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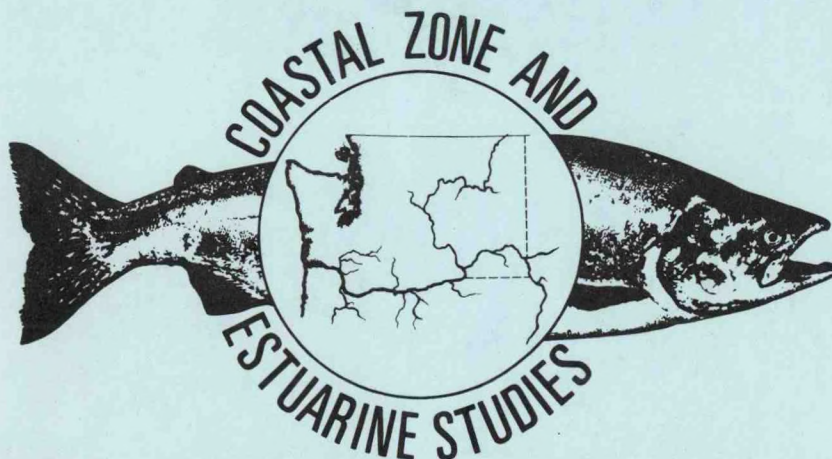
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Effects of Flow on the Migratory Behavior and Survival of Juvenile Fall and Summer Chinook Salmon in John Day Reservoir

by
David R. Miller
and
Carl W. Sims

June 1984

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ABSTRACT

The National Marine Fisheries Service in cooperation with the Bonneville Power Administration is conducting a 6-year study of the effects of instream river flow on the passage time, survival, and migrational behavior of juvenile fall and summer (0-age) chinook salmon in John Day Reservoir. In 1983, the final year of juvenile sampling in the reservoir, research activities continued to refine flow/travel time relationships and distributional behavior of 0-age chinook salmon.

Fifteen groups (72,559 fish) of marked 0-age chinook salmon were wire-tagged, branded, and released into the tailrace at McNary Dam, and thirty-two groups (22,206 fish) were branded and released into the reservoir at various other sites.

Sampling at John Day Dam, utilizing the airlift pump system in the B and C slots of Turbine Intake Unit 3, captured 82,698 subyearling chinook salmon including 640 mark recoveries. Additional marks (458) were recovered from purse seine samples taken at various sites throughout the reservoir.

Weekly mean fork lengths of 0-age chinook salmon captured at McNary and John Day Dams and in the reservoir by purse seine ranged from 103 mm in mid-June to 166 mm in mid-December. Fish captured at the John Day Dam monitoring facility and by purse seine throughout the reservoir were in excellent condition. Preliminary analysis of stomach samples taken in 1982 and 1983 from purse seine catches indicates active feeding is taking place in the reservoir.

The average passage time of the fastest moving marked 0-age chinook salmon from McNary Dam to John Day Dam was 11 days (based on 25th percentile of mark recaptures). The average reservoir residence time (calculated from the median date of the mark recoveries from each group at John Day Dam) was 22 days.

Regression analysis was used to develop a description of the relationship of river flow to the rate of downstream movement of 0-age chinook salmon in John Day Reservoir in 1983. The slope of this line and the correlation coefficient (R) were not significantly different from zero.

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INTRODUCTION

The National Marine Fisheries Service (NMFS), in cooperation with the Bonneville Power Administration (BPA), is conducting a 6-year study of the effects of flow on the migratory behavior and survival of juvenile fall and summer chinook salmon in John Day Reservoir (Lake Umatilla).

The objectives of the study are to:

1. Define the effect of instream flow on the passage time and rate of downstream movement of 0-age chinook salmon in John Day Reservoir.
2. Define the effect of instream flow levels on the distribution and passage behavior of 0-age chinook salmon in John Day Reservoir.
3. Define the effect of reservoir passage time on relative survival of 0-age chinook salmon.

The study is divided into 3 years (1981-83) of juvenile marking and recovery of marks to define flow/travel time relationships and 3 years (1984-86) of recoveries of marked adults to define flow/survival relationships. This report summarizes results of research activities conducted during the final year of juvenile marking and recovery.

METHODS

Groups of 0-age chinook salmon from early (16 June - 8 July), middle (13 - 29 July), and late (5 August - 2 September) segments of the 1983 migration entering John Day Reservoir were collected at McNary Dam, wire-tagged, freeze branded, and released into the tailrace below the dam. Recoveries of these marks from the airlift fish collection facility at John Day Dam (Sims et al. 1981) were used to define reservoir travel and residence time.

Travel time for each release group was computed based on the first 25% of marked recoveries. This ensured that travel time and rate of movement data points calculated for each release group were based on actively migrating fish and adjusted for the possibility that later release groups may contain larger percentages of nonsmolting fish than earlier releases.

Average instream flows affecting each release group were calculated by averaging the daily river discharge at McNary Dam for the 10-day period following each release. Regression analysis was used to define the significance of travel time/flow relationships.

Residence time was calculated from the median date of the mark recoveries from each group. The use of median recovery dates ensures that the slower nonsmolting fish are included in the computation. The residence times calculated must be considered to be minimum since they were based only on recoveries at John Day Dam through 16 December. Surviving fish still in the reservoir were not included. Subsequent recaptures, if any, at John Day Dam in the spring and summer of 1984 would increase the average residence time calculations.

An 11-m power block purse seiner (NMFS research vessel Columbia) was used to sample 0-age chinook salmon in John Day Reservoir from 29 June to 29 September 1983. Sampling extended from the John Day Dam forebay [River Kilometer (Rkm) 348] to just above Crow Butte, (Rkm 430). Six sampling transects were established, with sets made near each shore and at mid-reservoir (Table 1). These transects were grouped into two major areas of the reservoir: lower (Rkm 348-378) and middle (Rkm 385-431).

Recoveries of marked fish by the purse seine from releases in the McNary Dam tailrace and from the Columbia were used to define 0-age chinook

Table 1.--Purse seine sampling transect locations by river mile and kilometer in John Day Reservoir, 1983.

River Mile (RM)	River Kilometer (Rkm)	Area
216	348	John Day Dam Forebay
222	357	Goodnoe
232	373	Blalock
242	389	Arlington
253	407	Willow Creek
267	430	Crow Butte

Table 2.--Summary of 0-age chinook salmon wire-tagged, cold branded, and released in the McNary Dam tailrace and recovered at John Day Dam, 1983.

Branda/ Label	Release date	Total released	Total recaptured	Date of first recapture	Mean recapture date	Date of last recapture	Minimum residence ^{b/} time (days)
LA 7T 1	06/16	4,839	41	06/20	07/02	09/19	17
LA 7T 3	06/23	5,196	23	07/02	07/12	08/06	20
LD 7T 1	07/01	5,010	28	07/09	07/15	07/27	15
LA 2L 1	07/08	4,988	35	07/16	07/22	11/28	15
LA 2L 3	07/13	5,005	20	07/16	07/21	08/08	9
LD 2L 1	07/15	5,014	42	07/18	07/23	12/05	9
LA 2T 1	07/20	5,019	60	07/24	08/09	11/30	21
LA 2T 3	07/23	5,009	62	07/23	08/25	12/14	34
LD 2T 1	07/27	4,659	41	07/31	09/01	11/28	37
LA 2X 1	07/29	5,939	71	08/02	09/05	12/02	39
LA 2X 3	08/05	4,657	60	08/09	09/02	12/05	29
LA 7S 1	08/12	4,850	39	08/16	09/09	11/23	29
LA 7S 3	08/19	4,878	47	08/22	09/11	12/02	24
LD 7S 1	08/26	5,641	54	08/30	09/11	12/07	17
LD 7S 3	09/02	1,855	17	09/08	09/11	11/16	10
TOTAL		72,559	640				

^{a/} Position, brand, and orientation. LA indicates left anterior, LD indicates left dorsal. Orientation refers to rotation of the brand around its center point, (i.e., 1 equals normal orientation ID, 2 equals **B**, 3 equals **QI**, and 4 equals **A**).

