FINAL REPORT

EVALUATION OF THE ADULT SALMONID TRAP INSTALLED IN THE BRADFORD ISLAND "A" BRANCH FISH LADDER, BONNEVILLE DAM

by

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INTRODUCTION

A need for a trapping facility to collect adult salmonids for research purposes exists at Bonneville Dam. The Fisheries-Engineering Research Laboratory adjacent to the Washington shore fish ladder has been providing this capability, but because of the high cost of maintaining the aging laboratory, the Corps of Engineers proposed that a new trapping facility be built. The new trapping facility, known as the "A" Branch Trap, was designed and constructed in 1975 by the Corps of Engineers and installed in the "A" Branch of the Bradford Island ladder.

At the request of the Pacific Northwest fishery agencies, the National Marine Fisheries Service (NMFS) was contracted with by the Corps to evaluate the trap during the migration of adult salmonids in 1975. The objectives were to determine the efficiency of the trap and the effects of trapping and tagging on fish passage in the "A" Branch ladder for each of the major groups of adult salmon and steelhead trout migrating upstream. As a point of reference, these data were compared, where possible, to similar data from trapping and tagging operations in the Fisheries-Engineering Research Laboratory adjacent to the Washington shore ladder.

METHODS AND MATERIALS

Facilities

The new trap was installed between weirs 44 and 50 in the "A" Branch ladder. Its basic components consisted of a steeppass fishway,

fish handling facilities, and counting stations to record fish passage during evaluation tests (Figure 1). Fish ascending the ladder were counted at weir 42 below the steeppass. Those migrating up the south side were confined to the steeppass entrance by picketed leads in line with fishway flow between weirs 42-43 and 43-44 (Figure 2). Those ascending the north side bypassed the trap. During evaluation tests the orifices in weir 42 were screened to force fish over the counting weirs. Orifice screens were opened and left flat on the fishway floor in the interim between tests. When few fish were ascending the ladder, a diversion lead below weir 42 north could be lowered to divert all fish to weir 42 south (Figure 3). The lead contained an 11-inch by 30-inch opening in the pickets to allow fallbacks passage downstream. The passage of upstream migrants through the opening was prevented by a web fyke trailing downstream (like a wind sock).

To prevent shad from ascending the steeppass, a barrier consisting of a horizontal wooden grating was installed on the crest of weir 44 (Figure 4). Shad, being reluctant orifice swimmers, were expected to avoid the submerged orifice below the barrier while salmonids entered the orifice into the steeppass entry pool.

The steeppass, 66 feet long on a 27.3 percent slope, is the model A steeppass (a Denil-type fish pass) described by Ziemer (1962). It is an aluminum flume 22 inches wide by 27 inches high with internal baffles to control water velocity. The open area for fish passage (14 inches wide by 22 inches high) requires a flow of approximately 5 cfs.

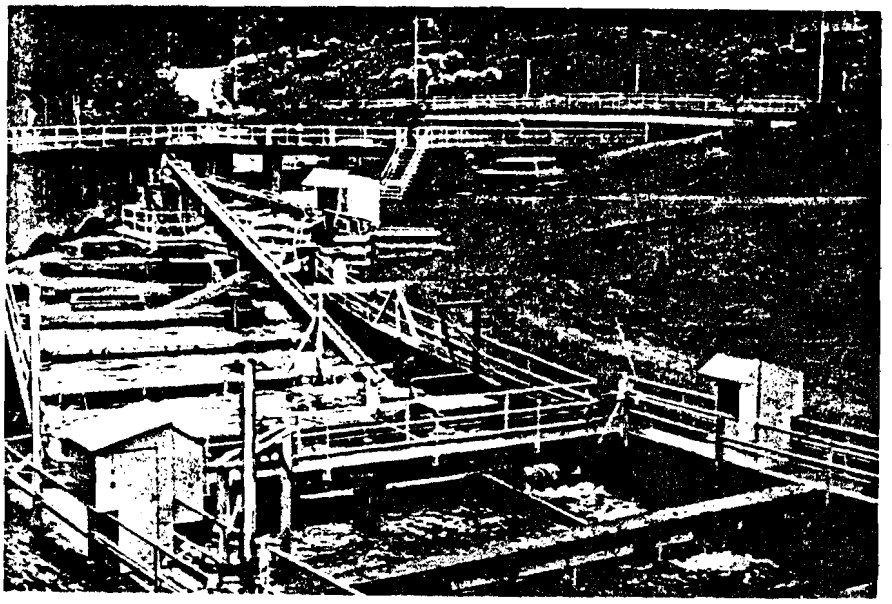


Figure 1.--A view of the adult salmonid trap in the "A" Branch of the Bradford Island fish ladder at Bonneville Dam showing the steeppass (center), fish handling facilities and the counting station to the right of the steeppass, and the counting station on each side of weir 42 below the steeppass.

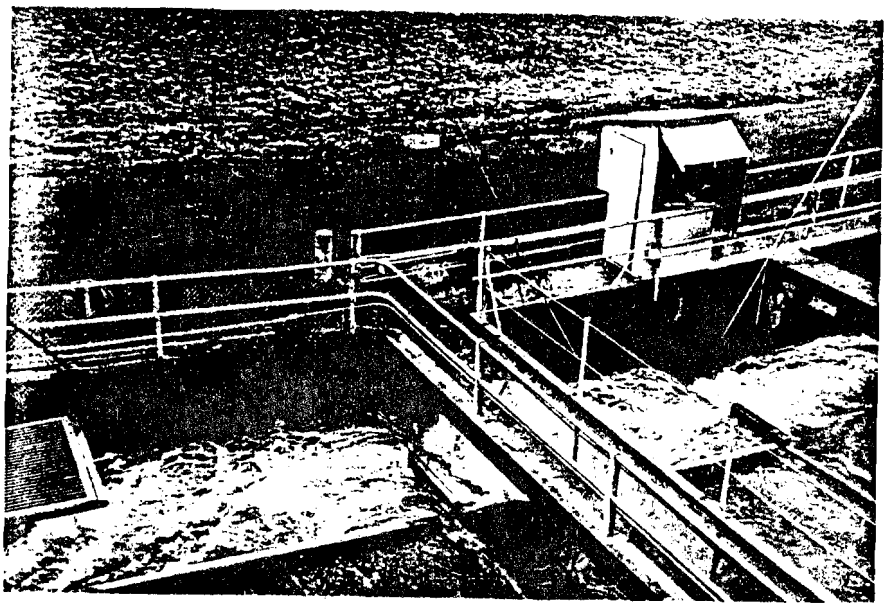


Figure 2.--Fish counted at weir 42 south were confined to the steeppass entrance by the picketed leads extending from the counting weir upstream to the steeppass.

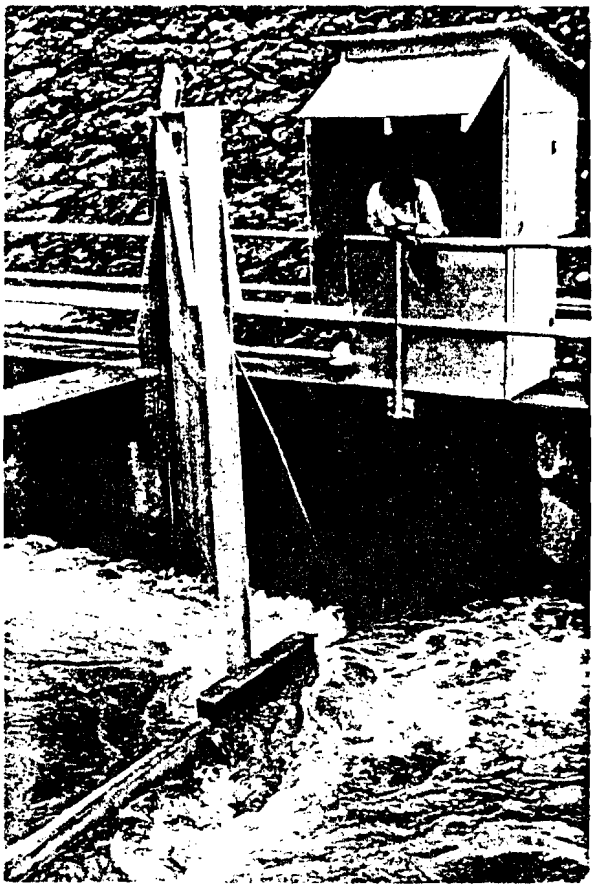


Figure 3.--Fish counted at weir 42 north bypassed the trap. The diversion lead shown below the counting weir could be lowered to divert all fish to the steeppass entrance. The orifice below the counting weir was drilled in the same manner as weir 42 south.

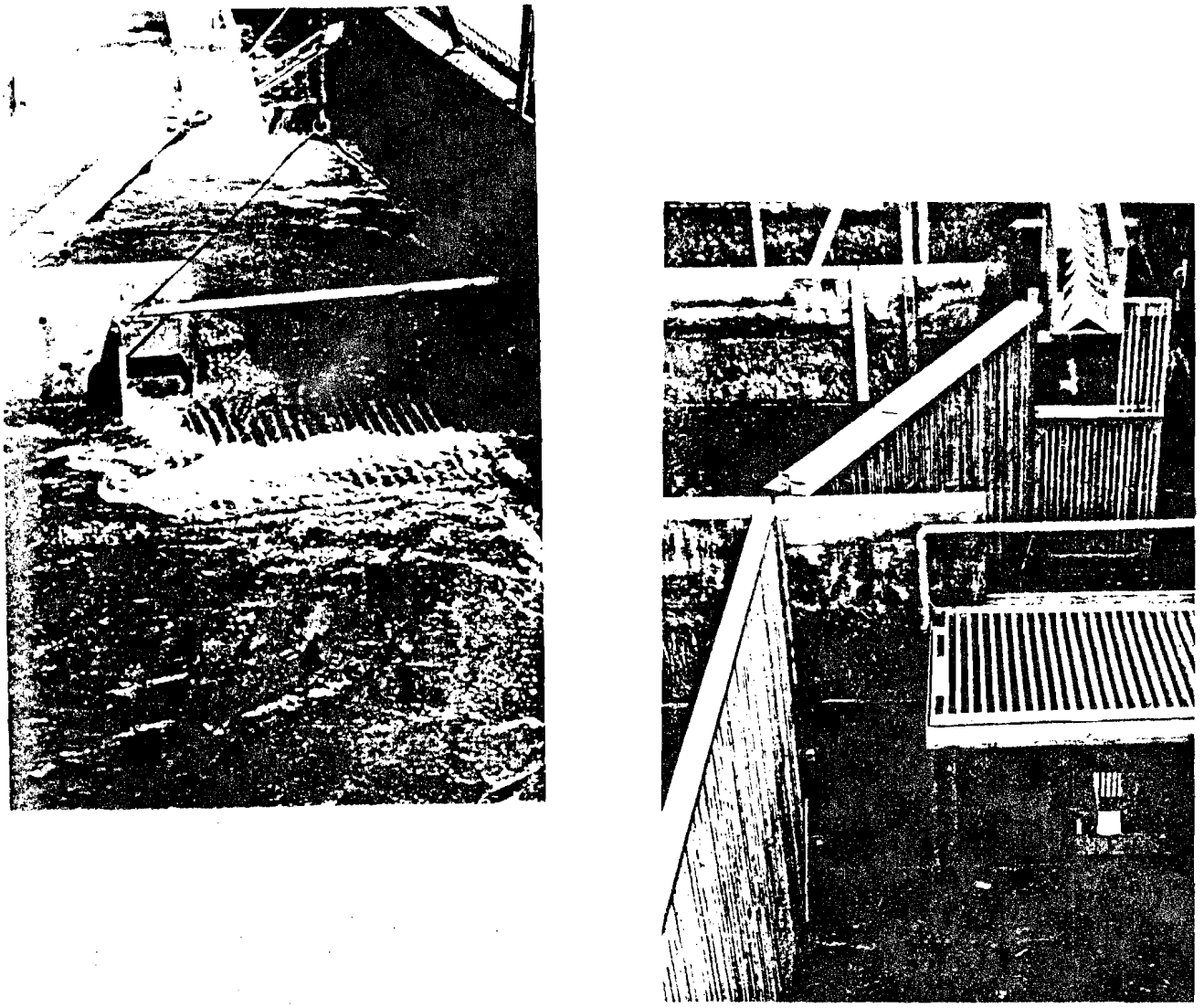


Figure 4.--The shad barrier installed at weir 44 below the steeppass entry pool to detain shad. Top photo shows the barrier in operation with concentrations of shad below. Botton photo is a view of this installation in the dry and shows the orifice which allows salmonids access to the steeppass entrance. Note: In the bottom photo the steeppass has been raised. During trap operation it would be lowered to occupy the opening in the picketed lead.

The flow, supplied by three 10 hp pumps in the "A" Branch ladder, emerged at the top of the steeppass through an upwell weir. Baffles in the weir dissipated the flow velocity while a louvered panel directed the flow into the steeppass. A small amount of the water spilled into the chute to the sorter.

Fish passage through the entrance pool and steeppass was volitional. However, after fish swam through the upwell at the top of the steeppass they had no control over their movement, and their momentum carried them down the chute to the sorter in 3 to 4 seconds. An operator at the sorter identified the fish and either diverted them back into the ladder or passed them into the trap for tagging or other purposes.

Tagging

Two periods of tagging were included in the evaluation study. Oregon Department of Fish and Wildlife (ODFW) personnel tagged chinook salmon and steelhead trout during the summer run tests (June 30-July 13) using the same type of tags used in their Washington shore tagging operation. Chinook were tagged with a brown anchor tag plus a yellow jaw tag on the left side. Steelhead were tagged with a white anchor tag. During the fall run tests (September 1-19), we tagged chinook and coho salmon with colored aluminum discs on the left opercle. A different colored opercle tag was used each day of the week. No steelhead were tagged during the fall run.

No fish were tagged during the spring run evaluation tests; operational difficulties precluded tagging as originally planned.

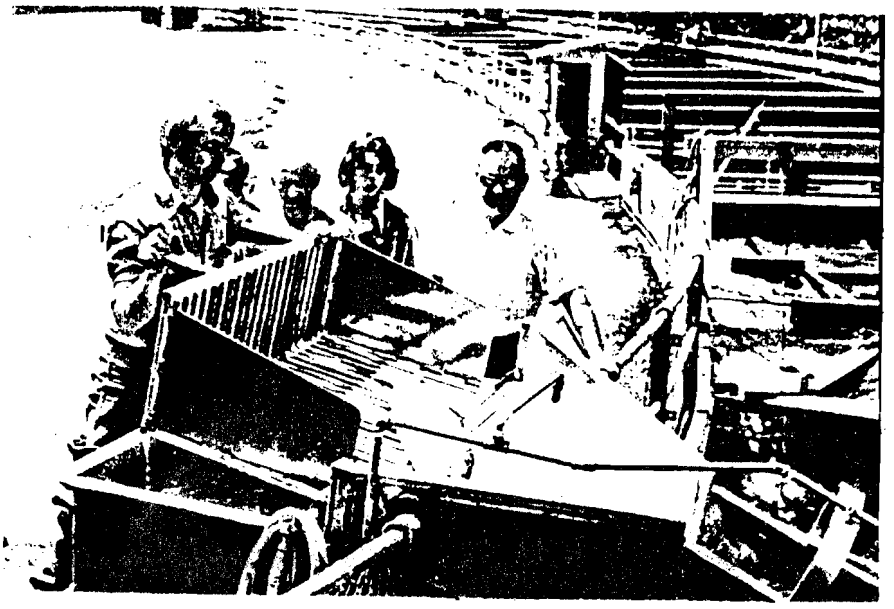
Fish to be tagged were diverted to one of two 550-gallon tanks containing anesthetic. A shunt gate below the diverter could be positioned to route fish to either tank while water in the chute dropped through a perforated plate and drained away to prevent dilution of the solution in the tanks. Maximum oxygen level was maintained in the anesthetic by bubbling air through perforated pipes in the bottom of each tank. After each days operation the anesthetic was drained into a drywell. The special drywell was installed to dispose of waste water that might contaminate the fish ladder.

A wash tank was provided to rinse the anesthetic from anesthetized fish before their return to the fish ladder. The 125-gallon tank received a constant flow of water with the outflow draining into the drywell. Anesthetized fish were transferred from the anesthetic to the wash tank and, after a brief rinse, brailed into a chute to the recovery pen in the fish ladder (Figure 5A).

