Evaluation of Transportation of Juvenile Salmonids and Related Research on the Columbia and Snake Rivers, 1983

by
Donn L. Park
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Jim R. Smith
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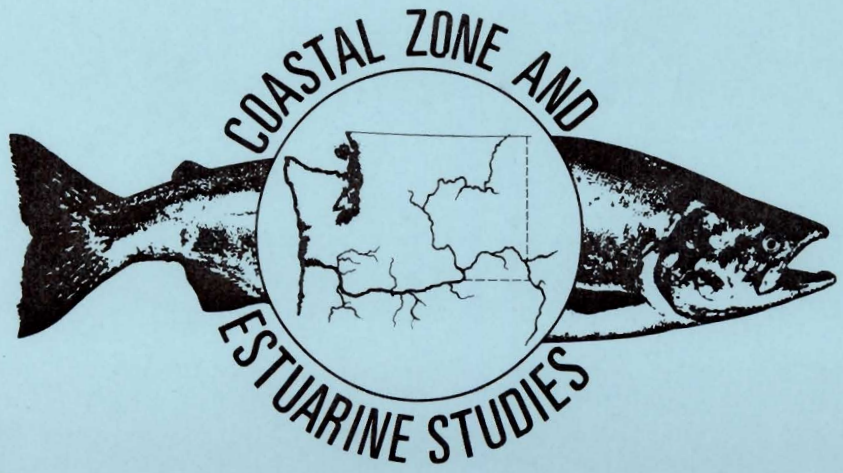
and
Stephen Achord

April 1984



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In 1983, the National Marine Fisheries Service continued evaluation of the effects of transporting juvenile salmonids from upriver dams (Lower Granite, Little Goose, and McNary) on the Snake and Columbia Rivers to a release site in the Columbia River downstream from Bonneville Dam. In addition, research was conducted to verify whether changes to fingerling bypass systems at McNary Dam improved passage.

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Delayed mortality tests with fall chinook salmon at McNary Dam indicated there was no significant difference in mortality between marked and unmarked non-transported fish and unmarked transported fish. Marked, transported fish had significantly higher mortality than the other groups; however, the mortality rate was low (about 6.5%).

Adult return data for juvenile steelhead transported from Lower Granite, Little Goose, and McNary Dams through 1980 are complete and generally indicate that transported fish returned in significantly greater numbers than non-transported fish regardless of year of transport, mode of transport tested, or transport location.

Adult return data for juvenile spring chinook salmon transported from Lower Granite and McNary Dams 1978-1980 are complete and generally low numbers of returning adults make analysis difficult. Returns from fish transported in 1978 indicate transported fish returned in significantly higher numbers than controls, but overall survival of smolts is still disappointing.

Based on adult return data, transportation of fall chinook salmon smolts from McNary Dam to below Bonneville Dam continues to provide significant benefits compared to controls released below McNary Dam.

Tests using spring chinook salmon to evaluate the fingerling bypass system at McNary Dam indicated an orifice passage problem based upon delay--further research is needed to determine the cause of the delay and the role delay plays in the ultimate survival of smolts.

Seawater challenge tests at Little Goose Dam indicated that higher stress occurred with juvenile chinook salmon held with steelhead than in those fish held only with conspecifics.

EVALUATION OF TRANSPORTATION OF JUVENILE SALMONIDS AND RELATED RESEARCH ON THE COLUMBIA AND SNAKE RIVERS, 1983

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INTRODUCTION

In 1983, the National Marine Fisheries Service (NMFS) continued evaluation of the effects of transportation of juvenile salmonids from dams (Park et al. 1980; 1981; 1982). In addition, research was conducted to verify whether improvements to fingerling bypass systems at McNary Dam accomplished desired objectives or whether further improvements were required. Major research objectives were to: (1) continue marking juvenile fall chinook salmon at McNary Dam for truck transport tests and initiate a comparison barge transport group; (2) in conjunction with the above objective, continue to evaluate the relative survival of marked versus unmarked fall chinook salmon transported to Bonneville Dam compared to marked and unmarked fish not transported (released at McNary Dam); (3) evaluate the modified fingerling bypass at McNary Dam by measuring descaling and delay for spring chinook salmon released at various points within the system; (4) mark spring chinook salmon at Lower Granite Dam to index the success of transport by barge; (5) determine stress of spring chinook salmon as influenced by steelhead at Little Goose Dam; and (6) continue evaluation of previous transport efforts by recovering adults, previously tagged as juveniles, in the various fisheries, at hatcheries, from spawning areas, and at dams.

FALL CHINOOK SALMON MARKING--McNARY DAM

In 1983, marking of juvenile fall chinook salmon was carried out at McNary Dam for two purposes: (1) to continue to monitor the effectiveness of the truck transportation program for fall chinook salmon and to compare

it with barging and (2) to continue to evaluate the relative survival of marked to unmarked fish transported to Bonneville Dam compared to marked to unmarked fish released at McNary Dam.

Methods

In July and August, 35,279 juvenile fall chinook salmon were marked for truck transport, and 38,860 were marked for barge transport--both lots were subsequently released downstream from Bonneville Dam (Appendix Table 1). An additional 40,301 fish were marked and released in the tailrace of McNary Dam as controls. Marking began on 7 July and was terminated on 2 August. All fish were marked with a coded wire tag (CWT), brand, and adipose fin clip. Tag code and brands were changed three times during the marking period. Approximately equal numbers were marked for each brand and tag code. Evaluation of this test will be made when marked adults are recovered.

To compare survival of fish that were marked and transported, fish unmarked and transported, fish marked but not transported, and fish not marked or transported, we conducted the test as in 1982, (Park et al. 1983) except that we used no experimental tank--all transported fish were placed in U.S. Army Corps of Engineers' (CofE) tankers. Prior to loading, marked fish were subjected to all handling routines, but unmarked fish were loaded by standard gravity techniques without handling. Marked and unmarked fish were hauled together in one of the individual CofE tanker compartments. We attempted to haul each load at an estimated 0.5 lb of fish per gallon of water within the small compartment. The transported lots were sampled from trucks by sanctuary sampling nets. Numerous dips were required to achieve

an adequate sample of marked fish because the ratio of unmarked fish to marked fish in the truck varied from 5 to 10:1. For the non-transported groups, the marked fish were handled through standard marking routines; the unmarked fish were sampled from a standard collection raceway and transferred to a holding facility. The latter group was subjected only to water to water transfer without additional handling. All fish sampled at both dams were held in live tanks for a similar 5-d delayed mortality observation.

Analyses of test results were based on dead and live fish counts from each 5-d holding period (Appendix Table 2). There were eight replicates (holding periods) beginning 7 July and ending 4 August. Counts were used to form contingency tables using the "G" statistic ($P<0.05$, df=n).

Results

1. Evaluations of the monitoring tests and the tests of trucked vs barged fish rely on adult returns so no results will be available until 1984-88.

2. In a 3-way analysis there was no significant difference in mortality between marked and unmarked non-transported fish, and unmarked transported fish ($P=0.24$, df=2).

3. Marked transported fish had significantly higher mortality when compared independently to all other groups ($P<0.05$, df=1); this finding repeats that observed in last year's test. Even though higher, the mortality of about 6.5% for the marked transport group vs 3.5 to 4.0% for the other groups (Figure 1) is still relatively low. The data from these tests indicate that marking coupled with transportation results in slightly

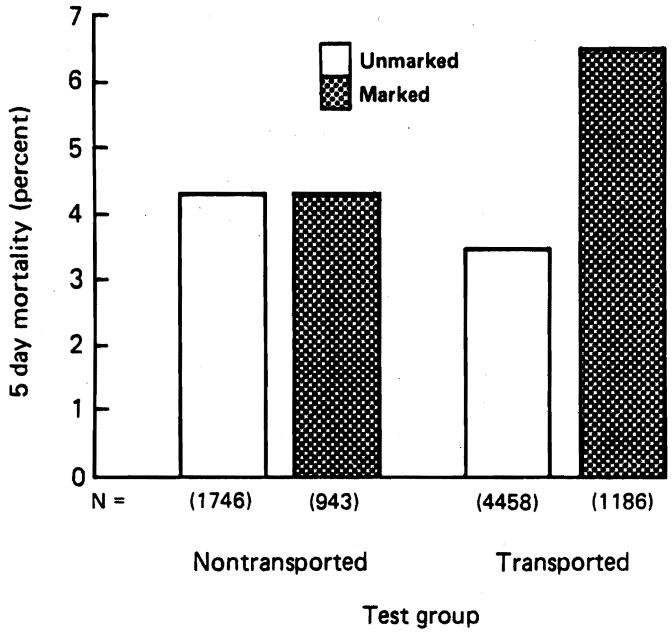

Figure 1.--Delayed mortality of marked and unmarked juvenile fall chinook salmon held at McNary Dam or transported to Bonneville Dam.

higher short-term mortality, which presumably carries forward to higher long-term mortality. Hence, when transport/control ratios are compared for adult fish, stated ratios are likely conservative when applied to the unmarked population.

BYPASS SYSTEM EVALUATION--MCNARY DAM

Impingement of 0-age chinook salmon <50 mm long and descaling of juvenile spring chinook and sockeye salmon have been continuing problems in the juvenile bypass/collection system at McNary Dam. Two remedial modifications were made for 1983. First, 27 of 42 steel tees at the orifice exits were replaced with clear PVC spools to reduce abrasive surfaces. Secondly, at the downstream end of the flume, where the problem was most severe due to the hydraulics of the region, an inner wall of perforated plate was installed, and additional water elimination gates were added. With these modifications, it was hoped that velocity in the fish channel would increase but because of the increased area of screened surface, tangential velocity through any point on the water elimination screen surface should be below impingement levels. The above modifications were evaluated in April 1983.

Methods

To determine the extent of descaling, injury, and delay within the bypass system, groups of marked, nondescaled juvenile spring chinook salmon were released at the following locations (Figure 2):

Gatewell 1A (G-1A)

Gatewell 11A (G11A)

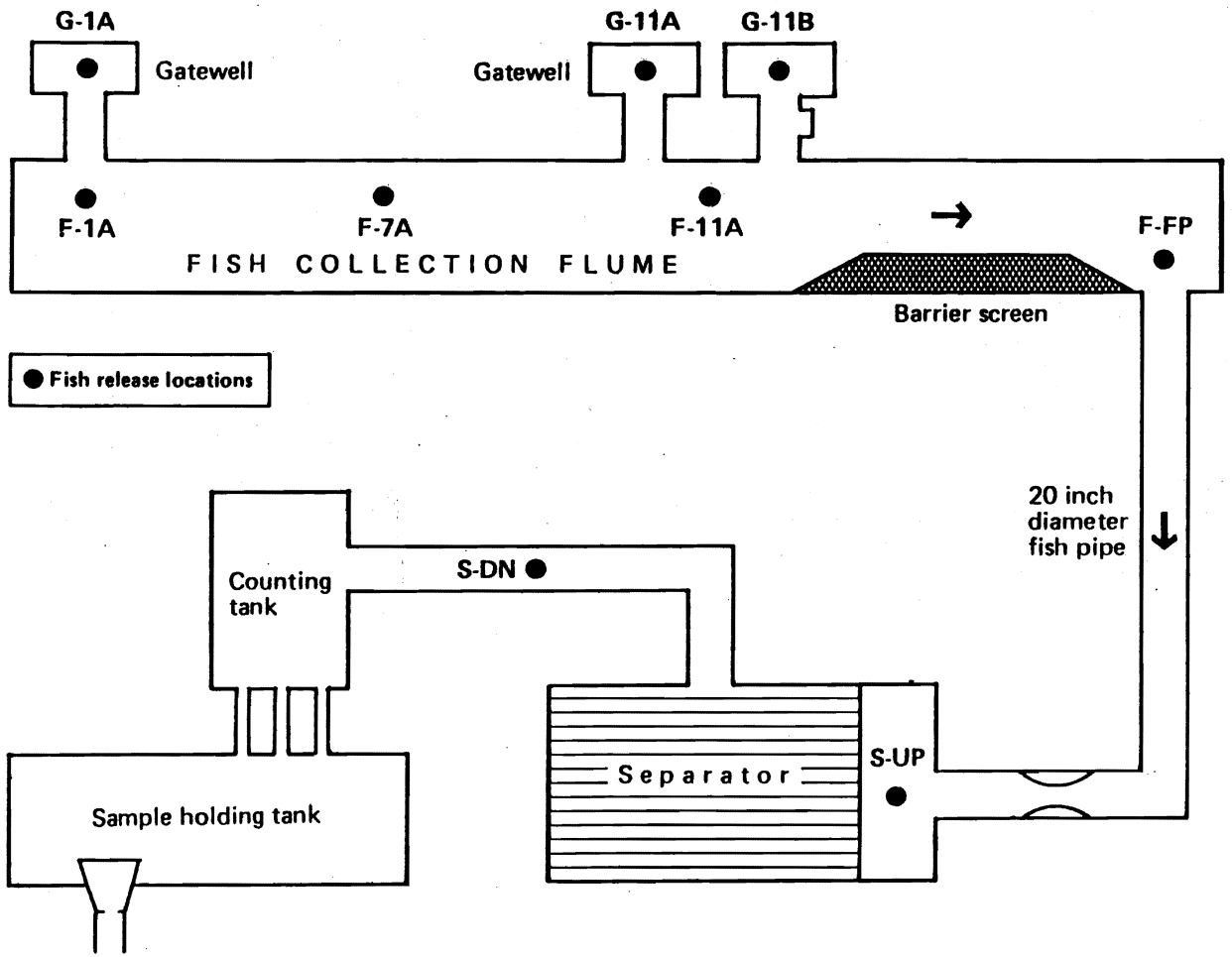

Figure 2.--Schematic view of fingerling collection system at McNary Dam indicating where fish were released.

Gatewell 11B (G-11B)

Upper end of collection flume (F-1A)

Middle of collection flume (F-1A)

Collection flume upstream from new perforated plate wall (F-11A)

Collection flume just upstream from entrance to fish pipe (F-FP)

Upwell just upstream from separator (S-UP)

Channel downstream from separator (S-DN)

Fish were marked into discrete groups of 100 by using freeze-branding and an upper caudal fin clip. The caudal clip was used as a flag to alert fish observers to the presence of an accompanying brand. The fish were held at least 24 h after marking to allow fish to resume near normal behavior and to provide time for the brand to become more legible. Releases occurred at approximately 1800 h on 15, 18, and 20 April. All fish collected were diverted to the sample tank which had been cleared, and fish were inspected every 2 h. Descaling, injury, and time of recovery were recorded for all marked fish in each group. The test was terminated 68 h after release of the last group.

Descaling was based on scale loss in defined body areas. Five areas on each side were defined as: (1) caudal peduncle to anterior edge of the adipose fin; (2) adipose fin to the posterior insertion of the dorsal fin; (3) under the dorsal fin; and (4) and (5) two portions split equally between the anterior insertion of the dorsal fin and the insertion of the pectoral fin. Fish observers were instructed to classify a specific body area as descaled if 40% of its scales were missing. We further assigned codes for each fish observed to rank descaling, injury, or mortality as follows:

Code	Condition
1	No descaling
2	Scattered descaling
3	One area descaled
4	Two or more areas descaled on one side
5	Injured
6	Dead

Normally, fish observers are instructed to classify a fish as descaled only if a Code 4 condition existed (descaling criteria as established at Descaling Workshop in Boise, Idaho, March 1983). To handle our descaling data more easily and increase the sensitivity of our measurements, we considered all fish in Codes 3 and 4 to be descaled--thus providing a more stringent descaling assessment.

Results

Descaling results were analyzed using the Chi-square statistic (Contingency Table Analysis). Preliminary analysis indicated homogeneity among replicates [no significant difference ($P>0.05$, $df=4$)]. Descaling ranged from 4.8 to 16.0%, and injury or mortality ranged from 0.4 to 4.0% (Table 1 and Appendix Table 3). Analysis revealed no significant differences among release sites with two exceptions, G-11B (comparison of Gatewells 11A and 11B) and F-7A (comparison of flume releases). Fish released into Gatewell 11B had to pass through an orifice with a steel tee, fish from other gatewell releases did not. It may be that the significantly higher descaling associated with release site G-11B was due to the steel tee. No explanation is offered for the significantly lower

Table 1.--Descaling and severe injury to juvenile spring chinook salmon released at various sites within the McNary Dam fingerling collection system, 1983. Values are expressed as percentages of total release per site.

Release site[a/]	Percent descaled[b/]	Percent with severe injury or mortality
G-1A	9.6	4.0
G-11A	11.6	1.6
G-11B	16.0	2.2
F-1A	7.7	2.2
F-7A	4.8	2.2
F-11A	12.5	1.1
F-FP	12.3	1.1
S-UP	10.0	0.4
S-DN	8.2	0.6

a/ See Figure 2 for location.

b/ This group includes all fish which exhibited a 40% scale loss in one or more body areas. This is more stringent assessment of descaling than was used previously.

descaling rate associated with release site F-7A (significance established at $P<0.05$ in all tests). In general, a fish passing through an orifice and a flume, past perforated plate screens, and through the transfer pipe and separator encountered no area which led to substantial descaling or injury.

Delay in the bypass system was analyzed using only fish released on 18 and 20 April because fish released on 15 April did not migrate as expected. Comparisons were made on the 50th and 75th percentile recovery of fish from each release location. Passage through the flume, pipe, and separator was relatively rapid--less than 4 h for the 50th percentile and 12 h for the 75th precentile recoveries (Figure 3). However, the average passage time from the gatewells was considerably longer--24 h for 50th percentile recoveries and 45 h for the 75th percentile recoveries. The delay from the gatewell releases would seem to indicate an orifice passage problem. Further research is needed to determine the actual cause of the delay and the role delay plays in the ultimate survival of the smolts.

SPRING CHINOOK SALMON MARKING--LOWER GRANITE DAM

A total of 44,648 spring chinook salmon were marked with coded wire tags, freeze brands, and adipose fin clips to index the relative success of barge transportation (Appendix Table 4). To identify discrete portions of the outmigration, freeze brands were rotated four times and wire tag codes were changed twice during the marking season. No controls were marked. The evaluation of results will be based on adult returns.

Standard marking techniques and procedures were the same as in past transport experiments except that in 1983 a pre-anesthetizer was designed and installed in the upwell to anesthetize fish prior to dipnetting.

