



NIAGARA SPRINGS FISH HATCHERY

1998 Steelhead Brood Year Report



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ABSTRACT

Niagara Springs Fish Hatchery (NSFH) received 2,805,383 steelhead *Oncorhynchus mykiss* eggs and fry during the 1998 brood year. A total of 1,412,000 eggs were received from Pahsimeroi and Sawtooth hatcheries, while 793,258 eggs and 600,125 swim-up fry were received from Oxbow Hatchery.

Mortalities from pathogens were normal this year. All steelhead were vaccinated for furunculosis *Aeromonas salmonicida*, and enteric redmouth disease *Yersinia ruckeri*, and only a minor outbreak of furunculosis occurred late in the year. Coldwater disease, *flexibacter psychrophilus*, and *Aeromonas hydrophila*, were prevalent throughout the year.

Total production for the 1998 brood year at Niagara Springs Fish Hatchery was 2,045,574 steelhead (444,455 lbs at 4.60 fish/lb). There were both fall and spring releases for this brood year.

A total of 60,634 steelhead (1,220 lbs at 49.7 fish/lb) were released into Paddock and Lucky Peak reservoirs on November 10, 1998. Spring releases included 141,740 steelhead (36,100 lbs at 3.93 fish/lb) and were stocked into Salmon Falls, C.J. Strike, Roseworth, Oakley, and Mt. Home reservoirs. These stockings took place after all smolt requests were filled.

A total of 1,843,200 steelhead smolts (407,135 lbs at 4.53 fish/lb) were released into the Snake and Salmon rivers from March 22 to May 1, 1999. A total of 829,199 smolts of Pahsimeroi stock (180,035 lbs at 4.61 fish/lb) were released in the Pahsimeroi River at the weir. NSFH released 171,920 smolts of Pahsimeroi stock (44,100 lbs at 3.90 fish/lb) in the Little Salmon River at Hazard Creek.

NSFH stocked 657,665 smolts of Hells Canyon stock (148,570 lbs at 4.43 fish/lb) in the Snake River at Hells Canyon Dam and 154,047 smolts of Hells Canyon stock (28,050 lbs at 5.49 fish/lb) in the Salmon River at Hammer Creek. Additionally, 30,369 smolts of Hells Canyon stock (6,380 lbs at 4.76 fish/lb) were released into the Salmon River at Pine Bar Rapids.

A total of 484,110 lbs of fish feed was fed (29,340 lb of Bioproducts and 454,770 lbs of Rangen) at a cost of \$197,241.54 to produce 444,455 lbs of steelhead for a conversion rate of 1.09:1.

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INTRODUCTION

The Niagara Springs Fish Hatchery (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 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, *Oncorhynchus mykiss*, smolts annually. Originally, these smolts were used to relocate a portion of the Snake River steelhead run into the Salmon River. Now, 200,000 lbs of production is used to enhance the 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 IPCs NSFH are to produce quality steelhead smolts to supplement the 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. To 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 sports fisheries in these waters and to supply sufficient brood stock (1,000 adults) to the Pahsimeroi Fish Hatchery for the collection of spawn for the next production cycle.
2. To 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 brood stock (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 and the wild genetic component.

FACILITY DESCRIPTION

The NSFH facility 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 to a density index of less than the recommended 0.35 lbs/cu.ft./in. In addition, the odd-numbered raceways are divided in the upper sections into two (4.5 x 20 ft) raceways (3,440 cf) for fry and fingerling rearing.

Two flow-through settling ponds (150 ft x 60 ft) have been constructed to remove settleable solids from the NSFH effluent. The settling ponds handle all the flow from the raceways and meet Environmental Protection Act (EPA) guidelines for effluent discharge. Monitoring of dissolved organics is done on a biweekly basis. Samples are collected by Sigma water samplers and sent to Rangen's research lab for analysis.

