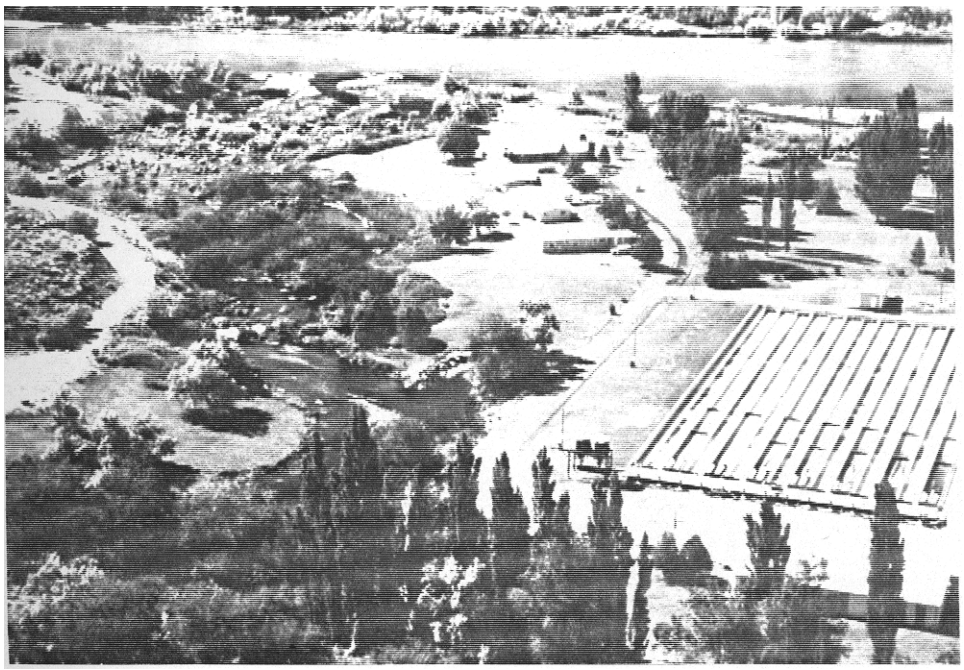
NIAGARA SPRINGS FISH HATCHERY

1997 Steelhead Brood Year Report



By:

Jerry Chapman, Fish Hatchery Manager II
Mike Graham, Fish Hatchery Assistant Manager
R. Paul Dorman, Fish Culturist
Tom Tighe, Fish Culturist

IDFG 99-11
October 1999

TABLE OF CONTENTS

LIST OF APPENDICES

LIST OF APPENDICES (Continued)

ABSTRACT

Niagara Springs Fish Hatchery (NSFH) received 2,646,474 steelhead *Oncorhynchus mykiss* eggs and fry during the 1997 brood year. A total of 729,400 eggs and 705,097 swimup fry were received from Pahsimeroi and Sawtooth hatcheries, while 549,154 eggs and 662,823 swimup fry were received from Oxbow Hatchery.

Mortalities from pathogens were higher than normal this year. An outbreak of Infectious Hematopoietic Necrosis (IHN) virus caused about 7.2% mortality. All steelhead were vaccinated for furunculosis, *Aeromonas salmonicida*, and entric redmouth disease, *Yersinia ruckerii*, and no outbreaks occurred during the year. Minor outbreaks occurred from coldwater disease, *flexibacters psychrophilus*, and *Aeromonas hydrophila,* as secondary infections to IHN throughout the year.

A total of 1,653,825 steelhead smolts (361,745 lb at 4.57 fish/lb) were released into the Snake and Salmon rivers from the period March 23 to April 29, 1998. No fingerlings were released during this brood year. A total of 801,541 smolts of Pahsimeroi stock (177,570 lb at 4.51 fish/lb) were released in the Pahsimeroi River at the weir. The NSFH released 26,528 smolts of Pahsimeroi stock (6,750 lb at 3.93 fish/lb) in the Little Salmon River at Hazard Creek and 141,320 smolts of Pahsimeroi stock (34,000 lb at 4.16 fish/lb) in the Salmon River at Hammer Creek. The NSFH stocked 653,276 smolts of Hells Canyon stock (135,825 lb at 4.81 fish/lb) in the Snake River at Hells Canyon Dam and 31,160 smolts of Hells Canyon stock (7,600 lb at 4.10 fish/lb) in the Salmon River at Pine Bar Rapids.

