NIAGARA SPRINGS FISH HATCHERY

2008 Steelhead Brood Year Report

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ABSTRACT

Niagara Springs Fish Hatchery (NSFH) received 2,217,881 steelhead (*Oncorhynchus mykiss)* eggs and fry during the 2008 brood year. A total of 1,213,185 Pahsimeroi stock eggs and fry (786,756 eggs and 426,429 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. Approximately 35% of the Pahsimeroi egg lots were shipped to NSFH as first feeding fry. A total of 1,004,696 Hells Canyon stock eggs and fry (338,061 eggs and 666,635 swim-up fry) were received from Oxbow Hatchery. Two thirds (66.4%) of the Hells Canyon egg lots were shipped to NSFH as first feeding fry.

Total production for the 2008 brood year at NSFH was 2,028,909 fish (440,900 lbs). Total smolt production was 1,774,844 steelhead (437,850 lbs). Excess fish were available to be stocked as fall releases for the first time since 2001. NSFH stocked 254,065 fingerlings totaling 3,050 lbs into Salmon Falls Creek Reservoir.

A total of 1,774,844 steelhead smolts (437,850 lbs averaging 4.05 fish/lb) were released into the Snake and Salmon rivers from March 23 to May 4, 2009. A total of 825,525 smolts (225,400 lbs at 3.66 fish/lb) of Pahsimeroi stock were released in the Pahsimeroi River at the weir, and 178,849 smolts (45,150 lbs at 3.96 fish/lb) of Pahsimeroi stock were released in the Little Salmon River at Stinky Springs. A total of 526,743 smolts (113,550 lbs at 4.64 fish/lb) of Hells Canyon stock were released in the Snake River at Hells Canyon Dam, and 243,727 smolts (53,750 lbs at 4.53 fish/lb) of Hells Canyon stock were stocked in the Little Salmon River at Stinky Springs.

Mortalities from pathogens decreased this year (7.76% compared to 16.46% for BY 2007). NSFH vaccinated 53% of the total steelhead production for furunculosis (*Aeromonas salmonicida).* NSFH did not vaccinate for enteric redmouth disease (ERM-*Yersinia ruckerii)* during this brood year. Furunculosis, ERM, Infectious Pancreatic Necrosis Virus (IPNV), and Infectious Hematopoietic Necrosis Virus (IHNV) were not isolated during the 2008 brood year. An epizootic caused by bacterial coldwater disease (CWD-*Flavobacterium psychrophilum)* occurred in August 2008. NSFH implemented an oxytetracycline feed treatment with good results. *F. psychrophilum* was detected again in January and March 2009 during routine fish health inspections.

A total of 432,562 lbs of Rangen fish feed was fed at a cost of $244,414.39 to produce 440,900 lbs of steelhead for a conversion rate of 0.981:1.

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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 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. 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 ft^3 of hatching and early rearing space. The nursery tanks are supplied by constant temperature, gravity flow, spring water.

The outdoor rearing space consists of nineteen raceways (300-ft x 10-ft), (142,500 ft^3), 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 $lbs/ft^3/in$ as recommended by Piper (1982).

Two flow-through settling ponds (150-ft x 60-ft), (72,000 ft^3) 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.

Water analysis is performed quarterly in accordance with the EPA National Pollutant Discharge Elimination System permit. 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 (RARC) for nutrient and total suspended solids analysis.

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 modular 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 12-ft), an open front shed (10-ft x 30-ft), and 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. The total discharge from Niagara Springs is approximately 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 the Niagara Springs water whereby NSFH will receive water according to a stepped flow chart (Appendix 1). IPC holds a water right for NSFH 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 Morgan Fife, Fish Culturists, handle most operational duties. During peak work activities there are several Bio Aides throughout the year. Lonnie Medina, Michael Hart, Brandon Cox, and Zach Welch 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 slow embryonic development, steelhead eggs spawned at Pahsimeroi Hatchery (PFH) were transported by aircraft to Oxbow Hatchery (OFH) for incubation in chilled well water (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 OFH, a 70 horsepower chiller unit was utilized to chill 52°F well water to 43°F for incubation. PFH does not yet have a chiller unit for this purpose. The

NSFH received both eggs and fry for the 2008 brood year (Appendix 4). Of the Pahsimeroi stock eggs incubated at OFH and destined for NSFH, approximately two-thirds (64.85%) were delivered to NSFH as eyed eggs while the remaining (35.15%) 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 786,756 eyed-eggs of Pahsimeroi stock from June 10 through June 16, 2008. These shipments came from egg lots 6-10. A total of 426,429 Pahsimeroi stock swim-up fry, from egg lots 1-3, were received from June 13 through July 23, 2008. A total of 1,213,185 Pahsimeroi stock eggs and fry were received at NSFH for the 2008 brood year.

A total of 338,061 eyed-eggs of Hells Canyon stock (lots 13-15) were shipped to NSFH on May 28, 2008. Egg lots 4-18 were transported to NSFH as swim-up fry (666,635) between June 10 and June 26, 2008, 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 1,004,696 eggs and fry of Hells Canyon stock were received at NSFH for the 2008 brood year. NSFH's steelhead survival for brood year 2008 is summarized in Appendix 4.