^{b/} Difference between median date of recovery and release date.

salmon distribution and migrational behavior in John Day Reservoir.

Purse seine catches were processed aboard the Columbia. Catches at John Day Dam were processed on site. All fish were anesthetized with MS-222, counted, and examined for marks. Those fish to be marked were freeze branded. A subsample was measured for fork-length. After processing, all fish were allowed to recover from the anesthetic and released on site.

RESULTS AND DISCUSSION

A total of 94,765 0-age chinook salmon were marked and released into John Day Reservoir in 1983. Fifteen groups (72,559 fish) were wire-tagged, branded, and released into the tailrace at McNary Dam (Table 2). Of the fifteen groups released, four groups (20,033) were released during the early migration (29 June - 8 July), six groups (30,645) during the middle migration (13 - 29 July), and five groups (21,881) during the late migration (5 August - 2 September). An additional 22,206 fish from purse seine catches were marked and released at the six reservoir sampling transects (Table 3).

Total passage of 0-age chinook salmon at John Day Dam was estimated at 7.5 million fish. The airlift collection facility at John Day Dam captured 82,698 0-age chinook salmon between 27 May and 16 December 1983 (Table 4). Airlift catches included 640 marked fish from the McNary tailrace releases and 411 marked fish from purse seine releases. Detailed mark recovery information is included in Appendix Table A-1.

Purse seine sampling began on 29 June and was maintained on a 3-day/week schedule, when possible, through 29 September. One hundred

Table 3.--Summary of 0-age chinook salmon captured by purse seining, cold branded, and released at various locations in John Day Reservoir, 6 July - 29 September 1983.

Mark ^{a/}	Release date	Number released	Release site (RKm)
LA E 4	07/06	363	373
LA E 3	07/07	534	348
LA E 2	07/12	1,108	407
LA E 1	07/13	1,655	430
LD E 1	07/14	1,786	389
LD E 2	07/20	979	357
LD E 3	07/21	1,902	348
LA HE 1	07/26	735	407
LA HE 2	07/27	289	430
LA HE 3	07/28	1,751	389
LA HE 4	08/02	1,194	373
LD HE 1	08/03	604	357
LD HE 2	08/04	931	348
LD HE 3	08/10	853	430
LD HE 4	08/11	1,139	389
LP HE 1	08/16	1,011	373
LP HE 2	08/17	1,047	357
LP HE 3	08/18	411	348
LP HE 4	08/23	319	407
RA HE 1	08/24	788	430
RA HE 2	09/01	305	348
RA HE 3	09/06	572	407
RA HE 4	09/07	552	348
RD HE 1	09/08	194	389
RD HE 2	09/13	280	373
RD HE 3	09/14	170	357
RD HE 4	09/15	39	348
RP HE 1	09/20	171	407
RP HE 2	09/21	146	430
RP HE 3	09/22	213	389
RP HE 4	09/28	62	357
LA D 1	09/29	103	348
TOTAL		22,206	




^{a/} Position, brand, and orientation. LA indicates left anterior, LD indicates left dorsal. Orientation refers to rotation of the brand around its center point, (i.e., 1 equals normal orientation ID, 2 equals , 3 equals , and 4 equals ).

Table 4.--Weekly catch of subyearling chinook salmon from Turbine Intake Gatewells 3A and 3B at John Day Dam and weekly estimated passage by John Day Dam 27 May to 16 December 1983.

Date	Catch	Estimated passage
05/27 - 06/03	270	45,829
06/04 - 06/10	2,753	412,341
06/11 - 06/17	4,044	512,139
06/18 - 06/24	6,752	707,343
06/25 - 07/01	4,936	470,382
07/02 - 07/08	901	73,327
07/09 - 07/15	11,055	1,001,349
07/16 - 07/22	19,671	2,057,546
07/23 - 07/29	5,336	544,709
07/30 - 08/05	4,201	425,782
08/06 - 08/12	4,008	268,181
08/13 - 08/19	2,618	160,021
08/20 - 08/26	2,073	134,381
08/27 - 09/02	2,273	128,138
09/03 - 09/09	3,069	154,372
09/10 - 09/16	2,077	102,076
09/17 - 09/23	861	41,973
09/24 - 09/30	290	12,291
10/01 - 10/07	382	17,416
10/08 - 10/14	395	17,932
10/15 - 10/21	270	12,716
10/22 - 10/28	154	10,884
10/29 - 11/04	450	20,117
11/05 - 11/11	441	21,723
11/12 - 11/18	864	38,726
11/19 - 11/25	674	42,763
11/26 - 12/02	1,199	68,133
12/03 - 12/09	461	28,702
12/10 - 12/16	220	11,292
TOTAL	82,698	7,542,584

thirty-five (135) purse seine sets were made, and 22,484 0-age chinook salmon were captured (Tables 5 and 6). Purse seine catches included 345 marks from the McNary Dam tailrace releases and 113 marks from purse seine releases. Detailed purse seine mark recovery information is included in Appendix Table A-2.

Mean fork lengths of 0-age chinook salmon captured at McNary and John Day Dams and at purse seine sites throughout John Day Reservoir are shown in Table 7. Mean fork length increased from 103 mm (mid-June) to 166 mm (mid-December). Gross observations of subyearling migrants as they were examined for marks at both John Day Dam and in reservoir purse seine catches showed the fish to be in excellent condition. Preliminary analysis of stomach samples taken at the purse seine sites in 1982 and 1983 demonstrated a low number of empty stomachs and a high percentage of stomachs that were \geq half full. These data and the growth rate indicated by the weekly mean fork lengths indicated that the fish were actively feeding in the reservoir.

Incidental purse seine catches of species other than juvenile salmonids in John Day Reservoir are summarized in Table 8. Juvenile shad were again the most abundant species taken, only small numbers of other species were caught. Numbers and distribution of squawfish were similar to the 1982 catch.

Migrational Behavior

The 1983 migration of 0-age chinook salmon began to enter John Day Reservoir in early May and peaked at John Day Dam in mid-July. Fish were still being taken at John Day Dam on 16 December when monitoring was discontinued. The average reservoir residence time, based on median date

Table 5.--A summary of purse seine catches of subyearling chinook salmon in John Day Reservoir by major area, 26 June to 29 September 1983.

Date	Area	No. sets	Total catch	Catch/set
June-July	Lower (Rkm 348-378)	24	4,056	193
	Middle (Rkm 385-431)	17	7,324	431
August	Lower	31	5,198	168
	Middle	8	3,099	387
September	Lower	36	961	27
	Middle	<u>19</u>	<u>1,846</u>	<u>97</u>
	TOTAL	135	22,484	
	GRAND AVERAGE			167

Table 6.--Weekly summary of purse seine catches in John Day Reservoir, 26 June to 29 September 1983.

