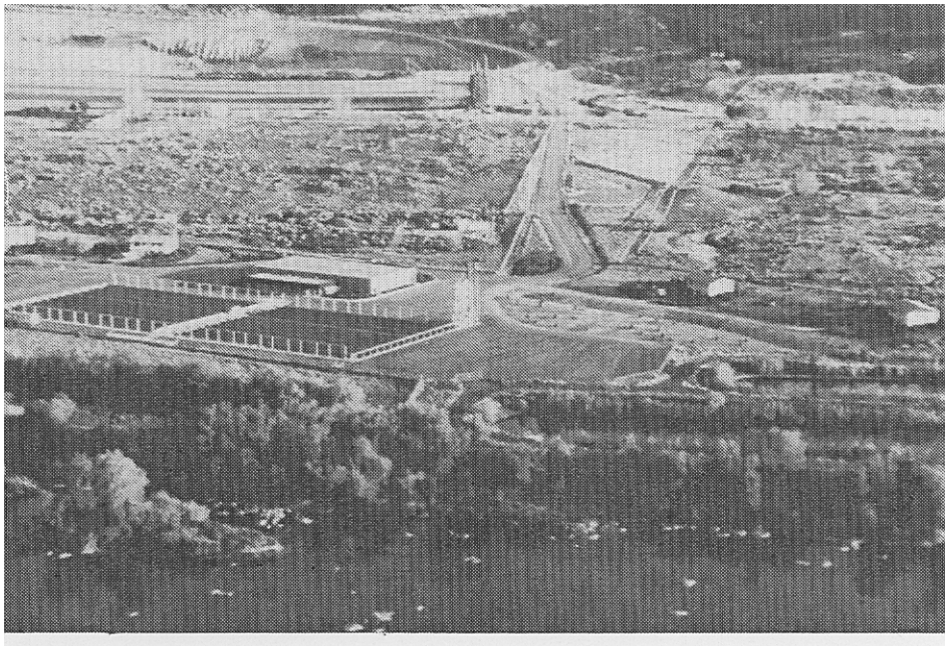
LOWER SNAKE RIVER
COMPENSATION PLAN
Hatchery Program

MAGIC VALLEY FISH HATCHERY

1993 Brood Year Report



by

Bud Ainsworth, Fish Hatchery Superintendent III
Dave May, Fish Hatchery Superintendent I
Dwight Aplanalp, Fish Culturist
Kent Hills, Fish Culturist

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ABSTRACT

The seventh year (May 1, 1993 to April 30, 1994) of steelhead Oncorhynchus mykiss production at Magic Valley Hatchery was completed with a total of 1,919,250 'A' and 'B' steelhead smolts stocked weighing 405,450 pounds. These fish were fed 654,693 pounds of feed for a conversion of 1.61. Excess fry from the Dworshak 'B' lot were planted locally on July 13 and 14. Salmon Falls Reservoir received 227,600 fry averaging 2.32 inches in length. Another 164,700 2.49-inch fry went into Oakley Reservoir.

Three different stocks of steelhead were received as eyed eggs including 1,081,500 'A' strain (Pahsimeroi stock) steelhead eggs yielding 484,440 smolts to the Pahsimeroi River and 467,550 to the Little Salmon River at Warm Springs Creek. Between June 4 and 11, 1993, a total of 179,080 'B' strain eggs (East Fork Salmon River stock) were received, and 160,040 smolts were returned to the East Fork Salmon River. In addition, 1,507,033 eggs (Dworshak, Clearwater 'B' Stock) were received contributing 357,140 smolts to the East Fork Salmon River, 211,355 smolts to Slate Creek, and 238,725 to Hazard Creek on the Little Salmon River.

Authors:

Bud Ainsworth
Hatchery Superintendent III

Dave May
Hatchery Superintendent I

Dwight Aplanalp
Fish Culturist

Kent Hills Fish
Culturist

INTRODUCTION

Magic Valley Hatchery is part of the U.S. Fish and Wildlife Service Lower Snake River Fish and Wildlife Compensation Plan (LSRCP), compensating for losses of steelhead Oncorhynchus mykiss caused by the Lower Snake River Dams. The hatchery was constructed by the U.S. Army Corps of Engineers, is administered and funded by the U.S. Fish and Wildlife Service, and operated by the Idaho Department of Fish and Game (IDFG).