Upon arrival at NSFH, all eggs were tempered and disinfected with Ovadine at 100-ppm for 30 minutes and placed in upwelling incubators (25,250 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 increased survival of Pahsimeroi stock received as eyed eggs and swim up fry. Survival of fry to fingerling was estimated at 92.69% in Pahsimeroi steelhead and 93.39% in Hells Canyon steelhead. This year, fry were given a treatment of Florfenicol, which began two days after swim up. This was done to prevent predictable outbreaks of CWD which have plagued fry just after swim up in recent years. Overall, fry to fingerling survival was 93.00%.

Nursery sections in the raceways were screened at both ends and remained expanded from 20-ft to 35-ft in length for raceways that receive swim up fry directly from OFH, and were screened from 20-ft to 50-ft for raceways that receive fry from the indoor vats. 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 thus decreasing the cleaning times required when using the standard keyway distances, yet still allows densities to be lowered for better 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 21,000 to 32,000 untagged steelhead per raceway, depending on the stock and tagging requests. In the production cycle, these 21,000 to 32,000 fish require less or more than the normal 100-ft raceway sections depending on the number and size of the fish. Installing new screen brackets at 250-ft allows for better cleaning, feeding and density control. Fish are given more room before they attain a density index of 0.30 lb/ft^3/in. All of these fish culture practices are now standard protocol.

Throughout the entire early rearing period, steelhead at NSFH were fed Rangen dry feeds. Feed was dispensed by hand and supplemented with Ziegler belt feeders in the indoor and outdoor nursery areas. When the steelhead reached 75 fish/lb, all NSFH fish were switched to a Rangen 470 exsl slow sink diet. The switch to Rangen bulk feed allowed NSFH staff to utilize the bulk tanks, feed conveyor system, fines separator, and bridge feeders.

Final Production Rearing

Adipose fin-clipping (ad-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 of the fish are clipped and put into the upper 100-ft of the raceway, while the other half are clipped into the upper 100-ft section of the adjacent even-numbered raceway. Hells Canyon fish were placed in raceways 1 through 8, while Pahsimeroi fish were placed in raceways 9 through 19. Brood Year 2008 marked the second brood year all the fish on station were marked using the new Mobile Automated Tagging System (MATS).

Ad-clipping operations started on September 9, and were completed by September 15, 2008. Utilizing the MATS system during brood year 2008 resulted in the following benefits; fish were ad-clipped earlier in the rearing cycle (ad-clipping usually began in mid-September for brood years prior to 2007), and the process was completed faster (a 3-week decrease in clipping time compared to brood year 2006).

Fish were given the final 100-ft of rearing space in early January. 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, length frequency and fin quality data 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 6 days to slow their growth, and 14 days for other fish culture reasons. Hells Canyon steelhead were off feed for 11 days to slow their growth and 12 days for other fish culture reasons. These reasons include; vaccination, sample counts, ad-clipping, CWT and PIT-tagging programs, and stocking operations. This is a dramatic decrease from prior years, when 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 later in the rearing cycle. Slowing the growth rates has been accomplished through feeding practices which reduce the amount of feed fed per raceway per day, but still involve feeding 7 days per week.

A total of 432,562 lbs of Rangen was fed over the course of the brood year (Appendix 5). The Rangen feed total includes 557 lbs of Aquaflor top dressed feed, and 37,100 lbs of

Oxytetracycline (OTC) medicated feed used for two medicated feed treatments 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 Aquaflor feed was $336.03, the OTC feed was $29,839.53, and the total cost of regular feed was $214,238.83. A total of 440,900 lbs of fish were produced on 432,562 lbs of feed for a conversion rate of 0.981:1. Total NSFH production costs incurred by IPC during the 2008 brood year were $1,230,930.78 which includes IDFG overhead, smolt hauling, and shop expenditures, but does not include capital outlay expenditures. The cost/lb of fish produced was $2.81 (Appendix 7).

Fin quality assessments using methods developed by the NSFH personnel was done in March to comply with 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, out-migrating steelhead collected from the Salmon and Pahsimeroi rivers over a two-year period. Twenty fish were sampled from four CWT raceways (80 total), for this comparison. After measuring the lengths of the dorsal and pectoral fins, a fork length measurement 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 71% of that of wild fish (Appendix 8). This was a 2% increase from brood year 2007 fish. .

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 evaluate compliance with these criteria, length frequency data were collected prior to stocking. One hundred fish were sampled from four of the CWT raceways (400 total). Of the fish sampled, 94.25% (377 of 400) fell within release guidelines (Appendix 9). The average length of CWT fish sampled from four raceways in March was 208.15 mm (8.2 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 23 and ended on May 4, 2009. Eighty eight loads of steelhead (437,850 lbs averaging 4.05 fish/lb) were transported to the Snake and Salmon rivers (Appendix 6). The first fish were transported to the Snake River at Hells Canyon Dam (Hells Canyon stock), then to the Little Salmon River at 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).

