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MIGRATORY BEHAVIOR AND ADULT CONTRIBUTION OF SUMMER OUTMIGRATING SUBYEARLING CHINOOK SALMON IN JOHN DAY RESERVOIR, 1981 - 1983

Final Report

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MIGRATORY BEHAVIOR AND ADULT CONTRIBUTION OF SUMMER OUTMIGRATING SUBYEARLING CHINOOK SALMON IN JOHN DAY RESERVOIR, 1981 - 1983

FINAL REPORT

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Abstract

During summer 1981-1983, the National Marine Fisheries Service investigated the effects of river flow volumes on the travel time of subyearling chinook salmon migrating through John Day Reservoir. Analyses were based on mark recovery data from freeze-branded fish released in the McNary Dam tailrace and recaptured at John Day Dam. In addition to this effort, the distribution of juvenile chinook salmon within the reservoir was observed through purse seine sampling. Coded wire tag data provided a measure of intra- and interannual performance in terms of adult contribution.

The travel time data were largely inconclusive. This was due to poor mark-recovery capability coupled with the difficulty of isolating flow from other closely related variables. A large portion of the juveniles tended to range upstream and did not exhibit consistent displacement downstream.

Subyearling chinook salmon migrating through John Day Reservoir early in the summer contributed more adults than those juveniles migrating later in the summer. This pattern was consistent each year.

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INTRODU CTION

Hydroelectric development of the Columbia River system has resulted in decreased salmon and steelhead runs (Raymond 1979). In response to this problem, fisheries managers have developed minimum instream flow recommendations and are budgeting water to provide for optimum flows during periods of peak juvenile migrations. Scientific evidence supporting these actions is based for the most part on data relating to juvenile spring chinook salmon (Oncorhynchus tshawytscha and steelhead trout (O. mykiss) migrations (Raymond 1979; Sims and Ossiander 1981). It is not apparent if 6;sh passage enhancement benefits of increased flows demonstrated for yearling spring chinook salmon also apply to subyearling chinook salmon migrating during the summer.

Past research showed that even during high-flow years; large numbers of subyearhng chinook salmon remain in John Day Reservoir for a considerable time (Raymond et al. 1975; Sims et aI 1976; Miller and Sims 1984).

The National Marine Fisheries Service (NMFS) conducted a multiyear study of the migratory behavior of subyearhng chinook saImon (fa.U and summer races) in John Day Reservoir (Lake UmatilIa). From 1981 to 1983, marked [freeze brand and coded-wire tag (CWT)] juvenile faII chinook salmon were released in the tailrace of McNary Dam as part of the study. The objectives were to 1) describe migratory behavior, 2) assess the effects of flow on migration rate, and 3) assess the adult contribution data from various segments of the outmigrations.

Three annual reports covering the 3 years (1981-1983) of juvenile migratory studies in the reservoir (Sims and Miller 1982; Miller and Sims 1983, 1984) were submitted to the Bonneville Power Administraton (BPA). During the interim, NMFS has been collecting adult contribution data from those releases. The full complement of adult contributions were realized in 1988 with the return of 5-ocean fish from the 1983

outmigration. This final report evaluates the adult contribution data. Additionally, the authors of this report have reanalyzed the data describing the migratory behavior of subyearling chinook salmon in John Day Reservoir which were presented by Sims and Miller (1982) and Miller and Sims (1983, 1984).

STUDYAREA

John Day Dam is a hydroelectric project on the Columbia River at River Kilometer @Km) 345, approzimately 200 km east of Portland, Oregon. The project was constructed and is operated by the U.S. Army Corps of Engineers (COE). The reservoir (Lake Umatilla) formed by the dam extends 122 km upstream to the tailrace at McNary Dam which is about 52 km downstream from the confluence of the Columbia and Snake Rivers. The width of the reservoir ranges from 0.8 to 4.2 km, and its midpool depth ranges from 11 to 48 m.

METHODS

Juvenile (subyearling) fall and summer chinook salmon entering John Day Reservoir from mid-June through August were sampled and marked with both freeze brands and CWTs at McNary Dam each year (1981-1983). Each week, one to three groups of fish were freeze branded Wghell 1969) with a unique mark, held for a minimum of 1 day, and fish bearing the same brand were released into the tailrace below the dam at 2100 h on the release date. Freeze-branded fish were recovered in the airlift sampling system (Sims et al. 1981) at Turbine Unit 3, John Day Dam.

Three CWT codes were used in 1981, four in 1982, and five in 1983. They were blocked to roughly correspond to the early, middle, and late segments of the summer outmigration. Additionally, in all three study years, juvenile chinook salmon were caught by purse seine, freeze branded, and released on site back into the reservoir. An 11-m power block seiner (NMFS Research Vessel ColumbiaI was used to purse seine

sample John Day Reservoir throughout the summer and fall of 1981-1983. Purse seine fishing techniques were generally as described by Johnsen and Sims (1973). Sampling extended from the forebay at John Day Dam (RKm 348) to the McNary Dam tailrace (RKm 467). Nine sampling transects were established (Fig. 1). At each transect, the seine was set as near to each shore as possible (allowing a minimum depth of 5 m) and at mid-reservoir. At all sites except Willow Creek and Crow Butte, this was within 10 m of the shore. At Willow Creek, the Washington shore site was approximately 75 m offshore and the Crow Butte, Oregon, shore site was approximately 90 m offshore. Recoveries of marked fish in the purse seine from marked groups released in the McNary Dam tailrace, at RKm 468, as well as marked groups released at transects were used to describe subyearling chinook salmon distribution and migrational behavior within John Day Reservoir.

To describe the migratory patterns within the reservoir, fish were captured with a purse seine at transects, and the catches were processed shipboard. All fish were anesthetized with MS-222, counted, and examined for marks. Unmarked fish were freeze branded. A subsample was measured for fork-length. After processing, all fish were allowed to recover from the anesthetic and released.

Tagged adult salmon were recovered at hatcheries, spawning grounds, and ocean and river sport and commercial fisheries as well as by tag detection equipment operating in fishways at Bonneville, McNary, and Lower Granite Dams. Recovery data were acquired through the Pacific Marine Fisheries Commission (PMFC) database. Analyses included data reported through August 1989.

All of the fish that entered the gatewell slots at the Unit 3 sampling system were counted and inspected for brands. Typically, the airlift sampler was operated once each hour, 24 hours/day, 5 days/week. The fish were examined on the hour excepting weekends when fish were examined every day or two.

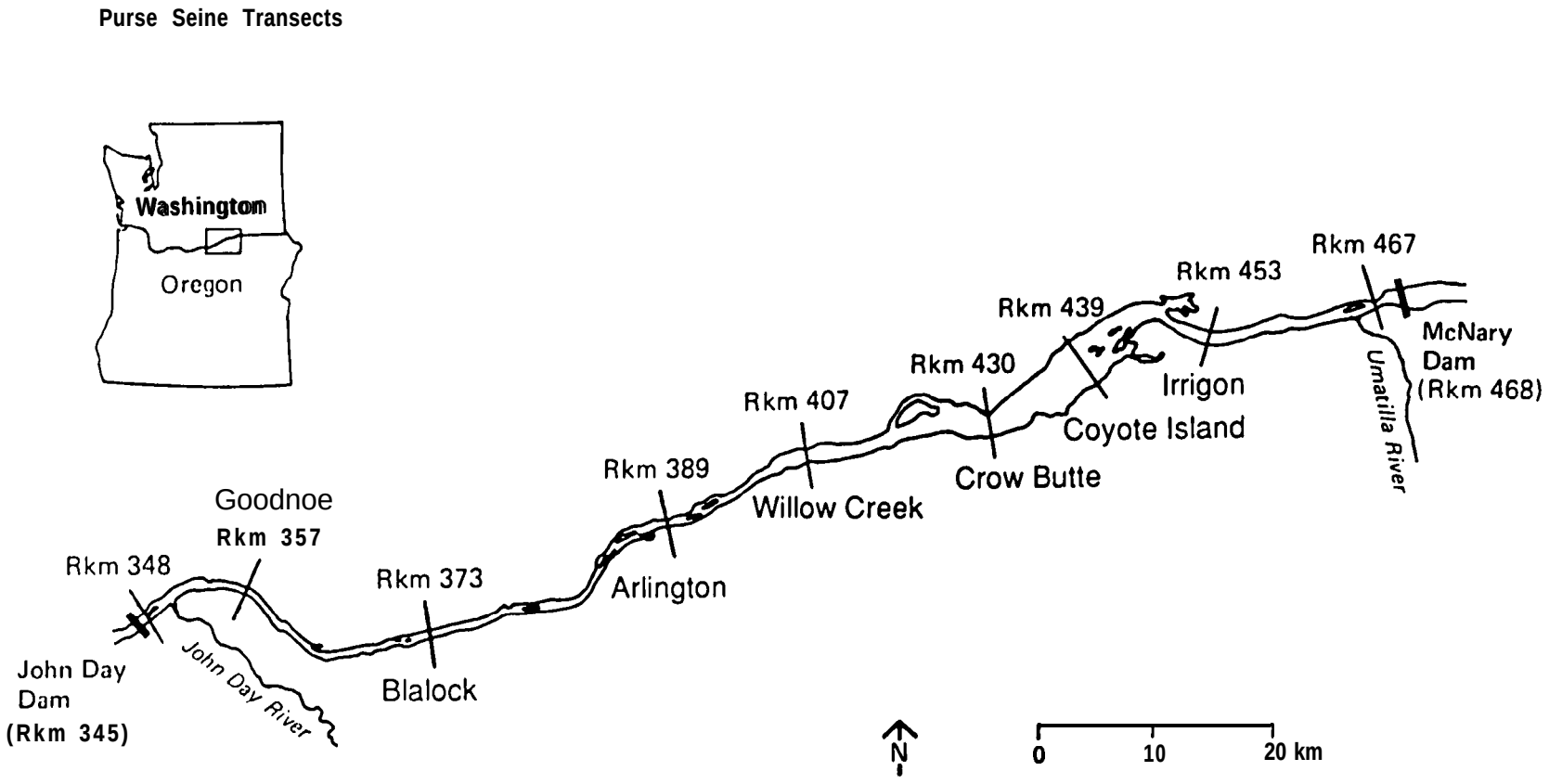

Figure 1.--Purse seine transect locations in John Day Reservoir.

Since the amount of river flow discharged through Unit 3 changed over the course of the sampling period, the sampling effort necessarily changed. Therefore, the daily catch was adjusted according to the proportion of the total river flow discharged through Unit 3. This adjusted catch is referred to as the passage index. The passage index is not a daily passage estimate.

RESULTS

Summer flow volumes varied considerably over the 3 years this study was conducted (Fig. 2). Most of the differences in flow volumes were observed between 15 June and 20 July each year. From 20 July until approximately 1 September, flow volumes were nearly the same from year to year. Based on the flow volumes prior to 20 July, the years 1981, 1982, and 1983 can be characterized as medium, high, and medium to low, respectively.

Water temperature patterns were generally similar among years (Fig. 3). Early in the summer, temperatures ranged between 57° and 59°F. Water temperatures increased steadily over the course of the summer and peaked near 70°F by the end of August.

In 1982 and 1983, two very different water years, the passage patterns of subyearling chinook salmon at John Day Dam were quite similar (Table 1). Each year, there was a minor peak near the beginning of July, and a major peak at the end of July (Fig. 4). In 1982, the year of highest flows, 90% of the outmigration had passed John Day Dam by the week ending 4 September. In 1983, the year of lowest flows, the 90% mark was realized one week earlier on 26 August. In 1981, the 90% mark occurred somewhat earlier, in the week ending 22 August.

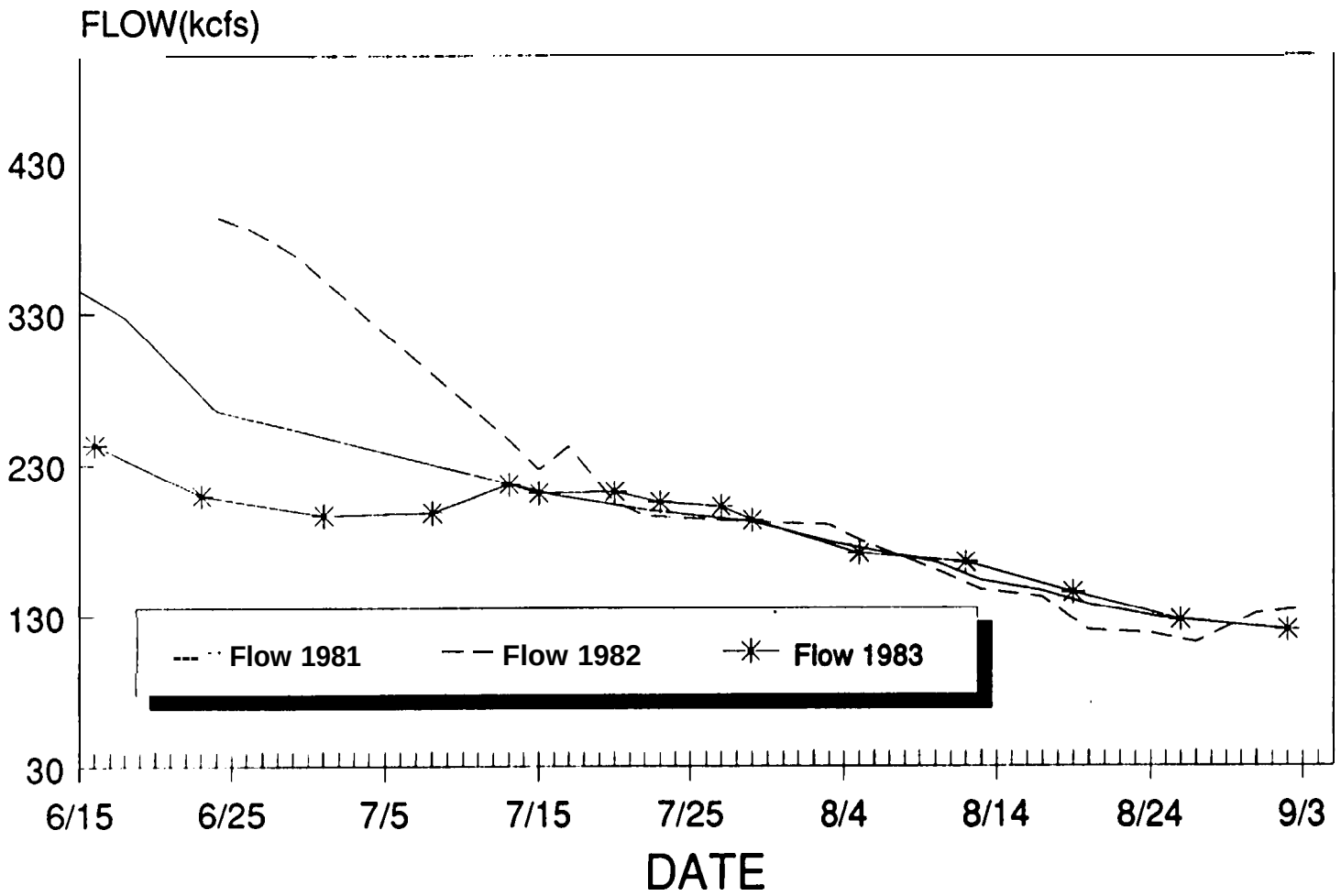

Figure 2.--Summer flow volumes in John Day Reservoir, 1981-1983. The hourly flow volumes occurring between 2100 and 0600 h were averaged for each day and plotted.