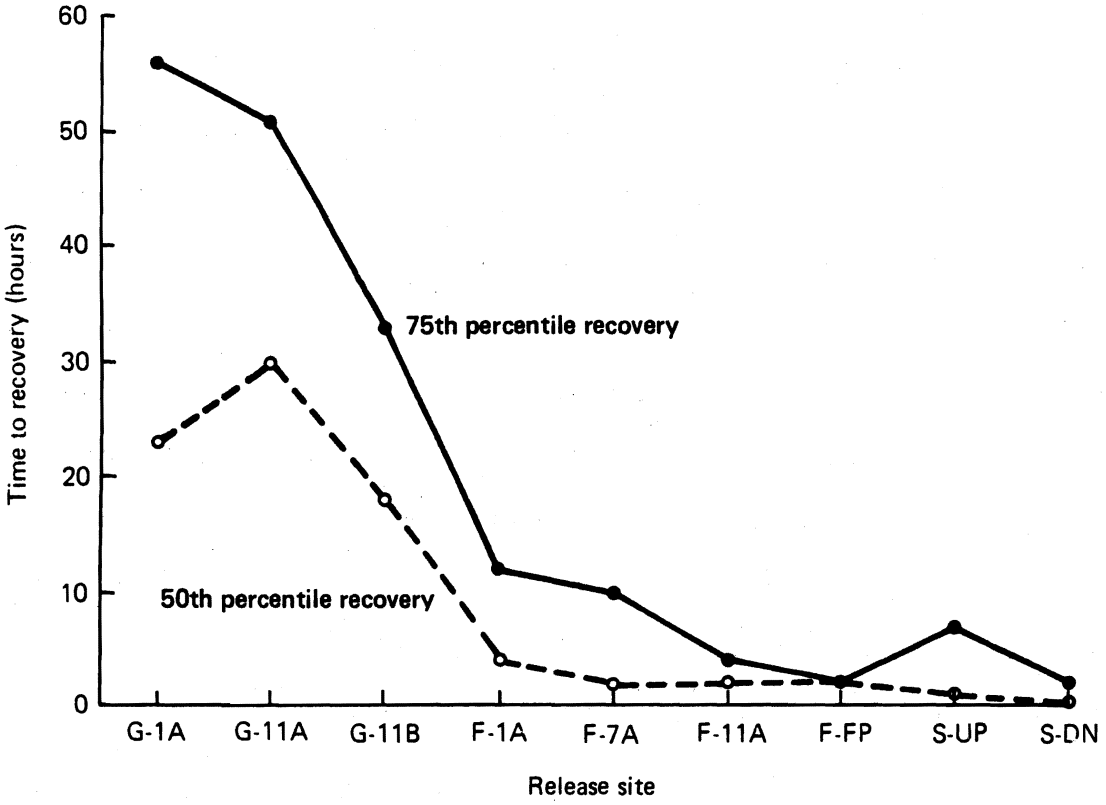

Figure 3.--Time (hours) for passage of spring chinook salmon from release sites in the collection system to sample raceway.

Previous research by Park et al. (1983) indicated a major handling stress occurred when fish were dipped from the upwell with a standard (fabric) dip net and released into the shallow, well-illuminated marking troughs for sorting and marking. Further, the research also indicated that this stress could be reduced by anesthetizing the fish before they were dipped.

The pre-anesthetizer is a rectangular aluminum box installed in a vertical position in one corner of the fish holding upwell box in the fingerling facility. The front side of the pre-anesthetizer is a sliding watertight aluminum plate, and the floor is made of aluminum perforated plate which covers a drain with a quick release valve. To operate the pre-anesthethetizer, the following procedures are utilized: (1) the aluminum plate is removed and the fish are either crowded in or enter volitionally; (2) the plate is then replaced and the water is drained to a predetermined level depending on the abundance of fish; and (3) based on a volume gauge reading, the appropriate amount of an anesthetic mixture of ethyl alcohol and benzocaine is added. Once anesthetized, the fish are gently dipped with a standard dip net into the sorting trough.

STRESS STUDIES--LITTLE GOOSE DAM

Seawater challenge stress tests conducted by NMFS at Lower Granite Dam in 1982 suggested that the stress level of spring chinook salmon smolts was influenced by holding or transporting them in the presence of steelhead smolts. To obtain additional data, two tests were designed to be conducted at Little Goose Dam during the spring smolt outmigration of 1983. Our research objectives were as follows:

1. Determine if stress levels in spring chinook salmon were lower when they were held separately from steelhead smolts during actual collection and transportation operations.

2. Determine if the size of steelhead smolts influenced the stress levels of chinook salmon smolts when they were held together at a common density (1:1) for 24 h.

Separation Tests

Methods

To accomplish these tests, the wet separator at Little Goose Dam was modified to separate smolts by size into three raceway categories as follows: (1) small fish raceway (predominately chinook salmon smolts with lesser numbers of small steelhead smolts), (2) large fish raceway (predominately steelhead smolts with lesser numbers of chinook salmon smolts), and (3) mixed fish raceway (representing an unseparated mode of operation).

During collection, smolts were diverted alternately to the three raceways to assure random size and species placement. Chinook salmon were sampled from the raceway after 0-45 min to obtain a base-line stress level for a minimum holding period with steelhead. This group also served as a comparison with the prior group (pre-separator). Samples were also taken after 14 h to coincide with the average time smolts are held in raceways awaiting transportation. Samples taken after 8 h holding in the raceway represents a mid-point between minimum and normal holding periods for additional comparisons. After the holding period in the raceways, which matched actual facility operation methods, smolts were subsampled from each

test raceway and loaded into a small transport tanker (300-gallon capacity) to simulate the transport phase of the operation. Subsamples of chinook salmon smolts were challenged to seawater at specific times during the raceway holding phase and immediately after the 8-h simulated transport phase.

Sampling and seawater challenge techniques were the same as those used by Park et al. (1983) with one exception; the preliminary challenge series indicated that the appropriate seawater concentration for these test was 32 ppt. At the termination of each seawater challenge test, counts of live and dead fish were made. Notations were also made on individual fish including: length, weight, descaling, injury, and gross disease symptoms. We used the live and dead fish counts to form contingency tables utilizing the G-statistic for significance. Significance was desired at ($P<0.05$, df=n) for comparisons between or among test groups.

Results

Two major developments occurred during the smolt outmigration that substantially affected our ability to satisfy the established test design. First, the delayed releases of steelhead smolts from Dworshak National Fish Hatchery (NFH) resulted in very low numbers of this species being available in the collection system during the early and middle portions of the spring chinook salmon outmigration. The few steelhead which were present were virtually all wild fish which were relatively small. Also, numbers of chinook salmon smolts collected were relatively low due to spilling at the project. As the numbers of both species began to increase to adequate numbers for test purposes, a second problem developed. High dissolved gas

levels (N_2) within the collection system prompted a decision by the fisheries agencies to bypass all smolts around the facility. By the time this problem was rectified and collection resumed, the majority of the spring chinook salmon outmigration had passed the project resulting in very low numbers of this species being present within the system. These conditions allowed us to conduct only one of three planned tests. In addition, loading densities within the raceways had to be reduced from 0.50 lb per gallon of water as planned to 0.25 lb per gallon. Even with this reduction during the single test, there were minimal numbers of chinook salmon smolts available to conduct the test as designed. For these reasons, the results of this single test should be considered tenuous at best.

Figure 4 and Appendix Table 5 illustrate the results, and pertinent findings are summarized as follows:

1. A comparison of the results between the preseparator group and the mixed raceway + 45 min group isolates stress due to the separator and raceway distribution system (Figure 4). There was a highly significant increase in the stress level of chinook salmon smolts between these two sample points ($P<0.01$, $df=1$). These findings were not pertinent to our objectives, however, they generally agree with 1982 results for the same sample areas at Lower Granite Dam, but the previous differences were not significant. The higher stress response between the two sample points at Little Goose Dam indicates that passage through the separator was probably more severe than at Lower Granite Dam. Visual observations of the differences in turbulences and surging of the two separators support the findings on stress responses.

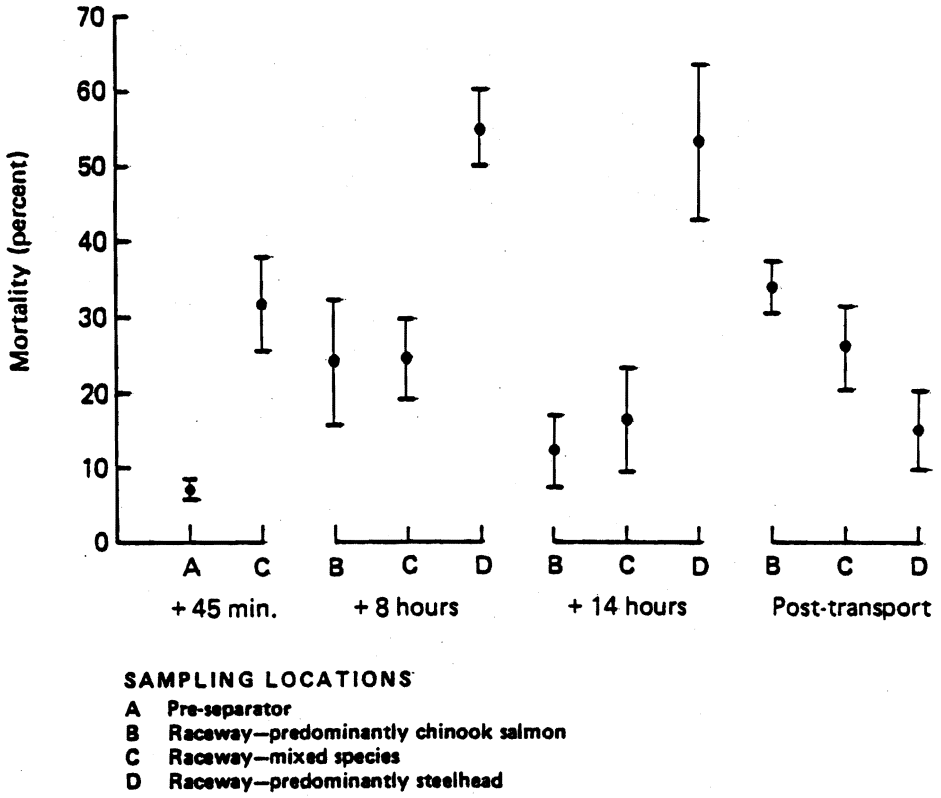

Figure 4.--Seawater challenge tests for relative stress of spring chinook salmon smolts before and after separation with a wet separator, at various times during raceway holding, and after an 8-h simulated transport at Little Goose Dam, 1983 (vertical lines indicate standard error).

2. As expected, chinook salmon smolts taken from the large fish raceway showed significantly higher levels of stress than fish taken from the other two raceways for the 8- to 14-h comparison ($P<0.01$, $df=2$).

3. Following 8 h of simulated transportation, chinook salmon smolts taken from the large fish raceway were significantly less stressed than fish transported from the other two raceways ($P<0.05$, $df=2$). This apparent contradiction of 2. above leads us to question the data from the entire test. Previous research has shown that stress increases significantly when chinook salmon were transported by truck (Park et al. 1983). Since results from our single test are contradictory, we require further replication before conclusions can be drawn.

Steelhead Size Tests

Methods

For these tests, chinook salmon smolts were anesthetized and randomly hand counted into holding pens. In addition to the chinook salmon, each test pen contained steelhead of a specific size range, either <185 mm, 185-230 mm, or >230 mm. The chinook salmon and steelhead smolts were held together in the three test pens at a 1:1 species ratio at a density of 0.50 lb per gallon of water. A pen containing chinook salmon only (random lengths) served as a control. Following the 24-h holding period, subsamples of chinook salmon smolts were randomly removed from the holding pens and challenged to seawater at 32 ppt salinity. All other test procedures were the same as previously described (Park et al. 1983). Five replicates were planned for the experiment.

Results

The aforementioned developments at Little Goose Dam also influenced this test series. We were only able to complete three of the five replicates planned before low numbers of chinook salmon smolts dictated that we terminate testing. The resultant lack of adequate replication makes these data difficult to interpret.

Figure 5 and Appendix Table 6 illustrate the results of these tests. Pertinent findings are summarized as follows:

1. When the control group was compared independently to each individual test group (2-way contingency table), only chinook salmon smolts held with steelhead smolts greater than 230 mm in length were at a higher stress level ($P<0.10$, df=1) (Figure 5). (Note: We desired $P<0.05$, df=1 for statistical significance. The probability is shown to indicate that significance might have been achieved had there been more replicates).

2. There was no statistically significant difference in the stress levels among chinook salmon smolts held with the three specific size groups of steelhead smolts.

3. When all groups including the control were compared together (4-way contingency table), there was no statistically significant difference in the stress levels among the groups.

4. If we combined the data for chinook salmon smolts in all three test groups and compared these data to the control (2-way contingency table), the analysis indicated a higher stress level for chinook salmon smolts when held with steelhead smolts ($P<0.10$, df=1) (see Note in 1. above).

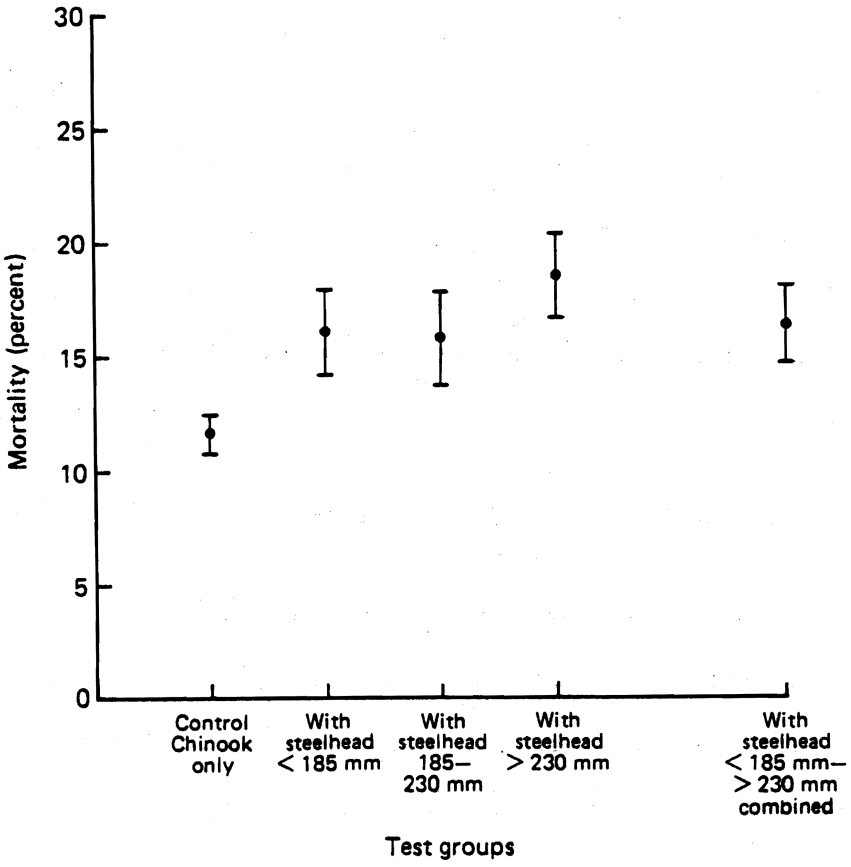

Figure 5.--Seawater challenge tests for relative stress of spring chinook salmon when held at a 1:1 species ratio with 3 size groups of steelhead smolts (< 185, 185-230, and > 230 mm) at 0.50 lb. per gallon of water for 24 h (vertical lines indicate standard error).

Discussion

The data from the two separate stress tests imply a species stress interaction, although the interaction may be more subtle than we had anticipated. The stress interaction does not appear to be influenced by the sizes of steelhead smolts tested. Further testing may clarify the issue.

We do not have sufficient data on stress of chinook salmon caused by interaction with steelhead during separation to recommend separation of species. More research is required to define potential benefits of separation. Whether or not hydro-mechanical separation occurs in the future, there may be substantial benefits toward reducing stress on chinook salmon if large releases of steelhead from Dworshak NFH are delayed to reduce the presence of steelhead at dams during the spring chinook salmon outmigration.

ADULT RETURNS TO THE COLUMBIA AND SNAKE RIVERS

Tagged adult salmonids were recovered at dams by operating tag detection equipment in fishways at Bonneville, McNary, and Lower Granite Dams. In 1983, these facilities, were operated from 1 April to 1 June and from 1 August to 15 October at Bonneville Dam, 20 May to 25 November at McNary Dam, and from 1 March to 30 November at Lower Granite Dam. Other tagged adults were recovered at hatcheries, from spawning grounds, in Columbia and Snake River sport fisheries, and from various commercial fisheries including ocean catches.

Steelhead

1978-80 Experiments--Lower Granite Dam

At trapping facilities at dams, once a wire tagged adult is recovered, the appropriate accompanying brand is recorded and a jaw tag is applied to each fish released. As requested by the Idaho Department of Fish and Game, steelhead identified as wild stock were not jaw tagged at Lower Granite Dam. The jaw tag serves two purposes: (1) tagged fish that fall back through the dam can be identified and thus are not recounted in our recovery statistics and (2) the subsequent recovery of jaw tagged fish and non-jaw tagged fish that bear a CWT at hatcheries upstream provides a means of establishing trap efficiency.

Adult returns from transportation experiments in 1978-80 are complete except for 3-ocean age fish which may enter sport fisheries or return to hatcheries in the winter/spring of 1984. A summary of returns for steelhead recovered at Lower Granite Dam for transport tests conducted at Lower Granite and Little Goose Dams is presented in Table 2 (see also Appendix Tables 7.1 to 7.9 for all observed tag recovery data for Snake River steelhead experimental groups).

Comparisons of test to control benefits were made by using observed returns to Lower Granite Dam for each experiment. Statistical analysis was done by using the "G" statistic (Sokal and Rohlf 1981). In all years, 1978-1980, transported groups returned at significantly higher ($P<0.05$; $df=1$) rates than the corresponding control group. Various transport techniques were also compared, i.e., barging versus trucking and traditional trucking versus trucking using 10 ppt salt water as hauling

Table 2.--Returns to Lower Granite Dam of 1-, 2, and 3- ocean age adult steelhead from control and transport release of smolts from Lower Granite and Little Goose Dams in 1978-80.

Year/ Dam	Release site and experimental groups	Number of smolts released	Number of adults recaptured and estimated number of adults returned ( )[a/] 1-ocean age N (est)	2-ocean age N (est)	3-ocean age N (est)	total N (est)	Adult return as % of smolts released Observed	Estimated	Transport benefit ratio	G statistic and probability based on observed returns
1978 Lower Granite Dam	Bonneville Dam-Truck	47899	336(575)	163(629)	15(105)	514(1309)	1.073	2.732	4.88:1[b/]	G= 217.55;P<0.001
	Bonneville Dam-Barge	43770	328(561)	162(625)	9(63)	499(1249)	1.140	2.854	5.18:1[b/]	G= 235.32;P<0.001
Little Goose Dam	Little Goose-Tailrace	30364	48(117)	18(67)	1(3)	67(187)	0.220	0.616	---	-----
	Bonneville Dam-Truck	35875	253(615)	105(392)	7(18)	365(1025)	1.017	2.857	4.62:1	G= 182.69;P<0.001
	Bonneville Dam-Truck/ Salt	32170	216(525)	112(418)	5(13)	334(956)	1.038	2.972	4.72:1	G= 259.36;P<0.001
1979 Lower Granite Dam	Beacon Rock-Barge	30495	55(275)	206(824)	0(0)	261(1099)	0.855	3.604	1.78:1	G= 26.46;P<0.001
	Lower Granite-Tailrace	21050	19(95)	82(328)	0(0)	101(423)	0.479	2.010	---	-----
1980 Lower Granite Dam	Beacon Rock-Barge	32559	38(114)	13(591)	4(182)	55(887)	0.168	2.724	1.71:1	G= 4.44;P<0.05
	Little Goose-Tailrace	19273	8(24)	6(273)	5(227)	19(524)	0.098	2.719	---	-----

[a/] Estimated numbers were calcuated as follows: Using the observed returns for the 1978 Lower Granite Dam truck group we determined the trap efficiency for 1-ocean age fish to be 58.5% (see Appendix Table 8). The resultant expansion factor is 1.71. Therefore, 1.71x336=575. This method was used to establish the estimated return for each age class for 1978-79. In 1980, the expansion factor established for 1-ocean age fish was used for all three year classes.