Steelhead smolt release figures are as follows; Snake River at Hells Canyon Dam (Hells Canyon stock): 526,743 fish (113,550 lbs at 4.64 fish/lb); Little Salmon at Stinky Springs (Hells Canyon stock): 243,727 fish (53,750 lbs at 4.53 fish/lb); Pahsimeroi River below the weir (Pahsimeroi stock): 825,525 fish (225,400 lbs at 3.66 fish/lb); and the Little Salmon River at Stinky Springs (Pahsimeroi stock): 178,849 fish (45,150 lbs at 3.96 fish/lb) (Appendix 6). Total Pahsimeroi production was 270,550 lbs, or 1,004,374 steelhead smolts at 3.71 fish/lb, and total Hells Canyon production was 167,300 lbs, or 770,470 steelhead smolts at 4.61 fish/lb. Total

NSFH smolt production for the year was 437,850 lbs, or 1,774,844 fish. In addition, NSFH stocked 254,065 fingerlings totaling 3,050 lbs into Salmon Falls Creek Reservoir. These fish were supplemental to fulfilling mitigation goals of the Snake and Salmon rivers.

Total survival to release was 91.88% for Pahsimeroi steelhead, while total survival to release for Hells Canyon steelhead was 90.99%. Overall, combined survival to release for NSFH steelhead smolts was 91.47% (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 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.

Just over half (53%) of the brood year 2008 fish were vaccinated with an autogenous *Aeromonas salmonicida* bacterin obtained from Aqua Health Limited. Fish were dipped in an oxygenated, vaccination solution of 18 liters of water to 2 liters of vaccine with a one-percent (1%) salt solution incorporated into the vaccine. The salt solution was introduced to the vaccination protocol to reduce stress brought about by physical handling and to increase the uptake of vaccine by the fish. Vaccine was applied at a rate of 220 lbs of fish per liter of vaccine, for 40 seconds.

The vaccination program started on September 17 and ended on October 3, 2008. Average fish size at the time of vaccination was 60.71 fish/lb. Furunculosis was a problem in brood year 2006 when vaccine was unavailable due to high demand from commercial hatcheries in Chile. Hatchery personnel decided to vaccinate over 50% of the brood year 2008 steelhead population. There were no outbreaks of furunculosis, and the pathogen was not detected in any fish sampled this brood year, so it may be inferred that the vaccination was a success. Due to the furunculosis outbreak during brood year 2006, and the lack of outbreaks during years when at least 50% of the population is vaccinated, NSFH will continue to vaccinate all future brood years. Mortalities were recorded on all the raceways each month after vaccination until stocking (Appendix 12).

Mortality for the year was below normal. All fish were placed on feed which was top dressed with Florfenicol two days after swim up with favorable results. Acute losses due to CWD were not observed early in the rearing cycle this brood year as we have seen in past years, so it can be inferred the treatment was a success. An epizootic caused by CWD occurred in August 2008. NSFH implemented an OTC feed treatment with good results. An additional application of OTC medicated feed was administered prior to release to reduce mortality due to CWD bacteria detected during a routine fish health inspection in January 2009. This was done to prevent predictable outbreaks of CWD which have a history of causing acute losses just prior to smolt release when raceway densities are highest and the fish are the most vulnerable. Fish were treated for 10 days with 8,000grams/ton OTC incorporated into the feed. FDA requirements for a 21 day withdraw period prior to stocking were met.

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. Leukocrit and serum protein levels were within normal parameters for the Hells Canyon and Pahsimeroi stock. Leukocrit, hematocrit, and serum protein levels are used as an indicator of fish health and are compared from year to year. As fish produce more white blood cells to combat infections, leukocrit and serum protein levels increase. Stress and smolting may also cause an increase in these levels, which are generally an indication that the immune system has been stimulated (Burton 2009). Mean hematocrit levels and serum protein for the Hells Canyon raceway sampled were 40.7% and 5.99% respectively (Burton 2009). Mean hematocrit levels and serum protein for the Pahsimeroi raceway sampled were 43.1% and 7.33% respectively (Burton 2009). The condition of fish from both Hells Canyon and Pahsimeroi stocks at liberation were within normal parameters.

Furunculosis, IHNV, IPNV, and ERM were not isolated at this facility during the 2008 brood year. A continuing aggressive disease management program at this facility has been effective in controlling mortality due to these etiological agents. As NSFH continues to follow strict fish culture practices a reduction in losses due to infectious agents should occur. Hatchery personnel will need to investigate some of the new feeds breaking into the market. These feeds might help fin quality, survival, or any number of fish health parameters while balancing gains verses costs (Munson 2003). Hatchery staff will continue current vaccination protocol.

FISH MARKING

Fin Clipping, CWT, and PIT Tags

All hatchery-reared steelhead in the state are marked with an adipose fin clip. Ad-clipping is done so that anglers can differentiate between hatchery and wild steelhead. Steelhead were ad-clipped at NSFH between September 9 and September 15, 2008.

