

# **IDAHO**

## **FISH & GAME DEPARTMENT**

Joseph C. Greenley, Director

FEDERAL AID IN FISH AND WILDLIFE RESTORATION

JOB PERFORMANCE REPORT

Project F-49-R-12



SALMON AND STEELHEAD INVESTIGATIONS

Job No. III - a . Evaluation of Pond Rearing Fish Culture Methods

Job No. III - b . Evaluation of Survival of Pond Reared Chinook Salmon March 1 ,

1973 to February 28, 1974

by

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JOB PROGRESS REPORT  
RESEARCH PROJECT STATEMENT

State of Idaho

Name: SALMON AND STEELHEAD INVESTIGATIONS

Project No. F-49-R-12

Title: Evaluation of Pond Rearing Fish  
Culture Methods

Job Nos. III-a III-b

Evaluation of Survival of Pond  
Reared Chinook Salmon

Period Covered: March 1, 1973 to February 28, 1974

ABSTRACT:

In late June 1973, we placed 100,000 spring chinook salmon fingerlings at 55 per pound in Decker Flat Rearing Pond. In late September, we released them at an average size of 119 mm fork length and 20 per pound. We marked 50,300 with a left ventral - 3/4 anal fin clip upon release.

Marked smolts from the pond were captured in traps 50 miles and 200 miles downstream on the Salmon River in October and November.

We marked and released 154 adult chinook salmon at a temporary weir installed in the Salmon River near the rearing pond and recovered 15.6% of these on subsequent spawning ground surveys.

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## RECOMMENDATIONS:

We recommend continuance of this project on an experimental basis (rather than production).

We recommend continuance of a marking and release program on adult salmon returning to the spawning grounds in the pond area to determine total spawning escapement and contribution of pond reared salmon.

We recommend that basic project operations remain as a summer rearing-fall release program.

## OBJECTIVES:

To maintain a pond and related water control structures for experimental rearing of spring chinook salmon.

To monitor growth and survival of artificially fed chinook salmon in the pond.

To develop rearing-release techniques that promote maximum smolt survival and adult returns.

To determine the contribution of pond reared chinook salmon to runs entering the Columbia River and Salmon River fisheries and spawning escapements.

## TECHNIQUES USED:

### Facilities

The Decker Flat Pond and associated facilities remained the same as described in the 1972-73 progress report. The repairs and modifications performed after the June, 1972 flood damage allowed more precise water flow control and facilitated pond draining and smolt release procedures.

The widened velocity barrier prevented any juvenile chinook in the pond from entering the inlet channel and jumping at the inlet drum screen.

We hand-built a rock diversion wing off the inlet headgate to increase water flow to the pond in late July.

As part of the adult return evaluation phase, we constructed a temporary weir and trap system in the Salmon River near the pond in 1973. We completed the weir July 8, and operated it until September 10. We used plywood and 2-inch x 4-inch beams for the framework and 3/4-inch galvanized thin-wall conduit pipe spaced at 1 1/2-inch intervals for the weir bars (Figure 1).

After the adult trapping phase was completed, we dismantled the weir and stored it at the pond, in the equipment-feed storage shed, for use in 1974.

## Methods

We set the automatic feeders to dispense the dry pelleted feed at 2-hour intervals from 8 a.m. to 6 p.m. daily. The amount of feed dispensed was a function of fish size and water temperatures determined from standard hatchery feeding tables.

We sampled the fish in the pond periodically with the use of an umbrella net. Fish were lured over the net with feed and the net raised to secure the sample. Heavy algae growth in the pond precluded the use of a seine for sampling.

Adult fish entering the trap box at the temporary weir were removed as soon as possible with a net, marked by making a small hole on the outer edge of the opercle with a paper punch, and released with a minimum of handling. Most adult fish were not in the trap more than a few minutes before being released. A weir tender was stationed next to the weir in a trailer and monitored the trap 24 hours a day, 7 days a week. He could hear the adult fish splashing in the trap when they entered.