Water Temperature X Date : John Day Pool

Subyearling Chinook, Summer 1981-I 983

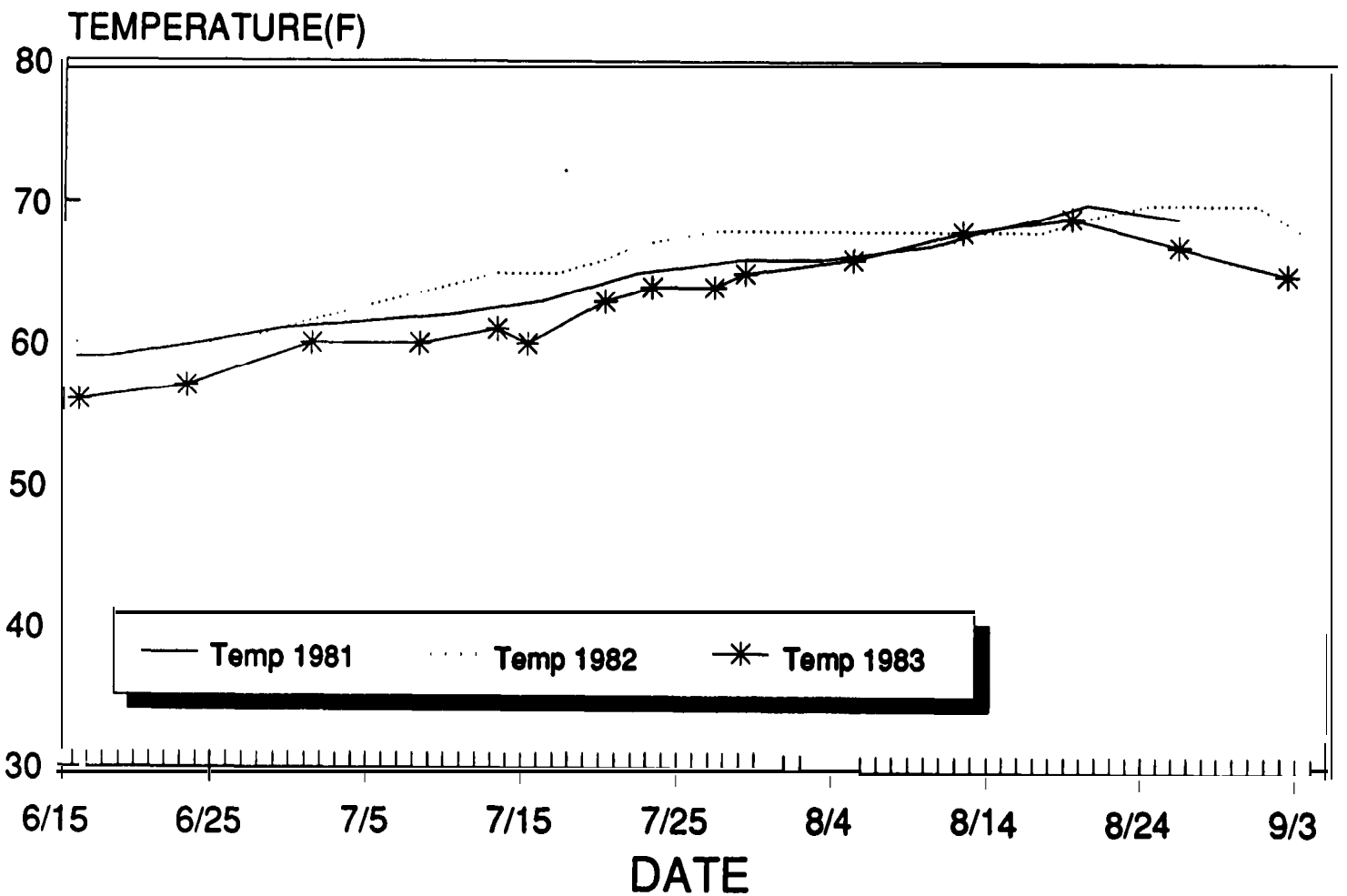

Figure 3.--Water temperatures recorded at John Day Dam, summer 1981-1983.

Table l.-Weekly passage indices for subyearliug chinook salmon at John Day Dam, 1981-1983. The paasage index is the ratio of the number of fish enumerated in Turbine Unit 3 to the proportion of the river flow discharged through that turbine.

1981		1982		1983	
Passage index	Week ending	Passage index	Week ending	Passage index	Week ending
10,698	6 Jun	35,211	5 Jun	6,920	3 Jun
29,239	14 Jun	55,786	12 Jun	62,263	10 Jun
27,956	20 Jun	53,616	19 Jun	77,333	17 Jun
13,449	27 Jun	72,578	26 Jun	106,809	24 Jun
97,006	7 Jul	83,428	3 Jul	71,028	1 Jul
39,108	11 Jul	41,750	10 Jul	11,072	8 Jul
71,412	18 Jul	37,997	17 Jul	151,204	15 Jul
53,772	25 Jul	244,567	24 Jul	310,690	22 Jul
124,236	1 Aug	140,691	31 Jul	82.251	29 Jul
65,934	8 Aug	62,339	7 Aug	64,293	5 Aug
26,039	15 Aug	30,541	14 Aug	40,495	12 Aug
25,000	22 Aug	28,213	21 Aug	24,163	19 Aug
4,384	29 Aug	28,346	28 Aug	20,292	26 Aug
6,188	5 Sep	21,046	4 Sep	19,349	2 Sep
5,560	12 Sep	3,370	11 sep	23,310	9 Sep
3,535	19 sep	3,854	18 Sep	15,413	16 Sep
3,479	26 Sep	7,208	25 Sep	6,338	23 Sep
3,062	3oct	16,429	2 Oct	1,856	30 Sep
1,814	10 Oct	8,448	9 Oct	2,630	7 Oct
1,223	17 Oct	7.160	16 Oct	2,708	14 Oct
686	24 Oct	5,250	23 Oct	1,920	21 Oct
1,002	31 Oct	7,638	30 Oct	1,643	28 Oct
1,095	7 Nov	6,979	6 Nov	3,038	4 Nov
959	14 Nov	7,324	13 Nov	3,280	11 Nov
2,341	21 Nov	6,795	20 Nov	5,848	18 Nov
1,258	26 Nov	2,776	27 Nov	6,457	25 Nov
2,196	5 Dec	7,825	4 Dec	10,288	2 Dec
1,552	12 Dec	4,402	11 Dec	4,334	9 Dec
4,161	17 Dec	1,909	18 Dec	1,705	16 Dec

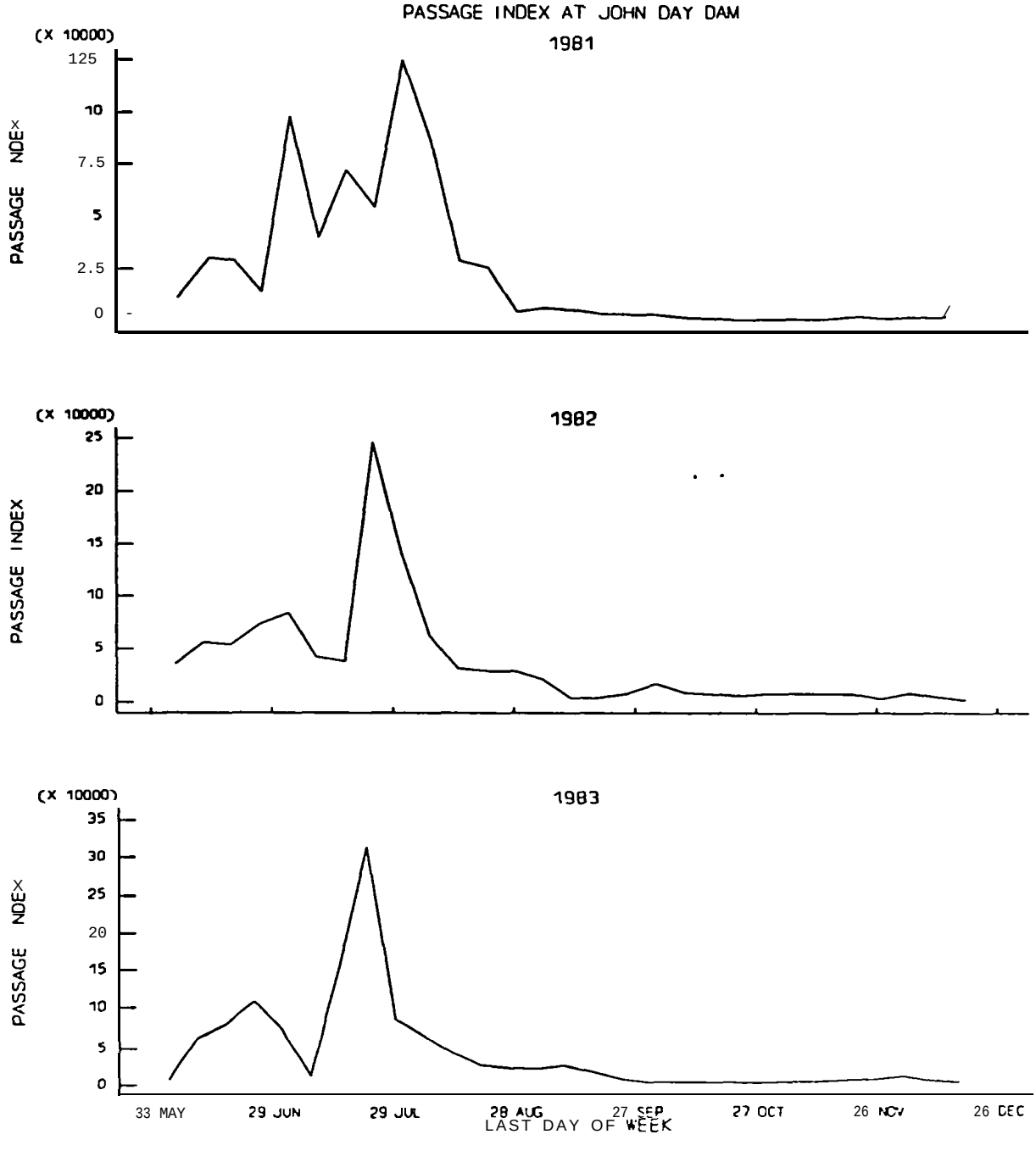

Figure 4.--Subyearling chinook salmon weekly passage indices at John Day Dam, summer 1981-1983.

Freeze-Branded Groups

Overall, fish moved slowest in 1982. The median travel time through John Day Reservoir for freeze-branded groups ranged from 6 to 26 days in 1981, 9 to 46 days in 1982, and 7 to 29 days in 1983 (Tables 2-4).

Correlations between median travel time and each variable (release date, water temperature, and flow) present confusing results. In 1981, no variable was correlated with travel time (Table 5, Fig. 5). In 1982, the year of the fewest mark recoveries, travel time was significantly correlated with each variable (Table 5, Fig. 6). In 1983, travel time was only correlated with water temperature (Table 5, Fig. 7).

Using the median travel time (days) of the passage index from each marked group as the behavioral response, we attempted to determine which factors (date of release, water temperature, or flow) best explain migration time by employing the stepwise regression routine in Statgraphics.[1] Results from 1981 indicated that travel time could not be described as a linear function of any of the three variables (Table 6, Appendix Table A1). In 1982, travel time was best described as a function of release date (Table 6, Appendix Table A1). Neither temperature nor flow entered the model, because there were such strong correlations among the variables (Table 5). In 1983, travel time was best described as a function of release date and temperature (Table 6, Appendix Table A1). In this case the model included a variable which alone was not correlated with travel time. It appears that in 1982 and 1983, fish marked and released later in the summer generally traveled slower, while water temperature increased and flows decreased (Figs. 5-7).

[1] References to trade names do not imply endorsement by the National Marine Fisheries Service, NOAA.

Table 2.--Summary of 1981 brand release and recovery data from groups of subyearling chinook salmon marked and released at McNary Dam and recaptured at John Day Dam. Travel time is the number of days required to traverse the reservoir from McNary Dam tailrace to John Day Dam. The medians were calculated from the passage indices.

Release date	Brand code	Number of fish			Flow[b] (kcfs)	Temperature[b] (°F)	Median travel time (days)
		Released	Recovered	Passage index[a]			
61581	LAID1	3,325	28	437	345	58.6	18
61881	LAID2	4,654	44	667	327	58.8	16
62481	LAID3	3,458	37	554	265	59.7	10
62981	LAID4	6,286	38	591	253	60.7	7
71081	LAIM1	10,115	79	840	225	62.4	19
71681	LAIM3	10,143	65	628	210	63.4	21
72281	LAIM2	10,012	50	526	200	64.5	14
72981	LAIM4	12,310	64	624	192	65.9	9
80381	LAUP1	2,512	11	105	179	66.3	6
81081	LAUP3	2,663	15	113	165	67.4	17
81381	LAUP4	2,545	12	81	153	67.9	26
81781	LA3X1	2,547	10	63	146	68.9	18
82081	LA3X2	2,536	22	145	137	69.5	19
82681	LA3X3	1,577	6	35	126	68.9	13

[a]The passage index is calculated daily as the ratio of the number recovered to the sampling effort and summed over days. Sampling effort was the average proportion of the total river flow discharged through Unit 3 during the 10-hour period 2000-0600 h.

[b]The average river flow volume and water temperature over the 10-day period following release of the marked group.

Table 3.--Summary of 1982 brand release and recovery data from groups of subyearling chinook salmon marked and released at McNary Dam and recaptured at John Day Dam. Travel time (median) is the number of days required to traverse the reservoir from McNary Dam tailrace to John Day Dam.

Release date	Brand code	Number of fish		Passage index[a]	Flow[b] (kcfs)	Temperature[b] (°F)	Median travel time (days)
		Released	Recovered				
62482	LAH-1	2,396	7	148	393	59.9	9
62682	LAH-2	3,235	17	346	386	60.3	13
62982	LAIF1	2,690	9	136	369	60.9	22
71382	LAIC3	3,035	15	181	246	64.7	13
71582	LAIM1	4,323	13	143	227	64.9	18
71782	LAIM3	4,012	17	219	242	65.4	13
72082	LAIF2	5,001	16	172	205	66.4	17
72282	LAIF4	2,012	19	168	196	66.8	31
72782	LAIC2	3,262	33	299	193	67.8	19
72982	LAIC4	4,500	44	368	192	67.9	24
80382	LAIM2	1,007	7	63	190	67.7	34
80582	LAIM4	2,383	29	253	180	67.8	24
81082	LA+Y1	3,000	32	259	160	68.0	12
81382	LA+Y3	2,571	31	247	147	67.7	46
81782	LA+U1	3,450	46	321	142	68.0	41
82082	LA+Y2	3,005	31	231	120	68.8	39
82482	LA+U3	1,467	22	160	118	69.7	35
82782	LA+Y4	3,581	35	246	112	69.6	31
83182	LA+U2	1,589	16	133	131	69.1	23
90382	LA+U4	4,541	16	125	134	68.4	45

[a]The passage index is calculated daily as the ratio of the number recovered to the sampling effort and summed over days. Sampling effort was the average proportion of the total river flow discharged through turbine Unit 3 during the 10-hour period 2000-0600 h each day.

[b]The average river flow volume and water temperature over the 10-day period following release of the marked group.

Table 4.--Summary of 1983 brand release and recovery data from groups of subyearling chinook salmon marked and released at McNary Dam and recaptured at John Day Dam. Travel time (median) is the number of days required to traverse the reservoir from McNary Dam tailrace to John Day Dam.

Release date	Brand code	Number of fish			Flow[b] (kcfs)	Temperature[b] (°F)	Median travel time (days)
		Released	Recovered	Passage index[a]			
61683	LA7T1	4,839	41	601	243	55.5	11
62383	LA7T3	5,196	23	327	209	57.4	19
70183	LD7T1	5,010	28	421	196	59.8	15
70883	LA2L1	4,988	35	557	198	59.9	12
71383	LA2L3	5,005	20	333	217	61.0	8
71583	LD2L1	5,014	42	627	211	59.7	7
72083	LA2T1	5,019	60	700	212	63.2	19
72383	LA2T3	5,009	62	596	205	64.0	29
72783	LD2T1	4,659	41	374	202	64.4	25
72983	LA2X1	5,939	71	621	193	64.6	29
80583	LA2X3	4,657	60	499	171	66.2	24
81283	LA7S1	4,850	39	304	165	68.2	28
81983	LA7S3	4,878	47	363	145	69.2	23
82683	LD7S1	5,641	54	417	127	66.7	15
90283	LD7S3	1,855	17	127	120	65.0	9

[a]The passage index is calculated daily as the ratio of the number recovered to the sampling effort, and summed over days. Sampling effort was the average proportion of the total river flow discharged through turbine Unit 3 during the 10-hour period 2000-0600 h.

[b]The average river flow volume and water temperature over the 10-day period following release of the marked group.

Table 5.--Correlation coefficients between median travel time and three variables are presented. Correlations include all data acquired in each of the 3 years. Data appear in Tables 2-4. Details are presented in Appendix Table A.