The NSFH feeding system is completely automated. Two moveable bridges span the 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 associated fines separator. Nursery areas are fed by Ziegler belt feeders.

Pond cleaning is also automated. An air blower cleaning system has been installed for the raceways. Three blower motors supply approximately 10 psi to the weighted, perforated, airlines on the bottom side corner of each pond. The resulting bubble screen creates a vortex of water currents that keep waste material suspended along the length of the ponds. This system saves many hours of labor sweeping ponds.

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 metal building (32 ft x 80 ft) contains an office, two incubator rooms, garage, shop, and feed storage room. Also on the grounds are one storage building (10 ft x 30 ft), one cinder block chiller building (70 ft x 45 ft) enclosing the chiller and blower-electrical room, a heated shop, and garage. The NSFH is also responsible for the two-acre park across from the springs. It has a public, handicapped-accessible restroom; picnic tables, and refuse containers.

WATER SUPPLY

In addition to NSFH, Niagara Springs supplies water to Rim View 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. IPC has entered into an agreement with the 4 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.

Water temperature is a constant 59°F and flows by gravity to feed the incubators, nursery vats, outdoor raceways, fire hydrants, and irrigation system. Water quality is checked on a regular basis at the NSFH (Appendix 2).

STAFFING

The NSFH is staffed by four permanent and two temporary personnel. The NSFH supervision is handled by Jerry Chapman, Fish Hatchery Manager II, and Michael Graham, Fish Hatchery Assistant Manager. There are two Fish Culturists, Paul Dorman and Jeffery Seggerman, to handle most operational duties. During peak work loads there are two Bio Aides, Gene Waltz and Mike Anderson, who assist the permanent staff with culture, maintenance, and other assignments.

FISH PRODUCTION

Egg Shipments and Early Rearing

The NSFH received both eggs and fry for the 1998 brood year (Appendix 3.). To retard embryonic development, steelhead eggs from Oxbow hatchery were incubated on chilled well water (43°F). A total of 793,258 eyed eggs from later lots (6-13) were shipped to NSFH on May 20 and June 2, 1998. Early lots (4-5) were transported to NSFH as button-up fry (600,125) between July 10 and July 17, 1998, and placed directly into outdoor nursery raceways. The timing of these shipments coincided with the swim-up timing of fish from the eyed eggs that were received earlier at NSFH. Fry were transported in specially designed, perforated, fry transport tubes.

The NSFH received 1,412,000 Pahsimeroi eyed eggs between May 29 and June 16, 1998 for the 1998 brood year (Appendix 3). Green eggs lots, from the Pahsimeroi Hatchery, (3-12) were transferred to Sawtooth Fish Hatchery and reared in 41°F well water.

All eggs were placed in upwelling incubators (85,000 per incubator) inside the vats. Eggs were tempered and disinfected with iodine at 200 ppm for 30 minutes. 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 above normal losses (4%) in the vats due to suffocation. Survival of fry to fingerling was 78.56% in Pahsimeroi steelhead and 74.99% in Hells Canyon steelhead.

Fry and fingerling were fed Bioproducts feed until they reached 50 fish/lb, then they were switched to Rangen extruded diet. Fry were started on BioDiet, a semi-moist feed, until they reached 300 fish/lb, then switched to BioDry diet. Fry were fed with Ziegler belt feeders in the nursery rearing area until they were given more room (100 ft) and the bridge feeders could be used.

Final Production Rearing

Once the fish outgrow the nursery area, they are moved to 50 ft, then 100 ft, and 200 ft. Next, 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. Half the fish are clipped

and put into the upper two-thirds of the raceway, while the other half are clipped into the adjacent raceway. Fin-clipping operations started on October 20 and were completed by November 7, 1998.

Fish were given the final 100-ft of rearing space in December. Hells Canyon fish were placed in raceways 1 through 9, while Pahsimeroi fish were placed in raceways 10 through 19. Normal fish culture techniques include feeding fish with the bridge, sweeping raceways, conducting sample counts, cleaning screens, removing mortalities, equipment maintenance, record keeping, and nutrient sampling.

