FISHERY RESEARCH

ASSESSMENT OF NATIVE SALMONIDS ABOVE HELLS CANYON DAM, IDAHO

ANNUAL PROGRESS REPORT
July 1, 2000—June 30, 2001

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IDFG Report Number 02-04
January 2002

Snake River Native Salmonids Assessment

Project Progress Report

2000 Annual Report

By

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To

U.S. Department of Energy
Bonneville Power Administration
Division of Fish and Wildlife
P.O. Box 3621
Portland, OR 97283-3621

Project Numbers 1998-00200
Contract Numbers 98-BI-01462

IDFG Report Number 02-04
January 2002

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PART #I: EVALUATING THE EFFECTIVENESS OF THE PIKE'S FORK BROOK TROUT REMOVAL PROJECT

ABSTRACT

In August 2000, brook trout *Salvelinus fontinalis* were removed for the third and final year from Pike's Fork of the Crooked River in a multi-agency effort to eliminate or reduce the exotic salmonid and facilitate bull trout *S. confluentus* recovery in the stream. Due to a lower turnout in manpower, removal efforts in 2000 were reduced below the two previous years. Above the barrier constructed on Pike's Fork, age-1+ (i.e., age-1 and older) brook trout decreased from 1,180 fish in 1999 to 629 fish in 2000. However, after decreasing from 1998 to 1999, age-0 brook trout abundance rebounded, increasing 224 in 1999 to 498 in 2000. A total of 510 age-1+ and 380 age-0 brook trout were removed from Pike's Fork in 2000, but as many as 463 age-1+ and 418 age-0 brook trout may have been missed. Age-1+ redband trout *Oncorhynchus mykiss gairdneri* abundance did not change, but age-0 abundance increased 400% from 213 to 953 fish. No bull trout were captured in 2000, compared to four in 1998 and five in 1999. Mean total annual mortality rate for brook trout in 2000 was 0.79, compared to 0.79 in 1999 and 0.90 in 1998. That total annual mortality changed very little, despite a drastic increase in exploitation caused by our removals, indicates that natural mortality has declined tremendously since the removals began. Few other demographic parameters have changed appreciably. Our results indicate that, despite experiencing a slight decrease in abundance, brook trout in Pike's Fork appear little affected by three years of relatively intensive removal efforts. The reintroduction of bull trout at this time is not warranted, considering the present abundance of brook trout still in the system.

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INTRODUCTION

A steady decline in the distribution and abundance of bull trout *Salvelinus confluentus* culminated in 1998 with the species being listed as threatened under the U.S. Endangered Species Act (U.S. Office of the Federal Register 64[210]:58910). Reasons for population declines generally include habitat alteration and the expansion of exotic species (Ratliff and Howell 1992; Markel 1992; Ziller 1992; Rieman and McIntyre 1993; Leary et al. 1993). Most notably among exotic species, the introduction of brook trout *S. fontinalis* has deleteriously affected bull trout through competitive interactions and hybridization between the two species (Markel 1992; Rieman and McIntyre 1993).

Though brook trout have been documented in only 14 of the 108 subwatersheds of the upper Boise River basin, they are considered to pose a serious risk to several populations of bull trout in the upper Boise River watershed (SBNFWAG 1998). Removal or suppression of brook trout where they coexist with bull trout has been recommended as a conservation action in six Priority 1 subwatersheds of the Boise River basin, including Pike's Fork of the Crooked River (SBNFWAG 1998). However, the effectiveness of removing brook trout where rare native salmonids occur has not been fully evaluated, especially with respect to bull trout conservation (Clancy et al. 1997). Thompson and Rahel (1996) effectively removed 73% to 100% of age-0 and 59% to 100% of age-1+ brook trout from three study streams, but failed to completely eradicate brook trout from any of them. Furthermore, any remaining brook trout may compensate after the fish population is reduced, through increased growth and fecundity and decreased natural mortality (McFadden 1961, 1976), negating some or all effects of the removal. Before brook trout removal or suppression is considered an effective tool for native salmonid conservation on a broad scale, the population-level effects should be more thoroughly studied.

OBJECTIVES

1. To assess whether an intensive brook trout removal effort over three years in a small stream can effectively eliminate brook trout and lead to an increase in bull trout numbers in subsequent years.

2. To assess whether any remaining brook trout undergo a compensatory response that has the potential to negate the effects of the removal effort.

STUDY AREA

Pike's Fork is a second-order tributary of the Crooked River, which flows into the North Fork of the Boise River. Mean summer stream width, gradient, and elevation were 2.8 m, 3.0%, and 1750 m, respectively. A wire gabion barrier constructed in 1998 above the Banner Creek confluence (Figure 1) by the U.S. Forest Service was designed to prevent upstream migration by resident brook trout while allowing migratory bull trout (i.e., fish greater than about 400 mm) to pass. Pike's Fork contains native redband trout *Oncorhynchus mykiss gairdneri*, a remnant population of bull trout, and the exotic brook trout. Hatchery rainbow trout *O. mykiss* are stocked in the stream below the study area. The only nongame fish in Pike's Fork is the shorthead sculpin *Cottus confusus*.

METHODS

The Pike's Fork project was initiated in August 1998 by the Southwest Basin Native Fish Watershed Advisory Group (SBNFWAG). Our goal was to evaluate the effectiveness of their removal project in diminishing or eliminating brook trout in the stream. Meyer (1999 and 2000) reported on methods and results from the first two years (1998 and 1999) of removal. In summary, about 4.5 km of Pike's Fork above the confluence of Banner Creek were electrofished to remove brook trout in August 1998. At that time, it was discovered that brook trout extended farther upstream than originally suspected. Before the second year of removal, we spot-surveyed the stream and found no trout above a high gradient stretch of stream 9.4 km above the gabion barrier. This 9.4 km of stream, along with 80 m of an unnamed tributary, was electrofished in both 1999 and 2000. The entire study section was divided into 29 reaches averaging 328 m in length.

Due to manpower shortages in 2000, removals were not as rigorous as in the previous two years. Two crews of four people, each with two backpack electrofishing units and two netters, were established for each day, and each crew covered one reach at a time. The crews made one or two electrofishing passes with one electrofishing operator proceeding upstream in front of the other by about 20 m. Brook trout were retained for population dynamics analysis. Redband trout, bull trout, and shorthead sculpins were measured for total length (to nearest millimeter) and released in the section from which they were captured after electrofishing was completed.

In sections where two removal passes were made, abundance, upper and lower 95% confidence limits, and capture probability (CP) for each species in each reach were estimated with the removal-depletion maximum-likelihood model using the MicroFish software package (Van Deventer and Platts 1989). Estimates were made for age-0 (<80 mm) and age-1+ (i.e., age-1 and older; >80 mm) fish. At sites where only one removal pass was made, estimates of abundance and upper and lower 95% prediction limits were made by regressing the number of fish captured in the first pass against the final population estimate from 1999 data (cf. Kruse et al. 1998), and applying that model to sites where only one pass was made in 2000. Data was lost for redband trout at five reaches. For these reaches, I regressed population estimates from 1999 against estimates from 2000 for reaches in which multi-pass estimates were available ($n = 9$, $r^2 = 0.66$; $P = 0.008$), and used the regression to predict abundance and 95% prediction limits for the missing data in 2000. Lower 95% confidence and predictions limits were always less than the total catch, so total catch was presented as lower confidence limits. Results from 1998 indicated that age-0 and age-1 brook trout were probably not fully recruited to the sampling gear, and thus the assumption of equal catchability was probably violated. This should be kept in mind when considering abundance, removal efficiency, and age-frequency estimates. I assumed that within each age class, catchability was equal, and thus the remaining parameter estimates should be unbiased.

Brook trout were transported to the Idaho Department of Fish and Game (IDFG) Nampa Research Station, where length and weight, age, mortality, growth, age at sexual maturity, fecundity, longevity, and sex ratio were determined. We collected paired scale and otolith samples from 320 randomly selected fish to age brook trout. Scales were removed from the area immediately above the lateral line and posterior to the dorsal fin, placed on paper strips in envelopes, and subsequently mounted on acetate slides using a scale press. Otoliths were removed and stored dry in vials, but were submersed in saline solution for reading. Otolith readings gave older ages and were presumably more accurate than scales (Meyer 1999); thus, we only read scales when the age from otoliths could not be ascertained. Because this occurred only 14 times, we did not attempt to correct the scale age readings. Readers had no knowledge of fish length during readings. A final determination of age for each fish was made by comparing results between two or three readers and resolving any differences with additional joint readings.