Year	Variables		
	Release date	Temperature	Flow
1981	0.191	0.203	-0.139
1982	0.707**	0.595**	-0.646**
1983	0.240	0.558*	-0.099

* $0.01 \leq P < 0.05$

** $P < 0.01$

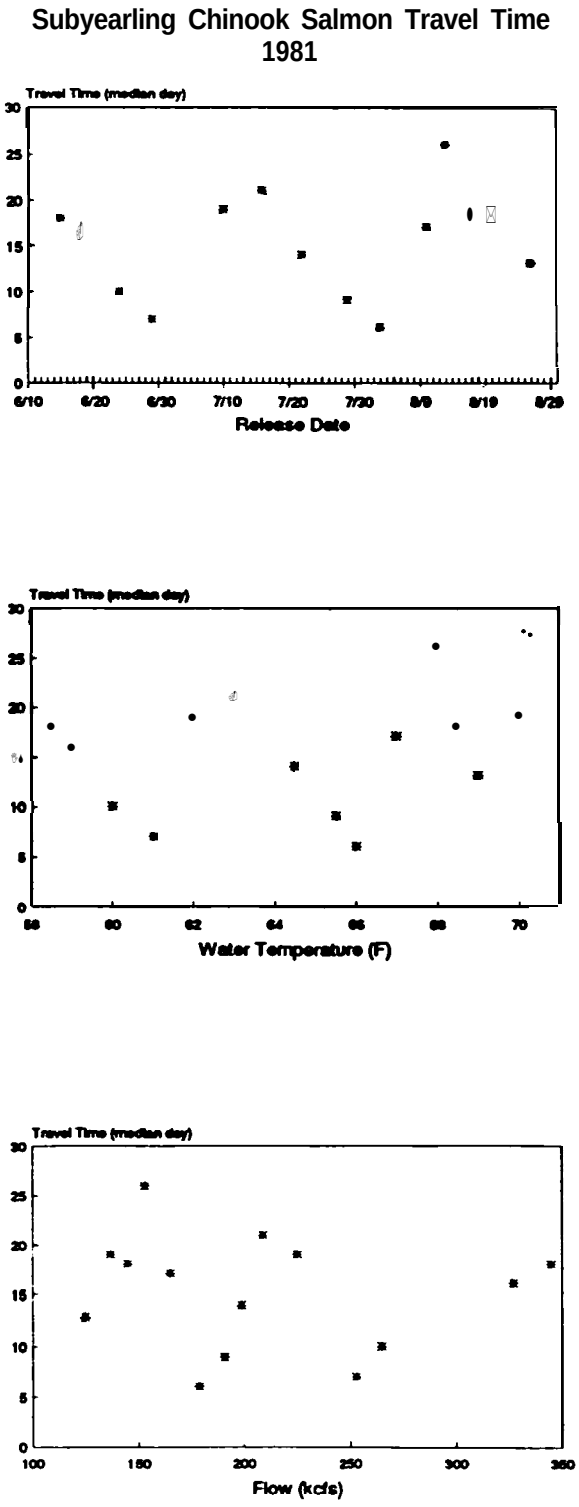

Figure 5.--Scattergrams of median travel times of freeze-branded groups vs release date, water temperature, and flow for 1981. Marked groups were released in the tailrace of McNary Dam and recovered at John Day Dam. Flows and temperatures were the 10-day means following release of each marked group.

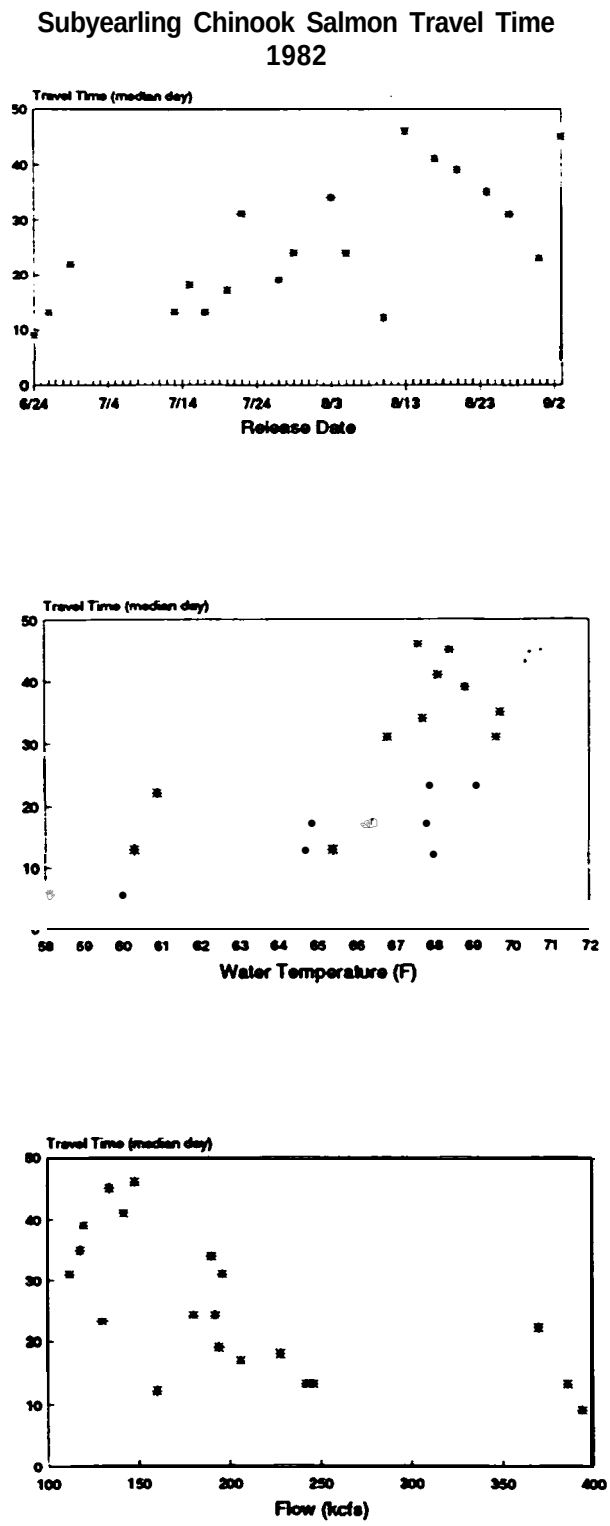

Figure 6.--Scattergrams of median travel times of freeze-branded groups vs release date, water temperature, and flow for 1982. Marked groups were released in the tailrace of McNary Dam and recovered at John Day Dam. Flows and temperatures were the 10-day means following release of each marked group.

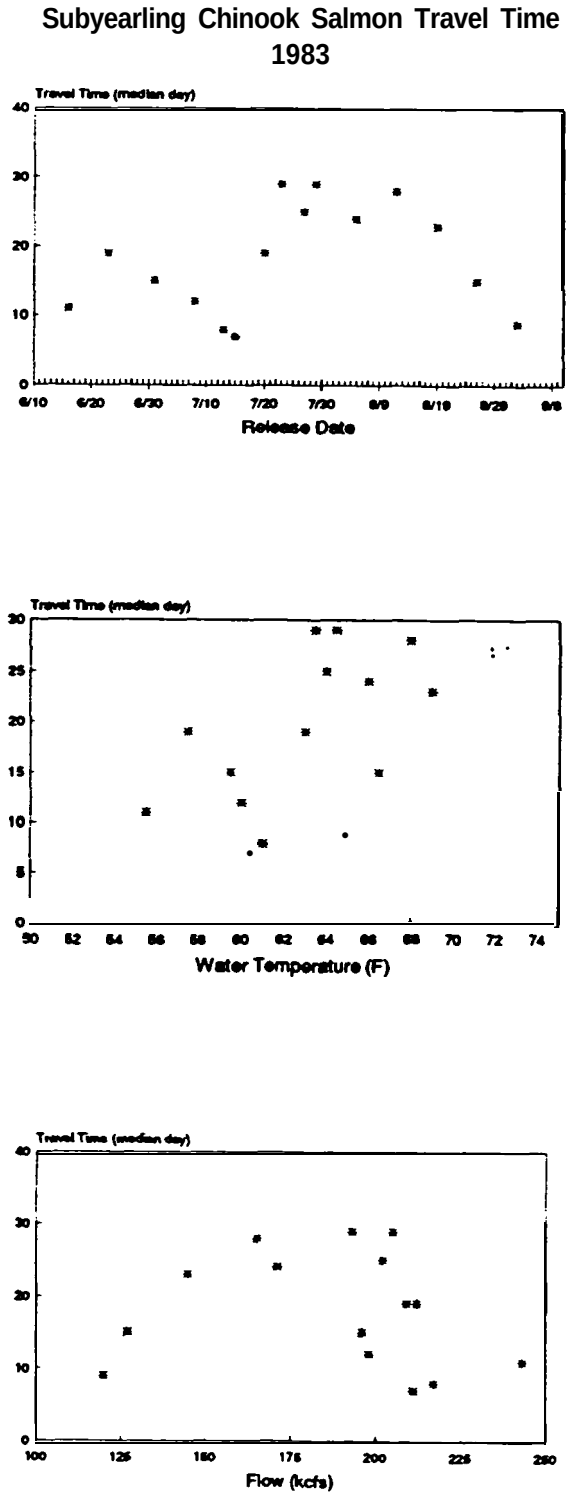

Figure 7.--Scattergrams of median travel times of freeze-branded groups vs release date, water temperature, and flow for 1983. Marked groups were released in the tailrace of McNary Dam and recovered at John Day Dam. Flows and temperatures were the 10-day mean following release of each marked group.

Table 6.--Regression models derived from stepwise multiple regression routine included in Statgraphics software. The modelling procedure was applied to (median) travel time presented in Tables 2-4. The Julian release date was used in the model.

Year	Model
1981	No variables were entered into the model
1982	Travel time = -54.46 + 0.38 (release date)
1983	Travel time = -107.62 + 3.53 (temperature) -0.47 (release date)

We further examined these data for evidence of relationships between travel time and the independent variables by blocking each year's data into three time-periods, then testing for correlations with each variable within each period. The first period extended through 9 July each year; this period included the first passage peak each year. The second period extended from 10 July through 8 August and bracketed the second passage peak each year. The third period extended from 9 August until the end of sampling each year. These analyses were inconclusive, for in many case6 there were only three to five data points with which to describe a relationship. In many cases, correlation coefficients were large and often significant, particularly for the early and middle segments of each year's outmigration (Table 7, Appendix Table A). However, the sign of the coefficient changed among and within years, indicating the relationship between travel time and any of the variables could be either positive or negative (Table 7). No consistent relationships were evident.

Fish Distribution

Fish distribution within the reservoir was described using catch per unit effort (CPUE) (i.e., the average number of fish caught per net set) from purse seine sampling at fixed transects (Tables 8-10). Originally, nine transects were sampled. However, catches were so low at the three upstream transects (McNary tailrace, Irrigon, and Coyote Islands) that they were abandoned half-way through 1981. Fish distribution across each transect throughout the sampling period showed consistent patterns from year to year. At Goodnoe, Blalock, and Arlington chinook salmon tended to concentrate near the Washington shore with strongest tendencies apparent from August through November (Figs. 8-10. Tables 8-10). In the John Day forebay. the pattern is similar but seems to be more variable particularly in June and July. In contrast, at Willow Creek fish tend to concentrate near the Oregon shore except in September and November. At Crow Butte the highest CPUEs were observed again on the Washington

Table 7.--Correlation coefficients between the median travel time for marked groups of fish and the variable indicated. The number of data points (groups) appear in parenthesis. Each year's data were blocked into three periods: prior to 10 July, 10 July through 8 August, and after 8 August.

Year	Variables		
	Date of release	Water temperature	Flow
1981			
Early	-0.995**(4)	-0.978* (4)	0.991**(4)
Mid	-0.945* (5)	-0.944* (5)	0.906* (5)
Late	-0.575 (5)	-0.297 (5)	0.461 (5)
1982			
Early	-0.995 (3)	-0.995 (3)	0.999* (3)
Mid	0.697* (9)	0.667* (9)	-0.747* (9)
Late	0.188 (8)	-0.168 (8)	-0.262 (8)
1983			
Early	-0.049 (4)	0.103 (4)	-0.407 (4)
Mid	0.782* (7)	0.879**(7)	-0.559 (7)
Late	-0.997**(4)	0.888 (4)	0.975 (4)

* $0.01 \leq P < 0.05$

** $P < 0.01$

Table 8--Catch per unit effort (subyearling chinook salmon/purse seine set) at six transects across John Day Reservoir, 1981. The proportion of each transect catch captured at the three sampling stations (Washington and Oregon shores, and middle) appear in parentheses.

	June/July	August	September	October	November
John Day forebay					
Oregon	243 (0.16)	54 (0.11)	13 (0.04)	33 (0.14)	4 (0.10)
Middle	619 (0.41)	80 (0.17)	12 (0.04)	24 (0.10)	9 (0.23)
Washington	665 (0.43)	343 (0.72)	299 (0.92)	180 (0.76)	27 (0.68)
Goodnoe					
Oregon	39 (0.09)	41 (0.03)	32 (0.07)	20 (0.26)	11 (0.21)
Middle	175 (0.40)	3 (0.00)	34 (0.08)	12 (0.16)	10 (0.19)
Washington	227 (0.51)	1,565 (0.97)	365 (0.85)	45 (0.58)	31 (0.60)
Blalock					
Oregon	90 (0.29)	264 (0.22)	21 (0.06)	17 (0.20)	5 (0.13)
Middle	118 (0.38)	215 (0.18)	20 (0.06)	9 (0.11)	7 (0.18)
Washington	102 (0.33)	721 (0.60)	296 (0.88)	59 (0.69)	28 (0.70)
Arlington					
Oregon	75 (0.13)	51 (0.11)	17 (0.03)	13 (0.12)	6 (0.12)
Middle	83 (0.14)	114 (0.24)	101 (0.17)	19 (0.17)	3 (0.06)
Washington	442 (0.74)	301 (0.65)	466 (0.80)	80 (0.71)	43 (0.83)
Willow Creek					
Oregon	121 (0.70)	76 (0.55)	54 (0.50)	126 (0.67)	19 (0.37)
Middle	33 (0.19)	27 (0.20)	26 (0.24)	28 (0.15)	5 (0.10)
Washington	20 (0.11)	35 (0.25)	29 (0.27)	33 (0.18)	27 (0.53)
Crow Butte					
Oregon	88 (0.22)	136 (0.16)	87 (0.14)	22 (0.13)	11 (0.23)
Middle	161 (0.41)	367 (0.44)	206 (0.33)	79 (0.46)	16 (0.34)
Washington	146 (0.37)	335 (0.40)	329 (0.53)	71 (0.41)	20 (0.43)

Table 9.--Catch per unit effort (subyearling chinook salmon/purse seine set) at six transects across John Day Reservoir, 1982. The proportion of each transect catch captured at the three sampling stations (Washington and Oregon shores, and middle) appear in parentheses.

	June/July	August	September	October	November
John Day forebay					
Oregon	393 (0.34)	84 (0.17)	9 (0.53)	55 (0.29)	2
Middle	426 (0.36)	119 (0.24)	5 (0.29)	31 (0.54)	
Washington	354 (0.30)	283 (0.58)	3 (0.18)	102 (0.54)	33
Goodnoe					
Oregon	163 (0.13)	14 (0.03)	37 (0.13)	47 (0.22)	12 (0.18)
Middle	398 (0.31)	39 (0.08)	40 (0.14)	39 (0.19)	21 (0.31)
Washington	707 (0.56)	417 (0.89)	214 (0.74)	123 (0.59)	35 (0.51)
Blalock					
Oregon	101 (0.12)	152 (0.26)	32 (0.11)	55 (0.25)	7 (0.13)
Middle	516 (0.62)	139 (0.24)	58 (0.20)	73 (0.33)	8 (0.15)
Washington	210 (0.25)	294 (0.50)	202 (0.69)	95 (0.43)	39 (0.72)
Arlington					
Oregon	1,294 (0.40)		7 (0.04)	26 (0.21)	7 (0.13)
Middle	207 (0.06)	63	29 (0.18)	13 (0.11)	8 (0.15)
Washington	1,762 (0.54)	316	129 (0.78)	83 (0.68)	39 (0.72)
Willow Creek					
Oregon	246 (0.53)	440 (0.69)	14 (0.28)	263 (0.60)	48 (0.28)
Middle	80 (0.17)	107 (0.17)	14 (0.28)	69 (0.16)	22 (0.13)
Washington	139 (0.30)	89 (0.14)	22 (0.44)	108 (0.25)	101 (0.59)
Crow Butte					
Oregon	58 (0.16)		108 (0.30)	54 (0.20)	39 (0.32)
Middle	100 (0.28)		92 (0.25)	37 (0.14)	14 (0.12)
Washington	196 (0.55)		161 (0.45)	273 (0.67)	68 (0.56)

Table 10.--Catch per unit effort (subyearling chinook salmon/purse seine set) at six transects across John Day Reservoir, 1983. The proportion of each transect catch captured at the three sampling stations (Washington and Oregon shores, and middle) appear in parentheses.