The hatchery is located in Twin Falls County, seven miles northwest of Filer in the Snake River Canyon. The hatchery uses a maximum 125 cubic feet/second (cfs) of 59°F water from Crystal Springs located on the north shore of the Snake River. The facility has 20 hatchery tanks with 418 cubic feet rearing space in each tank operating at a flow of 100-200 gpm.

All smolts were transported by truck to the Salmon River and tributaries. The brood sources were Dworshak 'B' stock, East Fork Salmon River 'B' stock, and Pahsimeroi 'A' stock. No disease problems were encountered during the brood year.

OBJECTIVES

1. To hatch and rear up to 1.9 million 'A' and 'B' strain steelhead smolts for stocking in the Salmon River and its tributaries to achieve the mitigation goal of 11,660 adult steelhead back to Idaho waters.

2. Provide smolts and consequently returning adults that could be utilized for harvest, broodstock supplementation, reintroduction, and research purposes.

3. Mark hatchery smolts prior to release to avoid mixed stock harvest and to maximize harvest and natural production management options.

FACILITIES

The hatchery building houses the incubation and early rearing room with 40 upwelling incubators (12-gallon) capable of handling and hatching 50,000-75,000 eyed eggs each. There are 20 concrete tanks (4 ft x 3 ft x 40 ft, 418 cubic feet rearing space) with a capacity of 115,000-125,000 steelhead from swim-up to 200 per pound. The early rearing room also houses two fiberglass troughs (2 ft x 1 ft x 12 ft) and 60 automatic fry feeders. The building also contains an office, laboratory, wet laboratory, shop, dormitory, enclosed storage room, covered vehicle storage area, feed storage room, walk-in freezer and mechanical room for water pumps, water chiller, and domestic water supply systems.

There are 32 outside rearing raceways (10 ft x 3 ft x 200 ft, 6,153 cubic feet of rearing space). These raceways are divided in the middle by the headrace resulting in 16 "East" raceways and 16 "West" raceways. Each raceway has the capacity to raise 60,000-70,000 smolt size steelhead. The outdoor raceways are spanned by a moveable bridge equipped with 16 automatic Neilsen fish feeders. Two 30,000-pound bulk feed bins, equipped with fish feed fines shakers, and a feed conveyor complete the outside feeding system.

There are two tailraces outside located on opposite ends of the facility. Each flows to the south and joins in a common channel before entering the flow-through settling pond. The hatchery effluent water is treated using a cleaning waste water pond and a hatchery flow-through waste water pond. All cleaning effluent passes through both ponds.

The limiting factors in producing more smolts are space and water flows. Density and flow indices may exceed the maximum desired levels of .3 and 1.25 the last two months of rearing before stocking. Water flows have not reached the 125 cfs maximum in several years due, at least in part, to the drought.

WATER SUPPLY

The Magic Valley Hatchery water supply collection facility is located on the north wall of the Snake River Canyon. It collects the 59°F spring water from Crystal Springs in a covered concrete channel system which consolidates the flow in a metal building. A 42-inch pipeline delivers the 125.47 cfs of water via gravity flow to a control tank that degasses and distributes the water to the hatchery tanks and raceways. The hatchery building receives water through a 14-inch pipeline, and a 42-inch pipeline supplies the outside raceways.

The water quality analysis is found in Appendix A.

STAFFING

Magic Valley Hatchery is staffed with four permanent employees: Hatchery Superintendent III, Hatchery Superintendent I, and two Fish Culturists. Several temporary positions of Bio-aides (Youth Conservation Corps workers) and Laborers are employed at various times of the year to assist with fish culture duties during peak production, transportation, and during adipose fin-clipping. Personnel from this hatchery oversee ad-marking operations at the three steelhead hatcheries located in southern Idaho.

FISH PRODUCTION

The hatchery received 1,507,033 'B' strain (Dworshak stock) eyed eggs, 179,080 'B' strain eyed eggs (East Fork Salmon River stock), and 1,081,500 'A' strain eyed eggs (Pahsimeroi stock). All eggs were received in April, May, and June 1993. The survival of eyed eggs to smolts is found in Table 1.

