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Test Rearing of Anadromous Fish, Lemhi River
Drainage, Idaho (Hayden Creek)

July 1, 1972 - June 30, 1973

By

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Experimental Rearing of Anadromous Fish at
the Hayden Creek Research Station, Idaho

ABSTRACT:

We released approximately 32,000 1971 brood-year steelhead from the Hayden Creek Research Station after two seasons in the raceways and North Pond. They averaged 169 mm total length and 7.1 per pound. We classified 61 percent as smolts, all over 160 mm total length. Our survival rate from ponding to release was 48 percent.

Evidence indicates that we can expect around 50 percent survival if we pond ungraded steelhead. It appears that careful grading prior to ponding steelhead leads to increased survival and smolt to sub-smolt ratios.

We released 298,000 spring chinook salmon in October 1972. They averaged 135 mm fork length and 14.5 per pound. Chinook thrive in the ponds at Hayden Creek and it appears that grading prior to ponding is not mandatory to achieve high survival and growth rates in this species.

Twenty adult steelhead and 30 adult salmon returned to the station in 1973 from earlier releases. Several of these carried fin clips applied at the station when they were released as smolts.

Future plans include rearing early-returning Clearwater steelhead stock on an experimental one-year basis.

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GENERAL HATCHERY OPERATIONS:

In 1971, we changed from a 1-year to a 2-year rearing cycle for summer steelhead and maintained a 1-year fall release cycle for spring chinook at the Hayden Creek Research Station. We continued this program through the 1972-73 rearing cycle.

We obtain steelhead eggs in April and May from adults returning to the Lemhi Weir, to the station, and from Dworshak Federal Hatchery. These are incubated, hatched and placed as fry in the station raceways by July. The fry are reared in the raceways until October, when they are transferred to one of the two .6-acre rearing ponds.

The 1971-73 program called for rearing these fish in natural water temperatures, with automatically dispensed feed, for approximately 18 months, from October through March of the second year. Any voluntary first-year emigrants (smolts) were allowed to leave the pond through a counting box.

Chinook salmon eggs are obtained from Rapid River Hatchery in the fall, hatched at the station, and reared to fingerling size in the raceways from January to April. After release of the steelhead smolts in May from one rearing pond, the chinook are placed in the refilled pond and reared until release the following October.

Both ponds are in continual production throughout the year with either steelhead or chinook occupying the facilities. Both raceways are also in continuous use except for 2 months each winter and spring when chinook and steelhead eggs are incubating.

Our annual production level of each species is dictated by pond carrying capacities at approximately a quarter million fish of each species. In past years, however, we have often been limited to lower production numbers due to a limited supply of eggs (Tables 1 and 2).

Table 1. Summary of steelhead smolt releases and adult returns to the Hayden Creek Research Station since the initiation of the program in 1966.

Brood year	Year released	Number juveniles released	Number marked	Mark used	River race	Number adults ret. as:	
						one-ocean fish	two-ocean fish
1966	1967 (May)	180,000	22,800	LV	Clearwater	48 (1969)	46 (1970)
1967	1968 (May)	340,000	12,000	LV Clip	Snake	8 (1970)	10 (1971)
1967	1968 (May)	340,000	11,700	LV AD	Snake		
1968	1969 (May)	87,500	26,700	LV Clip	Clearwater	5 (1971)	6 (1972)
1968	1969 (May)	87,500	20,000	L Brand	Clearwater		
1969	1970 (May)	187,400	55,000	LV	Clearwater, Lemhi 1969 Return	11 (1972)	15 (1973)
1970	1971 (May)	72,000	38,000	LV	Lemhi Weir, 1970 Return	5 (1973)	-- (1974)
1970	1972 (Mar.)	87,500	50,000	LV	Lemhi Weir, 1970 Return	-- (1974)	-- (1975)
1971	1973 (Apr.)	31,700	13,800	LV	Lemhi Weir, 1971 Return	-- (1975)	-- (1976)

Table 2. Summary of chinook smolt releases and adult returns to the Hayden Creek Research Station since the initiation of the program in 1969.