	June/July	August	September
John Day forebay			
Oregon	612 (0.34)	129 (0.18)	26 (0.15)
Middle	454 (0.25)	115 (0.16)	26 (0.15)
Washington	723 (0.40)	467 (0.66)	119 (0.70)
Goodnoe			
Oregon	20 (0.02)	72 (0.09)	14 (0.13)
Middle	123 (0.13)	101 (0.12)	18 (0.16)
Washington	836 (0.85)	671 (0.80)	79 (0.71)
Blalock			
Oregon	288 (0.33)	267 (0.23)	28 (0.17)
Middle	150 (0.17)	142 (0.13)	21 (0.13)
Washington	440 (0.50)	731 (0.64)	116 (0.70)
Arlington			
Oregon	383 (0.11)		53 (0.16)
Middle	79 (0.02)		26 (0.08)
Washington	3,000 (0.87)	1,786 (100)	253 (0.76)
Willow Creek			
Oregon	795 (0.43)		126 (0.18)
Middle	249 (0.14)		204 (0.29)
Washington	799 (0.43)	160 (100)	375 (0.53)
Crow Butte			
Oregon	276 (0.18)	73 (0.05)	76 (0.11)
Middle	819 (0.52)	452 (0.28)	161 (0.23)
Washington	468 (0.30)	1,116 (0.68)	461 (0.66)

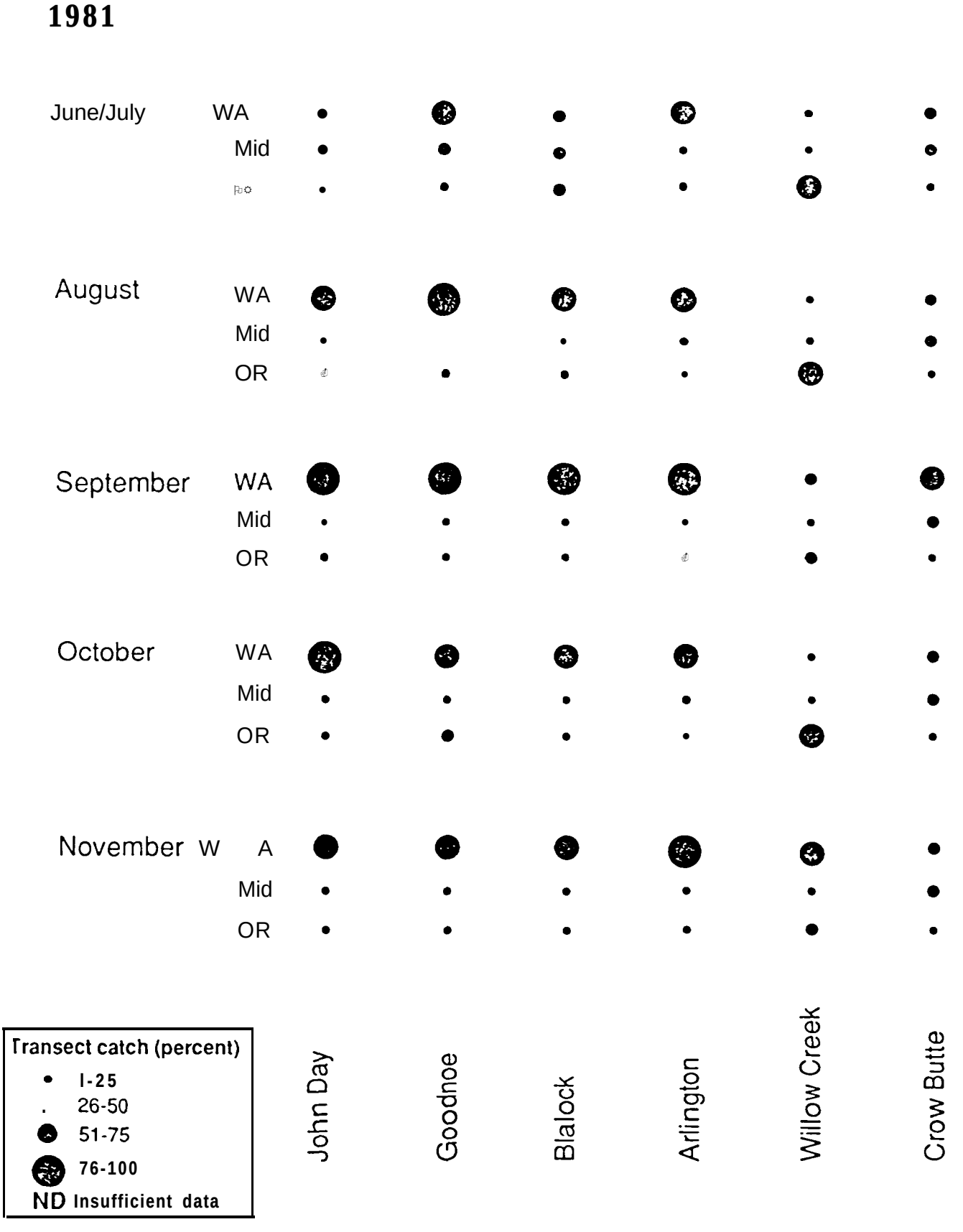

Figure 8.--Relative abundance, within transects, of subyearling chinook salmon caught with purse seine. Three stations were sampled at each transect, one station near each shore and one in the middle of the reservoir. Circle size represents the percentage of the total transect catch caught at the station during the months indicated in 1981.

1982

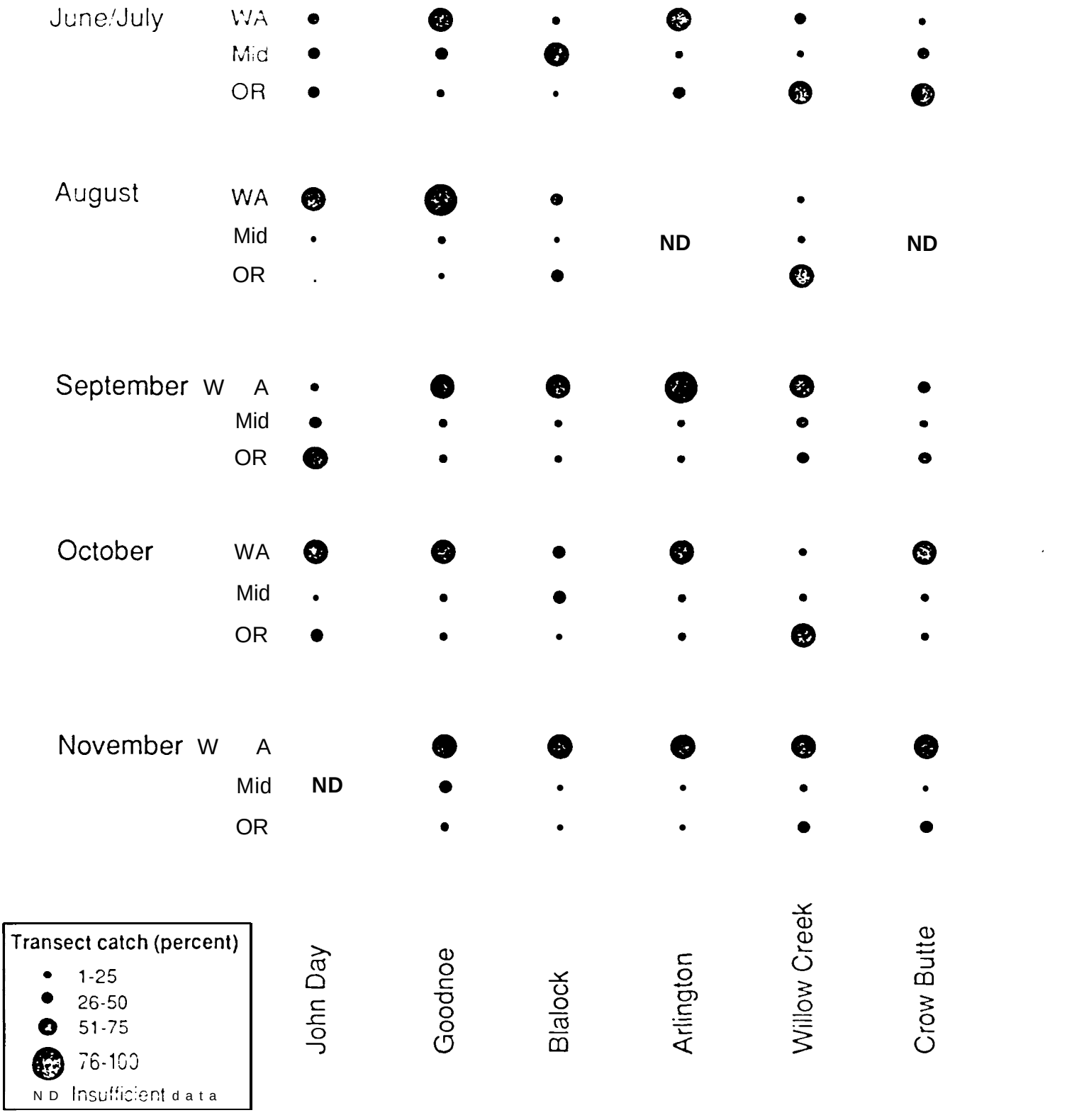

Figure 9.--Relative abundance, within transects, of subyearling chinook salmon caught with purse seine. Three stations were sampled at each transect, one station near each shore and one in the middle of the reservoir. Circle size represents the percentage of the total transect catch caught at the station during the months indicated in 1982.

1983

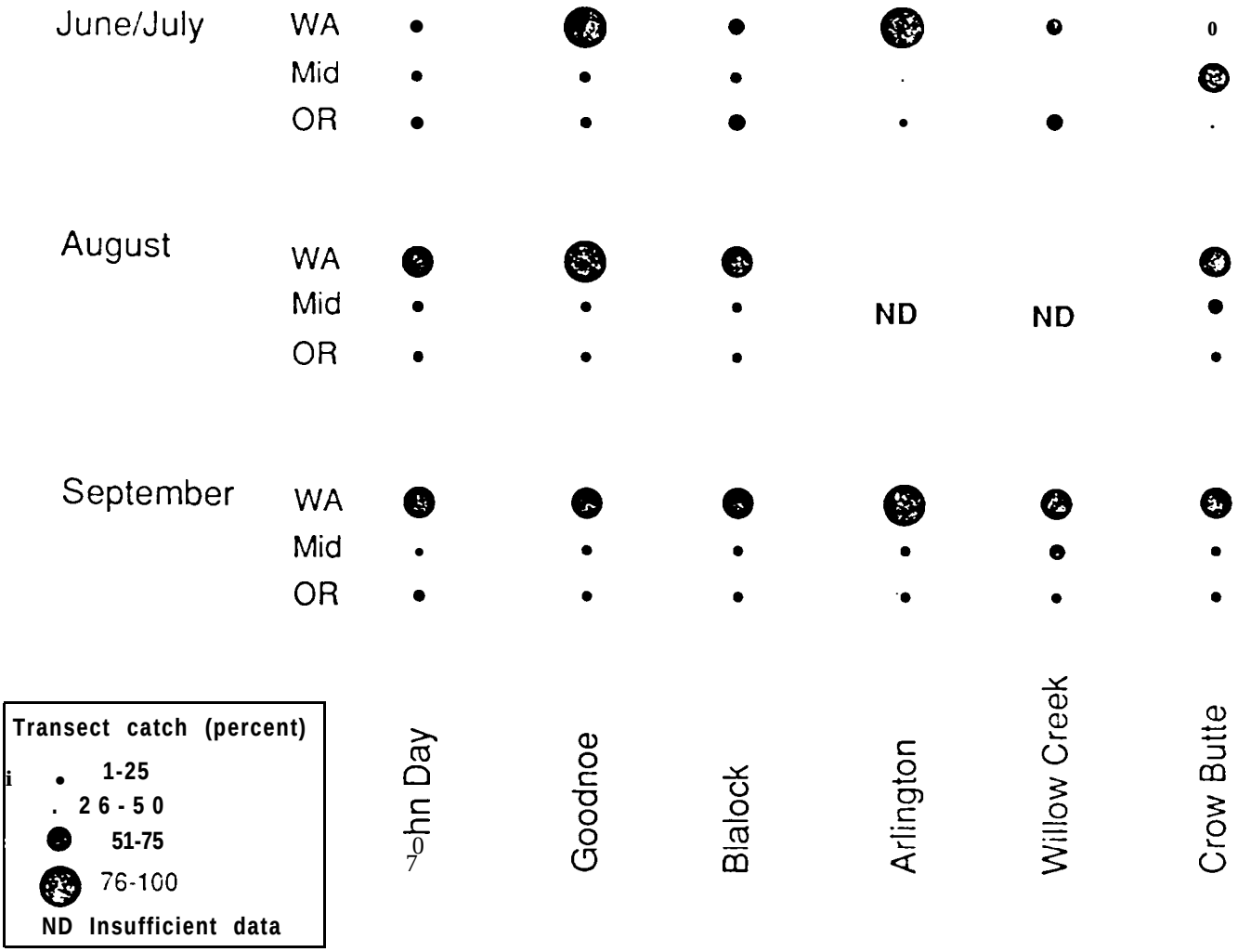

Figure 10.--Relative abundance, within transects, of subyearling chinook salmon caught with purse seine. Three stations were sampled at each transect, one station near each shore and one in the middle of the reservoir. Circle size represents the percentage of the total transect catch caught at the station during the months indicated in 1983.

side of the river but the concentration was not as great as at the downstream sites (Figs. 8-10).

Fish concentrations along the length of the reservoir show no consistent patterns and vary from year to year as well as seasonally (Tables 8-10). Fish moving in schools throughout the reservoir may explain this observation. Over the 3 years, CPUEs ranged from 2 fish per set (November 1982) to a maximum of 3,000 per set in June/July 1983 (Tables 9 and 10).

Mark-recovery data from fish which were branded in the body of the reservoir onboard the seine vessel and then released into the reservoir indicated that a large portion of subyearling chinook salmon mill within the reservoir rather than move continually downstream. Of 300 brand recoveries caught by purse seine, 163 (54%) were recaptured at or upstream from their original release site. In 1982, one extreme example was a fish released at RKm 348 which was recaptured 104 days later at RKm 430, 82 km upstream from the release site.

ADULT CONTRIBUTION

Adult contribution data show strong intra- and interannual patterns. Within any year, the chinook salmon which leave John Day Reservoir early in the summer contribute more than those that leave later. This pattern is evident in both the observed as well as the estimated adult contribution (Table 11, Fig. 11). Adults observed in the various fisheries and terminal sampling locations were as reported in the NMFS database (Appendix B). The overall adult contribution to the various fisheries and all terminal sampling locations was estimated (expanded for sampling effort) and reported by PMFC through 28 August 1989 (Appendix CL Based on those data, estimated adult contribution ranged from 0.23 to 1.02%. 0.41 to 1.80%, and 0.26 to 2.75% for fish migrating through John Day Reservoir in the summers of 1981, 1982, and 1983, respectively (Table 12, Fig. 11).

Table 11 .-Observed and estimated adult recoveries from subyearling chinook salmon tagged at McNary Dam and released in the tailrace. The observed numbers are those reported in the NMFS CWT database as of 26 July 1989; they do not include any trap fish which were released inriver. The estimated numbers are those reported by PMFC, as of 28 August 1989. Raw data are presented in Appendix Table C.

Release dates	Number released	CWT code	Observed/ e&mated	Number recovered 1982	1983	1984	1985	1986	1987	1988	Total recovered n	%
1981												
15-29 Jun	17,726	031731	O	3	6	42	14	2	0	0	67	0.38
			E	2	24	96	29	2	0	0	153	0.86
10-29 Jul	42,580	03 1732	0	3	15	78	33	3	0	0	132	0.31
			E	68	61	164	132	7	0	0	433	1.02
10-26 Aug	16,785	03 1730	0	1	0	8	5	0	0	0	13	0.08
			E	3	0	25	11	0	0	0	39	0.23
1982												
24 Jun-1 Jul	8,667	23 1609	0	0	1	4	13	5	0	0	23	0.27
			E	0	2	15	54	85	0	0	156	1.80
6-22 Jul	18.864	231611	0	0	1	3	25	9	1	0	39	0.21
			E	0	0	11	80	32	4	0	128	0.68
27 Jul-5 Aug	11,152	231613	0	0	0	3	17	3	0	0	23	0.21
			E	0	0	12	85	15	0	0	112	1.00
10 Aug-3 Scp	23,243	231615	0	0	1	1	19	5	0	0	26	0.11
			E	0	3	1	77	14	0	0	95	0.41
1983												
16 Jun-1 Jul	15,057	23 1623	0		0	6	54	51	17	0	128	0.85
			E	8	0	18	59	165	57	0	299	1.99
8-15 Jul	15,010	23 1627	O E	0	0	5	17	33	26	2	83	0.55
				0	0	10	81	231	83	6	413	2.75
20-27 Jul	14,690	23 1630	0	0		1	3	21	13	4	42	0.29
			E	0	8	6	10	51	33	17	117	0.80
29 Jul-5 Aug	10,601	23 1633	0	0	0	0	4	10	7	0	21	0.20
			E	0	0	0	12	32	16	0	60	0.57
12 Aug-2 Sep	17,292	23 1624	O E	0	0	0	0	5	3	0	8	0.05
				0	0	0	0	24	21	0	45	0.26

a/ Does not include juvenile fish from code 231611 sampled at Jones Beach and reported in PMFC database.