[b/] Transport benefit ratio is calculated by comparing this lot with the lot released in the Little Goose Dam tailrace.

media; no significant difference in the number of returning adults were observed (P=0.33 and P=0.79, respectively).

The estimated return of transported fish ranged from 2.7% in 1980 to 3.6% in 1979. The high rate of return for marked, transported fish compared favorably with that observed for 1975, when 2.5% returned (Park et al. 1980) and to the 3.0 to 4.0% rate of return of unmarked adults prior to new dams (Raymond 1979). The rate of return of transported fish was high in each study year, but because the rate of return of control fish was higher in 1979-80 than in 1978, computed transport benefits have been smaller in recent years--approximately 1.7:1 in 1979-80 versus 5:1 in 1978. One reason for the higher rate of return of control fish starting in 1979 is that many of the control fish were provided the benefits of collection and transportion from Little Goose Dam in 1979 and McNary Dam in both 1979 and 1980 rather than incurring mortalities from passage through the dam complex (Park et al. 1980).

The number of observed adult returns from each year's test has been steadily declining (Table 2). In 1980 we became aware that the CWT used in fish released in 1979 and 1980 were not all properly magnetized (Park et al. 1981). The problem was apparently solved for subsequent releases, but lack of CWT magnetization created problems in detecting tagged adults from the 1979 and 1980 releases. Because of the past CWT problems, expansion of observed returns to estimate total returns became more difficult each year as the number of fish intercepted at Lower Granite Dam, jaw tagged, and subsequently recovered at hatcheries declined [estimated adult returns to Lower Granite Dam are based on fish recovered at the hatcheries that are carrying CWT and jaw tags compared with those carrying only CWT (indicating

no previous interception)]. The observed recovery of each ocean-age group is expanded based on the efficiency of recovery at the dam for that group (Appendix Table 8). In 1980, because of limited returns the same factor was used for all three year classes of adults. As a result, estimated returns for 1980 were based upon less adequate data--than in prior years. There are, however, data from the return of untagged adults (1980 outmigration) that generally support the estimated return rate. In 1980, over 3.0 million smolts were transported from dams--including about 80% of the estimated Snake River outmigration (Sims et al. 1981). Sims also calculated that survival of nontransported fish to the Dalles Dam in 1980 was about 20%. In past years, 5% of the smolts surviving to the Dalles returned as adults (Ebel et al. 1979). Assuming this has not changed, then the 166,000 nontransported smolts estimated at the Dalles Dam would have contributed about 8,000 adult steelhead from the 1980 migration year. The actual return from 1980 was estimated to be 77,000 fish. Therefore about 69,000 or 2.3% of the transported fish returned as adults. This closely approximates the estimated 2.7% return of tagged fish. In 1980, 3.6 million smolts were estimated to have arrived at Lower Granite Dam (Sims et al. 1980). We calculated that, had there not been any transportation in 1980, only 36,000 adults would have returned [(3.6 million) (0.2) (0.05) = 36,000].

In summary, it appears that Snake River steelhead are benefiting from barge and truck transportation, and transportation of these stocks should continue.

1978-80 Experiments--McNary Dam

Transportation of steelhead from McNary Dam to below Bonneville Dam during 1978-80 has shown positive transport benefits in all years. The

benefit ratios have ranged from 1.3 to 1 (1980 trucked group) to over 3.0 to 1 (1979 barged group) (Figure 6 and Appendix Tables 9.1 to 9.8).

The degree of success of the transportation program at McNary Dam has been evaluated by the number of adults recovered at the McNary Dam trapping facility (Table 3). Analyses are based on the "G" statistic (Sokal and Rohlf 1981) where a probability of $P<0.05$ is desired. All test lots returned in significantly greater numbers than the corresponding control lots in 1978 and 1979. Further, barged fish returned in significantly greater numbers than trucked fish in 1979 ($G=4.006$, $P<0.05$; $df=1$). In 1980, only barged fish returned in significantly greater numbers than controls, and the number of barged fish vs trucked fish returning to the dams were not significantly greater ($G=0.141$, $df=1$). We believe that tag detection problems, as at Lower Granite Dam, resulted in many of the returning tagged fish being missed at the in-river traps. As a result, the number of fish available for analysis was only marginally sufficient for statistical treatment.

Calculations of estimated return of transported fish, as is being done on the Snake River, provides the best demonstration of transport benefits. We have examined the possibility of making similar measurements for McNary Dam operations by obtaining measures of trapping efficiency at McNary Dam. Recovery of adults, though, at hatcheries has been so erratic from year to year that it was not possible to make any estimates of trapping efficiency, and thus estimates of overall rate of return of transported fish. Actual returns for the 1978-80 period, though, to all four in-river traps, the fishery, and hatcheries (Appendix Tables 9.1 to 9.8) provided data that strongly suggested that positive benefits were being realized from

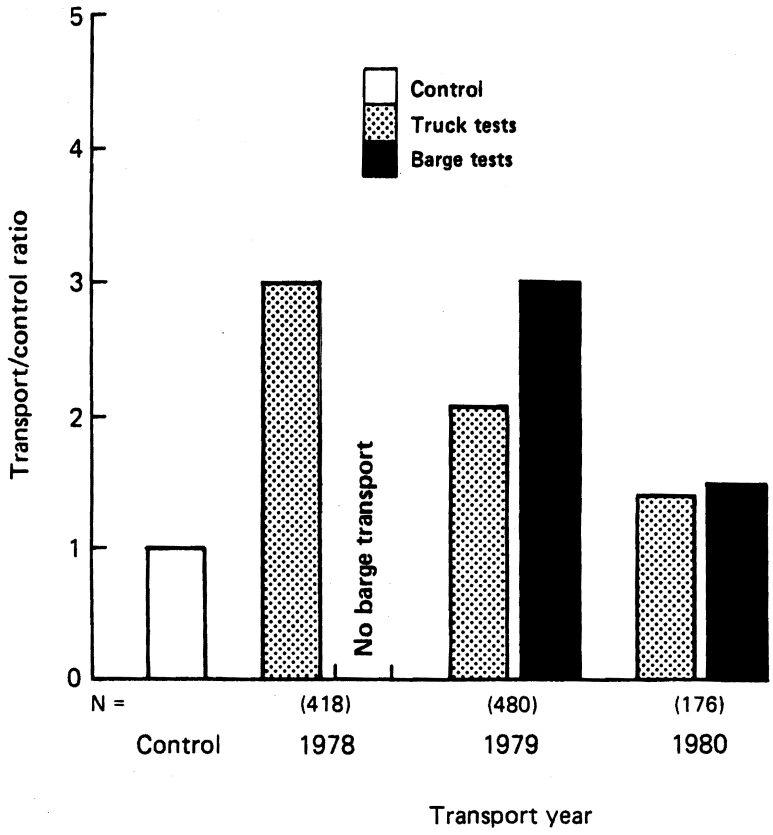

Figure 6.--Transport/control ratios for McNary Dam truck and barge transportation tests with steelhead, 1978-80.

Table 3.--"G" statistic analysis for steelhead and fall chinook salmon recovered at McNary Dam--transport tests 1978-80.

Steelhead	Adults recovered	Smolts released	T/C ratio	Probability
1978 - truck	67	20,416	2.85:1	P<0.001
control	18	15,585		
1979 - truck	38	15,379	2.7:1	P<0.01
control	8	8,595		
barge	67	18,182	4.0:1	P<0.001
1980 - truck	14	22,362	1.9:1	P=0.15
control	7	21,291		
barge	24	30,382	2.4:1	P<0.05
Fall Chinook Salmon				
1978 - truck	95	40,361		
control	11	38,137	8.4:1	P<0.001
1979 - truck	43	132,919	16.0:1	P<0.001
control	3	112,718		
1980 - truck	54	80,213	56.0:1	P<0.001
control	1	84,587		

transporting steelhead from McNary Dam. First, overall returns to hatcheries showed a positive transport benefit of about 2.5:1, closely approximating the benefits shown for all fish transported from McNary Dam during those year (Table 3, Figure 6). The Yakima Hatchery, especially, received positive benefits from transportation in 1979 and 1980. These data not only indicate that survival was enhanced, but homing of those hatchery fish was not impaired by hauling from McNary Dam. Second, the overall rate of return of transported fish from McNary Dam operations (1978-80) also compared closely to the overall rate of return of transported fish for Lower Granite Dam operations for these years (Appendix Tables 7.1 to 7.9). These data suggest that fish transported from McNary Dam are receiving comparable benefits to fish transported from the Snake River.

In summary, for all groups but the trucked groups in 1980, transported fish from McNary Dam returned in significantly greater numbers than the corresponding control lots. Furthermore, while there is no method available for obtaining a good measure of positive return from these transport operations there were strong indications from hatchery returns and overall returns that survival of fish transported from McNary Dam was being enhanced without adversely affecting their homing.

Spring Chinook Salmon

Return of adult spring chinook salmon to the upper Columbia and Snake River drainages continue to be poor. In 1983, only one marked spring chinook salmon was recovered at the dams. That single recovery was from the 1980 truck lot transported to below Bonneville Dam from McNary Dam.

Coded wire tag returns from all experimental spring chinook salmon

tagged at Lower Granite, Little Goose, and McNary Dams are presented in Appendix Tables 10.1 to 10.8, 11.1 to 11.5, and 12.1 to 12.8, respectively. "G" statistic analysis was used to measure significance of returns for experiments at Lower Granite Dam in 1978-80 and at Little Goose Dam in 1978. The analysis was based on adults returning to Lower Granite Dam.

When fish were transported from Lower Granite Dam in 1978, both truck and barge lots returned in significantly higher numbers than the control lot (Table 4). Also, barged fish returned in greater numbers than trucked fish ($G=4.423$, $P<0.05$). In other tests, salt treatment (10 ppt) prior to transport and 24-h holding prior to transport did not provide measureable benefit when compared with the experimental control. In 1979, barged fish returned in significantly greater numbers than the control. In 1980 tests, too few returns were observed to provide analysis.

In 1981, spring chinook salmon were marked for barge transport as an index lot to monitor transport success. To date, no fish have been observed in any recovery area from this marked lot.

At Little Goose Dam in 1978, transported smolts were hauled by truck in 10 ppt salt water and in standard fresh water. Neither media provided measureable benefits, and returns of transported fish were not significantly different than that of controls (Appendix Tables 11.1 to 11.5).

At McNary Dam, smolts were marked for transportation evaluation in 1978-80. Returns from these releases to in-river traps were insufficient for analysis (Appendix Tables 12.1 to 12.8).

Poor survival of upriver stocks of spring chinook salmon smolts is a continuing problem needing urgent solution. Although smolts may appear to

Table 4.--"G" statistic analysis for spring chinook salmon recovered as adults at Lower Granite Dam--transport tests 1978-80.

Dam/test group/year	Adults recovered	Smolts released	Probability or significance
Lower Granite Dam - 1978			
Truck (standard)	33	43,855	P<0.001
Truck (10 ppt salt water - 2h)	5	38,685	Not significant
Truck (24 h holding)	5	40,841	Not significant
Barge	66	56,546	P<0.001
Little Goose Dam			
Truck (standard)	5	49,391	Not significant
Truck (10 ppt saltwater)	1	47,661	Not significant
Control[a/]	5	36,441	---
Lower Granite Dam - 1979			
Barge	12	27,336	P<0.05
Control[b/]	3	25,532	---
Lower Granite Dam - 1980			
Truck	0	32,772	Not significant
Barge	1	40,719	Not significant
Control[c/]	0	21,876	---

a/ Control group at Little Goose Dam is also used for control group at Lower Granite Dam in 1978.

b/ Control group was released below Lower Granite Dam.

c/ Control group was released below Little Goose Dam.

be in excellent condition at the time of collection, [Delarm et al. (1984) noted that descaling rates for spring chinook salmon in 1983 was 2.8%], neither transported nor control groups have survived their remaining freshwater and ocean environments to returns as adults. This apparent poor survival of smolts, whether transported or not, has resulted in severely depressed upriver runs in recent years. The next logical area to examine is the survival of smolts downstream from Bonneville Dam through their first few months in seawater. Because the physiological ability of the smolts to adapt to seawater may be adversely impacted by the stress incurred in their seaward migration, the CofE is funding a study in 1984 to determine the relative ability of spring chinook salmon, exposed to various collection and transportation stresses, to survive for an extended period in seawater. Results of the test should lead toward development of improved transport techniques, collection methods, and/or smolt quality in hatchery production.

Fall Chinook Salmon

Transportation of fall chinook salmon smolts from McNary Dam to below Bonneville Dam continues to provide significant benefits compared to control lots released below McNary Dam. For example, in 1978 (adult return data are now complete) the benefit ratio ranged from 5.1 to 6.2:1 depending upon recovery area. Returns from releases between 1979 and 1982 are not complete; however, considerable data are available that continue to show that transportation is providing positive benefits for fall chinook salmon. Tagged adults returning to dams (Columbia River traps) had transport benefit ratios ranging from a low of 3.6:1 in 1982 to a high of 10.8:1 in 1981 (see Figure 7 and Table 4). Additional details on adult returns by transport year may be found in Appendix Tables 13.1 to 13.10.

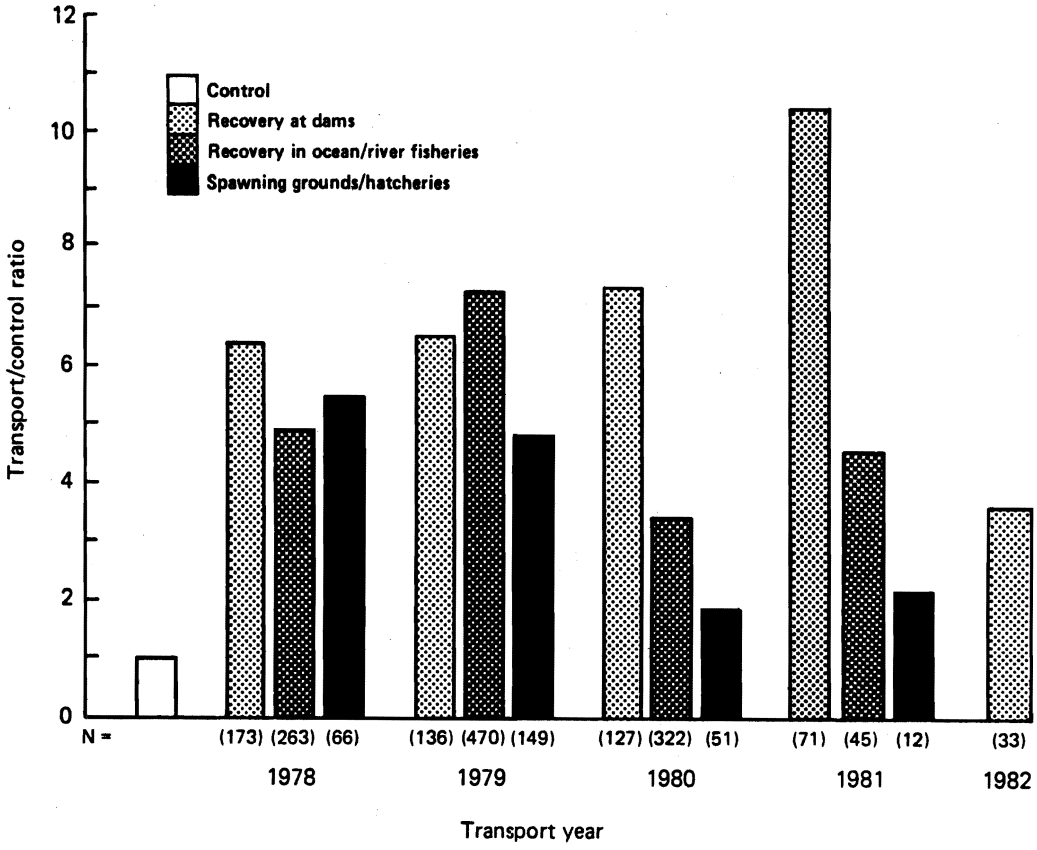

Figure 7.--Transport/control ratios for McNary Dam truck transportation tests with fall chinook salmon, 1978-81.

The preliminary data for 1979-82 were strongest for benefit ratios measured at dams, followed by returns to the fisheries, and weakest based on returns to hatcheries and spawning grounds. When final returns are analyzed, recoveries from the fisheries will be the most powerful simply because harvest rates are high on these upriver fall chinook salmon.

All adult returns through 17 February 1984 have been analyzed for statistical significance using the "G" statistic (Sokal and Rohlf 1981). We compared test vs. control groups from the 1978 to 1982 transport years in three major tag recovery areas: trapping facilities at dams, combined fisheries, and combined hatchery and spawning ground recoveries (Table 5). Sufficient data were available to show that significantly greater numbers of transport than control fish returned to traps at dams (all years), to the fishery through 1981, and to hatcheries or spawning grounds (1978 and 1979). We anticipate that comparable benefits will be realized when all of the data from the 1982 group in the fishery and the 1980-82 groups back to hatcheries are available.

The significant transport benefit ratio for all years of study is encouraging. The positive transport benefit together with the high recovery rate of transported fish in the fishery clearly suggests that survival of these fish is significantly enhanced by transportation from McNary Dam. Even with enhanced survival though, transportation of fall chinook salmon may not be a viable management tool if transported fish fail to return to their spawning grounds and/or hatcheries. Therefore, to complete the transport evaluation, we need to demonstrate that homing and migrational behavior are not adversely impacted by transportation from McNary Dam. The most complete data indicated homing of the transported

Table 5.--Transport benefit ratios and statistical significance for fall chinook salmon 1978-82.

Year of release	Adult recovery area	Number returns		Benefit ratio[a/]	"G" statistic; probability
		Transport	Control		
1978	Col. R. traps	150	23	6.2:1	"G"=97.344; P<0.001
	Combined fisheries	219	44	4.7:1	"G"=117.716; P<0.001
	Spawning grounds-hatcheries	56	10	5.3:1	"G"=32.823; P<0.001
1979	Col. R. traps	120	16	6.4:1	"G"=73.829; P<0.001
	Combined fisheries	420	50	7.2:1	"G"=275.651; P<0.001
	Spawning grounds-hatcheries	126	23	4.8:1	"G"=62.423; P<0.001
1980	Col. R. traps	111	16	7.3:1	"G"=85.068; P<0.001
	Combined fisheries	250	72	3.7:1	"G"=714.036; P<0.001
	Spawning grounds-hatcheries	32	19	1.8:1	"G"=4.078; P=0.05
1981	Col. R. traps	65	6	10.8:1	"G"=56.865; P<0.001
	Combined fisheries	37	8	4.2:1	"G"=20.040; P<0.001
	Spawning grounds-hatcheries	8	4	--Insufficient data--	"G"=1.327; Not significant
1982	Col. R. traps	26	7	3.6:1	"G"=11.162; P<0.001
	Combined fisheries		--Insufficient data--		
	Spawning grounds-hatcheries		--Insufficient data--		

a/ Adjusted for number of smolts released in each group.

fish was very strong, i.e., transport benefit ratios were nearly equal in the three recovery areas we analyzed. Also, no marked fish have returned to hatcheries other than those up-river sites where fish were expected. (Note: Some fish from our tests were reported at the Bonneville Hatchery; these were purposely intercepted at Bonneville Dam for the up-river "bright" egg bank program.)

