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FEDERAL AID IN FISH AND WILDLIFE RESTORATION

Job Performance Report

Project F-49-R-14

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

Period Covered: 1 March 1975 to 29 February 1976

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February, 1976

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JOB PERFORMANCE REPORT

State of Idaho

Name: SALMON AND STEELHEAD INVESTIGATIONS

Project No. F-49-R-14

Title: Evaluation of Pond Rearing Fish Culture Methods

Job Nos. III-a & III-b

Evaluation of Survival of Pond Reared Chinook Salmon

Period Covered: 1 March 1975 to 29 February 1976

ABSTRACT:

In late June 1975, we placed 400,000 spring chinook salmon fingerlings, at 154 per kilogram (70/lb), in Decker Flat Rearing Pond. In late September, we released them at an average size of 115 mm fork length and 64/kg (29/lb).

We operated the temporary weir and trap in 1975, and marked and released 37 adult salmon. We later recovered 41% of these fish on spawning ground counts and estimated a total escapement into the upper Salmon River of around 1,200 fish.

Although we inspected over 500 kelts in the pond area, we found no pond-marked kelts in 1975.

An eye fluke infestation diagnosed in 1975 will require control measures in future rearing cycles.

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RECOMMENDATIONS:

We recommend continuance of a smolt marking program to evaluate contribution of pond-reared salmon to the upper Salmon River spawning escapement.

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 estimate the survival of pond-reared chinook salmon and their contribution to Idaho's sport fishery.

TECHNIQUES USED:

Facilities

The Decker Flat chinook rearing pond is a reshaped gravel pit pond located approximately 13 kilometers south of Stanley, Idaho, on U.S. Highway 93. At operating level, it covers approximately 2 surface hectares 2 meters deep.

Water is diverted from the Salmon River through a headgate and an electric rotary drum screen. A velocity barrier at the pond inlet prevents most chinook from entering the pond inlet channel. An electric drum screen at the outlet prevents escape from the pond.

Near the outlet structure, 30 an and 61 cm valved culverts provide the means to drain the pond and release the fish.

Eight Nielsen electric automatic feeders on the pond perimeter distribute dry fish feed at selected intervals and at set amounts.

A 6-m diameter metal building near the pond provides equipment and feed storage needs.

A weir and trap system constructed of wood and thinwall conduit pipe was used in 1973 and 1975, to trap upstream migrating adult salmon as part of the evaluation phase of the project.

Methods

We set the automatic feeders to dispense the dry pelleted feed at 2-hour intervals from 0800 to 1800 hrs daily. From 1975, we maintained feed levels at approximately 1.5% of body weight throughout the summer rearing period. Experimental feeding programs at the Hayden Creek Research Station have shown this feed

level satisfactory for good chinook growth in a pond environment where some natural foods are also available.

We sample 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. This method was also used to capture fish for marking at the end of the rearing season.

Adult salmon entering the trap at the temporary weir were removed as soon as possible with a net, anesthetized with MS222, and marked by applying a numbered tag to the lower jaw and making a small hole on the posterior edge of an operculum with a paper punch. A weir tender stationed next to the weir in a trailer monitored the trap 24 hrs a day, 7 days a week. He could hear the adult fish splashing in the trap when they entered.

Commencing in early August, we surveyed the spawning areas above the weir to the upper limits of spawning. A diversion dam approximately 29 river km above the weir prevented upstream migration beyond that point after mid-June. We used a light canoe to search the lower 16 river km for carcasses and surveyed the upper areas on foot. We attempted to cover each section every 3 to 5 days looking for kelts. All kelts inspected were marked to prevent recounts on subsequent surveys. We commenced surveys on 3 August and terminated our efforts 17 September.

FINDINGS :

1974 Brood Year Chinook Salmon

Between 24 June and 26 June, we placed 400,000 1974 brood year spring chinook fry in the pond. These fish were taken as eggs at Rapid River Hatchery in September 1974, and hatched and reared to fry size at the Hayden Creek Research Station between September 1974 and June 1975. In late June 1975, they were collected by umbrella net from one of the rearing ponds at Hayden Creek and trucked to Decker Pond.

The fish averaged 154 per kg (70/lb) when placed in the pond and appeared to be in excellent condition. There was negligible hauling loss.