Once age was determined for the 320 fish used for aging analysis, the age of the remaining 569 brook trout was assigned using an age-length key (DeVries and Frie 1996). All demographic parameters except mortality were estimated only from the fish that were directly aged. Following Ricker (1975), I estimated mean instantaneous mortality rate (Z_w) for each year, assuming the population was stable and using yearly catch curves, and from this calculated mean weighted total annual mortality rate (S_w). Results from 1998 demonstrated that only age-2 and older brook trout were fully recruited to the electrofishing gear, and thus are the only fish that were used for mortality estimates. Growth was assessed by comparing average length of brook trout by age groups for both sexes. Fish were rated as immature or mature by laboratory examination of ovaries and testes. Mature males were those with large extended testes, whereas immature males had minute, strand-like testes. Mature females contained large, developed eggs, whereas immature females contained granular eggs that obviously would not reach ripeness by fall. The sex of most immature fish could not be determined. Maturity percentages were calculated for each age class. Sex ratio was expressed as the proportion of the population that was female. Comparisons between sexes and age classes were made for each parameter when possible. Ninety-five percent confidence intervals around the estimates were calculated as in McFadden (1961). I compared fish length-fecundity regressions between years by comparing regression coefficients and their confidence intervals. All demographic estimates and their confidence intervals were compared between 1998, 1999, and 2000 to assess whether brook trout had undergone any compensatory responses after two years of removal efforts.

RESULTS

One year after the first complete removal effort in Pike's Fork, age-1+ brook trout abundance above the barrier decreased from 1180 (95% CI 1127-1312) in 1999 to 629 (95% CI 510-973) in 2000 (Figure 2). In the lower 4.5 km that was treated all three years, it was estimated that age-1+ brook trout decreased from 699 fish (in 1998 and 1999) to 207 fish in 2000 (Table 1). Age-0 brook trout abundance increased from 224 (95% CI 114-390) in 1999 to 501 (95% CI 380-798) in 2000. A total of 510 age-1+ and 380 age-0 brook trout were removed from Pike's Fork in 2000, but as many as 463 age-1+ and 418 age-0 brook trout may have been missed in the 2000 removal efforts (total catch subtracted from upper 95% confidence limit; Table 1). Age-1+ redband trout abundance did not change appreciably (Figure 2, Table 1), but age-0 redband trout increased over four-fold from an estimated 213 (95% CI 198-227) in 1999 to 953 (95% CI 691-1002) in 2000. In 2000, no bull trout were captured in Pike's Fork above the barrier, compared to five bull trout that were captured in 1999 and four bull trout and one bull x brook hybrid in 1998.

The increase in redband trout and brook trout age-0 abundance in 2000 was also evident when comparing cumulative length frequencies of fish in Pike's Fork (Figure 3). A larger percentage of redband trout were less than 150 mm than in previous years, while the cumulative frequency of brook trout in 2000 mirrored that of 1998, before the removal efforts had begun.

In general, there were few changes in brook trout demographics two years after the initial removal effort. Of the 889 brook trout captured and removed from Pike's Fork in 2000, the majority (40.5%) of fish were age-0, followed by age-1 and age-2 (Table 2). Less than 10% of the brook trout were age-3 or older. As in previous years, there was substantial overlap in length-at-age. For the first time, an age-5 brook trout was captured. Mean weighted total annual mortality rate (S_w) in 2000 was 0.79, unchanged from 1999 (0.79) but lower than 1998 (0.90); mean weighted instantaneous mortality rate (Z_w) from 1998 to 2000 was -2.34, -1.57, and -1.58, respectively (Figure 4).

Mean length-at-age for brook trout was similar in 2000 to previous years (Figure 5). Average lengths for age-0 to age-4 were 71 mm, 104 mm, 141 mm, 165 mm, and 186 mm respectively. The length-weight relationship was nearly identical between years (Figure 6).

There has been no change in age at maturity for brook trout despite the removal efforts (Figure 7). As in previous years, there tended to be a higher proportion of mature males than females for each age class (Figure 7), especially for ages 1 and 2. The smallest mature male was 97 mm, and the largest immature male was 146 mm; for females the smallest mature and largest immature fish were 95 mm and 188 mm, respectively (Table 3). There were few noticeable changes between years in mean length-at-age for all comparisons of mature or immature brook trout for either sex (Figures 8 and 9). Mature brook trout were larger than immatures for age-1 males (P-value = 0.003) and for age-2 males (*P*-value = 0.0003) and females (*P*-value = 0.0001). Males were larger than females for age-1 fish (P-value = 0.006), but not for age-2 or age-3 fish (Table 3). Fish-length vs. fecundity regression coefficients did not differ between years for any comparison (1998 ß = 3.77 ± 1.08; 1999 ß = 5.25 ± 1.34; 2000 ß = 5.20 ± 1.22; Figure 10).

Of the brook trout whose sex could be determined, females outnumbered males for each year class with a large enough sample size to make comparisons (Table 3). The proportion of brook trout that were females was 0.66 (SE ± 0.04) for age-1, 0.55 (±0.05) for age-2, and 0.55 (±0.07) for age-3; over all age classes, the proportion was 0.59 (±0.03).

DISCUSSION

Although age-1+ brook trout declined 47% from 1999 to 2000, they showed no signs of being anywhere close to extirpated, and age-0 brook trout increased 122%. In 1999, estimates of population size and removal efficiency indicated that no more than 406 age-1+ brook trout would remain in Pike's Fork above the barrier, but we removed 510 age-1+ fish and certainly did not remove all of them. I may have overestimated removal efficiencies by underestimating population estimates. Fry are particularly difficult to capture with electrofishing (Reynolds 1996), and those fry that escape capture one year and survive their first winter become age-1+ fish the following year. Riley and Fausch (1992) found that two-pass electrofishing removals, such as the method used in this study, underestimated the number of trout present. Although their results are not directly comparable because in this study two electrofishing units were used instead of one for each pass, it is still likely that true population size and consequently the number of brook trout missed each year has been underestimated.

However, there are several other possible explanations for the lack of reduction in brook trout abundance above the barrier. One source of constant influx of brook trout could be the unnamed tributary near section 3.0C. Due to time constraints and manpower shortage, the SBNFWAG-led removals have only included this tributary in two years, and in each year teams have only electrofished the lower 200 meters. However, on a reconnaissance survey on July 13, 2000, before the removal efforts, I found brook trout at least 1 mile above the confluence to Pike's Fork and at all locations in between. Although the tributary is very small in size, it is possible that several hundred brook trout were present during our reconnaissance survey and possibly at other times of the year, especially before and during the spawning season, and that spawning activity in this tributary could contribute fish to the mainstem of Pike's Fork.

It is also possible that brook trout may be ascending the barrier that was designed for their exclusion. The barrier was designed with a 0.5 m drop at flood and a 0.8 m drop at baseflow, which was believed to be sufficient to exclude all fish except for large (greater than 400 mm) migratory bull trout (T. Burton, Bureau of Land Management, personal communication); the plunge pool below the barrier is less than 1 m deep. The nearest IDFG fish stocking location is downstream several miles in the Crooked River (B. Turik, IDFG Nampa Hatchery, personal communication), but we captured 250-300 mm hatchery rainbow trout above the barrier during the 2000 removals. Unless these fish were illegally transported by an angler, they ascended the barrier. Adams et al. (2000) found similar-sized brook trout to those in Pike's Fork ascending drops from 0.5 m to 1.2 m high.

That annual total mortality actually decreased in years two and three despite a tremendous increase in "fishing mortality" (i.e., our removals) after year one demonstrates a substantial compensatory response in natural mortality by the Pike's Fork brook trout population. McFadden (1961) found a strong negative relationship between exploitation and natural mortality rate over a number of years in a brook trout population. Any brook trout that avoided capture would have experienced reduced competition for food and space, especially important during winter (Chapman 1966). Such a reduction in competition most likely led to the decrease in annual total natural mortality that occurred in this study.

Since we failed to substantially reduce brook trout abundance with electrofishing removals, however, it is not surprising that there were no substantial changes in other demographic parameters, such as length or age at sexual maturity or growth. In Pike's Fork, stream habitat conditions have been somewhat degraded by anthropogenic disturbances, and spawning habitat is of relatively poor quality. Coupled with the lack of reduction in abundance of fish, there was probably very little decline in competition for spawning sites, and thus no selective pressure for earlier maturation (Hegge et al. 1991). Cooper et al. (1962) found no increase in brook trout growth after using rotenone in a stream to severely reduce the number of brook trout. Instead, brook trout abundance quickly recovered and within two years was no different than before the treatment. Almost all brook trout two years after the rotenone treatment were age-0 or age-1. Any increase in growth that might have been expected in this study under conditions of reduced competition could have been offset by a reduction in growth rate due to yearly exposure of the entire population to electrofishing (Dalbey et al. 1996; Thompson et al. 1997; Hughes 1998).