Date	No. sets	Chinook salmon subyearling catch	Catch/set
06/26 - 07/02	9	278	31
07/03 - 07/09	8	897	112
07/10 - 07/16	8	4,549	569
07/17 - 07/23	7	2,881	412
07/24 - 07/30	9	2,775	308
07/31 - 08/06	14	2,729	195
08/07 - 08/13	4	1,992	498
08/14 - 08/20	17	2,469	145
08/21 - 08/27	4	1,107	277
08/28 - 09/03	7	305	44
09/04 - 09/10	8	1,318	165
09/11 - 09/17	17	489	29
09/18 - 09/24	11	530	48
09/25 - 10/01	<u>12</u>	<u>165</u>	<u>14</u>
TOTAL	135	22,484	
GRAND AVERAGE			167

Table 7.--Weekly mean fork lengths in millimeters of 0-age chinook salmon captured at McNary and John Day Dam and by purse seine in John Day Reservoir, 18 June to 16 December 1983.

Date	Fork length (mm)		
	McNary Dam catch	John Day Dam catch	Purse Seine catch
06/11 - 06/17	99	109	
06/18 - 06/24	97	107	
06/25 - 07/01	93	98	96
07/02 - 07/08	104	107	103
07/09 - 07/15	116	115	110
07/16 - 07/22	113	114	115
07/23 - 07/29	121	116	110
07/30 - 08/05	128	120	120
08/06 - 08/12	129	128	126
08/13 - 08/19	131	133	129
08/20 - 08/26	135	134	136
08/27 - 09/02	142	137	135
09/03 - 09/09		141	142
09/10 - 09/16		145	147
09/17 - 09/23		147	146
09/24 - 09/30		149	148
10/01 - 10/07		149	
10/08 - 10/14		148	
10/15 - 10/21		153	
10/22 - 10/28		152	
10/29 - 11/04		153	
11/05 - 11/11		154	
11/12 - 11/18		157	
11/19 - 11/25		160	
11/26 - 12/02		159	
12/03 - 12/09		164	
12/10 - 12/16		166	

Table 8.--Catch summary of salmonid and nonsalmonid fish captured by purse seine in John Day Reservoir, June to September 1983.

Species	Number taken				Total
	June	July	August	September	
Subyearling chinook salmon	278	11,102	8,297	2,807	22,484
Yearling chinook salmon	10	11			
Jack chinook salmon				3	3
Adult chinook salmon				11	11
Juvenile sockeye salmon	3	32	22	3	60
Juvenile steelhead		1	2	1	4
Adult steelhead	1	2	11	38	52
Juvenile black bass		1			1
Juvenile whitefish		11	3		14
Adult whitefish			1		1
Juvenile shad			3,050	26,500	29,550
Adult shad		11	44		55
Adult squawfish		17	62	11	90
Adult sucker		1			1
Peamouth chubs		4			4
Chiselmouth chubs		9	1		10

of mark recaptures, of branded 0-age chinook salmon released into the McNary Dam tailrace in 1983, was 21 days (range 3-155+) (Table 9). As in 1981 and 1982, the average reservoir residence time in 1983 suggests that a large percentage of the 0-age chinook salmon entering John Day Reservoir are not actively smolting.

Purse seine recoveries of marked subyearling chinook salmon released at various locations within the reservoir (excluding the McNary Dam tailrace releases) also indicate, as in 1981 and 1982, that a significant number of the fish are in a nonsmolting condition. Nearly 60% of the recoveries (66 of 111) were either at the same site (19) or upstream (47) from the original release site (Table 10). Such behavior is not representative of actively smolting fish.

Flow/Travel Time Relationships

Travel time (based on 25th percentile of mark recaptures) from McNary Dam to John Day Dam was calculated for the 15 groups of marked fish released into the McNary Dam tailrace in 1983 (Table 11). Average river flow for the 10-day period following each release ranged from 120 to 243 thousand feet³/second (kcfs). The average travel time ranged from 7 to 20 days. Considerable variance in travel time occurred regardless of river flow. Overall, average travel time for the early (13 d), middle (14 d), and late (11 d) groups were nearly the same, although river flows declined from an average of 212 kcfs for the early group to 146 kcfs for the late group.

A regression line was constructed by plotting the travel time in hours for each release group against the appropriate river flow for the 15 groups

Table 9.--Average residence time (based on median date of recapture) of marked yearling and subyearling chinook salmon in John Day Reservoir based on median date of recovery at John Day Dam, 1981, 1982, and 1983. Range appears in parentheses.

Marked fish	Residence time in days		
	1981	1982	1983
Yearling chinook salmon ^{a/}	6(3-20)		
Subyearling chinook salmon	22(3-160)	23(3-164)	21(3-155)
Early run--16 June - 8 July	16(3-50)	12(5-164)	17(4-155)
Mid run--13 July - 5 August	24(3-160)	25(3-124)	25(3-155)
Late run--12 August - 2 September	30(3-130)	33(5-125)	20(3-120)

^{a/} Data from Sims et al. (1982).

Table 10.--Purse seine recoveries of marked 0-age chinook salmon taken at or above their reservoir release site.

Release site	Recapture site	Date released	Date recaptured	Time interval (days)	Distance traveled upstream (Km)
RKm 373	389	07/06	07/14	9	16
	389	07/06	07/14	9	16
348	430	07/07	07/27	21	82
	389		07/28	22	41
	373		08/02	27	25
	357		08/17	42	9
407	430	07/12	08/24	44	23
389	430	07/14	08/10	28	41
	389		08/11	29	0
	389		08/11	29	0
	407		09/06	55	18
357	407	07/20	07/26	7	50
	357		08/03	15	0
348	407	07/21	07/26	6	59
	407		07/26	6	59
	389		07/28	8	41
	373		08/02	13	25
	357		08/03	14	9
	357		08/03	14	9
	357		08/03	14	9
	348		08/04	15	0
	389		08/11	22	41
	373		08/16	27	25
	373		08/16	27	25
	430		08/24	35	82
	430		08/24	35	82
	373		09/13	55	25
	348		09/15	57	0
	430		09/21	63	82
407	430	07/26	08/24	30	23
430	430	07/27	08/10	15	0
	430		08/24	29	0
	430		08/24	29	0
389	389	07/28	08/11	15	0
	430		08/24	28	41
	407		09/06	41	18
	430		09/07	42	41
	389		09/22	57	0
373	373	08/02	08/16	15	0
357	373	08/03	08/16	14	16
	373		08/16	14	16
	357		08/17	15	0
	357		08/17	15	0

Table 10.--cont.

