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FISH & GAME DEPARTMENT

John R. Woodworth, Director

ANNUAL REPORT

July 1, 1968 to June 30, 1969

EXPERIMENTAL REARING OF STEELHEAD TROUT AT HAYDEN CREEK REARING PONDS

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Experimental Rearing of Steelhead Trout at Hayden Creek Rearing Ponds, 1968-1969

Summary of Production

In October, 1968, approximately 170,000 fingerling Clearwater River stock steelhead were placed in the Hayden Creek rearing ponds. In early May, 1969, approximately 87,500 of these were counted out of the ponds as smolts and released into the Salmon River system, a survival of 51 percent. When placed in the ponds, approximately 50 percent of the fingerlings showed a gill deformity. There were few gill deformities noted in the smolts released in May. It appears the afflicted fish died during the pond rearing cycle.

Upon release, the fish averaged 14 per pound and 151 millimeters total length. Forty-eight percent of the released fish were over 160 millimeters total length. Fish as small as 140 millimeters showed the silvery sheen and sliminess characteristic of smoltification. A total of 26,720 of these smolts were marked with a left ventral fin clip. Another 20,000 smolts were nitrogen-freeze-branded with the letter "L."

During the latter part of the 1968-69 rearing period, feed rates were nearly 100 percent above standard hatchery levels due to the undetected mortality. Consequently, the average conversion rate of 5.6 pounds of feed per pound of fish is not typical. We used 34,986 pounds of Idaho Dry Diet feed at a cost of $2,760 to rear 6,246 pounds of steelhead trout (Table 1).

Dissolved oxygen levels in the ponds dropped as low as 3 ppm during the last part of the rearing cycle and may have con-

Table 1. Summary of steelhead production, Hayden Creek Rearing Ponds, 1968-1969.

	South	North
INPUT: October 14, 1968 (Fingerlings)	85,000	85,000
OUTPUT: May 1, 1969 (Smolts)	43,700	43,700
REARING CYCLE SURVIVAL:	51%	51%
TOTAL POUNDS FEED USED:	34,986	
FEED COST:	$2,760	
AVERAGE COST PER POUND OF FISH:	44.2¢	
AVERAGE CONVERSION FACTOR:	5.6	

tributed to the loss of the deformed fish. The pond bottoms were scraped and cleaned during the summer of 1969 to remove decomposed matter before the 1969-70 rearing cycle (Figure 1).

Also, during the summer of 1969, seven additional automatic feeders were installed around the pond perimeters. This doubles the existing number of feeders (Figure 2). We hope this will result in more uniform sized smolts for release in May, 1970.

24-hour Feeding Test

Starting in November, 1968, a 24-hour feeding schedule was initiated on the South Pond using night lights. Daily amounts of feed were increased approximately 50 percent over standard hatchery rates and dispensed hourly by four automatic feeders. The North Pond (control) feeding schedule was from 8:00 a.m. to 5:00 p.m. daily at standard hatchery rates.

By January 1, 1969, the 24-hour (day and night fed) group had gained 98 percent more weight than the 8-hour (daytime fed only) control group. One month later the control group had nearly caught up in average size. By March 31, the control group fish averaged 5 millimeters longer and 6 grams heavier. The experiment was terminated on March 31, and both groups were placed on a normal daylight feeding program. A breakdown on the progression of the two groups is shown on Table 2.

Total cost of feed for the North Pond for the five-month experimental period was $818, compared with $1,166 for the South Pond. As can be seen on Table 2, the last month's cost-per-pound of fish gained and pounds of food fed per pound of fish gained (conversion factor) rose sharply.

The experimental group utilized the food dispensed at night but possibly some unnatural stress eventually manifested

