USE OF A FISH TRANSPORTATION BARGE FOR INCREASING RETURNS OF STEELHEAD IMPRINTED FOR HOMING, 1984-85

Annual Report of Research

by
Jerrel R. Harmon
and
Emil Slatick

Funded by
Bonneville Power Administration
Contract DE-A179-83BP39643

and

Coastal Zone and Estuarine Studies Division
Northwest and Alaska Fisheries Center
National Marine Fisheries Service
National Oceanic and Atmospheric Administration
2725 Montlake Boulevard East
Seattle, Washington 98112

June 1986

ABSTRACT

In 1982, the National Marine Fisheries Service (NMFS), under contract to the Bonneville Power Administration, began a 6-year study (Project 82-2) to determine if transporting steelhead, Salmo gairdneri, smolts by barge from Dworshak National Fish Hatchery (NFH) to a release site on the Columbia River below Bonneville Dam would result in increased returns of adults to the various fisheries and to the hatchery homing sites.

During 1982 and 1983, over 500,000 juveniles were marked for the study. Adults have returned to in-river sampling sites, to the sport and Indian fisheries, and to the Dworshak NFH homing site from these groups of fish that were serially released as controls from the hatchery or barged as test fish to below Bonneville Dam. As of July 1985, most returns were from test and control groups released in the spring of 1982. Most returns from 1983 releases are expected during the 1985 and 1986 steelhead migration.

Survival of both control and test fish released in late April and mid-May in 1982 was substantially higher than the survival of those released early (19 April) and late (31 May). Data collected in the Indian and sport fisheries and at Lower Granite Dam showed that most fish released directly from Dworshak NFH as controls migrated upstream as adults and overwintered in the Snake and Clearwater Rivers. Many steelhead transported directly from the hatchery as juveniles showed some delay in their subsequent upstream migration and overwintered in the Columbia River and the lower portion of the Snake River. Therefore, transported fish were more susceptible to fisheries in the lower portion of the river system, whereas control fish were more susceptible to the upriver fisheries. This resulted in high test to control ratios in the lower river and lower ratios upstream in the Snake and Clearwater Rivers.

nearly as many test fish as control fish released on 30 April and 19 May 1982 returned to the Dworshak NFH homing site. In contrast, recoveries at the hatchery from the early and late test releases (19 April and 31 May 1982) were substantially lower.

CONTENTS

INTRODUCTION

The National Marine Fisheries Service (NMFS) began a 6-year study in 1982 under contract to the Bonneville Power Administration to determine if transporting steelhead, *Salmo gairdneri*, smolts directly from Dworshak National Fish Hatchery (NFH) to a release point below Bonneville Dam on the Columbia River would increase returns of adults to the hatchery and various fisheries. In 1982 and 1983, eight groups of approximately 30,000 juvenile steelhead were marked and released each year for the study.

The primary objectives of this study are as follows:

1. Determine if steelhead reared and imprinted at Dworshak NFH and transported by truck to a transfer site near Lewiston, Idaho; transferred into a barge; and transported to a release site in the Columbia River below Bonneville Dam and released will return as adults to the hatchery and to the fishery in Idaho in greater numbers than fish released directly into the river at the hatchery.

2. Determine the proportion of fish in each test release that have accepted a homing imprint.

3. Determine the relationship between the physiological condition of steelhead and their ability to imprint.

During 1984 and 1985, we have been monitoring adult steelhead returning to the following locations: (1) our adult collection facilities at Bonneville, McNary, and Lower Granite Dams; (2) the sport fishery on the Columbia, Snake, and Clearwater Rivers; (3) the Zone 6 Indian fishery; and (4) the Dworshak NFH homing site. This report summarizes adult recovery efforts through July 1985.

METHODS

Juvenile Releases

Three groups of approximately 30,000 steelhead were marked and released from Dworshak NFH into the mainstem of the Clearwater River on 19 and 30 April and 19 May 1982 (Harmon and Slatick 1983). These groups of fish were designated as control releases. Comparisons between these control releases may indicate the best time frame for releasing steelhead directly from Dworshak NFH.

Five additional groups of approximately 30,000 steelhead were marked and transported by truck to a barge at Lewiston, Idaho, and then transported by barge and released below Bonneville Dam on 19 and 30 April and 19 and 31 May 1982. These groups were designated as test releases. On the first release date (19 April), a second test group was pumped from one raceway to another before being transported (Harmon and Slatick 1983). Comparisons between these groups of test fish and with control groups should indicate the best time frame for transporting fish from Dworshak NFH.

During the spring of 1983, three groups of approximately 30,000 steelhead were marked and released from Dworshak NFH into the mainstem of the Clearwater River on 20 April and 3 and 25 May 1983. In addition, on 3 May approximately 30,000 marked fish were pumped into the North Fork of the Clearwater River (Harmon and Slatick 1984). These groups were designated as control releases.

Four groups of approximately 30,000 fish were marked and transported directly from Dworshak NFH by truck to a barge at Lewiston, Idaho and then transported by barge and released below Bonneville Dam on 20 April and 3 and 24 May 1983. These groups were designated at test releases. On the first release date (20 April), a second test group was pumped from one raceway to another before being transported (Harmon and Slatick 1984).

Adult Collection Facilities at Dams

Adult trapping facilities at Bonneville and McNary Dams on the Columbia River and Lower Granite Dam on the Snake River were operated in 1984. All facilities were operated during the fall months. The trap at Lower Granite Dam was also monitored during the spring of 1985 since many Dworshak NFH steelhead overwinter in the Snake River below Lower Granite Dam before continuing their migration to the Clearwater River. The operation of all three trapping facilities were similar; however, at Bonneville and McNary Dams, the traps were located in the north fishways only, and hence only a small portion of the Columbia River steelhead population was sampled. At Lower Granite Dam on the Snake River virtually the entire run was sampled.

These in-river trapping facilities separated tagged fish from the untagged adult population. Fish entering the trapping area pass over a false weir and slide downward through a detection coil into a smooth horizontal trough. If the fish is tagged, the magnetic field is interrupted and a signal is transmitted to a solenoid that activates an air ram that operates a gate which shunts the tagged fish to a holding area (Durkin et al. 1969; Ebel 1974). Fish that are not tagged are simply diverted back to the main fishway. Tagged fish are removed from the holding area with a dipnet, placed in an anesthetic tank, anesthetized, measured, jaw tagged, and identified by brand. By reading the freeze brand, we can tell which group of fish is represented. Fish are then allowed to recover in fresh water before being released. The fish are jaw tagged for identification and recovered in the various fisheries and at hatcheries (Gilbreath et al. 1976; Slatick 1976). Some fish were recovered more than once, and recaptured fish are included in all data summaries (e.g., at Lower Granite Dam and Dworshak NFH). When the data are analyzed, comparisons will be made between treatment (experimental)

groups in each recovery area, and thus all fish recovered can be used whether recaptured or not. From these recoveries, we are able to identify straying as well as obtain trapping efficiencies for expansion purposes when returns are complete.