Release site	Recapture site	Date released	Date recaptured	Time interval (days)	Distance traveled upstream (Km)
	407		09/20	49	50
	357		09/28	57	0
348	389	08/04	08/11	8	41
	373		08/16	13	25
	373		08/16	13	25
	348		08/18	15	0
	348		08/18	15	0
	407		09/06	34	59
	357		09/14	42	9
	430		09/21	49	82
430	430	08/10	08/24	15	0
373	407	08/16	08/23	8	34
	389		09/08	24	16
357	357	08/17	09/14	29	0
	407		09/20	35	50
348	407	08/18	09/06	20	59
	407		09/06	20	59
	430		09/07	21	82
	389		09/08	22	41
407	407	08/23	09/06	15	0
	430		09/07	16	23
348	373	09/01	09/13	13	25
	389		09/22	22	41

Table 11.--Recoveries of 0-age chinook salmon (wire-tagged, cold branded, and released in McNary Dam tailrace, 24 June to 3 September 1983) at John Day Dam.

Brand	Release date	Average river ^{a/} flow (Kcfs)	Total recapture	Recapture date ^{b/}	Travel (days)	Time (hours)
LA 7T 1	06/16	243	41	06/25	10	232
LA 7T 3	06/23	209	23	07/11	19	443
LD 7T 1	07/01	196	28	07/11	11	253
LA 2L 1	07/08	198	35	07/19	12	275
Average		212			13	301
LA 2L 3	07/13	217	20	07/19	7	158
LD 2L 1	07/05	211	42	07/21	7	172
LA 2T 1	07/20	212	60	07/30	11	253
LA 2T 3	07/23	205	62	08/11	20	466
LD 2T 1	07/27	202	41	08/12	17	417
LA 2X 1	07/29	193	71	08/16	19	463
Average		207			14	322
LA 2X 3	08/05	171	60	08/15	11	254
LA 7S 1	08/12	165	39	08/27	16	372
LA 7S 3	08/19	145	47	08/29	11	272
LD 7S 1	08/26	127	54	09/03	9	210
LD 7S 3	09/02	120	17	09/09	8	180
Average		146			11	258

^{a/} For the 10-day period following each release date. Daily average river discharges at McNary Dam from 1 June to 30 September 1983 are given in Appendix A.

^{b/} 25th percentile.

in 1983 (Figure 1). The regression coefficient b (slope) of the line $\hat{y} = 95.8 + 0.53x$ was examined for significance by testing the null hypothesis that the population regression coefficient is equal to zero ($H_0: b=0$). This was done by applying a sample t -test according to the formula: $t = \frac{b-B}{S_b}$ where b = slope and S_b = standard error of the regression coefficient. The 15 data points developed showed a t value of 1.02. For a two-sided test of significance with 13 degrees of freedom with $\alpha = 0.05$, the table of t gave a value of ± 1.771 . Therefore, $H_0: b=0$ was accepted. Thus the slope (b) of this line did not possess a significant statistical difference from zero, and we found, as we did in 1981 and 1982, that there was no statistical evidence to indicate that river flows affected the rates of migration of 0-age chinook salmon migrating through John Day Reservoir (Miller and Sims 1983).

Flow/Survival Relationships

Samples of the three segments of the 0-age chinook salmon migration (early, middle, and late) entering John Day Reservoir in 1983 were wire-tagged and released into the McNary Dam tailrace. Adult returns from these releases will be used to determine relative survival of each segment. By plotting the survival estimates against the appropriate river flows, a regression line will be developed to determine if a significant flow/survival relationship existed.

SUMMARY AND CONCLUSIONS

1. Fifteen groups of 0-age chinook salmon (72,559 fish) were wire-tagged and branded at McNary Dam and released into the McNary Dam

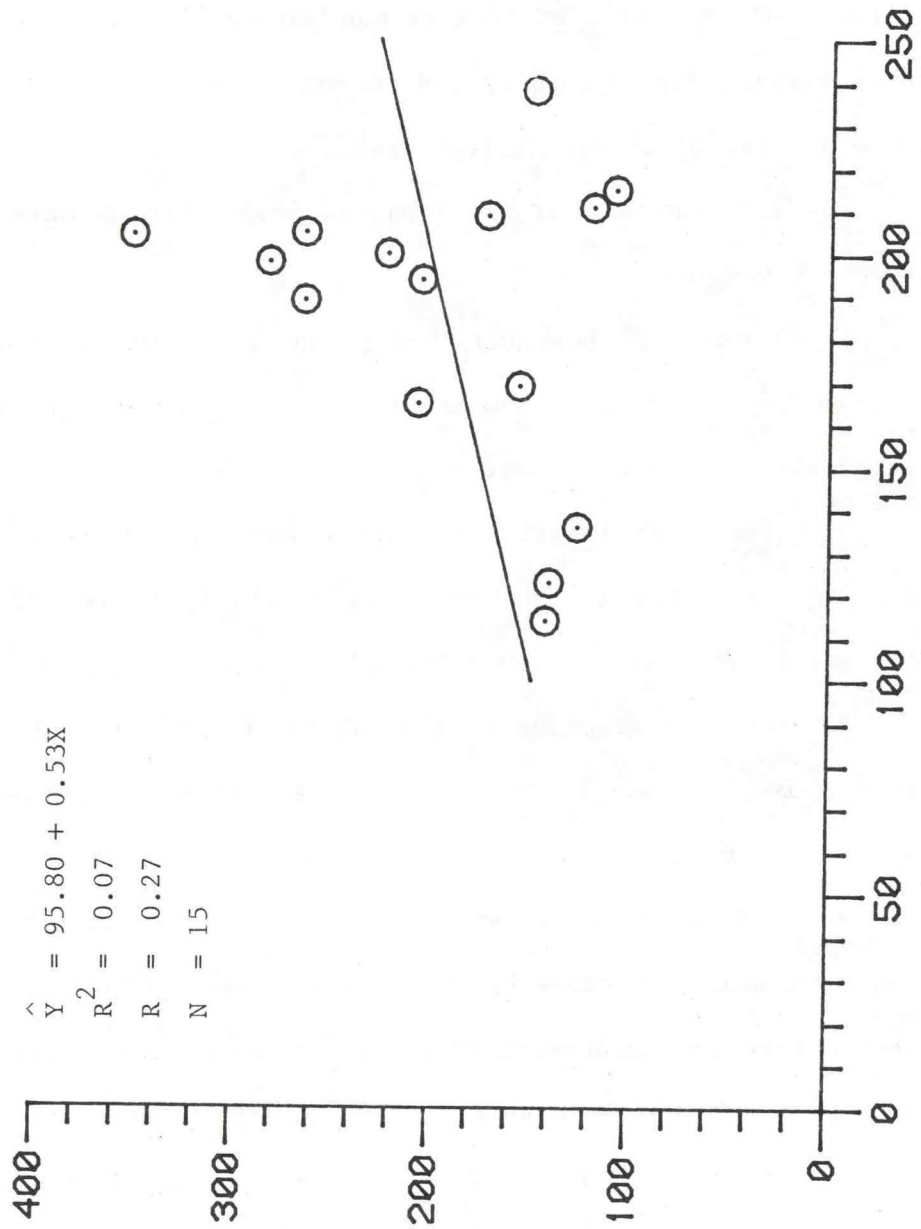


Figure 1.--Relationship of river flow to travel time of 0-age chinook salmon through John Day Reservoir (McNary Dam tailrace to John Day Dam), 1983.

tailrace during the period 16 June - 2 September 1983.

2. Additional mark releases of 22,206 purse seine captured 0-age chinook salmon were made at the six reservoir sampling transects.

3. The airlift collection facility in Turbine Unit 3, John Day Dam captured 82,698 0-age chinook salmon between 27 May and 16 December 1983. Total passage during this period, based on these collections, was estimated to be approximately 7.5 million fish.