A combination of Bioproducts and Rangen fish foods were fed over the course of the year. A total of 29,340 lbs of Bioproducts and 454,770 lbs of Rangen were fed for a total of 484,110 lbs (Appendix 5). This includes 54,860 lbs of Oxytetracycline and Romet medicated feed. The total cost of the Oxytetracycline and Romet feed was \$30,584.53. The total cost of regular feed was \$166,657.01. A total of 444,455 lbs of fish were produced on 484,110 lbs of feed for a conversion rate of 1.09:1. Total NSFH production costs were \$835,251.99 (including Idaho Power's expenditures), while the cost/lb of fish produced was \$1.88.

Hells Canyon steelhead were kept off feed for 24 days to slow growth rates, while Pahsimeroi steelhead were kept off feed for 23 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. During the last month, fish were not taken off feed in order to preserve body fat and reduce stress related to smolting. Oxytetracycline was fed allowing for a 21-day withdrawal time prior to stocking during the final feedings to meet Food and Drug Administration (FDA) requirements. Romet medicated feedings were administered to allow for a 42-day withdrawal period to meet the same FDA requirements.

Fin quality was assessed using the "Ashton Method" of qualitative fin measurement (Chapman 1991). Fins of steelhead reared at NSFH were compared to fins of wild rainbow trout collected from the Henrys Fork. A total of 100 steelhead from five raceways were analyzed for fin degradation. After measuring the lengths of the dorsal and two pectorals from each fish and comparing the average fin length to the average fork length, fins from fish raised at NSFH were 58.5% of wild fish fins (Appendix 6). This was a 5.50% improvement from the 1997 releases.

Length frequencies (fork length) were taken on a regular basis to keep track of variations in fish size and condition factors (Appendix 7). A target guideline of 170 to 220 mm was set by National Marine Fisheries Service (NMFS) biologists to maximize migration and minimize predation by hatchery steelhead on wild salmon. The average length of the fish at release for four raceways in March and April was 214.3 mm (8.44 inches).

Fish Distribution

Two IPC tanker trucks began transporting steelhead on March 22 and finished on May 1, 1998. Eighty loads of steelhead (407,135 lbs) were transported to the Snake and Salmon rivers (Appendix 4). The first fish were transported to Hells Canyon, then Pine Bar, Lower Salmon River at Hammer Creek, Pahsimeroi River at weir, and Little Salmon River at Hazard Creek. Biologists felt that Pahsimeroi fish do better if stocked after the second week in April.

Steelhead release figures are as follows: Snake River at Hells Canyon Dam: 657,665 fish (148,570 lbs at 4.43 fish/lb); Lower Salmon River at Pine Bar: 30,369 fish (6,380 lbs at 4.76 fish/lb);

Lower Salmon at Hammer Creek: 154,047 fish (28,050 lbs at 5.49 fish/lb); Pahsimeroi River at weir: 829,199 fish (180,035 lbs at 4.61 fish/lb); and Little Salmon River at Hazard Creek: 171,920 fish (44,100 lbs at 3.90 fish/lb).

Total survival to release was 73.2% for Pahsimeroi steelhead, while total survival to release for Hells Canyon steelhead was 72.63%. Average survival to release for smolts and excess steelhead was 72.92%. Total NSFH production for the year was 444,455 lbs or 2,045,564 fish.

A total of 60,634 excess steelhead (1,220 lbs at 49.7 fish/lb) were fall released into Paddock and Lucky Peak reservoirs on November 10, 1998. Excess spring releases included 141,740 steelhead (36,100 lbs at 3.93 fish/lb) and were stocked into Salmon Falls, C.J. Strike, Roseworth, Oakley, and Mt. Home reservoirs. All NSFH excess steelhead production, for brood year 1998, was transported by IDF&G, by the Hagerman State Fish Hatchery.