Bull trout were absent from Pike's Fork above the barrier in 2000. Whether adfluvial bull trout are currently using Pike's Fork or would recolonize the stream is not known. All five bull trout collected in Pike's Fork in 1999 were between 180 mm and 210 mm in length, and they probably out-migrated to Arrowrock Reservoir in fall 1999 or spring 2000. An ongoing study has found a number of sub-adult bull trout migrating downstream from the Crooked River system (T. Salow, U.S. Bureau of Reclamation, personal communication). Considering the slow rate at which bull trout reach maturity (Fraley and Shepard 1989; Scott and Crossman 1973) compared to brook trout (McFadden 1961; Scott and Crossman 1973), and the current abundance of brook trout, it is unlikely that reintroducing bull trout to Pike's Fork at this time would be beneficial. As Leary et al. (1993) argued, the more numerous and faster maturing species has the advantage, because less of their total reproductive effort is spent on unproductive hybrid production. A nearby source of bull trout, such as the headwater reaches of the Crooked River, should be considered by the SBNFWAG as a source to help reestablish a stable population of bull trout into Pike's Fork once brook trout are dealt with. At this time, however, it does not appear that electrofishing alone will reduce brook trout to a level sufficient to warrant bull trout reintroduction to Pike's Fork.

Removal efforts in 2000 were much lower than the previous two years, but the combined effort to date has been about 190 man-days, not including planning and preparation time before the actual removal efforts. Although there were a number of volunteers, most man-days came from permanent or temporary employees of the organizations involved in the removal. Assuming an average salary of $12/hour and an average field day of 9 hours (both are probably low estimates), at least $20,000 was spent for the removal efforts alone. This does not include planning time, reconnaissance trips to the site, or the cost of building and installing the barrier. Whether or not the expenditure of time and money is worthwhile depends in part on the results of the removal efforts. Based on our analysis of the Pike's Fork removal efforts, it does not appear that electrofishing removals should be considered a cost-effective method for future use in other Snake River tributaries to reduce the risk that brook trout pose on native resident salmonids.

ACKNOWLEDGMENTS

The brook trout removal project was initiated and carried out by a number of people from a number of organizations, including Idaho Division of Environmental Quality, Idaho Department of Fish and Game, U.S. Forest Service, Boise Cascade, Idaho Department of Lands, U.S. Bureau of Reclamation, and a number of volunteers. Win Taylor assisted with aging analysis, and Cheryl Leben assisted in report preparation. Funding for the evaluation phase of the removal project was provided by Bonneville Power Administration. Dan Schill, Jim Capurso, and Steve Yundt provided comments and suggestions which helped to improve the manuscript.

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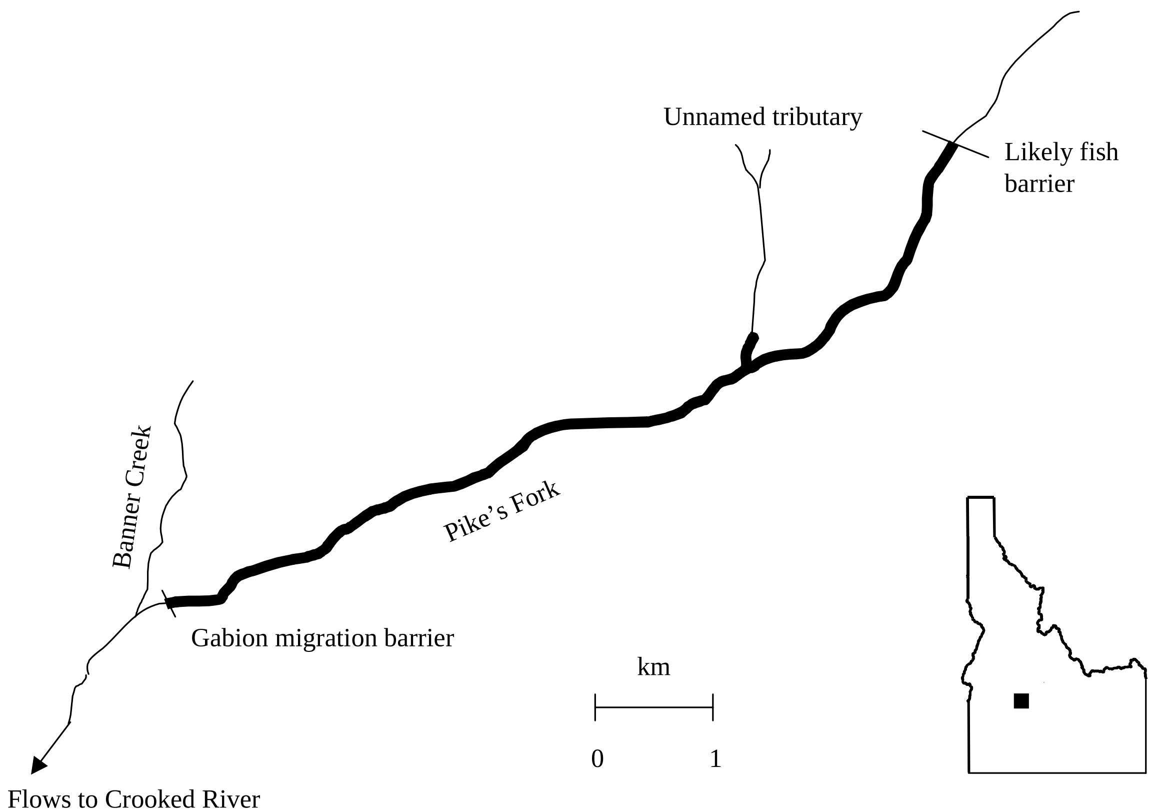

Figure 1. Location of gabion migration barrier and 9.4 km stream section (darkened stream section) where brook trout removal efforts have occurred in Pike's Fork, Idaho, 1998-2000.

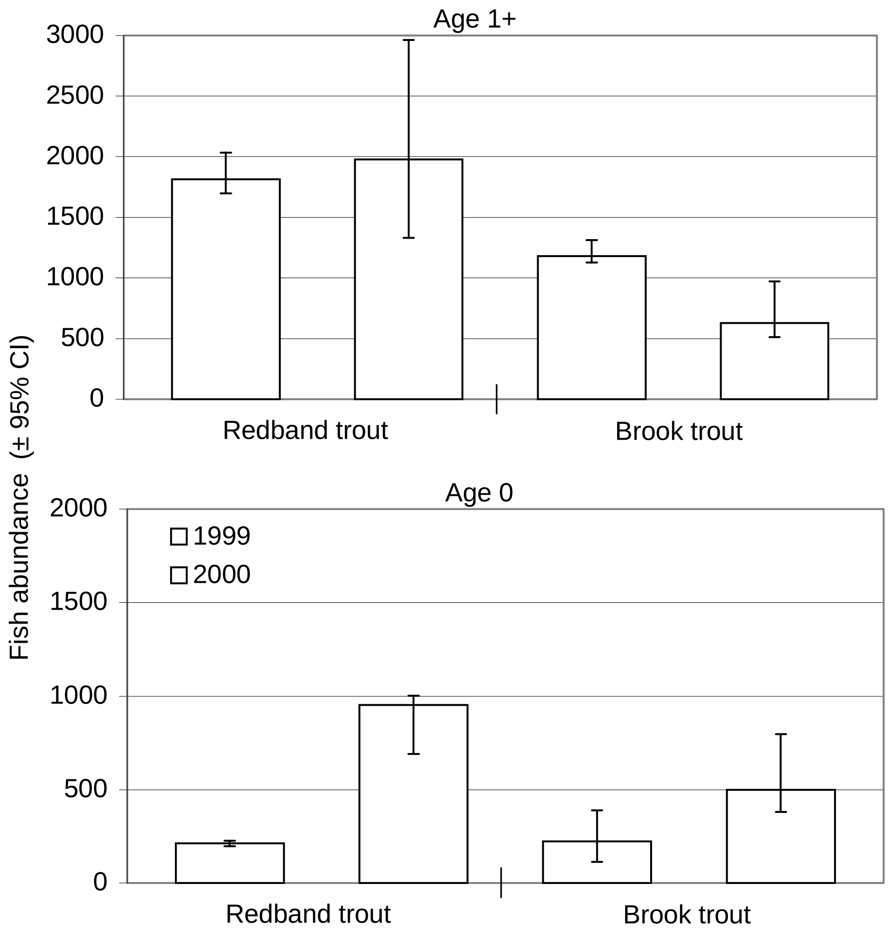

Figure 2. Abundance of brook trout and redband trout in 1999 and 2000 in Pike's Fork, Idaho.