4. Six hundred and forty marked 0-age chinook salmon were recovered at John Day Dam.

5. Between 29 June and 29 September, 135 purse seine sets were made in John Day Reservoir. Purse seine catches totaled 22,484 0-age chinook salmon with 458 mark recoveries.

6. Mean fork lengths of 0-age chinook salmon captured at McNary and John Day Dams and in the John Day Reservoir increased from 103 mm in mid-June to 166 mm in mid-December.

7. Gross examination of the subyearling migrants at John Day Dam and purse seine catches in the reservoir showed the fish to be in excellent condition. Preliminary analysis of stomach samples taken in 1982 and 1983 from purse seine catches demonstrated low numbers of empty stomachs and a high percentage of stomachs that were \geq half full. This would tend to substantiate the hypothesis that large numbers of 0-age chinook salmon are rearing in John Day Reservoir and may not be actively smolting.

8. The average residence time in John Day Reservoir for marked 0-age chinook salmon released into the McNary Dam tailrace was 21 days.

9. Sixty percent of purse seine mark recaptures of 0-age chinook salmon were made at or above the original release sites.

10. Length of residence and the amount of upstream movement suggests large numbers of subyearling migrants in John Day Reservoir may not be actively migrating.

11. Regression analysis based on 15 data points developed in 1983 provides no statistically significant evidence to indicate that river flows are affecting the rates of downstream movement or residence times of 0-age chinook salmon in John Day Reservoir.

ACKNOWLEDGEMENTS

Support for this research came from the regions electrical ratepayers through Bonneville Power Administration.

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APPENDIX A

BRAND RECAPTURE AND RIVER DISCHARGE DATA

Appendix Table A1.--Brand recapture summary, 0-age chinook salmon, John Day Dam (Turbine Unit 3), 1983.

Brand ^a /	Release site	Number released	Date released	Recaptures		Date recapture
				No.	Cumulative	
LA 7T 1	Rkm 470 (McNary Dam)	4,839	06/16	1	1	06/20
				3	4	06/21
				4	8	06/22
				3	11	06/25
				8	19	06/27
				1	20	06/29
				1	21	07/02
				1	22	07/08
				2	24	07/09
				1	25	07/10
				1	26	07/11
				2	28	07/13
				1	29	07/14
				6	35	07/15
				2	37	07/16
				1	38	07/17
				1	39	07/26
				1	40	08/07
				1	41	09/19
LA 7T 3	Rkm 470	5,196	06/23	1	1	07/02
				1	2	07/08
				3	5	07/09
				5	10	07/11
				2	12	07/12
				3	15	07/13
				1	16	07/14
				1	17	07/15
				2	19	07/16
				1	20	07/17
				1	21	07/19
1	22	07/20				
1	23	08/06				
LD 7T 1	Rkm 470	5,010	07/01	3	3	07/09
				1	4	07/10
				3	7	07/11
				2	9	07/12
				3	12	07/13
				1	13	07/14
				1	14	07/15
				4	18	07/16

Appendix Table A1.--cont.

Brand ^a /	Release site	Number released	Date released	Recaptures		Date recapture
				No.	Cumulative	
				5	23	07/17
				1	24	07/18
				3	27	07/20
				1	28	07/27
LA 2L 1	RKm 470	4,988	07/08	1	1	07/16
				3	4	07/17
				3	7	07/18
				3	10	07/19
				5	15	07/20
				2	17	07/21
				2	19	07/22
				3	22	07/23
				1	23	07/26
				3	26	07/27
				2	28	07/30
				1	29	08/01
				1	30	08/08
				1	31	08/23
				1	32	08/30
				2	34	09/09
				1	35	11/28
LA 2L 3	RKm 470	5,005	07/13	2	2	07/16
				1	3	07/18
				3	6	07/19
				3	9	07/20
				2	11	07/21
				2	13	07/22
				1	14	07/26
				2	16	07/30
				1	17	07/31
				1	18	08/05
				1	19	08/07
				1	20	08/08
LD 2L 1	RKm 470	5,014	07/15	1	1	07/18
				2	3	07/19
				1	4	07/20
				8	12	07/21
				8	20	07/22
				1	21	07/23
				1	22	07/25
				2	24	07/27
				2	26	07/28

Appendix Table A1.--cont.

Brand ^a /	Release site	Number released	Date released	Recaptures		Date recapture
				No.	Cumulative	
				1	27	07/29
				1	28	07/30
				1	29	07/31
				1	30	08/01
				1	31	08/02
				1	32	08/03
				1	33	08/05
				1	34	08/07
				1	35	08/08
				1	36	08/11
				1	37	08/12
				1	38	08/17
				1	39	09/05
				1	40	09/11
				1	41	10/06
				1	42	12/05
LA 2T 1	RKm 470	5,019	07/20	1	1	07/24
				4	5	07/25
				1	6	07/27
				3	9	07/28
				4	13	07/29
				4	17	07/30
				1	18	07/31
				3	21	08/01
				1	22	08/03
				7	29	08/08
				2	31	08/09
				2	33	08/10
				1	34	08/12
				1	35	08/14
				2	37	08/19
				2	39	08/24
				1	40	08/27
				1	41	08/28
				1	42	08/29
				1	43	08/30
				1	44	08/31
				1	45	09/01
				1	46	09/02
				2	48	09/05
				1	49	09/07
				1	50	09/08
				1	51	09/09
				2	53	09/11
				1	54	09/16

Appendix Table A1.--cont.

Brand ^a /	Release site	Number released	Date released	Recaptures		Date recapture
				No.	Cumulative	
				2	56	10/13
				1	57	11/14
				2	59	11/23
				1	60	11/30
LA 2T 3	RKm 470	5,009	07/23	1	1	07/28
				1	2	07/29
				5	7	07/30
				2	9	08/01
				1	10	08/06
				1	11	08/07
				2	13	08/08
				1	14	08/09
				1	15	08/10
				2	17	08/11
				3	20	08/12
				1	21	08/14
				1	22	08/16
				1	23	08/18
				1	24	08/19
				3	27	08/21
				2	29	08/23
				1	30	08/24
				1	31	08/25
				1	32	08/27
				1	33	08/30
				1	34	08/31
				2	36	09/01
				3	39	09/02
				1	40	09/03
				1	41	09/04
				2	43	09/05
				1	44	09/08
				3	47	09/10
				6	53	09/11
				2	55	09/12
				1	56	09/26
				1	57	10/04
				1	58	10/24
				2	60	11/16
				1	61	11/28
				1	62	12/14

Appendix Table A1.--Cont.

Brand ^a /	Release site	Number released	Date released	Recaptures		Date recapture				
				No.	Cumulative					
LD 2T 1	RKm 470	4,659	07/27	1	1	07/31				
				1	2	08/07				
				5	7	08/08				
				3	10	08/10				
				1	11	08/12				
				1	12	08/13				
				1	13	08/14				
				1	14	08/15				
				1	15	08/19				
				1	16	08/20				
				2	18	08/21				
				1	19	08/22				
				1	20	08/24				
				1	21	09/01				
				1	22	09/02				
				1	23	09/04				
				2	25	09/08				
				1	26	09/09				
				1	27	09/11				
				1	28	09/18				
				2	30	09/22				
				2	32	09/30				
				1	33	10/13				
				1	34	10/31				
				2	36	11/02				
				3	39	11/14				
				1	40	11/21				
				1	41	11/28				
				LA 2X 1	RKm 470	5,939	07/29	2	2	08/02
								2	4	08/03
								1	5	08/05
								3	8	08/07
								1	9	08/10
								1	10	08/11
								1	11	08/12
								3	14	08/13
								2	16	08/14
								2	18	08/16
								1	19	08/20
								3	22	08/21
								1	23	08/22
2	25	08/23								
5	30	08/24								
1	31	08/27								
1	32	08/28								

Appendix Table A1.--cont.

