NIAGARA SPRINGS FISH HATCHERY

2009 Steelhead Brood Year Report

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February 2011
IDFG 11-102

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ABSTRACT

Niagara Springs Fish Hatchery (NSFH) received 2,150,981 steelhead *Oncorhynchus mykiss* eggs and fry during the 2009 brood year. A total of 1,241,675 Pahsimeroi stock eggs and fry (614,453 eggs and 627,222 swim-up fry) were received from Pahsimeroi Hatchery. Approximately half (50.51%) of the Pahsimeroi egg lots were shipped to NSFH as first feeding fry. A total of 909,306 Hells Canyon stock eggs and fry (442,915 eggs and 466,391 swim-up fry) were received from Oxbow Hatchery. Just over half (51.29%) of the Hells Canyon egg lots were shipped to NSFH as first feeding fry.

Total production for the 2009 brood year at NSFH was 1,969,264 fish (430,225 lbs). Total smolt production was 1,789,794 steelhead (427,794 lbs). Excess fish were available to be stocked as fall releases. NSFH stocked 179,470 fingerlings totaling 2,275 lbs into Salmon Falls Creek Reservoir.

A total of 1,789,794 steelhead smolts (427,950 lbs at 4.18 fish/lb) were released into the Snake and Salmon rivers from March 22 to April 30, 2010. A total of 832,906 smolts (215,000 lbs at 3.87 fish/lb) of Pahsimeroi stock were released in the Pahsimeroi River at the weir, and 145,622 smolts (38,600 lbs at 3.77 fish/lb) of Pahsimeroi stock were released in the Little Salmon River at Stinky Springs. A total of 529,667 smolts (112,400 lbs at 4.71 fish/lb) of Hells Canyon stock were released in the Snake River at Hells Canyon Dam, and 281,599 smolts (61,950 lbs at 4.55 fish/lb) of Hells Canyon stock were stocked in the Little Salmon River at Stinky Springs.

Mortalities from pathogens increased slightly this year (8.45% compared to 7.76% for BY 2008). Overall survival at NSFH was 91.55% for the 2009 brood year. NSFH vaccinated 52.35% of the total steelhead production for furunculosis (*Aeromonas salmonicida*). NSFH did not vaccinate for enteric redmouth disease (ERM-*Yersinia ruckeri*) during this brood year. Furunculosis, ERM, IPN, and IHN were not isolated during the 2009 brood year.

A total of 431,835 lbs of Rangen fish feed were fed at a cost of $249,634.65 to produce 430,225 lbs of steelhead for a conversion rate of 1.009:1.

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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 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 19 raceways (300 ft x 10 ft), (142,500 ft^3), which are supplied by constant temperature, gravity flow, and 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 et al. (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 analysis. Samples are collected only on inflow and discharge water. The RARC conducts the analysis of nutrients and 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 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, a total of nine buildings. 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 Spring's 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 four other users of the Niagara Spring's 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; and 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, Megan McGilvary, and Alex Head 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 were incubated on chilled well water 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 well water to 43°F for incubation. The NSFH received both eggs and fry for the 2009 brood year (Appendix 4). The eggs lots were spawned at Oxbow and Pahsimeroi Hatcheries then delivered to NSFH. Approximately one-half (49.16%) were delivered to NSFH as eyed eggs while the remaining (50.84%) 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 614,453 eyed-eggs of Pahsimeroi stock from June 8 through June 10, 2009. This shipment came from lots 7, 11, and 12. A total of 627,222 Pahsimeroi stock swim-up fry, from egg lots 1-4, were received from June 8 through June 10, 2009 and placed

into outdoor raceways. A total of 1,241,675 Pahsimeroi stock eggs and fry were received at NSFH for the 2009 brood year.

A total of 442,915 eyed eggs of Hells Canyon stock (lots 12-17) were shipped to NSFH on June 5, 2009. A total of 466,391 swim-up fry, from egg lots 1-11, were transported to NSFH between June 12 and June 23, 2009 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. A total of 909,306 eggs and fry of Hells Canyon stock were received at NSFH for the 2009 brood year. NSFH's steelhead survival for brood year 2009 is summarized in Appendix 4.