Commencing in mid-August, we surveyed the spawning areas above the weir to the upper limits of spawning. A diversion dam approximately 18 river miles above the weir prevented any upstream migration beyond that point after mid-June.

We divided the river into six survey sections approximately 3 miles long, from this upper limit to the weir, including the major tributary, Alturas Lake Creek. We surveyed each section, on foot, every third to fifth day from August 14 through September 23, or until we counted fewer than 20 live fish in the section. We inspected every kelt found for clips, tags and opercle punches and marked it by removing the lower lobe of the caudal fin to prevent recounts.

## FINDINGS:

### 1972 Brood-Year Chinook Salmon

Project plans for the 1973 rearing cycle called for delivery of approximately 400,000 1972 brood-year spring chinook salmon fry to the pond in June from Rapid River Hatchery for rearing through the summer and eventual release in the fall.

However, due to extreme losses of fry at Rapid River, they were unable to supply fish for Decker Flat Pond in 1973. In order to avoid a blank year in the project, we obtained 100,000 1972 brood-year fingerlings from the Hayden Creek Research Station near Lemhi, Idaho, and these were placed in the pond June 25 and 26. These fish averaged 55 per pound at the time of delivery (Table 1). Plans are to hatch and start the fry for Decker Flat Pond at the Hayden Creek station, in future years, from Rapid River supplied eggs. Hauling distance is shorter and the chinook can be reared to a larger size at Hayden Creek prior to delivery to the pond.

We reared these fish in Decker Flat Pond until the end of September. During the week of September 24-28, we marked 50,300 of them with a left ventral-3/4 anal fin clip and released them directly to the Salmon River via the outlet

channel. On September 28, we opened the pond outlet valves and released the remaining fish. The pond was drained by the last day of September and we secured the facilities for the season. The fish averaged 119 mm fork length and 20 per pound upon release (Table 2).

From September 25 through October 12, 1973, we periodically operated a downstream migrant trap located on an irrigation ditch fish diversion screen some 50 miles downstream from Decker Pond. During this period, we operated 12 days and collected 69 chinook smolts bearing the left ventral - 3/4 anal fin clip applied at the pond. The first fish was captured on September 28, 4 days after the first marked fish was released.

National Marine Fisheries Service personnel, operating scoop traps on the Salmon River near Riggins, Idaho, some 200 river miles downstream from the pond, reported one left ventral - 3/4 anal marked chinook captured in mid-November 1973. It appears that the fish migrated downstream readily upon release.

Between June 26 and September 22, 1973, we fed 5,700 pounds of dry pelleted feed to the fish in the pond, at a cost of \$875.53. The total estimated pounds released was approximately 5,000 which computes to a food to flesh conversion of 1.14 lbs. and cost (feed only) per pound of \$.175.

#### 1971 Brood-Year Chinook Marking

During the 1972 rearing cycle, we distributed 2,500 pounds of medicated feed to the 1971 brood-year chinook in Decker Flat Pond as described in the 1972-1973 progress report. This feed contained 3,500 grams of Terramycin to impart a tetracycline mark within the bones of the fish for future identification.

During the winter of 1972-73, we inspected the cleithrum bones from 90 chinook salmon collected at random during the September 1972, fin clipping operations at the pond. We also inspected the cleithrum bones from 40 chinook from Rapid River Hatchery from the same brood-year egg source. Both groups of fish were fed Terramycin-laced feed at approximately the same time in 1972, and at about the same concentration with the Decker Pond fish being fed a slightly higher level.

We found readily obvious tetracycline marks on all the Rapid River samples under ultraviolet illuminated microscopic inspection. We found no discernible marks on the fish from Decker Flat Pond. We suspect that feed distribution methods and supplementation of diet with natural foods lowered the intake concentration of the Terramycin to below mark imparting levels. Field inspection of several stomachs from chinook in the pond, during the 1973 rearing cycle, showed considerable insect remains along with pelleted feed. Flying and aquatic insect forms are abundant at the 5-acre pond and the fish are apparently utilizing them along with the pelleted feeds.