Brood year 2008 steelhead were implanted with CWTs from September 9 to September 13, 2008. A total of 94,937 steelhead received CWTs (42,313 Hells Canyon stock, and 52,624 Pahsimeroi stock). Each tag group was held in an individual 100-ft raceway section so that separate mortality information could be gathered. The fish with CWTs (Hells Canyon and Pahsimeroi stock) that were destined for the Little Salmon River were moved into raceways closer together so that they could be shipped within days of each other. In brood years prior to 2003, the Pahsimeroi stock of fish that were destined for the Little Salmon River were shipped approximately one month later than the Hells Canyon stock fish. This continued practice should allow better evaluation of stock performance, as well as providing some possible insight into travel times for each stock, and comparisons with prior years' downstream migration rates.

A total of 92,424 CWT fish were released at three release sites (Appendix 10). A total of 20,231 CWT fish were released in the Snake River at Hells Canyon Dam from March 30 & 31, 2009, while 31,563 CWT fish were released at the Pahsimeroi weir (Pahsimeroi River) between April 17 and April 20, 2009. Both Hells Canyon stock, and Pahsimeroi stock, were released in the Little Salmon River at Stinky Springs. A total of 20,790 CWT-tagged Hells Canyon stock were released in the Little Salmon River between April 6, and April 9. The Pahsimeroi stock were released in the Little Salmon River from April 9 & 10, 2009 and included 19,840 CWT fish.

In addition to the CWT fish, 25,062 fish were tagged with PIT tags from January 12 -13, 2009 (raceways 2, 5, 7, 9, 11, 13, 15, 17). These computer chips are injected into the body cavities of the fish and information can be accessed as to hatchery origin, length, and weight, and 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 45 mortalities of PIT-tagged fish occurred after the tagging was completed and prior to release. However a fish kill occurred during shipping on March 25, 2009 when a driver overloaded one compartment of a fish tanker. This resulted in an additional 553 mortalities of PIT-tagged fish (total loss was 3,836 lbs at 4.37 f/lb totaling 16,761 smolts). Consequently, a total of 24,464 PIT-tagged fish were released from NSFH for the 2008 brood year. Of these, a total of 7,400 PIT-tagged fish were released below Hells Canyon Dam (Hells Canyon stock), while 4,175 PIT-tagged fish (Hells Canyon stock) and 2,581 (Pahsimeroi stock) were released in the Little Salmon River at Stinky Springs, and 10,308 PIT-tagged fish were released at the Pahsimeroi weir in the Pahsimeroi River (Pahsimeroi stock) (Appendix 11).

SPAWN TIMING MANIPULATIONS

Current fish feed technology and ingredients allow hatchery personnel to raise fish to smolt size much faster than in earlier years. Most steelhead smolts reared in southern Idaho are held off feed during the production year so they don't get too large. At times, holding fish off feed for extended periods of time can be detrimental to fish health. Consequently, hatchery personnel prefer eggs taken from later-spawning females.

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 OFH and PFH attempted to employ these recommendations again this year. While a high percentage of the early spawn takes were kept, the numbers were small compared to the larger lots kept later (Appendix 14).

At PFH, approximately 16.5% of the eggs shipped to NSFH from early spawning adults (3/31-4/14) were utilized for smolt production destined for return to the Pahsimeroi River, while 16.3% of eggs from the middle of the spawn (4/17-4/28) and 67.2% of eggs from late spawning fish (5/1-5/15) were utilized for smolt production destined for return to the Pahsimeroi River. At OFH, 41.2% of early spawning fish (3/24-4/14) were utilized for smolt production back to the Snake River at Hells Canyon Dam, while 46.5% of the middle of the spawn (4/17-4/28) and 12.3% of eggs from late spawning fish (5/1-5/12) were utilized for this purpose. Hells Canyon stock fish get stocked sooner in the spring, so it isn't as critical to move the spawn timing of that strain of steelhead back as far as the Pahsimeroi stock fish.

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 road to minimize dust and reduce road "washboards". New removable shade material was purchased for the nursery sections of the raceways. A pressure washer was purchased to help clean new damboards and screens. New clipping trailer pipe stands were constructed to aid with the clipping process. New aluminum keyways and screens were installed in several raceways to allow fish to be moved down as needed to alleviate overcrowding. The birdnetting was repaired several times. The water chiller baffle plates were painted with rust-proof paint and then repainted with a two-part epoxy paint. The chiller building overhead door lift springs were adjusted and new door sealant was installed on the door. Fry tubes were repaired and the bungee cords replaced with metal snaps for better lid attachment. New vat cleaning pipes were installed on one-half the vats to experiment with cleaning efficiency and possibly prevent sac-fry suffocation. New air lines were purchased and installed to replace one third of the old air lines in the raceways. The carpets were all professionally cleaned. A new multipurpose copier was purchased and wired for use by all office computers. Two new chairs were also purchased for the office.

IPC shop personnel repaired the bridge feeder electrical problems and tightened the bridge cable reel. They also constructed a chiller tank support structure on two sides of the failing chiller tank to prevent the two walls from bursting apart. The crew also repaired the broken hatchery incubator line coming from the main spring head-box. IPC shop personnel repaired cracks in the raceway floors and walls by filling them with an epoxy coating. They also removed the old water pumps from the bird sprayer system which is no longer used and performed routine maintenance on the bridge and blower systems. IPC electrical technicians inspected the annubar water measuring device and recalibrated it for better accuracy. Other IPC electricians installed new breakers on all hatchery buildings to meet new guidelines.