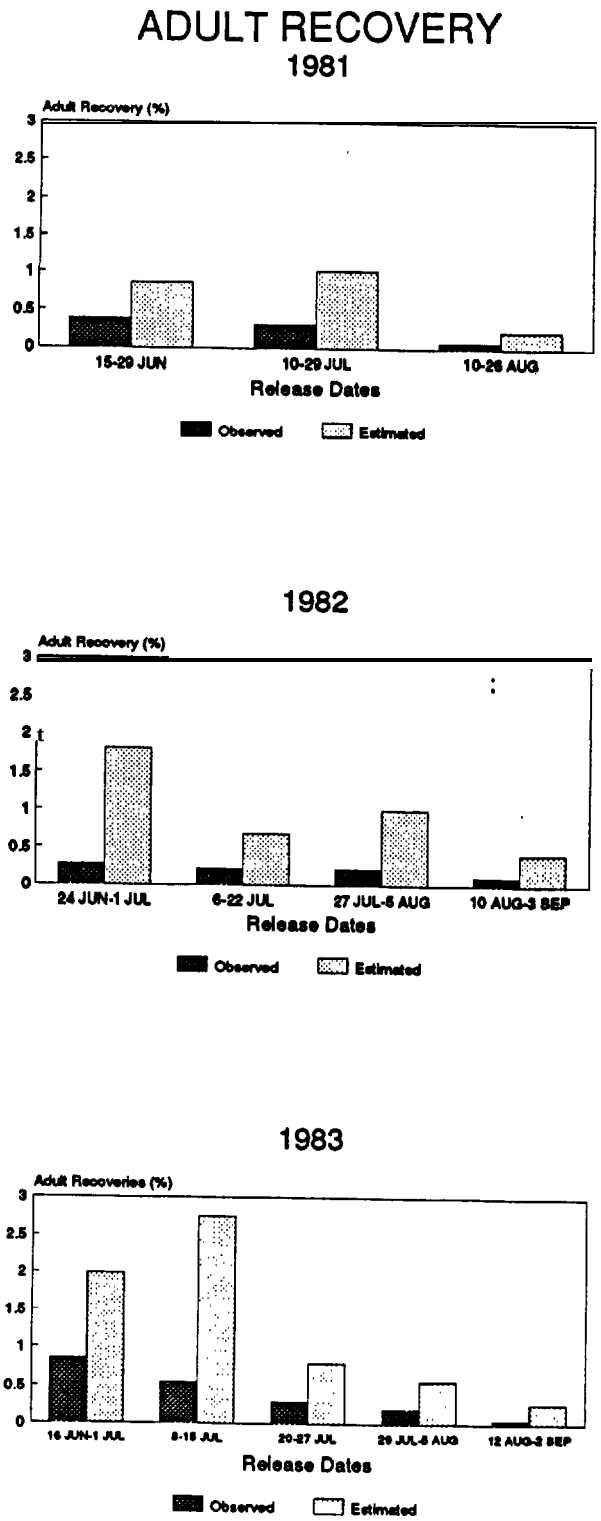

Figure Il.--Total adult recovery from coded-wire tag groups released in 1981, 1982, and 1983. Detailed data are presented in Appendixes B and C.2. The number observed were those actually sampled in each fishery and terminal sampling point. The estimated value is based on the PMFC expantion for sampling effort.

Table 12.--Adult recovery data for CWT groups which were blocked into three similar time periods corresponding to the date of marking: June (15 June to 1 July), July (6 July-5 August), and August (10 August to 3 September). Data are from PMFC database 28 August 1989.

	Number released	Estimated recoveries	
		No.	%
1981			
June	17,726	153	0.9
July	42,580	433	1.0
August	16,785	39	0.2
1982			
June	8,667	156	1.8
July	30,016	240	0.8
August	23,243	95	0.4
1983			
June	15,057	299	2.0
July	40,301	590	1.5
August	17,292	45	0.3

To determine if observed differences in intra-annual recovery proportions were significant, we used chi-square tests. Each year's data were blocked into three periods: fish marked in June (through 1 July), July (6 July through 5 August), and August (6 August through 3 September). Within each year, the groups marked earliest contributed significantly more than those marked later. The only exception was the June vs July comparison in 1981 (Table 13).

Another obvious trend in the adult recovery data is the steady increase in adult contribution over the 3-year study period. The highest estimated adult recovery for any CWT-marked group increased steadily from 1.0 to 1.8 to 2.8% during the outmigrant years 1981-1983 (Table 11). We compared adult recovery proportions among years for June, July, and August outmigrants using chi-square statistics. For June migrants, adult contribution from 1982 and 1983 were significantly greater than 1981 (Table 14). For July outmigrants, adult contribution in 1983 was significantly greater than in 1982, and 1982 was significantly greater than 1981 (Table 14). For the August outmigrants, 1982 exhibited adult returns which were significantly greater than both 1981 and 1983 (Table 14).

DISCUSSION

A primary objective of this research was to assess the effects of flow volumes on the migration speed of subyearling chinook salmon through John Day Reservoir. Activities which were conducted to evaluate the nature of the relationship were generally inconclusive. There are several reasons for this. First, John Day Dam afforded poor recovery capability for branded fish which were released at the head of the reservoir to describe travel time. Only 0.3 to 1.3% of any marked group was recovered at the dam. There were three groups from which less than 10 recoveries were observed (Tables 2 and 3). Also, all data were generated using the catch from a single turbine (Unit 3) at the dam. Such a limitation is a concern when assuming the

Table 13.--Results from chi-square tests on intra-annual comparisons of adult recovery data presented in Table 12.

Comparison	Chi-square	Probability
1981		
June vs July	3.08	0.0795
June vs August	62.00	0.0000
July vs August	93.95	0.0000
1982		
June vs July	66.42	0.0000
June vs August	156.57	0.0000
July vs August	32.02	0.0000
1983		
June vs July	18.89	0.0000
June vs August	227.78	0.0000
July vs August	160.80	0.0000

Table 14.-Results from chi-squaretests on interannual comparisons of adult recovery data presented in Table 12.

Comparison	chi-square	Probability
June 81 vs 82	44.15	0.0000
June 81 vs 83	75.46	0.0000
June 82 vs 83	1.01	0.3149
July 81 vs 82	9.05	0.0026
July 81 vs 83	33.95	0.0000
July 82 vs 83	65.11	0.0000
August 81 vs 82	9.09	0.0026
August 81 vs 83	0.27	0.6038
August 82 vs 83	6.35	0.0117

data constitute a random sample. Unfortunately, this unit was, and still is the only sampling device available at the site. Furthermore, over the course of any single years outmigration, it was only possible to brand 14 to 20 separate groups. This number would have been sufficient to describe seasonal patterns, but too small to describe relationships for date-blocked subsets within each year's outmigration.

Secondly, the study was not designed to identify the migratory characteristics of individual races or stocks within the composite population. It is entirely possible that certain stocks respond to fIows or water temperature in different fashions.

Another difficulty is the inability to isolate river flow from other variables, particularly water temperature or the release date of the marked group. The latter is important because fish size and physiological development change over the course of the summer and may have a pronounced effect on migratory behavior. However, the study design could not assess these factors. At the time this study was initiated, the understanding of the relationship between physiological development and specific migratory behaviors was poor. Even now, specific details regarding emolt development and migration speed are poorly defined, particularly for subyearling chinook salmon.

It is essential that any future analyses address these issues if the fIow requirements of subyearling chinook salmon are to be adequately defined.

The adult contribution data show two definite trends. First, migrants traversing the reservoir early in the summer contribute more in terms of adult production than fish that migrate later in the summer (Fig. 11). This pattern was consistent for each of the 3 years, 1981-1983. One generahy accepted explanation may be that as water temperature increases over the course of the summer predator activity increases and juvenile salmon incur increasing levels of predation related mortality. This process has been well documented within John Day Reservoir (Poe and Rieman 1988). Another possible explanation is that exposure of smolta to elevated temperatures may exacerbate the expression of latent diseases.

A second pattern apparent in the adult contribution data is the increase in adult contribution observed for the 1981-1983 outmigrations. The overall adult contribution from fish marked during those outmigration years increased steadily from 1.0 to 1.8 to 2.8%. Upriver bright chinook salmon which constituted a large portion of the population reflect the same pattern. Adult returns to the Columbia River for this stock increased steadily from 131,000 to 196,000 to 281,600 to 419,000 for the years 1984 through 1987, respectively (Anonymous 1989).

In terms of adult contribution there is no evidence to suggest a relationehip between river flow volumes that prevailed during the 1981-1983 outmigrationa and associated adult returns. However, in the context of recent summerflow volumes, the flows during 1981-1983 were relatively high Fig. 2). In 1987 and 1988, summerflow volumes were particularly low, with monthly averages ranging from 103.4 (August) to 108.3 kcfs (July), and 88.8 (August) to 111.8 kcfs (September) in each year, respectively.* Whether flows at these reduced levels may have a deleterious effect on adult contribution is uncertain at this time.

SUMMARY AND CONCLUSIONS

1) It was not possible to define a relationship between flow and migration speed of subyearling chinook salmon through John Day Reservoir. In our opinion, this is in a large part due to low mark-recoveries at John Day Dam prior to installation of submersible traveling screens (STS's). Also, specific effects attributable to flow were difficult, if not impossible, to isolate. This is because flow, water temperature, fish size, stock composition, and physiological status of the population change over the course of each summer,s outmigration. Any future investigations, with similar objectives, need to address this problem.

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* Monthly average flowe were provided by the Fish Passage Center as reported by the U.S. Army Corps of Engineers

2) The distribution and movement of juveniles within the reservoir indicated that they ranged the length of the reservoir and did not exhibit consistent displacement downstream.

3) CWT data indicated consistent intraseasonal patterns in adult contribution. Early summer migrants contributed greater adult returns than juvenilea which migrated through the reservoir later in the summer.

4) CWT data indicated that adult returns from the three outmigration years increased from year to year. The greatest contribution estimated for a particular CWT group in each year was 1.0, 1.8, and 2.8%, for 1981, 1982, and 1983, respectively.

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APPENDIX A.-Data output from stepwise regression routine in Statgraphics which was used to investigate the relationship between flow and travel time.

1981

Full Multiple Regression Model Using Flow, Temperature, And Date

Independent Variable	coefficient	std. error	sig. level
Constant	-120.17	168.5214	0.4921
McNary flow	0.08	0.1034	0.4829
McNary temperature	2.16	4.6132	0.6500
Julian date	-0.10	0.7867	0.9054

R^2(adj.)= 0.0000

Multiple Reqression Model Using Only Statitistically Significant Variables Selected By A Stepwise Procedure

Independent Variable	coefficient	std. error	sig. level
Constant	15.21	1.5234	0.0000

R^2(adj.)= 0.0000

Sample Correlations Between Variables For Full Data Set

	Temperature	Flow	Median Travel Time
Date	.9955	-.9701	.1912
	(14)	(14)	(14)
	(.0000)	(.0000)	(.5126)
Temperature		-.9660	.2034
		(14)	(14)
		(.0000)	(.4854)
Flow			-.1328
			(14)
			(.6508)

Sample Correlations Between Variables And Median Travel Time For Early, Middle, And Late Release Periods

	Date	Temperature	Flow
Early	-.9949	-.9784	.9912
	(4)	(4)	(4)
	(.0051)	(.0216)	(.0088)
Middle	-.9450	-.9435	.9059
	(5)	(5)	(5)
	(.0154)	(.0160)	(.0341)
Late	-.5753	-.2966	.4609
	(5)	(5)	(5)
	(.3103)	(.6279)	(.4345)

1982

Full Multiple Reqression Model Using Flow, Temperature, And Date

Independent Variable	coefficient	std. error	sig. level
Constant	289.61	296.2840	0.3429
McNary flow	-0.16	0.1498	0.3126
McNary temperature	-4.72	3.8425	0.2368
Julian date	0.38	0.2471	0.1389

R^2(adj.)= 0.4576

Multiple Regression Node1 Using Only Statisitically Significant Variables Selected By A Stepwise Procedure

Independent Variable	coefficient	std. error	sig. level
Constant	-54.46	18.9638	0.0101
Julian date	0.38	0.0889	0.0005

R^2(adj.)= 0.4713

Sample Correlations Between Variables For Full Data Set

	Temperature	Flow	median Travel Time
Date	.9093	-.9304	.7065
	(20)	(20)	(20)
	(.0000)	(.0000)	(.0005)
Temperature		-.9850	.5948
		(20)	(20)
		(.0000)	(.0057)
Flow			-.6457
			(20)
			(.0021)

Sample Correlations Between Variables And Median Travel Time For Early, Middle, And Late Release Periods

	Date	Temperature	Flow
Early	-.9946	-.9946	.9999
	(3)	(3)	(3)
	(.0659)	(.0659)	(.0112)
Middle	.6974	.6669	-.7465
	(9)	(9)	(9)
	(.0367)	(.0498)	(.0209)
Late	.1882	-.1676	-.2615
	(8)	(8)	(8)
	(.6556)	(.6919)	(.5314)

1983

Full Multiple Reqression Model Using Flow, Temperature, And Date

Independent Variable	coefficient	std. error	sig. level
Constant	-115.17	46.4933	0.0307
McNary flow	0.02	0.0974	0.8457
McNary temperature	3.48	0.8236	0.0014
Julian date	-0.44	0.2228	0.0767

R^2(adj.)= 0.5819

Multiple Reqression Model Using Only Statistically Significant Variables Selected By A Stepwise Procedure

Independent Variable	coefficient	std. error	sig. level
Constant	-107.62	25.8788	0.0013
McNary temperature	3.53	0.7479	0.0005
Julian date	-0.47	0.1301	0.0035

R^2(adj.)= 0.6153

Sample Correlations Betueen Variables For Full Data Set

	Temperature	Flow	Median Travel Time
Date	.8997	-.9076	.2403
	(15)	(15)	(15)
	(.0000)	(.0000)	(.3883)
Temperature		-.7576	.5578
		(15)	(15)
		(.0011)	(.0307)
Flow			-.0986
			(15)
			(.7266)

Sample Correlations Between Variables And Median Travel Time For Early, Middle, And Late Release Periods

	Date	Temperature	Flow
Early	-.0485	.1032	-.4070
	(4)	(4)	(4)
	(.9513)	(.8966)	(.5931)
Middle	.7822	.8793	-.5586
	(7)	(7)	(7)
	(.0377)	(.0023)	(.1924)
Late	-.9965	.8875	.9754
	(4)	(4)	(4)
	(.0035)	(.1125)	(.0246)

APPENDIX B.--Observed adult CWT recoveries from subyearling chinook salmon marked at McNary Dam and released in the tailrace during the summers 19814983. Data from the NMFS database. Only CWT verified by NMFS are reported here. No adults which were intercepted at dams, had brands read, and were released inriver are included in these data. Data were processed on 30 August 1989.

Master File Date : 30 August 1989
RELEASE GROUPS INCLUDED: 8106B

1981 MCNARY J.D. POOL CONTROL BELOW MCNARY

FALL CHINOOK

Brands Used: LAID1 LAID2 ID3 LAID4
Wire Codes Used: 031731 031731 if1731 031731

NUMBER RELEASED: 17736

RECOVERY AREA	YEAR OF RETURN 1981	1982	1983	1984	1985	1986	TOTAL	% RETURN
RIVER SYSTEM TRAPS								
BONNEVILLE TRAP	0	0	0	4	4	0	8	0.045
MCNARY TRAP	0	0	0	3	0	0	0	0.000
LOWER GRANITE TRAP	0	0	0	0	0	0	0	0.000
PRIEST RAPIDS TRAP	0	0	0	0	0	0	0	0.000
OCEAN FISHERIES								
ALASKA	0	2	0	14	3	1	20	0.113
BRITISH COLUMBIA	0	0	5	7	1	0	13	0.073
WASHINGTON	0	0	0	0	1	0	1	0.006
OREGON	0	0	0	0	0	0	0	0.000
CALIFORNIA	0	0	0	0	0	0	0	0.000
OTHER	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	1	0	0	1	0.006
WENATCHEE R.	0	0	0	0	0	0	0	0.000
SNAKE R.	0	0	0	0	0	0	0	0.000
RIVER COMMERCIAL								
COMMERCIAL NET	0	0	1	1	0	0	2	0.011
INDIAN FISHERY								
FALL INDIAN NET	0	0	0	5	2	1	8	0.045
HATCHERIES								
PRIEST RAPIDS H.	0	1	0	8	3	0	12	0.068
STREAM SURVEY								
OTHER STREAMS	0	0	0	2	0	0	2	0.011
TOTALS	0	3	6	42	14	2	67	0.378
PERCENT OF RECOVERY %	0.0	4.5	9.0	62.7	20.9	3.0		

Master File Date : 20 August 1989
RELEASE GROUPS INCLUDED: 81A1A

1381 MCNARY TRANS CONTROL BELOW MCNARY

FALL CHINOOK

Brands Used: LAIM1 LAIM3 LAIM2 LAIM4
Wire Codes Used: 031732 031732 031732 031732