It appears that the application of medicated feed to impart a biological mark in chinook fingerlings rearing in Decker Pond is not an effective method.

## Adult Mark and Release Evaluation

In order to evaluate the contribution of pond-reared chinook to the spawning escapement in the upper Salmon River, it is necessary to know what percent of the total spawning population the spawning ground kelt counts represent. To determine this, we installed a temporary weir in the Salmon River near Decker Pond in the summer of 1973. We marked 154 adult salmon at this weir and released them upstream to spawn (Table 3). We then looked for these marked fish as kelts on the spawning grounds. We planned to relate any pond-marked kelts to this recovery percentage to determine total pond contribution to the spawning escapement.

We recovered a total of 24 fish which had been marked at the weir on the spawning grounds and 1,001 unmarked fish (Table 4). Expanding this proportionately by the formula  $N=m(c+1)/R+1$  where  $m$  = number marked,  $c$  = sample and  $R$  = marks recovered, indicates an estimated total spawning escapement into the area above the weir of 6,320 fish. We recovered 15.6% of the fish marked at the weir. We walked each section of the river above the weir until we found fewer than 20 live fish in the entire section (approximately 3 miles long each). We took special care to cover the spawning areas carefully by wading in the riverbed where necessary. Some sections were surveyed seven times.

It appears, from past experience and other evidence, that the estimate of a 6,320 fish spawning escapement in this area is considerably inflated. The Salmon River, in the areas covered by the survey teams, is relatively small, low and clear, and the figure of 15.6% recovery of kelts does not seem realistic in view of the effort expended.

Other inconsistencies are evident: if we assume about a 50-50 adult sex ratio, and assume one female makes one redd (low according to previous Studies), there should have been around 2,500 redds counted in this area. We counted 788 redds.

On the Lemhi River where a permanent weir allows all upstream migrating adults to be counted, 1,043 adults yielded a redd count of 485; 46.5%. The Lemhi River is a brushy, difficult stream to survey. We feel that a 46.5% redd count on the Salmon River would probably be low. Even so, using the 46.5% figure yields an estimated 1,694 fish escapement figure, considerably lower than the 6,320 fish estimate drawn from the mark and recovery work. On the Lemhi River, one spawning ground survey over approximately 15 miles of stream yielded a kelt count of 126; 12.1% of the 1,043 adults counted through the weir. Twenty intensive surveys on the upper Salmon River yielded only a 15.6% recovery of marked fish.

In summation, it appears that the escapement figures drawn from our marking efforts at the weir appear to be considerably inflated. There is no apparent reason to suspect survey techniques as a cause. The most likely cause for a Has of this magnitude is differential survival of marked fish. We commenced marking adults on July 9, but did not conduct our first kelt survey until August 14, some 36 days after we marked our first fish. Between July 9 and August 14, we marked a total of 69 adult salmon. If the act of handling these fish for marking caused premature mortality during this period, we would not have detected it. However, of the 24 marked fish found, there were no partially spawned or unspawned females noted.

In order to detect possible premature mortality in 1974, we plan to conduct pre-spawning surveys and also put numbered tags on the adults in addition to the opercle punch marks.

Marked Adult Returns - 1973

Of the 1,025 kelts observed on the spawning ground surveys, we found one marked pond-reared fish, a jack 22 inches in length with a 1/2 dorsal-1/2 anal clip as applied to 66,000 1970 brood-year chinook released from the pond in October 1971 (Table 5).

Five adult salmon, ranging from 32 to 42 inches in length with right ventral-adipose fin clips were observed at our F-18-R salmon harvest check stations operated on the upper Salmon River during the summer of 1973. We released 25,000 right ventral-adipose marked 1969 brood-year smolts directly in the Salmon River in the fall of 1970.

