NIAGARA SPRINGS FISH HATCHERY

2001 Steelhead Brood Year Report

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August 2002
IDFG 02-32

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ABSTRACT

Niagara Springs Fish Hatchery (NSFH) received 2,453,220 steelhead (*Oncorhynchus mykiss*) eggs and fry during Brood Year 2001. A total of 1,502,313 Pahsimeroi stock eggs and fry (781,203 eggs and 721,110 swim-up fry) were received from Pahsimeroi, Sawtooth and Oxbow hatcheries. Pahsimeroi stock eggs were shipped from Oxbow Hatchery and Sawtooth Hatchery to NSFH as eyed eggs. Almost half (48%) of the earliest Pahsimeroi egg lots were incubated with chilled water at the Oxbow facility then shipped to NSFH as first feeding fry. A total of 950,907 Hells Canyon stock eggs and fry (456,435 eggs and 494,472 swim-up fry) were received directly from Oxbow Hatchery.

Total production for the 2001 brood year at NSFH was 2,315,739 steelhead (454,430 lbs), which included both surplus fish and anadromous smolt releases. Excess fish were stocked as fingerlings.

A total of 478,586 excess steelhead fingerlings (6,960 lbs at 68.76 fish/lb) were released into the Snake River at Bell Rapids, Salmon and American Falls reservoirs between October 12 and October 24, 2001. These stockings took place after fin clipping was concluded and final production numbers were determined.

A total of 1,837,153 steelhead smolts (447,470 lbs at 4.11 fish/lb) were released into the Snake and Salmon rivers from March 25 to May 9, 2002. A total of 836,713 smolts (212,100 lbs at 3.94 fish/lb) of Pahsimeroi stock were released in the Pahsimeroi River at the weir, and 195,788 smolts (49,650 lbs at 3.94 fish/lb) of Pahsimeroi stock were released in the Little Salmon River near Stinky Springs. A total of 526,168 smolts (120,020 lbs at 4.384 fish/lb) of Hells Canyon stock were released in the Snake River at Hells Canyon Dam, and 278,484 smolts (65,700 lbs at 4.239 fish/lb) of Hells Canyon stock were stocked in the Little Salmon River near Stinky Springs.

Mortalities from pathogens were well below normal this year. All steelhead were vaccinated for furunculosis (*Aeromonas salmonicida*). Steelhead at NSFH were not vaccinated for enteric redmouth disease (*Yersinia ruckerii),* during this brood year. Furunculosis, ERM, or IHNV were not isolated during the 2001 brood year. Coldwater disease (*Flavobacter psychrophilum*), and *Aeromonas hydrophila* caused minor mortality just prior to release.

A total of 442,864 lbs of fish feed was fed (433,525 lbs of Rangen and 9,339 lbs of Moore-Clark) at a cost of $166,595.69 to produce 454,430 lbs of steelhead for a conversion rate of 0.975:1.

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INTRODUCTION

The Niagara Springs Fish Hatchery 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 IPCs mitigation requirement under the Federal Energy Regulatory Commission (FERC) 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.

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 consists of an indoor nursery area, outdoor rearing raceways, and two flow-through settling ponds. Spring water supplies 21 upwelling incubators and 21 sixty-cubic-foot (cf), rectangular vats for the hatching and early rearing of fry. The incubators and nursery tanks provide 1,260 cf of hatching and early rearing space.

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

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

Dissolved nutrients are monitored on a biweekly basis to comply with the terms of a consent order between IPC and the Idaho Division of Environmental Quality (IDEQ). Samples of inflow, raceway effluent, and settling pond discharges to Niagara Springs Creek and Rimview Trout Company are collected using Sigma automated water samplers and sent to Rangen Aquaculture Research Center for analysis. Additional water analysis is performed monthly in accordance with the EPA National Pollutant Discharge Elimination System permit. Samples are collected only on inflow and discharge water. Nutrient analysis is conducted by the Rangen Aquaculture Research Center while analysis for total suspended solids is completed by the Department's Eagle Fish Health Laboratory.

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 an 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 also automated with an 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 as necessary to augment the air blower system and a power scrubber is also employed to remove excessive algal growth on a regular basis.

Buildings on the NSFH grounds include five residences. Three are wood-frame houses, one is a doublewide modular home, and one is a 14-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 a cinder 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, and refuse containers.