Table 1. Brood year 1993 steelhead survival from eyed eggs to released smolts.

Eyed egg number	Percent hatched	500/Pound number	Percent survival	Released smolts/fry	Percent survival
Pahsimeroi ‘A’					
1,081,500	99.5	1,074,269	99.3	951,990	88.0
Dworshak (Clearwater) ‘B’					
1,507,033	96.4	1,465,183	97.1	1,199,520	80.6
East Fork ‘B’					
179,080	99.7	178,105	99.4	160,040	89.4
Total					
2,767,613	98.2	2,717,557	98.6	2,311,557	83.5

All eggs received were treated with Argentyne at 100 parts per million (ppm) for ten minutes, enumerated by displacement, and put into the upwelling incubators (50,000-75,000 eggs per incubator, 15 gpm). The eggs hatched within five days and emerged from the incubators into the hatchery tanks 12 days after hatching. Each of the 20 hatchery tanks were loaded at a rate of 150,000 feeding fry until they reached a maximum size of 300 fish per pound, or two inches in length, then were moved to the larger outside raceways. The highest mortality rate was during the hatching, swim-up, and early rearing stages. This year, as is traditional, survival was lower in the Dworshak stock of eggs and fish than in the Pahsimeroi and East Fork stocks. Table 2 indicates the mortality by stock and month from eggs received to stocking.

Table 2. Brood year 1993 mortality.

Month	Eggs Received		
	Pahsimeroi	Dworshak	East Fork
	1,080,810	1,507,033	179,080
	Mortality		
May	---	83,701	
June	14,463	7,767	1,950
July	7,098	2,768	1,402
August	5,029	2,108	483
September	[1]	[1]	3,352
October	[1]	1,473	395
November	579	870	333
December	544	361	48
January	883	536	89
February	597	242	91
March	695	480	124
April[2]	19, 506[2]	18, 927[2]	2,611[2]

--- Lot not received.
[1] New number adjustment from ad clipping.
[2] April adjustment from stocking.

All of the feeding fry were started on either Bioproducts'" BioDiet soft-moist or Rangen soft-moist feed until moved from the hatchery building tanks to the larger outside raceways. They were then fed Rangen'" salmon diet using Haskell's (1967) feeding rate formula. The feeding rate was calculated using a projected growth of .033 inches per day, starting with 1-inch fish (swim-up fry) and ending with an 8.4-inch smolt.

Piper's (1970) formulas for density and flow indices were used to calculate the densities and flows for each tank or raceway. The maximum desired density index of .30 or 1.25 flow index was not reached until the end of March in some raceways. The final indices for the individual raceway numbers, densities, and flows are found in Table 3.

Table 3. Final raceway inventory and indices for Magic Valley Hatchery 'A' and 'B' strain steelhead trout for 1993 brood year.

Raceway	Strain	Fish numbers	Weight (lbs)	Number/ pound	Flow index	Density index
1	B	126,690	22,600	5.6	1.25	0.28
2	B	127,800	24,200	5.2	1.32	0.30
3	B	123,815	26,150	4.7	1.35	0.31
4	B	128,610	27,900	4.6	1.43	0.32
5	B	120,210	24,300	4.9	1.30	0.29
6	B	119,705	23,950	5.0	1.27	0.29
7 West	B	54,720	11,400	4.8	1.20	0.26
7 East	B	60,390	13,420	4.5	1.38	0.31
8	B	105,320	21,900	4.8	1.15	0.26
9	A	121,530	24,400	5.0	1.29	0.29
10	A	119,980	26,100	4.6	1.35	0.31
11	A	121,760	24,400	5.0	1.28	0.29
12	A	121,170	28,850	4.2	1.45	0.33
13	A	119,510	25,700	4.6	1.34	0.30
14	A	115,280	26,000	4.4	1.34	0.30
15	A	119,220	27,200	4.4	1.38	0.31
16	A	113,540	26,700	4.2	1.36	0.31
Total A'S		951,990	209,350	4.5	1.35	0.30
Total B'S		967,260	195,800	4.9	1.32	0.30
Grand Totals		1,919,250	405,450	4.7	1.32	0.30

Maximum flows for the year were between 107 and 118 cfs from October through March. Each of the 32 outside raceways (5,372 cubic feet of rearing space each) had 3 to 4 cfs water flow early in the year and 2.8 cfs at distribution time in April.