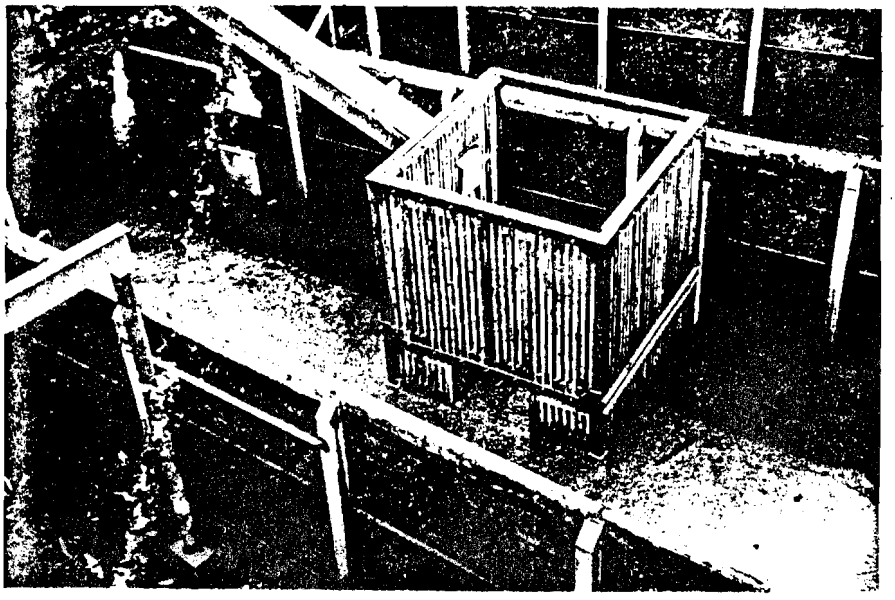
The recovery pen, an 8-foot square picketed enclosure in the middle of pool 47, provided a quiet area for fish to recover from anesthesia (Figure 5B). Upon recovery, fish swam through the opening at the bottom of the enclosure to regain unrestricted passage in the ladder.

Recording Fish Passage

Observers at all stations tallied fish passage on mechanical counters, and counts were recorded at the end of each hour. Passage through the trap as well as upstream and downstream passages at weir 42 (north and south) were recorded. Counts were categorized by



A



B

Figure 5.--Anesthetized fish are rinsed in the wash tank (A) before their return to the fish ladder via a chute to the recovery pen (B).

large chinook, small chinook, coho, sockeye, steelhead, and shad. During each shift, one of the observers was detailed to record hourly upstream passage, downstream passage, and net count up for each category as well as the number tallied at the sorter and number of each species tagged.

Passage of salmonids in the steeppass was recorded during random observation periods to determine the number of fallbacks in the steeppass. During some observations, we also recorded the number of successful passages (to the sorter) during the observation period.

Additional fish passage data were available from established "B" Branch and Bradford Island counting stations.

Test Conditions

The following basic operations were tested during the evaluation study:

A = Trapping facility not operating--the lower end of the steeppass ladder and fish lead were raised above the water and the shad barrier was removed (Figure 6).

B = Trapping facility operating. All fish ascending the steeppass were diverted back into the "A" Branch ladder without being handled.

C = Trapping facility operating. Salmon ascending the steeppass were passed into the anesthetic tank, tagged, transferred to the wash tank, and then placed in the recovery pen in the "A" Branch ladder. Species not tagged were diverted back into the "A" Branch ladder via the diversion chute. This represents a typical tagging operation.

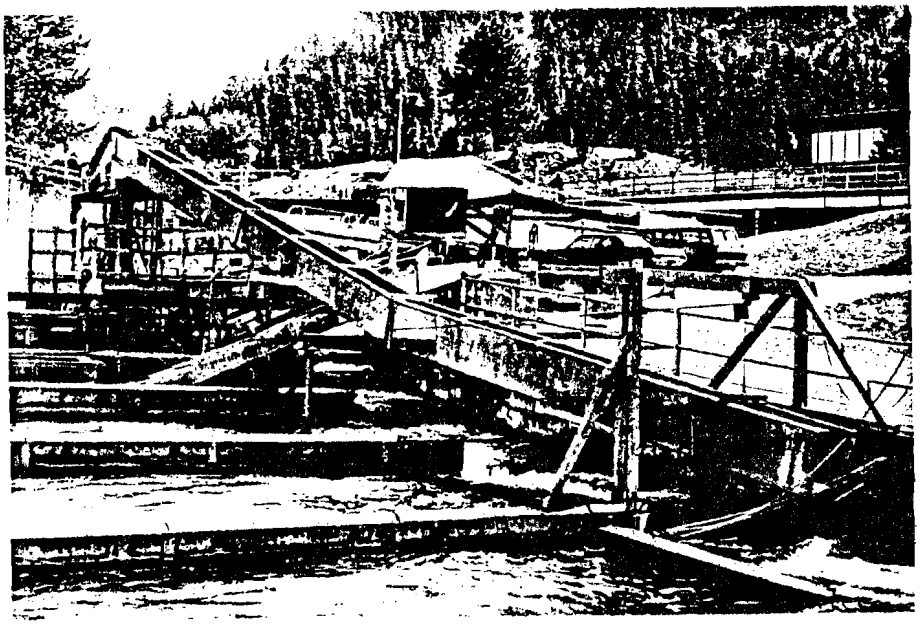


Figure 6.--The "A" Branch trap out of service. Note that the lower section of the steeppass is raised and the lead to the steeppass is positioned in line with the fishway flow to allow unrestricted fish passage up the ladder.

In addition, the basic operations were modified by the addition or removal of the diversion lead at weir 42 and/or the shad barrier at weir 44.

a = Trap operating with the shad barrier installed at weir 44.

b = Diversion lead installed below weir 42. Fish ascending the ladder on the north side were diverted from weir 42 north to the trap approach at weir 42 south.

Evaluation tests were scheduled during the spring, summer, and fall runs to compare fish passage through the fishway with and without the trap operating. The tests conducted and their objectives are given in Table 1. During each segment of the evaluation, we also counted fish for five days at weirs 42 north and south to determine the distribution of fish on each side of weir 42 when tests were not in progress.

PROCEDURE

Each weekly test (Monday through Friday) consisted of two 24-hour periods of trapping and two 24-hour periods without trapping plus an 8-hour period at each end--Monday a.m. with the trap out and Friday p.m. with the trap in. At 9 p.m. each Friday the trap was taken out of service and the orifice grills at the counting weirs opened to allow unrestricted fish passage in the "A" Branch ladder through the weekend.

Fluctuations in numbers and species of fish sometimes necessitated deviating from the original plan. Regardless of the order of testing, each test condition was given a 24-hour run before changing to another condition. Test conditions were changed at 1 p.m. (daylight saving time) each day. The powerhouse control room was advised of these changes, and operators noted trap status in the fishway log.

Table 1.--Evaluation tests and their objectives during the spring, summer, and fall runs.

Test	Run	Objective
A vs B_b A vs B	Spring	Determine the effect of trapping on fish passage and the efficiency of the trap with and without the diversion lead.
A vs C_b	Summer	Determine the effect of trapping and tagging on fish passage and the effectiveness of the trap to collect sufficient numbers of fish for a tagging operation with and without the diversion lead.
A vs C	Fall	
A vs $C_{a,b}$ A vs C_a	Summer	Determine the efficiency of the shad barrier and its effect on salmonid passage with and without the diversion lead.

Counting stations were manned for two 8-hour shifts each day of testing. The a.m. shift extended from 5 a.m. to 1 p.m.; the p.m. shift from 1 p.m. to 9 p.m. Counting personnel rotated from station to station during the shift--counting 45 minutes with a 15 minute break when the trap was in and counting 40 minutes with a 20 minute break when the trap was out.

OPERATIONAL CRITIQUE

Before presenting the results of the evaluation, obvious discrepancies in some counts between weir 42 south and the trap exit should be explained. Counting conditions at the trap exit were good throughout the tests. Fish descending the chute to the sorter were quite easily identified and posed little chance for counting error. On the other hand, counting conditions at weir 42 were never good and varied from day to day and often during the day. As counting condition deteriorated at weir 42, counts became less accurate. At times the net count of salmonids at weir 42 south was actually less than the number of salmonids counted at the sorter.

Most of the problem stemmed from inability to count smaller "jack" salmon due to a combination of high flows (up to 18" depth over the weir crest), fallbacks, and lampreys on the fishway walls.

Theoretically, the Bradford Island count should equal the sum of the "A" Branch and "B" Branch counts. The counts do show fair agreement during spring-run tests and the two days we counted early in the summer-run (Table 2). During early fall-run counts, however, jacks often

Table 2.--A comparison of weir 42 "A" Branch, "B" Branch, and Bradford Island salmonid counts during "A" Branch trap evaluation tests.

Date	Daily count of salmonids				Difference	
	"A" Branch	"B" Branch	Total A + B	Bradford Island	Number [BI - (A+B)]	% $\left[\frac{BI - (A+B)}{BI} \times 100\right]$
Spring						
Apr 3	127	73	200	200	0	0.0
4	260	50	310	267	- 43	-16.1
23	2347	381	2728	2425	-303	-12.5
24	3206	411	3617	3626	9	.2
25	1292	258	1550	1828	278	15.2
Summer						
June 12	84	305	389	421	32	7.6
13	115	234	349	420	71	16.9
Fall						
Aug 25	1225	73	1298	2579	1281	49.7
26	1413	38	1451	2614	1163	44.5
27	1699	78	1777	3476	1699	48.9
28	616	265	881	1440	559	38.8
29	991	328	1319	1454	135	9.3

outnumbered adults, and "A" Branch counters apparently missed many of the smaller fish at weir 42. Possibly some of these smaller fish were also missed by the "B" Branch counters.

RESULTS

Evaluation of the "A" Branch trap considered the ability of each of the major salmon and steelhead runs to ascend the steeppass and enter the trap (trap efficiency) as well as the effect of trapping and tagging on fish passage up the Bradford Island and Washington shore ladders. Major findings are summarized in this section. Daily fish counts and detailed test results by species may be found in Appendix Tables A1-A14.

Trap Efficiency

Trap efficiency is expressed as the proportion of fish at weir 42 that ascend the steeppass and enter the trap. As would be expected, the highest proportion of salmonids were trapped with the diversion lead in at weir 42. Percent efficiency calculated for all salmonids was about the same during spring and fall tests--about 8 percent without the diversion lead and about 53% with the lead (Figure 7). During summer-run tests, the respective percentages ranged from about 50 percent to over 100 percent (which we know is too high). The previously described counting difficulties at weir 42 probably produced the erroneous values.

Fallbacks in the steeppass may be largely responsible for the lower efficiency recorded for spring and fall run fish. The willingness of fish to ascend the steeppass has a profound effect on the efficiency of the trap. Fallback fish not only fail to enter the trap, but their descent impedes the passage of ascending fish.

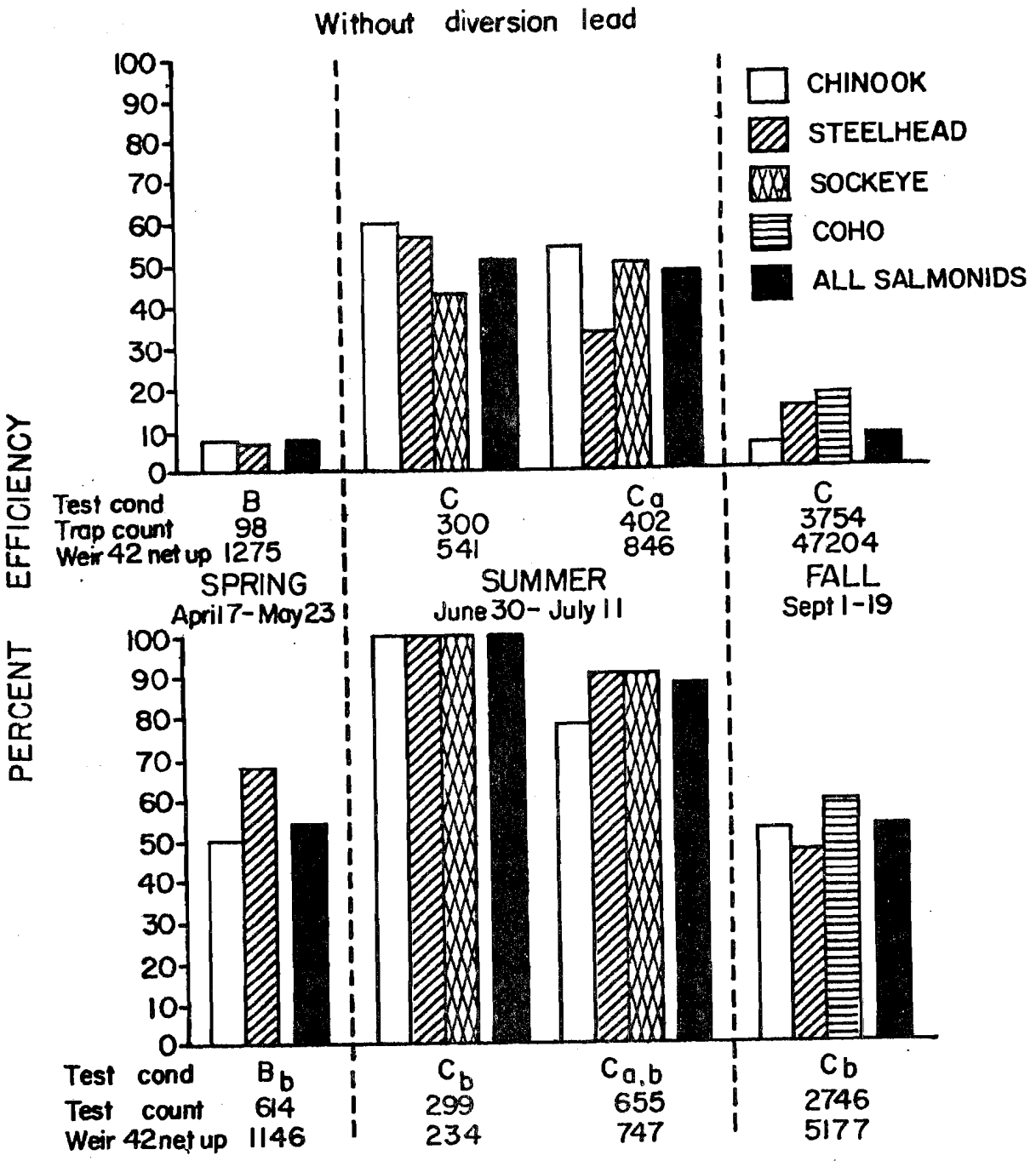


Figure 7.--"A" Branch trapping efficiency (calculated: $\frac{\text{Trap count x 100}}{\text{Weir 42 net up}}$) for salmonids during spring, summer, and fall runs -- a comparison of tests with and without the diversion lead at weir 42 north. Test conditions were: (B) trapping without tagging, (C) trapping with tagging, (a) shad barrier installed and (b) diversion lead in.
Note: The trap count exceeded weir 42 net count during C_b summer-run tests.

Observations revealed fallback activity only during the early spring and fall runs. During the April 18-22 test period, the average fallback rate was 7.3 per hour (Table 3). By contrast, no fallbacks were observed during the May 17-23 and June 30-July 11 operations. During the fall-run tests, September 1-19, salmonid counts through the trap were the highest during the season but so were fallbacks in the steeppass. Most of the fallbacks appeared to be large tule chinook. During 8.5 hours of observation time, 211 fallbacks were observed for an average of 24.8 per hour.

While the diversion lead effectively diverted fish to the steeppass entrance and, indeed, consistently increased trap efficiency, salmonid passage through the steeppass appeared to be less than expected. During 24-hour tests in the fall, the average rate of passage for 16-hour counting periods ranged from 46.3 to 65.6 salmonids per hour without the diversion lead and from 55.4 to 116.2 salmonids per hour with the diversion lead (Appendix Table A-11). The highest count for an hour occurred between 9 and 10 a.m. on September 2--175 salmonid--this represents the maximum capacity attained in the "A" Branch trap steeppass. Based on laboratory tests, a capacity of 650 to 1140 fish per hour is estimated for a 30-foot long steeppass at a 28.7 percent slope (Slatick, 1975). The additional length of the 66-foot long "A" Branch steeppass possibly increases fallbacks which in turn reduces the capacity of the steeppass.

Table 3.--Salmonid fallbacks observed in the steeppass during "A" Branch trap evaluation tests.

Date	Trapping Time	Successful passages		Obs. time	Fallbacks	
	Hours	Number	No./hr.	Hours	Number	No./hr.
April 7-17	72	115	1.6	1/		
April 18-22	24	466	19.4	2.6	19	7.3
May 17-23	56	310	5.5	4.6	0	0.0
June 30-July 11	80	2193	27.4	2/	0	
Sept 1-19	120	7779	64.8	8.5	211	24.8

1/ Occasional fallbacks observed but not recorded.

2/ No fallbacks observed during occasional observation periods. Observation time not recorded.

The Effects of Trapping on Fish Passage

Operating the trap altered fish passage in the "A" Branch ladder, ultimately causing some delay in overall passage through the Bradford Island ladder. The diversion lead at weir 42 north had the greatest impact upon passage while trapping without the lead seemed to cause only minor disruptions in fish passage. These effects are apparent in comparisons of counts at weir 42 in the "A" Branch ladder, a statistical analysis of counts at the Bradford Island counting station during evaluation tests, and passage of radio-tagged salmonids.

Passage in the "A" Branch Ladder at Weir 42

Data from the first week of trapping during the fall run (Sept. 1-5) provided an excellent example of the effects of trapping on passage at weir 42 in the "A" Branch ladder. With weir 42 north blocked to passage, counts rapidly increased at weir 42 south accompanied by successively higher hourly counts at the trap as fish density increased in the pools below the trap entry (Figure 8). Counts at both weir 42 south and the trap decreased toward the end of the counting day as fish movement in the ladder subsided. On the morning of the following day (Sept. 2) hourly counts at both weir 42 south and the trap increased rapidly for the first three hours. At that point weir 42 counts began to drop while the trap hourly counts seemed to level off--probably indicating a capacity density of fish in pools below the trap entry. This condition prevailed until the trap was taken out of service at 1 p.m.