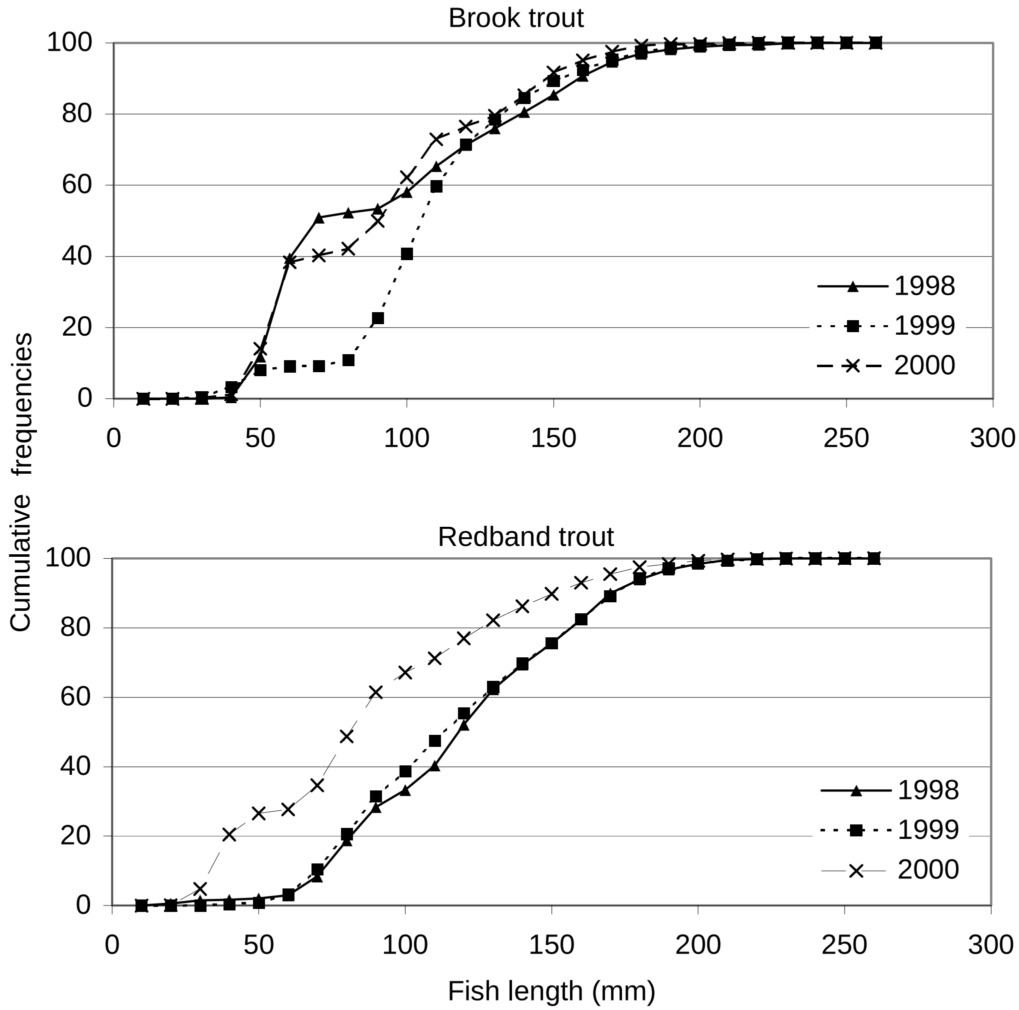

Figure 3. Cumulative length frequency of brook trout and redband trout from 1998 to 2000 in Pike's Fork, Idaho.

Table 1. Total catch, population estimates, and removal efficiencies of redband trout and brook trout in 9.4 km of Pike's Fork, Idaho in 2000. One-pass sites contain dashes in 2nd pass column. Sites with missing data contain question marks in pass columns. See methods for procedures used to estimate abundance. Dashed line indicates midpoint of treatment section about 4.5 km above barrier (reaches listed above dashed line have had removals performed every year).

	Redband age-1+ (> 80 mm)						Brook trout age-1+ (> 80 mm)						Brook trout age-0 (< 80 mm)					
Reach name	1st pass	2nd pass	Total caught	Pop. Estimate (# in reach)	Upper CI	Capt. Prob.	1st pass	2nd pass	Total caught	Pop. Estimate (# in reach)	Upper CI	Capt. Prob.	1st pass	2nd pass	Total caught	Pop. Estimate (# in reach)	Upper CI	Capt. Prob.
0.0 B	13	8	21	27	44	0.51	0	0	0	0	NA	NA	1	0	1	1	NA	NA
0.0 C	36	-	36	47	69.4		6	-	6	8	22.6		1	-	1	2	16.3	
0.5 A	56	17	73	79	88	0.72	4	0	4	4	NA	NA	4	0	4	4	NA	NA
0.5 B	87	-	87	113	136.1		6	-	6	8	21.6		13	-	13	20	34.0	
0.5 C	80	-	80	104	126.4		7	-	7	9	23.6		14	-	14	22	36.0	
1.0 A	62	25	87	101	119	0.62	5	3	8	8	11.3	0.73	26	12	38	45	59.2	0.59
1.0 B	19	17	36	99	334	0.20	3	0	3	3	NA	NA	4	0	4	4	NA	NA
1.0 C	??	-		78	123.2		3	-	3	4	18.7		1	-	1	2	16.3	
1.5 A	54	13	67	70	76	0.78	6	1	7	7	8.05	0.88	13	4	17	17	19.5	0.81
1.5 B	67	-	67	87	109.6		5	-	5	6	20.6		3	-	3	5	19.3	
1.5 C	79	-	79	103	125.9		13	-	13	16	31.4		2	-	2	3	17.3	
1.5D	17	13	30	53	117	0.34	2	0	2	2	NA	NA	3	0	3	3	NA	NA
2.0 A	40	19	59	73	95	0.56	3	1	4	4	5.95	0.80	0	3	3	3	NA	
2.0 B	39	-	39	51	73.4		7	-	7	9	23.6		7	-	7	11	25.1	
2.0 C	93	-	93	121	144.4		11	-	11	14	28.4		16	-	16	25	38.9	
2.5 A	70	29	99	117	138	0.60	20	13	33	48	82.5	0.43	17	8	25	29	39.7	0.61
2.5 B	40	-	40	52	74.4		22	-	22	28	42.2		1	-	1	2	16.3	
2.5 C	51	-	51	66	88.4		24	-	24	30	44.2		3	-	3	5	19.3	
3.0 A	??	??		58	105		10	8	18	30	72.5	0.36	4	2	6	6	8.7	0.75
3.0 B	??	-		58	105		20	-	20	25	39.2		12	-	12	19	33.0	
3.0 C	??	-		44	93.6		27	-	27	34	48.1		20	-	20	31	44.9	
3.5 A	34	9	43	45	50	0.77	29	7	36	37	40.8	0.80	16	7	23	26	34.7	0.64
3.5 B	32	-	32	42	64.5		35	-	35	44	58.1		27	-	27	42	55.9	
3.5 C	25	-	25	33	55.6		21	-	21	27	41.2		8	-	8	12	26.1	
4.0 A	25	15	40	56	88	0.46	20	5	25	25	27.4	0.83	10	5	15	17	24.8	0.63
4.0 B	31	-	31	40	62.5		32	-	32	40	54.1		29	-	29	45	58.9	
4.0 C	70	-	70	91	96.4		79	-	79	100	115.6		27	-	27	42	55.9	
4.5 A	40	2	42	42	43	0.96	20	4	24	24	25.95	0.86	44	13	57	61	68.6	0.73
4.5 B	??	-		26	79.7		26	-	26	33	47.2		0	-	0	0	14.4	
Unnamed trib.	2	-	2	3	26.3		2	-	2	3	17.7		0	-	0	0	14.4	
Total	1162	167	1329	1979	2952	0.59	468	42	510	629	973	0.71	326	54	380	501	798	0.68

Table 2. Age-frequency distribution of brook trout removed in 2000 from Pike's Fork, Idaho. Distribution was computed using an age-length key (n = 320).