LITERATURE CITED:

Reingold, Melvin. Salmon and steelhead investigations, F-49-R projects Jobs III-a and III-b, 1972. Idaho Fish and Game Dept. 1973.

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Table 1. Size of 1972 brood-year chinook salmon in Decker Flat Pond at various sampling dates - 1973.

Date	Length	No./lb.
June 26	85 - 90 mm	55
July 16	95 - 100	40
August 2	105 - 110	27
August 28	115 - 120	18
Sept. 27 (release)	115 - 120 (119 $\bar{x}$ )	20

Table 2. Length frequency of chinook salmon smolts collected from Decker Flat Pond at release - 1973.

Fork length (millimeters)	Number of fish
70	9
80	36
90	53
100	99
110	128
120	93
130	113
140	128
150	58
160	17
119 = $\bar{x}$	N = 734

Table 3. Dates and numbers of adult salmon marked and released at the adult weir near Decker Flat Pond, 1973.

Date	Number marked	Date	Number marked	Date	Number marked
7-9	2	7-29	0	8-19	2
7-10	4	7-30	2	8-20	8
7-11	1	7-31	0	8-21	10
7-12	1	8-1	1	8-22	5
7-13	3	8-2	1	8-23	2
7-14	5	8-3	1	8-24	2
7-15	2	8-4	3	8-25	11
7-16	2	8-5	2	8-26	2
7-17	4	8-6	2	8-27	7
7-18	2	8-7	1	8-28	1
7-19	1	8-8	3	8-29	3
7-20	2	8-9	0	8-30	5
7-21	0	8-10	4	8-31	10
7-22	1	8-11	3	9-1	0
7-23	2	8-12	4	9-2	0
7-24	3	8-13	2	9-3	4
7-25	3	8-14	5	9-4	1
7-26	1	8-15	0	9-5	2
7-27	0	8-16	2	9-6	1
7-28	2	8-17	0	9-7	<u>1</u>
		8-18	1	Total	154

Table 4. Summary of marked and unmarked kelts recovered from the spawning grounds above the upstream weir on various dates during the summer of 1973.

Date of recovery	Marked kelts	Unmarked kelts	Date of recovery	Marked kelts	Unmarked kelts
8-14-73	0	16	9-4-73	3	36
8-17-73	0	21	9-5-73	0	13
8-20-73	0	6	9-6-73	2	26
8-21-73	0	66	9-7-73	2	110
8-22-73	0	108	9-11-73	0	2
8-24-73	0	70	9-12-73	1	3
8-27-73	1	31	9-13-73	3	63
8-28-73	2	23	9-17-73	4	28
8-29-73	1	121	9-23-73	1	2
8-30-73	2	180	Dead on weir face	2	36
8-31-73	0	40	Totals	<u>24</u>	<u>1,001</u>

Table 5. Summary of chinook salmon stocks reared and released at the Decker Flat Experimental Rearing Pond since initiation of the project.

Brood Year Release yr.	Brood source	Number released	Release area	Number stocked	Number marked	Mark used	No. adults seen in sport catch or as spawners as:		
							1-ocean	2-ocean	3-ocean
1966 '68 spr.	Salmon River	7,000	Decker Pond	12,000	7,500	RV	1969 (0)	1970* (3)	1971 (0)
1967 '69 spr.	Marion Forks, Oregon	26,000	Decker Pond	180,000	18,500	RV	1970 (0)	1971 (1)	1972 (0)
1968 '70 spr.	Salmon River	0	100% Pond Loss	160,000	160,000	RV	1971 (0)	1972 (2)	1973 (0)
1969 '70 fall	Lemhi River	50,000	Upper Salmon River	50,000	25,000	RVAd	1972 (0)	1973 (5)	1974 ( )
1969 '71 spr.	Lemhi River	50,000	Decker Pond	50,000	50,000	RV	1972 (0)	1973 (0)	1974 ( )
1970 '71 fall	Rapid River	330,000	Decker Pond	350,000	66,000	1/2An1/2Dor	1973 (1)	1974 ( )	1975 ( )
1971 '72 fall	Rapid River	400,000	Decker Pond	400,000	30,000 30,000	Ad3/4AnRv Ad3/4AnLV	1974 ( )	1975 ( )	1976 ( )
1972 '73 fall	Rapid River	100,000	Decker Pond	100,000	50,300	LV3/4An	1975 ( )	1976 ( )	1977 ( )