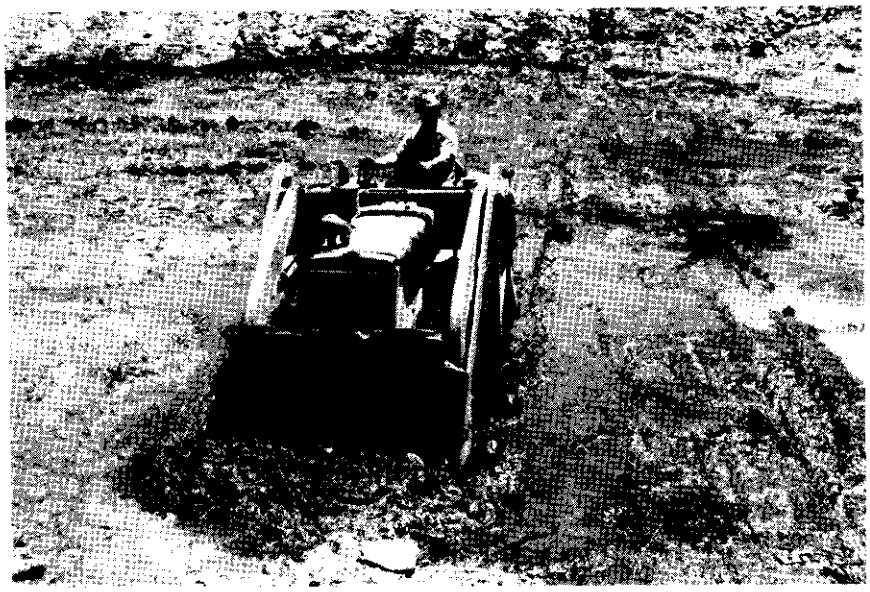

Figure 1. During July, 1969, approximately 350 cubic yards of black detritus were removed from the pond bottoms to prevent decomposition oxygen demand during following rearing cycles.

Figure 2. An additional seven feeder stations were installed during 1969 to provide better feed distribution to steelhead in the ponds.

Table 2. Growth record of 24-hour night light feed steelhead and normal day fed (control) steelhead at the Hayden Creek Rearing Ponds, 1968-1969.

	CONTROL					EXPERIMENTAL				
Month Ending:	Weight	Length	Pounds fed (month)	Feed Cost/ lb.	Conv. Factor	Weight	Length	Pounds fed (month)	Feed Cost/ lb.	Conver. Factor
Nov. 15	175/lb.	65mm	starting size			175/lb.	65mm	starting size		
Nov. 30	96	78	982	.30	3.8	94	78	1,210	.35	4.4
Dec. 31	57	93	1,300	.17	2.1	41	103	1,933	.13	1.6
Jan. 31	36	105	1,699	.15	1.9	30	107	3,034	.32	4.1
Feb. 28	20	126	2,352	.10	1.2	21	121	3,584	.23	2.9
Mar. 31	15	137	4,030	.24	3.0	20	132	5,022	1.42	18.0

itself to slow growth in spite of an increased 24-hour diet. The undetected mortalities possibly affected test results so these are not considered conclusive.

Appendum to 1968-1969 Report for 1-1-D-4

CHINOOK SALMON INCUBATION AND EGG LOADING TESTS -- HAYDEN CREEK RESEARCH STATION, 1969

Introduction

Since incubation facilities at Hayden Creek became operative in 1967, severe losses occurred on occasion in both steelhead and chinook salmon embryos hatched at the station. We suspected the naturally low (4-6 ppm) dissolved oxygen levels in the spring-fed water supply, coupled with presence of zinc, copper and iron ions.

We observed fry losses in conjunction with severe physical deformities; stiff whitish fins, coagulated yolk in the ventral slit, flared gill covers and swollen deformed gills. A shiny silver colored constriction commonly occurred just behind the head.

Preserved and fresh specimens sent to fishery laboratories yielded no diagnosis. Severely deformed fry rarely survived beyond 2,500 temperature units from incubation.

In the fall of 1969 we tested to determine if variations in incubation water supply, post swim-up holding water and egg loading density affected fry survival or frequency of deformity.

Materials and Methods

In the spring of 1969, crushed oyster shell spread on the bottom of the spring pond increased hardness of the water from 100 to 200 parts per million (ppm). Deformities in steelhead fry of the 1969 brood year reached only 15 percent, compared to 50 percent for fry of the 1968 brood year. We believe deformities lessened as a direct result of buffering action of

increased water hardness.

In August, 1969, we investigated hatching of chinook salmon eggs in four different incubator water supplies; undiluted spring water, oxygenated spring water, spring water diluted 50 percent with Hayden Creek water and undiluted Hayden Creek water.

Undiluted spring water drawn from the supply pond and piped directly into the test incubator received no aeration or other treatment. Just prior to the tests we seeded the spring pond with crushed oyster shell. Spring water hardness during the test registered 300 ppm, a 300 percent increase over 1968 levels. The undiluted spring water ranged in temperature from 53 to 56 degrees Fahrenheit (F), and dissolved oxygen ranged from 3 to 6 ppm.

We aerated spring water for another test by spilling it through a series of screens and pumping it to the top of the test incubator. Temperature of the aerated spring water ranged from 53° to 56° F. Dissolved oxygen ranged from 6 to 7 ppm.