Brood year	Year released	Number juveniles released	Number marked	Mark used	River race	Number adults ret. as:	
						one-ocean fish	two-ocean fish
1969	1970 (Oct.)	83,200	25,200	AD	Lemhi Weir	0 (1972)	20 (1973)
1970	1971 (Oct.)	201,000	52,000	1/2 D, AD, LV	Rapid River	10 (1973)	-- (1974)
1971	1972 (Oct.)	312,000	73,000	RVL Max.	Rapid River	-- (1974)	-- (1975)
1972	1973 (Oct.)	151,000	0		Rapid River	-- (1975)	-- (1976)

PRODUCTION 1972-73:

Steelhead - North Pond

In November 1971, we placed an estimated 73,000 steelhead fingerlings at 118 per pound in the north rearing pond. Due to generally depressed steelhead runs into Idaho in 1971, we were limited to eggs from the Lemhi Weir and returns to the station, hence the low number.

Project plans were to rear these fish on a natural water temperature regime until the spring of 1973. We raised the drum screen in May 1972, and counted out 4,300 voluntary first-year emigrants. Visible mortality, less these first-year emigrants, left us with an estimated 66,300 fish in the pond entering the winter of 1972-73.

In April 1973, we drained the pond and released the remaining fish that had been in the pond for 18 months. We counted and/or weighed out 31,700 fish for a survival of 48% over the 2-year rearing cycle. Of these fish, we classed 61% (t 19,300) as top quality smolts, all over 160 mm, 13% precocious males and 26% sub-smolts (less than 160 mm). (Figures 1, 2 & 3).

The results of this first effort at a 2-year natural water temperature rearing regime were not encouraging. We achieved approximately this same level of survival and smolt percentage with 1-year cycles in past years. We feel that the next logical sequence in this experimental pond rearing project is to rear the steelhead for 2 years in slightly increased water temperatures to produce larger numbers of voluntarily emigrating first-year smolts. By doing this, we may be able to load the ponds slightly higher than our present limit of approximately 200,000 fish, and hopefully we can produce a larger percentage of smolts, which appears to be primarily size-linked.

In past years, we have been limited by not having enough steelhead eggs to grade fingerlings prior to ponding. This led to a large size disparity in