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 (BKD) 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 to both 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 of the fish were vaccinated with autogenous *Aeromonas salmonicida* and *Yersinia ruckerii* bacterins from Aqua Health Limited. These fish were dipped in an oxygenated solution of 8 liters of water to 2 liters of vaccine. This was done at a rate of 220 lbs of fish per liter of vaccine for 30 seconds. The vaccination program started on August 20 and ended on September 8, 1998. Total fish vaccinated was 2,601,857 (20,880 lbs at 124.61 fish/lb).

Mortality for the year was normal. Late in the year, two weeks after ad clipping was completed, fish broke out with *Flexibacter psychrophilus* and *Aeromonas hydrophila* in significant numbers. Some raceways experienced secondary infections of *Aeromonas salmonicida*. Fish were treated for 10 days with 4% oxytetracycline incorporated into the feed in accordance with FDA Investigational New Animal Drug (INAD) #9332 requirements. The furunculosis was treated with Romet incorporated into the feed and the fish were given a 42-day withdrawal period prior to release. This is in accordance with FDA (INAD) #9332 requirements. After the medicated feed treatments, mortality returned to near normal levels.

The organosomatic index showed normal values in all categories for both Pahsimeroi and Hells Canyon stocks. Although blood work was taken on both stocks of steelhead at NSFH, blood parameters were not assayed because the centrifuge was not working at the lab. The condition of the fish at liberation was good.

To improve fish health at Niagara Springs, several impediments to fish culture must be corrected. The nursery rearing should be expanded and improved. A degassing tower should be installed on the existing incubator line to utilize another 400 gpm of water that is currently high in

nitrogen gas; or, another water supply line should feed the hatchery building from the lower intake pool.

PRECOCITY TESTING

At the end of March, during pre-liberation examinations, Department fish pathologists sampled 585 Oxbow A- and Pahsimeroi A-stock steelhead from six different raceways. Of the 235 total male steelhead sampled only five fish (2.13% of males) were considered precocial (Rhine 1999). These five fish were found in three of the six raceways sampled and three of these fish were found in one raceway. Sampling for precocity will probably continue for the 1999 brood year.

FISH MARKING

Fin Clipping, CWT, and PIT Tags

All hatchery-reared steelhead in the state are marked with an adipose fin clip. Adipose fin (AD) clipping is done so that the fishermen can differentiate between NSFH 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 20 and November 7, 1998.

Brood year 1998 steelhead were coded-wire tagged (CWT) from September 30 to October 7, 1998. Each tag group is held in an individual section so that separate mortality information can be gathered. The CWT groups of 30,000 fish were given a 100-ft section, while CWT groups of 60,000 fish were given 200 ft of rearing space.

A total of 131,809 CWT fish were released at Hells Canyon Dam, Hammer Creek, Pahsimeroi weir and the Little Salmon River release sites (Appendix 8). A total of 41,249 CWT fish were released in the Snake River at Hells Canyon Dam between March 29 and April 4, 1999, while 35,232 CWT fish were released at the Pahsimeroi weir (Pahsimeroi River) between April 10 and April 27, 1999. A total of 38,003 CWT fish were released in the lower Salmon at Hammer Creek between April 6 and April 8, and 17,325 CWT fish were released in the Little Salmon at Hazard Creek from April 28 through May 1, 1999.

In addition to the CWT fish, 1,200 fish were tagged with Passive Integrated Transponders (PIT) tags on February 24, 1998 (raceways 4, 9, 12, and 19). 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 traced on its seaward migration without sacrificing the fish.

A total of 1,200 PIT-tagged fish from the four raceways were tagged for the 98 brood year at NSFH (Appendix 9). A total of 300 PIT-tagged fish were released at Hells Canyon, while 300 PIT-tagged fish were released in the lower Salmon River at Hammer Creek. In addition, 300 PIT-tagged fish were released at the Pahsimeroi weir (Pahsimeroi River), and 298 PIT-tagged fish were released in the Little Salmon River at Hazard Creek.