Egg and fry deliveries are arranged to have fish the appropriate size for AD/CWT marking, yet still be within release guidelines the following spring for smolt shipments. 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 90.18% in Pahsimeroi steelhead and 94.82% 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 bacterial coldwater disease that have plagued fry just after swim up in recent years. Overall, fry to fingerling survival was 92.14%.

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, and were screened from 20 ft to 50 ft for raceways that receive fry from the indoor vats because the fry were larger. 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, which decreases the cleaning times while still allowing densities to be lowered and greater management of inventories to be achieved. 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 30,000 to 32,000 untagged steelhead per raceway, depending on the stock and tagging requests. In the production cycle, these 30,000 to 32,000 fish require different volumes than the normal 100 ft keyway sections provide, depending on the number and size of the fish. 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 are now standard protocol.

Throughout the entire early rearing period, steelhead at NSFH were 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 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 operations are used to split the fish into even-numbered and odd-numbered raceway sections. During this program, fish are crowded to the lower 150 ft section of each odd-numbered raceway. Half the fish are clipped and put into the upper 150 ft of the raceway, while the other half are clipped into the upper 150 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 2009 marked the third brood year all the fish on station were marked using the new Mobile Automated Tagging System (MATS).

Fin-clipping operations started on September 2 and were completed by September 7, 2009. Utilizing the MATS system during brood year 2009 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 December. 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 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 14 days for fish culture reasons. Hells Canyon steelhead were off feed 18 days for fish culture reasons. These reasons include off feed prior to handling for vaccination, sample counts, adipose fin clipping, CWT and PIT-tagging programs, fin and length frequency sampling, 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 0.027 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.

A total of 431,835 lbs of Rangen was fed over the course of the brood year (Appendix 5). The Rangen feed total includes 600 lbs of Aquaflor® top-dressed feed and 35,950 lbs of Oxytetracycline (OTC) medicated feed used for a OTC-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 Aquaflor® feed was $728.54, the OTC feed was $30,290.98, and the total cost of regular feed was $218,952.63. A total of 427,950 lbs of fish were produced on 431,835 lbs of feed for a conversion rate of 1.009:1. Total NSFH production costs incurred by IPC during the 2009 brood year were $1,182,808.89, which includes IPC overhead, smolt hauling, and shop expenditures, but does not include capital outlay expenditures. The cost/lb of fish produced was $2.75 (Appendix 7).

Fin quality assessments using methods developed by the NSFH personnel was done one month 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, out-migrating 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. Twenty fish were sampled from four raceways (80 total) 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 77% of that of wild fish (Appendix 8). This was a 6% increase from brood year 2008 releases using the fin index based on wild steelhead. Steelhead were provided more rearing space earlier in the brood year this year (extended the full 300 feet of raceways about a month earlier in brood year 2009 compared to earlier brood years). A rubber seal was placed on some of the 10' dam boards that are utilized as baffles to facilitate raceway cleaning. The theory is some dorsal fin erosion occurs as fish swim under the baffles, and the rubber would provide a softer, less abrasive surface for the fish as they move under the baffles. More work will be done on this in the future to evaluate if this will allow NSFH to produce steelhead with higher quality fins for release.

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 one month prior to shipping to determine fish size at the time of release (Appendix 9). One hundred fish were sampled from four of the raceways (400 total). Eighty-nine percent of the sample size (357 of 400) fell within release guidelines. The average length of CWT-tagged fish sampled from four raceways was 203.01 mm (7.99 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 22 and ended on April 30, 2010. Eighty-six loads of steelhead (427,950 lbs at 4.18 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 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, 1997).

Steelhead smolt release figures are as follows: Snake River at Hells Canyon Dam (Hells Canyon stock): 529,667 fish (112,400 lbs at 4.71 fish/lb); Little Salmon at Stinky Springs (Hells Canyon stock): 281,599 fish (61,950 lbs at 4.55 fish/lb); Pahsimeroi River below the weir (Pahsimeroi stock): 832,906 fish (215,000 lbs at 3.87 fish/lb); and the Little Salmon River at Stinky Springs (Pahsimeroi stock): 145,622 fish (38,600 lbs at 3.77 fish/lb) (Appendix 6). Total Pahsimeroi production was 253,600 lbs, or 978,528 steelhead smolts at 3.86 fish/lb, and total Hells Canyon production was 174,350 lbs, or 811,266 steelhead smolts at 4.65 fish/lb. Total NSFH smolt production for the year was 427,950 lbs, or 1,789,794 fish.