Brand ^a /	Release site	Number released	Date released	Recaptures		Date recapture
				No.	Cumulative	
				1	33	08/29
				1	34	08/30
				1	35	08/31
				3	38	09/05
				1	39	09/07
				1	40	09/08
				3	43	09/09
				3	46	09/10
				7	53	09/11
				1	54	09/12
				1	55	09/17
				1	56	09/18
				1	57	09/19
				1	58	09/20
				1	59	10/04
				1	60	10/05
				1	61	10/17
				1	62	10/19
				2	64	10/20
				1	65	10/21
				1	66	11/04
				1	67	11/11
				1	68	11/23
				1	69	11/24
				2	71	12/02
LA 2X 3	RKm 470	4,657	08/05	1	1	08/09
				1	2	08/10
				5	7	08/11
				4	11	08/12
				3	14	08/13
				1	15	08/15
				1	16	08/18
				1	17	08/19
				2	19	08/20
				1	20	08/22
				2	22	08/23
				3	25	08/24
				2	27	08/29
				1	28	09/01
				2	30	09/02
				2	32	09/05
				1	33	09/07
				1	34	09/08
				2	36	09/09
				1	37	09/10

Appendix Table A1.--cont.

Brand ^a /	Release site	Number released	Date released	Recaptures		Date recapture
				No.	Cumulative	
				3	40	09/11
				1	41	09/16
				1	42	09/17
				1	43	09/20
				1	44	09/21
				1	45	09/22
				1	46	09/27
				3	49	10/03
				1	50	10/20
				1	51	11/07
				1	52	11/16
				1	53	11/21
				4	57	11/28
				1	58	11/30
				1	59	12/02
				1	60	12/05
LA 7S 1	RKm 470	4,850	08/12	1	1	08/16
				2	3	08/17
				1	4	08/18
				2	6	08/21
				3	9	08/24
				2	11	08/27
				3	14	08/29
				1	15	09/03
				1	16	09/06
				1	17	09/08
				5	22	09/09
				4	26	09/10
				4	30	09/11
				1	31	09/20
				1	32	10/05
				1	33	10/07
				1	34	10/20
				1	35	10/31
				1	36	11/21
				3	39	11/23
LA 7S 3	RKm 470	4,878	08/19	1	1	08/22
				4	5	08/23
				3	8	08/24
				1	9	08/25
				1	10	08/28
				4	14	08/29
				2	16	08/30
				2	18	09/05

Appendix Table A1.--cont.

Brand ^a /	Release site	Number released	Date released	Recaptures		Date recapture
				No.	Cumulative	
				1	19	09/06
				1	20	09/08
				1	21	09/10
				5	26	09/11
				2	28	09/12
				1	29	09/13
				2	31	09/16
				1	32	09/17
				3	35	09/18
				1	36	09/19
				1	37	09/21
				2	39	09/22
				1	40	10/03
				1	41	10/31
				1	42	11/07
				2	44	11/16
				1	45	11/28
				2	47	12/02
LD 7S 1	RKm 470	5,641	08/26	1	1	08/30
				4	5	08/31
				4	9	09/01
				3	12	09/02
				1	13	09/03
				5	18	09/05
				2	20	09/06
				2	22	09/07
				1	23	09/08
				1	24	09/09
				2	26	09/10
				1	27	09/11
				1	28	09/12
				1	29	09/16
				2	31	09/18
				1	32	09/19
				1	33	09/21
				2	35	09/22
				1	36	09/26
				1	37	09/30
				1	38	10/17
				1	39	10/20
				2	41	10/31
				2	43	11/07
				1	44	11/11
				2	46	11/14
				1	47	11/16

Appendix Table A1.--cont.

Brand ^a /	Release site	Number released	Date released	Recaptures		Date recapture
				No.	Cumulative	
				3	50	11/18
				1	51	11/28
				1	52	11/30
				1	53	12/02
				1	54	12/07
LD 7S 3	RKm 470	1,855	09/02	3	3	09/08
				2	5	09/09
				6	11	09/11
				1	12	09/12
				1	13	10/06
				1	14	10/12
				1	15	10/31
				1	16	11/11
				1	17	11/16
LA E 4	RKm 373 (purse seine)	363	07/06	1	1	07/10
LA E 3	RKm 348	534	07/07	8	8	07/08
				1	9	07/09
LA E 2	RKm 407	1,108	07/12	1	1	07/19
				2	3	07/23
LA E 1	RKm 430	1,655	07/13	3	3	07/21
				1	4	07/28
LD E 1	RKm 389	1,786	07/14	2	2	07/19
				1	3	07/20
				1	4	07/27
				1	5	08/16
				1	6	09/10
LD E 2	RKm 357	979	07/20	2	2	07/21
				1	3	07/22
LD E 3	RKm 348	1,902	07/21	7	7	07/22
				4	11	07/23
				5	16	07/24
				1	17	07/30
				1	18	08/13
LA HE 1	RKm 407	735	07/26	1	1	08/01
				1	2	09/10

Appendix Table A1.--cont.

Brand ^a /	Release site	Number released	Date released	Recaptures		Date recapture
				No.	Cumulative	
LA HE 2	RKm 430	289	07/27		No recaptures	
LA HE 3	RKm 389	1,751	07/28	1	1	07/30
				1	2	07/31
				2	4	08/06
				1	5	08/07
				3	8	08/08
				1	9	08/12
				1	10	08/13
				1	11	08/19
				1	12	08/24
				1	13	09/05
				1	14	09/10
				1	15	10/06
LA HE 4	RKm 373	1,194	08/02	1	1	08/07
				1	2	08/09
				1	3	09/05
				1	4	09/10
LD HE 1	RKm 357	604	08/03	1	1	08/08
				1	2	08/23
				1	3	10/17
				1	4	11/07
				1	5	11/14
LD HE 2	RKm 348	931	08/04	5	5	08/04
				2	7	08/20
				1	8	09/02
				3	11	09/10
LD HE 3	RKm 430	853	08/10	1	1	08/24
				1	2	08/30
				1	3	09/02
				3	6	09/10
				1	7	09/21
LD HE 4	RKm 389	1,139	08/11	1	1	10/03
LP HE 1	RKm 373	1,011	08/16		No recaptures	
LP HE 2	RKm 357	1,047	08/17		No recaptures	
LP HE 3	RKm 348	411	08/18	1	1	09/05
LP HE 4	RKm 407	319	08/23		No recaptures	

Appendix Table A1.--cont.