Fish length (mm)	Age group 0	1	2	3	4	5	Total
30	2						2
40	9						9
50	114						114
60	216						216
70	17						17
80	2	15					17
90		69					69
100		27	82				109
110		65	30				95
120		13	19				32
130		3	24				27
140			35	16			51
150			37	20			57
160			18	12			30
170			10	9	3		22
180			4	8	3		15
190				3	1		4
200							0
210					1	1	2
220				1			1
230							0
Total	360	192	259	69	8	1	889
Percent	40.5	21.6	29.1	7.8	0.9	0.1	100.0

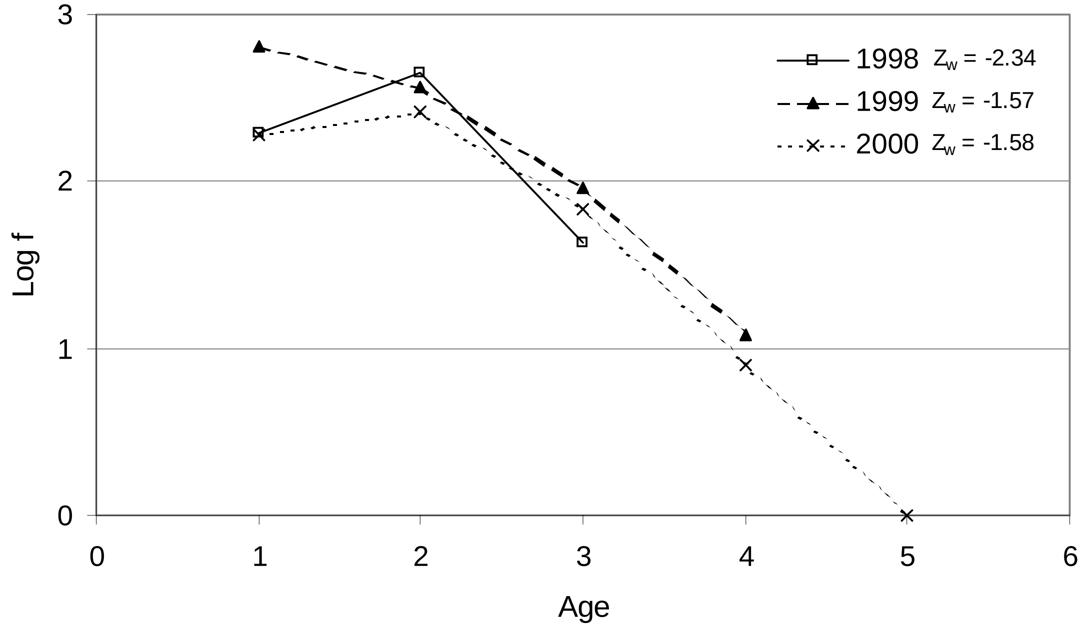

Figure 4. Catch curves for brook trout from 1998 to 2000 in Pike's Fork, Idaho.

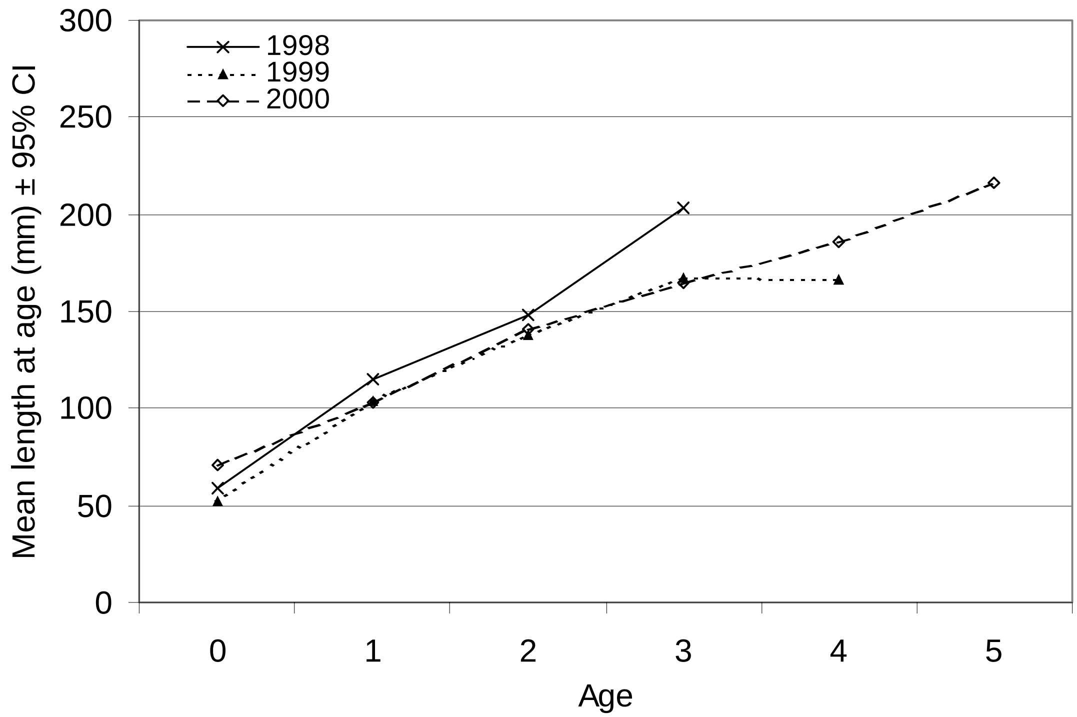

Figure 5. Growth of brook trout from 1998 to 2000 in Pike's Fork, Idaho.

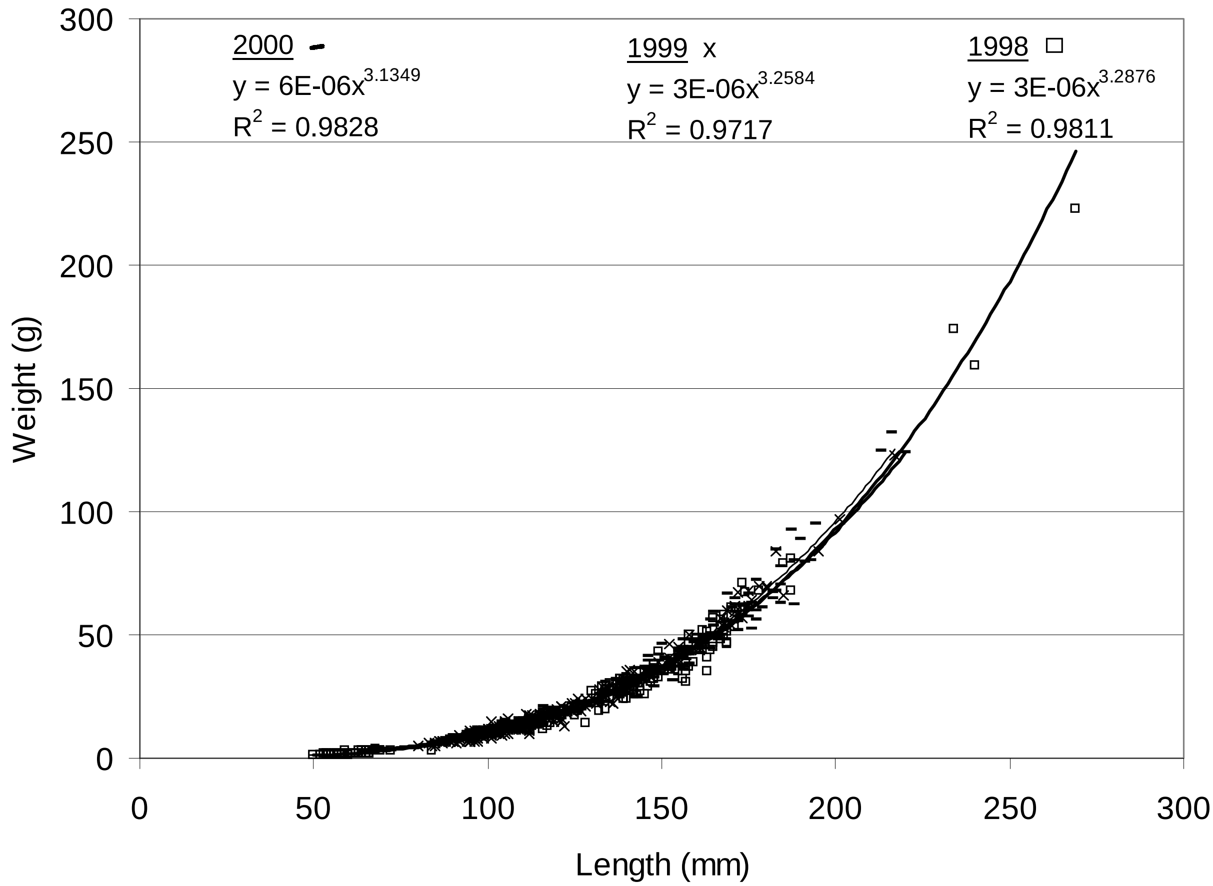

Figure 6. Length-weight relationship for brook trout from 1998 to 2000 in Pike's Fork, Idaho.