NUMBER RELEASED: 42580

RECOVERY AREA		YEAR OF RETURN 1981	1982	1983	1984	1985	1986	TOTAL	% RETURN
RIVER SYSTEM TRAPS									
BONNEVILLE TRAP		0	0	0	19	6	0	25	0.059
MCNARY TRAP		0	0	0	0	0	0	0	0.000
LOWER GRANITE TRAP		0	0	0	0	0	0	0	0.000
PRIEST RAPIDS TRAP		0	0	0	0	0	0	0	0.000
OCEAN FISHERIES									
ALASKA		0	0	3	20	5	1	29	0.068
BRITISH COLUMBIA		0	1	5	6	0	0	20	0.047
WASHINGTON		0	0	0	1	0	0	1	0.002
OREGON		0	0	0	1	0	0	1	0.002
CALIFORNIA		0	0	0	0	0	0	0	0.000
OTHER		0	0	0	0	0	0	0	0.000
RIVER SPORT		0	0	0	0	0	0	0	0.000
RIVER COMMERCIAL									
COMMERCIAL NET		0	0	0	9	1	0	10	0.023
INDIAN FISHERY									
FALL INDIAN NET		0	0	5	13	11	2	31	0.073
HATCHERIES									
BONNEVILLE H.		0	0	0	1	0	0		0.002
PRIEST RAPIDS H		0	1	0	6	1	0		0.019
STREAM SURVEY									
OTHER STREAMS		0	1	2	2	1	0	6	0.014
TOTALS		0	3	15	78	33	3	132	0.310
PERCENT OF RECOVERY	%	0.0	2.3	11.4	59.1	25.0	2.3		

RELEASE GROUPS INCLUDED: 8106A

1981 MCNARY J. D. POOL CONTROL BELOW MCNARY

FALL CHINOOK

Brands Used: LA3X1 LA3X2 LA3X3 LAUP1 LAUP2 LAUP3 LAUP4
Wire Codes Used: 031730 031730 031730 031730 031730 031730 031730

NUMBER RELEASED: 16785

RECOVERY AREA		YEAR OF RETURN 1981	1982	1983	1984	1985	1986	TOTAL	% RETURN
RIVER SYSTEM TRAPS									
BONNEVILLE TRAP		0	0	0	0	1	0	1	0.006
MCNARY TRAP		0	0	0	0	0	0	0	0.000
LOWER GRANITE TRAP		0	0	0	0	0	0	0	0.000
PRIEST RAPIDS TRAP		0	0	0	0	0	0	0	0.000
OCEAN FISHERIES									
ALASKA		0	0	0	2	2	0	4	0.024
BRITISH COLUMBIA		0	1	0	2	1	0	4	0.024
WASHINGTON		0	0	0	0	0	0	0	0.000
OREGON		0	0	0	0	0	0	0	0.000
CALIFORNIA		0	0	0	0	0	0	0	0.000
OTHER		0	0	0	0	0	0	0	0.000
RIVER SPORT		0	0	0	0	0	0	0	0.000
RIVER COMMERCIAL									
COMMERCIAL UNIT		0	0	0	1	0	0	1	0.006
INDIAN FISHERY									
FALL INDIAN NET		0	0	0	2	1	0	3	0.018
HATCHERIES									
WELLS H.		0	0	0	1	0	0	1	0.006
STREAM SURVEY		0	0	0	0	0	0	0	0.000
TOTALS		0	1	0	8	5	0	14	0.083
PERCENT RECOVERY	%	0.0	7.1	0.0	57.1	35.7	0.0		

Haster File Date : 30 August 1989
RELEASEGROUPSINCLUDED:8205A

1982 MCNARY TRANS CONTROL BELOW MCNARY

FALL CHINOOK

Brands Used: LAB 1 LAH 2 LAIF1 LAIF3
Nire Codes Used: 231609 231609 231609 231609

NUMBER RELEASED: 8667

RECOVERY AREA		YEAR OF RETURN 1982	1983	1984	1985	1986	1987	TOTAL	% RETURN
RIVER SYSTEM TRAPS									
BONNEVILLE TRAP		0	0	0	1	0	0	1	0.012
MCNARY TRAP		0	0	0	0	0	0	0	0.000
LOWER GRANITE TRAP		0	0	0	0	0	0	0	0.000
PRIEST RAPIDS TRAP		0	0	0	0	0	0	0	0.000
OCEAN FISHERIES									
ALASKA		0	0	0	4	1	0	5	0.058
BRITISH COLUMBIA		0	1	2	2	1	0	6	0.069
WASHINGTON		0	0	0	a	0	0	0	0.000
OREGON		0	0	0	R	0	0	0	0.000
CALIFORNIA		0	0	0	0	0	0	0	0.000
OTHER		0	0	0	0	0	0	0	0.000
RIVER SPORT									
COLUMBIA R. BELOW SNAKE R.		R	0	0	0	0	0	0	0.000
COLUMBIA R. ABOVE SNAKE R.		0	0	0	1	0	0	1	0.012
WENATCHEE R.		0	0	0	0	0	0	0	0.000
SNAKE R.		0	0	0	0	0	0	0	0.000
RIVER COMMERCIAL									
COMMERCIAL NET		0	0	1	1	0	0	2	0.023
INDIAN FISHERY									
FALL INDIAN NET		0	0	0	2	3	0	5	0.058
HATCHERIES									
PRIEST RAPIDS H.		0	0	1	1	0	0	2	0.023
STREAM SURVEY									
OTHER STREAMS		0	0	0	1	0	0	1	0.012
TOTALS		0	1	4	13	5	0	23	0.265
PERCENTS OF RECOVERY	%	3.R	4.3	17.4	56.5	21.7	0.0		

1982 MCNARY TRANS CONTROL BELOW MCNARY

FALL CHINOOK

Brands Used: LAIC1 LAIC3 LAIM1 LAIM3 LAIF2 LAIF4
Wire Codes Used: 231611 231611 231611 231611 231611 231611

NUMBER RELEASED 18844

RECOVERY AREA	1982	YEAR OF RETURN 1983	1984	1985	1986	1987	TOTAL	% RETURN
RIVER SYSTEM TRAPS								
BONNEVILLE TRAP	0	0	0	1	1	0	2	0.011
MCNARY TRAP	0	0	0	0	0	0	0	0.000
LOWER GRANITE TRAP	0	0	0	0	3	3	3	0.000
PRIEST RAPIDS TRAP	0	0	0	0	0	0	0	0.000
OCEAN FISHERIES								
ALASKA	0	1	0	6	1	0	8	0.042
BRITISH COLUMBIA	0	0	2	3	2	0	7	0.037
WASHINGTON	0	0	0	0	0	0	0	0.000
OREGON	0	0	0	0	0	0	0	0.000
CALIFORNIA	0	0	0	1	0	0	1	0.005
OTHER	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	2	0	2	0.011
WENATCHEE R.	0	0	0	0	0	0	0	0.000
SNAKE R.	0	0	0	0	0	0	0	0.000
RIVER COMMERCIAL								
COMMERCIAL NET	0	0	0	4	0	1	5	0.027
INDIAN FISHERY								
FALL INDIAN NET	0	0	0	8	3	0	11	0.058
HATCHERIES								
PRIEST RAPIDS H.	0	0	1	2	0	0	3	0.016
STREAM SURVEY	0	0	0	0	0	0	0	0.000
TOTALS	0	1	3	25	9	1	39	0.207
PERCENT OF RECOVERY %	0.0	2.6	7.7	64.1	23.1	2.6		

laster File Date : 30 August 1989
RELEASEGROUPSINCLUDED82Ø5C

1982 MCNARY TRANS CONTROL BELOW MCNARY

FALL CHINOOK

Brands Used: LAIC2 LAIC4 LAIM2 LAIM4
Wire Codes Used: 231613 231613 231613 231613

NUMBER RELEASED: 11152

RECOVERY AREA	YEAR OF RETURN 1982	1983	1984	1985	1986	1987	TOTAL	% RETURN
RIVERSYSTEMTRAPS								
BONNEVILLE TRAP	Ø	Ø	Ø	1	Ø	Ø	1	Ø.ØØ9
MCNARYTRAP	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø.ØØØ
LOWERGRANITETRAP	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø.ØØØ
PRIESTRAPIDSTRAP	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø.ØØØ
OCEAN FISHERIES								
ALASKA	Ø	Ø	Ø	5	2	Ø	7	Ø.Ø63
BRITISHCOLUMBIA	Ø	Ø	Ø	3	1	Ø	4	Ø.Ø36
WASHINGTON	Ø	Ø	Ø	1	Ø	Ø	1	Ø.ØØ9
OREGON	Ø	Ø	Ø	Ø	3	Ø	3	Ø.ØØØ
CALIFORNIA	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø.ØØØ
OTHER	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø.ØØØ
RIVER SPORT								
COLUMBIAR.BELOWSNAKER.	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø.ØØØ
COLUMBIAR.ABOVESNARER.	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø.ØØØ
WENATCHEE R.	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø.ØØØ
SNAKE R.	Ø	Ø	Ø	Ø	Ø	Ø	Ø	Ø.ØØØ
OTHER RIVERS	Ø	Ø	Ø	1	Ø	Ø	1	Ø.ØØ9
RIVERCOMMERCIAL								
COMMERCIAL NET	Ø	Ø	1	3	Ø	Ø	4	Ø.Ø36
INDIAN FISHERY								
FALLINDIANNET	a	Ø	1	3	a	Ø	4	Ø.Ø36
HATCHERIES	Ø	Ø	Ø	Ø	a	Ø	Ø	Ø.ØØØ
STREAMSURVEY								
OTHERSTREAMS	a	Ø	1	Ø	Ø	Ø	1	Ø.ØØ9
TOTALS	a	Ø	3	17	3	Ø	23	Ø.2Ø6
PERCENTOFRECOVERY %	a.Ø	Ø.Ø	13.Ø	73.9	13.Ø	Ø.Ø		

Master File Date : 30 August 1989
RELEASE GROUPS INCLUDED: 8206A

1982 MCNARY JOHN DAY FOOL EVAL BELOW MCNARY

FALL CHINOOK

Brands Used: LA+Y1 LA+Y3 LA+U1 LA+Y2 LA+U3 LA+Y4 LA+U2 LA+U4
Wire Codes Used: 231615 231615 231615 231615 231615, 231615 231615 231615

NUMBER RELEASED: 23004

RECOVERY AREA		YEAR OF RETURN 1382	1383	1394	1385	1986	1387	TOTAL	% RETURN
RIVER SYSTEM TRAPS									
BONNEVILLE TRAP		0	0	0	0	1	0	1	0.004
MCNARY TRAP		0	0	0	0	0	0	0	0.000
LONER GRANITE TRAP		0	0	0	0	0	0	0	0.000
PRIEST RAPIDS TRAP		0	0	0	0	0	0	0	0.000
OCEAN FISHERIES									
ALASKA		0	0	0	12	2	0	14	0.061
BRITISH COLOMBIA		0	0	0	0	0	0	0	0.000
WASHINGTON		0	1	0	1	0	0	2	0.009
OREGON		0	0	0	0	0	0	0	0.000
CALIFORNIA		0	0	0	0	0	0	0	0.000
OTHER		0	0	1	0	3	0	1	0.004
RIVER SPORT		0	0	0	0	N	0	0	0.000
RIVER COMMERCIAL									
COMMERCIAL NET		0	0	3	1	0	0	1	0.004
INDIAN FISHERY									
FALL INDIAN NET		0	0	0	3	2	0	5	0.022
SUMMER INDIAN NET		0	0	0	1	0	0	1	0.004
HATCBERIES		0	0	0	0	0	0	0	0.000
STREAM SURVEY									
OTHER STREAMS		0	0	0	1	3	0	1	0.004
TOTALS		0	1	1	19	5	0	26	0.113
PERCENT OF RECOVERY	%	0.0	3.8	3.8	73.1	19.2	0.0		

Master File Date : 30 August 1989
RELEASE GROUPS INCLUDED: 8206A

1982 MCNARY JOHN PAY FOOL EVAL BELOW MCNARY

FALL CHINOOK

Brands Used: LA+Y1 LA+Y3 LA+Q1 LA+Y2 LA+Q3 LA+Q4 LA+Q2 LA+Q4
Wire Codes Used: 231615 231615 231615 231615 231615 231615 231615 231615

NUMBER RELEASED: 23004

RECOVERY AREA		YEAR OF RETURN 1982	1983	1984	1985	1986	1987	TOTAL	% RETURN
RIVER SYSTEM TRAPS									
BONNEVILLE TRAP		0	0	0	0	1	0	1	0.004
MCNARY TRAP		0	0	0	0	0	0	0	0.000
LOWER GRANITE TRAP		0	0	0	0	0	0	0	0.000
PRIEST RAPIDS TRAP		0	0	0	0	0	0	0	0.000
OCEAN FISHERIES									
ALASKA		0	0	0	12	2	0	14	0.061
BRITISH COLUMBIA		0	0	0	0	0	0	0	0.000
WASHINGTON		0	1	0	1	0	0	2	0.009
OREGON		0	0	0	0	0	0	0	0.000
CALIFORNIA		0	0	0	0	0	0	0	0.000
OTHER		0	0	1	0	0	0	1	0.004
RIVER SPORT		0	0	0	0	0	0	0	0.000
RIVER COMMERCIAL									
COMMERCIAL NET		0	0	0	1	0	0	1	0.004
IHDIAN FISHERY									
FALL INDIAN NET		0	0	0	3	2	0	5	0.022
SUMMER INDIAN NET		0	0	0	1	0	0	1	0.004
HATCHERIES		0	0	0	0	0	0	0	0.000
STREAM SURVEY									
OTHER STREAM		0	0	0	1	0	0	1	0.004
TOTALS		0	1	1	19	5	0	26	0.113
PERCENT OF RECOVERY	%	0.0	3.8	3.8	73.1	19.2	0.0		

Master File Date : 30 August 1999
RELEASE GROUPS INCLUDED: 8310A

1983 MCNARY JOHN DAY POOL EVAL BELOW MCNARY FALL CHINOOK

Brands Used: LA7T1LA7T3LD7T1
Wire Codes Used: 231623 231623 231523

NUMBER RELEASED 15059

RECOVERY AREA	YEAR OF RETURN 1983	1984	1985	1986	1987	1988	TOTAL	% RETURN
RIVER SYSTEM TRAPS								
BONNEVILLE TRAP	0	0	0	2	0	0	2	0.013
MCNARY TRAP	0	0	0	0	0	0	0	0.000
LOWER GRANITE TRAP	0	0	0	0	0	0	0	0.000
PRIEST RAPIDS TRAP	0	0	0	0	1	0	1	0.007
OCEAN FISHERIES								
ALASKA	0	0	35	14	5	0	54	0.359
BRITISH COLUMBIA	0	0	5	8	1	0	14	0.093
WASHINGTON	0	0	0	1	0	0	1	0.007
OREGON	0	0	0	1	0	0	1	0.007
CALIFORNIA	0	0	0	0	0	0	0	0.000
OTHER	0	2	0	0	0	0	2	0.013
RIVER SPORT								
COLUMBIA R. BELOW SNAKE R.	0	0	0	0	0	0	0	0.000
COLUMBIA R. ABOVE SNAKE R.	0	0	1	0	1	0	2	0.013
WENATCHEE R.	0	0	0	0	0	0	0	0.000
SNAKE R.	0	0	0	0	0	0	0	0.000
OTHER RIVERS	0	0	0	0	1	0	1	0.007
RIVER COMMERCIAL								
COMMERCIAL NET	0	0	2	0	5	0	7	0.046
INDIAN FISHERY								
FALL INDIAN NET	0	0	4	16	3	0	23	0.153
HATCHERIES								
WELLS H.	0	0	0	2	0	0	2	0.013
PRIEST RAPIDS H.	0	3	7	7	0	0	17	0.113
STREAM SURV BY								
OTHER STREAK	2	1	0	0	0	0	1	0.007
TOTALS	3	6	54	51	17	0	128	0.850
PERCENT OF RECOVERY %	0.0	4.7	42.2	39.8	13.3	0.0		

blaster File Date : 30 August 1959
RELEASE GROUPS INCLUDED: 8304A

1983 MCNARY TRANS CONTROL BELOW MCNARY

FALL CHINOOK

Brands Used: LA2L1 LA2L3 LD2L1
Wire Codes Used: 231627 231627 231627

NUMBER RELEASED: 150190

RECOVERY AREA	YEAR OF RETURN 1983	1984	1985	1986	1987	1988	TOTAL	% RETURN
RIVER SYSTEM TRAPS								
BONNEVILLE TRAP	0	0	0	2	0	0	2	0.013
MCNARY TRAP	0	0	0	0	0	0	0	0.000
LOWER GRANITE TRAP	0	0	0	0	0	0	0	0.000
PRIEST RAPIDS TRAP	0	2	0	0	2	0	4	0.027
OCEAN FISHERIES								
ALASKA	0	0	0	15	5	0	20	0.133
BRITISH COLUMBIA	0	1	4	5	7	0	17	0.113
WASHINGTON	0	0	0	1	0	0	1	0.007
OREGON	0	0	1	1	0	2	4	0.027
CALIFORNIA	0	0	0	0	0	0	0	0.000
OTHER	0	1	0	0	0	0	1	0.007
RIVER SPORT								
COLUHBIAR BELOWSNAKER.	0	0	0	1	0	0	1	0.007
COLUHBIAR ABOVESNAKER.	0	0	1	0	0	0	1	0.007
WENATCHEE R.	0	0	0	0	0	0	0	0.000
SNAKE R.	0	0	0	0	0	0	0	0.000
RIVER COHHERCIAL								
COMMERCIAL NET	0	0	3	0	3	0	6	0.040
INDIAN FISHERY								
INDIAN FISHERY	0	0	0	0	1	0	1	0.007
FALL INDIAN NET	0	0	4	6	7	0	17	0.113
HATCHERIES								
PRIEST RAPIDS H.	0	1	3	2	0	0	6	0.040
STREAM SURVEY								
OTHER STREAMS	0	0	1	0	1	0	2	0.013
TOTALS	0	5	17	33	26	2	83	0.553
PERCENT RECOVERY %	0.0	6.0	20.5	39.8	31.3	2.4		