WATER SUPPLY

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

The IPC has entered into an agreement with the four other users of Niagara Springs water whereby NSFH will receive water according to a stepped flow chart (Appendix 1). The NSFH has a water right of 132 cfs. A diversion canal was built by IPC in 2001, allowing up to 75 cfs of water to be discharged to Rimview Trout Company from December 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 (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 and two year-round temporary personnel staff the NSFH. Jerry Chapman, Fish Hatchery Manager II, Paul Dorman, Fish Hatchery Assistant Manager, Brian Thompson and Randy Hutzenbiler, Fish Culturists, handle most operational duties. During peak work activities there are three Bio Aides: Mike Anderson, Gene Waltz, and Rex Reist who assist the permanent staff with culture, maintenance, and other assignments. Brady Hancock was also a Bio Aide during the close of the 2001 brood year to replace Rex Reist.

FISH PRODUCTION

Egg Shipments and Early Rearing

Eggs and fry received at NSFH originate from broodstock trapping and spawning operations at IPC's Oxbow and Pahsimeroi hatcheries. To retard embryonic development, steelhead eggs spawned at Pahsimeroi Hatchery were transported by aircraft to Oxbow Hatchery for incubation in chilled wellwater (43°F) prior to delivery to NSFH. This procedure was done to control smolt size while minimizing the need to take fish off feed during the rearing cycle. At the Oxbow Hatchery a 70 horsepower chiller unit was utilized to chill 52°F wellwater to

43°F for incubation. Pahsimeroi Hatchery does not have a chiller unit for this purpose. The NSFH received both eggs and fry for the 2001 brood year (Appendix 4). Of the Pahsimeroi stock eggs incubated at Oxbow Hatchery, approximately half (52%) were delivered to NSFH as eyed eggs while the balance (48%) were delivered as first feeding fry. Approximately 40,000 Pahsimeroi stock eggs were incubated at Sawtooth Hatchery and delivered to NSFH as eyed eggs. Eyed eggs were transported in conventional coolers while fry were transported in specially designed, perforated; fry transport tubes and placed inside of a 2-ton fish truck furnished by Hagerman State Fish Hatchery (HSFH).

The NSFH received 781,203 eyed-eggs of Pahsimeroi stock between May 20 and June 11, 2001 (Appendix 4). A total of 721,110 Pahsimeroi stock swim-up fry from egg lots 1-4, 7-10, and 13 and 14 were received from June 26 through July 21.

A total of 456,435 eyed-eggs of Hells Canyon stock (lots 8-13) were shipped to NSFH from June 11 through June 18, 2001 (Appendix 4). Early lots (3-9) were transported to NSFH as swim-up fry (494,472) between July 10 and July 17, 2001, 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.

Upon arrival at NSFH, all eggs were tempered and disinfected with iodine at 100-ppm for 30 minutes and placed in upwelling incubators (49,600 per incubator) inside the vats. All 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 below-normal losses due to suffocation during the early rearing cycle. Survival of fry to fingerling was 97.89% in Pahsimeroi steelhead and 96.37% in Hells Canyon steelhead. Overall, fry to fingerling survival was 97.13%.

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

Throughout the entire early rearing production, 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 fingerlings reached approximately 250 fish/lb they were fed Moore-Clark's "Clarks Fry" (ProActive) dry feeds for 14 days. The purpose of feeding Moore-Clark's ProActive feed was to stimulate the fry's immune system prior to the vaccination program .

When they reached 75 fish/lb, all NSFH fish were switched to a Rangen extruded diet. The switch to Rangen bulk extruded feed allowed NSFH staff to utilize the bulk tanks, feed conveyor system, fines separator, and bridge feeders.

Final Production Rearing

Adipose fin-clipping operations are used to split the fish into even-numbered and odd-numbered raceway sections. During this program, fish are crowded to the lower 100-ft section of each odd-numbered raceway. Half the fish are clipped and put into the upper two-thirds of the raceway, while the other half are clipped into the adjacent even-numbered raceway. Fin-clipping operations started on October 1 and were completed by October 23, 2001.

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

Hells Canyon steelhead were kept off feed for 22 days to slow growth rates, while Pahsimeroi steelhead were kept off feed for 42 days. Although early growth rates exceeded 0.033 inches per day, growth rates were slowed to 0.021 inches per day by taking the fish off feed for one week at a time.

A combination of Rangen and Moore-Clark fish foods were fed over the course of the year. A total of 433,525 lbs of Rangen and 9,339 lbs of Moore-Clark were fed (Appendix 5). The Rangen feed total includes 42,360 lbs of oxytetracycline (OTC) medicated feed used for a single medicated feed treatment during this brood year. OTC was fed allowing for a 21-day withdrawal time prior to stocking, meeting Food and Drug Administration (FDA) requirements.