Total survival to release was 89.60% for Pahsimeroi steelhead, while total survival to release for Hells Canyon steelhead was 94.22%. Overall, combined survival to release for NSFH steelhead smolts was 91.55% (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 springwater 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 (52.35%) of the brood year 2009 fish were vaccinated with an autogenous *Aeromonas salmonicida* bacterin obtained from Western Chemical. 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 14 and ended on September 17, 2009. Average fish size at the time of vaccination was 63.31 fish/lb. Furunculosis was a problem in brood year 2006 when vaccine was unavailable due to high demand from commercial hatcheries in Chile. NSFH decided to vaccinate over 50% of the brood year 2009 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 the vaccination was a success. Due to the furunculosis outbreak during brood year 2006, and the lack of outbreaks during years at least 50% of the population is vaccinated, NSFH will continue to vaccinate at least 50% of the fish in all future brood years. Mortalities were recorded on all the raceways each month after vaccination until shipping (Appendix 12).

Mortality for the year was below normal. All fish were placed on feed that was top dressed with Florfenicol two days after swim-up for 10 days with favorable results. Acute losses due to bacterial coldwater disease (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. Low-level mortalities were encountered in January and February of 2010 due to *Aeromonas hydrophila* (Munson 2010). An application of OTC-medicated feed was administered prior to release to prevent predictable outbreaks of bacterial coldwater disease, which has a history of causing acute losses just prior to releases when raceway densities are highest and the fish are the most vulnerable. Fish were treated for 10 days with 8,000 g/ton OTC incorporated into the feed with a target dose of 3.75 g per 100 pound of biomass treated. Fish were released in accordance with FDA requirements for a 21-day withdrawal period prior to stocking.

A *Gyrodactylus* infestation was treated with 1 ppm potassium permanganate for 1 hour. These treatments were successful in clearing up the infestation.

The organosomatic index showed normal values in all categories for both Pahsimeroi and Hells Canyon stocks. Blood work was not taken on either stock at NSFH this brood year during pre-liberation sampling. The condition of fish from both Hells Canyon and Pahsimeroi stocks at liberation was excellent (Munson 2010).

Furunculosis, IHN, IPN, and ERM were not isolated at this facility during the 2009 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 versus costs (Munson 2003).

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 2 and September 7, 2009.

Brood year 2009 steelhead were implanted with CWTs from September 2 to September 7, 2009. A total of 240,810 steelhead received CWTs (120,810 Hells Canyon stock and 120,000 Pahsimeroi stock). Each tag group was held in an individual 100 ft raceway section so that separate mortality and tag shed rate information could be gathered. 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 brood years prior to 2003, 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.

A total of 232,865 CWT-tagged fish were released at three release sites (Appendix 10). A total of 87,374 CWT-tagged fish were released in the Snake River at Hells Canyon Dam from March 22-30, 2010, while 86,554 CWT-tagged fish were released at the Pahsimeroi weir (Pahsimeroi River) between April 14 and April 26, 2010. Both Hells Canyon stock and Pahsimeroi stock were released in the Little Salmon River at Stinky Springs. A total of 30,245 CWT-tagged Hells Canyon stock were released in the Little Salmon River between April 1 and April 5. The Pahsimeroi stock was released in the Little Salmon River from April 6- 9, 2010 and totaled 28,692 CWT-tagged fish.

In addition to the CWT-tagged fish, 28,222 fish were tagged with PIT tags from January 8-10, 2010 (raceways 2, 4, 8, 9, 12, 14, and 16). These computer chips are 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. A total of 95 mortalities of PIT-tagged fish occurred after the tagging was completed and prior to release. Consequently, 28,127 PIT-tagged fish were released from NSFH for the 2009 brood year. Of these, 8,256 PIT-tagged fish were released below Hells Canyon Dam (Hells Canyon stock), while 4,287 PIT-tagged fish (Hells Canyon stock) and 2,687 PIT-tagged fish (Pahsimeroi stock) were released in the Little Salmon River at Stinky Springs. In addition, 12,958 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 do not 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 to minimize the time those fish are held off feed.