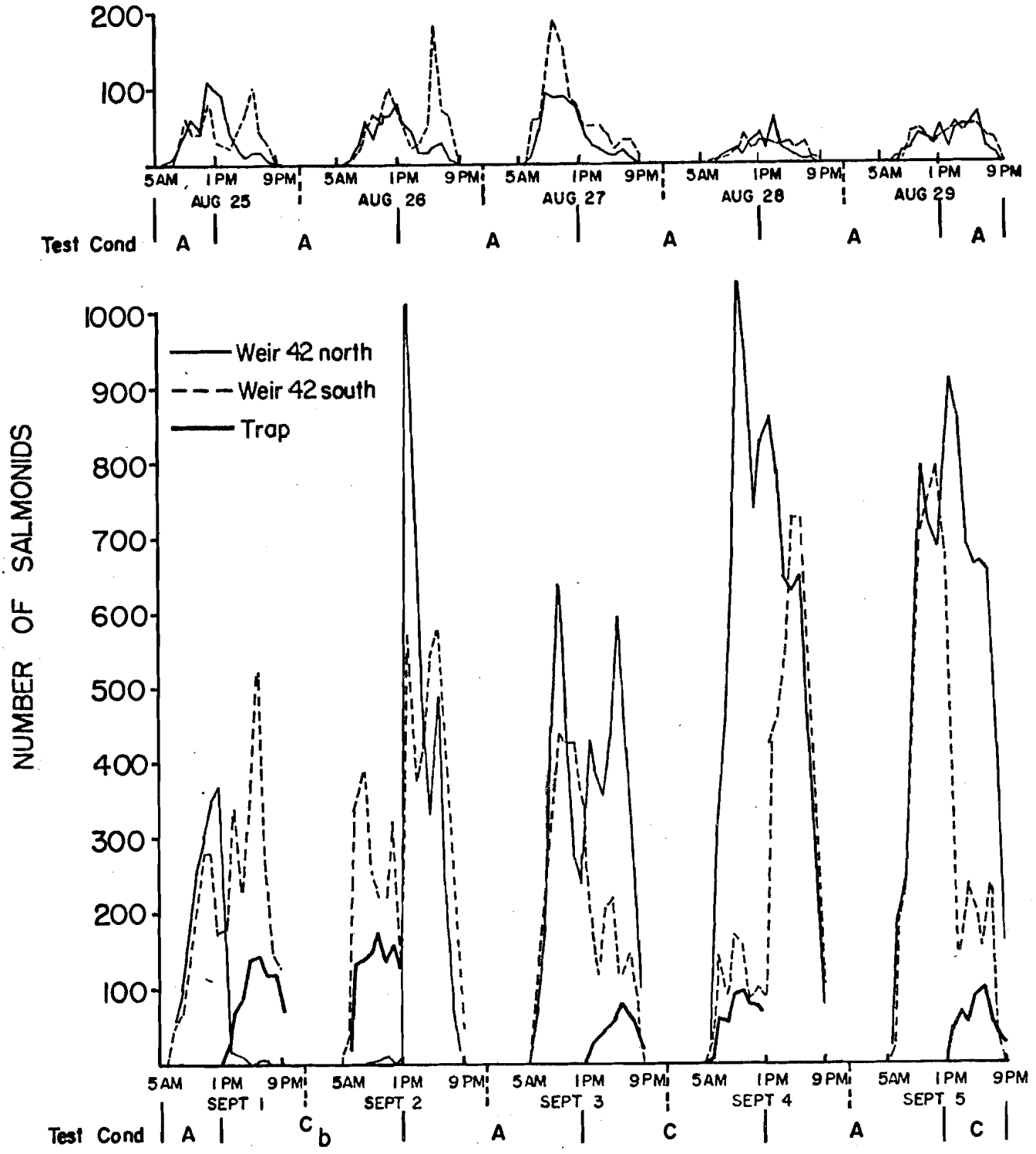


Figure 8.--Hourly net upstream counts of salmonids at "A" Branch weir 42 north, 42 south, and the trap during tests without the trap operating (test condition A), trapping and tagging (test condition C) without the diversion lead, and trapping and tagging (test condition C_b) with the diversion lead. August 25-29 and September 1-5, 1975.

When the trap and diversion lead were raised, counts increased dramatically at both weirs 42 north and south (Figure 8). Counts were higher on the north indicating that numbers of fish were beginning to build up below weir 42. After a couple of hours, counts at both weirs dropped and equalized. This condition continued through the following day until the trap went in again at 1 p.m. September 3.

During the second trapping period, weir 42 north was open to fish passage. When the trap went in at 1 p.m., hourly counts at 42 south declined while corresponding counts at 42 north steadily increased. The pattern of trap counts was similar to the pattern for the first trapping period, but it never reached as high an hourly count as was recorded when the diversion lead was in even though more fish were ascending the ladder. Obviously, most migrants were simply bypassing the trap by ascending weir 42 north. This pattern of movement at weir 42 continued through the following a.m. shift (Sept. 4) until trapping ceased at 1 p.m.

Again, when the trap was taken out of service, counts at weir 42 south increased until passage at both stations reached equilibrium. A final 8-hour run with the trap operating on September 5 showed the same pattern of counts as before--when the trap went in, hourly counts dropped at weir 42 south and increased at 42 north.

Passage Up the Bradford Island Fish Ladder

Monitoring hourly counts at the Bradford Island counting station during varying trapping conditions at the "A" Branch trap provided a means of assessing the degree each condition affected passage.

A cumulative distribution curve of the hourly fish counts at the Bradford Island counting station was used to estimate the migration rate and the time of median passage. These two parameters are equivalent to the variance and control location of a probability distribution for a random process. Multiple comparisons among the daily runs for different trapping conditions were made by using the cumulative distributions to statistically test for a change in variance and mean.

For this data it was preferable to use a distribution-free or nonparametric statistical test so that no assumptions need be made about the underlying probability distribution. A powerful nonparametric statistical test applicable for comparing the variance and location parameters is the Kolmogorov-Smirnov D statistic. The D statistic is a measure of the maximum distance between two cumulative distribution curves. If the distance between the curves, as computed from the data, exceeds the tabular value for a specified probability level, we can conclude that the two curves are significantly different in location or scale. The multi-sample development of the Kolmogorov-Smirnov statistic as given by Kiefer (1959) and Conover (1971) was used to compare the different trapping conditions in the evaluation tests.

The mean values of D statistics computed for each species during different trapping conditions are compared in Figures 9 and 10. On both graphs the abscissa represents an ordering of test categories by severity of passage restrictions from no restriction (Category T_1 or control) to total trapping with diversion lead and shad barrier (Category T_7). The ordinate represents increasing values of D which indicates impairment of passage. Additional details may be found in Appendix Table A-12.

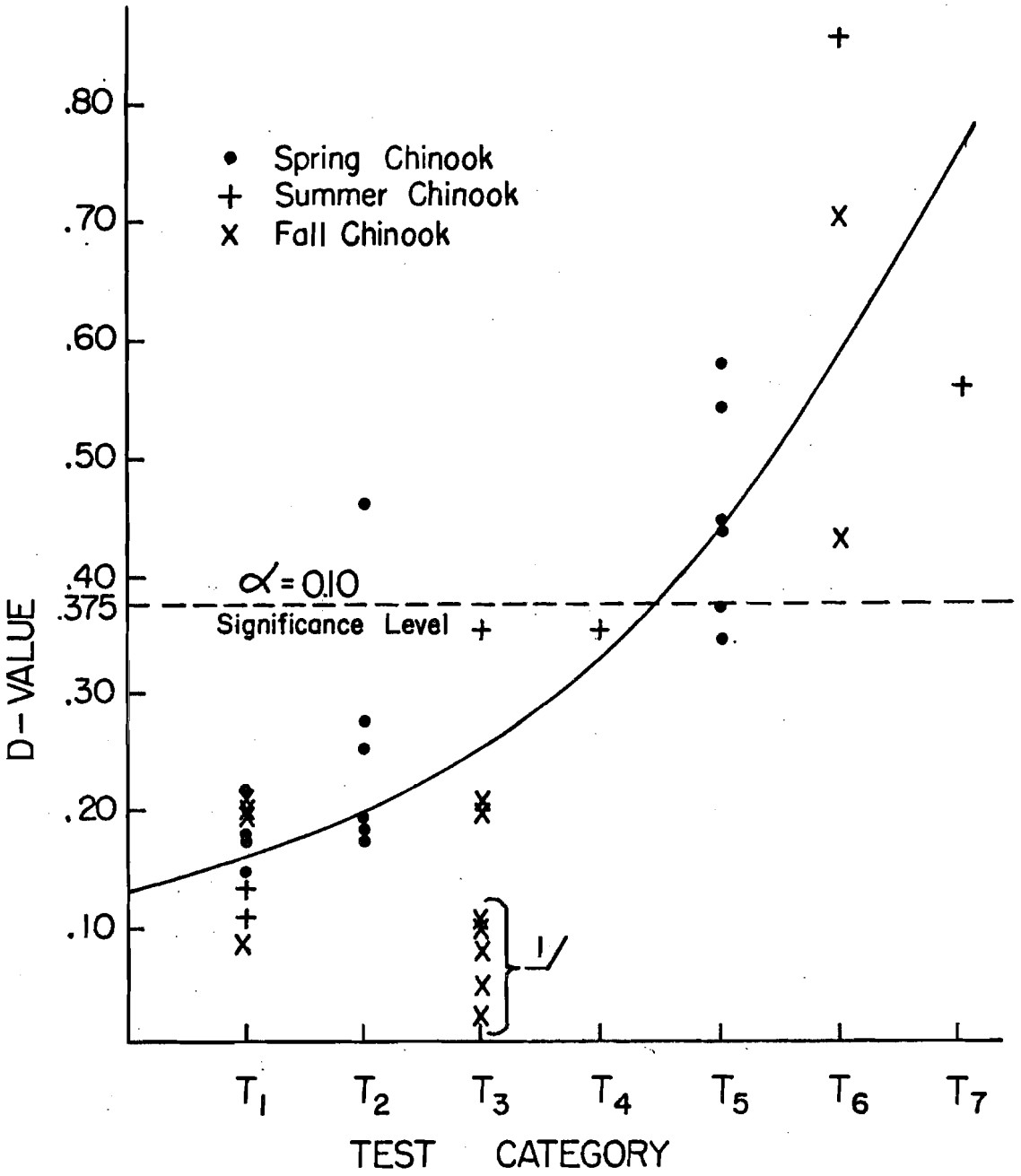


Figure 9.--Comparisons of the mean D values from Kolmogorov-Smirnov statistical tests for test categories ordered by severity from no passage restriction (T_1) to trapping and tagging with the diversion lead and shad barrier (T_7) during "A" Branch trap evaluation tests. Spring-, summer-, and fall-run chinook salmon.

1/ Peak of migration

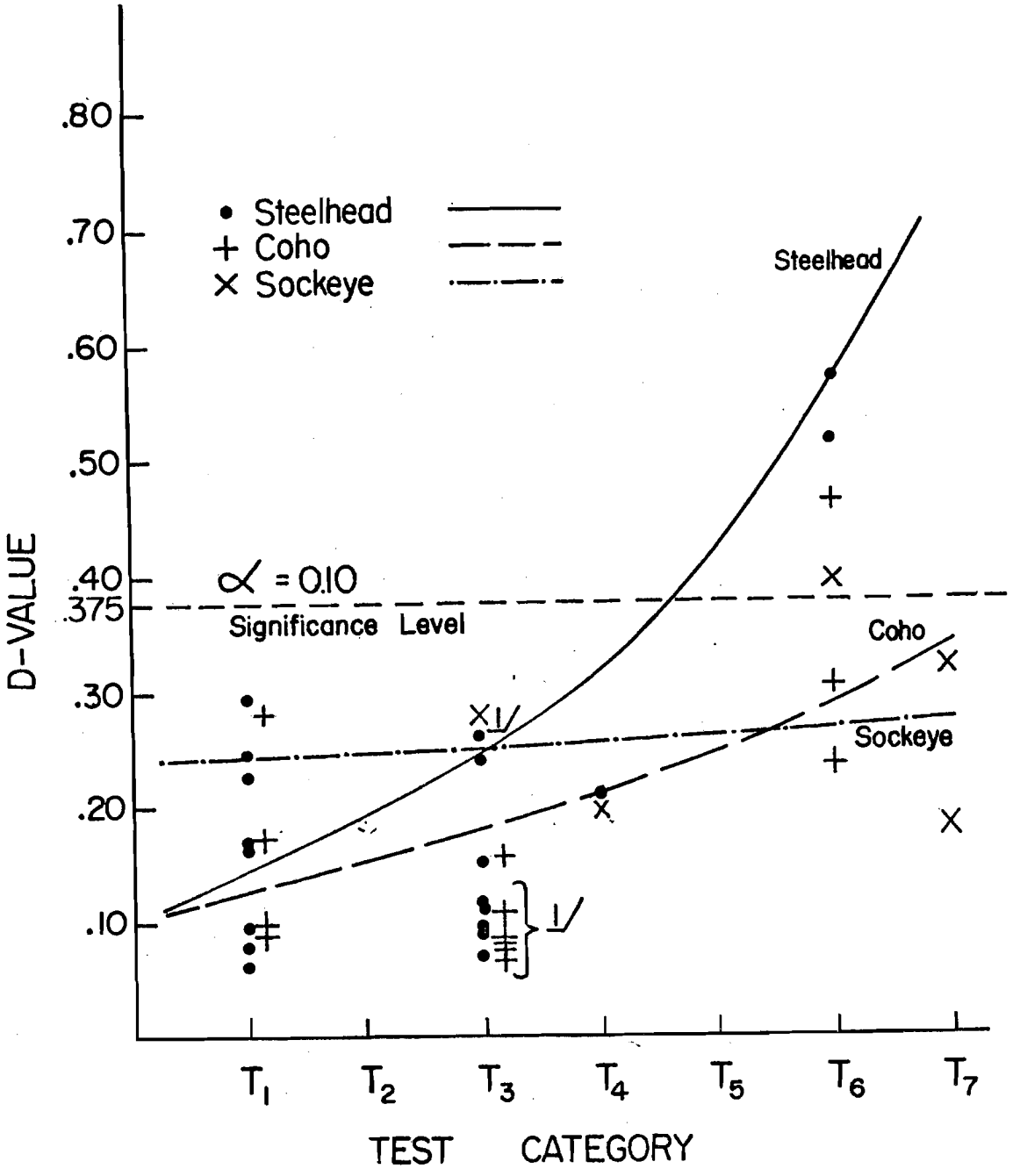


Figure 10.--Comparisons of the mean D values from Kolmogorov-Smirnov statistical tests for test categories ordered by severity from no passage restriction (T_1) to trapping and tagging with the diversion lead and shad barrier (T_7) during "A" Branch trap evaluation tests. Sockeye salmon, coho salmon, and steelhead trout.

1/ Peak of migration

For all species there was a progressively more severe impairment of fish passage as more restrictive diversion conditions were imposed in the ladder. Fish passage, though, was not significantly affected by trapping until the diversion lead was installed (Condition T_4).

Rate of impairment for each of the spring, summer, and fall chinook runs was significant, but the differences among the runs was not significant. The rate of impairment for the combined chinook data was statistically significant with $F = 212.5$, d.f. = (1,5), $P<0.001$. Rate of impairment for steelhead was also statistically significant ($F=25.12$, d.f.= (1, 2), $P<0.05$). For coho salmon there was a progressive increase in the impairment curve, but it was not statistically significant ($F=1.49$, d.f.=(1, 2), $P>0.25$). For sockeye salmon the curve is almost horizontal indicating no impairment in passage. Each species did show some statistically significant D values for test category T_6 which was trapping and tagging with the diversion lead in place.

The Shad Barrier

The shad barrier below the trap entrance at weir 44 seemed to function effectively but results are not conclusive. Shad did not ascend the steeppass at any time during trapping operations so we cannot actually determine the efficiency of the shad barrier. However, the percentage of upstream migrants dropping back over weir 42 south (fallbacks) might represent a measure of the impact of the barrier on shad and salmonid upstream passage (Table 4).

Table 4.--Upstream passage and percentage of fallbacks of shad and salmonids at weir 42 south during 24-hour tests with the shad barrier installed at weir 44 and during tests without the shad barrier. June 30-July 11, 1975.

