%, a decrease of nearly 3 times from the first thirty-one years of production (Appendix 13).

As NSFH reduces egg request numbers and the stated management practices of the inventory continue, a reduction in losses due to MAS and CWD should occur. The reappearance of furunculosis has prompted hatchery staff to continue with furunculosis vaccination as part of the fish health management program at NSFH.

FISH MARKING

Fin Clipping, CWT, and PIT Tags

All hatchery-reared steelhead in the state are marked with an adipose fin clip. Adipose fin clipping is done so that anglers can differentiate between hatchery and wild steelhead. Steelhead were adipose-fin clipped at NSFH between September 18 and October 24, 2006.

Brood year 2006 steelhead were implanted with CWTs from September 11 to September 13, 2006. A total of 159,023 steelhead received CWTs (63,291 Hells Canyon stock, and 95,732 Pahsimeroi stock). Each tag group was held in an individual raceway section so that separate mortality information could be gathered. The CWT groups of 30,000 fish were given a 100-ft section and the one raceway with 60,000 (RCWY 12) was given 200 ft as densities increased. The fish with CWTs (Hells Canyon and Pahsimeroi stock) that were destined for the Little Salmon River were again moved into raceways closer together so that they could be shipped within days of each group. In prior years, the Pahsimeroi stock of fish that were destined for the Little Salmon River were shipped approximately a month later than the Hells Canyon stock fish. This continued practice should allow better evaluation of stock performance, as well as some possible insight into travel times for each stock, and comparisons into prior years' downstream migration times. The first fish that will be evaluated were from returning adults in 2006, and then every succeeding year.

A total of 155,702 CWT-tagged fish were released at three release sites (Appendix 10). A total of 30,806 CWT-tagged fish were released in the Snake River at Hells Canyon Dam from March 23 through March 27, 2007, while 63,422 CWT-tagged fish were released at the Pahsimeroi weir (Pahsimeroi River) between April 10 and April 11, 2007. Both Hells Canyon stock, and Pahsimeroi stock, were released in the Little Salmon River near Stinky Springs for the 2006 brood year. A total of 31,378 CWT-tagged Hells Canyon stock were released at Stinky Springs between April 2, and April 4. The Pahsimeroi stock were released at Stinky Springs between April 4, and April 5, 2007 and totaled 30,096 CWT- tagged fish.

In addition to CWT, other fish were tagged with PIT tags on February 21 2007 (raceways 4, 8, 9, and 12). These computer chips were injected into the body cavities of the fish and information can be accessed as to hatchery origin, length, weight, release watershed, date of release, downstream migration, timing, and travel rates. In this manner, an individual fish can be tracked on its seaward migration without sacrificing the fish.

All mortalities were scanned for PIT-tag detection after tagging had occurred, prior to release and during release. Only four (4) mortalities of PIT-tagged fish occurred after the tagging was completed and prior to release. Consequently, a total of 1,175 PIT-tagged fish were released from NSFH for the 2006 brood year. Of these, a total of 288 PIT-tagged fish were released below Hells Canyon Dam (Hells Canyon stock), while 295 PIT-tagged fish (Hells Canyon stock) and 298 (Pahsimeroi stock) were released in the Little Salmon River near Hazard Creek. In addition, 294 PIT-tagged fish were released at the Pahsimeroi weir in the Pahsimeroi River (Pahsimeroi stock) (Appendix 11).

SPAWN TIMING MANIPULATIONS

Several years ago, the Department consulted University of Idaho geneticist Dr. Madison Powell for recommendations on the proper methods to move the spawn timing back to historical spawning times. Dr. Powell suggested that 10% of early-spawning steelhead and 100% of late-spawning steelhead be spawned if Department personnel desire to move the spawn timing back without impacting the existing program. Department personnel at Pahsimeroi Hatchery attempted to employ these recommendations again this year and will continue to do so in future years. While a high percentage of the early spawn takes were kept, the numbers were small compared to the larger lots kept later (Appendix 14).