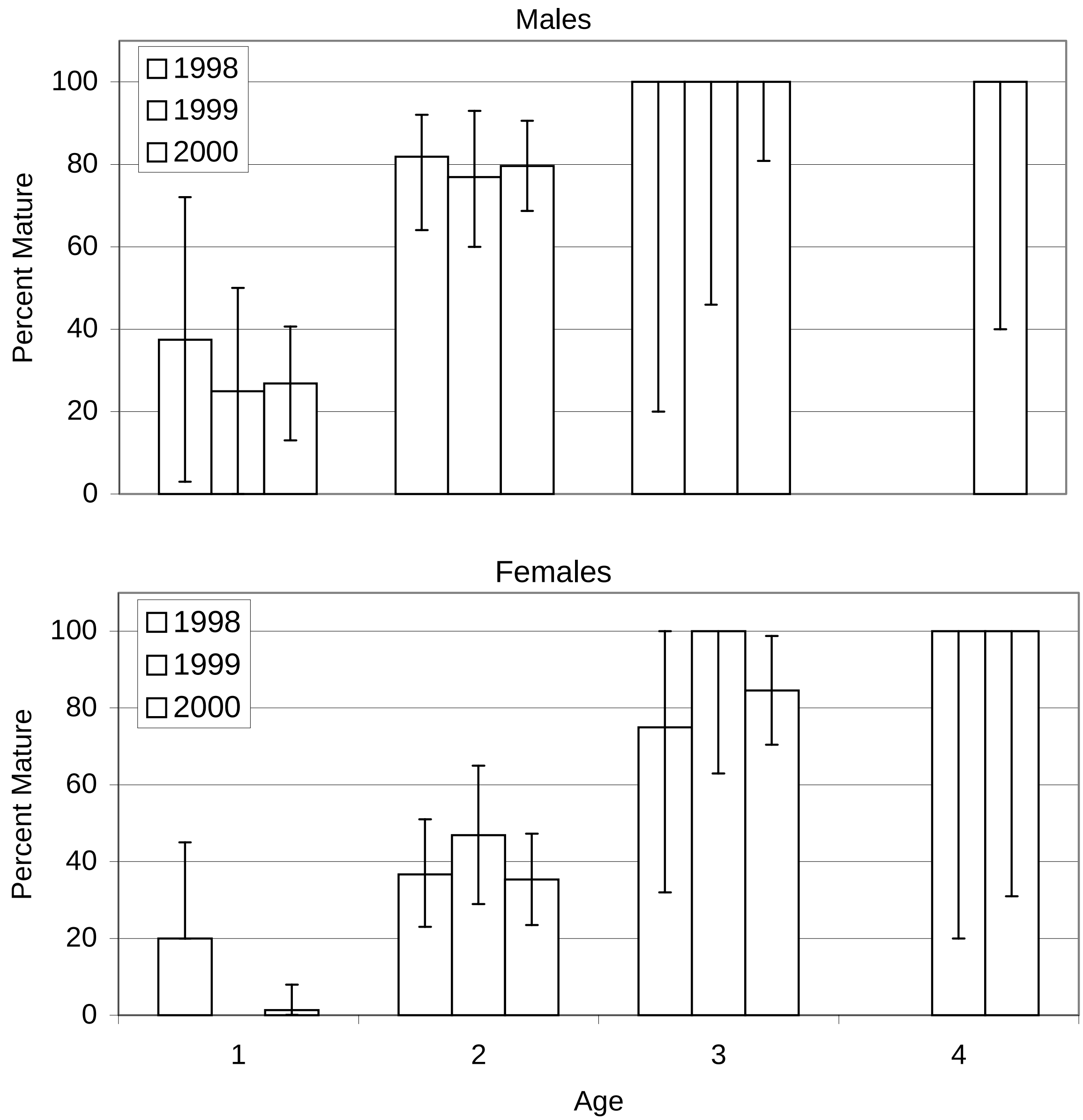

Figure 7. Proportion of male and female brook trout mature at age from 1998 to 2000 in Pike's Fork, Idaho.

Table 3. The length of male and female brook trout at age in 2000 in Pike's Fork, Idaho. NA highlights data points with sample sizes too small to calculate.

			Fish length (mm)				P-value	
Age	Sex	Maturity	n	Mean	SE	Range	Maturity	Sex
1	F	I	76	102.6	1.1	85-131	NA	
		M	1	95	NA	NA		
		combined	77	102.5	1.1	85-131		
								0.006
	M	I	30	105.0	1.6	89-120	0.003	
		M	11	115.6	3.5	97-134		
		combined	41	107.9	1.6	89-134		
2	F	I	42	131.2	3.4	101-188	0.0001	
		M	23	151.8	2.4	127-176		
		combined	65	138.5	2.7	101-188		
								0.139
	M	I	11	125.5	4.6	101-146	0.0003	
		M	43	149.0	2.9	112-182		
		combined	54	144.2	2.8	101-182		
3	F	I	4	159.8	5.4	147-172	0.454	
		M	22	166.2	3.4	148-191		
		combined	26	165.2	3.0	147-191		
								0.780
	M	I	0				NA	
		M	21	163.8	4.3	140-220		
		combined	21	163.8	4.3	140-220		
4	F	I	0				NA	
		M	3	200.7	13.9	173-216		
		combined	3	200.7	13.9	173-216		
								0.216
	M	I	0				NA	
		M	4	182.8	4.3	172-193		
		combined	4	182.8	4.3	172-193		