A total of 412,624 lb of fish feed was fed (38,564 lb of Bioproducts and 374,060 lb of Rangen) at a cost of $173,648.29 to produce 361,745 lb of steelhead for a conversion rate of 1.14:1.

Authors:

Jerry Chapman
Fish Hatchery Manager II

Mike Graham
Fish Hatchery Assistant Manager

R. Paul Dorman
Fish Culturist

Tom Tighe
Fish Culturist

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 that IPC owns and Department staffs and operates that fulfill IPC's mitigation requirement under the Federal Energy Regulatory Commission (FERC) license #1971. The goal of NSFH is to rear 400,000 (lb) 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 lb of production is used to enhance the steelhead run below Hells Canyon Dam in the Snake River, and 200,000 lb 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 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 lb 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 sports fishery in the Snake River and to supply sufficient brood stock (1,000 adults) to 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 by 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 .35. 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 discharge. The settling ponds handle all the flow from the raceways and meet Environmental Protection Agency (EPA) guidelines for effluent discharge. Monitoring of dissolved organics is done on a bi-weekly bias. Samples are collected by Sigma water samplers and sent to Rangens 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 four residences. Three are wood frame houses and one is a 14-ft wide mobile home. A metal building (32 ft x 80 ft) contains the 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. 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, Department 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 NSFH has a water right of 132 cfs.

Idaho Power Company has entered an agreement with Rim View Trout Company regarding future use of water at Niagara Springs. The four users of Niagara Springs water have signed a stepped agreement whereby NSFH will receive water according to a stepped flow chart (Appendix 1).

Water temperature is a constant 59°F and flows by gravity to feed the incubators, nursery vats, outdoor raceways, fire hydrants, and irrigation system. Domestic water has been supplied from a groundwater well since September 1995. Water quality is checked on a regular basis at the NSFH (Appendix 2).

Increased demand on the aquifer by agricultural and domestic uses has caused a decline in both quality and quantity of water in the spring. As ground water demands have expanded, the springs have declined by 30% to 40% of historic conditions.

STAFFING

The NSFH is staffed by four permanent and two temporary personnel. The NSFH supervision is handled by a Fish Hatchery Manager II, Jerry Chapman, and Fish Hatchery Assistant Manager, Michael Graham. There are two Fish Culturists, Russ Wood and Tom Tighe, to handle most operational duties. During peak work loads there are two Bioaides, Gene Waltz and Mike Anderson, that 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 1997 brood year. Egg development was delayed at Oxbow Hatchery so early eggs would mature at the same time as later lots. Early lots of Hells Canyon eggs were held at Oxbow Hatchery in 43°F well water from the end of March until they were shipped to NSFH. Fry were transported in hatching trays in a borrowed two-ton fish truck. The timing of these shipments coincided with the swimup time of the Hells Canyon lots of eyed eggs received at NSFH.

The NSFH received a total 1,434,497 Pahsimeroi eggs and fry (729,400 eggs and 705,097 fry) for the 1997 brood year (Appendix 3). Pahsimeroi eggs were transferred to Sawtooth Fish Hatchery and reared in 41°F well water. Early Pahsimeroi lots (1- 5) were shipped in a one-ton fish truck as swimup fry between July 11 to July 21, 1997. These fry were tempered before placing them directly in nursery raceways. Later lots (6 - 12) were received as eggs between June 10 and June 24, 1997.

The NSFH received a total 1,211,977 Hells Canyon eggs and fry (549,154 eggs and 662,823 fry) (Appendix 3). Early lots of fry (1 - 3) were transported in specially designed perforated transport tubes from Oxbow Hatchery between June 27 and July 3, 1997, and placed directly in outdoor

nursery raceways. Hells Canyon lots (4 - 14) were shipped as eggs on May 13, 19, and May 29, 1997.

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 (5%) in the vats due to suffocation. Survival of fry to fingerling was 76.39% in the Pahsimeroi steelhead and 66.28% in Hells Canyon steelhead.