Approximately 13.2% of the eggs shipped to NSFH from early spawning adults (3/28-4/10) were utilized for smolt production destined for the Pahsimeroi River, while 9.2% of eggs from the middle of the spawn (4/11-4/24) and 77.6% of eggs from late spawning fish (5/1-5/11) were utilized for smolt production at the Pahsimeroi River. At Oxbow Hatchery, 38.7% of early spawning fish (3/9-4/10) were utilized for smolt production back to Hells Canyon Dam, while 59.5% of the middle of the spawn (4/13-4/24) and 1.8% of eggs from late spawning fish (4/25-4/27) were utilized. Seven lots of fish were spawned and retained at Oxbow Hatchery during March, while only one lot from March (30) was retained for NSFH at the Pahsimeroi Hatchery. Since fish from Oxbow Hatchery are the first to be stocked in the spring, it isn't as critical to move their spawn timing date to a later time to reduce the number of days on feed.

Spawn timing may also be directly correlated to winter river water temperatures. Colder winter river temperatures may delay spawning by delaying egg development in the female based on the temperature unit philosophy. A correlation could exist to associate winter river water temperature with ensuing spawn timing in conjunction with artificially moving the spawn timing back by choosing eggs from later females. In the future, hatchery managers may be able to predict when the bulk of spawning will occur based on winter river water temperatures and spawn timing manipulations from preceding years.

RECOMMENDATIONS

Completed Improvements

Several hatchery improvement projects were completed this past year. Dust-Gard solution was applied again this year to the main springs road to minimize dust and reduce road "washboards". A locksmith worked on all the door locks around the hatchery. The birdnetting was repaired several times. The interior and exterior of the park restroom, parking barriers, and garbage can lids were repainted to cover numerous vandalism inscriptions. All of the septic tanks were pumped this year and the house carpets were all professionally cleaned.

New air lines were purchased to replace one third of the old air lines in the raceways. A new pressure washer was purchased to replace the old broken Karcher washer. The chiller baffle plates were painted with a rust-proof paint. A four-foot high fence with 1" by 2" mesh was installed around the perimeter of the raceways to exclude small mammalian predators. An electrician put new ballasts in the vat room and chiller building for emergency lighting. He also rewired the lower 480-volt outlets over the tailrace for 50-amp service for the clipping trailers. All personnel received professional training to operate the forklift.

IPC shop personnel repaired the bridge brake problems and tightened the bridge cable reel. They also replaced all the worn belts and bearings on the bridge and repaired the broken cooling system for the air blower motors. They installed new brushes on the pond scrubber and repaired a broken main irrigation line near the settling ponds. Shop personnel also strengthened the tailrace walkway by replacing the 4" I-beam with an 8" I-beam. They then welded the tail keyways to the new I-beam. A variance was received from the State Safety Inspector to install catwalks on all the raceway walls, so this work was completed by IPC personnel also. They also replaced the fiberglass disinfection tank with one made of steel and painted with epoxy paint. This should reduce chances of possible water contamination to Rimview when we are using the diversion canal.

Several landscaping projects were also completed this past year. All trees and bushes along the entrance and spring roads, and the visitor path to the springs, were trimmed for better visibility. Dust-Gard was applied to the road to reduce dust and washboards on the road. The wooden park picnic tables were all repaired and painted. Two dead trees in the day park were replaced with new trees. Other trees were cut down to prevent swimmers from accessing the intake pool along a path. Numerous sprinkler heads were replaced for better lawn coverage. Redwood stain was applied to all the parking barrier logs in the park, and the yellow bollards around the property were repainted. Landscaping rock was applied to new areas around the hatchery to make mowing easier and added to existing rock areas. Soil-pep was added around all the trees and bushes on the property, and wildflowers were planted on the border with Rimview Trout Company. Grass was replanted in many areas. Weeds were sprayed in the spring and fall, and fertilizer was applied to all the grounds and park in the spring. New trees were sprayed to prevent codling moth infestations and bat boxes were installed to encourage bats to take up residence and eat mosquitoes carrying West Nile virus.