In summary, there is a solid data base in our adult fall chinook salmon returns that clearly demonstrates the positive benefits from transporting these fish from McNary Dam. Therefore, we strongly recommend that management continue the present transport program for the future protection of fall chinook salmon regardless of river conditions. We also recommend that marking of these fish be resumed in 1985 so that benefits received can continue to be observed (marking was dropped in 1984). Even though there have been positive transport benefits each year, the range has fluctuated, as mentioned previously, from 3.6:1 to 10.8:1. The catches in the ocean also fluctuated from year to year. Indexing these fluctuations would provide management with data on differences in survival, transport benefits, and fishing contribution each year. Such data should be most useful in predicting rate of return to the Columbia River for setting seasons, etc. Such a program could be achieved by marking at least one transport group and a control group each year. Impacts from marking and handling of fish should be minimal. We have mentioned earlier that in two consecutive years of study, we observed only minor but equal mortality of marked fish and non-handled fish (non-transported fish). We further observed that although higher than other groups, mortality of marked, transported fish was low. Therefore, there is essentially no risk to the resource in continuing the evaluation of transportation.

SUMMARY AND RECOMMENDATIONS

1. In continuation studies to evaluate the transportation of fall chinook salmon smolts at McNary dam, 35,279 juveniles were marked and transported by truck, and 38,860 were marked for barge transport--both test lots were subsequently released downstream from Bonneville Dam. An additional 40,301 fish were marked and released in the tailrace of McNary Dam as controls.

2. In a delayed mortality test using fall chinook salmon, there was no significant difference in mortality between marked and unmarked non-transported fish and unmarked transported fish. Marked, transported fish had significantly higher mortality than the other groups; however, the mortality rate was low (about 6.5%).

3. The fingerling bypass system at McNary Dam was evaluated in April 1983 using spring chinook salmon. Marked fish released in Gatewell 11B (where steel tees remain at the orifice exit) had significantly higher descaling than fish released in all other locations. Substantial delay of fish released in gatewell locations--averaging about 45 h to the 75th percentile recovery compared to about 10 h for releases in the flume appear to indicate an orifice passage problem. Further research is needed to determine the actual cause of the delay and the role delay plays in the ultimate survival of the smolts.

4. A total of 44,648 spring chinook salmon were marked and subsequently transported from Lower Granite Dam to index the relative success of transportation of salmon from the Snake River. A pre-anesthetizer was used for the first time in 1983 to minimize stress from handling.

5. At Little Goose Dam, seawater challenge test were conducted to determine the relationship of species separation and the size of steelhead to stress of spring chinook salmon. Tests were confounded by problems at the collection facility; however, results indicated that higher stress occurred in chinook salmon held with steelhead (all sizes) than those fish held only with conspecifics.

6. Adult return data for steelhead transported as smolts from Lower Granite, Little Goose, and McNary Dams through 1980 are complete. In general, transported fish returned in significantly greater numbers than controls regardless of transport location, mode of transport, or year of transport. The estimated return of transported fish from the Snake River ranged from 2.7% in 1980 to 3.6% in 1979; approaching the 3 to 4% rate of return prior to dams. Similar benefits appear to be occurring to steelhead transported from McNary Dam.

7. Adult returns from transportation tests of spring chinook salmon conducted in 1978-80 from Lower Granite and McNary Dams are complete. Except for returns for the 1978 transport year, numbers of fish returning from transport tests were insufficient for analysis. Poor survival of smolts, whether transported or not, resulted in severely depressed upriver runs in recent years. The physiological inability to adapt to seawater due to stresses incurred in the seaward migration may be a contributing cause of the problem. In 1984, the CofE is funding a study to determine the relative ability of spring chinook salmon exposed to various collection and transportation stresses to survive for an extended period in seawater. Results of this research could lead to improved transportation techniques, collection methods, and/or smolt quality in hatchery production.

8. Transporation of fall chinook salmon smolts from McNary Dam to below Bonneville Dam continues to provide significant benefits compared to control lots released below McNary Dam. Transported (truck) fish have returned and contributed to fisheries in significantly greater numbers than the control fish in all years, 1978-81. Marking to provide an index of success of transportation in future years is recommended.

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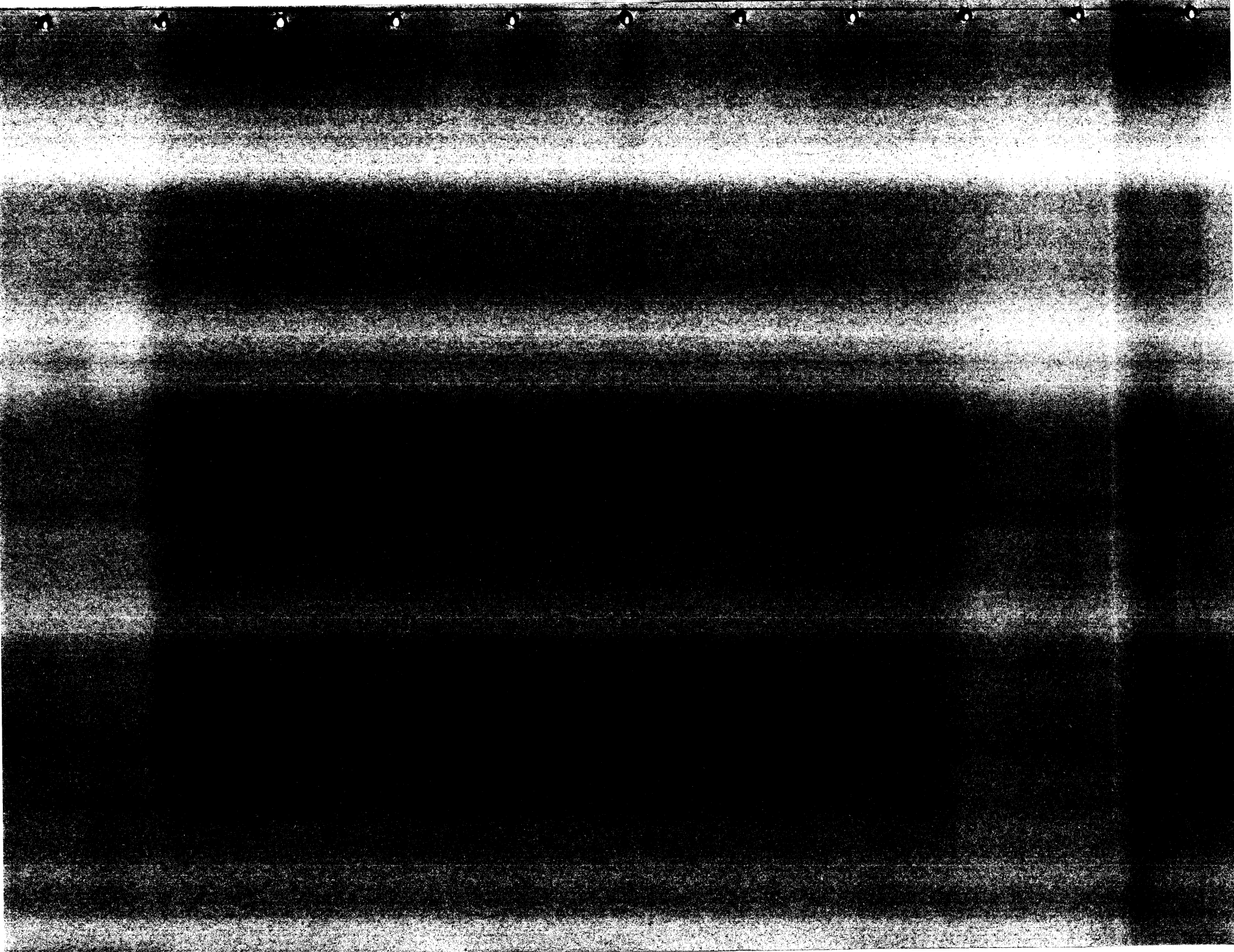

Appendix Table 1.--Summary of brands and wire codes used to identify juvenile fall chinook salmon that were marked at McNary Dam and released as controls below McNary or transported by truck or barge to below Bonneville Dam, 1983.

Marking period	Brand position, symbol, and orientation[a/]	Tag code	Number marked
Truck transport			
07 July - 14 July	RA - IJ, 1	23-16-25	15,096
19 July - 25 July	RA - IJ, 3	23-16-28	13,973
30 July - 02 Aug	RA - IJ, 2	23-16-31	6,210
		Subtotal	35,279
Barge transport			
10 July - 16 July	RA - 3, 1	23-16-26	15,040
18 July - 26 July	RA - 3, 3	23-16-29	15,230
28 July - 01 Aug	RA - 3, 2	23-16-32	8,590
		Subtotal	38,860
Control			
08 July	LA - 2L, 1	23-16-27	4,990
13 July	LA - 2L, 3	23-16-27	5,005
15 July	LD - 2L, 1	23-16-27	5,015
20 July	LA - 2T, 1	23-16-30	5,020
23 July	LA - 2T, 3	23-16-30	5,010
27 July	LD - 2T, 1	23-16-30	4,660
29 July	LA - 2X, 1	23-16-33	5,941
05 Aug	LA - 2X, 3	23-16-33	4,660
		Subtotal	40,301

a/ Brand positions abbreviations are: RA-Right anterior, LA-Left anterior, and LD-Left dorsal. Brand symbol is self explanatory. Brand orientation is as follows: 1-V, 2-<, 3-^, and 4->.

Appendix Table 2. --Survival and mortality after 5-day holding of marked and unmarked fall chinook salmon either held or transported from McNary Dam - 1983.

Trial no./date	Marked		Unmarked	
	Alive	Dead	Alive	Dead
	(No.)	(No.)	(No.)	(No.)
Transported				
1. 07 July	172	0	869	7
2. 11 July	120	4	1,045	19
3. 14 July	127	5	752	5
4. 19 July	122	29	401	50
5. 21 July	78	6	315	9
6. 25 July	70	5	331	8
7. 30 July	246	5	403	5
8. 02 Aug	174	23	309	62
Nontransported				
1. 21 July	96	2	263	10
2. 21 July	98	2	246	5
3. 25 July	120	5	128	15
4. 27 July	121	3	217	7
5. 27 July	122	4	165	7
6. 30 July	114	7	199	6
7. 02 Aug	108	12	352	21
8. 04 Aug	123	6	101	4

Appendix Table 3.--Recovery of spring chinook salmon during the fingerling bypass test at McNary Dam indicating the release site, date of release, and the number recovered by condition of fish.

Release site	Release date	Recovery condition					
		No descaling	Scattered descaling	Only one area with 40% scale loss	At least two areas with scale loss	Dying	Mortality
Gatewell 1A	April 15	69	10	4	5	2	0
"	April 18	58	22	2	3	2	1
"	April 20	38	20	2	8	1	4
Gatewell 11A	April 15	58	13	2	5	0	1
"	April 18	60	18	7	6	0	0
"	April 20	56	12	6	3	0	3
Gatewell 11B	April 18	54	17	6	13	1	2
"	April 20	68	14	6	5	1	0
Flume 1A	April 15	59	16	5	3	0	0
"	April 18	63	23	0	6	1	3
"	April 20	36	14	2	2	1	0
Flume 7A	April 15	57	15	4	2	0	0
"	April 18	51	35	1	4	1	2
"	April 20	63	32	2	0	3	0
Flume 11A	April 15	55	19	6	7	0	1
"	April 18	46	28	8	8	2	0
"	April 20	57	35	4	2	0	0
Flume at fish pipe entrance	April 15	48	17	8	2	2	0
"	April 18	57	33	6	3	0	1
"	April 20	55	22	5	9	0	0
Upstream of separator	April 15	69	5	6	3	1	0
"	April 18	58	24	8	2	0	0
"	April 20	54	31	4	4	0	0
Downstream of separator (control)	April 15	80	14	9	1	0	1
"	April 18	70	28	2	2	0	1
"	April 20	49	36	8	3	0	0

Appendix Table 4.--Summary of brands and wire tag codes used to identify juvenile spring chinook salmon marked at Lower Granite Dam and transported by barge to below Bonneville Dam, 1983. The table also includes the percentage of juvenile chinook salmon in the total fish population in the bypass collection sample.

Date	Position of brand and orientation	Wire tag code	Number marked	Percent spring chinook salmon in sample
4-21	RA-F, 1	23-16-21	6,763	97.0
4-23	RA-F, 1	23-16-21	6,735	97.5
Totals and averages	RA-F, 1	23-16-21	13,498	97.5
4-25	RA-F, 2	23-16-21	6,877	93.4
4-27	RA-F, 2	23-16-21	4,417	82.0
Totals and averages	RA-F, 2	23-16-21	11,294	90.3
4-29	RA-F, 3	23-16-22	3,207	71.9
5-1	RA-F, 3	23-16-22	2,780	70.9
5-3	RA-F, 3	23-16-22	4,294	65.9
5-5	RA-F, 3	23-16-22	3,997	58.6
Totals and averages	RA-F, 3	23-16-22	14,278	65.7
5-7	RA-F, 4	23-16-22	1,838	38.0
5-9	RA-F, 4	23-16-22	1,101	19.7
5-11	RA-F, 4	23-16-22	484	12.3
5-12	RA-F, 4	23-16-22	628	12.7
5-16	RA-F, 4	23-16-22	634	10.6
5-12	RA-F, 4	23-16-22	318	6.6
5-25	RA-F, 4	23-16-22	575	7.5
Totals and averages	RA-F, 4	23-16,22	5,578	14.9

Total marked--44,648

Appendix table 5.—Little Goose Dam collection facility separation tests data when chinook salmon smolts were collected prior to the separator and after separation by size into 3 raceway categories (small fish raceway, large fish raceway, and mixed fish raceway) and subsequently challenged with artificial seawater at 32 ppt for 48-h at specific times during the raceway holding phase and immediately after an 8-h simulated transport phase. Table includes test numbers, descaling, total biomass, and average length of live and dead fish by test condition and replicate. (Includes steelhead which were unintentionally sampled with spring chinook in some tests).

Test No.	Date	Dead fish						Live fish						Total biomass (gm)
		Number nondescaled		Number descaled		Average fork length (mm)		Number nondescaled		Number descaled		Average fork length (mm)		
		Chin.	Sthd.	Chin.	Sthd.	Chin.	Sthd.	Chin.	Sthd.	Chin.	Sthd.	Chin.	Sthd.	
							Test condition - prior to separator							
1a	5/9-12	0	0	2	0	110.0	—	18	3	1	0	125.3	155.0	504.6
1b	5/9-12	0	0	1	0	110.0	—	14	1	3	0	125.3	150.0	360.5
1c	5/9-12	0	0	1	0	105.0	—	14	3	2	0	123.4	176.7	437.8
Totals or averages		0	0	4	0	108.7	—	46	7	6	0	124.7	163.6	434.3
							Test condition - mixed raceway + 45 minutes							
1a	5/9-12	3	1	0	0	125.0	165.0	11	6	2	1	129.2	167.9	642.1
1b	5/9-12	2	0	3	0	119.0	—	6	5	3	0	132.8	168.0	505.6
1c	5/9-12	5	0	4	0	122.8	—	11	7	2	0	123.8	160.7	612.5
Totals or averages		10	1	7	0	122.1	165.0	28	18	7	1	128.1	165.3	586.7
							Test condition - mixed raceway + 8 h							
1a	5/10-12	3	0	1	0	123.7	—	18	7	1	0	122.1	170.0	628.5
1b	5/10-12	2	0	3	0	113.0	—	8	14	1	2	136.1	168.1	900.3
1c	5/10-12	2	0	3	0	122.0	—	18	12	1	1	125.3	168.1	874.8
Totals or averages		7	0	7	0	119.3	—	44	33	3	3	126.1	168.5	801.2

Appendix table 5.—continued

Test No.	Date	Dead fish: Number nondescaled Chin.	Dead fish: Number nondescaled Sthd.	Dead fish: Number descaled Chin.	Dead fish: Number descaled Sthd.	Dead fish: Average fork length (mm) Chin.	Dead fish: Average fork length (mm) Sthd.	Live fish: Number nondescaled Chin.	Live fish: Number nondescaled Sthd.	Live fish: Number descaled Chin.	Live fish: Number descaled Sthd.	Live fish: Average fork length (mm) Chin.	Live fish: Average fork length (mm) Sthd.	Total biomass (gm)
						Test condition - mixed raceway + 14 h								
1a	5/10-12	1	0	3	0	125.0	—	8	10	2	2	122.5	180.4	840.0
1b	5/10-12	0	0	1	0	100.0	—	22	8	0	0	121.1	160.6	650.0
1c	5/10-12	1	0	3	0	132.5	—	19	15	2	1	120.0	175.0	1,180.0
Totals or averages		2	0	7	0	125.6	—	49	33	4	3	120.9	173.6	890.0
						Test condition - small size raceway + 8 h								
1a	5/10-12	1	0	9	0	120.5	—	14	14	2	0	128.4	182.5	586.5
1b	5/10-12	2	0	0	0	112.5	—	19	6	3	0	124.8	176.7	742.6
1c	5/10-12	2	0	4	0	115.8	—	16	6	2	0	126.7	163.3	649.0
Totals or averages		5	0	13	0	118.1	—	49	26	7	0	126.4	176.7	659.4
						Test condition - small size raceway + 14 h								
1a	5/10-12	0	0	2	0	115.0	—	22	14	3	2	121.8	166.2	1,039.6
1b	5/10-12	0	0	2	0	120.0	—	21	18	6	1	125.0	165.8	1,284.0
1c	5/10-12	2	1	2	0	136.2	165.0	14	29	0	1	125.4	171.5	1,688.0
Totals or averages		2	1	6	0	126.9	165.0	57	61	9	4	123.9	168.5	1,337.2
						Test condition - large sized raceway + 8 h								
1a	5/10-12	2	0	3	0	122.0	—	3	18	0	6	131.7	184.2	1,480.5
1b	5/10-12	4	2	15	1	123.7	181.7	18	9	5	1	123.7	179.5	1,396.8
1c	5/10-12	0	0	8	1	127.5	145.0	4	16	2	1	125.8	185.0	597.8
Totals or averages		6	2	26	2	124.4	172.5	25	43	7	8	124.8	183.5	1,158.4

Appendix table 5.--continued

Test No.	Date	Dead fish: Number nondescaled Chin.	Dead fish: Number nondescaled Sthd.	Dead fish: Number descaled Chin.	Dead fish: Number descaled Sthd.	Dead fish: Average fork length (mm) Chin.	Dead fish: Average fork length (mm) Sthd.	Live fish: Number nondescaled Chin.	Live fish: Number nondescaled Sthd.	Live fish: Number descaled Chin.	Live fish: Number descaled Sthd.	Live fish: Average fork length (mm) Chin.	Live fish: Average fork length (mm) Sthd.	Total biomass (gm)
Test condition - large size raceway + 14 h														
1a	5/10-12	0	1	3	0	120.0	220.0	2	22	0	1	145.0	187.4	1,469.4
1b	5/10-12	5	1	7	0	126.7	195.0	6	18	0	1	128.3	187.2	1,408.0
1c	5/10-12	2	0	0	0	102.5	--	3	23	1	1	132.5	186.2	1,351.6
Totals or averages		7	2	10	0	122.6	207.5	11	63	1	3	132.5	186.9	1,409.7
Test condition - mixed raceway, post transport (simulated in experimental tanker)														
1a	5/10-13	2	1	2	0	116.2	160.0	6	4	1	0	124.3	166.2	382.0
1b	5/10-13	0	1	2	0	117.5	145.0	8	3	2	0	127.5	166.7	364.0
1c	5/10-13	2	0	0	0	127.5	—	5	5	1	0	134.2	182.0	434.0
Totals or averages		4	2	4	0	119.4	152.5	19	12	4	0	128.3	172.9	393.3
Test condition - small size raceway, post transport (simulated in experimental tanker)														
1a	5/10-13	5	0	4	0	115.0	—	10	4	3	0	120.4	161.2	540.0
1b	5/10-13	4	0	1	0	117.0	—	11	6	0	0	119.1	161.7	437.0
1c	5/10-13	4	0	1	0	121.0	—	11	9	1	0	124.2	163.9	588.0
Totals or averages		13	0	6	0	117.1	—	32	19	4	0	121.2	162.6	521.7
Test condition - large size raceway, post transport (simulated in experimental tanker)														
1a	5/10-13	4	0	0	0	122.5	—	17	2	1	1	128.6	170.0	521.0
1b	5/10-13	1	0	0	0	120.0	—	16	2	4	0	125.2	170.0	518.0
1c	5/10-13	4	0	1	0	120.0	—	18	4	0	0	125.3	167.5	575.0
Totals or averages		9	0	1	0	121.0	--	51	8	5	1	126.3	168.9	538.0

Appendix Table 6 —Steelhead size effects tests data from Little Goose Dam when chinook salmon smolts were held alone and with 3 size groups of steelhead smolts (<185 mm, 185-230 mm and >230 mm), at a 1:1 species ratio for 24 h, including test numbers, descaling, total biomass, and average length of live and dead fish by test condition and replicate after a 48-h exposure to 32 ppt artificial seawater (includes steelhead which were unintentionally sampled with spring chinook in some tests).