Date	Test[1/] condition	Shad		Chinook		Steelhead		Sockeye		Total salmonids	
		Up	Fallbacks	Up	Fallbacks	Up	Fallbacks	Up	Fallbacks	Up	Fallbacks
		No.	%[2/]	No.	%[2/]	No.	%[2/]	No.	%[2/]	No.	%[2/]
June 30-July 1	C_b	4948	51.2	68	36.8	49	14.3	185	18.9	302	22.1
July 1-2	A	1678	24.3	175	5.1	102	1.0	437	2.7	714	3.1
July 2-3	$C_{a,b}$	7868	51.3	240	33.3	164	7.9	570	25.4	238	24.4
July 3-4	A	10958	15.7	148	3.4	112	.9	349	3.4	609	3.0
July 7-8	C_a	2138	35.7	211	47.9	131	19.8	321	18.4	663	28.1
July 8-9	A	820	20.1	145	8.3	81	2.5	205	4.4	431	5.3
July 9-10	C	1169	37.4	153	45.8	71	15.5	185	11.4	409	24.9
July 10-11	A	689	22.6	160	3.8	50	6.0	70	0.0	280	3.2

1/ A = No trapping
C = Trapping
C_b = Trapping with the diversion lead in at weir 42 north.
C_a = Trapping with the shad barrier installed at weir 44.
$C_{a,b}$ = Trapping with the diversion lead and the shad barrier.

2/ % Fallbacks = $\frac{\text{Weir 42 south count down}}{\text{Weir 42 south count up}} \times 100$

Fallback activity for shad at weir 42 south was not affected by installation of the shad barrier. When trapping with the diversion lead in at weir 42 north, the proportion of shad fallbacks was 51.3 percent with the barrier and 51.2 percent without the barrier. Without the diversion lead, respective fallback percentages were 35.7 with the barrier and 37.4 without the barrier. Since shad passage terminated at the steeppass entry pool, about all we can opine is that shad density in the steeppass entry pool "looked" to be less than in the pool below the barrier (Figure 4).

The use of the shad barrier seemed to slightly impede the passage of salmonids--especially sockeye. With the barrier in, fallback rate at weir 42 south increased about 7% for sockeye and 2 to 4% for all salmonids combined (Table 4).

Passage of Non-Salmonids

Shad, suckers, squawfish, and lampreys were observed at the counting weir below the trap, but only lampreys entered the trap. A few lampreys were trapped from day to day during the season, but only on a few occasions did significant numbers enter the trap during a single trapping period. The highest count was 1,372 during a 24-hour period.

Passage of Radio Tagged Salmonids

During radio-tracking studies of summer chinook salmon and steelhead trout at Bonneville Dam, several tagged fish were tracked through the "A" Branch ladder. Four chinook salmon ascended the ladder when the trap was not operating, and one chinook and one steelhead went through when the trap was operating.

Passage times varied between individuals, but there did not appear to be any significant difference between chinook ascending the ladder when the trap was in and when it was out (Table 5). A tagged chinook was tracked through the "A" Branch ladder to the Bradford Island counting station in 2.4 hours while the trap was operating. This passage included a circuit through the trap, the anesthetic, and recovery pen. Passage times of tagged chinook ascending the "A" Branch ladder when the trap was not operating ranged from 2.0 to 3.9 hours with an average of 3.0 hours.

The radio-tagged steelhead that went through the trapping facility made an overnight trip of it, but passage appeared to be normal. The fish did not cross weir 42 until 7:26 p.m. After one descent or fallback at weir 42 south, this fish reascended weir 42, ascended the steeppass, and went through the trap at 8:11 p.m.--at which time it became dark, and fish movement in the ladder subsided. Passage was resumed the next morning, and the steelhead passed the Bradford Island counting station at 8:05 a.m.

Effects of Tagging on Salmonid Passage

During the summer and fall runs, salmonids were tagged at the trap and released into the recovery pen in the "A" Branch ladder. Subsequently, their passage was observed at the various counting stations.

Table 5.--Passage times of radio tagged salmonids from "A" Branch ladder entrance to the trap, and from the trap to the Bradford Island ladder exit during "A" Branch trap evaluation tests.

Date	Species	Entered "A" Branch	Trap out			Trap in		
			Ladder entrance to trap	Trap to B.I. exit	Total	Ladder entrance to trap	Trap to B.I. exit	Total
		Time	Hours	Hours	Hours	Hours	Hours	Hours
July 2	Chinook	8:40 a.m.				1.2	1.2	2.4
July 4	Chinook	6:45 a.m.	3.1	.8	3.9			
July 6	Chinook	10:25 a.m.	.4	1.6	2.0			
July 11	Chinook	8:25 a.m.	.9	1.9	2.8			
July 11	Steelhead	7:05 p.m.				1.1	11.9[1/]	13.0
July 18	Chinook	7:49 a.m.	.9	2.3	3.2			

1/ Passage time includes about eight hours of darkness--a time when fish do not normally move.

Summer Run

Personnel from the ODFW tagged chinook and steelhead at the "A" Branch trap in the same manner as they did at the Washington shore facilities. Chinook were tagged with a brown anchor tag plus a yellow jaw tag (left side), and steelhead were tagged with a white anchor tag. The counters were able to see the jaw tags fairly well, and 64.5 percent of the 431 tagged chinook were observed at the Bradford Island counting station (Table A-4). The anchor tags were barely visible, and only 10.5 percent of the 345 tagged steelhead were observed at the counting station.

The release of tagged fish into the ladder had no apparent adverse effect on fish passage, but during the two-week tagging period, 17 tagged salmonids were recaptured in the trap indicating that some of the tagged fish dropped back after tagging. This behavior, however, was not unusual. A small percentage of the fish tagged at the Washington shore trap were recaptured there and at the "A" Branch trap (see Table A-8).

Fall Run

During fall-run tests (September 1-19), personnel from the NMFS tagged 2,317 chinook and 762 coho salmon on the left opercle with colored aluminum discs (Table A-5). To determine the time required for fish to reach the Bradford Island counting station from the "A" Branch trap, a different colored tag was used each day of the week.

The tags were easily distinguishable, but on days of high counts the counters were too busy counting to record all tags observed. However, there were sufficient numbers of days with good counts of tagged fish to determine passage of tagged salmonids.

Because the passage of tagged chinook and coho salmon was similar, the two species were combined to compare cumulative percentage distributions of fish tagged at the trap during an 8-hour period with similar distributions of tagged fish observed at the counting station. Practically all tagged fish observed, passed the Bradford Island counting station by the end of the 8-hour counting period following tagging. The distributions in Figure 11 show that salmonids tagged at the trap during the a.m. shift reached the counting station in about 3.4 hours. Those tagged during the p.m. shift followed a similar pattern of movement except that about half of the fish spent the night in the fish ladder and passed the counting station the following morning. If we can consider 1.6 hours as an average passage time between the trap and the Bradford Island counting station--the average passage time for four radio-tagged chinook with the trap out (Table 5)--it apparently took the salmonids about two hours to recover from the effects of tagging and resume passage.

Tagged chinook were also observed at the "A" Branch trap and the Washington shore ladder during the fall evaluation tests (Table 6); one was counted downstream at weir 42, six were recaptured in the trap, and nine upstream and six downstream passages were observed by

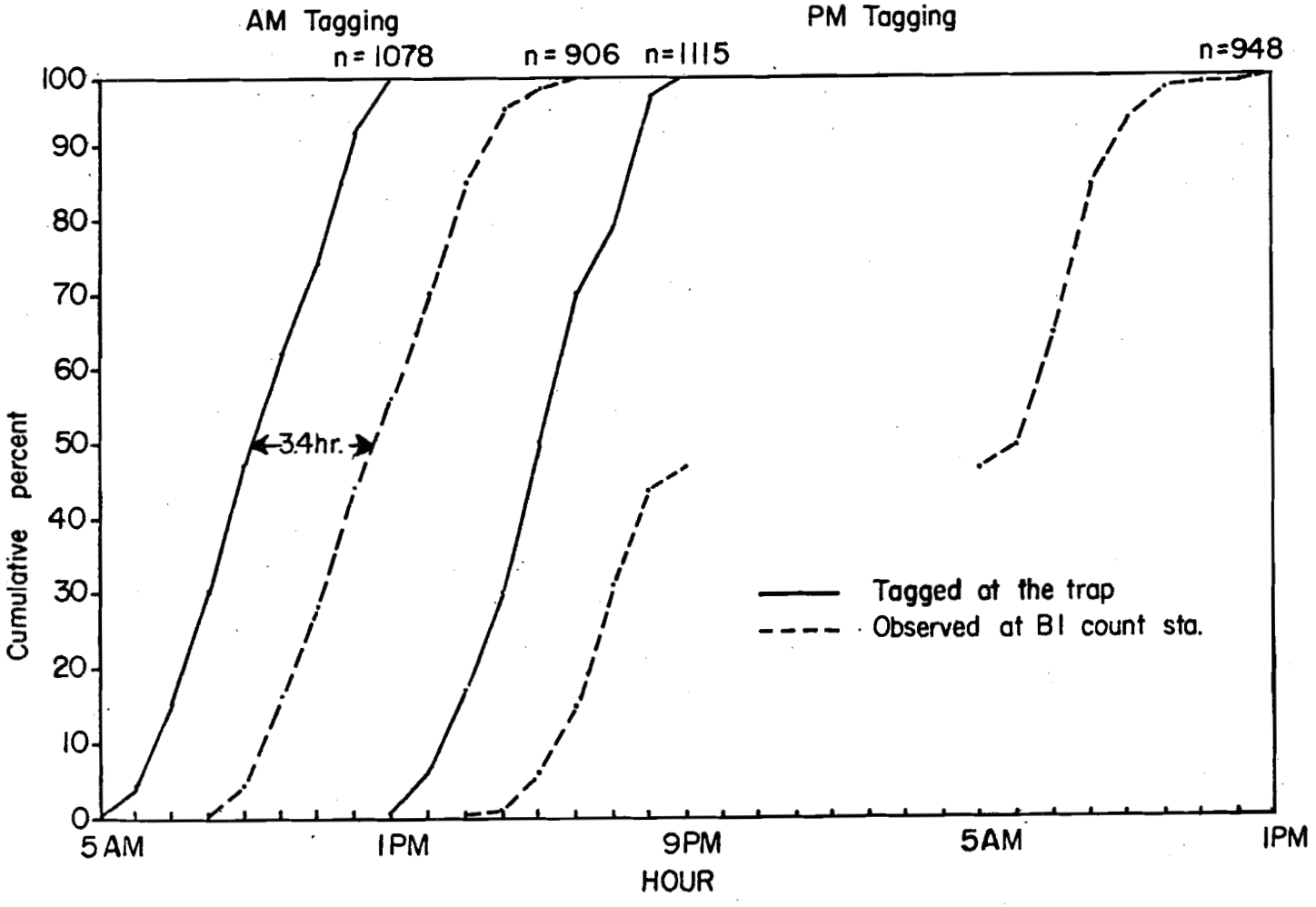


Figure 11.--Cumulative percentage distributions of salmonids tagged at the "A" Branch trap and observations of tagged fish at the Bradford Island counting station, September 1-19, 1975.

Table 6.--Observations of opercle tagged chinook at locations other than the Bradford Island counting station, September 1-20, 1976.

Date	Wash. shore		"A" Branch trap	"A" Branch Weir 42	
	Up	Dn	Recaptured	Up	Dn
Sept 1					
2					1
3	1				
4					
5					
6					
7	1				
8					
9	1				
10					
11		1	1		
12	1				
13					
14					
15	2	1			
16	1		1		
17		1	1		
18		2	3		
19	2	1			
20					
Total	9	6	6		1

Note: No coho observed.

counters at the Washington shore counting station (the Washington shore counters noted that most of the passages appeared to be one or two fish making repeated up and down passages at the counting station).

Tag Returns from Fall-Run Tagging

The ultimate destination of tagged fish based on tag returns, while not really pertinent to the "A" Branch evaluation tests, is included as a matter of interest. Fish hatcheries and fishery workers in the field were asked to report tag returns from the fall-run tagging. We were unable to monitor the recovery effort, but we know the effort was not consistent in all areas.

Nearly all tags returned were from above Bonneville Dam (Table 7). The largest number of returns were from the Little White Salmon Hatchery--359 coho tags were returned which represented 47.1 percent of the total number tagged. Spring Creek Hatchery personnel returned 202 chinook tags or 8.7 percent of the total number tagged. Two chinook and three coho tags were recovered below Bonneville Dam.

Comparison of "A" Branch Trapping to Washington Shore Trapping

For a gross evaluation of the overall efficiency of the "A" Branch trap and its effect on fish passage, these factors were compared with similar factors for the trapping facility adjacent to the Washington ladder. The trapping facility in the Washington shore ladder has been in use for a number of years. Its trapping efficiency and its effect on fish passage in the ladder are acceptable to the fishery agencies.

Table 7.--Tag returns from "A" Branch Trap Evaluation tagging Sept. 1-19, 1975

Species	Chinook		Coho	
Number tagged	2317		762	
Tags returned	No.	Percent	No.	Percent
Above Bonneville				
Spring Cr. Hatchery	202	8.7	1	.1
Cascade Hatchery	21	.9	20	2.6
Little White Sal. Hatchery	12	.5	359	47.1
Indian fishery 1/	28	1.2	1	.1
Total	263	11.3	381	49.9
Below Bonneville				
Bonneville Hatchery	1	.04		
Washougal Hatchery			2	.3
Camas (Sport catch)			1	.1
St. Helens & Ellsworth buying station	1	.04		
Total	2	.08	3	.4
Total returns	265	11.4	384	50.3

1/ Includes returns from Oregon Dept. of Fish and Wildlife; Plancich Fish Company, Portland, OR; and buyer at Lyle, WA.

If the "A" Branch trap collected fish as efficiently with no greater adverse affect on fish passage then it should also have a degree of acceptability as a trapping facility. However, precise comparisons were not possible--the two facilities operated independently, in different fish ladders, and on different schedules and it is difficult to find much common grounds upon which to adequately compare the two facilities.

Trap Efficiency

From April 1 to August 8, personnel from the ODFW frequently trapped 10 to 11 hours each day at the Washington shore facility (Table A-8). They attained their goal of tagging approximately 10 percent of the Bonneville chinook and steelhead runs by operating with a lead that diverted all fish from the Washington shore ladder into the facility. By comparison, the "A" Branch trap operated 8 hours daily--either 5 a.m. to 1 p.m. or 1 p.m. to 9 p.m. with the diversion lead in use only during certain tests.

During tests with the diversion lead in during the spring and summer runs, the "A" Branch trap collected about 10% of the total Bonneville count of salmonids (Appendix Table A-14), which compares with the 10% goal attained at the Washington shore trapping facility. During "A" Branch trapping in the fall, 21% of the total count of salmonids was trapped using the diversion lead. The increased efficiency over the Washington shore facility probably reflected greater utilization of the "A" Branch ladder by fall chinook.

Effect of Trapping on Fish Passage

Chinook salmon counts at the Washington ladder counting station were compared during an 8-day period (May 7-14) when two, 2-day intervals of no trapping resulted from a brief suspension of the tagging being done by personnel of the ODFW. Cumulative percentage distributions of the hourly chinook counts during four days with trapping and four days without trapping show the effects of trapping on passage in the ladder (Figure 12). The median of the distribution for days with trapping occurs three hours later than the median for days without trapping, indicating a three-hour delay in passage results from trapping in the Washington shore ladder.

Similar comparisons of passage up the Bradford Island ladder were made between May 17 and 23. Trapping with the diversion lead down did significantly delay passage as indicated earlier but the 3-hour delay indicated was no greater than the delay indicated for the Washington shore ladder (Figure 13). The only difference appears to be that the delay shows up almost immediately in the Bradford Island ladder, while it takes 5-6 hours before affecting passage in the Washington shore ladder.