Sampling in Fisheries and Hatcheries

The sport fishery was monitored from 1 October 1984 through 30 April 1985. The area with the largest concentrations of fishing pressure and fish (Clearwater River and the Snake River near its confluence with the Clearwater River) received the majority of our sampling effort. Recoveries came from sport fishermen in the form of jaw tags and fish snouts containing coded wire tags (CWT).

Most recoveries from the Columbia River Zone 6 fall and winter Indian fishery came from sampling by the Oregon Department of Fish and Wildlife and the Washington Department of Game. We also received voluntary recoveries from tribal members fishing the Clearwater River in Idaho.

Adult steelhead enter Dworshak NFH through a fish ladder and are held in holding ponds until mature enough to spawn. Generally, hatchery personnel check each fish weekly. If the fish is not ripe, it is returned to one of the holding ponds to be checked the following week. Mature fish are killed, spawned, and checked for a CWT. All snouts of tagged fish are retained for extraction and decoding of the CWT at a later date.

Cooperative Research with Idaho Department of Fish and Game

In the fall of 1985, the Idaho Department of Fish and Game requested that NMFS personnel at Lower Granite Dam randomly sample the steelhead run. Nearly 1,000 fish were marked with a plastic anchor tag for recovery in upriver fisheries to provide valuable timing information. Scale samples were also

taken to determine wild to hatchery ratios. For general information, Appendix A provides information on the work conducted for Idaho even though BPA funds were not involved.

RESULTS AND DISCUSSION

Adult Returns from 1982 Smolt Releases

Recoveries from 1982 test and control releases include one- and two-ocean returns. Three-ocean fish will return during the 1985-86 steelhead migration. Sampling rates differ between recovery sites, therefore, results are comparable only between experimental groups. Recoveries from each experimental group are detailed in Appendix Tables B1-B8.

Survival of Control Groups

Adult returns to Bonneville Dam showed that fish released from the second control group (30 April 1982) returned at a higher rate (0.708%) than fish released from either the first control group (19 April 1982) (0.579%) or from the third control group (19 May) (0.416%) (Table 1).

Control returns in the Indian fishery showed a similar pattern with returns from the second release recovered at a slightly higher rate (0.477%) than recoveries from the first (0.466%) or the third (0.325%) releases.

The sampling rate at McNary Dam was low, therefore, the number of returns are much lower. Returns from the first group were highest (0.070%). Returns to the second and third control groups were 0.028 and 0.040%, respectively.

Recoveries of the first control release at Lower Granite Dam were slightly higher (1.598%) than the second release (1.562%) and considerably higher than the third release (0.977%). The overall higher returns to Lower Granite Dam reflect a higher sampling rate because all fish passing the dam were being sampled.

Table 1.--A comparison of adult steehead from three control groups of juveniles that were released into the mainstem of the Clearwater River from Dworshak NFH in 1982. Preliminary recoveries through July 1985.

Recovery locations	% of juvenile releases recovered as adults[a/]		
	19 April release	30 April release	19 May release
Bonneville Dam	0.579	0.708	0.416
Indian fishery	0.466	0.477	0.325
McNary Dam	0.070	0.028	0.040
Lower Granite Dam	1.598	1.562	0.977
Sport fishery	0.345	0.396	0.167
Dworshak NFH	0.670	0.801	0.381

[a/] Because of differences in sampling intensity at each recovery site, results are not comparable between sites.

Most of the control fish recovered in the sport fishery were caught in the Snake and Clearwater Rivers. The second control group showed the highest rate of return (0.396%). Recoveries from the first and third control groups were 0.345 and 0.167%, respectively.

At Dworshak NFH homing site survival of control fish was highest for the second release (0.801%). Returns of the first and third control groups were 0.670 and 0.381%, respectively.

These returns indicate that survival of control releases from the first two groups (19 April and 30 April) were substantially higher than survival of the third release on 19 May. Of the two April releases, fish from the 30 April group were recovered at a higher rate at four of the six sampling locations. This shows that survival was best when fish were released from Dworshak NFH in late April. Releases made after that time apparently had drastically reduced survival. It should be pointed out that the rates of return shown are not indicative of survival of fish passing downstream through the dam complex in 1982. Approximately 57% of the fish released as controls had the benefit of transportation from Lower Granite, Little Goose, or McNary Dams as part of the U.S. Army Corps of Engineers' annual transport program (Harmon and Slatick 1983).

Survival and Homing of Test Groups

A total of 1,484 adult steelhead from releases in 1982 were recovered at Bonneville Dam through July 1985 (Table 2). Most of these fish were recaptured in the fall of 1984 as two-ocean returns and represent approximately a 30% sample rate during the time when Dworshak NFH fish were in the Columbia River (Harmon and Slatick 1985). Fish from the first control group released on 19 April returned to Bonneville Dam at a higher rate than

Table 2.--Returns of one- and two-ocean adult steelhead to Bonneville, McNary, and Lower Granite Dams from juveniles released in the spring of 1982 from Dworshak National Fish Hatchery. Preliminary recoveries through July 1985.

				Adult recoveries														
				Bonneville Dam[a]			McNary Dam[a]			Lower Granite Dam[a]								
										Fall returns			Spring returns			Total returns		
Test no.		Date juveniles released	Number juveniles released	N	%	Test to control ratio	N	%	Test to control ratio	N	%	Test to control ratio	N	%	Test to control ratio	N	%	Test to control ratio
1982 releases																		
Control	(C1)	19 Apr 82	29,838	173	0.579		21	0.070		377	1.263		100	0.335		477	1.598	
Test	(T1)	19 Apr 82	33,012	147	0.445	0.77:1	51	0.154	2.20:1	47	0.142	0.11:1	154	0.466	1.39:1	201	0.608	0.38:1
Test	(T1A)	19 Apr 82	32,185	119	0.369	0.64:1	24	0.074	1.06:1	31	0.100	0.08:1	108	0.336	1.00:1	139	0.431	0.27:1
Control	(C2)	30 Apr 82	31,048	220	0.708		9	0.028		352	1.134		133	0.428		485	1.562	
Test	(T2)	30 Apr 83	32,911	320	0.972	1.37:1	48	0.145	5.18:1	126	0.383	0.34:1	283	0.860	2.01:1	409	1.242	0.80:1
Control	(C3)	19 May 82	31,714	132	0.416		13	0.040		242	0.763		68	0.214		310	0.977	
Test	(T3)	19 May 82	29,456	314	1.065	2.56:1	34	0.115	2.88:1	60	0.204	0.27:1	221	0.750	3.50:1	281	0.953	0.98:1
Test	(T4)	31 May 82	31,915	59	0.184	0.44:1[b]	17	0.053	1.33:1[b]	8	0.025	0.03:1[b]	68	0.213	1.04:1[b]	76	0.238	0.24:1[b]
Totals			252,079	1,484			217			1,243			1,135			2,378		

[a] Sampling intensity differed between sites, therefore, only test to control ratio should be used for comparisons.