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

Approximately 33% of the eggs shipped to NSFH from early spawning adults (March 30-April 12) were utilized for smolt production destined for the Pahsimeroi River, while 25% of eggs from the middle of the spawn (April 13-April 28) and 42% of eggs from late spawning fish (April 29-May 7) were utilized for smolt production at the Pahsimeroi River. At Oxbow Hatchery, 16% of early spawning fish (March12-April12) were utilized for smolt production back to Hells Canyon Dam, while 25% of the middle of the spawn (April 13-April 23) and 59% of eggs from late spawning fish (April 27-May11) were utilized. Oxbow stock fish get stocked sooner in the spring, so it is not 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. Removable shade material was purchased for the nursery sections of the raceways and hung in several locations from the overhead bird netting. The old three-inch bird netting over the top of the raceways was replaced with new three-inch netting, since the overhead cables would not support the weight of smaller netting. The three-inch netting around the sides of the raceways was replaced with one-and-one-half-inch netting to deter kingfishers. A pressure washer was purchased to help clean new dam boards and screens. New aluminum keyways and screens were installed in several raceways to allow fish to be moved down as needed to alleviate overcrowding. All old wooden crowd screens were rebuilt and strengthened. Garage door sealant was applied to all the bottom dam boards used as baffles to minimize dorsal fin erosion

when the fish swam under them. New air lines and valves were purchased and installed to replace some of the old air lines in the raceways. Two new storage sheds were constructed on the west side of the settling ponds to minimize congestion in the chiller building. The carpets were all professionally cleaned and a deck was added to the third residence house.

IPC shop personnel repaired the bridge feeder electrical problems and tightened the bridge cable reel. They also replaced bridge bearings and wheels as needed and adjusted the chain tension. IPC shop personnel also placed supports on the sides of the chiller to keep it from breaking and serviced the blower motors on a regular maintenance schedule. IPC electrical technicians inspected the annubar water measuring device and recalibrated it for better accuracy. Gooding IPC personnel replaced three large overhead lights and their electrical controllers.

Several landscaping projects were also completed this past year. A four-foot-high wire-mesh fence was constructed between Rimview Trout Company and NSFH from the river to the entrance driveway to deter mink, skunks, and raccoons from entering NSFH property. The clipping pipe portals and hog ring clamps for the lower mink fence around the raceway perimeter were painted to match the chain link fence. All trees along the entrance and spring roads were trimmed for better visibility. Brush and trees were eliminated the entire length of the lower guardrail along the creek 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 and wedding participants. 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 12 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. A smaller mesh for the top of the bird netting is recommended to prevent kingfishers from flying through the net. The large bridge needs to be professionally sandblasted and painted and should be cut in half to be able to add support structure for smaller-mesh bird netting. Fourteen more ten-foot aluminum tailscreens are needed to accommodate the new PBT and CWT plans. A diesel-powered compressor needs to be purchased so hatchery personnel do not have to borrow the IPC shop compressor or rent one once per month. New automatic bridge feeders need to be purchased to replace the older worn feeders.

Adipose fin 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 to accommodate new CWT and PBT requirements.

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. A water alarm should also be installed in the water collection box to prevent nitrogen supersaturation in the incubation line. The incubation line should be separated from the sprinkler and fire water line so the pressure is not reduced when those systems are operated.

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 adequate feed storage space. A three-stall garage for the trucks and mowers would be beneficial to protect these items from vandalism and weather. A chain link gate is needed for each screen shed to protect these items from theft and vandalism. Metal storage sheds are needed in each residence back yard to store garden tools, wheelbarrows, and other miscellaneous yard items.

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. Automatic electric gates should be installed at the entrance to the hatchery and day park for additional security.

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Munson, A. D. 2010. Niagara Springs Fish Inspection Report. Department Eagle Fish Health Laboratory. 1800 Trout Road, Eagle.

Piper, R. G., I. B. McElwain, L. E. Orme, J. P. McCraren, L. G. Fowler, and J. R. Leonard. 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 by month from December 2009 to May 2010.

