FINAL REPORT

PROJECT NAME: Enumeration and Monitoring of Two Stocks of Wild Summer Steelhead in the Snake River Basin.

AWARD NUMBER: NA06FI0479

REPORTING PERIOD: October 1, 2003 to September 30, 2004

OVERVIEW

Snake River Steelhead *Oncorhynchus mykiss* were listed as threatened under the Endangered Species Act (ESA) on August 18, 1997. In the Snake River Basin, two life history variations, commonly referred to as A-run and B-run are recognized (Busby et al 1996). These two life history variations are characterized by differences in location of spawning, size at age, ocean age composition, and time of migration into freshwater. B – run fish are believed to spawn primarily in the Clearwater River, South Fork of the Salmon River and Middle Fork of the Salmon River, while A-run fish are found primarily in the lower Clearwater River, upper Salmon River, lower Salmon River, Grande Ronde River, Imnaha River and tributaries of the Snake River below Hells Canyon Dam. While A-run steelhead are also found throughout the inland Columbia River basin, B-Run steelhead are believed to be found only in the Snake River drainage. B-run steelhead enter freshwater later than A-run steelhead, are typically larger at age (likely because of the additional time they spend feeding in the ocean before migrating into freshwater), and the annual run typically has a higher proportion of fish that have spent two years at sea. These differences in life history led the National Marine Fisheries Service (NOAA Fisheries) to consider B-run steelhead as a biologically significant and distinct component of the Snake River ESU (NOAA 2003).

Estimates of escapement goals for Snake River steelhead (NOAA 2003) range from 10,000 to 32,000 for B-run fish, and 20,000 to 33,000 for A-run fish. The interim abundance target (Lohn 2002) set by NOAA Fisheries as guidance for implementing recovery planning, is 22,900 for A-run fish, and 29,100 for B-run fish. The Technical Advisory Committee to the U.S. vs. Oregon process (TAC) has used scale analysis and size criteria to estimate the abundance of A-run and B-run fish crossing Bonneville Dam, caught in various fisheries, and crossing Lower Granite Dam beginning with the 1985 run (TAC 2003). Since 1985, the interim abundance target at Lower Granite Dam has not been achieved for B-Run fish (based on the scale/length method). Escapements of A-run fish (also based on the scale/length method) have generally been two to three times larger than B-run fish, and below the interim goal in all but the last few years since 1985.

The small population size of Snake River steelhead, and poor population growth rates led NOAA Fisheries to conclude that maximizing the escapement was necessary. Because B-run fish are the weakest of the two stocks, their strategy since 1998 has been to limit the harvest rates on

fisheries in the Columbia River to no more than 17% (treaty Indian < 15%, non-Indian fisheries <2%). In the treaty Indian fisheries, many of these steelhead are caught when fishing for fall chinook salmon between Bonneville Dam and McNary Dam (Zone 6). In the non-Indian fisheries, many are caught incidentally in the lower river gillnet fishery that targets fall chinook. NOAA Fisheries has limited fishing mortality in the Columbia River on listed Snake River fall chinook to no more than 31.29%. Because neither the Tribes nor States desire to limit access to these fall chinook because they have reached the allowable harvest rate on B-run steelhead, substantial work has been done to evaluate, and implement fishing methods to minimize the mortality of large, B-run steelhead.

In the last four years (1999 –2002) 58.6% of the wild B-run steelhead (wild steelhead larger than 78 cm) estimated to have crossed Bonneville Dam (after accounting for harvest in Zone 6) did not arrive at Lower Granite Dam. This apparent failure of wild B-run steelhead to survive between Bonneville Dam and Lower Granite Dam, led me to summarize the available information to:

- Determine if the harvest rate on wild B-run steelhead in the Tribal Zone 6 fishery is related to the harvest rate on fall chinook.
- Compare the existing methodology used by TAC to estimate harvest rates and conversion rates for Snake River steelhead with survival rates computed using mark-recapture estimates based on PIT tag detections at Bonneville, McNary and Lower Granite dams.

OBJECTIVE

- Compare estimates of the survival between Bonneville Dam and Lower Granite Dam for adult Snake River Steelhead based on detections of PIT tagged fish and estimates based on size criteria used by TAC.
- Summarize estimates of the number of hatchery and wild, A-run and B-run steelhead crossing Lower Granite Dam based on size and scale criteria.

ACCOMPLISHMENTS

- A report on survival rates based on PIT tags is attached.
- A table summarizing estimates of the number of hatchery and wild, A-run and B-run steelhead crossing Lower Granite Dam based on size and scale criteria is attached.

PROBLEMS ENCOUNTERED

No problems were encountered.

FUTURE NEEDS

Continued support for evaluating the status of Snake River steelhead.

REPORTS

Attached.

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Attachment 1. Estimated number of hatchery and wild steelhead crossing Lower Granite Dam by size class, 1986 – 2003 run years 1/.