[b] Since no control group was released with Test (T4) it was compared to Control (C3) to obtain the test to control ratio.

either test groups released on that date. Test to control ratios were 0.77:1 for the first test group and 0.64:1 for the pumped group (Test T1A). In contrast, test fish from the second and third groups released on 30 April and 19 May, respectively, returned at higher rates than controls and showed benefits of 1.37:1 and 2.56:1, respectively. Returns of test fish from the fourth release (31 May) were poorest, with a test to control ratio of 0.44:1 (test fish were compared to control fish in the third release).

A total of 217 adults (1982 release) were recaptured at McNary Dam. Most of these fish (213) were 2-ocean fish recaptured in the fall of 1984. These returns represent a sampling rate of approximately 4% of the steelhead passing that dam. Each test group showed a positive benefit: 2.20:1 and 1.06:1 for the first releases, 5.18:1 for the second release, 2.88:1 for the third release, and 1.33:1 for the last release.

Fall returns to Lower Granite Dam of test fish from 1982 releases were quite low when compared to control releases. Test to control ratios for each test group were low, ranging from 0.03:1 to 0.34:1. In contrast, spring returns reflected a positive benefit for each test release. Test to control ratios ranged from 1.00:1 to 3.50:1, with the second and third test groups showing the highest benefits of 2.01:1 and 3.50:1, respectively. When fall and spring returns are combined, test to control ratios are 0.38:1 and 0.27:1 for the first release, 0.80:1 for the second release, 0.98:1 for the third release, and 0.24:1 for the last release. The difference between recoveries in the fall and spring at Lower Granite Dam are supported by data downriver from Bonneville Dam and the Indian fishery and provide overwhelming evidence that test (barged) fish returned to the Snake and Clearwater Rivers later than control fish.

The relatively high test to control ratio of the third release group (0.98:1) is probably more the result of poor survival of the control group (C3) rather than better homing of test fish. We have previously noted that the rate of return of the third control group was poorest among all control groups.

Recoveries from the fall Indian fishery were very similar to returns to Bonneville Dam (Table 3). Recoveries from the first release showed fish returning from the control release at a slightly higher level than fish from either test release, with benefits of 0.86:1 for the first test and 0.82:1 for the pumped group. However, test fish from the second and third releases returned at higher rates than control fish and showed benefits of 1.82:1 and 1.99:1, respectively. The late release had the poorest return, with a test to control ratio 0.50:1.

Recoveries from the winter Indian fishery indicate there may have been some homing impairment or delay in migration of fish that were barged as test fish. Test to control ratios are 5.31:1 and 5.69:1 for the first release, 7.88:1 for the second release, 19.75:1 for the third release, and 3.58:1 for the last release. These high benefits suggest that many test fish but not many control fish overwintered in the Bonneville pool and were available to the winter Indian fishery. There is no way to determine how many of these test fish would never have returned to the homing site and how many were simply delayed in their upstream migration and would have eventually returned to Dworshak NFH. We feel that many are in the latter category as evidenced by the high numbers of test fish recovered in the spring at Lower Granite Dam.

In contrast, most of the control fish from each release seemed to move through the Bonneville pool during the fall and overwintered in the Snake and

Table 3.--Returns of one- and two-ocean adult steelhead to the fall and winter Zone 6 Indian fishery on the Columbia River and to the Clearwater River Indian fishery from juveniles released in the spring of 1982 from Dworshak National Fish Hatchery. Preliminary recoveries through July 1985.

				Adult recoveries										
				Fall Zone 6			Winter Zone 6			Clearwater River		Total		
Test no.		Date juveniles released	Number juveniles released	Total N	Total %	Test to control ratio	Total N	Total %	Test to control ratio	Total N	Total %	Total N	Total %	Test to control ratio
1982 Releases														
Control	(C1)	19 Apr 82	29,838	135	0.452		4	0.013		0		139	0.466	
Test	(T1)	19 Apr 82	33,012	129	0.390	0.86:1	23	0.069	5.31:1	1	0.003	153	0.463	0.99:1
Test	(T1A)	19 Apr 82	32,185	120	0.372	0.82:1	24	0.074	5.69:1	0		144	0.447	0.96:1
Control	(C2)	30 Apr 82	31,048	137	0.441		10	0.032		1	0.003	148	0.477	
Test	(T2)	30 Apr 82	32,911	264	0.802	1.82:1	83	0.252	7.88:1	0		347	1.054	2.21:1
Control	(C3)	19 May 82	31,714	99	0.312		4	0.012		0		103	0.325	
Test	(T3)	19 May 82	29,456	183	0.621	1.99:1	70	0.237	19.75:1	0		253	0.859	2.64:1
Test	(T4)	31 May 82	31,915	50	0.156	0.50:1[a]	14	0.043	3.58:1[a]	0		64	0.201	0.62:1[a]
		Totals	252,079	1,117			232			2		1,351		

[a] Since no control group was released with Test (T4) it was compared to Control (C3) to obtain the test to control ratio.

Clearwater Rivers where they were less susceptible to the winter Indian fishery in the Columbia River. This is confirmed by the large numbers of control fish from each group that were recaptured in the fall at Lower Granite Dam (Table 3) and in the sport fishery on the Snake and Clearwater Rivers (Table 4).

Adults recovered in the sport fishery are shown in Table 4. Data are divided into the following four recapture areas: Columbia River below the Snake River, Columbia River above the Snake River, Snake River, and Clearwater River. On the Columbia River below the Snake River, positive test to control ratios range from 1.20:1 to 2.56:1 for the first three groups, whereas the last release shows a lower benefit of 0.67:1. Recoveries of fish in the Columbia River above the Snake River total four fish (3 control and 1 test fish) which indicates minimal straying. The recoveries in the Snake and Clearwater Rivers are substantially higher than for the Columbia River reflecting a more intensive sport fishery in those areas coupled with the river's proximity to the homing site. However, test to control ratios are low on the Snake River, ranging from 0.18:1 to 0.66:1 and even lower on the Clearwater River (0.03:1 to 0.24:1). The lower benefits as one proceeds upriver are due to the fact that the majority of the control fish arrived in the Snake and Clearwater Rivers during the fall, whereas most test fish arrived during the spring of the following year. Therefore, more fish from control groups were in the Snake and Clearwater Rivers for a longer period of time than test fish, making the control fish more susceptible to harvest in the sport fishery.

A total of 1,207 test and control fish from 1982 releases have been recovered at the Dworshak NFH homing site (Table 5). Test to control ratios are 0.55:1 and 0.49:1 for the first releases, 0.78:1 for the second release,

Table 4.--Returns of one- and two-ocean adult steelhead to the Columbia, Snake, and Clearwater Rivers in the sport fishery from juveniles released in the spring of 1982 from Dworshak National Fish Hatchery.