Several landscaping projects were also completed this past year. All trees along the entrance and spring roads were trimmed for better visibility. Numerous live elm trees were removed around the intake to reduce the leaves and seeds that plug our raceway intake screens. Elm and Russian Olive trees were removed around the lower falls for better visibility of the falls by tourists. The entire west side of the hatchery outlet was cleaned up and numerous bushes and trees removed for better access to the area. 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. Soil-pep was added around all the trees and bushes on the property, and numerous trees received vitamin spikes to aid growth. Grass was replanted in many areas after weeds were killed. Weeds were professionally sprayed in the spring and fall, and fertilizer was applied to all the grounds and park in the spring. New trees were professionally sprayed to prevent coddling moth infestations.

Needed Improvements

Early Rearing and Incubation

An expansion of the present nursery facility to at least twelve times its present size is needed. The number of vats should be based on a desired density index of 0.30 at a fish size of 130 fish/lb or 2.73 inches in length. This building would protect fry from bird predation, reduce loading densities in the vats, 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. Stainless steel 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. A smaller mesh is recommended to prevent kingfishers from flying through the net. 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 new water chiller tank will be needed to replace the current rusted tank before it bursts apart.

Ad-clipping equipment needed includes a hydraulic pump unit and 4 inch pump with associated intake basket, and 200 feet of 4-inch flexible line with cam locks on both ends.

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. Trash racks should also be installed at the entrance to the discharge canal to Rimview Hatchery and in front of the two intake pipes to the settling basins.

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.

LITERATURE CITED

Burton, D. 2009 Niagara Springs Fish Inspection Report. Department Eagle Fish Health Laboratory. 1800 Trout Road, Eagle, Idaho.

Munson, A. D. 1996. Niagara Springs Fish Inspection Report. Department Eagle Fish Health Laboratory. 1800 Trout Road, Eagle, Idaho.

Munson, A. D. 2003. Niagara Springs Fish Inspection Report. Department Eagle Fish Health Laboratory. 1800 Trout Road, Eagle, Idaho.

Piper, R.G., I.B. McElwain, L..E. Orme, J.P. McCraren, L.G. Fowler, and J.R. Leanard. 1982. Fish Hatchery Management. U.S. Fish and Wildlife Service, Washington, D.C.

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 and Niagara Springs Creek by month from November 2008 to May 2009.

Month	Hatchery Inflow	Discharge to Rimview	Discharge to Niagara Springs Crk.
November	70 cfs	0 cfs	70 cfs
December	90 cfs	22 cfs	68cfs
January	100 cfs	38 cfs	62 cfs
February	110 cfs	60 cfs	50 cfs
March	120 cfs	70 cfs	50 cfs
April	48 cfs	0 cfs	48 cfs
May	0 cfs	0 cfs	0 cfs

Appendix 3. Results of annual analysis of NSFH source water, 1994 through 2008.

	Yearly Results							
Analysis	**1994 (mg/l)**	**2003 (mg/l)**	**2004 (mg/l)**	**2005 (mg/l)**	**2006 (mg/l)**	**2007 (mg/l)**	**2008 (mg/l)**	**Maximum Allowable Contaminant Levels**
Alkalinity	166	170	160	170	170	160	180	10.0
Antimony	0.002	N/D*	N/D*	N/D*	N/T*	N/T*	N/T*	0.006
Arsenic	0.005	N/D*	N/D*	N/D*	N/D*	.007	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	41	46	44	47	40	50	250
Copper	0.010	N/D*	N/D*	N/D*	.006	.006	N/D*	1.3
Cyanide	0.005	N/T*	N/T*	N/T*	N/T*	N/T*	N/T*	0.200
Fluoride	0.570	0.6	N/D*	N/D*	.5	1.0	.07	4
Hardness	234	220	230	230	220	200	260	100
Iron	0.010	N/D*	N/D*	N/D*	.031	.022	N/D*	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*	.013	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	1.4	1.8	2.0	1.7	1.6	2.2	10
Nitrite as N	0.01	N/D*	N/D*	N/D*	N/D*	N/D*	N/D*	1
PH	8.00	7.9	8.1	8.0	7.8	7.3	7.6	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 2008 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	786,756	426,429	1,213,185	110,313	*92.69%	1,004,374	1,114,687	91.88%
Oxbow	338,061	666,635	1,004,696	143,752	*93.39%	770,470	914,222	90.99%
Totals	**1,124,817**	**1,093,064**	**2,217,881**	**254,065**	***93.00%**	**1,774,844**	**2,028,909**	**91.47%**

*Estimated percentages

Appendix 5. NSFH brood year 2008 feed usage.