Needed Improvements

Early Rearing and Incubation

An expansion of the present nursery facility is needed. The number of vats should be based on a desired density index of 0.30 at a fish size of 200 fish/lb or 2.5 inches in length. This expansion would protect fry from bird predation, increase rearing space, eliminate the fry transport program, and provide them with shade from the sun.

Final Rearing

Concrete repair work needs to be completed at 300' on all the raceways, with additional repairs on some raceway walls. Galvanized keyways should be installed to replace the severely rusted steel keyways in the raceways. The birdnetting will have to be replaced in the near future because it requires more maintenance and is starting to deteriorate. The large bridge needs to be professionally sandblasted and painted, and a diesel-powered compressor needs to be purchased so hatchery personnel don't have to borrow the IPC shop compressor or rent one once per month.

A fish counter is needed for better inventory accuracy and management. Other adipose fin clipping equipment needed includes a hydraulic pump unit, and 4 inch pump, 170 feet of 4 inch flexible line with cam locks on both ends, and a new fresh-flow pump for backup water to the trailer. A Kawasaki "Mule" or Cushman is needed for quick trips around the hatchery to haul equipment and save wear and tear on the trucks and mowers.

Employee Safety

A trash rack needs to be installed in front of the intake gate at the upper pool to prevent access to the spring and injury to the public. A trash rack should also be installed at the entrance to the discharge canal to Rimview Hatchery.

The bulk tank, conveyor line, and entrance gates to the outdoor raceways need to be raised. This is a safety issue as the low height of the conveyor line and gate doorways have caused numerous bumps and bruises.

Water Source

An intake-traveling screen is needed to remove leaves and macrophytes from the water at our intake. Entire raceways are in jeopardy every fall when leaves plug head screens during the night. Weeds also break loose from the springs all year long that could plug our head screens.

Building Improvements

A new hatchery and incubation building with functional nursery vats is badly needed. The building should also include public restrooms that are handicapped accessible, an office, shop, meeting room, and an adequate feed storage space. A three-stall garage for the trucks and mowers would be beneficial to protect these items from vandalism and weather.

Sliding glass doors should be installed in the living rooms of the three wood frame houses to allow access to decks and improved access to the outside for fire safety. Bathroom remodeling in all the wood-frame houses is needed, along with some kind of awning or roof over the outside decks for the two residences with the most sun exposure.

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APPENDICES

Appendix 1. NSFH monthly water use allocations.

Month	Max. Flow	Month	Max. Flow
May	50 cfs	November	70 cfs
June	50 cfs	December	90 cfs
July	50 cfs	January	100 cfs
August	50 cfs	February	110 cfs
September	50 cfs	March	120 cfs
October	60 cfs	April	120 cfs

Appendix 2. Volume of water discharged from NSFH to Rimview Trout Company by month from November 2006 to April 2007.

Month	Hatchery Inflow	Flow to Rimview	Discharge Flow to Niagara Springs Crk.
November	70 cfs	0 cfs	70 cfs
December	90 cfs	25 cfs	65cfs
January	90 cfs	25 cfs	65 cfs
February	110 cfs	60 cfs	50 cfs
March	120 cfs	70 cfs	50 cfs
April	80 cfs	45 cfs	35 cfs
May	30 cfs	0 cfs	30 cfs

Appendix 3. Results of annual analysis of NSFH source water, 1994 through 2006.