RECOMMENDATIONS TO IMPROVE TRAP OPERATION

Our experience in operating the "A" Branch trap during the evaluation tests revealed that both efficiency and operation of the trap may be improved by making certain modifications. Some of these are minor, but some (i.e. shortening the steeppass) may require considerable

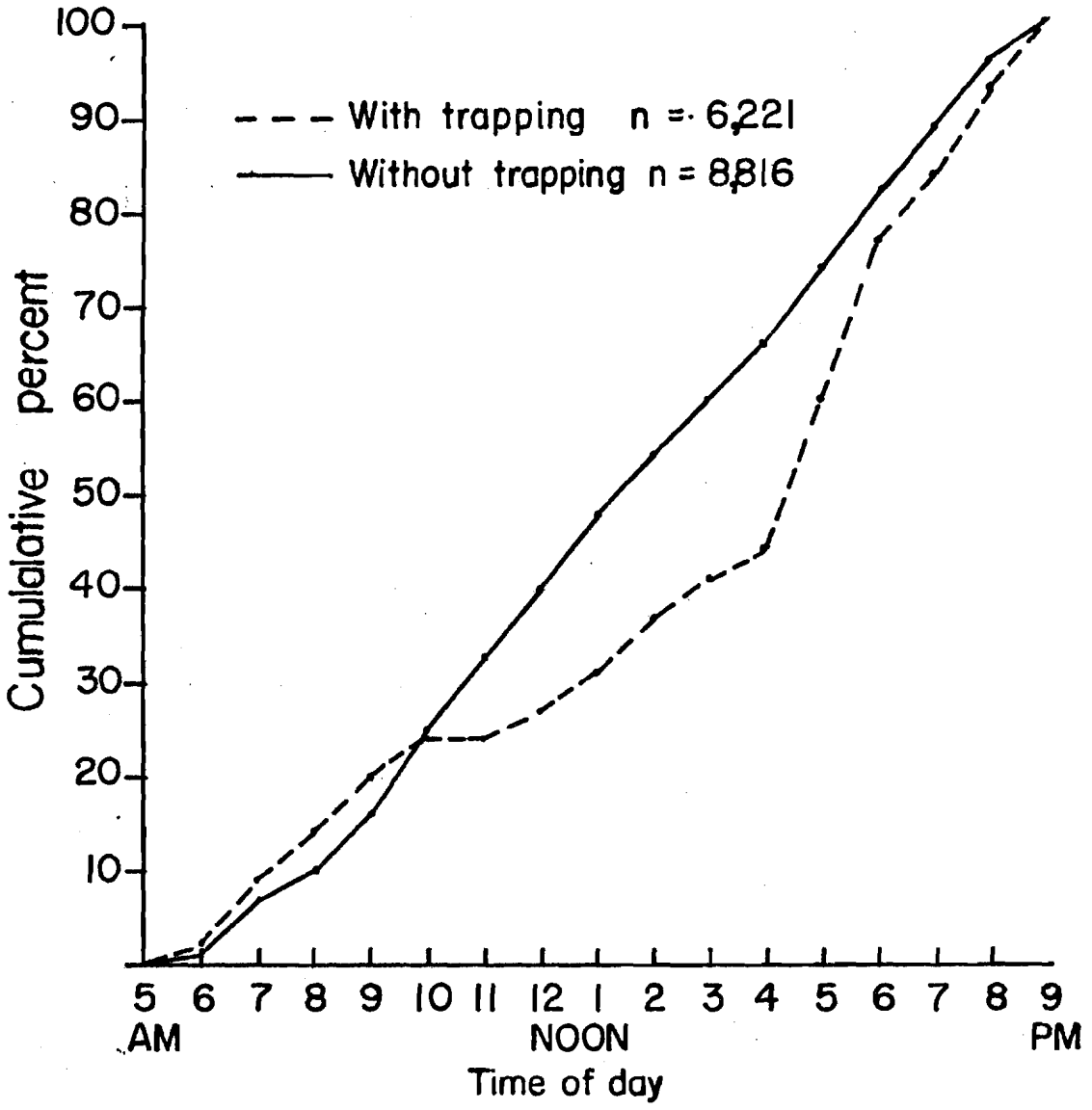


Figure 12.--Cumulative percentage distributions of chinook salmon hourly counts at the Washington shore counting station during four days with trapping in the NMFS Laboratory (May 7, 8, 11, and 12) and four days without trapping (May 9, 10, 13, and 14), 1975. Percentages were calculated after totaling the hourly counts for the four days of each condition.

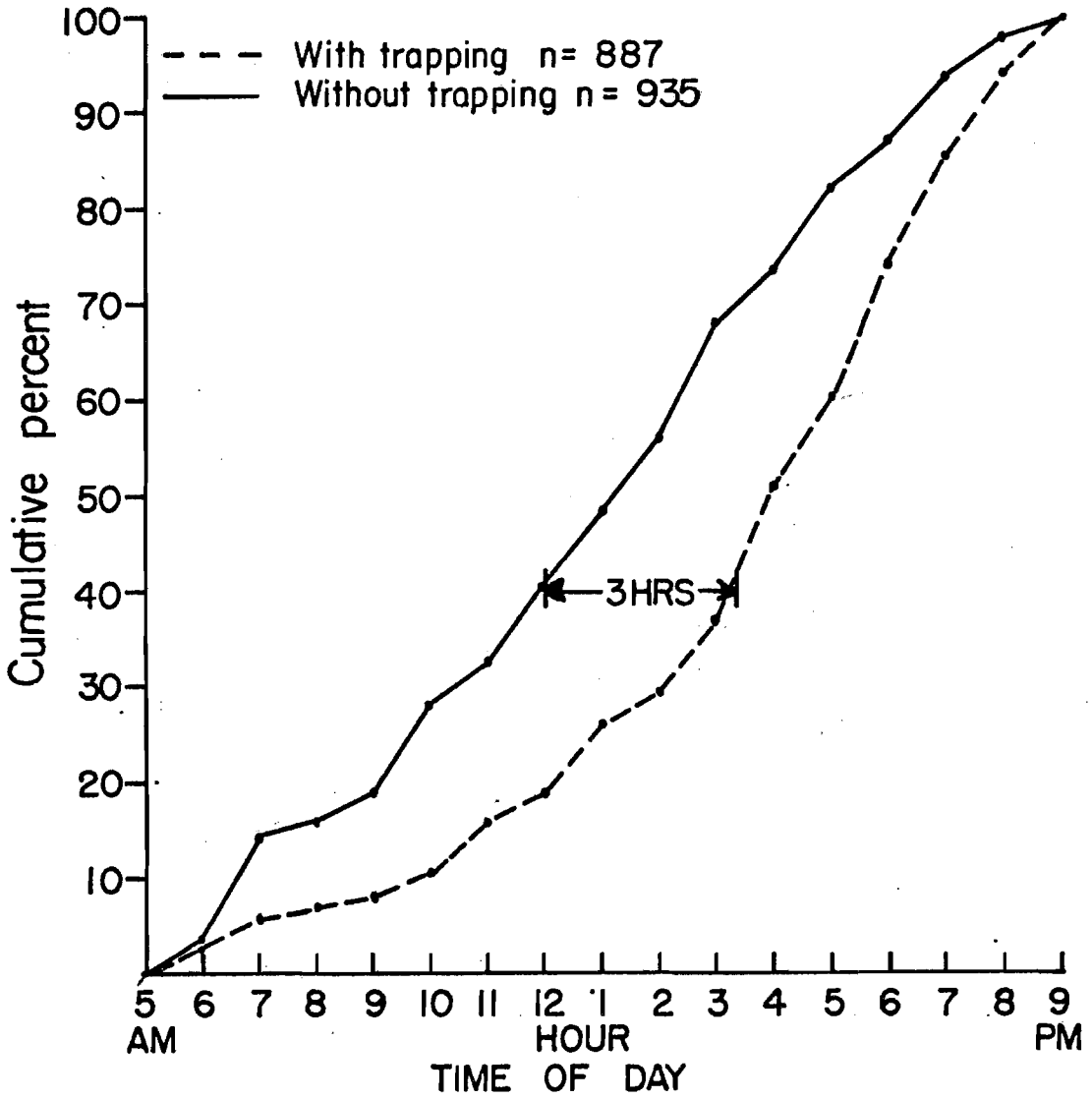


Figure 13.--Cumulative percentage distributions of chinook salmon hourly counts at the Bradford Island counting station during three days with trapping in the "A" branch with the diversion lead (May 18, 20, 22) and four days without trapping (May 17, 19, 21, 23). Percentages calculated differ totaling the hourly counts for each days counting.

structural remodeling. For this reason it seems logical that trap modifications--the major ones at least--be postponed until a final decision is made on a permanent trapping site. If the trap is relocated, modifications can be more economically incorporated into the new installation.

The following modifications are recommended:

1. Shorten the steeppass to a length of 50 feet or less if possible. A 50-foot steeppass at a 28.7 percent slope has successfully passed salmonids during tests at the Bonneville Laboratory and during operation of the fish separating system at Little Goose Dam.

2. Submerge the entrance to the steeppass so the top is just below the water surface.

3. Modify the diverter gate at the sorter. The diverter gate as designed does not operate satisfactorily. During operation, the parallel leaves of the diverter bang against the sides of the chute and bounce back out of position. The turnbuckle keeping the leaves parallel frequently needs adjusting and the hinges wear so that the lower end of the leaves drag on the bottom of the chute. We suggest replacing the turnbuckle with a metal bar of proper length, rework hinges, and adjust stroke on air actuating cylinder so that diverter leaves do not strike the chute.

4. Modify the shad barrier. The horizontal wood grating should be repositioned at a slight angle (2 to 5 degrees) downstream so that fish dropping back over the grating will slide off. A plate should be added

on the upstream edge to seal the gap between the bottom of the grating and the weir crest when the barrier is raised to adjust for slight increases in fishway pool elevations. A 6- to 8-inch seal aligned with the downstream face of the weir crest should be adequate and still clear the weir overfall when the barrier is out of service in the raised position.

5. Cover the lower 5 feet of the chute to the recovery pen to prevent fish from jumping out. The underside of the cover should be padded.

6. Replace the pumped flow to the steeppass with gravity flow. (This is not practical at the Bradford Island installation but could easily be done on the Washington shore site.)

7. Use river water in the wash tank instead of domestic water to avoid subjecting fish to sudden temperature change. We did this by running a hose from the pumped water supply. However, this feature should be included on a permanent installation.

8. Modify anesthetic tanks. Install cooling coils in the bottom to prevent the anesthetic solution from heating during hot weather. A perforated plate should be installed over the bottom of the anesthetic tanks to protect the coils and plastic aerator pipes as well as to keep lampreys and other foreign material out of the waste drain valve.

SUMMARY AND CONCLUSIONS

A trapping facility to collect adult salmonids for research purposes was designed and constructed by the Corps of Engineers to replace the

trapping facility in the aging Fisheries-Engineering Research Laboratory at Bonneville Dam. The new facility was installed in the "A" Branch of the Bradford Island ladder. When the trap is operating, fish ascending the south side of the Bradford Island ladder are diverted into a steeppass fishway, ascend the fishway to the upper end, pass over an upwell weir, and slide down a chute to a sorting device. An operator at the sorter diverts fish either back to the "A" Branch fish ladder or to one of the anesthetic tanks for research purposes. A diversion lead on the north side of the ladder could be lowered to divert all fish to the steeppass entry. When the trap is not in use, the lower end of the steeppass is raised and the entry lead swung clear to allow unrestricted upstream passage in the fish ladder.

The trap was installed early in 1975 and, at the request of the Pacific Northwest fishery agencies, the National Marine Fisheries Service was contracted with by the Corps to evaluate the prototype installation during the ensuing adult salmonid migrations. The objectives of this evaluation were to determine the efficiency of the trap and determine the effects of trapping and tagging on fish passage in the "A" Branch ladder.

Special counting stations were installed below the trap (weir 42) to monitor fish passage in the "A" Branch ladder and at the sorter to tally the number and species of fish trapped. Hourly counts at these stations and at the Corps "B" Branch and Bradford Island counting stations were used to evaluate the trap and its effect on fish passage.

The "A" Branch trap evaluation tests included all segments of the salmonid runs--spring, summer, and fall. From the tests and observations on fish passage we have concluded the following:

1. Trap efficiency (calculated: $\frac{\text{Trap count x 100}}{\text{Weir 42 net count up}}$) for salmonids during spring and fall tests ranged from about 8 percent without the diversion lead to about 53 percent with the lead. Efficiency during the summer run appeared to be as good or better; but due to counting difficulties, trap counts often exceeded counts at weir 42.

2. The proportion of the total Bonneville salmonid count trapped (calculated for corresponding periods of "A" Branch trapping) ranged from 3.9 percent without the diversion lead during the spring run to 21.0 percent with the lead during the fall run.

3. Fallbacks observed in the steeppass during the spring and fall runs reduced the efficiency of the trap. The rate of fallbacks ranged from 7.3 per hour during observations in the spring to 24.8 per hour during the fall-run observations.

4. The trap as presently installed collects fair numbers of salmonids, however, the fish passage rate for the 66-foot-long steeppass did not approach expectations. The hourly rate of salmonid passage in the "A" Branch steeppass ranged from 2.1 salmonids per hour during spring tests without the diversion lead to 85.8 per hour during fall tests with the diversion lead. The highest hourly count was 175 salmonids recorded at 10 a.m. September 2. By comparison, laboratory tests of a 30-foot-long steeppass indicated passage rates of 650 to 1140 fish per hour were possible.

5. Salmonid counts at weir 42 below the trap and a statistical analysis of cumulative distributions of counts at the Bradford Island counting station indicated that trapping and tagging without the diversion lead had only insignificant effects on fish passage in the ladder. Using the diversion lead to divert all fish to the "A" Branch trap, however, significantly slowed passage in the ladder.

6. During the fall run, tagged chinook and coho salmon released at the trap during the a.m. shift reached the Bradford Island counting station the same day with a median elapsed passage time of about three hours. About half of the fish tagged during the p.m. shift exited the Bradford Island ladder the same day while the remainder exited the following morning. Only six of 3,079 tagged salmonids were recaptured at the trap.

7. While shad did not ascend the steeppass at any time during the evaluation tests, the observed concentrations of shad at the steeppass entry appeared to be less with the shad barrier installed. Use of the shad barrier slightly increased the number of salmonid fallbacks counted at weir 42 south.

8. Lampreys were the only non-salmonids that entered the trap. The highest count was 1,372 during a 24-hour trapping period.

9. The "A" Branch trapping operation with the diversion lead in place collected salmonids about as well as the Washington shore trapping operations. Both operations delayed fish passage approximately 3 hours in the ladders.

10. Relocation of the trap to an off-ladder site on the Washington shore plus adoption of suggested recommendations to improve trap operations should result in an improved method of trapping adult salmon and steelhead trout.

ACKNOWLEDGMENTS

The original proposal for this evaluation was drafted by Dick Weaver of the National Marine Fisheries Service and Frank Young of the Oregon Department of Fish and Wildlife.

I am grateful to those personnel of the Portland District Corps of Engineers and the various fishery agencies that gave special assistance, especially during the early part of the evaluation study. The ODFW cooperated by providing personnel for tagging during the summer run. Corps of Engineers counters made special observations and recorded tagged fish for us during both the summer and fall runs.

Biometrician Frank Ossiander of the NMFS provided the statistical analysis for this report.

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Table A-1.--Fish counted at weir 42 and the trap during evaluation tests of the adult fish trap in the "A" Branch of the Bradford Island fish ladder at Bonneville Dam, Spring Run tests, April 7-May 23, 1975. Counts are for 8-hour periods, 5AM - 1PM and 1PM - 9PM (Daylight savings time)

Date	Time	Test cond.	Weir 42 north						Weir 42 south						Trap	
			Chinook			Steelhead			Chinook			Steelhead			Ch	Sthd
			Up	Dn	Net up	Up	Dn	Net up	Up	Dn	Net up	Up	Dn	Net up		
Apr 3	AM	A	7	0	7	5	2	3	12	0	12	4	0	4		
	PM	A	43	3	40	7	0	7	55	5	50	5	1	4		
Apr 4	AM	A	8	0	8	0	0	0	20	0	20	1	0	1		
	PM	A	155	8	147	2	1	1	102	20	82	1	0	1		
Apr 7	AM	A	14	1	13	1	0	1	35	1	34	1	0	1		
	PM	B_b	0	0	0	0	0	0	115	89	26	5	1	4	0	2
Apr 8	AM	B_b	0	0	0	0	0	0	25	11	14	5	0	5	0	2
	PM	A	162	7	155	37	2	35	136	11	125	35	2	33		
Apr 9	AM	A	41	0	41	7	0	7	36	2	34	9	1	8		
	PM	B	183	12	171	15	0	15	124	91	33	15	8	7	2	2
Apr 10	AM	B	38	3	35	9	0	9	31	22	9	11	5	6	2	0
	PM	A	190	15	175	19	1	18	205	36	169	26	3	23		
Apr 11	AM	A	50	1	49	11	0	11	102	3	99	15	2	13		
	PM	B	264	35	229	47	5	42	200	165	35	36	28	7	7	6
Apr 14	AM	A	124	4	120	8	1	7	166	13	153	7	1	6		
	PM	B	396	76	320	61	15	46	173	137	36	24	18	6	19	8
Apr 15	AM	B	113	8	105	20	1	19	59	28	31	8	1	7	9	0
	PM	A	288	24	264	47	3	44	262	49	213	38	5	33		
Apr 16	AM	A	71	15	56	36	1	35	93	10	83	31	5	26		
	PM	B	203	36	167	29	2	27	115	81	34	20	5	15	33	4
Apr 17	AM	B	112	11	101	28	0	28	100	63	37	13	2	11	19	0
	PM	A	206	22	184	33	0	33	374	44	330	37	6	31		
Apr 18	AM	A	73	12	61	16	2	14	118	18	100	21	0	21		
	PM	B	381	120	261	22	5	17	485	325	160	36	9	27	123	12
Apr 21	AM	A	329	16	313	24	0	24	668	10	658	28	3	25		
	PM	B_b	308	76	232	30	6	24	734	490	244	44	15	29	182	25
Apr 22	AM	B_b	78	14	64	12	3	9	375	196	179	23	8	15	116	8
	PM	A	536	32	504	23	0	23	515	72	443	30	2	28		
Apr 23	AM	A	221	2	219	31	3	28	225	12	213	18	0	18		
	PM	A	762	46	716	61	3	58	843	67	776	100	3	97		
Apr 24	AM	A	527	16	511	38	3	35	523	18	505	48	2	46		
	PM	A	971	52	919	33	4	29	1192	84	1108	56	1	55		
Apr 25	AM	A	139	17	122	15	1	14	240	15	225	30	1	29		
	PM	A	341	47	294	12	1	11	563	33	530	20	1	19		

Table A-1.--(Continued) Fish counted at weir 42 and the trap during evaluation tests of the adult fish trap in the "A" Branch of the Bradford Island fish ladder at Bonneville Dam, Spring Run tests, April 7-May 23, 1975. Counts are for 8-hour periods, 5AM - 1PM and 1PM - 9PM (Daylight saving time)