\* Year of recovery.

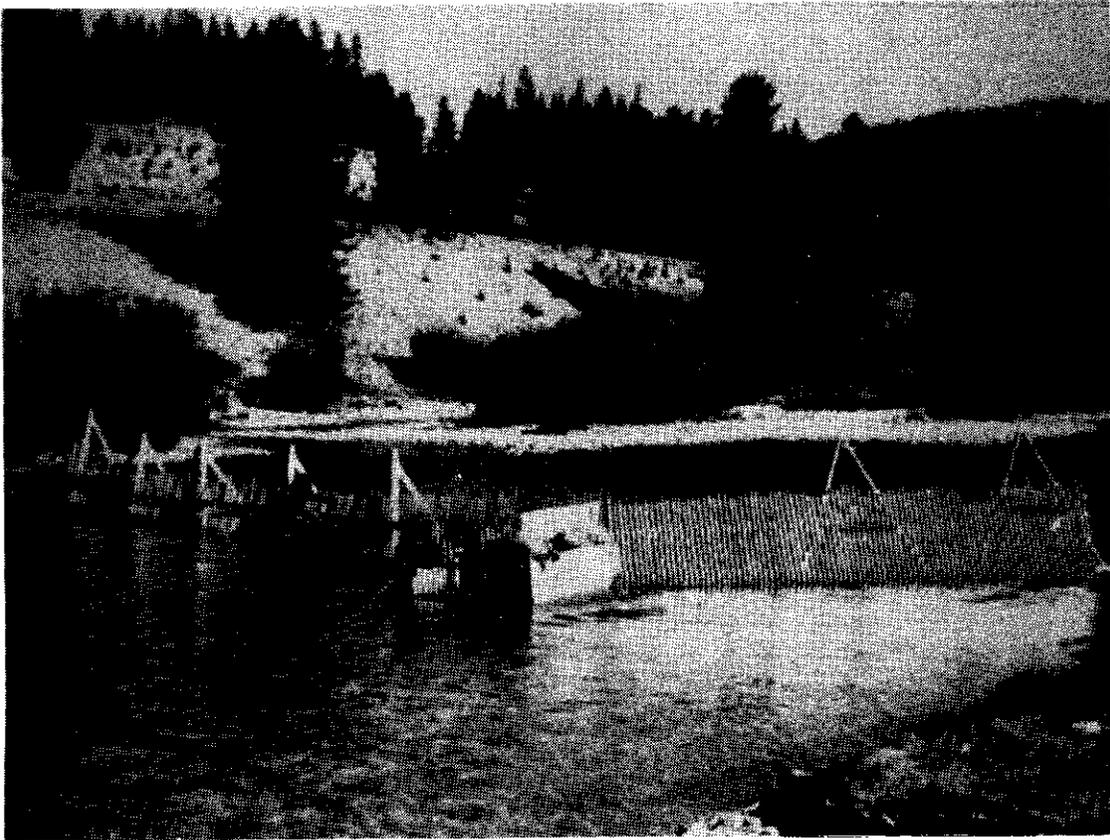


Figure 1. We installed a temporary upstream migrant weir and trap in the Salmon River near Decker Pond in 1973, and marked and released 154 adult chinook salmon.