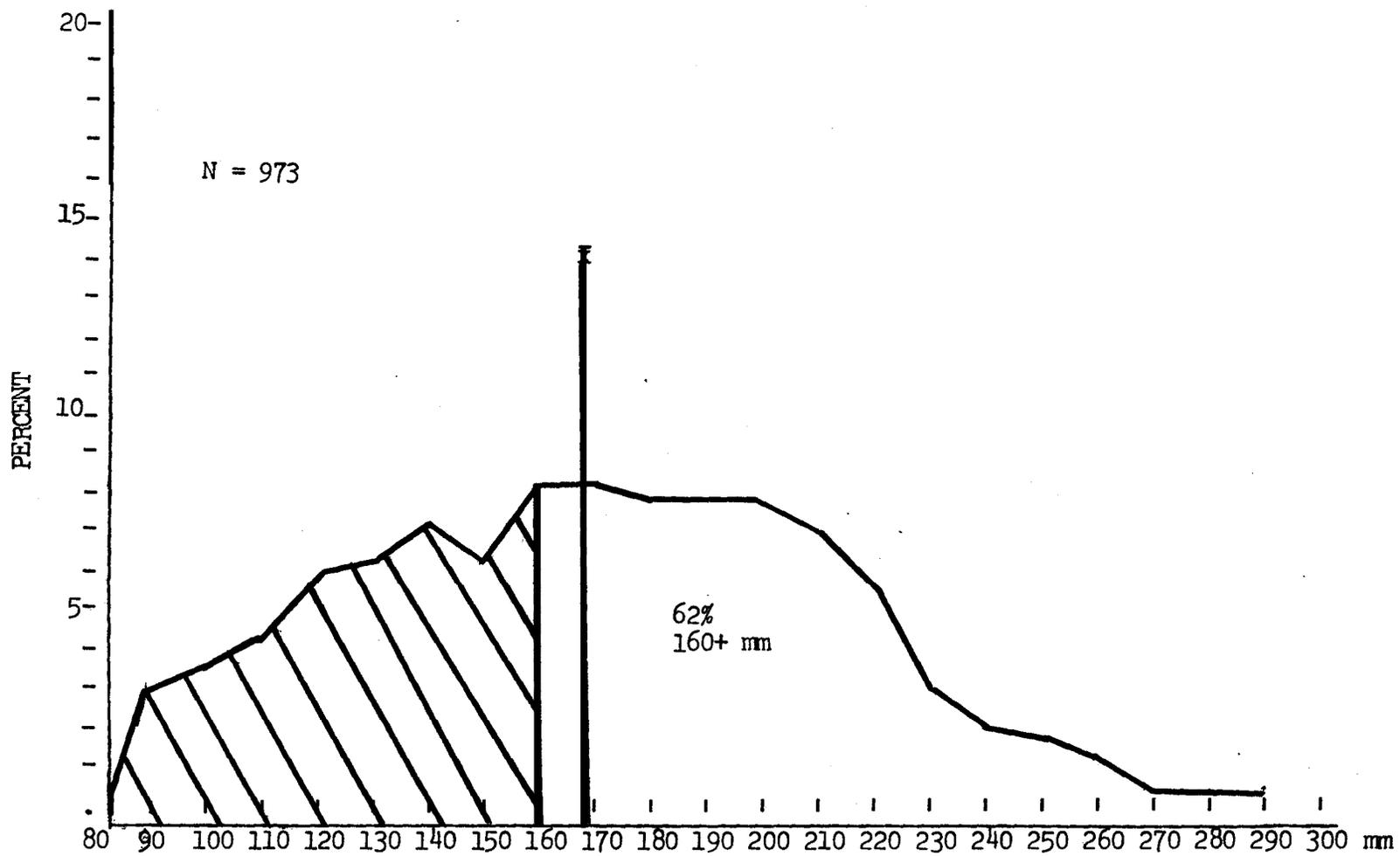


Figure 1. Length frequency of steelhead released from Hayden Creek South Pond, March 1973. Sixty-two percent of the fish sampled exceeded 160 millimeters total length.

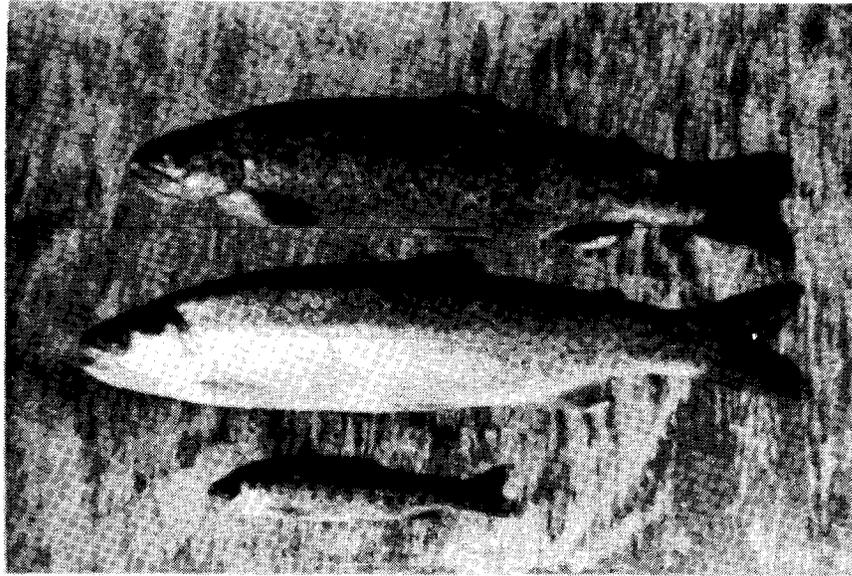


Figure 2. The 1971 brood-year steelhead released from the North Pond in April 1973 consisted of 61% smolts (center), 13% precocial males (top) and 26% sub-smolts (bottom).