Manufacturer	Type and Size	Dates Received	Total Pounds Received	Total Pounds Used	Total Feed cost ($)
Rangen	Trout and Salmon Starter #0	6/02/08	750	750	$920.87
Rangen	Aquaflor Medicated Feed #0	6/10/08	600	557	$336.03
Rangen	Trout and Salmon Starter #1	6/02/08	2,250	2,250	$1,657.58
Rangen	TM Medicated Feed 4000g #2	8/11/08	950	950	$859.24
Rangen	Trout and Salmon Starter #2	7/07-8/07/08	5,250	5,250	$4,106.18
Rangen	TM Medicated Feed 4000g #3	8/11-8/19/08	1,100	1,100	$818.32
Rangen	Trout and Salmon Starter #3	7/28-9/16/08	9,950	9,950	$8,763.25
Rangen	Bulk 470 exsl. 2.0mm slow-sink	9/02/-11/16/08	49,700	49,700	$30,028.74
Rangen	Bulk 470 exsl. 3/32 slow-sink	11/13-12/09/08	64,100	64,100	$38,729.25
Rangen	Bulk 470 exsl. 1/8 slow-sink	12/18/08-4/17/09	263,380	263,380	$130,174.58
Rangen	Sack Medicated feed TM (8000g) 1/8 pellet	2/13-3/10/09	35,050	35,050	$28,161.97
Rangen	Fines credit "exsl" Bulk	1/06-5/13/09		-474	-$141.62
	Grand Total		433,080	432,562	$244,414.39

Appendix 6. NSFH brood year 2008 steelhead smolt distribution.

Destination		Stock	Weight	Dates	Number Per Pound	Number Released
Hells Canyon	(Snake R.)	H.C.	113,550	3/23-4/02	4.64	526,743
Stinky Springs	(Little Salmon R.)	H.C.	53,750	4/02-4/09	4.53	243,727
Pahsimeroi	(Pahsimeroi R.)	Pah.	225,400	4/13-5/03	3.66	825,525
Stinky Springs	(Little Salmon R.)	Pah.	45,150	4/09-4/10,5/4	3.96	178,849
Total			**437,850**		**4.05**	**1,774,844**

Appendix 7. NSFH production costs for brood year 2008.

Number of Fish	Lbs of Feed	Cost of Feed	Pounds of Fish	Feed Conversion	Total Cost	Cost per 1,000	Cost per Pound
2,045,671	432,562	$244,414.39	440,900	0.981	$1,230,930.78	$601.72	$2.79

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

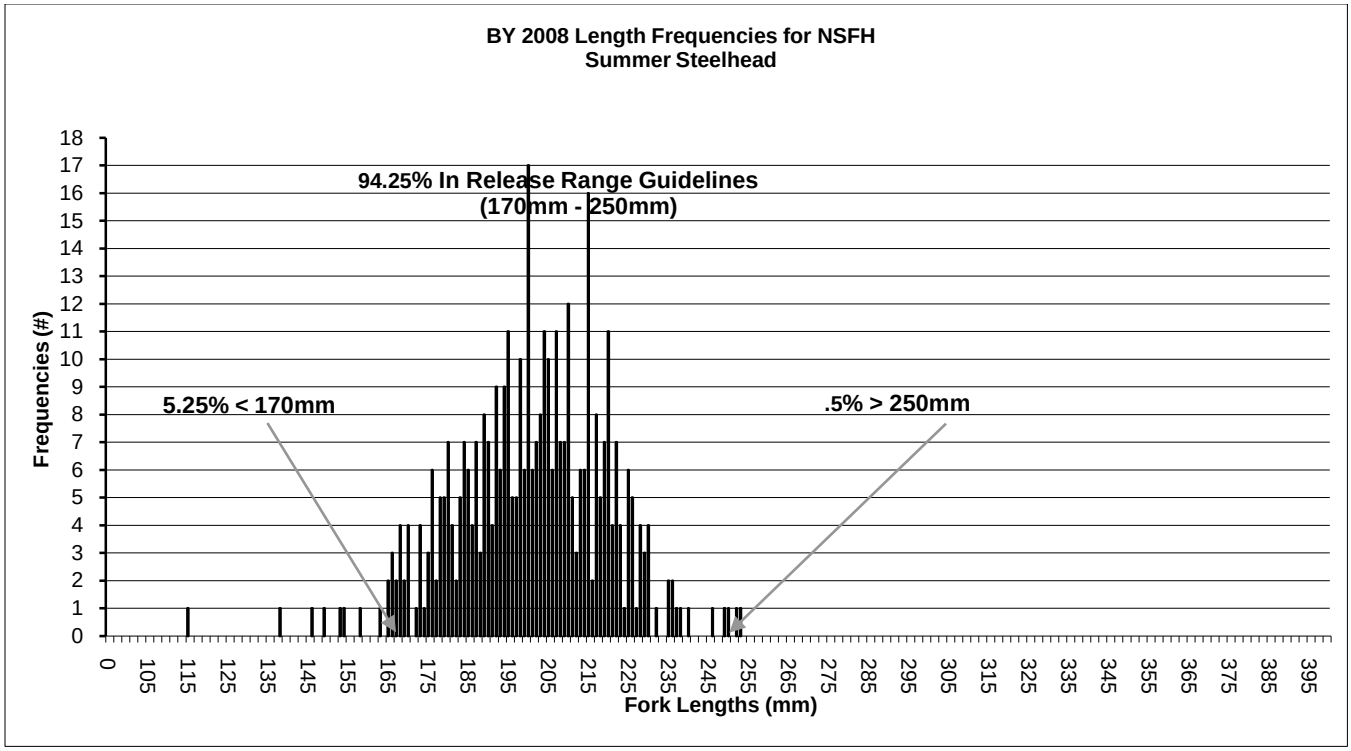
Appendix 8. Fin quality index of NSFH steelhead; March 2009.