Month	Hatchery Inflow	Flow to Rimview	Discharge Flow to Niagara Springs Crk.
November	70 cfs	0 cfs	70 cfs
December	90 cfs	44 cfs	46 cfs
January	100 cfs	48 cfs	52 cfs
February	110 cfs	60 cfs	50 cfs
March	120 cfs	70 cfs	50 cfs
April	77 cfs	27 cfs	50 cfs
May	0 cfs	0 cfs	0 cfs

Appendix 3. Results of annual analysis of NSFH source water, 1994 through 2010.

Analysis	Yearly Results 1994 (mg/l)	2005 (mg/l)	2006 (mg/l)	2007 (mg/l)	2008 (mg/l)	2009 (mg/l)	2010 (mg/l)	Maximum Allowable Contaminant Levels
Alkalinity	166	160	170	170	160	180	180	10.0
Antimony	0.002	N/D*	N/D*	N/T*	N/T*	N/T*	N/T*	0.006
Arsenic	0.005	N/D*	N/D*	N/D*	.007	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	46	44	47	40	50	43	250
Copper	0.010	N/D*	N/D*	.006	.006	N/D*	N/D*	1.3
Cyanide	0.005	N/T*	N/T*	N/T*	N/T*	N/T*	N/T*	0.200
Fluoride	0.570	N/D*	N/D*	.5	1.0	.07	N/D*	4
Hardness	234	230	230	220	200	260	250	100
Iron	0.010	N/D*	N/D*	.031	.022	N/D*	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*	.013	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	1.8	2.0	1.7	1.6	2.2	2.3	10
Nitrite as N	0.01	N/D*	N/D*	N/D*	N/D*	N/D*	N/D*	1
PH	8.00	8.1	8.0	7.8	7.3	7.6	8.0	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 2009 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	614,453	627,222	1,241,675	133,979	*90.18%	978,528	1,112,507	89.60%
Oxbow	442,915	466,391	909,306	45,491	*94.82%	811,266	856,757	94.22%
Totals	1,057,368	1,093,613	2,150,981	179,470	*92.14%	1,789,794	1,969,264	91.55%

*Estimated percentages

Appendix 5. NSFH brood year 2009 feed usage.

Manufacturer	Type and Size	Dates Received	Total Pounds Received	Total Pounds Used	Total Feed cost ($)
Rangen	Trout and Salmon Starter #0	6/08-7/09/09	500	500	$384.04
Rangen	Aquaflor Medicated Feed #0	6/09/09	600	600	$728.54
Rangen	Trout and Salmon Starter #1	6/24/09	2,250	2,250	$1,748.21
Rangen	Trout and Salmon Starter #2	7/08-7/16/09	4,150	4,150	$3,132.09
Rangen	Trout and Salmon Starter #3	6/17-9/03/09	14,850	14,850	$11,207.59
Rangen	Bulk 470 EXSL 2.0 mm slow-sink	8/24-10/15/09	47,620	47,620	$25,087.16
Rangen	Bulk 470 EXSL 3/32 slow-sink	10/28-11/02/09	31,040	31,040	$16,352.49
Rangen	Bulk 470 EXSL 1/8 slow-sink	11/24/09-4/13/10	297,410	297,410	$160,486.54
Rangen	Sack Medicated feed TM (8000 g) 1/8 pellet	2/16-3/22/10	35,550	35,550	$29,953.48
Rangen	Sack Medicated feed TM (8000 g) 5/32 pellet	4/01/10	400	400	337.50
Rangen	Returned Credit Sack feed	7/29/10		-450	-349.64
Rangen	Returned credit EXSL Bulk feed	5/12/10		-990	-$602.89
Rangen	Returned Credit Fines EXSL Bulk	12/17/09-5/12/10		-1095	-36.24
Grand Total		434,370	431,835	$249,634.65	

Appendix 6. NSFH brood year 2009 steelhead smolt distribution.

Destination	Stock	Weight	Dates	Number Per Pound	Number Released
Hells Canyon (Snake R.)	H.C.	112,400	3/22-3/31	4.71	529,667
Stinky Springs (Little Salmon R.)	H.C.	61,950	3/31-4/06	4.55	281,599
Pahsimeroi (Pahsimeroi R.)	Pah.	215,000	4/09-4/29	3.87	832,906
Stinky Springs (Little Salmon R.)	Pah.	38,600	4/06-4/09, 4/30	3.77	145,622
Total		427,950		4.18	1,789,794

Appendix 7. NSFH production costs for brood year 2009.