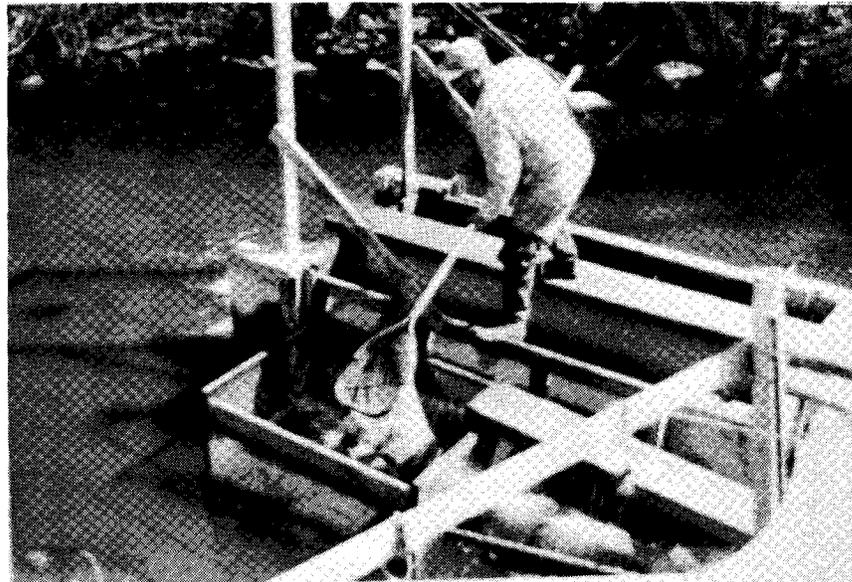


Figure 3. Steelhead smolts being weighed out of the outlet trap into a live box for fin-clipping.

the ponds and a high percentage of sub-smolts. Our experience has shown us that if steelhead fingerlings are not graded prior to ponding, the larger individuals quickly dominate the feeder stations, relegating smaller individuals to the pond perimeters where they do not compete and receive little or no feed. Their growth ceases and most of them perish. Most of this mortality appears to occur within the first few months of ponding and because the fish are small and die off over an extended period, most of the loss is not visible. Over the previous 5 years (1969-1973), the percent survival from ponding to release has been 51, 87, 47, 58, and 48%, respectively. Some of the loss in the earlier years we felt was due to escapement from the ponds. While this has been a factor, it appears that the majority of this loss was from mortality of small fish. The 1969-70 survival percentage of 87% reflects the only year in that 5-year period when we graded the fish prior to ponding. The other years we wished to approach pond rearing capacity and felt we had too few fish on hand to discard grade-outs. It appears that if we attempt to rear ungraded steelhead in the ponds we can expect a survival level of around 50%.

If an adequate egg supply is not available from station returns or the Lemhi Weir in future years, all attempts will be made to obtain two-ocean stock eggs from outside sources to ensure enough steelhead fingerlings to selectively grade prior to ponding.

Average size of the total release was 169 mm total length and 7.1 fish per pound. Of the fish we classified as smolts (bright, silvery, slim fish over 160 millimeters in length, with deciduous scales), the average size was 197 mm total length and approximately 6.2 per pound. We used 20,379 pounds of pelleted feed at a cost of \$1,954.83 between July 1, 1971 and April 1, 1973.

Plans for the 1973-75 program call for rearing 250-300,000 top graded steelhead for 18 months in the North Pond, in close to natural water temperatures, with voluntary first-year emigrants allowed to leave.

Steelhead - South Pond

In December 1972, we placed 108,000 1972 brood-year steelhead fingerlings at 125 per pound into the South Pond. A limited supply of eggs, plus pick-off and some disease problems in the fry stage, prevented us from having sufficient numbers to grade and load to capacity in 1972. We noted considerable size disparity among the fish when we ponded them.

In late May 1973, we conducted a mark and recovery estimate on the South Pond. We captured and marked 8,420 steelhead with an adipose clip and returned them to the pond. Eight days later we collected a sample of 5,108 steelhead from the pond of which 858 were marked. This indicated a pond population of approximately 50,000 fish, an estimated loss of 54% of the original pond stock in the first 6 months. This falls in line with survival rates for ungraded fish noted earlier in the North Pond segment of this report.