Raceway	Fork Length	Right Pectoral	Left Pectoral	Dorsal	Ave. Fin Length	Fin Quality Index	Wild Fin Quality Index	Percent of Wild FQI
4	198.8	18.4	19.3	12.2	16.6	.084	0.1185	71%
8	198.0	20.3	17.6	13.8	17.2	.087	0.1185	73%
9	205.3	19.8	16.1	14.1	16.7	.081	0.1185	68%
12	197.3	18.1	18.9	13.9	16.9	.086	0.1185	72%
Average	199.85	19.2	17.98	13.5	16.85	.0845	0.1185	**71%**

Appendix 9. Fork length frequencies at release for four Coded Wire-tagged raceways; March 2009.

Raceway #	H.C. 4	H.C. 8	Pah. 9	Pah. 12
Sample Size	100	100	100	100
Ave. Frk. Length	201.73	201.77	203.48	196.48
Lower Range (mm)	153.00	115.00	149.00	165.00
Upper Range (mm)	237.00	263.00	235.00	230.00

	(mm)	(Inches)
Hells Canyon Average Length	203.75	8.02
Pahsimeroi Average Length	212.55	8.37
Overall Average Length	**208.15**	**8.2**



Appendix 10. CWT summary for brood year 2008 steelhead at NSFH.

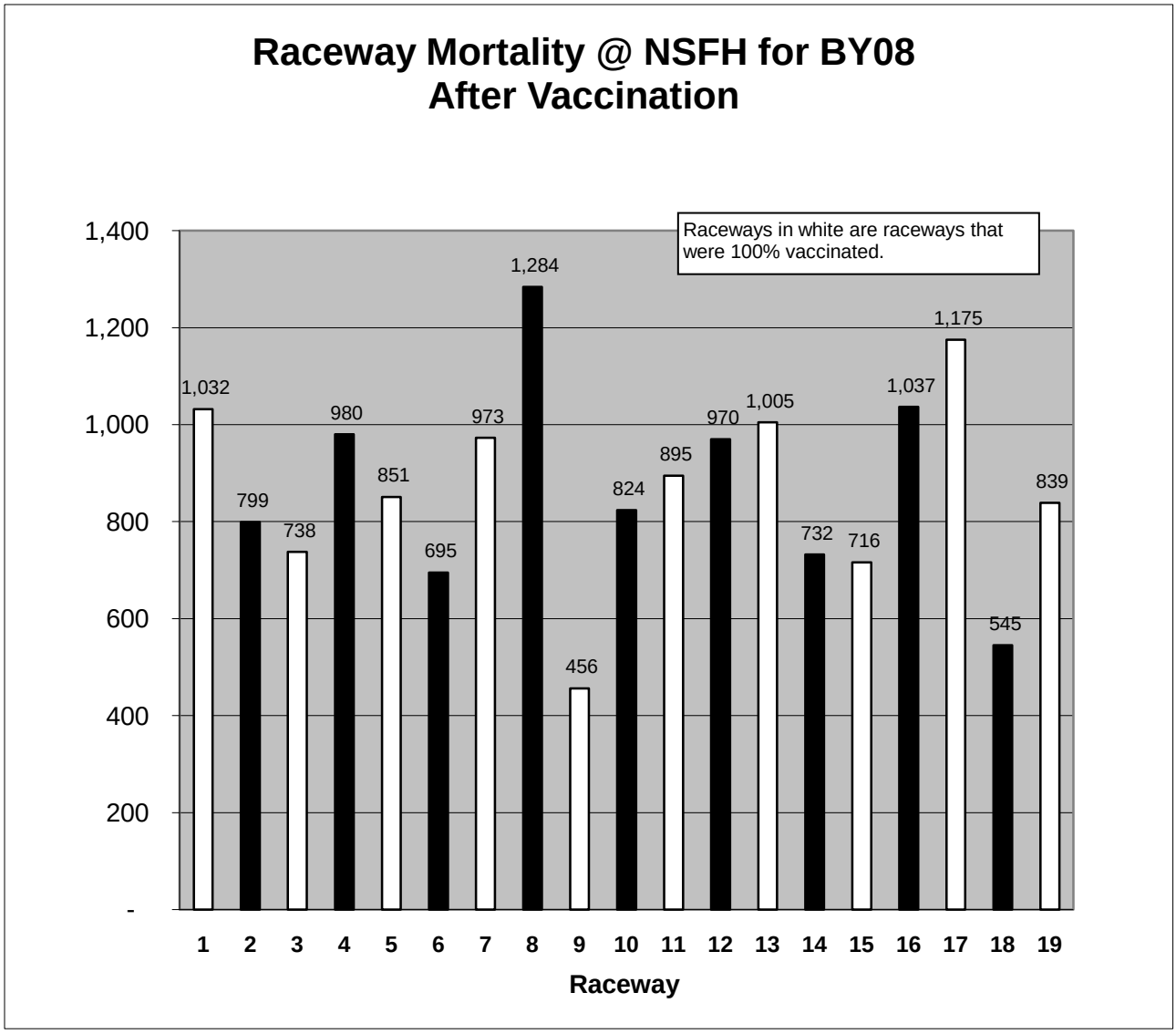
Raceway	Release Site	CWT Number	Number Tag	Mortality to Release	Number Shed	CWT Number Released	CWT Number Untagged	Total Tagged Group Release	Total Site Release
	Snake River								
4	Hells Canyon Dam	10-13-71	21,078	151	696	20,231	78,263	20,231	
Total			**21,078**	**151**	**696**	**20,231**	**78,263**	**20,231**	**526,743**
	Salmon River								
8	Little Salmon River	10-74-70	21,235	169	276	20,790	87,365	20,790	
Total			**21,235**	**169**	**276**	**20,790**	**87,365**	**20,790**	**243,727**
	Pahsimeroi River								
12	Pahsimeroi Trap	10-43-82, 10-15-73	32,297	185	**549**	31,563	59,778	31,563	
Total			**32,297**	**185**	**549**	**31,563**	**59,778**	**31,563**	**825,525**
	Salmon River								
9	Little Salmon River	10-73-70	20,327	60	**427**	19,840	73,796	19,840	
Total			**20,327**	**60**	**427**	**19,840**	**73,796**	**19,840**	**178,849**