			Adult recoveries																
			Columbia R. below Snake R.			Columbia R. above Snake R.			Snake R.			Clearwater R.			Total		
Test no.	Date juveniles released	Number juveniles released	Total N	Total %	Test to control ratio	Total N	Total %	Test to control ratio	Total N	Total %	Test to control ratio	Total N	Total %	Test to control ratio	Total N	Total %	Test to control ratio
1982 Releases																	
Control (C1)	19 Apr 82	29,838	3	0.010		3	0.010		35	0.117		62	0.207		103	0.345	
Test (T1)	19 Apr 82	33,012	5	0.015	1.50:1	0	0.000		10	0.030	0.26:1	5	0.015	0.07:1	20	0.061	0.18:1
Test (T1A)	19 Apr 82	32,185	4	0.012	1.20:1	1	0.003	0.30:1	7	0.021	0.18:1	9	0.027	0.13:1	21	0.065	0.19:1
Control (C2)	30 Apr 82	31,048	7	0.022		0	0.000		53	0.170		63	0.202		123	0.396	
Test (T2)	30 Apr 82	32,911	14	0.042	1.91:1	0	0.000		22	0.066	0.39:1	16	0.048	0.24:1	52	0.158	0.40:1
Control (C3)	19 May 82	31,714	3	0.009		0	0.000		16	0.050		34	0.107		53	0.167	
Test (T3)	19 May 82	29,456	7	0.023	2.56:1	0	0.000		10	0.033	0.66:1	6	0.020	0.19:1	23	0.078	0.47:1
Test (T4)	31 May 82	31,915	2	0.006	0.67:1[a]	0	0.000		4	0.0112	0.24:1[a]	1	0.003	0.03:1[a]	7	0.022	0.13:1[a]
Total		252,079	45			4			157			196			402		

[a] Since no control group was released with Test (T4) it was compared to Control (C3) to obtain the test to control ratio.

Table 5.--Returns of one- and two-ocean adult steelhead to the Dworshak National Fish Hatchery (NFH) homing site from juveniles released in the spring of 1982 from Dworshak NFH. Preliminary recoveries through July 1985.

Test no.	Date juveniles released	Number juveniles released	Adult recoveries				
			1-ocean	2-ocean	Total		
			N	N	N	%	Test to control ratio
1982 releases							
Control (C1)	19 Apr 82	29,838	10	190	200	0.670	
Test (T1)	19 Apr 82	33,012	8	114	122	0.369	0.55:1
Test (T1A)	19 Apr 82	32,185	4	101	105	0.326	0.49:1
Control (C2)	30 Apr 82	31,048	12	237	249	0.801	
Test (T2)	30 Apr 82	32,911	11	196	207	0.628	0.78:1
Control (C3)	19 May 82	31,714	6	115	121	0.381	
Test (T3)	19 May 82	29,456	13	150	163	0.553	1.45:1
Test (T4)	31 May 82	31,915	2	38	40	0.125	0.33:1[a]
Totals		252,079	66	1,141	1,207		

[a] Since no control group was released with Test (T4), it was compared to Control (C3) to obtain the test to control ratio.

1.45:1 for the third release, and 0.33:1 for the last release. The test to control ratios for the second and third release groups are encouraging and may indicate that smolts transported directly from Dworshak NFH may return to the homing site as adults at levels nearly as good as or better than fish released directly from Dworshak NFH.

The complete returns from the 1982 releases, together with additional returns from the 1983 releases expected in 1986 should solidify conclusions to be drawn from the study. Based on preliminary returns, the data suggest that survival of test fish was increased by transportation from the hatchery, for example, all test groups showed a positive test to control ratio ranging from 1.06:1 to 5.18:1 at McNary Dam. However, farther upriver at Lower Granite Dam and Dworshak NFH, test to control ratios were reduced indicating some homing impairment. Even so, the second test group returned to the hatchery at a rate of 0.628%, compared to a rate of 0.801% for the corresponding control. It appears that survival and homing are best if steelhead smolts are released from the hatchery or if they are transported near the first of May.

Adult Returns from 1983 Smolt Releases

Recoveries of these one-ocean fish through July 1985 are low. Most fish from these groups will be returning as two-ocean fish during the 1985 and 1986 migration. Recoveries from all groups released in 1983 are shown in Appendix Tables B-9 through B16.

Most returns from the control releases came from the group of fish released on 3 May into the mainstem of the Clearwater River. This group showed the highest recovery rates to Bonneville Dam, the Indian fishery, Lower Granite Dam, and to the Dworshak NFH homing site (Table 6). Returns from the other control releases are much lower. These preliminary results are consistent with data collected from the 1982 releases.

Table 6.--Preliminary returns of 1-ocean adult steelhead from marked groups of juveniles released in 1983 from Dworshak National Fish Hatchery. Recoveries were made through July 1985.

Test number	Date juvenile released	Number juveniles released	Number of adults recaptured						
			Bonneville Dam	McNary Dam	Lower Granite Dam	Sport fishery	Indian fishery	Dworshak Hatchery	Total
Control (C1)	20 Apr 83	33,178	2	1	10	2	0	6	21
Test (T1)	20 Apr 83	30,341	3	1	5	2	6	2	19
Test (T1A)	20 Apr 83	28,658	7	0	4	2	9	2	24
Control (C2)	03 May 83	32,236	9	0	17	1	7	11	45
Control (C2A)	03 May 83	31,956	1	0	6	6	3	1	17
Test (T2)	03 May 83	32,465	35	2	24	5	32	9	107
Control (C3)	25 May 83	30,751	1	0	1	0	0	0	2
Test (T3)	24 May 83	31,906	0	2	0	0	2	0	4
Totals		251,491	58	6	67	18	59	31	239

Test fish returned to Bonneville Dam in larger numbers than control fish from 1983 releases, except for the last release. Most of the test fish recovered (35) were from the group released on 3 May. Low returns to McNary Dam preclude any analysis at this time. The majority of the test fish recovered at Lower Granite Dam (24) were also from the 3 May release. Returns to the sport fishery were low, however, most of the test recoveries were from the 3 May release (5). Most fish recaptured in the Indian fishery were also from the test group released on 3 May. A total of 32 fish were recovered from the fall and winter Zone 6 fisheries from that group. Nine of the thirteen test fish recovered at the Dworshak NFH homing site were from the 3 May release. These preliminary results from the 1983 releases are consistent with data obtained from the 1982 releases.

SUMMARY AND CONCLUSIONS

1. In 1982 and 1983, eight groups of approximately 30,000 juvenile steelhead were marked each year for a total of over 500,000 fish. Adults from these groups of fish that were serially released as controls from the hatchery or barged as test fish to below Bonneville Dam are returning to our adult inriver sampling sites, to the sport and Indian fisheries, and to the Dworshak NFH homing site.

2. Survival of control groups released on 19 and 30 April 1982 was excellent at all recovery sites. This suggests that fish released from Dworshak NFH into the mainstem of the Clearwater River (i.e., normal hatchery production fish) during late April to early May would provide the best returns.

3. At all sampling locations, the survival of test fish from the 1982 smolt releases was consistently higher from the second and third releases on

30 April and 19 May, respectively. The highest transport to control ratio (benefit) was realized from the third release. Thus, poor survival of late hatchery production releases does not preclude the consideration of future truck/barge transport releases as late as mid-May.