As of June 30, 1973, these steelhead remained in the South Pond to be reared for release at a later date (Figure 4).

In past years, we have determined that it is difficult, if not impossible, to successfully rear summer steelhead to a smolt sized fish in 1 year at Hayden Creek. The adults are not available until May generally, and the 9-month period from hatch to spring release is not enough time to bring a majority of the fish to the smolt stage.

We changed to a 2-year rearing program in 1971, on an experimental basis. We feel, however, that with an additional 2 months of rearing time we could possibly rear a 1-year smolt at the station.

In May 1973, we requested 200,000 steelhead fingerlings from Dworshak Federal Fish Hatchery in Orofino, Idaho, from their earliest returning adults. These fish are approximately 2 months ahead of the steelhead fingerlings hatched from adults that returned to the Lemhi Weir and Hayden Creek in 1973. Plans are to release the 50,000 steelhead in the South Pond in the fall of

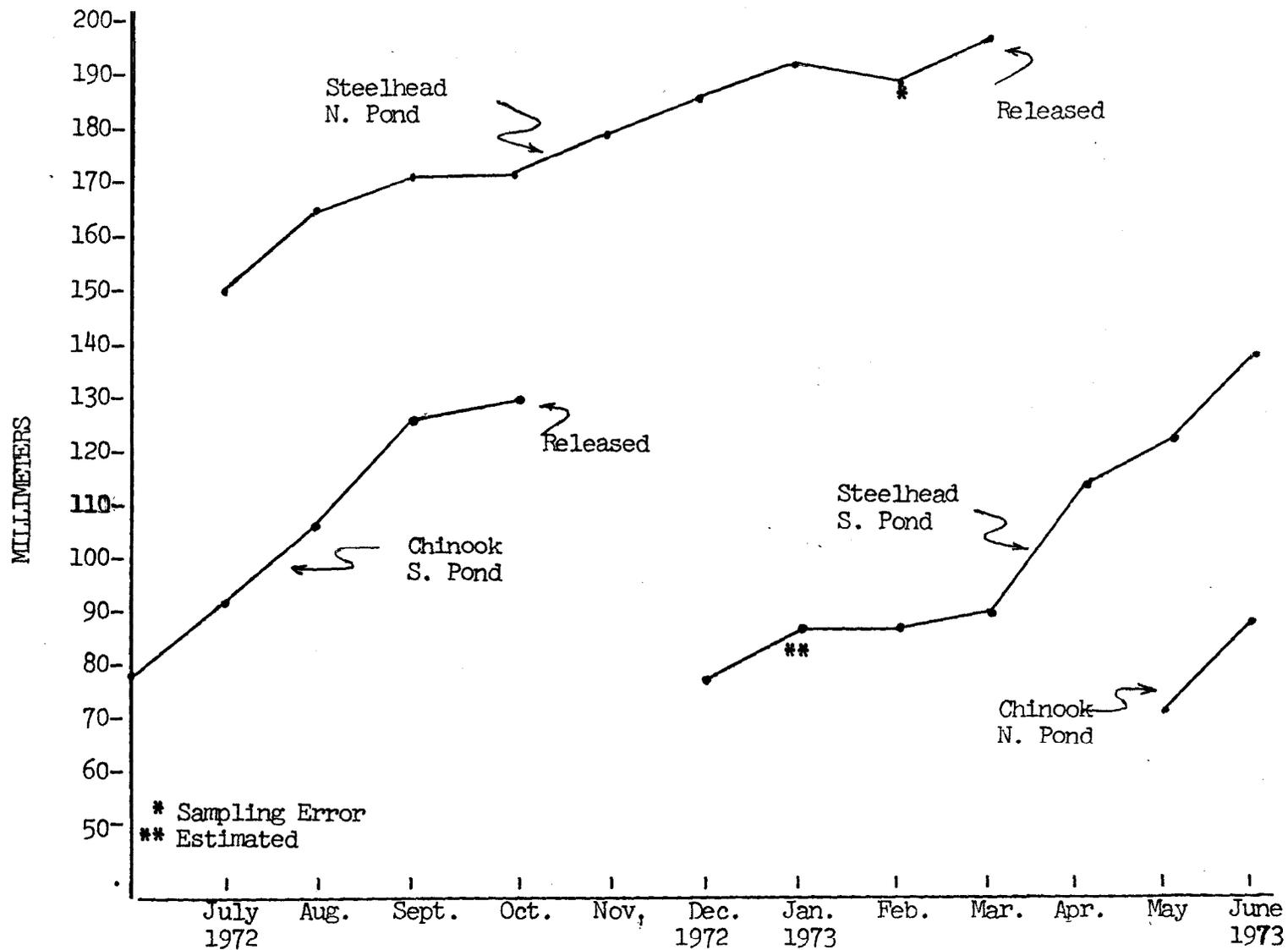


Figure 4. Growth rates of chinook salmon and steelhead trout reared in the Hayden Creek ponds during the period July 1, 1972, through June 30, 1973. Points on the curve represent average size at end of month. Steelhead - total length, chinook - fork length.

1973, and replace them with 200,000 top graded, Dworshak Hatchery steelhead fingerlings. We would then rear these through the winter of 1973-74 on warm water temperatures (48-52 F) and release them as seaward-bound molts in May 1974. Future plans include obtaining early eggs from Dworshak annually, hatching these at Hayden Creek and gaining 2 months of rearing time in this manner. Our plans are to select early returning adults from these rearing cycles in future years to attempt to create an early-returning 1-year-reared stock back to Hayden Creek.

Chinook Salmon - South Pond 1972

On May 13, 1972, we placed 312,000 spring chinook salmon in the South Pond. This was a 50% increase over previous stocking density. The fish averaged 136 per pound. The intent of this increased loading density was to experiment with pond carrying capacity.