Fry and fingerling were fed Bioproducts feed until they reached 50 fish/lb, then they were switched to Rangens extruded diet. Fry were started on BioDiet, a semi-moist feed, until they reached 300 fish/lb, then they were 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. raceways. Next, fin-clipping operations are used to split the fish into even- and odd-numbered raceways. 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, 1997.

Fish were given the final 100 ft of rearing space in December 1997. Hells Canyon fish were placed in raceways 1 through 8, while Pahsimeroi fish were placed in raceways 9 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 88,564 lb of Bioproducts and 324,060 lb of Rangens was fed for a total of 412,624 lbs (Appendix 5). This includes 41,140 lbs of Oxytetracycline medicated feed. The total cost of the Oxytetracycline feed was $23,332.67. The total cost of regular feed was $150,315.62. A total of 361,745 lbs of fish were produced on 412,624 lbs of feed for a conversion rate of 1.14:1. Total NSFH production costs were $831,548.96 (including Idaho Power's expenditures), while the cost/lb of fish produced was $2.04.

Hells Canyon steelhead were kept off feed for 23 days to slow growth rates, while Pahsimeroi steelhead were kept off feed for 24 days. Although early growth rates exceeded 0.33 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 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.

Fin quality was assessed using the "Ashton Method" of qualitative fin measurement. 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 57.7% of wild fish fins (Appendix 6).

Length frequencies 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 on April 13 was 205.0 mm (8.07 inches).

Fish Distribution

Two IPC tanker trucks began transporting steelhead on March 23 and finished on April 29. A total of 72 loads of steelhead (361,745 lb) were transported to the Snake and Salmon rivers (Appendix 4). The first fish were transported to Hells Canyon, then Pine Bar, Hammer Creek, Pahsimeroi, and Hazard Creek (Little Salmon River). Biologists felt that Pahsimeroi fish do better if stocked after the second week in April. Steelhead release figures are as follows: Hells Canyon Dam (Snake River) received 653,276 fish (135,825 lb at 4.81 fish/lb); Pine Bar (Lower Salmon River) received 31,160 fish (7,600 lb at 4.10 fish/lb); Hammer Creek (Lower Salmon) received 141,320 fish (34,000 lb at 4.16 fish/lb); Pahsimeroi River received 801,541 fish (177,570 lb at 4.51 fish/lb); and Hazard Creek (Little Salmon River) received 26,528 fish (6,750 lb at 3.93 fish/lb). Total survival-to-release was 65.7% for Pahsimeroi steelhead, while total survival-to-release for Hells Canyon steelhead was 58.70%. Average survival to release was 62.2%. Total NSFH production for the year was 361,745 lb or 1,653,825 fish.

FISH HEALTH

Fish health is always a concern at NSFH. The location of Niagara Springs, in the heart of the commercial trout industry, makes it vulnerable to the horizontal transmission of many etiologic agents. Disease problems from IHNV, IPNV, bacterial furunculosis *Aeromonas salmonicida*, and bacterial coldwater disease *Flexibacter psychrophilus* have caused significant losses in years past (Munson, 1995). Also, the NSFH and 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 of the fish were vaccinated with an autogenous *Aeromonas salmonicida* bacterin from Aqua Health Limited. These fish were dipped in an oxygenated solution of eight liters of water to two liters of vaccine at a rate of 220 lb of fish per liter of vaccine for 30 seconds.

Mortality for the year was high. In September, October, and November, outbreaks of IHNV occurred and total losses were 170,987 fish or 7.20% of the total production. Outbreaks of *Flexibacter psychrophilus* and *Aeromonas hydrophila* occurred as secondary infections to IHN throughout the year. Fish were treated for 10 days with 4% oxytetracycline incorporated into the feed in accordance with FDA Investigational New Animal Drug (INAD) (#9332) requirements. After the medicated feed treatments, mortality returned to near-normal levels. Furunculosis was not a problem this year, possibly due to the vaccination program initiated the prior year.

The organosomatic index showed normal values in all categories for both Pahsimeroi and Hells Canyon stocks. Even though blood work was taken on both stocks of steelhead at NSFH, blood parameters were not assayed due to the centrifuge not working at the lab. The condition of the fish at liberation was the best that pathologist Doug Munson has seen at this facility.