	Steelhead<77.5 cm FL			Steelhead => 77.5 cm FL			Run Totals		
	Wild	Hatchery	Total	Wild	Hatchery	Total	Wild	Hatchery	Total
1986-87	16,772	72,097	88,869	5,257	35,856	41,114	22,029	107,954	129,983
1987-88	20,019	32,045	52,064	5,373	13,851	19,224	25,392	45,896	71,288
1988-89	16,327	44,132	60,459	4,758	21,920	26,678	21,085	66,052	87,137
1989-90	16,952	66,553	83,505	8,016	39,899	47,915	24,968	106,452	131,420
1990-91	4,803	25,561	30,364	4,483	22,018	26,501	9,287	47,578	56,865
1991-92	14,138	69,852	83,990	3,178	11,881	15,059	17,316	81,733	99,049
1992-93	13,574	83,353	96,927	5,772	25,566	31,338	19,346	108,919	128,265
1993-94	5,906	35,475	41,381	1,438	16,887	18,326	7,345	52,362	59,707
1994-95	5,076	32,435	37,512	2,446	7,380	9,825	7,522	39,815	47,337
1995-96	6,700	63,563	70,263	1,290	7,573	8,863	7,990	71,136	79,126
1996-97	5,979	67,066	73,045	1,644	12,209	13,853	7,623	79,275	86,898
1997-98	7,417	67,003	74,420	1,323	10,874	12,197	8,740	77,877	86,617
1998-99	7,083	43,878	50,962	2,301	17,458	19,759	9,384	61,337	70,721
1999-00	10,129	53,946	64,075	909	8,827	9,736	11,038	62,773	73,811
2000-01	17,389	79,094	96,483	2,874	17,133	20,007	20,263	96,227	116,490
2001-02	37,855	197,587	235,442	3,169	30,670	33,839	41,024	228,257	269,281
2002-03 [2]	30,758	130,947	161,705	14,377	58,733	73,110	45,135	189,680	234,815
2003-04 [3]	21,873	118,108	139,981	7,259	25,168	32,427	29,132	143,277	172,409

1. daily fish counts cross checked with UACOE fish passage reports.

2. There was no sampling at Lower Granite Dam in the spring of 2003. We estimated the proportions using average values form the previous and following years.

3. Counts are preliminary.

Comparison of Survival Estimates of Snake River Wild B-Run Steelhead Between Bonneville Dam and Lower Granite Dam Based on Scale Analysis & Length vs. Mark-Recapture Estimates using Passive Integrated Transponder (PIT) Tags

By

Scott Marshall
Idaho Department of Fish and Game

October 2004

Introduction

Snake River Steelhead *Oncorhynchus mykiss* were listed as threatened under the Endangered Species Act (ESA) on August 18, 1997. In the Snake River Basin, two life history variations, commonly referred to as A-run and B-run are recognized (Busby et al 1996). These two life history variations are characterized by differences in location of spawning, size at age, ocean age composition, and time of migration into freshwater. B – run fish are believed to spawn primarily in the Clearwater River, South Fork of the Salmon River and Middle Fork of the Salmon River, while A-run fish are found primarily in the lower Clearwater River, upper Salmon River, lower Salmon River, Grande Ronde River, Imnaha River and tributaries of the Snake River below Hells Canyon Dam. While A-run steelhead are also found throughout the inland Columbia River basin, B-Run steelhead are believed to be found only in the Snake River drainage. B-run steelhead enter freshwater later than A-run steelhead, are typically larger at age (likely because of the additional time they spend feeding in the ocean before migrating into freshwater), and the annual run typically has a higher proportion of fish that have spent two years at sea. These differences in life history led the National Marine Fisheries Service (NOAA Fisheries) to consider B-run steelhead as a biologically significant and distinct component of the Snake River ESU (NOAA 2003).

Estimates of escapement goals for Snake River steelhead (NOAA 2003) range from 10,000 to 32,000 for B-run fish, and 20,000 to 33,000 for A-run fish. The interim abundance target (Lohn 2002) set by NOAA Fisheries as guidance for implementing recovery planning, is 22,900 for A-run fish, and 29,100 for B-run fish. The Technical Advisory Committee to the U.S. vs. Oregon process (TAC) has used scale analysis and size criteria to estimate the abundance of A-run and B-run fish crossing Bonneville Dam, caught in various fisheries, and crossing Lower Granite Dam beginning with the 1985 run (TAC 2003). Since 1985, the interim abundance target at Lower Granite Dam has not been achieved for B-Run fish (based on the scale/length method). Escapements of A-run fish (also based on the scale/length method) have generally been two to three times larger than B-run fish, and below the interim goal in all but the last few years since 1985.

The small population size of Snake River steelhead, and poor population growth rates led NOAA Fisheries to conclude that maximizing the escapement was necessary. Because B-run fish are the weakest of the two stocks, their strategy since 1998 has been to limit the harvest rates on fisheries in the Columbia River to no more than 17% (treaty Indian < 15%, non-Indian fisheries <2%). In the treaty Indian fisheries, many of these steelhead are caught when fishing for fall chinook salmon between Bonneville Dam and McNary Dam (Zone 6). In the non-Indian fisheries, many are caught incidentally in the lower river gillnet fishery that targets fall chinook. NOAA Fisheries has limited fishing mortality in the Columbia River on listed Snake River fall chinook to no more than 31.29%. Because neither the Tribes nor States desire to limit access to these fall chinook because they have reached the allowable harvest rate on B-run steelhead, substantial work has been done to evaluate, and implement fishing methods to minimize the mortality of large, B-run steelhead.
In the last four years (1999 –2002) 58.6% of the wild B-run steelhead (wild steelhead

larger than 78 cm) estimated to have crossed Bonneville Dam (after accounting for harvest in Zone 6) did not arrive at Lower Granite Dam. This apparent failure of wild B-run steelhead to survive between Bonneville Dam and Lower Granite Dam, led me to summarize the available information to:

- determine if the harvest rate on wild B-run steelhead in the Tribal Zone 6 fishery is related to the harvest rate on fall chinook and;
- compare the existing methodology used by TAC to estimate harvest rates and conversion rates for Snake River steelhead with survival rates computed using mark-recapture estimates based on PIT tag detections at Bonneville, McNary and Lower Granite dams.