4. Recoveries of 1983 test and control fish are low. Most fish from these releases will return during the 1985 and 1986 steelhead migration. Returns to all sampling points are predominately from the test and control groups released on 3 May 1983. These preliminary results are consistent with data from 1982 releases.

ACKNOWLEDGMENTS

Support for this research came from the Pacific Northwest's electrical ratepayers through the Bonneville Power Administration. The U.S. Army Corps of Engineers provided the fish barges for transporting smolts and helped maintain adult collection facilities at dams on the Columbia and Snake Rivers. The U.S. Fish and Wildlife Service at Dworshak National Fish Hatchery assisted in the marking and transportation of smolts as well as in the recovery of adults. Assistance in adult recoveries was also provided by the Oregon Department of Fish and Wildlife, Washington Department of Game, and the Idaho Department of Fish and Game.

LITERATURE CITED

Durkin, J. T., W. J. Ebel, and J. R. Smith.
1969. A device to detect magnetized wire tags in migrating adult coho salmon. J. Fish Res. Board Can. 26:3083-3088.

Ebel, W. J.
1974. Marking fishes and invertebrates. III. Coded wire tag useful in automatic recovery of chinook salmon and steelhead trout. Mar. Fish. Rev. 36(7):10-13.

Gilbreath, L. G., L. R. Basham, and E. Slatick.
1976. Distribution, age, and size of tagged adult steelhead trout in the Snake River drainage. Mar. Fish. Rev. 39(6): 14-18.

Harmon, J. R., and E. Slatick.
1983. Use of a fish transportation barge for increasing returns of steelhead imprinted for homing. U.S. Dep. of Commer., Natl. Oceanic Atmos. Admin., Natl. Mar. Fish. Serv., Northwest and Alaska Fish. Cent., Seattle, Wash. 13 p. plus Appendix. (Report to Bonneville Power Administration, Contract DE-A179-83BP39643).

Harmon, J. R., and E. Slatick.
1984. Use of a fish transportation barge for increasing returns of steelhead imprinted for homing, 1983. U.S. Dep. of Commer., Natl. Oceanic Atmos. Admin., Natl. Mar. Fish. Serv., Northwest and Alaska Fish. Cent., Seattle, Wash. 17 p. plus Appendix. (Report to Bonneville Power Administration, Contract DE-A179-83-BP39643).

Harmon, J. R., and E. Slatick.
1985. Use of a fish transportation barge for increasing returns of steelhead imprinted for homing, 1984. U.S. Dep. of Commer., Natl. Oceanic Atmos. Admin., Natl. Mar. Fish. Serv., Northwest and Alaska Fish. Cent., Seattle, Wash. 10 p. plus Appendix. (Report to Bonneville Power Administration, Contract DE-A179-83-BP39643).

Slatick, E.
1976. Comparative retention of dart and jaw tags on chinook salmon and steelhead trout tagged on their spawning migration. Mar. Fish. Rev. 38(7):24-26.

APPENDIX A

A report from Steve Pettit of the Idaho Department of Fish and Game on research conducted by the National Marine Fisheries Service at Lower Granite Dam.

In order to improve our management options of the Snake River steelhead run, the Idaho Department of Fish and Game determined that the wild-hatchery ratio of adult fish crossing Lower Granite Dam was a vital tool in this direction. In addition, we also sought information on the timing of major Idaho steelhead stocks, between Lower Granite and their target spawning streams.

Since the separation between wild and hatchery steelhead based on visual inspection of their dorsal fin condition is too often subjective, a separation based on scale analysis was deemed necessary. Idaho formally requested that NMFS assist us in the acquisition of wild-hatchery ratio, since their workers were engaged in adult sampling research at Granite's fish ladder. At the same time, we requested that the workers place tags on the individuals acquired for scale analysis.

During the 1984 adult return (September-November), NMFS workers operating Lower Granite's adult ladder sampled 950 steelhead randomly selected from the adult trap. Key scales were removed from each fish, lengths recorded as well as the worker's classification (wild or hatchery) of each fish based on external characteristics. Their classification was then subsequently compared with the origin determined by scale analysis.

NMFS workers tagged each individual with a plastic anchor tag (Floy-type) provided by the Idaho Department of Fish and Game. After sampling, the steelhead were returned to the fish ladder to continue their upstream migration.

After the fall steelhead run, the scales were read and analysed by Idaho workers familiar with techniques of scale analysis. It was determined through this method that approximately 22.5% fo the 838 readable scale samples were from steelhead of wild origin. NMFS workers estimated that 24.0% of the fish

from steelhead of wild origin. NMFS workers estimated that 24.0% of the fish sampled from the 1984 return were wild, based on external characteristics and marks.

Idaho considers this comparison extremely useful, and should be valuable in the future when stock identification is necessary. Idaho fisheries workers were able to recover 115 tags from steelhead captured in the sports fishery and from hatcheries located on Snake River tributaries. Although the complete analysis of these recoveries has not been completed, valuable data on movement and timing has been possible.

For example, we have documented that some steelhead which crossed Lower Granite in late September remained at the project's immediate forebay for up to four months. This information could have significant management implications in the future of the Snake River steelhead fisheries.

Idaho plans on continuing this work at Lower Granite during the 1985 steelhead run over Lower Granite Dam.

APPENDIX B

Adult Recovery Summaries

Appendix Table B1.--Preliminary summary of adult steelhead marked as juveniles at Dworshak National Fish Hatchery in 1982.

28 AUG 85

1982 DWORSHAK — CONTROL (C1)

STEELHEAD

MARKS USED LAK 3 230606 NUMBER RELEASED 29838

RECOVERY AREA	1982	1983	1984	1985	TOTALS	PERCENT RETURN
RIVER SYSTEM LIVE TRAPS						
BONNEVILLE TRAP	0	3	170	0	173	0.579
MCNARY TRAP	0	0	21	0	21	0.070
LOWER GRANITE TRAP	0	33	444	0	477	1.598
OCEAN FISHERIES						
OTHER	0	1	0	0	1	0.003
RIVER SPORT						
COLUMBIA R. BELOW SNAKE R.	0	0	3	0	3	0.010
COLUMBIA R. ABOVE SNAKE R.	0	1	2	0	3	0.010
SNAKE R.	0	2	33	0	35	0.117
CLEARWATER R.	0	9	53	0	62	0.207
OTHER RIVERS	0	0	6	0	6	0.020
RIVER COMMERCIAL	0	0	1	0	1	0.003
INDIAN FISHERY						
FALL INDIAN NET	0	2	133	0	135	0.452
WINTER INDIAN NET	0	0	4	0	4	0.013
HATCHERIES						
DWORSHAK H.	0	10	190	0	200	0.670
STREAM SURVEY	0	0	0	0	0	0.000
TOTALS	0	61	1060	0	1121	3.756
PERCENT OF RECOVERY	0.0	5.4	94.5	0.0		

Appendix Table B2.--Preliminary summary of adult steelhead marked as juveniles at Dworshak National Fish Hatchery in 1982.