The total cost of the OTC feed was $21,038.09. The total cost of regular feed was $145,557.60. A total of 454,430 lbs of fish were produced on 442,864 lbs of feed for a conversion rate of 0.975:1. Total NSFH production costs incurred by IPC during the 2001 brood year were $542,763.12, which includes IPC overhead, smolt hauling, and shop expenditures, but does not include capital outlay expenditures. The cost/lb of fish produced was $1.19 (Appendix 7).

Fin quality was assessed in April and May using methods developed by Chapman (1991). Fins of steelhead reared at NSFH were compared to fins of wild rainbow trout collected from the Henrys Fork of the Snake River. A total of 100 steelhead from all three of the PIT-tagged raceways were analyzed for fin degradation. 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 Henrys Fork rainbow trout. Results indicate that the fin quality index from fish raised at NSFH was 61.8% of that of wild fish (Appendix 8). This was a 1.62% decrease from the 2000 releases but still a 3.98% increase from the 1997 releases at NSFH. NSFH has averaged in the lower 60th percentile for the past 3 brood years.

A target smolt size of 170 to 250 mm fork length has been established by the NMFS to maximize smolt outmigration and minimize the potential for predation by hatchery steelhead on wild salmon. To demonstrate compliance with this criterion, length frequency data were collected prior to shipping to determine fish size at the time of release (Appendix 9). The

average length of PIT tagged fish sampled from three raceways in April and May was 209.62 mm (8.25 inches).

Fish Distribution

The IPC contracted with Neil Ring Trucking of Buhl, to transport steelhead smolts to release sites using two IPC tank trailers. Transport of steelhead from NSFH began on March 25 and ended on May 9, 2002. Eighty-nine loads of steelhead (447,470 lbs at 4.11 fish/lb) were transported to the Snake and Salmon rivers (Appendix 4). The first fish were transported to Hells Canyon (Hells Canyon stock), then the Little Salmon River near Stinky Springs (Hells Canyon stock), Pahsimeroi River below the weir, and then back to the Lower Salmon River near Stinky Springs (Pahsimeroi stock). Department biologists feel that Pahsimeroi fish do better if stocked after the second week in April.

Steelhead smolt release figures are as follows; Snake River at Hells Canyon Dam (Hells Canyon stock): 526,168 fish (120,020 lbs at 4.384 fish/lb); Little Salmon near Stinky Springs (Hells Canyon stock): 278,484 fish (65,700 lbs at 4.239 fish/lb); Pahsimeroi River below the weir (Pahsimeroi stock): 836,713 fish (212,100 lbs at 3.94 fish/lb); and the Little Salmon near Stinky Springs (Pahsimeroi stock): 195,788 fish (49,650 lbs at 3.94 fish/lb) (Appendix 6). Total Pahsimeroi production was 261,750 lbs, or 1,032,501 steelhead smolts and total Hells Canyon production was 185,720 lbs, or 804,652 steelhead smolts.

In addition to steelhead released as part of normal production, a total of 478,586 steelhead fingerlings (6,960 lbs at 68.76 fish/lb) were released into the Snake River at Bell Rapids, Salmon Falls Creek and American Falls reservoirs between October 12 and October 24, 2001 (Appendix 13). These fingerlings were considered excess after the fin-clipping operations were concluded and final inventories had been placed into all raceways. Department personnel from HSFH transported all NSFH excess steelhead production for this brood year. Total NSFH production for the year, including surplus fingerlings, was 454,430 lbs, or 2,315,739 fish.

Total survival to release was 94.93% for Pahsimeroi steelhead, while total survival to release for Hells Canyon steelhead was 93.55%. Overall survival to release for smolts and excess steelhead was 94.40% (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 Infectious Hematopoietic Necrosis Virus (IHNV), Infectious Hematopoietic Pancreatic Necrosis Virus (IPNV), bacterial furunculosis *(Aeromonas salmonicida)*, and bacterial coldwater disease (CWD) have caused significant losses in years past (Munson, 1996). In addition, the NSFH and its spring (water source) are located directly below agricultural land, exposing both to toxic drift and runoff from chemical application to fields above the NSFH. Stringent sanitation programs are implemented to facilitate disease control.

Because furunculosis has been a problem in recent years, all the fish were vaccinated with an autogenous *Aeromonas salmonicida* bacterin from Aqua Health Limited. Fish were

dipped in an oxygenated solution of 18 liters of water to 2 liters of vaccine with a one-percent (1%) salt solution incorporated into the vaccination solution. 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 30 seconds. The vaccination program started on August 23 and ended on September 14, 2001. Average fish size at the time of vaccination was 127.35 fish/lb.

