A MECHANICAL METHOD FOR SEPARATING ADULT MIGRANT SALMONIDS

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INTRODUCTION

When John Day Dam is completed, one of the last primal reaches of the Columbia River channel will be inundated. A substantial number of chinook salmon (Oncorhynchus tshawytscha) is reported to use this section of river for spawning and it is generally held that flooding from the John Day pool will take this area out of production. The responsible fishery agencies have proposed that the stock now spawning in this area be separated from other salmon populations bound for more distant upriver spawning grounds. Fish would be separated in the fishways at John Day Dam, the segregation being based on external coloration of the fish. Bright, silvery fish would be returned to the river to continue their upstream migration, whereas dark-colored fish (generally considered lower river spawners) would be collected for artificial propagation. A mechanical separator would be used to shunt the fish into appropriate channels following visual inspection for determination of fish stock.

The following is a report of laboratory study to determine the feasibility of separating salmonids in the manner described above.

EXPERIMENTAL EQUIPMENT

Operating features of a floating fish separator for John Day Dam, designed by the Washington State Department of Fisheries, were incorporated into a laboratory model. The main features of the laboratory separator (fig. 1) included a short three-pool approach fishway; a false or hollow weir (fig. 2); and a 12-foot-long slide with a manually operated deflector that diverted fish into either of two chutes. Water (about 8 cubic feet per second) supplied through the hollow weir (A, fig. 1) flowed upward through a series of baffles. Most of this water spilled over the hollow weir into the fishway, whereas a smaller amount spilled onto the separator on the upstream side of the weir. A grill (B) drained off all but a thin film of water for sluicing fish down the 5-degree slope of the slide area (C). At the bottom of the slide, fish were diverted into one of two chutes by turning the deflector (D).

TEST PROCEDURE

Fish entered the separator on their own volition by ascending the false weir and dropping onto the slide. They were then identified as they slid down the incline (fig. 3). This gave the operator about 2 to 5 seconds to classify the fish and position the gate to send each fish through the proper chute.