Test No.	Date	Dead fish: Number nondescaled Chin.	Dead fish: Number nondescaled Sthd.	Dead fish: Number descaled Chin.	Dead fish: Number descaled Sthd.	Dead fish: Average fork length (mm) Chin.	Dead fish: Average fork length (mm) Sthd.	Live fish: Number nondescaled Chin.	Live fish: Number nondescaled Sthd.	Live fish: Number descaled Chin.	Live fish: Number descaled Sthd.	Live fish: Average fork length (mm) Chin.	Live fish: Average fork length (mm) Sthd.	Total biomass (gm)
Test Condition - Control (chinook only)														
1a	5/11-13	0	0	4	0	115.0	—	24	0	3	0	127.2	—	560.0
1b	5/11-13	2	0	2	0	120.0	—	20	0	3	0	123.0	—	574.6
1c	5/11-13	0	0	4	0	108.7	—	23	0	2	0	124.4	—	452.3
2a	5/12-14	2	0	1	0	113.3	—	23	0	5	0	127.1	—	558.0
2b	5/12-14	2	0	1	0	115.0	—	19	0	4	0	125.2	—	422.0
2c	5/12-14	3	0	1	0	108.7	—	20	0	4	0	122.3	—	457.0
3a	5/13-15	2	0	1	0	123.3	—	21	0	3	0	124.4	—	427.0
3b	5/13-15	1	0	1	0	132.5	—	25	1	2	0	127.2	140.0	545.0
3c	5/13-15	1	0	2	0	123.3	—	24	0	4	0	122.7	—	529.0
Totals or averages		13	0	17	0	116.7	—	199	1	30	0	124.9	140.0	502.8
Test condition - <185 mm														
1a	5/11-13	2	0	3	0	111.0	—	18	2	0	1	118.1	166.7	445.2
1b	5/11-13	1	0	3	0	115.0	—	16	6	3	0	126.3	168.3	663.6
1c	5/11-13	1	0	2	0	105.0	—	20	4	3	0	121.5	163.7	562.0
2a	5/12-14	2	0	0	0	105.0	—	17	3	3	1	121.2	175.0	524.0
2b	5/12-14	2	0	2	0	117.5	—	23	2	3	0	124.8	175.0	613.0
2c	5/12-14	2	0	3	0	121.0	—	19	1	1	0	122.5	170.0	470.0
3a	5/13-15	1	0	1	0	135.0	—	15	7	1	1	130.9	161.9	590.0
3b	5/13-15	2	0	2	0	118.7	—	17	7	2	1	126.8	156.2	566.0
3c	5/13-15	1	0	3	0	120.0	—	13	8	0	0	128.5	163.1	553.0
Totals or averages		14	0	19	0	116.4	—	158	40	16	4	124.2	164.4	554.1

Appendix Table 6—continued

Test No.	Date	Dead fish: Number nondescaled Chin.	Dead fish: Number nondescaled Sthd.	Dead fish: Number descaled Chin.	Dead fish: Number descaled Sthd.	Dead fish: Average fork length (mm) Chin.	Dead fish: Average fork length (mm) Sthd.	Live fish: Number nondescaled Chin.	Live fish: Number nondescaled Sthd.	Live fish: Number descaled Chin.	Live fish: Number descaled Sthd.	Live fish: Average fork length (mm) Chin.	Live fish: Average fork length (mm) Sthd.	Total biomass (gm)
						Test condition - 185-230 mm								
1a	5/11-13	2	0	2	0	131.2	—	14	2	2	0	126.2	167.5	422.0
1b	5/11-13	2	0	2	0	107.5	—	16	0	5	0	126.4	—	460.0
1c	5/11-13	0	0	3	0	116.7	—	19	0	2	0	122.4	—	425.0
2a	5/12-14	4	0	3	0	121.4	—	21	0	1	0	121.8	—	507.0
2b	5/12-14	2	0	1	0	116.7	—	19	0	2	0	122.1	—	407.0
2c	5/12-14	2	0	3	0	122.0	—	17	1	3	0	122.5	190.0	452.0
3a	5/13-15	1	0	0	0	145.0	—	22	0	1	0	120.9	—	375.0
3b	5/13-15	4	0	2	0	110.8	—	21	0	2	0	119.8	—	440.0
3c	5/13-15	3	0	0	0	116.7	—	20	0	2	0	123.2	—	397.0
Totals or averages		20	0	16	0	118.7	—	169	3	20	0	122.7	175.0	431.7
						Test condition - >230 mm								
1a	5/11-13	2	0	2	0	128.7	—	10	0	3	0	123.8	—	284.0
1b	No replicate													
1c	No replicate													
2a	5/12-14	5	0	2	0	117.1	—	19	0	1	0	120.2	—	402.0
2b	5/12-14	2	0	1	0	131.7	—	18	0	2	0	127.2	—	405.0
2c	5/12-14	3	0	1	0	123.7	—	15	0	4	0	122.9	—	319.0
3a	5/13-15	1	0	2	0	121.7	—	18	0	0	0	115.0	—	289.0
3b	5/13-15	2	0	1	0	128.3	—	13	0	1	0	130.4	—	361.0
3c	5/13-15	3	0	1	0	127.5	—	18	0	1	0	126.1	—	431.0
Totals or averages		18	0	10	0	124.5	—	111	0	12	0	123.5	—	355.9

Appendix Table 7.1

15 DEC 83

1978 LOWER GRANITE – TRUCK

STEELHEAD

MARKS USED RAW 1 RAW 2 RDGN RDBL NUMBER RELEASED 47899

RECOVERY AREA	1978	1979	1980	1981	1982	1983	TOTALS	PERCENT RETURN
RIVER SYSTEM TRAPS								
BONNEVILLE TRAP	0	20	8	1	0	0	29	0.060
MCNARY TRAP	0	26	9	0	0	0	35	0.073
LOWER GRANITE TRAP	0	336	163	15	0	0	514	1.073
PRIEST RAPIDS TRAP	0	1	0	0	0	0	1	0.002
OCEAN FISHERIES								
BRITISH COLUMBIA	0	1	0	0	0	0	1	0.002
RIVER SPORT								
COLUMBIA R. BELOW SNAKE R.	0	2	7	0	0	0	9	0.018
COLUMBIA R. ABOVE SNAKE R.	0	1	0	1	0	0	2	0.004
SNAKE RIVER	1	53	25	0	0	0	79	0.164
OTHER	0	3	1	0	0	0	4	0.008
RIVER COMMERCIAL	0	1	0	1	0	0	2	0.004
INDIAN FISHERY	0	15	16	2	0	0	33	0.068
HATCHERIES								
DWORSHAK H.	0	3	40	4	0	0	47	0.098
PAHSIMEROI H.	0	46	8	0	0	0	54	0.112
HAYDEN CREEK H.	0	0	2	0	0	0	2	0.004
HELLS CANYON (OXBOW) H.	0	4	4	0	0	0	8	0.016
KOOSKIA H.	5	2	3	1	0	0	11	0.022
BIG CREEK H.	0	1	0	0	0	0	1	0.002
HATCHERIES (GENERAL)	0	2	0	0	0	0	2	0.004
TOTALS	6	517	286	25	0	0	834	1.741
PERCENT OF RECOVERY	0.7	61.9	34.2	2.9	0.0	0.0		

Appendix Table 7.2 1978 LOWER GRANITE – BARGE 15 DEC 83

STEELHEAD

MARKS USED RAW 3 RAW 4 RDRD RDRDOR NUMBER RELEASED 43770

RECOVERY AREA	1978	1979	1980	1981	1982	1983	TOTALS	PERCENT RETURN
RIVER SYSTEM TRAPS								
BONNEVILLE TRAP	0	15	8	3	0	0	26	0.059
MCNARY TRAP	0	15	12	0	0	0	27	0.061
LOWER GRANITE TRAP	0	328	162	9	0	0	499	1.140
OCEAN FISHERIES	0	0	0	0	0	0	0	0.000
RIVER SPORT								
COLUMBIA R. BELOW SNAKE R.	0	2	4	1	0	0	7	0.015
COLUMBIA R. ABOVE SNAKE R.	0	0	0	0	0	0	0	0.000
SNAKE RIVER	1	30	22	0	0	0	53	0.121
OTHER	1	5	1	0	0	0	7	0.015
RIVER COMMERCIAL	0	1	1	0	0	0	2	0.004
INDIAN FISHERY	0	12	31	3	1	0	47	0.107
HATCHERIES								
DWORSHAK H.	0	3	41	2	0	0	46	0.105
PAHSIMEROI H.	0	30	7	0	0	0	37	0.084
RAPID RIVER H.	0	2	0	0	0	0	2	0.004
HAYDEN CREEK H.	0	0	1	0	0	0	1	0.002
HELLS CANYON (OXBOW) H.	0	6	1	0	0	0	7	0.015
KOOSKIA H.	0	1	12	0	0	0	13	0.029
TOTALS	2	450	303	18	1	0	774	1.768
PERCENT OF RECOVERY	0.2	58.1	39.1	2.3	0.1	0.0		

Appendix Table 7.3 1978 LITTLE GOOSE - TAILRACE 15 DEC 83

STEELHEAD

MARKS USED LAPI1 YWBRBR LAPI2 ORGNRD LAPI3 LAPI4 ORPK NUMBER RELEASED 30364

RECOVERY AREA	1978	1979	1980	1981	1982	1983	TOTALS	PERCENT RETURN
RIVER SYSTEM TRAPS								
BONNEVILLE TRAP	0	2	3	1	0	0	6	0.019
MCNARY TRAP	0	3	2	0	0	0	5	0.016
LOWER GRANITE TRAP	0	48	18	1	0	0	67	0.220
OCEAN FISHERIES	0	0	0	0	0	0	0	0.000
RIVER SPORT								
COLUMBIA R. BELOW SNAKE R.	0	1	0	0	0	0	1	0.003
COLUMBIA R. ABOVE SNAKE R.	0	0	0	0	0	0	0	0.000
SNAKE RIVER	0	4	5	0	0	0	9	0.029
OTHER	0	0	3	0	0	0	3	0.009
RIVER COMMERCIAL	0	0	0	0	0	0	0	0.000
INDIAN FISHERY	0	0	3	0	0	0	3	0.009
HATCHERIES								
DWORSHAK H.	0	0	1	0	0	0	1	0.003
PAHSIMEROI H.	0	3	0	0	0	0	3	0.009
KOOSKIA H.	0	0	2	0	0	0	2	0.006
TOTALS	0	61	37	2	0	0	100	0.329
PERCENT OF RECOVERY	0.0	61.0	37.0	2.0	0.0	0.0		

15 DEC 83

Appendix Table 7.4 1978 LITTLE GOOSE – TRUCK

STEELHEAD

MARKS USED RAJ 1 RAJ 3 RDOR RD NUMBER RELEASED 35875

RECOVERY AREA	1978	1979	1980	1981	1982	1983	TOTALS	PERCENT RETURN
RIVER SYSTEM TRAPS								
BONNEVILLE TRAP	0	10	14	1	0	0	25	0.069
MCNARY TRAP	0	17	5	1	0	0	23	0.064
LOWER GRANITE TRAP	0	253	105	7	0	0	365	1.017
PRIEST RAPIDS TRAP	0	1	0	0	0	0	1	0.002
OCEAN FISHERIES	0	0	0	0	0	0	0	0.000
RIVER SPORT								
COLUMBIA R. BELOW SNAKE R.	0	0	1	0	0	0	1	0.002
COLUMBIA R. ABOVE SNAKE R.	0	0	0	0	0	0	0	0.000
SNAKE RIVER	4	16	16	1	0	0	37	0.103
OTHER	0	2	1	0	0	0	3	0.008
RIVER COMMERCIAL	0	0	1	1	0	0	2	0.005
INDIAN FISHERY	0	13	10	1	0	0	24	0.066
HATCHERIES								
DWORSHAK H.	0	2	13	1	0	0	16	0.044
PAHSIMEROI H.	0	13	2	0	0	0	15	0.041
RAPID RIVER H.	0	1	0	0	0	0	1	0.002
HELLS CANYON (OXBOW) H.	0	1	0	0	0	0	1	0.002
KOOSKIA H.	0	0	6	0	0	0	6	0.016
TOTALS	4	329	174	13	0	0	520	1.449
PERCENT OF RECOVERY	0.7	63.2	33.4	2.5	0.0	0.0		

Appendix Table 7.5 1978 LITTLE GOOSE - TRUCK - 10PPT SALT 15 DEC 83

STEELHEAD

MARKS USED RAJ 2 RAJ 4 RDLG ORGNYW NUMBER RELEASED 32170

RECOVERY AREA	1978	1979	1980	1981	1982	1983	TOTALS	PERCENT RETURN
RIVER SYSTEM TRAPS								
BONNEVILLE TRAP	0	10	5	1	0	0	16	0.049
MCNARY TRAP	0	4	9	0	0	0	13	0.040
LOWER GRANITE TRAP	1	216	112	5	0	0	334	1.038
OCEAN FISHERIES								
WASHINGTON	0	0	2	0	0	0	2	0.006
RIVER SPORT								
COLUMBIA R. BELOW SNAKE R.	0	0	2	0	0	0	2	0.006
COLUMBIA R. ABOVE SNAKE R.	0	0	0	1	0	0	1	0.003
SNAKE RIVER	0	13	34	1	0	0	48	0.149
OTHER	0	1	0	0	0	0	1	0.003
RIVER COMMERCIAL	0	0	0	0	0	0	0	0.000
INDIAN FISHERY	0	6	11	1	0	0	18	0.055
HATCHERIES								
DWORSHAK H.	0	3	14	4	0	0	21	0.065
PAHSIMEROI H.	0	12	2	0	0	0	14	0.043
HAYDEN CREEK H.	0	0	2	0	0	0	2	0.006
KOOSKIA H.	0	0	3	0	0	0	3	0.009
CHELAN H.	0	1	0	0	0	0	1	0.003
HATCHERIES (GENERAL)	0	1	0	0	0	0	1	0.003
TOTALS	1	267	196	13	0	0	477	1.482
PERCENT OF RECOVERY	0.2	55.9	41.0	2.7	0.0	0.0		

15 DEC 83

Appendix Table 7.6 1979 LOWER GRANITE – BARGE

STEELHEAD

MARKS USED RAF 1 RAF 2 RDYWOR NUMBER RELEASED 30495

RECOVERY AREA	1979	1980	1981	1982	1983	TOTALS	PERCENT RETURN
RIVER SYSTEM TRAPS							
BONNEVILLE TRAP	0	2	35	1	0	38	0.124
MCNARY TRAP	0	2	2	0	0	4	0.013
LOWER GRANITE TRAP	0	55	206	0	0	261	0.855
OCEAN FISHERIES	0	0	0	0	0	0	0.000
RIVER SPORT							
COLUMBIA R. BELOW SNAKE R.	0	8	6	0	0	14	0.045
COLUMBIA R. ABOVE SNAKE R.	0	0	1	0	0	1	0.003
SNAKE RIVER	1	18	24	0	0	43	0.141
RIVER COMMERCIAL	0	0	3	0	0	3	0.009
INDIAN FISHERY	0	13	42	0	3	58	0.190
HATCHERIES							
DWORSHAK H.	0	2	44	1	0	47	0.154
PAHSIMEROI H.	0	16	15	1	0	32	0.104
TOTALS	1	116	378	3	3	501	1.642
PERCENT OF RECOVERY	0.1	23.1	75.4	0.5	0.5		

Appendix Table 7.7

1979 LOWER GRANITE – TAILRACE STEELHEAD

15 DEC 83

MARKS USED LAK 3 LAK 4 RDYWLB

NUMBER RELEASED 21050

RECOVERY AREA	1979	1980	1981	1982	1983	TOTALS	PERCENT RETURN
RIVER SYSTEM TRAPS							
BONNEVILLE TRAP	0	1	11	0	0	12	0.057
MCNARY TRAP	0	0	1	0	0	1	0.004
LOWER GRANITE TRAP	0	19	82	0	0	101	0.479
OCEAN FISHERIES	0	0	0	0	0	0	0.000
RIVER SPORT							
COLUMBIA R. BELOW SNAKE R.	0	1	1	0	0	2	0.009
COLUMBIA R. ABOVE SNAKE R.	0	0	0	0	0	0	0.000
SNAKE RIVER	2	4	7	0	0	13	0.061
RIVER COMMERCIAL	0	0	0	0	0	0	0.000
INDIAN FISHERY	0	2	14	0	0	16	0.076
HATCHERIES							
DWORSHAK H.	0	1	26	0	0	27	0.128
PAHSIMEROI H.	0	8	7	0	0	15	0.071
RAPID RIVER H.	0	1	0	0	0	1	0.004
YAKIMA H.	0	0	1	0	0	1	0.004
HATCHERIES (GENERAL)	0	0	1	0	0	1	0.004
TOTALS	2	37	151	0	0	190	0.902
PERCENT OF RECOVERY	1.0	19.4	79.4	0.0	0.0		

Appendix Table 7.8

27 DEC 83

1980 LOWER GRANITE — BARGE

STEELHEAD

MARKS USED RAW 1 RAW 2 HOPR DYPR NUMBER RELEASED 32559

RECOVERY AREA	1980	1981	1982	1983	TOTALS	PERCENT RETURN
RIVER SYSTEM TRAPS						
BONNEVILLE TRAP	0	20	1	1	22	0.067
MCNARY TRAP	0	0	0	0	0	0.000
LOWER GRANITE TRAP	0	38	13	4	55	0.168
OCEAN FISHERIES						
OREGON	0	0	3	0	3	0.009
RIVER SPORT						
COLUMBIA R. BELOW SNAKE R.	0	3	1	0	4	0.012
COLUMBIA R. ABOVE SNAKE R.	0	0	0	0	0	0.000
SNAKE RIVER	0	3	18	0	21	0.064
RIVER COMMERCIAL	0	0	0	0	0	0.000
INDIAN FISHERY	0	6	13	6	25	0.076
HATCHERIES						
DWORSHAK H.	0	0	37	0	37	0.113
PAHSIMEROI H.	0	3	7	6	16	0.049
TOTALS	0	73	93	17	183	0.562
PERCENT OF RECOVERY	0.0	39.8	50.8	9.2		

Appendix Table 7.9

1980 LITTLE GOOSE - TAILRACE STEELHEAD

27 DEC 83

MARKS USED LAP 1 LAP 2 LAP 3 ER NUMBER RELEASED 19273

RECOVERY AREA	1980	1981	1982	1983	TOTALS	PERCENT RETURN
RIVER SYSTEM TRAPS						
BONNEVILLE TRAP	0	0	2	0	2	0.010
MCNARY TRAP	0	0	1	0	1	0.005
LOWER GRANITE TRAP	0	8	6	5	19	0.098
OCEAN FISHERIES	0	0	0	0	0	0.000
RIVER SPORT						
COLUMBIA R. BELOW SNAKE R.	0	0	1	0	1	0.005
COLUMBIA R. ABOVE SNAKE R.	0	0	0	0	0	0.000
SNAKE RIVER	0	3	6	0	9	0.046
RIVER COMMERCIAL	0	0	1	0	1	0.005
INDIAN FISHERY	0	0	4	0	4	0.020
HATCHERIES						
DWORSHAK H.	0	1	13	0	14	0.072
PAHSIMEROI H.	0	1	5	1	7	0.036
TOTALS	0	13	39	6	58	0.300
PERCENT OF RECOVERY	0.0	22.4	67.2	10.3		

Appendix Table 8.--Recovery of adult steelhead at hatcheries upstream from Lower Granite Dam that had a coded wire tag (CWT) or a CWT in combination with a jaw tag indicating previous interception at Lower Granite Dam.