Methods

Survival Estimates Based on Dam Counts and Separation Stock Identification Using Scales, Size, and Marks

Summer run steelhead crossing Bonneville Dam prior to July 1 are classified as Skamania stock. Beginning July 1, the number of A-run and B-run steelhead that are hatchery and wild origin crossing Bonneville Dam is estimated by using fish length, scale analysis, and the presence of marks. Steelhead are classified as either hatchery or wild-origin based on both an examination of external marks and examination of scales. Most hatchery-origin steelhead are marked by removal of their adipose fin and this permits easy identification for this component of the run. However, some hatchery steelhead are not marked. For fish without missing adipose fins, it is possible to distinguish hatchery from wild fish by scale pattern. This is possible because hatchery steelhead are reared for only one summer, and at accelerated rates relative to wild steelhead that may spend two or three years in freshwater. Once a fish is classified as either hatchery or wild-origin, it further classified as either an A or B-run fish by length. A-run steelhead are those fish less than 78 cm and B-run steelhead are those greater than or equal to 78 cm. The results of the analysis conducted by the respective state and tribal agencies are reported to the TAC and are used to monitor with compliance of an ESA Section 7 consultation that provides ESA authorization for the fisheries in the area. The data used in this report are from the June 10, 2003 fall fishing season Biological Assessment (TAC 2003).

Survival estimates Based on Mark – Recapture Using PIT Tag Detections

PIT tags have been implanted in rearing juvenile steelhead and smolts at various locations in the Snake River basin since the late 1980s. A query of the PIT TAGIS database in September 2003 indicates that the first PIT tagged adults were detected at Bonneville Dam in 1988, but detections were less than 100 fish each year until 2000 and, more importantly, the number of B-run fish detected at Bonneville Dam was less than 40 per year fish until 2001. I restricted this analysis to 2001 and 2002 to improve the precision of estimates.

Based on location of tagging in the Snake River basin, each fish detected at Bonneville Dam was classified as either an A-run, B-run, or unknown run type fish. Fish were also

classified as hatchery origin, wild origin, or unknown origin at the time of tagging. The number of fish detected at Bonneville Dam in 2001 and 2002 by run and origin is summarized in Table 1, the locations where the fish were tagged are shown in Figure 1.

Results

Scale and Length Separation Method

The number of wild B-run steelhead estimated to have crossed Bonneville Dam, caught in the Zone 6 fishery, and estimated to have crossed Lower Granite Dam from 1985 to 2002 as reported by TAC (2003) is summarized in Table 2. These data show that after accounting for harvest in the Zone 6 fishery that on average 23.8 % (range 0.1 – 65.8%) of the wild B-run fish did not arrive at Lower Granite Dam (Figure 2). These data also show that harvest rate on wild B-run fish has declined over time (Figure 3). Although the harvest rate has declined to very low levels in the last four years, the proportion of the run that is unaccounted for at Lower Granite Dam has been at its highest level, averaging 58.6%.

To determine if the number of missing B-run wild steelhead is related to fishing activity in Zone 6, I computed the proportion of the run that crossed Bonneville Dam each year that was harvested plus those that were missing and plotted it as a function of the proportion of the fall chinook run over Bonneville that was harvested in Zone 6 (Figure 4). This approach is intended to account for possible changes in fishing practices, prices and regulatory impacts, if these conditions led Zone 6 fishermen to not land or report landings of wild B-run steelhead in recent years when the proportion of the run that was missing has increased. There is no relationship between the harvest rate on fall chinook in Zone 6 and the proportion of the wild B-run steelhead that were harvested plus those that were missing (Figure 4). In fact, these data show that while on average 0.33 of the fall chinook crossing Bonneville were harvested each year, a much higher proportion (0.55) of wild B-run steelhead were either caught or missing.

PIT Tag Data

In 2001, there were 41 PIT tagged wild B-run adult steelhead detected at Bonneville Dam (Table 3) and all but 4 (90.2%) were subsequently detected at Lower Granite Dam (Table 4). In 2002, 108 PIT tagged wild B-run steelhead were detected at Bonneville Dam and 82 (75.9%) were subsequently detected at Lower Granite Dam. When detections were pooled across years, run types, and origins 78.5 % of the Snake River steelhead detected at Bonneville Dam were subsequently detected at Lower Granite Dam (Table 4). When factored by year, run type and origin, no fewer than 70.2% of the fish belonging to a group (in this case 2001 hatchery-origin A-run fish) were subsequently detected at Lower Granite Dam and the highest value observed was 90.2% for wild B-run fish in 2001. Overall, there appears to be no difference between run-types across years and origin (77.4% vs. 80.0%) or between years for all origins and stock types (80.0% vs. 77.0%). There may be a significant difference between hatchery-origin (74.2%) and wild-origin (82.0%), but this difference is striking only for A-run fish in 2001. Because of the high variation between groups, the limited sample sizes within groups, I believe a

reasonable estimate of the survival of Snake River steelhead in 2001 and 2002 is the overall average of 78.5%.