Date	Time	Test cond.	Weir 42 north						Weir 42 south						Trap	
			Chinook			Steelhead			Chinook			Steelhead			Ch	Sthd
			Up	Dn	Net up	Up	Dn	Net up	Up	Dn	Net up	Up	Dn	Net up		
May 17	AM	A	16	2	14	0	0	0	34	0	34	0	0	0		
	PM	B_b	4	1	3	0	0	0	87	26	61	1	0	1	66	7
May 18	AM	B_b	2	0	0	0	0	0	39	27	12	2	0	2	36	5
	PM	A	51	5	46	1	0	1	36	3	33	1	0	1		
May 19	AM	A	25	0	25	3	0	3	22	1	21	2	0	2		
	PM	B_b	17	5	12	1	0	1	69	27	42	4	1	3	43	6
May 20	AM	B_b	7	1	6	1	0	1	35	3	32	7	2	5	30	2
	PM	A	77	4	73	3	0	3	35	1	34	1	0	1		
May 21	AM	A	37	2	35	1	0	1	21	0	21	2	0	2		
	PM	B_b	37	6	31	3	0	3	56	15	41	6	0	6	35	14
May 22	AM	B_b	8	2	6	1	0	1	38	8	30	0	0	0	32	3
	PM	A	69	7	62	3	0	3	38	5	33	3	0	3		
May 23	AM	A	30	3	27	1	0	1	19	0	19	2	0	2		
	PM	B_b	16	12	4	2	1	1	47	15	32	6	0	6	24	7

Table A-2.--Fish counted at weir 42 and the trap during evaluation test of the adult fish trap in the "A" Branch of the Bradford Island fish ladder at Bonneville Dam, Summer Run tests, June 30-July 11, 1975. Counts are for 8-hour periods, 5AM - 1PM and 1PM - 9PM (Daylight saving time)

Date	Time	Test cond.	Weir 42 north						Weir 42 south						Trap	
			Chinook			Steelhead			Chinook			Steelhead			Ch	Sthd
			Up	Dn	Net up	Up	Dn	Net up	Up	Dn	Net up	Up	Dn	Net up		
June 12	AM	A	12	4	8	3	0	3	27	0	27	6	0	6		
	PM	A	16	10	6	3	1	2	31	2	29	3	0	3		
June 13	AM	A	11	0	11	11	0	11	31	5	26	7	1	6		
	PM	A	10	7	3	1	1	0	52	2	50	8	0	8		
June 30	AM	A	22	2	20	3	0	3	39	1	38	1	0	1		
	PM	B_b	4	2	2	0	0	0	46	19	26	29	3	26	28	27
July 1	AM	B_b	3	2	1	1	1	0	22	6	16	20	4	16	34	40
	PM	A	21	4	17	12	0	12	48	4	46	20	1	19		
July 2	AM	A	72	9	63	58	1	57	127	5	122	82	0	82		
	PM	$C_{a,b}$	9	6	3	4	2	2	120	42	78	62	7	55	55	63
July 3	AM	$C_{a,b}$	13	14	- 1	2	1	1	120	38	82	102	6	96	71	76
	PM	A	27	4	23	40	1	39	78	3	75	59	1	58		
July 4	AM	A	64	0	64	48	0	48	70	2	68	53	0	53		
	PM	$C_{a,b}$	5	7	- 2	3	2	1	81	15	66	51	12	39	65	65
July 7	AM	A	45	5	40	13	2	11	47	5	42	21	0	21		
	PM	C_a	30	4	26	37	4	33	53	22	31	59	8	51	45	25
July 8	AM	C_a	94	7	87	47	5	42	158	79	79	72	18	54	76	35
	PM	A	39	8	31	21	2	19	51	7	44	39	2	37		
July 9	AM	A	63	9	54	43	1	42	95	5	90	42	0	42		
	PM	C	30	13	17	24	5	19	36	14	22	35	6	29	24	21
July 10	AM	C	85	14	71	38	2	36	117	56	61	36	5	31	78	45
	PM	A	63	6	57	38	4	34	83	4	79	30	2	28		
July 11	AM	A	58	4	54	21	0	21	77	2	75	20	1	19		
	PM	C_a	87	9	78	56	4	52	108	27	81	50	9	41	67	58

Table A-2.---(Continued) Fish counted at weir 42 and the trap during evaluation test of the adult fish trap in the "A" Branch of the Bradford Island fish ladder at Bonneville Dam, Summer Run tests, June 30-July 11, 1975. Counts are for 8-hour periods, 5AM - 1PM and 1PM - 9PM (Daylight saving time)

Date	Time	Test cond.	Weir 42 north						Weir 42 south						Trap	
			Sockeye			Shad			Sockeye			Shad			Sock	Shad
			Up	Dn	Net	Up	Dn	Net	Up	Dn	Net	Up	Dn	Net		
June 12	AM	A	3	0	3	1325	231	1094	0	0	0	1246	369	877		
	PM	A	3	0	3	1383	306	1077	6	3	3	2168	581	1587		
June 13	AM	A	5	1	4	1089	263	826	0	0	0	1222	242	980		
	PM	A	2	0	2	2018	639	1379	4	1	3	3489	1494	1995		
June 30	AM	A	53	2	51	755	134	621	101	4	97	711	89	622		
	PM	C_b	2	0	2	170	157	13	87	15	72	2917	1354	1563	130	0
July 1	AM	C_b	0	0	0	66	44	22	98	20	78	2031	1189	842	40	0
	PM	A	48	6	42	437	100	337	101	5	96	1117	345	772		
July 2	AM	A	196	3	193	497	36	461	336	7	329	561	63	498		
	PM	$C_{a,b}$	15	9	6	292	211	81	253	72	181	3919	1739	2180	195	0
July 3	AM	$C_{a,b}$	1	1	0	128	94	34	317	73	244	3949	2294	1655	195	0
	PM	A	72	2	70	2327	507	1820	191	12	179	2571	709	1862		
July 4	AM	A	130	3	127	9524	822	8702	158	0	158	8387	1008	7379		
	PM	$C_{a,b}$	13	16	-3	1369	1504	-135	166	25	141	5770	2543	3237	225	0
July 7	AM	A	49	1	48	363	16	347	32	1	31	324	36	288		
	PM	C_a	75	7	68	1373	315	1058	136	27	109	1745	631	1114	100	0
July 8	AM	C_a	115	2	113	447	69	378	185	32	153	393	133	260	121	0
	PM	A	55	2	53	396	139	257	55	2	53	362	80	282		
July 9	AM	A	118	8	110	507	104	403	150	7	143	458	85	373		
	PM	C	55	3	52	543	247	296	65	5	60	643	277	366	52	0
July 10	AM	C	91	2	89	425	88	337	120	16	104	526	160	366	80	0
	PM	A	45	2	43	362	80	282	38	0	38	423	135	288		
July 11	AM	A	41	0	41	250	16	234	32	0	32	266	21	245		
	PM	C_a	37	0	37	398	144	254	41	4	37	461	159	302	57	0

Table A-3--Fish counted at weir 42 and the trap during evaluation test of the adult fish trap in the "A" Branch of the Bradford Island fish ladder at Bonneville Dam, Fall Run tests, August 25-September 19, 1975. Counting periods, 5AM - 1PM and 1PM - 9PM (Daylight saving time)

Date	Time	Test cond.	Weir 42 north									Weir 42 south									Trap		
			Chinook			Steelhead			Coho			Chinook			Steelhead			Coho			Chin	Sthd	Coho
			Up	Dn	Net up	Up	Dn	Net up	Up	Dn	Net up	Up	Dn	Net up	Up	Dn	Net up	Up	Dn	Net up			
Aug 25	AM	A	245	4	241	106	0	106	31	0	31	203	8	195	81	0	81	11	1	10			
	PM	A	140	6	134	53	1	52	12	1	11	211	7	204	133	1	132	21	1	20			
Aug 26	AM	A	239	11	228	64	1	63	40	0	40	264	5	259	80	0	80	49	0	49			
	PM	A	137	1	136	39	0	39	15	0	15	356	11	345	112	0	112	47	1	46			
Aug 27	AM	A	336	12	324	73	0	73	93	0	93	539	18	521	117	2	115	127	2	125			
	PM	A	145	8	137	10	0	10	7	0	7	239	5	234	48	0	48	12	0	12			
Aug 28	AM	A	127	10	117	15	0	15	10	3	7	112	14	98	24	0	24	23	1	22			
	PM	A	153	20	133	9	0	9	7	0	7	163	19	144	31	2	29	12	1	11			
Aug 29	AM	A	167	25	142	35	2	33	26	2	24	153	21	132	35	1	34	44	4	40			
	PM	A	239	22	217	28	0	28	34	1	33	259	25	234	49	1	48	26	0	26			
Sept 1	AM	A	1458	52	1406	103	2	101	132	1	131	1034	26	1008	108	1	107	160	4	156			
	PM	C_b	96	57	39	12	11	1	8	2	6	3640	2251	1389	464	151	313	714	256	458	549	126	115
Sept 2	AM	C_b	69	25	44	0	0	0	3	2	1	5187	3744	1443	386	133	253	431	194	237	773	122	175
	PM	A	3092	62	3030	257	2	255	150	1	149	2952	194	2758	293	9	284	171	9	162			
Sept 3	AM	A	2079	91	1988	176	3	173	147	1	146	2147	46	2101	265	3	262	174	1	173			
	PM	C	2752	96	2656	227	6	221	197	7	190	2153	1214	939	163	33	130	119	44	75	254	68	86
Sept 4	AM	C	4543	62	4481	279	4	275	300	8	292	2112	1428	684	121	22	99	142	39	103	394	52	112
	PM	A	4057	89	3968	195	1	194	228	5	223	3634	125	3509	189	5	184	187	6	181			
Sept 5	AM	A	3539	104	3435	172	7	165	354	12	342	3553	79	3474	151	5	146	324	9	315			
	PM	C	4748	160	4588	194	6	188	278	6	272	2479	1364	1115	117	22	95	122	41	81	429	41	82

Table A-3--(Continued). Fish counted at weir 42 and the trap during evaluation test of the adult fish trap in the "A" Branch of the Bradford Island fish ladder at Bonneville Dam, Fall Run tests, August 25-September 19, 1975. Counting periods, 5 AM - 1PM and 1PM - 9PM (Daylight saving time)

Date	Time	Test cond.	Weir 42 north									Weir 42 south									Trap		
			Chinook			Steelhead			Coho			Chinook			Steelhead			Coho			Chin	Sthd	Coho
			Up	Dn	Net up	Up	Dn	Net up	Up	Dn	Net up	Up	Dn	Net up	Up	Dn	Net up	Up	Dn	Net up			
Sept 8	AM	A	4542	89	4453	158	7	151	415	8	407	4460	86	4374	149	3	146	341	3	338			
	PM	C	6118	82	6036	236	7	229	580	3	577	2672	1699	973	97	18	79	290	106	184	409	66	133
Sept 9	AM	C	5999	89	5910	329	12	317	610	12	598	1998	1206	792	90	28	62	365	158	207	326	35	81
	PM	A	5286	82	5204	198	6	192	696	11	685	2223	134	2089	50	2	48	276	20	256			
Sept 10	AM	A	4134	104	4030	172	3	169	517	11	506	1964	81	1883	146	5	141	379	8	371			
	PM	C	5142	100	5042	213	2	211	789	12	777	1675	1122	553	65	10	55	276	96	180	306	37	166
Sept 11	AM	C	4807	98	4709	156	7	149	713	11	702	1415	1004	411	65	13	52	233	63	170	290	28	164
	PM	A	4907	73	4834	199	5	194	634	9	625	1410	107	1303	62	3	59	272	16	256			
Sept 12	AM	A	4380	86	4294	146	1	145	580	16	564	1096	69	1027	59	1	58	289	8	281			
	PM	C	4643	128	4515	220	5	215	596	16	580	1003	480	523	44	5	39	197	55	142	356	19	139
Sept 15	AM	A	3444	90	3354	110	3	107	617	6	611	1419	78	1341	33	0	33	349	6	343			
	PM	C	3311	85	3226	107	2	105	369	5	364	815	424	391	19	1	18	131	36	95	243	6	86
Sept 16	AM	C	2823	92	2731	70	1	69	665	12	653	689	435	254	37	1	36	174	32	142	265	19	121
	PM	A	1294	42	1252	42	0	42	228	6	222	814	67	747	25	5	20	129	5	124			
Sept 17	AM	A	728	46	682	31	1	30	240	11	229	225	25	200	10	5	5	72	2	70			
	PM	C_b	155	127	28	1	0	1	38	31	7	649	293	356	36	1	35	259	77	182	210	25	185
Sept 18	AM	C_b	167	159	8	0	0	0	22	19	3	734	581	153	25	6	19	296	95	201	278	21	167
	PM	A	491	28	463	20	1	19	199	7	192	204	37	167	5	1	4	89	3	86			
Sept 19	AM	A	141	21	120	8	0	8	107	10	97	70	15	55	4	2	2	33	4	29			
	PM	C_b	74	68	6	0	0	0	21	16	5	221	76	145	18	1	17	120	30	90	127	20	73

Table A-4--.Number of chinook salmon and steelhead trout tagged at the "A" Branch trap by Oregon Fish and Wildlife personnel and number of tagged fish observed at the Bradford Island counting station June 30 - July 11, 1975

Date	Chinook				Steelhead				Tag recaptures at the trap 1/	
	Tagged at "A" Branch trap		Observed at B.I. Count sta.		Tagged at "A" Branch trap		Observed at B.I. Count sta.			
	AM	PM	AM	PM	AM	PM	AM	PM	Chin	Sthd
June 30	-	24	0	0	-	22	0	0	0	0
July 1	18	-	0	2	38	-	0	0	1	0
2	-	52	1	8	-	62	0	0	1	1
3	58	-	24	29	68	-	0	0	1	2
4	-	57	0	22	-	63	0	0	1	2
5	-	-	18	6	-	-	1	0	-	-
6	-	-	0	1	-	-	0	0	-	-
7	-	32	0	10	-	0	0	0	1	0
8	43	-	17	30	22	-	1	0	0	1
9	-	19	0	1	-	0	0	0	0	0
10	65	-	13	2	28	-	4	0	4	1
11	-	63	11	32	-	51	0	7	1	0
12	-	-	37	14	-	-	16	7	-	-
13	-	-	0	0	-	-	1	1	-	-
Total	184	247	121	157	156	198	23	14	10	7
		431		278		354		37		

Note: Chinook were tagged with a brown anchor tag plus a yellow jaw tag (left side). Steelhead were tagged with only a white anchor tag. The jaw tags were quite easily distinguished by the counters while the anchor tags were barely visible, hence few of the tagged steelhead were seen at the Bradford Island counting station.

1/ Includes fish tagged at both Washington shore trap and "A" Branch trap.

Table A-5.--Hourly record of Chinook and Coho salmon tagged at the "A" Branch trap during evaluation tests September 1-19, 1975

Date		Time	Tag color	Chinook Hour 1	2	3	4	5	6	7	8	Total	Coho Hour 1	2	3	4	5	6	7	8	Total
Sept	1	PM	Red	6	16	26	43	52	15	42	14	214	6	6	7	1	8	2	1	0	31
	2	AM	Yellow	19	30	37	46	38	18	39	20	247	3	4	8	9	8	2	9	1	44
	3	PM	Blue	9	9	18	24	33	6	21	0	120	0	1	3	8	7	0	8	2	29
	4	AM	Silver	3	18	25	36	28	17	40	13	180	2	8	13	13	4	4	4	3	51
	5	PM	Green	13	35	37	52	14	27	40	20	238	6	0	4	1	5	0	8	1	25
	6																				
	7																				
	8	PM	Red	20	29	33	34	47	18	33	17	231	4	14	12	11	5	9	10	3	68
	9	AM	Yellow	5	26	12	18	14	16	30	19	140	0	3	6	15	13	7	8	4	56
	10	PM	Blue	13	16	20	30	18	9	26	6	138	14	4	6	24	17	2	5	2	74
	11	AM	White	7	18	22	12	27	11	36	14	147	0	5	19	12	14	4	11	4	69
	12	PM	Green	13	21	21	32	29	36	26	5	183	5	8	5	6	4	7	3	0	38
	13																				
	14																				
	15	PM	Red	3	20	15	16	27	7	17	3	108	1	3	3	9	10	3	12	0	41
	16	AM	Yellow	4	10	20	23	8	21	29	14	129	2	6	8	16	7	8	3	7	57
	17	PM	Blue	0	11	11	13	11	7	20	3	76	0	7	19	23	17	8	13	1	88
	18	AM	White	2	4	18	12	20	27	24	7	114	1	7	10	12	9	11	11	2	63
	19	PM	Green	1	6	3	14	10	12	4	2	52	1	4	2	5	5	6	2	3	28
												2317									782

Table A-6--.Hourly record of "A" Branch tagged Chinook salmon observed at the Bradford Island counting station September 1-20, 1975. Number of tags observed during 50 minute counting periods multiplied by 1.2 count factor to give adjusted hourly counts.