Year tagged	Dam where fish tagged as juvenile	Year class of recovery	Number of adults with only CWT	Number of adults with CWT and jaw tag	Indicated recovery efficiency at Lower Granite Dam
1978	Lower Granite	1-ocean	39	55	58.5
		2-ocean	83	29	25.9
		3-ocean	6	1	14.3
	Little Goose	1-ocean	20	14	41.2
		2-ocean	30	11	26.8
		3-ocean	3	2	40.0
1979	Lower Granite	1-ocean	26	1	3.7
		2-ocean	69	23	25.0
		3-ocean	1	0	0
1980	Lower Granite	1-ocean	4	2	33.3
		2-ocean	66	0	0
		3-ocean	----------Data not available----------		

Appendix Table 9.1 1978 MCNARY — TRUCK 27 DEC 83

STEELHEAD

MARKS USED RAV 1 RAV 2 GM GMWH PUYWYW NUMBER RELEASED 20416

RECOVERY AREA	1978	1979	1980	1981	1982	1983	TOTALS	PERCENT RETURN
RIVER SYSTEM TRAPS								
BONNEVILLE TRAP	0	15	29	8	0	0	52	0.254
MCNARY TRAP	0	19	45	3	0	0	67	0.328
LOWER GRANITE TRAP	0	111	74	2	0	0	187	0.915
PRIEST RAPIDS TRAP	0	21	7	0	0	0	28	0.137
OCEAN FISHERIES								
BRITISH COLUMBIA	0	1	0	0	0	0	1	0.004
RIVER SPORT								
COLUMBIA R. BELOW SNAKE R.	0	1	2	0	0	0	3	0.014
COLUMBIA R. ABOVE SNAKE R.	0	17	24	2	0	0	43	0.210
SNAKE RIVER	0	9	13	0	0	0	22	0.107
OTHER	0	0	2	0	0	0	2	0.009
RIVER COMMERCIAL	0	0	1	0	0	0	1	0.004
INDIAN FISHERY	0	0	4	1	0	0	5	0.024
HATCHERIES								
DWORSHAK H.	0	0	5	1	0	0	6	0.029
PAHSIMEROI H.	0	1	2	0	0	0	3	0.014
RAPID RIVER H.	0	0	1	0	0	0	1	0.004
CHELAN H.	0	2	0	0	0	0	2	0.009
WELLS H.	0	3	0	0	0	0	3	0.014
RINGOLD H.	0	0	1	1	0	0	2	0.009
TOTALS	0	200	210	18	0	0	428	2.096
PERCENT OF RECOVERY	0.0	46.7	49.0	4.2	0.0	0.0		

Appendix Table 9.2

1978 MCNARY – TAIL RACE

STEELHEAD

27 DEC 83

MARKS USED: LAH 1 RDWRD; LAH 2; LAS 1; LAS 2; RDYWRD

NUMBER RELEASED: 15585

RECOVERY AREA	1978	1979	1980	1981	1982	1983	TOTALS	PERCENT RETURN
RIVER SYSTEM TRAPS								
BONNEVILLE TRAP	0	5	7	2	0	0	14	0.089
MCNARY TRAP	0	8	9	1	0	0	18	0.115
LOWER GRANITE TRAP	0	24	17	1	0	0	42	0.269
PRIEST RAPIDS TRAP	0	6	4	0	0	0	10	0.064
OCEAN FISHERIES	0	0	0	0	0	0	0	0.000
RIVER SPORT								
COLUMBIA R. BELOW SNAKE R.	0	2	2	0	0	0	4	0.025
COLUMBIA R. ABOVE SNAKE R.	0	3	6	0	0	0	9	0.057
SNAKE RIVER	0	1	2	0	0	0	3	0.019
RIVER COMMERCIAL	0	0	0	0	0	0	0	0.000
INDIAN FISHERY	0	2	2	0	0	0	4	0.025
HATCHERIES								
DWORSHAK H.	0	0	2	1	0	0	3	0.019
PAHSIMEROI H.	0	1	0	0	0	0	1	0.006
KOOSKIA H.	0	0	1	0	0	0	1	0.006
CHELAN H.	0	3	0	0	0	0	3	0.019
RINGOLD H.	0	0	1	0	0	0	1	0.006
TOTALS	0	55	53	5	0	0	113	0.725
PERCENT OF RECOVERY	0.0	48.6	46.9	4.4	0.0	0.0		

Appendix Table 9.3

1979 MCNARY — TRUCK

STEELHEAD

27 DEC 83

MARKS USED RAB 1 RDLGPK RAB 2 RAB 3 RAB 4 SM

NUMBER RELEASED 15379

RECOVERY AREA	1979	1980	1981	1982	1983	TOTALS	PERCENT RETURN
RIVER SYSTEM TRAPS							
BONNEVILLE TRAP	0	15	30	0	0	45	0.292
MCNARY TRAP	0	15	23	0	0	38	0.247
LOWER GRANITE TRAP	0	19	38	0	0	57	0.370
PRIEST RAPIDS TRAP	0	19	6	0	0	25	0.162
OCEAN FISHERIES	0	0	0	0	0	0	0.000
RIVER SPORT							
COLUMBIA R. BELOW SNAKE R.	0	6	3	1	0	10	0.065
COLUMBIA R. ABOVE SNAKE R.	0	24	20	1	0	45	0.292
SNAKE RIVER	0	3	3	0	0	6	0.039
RIVER COMMERCIAL	0	0	0	0	0	0	0.000
INDIAN FISHERY	0	15	11	0	0	26	0.169
HATCHERIES							
DWORSHAK H.	0	0	3	0	0	3	0.019
PAHSIMEROI H.	0	4	3	1	0	8	0.052
CHELAN H.	0	0	1	0	0	1	0.006
WELLS H.	0	1	7	0	0	8	0.052
RINGOLD H.	0	0	1	0	0	1	0.006
LEAVENWORTH H.	0	1	2	0	0	3	0.019
YAKIMA H.	0	0	11	1	0	12	0.078
OTHER	0	1	0	0	0	1	0.006
TOTALS	0	123	162	4	0	289	1.879
PERCENT OF RECOVERY	0.0	42.5	56.0	1.3	0.0		

Appendix Table 9.4

1979 MCNARY – BARGE

STEELHEAD

27 DEC 83

MARKS USED RAR 1 RDPKYW RAR 2 RDYWPK RAR 3 RAR 4 RDYWLG NUMBER RELEASED 18182

RECOVERY AREA	1979	1980	1981	1982	1983	TOTALS	PERCENT RETURN
RIVER SYSTEM TRAPS							
BONNEVILLE TRAP	0	25	49	0	1	75	0.412
MCNARY TRAP	0	20	40	7	0	67	0.368
LOWER GRANITE TRAP	0	30	59	0	0	89	0.489
PRIEST RAPIDS TRAP	0	34	8	0	0	42	0.230
OCEAN FISHERIES	0	0	0	0	0	0	0.000
RIVER SPORT							
COLUMBIA R. BELOW SNAKE R.	0	5	4	1	0	10	0.054
COLUMBIA R. ABOVE SNAKE R.	0	49	31	0	0	80	0.439
SNAKE RIVER	0	4	5	0	0	9	0.049
RIVER COMMERCIAL	0	0	0	0	0	0	0.000
INDIAN FISHERY	0	12	16	1	0	29	0.159
HATCHERIES							
DWORSHAK H.	0	0	9	0	0	9	0.049
PAHSIMEROI H.	0	3	0	0	0	3	0.016
RAPID RIVER H.	0	0	0	1	0	1	0.005
CHELAN H.	0	0	1	0	0	1	0.005
WELLS H.	0	2	5	0	0	7	0.038
WINTHROP H.	0	3	0	1	0	4	0.021
RINGOLD H.	0	0	3	0	0	3	0.016
LEAVENWORTH H.	0	0	1	0	0	1	0.005
YAKIMA H.	0	0	20	3	0	23	0.126
TOTALS	0	187	251	14	1	453	2.491
PERCENT OF RECOVERY	0.0	41.2	55.4	3.0	0.2		

Appendix Table 9.5

1979 MCNARY – TAILRACE

STEELHEAD

27 DEC 83

MARKS USED	LAS 1 RDLGYW	LAS 2	LAS 3	LAS 4	PR		NUMBER RELEASED	R595
RECOVERY AREA		1979	1980	1981	1982	1983	TOTALS	PERCENT RETURN
RIVER SYSTEM TRAPS								
BONNEVILLE TRAP		0	2	14	1	0	17	0.197
MCNARY TRAP		0	4	4	0	0	8	0.093
LOWER GRANITE TRAP		0	6	8	0	0	14	0.162
PRIEST RAPIDS TRAP		0	4	0	0	0	4	0.046
OCEAN FISHERIES								
BRITISH COLUMBIA		0	1	0	0	0	1	0.011
RIVER SPORT								
COLUMBIA R. BELOW SNAKE R.		0	1	4	1	0	6	0.069
COLUMBIA R. ABOVE SNAKE R.		0	6	3	10	0	19	0.221
SNAKE RIVER		0	1	1	0	0	2	0.023
RIVER COMMERCIAL		0	0	0	0	0	0	0.000
INDIAN FISHERY		0	1	4	10	0	15	0.174
HATCHERIES								
DWORSHAK H.		0	0	3	0	0	3	0.034
PAHSIMEROI H.		0	0	2	1	0	3	0.034
HELLS CANYON (OXBOW) H.		0	0	1	0	0	1	0.011
CHELAN H.		0	0	1	0	0	1	0.011
YAKIMA H.		0	0	2	0	0	2	0.023
TOTALS		0	26	47	23	0	96	1.116
PERCENT OF RECOVERY		0.0	27.0	48.9	23.9	0.0		

Appendix Table 9.6

1980 MCNARY — TRUCK

STEELHEAD

27 DEC 83

MARKS USED RAV 1 RAV 2 NDSM DY NUMBER RELEASED 22362

RECOVERY AREA	1980	1981	1982	1983	TOTALS	PERCENT RETURN
RIVER SYSTEM TRAPS						
BONNEVILLE TRAP	0	17	5	1	23	0.102
MCNARY TRAP	0	3	11	0	14	0.062
LOWER GRANITE TRAP	0	11	6	1	18	0.080
PRIEST RAPIDS TRAP	0	3	0	0	3	0.013
OCEAN FISHERIES	0	0	0	0	0	0.000
RIVER SPORT						
COLUMBIA R. BELOW SNAKE R.	0	2	6	0	8	0.035
COLUMBIA R. ABOVE SNAKE R.	0	1	8	0	9	0.040
SNAKE RIVER	0	1	3	0	4	0.017
RIVER COMMERCIAL	0	1	0	0	1	0.004
INDIAN FISHERY	0	4	3	2	9	0.040
HATCHERIES						
DWORSHAK H.	0	0	6	0	6	0.026
PAHSIMEROI H.	0	1	2	2	5	0.022
CHELAN H.	0	1	0	0	1	0.004
WELLS H.	0	0	7	0	7	0.031
PRIEST RAPIDS H.	0	0	9	0	9	0.040
LEAVENWORTH H.	0	2	0	0	2	0.008
YAKIMA H.	0	0	35	0	35	0.156
TOTALS	0	47	101	6	154	0.688
PERCENT OF RECOVERY	0.0	30.5	65.5	3.8		

Appendix Table 9.7 1980 MCNARY — BARGE 27 DEC 83

STEELHEAD

MARKS USED RA2 1 RA2 2 ERPR LATB NUMBER RELEASED 30382

RECOVERY AREA	1980	1981	1982	1983	TOTALS	PERCENT RETURN
RIVER SYSTEM TRAPS						
BONNEVILLE TRAP	0	25	4	0	29	0.095
MCNARY TRAP	0	2	22	0	24	0.078
LOWER GRANITE TRAP	0	19	6	1	26	0.085
PRIEST RAPIDS TRAP	0	5	0	0	5	0.016
OCEAN FISHERIES						
OREGON	0	0	3	0	3	0.009
RIVER SPORT						
COLUMBIA R. BELOW SNAKE R.	0	5	7	0	12	0.039
COLUMBIA R. ABOVE SNAKE R.	0	2	11	0	13	0.042
SNAKE RIVER	0	2	3	0	5	0.016
RIVER COMMERCIAL	0	0	0	0	0	0.000
INDIAN FISHERY	0	4	10	1	15	0.049
HATCHERIES						
DWORSHAK H.	0	0	7	0	7	0.023
PAHSIMEROI H.	0	0	2	1	3	0.009
CHELAN H.	0	1	0	0	1	0.003
WELLS H.	0	1	2	0	3	0.009
PRIEST RAPIDS H.	0	0	14	0	14	0.046
RINGOLD H.	0	0	3	0	3	0.009
LEAVENWORTH H.	0	2	0	0	2	0.006
YAKIMA H.	0	1	50	0	51	0.167
TOTALS	0	69	144	3	216	0.710
PERCENT OF RECOVERY	0.0	31.9	66.6	1.3		

Appendix Table 9.8

27 DEC 83

1980 MCNARY – TAILRACE

STEELHEAD

MARKS USED LAH 1 LAH 2 ERLA CEND NUMBER RELEASED 21291

RECOVERY AREA	1980	1981	1982	1983	TOTALS	PERCENT RETURN
RIVER SYSTEM TRAPS						
BONNEVILLE TRAP	0	8	5	0	13	0.061
MCNARY TRAP	0	0	7	0	7	0.032
LOWER GRANITE TRAP	0	10	4	4	18	0.084
PRIEST RAPIDS TRAP	0	5	0	0	5	0.023
OCEAN FISHERIES						
OREGON	0	0	1	0	1	0.004
RIVER SPORT						
COLUMBIA R. BELOW SNAKE R.	0	3	4	0	7	0.032
COLUMBIA R. ABOVE SNAKE R.	0	1	2	0	3	0.014
SNAKE RIVER	0	1	2	0	3	0.014
RIVER COMMERCIAL	0	0	0	0	0	0.000
INDIAN FISHERY	0	0	4	0	4	0.018
HATCHERIES						
DWORSHAK H.	0	0	2	0	2	0.009
WELLS H.	0	1	1	0	2	0.009
PRIEST RAPIDS H.	0	0	7	0	7	0.032
RINGOLD H.	0	0	1	0	1	0.004
YAKIMA H.	0	0	16	0	16	0.075
TOTALS	0	29	56	4	89	0.418
PERCENT OF RECOVERY	0.0	32.5	62.9	4.4		

Appendix Table 10.1

15 DEC 83

1978 LOWER GRANITE - TRUCK
SPRING/SUMMER CHINOOK

MARKS USED RAW 1 RAW 2 RDGN RDBL NUMBER RELEASED 43855

RECOVERY AREA	1978	1979	1980	1981	1982	1983	TOTALS	PERCENT RETURN
RIVER SYSTEM TRAPS								
BONNEVILLE TRAP	0	0	0	0	0	0	0	0.000
MCNARY TRAP	0	0	0	0	0	0	0	0.000
LOWER GRANITE TRAP	0	4	24	5	0	0	33	0.075
OCEAN FISHERIES	0	0	0	0	0	0	0	0.000
RIVER SPORT								
COLUMBIA R. BELOW SNAKE R.	0	0	0	0	0	0	0	0.000
COLUMBIA R. ABOVE SNAKE R.	0	0	0	0	0	0	0	0.000
SNAKE RIVER	0	0	0	1	0	0	1	0.002
RIVER COMMERCIAL	0	0	1	0	0	0	1	0.002
INDIAN FISHERY	0	0	0	0	0	0	0	0.000
HATCHERIES								
DWORSHAK H.	0	0	2	0	0	0	2	0.004
RAPID RIVER H.	0	2	2	0	0	0	4	0.009
MCCALL H.	0	0	0	1	0	0	1	0.002
DESCHUTES R. HATCHERIES	0	2	0	0	0	0	2	0.004
STREAM SURVEY	0	0	1	0	0	0	1	0.002
TOTALS	0	8	30	7	0	0	45	0.102
PERCENT OF RECOVERY	0.0	17.7	66.6	15.5	0.0	0.0		

Appendix Table 10.2 1978 LOWER GRANITE – BARGE

15 DEC 83

SPRING/SUMMER CHINOOK

MARKS USED RAW 3 RAW 4 RDRD RDRDOR NUMBER RELEASED 56546

RECOVERY AREA	1978	1979	1980	1981	1982	1983	TOTALS	PERCENT RETURN
RIVER SYSTEM TRAPS								
BONNEVILLE TRAP	0	0	0	0	0	0	0	0.000
MCNARY TRAP	0	0	0	0	0	0	0	0.000
LOWER GRANITE TRAP	0	6	50	10	0	0	66	0.116
OCEAN FISHERIES	0	0	0	0	0	0	0	0.000
RIVER SPORT								
COLUMBIA R. BELOW SNAKE R.	0	0	0	0	0	0	0	0.000
COLUMBIA R. ABOVE SNAKE R.	0	0	0	0	0	0	0	0.000
SNAKE RIVER	0	0	3	0	0	0	3	0.005
RIVER COMMERCIAL	0	0	0	1	0	0	1	0.001
INDIAN FISHERY	0	0	0	1	0	0	1	0.001
HATCHERIES								
RAPID RIVER H.	0	3	5	0	0	0	8	0.014
MCCALL H.	0	0	1	2	0	0	3	0.005
KOOSKIA H.	0	0	1	0	0	0	1	0.001
DESCHUTES R. HATCHERIES	0	0	0	1	0	0	1	0.001
HATCHERIES (GENERAL)	0	0	0	1	0	0	1	0.001
TOTALS	0	9	60	16	0	0	85	0.150
PERCENT OF RECOVERY	0.0	10.5	70.5	18.8	0.0	0.0		