The vaccination program for enteric redmouth disease, *Yersinia ruckerii,* was not implemented during this brood year. Failure to detect this disease in pathological examinations over the last several years was the deciding factor in discontinuing this program.

Mortality for the year was well below normal. Acute losses were not experienced at NSFH. Minor losses were attributed to Motile Aeromonad Septicemia (MAS), (*Aeromonas sp.),* and Cold Water Disease caused by *Flavobacterium psychrophilum*. An application of OTC - medicated feed was administered prior to release to reduce mortality due to MAS. Fish were treated for 10 days with 4% OTC incorporated into the feed in accordance with FDA Investigational New Animal Drug #9332 requirements.

The organosomatic index showed normal and above-normal values in all categories for both Pahsimeroi and Hells Canyon stocks. Blood work was taken on both stocks of steelhead at NSFH, and all parameter levels for serum protein, leukocrit, and hematocrit were excellent. CTL and KTL were not assayed for this brood year. The condition of fish from both Hells Canyon and Pahsimeroi stocks at liberation was excellent.

Furunculosis, IHNV, and ERM were not isolated again at this facility during the 2001 brood year. A continuing aggressive disease management program at this facility has been effective in controlling mortality due to these etiological agents. During the first 31 years of fish production at NSFH, (1966-1997), the yearly mortality averaged 30.70%. During the last five years, 1997-2002, the yearly mortality averaged 16.82%. During the last 3 years of production at NSFH, the average yearly mortality has declined to 6.51%, a decrease of almost 5 times from the first thirty-one years of production (Appendix 12).

As NSFH reduces egg request numbers and started management of the inventory, losses due to MAS and CWD have been reduced. In the future, hatchery staff and Eagle Fish Health Laboratory personnel should investigate the necessity of furunculosis vaccination (Munson 2001).

FISH MARKING

Fin Clipping, CWT, and PIT Tags

All hatchery-reared steelhead in the state are marked with an adipose (AD) fin clip. Adipose fin clipping is done so that anglers can differentiate between hatchery and wild steelhead. The clipping process also gives the NSFH staff an accurate inventory, since all fish are counted during clipping. Steelhead were clipped at NSFH between October 1 and October 23, 2001.

Brood year 2001 steelhead were coded-wire-tagged (CWT) from October 3 to October 5, 2001. A total of 68,457 steelhead were CWT (33,589 Hells Canyon stock, and 34,868 Pahsimeroi stock). Each tag group was held in an individual raceway section so that separate mortality information can be gathered. The CWT groups of 30,000 fish were given a 100-ft section.

A total of 65,949 CWT fish were released at two release sites (Appendix 10). A total of 32,369 CWT fish were released in the Snake River at Hells Canyon Dam through April 1 and April 3, 2002, while 33,580 CWT fish were released at the Pahsimeroi weir (Pahsimeroi River) between April 22 and April 23, 2002. No CWT fish, of either stock, were released in the Little Salmon River near Stinky Springs for the 2001 broodyear.

In addition to the CWT fish, 900 fish were tagged with PIT tags on March 5-6, 2002 (raceways 4, 12, and 19) (Appendix 11). 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. No mortalities of PIT- tagged fish occurred after the tagging was completed and prior to release. A total of 300 PIT-tagged fish were released at Hells Canyon (Oxbow stock), while 300 PIT-tagged fish were released in the Little Salmon River near Stinky Springs (Pahsimeroi Stock). In addition, 300 PIT-tagged fish were released at the Pahsimeroi weir in the Pahsimeroi River (Pahsimeroi stock).

SPAWN TIMING MANIPULATIONS

When hatchery managers are given an egg request by their supervisors, the natural tendency is to collect eggs from early-spawning fish and quit spawning when the egg request has been met, thus selecting out a portion of the spawning population. Over many generations of selecting for early-spawning fish, spawn timing could feasibly move forward. Historical records from Oxbow and Pahsimeroi hatcheries show steelhead spawning throughout May. Currently, hatchery females are spawned as late as possible, but spawning operations are usually finished by early May.

Current fish feed technology and ingredients allow hatchery managers to raise fish to smolt size much faster than in earlier years. In fact, 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 managers currently prefer eggs taken from later-spawning females.

In an effort to begin moving the spawn timing back to historical spawning times, the Department consulted University of Idaho geneticist, Dr. Matt Powell for recommendations. 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 this year (Appendix 14) and will continue to do so in future years.