Date	Tag color	Hour (AM) 1	2	3	4	5	6	7	8	Total	Hour (PM) 9	10	11	12	13	14	15	16	Total
Sept 1	Red													8	13	32	26	12	92
2	Red	5	44	54	7			4		114	1	3							4
	Yellow				14	30	24	28	16	112	29	35	36	8	1	4			112
3	Red											1							1
	Yellow	1	1							2									
	Blue													1	8	14	22	7	51
4	Yellow															1			1
	Blue		13	24	11	2	1			51									
	Silver				1	2	22	22	10	54	14	16	6	8	1				45
5	Red	1/			1					1									
	Yellow											1							1
	Blue				1		1			2									
	Green												1	5	16	26	30	8	86
6		1/																	
7		1/																	
8	Red	1/											4	31	19	20	11		85
	Green												1	1					2
9		1/																	
10	Blue												2	4	12	22	13	2	55
11	Red					1			1	2	-1		1		2				2
	Yellow				1			3		4	1								1
	Blue	2	13	13	6	2	1			37	1			1					2
	White				5	16	12	19	22	74	17	23	14	5					59
12	Red												1	1					2
	White													1					1
	Green												1	11	13	22	20	-2	65
13	Red			1						1									
	Silver				1					1									
	Green		10	30	19	1	4	2	1	67	3		1						4
14	Red								1	1									
	Blue						1		1	2									
	Silver				1					1									
	Green											1		1					2
15	Red													4	18	13	14	6	55
	Blue																1		1
16	Red	2	10	24	12	2				50	2	-1	1						2
	Yellow				6	16	18	23	13	76	14	20	17		4		1		56
	Green																		
17	Red			-1						-1									
	Yellow		1							1			1						1
	Blue			1						1				1	8	11	6	1	27
	Green					1				1		1							1
18	Red			1					1	2									
	Blue		7	11	4	3	1		3	27	1			1					2
	White					7	8	12	18	45	22	12	6	1	1	3	1		46
19	Yellow							1		1									
	Blue			2						2									

Table A-6 (Cont.).-- Hourly record of "A" Branch tagged Chinook salmon observed at the Bradford Island counting station September 1-20, 1975

Date	Tag color	Hour(AM) 1	2	3	4	5	6	7	8	Total	Hour(PM) 9	10	11	12	13	14	15	16	Total
Sept 19	Silver										1								1
	White		5	11				-1	1	16									
	Green														1	7	8	1	17
20	Red										1								1
	Blue				-1					-1				-1					-1
	Silver				-1					-1									
	White			1	-1	-1	1												
	Green	2	10	6		1				19									

1/ Incomplete observation record.

Table A-7--Hourly record of "A" Branch tagged Coho salmon observed at the Bradford Island counting station September 1-20, 1975. Number of tags observed during 50 minute counting periods multiplied by 1.2 count factor to give adjusted hourly counts.

Date		Tag color	Hour (AM) 1	2	3	4	5	6	7	8	Total	Hour (PM) 9	10	11	12	13	14	15	16	Total
Sept	1	Red												2	4	4	5			15
	2	Red		4	2	2	1	1			10									
		Yellow				2	7	2	5	5	21	11	5	4	1					21
	3	Blue															2	5	1	8
	4	Blue		1	5	5	5				16									
		Silver						6	1	1	8	1	1							2
	5	Green	1/													4	1		1	6
	6		1/																	
	7		1/																	
	8	Red	1/											7	2	6	7			22
	9		1/																	
	10	Yellow										1								1
		Blue													10	2	7	6	1	26
	11	White				2	7	6	13	8	36	8	5	4		1				18
		Blue		7	6	14	4				31									
	12	Blue					1				1									
		Green													6	2	1	2		11
	13	Blue				1			1		2									
		White														1				1
		Green		6	11	5	6			2	30									
	14	Green		1							11		1							1
	15	Red														1	5	2		8
	16	Red		4	10	4	1				19									
		Yellow				4	6	7	8	7	32	1	8	4					1	14
	17	Yellow					1				1									
		Blue														2	17	11	1	31
	18	Blue		16	14	7	2	2		1	42									
		White				2	16	8	12	8	46	7	8	5		1	1			22
		Green	1								1									
	19	Blue						1			1									
		White		1		1					2									
		Green																2		2
	20	White				-1					-1									
		Green	-1	7	6	7	2				21									

1/ Incomplete observation record.

Table A- 8 ---Periods of trapping at the Washington shore trapping facility, number of chinook salmon and steelhead trout tagged, and number of tagged fish recaptured. April 1 - August 8, 1975

Date		Period of trapping 1/			Chinook			Steelhead		
					Tagged	Tag recap.	Total	Tagged	Tag recap.	Total
		Time	Time	Hours	Number	Number	Number	Number	Number	Number
April	1	0600	1500	9.0	0	0	0	0	0	0
	2	0600	1500	9.0	0	0	0	1	0	1
	3	0600	1500	9.0	0	0	0	2	0	2
	4	0600	1500	9.0	2	0	2	4	0	4
	5	-	-	0.0	-	-	-	-	-	-
	6	-	-	0.0	-	-	-	-	-	-
	7	-	-	0.0	-	-	-	-	-	-
	8	1100	1600	5.0	0	0	0	4	0	4
	9	0600	1700	11.0	1	0	1	7	0	7
	10	0700	1600	9.0	0	0	0	4	0	4
	11	0600	1730	11.5	62	0	62	17	0	17
	12	0600	2100	15.0	209	0	209	53	1	54
	13	0600	1700	11.0	211	1	212	40	0	40
	14	0600	↓		112	1	113	20	0	20
	15		↓		126	1	127	23	0	23
	16		↓		64	0	64	7	0	7
	17		1830	84.5	282	0	282	45	3	48
	18	0600	↓		403	5	408	56	2	58
	19		↓		366	3	369	51	2	53
	20		1630	58.5	208	1	209	25	0	25
	21	0600	1730	11.5	208	8	216	15	0	15
	22	0600	1700	11.0	186	3	189	24	3	27
	23	0600	1900	13.0	370	3	373	41	1	42
	24	0600	1700	11.0	388	9	397	43	4	47
	25	0600	1630	10.5	231	8	239	23	1	24
	26	0600	1700	11.0	180	6	186	21	1	22
	27	0600	1600	10.0	210	10	220	17	1	18
	28	0600	1700	11.0	268	9	277	20	2	22
	29	0600	1730	11.5	485	18	503	28	2	30
	30	0600	1700	11.0	408	12	420	8	4	12
May	1	0600	1700	11.0	504	18	522	30	3	33
	2	0600	1800	12.0	577	12	589	39	2	41
	3	-	-	0.0	-	-	-	-	-	-
	4	0700	1800	11.0	302	10	312	20	7	27
	5	0700	1800	11.0	502	20	522	34	1	35
	6	0700	1500	9.0	584	24	608	29	7	36
	7	0800	1400	6.0	473	29	502	19	1	20
	8	0800	1500	7.0	400	27	427	20	3	23
	9	-	-	0.0	-	-	-	-	-	-
	10	-	-	0.0	-	-	-	-	-	-
	11	0800	1800	10.0	434	31	465	30	6	36
	12	0800	1930	11.5	540	29	569	39	1	40
	13	-	-	0.0	-	-	-	-	-	-
	14	-	-	0.0	-	-	-	-	-	-
	15	0700	1700	10.0	178	20	198	34	2	36
	16	0700	1800	11.0	233	17	250	27	1	28
	17	0700	1800	11.0	152	10	162	19	0	19
	18	0700	1800	11.0	99	9	108	18	1	19

1/ Based on time the diversion lead was in use in the Washington shore ladder.

Table A- 8 --.(Continued) Periods of trapping at the Washington shore trapping facility, number of chinook salmon and steelhead trout tagged, and number of tagged fish recaptured. April 1 - August 8, 1975

Date		Period of trapping 1/			Chinook			Steelhead		
					Tagged	Tag recap.	Total	Tagged	Tag recap.	Total
		Time	Time	Hours	Number	Number	Number	Number	Number	Number
May	19	0700	1800	11.0	89	10	99	11	2	13
	20	0700	1800	11.0	88	5	93	9	0	9
	21	0700	1800	11.0	137	8	145	27	1	28
	22	0700	1730	10.5	167	7	174	71	5	76
	23	-	-	0.0	-	-	-	-	-	-
	24	-	-	0.0	-	-	-	-	-	-
	25	-	-	0.0	-	-	-	-	-	-
	26	-	-	0.0	-	-	-	-	-	-
	27	0700	1800	11.0	90	6	96	47	3	50
	28	0700	1800	11.0	146	4	150	59	1	60
	29	0700	1730	10.5	207	18	225	55	1	56
	30	0530	1630	11.0	108	9	117	39	1	40
	31	-	-	0.0	-	-	-	-	-	-
June	1	-	-	0.0	-	-	-	-	-	-
	2	0700	1730	10.5	74	5	79	47	1	48
	3	0700	1730	10.5	85	1	86	40	1	41
	4	0700	1730	10.5	53	3	56	35	1	36
	5	0700	1700	10.0	76	4	80	41	0	41
	6	0700	1430	7.5	55	2	56	21	2	23
	7	-	-	0.0	-	-	-	-	-	-
	8	0800	1730	9.5	35	6	41	22	1	23
	9	0700	1730	10.5	83	4	87	48	1	49
	10	0700	1730	10.5	75	3	78	31	2	33
	11	0730	1700	9.5	46	2	48	41	3	44
	12	0700	1700	10.0	74	6	80	43	2	45
	13	-	-	0.0	-	-	-	-	-	-
	14	-	-	0.0	-	-	-	-	-	-
	15	0730	1700	9.5	50	0	50	38	0	38
	16	0700	1700	10.0	120	2	122	23	0	23
	17	0700	1700	10.0	73	4	77	28	1	29
	18	0700	1700	10.0	73	5	78	48	2	50
	19	0730	1700	9.5	150	4	154	81	4	85
	20	-	-	0.0	-	-	-	-	-	-
	21	-	-	0.0	-	-	-	-	-	-
	22	0700	1700	10.0	54	3	57	66	3	69
	23	0700	1700	10.0	90	7	97	100	3	103
	24	0700	1700	10.0	19	4	23	71	1	72
	25	0700	1700	10.0	183	4	187	87	6	93
	26	-	-	0.0	-	-	-	-	-	-
	27	-	-	0.0	-	-	-	-	-	-
	28	-	-	0.0	-	-	-	-	-	-
	29	-	-	0.0	-	-	-	-	-	-
	30	0700	1700	10.0	147	3	150	50	2	52
July	1	0600	1700	11.0	43	1	44	114	3	117
	2	0600	1330	7.5	46	1	47	71	7	78
	3	-	-	0.0	-	-	-	-	-	-
	4	0700	1400	7.0	57	1	58	63	2	65
	5	-	-	0.0	-	-	-	-	-	-

Table A- 8 --.(Continued) Periods of trapping at the Washington shore trapping facility, number of chinook salmon and steelhead trout tagged, and number of tagged fish recaptured. April 1 - August 8, 1975

Date	Period of trapping 1/			Chinook			Steelhead		
				Tagged	Tag recap.	Total	Tagged	Tag recap.	Total
	Time	Time	Hours	Number	Number	Number	Number	Number	Number
July 6	0600	1400	7.0	2/					
7	0600	1700	11.0	59	2	61	33	0	33
8	0600	1700	11.0	133	3	136	103	4	107
9	0600	1700	11.0	172	6	178	113	2	115
10	1030	1500	4.5	64	4	68	69	1	70
11	0630	0930							
	1130	1200	3.5	63	1	64	50	1	51
12	0630	0930	3.0	2/					
13	-	-	0.0	-	-	-	-	-	-
14	0700	↓		64	4	68	69	1	70
15				131	1	132	34	1	35
16				138	0	138	54	0	54
17		1500	80.0	117	0	117	5	1	6
18	-	-	0.0	-	-	-	-	-	-
19	0630	1130	5.0	2/					
20	0600	1400	8.0	127	1	128	34	0	34
21	0600	1630	10.5	53	0	53	40	0	40
22	0600	1630	10.5	150	0	150	41	0	41
23	0700	1530							
	1600	1930	12.0	130	1	131	40	1	41
24	0700	1530	8.5	146	0	146	80	0	80
25	1600	1800	2.0	2/					
26	-	-	0.0	-	-	-	-	-	-
27	0700	1500	8.0	69	0	69	77	0	77
28	0700	1530	8.5	60	0	60	80	0	80
29	0700	1530	8.5	39	1	40	40	0	40
30	0700	1530	8.5	53	0	53	40	0	40
31	0700	1530	8.5	55	0	55	41	0	41
Aug 1	-	-	0.0	-	-	-	-	-	-
2	-	-	0.0	-	-	-	-	-	-
3	-	-	0.0	-	-	-	-	-	-
4	0800	1530	7.5	3/ -	1	1	95	0	95
5	0800	1530	7.5	-	-	-	106	0	106
6	0830	1530	7.0	-	-	-	72	0	72
7	0800	1530	7.5	-	-	-	200	1	201
8	0800	1100	3.0	-	-	-	106	0	106

2/ Trapping by NMFS fish trackers.

3/ Terminated chinook tagging on August 4.

Table A-9.---Trap efficiency determined by numbers of chinook salmon and steelhead trout counted at weir 42 and at the trap during spring-run evaluation tests, April 7 - May 23, 1975. Each test included two 8-hour counting periods (1 PM to 9 PM and 5 AM - 1 PM d.s.t.) during 24 hours with the trap in operation followed by two 8-hour counting periods during 24 hours with the trap out of operation.

Date	Test cond.	Species	Trap out (A)				Trap in (B or B_E)						
			Weir 42				Weir 42				Trap		
			Up	Down	Net up	1/ No/hr	Up	Down	Net up	1/ No/hr	Count	2/ No/hr	Eff.
Apr. 7-9	A vs B_b	Chin	375	20	355	22.2	140	100	40	2.5	0	0.0	0.0
		Sthd.	88	5	83	5.2	10	1	9	.6	4	.3	44.4
		Tot sal	463	25	438	27.4	150	101	49	3.1	4	.3	8.2
Apr. 9-11	A vs B	Chin	547	55	492	30.8	376	128	248	15.5	4	.3	1.6
		Sthd.	71	6	65	4.0	50	13	37	2.3	2	.1	5.4
		Tot sal	618	61	557	34.8	426	141	285	17.8	6	.4	2.1
Apr. 14-16	A vs B	Chin	714	98	616	38.5	741	249	492	30.8	28	1.8	5.7
		Sthd.	152	14	138	8.6	113	35	78	4.8	8	.5	10.3
		Tot sal	866	112	754	47.1	854	284	570	35.6	36	2.3	6.3
Apr. 16-18	A vs B	Chin	771	96	675	42.2	530	191	339	21.2	52	3.2	15.3
		Sthd.	107	8	99	6.2	90	9	81	5.1	4	.3	4.9
		Tot sal	878	104	774	48.4	620	200	420	26.3	56	3.5	13.3
Apr. 21-23	A vs B_b	Chin	1497	118	1379	86.2	1495	776	719	44.9	298	18.6	41.4
		Sthd.	102	5	97	6.0	109	32	77	4.8	33	2.1	42.9
		Tot sal	1599	123	1476	92.2	1604	808	796	49.8	331	20.7	41.6
May 17-19	A vs B_b	Chin	134	9	125	7.8	132	54	78	4.9	102	6.4	3/
		Sthd.	7	0	7	.4	3	0	3	.2	12	.7	3/
		Tot sal	141	9	132	8.2	135	54	81	5.1	114	7.1	3/
May 19-21	A vs B_b	Chin	170	7	163	10.2	128	36	92	5.8	73	4.6	79.3
		Sthd.	7	0	7	.4	13	3	10	.6	8	.5	80.0
		Tot sal	177	7	170	10.6	141	39	102	6.4	81	5.1	79.4
May 21-23	A vs B_b	Chin	156	15	141	8.8	139	31	108	6.8	67	4.2	62.0
		Sthd.	9	0	9	.6	10	0	10	.6	17	1.1	3/
		Tot sal	165	15	150	9.4	149	31	118	7.4	84	5.3	71.2
Summary 3 tests	A vs B	Chin	2032	249	1783	37.1	1647	568	1079	22.5	84	1.8	7.8
		Sthd.	330	28	302	6.3	253	57	196	4.1	14	.3	7.1
		Tot sal	2362	277	2085	43.4	1900	625	1275	26.6	98	2.1	7.7
5 tests	A vs B_b	Chin	2332	169	2163	27.0	2034	997	1037	13.0	540	6.8	50.3
		Sthd	213	10	203	2.5	145	36	109	1.4	74	.9	67.9
		Tot sal	2545	179	2366	29.6	2179	1033	1146	14.3	6.4	7.7	53.6

1/ Weir 42 net up and trap count ÷ 16.

2/ Trap efficiency = $\frac{\text{Trap count} \times 100}{\text{Weir 42 net up}}$

3/ Trap count exceeded weir 42 net count.

Table A-10--Trap efficiency determined by numbers of chinook salmon, sockeye salmon, steelhead trout, and shad counted at weir 42 and at the trap during summer-run evaluation tests June 30 - July 11, 1976. Each test included two 8-hour counting periods (1 PM to 9 PM and 5 AM - 1 PM d.s.t.) during 24 hours with the trap in operation followed by two 8-hour counting periods during 24 hours with the trap out of operation.