Appendix Table 10.3 1978 LOWER GRANITE - TRUCK - 24HR HOLD 15 DEC 83

SPRING/SUMMER CHINOOK

MARKS USED RAIS1 ORBL NUMBER RELEASED 38685

RECOVERY AREA	1978	1979	1980	1981	1982	1983	TOTALS	PERCENT RETURN
RIVER SYSTEM TRAPS								
BONNEVILLE TRAP	0	0	0	0	0	0	0	0.000
MCNARY TRAP	0	0	0	0	1	0	1	0.002
LOWER GRANITE TRAP	0	2	3	0	0	0	5	0.012
OCEAN FISHERIES	0	0	0	0	0	0	0	0.000
RIVER SPORT	0	0	0	0	0	0	0	0.000
RIVER COMMERCIAL	0	0	0	0	0	0	0	0.000
INDIAN FISHERY	0	0	0	0	0	0	0	0.000
HATCHERIES								
RAPID RIVER H.	0	2	3	0	0	0	5	0.012
DESCHUTES R. HATCHERIES	0	0	1	0	0	0	1	0.002
TOTALS	0	4	7	0	1	0	12	0.031
PERCENT OF RECOVERY	0.0	33.3	58.3	0.0	8.3	0.0		

Appendix Table 10.4 1978 LOWER GRANITE - TRUCK - 2HR SALT

15 DEC 83

SPRING/SUMMER CHINOOK

MARKS USED RA1S2 ORDR NUMBER RELEASED 40841

RECOVERY AREA	1978	1979	1980	1981	1982	1983	TOTALS	PERCENT RETURN
RIVER SYSTEM TRAPS								
BONNEVILLE TRAP	0	0	0	0	0	0	0	0.000
MCNARY TRAP	0	0	0	0	0	0	0	0.000
LOWER GRANITE TRAP	0	1	4	0	0	0	5	0.012
OCEAN FISHERIES	0	0	0	0	0	0	0	0.000
RIVER SPORT								
COLUMBIA R. BELOW SNAKE R.	0	0	0	0	0	0	0	0.000
COLUMBIA R. ABOVE SNAKE R.	0	0	0	0	0	0	0	0.000
SNAKE RIVER	0	0	1	0	0	0	1	0.002
RIVER COMMERCIAL	0	0	0	0	0	0	0	0.000
INDIAN FISHERY	0	0	0	0	0	0	0	0.000
HATCHERIES								
MCCALL H.	0	0	0	1	0	0	1	0.002
KOOSKIA H.	0	0	1	0	0	0	1	0.002
TOTALS	0	1	6	1	0	0	8	0.019
PERCENT OF RECOVERY	0.0	12.5	75.0	12.5	0.0	0.0		

Appendix Table 10.5 **1979 LOWER GRANITE - BARGE SPRING/SUMMER CHINOOK**

15 DEC 83

MARKS USED RAF 1 RAF 2 RDYWOR NUMBER RELEASED 27336

RECOVERY AREA	1979	1980	1981	1982	1983	TOTALS	PERCENT RETURN
RIVER SYSTEM TRAPS							
BONNEVILLE TRAP	1	0	0	0	0	1	0.003
MCNARY TRAP	0	0	1	0	0	1	0.003
LOWER GRANITE TRAP	0	4	7	1	0	12	0.043
OCEAN FISHERIES							
OREGON	1	0	0	0	0	1	0.003
RIVER SPORT	0	0	0	0	0	0	0.000
RIVER COMMERCIAL	0	0	0	0	0	0	0.000
INDIAN FISHERY	0	0	2	2	0	4	0.014
HATCHERIES							
RAPID RIVER H.	0	1	7	1	0	9	0.032
MCCALL H.	0	1	1	2	0	4	0.014
DESCHUTES R. HATCHERIES	0	1	0	0	0	1	0.003
HATCHERIES (GENERAL)	0	0	1	0	0	1	0.003
TOTALS	2	7	19	6	0	34	0.124
PERCENT OF RECOVERY	5.8	20.5	55.8	17.6	0.0		

15 DEC 83

Appendix Table 10.6 1979 LOWER GRANITE - TAILRACE

SPRING/SUMMER CHINOOK

MARKS USED LAK 3 LAK 4 RDYWLB NUMBER RELEASED 25532

RECOVERY AREA	1979	1980	1981	1982	1983	TOTALS	PERCENT RETURN
RIVER SYSTEM TRAPS							
BONNEVILLE TRAP	0	0	1	1	0	2	0.007
MCNARY TRAP	0	0	0	0	0	0	0.000
LOWER GRANITE TRAP	0	0	3	0	0	3	0.011
OCEAN FISHERIES							
WASHINGTON	0	0	1	0	0	1	0.003
RIVER SPORT	0	0	0	0	0	0	0.000
RIVER COMMERCIAL	0	0	0	1	0	1	0.003
INDIAN FISHERY	0	0	0	0	0	0	0.000
HATCHERIES							
RAPID RIVER H.	1	0	0	1	0	2	0.007
HATCHERIES (GENERAL)	0	0	0	1	0	1	0.003
TOTALS	1	0	5	4	0	10	0.039
PERCENT OF RECOVERY	10.0	0.0	50.0	40.0	0.0		

Appendix Table 10.7 1980 LOWER GRANITE – BARGE

15 DEC 83

SPRING/SUMMER CHINOOK

MARKS USED RAW 1 RAW 2 HOPR DYPR NUMBER RELEASED 40719

RECOVERY AREA	1980	1981	1982	1983	TOTALS	PERCENT RETURN
RIVER SYSTEM TRAPS						
BONNEVILLE TRAP	0	0	0	0	0	0.000
MCNARY TRAP	0	0	0	0	0	0.000
LOWER GRANITE TRAP	0	0	1	0	1	0.002
OCEAN FISHERIES	0	0	0	0	0	0.000
RIVER SPORT	0	0	0	0	0	0.000
RIVER COMMERCIAL	0	0	0	0	0	0.000
INDIAN FISHERY	0	0	0	0	0	0.000
HATCHERIES						
RAPID RIVER H.	0	0	2	0	2	0.004
MCCALL H.	0	0	2	0	2	0.004
HATCHERIES (GENERAL)	0	0	2	0	2	0.004
TOTALS	0	0	7	0	7	0.017
PERCENT OF RECOVERY	0.0	0.0	100.0	0.0		

Appendix Table 10.8

1980 LOWER GRANITE - TRUCK
SPRING/SUMMER CHINOOK

15 DEC 83

MARKS USED RA3T1 RA3T3 RA2T1 PRTB

NUMBER RELEASED 32772

RECOVERY AREA	1980	1981	1982	1983	TOTALS	PERCENT RETURN
RIVER SYSTEM TRAPS						
BONNEVILLE TRAP	0	0	0	0	0	0.000
MCNARY TRAP	0	0	0	0	0	0.000
LOWER GRANITE TRAP	0	0	0	0	0	0.000
OCEAN FISHERIES	0	0	0	0	0	0.000
RIVER SPORT	0	0	0	0	0	0.000
RIVER COMMERCIAL	0	0	0	0	0	0.000
INDIAN FISHERY	0	0	0	0	0	0.000
HATCHERIES	0	0	0	0	0	0.000
TOTALS	0	0	0	0	0	0.000
PERCENT OF RECOVERY	0.0	0.0	0.0	0.0		

Appendix Table 11.1 1980 LITTLE GOOSE - TAILRACE

15 DEC 83

SPRING/SUMMER CHINOOK

MARKS USED LAP 1 LAP 2 LAP 3 ER NUMBER RELEASED 21876

RECOVERY AREA	1980	1981	1982	1983	TOTALS	PERCENT RETURN
RIVER SYSTEM TRAPS						
BONNEVILLE TRAP	0	1	0	0	1	0.004
MCNARY TRAP	0	0	0	0	0	0.000
LOWER GRANITE TRAP	0	0	0	0	0	0.000
OCEAN FISHERIES	0	0	0	0	0	0.000
RIVER SPORT	0	0	0	0	0	0.000
RIVER COMMERCIAL	0	0	0	0	0	0.000
INDIAN FISHERY	0	0	0	0	0	0.000
HATCHERIES	0	0	0	0	0	0.000
TOTALS	0	1	0	0	1	0.004
PERCENT OF RECOVERY	0.0	100.0	0.0	0.0		

15 DEC 83

Appendix Table 11.2 1981 LOWER GRANITE - BARGE
SPRING/SUMMER CHINOOK

MARKS USED CEYB NUMBER RELEASED 20363

RECOVERY AREA	1981	1982	1983	TOTALS	PERCENT RETURN
RIVER SYSTEM TRAPS					
BONNEVILLE TRAP	0	0	0	0	0.000
MCNARY TRAP	0	0	0	0	0.000
LOWER GRANITE TRAP	0	0	0	0	0.000
OCEAN FISHERIES	0	0	0	0	0.000
RIVER SPORT	0	0	0	0	0.000
RIVER COMMERCIAL	0	0	0	0	0.000
INDIAN FISHERY	0	0	0	0	0.000
HATCHERIES	0	0	0	0	0.000
TOTALS	0	0	0	0	0.000
PERCENT OF RECOVERY	0.0	0.0	0.0		

Appendix Table 11.3 **1978 LITTLE GOOSE - TRUCK - 10PPT SALT** 15 DEC 83

SPRING/SUMMER CHINOOK

MARKS USED RAJ 2 RAJ 4 RDLG ORGNYW NUMBER RELEASED 47661

RECOVERY AREA	1978	1979	1980	1981	1982	1983	TOTALS	PERCENT RETURN
RIVER SYSTEM TRAPS								
BONNEVILLE TRAP	0	0	0	0	0	0	0	0.000
MCNARY TRAP	0	0	0	0	0	0	0	0.000
LOWER GRANITE TRAP	0	0	0	1	0	0	1	0.002
OCEAN FISHERIES	0	0	0	0	0	0	0	0.000
RIVER SPORT	0	0	0	0	0	0	0	0.000
RIVER COMMERCIAL	0	0	0	0	0	0	0	0.000
INDIAN FISHERY	0	0	0	0	0	0	0	0.000
HATCHERIES								
RAPID RIVER H.	0	0	0	1	0	0	1	0.002
TOTALS	0	0	0	2	0	0	2	0.004
PERCENT OF RECOVERY	0.0	0.0	0.0	100.0	0.0	0.0		

15 DEC 83

Appendix Table 11.4 1978 LITTLE GOOSE – TRUCK

SPRING/SUMMER CHINOOK

MARKS USED RAJ 1 RAJ 3 RDOR RD NUMBER RELEASED 49391

RECOVERY AREA	1978	1979	1980	1981	1982	1983	TOTALS	PERCENT RETURN
RIVER SYSTEM TRAPS								
BONNEVILLE TRAP	0	0	0	0	0	0	0	0.000
MCNARY TRAP	0	0	0	0	0	0	0	0.000
LOWER GRANITE TRAP	0	1	2	2	0	0	5	0.010
OCEAN FISHERIES	0	0	0	0	0	0	0	0.000
RIVER SPORT	0	0	0	0	0	0	0	0.000
RIVER COMMERCIAL	0	0	0	0	0	0	0	0.000
INDIAN FISHERY	0	0	0	0	0	0	0	0.000
HATCHERIES								
RAPID RIVER H.	0	0	2	0	0	0	2	0.004
MCCALL H.	0	0	0	1	0	0	1	0.002
TOTALS	0	1	4	3	0	0	8	0.016
PERCENT OF RECOVERY	0.0	12.5	50.0	37.5	0.0	0.0		

Appendix Table 11.5 **1978 LITTLE GOOSE – TAILRACE** 15 DEC 83

SPRING/SUMMER CHINOOK

MARKS USED LAPI1 YWBRBR LAPI2 ORGNRD LAPI3 LAPI4 ORPK NUMBER RELEASED 36441

RECOVERY AREA	1978	1979	1980	1981	1982	1983	TOTALS	PERCENT RETURN
RIVER SYSTEM TRAPS								
BONNEVILLE TRAP	0	0	0	0	0	0	0	0.000
MCNARY TRAP	0	0	0	0	0	0	0	0.000
LOWER GRANITE TRAP	0	0	5	0	0	0	5	0.013
OCEAN FISHERIES	0	0	0	0	0	0	0	0.000
RIVER SPORT	0	0	0	0	0	0	0	0.000
RIVER COMMERCIAL	0	0	0	0	0	0	0	0.000
INDIAN FISHERY	0	0	0	0	0	0	0	0.000
HATCHERIES								
DWORSHAK H.	0	0	1	0	0	0	1	0.002
RAPID RIVER H.	0	0	2	1	0	0	3	0.008
MCCALL H.	0	0	1	1	0	0	2	0.005
TOTALS	0	0	9	2	0	0	11	0.030
PERCENT OF RECOVERY	0.0	0.0	81.8	18.1	0.0	0.0		

Appendix Table 12.1 1978 MCNARY – TRUCK 15 DEC 83

SPRING/SUMMER CHINOOK

MARKS USED RAV 1 RAV 2 GM GMWH PUYWYW NUMBER RELEASED 31956

RECOVERY AREA	1978	1979	1980	1981	1982	1983	TOTALS	PERCENT RETURN
RIVER SYSTEM TRAPS								
BONNEVILLE TRAP	0	0	1	2	0	0	3	0.009
MCNARY TRAP	0	0	1	2	0	0	3	0.009
LOWER GRANITE TRAP	0	3	10	1	0	0	14	0.043
OCEAN FISHERIES								
BRITISH COLUMBIA	1	0	0	0	0	0	1	0.003
WASHINGTON	2	3	0	0	0	0	5	0.015
RIVER SPORT	0	0	0	0	0	0	0	0.000
RIVER COMMERCIAL	0	1	1	1	0	0	3	0.009
INDIAN FISHERY	0	0	0	2	0	0	2	0.006
HATCHERIES								
RAPID RIVER H.	0	1	4	0	0	0	5	0.015
HAYDEN CREEK H.	0	0	1	0	0	0	1	0.003
RINGOLD H.	0	1	0	0	0	0	1	0.003
LEAVENWORTH H.	0	0	0	1	0	0	1	0.003
TOTALS	3	9	18	9	0	0	39	0.122
PERCENT OF RECOVERY	7.6	23.0	46.1	23.0	0.0	0.0		

Appendix Table 12.2 1978 MCNARY - TAILRACE 15 DEC 83

SPRING/SUMMER CHINOOK

MARKS USED LAH 1 RDDRRD LAH 2 LAS 1 LAS 2 RDYWRD NUMBER RELEASED 31376

RECOVERY AREA	1978	1979	1980	1981	1982	1983	TOTALS	PERCENT RETURN
RIVER SYSTEM TRAPS								
BONNEVILLE TRAP	0	0	0	1	0	0	1	0.003
MCNARY TRAP	0	0	0	1	0	0	1	0.003
LOWER GRANITE TRAP	0	2	2	1	0	0	5	0.015
OCEAN FISHERIES								
WASHINGTON	0	0	2	0	0	0	2	0.006
RIVER SPORT	0	0	0	0	0	0	0	0.000
RIVER COMMERCIAL	0	1	0	0	0	0	1	0.003
INDIAN FISHERY	0	0	0	2	0	0	2	0.006
HATCHERIES								
DWORSHAK H.	0	0	1	0	0	0	1	0.003
RAPID RIVER H.	0	0	1	0	0	0	1	0.003
RINGOLD H.	0	1	0	0	0	0	1	0.003
LEAVENWORTH H.	0	0	0	4	0	0	4	0.012
TOTALS	0	4	6	9	0	0	19	0.060
PERCENT OF RECOVERY	0.0	21.0	31.5	47.3	0.0	0.0		

15 DEC 83

Appendix Table 12.3 1979 MCNARY – TRUCK

SPRING/SUMMER CHINOOK

MARKS USED RA3 1 RDLGPK RA3 2 RA3 3 RA3 4 SM NUMBER RELEASED 42748

RECOVERY AREA	1979	1980	1981	1982	1983	TOTALS	PERCENT RETURN
RIVER SYSTEM TRAPS							
BONNEVILLE TRAP	5	0	2	0	0	7	0.016
MCNARY TRAP	0	0	3	0	0	3	0.007
LOWER GRANITE TRAP	0	1	1	0	0	2	0.004
OCEAN FISHERIES							
ALASKA	0	0	2	0	0	2	0.004
BRITISH COLUMBIA	0	5	3	0	0	8	0.018
WASHINGTON	0	12	7	0	0	19	0.044
OREGON	1	6	3	0	0	10	0.023
RIVER SPORT							
COLUMBIA R. BELOW SNAKE R.	0	0	0	0	0	0	0.000
COLUMBIA R. ABOVE SNAKE R.	0	2	1	2	0	5	0.011
SNAKE RIVER	0	0	0	0	0	0	0.000
RIVER COMMERCIAL	0	0	2	2	0	4	0.009
INDIAN FISHERY	0	0	20	3	0	23	0.053
HATCHERIES							
RAPID RIVER H.	0	1	0	0	0	1	0.002
RINGOLD H.	0	0	7	0	0	7	0.016
LEAVENWORTH H.	0	0	2	0	0	2	0.004
ENTIAT H.	0	0	1	0	0	1	0.002
TOTALS	6	27	54	7	0	94	0.219
PERCENT OF RECOVERY	6.3	28.7	57.4	7.4	0.0		

Appendix Table 12.4 1979 MCNARY - BARGE 15 DEC 83

SPRING/SUMMER CHINOOK

MARKS USED RAR 1 RDPKYW RAR 2 RDYWPK RAR 3 RAR 4 RDYWLG NUMBER RELEASED 40126

RECOVERY AREA	1979	1980	1981	1982	1983	TOTALS	PERCENT RETURN
RIVER SYSTEM TRAPS							
BONNEVILLE TRAP	4	1	0	0	0	5	0.012
MCNARY TRAP	0	0	0	0	0	0	0.000
LOWER GRANITE TRAP	0	3	2	0	0	5	0.012
OCEAN FISHERIES							
BRITISH COLUMBIA	0	0	2	0	0	2	0.004
WASHINGTON	0	11	3	0	0	14	0.034
OREGON	0	2	0	0	0	2	0.004
RIVER SPORT							
COLUMBIA R. BELOW SNAKE R.	0	0	2	0	0	2	0.004
COLUMBIA R. ABOVE SNAKE R.	0	0	2	0	0	2	0.004
SNAKE RIVER	0	0	0	0	0	0	0.000
RIVER COMMERCIAL	1	0	1	1	0	3	0.007
INDIAN FISHERY	0	0	2	0	0	2	0.004
HATCHERIES							
RINGOLD H.	1	0	2	0	0	3	0.007
STREAM SURVEY	0	0	2	0	0	2	0.004
TOTALS	6	17	18	1	0	42	0.104
PERCENT OF RECOVERY	14.2	40.4	42.8	2.3	0.0		