We reared these fish in the Decker Pond until the end of September (Table 1). During the week of 22-26 September, we marked 100,000 fish with a right ventral fin clip and released them to the Salmon River via the outlet channel. On 27 September, we opened the pond outlet valves and released the remaining fish. The pond was drained by the last day of September, and in early October, we secured the facilities for the season. The fish averaged 115 mm (fork length) and 64/kg (29/lb) upon release (Table 2).

Between 26 June and 19 September, we fed 24,250 kg (11,000 lb) of Rangen dry fish feed to the chinook in the pond at a cost of $1,652.20. During the period the chinook were at the Hayden Creek Research Station, they were fed 3,747 kg (1,700 lb) of Oregon Moist starter feed at a cost of $445.40, and 8,020 kg (3,638 lb) of dry feed at a cost of $546.43. The total estimated kilograms of fish released was approximately 30,401 (13,790 lb) which computes to a food-to-

Table 1. Size of 1974 brood year chinook salmon in Decker Flat Pond on various sampling dates - 1975.

Date	Fork length (millimeters)	No./kg.	No./lb.
25 June	75 - 85	154	70
8 July	80 - 90	126	57
20 July	80 - 90	119	54
9 August	95 - 105	79	36
22 August	100 - 110	77	35
4 September	100 - 110	73	33
17,September	110 - 120	55	25
26 September (release)	115 (x)	64	29

Table 2. Length frequency of spring chinook salmon smolts collected from Decker Flat Pond at release - September 1975.

Fork length (millimeters)	Number of fish
60 - 69	10
70 - 79	28
80 - 89	103
90 - 99	123
100 - 109	163
110 - 119	149
120 - 129	154
130 - 139	116
140 - 149	83
150 - 159	34
160 - 169	13
x = 115	N = 976

fish conversion of 1.18 and cost (feed only) per kg of $.086 ($.19/lb).

Adult Mark and Release Evaluation

As part of the evaluation phase of the Decker Pond project, we felt it would be desirable to enumerate the total contribution of pond-reared adults to the upper Salmon River spawning escapement. We attempted to do this by capturing and marking a portion of the adult chinook as they migrated into the spawning areas. The percentages of these marked fish recovered on the spawning grounds could then be related to the total number of carcasses counted to draw total estimated escapement figures and total contribution of pond-marked fish.

We first installed the weir in 1973. The results of this first effort produced inconsistencies in the data, led to inflated estimates and indicated a possible early pre-spawning mortality for weir-marked fish (Reingold 1974).

We were unable to install the weir in 1974 because of excessive flows. The spring of 1975 was also a high extended flow period. We installed the weir on a side channel of the Salmon River near the pond on 9 July, and moved it into the main river channel 23 July. We did not capture any adults during that time period.

Between 23 July and 15 September, we captured and marked 37 adult chinook salmon. We found 15 (41%) of these marked fish on subsequent spawning ground surveys. Expanding this proportionately by the formula $N = M(C+1)/R+l$ where M = number marked, C = sample and R = marks recovered, indicated an estimated total spawning escapement into the area above the weir of 1,158 fish.

A count of salmon redds (nests) in the survey area was 569. The Salmon River in the study area is a relatively shallow, open, meandering stream, readily observable from the bank with the probability of observing a high percentage of the redds. If we assume a 50-50 adult sex ratio and assume one female constructs one redd, the redd counts indicate a spawning escapement of 1,264 fish at a 90% observance level. While all three of these factors may have varied from the assumed values, the redd estimate does tend to support the escapement estimate of around 1,200 fish.

The summer of 1973 was an extremely low flow year and we were able to install and maintain the weir by 8 July. Even so, we were able to collect only 154 adults. We were not able to weir the river at all in 1974, and could not erect the trap system in the main river channel until 23 July in 1975, and captured only 37 adults. It appears that even in an average runoff year, most of the adults would be in the spawning area above the weir before we could install it. It is questionable whether the small numbers of fish trapped and marked, and the amount of data gained is worth the effort of maintaining the weft· 24 hrs a day, 7 days a week for 2 months. We also noted that the weir structure tended to cause a large number of salmon to spawn just downstream of it rather than pass through on their way to upper spawning areas. We found that the anesthetized females tended to lose a portion of their eggs when they relaxed while we handled and tagged them.

We felt that the weir marking work would enable us to enumerate adult returns

to the pond area rather than express returns as a percent of the total escapement. However, we can draw rough estimates of numbers returned from redd counts, and in lieu of the aforementioned problems, I believe expressing adult returns as a percent of spawning escapement to be preferable over operating the weir in future years.