The steelhead maintained a .8- to .9-inch per month growth. The fish had a conversion of 1.61 lbs of feed to produce a pound of fish. Some of the fish were growing faster than desired and were put on an intermittent schedule of feed, 7 days off feed and 7 days on feed for parts of the last two months. This may have contributed to the higher conversion rate.

Steelhead smolt distribution began on April 11 and continued six days a week to April 28. An average of four trucks per day was used for the transportation of 405,350 pounds of fish and involved 70 truckloads (Appendix B).

Feed Comparison Study

Data was collected from July 1, 1993 to April 7, 1994 to evaluate three different feeds to see if one was superior. The main criteria were:

1. Cost of feed for pound of fish gained.
2. Health and mortality during the study.
3. Rate of growth over the ten-month study.

Three outside raceways, 4, 5, and 6, were set up July 1 with 125,731, 121,854, and 121,259 fish, respectively. Raceway 4 was fed a Rangen™ Low Phosphate Feed. Raceway 5 was fed BioDry Feed. Raceway 6 was fed Rangen™ Bulk Feed. Results are summarized in Table 4 for total mortality, feed conversion,

and cost of feed per pound of fish growth. The information collected monthly is available.

Table 4. Feed comparison table.

	Type of feed	Mortality	Pounds of food fed per pound of fish gained	Cost per pound of fish gained	Pounds gained
Raceway 4*	Rangen'™ Low Phosphate	271	1.41	$ .51	23,688
Raceway 5	Bioproducts BioDry	1,644	1.621	$ .58	31,081
Raceway 6	Rangen Bulk	1,554	1.88	$ .55	3,222

* Data for raceway four was only from December to April.

Results

Statistical analysis was performed on the data collected. The 'F' test values did not indicate that any one feed performed significantly better than the others. This was true of both conversion and cost per pound of fish produced.

Discussion

At the Magic Valley Hatchery, feed needs are different than that of other hatcheries in the State of Idaho. Steelhead are off feed for an average of 30 days every year to slow their growth to meet 4.5 fish per pound at time of release. The requirements at Magic Valley Hatchery are for a food that could be fed continuously and meet the nutritional needs of the fish at a reduced growth rate. This would decrease fin erosion due to fin nipping during low feed periods. This could possibly be accomplished with a feed containing more fiber. But this may create a secondary problem of increased metabolic waste.

Phosphorus Monitoring and Low Phosphorus Feed Comparison

In conjunction with the feed experiment, another study was conducted to analyze the value of using lower phosphorus feeds for reducing phosphorus levels in hatchery effluent.

Monthly water samples were taken and analyzed for phosphorus concentration at the Magic Valley Hatchery for a nine-month period in 1993-1994. The purpose of phosphorus monitoring was primarily to establish and document amounts of total phosphorus as 'P' in effluent discharge water into the Snake River, and to compare three types of commercial salmon feeds for phosphorus contribution to water used in fish culture.

Monthly water samples were taken at each of six sample sites as follows:

1. Hatchery intake or head box; spring water collected from Crystal Springs.

2. Inflow from number 2 settling pond (total volume flow-through); sampled water from all raceways as it crossed over the weir.

3. Hatchery effluent; sampled the water that flowed out of number 2 settling pond into the Snake River.

4. Raceways 4, 5, and 6 inflow; measured phosphorus concentration of water over the dam boards as it flowed out of each of these raceways. Raceway number 4 steelhead were fed Rangen low phosphorus salmon pellets with a guaranteed analysis of 0.8% phosphorus.

   Raceway 5 steelhead were fed a Bioproducts™ BioDry Diet with an analysis of 0.95% phosphorus. Raceway 6 steelhead were fed Rangen Bulk Salmon Diet 1.2% analysis along with the rest of the steelhead on the station.

The hatchery intake and three treatment sample locations had approximately the same mean phosphorus concentration measurement of 0.12 mg/l. Mean phosphorus concentration increased 29% at the #2 pond inflow sample location and 48% at the hatchery effluent sample location, 0.17 mg/l and 0.23 mg/l, respectively. See Table 5 for illustration of data.