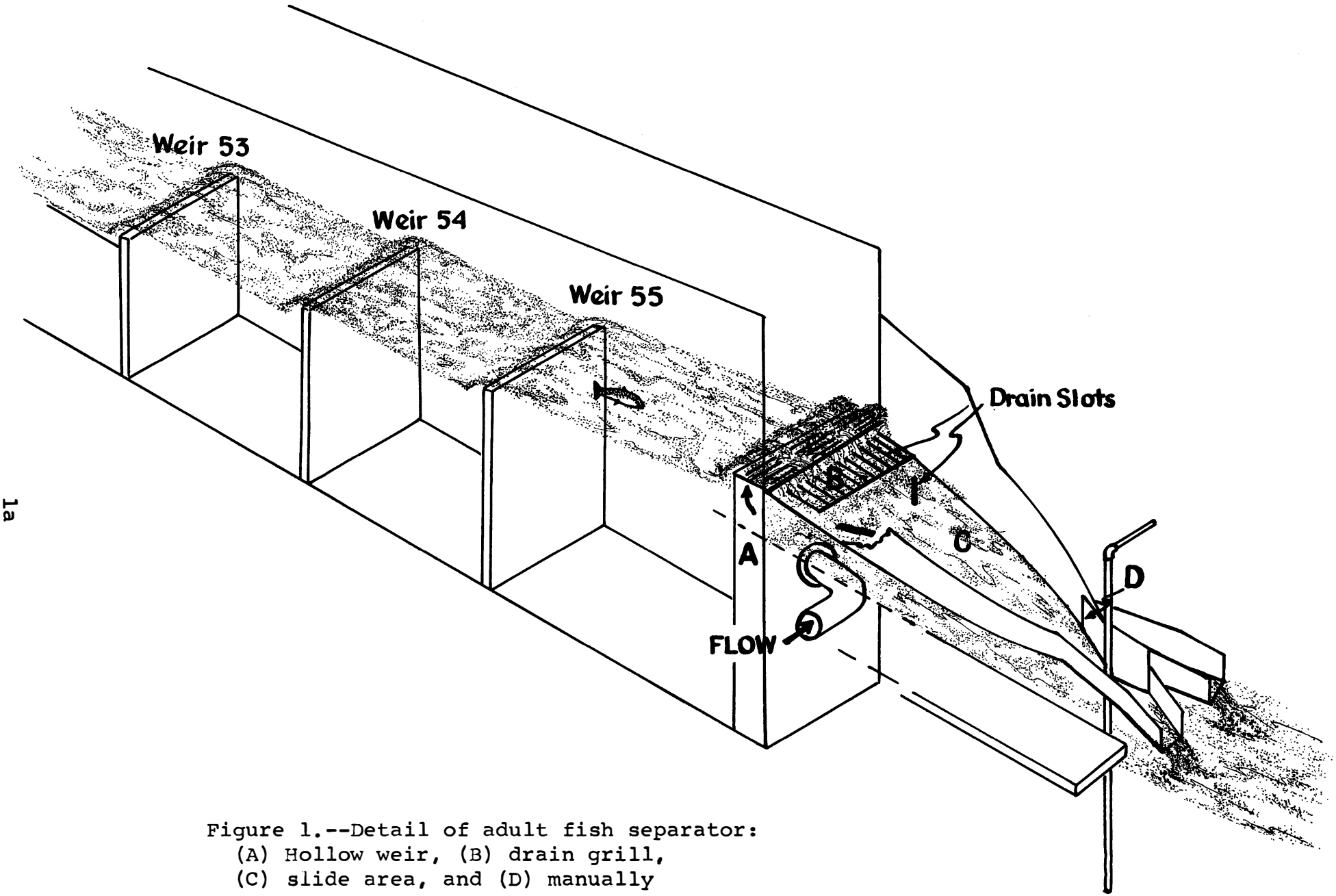

Figure 1.--Detail of adult fish separator: (A) Hollow weir, (B) drain grill, (C) slide area, and (D) manually operated deflector.

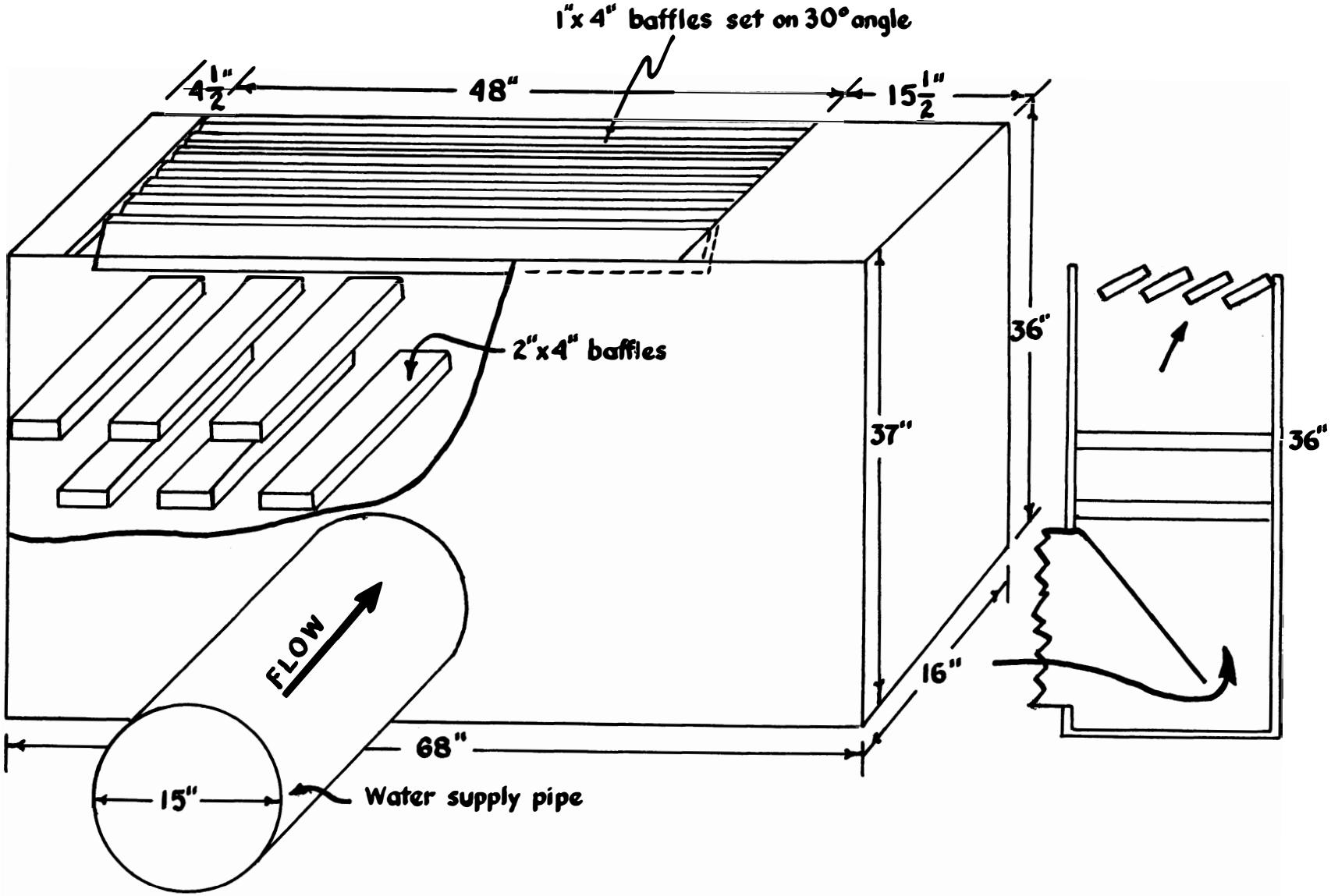

Figure 2.--Detail of false (hollow) weir design.