RECOMMENDATIONS

Completed Improvements

Several improvements were completed this past year. A new modular home was installed across from residence #3 for the second fish culturist. In the past, one of the fish culturists had to live in an old singlewide trailer because there were not enough full-size houses to accommodate all permanent personnel on staff. The new modular home is a welcome addition to the other three homes on station. A 2-car garage and a redwood deck were also constructed next to the home.

Several completed projects involved compliance with Americans with Disabilities (ADA) regulations, including an upgrading of the visitor restroom and the expansion of the sidewalk leading to the restroom to make it wheelchair accessible. Elevated barbecues were installed next to the picnic tables in the park, and concrete was poured to also make these ADA compliant.

A new raceway cleaner, built by a crew from the IPC Malad Shop, will allow better and faster removal of macrophyte growth from the raceway floor. In addition to enhancing fish health, hatchery personnel will be able to chlorinate the raceways sooner and consequently reduce densities in the crowded nursery vats. Additionally, the pushcart was intensely modified to lift the ½ ton pond cleaner.

A new Dodge truck was leased to replace an older Department vehicle that was hauled to auction. Several new upwelling incubators, a Xerox copier, a portable generator and additional capital outlay items were purchased.

Hatchery beautification projects included the placement of additional washed river gravel and weed barrier along the hatchery entrance, driveway, settling ponds and fire hydrants. Numerous trees and shrubs were also planted. An underground sprinkler system was installed behind the office.

Needed Improvements

Early Rearing and Incubation

An expansion of the present nursery facility to at least ten times the 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.

Final Rearing

At least one more smolt hauling truck and trailer is 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 less than half the 45 hauling days we are currently using.

Ten more raceway head screens need to be built to keep fish from jumping into the headbox. Only ten would need to be built, since they can be used as tail screens in the nursery raceways, and then transferred to even-numbered raceways for use as head screens.

The hatchery birdnetting needs to be raised to allow the "modified" pushcart to move across the bridges. A new computer is also needed since demands on the existing computer by different personnel at the same time are becoming common. Raceway keyways are corroded and do not allow for tail and head screens to seat or be interchanged.

A new (PIT) tag detector and CWT scanner is required for the new (PIT) tags that are coming out next year. Hatchery personnel currently borrow the detector and scanners from Magic Valley Hatchery, but passing the scanners back and forth between hatcheries is not a good disease prevention practice.

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.

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 needs to 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 handicap accessible, an office, shop, meeting room, and an adequate feed storage space.

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APPENDIX

Appendix 1. Niagara Springs Hatchery Monthly Water 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. Water Analysis of Niagara Springs Fish Hatchery

Analysis	Results 94 (mg/l)	Results 96 (mg/l)	Results 97 (mg/l)	Results 98 (mg/l)	Results 99 (mg/l)	Maximum Contamination Level
Alkalinity	166	145	195	160	140	10.0
Antimony	0.002	0.002	N/T*	N/T*	NT*	0.006
Arsenic	0.005	N/D*	N/D*	N/D*	ND*	0.05
Barium	0.180	N/D	N/D*	N/D*	ND*	1.000
Beryllium	0.0002	N/T*	N/T*	N/T*	NT*	0.004
Cadmium	0.00034	N/D	N/D*	N/D*	ND*	0.004
Chromium	0.002	N/D	N/D*	N/D*	ND*	0.1
Chloride	N/T	11	46	48	47	250
Copper	0.010	N/D	N/D*	N/D*	ND*	1.3
Cyanide	0.005	N/T	N/T*	N/T*	NT*	0.200
Fluoride	0.570	0.9	N/D*	N/D*	0.5	4.0
Hardness	234	130	270	230	230	100
Iron	0.010	N/D	N/D*	N/D*	ND*	0.3
Lead	0.002	N/D	N/D*	N/D*	ND*	0.015
Manganese	N/T	N/D	N/D*	N/D*	ND*	0.05
Mercury	0.0002	N/D	N/D*	N/D*	ND*	0.002
Nickel	0.003	N/D	N/D*	N/D*	ND*	0.1
Nitrate as N	1.630	0.9	1.9	1.9	1.8	10
Nitrite as N	0.01	N/D	N/D*	N/D*	ND*	1.0
pH	8.00	8.4	8.1	8.3	8.2	6.5 - 8.5
Selenium	0.005	N/D	N/D*	N/D*	ND*	0.05