Number of Fish	Lbs of Feed	Cost of Feed	Pounds of Fish	Feed Conversion	Total Cost	Cost per 1,000	Cost per Pound
1,969,264	431,835	$249,634.65	430,225	.981	$1,182,808.89	$600.63	$2.75

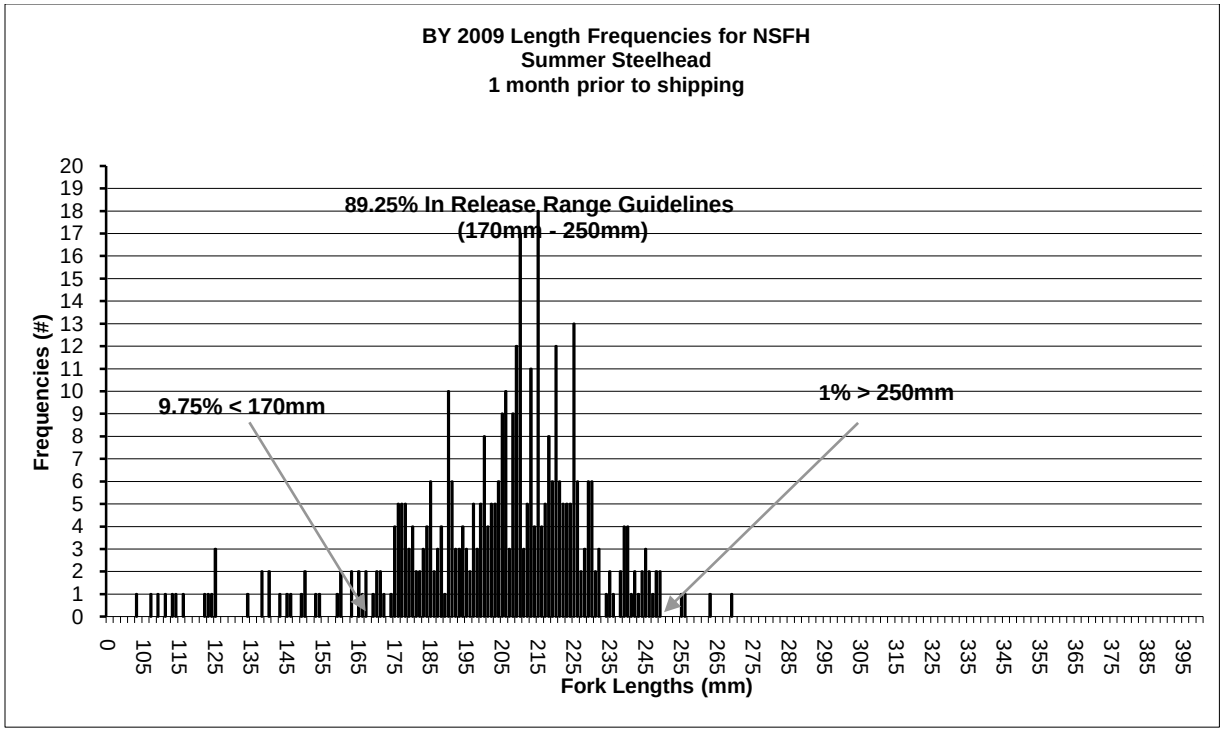
*Cost includes IPC cost for overhead, smolt hauling, and shop expenditures, and does not include capital outlay expenditures.

Appendix 8. Fin lengths of NSFH steelhead; March 2010.

Raceway	Fork Length	Right Pectoral	Left Pectoral	Dorsal	Ave. Fin Length	Fin Quality Index	Wild Fin Quality Index	Percent of Wild FQI
4	190.79	21.4	21.3	12.6	18.4	.092	0.1185	78%
8	199.92	21.4	20.9	12.5	18.3	.091	0.1185	77%
9	209.94	19.9	20.7	15.2	18.6	.091	0.1185	77%
12	211.38	21.8	22.4	14.5	19.5	.090	0.1185	76%
Average	203.01	21.3	21.3	13.7	18.7	.091	0.1185	77%

Appendix 9. Fork length frequencies at release for four raceways, one month prior to shipping 2010.