To improve fish health at NSFH, several impediments to fish culture must be corrected. The nursery rearing should be expanded and improved, and the spring intake should be enclosed. A degassing tower should be installed on the existing incubator water 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.

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 steelhead 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, 1997.

BY 1997 steelhead were coded-wire tagged (CWT) from September 29 to October 15, 1997. 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 209,355 CWT fish were released at Hells Canyon Dam, Hammer Creek, Pahsimeroi weir and the Little Salmon River release sites (Appendix 8). A total of 63,578 CWT fish were released at Hells Canyon Dam between March 23 and April 5, 1998, while 60,096 CWT fish were released at the Pahsimeroi weir between April 11 and April 28, 1998. A total of 59,153 CWT fish were released at Hammer Creek between April 7 and April 8, and 26,528 CWT fish were released at Hazard Creek on April 29, 1998.

In addition to the CWT fish, 1,200 fish were tagged with Passive Integrated Transponders (PIT) tags on February 24 (raceways 6, 9, 16, 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.

RECOMMENDATIONS

Completed Improvements

Several improvements were completed this past year. Bird screening was installed over the outdoor production raceways. Prior to installation, piscivorous birds, including great blue herons, black-crowned night herons and several species of gulls and terns, created significant losses. A person was hired to haze birds. A total of 277 birds during a 34-night period were recorded. The average was 8 herons per night with a high of 25 in one night. The hatchery staff hazed numerous birds, mostly seagulls, during the daylight hours. The bird screening project has effectively eliminated the bird problem at NSFH.

Other completed projects include the installation of 21 new nursery rearing vats in the incubation room. These have been plumbed to allow the transfer of fry from the incubation rooms to the outdoor raceways via a pipeline system. A reduction in stress and handling mortalities, along with the elimination of smothering mortality due to high densities associated with the old circular vats, should improve the early rearing health and survivability.

An air conditioning system was installed in the feed storage shed to greatly increase the shelf life of the soft-moist feeds used during early rearing. The IPC installed a new chain drive for the large feeding bridge. The oldest truck was replaced with a 4X4 from the Department's fleet. It has 105,000 miles on it.

Hatchery beautification projects included the placement of washed river gravel and weed barrier along the hatchery entrance, driveway, settling ponds and fire hydrants. Numerous trees and shrubs were also planted.

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 8,500 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 40 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 40 hauling days we are currently using.

An ice machine would pay for itself during the first two years of use. Currently, ice is being purchased to keep organic water samples chilled.

Employee Safety

The eight-inch wide raceway walls are used as walkways to clean raceways and screens. Walking these walls is a safety problem all year and becomes extremely dangerous in winter. Nonskid walkways need to be installed the full length of the raceway wall to eliminate this hazard. 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. It would seem reasonable to move the collection box to a place in the spring where more water could be collected. However, this is not possible because it would disturb a population of endangered snails and their habitat. Therefore, 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.

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, office, shop, meeting room, and an adequate feed storage space.

LITERATURE CITED

Munson, A. D. 1995. Niagara Springs Fish Inspection Report. Department Eagle Fish Health Laboratory. 1800 Trout Road, Eagle, Idaho.

APPENDICES

Appendix 1. Niagara Springs Fish 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)	Maximum Contamination Level
Alkalinity	166	145	195	160	10.0
Antimony	0.002	0.002	N/T*	N/T*	0.006
Arsenic	0.005	N/D*	N/D*	N/D*	0.05
Barium	0.180	N/D	N/D*	N/D*	1.000
Beryllium	0.0002	N/T*	N/T*	N/T*	0.004
Cadmium	0.00034	N/D	N/D*	N/D*	0.004
Chromium	0.002	N/d	N/D*	N/D*	0.1
Chloride	N/T	11	46	48	250
Copper	0.010	N/D	N/D*	N/D*	1.3
Cyanide	0.005	N/T	N/T*	N/T*	0.200
Fluoride	0.570	0.9	N/D*	N/D*	4.0
Hardness	234	130	270	230	100
Iron	0.010	N/D	N/D*	N/D*	0.3
Lead	0.002	N/D	N/D*	N/D*	0.015
Manganese	N/T	N/D	N/D*	N/D*	0.05
Mercury	0.0002	N/D	N/D*	N/D*	0.002
Nickel	0.003	N/D	N/D*	N/D*	0.1
Nitrate as N	1.630	0.9	1.9	1.9	10
Nitrite as N	0.01	N/D	N/D*	N/D*	1.0
pH	8.00	8.4	8.1	8.3	6.5 - 8.5
Selenium	0.005	N/D	N/D*	N/D*	0.05