Analysis	<u>Yearly Results</u>							Maximum Allowable Contaminant Levels
	1994 (mg/l)	2001 (mg/l)	2002 (mg/l)	2003 (mg/l)	2004 (mg/l)	2005 (mg/l)	2006 (mg/l)	
Alkalinity	166	180	170	170	160	170	170	10.0
Antimony	0.002	N/D*	N/D*	N/D*	N/D*	N/D*	N/T*	0.006
Arsenic	0.005	N/D*	N/D*	N/D*	N/D*	N/D*	N/D*	0.05
Barium	0.180	N/D*	N/D*	N/D*	N/D*	N/D*	N/D*	2
Beryllium	0.0002	N/T*	N/T*	N/T*	N/T*	N/T*	N/T*	0.004
Cadmium	0.00034	N/D*	N/D*	N/D*	N/D*	N/D*	N/D*	0.005
Chromium	0.002	N/D*	N/D*	N/D*	N/D*	N/D*	N/D*	0.1
Chloride	N/T	44	45	41	46	44	47	250
Copper	0.010	N/D*	N/D*	N/D*	N/D*	N/D*	.006	1.3
Cyanide	0.005	N/T*	N/T*	N/T*	N/T*	N/T*		0.200
Fluoride	0.570	0.7	N/D*	0.6	N/D*	N/D*	.5	4
Hardness	234	230	240	220	230	230	220	100
Iron	0.010	N/D*	N/D*	N/D*	N/D*	N/D*	.031	0.3
Lead	0.002	N/D*	N/D*	N/D*	N/D*	N/D*	N/D*	0.015
Manganese	N/T	N/D*	N/D*	N/D*	N/D*	N/D*	N/D*	0.05
Mercury	0.0002	N/D*	N/D*	N/D*	N/D*	N/D*	N/D*	0.002
Nickel	0.003	N/D*	N/D*	N/D*	N/D*	N/D*	N/D*	0.1
Nitrate as N	1.630	1.7	1.8	1.4	1.8	2.0	1.7	10
Nitrite as N	0.01	N/D*	N/D*	N/D*	N/D*	N/D*	N/D*	1
PH	8.00	8.2	8.2	7.9	8.1	8.0	7.8	6.5 - 8.5
Selenium	0.005	N/D*	N/D*	N/D*	N/D*	N/D*	N/D*	0.05

*N/D = Not detected

*N/T = Not tested

Appendix 4. NSFH brood year 2006 steelhead survival from egg to smolt .

Source	Eggs Received	Fry Received	Total Received	Fingerlings Released	% Survival Fingerlings	Smolts Released	Total Release	% Survival To Release
Pahsimeroi	595,362	616,260	1,211,622	0	*92.61%	1,097,185	1,097,185	90.55%
Oxbow	446,984	469,396	916,380	0	*88.54%	767,569	767,569	83.76%
Totals	1,042,346	1,085,656	2,128,002	0	*90.86%	1,864,754	1,864,754	87.63%

*Estimated percentages

Appendix 5. NSFH brood year 2006 feed usage.

Manufacturer	Type and Size	Dates Received	Total Pounds Received	Total Pounds Used	Total Feed cost (\$)
Rangen	Trout and Salmon Starter #0	6/07/06-7/31/06	1,250	1,250	689.01
Rangen	Trout and Salmon Starter #1	6/07/06-8/14/06	2,250	2,250	1,248.77
Rangen	Trout and Salmon Starter #2	7/18/06-8/17/06	3,650	3,650	2,150.61
Rangen	Trout and Salmon Starter #3	8/04/06-9/06/06	6,850	6,850	2,541.63
Moore Clark	Clark's Fry 1.5mm ProActive	7/18/06	3,036	3,036	1,882.32
Rangen	Bulk 470 exsl. 2.0mm slow-sink	8/31/06-11/13/06	52,720	52,720	14,400.99
Rangen	Bulk 470 exsl. 3/32 slow-sink	11/24/06-01/04/07	81,700	81,700	34,325.80
Rangen	Bulk 470 exsl. 1/8 slow-sink	1/12/07-4/16/07	192,480	192,480	63,352.64
Rangen	Sack Trout Production TM (8000g) 1/8 pellet	2/07/07-3/20/07	27,500	27,500	14,267.60
Rangen	TM Medicated Feed 4000g #1	6/26/07-8/7/07	600	600	376.44
Rangen	Feed credit 470"exsl" bulk	04/27/2007	-1,180	-1,180	517.83
Rangen	Fines credit "exsl" Bulk	7/13/06-4/27/07	-386	-386	162.31
Grand Total			372,470	372,470	135,386.71

Appendix 6. NSFH brood year 2006 steelhead smolt distribution.