PIT Tag detectors were installed at McNary Dam in 2002, and this permitted estimation of the detection rates between Bonneville Dam and McNary Dam, and between McNary Dam and Lower Granite Dam. Overall, 82.0% of the fish detected at Bonneville Dam were subsequently detected at McNary Dam, and 93.9% detected at McNary Dam were subsequently detected at Lower Granite Dam (Table 5). Therefore, 78.1% of the fish that crossed Bonneville Dam but did not cross Lower Granite Dam were lost between Bonneville Dam and McNary Dam while 21.9% were lost between McNary Dam and Lower Granite Dam.

Based on the date Snake River steelhead were detected at Bonneville, there is little evidence that time of arrival had much influence on whether or not wild B-run steelhead (or fish from the other run types and origins) were subsequently detected at Lower Granite Dam (Figure 5). However, there is weak evidence that late arriving B-run steelhead in 2001 may have had a higher probability of subsequently being detected at Lower Granite Dam. In 2002, a significant proportion of the A-run fish had exited Zone 6 prior to the opening of the commercial fishing season, but the fishery occurred when virtually all the B-run fish were in Zone 6 (Figure 6).

In both 2001 and 2002, the timing of A-run fish at Bonneville Dam was similar, with half the run arriving by August 1. The timing of B-run fish was earlier in 2002 than in 2001 with half the run arriving by September 8 in 2002, and by September 12 in 2001 (Figure 7).

Discussion and Recommendations

There are large differences in the proportion of wild B-run Snake River steelhead estimated to have survived the migration between Bonneville Dam and Lower Granite Dam based on scale/length analysis and PIT tag detections in both 2001 and 2002. In 2001, the scale/length method estimated that only 25.2% of the wild B-run Snake River steelhead survived from Bonneville to Lower Granite Dam, while the PIT tag method estimated that 90.2% of the run survived the migration (Table 6). Even if we use the average overall survival rate (for both years, run types and origins) of 78.5 % there is still a three fold difference in the estimated percent of fish that survived between Bonneville Dam and Lower Granite Dam. In 2002, the scale/length method estimated that 44.0% of the wild B-run fish survived the migration while the PIT tag method indicates that 75.9% of the run survived; a difference of nearly two fold. In 2002, 20.3% of the PIT tagged wild B-run Snake River steelhead that crossed Bonneville Dam did not cross McNary Dam. While the fate of these fish is unknown, the reported harvest rate in the Zone 6 fishery was 3.4% based on the scale/length method, and this is one-sixth the loss of PIT tagged fish.

Assumptions used to implement the scale/length method may explain these differences. First, is the assumption that all B-run fish are greater than or equal to 78 cm, that all A-

run fish are less than 78 cm, or that in a given year, the numbers of A-run and B-run fish misclassified is equal. I examined size data collected on wild steelhead at two locations in Idaho to gain insight into this issue. Since 1992, an adult weir has been operated at Fish Creek in the upper Lochsa River. The steelhead returning to Fish Creek stock are considered B-run type. In these 12 years, the percent of the annual run that has been composed of steelhead less 78 cm has ranged from 16% to 64.5% and averaged 37.5%. Rapid River steelhead are an A-run stock, and since 1997 the percent of adults less than 78 cm has ranged form 66.7% to 85.7% and averaged 79.1%. While these data provide only limited insight into the size of known wild adult steelhead, they do show that not all A-run fish are less than 78 cm, that not all B-run fish are greater than 78 cm and that for the B-run at least, the percent of the annual run that is greater or less than 78 cm is highly variable.

The second assumption in the scale/length method is that all B-run fish (defined as those greater than 78 cm) are bound for Idaho. Above Bonneville Dam, there are two groups of steelhead not bound for Idaho: those bound for tributaries in the upper Columbia above Priest Rapids Dam and those bound for tributaries between Bonneville and Priest Rapids Dam. Age and size are collected at Priest Rapids Dam unfortunately the data I obtained did not identify individual fish as either hatchery of wild origin. Despite this shortcoming, these data for the period 1998 – 2002 illustrate two important points. First is that while the annul run is usually composed primarily of 1-ocean age fish (59% - 74%) the 2002 run was dominated (80%) by 2-ocean age fish. Second, while the mean size of 2-ocean age varied from 70.3 cm to 78.3 cm. Interestingly, in 2002 when the run was dominated by 2-ocean age fish, the mean size was the largest at 78.3 cm and as such about 40% (0.40 = 0.80 * ½) would have been classified as either hatchery of wild B-run fish at Bonneville Dam. If age and size data are available for mid-Columbia stocks (e.g. Deschutes and John Day) this may further clarify if this assumption is or is not being met.

The PIT tag analysis assumes that the stocks have been properly classified, that large differences in survival do not exist between stocks, and that the PIT tag detectors are highly effective (near 100% detection probability). The lack of large differences in survival rates between runs and origins, strongly suggests that minor errors in classifying stocks, or in tagging rates between stocks is not likely to alter estimates significantly. Because I excluded fish that were not detected at Bonneville Dam, even if they were detected at upstream dams, I eliminated any bias associated with detection probability at this facility. A failure to detect PIT Tag fish above Bonneville Dam that had survived would bias estimated survival rates towards estimates based on the scale/length. Detection probabilities have been shown to be at, or above 95% for steelhead (Downing and Prentice 2004). As such estimates of survival based on detections between dams can be biased low. However, even if this small possible bias in survival was present, there still remains a very large difference between survival rates computed using the two methods.