Raceway #	H.C. 4	H.C. 8	Pah. 9	Pah. 12
Sample Size	100	100	100	100
Ave. Frk. Length	190.79	199.92	209.94	211.38
Lower Range (mm)	103.00	114.00	169.00	113.00
Upper Range (mm)	245.00	255.00	249.00	269.00
	(mm)	(Inches)		
Hells Canyon Average Length	195.36	7.69		
Pahsimeroi Average Length	210.66	8.29		
Overall Average Length	**203.01**	**7.99**		



Appendix 10. CWT summary for brood year 2009 steelhead at NSFH.

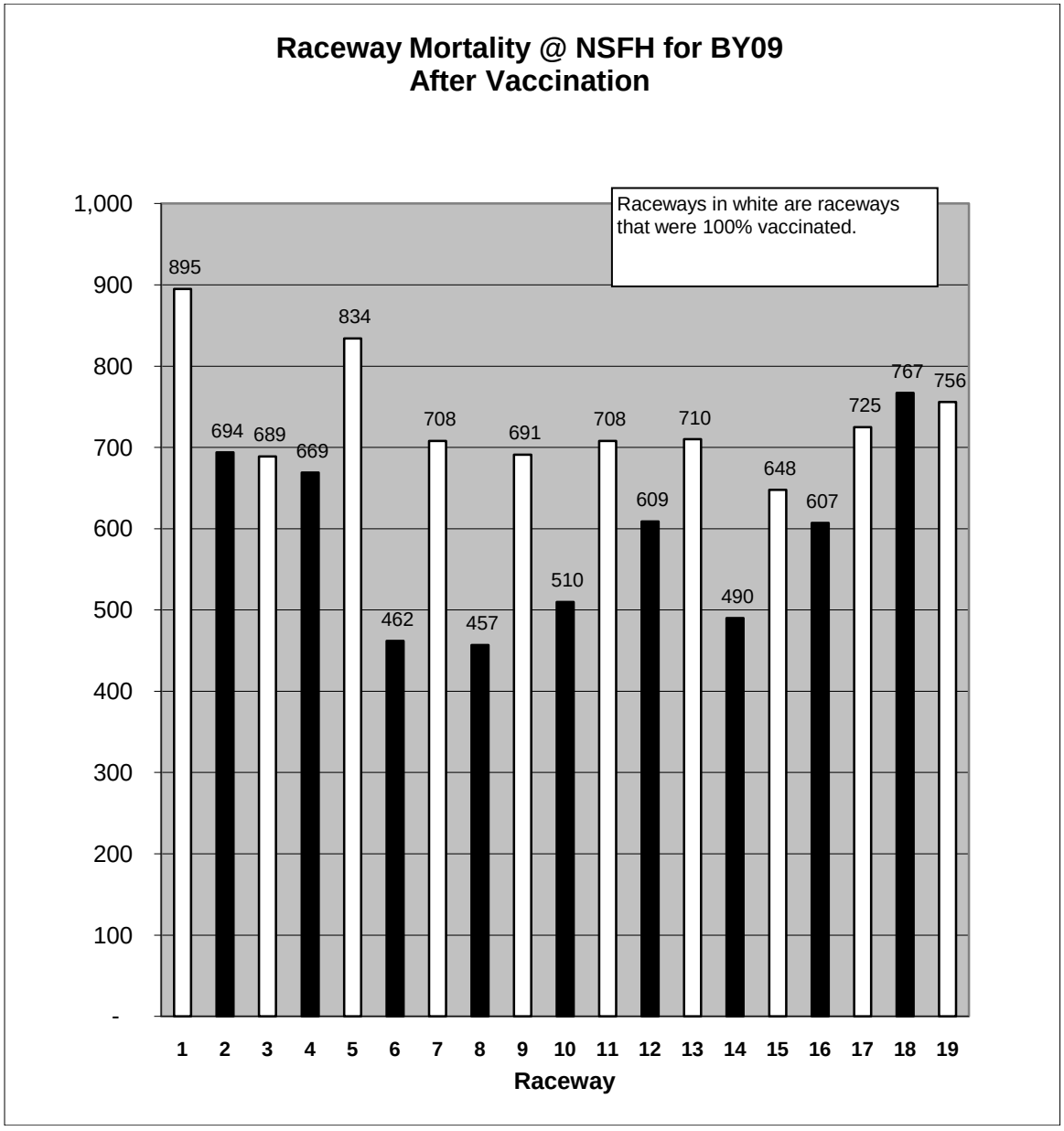
Stock	Release Site	CWT Number	Number Tag	Mortality to Release	Number Shed	CWT Number Released Untagged	Total Tagged Group Release	Total Site Release
	Snake River							
Oxbow A	Hells Canyon Dam	10-45-83 10-18-83	90,132	669	2,089	87,374	214,047	87,374
Total		**90,132**	**669**	**2,089**	**87,374**	**214,047**	**87,374**	**529,667**
	Salmon River							
Oxbow A	Little Salmon River	10-19-83	30,678	230	203	30,245	71,164	30,245
Total		**30,678**	**230**	**203**	**30,245**	**71,164**	**30,245**	**281,599**
	Pahsimeroi River							
Pahsimeroi A	Pahsimeroi Trap	10-16-83 10-46-83	90,000	666	2,780	86,554	184,707	86,554
Total		**90,000**	**666**	**2,780**	**86,554**	**184,707**	**86,554**	**832,906**
	Salmon River							
Pahsimeroi A	Little Salmon River	10-17-83	30,000	230	1,078	28,692	61,238	28,692
Total		**30,000**	**230**	**1,078**	**28,692**	**61,238**	**28,692**	**145,622**