During the first week of September, the chinook in the pond showed signs of distress and nocturnal losses of 400 to 600 fish occurred three or four nights in sequence despite an increase in the pond inlet flow to nearly 7 cfs. Dissolved oxygen tests showed 8 ppm D.O. at the inlet and 5 ppm at the outlet. The drop of 3 ppm indicated the probability of excess buildup of wastes aggravated by the seasonal die-off of algae in the pond. We released 13,000 chinook into Hayden Creek (approximately 800 lbs.) which alleviated the problem. It appears that the pond carrying capacity for chinook is around 18,000 pounds maximum.

Between October 5 and 10, 1972, we released the remaining 298,000 chinook. We applied a right ventral-left maxillary clip to 73,600. The chinook averaged 135 mm fork length and 14.5 per pound (Table 3).

There were two general size groups of chinook released from the pond as shown in Table 3; one group from 70 to 129 mm and one group from 130 mm to

Table 3. Length frequency distribution of spring chinook smolts released from the Hayden Creek North Pond in October 1972.

<u>Millimeters fork length</u>	<u>Number of fish</u>
70-79	1
80	21
90	52
100	59
110	30
120	21
130	49
140	91
150	171
160	108
170	28
<u>180-189</u>	<u>1</u>
 x = 135 mm	 N = 632

189 mm fork length. When we ponded these ungraded fish **in** May, it appeared, as with steelhead, that the larger fish immediately dominated the feeder stations. Unlike steelhead, however, the smaller chinook appeared to maintain their aggressiveness and competed strongly for feed. As they gained size and strength, they eventually moved into the main feeding areas and resumed their normal rate of growth. We believe this is reflected in the final two general size groups at the end of the rearing cycle. We believe because the pond was loaded above optimum capacity in 1972, this phenomenon was more noticeable than in previous rearing cycles.

To answer the question as to whether the smaller size chinook would migrate as readily as the larger size, we placed 50 fish from each group in two artificial stream channels equipped with outlet traps. Between October 6 and October 16, 37 large size and 34 small size fish migrated downstream out of the channels (Table 4). It appears that both size groups migrated downstream equally as well.

Sampling showed that approximately 71% of the total pond population consisted of fish over 130 mm fork length.

During the period January through September 1972, we used 29,238 pounds of pelleted and moist feed at a cost of \$2,937.03 to rear these 1971 brood-year chinook.