Destination	Stock	Weight	Dates	Number Per Pound	Number Released
Hells Canyon (Snake R.)	H.C.	105,850	3/19-3/29	4.99	527,701
Stinky Springs (Little Salmon R.)	H.C.	45,500	3/29-4/4	5.27	239,868
Pahsimeroi (Pahsimeroi R.)	Pah.	181,300	4/6-4/24	4.58	830,447
Stinky Springs (Little Salmon R.)	Pah.	52,200	4/4-4/5,4/24-4/26	5.11	266,738
Total		384,850		4.85	1,864,754

Appendix 7. NSFH production costs for brood year 2006.

Number of Fish	Lbs of Feed	Cost of Feed	Pounds of Fish	Feed Conversion	Total Cost	Cost per 1,000	Cost per Pound
1,864,754	372,470	\$135,386.71	384,850	.97	\$994,671.57	\$553.41	\$2.58

*Cost includes IPC cost for overhead, smolt hauling and shop expenditures and does not include capital outlay expenditures.

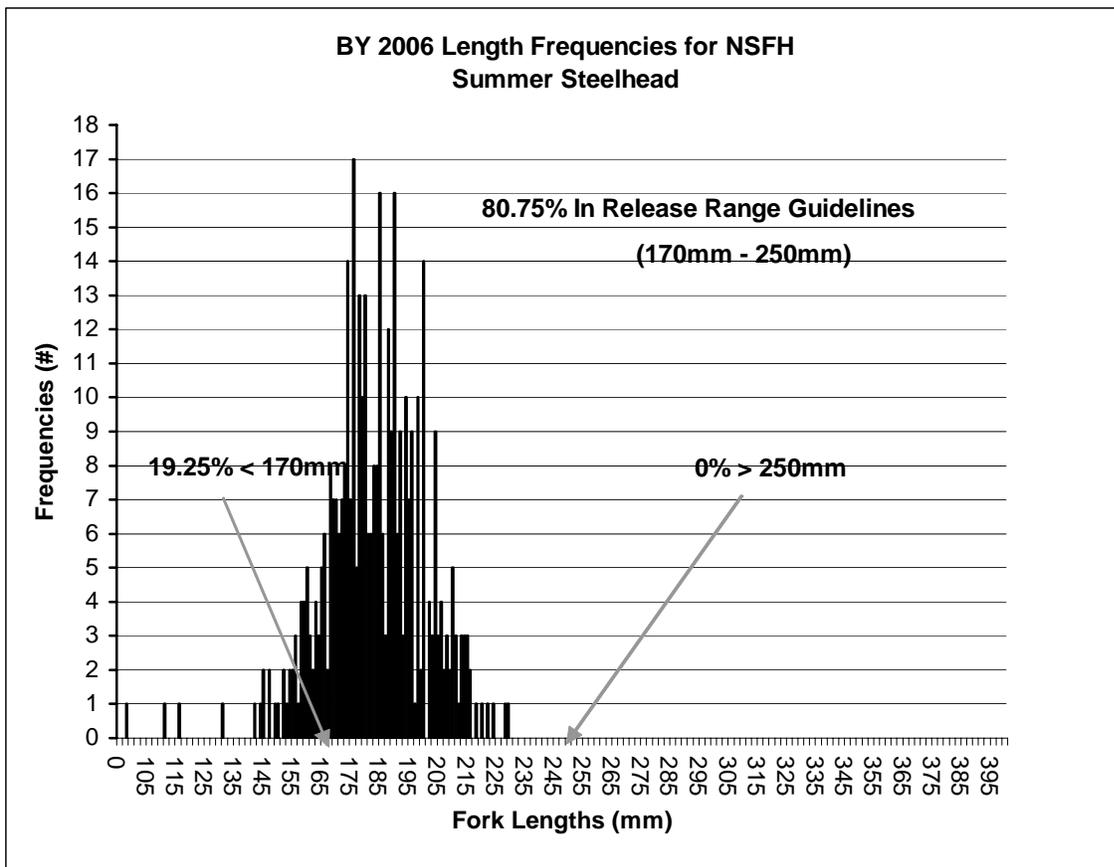
Appendix 8. Fin lengths of NSFH steelhead; one month prior to release 2006.