We diluted unoxygenated spring water with an equal amount of water from Hayden Creek for another test series. Temperature of this 50:50 mix ranged from 52° to 60° F. Dissolved oxygen levels ranged from 5 to 7 ppm.

Undiluted, unaltered Hayden Creek water used as the fourth test supply ranged in temperature from 50° to 62° F. Dissolved oxygen ranged from 5 to 7 ppm.

Each of the four test incubators contained 18,720 eggs distributed in eight separate trays. After the fry reached swim-up stage, we mixed the fish from all eight trays in each stack and randomly selected about 5,000 fry and placed them in troughs. These lots of 5,000 fish provided the data for our

assessment of survival and deformities.

Results

The incubation tests showed that a 50:50 mixture of Hayden Creek and spring water resulted in the highest survival of fry and fewer deformities for the shortest incubation time (Table 3).

Fry hatched in oxygenated spring water had slightly higher survival and fewer deformities than those hatched in unaltered spring water. Practically all severely deformed fry died before accruing 2,500 temperature units.

I attribute the reduction in deformities in all tests to increased hardness of spring pond water caused by addition of oyster shell.

A post swim-up test on fry hatched in oxygenated and unoxygenated spring water indicated no differential survival between fish held in either spring or creek water for one month after swim-up (Table 4). We felt this indicated that damage to fry occurred earlier during embryonic development.

We assessed the relationship of density of eggs loaded in trays on survival. Using eggs incubated and hatched in Hayden Creek water, we varied loading only at densities of 30, 40, 50, and 60 ounces per Heath Incubator tray. We found no apparent difference among densities in survival to hatch (Table 5).

Discussion

As a result of these tests, we plan to add crushed oyster shell to the spring pond and use 50:50 Hayden Creek spring water supply in the incubators when possible. Hayden Creek water may become too turbid to use during spring runoff periods.

We realize that temperature, oxygen, ionic variation and

other factors confounded the tests. Also, time and facilities did not allow enough test repetitions to provide data amenable to statistical analyses.

We feel, however, that inspection of the data collected shows significant enough results for practical application in our operations.

Table 3. Summary of incubation tests with chinook salmon with various water supplies at the Hayden Creek Rearing Ponds, August, 1969 - January, 1970. A mixture of half spring water and half Hayden Creek water produced best results.

WATER SUPPLY:	Hayden Creek	1/2 Hayden Cr. 1/2 Spring	Spring	Spring + O_2
Placed in incubators	8/26/69	8/26/69	8/26/69	8/26/69
Number incubated	18,720	18,720	18,720	18,720
% survival to eye-up	90%	91%	89%	90%
% survival to hatch	83%	85%	81%	82%
% survival to swim-up	82%	82%	80%	81%
% deformities at 2,000 temp. units	0.0%	0.8%	5.7%	2.1%
% deformities at 2,500 temp. units	0.0%	0.0%	0.0%	0.4%
% survival to 2,500 temp. units	82%	82%	70%	73%
Number days to swim-up	113	91	78	71
Av. temp. units per day	15.0	18.6	21.7	23.9

Table 4. Summary of chinook salmon post swim-up holding water supply tests conducted at Hayden Creek Rearing Ponds, November-December, 1969. Post swim-up water supply had no apparent effect on survival up to one month after swim-up.

INCUBATION WATER SUPPLY:	Spring	Spring	Spring + O_2	Spring + O_2
HOLDING WATER SUPPLY:	Spring	Hayden Creek	Spring	Hayden Creek
Number of fish	2,532	2,504	2,606	2,617
Date put in trough	11/7/69	11/7/69	11/7/69	11/7/69
Date removed from trough	12/8/69	12/8/69	12/8/69	12/8/69
Accrued temp. units	668	244	668	244
Total mortality	100	102	193	231
Percent survival	96%	96%	93%	91%

Table 5. Summary of chinook salmon egg density loading tests. We varied only ounces of eggs per Heath Incubator tray. Water supply was undiluted Hayden Creek. More variation occurred in survival among identical densities than density extremes. Hayden Creek Rearing Ponds, 1969.

Incubation Date	Incubator	Ounces per Tray	Number of Eggs	Percent Eye-up	Percent Hatch
8/29/69	F	50	59,700	94%	88%
8/29/69	G	40	43,900	94%	89%
8/26/69	H	60	65,900	92%	84%
8/26/69	I	40	46,800	89%	81%
8/26/69	J	30	32,700	91%	82%

Construction Report, Contract 14-17-0001-1833

Because of previously reported delays in land acquisition there was no major construction at Hayden Creek during 1968-69. The long delayed construction of the feed and storage shed and the septic line and drain field is now underway.

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