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

Appendix 3. Niagara Springs 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	1,412,000	0	1,412,000	9,000	58.56%	*1,001,119	1,033,519	73.20%
Oxbow	793,258	600,125	1,393,383	51,634	74.99%	*842,081	1,012,055	72.63%
Totals	2,205,258	600,125	2,805,383	60,634	76.79%	*1,843,200	2,045,574	72.92%

*smolt release totals do not reflect 141,740 excess production

Appendix 4. Niagara Springs Steelhead Distribution

Destination	Stock	Weight	Dates	Number Per Pound	Number Released
Hells Canyon	H.C.	148,570	3/22-4/4/99	4.43	657,665
Pine Bar	H.C.	6,380	4/5/99	4.76	30,369
Hammer Creek	H.C.	28,050	4/6-4/8/99	5.49	154,047
Pahsimeroi	Pah	180,035	4/10-4/27/99	4.61	829,199
Hazard Creek (Little Salmon)	Pah	44,100	4/28-5/1/99	3.9	171,920
Total		407,135		4.63	1,843,200

Appendix 5. Niagara Springs 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
2,045,574	484,110	\$197,241.54	444,455	1.09	*\$835,251.99	*\$408.32	*\$1.88

*Cost includes IPC cost for overhead, smolt hauling and shop expenditures

Appendix 6. Fin Lengths of Niagara Springs Fish Hatchery Steelhead, April 1999

Average of 100 fish groups

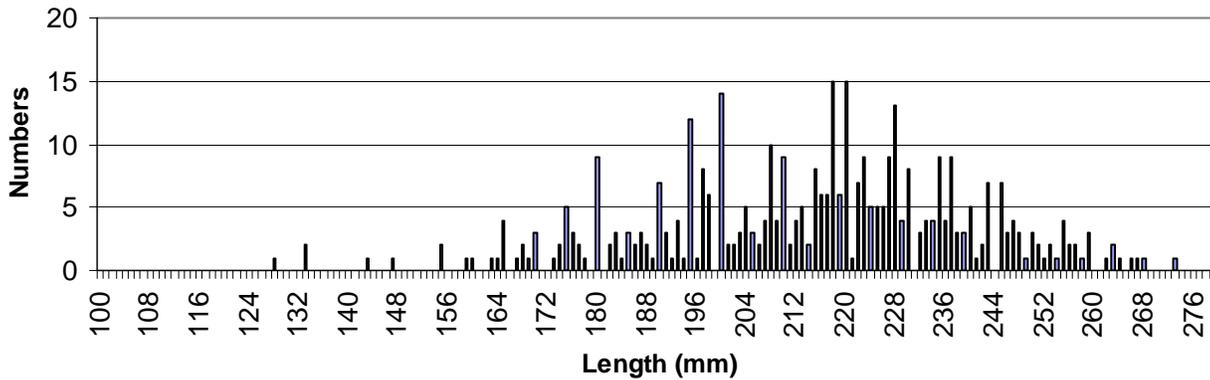
Raceway	Fork Length	Right Pectoral	Left Pectoral	Dorsal	Ave. Fin Length	Fin Factor
4	233	22	23	9	18	59
9	194	20	18	9	15.3	61
12	225	21	19	9	16.5	57
19	216	20	19	9	16	57
Average	217	20.8	19.8	9	16.5	59