It has been a general observation at the station over past years that chinook are markedly more responsive to pond rearing than steelhead and appear to thrive in a pond situation. Where we find it difficult to rear steelhead to a size approximating the natural smolts in the Lemhi River in an 18-month period, we can readily rear chinook to nearly twice the size of the naturally occurring wild chinook in 4 months.

Chinook Salmon - North Pond 1973

On April 30, 1973, we placed some 266,000 Rapid River stock 1972 brood-year

Table 4. The number of chinook smolts of two size groups emigrating from artificial channels, Hayden Creek Research Station, 1972.

Date	Large fish 130-189 mm	Small fish 70-129 mm
10/6/72	2	3
10/7/72	0	21
10/8/72	24	9
10/9/72	0	0
10/10/72	0	0
10/11/72	0	0
10/12/72	0	0
10/13/72	0	0
10/14/72	11	1
10/15/72	0	0
10/16/72	<u>0</u>	<u>0</u>
Total	37	34

spring chinook, averaging 193 per pound, in the North Pond. In late June, we transferred 100,000 of these to a Dingell-Johnson rearing pond project on the upper Salmon River. On June 30, 1973, the remaining 160,000 fish averaged 55 per pound and 85-95 mm fork length. Plans are to release these fish in October 1973.

ADULT RETURNS, 1973:

Steelhead

Between March 25 and May 31, 1973, 20 adult steelhead entered the trap at the Hayden Creek Research Station. Of this number, three fish carried a left ventral fin clip, 12 showed fin deformities recognizable as hatchery origin, and five were unmarked. Of these 20 fish, we classified five as one-ocean returns from the 1971 smolt release and 15 as two-ocean 1970 release fish (Table 1). Of the 20 returning adults, 17 were females that yielded some 80,000 eggs.

Chinook

Between June 5 and September 5, 1973, 30 adult spring chinook salmon entered the trap at the Hayden Creek Research Station. Of this number, two, fish carried an adipose fin clip as applied to the 1969 brood-year fish released in the fall of 1970, and two carried one-half dorsal-adipose-left ventral clips as applied to the 1970 brood-year fish released in the fall of 1971 (Table 2). Twenty-six fish were unmarked. Of the 30 fish total, we classified 10 as one-ocean 1970 brood-year fish released in 1971 and 20 as two-ocean 1969 brood-year fish.

Two two-ocean adult salmon bearing clips were noted passing over the Lemhi Weir counting board. Twenty-three percent of the 1970 release were marked. This indicates an additional eight unmarked fish passed through that weir located just above the mouth of Hayden Creek on the Lemhi River.

One two-ocean clipped adult was found on a spawning ground survey on Hayden Creek above the station. This indicates that four of the unmarked adults counted on that survey were probably of hatchery origin.

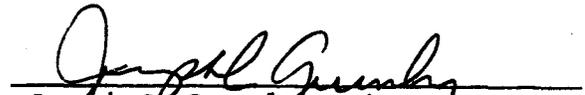
SAMPLING TECHNIQUES:

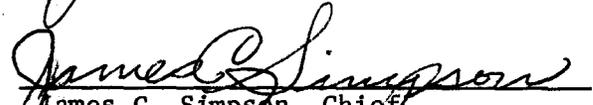
Because of heavy algae growth in the Hayden Creek ponds we cannot take steelhead samples for growth rate records with a seine without killing or injuring large numbers of fish. To sample the ponds, we use a 6' x 6' umbrella net. The fish are lured over the net with feed and the net is raised to collect the sample. This method collects only those fish actively feeding. It does not collect the small "runts" along the pond perimeters that do not compete for feed. The samples, therefore, mainly reflect the growth of those fish that contribute to the "smolt" output of the pond. When we release the fish each cycle, the ponds are drained through a collection box. Samples taken from this box consist of both smolts and sub-smolts and the "average" size of the total pond population appears smaller than the final sample size obtained from the ponds. For this reason, the final average size of the "smolts" released is noted separately in this report. This does not apply for chinook salmon, as explained earlier.

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