28 AUG 85

1982 DWORSHAK - TEST (T1)

STEELHEAD

MARKS USED RAL 4 230608 NUMBER RELEASED 33012

RECOVERY AREA	1982	1983	1984	1985	TOTALS	PERCENT RETURN
RIVER SYSTEM LIVE TRAPS						
BONNEVILLE TRAP	0	4	143	0	147	0.445
MCNARY TRAP	0	1	50	0	51	0.154
LOWER GRANITE TRAP	0	8	193	0	201	0.608
OCEAN FISHERIES	0	0	0	0	0	0.000
RIVER SPORT						
COLUMBIA R. BELOW SNAKE R.	0	0	5	0	5	0.015
SNAKE R.	0	0	10	0	10	0.030
CLEARWATER R.	0	0	5	0	5	0.015
OTHER RIVERS	0	0	1	0	1	0.003
RIVER COMMERCIAL	0	0	0	0	0	0.000
INDIAN FISHERY						
FALL INDIAN NET	0	3	126	0	129	0.390
WINTER INDIAN NET	0	0	23	0	23	0.069
CLEARWATER INDIAN	0	0	1	0	1	0.003
HATCHERIES						
DWORSHAK H.	0	8	114	0	122	0.369
STREAM SURVEY	0	0	0	0	0	0.000
TOTALS	0	24	671	0	695	2.105
PERCENT OF RECOVERY	0.0	3.4	96.5	0.0		

Appendix Table B3.--Preliminary summary of adult steelhead marked as juveniles at Dworshak National Fish Hatchery in 1982.

28 AUG 85

1982 DWORSHAK - TEST (T1A)

STEELHEAD

MARKS USED RAL 3 230607 NUMBER RELEASED 32185

RECOVERY AREA	1982	1983	1984	1985	TOTALS	PERCENT RETURN
RIVER SYSTEM LIVE TRAPS						
BONNEVILLE TRAP	0	3	116	0	119	0.369
MCNARY TRAP	0	0	24	0	24	0.074
LOWER GRANITE TRAP	0	6	133	0	139	0.431
OCEAN FISHERIES	0	0	0	0	0	0.000
RIVER SPORT						
COLUMBIA R. BELOW SNAKE R.	1	0	3	0	4	0.012
COLUMBIA R. ABOVE SNAKE R.	0	0	1	0	1	0.003
SNAKE R.	0	0	7	0	7	0.021
CLEARWATER R.	0	3	6	0	9	0.027
OTHER RIVERS	0	0	4	0	4	0.012
RIVER COMMERCIAL	0	0	1	0	1	0.003
INDIAN FISHERY						
FALL INDIAN NET	0	0	120	0	120	0.372
WINTER INDIAN NET	0	0	24	0	24	0.074
HATCHERIES						
DWORSHAK H.	0	4	101	0	105	0.326
HATCHERIES (GENERAL)	0	0	2	0	2	0.006
STREAM SURVEY	0	0	0	0	0	0.000
TOTALS	1	16	542	0	559	1.736
PERCENT OF RECOVERY	0.1	2.8	96.9	0.0		

Appendix Table B4.--Preliminary summary of adult steelhead marked as juveniles at Dworshak National Fish Hatchery in 1982.

28 AUG 85

1982 DWORSHAK — CONTROL (C2)

STEELHEAD

MARKS USED LAK 2 231604 NUMBER RELEASED 31048

RECOVERY AREA	1982	1983	1984	1985	TOTALS	PERCENT RETURN
RIVER SYSTEM LIVE TRAPS						
BONNEVILLE TRAP	0	6	214	0	220	0.708
MCNARY TRAP	0	0	9	0	9	0.028
LOWER GRANITE TRAP	0	43	442	0	485	1.562
OCEAN FISHERIES	0	0	0	0	0	0.000
RIVER SPORT						
COLUMBIA R. BELOW SNAKE R.	0	0	7	0	7	0.022
SNAKE R.	0	2	51	0	53	0.170
CLEARWATER R.	0	5	58	0	63	0.202
OTHER RIVERS	0	0	2	0	2	0.006
RIVER COMMERCIAL	0	0	0	0	0	0.000
INDIAN FISHERY						
FALL INDIAN NET	0	5	132	0	137	0.441
WINTER INDIAN NET	0	0	10	0	10	0.032
CLEARWATER INDIAN	0	0	1	0	1	0.003
HATCHERIES						
DWORSHAK H.	0	12	237	0	249	0.801
KOOSKIA H.	0	0	1	0	1	0.003
STREAM SURVEY	0	0	0	0	0	0.000
TOTALS	0	73	1164	0	1237	3.984
PERCENT OF RECOVERY	0.0	5.9	94.0	0.0		

Appendix Table B5.--Preliminary summary of adult steelhead marked as juveniles at Dworshak National Fish Hatchery in 1982.

28 AUG 85

1982 DWORSHAK — TEST (T2)

STEELHEAD

MARKS USED RAL 2 231605 NUMBER RELEASED 32911

RECOVERY AREA	1982	1983	1984	1985	TOTALS	PERCENT RETURN
RIVER SYSTEM LIVE TRAPS						
BONNEVILLE TRAP	0	6	314	0	320	0.972
MCNARY TRAP	0	1	47	0	48	0.145
LOWER GRANITE TRAP	0	26	383	0	409	1.242
OCEAN FISHERIES	0	0	0	0	0	0.000
RIVER SPORT						
COLUMBIA R. BELOW SNAKE R.	0	1	13	0	14	0.042
SNAKE R.	0	3	18	1	22	0.066
CLEARWATER R.	0	1	15	0	16	0.048
RIVER COMMERCIAL	0	0	0	0	0	0.000
INDIAN FISHERY						
FALL INDIAN NET	0	11	253	0	264	0.802
WINTER INDIAN NET	0	1	82	0	83	0.252
HATCHERIES						
DWORSHAK H.	0	11	196	0	207	0.628
STREAM SURVEY	0	0	0	0	0	0.000
TOTALS	0	61	1321	1	1383	4.202
PERCENT OF RECOVERY	0.0	4.4	95.5	0.0		

Appendix Table B6.--Preliminary summary of adult steelhead marked as juveniles at Dworshak National Fish Hatchery in 1982.