I conclude that PIT tagging provides the most accurate method for estimating survival rates of Snake River steelhead between mainstem dams on the Columbia and Snake rivers. I recommend TAC use PIT tags rather than scales and lengths for estimating

survival rates. Sufficient tags were detected beginning in 2001 to start a new data set.

Because the landed catch in the Zone 6 fishery is not screened for PIT tags, it is not possible to directly estimate harvest rates using this technology. Even if the landed catch is screened, there may be disincentives for landing steelhead. However, the current scale/length method appears to greatly overestimate the number of wild B-run steelhead crossing Bonneville Dam and has led to considerable misunderstanding and speculation regarding unexplained mortality of B-run Snake River steelhead between Bonneville and Lower Granite Dam. For this reason, I recommend that all steelhead caught in the Zone 6 fishery be screened for PIT tags and that all other fisheries in the Columbia and Snake Rivers that currently do not screen steelhead do so in the future.

To improve the precision of inter-dam survival estimates and insure that precise estimates can be made each year, I recommend more PIT tags be implanted in Snake River steelhead. The additional number to tag should take into account the observed range of smolt to adult survival rates to ensure that precise estimates of inter-dam survival can be made in most years, regardless of the SAR.

Because there appears to be only small differences in the inter-dam survival rates for hatchery and wild B-run steelhead, it may be possible to use hatchery fish as a surrogate for wild fish. Therefore, I recommend that PIT tagging be expanded on B-run hatchery steelhead. However, I also recommend that The feasibility of marking large numbers of wild B-run smolts in additional areas (e.g. South Fork, Middle Fork) be evaluated.

Literature Cited

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Table 1. Number of Snake River steelhead detected at Bonneville Dam, by run type and location in 2001 and 2002. Migration year is the year the fish was detected at Bonneville Dam. Location names are standard names used by PIT TAGS (Stein et al 2001).

		Migration Year	
Run Type	Tagging Location	2001	2002
Unknown	Salmon River	7	1
A	Bargamin Creek	3	8
A	Big Canyon Facility	8	6
A	Catherine Creek	3	2
A	Chamberlain Creek	16	14
A	Cottonwood Acclimation Pond	4	4
A	Grande Ronde River	76	21
A	Hells Canyon Dam	6	1
A	Horse Creek	1	3
A	Imnaha River	5	2
A	Imnaha Trap	137	44
A	Lemhi River	8	
A	Little Salmon River	4	
A	Little Sheep Facility	2	1
A	Lookingglass Creek	1	
A	Lostine River	7	6
A	Minam River		2
A	North Fork Salmon River	3	1
A	Pahsimeroi River Trap	8	1
A	Panther Creek (Salmon River)		1
A	Sawtooth Hatchery	16	4
A	Sawtooth Trap		1
A	Slate Creek	5	
A	Wallowa Hatchery	7	6
A Total		320	128

Table 1 (continued).

		Migration Year	
Run Type	Tagging Location	2001	2002
B	Brushy Fork Creek		1
B	Camas Creek		1
B	Clear Creek	8	16
B	Clearwater River	7	
B	Crooked Fork Creek Trap	3	5
B	Crooked River Pond		4
B	Dworshak Hatchery - Released Main Clearwater	16	18
B	East Fork South Fork Salmon River	1	1
B	Fish Creek	3	1
B	Fish Creek Trap	44	63
B	Gedney Creek	2	5
B	Johns Creek	1	
B	Johnson Creek		1
B	Johnson Creek Trap	4	8
B	Lake Creek		1
B	Lick Creek	1	1
B	Lochsa River		2
B	Lolo Creek		2
B	Lower South Fork Salmon River Trap	1	5
B	Marsh Creek Trap	1	
B	Newsome Creek		4
B	Rapid River - Middle Fork_ Salmon River		1
B	Red River	11	
B	Red River Rearing Pond		1
B	Red River Trap		1
B	Secesh River	2	3
B	Selway River		1
B	South Fork Clearwater River	8	16
B	South Fork Red River	1	1
B	South Fork Salmon River		1
B	Squaw Creek Acclimation Pond	6	1
B	Storm Creek		3
B	West Fork Gedney Creek		2
B	White Sand Creek - Replaced by COLTKC	5	4
B Total		125	174
MIX	Salmon Trap	29	4
MIX	Snake Trap	62	22
MIX Total		91	26
Grand Total		543	329

Table 2. The number of wild B-run steelhead estimated to have crossed Bonneville Dam, caught in the Zone 6 fishery, and estimated to have crossed Lower Granite Dam, 1985 to 2002. Data from TAC (2003).

Year	Bonneville Count	Zone 6 Harvest	Zone 6 Harvest Rate	Lower Granite Count	Number Missing at Granite	Percent Missing
1985	12,990	4,030	0.310	8,858	102	0.8%
1986	9,980	2,670	0.268	5,264	2,046	20.5%
1987	14,000	5,210	0.372	5,377	3,413	24.4%
1988	17,740	4,161	0.235	4,758	8,821	49.7%
1989	12,360	4,330	0.350	8,016	14	0.1%
1990	8,820	1,900	0.215	4,483	2,437	27.6%
1991	6,210	1,860	0.300	3,180	1,170	18.8%
1992	12,720	3,350	0.263	5,772	3,598	28.3%
1993	4,380	840	0.192	1,440	2,100	47.9%
1994	5,150	960	0.186	2,444	1,746	33.9%
1995	1,850	340	0.184	1,290	220	11.9%
1996	3,910	1,369	0.350	1,644	897	22.9%
1997	3,910	559	0.143	1,327	2,024	51.8%
1998	3,410	530	0.155	2,300	580	17.0%
1999	3,740	370	0.099	909	2,461	65.8%
2000	8,368	1,113	0.133	2,849	4,406	52.7%
2001	12,100	1,388	0.115	3,050	7,662	63.3%
2002	32,300	1,098	0.034	14,198	17,004	52.6%
Average						32.8%

Table 3. The number of PIT tagged Snake River steelhead that were detected at Bonneville Dam that were (were = yes) and were not (were not = no) subsequently detected at Lower Granite Dam, by rearing origin and run type, 2001 – 2002.