1983 MCNARY TRANS CONTROL BELOW MCNARY

FALL CHINOOK

Brands Used: LA2T1 LA2T3 LD2T1
Wire Codes Used: 231638 231630 231630

NUMBER RELEASED: 14690

RECOVERY AREA	1983	YEAR OF RETURN 1984	1985	1986	1987	1988	TOTAL	% RETURN
RIVER SYSTEM TRAPS								
BONNEVILLE TRAP	0	0	0	0	1	0	1	0.007
MCNARY TRAP	0	0	0	0	0	0	0	0.000
LOWER GRANITE TRAP	0	0	0	0	0	0	0	0.000
PRIEST RAPIDS TRAP	0	0	0	0	1	0	1	0.007
OCEAN FISHERIES								
ALASKA	0	0	0	7	6	2	15	0.102
BRITISH COLUMBIA	0	1	0	6	0	1	8	0.054
WASHINGTON	0	0	0	0	0	0	0	0.000
OREGON	0	0	0	0	0	1	1	0.007
CALIFORNIA	0	0	0	0	0	0	0	0.000
OTHER	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	1	0	0	0	1	0.007
WENATCHEE R.	0	0	0	0	0	0	0	0.000
SNAKE R.	0	0	0	0	0	0	0	0.000
OTHER RIVERS	0	0	0	0	1	0	1	0.007
RIVER COMMERCIAL								
COMMERCIAL NET	0	0	0	0	1	0	1	0.007
INDIAN FISHERY								
FALL INDIAN PET	0	0	0	6	2	0	8	0.054
HATCHERIES								
PRIEST RAPIDS H.	0	0	2	2	0	0	4	0.027
STREAM SURVEY								
OTHER STREAMS	0	0	0	0	1	0	1	0.007
TOTALS	0	1	3	21	13	4	42	0.286
PERCENT OF RECOVERY %	0.0	2.4	7.1	50.0	31.0	9.5		

Master File Date : 30 August 1989
RELEASE GROUPS INCLUDED: 83340

1383 McNARY TRANS CONTROL BELOW MCNARY

FALL CHINOOK

Brands Used: LA2X1 LA2X3
Wire Codes Used: 231633 231633

NUMBER RELEASED 13601

RECOVERY AREA		YEAR OF RETURN 1983	1984	1985	1986	1987	1988	TOTAL	% RETURN
RIVER SYSTEM TRAPS									
BONNEVILLE TRAP		0	0	0	1	0	0	1	0.008
MCNARY TRAP		0	0	0	0	0	0	0	0.000
LOWER GRANITE TRAP		0	0	0	0	0	0	0	0.000
PRIEST RAPIDS TRAP		0	0	0	0	2	0	2	0.015
OCEAN FISHERIES									
ALASKA		0	0	0	2	1	0	3	0.023
BRITISH COLUMBIA		0	0	1	1	0	0	2	0.015
WASHINGTON		0	0	1	0	0	0	1	0.008
OREGON		0	0	0	0	0	0	0	0.000
CALIFORNIA		0	0	0	0	0	0	0	0.000
OTHER		0	0	0	0	0	0	0	0.000
RIVER SPORT		0	0	0	0	0	0	0	0.000
RIVER COMMERCIAL									
COMMERCIAL NET		0	0	1	0	1	0	2	0.015
INDIAN FISHERY									
FALL INDIAN NET		0	0	0	6	2	0	8	0.075
HATCHERIES									
WELLS H.		0	0	0	0		0		0.000
PRIEST RAPIDS H.		0	0	1	0	a	0		0.008
STREAM SURVEY		0	0	0	0	0	0	0	0.000
TOTALS		0	0	4	10	7	0	21	0.138
PERCENT OF RECOVERY	%	0.0	0.0	19.0	47.6	33.3	0.0		

Master File Pate : 30 August 1969
RELEASE GROCFS INCLUDED: 83108

1983 MCNARY JOHN DAY POOL EVAL BELOW MCNARY

FALL CHINOOK

Brands Used: LA7S1 LA7S3 LD7S1 LD7S3
Hire Codes Used: 231624 231624 231624 231524

NUMBER RELEASED: 11235

RECOVERY AREA	YEAR OF RETURN 1983	1984	1985	1986	1987	1988	TOTAL	% 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
LONER GRANITE TRAP	0	0	0	0	0	0	0	0.000
PRIEST RAPIDS TEAF	0	0	0	0	0	0	0	0.000
OCEAN FISHERIES								
ALASKA	0	0	0	1	0	0	1	0.006
BRITISH COLUMBIA	0	0	0	0	1	0	1	0.006
WASHINGTON	0	0	0	0	0	0	0	0.000
OREGON	0	0	0	0	0	0	0	0.000
CALIFORNIA	0	0	0		0	0	0	0.000
OTHER	0	0	0	5	0	0	0	0.000
RIVER SPORT								
COLUMBIA R. BELOW SNAKE R.	0	0	0	0	1	0	1	0.006
COLUMBIA R. ABOVE SNAKE R.	0	0	0	0	0	0	0	0.000
WENATCHEE R.	0	0	0	0	0	0	0	0.000
SNAKE R.	0	0	0	0	0	0	0	0.000
RIVER COMMERCIAL								
COMMERCIAL NET	a	0	0	0	1	0	1	0.006
INDIAN FISHERY								
FALL INDIAN NET	0	0	0	2	0	0	2	0.012
EATCAERIES								
WELLS H.	0	0	0	1	0	0	1	0.006
PRIEST RAPIDS H.	0	0	0	1	0	0	1	0.006
STREAM SURVEY	0	0	0	0	0	0	0	0.000
TOTALS	0	0	0	5	3	0	8	0.046
PERCENT OF RECOVERY %	B.O	0.0	0.0	62.5	37.5	0.0		

APPENDIX C.--CWT data for subyearling chinook salmon released into the tailrace of McNary Dam, during the summers 1981-1983, as reported by the Pacific Marine Fisheries Commission. Report was generated on 28 August 1989. Estimated numbers were used in analyses presented in this research report.

TAGCODE: 031731

RELEASING AGENCY: NMFS — STUDY TYPE: E
80 CHINOOK — TAGGED: 17723 — RELEASED: 06/81 — % TAG LOSS:
#/LB: 15.5 — UNTAGGED: — STOCK...: — DAYS:
SITE: COL. R, BELOW MCNARY — HATCHERY : MCNARY (M)

YEAR	FISHERY	ST	OBS'D	EST'D	MEAS'D	AVG MM
1982	WASHINGTON HATCHERY	C	1	1	1	470
	SE ALASKA COMMERCIAL (UNKN/MULT GEAR)	C	1		1	480
	S.E. ALASKA COMMERCIAL SEINE	C	1	1	1	410
1982	TOTALS:		3	2	3	453
1983	EC: SW VANC. ISLAND TROLL (21,23,24)	C	1	7	1	700
	BC: NORTHERN TROLL (STAT. AREAS 1-5)	C	3	14	3	551
	COLUMBIA RIVER NET	C	1	3	1	568
1983	TOTALS:		5	24	5	584
1984	COLUMBIA RIVER'NET	C	6	16	6	85.3
	OREGON FISH TRAP	C	4	4	4	880

28 AUG 1989 SUMMARY OF RECOVERIES OF TAGCODES PAGE 11

TAGCODE: 031731 (CONTINUED)

YEAR	FISHERY	ST	OBS'D	EST'D	MEAS'D	AVG MM
	WASHINGTON HATCHERY	C	8	8	8	873
	WASHINGTON RIVER SPORT	C	1	4	1	880
	WASHINGTON SPAWNING GROUNDS	C	2	2	2	925
	SE ALASKA COMMERCIAL (UNKN/MULT GEAR)	C	1			
	S.E. ALASKA COMMERCIAL TROLL	I	13	29	10	793
	BC: NW VANC. ISLAND TROLL (25-27)	C	3	15	3	810
	PC: SW VANC. ISLAND TROLL (21,23,24)	C	1	9	1	836
	BC: NORTHERN TROLL (STAT. AREAS 1-5)	C	1	6	1	896
	PC: NORTHERN NET (STAT. AREAS 1-5)	C	1	3	1	945
	PC: NORTH CENTRAL TROLL (6-9, 30)	C	1		1	766
1984	TOTALS:		42	96	38	845
1985	COLUMBIA RIVER NET	C	2	7	2	958
	OREGON FISH TRAP	C	4	4	4	916
	WASHINGTON OCEAN SPORT (KICKER BOAT)	C	1	3	1	1090
	WASHINGTON HATCHERY	C	3	3	3	1050
	S.E. ALASKA COMMERCIAL TROLL	I	3	7	2	895
	BC: NW VANC. ISLAND TROLL (25-27)	C	1	6	1	930
1985	TOTALS:		14	29	13	965
1986	COLUMBIA RIVER NET	C	1	2	1	941
	S.E. ALASKA COMMERCIAL TROLL	I	1			
1986	TOTALS:		2	2	1	941
TOTALS FOR TAGCODE 031731:			66	153	60	831

TAGCODE: 031732

RELEASING AGENCY: NMFS — STUDY TYPE: E
80 CHINOOK — TAGGED: 42580 — RELEASED: 07/81 — % TAG LOSS:
#/LB: 15.5 — UNTAGGED: — STOCK .... — DAYS;
SITE: COL. R, BELOW MCNARY — HATCHERY: MCNARY (M)

YEAR	FISHERY	ST	OHS D	EST'D	MEAS'D	AVG MM
1982	WASHINGTON HATCHERY	C	1	1	1	480
	WASHINGTON SFAWNING GROUNDS	C	1	64	1	510
	BC: CENTRAL NET (STAT. AREAS 6-11)	C	1	3	1	350
1982	TOTALS:		3	68	3	447
1983	BC: SW VANC. ISLAND TROLL (21,23,24)	C	1	6	1	593
	BC: NORTHERN TROLL (STAT. AREAS 1-5)	C	2	11	2	631
	COLUMBIA RIVER NET	C	6	13	6	727
	WASHINGTON SPAWNING GROUNDS	C	2	28	2	720
	SE ALASKA COMMERCIAL (UNKN/MULT GEAR)	C	1			
	S.E. ALASKA COMMERCIAL TROLL	C	1			
	S.E. ALASKA COMMERCIAL SEINE	C	1			620
	BC: NORTH CENTRAL TROLL (6-9, 30)	C	1	3	1	603

20 AUG 1989 SUMMARY OF RECOVERIES OF TAGCODES PAGE 12

TAGCODE: 03 1732 (CONTINUED)

YEAR	FISHERY	S T	OBS'D	EST' D	MEAS'D	AVG MM
1983	TOTALS:		15	61	13	683
1984	OREGON OCEAN TROLL	C	1	1	1	910
	COLUMBIA RIVER NET	C	21	53	21	856
	ODFW HATCHERIES	C	1	1	1	892
	OREGON FISH TRAP	C	18	18	18	879
	WASHINQTON OCEAN TROLL	C	1	1	1	810
	WASHINGTON HATCHERY	C	6	6	6	807
	WASHINGTON SPAWNING GROUNDS	C	2	2	2	935
	SE ALASKA COMMERCIAL (UNKN/MULT GEAR)	C	2			
	S.E. ALASKA COMMERCIAL TROLL	I	18	65	15	704
	BC: NW VANC. ISLAND TROLL (25-27)	C	3	8	3	790
	BC: SW VANC. ISLAND TROLL (21,23,24)	C	1	4	1	718
	BC: NORTHERN TROLL (STAT. AREAS 1-5)	C	1	5	1	757
1984	TOTALS:		75	164	70	839
1985	COLUMBIA RIVER NET	C	13	46	13	948
	OREGON FISH TRAP	C	6	6	6	974
	WASHINQTON HATCHERY	C	1	1	1	900
	WASHINGTON SPAWNING GROUNDS	C	1	22	1	950
	S. E. ALASKA COMMERCIAL TROLL	I	4	30	3	914
	S.E. ALASKA COMMERCIAL SEINE	C	1	3	1	830
	BC: NW VANC. ISLAND TROLL (25-27)	C	1	2	1	956
	BC: SW VANC. ISLAND TROLL (21,23,24)	C	1	4	1	913
	BC: NORTHERN TROLL (STAT. AREAS 1-5)	C	2	9	2	828
	BC: NORTHERN NET (STAT. AREAS 1-5)	C	1	5	1	738
	BC: NORTH CENTRAL TROLL (6-9, 30)	C	1	5	1	898
1985	TOTALS:		32	132	31	927
1986	COLUMBIA RIVER NET	C	2	7	2	968
	S.E. ALASKA COMMERCIAL TROLL	I	1			
1986	TOTALS:		3	7	2	968
TOTALS FOR TAGCODE 031732:			128	433	119	837

TAGCODE: 031730

RELEASING AGENCY: NMFS
80 CHINOOK TAGGED: 16779 RELEASED: 08/81
#/LB: 15.9 UNTAGGED: STOCK. . . :
SITE: COL. R, BELOW MCNARY HATCHERY: MCNARY (M)

STUDY TYPE: E
% TAG LOSS:
DAYS:

YEAR	FISHERY	S T	OBS'D	EST'D	MEAS'D	AVG MM
1982	BC: CEN'IRAL NET (STAT. AREAS 6-11)	C	1	3	1	355
1982	TOTALS:		1	3	1	355
1984	COLUMBIA RIVER NET	C	3	8	3	768

TAGCODE: 031730 (CONTINUED)

YEAR FISHERY	S T	OBS' D	EST' D	MEAS'D	AVG MM
WASHINGTON HATCHERY	C	1	1	1	960
S.E. ALASKA COMMERCIAL TROLL	I	2	6	2	799
BC: NORTHERN TROLL (STAT. AREAS 1-5)	C	2	11	2	810
1984 TOTALS:		8	25	8	810
1985 COLUMBIA RIVER NET	C	1	4	1	921
OREGON FISH TRAP	C	1	1	1	1050
S.E. ALASKA COMMERCIAL TROLL	I	2	3	2	853
BC: NORTHERN TROLL (STAT. AREA8 1-S)	C	1	3	1	920
1985 TOTALS:		5	11	5	919
TOTALS FOR TAGCODE 031730:		14	39	14	817

TAGCODE: 23 1609

RELEASING AGENCY: NMFS STUDY TYPE: E
81 FALL CHINOOK TAGGED: 8667 RELEASED: 06/82-07/82 % TAG LOSS:
#/LB: UNTAGGED: 0 STOCK.. . : MID COLUMBIA R DAYS:
SITE: COL. R, BELOW MCNARY HATCHERY: MCNARY (M)

YEAR FISHERY	S T	OBS' D	E S T ' D	MEAS'D	AVG MM
1983 BC: CENTRAL NET (STAT. AREAS 6-11)	C	1	2	1	376
1983 TOTALS:		1	2	1	376
1984 COLUMBIA RIVER NET	C	1	2	1	629
WASHINGTON HATCHERY	C	1	1	1	790
BC: NW VANC. ISLAND TROLL (25-27)	C	1	4	1	712
BC: SW VANC. ISLAND TROLL (21,23,24)	C	1	8	1	612
1984 TOTALS:		4	15	4	686
1985 COLUMBIA RIVER NET	C	3	10	3	812
OREGON FISH TRAP	C	1	1	1	873
WASHINGTON HATCHERY	C	1	1	1	800
WASHINGTON RIVER SPORT	C	1	5	1	760
WASHINGTON SPAWNING GROUNDS	C	1	22	1	910
S. E. ALASKA COMMERCIAL TROLL	I	6	7	4	738
BC: NORTHERN TROLL (STAT. AREAS 1-S)	C	1	5	1	930
BC: JOHNSTONE STRAIT NET (12,13)	C	1	3	1	871
1985 TOTALS:		15	54	13	810
1986 OREGON OCEAN TROLL	C	1	4	1	947
COLUMBIA RIVER NET	C	4	17	4	94s
WASHINGTON SPAWNING GROUNDS	C	2	57	2	990
S.E. ALASKA COMMERCIAL TROLL	I	1	4	1	941
PC: NORTHERN NET (STAT. AREAS 1-5)	C	1	3		

TAGCODE: 231609 (CONTINUED)