Table 5. Sample results total phosphorus milligrams per liter.

Date Sampled Feed	Raceway (#4) Low Phos Feed	Raceway (#5) BioDiet	Raceway (#6) tm Rangen	Hatchery intake	#2 Pond inflow	Hatchery Efficiency
7/28/93	---	0.19	0.07	0.05	---	0.05
8/19/93	---	0.05	0.09	0.21	---	0.22
9/17/93	---	0.08	0.16	0.18	0.30	0.58
10/18/93	0.10	0.05	0.17	0.022	0.30	0.18
11/22/93	0.05	0.12	0.09	0.07	0.07	0.12
12/20/93	0.06	0.06	0.10	0.11	0.13	0.12
1/18/94	0.05	0.06	0.05	0.05	0.09	0.09
2/16/94	0.12	0.12	0.14	0.05	0.13	0.19
3/21/94	0.31	0.27	0.30	0.18	0.18	0.52
MEAN	0.12	0.11	0.13	0.12	0.17	0.23
STANDARD DEVIATION	0.09	0.07	0.07	0.07	0.09	0.18
VARIANCE	0.008	0.005	0.005	0.004	0.008	0.032

--- Diet unavailable

A statistical test was performed on the feed data set for further analysis. Analysis of variance (ANOVA) and 'F' tests were used to see if sampling variability was significant enough to warrant further study and analysis. The statistical test results stated that the means are equal and there is no significant difference in the feed treatments for contribution of phosphorus to waters leaving treatment raceways.

FISH HEALTH

Diseases Encountered and Treatments

No significant mortality at Magic Valley can be attributed to etiologic agents. Infectious Pancreatic Necrosis Virus (IPNV) was isolated in Pahsimeroi steelhead 'A' run and East Fork steelhead 'B' run stock. The IPNV was not isolated in the Dworshak steelhead 'B' stock until the preliberation sample. Mortality was not associated with these isolations.

Other Assessments

Due to the later date of organosomatic analysis and preliberation samples, some of the parameters may vary from previous years.

Although IPNV was isolated from each group of fish raised at Magic Valley, mortality was not associated with these findings. Apparently this particular isolate is not pathogenic or there was not enough stress to predispose fish to disease. Magic Valley will undergo thorough disinfection before new fish are introduced into these raceways.

Despite carrying IPNV, these fish appeared healthy and able to survive migration. If survival is low, as compared to previous years, we should assume that this virus has contributed to the mortality. If survival to the dams is comparable to recent years, it can be assumed that this particular strain of IPNV is not as pathogenic as other strains.

FISH MARKING

Adipose Fin Clipping

All of the 'A' and 'B' strain hatchery steelhead are required to have an adipose fin clip identifying them from wild steelhead. At Magic Valley Hatchery, the fin clipping crews marked 2,166,596 fish during October and November. Fin clipping attributed to a .05% mortality rate. Personnel randomly sampled the population of fish prior to stocking and found 95.2% had an acceptable fin clip. Treatment was unnecessary after handling.

Coded Wire Tagging

Three groups of steelhead were coded wire tagged this 1993 brood year. There were 341,249 fish marked with the coded wire tag and 340,737 were stocked. Very little loss was encountered from handling, and treatment was not necessary. Quality checks done before stocking revealed a 99.2% retention of coded wire tags and a 96.8% acceptable left ventral fin clip.

Pit Tagging

All three groups of steelhead had a total of 1,701 PIT tags inserted in them, and all survived to be stocked (Appendix F).

LITERATURE CITED

Haskell, D.C. 1967. Calculations of amounts to feed trout in hatcheries. Progressive Fish Culturist 19(4):194.

Piper, R.G. 1970a. Know the proper carrying capacities of your farm. American Fishes and U.S. Trout News 15(1):4.

A P P E N D I C E S

Appendix A. Water analysis for Magic Valley Hatchery taken from inflow.