Year	Origin	A - run			B - Run			Both Runs		
		No	Yes	Total	No	Yes	Total	No	Yes	Total
2001	Hatchery	34	80	114	4	21	25	38	101	139
	Wild	11	74	85	4	37	41	15	111	126
	Total	45	154	199	8	58	66	53	212	265
2002	Hatchery	15	43	58	11	40	51	26	83	109
	Wild	12	49	61	26	82	108	38	131	169
	Total	27	92	119	37	122	159	64	214	278
All Years	Hatchery	49	123	172	15	61	76	64	184	248
	Wild	23	123	146	30	119	149	53	242	295
All Years and Origins		72	246	318	45	180	225	117	426	543

Table 4. The percentage of PIT tagged Snake River steelhead detected at Bonneville Dam that were subsequently detected at Lower Granite Dam, by rearing origin and designated run type, 2001 – 2002.

Year	Origin	A - Run	B-Run	Both Runs
2001	Hatchery	70.2%	84.0%	72.7%
	Wild	87.1%	90.2%	88.1%
	Total	77.4%	87.9%	80.0%
2002	Hatchery	74.1%	78.4%	76.1%
	Wild	80.3%	75.9%	77.5%
	Total	77.3%	76.7%	77.0%
All Years	Hatchery	71.5%	80.3%	74.2%
	Wild	84.2%	79.9%	82.0%
All Years and Origin		77.4%	80.0%	78.5%

Table 5. Survival of PIT tagged Snake River steelhead between Bonneville Dam and McNary Dam and bewteen McNary Dam and Lower Granite Dam, 2002.

Run	Origin	Number at Bonneville	Number at McNary	Percent Survival to McNary	Number at Granite	Percent Survival Between McNary and Granite	Number Lost Between Bonneville & Granite	Number Lost Between Bonneville & McNary	Number Lost Between Mc Nary & Granite	Percent of Lost Fish that Disappeared Between Booneville & McNary	Percent of Lost Fish that Disappeared Between McNary & Granite
A	Hatchery	58	48	82.8%	43	89.6%	15	10	5	66.7%	33.3%
	Wild	61	50	82.0%	49	98.0%	12	11	1	91.7%	8.3%
	Total	119	98	82.4%	92	93.9%	27	21	6	77.8%	22.2%
B	Hatchery	51	44	86.3%	40	90.9%	11	7	4	63.6%	36.4%
	Wild	108	86	79.6%	82	95.3%	26	22	4	84.6%	15.4%
	Total	159	130	81.8%	122	93.8%	37	29	8	78.4%	21.6%
Both	Hatchery	109	92	84.4%	83	90.2%	26	17	9	65.4%	34.6%
	Wild	169	136	80.5%	131	96.3%	38	33	5	86.8%	13.2%
	Total	278	228	82.0%	214	93.9%	64	50	14	78.1%	21.9%

Table 6. Comparison of survival rates of Snake River wild B-run steelhead computed using PIT tags and scales/size between dams, 2001 and 2002.

Method	Year	Bonneville Count	Zone 6 Harvest or Loss	Zone 6 Harvest Rate or Loss Rate	Lower Granite Count	Number Missing at Granite	Scale Method Percent Missing at Granite	Percent of Bonneville Run at Granite
Scale	2001	12,100	1,388	0.115	3,050	7,662	63.3%	25.2%
PIT	2001	41	Ukn	Ukn	37	4		90.2%
Scale	2002	32,300	1,098	0.034	14,198	17,004	52.6%	44.0%
PIT	2002	108	22	0.203	82	4		75.9%

Figure 1. Map of the Snake River basin showing locations where adult steelhead detected in 2001 and 2002 were Pit taged.