15 DEC 83

Appendix Table 12.5 1979 MCNARY - TAILRACE

SPRING/SUMMER CHINOOK

MARKS USED LA5 1 RDLGYW LA5 2 LA5 3 LA5 4 PR NUMBER RELEASED 31229

RECOVERY AREA	1979	1980	1981	1982	1983	TOTALS	PERCENT RETURN
RIVER SYSTEM TRAPS							
BONNEVILLE TRAP	6	0	3	0	0	9	0.028
MCNARY TRAP	0	0	1	0	0	1	0.003
LOWER GRANITE TRAP	0	1	2	0	0	3	0.009
OCEAN FISHERIES							
BRITISH COLUMBIA	0	1	1	0	0	2	0.006
WASHINGTON	0	8	3	0	0	11	0.035
OREGON	0	2	4	0	0	6	0.019
RIVER SPORT							
COLUMBIA R. BELOW SNAKE R.	0	0	0	0	0	0	0.000
COLUMBIA R. ABOVE SNAKE R.	0	0	0	1	0	1	0.003
SNAKE RIVER	0	0	0	0	0	0	0.000
RIVER COMMERCIAL	1	0	3	2	0	6	0.019
INDIAN FISHERY	0	0	12	1	0	13	0.041
HATCHERIES							
RAPID RIVER H.	0	0	1	0	0	1	0.003
RINGOLD H.	0	0	7	2	0	9	0.028
LEAVENWORTH H.	0	0	1	4	0	5	0.016
STREAM SURVEY	0	0	1	1	0	2	0.006
TOTALS	7	12	39	11	0	69	0.220
PERCENT OF RECOVERY	10.1	17.3	56.5	15.9	0.0		

Appendix Table 12.6 1980 MCNARY - TRUCK 15 DEC 83

SPRING/SUMMER CHINOOK

MARKS USED RAV 1 RAV 2 NDSM DY NUMBER RELEASED 40938

RECOVERY AREA	1980	1981	1982	1983	TOTALS	PERCENT RETURN
RIVER SYSTEM TRAPS						
BONNEVILLE TRAP	0	3	2	1	6	0.014
MCNARY TRAP	1	0	2	0	3	0.007
LOWER GRANITE TRAP	0	0	0	0	0	0.000
OCEAN FISHERIES						
WASHINGTON	0	7	7	0	14	0.034
OREGON	0	1	0	0	1	0.002
RIVER SPORT						
COLUMBIA R. BELOW SNAKE R.	0	0	0	0	0	0.000
COLUMBIA R. ABOVE SNAKE R.	0	0	0	0	0	0.000
SNAKE RIVER	0	0	1	0	1	0.002
RIVER COMMERCIAL	0	0	0	0	0	0.000
INDIAN FISHERY	0	1	0	0	1	0.002
HATCHERIES						
RINGOLD H.	0	2	0	0	2	0.004
TOTALS	1	14	12	1	28	0.068
PERCENT OF RECOVERY	3.5	50.0	42.8	3.5		

Appendix Table 12.7 1980 MCNARY – BARGE

15 DEC 83

SPRING/SUMMER CHINOOK

MARKS USED RA2 1 RA2 2 ERPR LATB NUMBER RELEASED 44023

RECOVERY AREA	1980	1981	1982	1983	TOTALS	PERCENT RETURN
RIVER SYSTEM TRAPS						
BONNEVILLE TRAP	0	0	2	0	2	0.004
MCNARY TRAP	2	0	0	0	2	0.004
LOWER GRANITE TRAP	0	0	0	0	0	0.000
OCEAN FISHERIES						
BRITISH COLUMBIA	0	2	0	0	2	0.004
WASHINGTON	0	3	1	0	4	0.009
OREGON	0	0	1	0	1	0.002
RIVER SPORT						
COLUMBIA R. BELOW SNAKE R.	0	0	0	0	0	0.000
COLUMBIA R. ABOVE SNAKE R.	0	0	1	0	1	0.002
SNAKE RIVER	0	0	0	0	0	0.000
RIVER COMMERCIAL	0	0	0	0	0	0.000
INDIAN FISHERY	0	0	0	0	0	0.000
HATCHERIES						
LEAVENWORTH H.	0	0	2	0	2	0.004
TOTALS	2	5	7	0	14	0.031
PERCENT OF RECOVERY	14.2	35.7	50.0	0.0		

Appendix Table 12.8 1980 MCNARY - TAILRACE 15 DEC 83

SPRING/SUMMER CHINOOK

MARKS USED LAH 1 LAH 2 ERLA CEND NUMBER RELEASED 46585

RECOVERY AREA	1980	1981	1982	1983	TOTALS	PERCENT RETURN
RIVER SYSTEM TRAPS						
BONNEVILLE TRAP	0	1	1	0	2	0.004
MCNARY TRAP	0	0	0	0	0	0.000
LOWER GRANITE TRAP	0	0	0	0	0	0.000
OCEAN FISHERIES						
BRITISH COLUMBIA	0	1	0	0	1	0.002
WASHINGTON	0	2	1	0	3	0.006
OREGON	0	1	0	0	1	0.002
RIVER SPORT						
COLUMBIA R. BELOW SNAKE R.	0	0	0	0	0	0.000
COLUMBIA R. ABOVE SNAKE R.	0	0	2	0	2	0.004
SNAKE RIVER	0	0	0	0	0	0.000
RIVER COMMERCIAL	0	0	0	0	0	0.000
INDIAN FISHERY	0	0	0	0	0	0.000
HATCHERIES						
RINGOLD H.	0	1	1	0	2	0.004
TOTALS	0	6	5	0	11	0.023
PERCENT OF RECOVERY	0.0	54.5	45.4	0.0		

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Appendix Table 13.1 **1978 MCNARY - TRUCK**

FALL CHINOOK

MARKS USED RAIC1 RAIC3 ORGNLG LG NUMBER RELEASED 40361

RECOVERY AREA	1978	1979	1980	1981	1982	1983	TOTALS	PERCENT RETURN
RIVER SYSTEM TRAPS								
BONNEVILLE TRAP	0	21	4	5	13	1	44	0.109
MCNARY TRAP	0	59	15	11	10	0	95	0.235
ICE HARBOR TRAP	0	0	1	3	1	0	5	0.012
LOWER GRANITE TRAP	0	5	0	0	0	0	5	0.012
PRIEST RAPIDS TRAP	0	0	0	0	1	0	1	0.002
OCEAN FISHERIES								
ALASKA	0	0	4	61	30	0	95	0.235
BRITISH COLUMBIA	0	10	13	28	9	0	60	0.148
WASHINGTON	0	0	2	0	1	0	3	0.007
OREGON	0	0	0	2	0	0	2	0.004
RIVER SPORT								
COLUMBIA R. BELOW SNAKE R.	0	3	0	1	0	0	4	0.009
COLUMBIA R. ABOVE SNAKE R.	0	1	0	0	0	0	1	0.002
SNAKE RIVER	0	0	0	0	0	0	0	0.000
RIVER COMMERCIAL	0	6	8	5	5	0	24	0.059
INDIAN FISHERY	0	3	3	22	2	0	30	0.074
HATCHERIES								
DWORSHAK H.	0	0	1	0	0	0	1	0.002
BONNEVILLE H.	0	0	0	0	1	0	1	0.002
WELLS H.	0	4	0	11	1	0	16	0.039
PRIEST RAPIDS H.	0	13	0	16	1	0	30	0.074
STREAM SURVEY	0	0	0	2	6	0	8	0.019
TOTALS	0	125	51	167	81	1	425	1.052
PERCENT OF RECOVERY	0.0	29.4	12.0	39.2	19.0	0.2		

Appendix Table 13.2 **1978 MCNARY - TAILRACE**

17 FEB 84

FALL CHINOOK

MARKS USED LA1F1 LA1F3 PUGNBL YWXYGN NUMBER RELEASED 38137

RECOVERY AREA	1978	1979	1980	1981	1982	1983	TOTALS	PERCENT RETURN
RIVER SYSTEM TRAPS								
BONNEVILLE TRAP	0	4	1	4	2	0	11	0.028
MCNARY TRAP	0	7	2	1	1	0	11	0.028
LOWER GRANITE TRAP	0	1	0	0	0	0	1	0.002
OCEAN FISHERIES								
ALASKA	0	0	0	16	2	0	18	0.047
BRITISH COLUMBIA	0	2	3	4	3	0	12	0.031
WASHINGTON	0	0	1	1	0	0	2	0.005
RIVER SPORT								
COLUMBIA R. BELOW SNAKE R.	0	1	0	1	0	0	2	0.005
COLUMBIA R. ABOVE SNAKE R.	0	0	0	1	0	0	1	0.002
SNAKE RIVER	0	0	0	0	0	0	0	0.000
RIVER COMMERCIAL	0	0	3	0	0	0	3	0.007
INDIAN FISHERY	0	2	1	2	1	0	6	0.015
HATCHERIES								
WELLS H.	0	1	0	1	1	0	3	0.007
PRIEST RAPIDS H.	0	1	0	5	0	0	6	0.015
STREAM SURVEY	0	0	0	0	1	0	1	0.002
TOTALS	0	19	11	36	11	0	77	0.201
PERCENT OF RECOVERY	0.0	24.6	14.2	46.7	14.2	0.0		

17 FEB 84

Appendix Table 13.3 1979 MCNARY - TRUCK

FALL CHINOOK

MARKS USED	RA3 1 RAI+3 RDPKOR	RA3 2 RAI+4 LBYWLG	RA3 3 SM RDLBYW	RAI+1 RDLGPK	RAI+2 RDPKLB	NUMBER RELEASED	132919

RECOVERY AREA	1979	1980	1981	1982	1983	TOTALS	PERCENT RETURN
RIVER SYSTEM TRAPS							
BONNEVILLE TRAP	0	26	9	25	6	66	0.049
MCNARY TRAP	0	34	5	4	0	43	0.032
LOWER GRANITE TRAP	0	0	0	0	0	0	0.000
PRIEST RAPIDS TRAP	0	0	0	11	0	11	0.008
OCEAN FISHERIES							
ALASKA	0	0	11	157	75	243	0.182
BRITISH COLUMBIA	0	10	31	45	11	97	0.072
WASHINGTON	0	0	5	4	1	10	0.007
OREGON	0	0	0	1	0	1	0.000
RIVER SPORT							
COLUMBIA R. BELOW SNAKE R.	0	1	0	0	0	1	0.000
COLUMBIA R. ABOVE SNAKE R.	0	2	0	0	0	2	0.001
SNAKE RIVER	0	0	0	0	0	0	0.000
RIVER COMMERCIAL	0	2	5	15	3	25	0.018
INDIAN FISHERY	0	1	9	19	12	41	0.030
HATCHERIES							
DWORSHAK H.	0	0	1	0	0	1	0.000
BONNEVILLE H.	0	0	0	2	0	2	0.001
WELLS H.	0	0	5	17	0	22	0.016
PRIEST RAPIDS H.	0	0	21	35	0	56	0.042
STREAM SURVEY	0	0	1	37	7	45	0.033
TOTALS	0	76	103	372	115	666	0.501
PERCENT OF RECOVERY	0.0	11.4	15.4	55.8	17.2		

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Appendix Table 13.4 1979 MCNARY - TAILRACE

FALL CHINOOK

MARKS USED: LAS 1, LAIM3, LBYWLB; LAS 2, LAIM4, RDLBPK; LAS 3, PR; LAIM1, RDLGYW; LAIM2, RDYWPK

NUMBER RELEASED 112718

RECOVERY AREA	1979	1980	1981	1982	1983	TOTALS	PERCENT RETURN
RIVER SYSTEM TRAPS							
BONNEVILLE TRAP	0	4	0	5	1	10	0.008
MCNARY TRAP	0	2	0	1	0	3	0.002
LOWER GRANITE TRAP	0	0	0	0	0	0	0.000
PRIEST RAPIDS TRAP	0	0	0	3	0	3	0.002
OCEAN FISHERIES							
ALASKA	0	0	3	16	10	29	0.025
BRITISH COLUMBIA	0	1	2	5	0	8	0.007
WASHINGTON	0	0	0	1	0	1	0.000
RIVER SPORT	0	0	0	0	0	0	0.000
RIVER COMMERCIAL	0	0	3	4	0	7	0.006
INDIAN FISHERY	0	0	2	1	2	5	0.004
HATCHERIES							
DWORSHAK H.	0	0	1	0	0	1	0.000
WELLS H.	0	0	1	3	0	4	0.003
PRIEST RAPIDS H.	0	0	8	7	0	15	0.013
RINGOLD H.	0	0	0	1	0	1	0.000
STREAM SURVEY	0	0	0	2	0	2	0.001
TOTALS	0	7	20	49	13	89	0.078
PERCENT OF RECOVERY	0.0	7.8	22.4	55.0	14.6		

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Appendix Table 13.5 1980 MCNARY – TRUCK

FALL CHINOOK

MARKS USED RA1C1 RA1C3 LA HO NUMBER RELEASED 80213

RECOVERY AREA	1980	1981	1982	1983	TOTALS	PERCENT RETURN
RIVER SYSTEM TRAPS						
BONNEVILLE TRAP	0	19	8	27	54	0.067
MCNARY TRAP	0	12	18	24	54	0.067
LOWER GRANITE TRAP	0	0	1	2	3	0.003
OCEAN FISHERIES						
ALASKA	0	0	10	120	130	0.162
BRITISH COLUMBIA	0	1	34	14	49	0.061
WASHINGTON	0	1	5	6	12	0.014
RIVER SPORT	0	0	0	0	0	0.000
RIVER COMMERCIAL	0	1	2	12	15	0.018
INDIAN FISHERY	0	4	8	32	44	0.054
HATCHERIES						
WELLS H.	0	2	0	0	2	0.002
PRIEST RAPIDS H.	0	4	2	0	6	0.007
STREAM SURVEY	0	0	10	14	24	0.029
TOTALS	0	44	98	251	393	0.489
PERCENT OF RECOVERY	0.0	11.1	24.9	63.8		

Appendix Table 13.6 1980 MCNARY - TAILRACE 17 FEB 84

FALL CHINOOK

MARKS USED LAIF1 LAIF3 CE CEDY NUMBER RELEASED 84587

RECOVERY AREA	1980	1981	1982	1983	TOTALS	PERCENT RETURN
RIVER SYSTEM TRAPS						
BONNEVILLE TRAP	0	4	1	7	12	0.014
MCNARY TRAP	0	0	1	0	1	0.001
ICE HARBOR TRAP	0	2	0	0	2	0.002
LOWER GRANITE TRAP	0	1	0	0	1	0.001
OCEAN FISHERIES						
ALASKA	0	0	5	27	32	0.037
BRITISH COLUMBIA	0	0	11	4	15	0.017
WASHINGTON	0	0	0	3	3	0.003
OREGON	0	0	1	0	1	0.001
RIVER SPORT	0	0	0	0	0	0.000
RIVER COMMERCIAL	0	0	0	2	2	0.002
INDIAN FISHERY	0	1	2	16	19	0.022
HATCHERIES						
PRIEST RAPIDS H.	0	4	3	0	7	0.008
STREAM SURVEY	0	0	6	6	12	0.014
TOTALS	0	12	30	65	107	0.126
PERCENT OF RECOVERY	0.0	11.2	28.0	60.7		

Appendix Table 13.7

1981 MCNARY - TRUCK
FALL CHINOOK

17 FEB 84

MARKS USED RAI+1 RAI+2 RAI+3 RAI+4 031733 NUMBER RELEASED 42924

RECOVERY AREA	1981	1982	1983	TOTALS	PERCENT RETURN
RIVER SYSTEM TRAPS					
BONNEVILLE TRAP	0	2	12	14	0.032
MCNARY TRAP	0	38	12	50	0.116
LOWER GRANITE TRAP	0	1	0	1	0.002
OCEAN FISHERIES					
ALASKA	0	2	0	2	0.004
BRITISH COLUMBIA	0	7	16	23	0.053
OREGON	1	0	0	1	0.002
RIVER SPORT					
COLUMBIA R. BELOW SNAKE R.	0	0	0	0	0.000
COLUMBIA R. ABOVE SNAKE R.	0	0	2	2	0.004
SNAKE RIVER	0	0	0	0	0.000
RIVER COMMERCIAL	0	0	2	2	0.004
INDIAN FISHERY	0	0	7	7	0.016
HATCHERIES					
PRIEST RAPIDS H.	0	2	0	2	0.004
STREAM SURVEY	0	1	5	6	0.013
TOTALS	1	53	56	110	0.256
PERCENT OF RECOVERY	0.9	48.1	50.9		

Appendix Table 13.8 1981 MCNARY - TAILRACE

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FALL CHINOOK

MARKS USED LAIM1 LAIM2 LAIM3 LAIM4 031732 NUMBER RELEASED 42580

RECOVERY AREA	1981	1982	1983	TOTALS	PERCENT RETURN
RIVER SYSTEM TRAPS					
BONNEVILLE TRAP	0	1	0	1	0.002
MCNARY TRAP	0	4	0	4	0.009
LOWER GRANITE TRAP	0	1	0	1	0.002
OCEAN FISHERIES					
BRITISH COLUMBIA	0	1	2	3	0.007
RIVER SPORT	0	0	0	0	0.000
RIVER COMMERCIAL	0	0	0	0	0.000
INDIAN FISHERY	0	0	5	5	0.011
HATCHERIES					
PRIEST RAPIDS H.	0	1	0	1	0.002
STREAM SURVEY	0	1	2	3	0.007
TOTALS	0	9	9	18	0.042
PERCENT OF RECOVERY	0.0	50.0	50.0		

Appendix Table 13.9

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1982 MCNARY - TAILRACE

FALL CHINOOK

MARKS USED	LAH 1	LAH 2	LAIF1	LAIF2	LAIF3	NUMBER RELEASED	38683
	LAIF4	LAIC1	LAIC2	LAIC3	LAIC4		
	LAIM1	LAIM2	LAIM3	LAIM4	231609		
	231611	231613					

RECOVERY AREA	1982	1983	TOTALS	PERCENT RETURN
RIVER SYSTEM TRAPS				
BONNEVILLE TRAP	0	5	5	0.012
MCNARY TRAP	0	1	1	0.002
LOWER GRANITE TRAP	0	1	1	0.002
OCEAN FISHERIES	0	0	0	0.000
RIVER SPORT	0	0	0	0.000
RIVER COMMERCIAL	0	0	0	0.000
INDIAN FISHERY	0	0	0	0.000
HATCHERIES	0	0	0	0.000
TOTALS	0	7	7	0.018
PERCENT OF RECOVERY	0.0	100.0		

Appendix Table 13.10 1982 MCNARY - TRUCK

FALL CHINOOK

17 FEB 84

MARKS USED RAV 1 231614 RAV 2 RAV 3 231610 231612 NUMBER RELEASED 39693

RECOVERY AREA	1982	1983	TOTALS	PERCENT RETURN
RIVER SYSTEM TRAPS				
BONNEVILLE TRAP	0	15	15	0.037
MCNARY TRAP	0	11	11	0.027
LOWER GRANITE TRAP	0	0	0	0.000
OCEAN FISHERIES	0	0	0	0.000
RIVER SPORT	0	0	0	0.000
RIVER COMMERCIAL	0	0	0	0.000
INDIAN FISHERY	0	2	2	0.005
HATCHERIES	0	0	0	0.000
TOTALS	0	28	28	0.070
PERCENT OF RECOVERY	0.0	100.0		