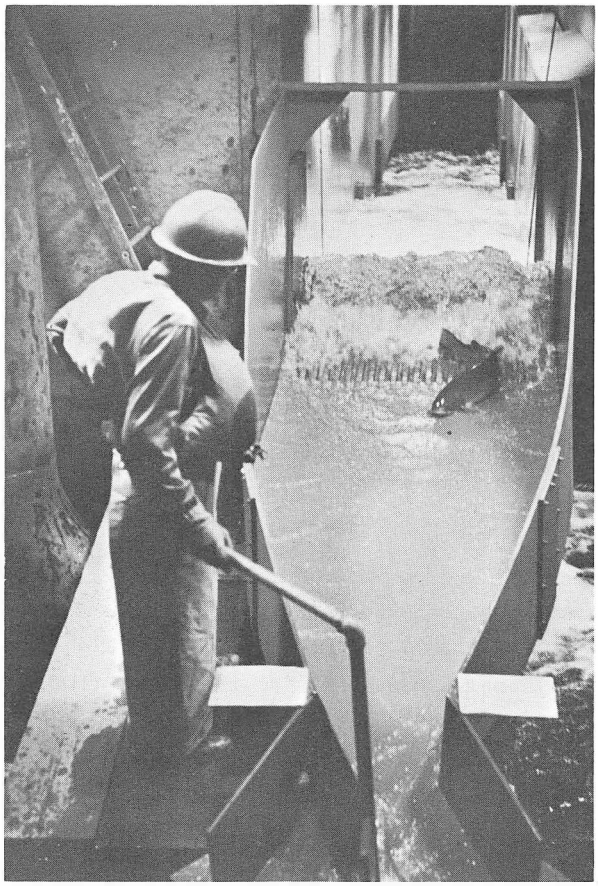

Figure 3.--Laboratory model of the adult fish separator in operation. Fish ascend the approach fishway (background), pass through the overfall flow from the hollow weir, and slide down to the separator. The operator uses the "rudder-like" deflector to shunt fish into one of two chutes.

The test procedure was as follows: Fish were collected for about 3 hours prior to each test to provide as many test individuals as possible. Upon release, fish were counted and identified as they passed over each weir of the approach fishway and over the false weir onto the slide. As no "dark" chinook were present during the test period, sorting involved the separation of chinook salmon and steelhead trout (Salmo gairdneri). An experienced observer stood by and recorded errors in sorting by the operator. All weir crossings and passage times through the separator (time on slide area) were noted on a time event recorder.

RESULTS

The results of 13 tests are given in table 1. Trial periods ranged from 40 to 74 minutes and numbers of fish varied from 12 to 82 in the individual tests. The rate of entry into the separator briefly reached seven fish per minute in one of the tests (table 2); but 50 percent of the time, less than one fish per minute entered the sorter. Occasionally more than one fish was present on the slide area at the same time. If the fish were of the same species, they were simply directed into the appropriate chute, but if both steelhead and chinook were present simultaneously, the operator was required to switch the deflector bar quite rapidly to achieve separation. On the few occasions this occurred, separation was accomplished with no difficulty.

Although most of the fish were on the slide for only 2 or 3 seconds, operators achieved a high sorting accuracy. The average error was less than one fish per test. Some steelhead and jack chinook attempted to struggle up the slide, whereas large chinook passed down the slide with relative ease.

The false or hollow weir (fig. 2) functioned satisfactorily. Only rarely did a fish start over the weir and then fall back into the fishway. There was no evidence of injury to the fish in any of the tests.

DISCUSSION

These preliminary studies indicate that mechanical separation of fish is feasible. Additional tests with larger numbers are needed, however, to establish more accurate criteria for a separator. These criteria include the maximum number of fish that can be separated per unit of time plus optimum degree of slope and length of slide that will minimize struggling and permit accurate identification.

Table 1.--Summary of sorting tests, August 23-29, 1963.

Test number	Test period	Composition at sorter		Errors	Average time in slide area	
		Chinook	Steelhead		Chinook	Steelhead
	Minutes	Number	Number	Number	Minutes	Minutes
1	43	6	6	1	--	--
2	65	31	20	0	.04	.06
3	45	17	14	0	.04	.04
4	56	20	27	0	.08	.06
5	49	15	11	1	.05	.08
6	74	19	27	1	.07	.08
7	40	26	17	0	.04	.06
8	70	41	25	0	.05	.05
9[1/]	58	5	18	1	.03	.06
10	67	35	28	0	.03	.06
11	43	52	26	6	.03	.04
12	62	53	29	1	.03	.05
13	39	55	15	1	.04	.06

1/ Beginning with test no. 9, the slide was covered with rubber, 1/4-inch thick. This somewhat reduced friction and slide time.

Table 2.--Rate of entry and frequency during fish sorting tests.

Rate of entry	Frequency
Fish per minute	Percent of total time
0	50.1
1	27.0
2	13.4
3	5.8
4	1.8
5	.8
6	.8
7	.3

Further tests are planned with a device 30 feet long. The slide area will have an operable width of 2 to 4 feet and the slope will be adjustable to a maximum of 12 degrees (1-on-5 slope).