RECOMMENDATIONS

Completed Improvements

Several hatchery construction projects were completed this past year. A deck was constructed east of residence 3, and cement slabs were poured to extend the patio to the edge of the decks. All of the decks were restained to protect the wood. A 10-ft x 12'-ft storage shed was constructed for additional screen storage and new raceway screens were purchased by IPC. A new shelf was constructed in the computer room and two new cupboards were added for storage of hatchery records. Used file cabinets were obtained to store old hatchery files and computer data, in the feed room, where temperature and humidity could be regulated.

New aluminum dam board supports were built to better facilitate raceway cleaning, and a fire hose cabinet was added to the north end of the raceways. An electric garage door opener was added to residence 3, and five cracked windows were replaced in the trailer. A new air conditioner was installed in the office, and both computers were sent to Boise to overhaul the hard drives.

Blower motors number 1 and 3 were replaced and all 3 blower motor check valves were replaced. A separate 480-volt circuit was added to the south end of the raceways to run the fish pump and clipping trailer at the same time. Ten new feeder funnels were purchased for use with the bridge feeders. Finally, a new air compressor was purchased for the shop, along with a new refrigerator and queen-size bed for the crews quarters.

A diversion canal was constructed by IPC to deliver water from the Niagara Springs settling ponds to Rimview Trout Company. The canal can deliver up to 75 cfs of water to Rimview from December through April.

Several landscaping projects were also completed this past year. Numerous deciduous trees were planted around the hatchery and the park. All entrance road trees and trees along the overlook road were trimmed for better visibility. Five large dead poplar trees were cut down near the entrance road. Numerous sprinkler heads were replaced with larger heads for better lawn coverage. Redwood stain was applied to all the parking barriers in the park. Fencing was installed around all the new trees planted in the park to prevent porcupine damage. Weeds were sprayed in the spring and fall, and fertilizer was applied to all the grounds and park in the spring. Wildflowers were planted along the border of the adjacent property line with Rimview, and a new water line was installed to the burm below the settling ponds.

Needed Improvements

Early Rearing and Incubation

An expansion of the present nursery facility to at least twelve times its present size would adequately accommodate early rearing systems. The number of raceways should be

based on optimum density indices needed to rear fish to a larger size (200 fish/lb or 2.5 inches in length) before moving them to outside raceways. Using these criteria, there should be at least 15,120 cf of rearing space to ensure adequate rearing for fry. This system would protect fry from bird predation and provide them with shade from the sun.

Fry from Oxbow Hatchery are transported back to NSFH in a 2-ton truck borrowed from HSFH. This practice will probably continue until Pahsimeroi Hatchery obtains a disease-free water source for early incubation of steelhead eggs. Therefore, a 2-ton fish transport truck should be purchased to reduce disease transmission from a borrowed truck. The HSFH truck is thoroughly disinfected prior to use, but disease contamination is still possible by using it.

Final Rearing

At least one more smolt-hauling truck and trailer are needed to ensure that smolts are released in a timely manner. Current hauling procedures require up to 45 days to haul fish to their respective release sites. Optimum release timing for smolts to minimize residualism and maximize downstream survival should involve fewer than half the 45 hauling days currently needed.

Employee Safety

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

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

Water Source

The water collection box, which supplies water to the incubator rooms, is located near the top of the spring and the amount collected is not enough to safely produce fry. Plans should be developed to tap into the existing pipeline delivering water to the raceways or the hatchery head pool as a new supply source. For now, a degassing tower should be installed on the existing hatchery building pipeline because of the possibility of nitrogen gas toxicity. The line will hold 1,600 gpm of water, but only 1,200 gpm is useable because of nitrogen toxicity at 1,250 gpm.

Building Improvements

A new hatchery and incubation building with functional nursery raceways 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.

LITERATURE CITED

Chapman, J., and Sadecki, M. 1991. Ashton Hatchery, Resident Hatchery Annual Report.

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

Munson, A. D. 2001. 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. Niagara Springs Fish Hatchery 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. Niagara Springs Fish Hatchery water allocations to Rimview Trout Company 2001-2002

Month	Hatchery Inflow	Flow to Rimview	Discharge Flow to Niagara Springs Crk.
December	90 cfs	0 cfs	90 cfs
January	100 cfs	17 cfs	83 cfs
February	110 cfs	35 cfs	75 cfs
March	120 cfs	57 cfs	63 cfs
April	70 cfs	49 cfs	21 cfs
May	47 cfs	0 cfs	47 cfs

Appendix 3. Analysis of Niagara Springs Fish Hatchery source water.