Analysis	Results(mg/1) june 1992	Results(mg/1) may 1994
Alkalinity	179.000	183.000
Ammonia as N	<0.050	<0.050
Arsenic	<0.005	<0.005
Cadmium Graphite	<0.001	<0.001
Calcium	59.000	63.000
Chloride	50.500	48.300
Copper	<0.010	<0.010
Hardness	243.000	253.000
Iron	<0.010	<0.010
Lead Graphite	<0.002	<0.020
Magnesium	24.000	25.000
Manganese	<0.010	<0.010
Nitrate as N	1.860	2.060
Mercury	<0.0005	<0.0002
Nitrite as N	<0.010	<0.010
Phosphate, Total	0.020	.060
Sulfide	<0.050	<0.050
Sulfate	60.600	61.800
Total Dissolved Solids	525.000	423.000
Total Kjeldahl Nitrogen	<0.010	.300
Zinc	<0.001	<0.001
pH (SU)	7.950	8.000

Appendix B. Smolt distribution in the Salmon River and Tributaries.

Species	Numbers	Pounds	Number per pound	Receiving waters	Dates released	Hauling Mortality
Dworshak 'B'	357,140	68,900	5.1	East Fork	4/11-16/94	310
East Fork 'B'	160,040	33,400	4.8	East Fork	4/11-16/94	20
Dworshak 'B'	211,355	42,650	4.9	Slate Creek	4/22-28/94	48
Dworshak 'B'	238,725	51,050	4.6	Hazard Creek	4/12-20/94	54
Pahsimeroi 'A'	484,440	103,85	5.70	Pahsimeroi River	4/16-22/94	123
Pahsimeroi 'A'	467,550	105,600	4.4	Little Salmon at Warm Springs Creek	4/23-27/94	111

Appendix C. Brood Year production cost table.

Number of fish	Pounds of feed	Cost of feed	Pounds of fish	Conversion	Total cost	Cost per 1,000	Cost per pound
2,311,550	654,693	$195,775	407,350	1.61	489,691	$211.8	$1.20

Appendix D. Summary of fish autopsy preliberation examinations.

SUMMARY OF NORMALS (PERCENT)									
Eyes	Gills	Pseudo-branches	Thymus	Mesentary Fat	Spleen	Hind gut	Kidney	Liver	Bile
DWORSHAK (B)									
100	90	100	100	100	100	100	100	100	100
EAST FORK (B)									
100	100	100	100	100	100	100	100	100	100
PAHSIMEROI (A)									
100	100	100	100	100	100	100	100	100	100

Appendix E. Steelhead marking at Pahsimeroi and East Fork Salmon River release sites.

STEELHEAD MARKING						
Date marked		Number of fish marked	Type of mark	Purpose	Number of marked released	Site of release
PAHSIMEROI A'S						
9/13-10/5	1993	966,786	Adipose fin clip	Wild/Hatchery	951,990	Pahsimeroi River
11/1-7	1994	86,472	Coded wire tag 10-47-25 10-47-26 10-47-23 10-47-24	Mitigation Research Harvest	86,360	Pahsimeroi River
2/23-24	1994	501	Pit Tag	Smolts travel time, Adult return	501	Pahsimeroi River
DWORSHAK, CLEARWATER B'S						
9/13-10/5	1993	829,019	Adipose fin clip	Wild/Hatchery	807,220	East Fork Salmon River
11/1-7	1993	190,788	Coded wire tag 10-47-21 10-47-10 10-49-25 10-47-14 10-47-15 10-47-16	Mitigation Research Harvest Biodiet Low P Low P	190,519	East Fork Salmon River
2/23-24	1993	900	Pit Tag	Smolts travel time, Adult return	900	East Fork Salmon River
EAST FORK SALMON RIVER B'S						
9/13-10/5	1993	163,560	Adipose fin clip	Wild/Hatchery	160,060	East Fork Salmon River
11/1-7	1993	63,989	Coded wire tag 10-47-11 10-47-12 10-47-13	Mitigation Research Harvest	63,858	East Fork Salmon River
2/23-24	1994	300	Pit Tag	Smolts travel time, Adult return	100	East Fork Salmon River
TOTALS		1,959,365			1,919,250	

Submitted by:

Bud Ainsworth
Hatchery Superintendent III

Dave May
Fish Hatchery Superintendent I

Dwight Aplanalp
Fish Culturist

Kent Hills
Fish Culturist

Approved by:

IDAHO DEPARTMENT OF FISH AND GAME Fish

Steven M. Huffaker, Chief
Bureau of Fisheries

Bill Hutchinson
Hatcheries Manager