Raceway	Fork Length	Right Pectoral	Left Pectoral	Dorsal	Ave. Fin Length	Fin Quality Index	Wild Fin Quality Index	Percent of Wild FQI
4	186.3	12.4	16.9	7.6	12.3	.066	0.1185	56%
8	187.7	12	15.9	8.8	12.2	.065	0.1185	55%
9	177	14.9	14.3	9.1	12.7	.072	0.1185	61%
12	201.6	17.1	19	13.6	16.5	.082	0.1185	69%
Average						.071	0.1185	60%

Appendix 9. Fork length frequencies one month prior to release for four Coded Wire-tagged raceways 2006.

Raceway #	H.C. 4	H.C. 8	Pah. 9	Pah. 12
Sample Size	100	100	100	100
Ave. Frk. Length	181.32	182.52	177.19	190.33
Lower Range (mm)	111.00	116.00	72.00	131.00
Upper Range (mm)	222.00	228.00	218.00	229.00

	(mm)	(Inches)
Hells Canyon Average Length	181.92	7.16
Pahsimeroi Average Length	183.76	7.23
Overall Average Length	182.84	7.2



Appendix 10. CWT summary for brood year 2006 steelhead at NSFH.

Raceway	Release Site	CWT Number	Number Tag	Mortality to Release	Number Shed	CWT Number Released	Untagged	Total Tagged Group Release	Total Site Release
Snake River									
4	Hells Canyon Dam	10-14-80	31,352	443	103	30,806	57,994	30,806	
Total			31,352	443	103	30,806	57,994	30,806	527,700
Salmon River									
8	Little Salmon River	10-15-80	31,939	245	316	31,378	66,858	31,378	
Total			31,939	245	316	31,378	66,858	31,378	239,868
Pahsimeroi River									
12	Pahsimeroi Trap	10-50-80	33,528	157	540	32,831	17,114	32,831	
		10-51-80	31,241	147	503	30,591	17,114	30,591	
Total			64,769	304	1,043	63,422	34,228	63,422	830,446
Salmon River									
9	Little Salmon River	10-49-80	30,963	151	716	30,096	61,592	30,096	
Total			30,963	151	716	30,096	61,592	30,096	266,738

Total CWT Release: 155,702
Total Site Releases: 1,864,754
Total Smolt Releases: 1,864,754

Appendix 11. PIT tag summary for brood year 2006 steelhead at NSFH.

Raceway	Release Site	Number Tagged	Number Released	Mortality
4	Hells Canyon Dam Snake River	289	288	1
8	Stinky Springs Little Salmon River	295	295	0
9	Stinky Springs Little Salmon River	298	298	0
13	Pahsimeroi Weir Pahsimeroi River	297	294	3
Totals		1,179	1,175	4

Appendix 12. NSFH production history, BY66 to present.