Total CWT Release: 232,865
Total Site Releases: 1,789,794
Total Smolt Releases: 1,789,794

Appendix 11. PIT tag summary for brood year 2009 steelhead at NSFH.

Raceway	Release Site	Number Tagged	Number Released	Mortality
2	Hells Canyon Dam Snake River	4,185	4,180	5
4	Hells Canyon Dam Snake River	4,089	4076	13
8	Stinky Springs Little Salmon River	4,294	4,287	7
9	Stinky Springs Little Salmon River	2,696	2,687	9
12	Pahsimeroi Weir Pahsimeroi River	3,292	3,277	15
14	Pahsimeroi Weir Pahsimeroi River	3,189	3,180	9
16	Pahsimeroi Weir Pahsimeroi River	6,477	6,440	37
Totals		**28,222**	**28,127**	**95**

Appendix 12. Comparison of mortality in vaccinated and non-vaccinated raceways at NSFH for brood year 2009.



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	Total Feed Fed	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
	Wallowa	812,000	812,00	394,936	48.64	0		417,064	417,064	72,786			5.73
1992-93	1,131,951	1,013,846	2,145,797				761,800	353,600		235,075			
1992-93	Babington		*Babington **Brownlee	Release Reservoir	In Little	Salmon	*222,560	306,907	**47,089	131,090			
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
2009-10	1,241,675	909,306	2,150,981	181,717	8.45	179,470	1,260,127	529,667	1,789,794	427,950	431,835	1.01	4.18

Appendix 14. Oxbow and Pahsimeroi stock spawn timing manipulations at NSFH for brood year 2009.

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	03/12/09	1%	0.1%	1	03/30/09	21%	9%
2	03/16/09	1%	0.1%	2	04/02/09	21%	3%
3	03/23/09	5%	0.8%	3	04/06/09	50%	21%
4	03/26/09	4%	0.6%	4	04/13/09	18%	22%
5	03/30/09	19%	3.0%	5	04/15/09	0%	0%
6	04/02/09	35%	5.8%	6	04/16/09	0%	0%
7	04/06/09	24%	3.9%	7	04/20/09	6%	3%
8	04/09/09	12%	1.9%	8	04/22/09	0%	0%
9	04/13/09	32%	0.0%	9	04/23/09	0%	0%
10	04/16/09	36%	0.0%	10	04/29/09	0%	0%
11	04/20/09	33%	0.0%	11	04/30/09	59%	20%
12	04/23/09	59%	25.0%	12	05/07/09	12%	22%
13a	04/27/09	41%	17.2%				100%
13b	04/2709	31%	12.9**%**				
14	04/30/09	57%	23.9%				
15	05/03/09	0%	0.0%				
16	05/07/09	7%	2.9%				
17	05/11/09	5%	1.9%				
			100%				

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