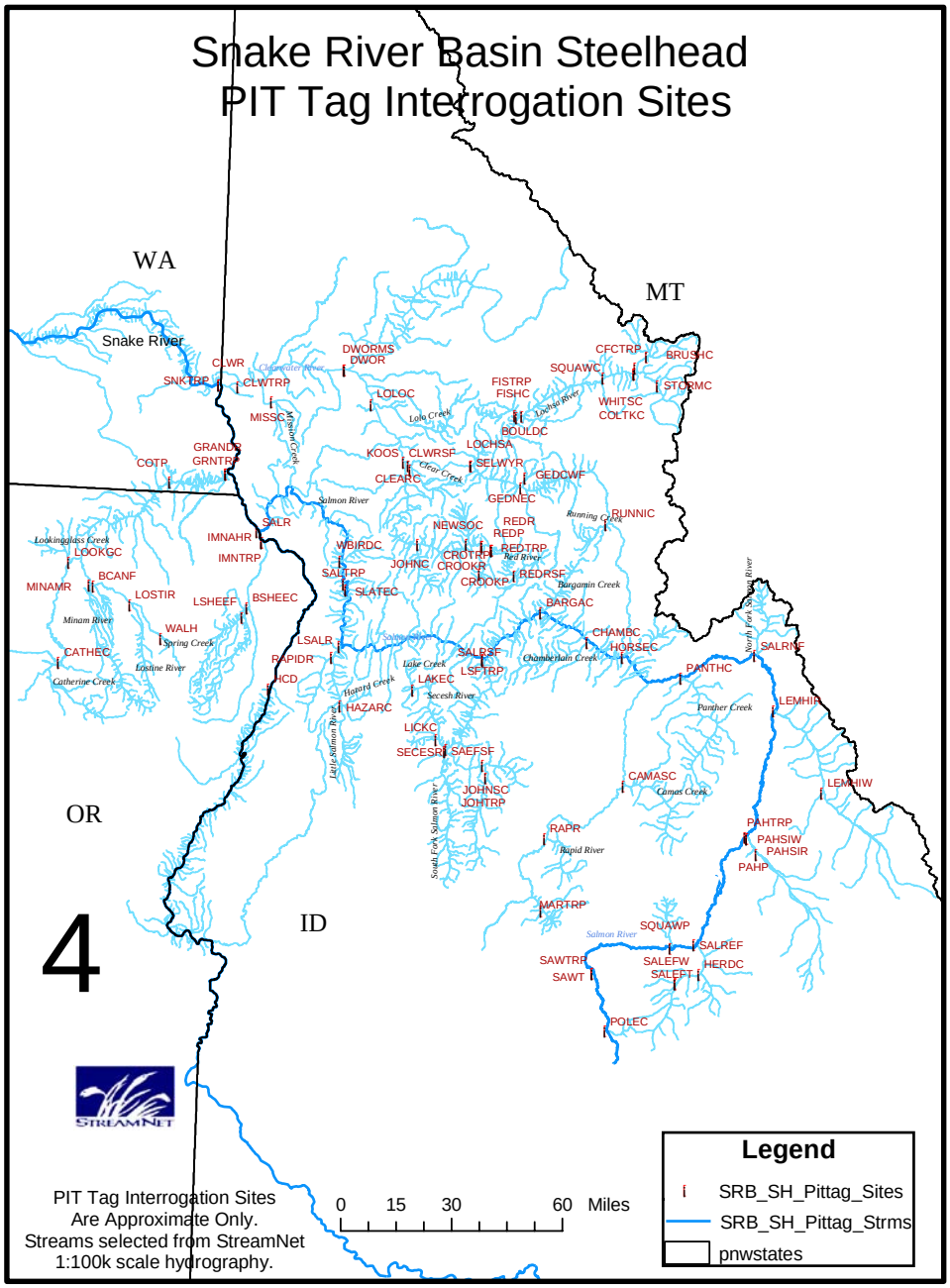

Figure 3. Annual Harvest Rate on Wild "B" Run Steelhead in Zone 6 and Annual Caps 1985 -2002

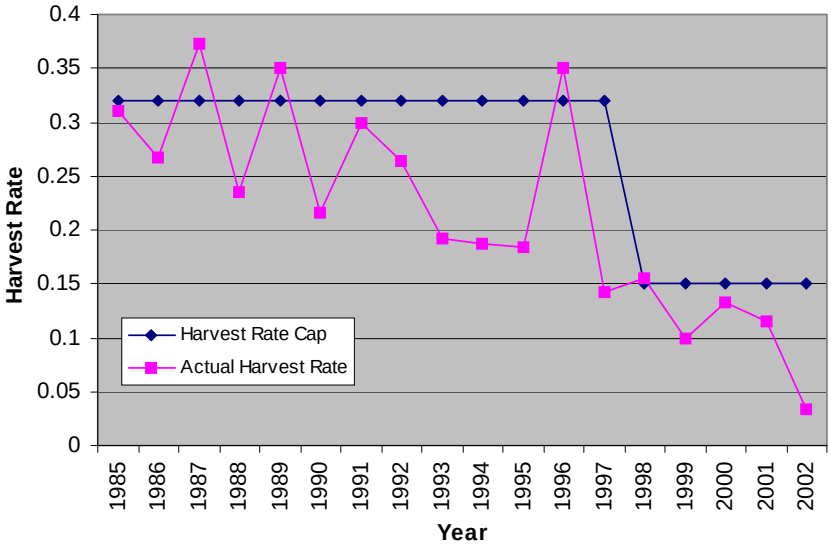

Figure 2. Proportion of the wild "B" run of Steelhead that Crossed Bonneville Dam Minus the Zone 6 Harvest that Did Not Arrive at Lower Granite Dam 1985 - 2002