Brand ^a /	Release site	Number released	Date released	Recaptures		Date recapture
				No.	Cumulative	
RA HE 1	RKm 430	788	08/24			No recaptures
RA HE 2	RKm 348	305	09/01	1	1	10/04
RA HE 3	RKm 407	572	09/06	1 1	1 2	09/19 09/26
RA HE 4	RKm 348	552	09/07			No recaptures
RD HE 1	RKm 389	194	09/08	1	1	11/14
RD HE 2	RKm 373	280	09/13			No recaptures
RD HE 3	RKm 357	170	09/14	1 1	1 2	10/31 11/28
RD HE 4	RKm 348	39	09/15			No recaptures
RP HE 1	RKm 407	171	09/20	1	1	10/19
RP HE 2	RKm 430	146	09/21			No recaptures
RP HE 3	RKm 389	213	09/22			No recaptures
RP HE 4	RKm 357	62	09/28	1	1	10/03
LA D 1	RKm 348	103	09/29			No recaptures

Appendix Table A2.--Brand recapture summary--purse seine catches of 0-age chinook salmon in John Day Reservoir, 1983.

Brand ^a /	Release site	Number released	Date released	Recaptures		Date recapture	Recapture site (Rkm)
				No.	Cumulative		
LA 7T 1	RKm 470 (McNary Dam)	4,839	06/16	2	2	07/06	373
				3	5	07/07	348
				2	7	07/12	407
				3	10	07/13	430
				1	11	07/14	389
				1	12	07/20	357
				3	15	07/21	348
				1	16	07/28	389
LA 7T 3	RKm 470	5,196	06/23	2	2	07/06	373
				3	5	07/07	348
				2	7	07/12	407
				1	8	07/13	430
				1	9	07/14	389
				2	11	07/20	357
				3	14	07/21	348
				1	15	07/26	407
				1	16	07/28	389
1	17	08/03	357				
LD 7T 1	RKm 470	5,010	07/01	3	3	07/12	407
				3	6	07/13	430
				5	11	07/14	389
				1	12	07/20	357
				2	14	07/21	348
				3	17	07/26	407
				1	18	08/02	373
				1	19	08/10	430
				1	20	08/11	389
LA 2L 1	RKm 470	4,988	07/08	4	4	07/12	407
				6	10	07/13	430
				5	15	07/14	389
				1	16	07/20	357
				2	18	07/21	348
				2	20	07/28	389
				1	21	08/16	373
				2	23	08/24	430
				1	24	09/06	407
1	25	09/08	389				

Appendix Table A2.--cont.

Brand ^a /	Release site	Number released	Date released	Recaptures		Date recapture	Recapture site (Rkm)				
				No.	Cumulative						
LA 2L 3	Rkm 470	5,005	07/13	4	4	07/14	389				
				2	6	07/20	357				
				2	8	07/21	348				
				3	11	07/26	407				
				3	14	08/16	373				
				1	15	08/18	348				
				1	16	08/23	407				
				1	17	08/24	430				
				1	18	09/01	348				
				2	20	09/06	407				
				1	21	09/07	430				
				1	22	09/15	348				
				LD 2L 1	Rkm 470	5,014	07/15	3	3	07/20	357
								9	12	07/21	348
3	15	07/26	407								
8	23	07/28	389								
2	25	08/02	373								
2	27	08/03	357								
2	29	08/04	348								
2	31	08/10	430								
1	32	08/11	389								
1	33	08/17	373								
3	36	08/17	357								
1	37	09/06	407								
1	38	09/07	430								
1	39	09/08	389								
1	40	09/20	407								
1	41	09/22	389								
LA 2T 1	Rkm 470	5,019	07/20	2	2	07/26	407				
				3	5	07/27	430				
				5	10	07/28	389				
				1	11	08/02	373				
				2	13	08/03	357				
				3	16	08/04	348				
				3	19	08/16	373				
				3	22	08/17	357				
				3	25	08/23	348				
				3	28	08/24	430				
				1	29	09/06	407				
				1	30	09/07	430				
				1	31	09/13	373				
				1	32	09/20	407				
1	33	09/22	389								

Appendix Table A2.--cont.

Brand ^a /	Release site	Number released	Date released	Recaptures		Date recapture	Recapture site (Rkm)
				No.	Cumulative		
LA 2T 3	Rkm 470	5,009	07/23	5	5	07/26	407
				2	7	07/27	430
				5	12	07/28	389
				1	13	08/02	373
				3	16	08/03	357
				1	17	08/04	348
				2	19	08/10	430
				1	20	08/11	389
				2	22	08/16	373
				1	23	08/17	357
				3	26	08/18	348
				1	27	08/23	407
				1	28	09/06	407
				1	29	09/08	389
				1	30	09/14	357
				1	31	09/20	407
				1	32	09/28	357
LD 2T 1	Rkm 470	4,659	07/27	3	3	08/02	373
				4	7	08/04	348
				1	8	08/11	389
				3	11	08/16	373
				1	12	08/17	357
				4	16	08/24	430
				2	18	09/06	407
				2	20	09/07	430
				2	22	09/08	389
				1	23	09/13	373
LA 2X 1	Rkm 470	5,939	07/29	3	3	08/02	373
				3	6	08/04	348
				3	9	08/10	430
				1	10	08/11	389
				3	13	08/16	373
				2	15	08/17	357
				4	19	08/24	430
				1	20	09/01	348
				3	23	09/06	407
				1	24	09/07	430
1	25	09/15	348				
2	27	09/29	348				

Appendix Table A2.--cont.

Brand ^a /	Release site	Number released	Date released	Recaptures		Date recapture	Recapture site (Rkm)
				No.	Cumulative		
LA 2X 3	Rkm 470	4,657	08/05	3	3	08/10	430
				4	7	08/11	389
				3	10	08/16	373
				7	17	08/17	357
				2	19	08/18	348
				1	20	08/23	407
				3	23	08/24	430
				1	24	09/06	407
				2	26	09/07	430
				1	27	09/08	389
				1	28	09/21	430
				1	29	09/22	389
				1	30	09/29	348
				LA 7S 1	Rkm 470	4,850	08/12
1	4	08/17	357				
3	7	08/18	348				
3	10	08/23	407				
4	14	08/24	430				
1	15	09/01	348				
3	18	09/06	407				
1	19	09/07	430				
1	20	09/08	389				
1	21	09/22	389				
LA 7S 3	Rkm 470	4,878	08/19	1	1	08/23	407
				1	2	08/24	430
				2	4	09/01	348
				1	5	09/07	430
				2	7	09/08	389
				1	8	09/13	373
				1	9	09/20	407
				1	10	09/21	430
LD 7S 1	Rkm 470	5,641	08/26	1	1	09/01	348
				4	5	09/06	407
				3	8	09/07	430
				5	13	09/08	389
				2	15	09/13	373
				1	16	09/14	357
				3	19	09/20	407
				2	21	09/22	389
				1	22	09/29	348

Appendix Table A2.--cont.