28 AUG 85

1982 DWORSHAK — CONTROL (C3)

STEELHEAD

MARKS USED LAK 1 231602 NUMBER RELEASED 31714

RECOVERY AREA	1982	1983	1984	1985	TOTALS	PERCENT RETURN
RIVER SYSTEM LIVE TRAPS						
BONNEVILLE TRAP	0	5	127	0	132	0.416
MCNARY TRAP	0	0	13	0	13	0.040
LOWER GRANITE TRAP	0	18	292	0	310	0.977
OCEAN FISHERIES	0	0	0	0	0	0.000
RIVER SPORT						
COLUMBIA R. BELOW SNAKE R.	0	0	3	0	3	0.009
SNAKE R.	0	0	16	0	16	0.050
CLEARWATER R.	0	3	31	0	34	0.107
OTHER RIVERS	0	0	2	0	2	0.006
RIVER COMMERCIAL	0	0	0	0	0	0.000
INDIAN FISHERY						
FALL INDIAN NET	0	1	98	0	99	0.312
WINTER INDIAN NET	0	0	4	0	4	0.012
OTHER INDIAN SOURCES	0	0	1	0	1	0.000
HATCHERIES						
DWORSHAK H.	0	6	115	0	121	0.381
STREAM SURVEY	0	0	0	0	0	0.000
TOTALS	0	33	702	0	735	2.317
PERCENT OF RECOVERY	0.0	4.4	95.5	0.0		

Appendix Table B7.--Preliminary summary of adult steelhead marked as juveniles at Dworshak National Fish Hatchery in 1982.

28 AUG 85

1982 DWORSHAK — TEST (T3)

STEELHEAD

MARKS USED RAPP1 231603 NUMBER RELEASED 29456

RECOVERY AREA	1982	1983	1984	1985	TOTALS	PERCENT RETURN
RIVER SYSTEM LIVE TRAPS						
BONNEVILLE TRAP	0	8	306	0	314	1.065
MCNARY TRAP	0	2	32	0	34	0.115
LOWER GRANITE TRAP	0	15	266	0	281	0.953
OCEAN FISHERIES	0	0	0	0	0	0.000
RIVER SPORT						
COLUMBIA R. BELOW SNAKE R.	0	0	7	0	7	0.023
SNAKE R.	0	0	10	0	10	0.033
CLEARWATER R.	0	0	5	1	6	0.020
OTHER RIVERS	0	0	1	0	1	0.003
RIVER COMMERCIAL	0	0	0	0	0	0.000
INDIAN FISHERY						
FALL INDIAN NET	0	4	179	0	183	0.621
WINTER INDIAN NET	0	3	67	0	70	0.237
HATCHERIES						
DWORSHAK H.	0	13	150	0	163	0.553
STREAM SURVEY	0	0	0	0	0	0.000
TOTALS	0	45	1023	1	1069	3.629
PERCENT OF RECOVERY	0.0	4.2	95.6	0.0		

Appendix Table B8.--Preliminary summary of adult steelhead marked as juveniles at Dworshak National Fish Hatchery in 1982.

28 AUG 85

1982 DWORSHAK — TEST (T4)

STEELHEAD

MARKS USED RAL 1 231601 NUMBER RELEASED 31915

RECOVERY AREA	1982	1983	1984	1985	TOTALS	PERCENT RETURN
RIVER SYSTEM LIVE TRAPS						
BONNEVILLE TRAP	0	2	57	0	59	0.184
MCNARY TRAP	0	0	17	0	17	0.053
LOWER GRANITE TRAP	0	6	70	0	76	0.238
OCEAN FISHERIES						
OTHER	0	1	0	0	1	0.003
RIVER SPORT						
COLUMBIA R. BELOW SNAKE R.	0	0	2	0	2	0.006
SNAKE R.	0	0	4	0	4	0.012
CLEARWATER R.	0	0	1	0	1	0.003
OTHER RIVERS	0	0	1	0	1	0.003
RIVER COMMERCIAL	0	0	0	0	0	0.000
INDIAN FISHERY						
FALL INDIAN NET	0	0	50	0	50	0.156
WINTER INDIAN NET	0	0	14	0	14	0.043
HATCHERIES						
DWORSHAK H.	0	2	38	0	40	0.125
STREAM SURVEY	0	0	0	0	0	0.000
TOTALS	0	11	254	0	265	0.830
PERCENT OF RECOVERY	0.0	4.1	95.8	0.0		

Appendix Table B 9.--Preliminary summary of adult steelhead marked as juveniles at Dworshak National Fish Hatchery in 1983.

28 AUG 85

1983 DWORSHAK — CONTROL (C1)

STEELHEAD

MARKS USED LAW 1 231638 NUMBER RELEASED 33178

RECOVERY AREA	1983	1984	1985	TOTALS	PERCENT RETURN
RIVER SYSTEM LIVE TRAPS					
BONNEVILLE TRAP	0	2	0	2	0.006
MCNARY TRAP	0	1	0	1	0.003
LOWER GRANITE TRAP	0	10	0	10	0.030
OCEAN FISHERIES	0	0	0	0	0.000
RIVER SPORT					
CLEARWATER R.	0	2	0	2	0.006
RIVER COMMERCIAL	0	0	0	0	0.000
INDIAN FISHERY	0	0	0	0	0.000
HATCHERIES					
DWORSHAK H.	0	6	0	6	0.018
STREAM SURVEY	0	0	0	0	0.000
TOTALS	0	21	0	21	0.063
PERCENT OF RECOVERY	0.0	100.0	0.0		

Appendix Table B10.--Preliminary summary of adult steelhead marked as juveniles at Dworshak National Fish Hatchery in 1983.

28 AUG 85

1983 DWORSHAK — TEST (T1)

STEELHEAD

MARKS USED RAF 1 231640 NUMBER RELEASED 30341

RECOVERY AREA	1983	1984	1985	TOTALS	PERCENT RETURN
RIVER SYSTEM LIVE TRAPS					
BONNEVILLE TRAP	0	3	0	3	0.009
MCNARY TRAP	0	1	0	1	0.003
LOWER GRANITE TRAP	0	5	0	5	0.016
OCEAN FISHERIES	0	0	0	0	0.000
RIVER SPORT					
COLUMBIA R. BELOW SNAKE R.	0	1	0	1	0.003
CLEARWATER R.	0	1	0	1	0.003
RIVER COMMERCIAL	0	0	0	0	0.000
INDIAN FISHERY					
FALL INDIAN NET	0	2	0	2	0.006
WINTER INDIAN NET	0	4	0	4	0.013
HATCHERIES					
DWORSHAK H.	0	2	0	2	0.006
STREAM SURVEY	0	0	0	0	0.000
TOTALS	0	19	0	19	0.062
PERCENT OF RECOVERY	0.0	100.0	0.0		

Appendix Table B11.--Preliminary summary of adult steelhead marked as juveniles at Dworshak National Fish Hatchery in 1983.

28 AUG 85

1983 DWORSHAK — TEST (T1A)

STEELHEAD

MARKS USED RAZ 1 231639

NUMBER RELEASED 28658

RECOVERY AREA	1983	1984	1985	TOTALS	PERCENT RETURN
RIVER SYSTEM LIVE TRAPS					
BONNEVILLE TRAP	0	7	0	7	0.024
MCNARY TRAP	0	0	0	0	0.000
LOWER GRANITE TRAP	0	4	0	4	0.013
OCEAN FISHERIES	0	0	0	0	0.000
RIVER SPORT					
COLUMBIA R. BELOW SNAKE R.	0	1	0	1	0.003
SNAKE R.	0	1	0	1	0.003
RIVER COMMERCIAL	0	0	0	0	0.000
INDIAN FISHERY					
FALL INDIAN NET	0	4	0	4	0.013
WINTER INDIAN NET	0	5	0	5	0.017
HATCHERIES					
DWORSHAK H.	0	2	0	2	0.006
STREAM SURVEY	0	0	0	0	0.000
TOTALS	0	24	0	24	0.083
PERCENT OF RECOVERY	0.0	100.0	0.0		

Appendix Table B12.--Preliminary summary of adult steelhead marked as juveniles at Dworshak National Fish Hatchery in 1983.