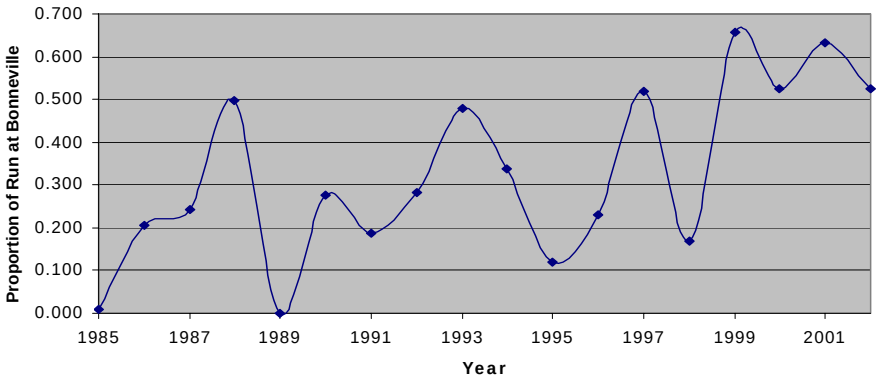

Figure 4. The Proportion of the Wild B-Run Steelhead Run at Bonneville Dam that were Caught in Zone 6 and Missing at Lower Granite Dam as a Function of the Harvest of Fall Chinook in Zone 6 Divided by the Count of Fall Chinook at Bonneville 1985 - 2002.

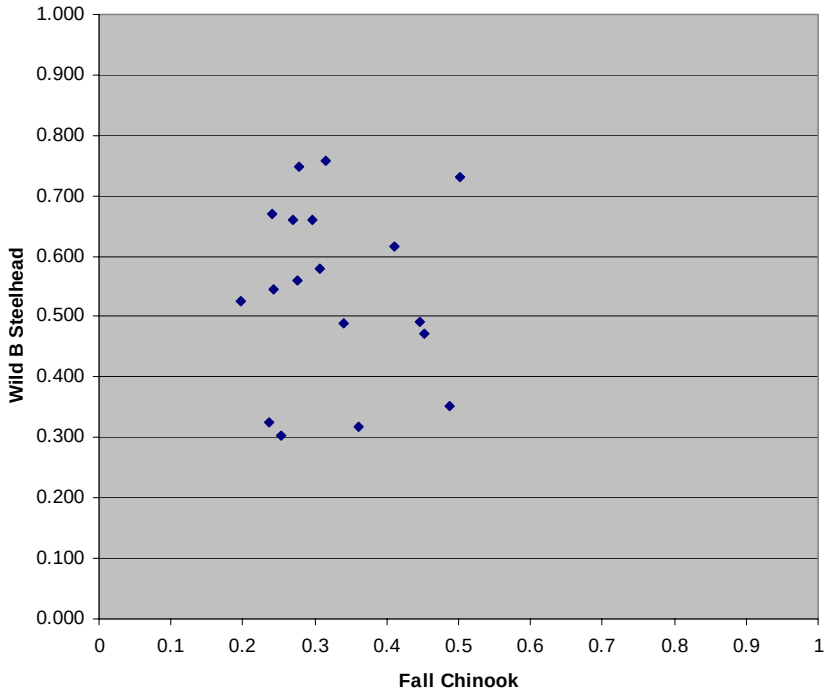

Figure 5. Date that Snake River steelhead were detected at Bonneville Dam for fish that were and were not subsequently detected at Lower Granite Dam (1 = detected at Lower Granite Dam and -1, = not detected), for B-run wild steelhead and all origins and run-types, 2001 and 2002.

Figure 6. Timing of Snake River Steelhead Past Bonneville and McNary Dams in Relation to the Zone 6 Commercial Catch in 2002.

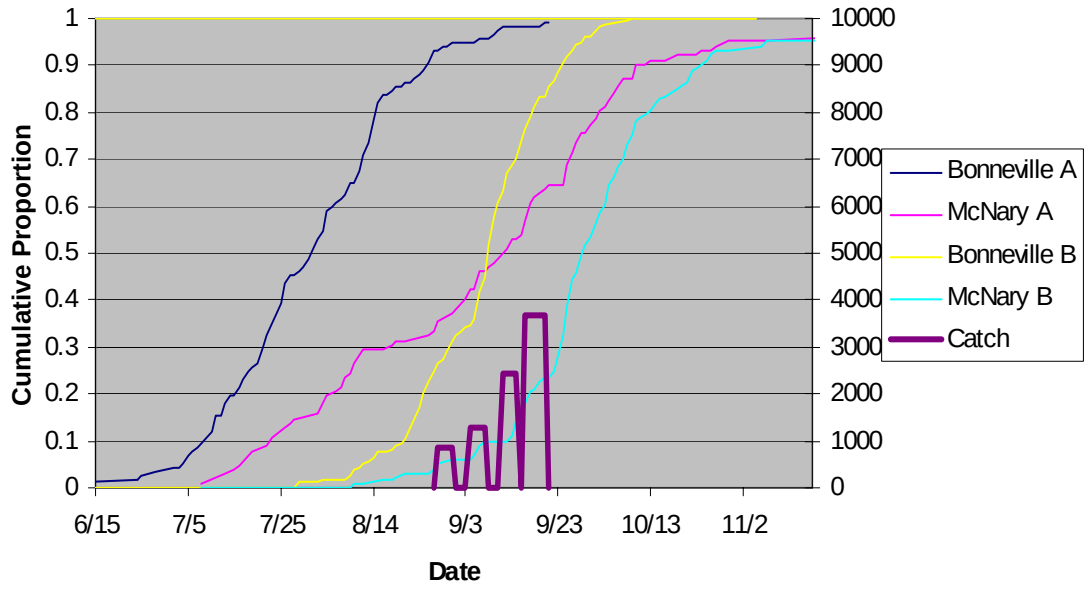

Figure 7. Timing of Snake River Steelhead at Bonneville Dam Based on PIT Tag Detections 2001 and 2002 Run Years