N/D* Not detected

N/T* Not tested

Appendix 3. 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	729,400	705,097	1,434,497	0	76.39%	942,430	942,430	65.70%
Oxbow	549,154	662,823	1,211,977	0	66.28%	711,395	711,395	58.70%
Totals	**1,278,554**	**1,367,920**	**2,646,474**	**0**	**71.67%**	**1,653,825**	**1,653,825**	**62.20%**

Appendix 4. Niagara Springs Fish Hatchery Steelhead Distribution.

Destination	Stock	Weight	Dates	Number Per Pound	Number Released
Hells Canyon	H.C.	132,825	3/23-4/5/98	4.81	653,276
Pine Bar	H.C.	7,600	4/6/1998	4.1	31,160
Hammer Creek	Pah	34,000	4/7-4/9/98	4.16	141,320
Pahsimeroi	Pah	177,570	4/11-4/28/98	4.51	801,541
Hazard Creek (Little Salmon)	Pah	6,750	4/29/1998	0.93	26,527
Total		**361,745**		**4.57**	**1,653,825**

Appendix 5. 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
1,653,825	412,624	$173,648.29	361,745	1.14	*$831,548.96	*$502.80	*$2.04

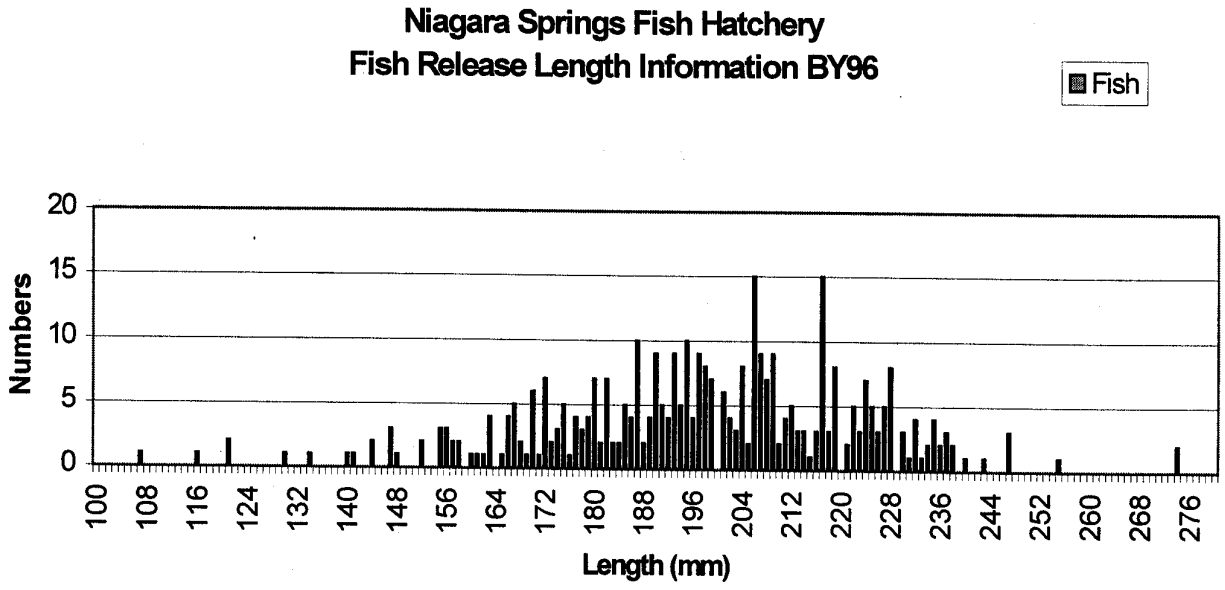
Appendix 6. Fin lengths of Niagara Springs Fish Hatchery Steelhead, April 11, 1997.