NIAGARA SPRINGS HATCHERY HATCHERY HISTORY BY66-PRESENT													
YEAR	PAHSIM. Eggs/fry Received	OXBOW Eggs/fry Received	TOTAL Eggs/fry Receive d	TOTAL Yearly MORT.	% MORT Yearly	FALL Releases	Salmon R. SMOLT Release	Hells C. SMOLT Release	SPRING Releases	TOTAL LBS Released	Feed fed Total	Conv.	Fish/lb
1965-66	0	3,085,194	3,085,194	---	---	---	---	---	---	---	---	---	---
1966-67	0	2,605,288	2,605,288	623,533	23.93	29,400	1,364,842	587,513	1,952,355	153,552	305,890	1.99	12.7 1
1967-68	0	3,215,652	3,215,652	1,209,183	37.60	0	1,664,325	342,144	2,006,469	204,251	298,450	1.46	9.82
1968-69	0	2,469,536	2,469,536	695,219	28.15	0	1,665,117	109,200	1,774,317	184,186	280,430	1.52	9.63
1969-70	1,477,695	1,927,727	3,405,422	654,022	19.21	757,500	1,608,000	385,900	1,993,900	299,235	502,410	1.68	6.66
1970-71	1,330,494	1,480,150	2,810,644	305,176	10.86	670,960	1,630,002	0	2,444,860	202,025	384,040	1.90	12.1 0
1971-72	1,439,842	700,061	2,139,903	153,603	7.18	215,625	1,555,050	0	1,770,675	235,375	376,080	1.60	7.52
1972-73	8,850,764	1,819,721	10,670,485	3,105,637	29.10	3,008,664	1,543,349	0	4,556,184	163,839	266,800	1.63	27.8 1
1973-74	3,663,990	1,264,384	4,928,374	2,953,847	59.94	0	1,960,378	0	1,974,527	187,494	319,130	1.70	10.5 3
1974-75	3,160,144	280,098	3,440,242	2,108,426	61.29	0	1,331,280	0	1,331,816	166,640	352,890	2.12	7.99
1975-76	2,234,978	51,559	2,286,537	513,688	22.47	40,977	1,690,390	0	1,731,872	248,708	437,600	1.76	6.96
1976-77	2,487,824	730,862	3,218,686	1,642,383	51.03	0	1,433,675	141,005	1,576,303	251,835	454,762	1.81	6.26
1977-78	2,540,728	517,250	3,057,978	1,229,537	40.21	281,208	1,266,025	0	1,547,233	154,829	370,080	2.39	9.99
1978-79	2,048,350	441,069	2,489,419	426,977	17.15	344,944	1,372,454	0	1,717,498	244,887	643,680	2.63	7.01
1979-80	2,622,425	124,814	2,747,239	203,985	7.43	548,987	1,097,060	348,220	1,994,267	314,100	629,580	2.00	6.35
1980-81	1,697,010	498,416	2,195,426	720,172	32.80	0	862,494	612,760	1,475,254	316,330	622,930	1.97	4.66
1981-82	2,003,418	298,952	2,302,370	953,015	41.39	0	995,205	354,150	1,349,355	374,350	663,850	1.77	3.60
1982-83	2,313,339	253,776	2,567,115	1,431,975	55.78	500,000	542,390	92,750	635,140	181,150	448,860	2.48	3.51
1983-84	2,749,292	709,716	3,459,008	1,849,313	53.46	449,070	752,195	408,430	1,160,625	310,000	632,400	2.04	3.74
1984-85	2,333,760	598,404	2,932,164	613,771	20.93	630,500	1,273,181	414,712	1,687,893	314,650	541,198	1.72	5.36
1985-86	1,332,152	1,582,340	2,914,492	903,999	31.02	330,640	860,358	819,495	1,679,853	339,885	580,850	1.71	4.94
1986-87	1,339,176	935,195	2,274,371	422,476	18.58	39,995	1,011,900	800,000	1,811,900	419,000	557,960	1.33	4.32
1987-88	1,640,040	1,289,029	2,929,069	775,569	26.48	404,000	872,100	877,400	1,749,500	405,515	584,290	1.44	4.31
1988-89	1,256,289	1,213,399	2,469,688	803,488	32.53	0	930,700	735,500	1,666,200	406,800	574,770	1.41	4.10
1989-90	1,925,795	833,397	2,759,192	252,892	9.17	603,000	956,100	947,200	1,903,300	465,400	597,310	1.25	4.09
1990-91	1,966,434	113,190	2,079,624	311,624	14.98	0	856,000	912,000	1,768,000	484,025	632,030	1.28	3.65
1991-92	650,400	691,500	1,341,900	311,400	23.21	0	786,600	243,900	1,030,500	232,500	283,000	1.22	4.43
		812,000	812,000	394,936	48.64	0		417,064	417,064	72,786			5.73
1992-93	Wallowa	1,131,951	2,145,797				761,800	353,600		235,075			
1992-93	Babington		*Babington	Release	In Little	Salmon	*222,560	306,907	**47,089	131,090			
			**Brownlee	Reservoir									
1993-94	954,294	1,509,596	2,463,890	1,263,820	54.89	0	928,981	609,115	1,538,096	350,151	440,143	1.26	4.40
1994-95	1,042,728	1,099,915	2,142,643	281,034	13	160,000	741,180	960,429	1,701,609	376,060	489,960	1.29	4.52
1995-96	1,400,000	1,397,103	2,797,103	906,008	32.4	157,600	890,135	843,360	1,733,495	352,750	429,528	1.22	5.00
1996-97	1,297,250	1,303,599	2,600,849	698,156	26.84	149,040	1,093,002	660,651	1,753,653	370,520	421,144	1.14	4.79
1997-98	1,434,497	1,211,977	2,646,474	992,649	37.5	0	942,430	711,395	1,653,825	361,745	412,624	1.14	4.57
1998-99	1,412,000	1,393,383	2,805,383	759,809	27.08	60,634	1,185,535	657,665	1,843,200	444,455	484,110	1.09	4.63
1999-00	1,712,675	1,133,871	2,846,546	281,131	9.87	364,923	1,011,633	792,902	2,295,605	457,626	469,043	1.02	4.30
2000-01	1,416,442	1,045,825	2,462,267	100,330	4.07	431,133	1,351,337	579,467	1,930,804	459,580	473,540	1.03	4.29
2001-02	1,502,313	950,907	2,453,220	137,481	5.60	478,586	1,310,985	526,168	1,837,153	454,430	442,864	0.98	4.11
2002-03	1,161,547	919,416	2,080,963	224,277	10.78	0	1,330,802	525,884	1,856,686	417,275	415,155	0.99	4.45
2003-04	1,151,911	921,800	2,073,711	185,403	8.94	0	1,355,364	532,944	1,888,308	409,050	388,744	0.95	4.61
2004-05	1,133,186	924,927	2,058,113	353,035	17.15	0	1,179,054	526,024	1,705,078	369,600	368,040	0.99	4.61
2005-06	1,129,690	891,760	2,021,450	208,576	10.32	0	1,292,416	520,458	1,812,874	402,306	364,435	0.95	4.51
2006-07	1,211,622	916,380	2,128,002	263,248	12.37	0	1,337,054	527,700	1,864,754	384,850	372,470	0.97	4.85