Appendix 7. Length Frequencies (Fork) at Release for Four Raceways, April 1999

Raceway #	H.C. 4	H.C. 9	Pah 12	Pah 19
Sample Size	100	100	100	100
Ave. Length	223	199	218	217
Lower Range (mm)	128	155	155	133
Upper Range (mm)	290	252	262	263
			(mm)	(inches)
Hells Canyon Average Length			211.5	8.33
Pahsimeroi Average Length			217.5	8.56
Overall Average Length			214.3	8.44

Niagara Springs Hatchery
Fish Release Length Information BY98

Fish



Appendix 8. The CWT Summary for Steelhead at Niagara Springs Fish Hatchery

Raceway	Release Site	CWT Number	Number Tag	Mortality to Release	Number Shed	CWT Number Released	Untagged	Total Tagged Group Release	Total Site Release
4	Hells Canyon Dam	10-52-41	15,375	322	4,382	10,671	49,800		
4	Hells Canyon Dam	10-52-42	14,623	305	4,167	10,151	47,371		
Total-4			29,998	627	8,549	20,822	97,171	117,993	
6	Hells Canyon Dam	10-52-41	6,439	70	1,738	4,631	17,986		
6	Hells Canyon Dam	10-52-42	6,532	71	1,764	4,697	18,248		
6	Hells Canyon Dam	10-52-43	15,433	167	4,167	11,099	43,127		
Total-6			28,404	308	7,669	20,427	79,361	99,788	657,665
9	Hammer Creek	10-52-47	21,611	2,302	6,311	12,985	20,516		
9	Hammer Creek	10-52-48	21,568	2,298	6,297	12,978	20,474		
9	Hammer Creek	10-52-49	20,004	2,131	5,841	12,040	18,990		
Total-9			63,183	6,731	18,449	38,003	59,980	97,983	154,047
12	Pahsimeroi Trap	10-52-44	14,254	322	4,490	9,442	40,245		
12	Pahsimeroi Trap	10-52-45	15,742	355	4,959	10,428	44,446		
Total-12			29,996	677	9,449	19,870	84,691	104,561	
16	Pahsimeroi Trap	10-52-44	7,383	358	3,245	3,773	24,336		
16	Pahsimeroi Trap	10-52-45	6,490	315	2,856	3,320	21,394		
16	Pahsimeroi Trap	10-52-46	16,167	785	7,114	8,269	53,316		
Total-16			30,035	1,458	13,215	15,362	99,046	114,408	829,199
19	Hazard Creek	10-52-51	15,570	1,647	4,983	8,941			
19	Hazard Creek	10-52-52	14,601	1,544	4,672	8,384			
Total-19			30,171	3,191	9,655	17,325	96,500	113,825	171,920
								Total CWT Release	131,809
								^Total Site Release	1,812,831
								Total Smolt Release	1,843,200
								Total Hatchery Release	1,843,200

^Does not include 30,369 non-CWT smolts released at Pine Bar release site.