Brand ^a /	Release site	Number released	Date released	Recaptures		Date recapture	Recapture site (Rkm)
				No.	Cumulative		
LD 7S 3	RKm 470	1,855	09/02	1	1	09/08	389
				1	2	09/14	357
				1	3	09/15	348
				1	4	09/21	430
				1	5	09/22	389
				1	6	09/29	348
LA E 4	RKm 373 (purse seine)	363	07/06	2	2	07/14	389
				8	10	07/21	348
LA E 3	RKm 348	534	07/07	1	1	07/27	430
				1	2	07/28	389
				1	3	08/02	373
				1	4	08/17	357
LA E 2	RKm 407	1,108	07/12	1	1	08/24	430
LA E 1	RKm 430	1,655	07/13	1	1	07/20	357
				1	2	07/21	348
				1	3	07/26	407
				1	4	08/11	389
LD E 1	RKm 389	1,786	07/14	1	1	07/20	357
				1	2	07/21	348
				1	3	08/10	430
				2	5	08/11	389
				1	6	09/06	407
				1	6	09/06	407
LD E 2	RKm 357	979	07/20	1	1	07/26	407
				1	2	08/03	357
LD E 3	RKm 348	1,902	07/21	2	2	07/26	407
				1	3	07/28	389
				1	4	08/02	373
				3	7	08/03	357
				1	8	08/04	348
				1	9	08/11	389
				2	11	08/16	373
				2	13	08/24	430
				1	14	09/13	373
				1	15	09/15	348
				1	16	08/21	430

Appendix Table A2.--cont.

Brand ^a /	Release site	Number released	Date released	Recaptures		Date recapture	Recapture site (Rkm)				
				No.	Cumulative						
LA HE 1	RKm 407	735	07/26	1	1	07/28	389				
				1	2	08/02	373				
				1	3	08/03	357				
				1	4	08/04	348				
				1	5	08/24	430				
LA HE 2	RKm 430	289	07/27	1	1	08/04	348				
				1	2	08/10	430				
				1	3	08/23	407				
				2	5	08/24	430				
				1	6	09/29	348				
LA HE 3	RKm 389	1,751	07/28	1	1	08/02	373				
				2	3	08/03	357				
				3	6	08/04	348				
				1	7	08/11	389				
				1	8	08/16	373				
				2	10	08/17	357				
				1	11	08/18	348				
				1	12	08/24	430				
				1	13	09/01	348				
				1	14	09/06	407				
				1	15	09/07	430				
				1	16	09/13	373				
				1	17	09/22	389				
				LA HE 4	RKm 373	1,194	08/02	1	1	08/16	373
								1	2	08/17	357
								1	3	09/01	348
								1	4	09/14	357
LD HE 1	RKm 357	604	08/03	1	1	08/04	348				
				2	3	08/16	373				
				2	5	08/17	357				
				1	6	09/20	407				
				1	7	09/28	357				
LD HE 2	RKm 348	931	08/04	1	1	08/11	389				
				2	3	08/16	373				
				2	5	08/18	348				
				1	6	09/06	407				
				1	7	09/14	357				
				1	8	09/21	430				

Appendix Table A2.--cont.

Brand ^a /	Release site	Number released	Date released	Recaptures		Date recapture	Recapture site (Rkm)
				No.	Cumulative		
LD HE 3	RKm 430	853	08/10	1	1	08/23	407
				1	2	08/24	430
				1	3	09/01	348
				1	4	09/06	407
				1	5	09/13	373
				1	6	09/29	348
LD HE 4	RKm 389	1,139	08/11	1	1	09/01	348
LP HE 1	RKm 373	1,011	08/16	1	1	08/23	407
				1	2	09/08	389
LP HE 2	RKm 357	1,047	08/17	1	1	09/14	357
				1	2	09/20	407
LP HE 3	RKm 348	411	08/18	2	2	09/06	407
				1	3	09/07	430
				1	4	09/08	389
LP HE 4	RKm 407	309	08/23	1	1	09/06	407
				1	2	09/07	430
				1	3	09/15	348
RA HE 1	RKm 430	788	08/24	1	1	09/15	348
RA HE 2	RKm 348	305	09/01	1	1	09/13	373
				1	2	09/22	389
RA HE 3	Rkm 407	572	09/06			No recaptures	
RA HE 4	Rkm 430	552	09/07			No recaptures	
RD HE 1	RKm 389	194	09/08			No recaptures	
RD HE 2	RKm 373	280	09/13			No recaptures	
RD HE 3	RKm 357	170	09/14			No recaptures	
RD HE 4	RKm 348	39	09/15			No recaptures	
RP HE 1	RKm 407	171	09/20			No recaptures	
RP HE 2	RKm 430	146	09/21			No recaptures	
RP HE 3	RKm 389	213	09/22			No recaptures	

Appendix Table A2.--cont.

Brand ^a /	Release site	Number released	Date released	Recaptures		Date recapture	Recapture site (Rkm)
				No.	Cumulative		
RP HE 4	RKm 357	62	09/28			No recaptures	
LA D 1	RKm 348	103	09/29			No recaptures	
RA 3 1				1	1	07/27	430
RA 3 3				1	1	08/24	430

Appendix Table A3.--Average daily discharge McNary Dam, 1983.

Date	Discharge (Kcfs)	Date	Discharge (Kcfs)	Date	Discharge (Kcfs)	Date	Discharge (Kcfs)
June 1	398.7	July 1	203.2	August 1	198.5	September 1	171.4
2	367.0	2	178.3	2	196.6	2	150.4
3	379.3	3	177.9	3	180.4	3	129.1
4	368.4	4	187.7	4	188.7	4	94.4
5	352.9	5	207.8	5	180.9	5	86.8
6	344.8	6	216.0	6	187.5	6	96.0
7	323.0	7	234.3	7	164.7	7	140.8
8	359.8	8	213.8	8	181.0	8	130.5
9	342.2	9	190.3	9	186.8	9	130.1
10	343.5	10	152.3	10	176.3	10	151.9
11	323.6	11	182.5	11	179.6	11	89.3
12	306.6	12	206.9	12	166.9	12	86.2
13	306.1	13	223.2	13	143.7	13	120.7
14	312.3	14	204.5	14	145.1	14	127.5
15	258.9	15	189.2	15	156.9	15	116.4
16	268.2	16	207.9	16	157.3	16	116.5
17	265.4	17	211.4	17	178.9	17	120.1
18	263.8	18	226.9	18	179.1	18	96.7
19	245.1	19	221.6	19	191.8	19	121.0
20	254.9	20	230.1	20	186.0	20	105.2
21	234.3	21	228.7	21	146.5	21	142.1
22	240.7	22	221.8	22	162.4	22	111.1
23	230.4	23	203.0	23	137.3	23	144.4
24	218.9	24	169.4	24	140.8	24	91.8
25	206.7	25	193.4	25	138.0	25	69.1
26	216.5	26	213.5	26	128.4	26	115.0
27	200.0	27	229.6	27	122.7	27	120.1
28	210.6	28	213.8	28	94.1	28	114.0
29	212.4	29	218.6	29	105.6	29	117.8
30	215.2	30	193.8	30	129.1	30	109.8
		31	218.1	31	148.2		

APPENDIX B

SUMMARY OF EXPENDITURES - FY 1983

SUMMARY OF EXPENDITURES

<u>Category</u>	<u>Amount</u>
Personnel	\$ 95,593.26
Travel	2,464.64
Vehicles	6,843.46
Rent, Communications, SLUC, and Utilities	2,620.31
Printing	234.48
Contract Services	5,269.19
Supplies and Materials	25,828.89
Support	32,978.66
TOTAL	171,832.89

*Major individual expenditures exceeding \$500.00.

<u>Item</u>	<u>Amount</u>
Coded wire tags	\$ 2,683.40