	Yearly Results							Maximum
Analysis	**1994 (mg/l)**	**1997 (mg/l)**	**1998 (mg/l)**	**1999 (mg/l)**	**2000 (mg/l)**	**2001 (mg/l)**	**2002 (mg/l)**	**Contamination Levels**
Alkalinity	166	195	160	140	170	180	170	10.0
Antimony	0.002	N/T*	N/T*	NT*	ND*	ND*	ND*	0.006
Arsenic	0.005	N/D*	N/D*	ND*	ND*	ND*	ND*	0.05
Barium	0.180	N/D*	N/D*	ND*	ND*	ND*	ND*	2
Beryllium	0.0002	N/T*	N/T*	NT*	NT*	NT*	NT*	0.004
Cadmium	0.00034	N/D*	N/D*	ND*	ND*	ND*	ND*	0.005
Chromium	0.002	N/D*	N/D*	ND*	ND*	ND*	ND*	0.1
Chloride	N/T	46	48	47	46	44	45	250
Copper	0.010	N/D*	N/D*	ND*	ND*	ND*	ND*	1.3
Cyanide	0.005	N/T*	N/T*	NT*	NT*	NT*	NT*	0.200
Fluoride	0.570	N/D*	N/D*	0.5	0.6	0.7	ND*	4
Hardness	234	270	230	230	230	230	240	100
Iron	0.010	N/D*	N/D*	ND*	ND*	ND*	ND*	0.3
Lead	0.002	N/D*	N/D*	ND*	ND*	ND*	ND*	0.015
Manganese	N/T	N/D*	N/D*	ND*	ND*	ND*	ND*	0.05
Mercury	0.0002	N/D*	N/D*	ND*	ND*	ND*	ND*	0.002
Nickel	0.003	N/D*	N/D*	ND*	ND*	ND*	ND*	0.1
Nitrate as N	1.630	1.9	1.9	1.8	1.6	1.7	1.8	10
Nitrite as N	0.01	N/D*	N/D*	ND*	ND*	ND*	ND*	1
PH	8.00	8.1	8.3	8.2	8.4	8.2	8.2	6.5 - 8.5
Selenium	0.005	N/D*	N/D*	ND*	ND*	ND*	ND*	0.05

*N/D = Not detected
*N/T = Not tested

Appendix 4. Niagara Springs Fish Hatchery 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	781,203	721,110	1,502,313	393,626	*97.89%	1,032,501	1,426,127	94.93%
Oxbow	456,435	494,472	950,907	84,960	*96.37 %	804,652	889,612	93.55%
Totals	**1,237,638**	**1,215,582**	**2,453,220**	**478,586**	***97.13%**	**1,837,153**	**2,315,739**	**94.40%**

*Estimated percentages

Appendix 5. Niagara Springs Fish Hatchery Brood Year 2001 feed usage.

Manufacturer	Type and Size	Dates Received	Total Pounds Received	Total Pounds Used	Total Feed cost ($)
Rangen	Trout and Salmon Starter Swimup	6/4/01 - 8/1/01	1,750	1,750	783.30
Rangen	Trout and Salmon Starter #1	6/4/01 -8/13/01	1,750	1,750	807.48
Rangen	Trout and Salmon Starter #2	6/18/01 - 8/20/01	5,100	5,100	2,294.11
Rangen	Trout and Salmon Starter #3	7/25/01 - 9/24/01	4,150	4,150	1,880.30
Moore Clark	Clark's Fry 1.2mm ProActive	8/3/01	9,339	9,339	7,798.06
Rangen	Soft Moist 1/16 sinking pellet	8/24/01	45	45	32.34
Rangen	Bulk 450 extr. 1/16 slow-sink	8/24/01 - 9/14/01	15,760	15,760	6,437.17
Rangen	Bulk 470 extr. 3/32 slow-sink	10/12/01 - 12/21/01	108,810	108,810	36,249.78
Rangen	Bulk 470 exsl. 1/8 slow-sink	12/27/01 - 4/19/02	251,400	251,400	88,816.62
Rangen	Bulk TM (4000g) 1/8 pellet	2/15/02 - 3/18/02	42,360	42,360	21,038.09
Rangen	Sack Salmon Grower Pellets 1/8	4/26/02	1,150	1,150	368.29
Rangen	Sack Steelhead Pellets 1/8 sinking	4/24/02	1,250	1,250	400.32
Rangen	Fines credit "EXSL" bulk feed"	6/1/01 - 4/30/02	0	0	(139.77)
Rangen	Fines credit "TM-100" med. Bulk"	6/1/01 - 4/30/02	0	0	(170.40)
	Grand Total		442,864	442,864	166,595.69

Appendix 6. Niagara Springs Fish Hatchery steelhead smolt distribution.