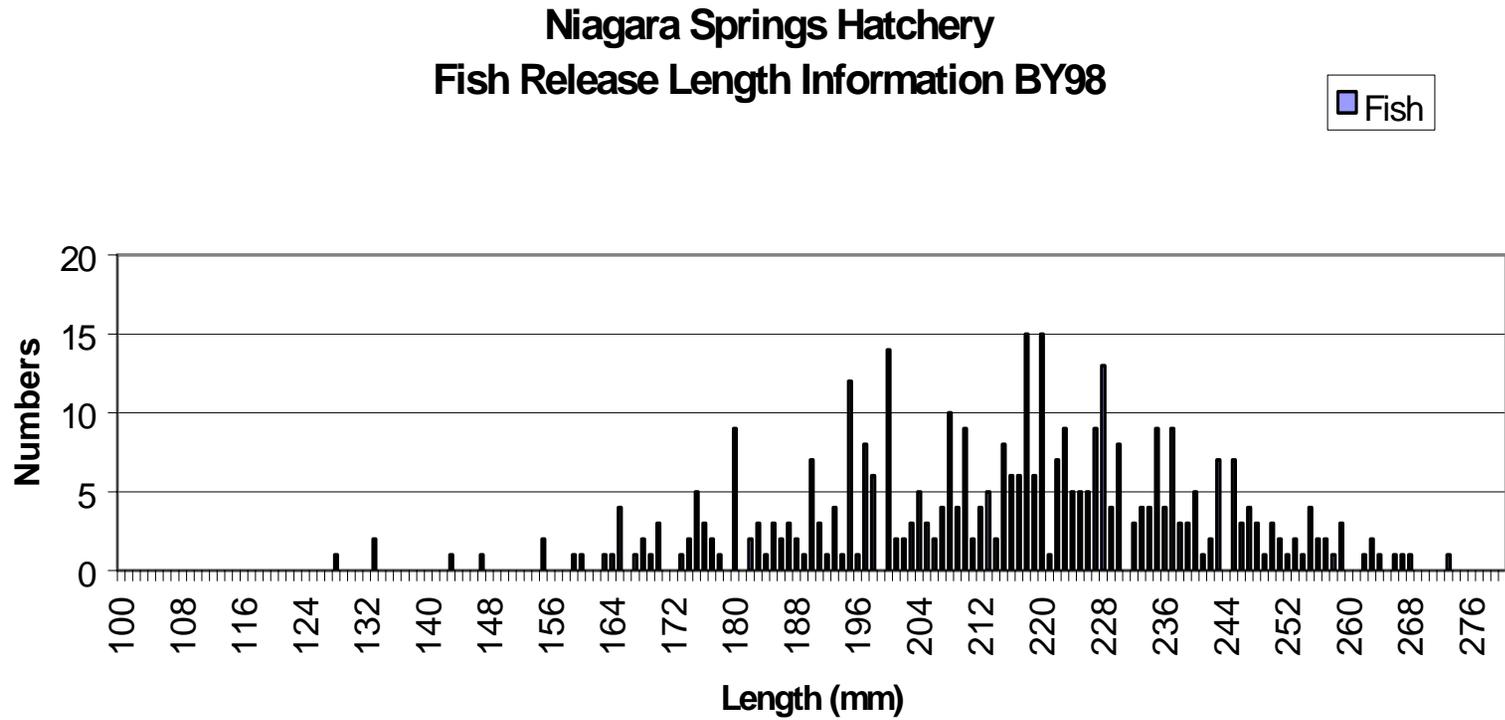
Appendix 9. Pit Tag Summary for Steelhead at Niagara Springs Hatchery

Raceway	Release Site	Number Tagged	Number Released	Mortality
4	Hells Canyon	300	300	0
9	Hammer Creek	300	300	0
12	Pahsimeroi Weir	300	300	0
19	Hazard Creek	300	298	2
Totals		1,200	1,198	2

Appendix 10. Niagara Springs Fish Hatchery history, BY66 to present

NIAGARA SPRINGS HATCHERY
HATCHERY HISTORY BY66-PRESENT

YEAR	PAHSIM.	OXBOW	TOTAL	TOTAL	% MORT YEARLY	SALMON R.			HELLS C.	TOTAL			CONV	FISH/LB
	EGGS\ FRY RECEIVED	EGGS\ FRY RECEIVED	EGGS\ FRY RECEIVED	YEARLY MORT.		FALL RELEASES	SMOLT RELEASES	SMOLT RELEASES	SMOLT RELEASES	SPRING RELEASES	LBS RELEASED	FED		
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's	*Babington's released 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	



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