Total CWT Release: 92,424
Total Site Releases: 1,774,844
Total Smolt Releases: 1,774,844

Appendix 11. PIT tag summary for brood year 2008 steelhead at NSFH.

Raceway	Release Site	Number Tagged	Number Released	Mortality
2	Hells Canyon Dam Snake River	3,986	3,433	553
5	Hells Canyon Dam Snake River	3,970	3,967	3
7	Stinky Springs Little Salmon River	4,178	4,175	3
9	Stinky Springs Little Salmon River	2,586	2,581	5
11	Pahsimeroi Weir Pahsimeroi River	2,583	2,574	9
13	Pahsimeroi Weir Pahsimeroi River	2,591	2,584	7
15	Pahsimeroi Weir Pahsimeroi River	2,582	2,573	9
17	Pahsimeroi Weir Pahsimeroi River	2,586	2,577	9
Totals		**25,062**	**24,464**	**598**

Appendix 12. Comparison of mortality in vaccinated and non-vaccinated raceways at NSFH for brood year 2008.



Appendix 13. 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 Received	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	12.71
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	12.10
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	27.81
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	10.53
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	812,00	394,936	48.64	0		417,064	417,064	72,786			5.73
	Wallowa												
1992-93	1,131,951	1,013,846	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
2007-08	1,108,682	913,973	2,022,655	332,783	16.46	0	1,152,501	537,371	1,689,872	376,800	379,638	1.01	4.48
2008-09	1,213,185	1,004,696	2,217,881	172,210	7.76	254,065	1,248,101	526,743	1,774,844	437,850	432,562	0.98	4.05

Appendix 14. Hells Canyon and Pahsimeroi stock spawn timing manipulations at NSFH for brood year 2008.

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	03/14/08	0.0%	0.0%	1	03/24/08	0.0%	0.0%
2	03/17/08	0.0%	0.0%	2	03/27/08	60%	9.5%
3	03/21/08	0.0%	0.0%	3	04/03/08	78%	7.0%
4	03/24/08	27%	1.8%	4	04/07/08	0.0%	0.0%
5	03/27/08	25%	1.2%	5	04/10/08	0.0%	0.0%
6	03/31/08	37%	2.8%	6	04/14/08	0.0%	0.0%
7	04/03/08	58%	8.8%	7	04/17/08	46%	0.0%
8	04/07/08	60%	12.3%	8	04/18/08	0.0%	0.0%
9	04/10/08	56%	9.8%	9	04/21/08	0.0%	0.0%
10	04/14/08	65%	4.5%	10	04/24/08	74%	16.3%
11	04/17/08	75%	6.6%	11	04/25/08	0.0%	0.0%
12	04/21/08	92%	3.4%	12	04/28/08	0.0%	0.0%
13	04/24/08	100%	14.5%	13	05/01/08	49%	16.4%
14	04/2808	100%	22.0**%**	14	05/02/08	0.0%	0.0%
15	05/01/08	78%	12.3%	15	05/05/08	60%	20.3%
16	05/05/08	0.0%	0.0%	16	05/08/08	91%	30.5%
17	05/08/08	0.0%	0.0%	17	05/15/08	0.0%	0.0%
18	05/12/08	0.0%	0.0%				---
			---				100%
			100%				

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