Destination		Stock	Weight	Dates	Number Per Pound	Number Released
Hells Canyon	(Snake R.)	H.C.	120,020	3/25-4/5/02	4.38	526,168
Stinky Springs	(Little Salmon R.)	H.C.	65,700	4/6-4/13/02	4.23	278,484
Pahsimeroi	(Pahsimeroi R.)	Pah.	212,100	4/14-5/4/02	3.94	836,713
Stinky Springs	(Little Salmon R.)	Pah.	49,650	5/5-5/9/02	3.94	195,788
Total			**447,470**		**4.11**	**1,837,153**

Appendix 7. Niagara Springs Fish Hatchery production costs.

Number of Fish	Lbs of Feed	Cost of Feed	Pounds of Fish	Feed Conversion	Total Cost	Cost per 1,000	Cost per Pound
2,315,793	442,864	$166,595.69	454,430	0.975	*$542,763.16	*$234.38	*$1.19

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

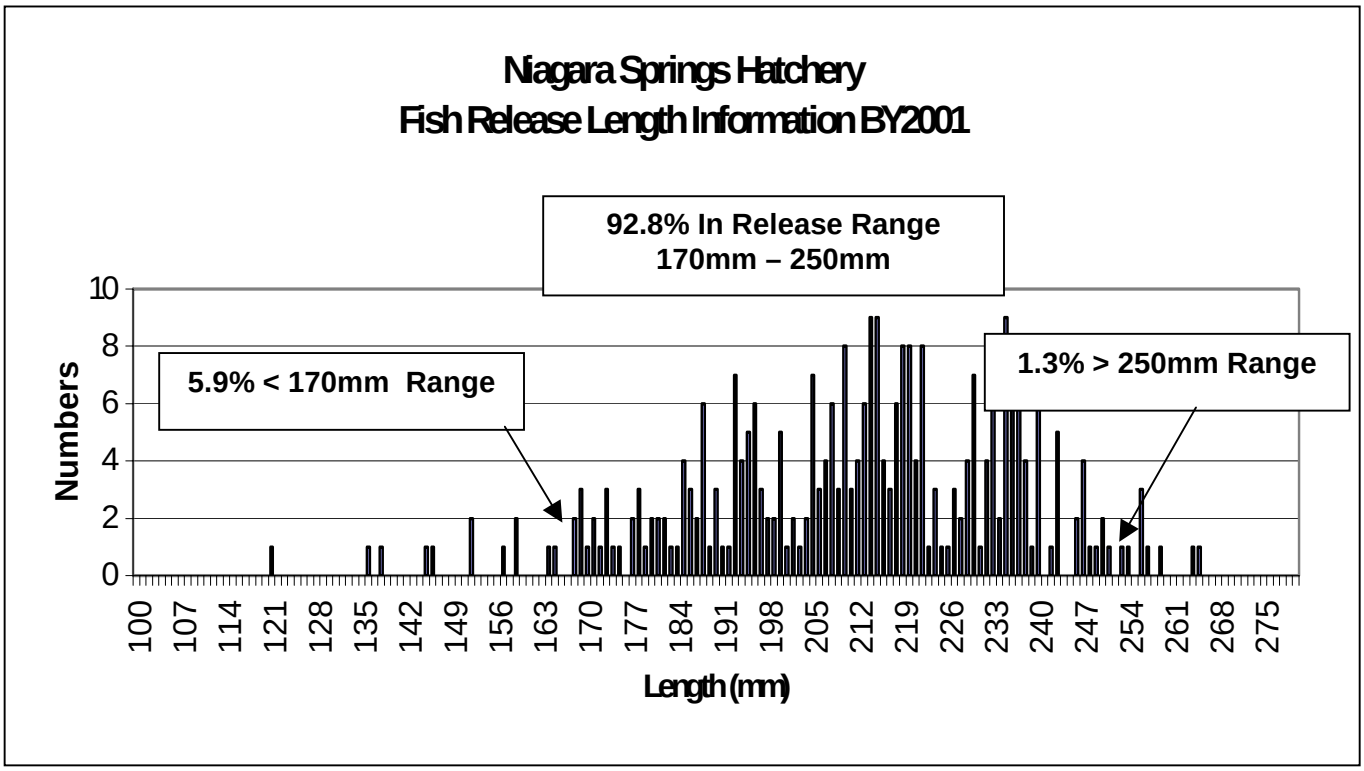
Appendix 8. Fin Lengths of Niagara Springs Fish Hatchery Steelhead, April and May 2002.