YEAR FISHERY	S T	OBS'D	EST'D	MEAS'D	AVG MM
1986 TOTALS:		9	85	8	956
TOTALS FOR TAGCODE 231609:		29	156	26	819

TAGCODE: 231611

RELEASING AGENCY: NMFS
81 FALL CHINOOK TAGGED: 18864 RELEASED: 07/82
#/LB: UNTAGGED: 0 STOCK...: MID COLUMBIA R
SITE: COL. R. BELOW MCNARY HATCHERY: MCNARY (M)
STUDY TYPE: E
% TAG LOSS:
DAYS:

YEAR FISHERY	S T	OBS'D	EST'D	MEAS'D	AVG MM
1982 NMFS JUVENILE SAMPLING, COL. RIVER	C	1	2	1	157
1982 TOTALS :		1	2	1	157
1983 S.E. ALASKA COMMERCIAL SEINE	C	1		1	380
1983 TOTALS:		1		1	380
1984 WASHINGTON HATCHERY	C	1	1	1	670
PC: NORTHERN TROLL (STAT. AREAS 1-5)	C	1	7	1	659
BC: NORTHERN NET (STAT. AREAS I-5)	C	1	3	1	605
1984 TOTALS:		3	11	3	645
1985 CALIFORNIA OCEAN TROLL	C	1	7	1	890
COLUMHIA RIVER NET	C	12	40	12	802
OREGON FISH TRAP	C	1	1	1	858
WASHINGTON HATCHERY	C	2	2	2	825
S.E. ALASKA COMMERCIAL TROLL	I	8	11	6	764
BC: NORTHERN TROLL (STAT. AREAS 1-5)	C	2	14	2	886
BC: NORTHERN NET (STAT. AREAS 1-5)	C	1	5	1	750
1985 T O T A L S :		27	80	25	805
1986 COLUMBIA RIVER NET	C	3	14	3	966
OREGON FISH TRAF	C	1	1	1	912
WASHINGTON RIVER SPORT	C	2	10	2	950
S.E. ALASKA COMMERCIAL SEINE	I	1		1	980
EC: NW VANC. ISLAND TROLL (25-27)	C	1	4	1	963
BC: NORTHERN TROLL (STAT. AREAS 1-S)	C	1	4		
1986 TOTALS:		9	32	8	957
1987 COLUMBIA RIVER NET	C	1	4	1	1030
1987 TOTALS:		1	4	1	1030
TOTALS FOR TAGCODE 231611:		42	130	39	802

TAGCODE: 231613

RELEASING AGENCY: NMFS
81 FALL CHINOOK TAGGED: 11152 RELEASED: 07/82-08/82 % TAG LOSS:
W/LB: UNTAGGED: 0 STOCK.... MID COLUMBIA R DAYS:
SITE: COL. R, BELOW MCNARY HATCHERY: MCNARY (M)
STUDY TYPE: E

YEAR	FISHERY	S T	OBS'D	EST'D	MEAS'D	AVG MM
1984	COLUMBIA RIVER NET	C	2	11	2	581
	WASHINGTON SPAWNING GROUNDS	C	1	1	1	750
1984	TOTALS:		3	12	3	637
1985	COLUMBIA RIVER SPORT	C	1	35	1	830
	COLUMBIA RIVER NET	C	6	20	6	802
	OREGON FISH TRAP	C	1	1	1	889
	WASHINGTON OCEAN SPORT (KICKER BOAT)	C	1	3	1	800
	S.E. ALASKA COMMERCIAL TROLL	I	5	10	4	768
	S.E. ALASKA COMMERCIAL SEINE	C	1		1	800
	BC: NORTHERN TROLL (STAT. AREAS 1-5)	C	2	9	2	803
	BC: NORTH CENTRAL TROLL (6-9, 30)	C	1	8		
1985	TOTALS:		18	85	16	800
1986	COLUMBIA RIVER NET	C	3	11	3	850
	S.E. ALASKA COMMERCIAL TROLL	I	2	1	1	865
	BC: NORTHERN TROLL (STAT. AREAS 1-5)	C	1	3	1	951
1986	TOTALS:		6	15	5	873
TOTALS FOR TAGCODE 231613:			27	112	24	795

TAGCODE: 231615

RELEASING AGENCY: NMFS
81 FALL CHINOOK TAGGED: 23243 RELEASED: 08/82-09/82 % TAG LOSS:
#/LB: UNTAGGED: 0 STOCK...: MID COLUMBIA R DAYS:
SITE: COL. R, BELOW MCNARY HATCHERY: MCNARY (M)
STUDY TYPE: E

YEAR	FISHERY	S T	OBS'D	EST'D	MEAS'D	AVG MM
1983	WASHINGTON OCEAN SPORT (KICKER BOAT)	C	1	3	1	360
1983	TOTALS:		1	3	1	360
1984	NMFS-ALASKA JUVENILE SAMPLING: RESEARCH T	C	1	1	1	500
1984	TOTALS:		1	1	1	500
1985	COLUMBIA RIVER NET	C	5	16	5	799
	PUGET SOUND SPORT	C	1	5	1	830
	WASHINGTON SPAWNING GROUNDS	C	1	22	1	800
	S.E. ALASKA COMMERC I AL TROLL	I	12	34	10	738

28 AUG 1989 SUMMARY OF RECOVERIES OF TAGCODES FAGE 16

TAGCODE: 231615 (CONTINUED)

YEAR FISHERY	S T	OBS' D	EST'D	MEAS'D	AVG MM
1985 TOTALS:		19	77	17	765
1986 COLUMBIA RIVER NET	C	2	7	2	951
OREGON FISH TRAP	C	1	1	1	1011
S.E. ALASKA COMMERCIAL TROLL	I	2	6 '	2	863
1986 TOTALS:		5	14	5	928
TOTALS FOR TAGCODE 231615:		26	95	24	771

TAGCODE: 231623

RELEASING AGENCY: NMFS
82 FALL CHINOOK TAGGED: 15057 RELEASED: 06/83
/ L B : UNTAGGED: 0 STOCK...: HID COLUMBIA R
SITE: COL. R, BELOW MCNARY HATCHERY : MCNARY (M)

STUDY TYPE: E
% TAG LOSS:
DAYS:

YEAR FISHERY	S T	OBS' D	EST'D	MEAS'D	AVG MM
1984 WASHINGTON HATCHERY	C	3	13	3	423
WASHINGTON SPAWNING GROUNDS	C	1	1	1	480
GROUNDFISH OBSERVER, GULF OF ALASKA	C	2	5	2	490
1984 TOTALS:		6	18	6	455
1985 COLUMBIA RIVER NET	C	6	22	6	676
PUGET SOUND NET	C	1	6	1	540
WASHINGTON HATCHERY	C	7	7	7	684
WASHINGTON RIVER SPORT	C	1	5	1	680
S.E. ALASKA COMMERCIAL TROLL	I	2	3	2	650
BC: NW VANC. ISLAND TROLL (25-27)	C	2	7	2	690
BC: NORTHERN TROLL (STAT. AREAS 1-5)	C	1	5	1	640
PC: NORTH CENTRAL TROLL (6-9, 30)	C	2	5	2	658
1985 TOTALS:		22	59	22	660
1986 OREGON OCEAN TROLL	C	1	4	1	871
COLUMBIA RIVER NET	C	20	68	20	878
OREGON FISH TRAP	C	2	2	2	848
WASHINGTON OCEAN SPORT (K ICKER BOAT)	C	1	3	1	820
WASHINGTON HATCHERY	C	9	10	9	858
WASHINGTON SPAWNING GROUNDS	C	1	29	1	780
S.E. ALASKA COMMERCIAL TROLL	I	15	23	9	790
BC: NW VANC. ISLAND TROLL (25-27)	C	1	3	1	885
BC: SW VANC. ISLAND TROLL (21, 23, 24)	C	1	5	1	677
BC: NORTHERN TROLL (STAT. AREAS 1-5)	C	3	10	3	821
BC: NORTHERN NET (STAT. AREAS 1-5)	C	1	3	1	800
BC: SOUTH CENTRAL TROLL (10-12)	C	2	6	2	759
1986 TOTALS:		57	165	51	841
1987 PC: NORTHERN TROLL (STAT. AREAS 1-5)	C	1	5		

28 AUG 1989 SUMMARY OF RECOVERIES OF TAGCODES PAGE 17

TAGCODE: 231623 (CONTINUED)

YEAR	FISHERY	ST	OBS' D	EST' D	MEAS' D	AVG MM
	COLUMBIA RIVER SPORT	C	1	11	1	87
	COLUMBIA RIVER NET	C	8	31	8	945
	SE ALASKA COMMERCIAL (UNKN/MULT GEAR)	C	1			
	S.E. ALASKA COMHERCIAL TROLL	I	4	10	3	885
1987	TOTALS:		15	57	12	858
TOTALS FOR TAGCODE 231623:			100	299	91	776

TAGCODE: 231627

RELEASING AGENCY: NMFS
82 FALL CHINOOK TAGGED: 15010 RELEASED: 07/83 STUDY TYPE: E
#/LB: UNTAGGED: 0 STOCK..: MID COLUMBIA R % TAG LOSS: DAYS:
SITE: COL. R. BELOW MCNARY HATCHERY: MCNARY (M)

YEAR	FISHERY	ST	OBS' D	EST' D	MEAS'D	AVG MM
1984	WASHINGTON HATCHERY	C	1	4	1	390
	WASHINGTON SPAWNING GROUNDS	C	2	2	2	455
	NMFS-ALASKA JUVENILE SAMPLING: RESEARCH T	C	1	1	1	421
	BC: NORTHERN NET (STAT. AREAS 1-5)	C	1	3	1	420
1984	TOTALS:		5	10	5	428
1985	OREGON OCEAN TROLL	C	1	3	1	640
	COLUMBIA RIVER NET	C	7	24	7	653
	WASHINGTON HATCHERY	C	3	3	3	633
	WASHINGTON RIVER SPORT	C	1	5	1	660
	WASHINGTON SPAWNING GROUNDS	C	1	22	1	620
	S.E. ALASKA COMMERCIAL TROLL	I	1			
	S.E. ALASKA COMMERCIAL SEINE	C	2	3	2	483
	EC: SW VANC. ISLAND TROLL (21,23,24)	C	2	7	2	629
	BC: NORTHERN TROLL (STAT. AREAS 1-5)	C	2	13	2	662
1985	TOTALS:		20	81	19	628
1986	OREGON OCEAN TROLL	C	1	3	1	870
	COLUMBIA RIVER NET	C	10	38	10	860
	OREGON FISH TRAP	C	2	2	2	835
	OREGON ESTUARY SPORT	C	1	4	1	830
	WASHINGTON OCEAN SPORT (KICKER BOAT)	C	1	4	1	820
	WASHINGTON HATCHERY	C	2	2	2	760
	WASHINGTON SPAWNING GROUNDS	C	4	114	4	838
	S. E. ALASKA COMMERCIAL TROLL	I	14	43	12	760
	S. E. ALASKA TEST FISHERY TROLL	I	1		1	666
	BC: NW VANC. ISLAND TROLL (25-27)	C	1	6	1	755
	BC: SW VANC. ISLAND TROLL (21,23,24)	C	1	5	1	666
	BC: NORTHERN TROLL (STAT. AREAS 1-5)	C	3	10	1	890
1986	TOTALS:		41	231	37	811

TAGCODE: 231627 (CONTINUED)

YEAR	FISHERY	S T	OBS'D	EST'D	MEAS'D	AVG MM
1987	EC: NORTHERN TROLL (STAT. AREAS 1-5)	C	7	26	5	930
	COLUMBIA RIVER NET	C	10	43	10	891
	PUGET SOUND NET	I	1	7	1	850
	S.E. ALASKA COMMERCIAL TROLL	I	5	8	4	908
1987	TOTALS:		23	83	20	902
1988	COLUMBIA RIVER NET	I	2	6	2	948
1988	TOTALS:		2	6	2	948
TOTALS FOR TAGCODE 231627:			91	413	83	771

TAGCODE: 231630

RELEASING AGENCY: NMFS STUDY TYPE: E
82 FALL CHINOOK TAGGED: 14690 RELEASED: 07/83 % TAG LOSS:
#/LB: UNTAGGED: 0 STOCK...: MID COLUMBIA R DAYS:
SITE: COL. R, BELOW MCNARY HATCHERY: MCNARY (M)

YEAR	FISHERY	S T	OBS'D	EST'D	MEAS'D	AVG MM
1984	BC: NORTHERN NET (STAT. AREAS 1-5)	C	1	6	1	367
1984	TOTALS:		1	6	1	367
1985	COLUMBIA RIVER NET	C	1	3	1	730
	WASHINGTON HATCHERY	C	2	2	2	650
	WASHINGTON RIVER SPORT	C	1	5	1	530
1985	TOTALS:		4	10	4	640
1986	COLUMBIA RIVER NET	C	6	18	6	841
	WASHINGTON HATCHERY	C	2	2	2	900
	S. E. ALASKA COMMERCIAL TROLL	I	6	6	5	827
	S.E. ALASKA COMMERCIAL SE I NE	I	1	4	1	885
	PC: SW VANC. ISLAND TROLL (21,23,24)	C	1	5	1	687
	BC: NORTHERN TROLL (STAT. AREAS 1-S)	C	3	11	3	830
	HC: NORTHERN NET (STAT. AREAS 1-5)	C	1	3	1	836
	PC: SOUTH CENTRAL TROLL (10-12)	C	1	3	1	990
1986	TOTALS:		21	51	20	843
1987	COLUMBIA RIVER SPORT	C	1	10	1	940
	COLUMBIA RIVER NET	C	3	11	3	953
	OREGON FISH TRAP	C	1	1	1	965
	S. E. ALASKA COMMERC I AL TROLL	I	6	11	3	944
1987	TOTALS:		11	33	8	949
1988	COLUMBIA RIVER NET	I	1	3	1	1000
	S.E. ALASKA COMMERC I AL TROLL	I	7	8	1	950

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TAGCODE: 23 1630 (CONTINUED)

YEAR FISHERY	S T	OBS'D	EST'D	MEAS'D	AVG MM
BC: NORTHERN TROLL (STAT. AREAS 1-5)	I	1	5	1	1041
1988 TOTALS:		4	17	3	997
TOTALS FOR TAGCODE 231630:		41	117	36	844

TAGCODE: 23 1633

RELEASING AGENCY: NMFS — STUDY TYPE: E
82 FALL CHINOOK TAGGED: 10601 — RELEASED: 08/83 — % TAG LOSS:
#/LB: UNTAGGED: 0 — STOCK. . . : MID COLUMBIA R — DAYS:
SITE: COL. R, BELOW MCNARY — HATCHERY: MCNARY (M)

YEAR FISHERY	S T	OBS'D	EST'D	MEAS'D	AVG MM
1985 COLUMBIA RIVER NET	C	1	3	1	602
WASHINGTON OCEAN SPORT (CHARTER BOAT)	C	1	2	1	570
WASHINGTON HATCHERY	C	1	1	1	620
PC: NORTHERN NET (STAT. AREAS 1-5)	C	1	5		
1985 TOTALS:		4	12	3	597
1986 COLUMBIA RIVER NET	C	7	25	7	822
OREGON FISH TRAP	C	1	1	1	800
S.E. ALASKA COMMERCIAL TROLL	I	2	2	1	700
DC: NORTHERN TROLL (STAT. AREA8 1-5)	C	1	4	1	760
1986 TOTALS:		11	32	10	802
1987 COLUMBIA RIVER NET	C	3	13	3	933
S.E. ALASKA COMMERCIAL TROLL	I	1	3	1	810
1987 TOTALS:		4	16	4	903
TOTALS FOR TAGCODE 231633:		19	60	17	789

TAGCODE: 231624

RELEASING AGENCY: NMFS — STUDY TYPE: E
82 FALL CHINOOK TAGGED: 17292 — RELEASED: 09/83 — % TAG LOSS:
#/LB: UNTAGGED: 0 — STOCK . . . . MID COLUMBIA R — DAYS:
SITE: COL. R, BELOW MCNARY — HATCHERY: MCNARY (M)

YEAR FISHERY	S T	OBS'D	EST'D	MEAS'D	AVG MM
1986 COLUMBIA RIVER NET	C	5	20	5	807
WASHINGTON HATCHERY	C	2	2	2	645
s. E. ALASKA COMMERCIAL TROLL	I	1	2	1	760
1986 TO TALS:		8	24	8	760

TAGCODE: 231624 (CONTINUED)

YEAR FISHERY	ST	OBS'D	EST'D	MEAS'D	AVG MM
1987 BC: NORTHERN TROLL (STAT. AREAS 1-5)	C	1	3	1	959
COLUMBIA RIVER NET	C	1	16	1	904
OREGON ESTUARY SPORT	C	1	3	1	900
1987 TOTALS:		3	21	3	921
1988 S.E. ALASKA COMMERCIAL TROLL	I	1		1	935.
1988 TOTALS		1		1	935
TOTALS FOR TAGCODE 231624:		12	45	12	815

TAGCODES REPORTED: 22 - PAGES: 20