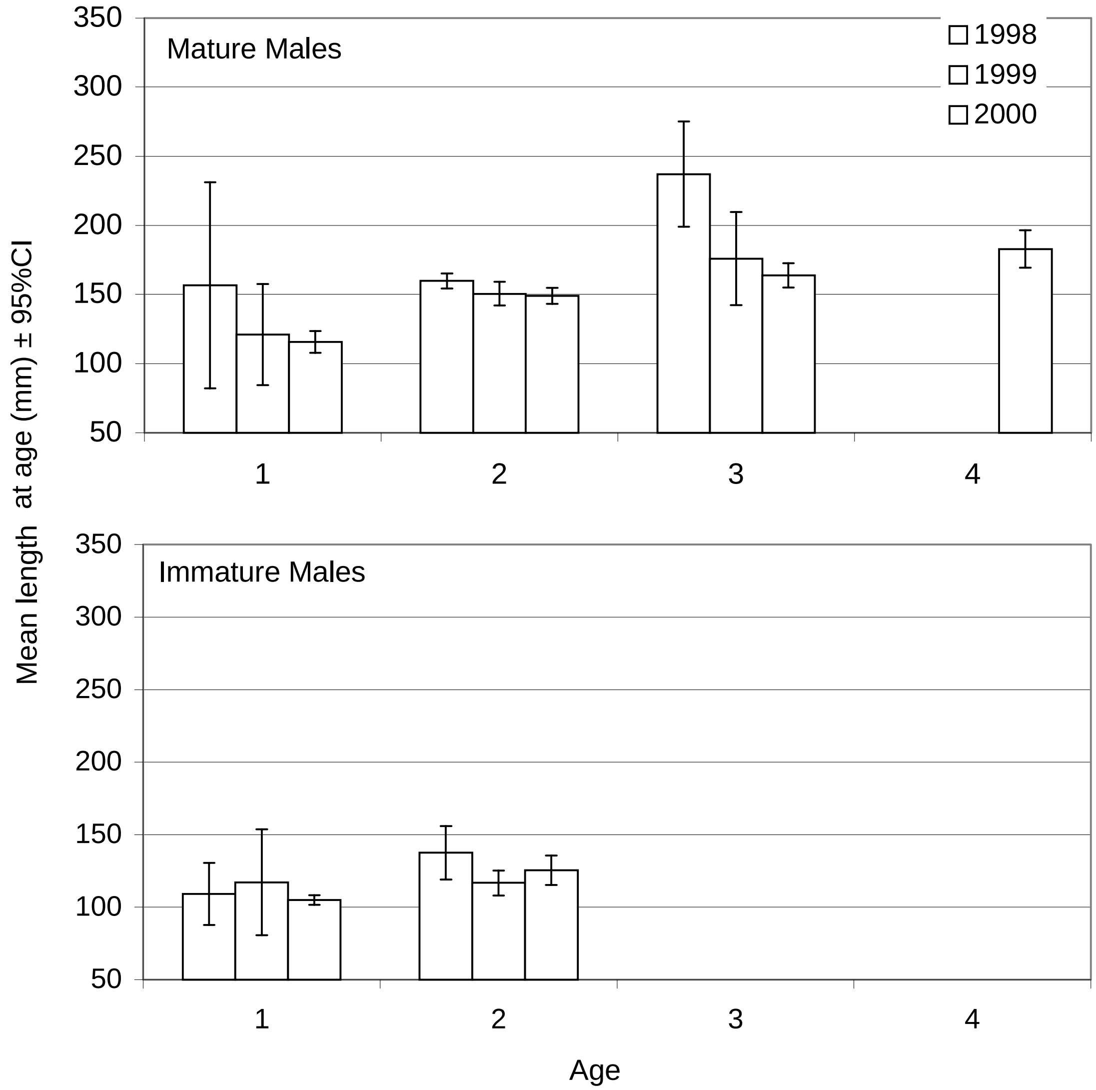

Figure 8. Mean length at age for mature and immature male brook trout from 1998 to 2000 in Pike's Fork, Idaho.

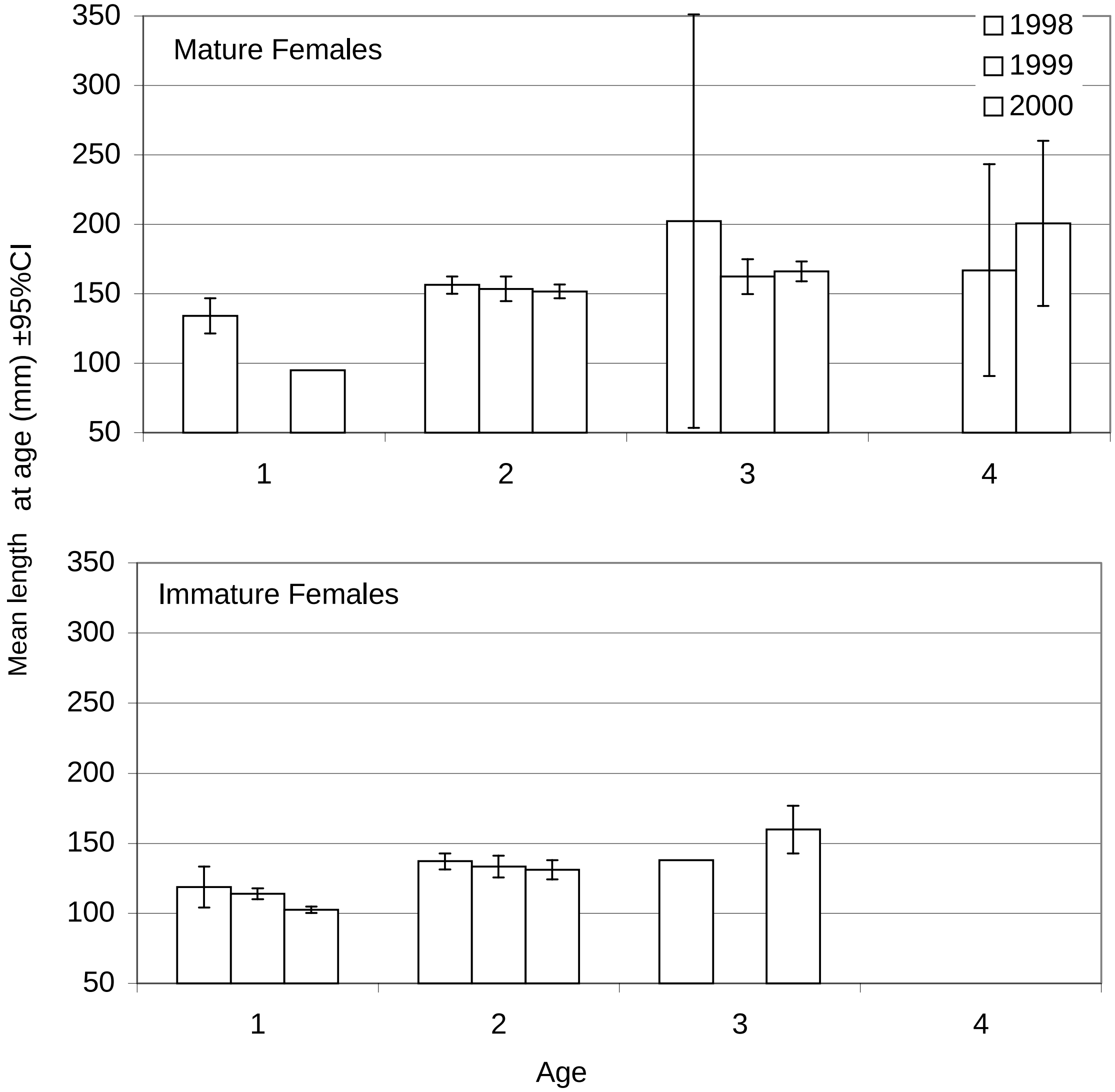

Figure 9. Mean length at age for mature and immature female brook trout from 1998 to 2000 in Pike's Fork, Idaho.

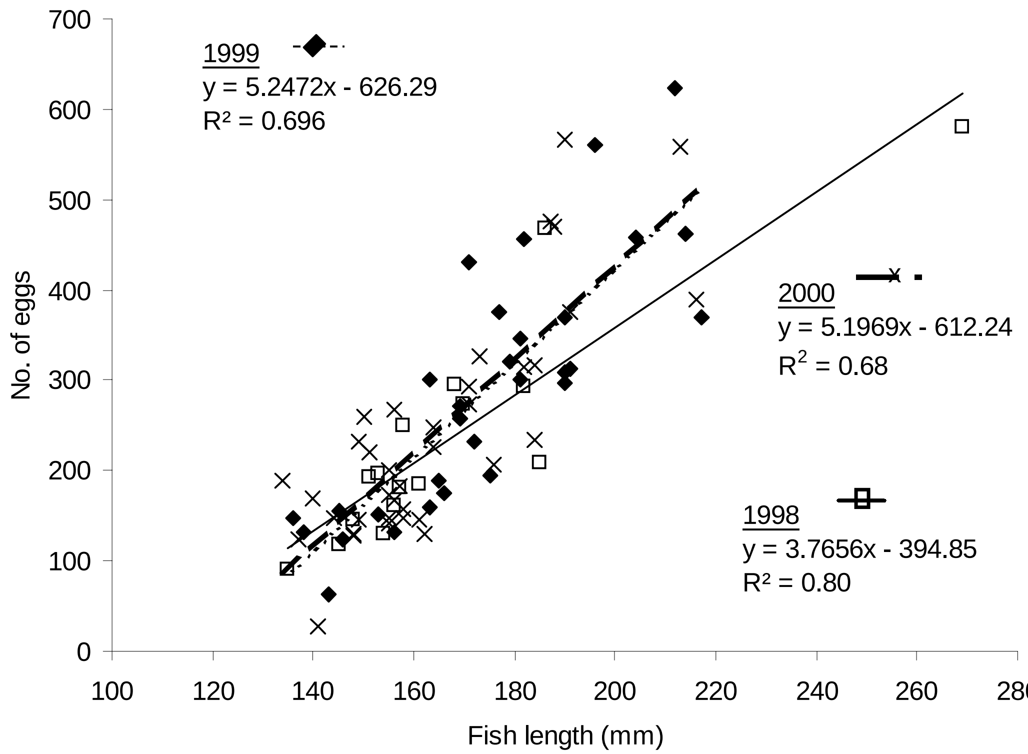

Figure 10. The relationship between fish length and fecundity of female brook trout from 1998 to 2000 in Pike's Fork, Idaho.