Raceway	Fork Length	Right Pectoral	Left Pectoral	Dorsal	Ave. Fin Length	Fin Quality Index	Wild Fin Quality Index	Percent of Wild FQI
4	196.9	20.4	18.6	12.3	17.1	0.087	0.13	66.9%
12	217.2	17.7	14.2	12.4	14.7	0.068	0.13	52.3%
19	209.7	21.1	20.2	12.8	18.0	0.086	0.13	66.2%
Average	**207.9**	**19.7**	**17.6**	**12.5**	**16.6**	**0.079**	**0.13**	**61.8%**

Appendix 9. Fork length frequencies at release for three PIT-tagged raceways, April and May 2002.

Raceway #	H.C. 4	Pah. 12	Pah. 19
Sample Size	100	100	100
Ave. Frk. Length	202	220	215
Lower Range (mm)	121	136	138
Upper Range (mm)	256	265	264

	(mm)	(inches)
Hells Canyon Average Length	201.71	7.94
Pahsimeroi Average Length	217.52	8.56
Overall Average Length	**209.62**	**8.25**



Appendix 10. CWT summary for steelhead at Niagara Springs Fish Hatchery.

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	10-15-72	10,950	48	350	10,552			
							67,335		
4	Hells Canyon Dam	10-69-70	22,639	98	724	21,817			
Total-4			**33,589**	**146**	**1,074**	**32,369**	**67,335**	**32,369**	**526,168**
	Pah. River								
12	Pahsimeroi Trap	10-14-72	11,528	58	367	11,103			
							62,142		
12	Pahsimeroi Trap	10-70-70	23,340	120	743	22,477			
Total-12			**34,868**	**178**	**1,110**	**33,580**	**62,142**	**33,580**	**836,713**
					Total	**CWT**	**Release**	**65,949**	
					Total	**Site**	**Releases**	**1,837,153**	
					Total	**Smolt**	**Releases**	**1,837,153**	

Appendix 11. PIT tag summary for steelhead at Niagara Springs Fish Hatchery.

Raceway	Release Site	Number Tagged	Number Released	Mortality
4	Hells Canyon Dam Snake River	300	300	0
12	Pahsimeroi Weir Pahsimeroi River	300	300	0
19	Stinky Springs Little Salmon River	300	300	0
Totals		**900**	**900**	**0**

Appendix 12. Niagara Springs Fish Hatchery history, Brood Year 1966 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

Appendix 13. Brood Year 2001 steelhead stocked from Niagara Springs Fish Hatchery.

Date	Treatment (Stock/Transfer)	Location	Stock	Size (fpp)	Total lbs	Number
10/12/01	Stocked	Salmon Falls Creek Reservoir	PAH.	77.30	810.0	62,613
10/16/01	Stocked	American Falls Reservoir	PAH.	72.75	4,550.0	331,013
10/24/01	Stocked	Snake River (Bell Rapids)	HC.	53.1	1,600.0	84,960
TOTALS				**68.76**	**6,960.0**	**478,586**

Appendix 14. Oxbow and Pahsimeroi stock spawn timing manipulations at Niagara Springs Fish Hatchery for Brood Year 2001

Hells Canyon Stock Eggs Used for Production Purposes			**Pahsimeroi Stock Eggs Used for Production Purposes**		
Lot Number	Spawn Date	Percentage Utilized for Smolt Production	Lot Number	Spawn Date	Percentage Utilized for Smolt Production
1	03/15/01	0%	1	03/19/01	97%
2	03/19/01	0%	2	03/22/01	97%
3	03/22/01	17%	3	03/26/01	36%
4	03/26/01	37%	4	03/29/01	19%
5	03/29/01	27%	5	03/30/01	0%
6	04/03/01	97%	6	04/02/01	0%
7	04/05/01	97%	7	04/05/01	14%
8	04/09/01	98%	8	04/09/01	34%
9	04/12/01	94%	9	04/12/01	19%
10	04/16/01	100%	10	04/16/01	18%
11	04/19/01	100%	11	04/19/01	0%
12	04/23/01	100%	12	04/20/01	0%
13	04/26/01	100%	13	04/23/01	40%
			14	04/26/01	99%
			15	04/30/01	90%
			16	05/03/01	100%
			17	05/07/01	100%
			18	05/10/01	100%

Submitted by:

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Virgil K. Moore, Chief
Fisheries Bureau

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Tom Rogers
Fish Hatcheries Supervisor