Date	Test cond.	Species	Trap out (A)				Trap in (C, C_a, C_b, or $C_{a,b}$)						
			Weir 42				Weir 42				Trap		
			Up	Down	Net up	1/ No/hr	Up	Down	Net up	1/ No/hr	Count	1/ No/hr	2/ Eff.
June 30-July 2	A vs C_b	Chin	268	22	248	15.5	75	29	45	2.8	62	3.9	3/
		Sthd	172	2	170	10.6	50	8	42	2.6	67	4.2	3/
		Sock	681	21	660	41.3	187	35	152	9.5	170	10.6	3/
		Tot sal	1121	45	1078	67.4	312	72	239	14.9	299	18.7	3/
		Shad	2612	544	2068	129.3	5184	2744	2440	152.5	0	0.0	0.0
July 2-4	A vs $C_{a,b}$	Chin	239	9	230	14.4	262	100	162	10.1	126	7.9	77.8
		Sthd	200	2	198	12.4	170	16	154	9.7	139	8.7	90.2
		Sock	551	17	534	33.3	586	155	431	26.9	390	24.4	90.5
		Tot sal	990	28	962	60.1	1018	271	747	46.7	655	41.0	87.7
		Shad	22800	3046	19763	1235.2	8288	4338	3950	246.9	0	0.0	0.0
July 7-9	A vs C_a	Chin	248	29	219	13.7	335	112	223	13.9	121	7.6	54.3
		Sthd	145	5	140	8.8	215	35	180	11.2	60	3.8	33.3
		Sock	378	19	359	22.4	511	68	443	27.7	221	13.8	49.9
		Tot sal	771	53	718	44.9	1061	215	846	52.8	402	25.2	47.5
		Shad	1723	408	1315	82.2	3958	1148	2810	175.6	0	0.0	0.0
July 9-11	A vs C	Chin	281	16	265	16.6	268	97	171	10.7	102	6.4	59.6
		Sthd	109	7	102	6.4	133	18	115	7.2	66	4.1	57.4
		Sock	156	2	154	9.6	331	26	305	19.1	132	8.2	43.3
		Tot sal	546	25	521	32.6	732	141	591	37.0	300	18.7	50.8
		Shad	1301	252	1049	65.6	2137	772	1365	85.3	0	0.0	0.0

1/ Weir 42 net up and trap count ÷ 16.

2/ Trap efficiency - $\frac{\text{Trap count} \times 100}{\text{Weir 42 net up}}$

3/ Trap count exceeded weir 42 net count

Table A-11.--Trap efficiency determined by numbers of chinook salmon, coho salmon, and steelhead trout counted at weir 42 and at the trap during fall-run evaluation tests September 1 - 19, 1975. Each test included two 8-hour counting periods (1 PM to 9 PM and 5 AM - 1 PM d.s.t.) during 24 hours with the trap in operation followed by two 8-hour counting periods during 24 hours with the trap out of operation.

Date	Test cond.	Species	Trap out (A)				Trap in (C or C_b)						
			Weir 42				Weir 42				Trap		
			Up	Down	Net up	1/ No/hr	Up	Down	Net up	1/ No/hr	Count	1/ No/hr	2/ Eff.
Sept 1-3	A vs C_b	Chin	10270	393	9877	617.3	8992	6077	2915	182.2	1322	82.6	45.4
		Sthd	991	17	974	60.9	862	295	567	35.4	248	15.5	43.7
		Coho	642	12	630	39.4	1156	454	702	43.9	290	18.1	41.3
		Tot sal	11903	422	11481	717.6	11010	6826	4184	261.5	1860	116.2	44.5
Sept 3-5	A vs C	Chin	14783	397	14386	899.1	11560	2800	8760	547.5	648	40.5	7.4
		Sthd	707	18	689	43.1	790	65	725	45.3	127	7.9	17.5
		Coho	1093	32	1061	66.3	758	98	660	41.2	198	12.4	30.0
		Tot sal	16583	447	16136	1008.5	13108	2963	10145	634.0	973	60.8	9.6
Sept 8-10	A vs C	Chin	13607	401	13206	825.4	16787	3076	13711	856.9	735	45.9	5.4
		Sthd	566	16	550	34.4	752	65	687	42.9	101	6.3	14.7
		Coho	1868	50	1818	113.6	1845	279	1566	97.9	214	13.4	13.7
		Tot sal	16041	467	15574	973.4	19384	3420	15964	997.7	1050	65.6	6.6
Sept 10-12	A vs C	Chin	11793	335	11458	716.1	13039	2324	10715	669.7	596	37.2	5.6
		Sthd	466	10	456	28.5	499	32	467	29.2	65	4.1	13.9
		Coho	1775	49	1726	107.9	2011	182	1829	114.3	330	20.6	18.0
		Tot sal	14034	394	13640	852.4	15549	2538	13011	813.2	991	61.9	7.6
Sept 15-17	A vs C	Chin	3061	180	2881	180.1	7638	1036	6602	412.6	508	31.8	7.7
		Sthd	108	11	97	6.1	233	5	228	14.3	25	1.6	11.0
		Coho	669	24	645	40.3	1339	85	1254	78.4	207	12.9	16.5
		Tot sal	3838	215	3623	226.5	9210	1126	8084	505.3	740	46.3	9.2
Sept 17-19	A vs C_b	Chin	906	101	805	50.3	1705	1160	545	34.1	488	30.5	89.5
		Sthd	37	4	33	2.1	62	7	55	3.4	46	2.9	83.6
		Coho	428	24	404	25.2	615	222	393	24.6	352	22.0	89.6
		Tot sal	1371	129	1242	77.6	2382	1389	993	62.1	886	55.4	89.2
Summary 4 tests	A vs C	Chin	43244	1313	41931	655.2	49024	9236	39788	621.7	2487	38.9	6.3
		Sthd	1847	55	1792	28.0	2274	167	2107	32.9	318	5.0	15.1
		Coho	5405	155	5250	82.0	5953	644	5309	83.0	949	14.8	17.9
		Tot sal	50496	1523	48973	765.2	57251	10047	47204	737.6	3754	58.7	8.0
2 tests	A vs C_b	Chin	11176	494	10682	333.8	10697	7237	3460	108.1	1810	56.6	52.3
		Sthd	1028	21	1007	31.5	924	302	622	19.4	294	9.2	47.3
		Coho	1070	36	1034	32.3	1771	676	1095	34.2	642	20.1	58.6
		Tot sal	13274	551	12660	395.6	13392	8215	5177	161.8	2746	85.8	53.0

1/ Weir 42 net up and trap count ÷ 16.

2/ Trap efficiency - $\frac{\text{Trap count} \times 100}{\text{Weir 42 net up}}$

Table A-12.--Statistical comparisons of the hourly counts of salmonids at the Bradford Island counting station during the "A" Branch trap evaluation tests. The D statistics are derived from Kolmogorov-Smirnov tests to show differences among trapping conditions for chinook salmon, sockeye salmon, coho salmon, and steelhead trout during evaluation tests April 7-September 19, 1975.

Date	Test Condition A.M.	Test Condition P.M.	Test Comparison	Test Category	D - Statistic Chinook	Steelhead	Coho	Sockeye
4-7	A	B_b	$AB_b - B_bA$	T_5	0.580			
8	B_b	A						
9	A	B	AB - BA	T_2	0.272			
10	B	A						
11	A	B	BA - AB	T_2	0.461			
14	A	B	AB - BA	T_2	0.180			
15	B	B						
16	A	B	BA - AB	T_2	0.252			
17	B	A	AB - BA	T_2	0.186			
18	A	B	BA - AB	T_2	0.176			
21	A	B_b	$AB_b - B_bA$	T_5	0.437			
22	B_b	A						
23	A	A	AA - AA	T_1	0.211			
24	A	A						
25	A	A	AA - AA	T_1	0.172			
5-5	A	A	AA - AA	T_1	0.145			
6	A	A	AA - AA	T_1	0.163			
7	A	A	AA - AA	T_1	0.176			
8	A	A	AA - AA	T_1	0.217			
9	A	A						
17	A	B_b						
18	B_b	A	$AB_b - B_bA$	T_5	0.341			
19	A	B_b						
20	B_b	A	$AB_b - B_bA$	T_5	0.541			
21	A	B_b						
22	B_b	A	$AB_b - B_bA$	T_5	0.374			
23	A	B_b						
6-30	A	C_b	$AC_b - C_bA$	T_6	0.858	0.359[1/]		0.398
7-1	C_b	A						
2	A	C	$AC_{a,b} - C_{a,b}A$	T_7	0.558	0.296[1/]		0.322
3	$C_{a,b}$	A						
4	A	$C_{a,b}$	$C_{a,b}A - AC_{a,b}$	T_7	0.331[1/]	0.194[1/]		0.182

Table A-12.--Continued

Date	Test Condition A.M.	Test Condition P.M.	Test Comparison	Test Category	D - Statistic Chinook	Steelhead	Coho	Sockeye
7-7	A	C_a	$AC_a - C_aA$	T_4	0.162[1]	0.095[1]		
8	C_a	A						
9	A	C	AC - CA	T_3	0.346	0.157		0.278
10	C	A						
11	A	C_a	$C_aA - AC_a$	T_4	0.346	0.212		
			$CA - AC_a$	T_4				0.197
14	A	A						
15	A	A	AA - AA	T_1	0.320[1]	0.296		[3]
16	A	A	AA - AA	T_1	0.183[1]	0.098		[3]
17	A	A	AA - AA	T_1	0.109	0.079		[3]
18	A	A	AA - AA	T_1	0.134	0.163		[3]
8-25	A	A						
26	A	A	AA - AA	T_1	0.085	0.060	0.088	
27	A	A	AA - AA	T_1	0.195	0.228	0.279	
28	A	A	AA - AA	T_1	0.205	0.244	0.099	
29	A	A	AA - AA	T_1	0.211	0.167	0.174	
9-1	A	C_b	$AC_b - C_bA$	T_6	0.705	0.516	0.468	
2	C_b	A						
3[2]	A	C	AC - CA	T_3	0.199	0.099	0.080	
4[2]	C	A						
5[2]	A	C	CA - AC	T_3	0.200	0.094	0.101	
8[2]	A	C						
9[2]	C	A	AC - CA	T_3	0.102	0.107	0.156	
10[2]	A	C	CA - AC	T_3	0.048	0.116	0.064	
11[2]	C	A	AC - CA	T_3	0.024	0.074	0.078	
12[2]	A	C	CA - AC	T_3	0.098	0.261	0.105	
15	A	C	AC - CA	T_3	0.077	0.239	0.077	
16	C	A						
17	A	C_b	$AC_b - C_bA$	T_6	0.431	0.934	0.236	
18	C_b	A						
19	A	C_b	$C_bA - AC_b$	T_6		0.573	0.305	

[1] Small numbers of fish migrating. The D-Statistic value was not used to evaluate the trapping condition.

[2] September 3 through September 12 generally covered the peak of the migration for fall chinook, steelhead and coho.

[3] Small numbers of sockeye migrating and possible counting errors. The D-Statistic was not calculated.

Table A-13.--Comparison of "A" Branch trapping and Washington shore trapping during days when both traps were operating.

Date	"A" Branch trap									Wash. shore trap								
	Period of trapping			Test cond.	No. trapped			Trapped per hr.			Period of trapping			No. trapped			Trapped per hr.		
					ch.	st.	Total	ch.	st.	Total				ch.	st.	Total	ch.	st.	Total
Spring run	Time	Time	Hours		No.	No.	No.	No.	No.	No.	Time	Time	Hours	No.	No.	No.	No.	No.	No.
April 8	0500	1300	8.0	C_b	0	2	2	0.0	.3	.3	1100	1600	5.0	0	4	4	0.0	.8	.8
9	1300	2100	8.0	C	2	2	4	.3	.3	.6	0600	1700	11.0	1	7	8	.1	.6	.7
10	0500	1300	8.0	C	2	0	2	.3	0.0	.3	0700	1600	9.0	0	4	4	0.0	.4	.4
11	1300	2100	8.0	C	7	6	13	.9	.8	1.7	0600	1730	11.5	62	17	79	5.4	1.5	6.9
14	1300	2100	8.0	C	19	8	27	2.4	1.0	3.4	0600	2100	15.0	113	20	133	7.5	1.3	8.8
15	0500	1300	8.0	C	9	0	9	1.1	0.0	1.1	0500	2100	16.0	127	23	150	7.9	1.4	9.3
16	1300	2100	8.0	C	33	4	37	4.1	.5	4.6	0500	2100	16.0	64	7	71	4.0	.4	4.4
17	0500	1300	8.0	C	19	0	19	2.4	0.0	2.4	0500	1830	13.5	282	48	330	20.9	3.6	24.5
18	1300	2100	8.0	C	123	12	135	15.4	1.5	16.9	0600	2100	15.0	408	58	466	27.2	3.9	31.1
21	1300	2100	8.0	C_b	182	25	207	22.8	3.1	25.9	0600	1730	11.5	216	15	231	18.8	1.3	20.1
22	0500	1300	8.0	C_b	116	8	124	14.5	1.0	15.5	0600	1700	11.0	189	27	216	17.2	2.5	19.7
May 17	1300	2100	8.0	C_b	66	7	73	8.3	.9	9.2	0700	1800	11.0	162	19	181	14.7	1.7	16.4
18	0500	1300	8.0	C_b	36	5	41	4.5	.6	5.1	0700	1800	11.0	108	19	127	9.8	1.7	11.5
19	1300	2100	8.0	C_b	43	6	59	5.4	.8	6.2	0700	1800	11.0	99	13	112	9.0	1.2	20.2
20	0500	1300	8.0	C_b	30	2	32	3.8	.3	4.1	0700	1800	11.0	93	9	102	8.5	.8	9.3
21	1300	2100	8.0	C_b	35	14	49	4.4	1.8	6.2	0700	1800	11.0	145	28	173	13.2	2.5	15.7
22	0500	1300	8.0	C_b	32	3	35	4.0	.4	4.4	0700	1730	10.5	174	76	250	16.6	7.2	23.8
Total	w/out lead		64.0	C	214	32	246	3.3	.5	3.8									
Total	with lead		72.0	C_b	540	72	612	7.5	1.0	8.5			200.0			2637			13.2
Summer run																			
June 30	1300	2100	8.0	C_b	28	27	55	3.5	3.4	6.9	0700	1700	10.0	150	52	202	15.0	5.2	20.2
July 1	0500	1300	8.0	C_b	34	40	74	4.3	5.0	9.3	0600	1700	11.0	44	117	161	4.0	10.6	14.6
2	1300	2100	8.0	$C_{a,b}$	55	63	118	6.9	7.9	14.8	0600	1330	7.5	47	78	125	6.3	10.4	16.7
4	1300	2100	8.0	$C_{a,b}$	65	65	130	8.2	8.2	16.4	0700	1400	7.0	57	63	120	8.1	9.0	17.1
7	1300	2100	8.0	C_a	45	25	70	5.6	3.1	8.7	0600	1700	11.0	61	33	94	5.5	3.0	8.5
8	0500	1300	8.0	C_a	76	35	111	9.5	4.4	13.9	0600	1700	11.0	136	107	243	12.4	9.7	22.1
9	1300	2100	8.0	C	24	21	45	3.0	2.6	5.6	0600	1700	11.0	178	115	293	16.2	10.4	26.6
10	0500	1300	8.0	C	78	45	123	9.8	5.6	15.4	1030	1500	4.5	68	70	138	15.1	15.6	30.7
11	1300	2100	8.0	C_a	67	58	125	8.4	7.3	15.7	0630 1130	0930 1200	3.5	63	50	113	18.0	14.3	32.3
Total	w/out lead		40.0	C	290	184	474	7.3	4.6	11.9									
Total	with lead		32.0	C_b	182	195	377	5.7	6.1	11.8			76.5			1489			19.5

Table A-14.--Summary of "A" Branch trap counts of salmonids during evaluation tests and the proportion of the total Bonneville count trapped.

Test period	Diversion lead	"A" Branch trap count					Percent of total B'v1le count 1/				
		Chin	Sthd	Sock	Coho	All sal.	Chin	Sthd	Sock	Coho	All sal.
Spring run	Out	214	32			246	4.0	3.9			3.9
	In	564	86			650	9.2	11.5			9.5
April 7-22											
May 17-23	Total	778	118			914					
Summer run	Out	290	184	410		884	10.5	10.7	6.5		8.2
	In	253	271	785		1309	10.6	18.8	8.5		10.0
June 30-July 11											
	Total	543	455	1195		2193					
Fall run	Out	3272	378		1125	4775	3.9	12.8		9.4	4.8
	In	1937	314		715	2966	19.1	36.5		23.0	21.0
Sept 1-19											
	Total	5209	692		1840	7741					
All tests	Out	3776	594	410	1125	5905	4.1	10.8	6.5	9.4	5.1
	In	2754	671	785	715	4925	14.8	22.0	8.5	23.0	14.5
April 7-Sept 19											
Total trapped		6530	1265	1195	1840	10830					

1/ Percentages calculated on Bonneville counts the day before trapping day for corresponding periods of trap operation.