Marked Adult Returns - 1975

During the 1975 field season we surveyed the upper Salmon River spawning grounds on a 3-5 day schedule to inspect as many kelts as possible. Between 3 August and 19 September, we inspected 501 carcasses. We found no fish indentifiable as being of Decker Pond origin (Table 3).

In 1974, we found 12 adult salmon bearing fin clips applied in earlier years at the pond and estimated that 22% of the upper Salmon River spawning escapement consisted of Decker Pond origin fish.

The adults expected back in 1975 were fish from the 1970 and 1971 brood years that would have migrated downstream as smolts in the spring of 1972 and 1973. Bot these years marked a low point in survival for smolts passing through dams on the Snake and Columbia rivers. The spring of 1973 was extremely poor for smolt passage with a National Marine Fisheries Service estimate of less than 5% survival to the ocean. This may account to the largest degree for the lack of returns in 1975. The return of an estimated 50 plus adults in 1974 led us to expect additional returns in 1975, and we were disappointed not to find a single marked fish on our kelt counts.

Pre-spawning Mortality

We commenced our spawning ground surveys on 3 August for the 1975 field season. Peak of spawning on that section of the main Salmon River historically occurs around the end of August or the first part of September but we wished to detect any early pre-spawning mortality not normally seen at standard redd counting times.

Prior to 1 September, we inspected 237 kelts. Of this number, we determined that 32 fish (13.5%) died prior to spawning. This included 12 males and 20 females. After 1 September, we inspected 264 kelts. We determined that 17 (6.4%) had died without successfully spawning, 14 males and 3 females. In past years, we normally observed 3-6% pre-spawning mortality in this area. The 13.5% mortality rate seemed high to us, but 1975 marked the first year we commenced surveys on 3 August. We intend to conduct these early surveys in future years to determine if this 13.5% pre-spawning mortality is a normal occurance or not.

Presence of Eye Fluke

' In the fall of 1975, a high incidence of clouded eye lenses noted during fin clipping operations led to the determination of the presence of the eye fluke *Diplostomum spathaceum*. This organism can cause partial or complete blindness in fish if it occurs in large numbers. Seagulls appear to be the primary vector and gulls do appear commonly on the pond. Snails of the genus *Lymnea* are the intermediate host of the sporocyst-circaria stage of this strigeid. These snails are abundant in the pond. Copper sulphate control measures will be an

Table 3. Summary of chinook salmon stocks reared and released at the Decker Flat Experimental Rearing Pond since initiation of the project.

Brood year / Release year	Brood source	Number released	Release area	Number stocked	Number marked	Mark used	(Year of recovery) 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 (1)
1969 / '71 spr.	Lemhi River	50,000	Decker Pond	50,000	50,000	RV	1972 (0)	1973 (0)	1974 (1)
1970 / '71 fall	Rapid River	330,000	Decker Pond	350,000	66,000	½An¼Dor	1973 (1)	1974 (9)	1975 (0)
1971 / '72 fall	Rapid River	400,000	Decker Pond	400,000	30,000 30,000	Ad3/4AnRV Ad3/4AnLV	1974 (0)	1975 (0)	1976 ( )
1972 / '73 fall	Rapid River	100,000	Decker Pond	100,000	50,300	LV3/4An	1975 (0)	1976 ( )	1977 ( )
1973 / '74 fall	Rapid River	380,000	Decker Pond	380,000	87,400	RV	1976 ( )	1977 ( )	1978 ( )
1974 / '75 fall	Rapid River	400,000	Decker Pond	400,000	100,000	RV	1977 ( )	1978 ( )	1979 ( )

annual necessity to reduce the snail population in Decker Pond to minimize the incidence of the parasite.

Idaho Fish and Game Fish Disease Specialist, Harold Ramsey, collected eight chinook from the pond in October 1975. These were stragglers left behind after the pond had been drained and most fish released into the Salmon River. All eight of the fish contained eye fluke cercaria in the lens. We do not know what percent of the smolts already released prior to this sample contained the parasites. We will make intensive determinations in successive rearing cycles for the presence of the fluke.

It is possible this condition could have gone undetected at lower levels in prior rearing cycles. A high incidence of partial or complete blindness in past releases would have an adverse effect on adult returns for the next few years. However, we believe if it did occur in past years, it was at a reduced level from the 1975 occurance.

LITERATURE CITED:

Reingold, M. 1973. Evaluation of survival of pond-reared chinook salmon. F-49-R-12, Job No. III-b.

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