28 AUG 85

1983 DWORSHAK - CONTROL (C2)

STEELHEAD

MARKS USED LAW 2 231616 NUMBER RELEASED 32236

RECOVERY AREA	1983	1984	1985	TOTALS	PERCENT RETURN
RIVER SYSTEM LIVE TRAPS					
BONNEVILLE TRAP	0	9	0	9	0.027
MCNARY TRAP	0	0	0	0	0.000
LOWER GRANITE TRAP	0	17	0	17	0.052
OCEAN FISHERIES	0	0	0	0	0.000
RIVER SPORT					
CLEARWATER R.	0	1	0	1	0.003
RIVER COMMERCIAL	0	0	0	0	0.000
INDIAN FISHERY					
FALL INDIAN NET	0	6	0	6	0.018
WINTER INDIAN NET	0	1	0	1	0.003
HATCHERIES					
DWORSHAK H.	0	11	0	11	0.034
STREAM SURVEY	0	0	0	0	0.000
TOTALS	0	45	0	45	0.139
PERCENT OF RECOVERY	0.0	100.0	0.0		

Appendix Table B13.--Preliminary summary of adult steelhead marked as juveniles at Dworshak National Fish Hatchery in 1983.

28 AUG 85

1983 DWORSHAK - CONTROL (C2A)

STEELHEAD

MARKS USED RAF 3 231619 NUMBER RELEASED 31956

RECOVERY AREA	1983	1984	1985	TOTALS	PERCENT RETURN
RIVER SYSTEM LIVE TRAPS					
BONNEVILLE TRAP	0	1	0	1	0.003
MCNARY TRAP	0	0	0	0	0.000
LOWER GRANITE TRAP	0	6	0	6	0.018
OCEAN FISHERIES	0	0	0	0	0.000
RIVER SPORT					
SNAKE R.	0	0	1	1	0.003
CLEARWATER R.	0	5	0	5	0.015
RIVER COMMERCIAL	0	0	0	0	0.000
INDIAN FISHERY					
FALL INDIAN NET	0	1	0	1	0.003
WINTER INDIAN NET	0	2	0	2	0.006
HATCHERIES					
DWORSHAK H.	0	1	0	1	0.003
STREAM SURVEY	0	0	0	0	0.000
TOTALS	0	16	1	17	0.053
PERCENT OF RECOVERY	0.0	94.1	5.8		

Appendix Table B14.--Preliminary summary of adult steelhead marked as juveniles at Dworshak National Fish Hatchery in 1983.

28 AUG 85

1983 DWORSHAK — TEST (T2)

STEELHEAD

MARKS USED RAF 2 231617

NUMBER RELEASED 32456

RECOVERY AREA	1983	1984	1985	TOTALS	PERCENT RETURN
RIVER SYSTEM LIVE TRAPS					
BONNEVILLE TRAP	0	35	0	35	0.107
MCNARY TRAP	0	2	0	2	0.006
LOWER GRANITE TRAP	0	24	0	24	0.073
OCEAN FISHERIES	0	0	0	0	0.000
RIVER SPORT					
COLUMBIA R. BELOW SNAKE R.	0	2	0	2	0.006
SNAKE R.	0	1	0	1	0.003
CLEARWATER R.	0	2	0	2	0.006
OTHER RIVERS	0	1	0	1	0.003
RIVER COMMERCIAL	0	0	0	0	0.000
INDIAN FISHERY					
FALL INDIAN NET	0	17	0	17	0.052
WINTER INDIAN NET	0	15	0	15	0.046
HATCHERIES					
DWORSHAK H.	0	9	0	9	0.027
STREAM SURVEY	0	0	0	0	0.000
TOTALS	0	108	0	108	0.332
PERCENT OF RECOVERY	0.0	100.0	0.0		

Appendix Table B15.--Preliminary summary of adult steelhead marked as juveniles at Dworshak National Fish Hatchery in 1983.

28 AUG 85

1983 DWORSHAK - CONTROL (C3)

STEELHEAD

MARKS USED RAF 4 231620 NUMBER RELEASED 30751

RECOVERY AREA	1983	1984	1985	TOTALS	PERCENT RETURN
RIVER SYSTEM LIVE TRAPS					
BONNEVILLE TRAP	0	1	0	1	0.003
MCNARY TRAP	0	0	0	0	0.000
LOWER GRANITE TRAP	0	1	0	1	0.003
OCEAN FISHERIES	0	0	0	0	0.000
RIVER SPORT	0	0	0	0	0.000
RIVER COMMERCIAL	0	0	0	0	0.000
INDIAN FISHERY	0	0	0	0	0.000
HATCHERIES	0	0	0	0	0.000
STREAM SURVEY	0	0	0	0	0.000
TOTALS	0	2	0	2	0.006
PERCENT OF RECOVERY	0.0	100.0	0.0		

Appendix Table B16.--Preliminary summary of adult steelhead marked as juveniles at Dworshak National Fish Hatchery in 1983.

28 AUG 85

1983 DWORSHAK — TEST (T3)

STEELHEAD

MARKS USED LAW 3 231618 NUMBER RELEASED 31906

RECOVERY AREA	1983	1984	1985	TOTALS	PERCENT RETURN
RIVER SYSTEM LIVE TRAPS					
BONNEVILLE TRAP	0	0	0	0	0.000
MCNARY TRAP	0	2	0	2	0.006
LOWER GRANITE TRAP	0	0	0	0	0.000
OCEAN FISHERIES	0	0	0	0	0.000
RIVER SPORT	0	0	0	0	0.000
RIVER COMMERCIAL	0	0	0	0	0.000
INDIAN FISHERY					
WINTER INDIAN NET	0	2	0	2	0.006
HATCHERIES	0	0	0	0	0.000
STREAM SURVEY	0	0	0	0	0.000
TOTALS	0	4	0	4	0.012
PERCENT OF RECOVERY	0.0	100.0	0.0		

APPENDIX C

Expenditure Information

EXPENDITURE INFORMATION

A. Summary of expenditures:

1.	Labor	$ 74.3K
2.	Travel of persons	6.0
3.	Transportation of things	5.6
4.	Rent, communications, and utilities	2.3
5.	Printing and reproduction	0.0
6.	Contract service	13.2
7.	Supplies, materials, and equipment	2.4
8.	SLUC	4.7
9.	NOAA and DOC overhead	29.1
	TOTAL	137.6K

B. Major property items:

None