Appendix 13. Oxbow and Pahsimeroi stock spawn timing manipulations at NSFH for brood year 2006.

Hells Canyon Stock Eggs Used for Production Purposes				Pahsimeroi Stock Eggs Used for Production Purposes			
Lot Number	Spawn Date	Percent of Eggs Available Utilized for Smolt Production	Percent of Total Smolts Utilized for Production Back to Rack	Lot Number	Spawn Date	Percent of Eggs Available Utilized for Smolt Production	Percent of Total Smolts Utilized for Production Back to Rack
1	03/09/06	61%	1.8%	1	03/28/06	0%	0.0%
2	03/13/06	100%	3.5%	2	03/30/06	5%	1.1%
3	03/16/06	100%	3.1%	3	04/03/06	0%	0.0%
4	03/20/06	100%	6.8%	4	0406/06	56%	12.1%
5	03/23/06	75%	6.3%	5	04/10/06	0%	0.0%
6	03/27/06	100%	6.3%	6	04/11/06	37%	8.9%
7	03/30/06	51%	0.3%	7	04/13/06	0%	0.0%
8	04/03/06	63%	0.7%	8	04/17/06	0%	0.0%
9	04/06/06	83%	1.1%	9	04/18/06	5%	0.3%
10	04/10/06	76%	8.8%	10	04/24/06	0%	0.0%
11	04/13/06	100%	26.3%	11	04/25/06	40%	8.8%
12	04/17/06	100%	17.7%	12	0427/06	100%	21.5%
13	04/20/06	100%	13.7%	13	05/01/06	100%	21.4%
14	04/24/06	100%	1.8%	14	05/04/06	51%	6.6%
15	04/27/06	100%	1.8%	15	05/08/06	100%	6.5%
				16	05/11/06	100%	12.8%

Submitted by:

Approved by:

Jarrett L. Page
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Steve Yundt, Chief
Fisheries Bureau

Jerry Chapman
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Tom Rogers
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