Raceway	Fork Length	Right Pectoral	Left Pectoral	Dorsal	Ave. Fin Length	Fin Factor
11	212.6	19.7	19.8	13.5	17.7	64
15	193.3	15.3	16.2	8.7	13.4	54
16	195.2	16.8	16.7	8.0	13.8	55
Average	**200.3**	**17.3**	**17.6**	**10.1**	**45.0**	**57.7**

Appendix 7. Length Frequencies at Release for Four Raceways, April 11, 1997.

Raceway #	**H.C. 4**	**H.C. 9**	**Pah 12**	**Pah 19**
Sample Size	102	106	61	105
Ave. Length	206	195	205	190
Lower Range (mm)	107	116	121	130
Upper Range (mm)	274	240	247	238

	(mm)	(inches)
Hells Canyon Average Length	200.5	7.89
Pahsimeroi Average Length	197.5	7.78
Overall Average Length	**195.0**	**7.83**



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	10-52-01	20,314	145	7	20,162	40,326		
4	Hells Canyon Dam	10-51-01	^11,281	81	4	11,196	22,396		
Total			**31,595**	**226**	**11**	**31,358**	**62,722**	**190,055**	**660,651**
6	Hells Canyon Dam	10-52-02	19,673	191	9	19,473	41,788		
6	Hells Canyon Dam	10-51-02	11,149	109	5	11,035	23,679		
Total			**30,822**	**300**	**14**	**30,508**	**65,467**	**190,055**	**660,651**
9	Hammer Creek	10-52-07	22,306	143	7	22,156	13,567		
9	Hammer Creek	10-52-08	21,717	139	6	21,572	^13,211		
9	Hammer Creek	10-52-09	^18,316	^118	5	18,193	11,141		
Total			**62,339**	**400**	**18**	**61,921**	**37,919**	**99,840**	**137,833**
12	Pahsimeroi Trap	10-51-03	10,440	142	0	10,298	22,841		
12	Pahsimeroi Trap	10-52-03	20,207	275	0	19,932	44,219		
Total			**30,647**	**417**	**0**	**30,230**	**67,060**	**186,120**	**830,654**
16	Pahsimeroi Trap	10-52-04	19,962	248	8	19,706	56,984		
16	Pahsimeroi Trap	10-51-04	11,159	138	5	11,016	31,846		
Total			**31,121**	**386**	**13**	**30,722**	**88,830**	**186,120**	**830,654**
19	Hazard Creek	10-51-63	22,356	621	34	21,701	73.114		
Total			**22,356**	**621**	**34**	**21,701**	**73,114**	**94,815**	**94,815**

Total CWT Release	**206,440**
Total Site Release	**1,723,953**
Total Smolt Release	**1,753,653**
Total Hatchery Release	**1,902,693**

Appendix 9. The PIT tag summary for steelhead at Niagara Springs Fish Hatchery.

Raceway	Release Site	Number Tagged	Number Released	Mortality
6	Hells Canyon	300	296	4
9	Hammer Creek	300	300	0
12	Pahsimeroi Weir	300	300	0
19	Hazard Creek	300	298	2
Totals		**1,200**	**1,194**	**6**

Fin Study PIT Tags

Raceway	Release Site	Fin Condition	Number Tagged	Number Released
11	Pahsimeroi Weir	bad	100	100
11	Pahsimeroi Weir	good	100	100
12	Pahsimeroi Weir	bad	100	100
12	Pahsimeroi Weir	good	99	99
15	Pahsimeroi Weir	bad	100	100
15	Pahsimeroi Weir	good	100	100
16	Pahsimeroi Weir	bad	100	100
16	Pahsimeroi Weir	good	100	100
Totals			**799**	**799**

Appendix 10. Niagara Springs Fish Hatchery 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 RELEASES	HELLS C. SMOLT RELEASES	SPRING RELEASES	TOTAL LBS RELEASED	FEED FED TOTAL LBS	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'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

Submitted by:

Jerry Chapman
Fish Hatchery Manager II

Mike Graham
Fish Hatchery Assistant Manager

R. Paul Dorman
Fish Culturist

Tom Tighe
Fish Culturist

Approved by:

_____
Virgil K. Moore, Chief
Bureau of Fisheries

_____
Tom Rogers
Anadromous Fish Hatchery Manager