PART II: DISTRIBUTION AND STATUS OF NATIVE SALMONIDS IN PORTIONS OF THE UPPER SNAKE RIVER BASIN IN IDAHO

ABSTRACT

In 2000, 169 stream sites were surveyed in the Teton and Portneuf river drainages within the native distribution of Yellowstone cutthroat trout (YCT) *Oncorhynchus clarki bouvieri* in the upper Snake River basin; fish and habitat were surveyed at 139 of these sites, and fish were present in 102 streams. YCT were the most common species of fish sampled (found in 58% of sites sampled), followed by brook trout *Salvelinus fontinalis* (41%), and mottled sculpin *Cottus bairdi* (29%).

Average trout density in the Teton River drainage was 0.15/m² for fish >100 mm total length (TL) and 0.26/m² for fish <100 mm TL. In the Portneuf River drainage, trout density for fish >100 mm TL and <100 mm TL averaged 0.15/m² and 0.13/m², respectively.

Variables that influenced the presence/absence and density of YCT differed between drainages. In the Teton River drainage, sites that contained YCT tended to be lower in elevation than sites without YCT, but no other variables that were tested appeared to affect YCT presence/absence. In contrast, a number of variables influenced YCT presence/absence in the Portneuf River drainage, including average water depth, the amount of fine, cobble, and boulder substrate present, the amount of riffle and run habitat present, stream order, and conductivity. A number of variables, including average and maximum depth, average width, stream order, and the percentage of scour pool habitat present, were related to trout density and biomass, but few of the relationships were notably strong.

Mottled sculpin were more likely to be found at sites with deeper water, deeper pools, wider channels, less shading, lower gradient, and higher stream order. These sites did not necessarily correspond to lower elevation.

The analysis provided herein is cursory, excludes discrete variables measured, and includes a number of highly correlated independent variables. It is meant to be preliminary, with complete analysis of YCT data occurring when sampling in the subspecies' range in Idaho is completed after the 2002 field season.

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INTRODUCTION

Yellowstone cutthroat trout (YCT) *Oncorhynchus clarki bouvieri* are more abundant and have a wider distribution than any other nonanadromous cutthroat trout subspecies (Varley and Gresswell 1988; Behnke 1992). Since European settlement of the western United States, however, YCT have experienced a considerable decline in abundance and distribution in portions of its historic range (Gresswell 1995; May 1996; Kruse et al. 2000). Factors that have contributed to this decline include water storage and diversion, grazing, mineral extraction, timber harvest, and overexploitation due to liberal fishing regulations. Such declines led to a petition for YCT protection under the Endangered Species Act in 1998 (USFWS 2001).

The extent of this decline, however, remains unclear because most previous assessments of YCT status have largely been qualitative (Thurow et al. 1988; Varley and Gresswell 1988; May 1996). May (1996) suggested that viable populations remain in only 43% of the historic range in Idaho. Assessments that have been quantitative have focused on the proportion of historic range now occupied. For example, Kruse et al. (2000) found that 26% of the 104 trout-bearing streams in the Greybull and Shoshone drainages in Wyoming outside of Yellowstone National Park contained genetically pure YCT.

Populations of YCT that have persisted despite widespread disturbance tend to be located in high elevation, steep gradient stream reaches that are relatively unproductive (Young 1995). Studies identifying specific reasons for salmonid persistence in some areas and decline in other areas, however, have been rare. In 1998, Idaho Department of Fish and Game undertook a multistage project, funded by Bonneville Power Administration, to protect and restore native resident salmonids in the upper Snake River basin to self-sustaining, harvestable levels. The first phase is to fully inventory the current status and trends of salmonid populations throughout Snake River tributaries above Hell's Canyon Dam. This report documents the second full year of data collection in this phase.

OBJECTIVES

1. Assess distribution and abundance of YCT in selected subbasins throughout their native range in the upper Snake River subbasin in Idaho.

2. Assess the influence that stream attributes have on YCT distribution and abundance.

STUDY AREA

Stream and fish surveys took place in the Goose, Raft, Rock, Bannock, Blackfoot, Portneuf, SF Snake, and Teton subbasins in the upper Snake River basin in eastern Idaho. The Teton and Portneuf drainage sampling was completed, while surveys in the remaining drainages were not finished and further sampling will be done in subsequent years. Thus, only data from the Teton and Portneuf river drainages will be presented here (Figure 11).

The Teton River originates on the west slope of the Teton Mountains and drains approximately 2300 km² to its mouth with the Henry's Fork of the Snake River. The Portneuf River originates on the south slope of the Chesterfield Range and drains about 3,400 km² to its mouth with the Snake River. Native fish in both the Teton and Portneuf river drainages include YCT, mountain whitefish *Prosopium williamsoni*, mottled sculpin *Cottus bairdi*, Piute sculpin *C. beldingi*, longnose dace *Rhinichthys cataractae*, speckled dace *R. asculus*, redside shiner *Richardsoni balteatus*, utah sucker *Catostomus ardens*, bluehead sucker *C. discobolus*, mountain sucker *C. platyrhynchus*, and utah chub *Gila atraria*.

METHODS

Our sampling in each subbasin was distributed randomly across public and private land; streams that had been quantitatively sampled numerous times in the recent past were avoided in order to avert sampling where ample data already existed to describe fish presence/absence and abundance. Within a subbasin, streams greater than first order (determined on Bureau of Land Management 1:100,000 maps) were identified and then selected randomly until 50% had been chosen. This did not exclude first-order portions of the selected streams. We randomly selected three 100 m sampling sites from the mouth to the headwaters (i.e., the end of perennial flow on 1:100,000 maps) in all streams between 5 km and 25 km in length. In streams less than 5 km or greater than 25 km long, two or four sites were established, respectively. Sampling occurred during low to moderate flow conditions (after spring runoff and before the onset of winter) to facilitate effective fish capture.

To increase the number of sites that could be sampled in a given amount of time, we did not make multi-pass removals at every site. Instead, I developed for each subbasin a relationship between the number of fish captured in the first pass and the maximum-likelihood abundance estimates calculated with the MicroFish software package (Van Deventer and Platts 1989). From this relationship, we predicted abundance at sites where only a single removal pass was made (Lobon-Cervia and Ultrilla 1993; Jones and Stockwell 1995; Kruse et al. 1998). Standardized residuals were investigated to remove outliers from the regression models (Montgomery 1991). Upper and lower 95% confidence intervals were calculated for the multi-pass estimates by the MicroFish software package, and 95% prediction intervals were calculated for the single-pass estimates following Zar (1996). Blocknets installed at the upper and lower end of the sites were used to meet the modeling assumption that the populations were closed. Fish were separated into age-0 [<100 mm total length (TL)] and age-1+ (>100 mm TL) categories, and abundance estimates were made separately for each size group. Not all populations of native salmonids in the upper Snake River basin adhere to such a length-age cutoff, but for the sake of consistency I applied this rule-of-thumb to all populations. Length was recorded for each salmonid captured and weight (g) recorded for approximately 30 fish per site. Capture efforts were focused on trout species, but at each site where they occurred, nongame fish were captured, identified to species, categorized as absent, sparse (1-10), many (10-50), or abundant (>50), and a subsample of 20 of each species was measured and weighed.

After completing the fish survey, we measured 11 physical stream characteristics (Appendix A) and delineated and characterized habitat units within the site. Physical characteristics included Rosgen channel type (Rosgen 1994), stream order, conductivity (µS/cm), instantaneous water temperature (°C), dominant left- and right-bank riparian vegetation, percent gradient, sinuosity, valley bottom type, angling pressure, streamflow condition, and land use activity. Gradient was measured with a hand-level and stadia rod at some sites and from 1:24,000 U.S. Geological Survey topographic maps at all sites. Map estimates (which exceeded field estimates by 31%: $t = 2.021$; P-value 0.05, $n = 125$) are reported herein. Habitat units were classified, following Hawkins et al. (1993), as turbulent fastwater, nonturbulent fastwater, scour pool, and dammed pool. For each habitat type, we measured the following characteristics: length, mean width, mean and maximum depth, the number of pieces or jams (two or more overlapping pieces) of large woody debris (LWD) greater than 10 cm in diameter and 2 m in length, and the number of pocketwater pockets (fastwater only). We also estimated percent of substrate that was fine (<1 mm), sand (1 mm-5 mm), gravel (5 mm-76 mm), cobble (76 mm-300 mm), boulder (>300 mm), or bedrock; percent LWD cover; percent boulder cover; percent undercut bank cover; percent overhanging vegetation cover; percent stream shading; and percent unstable banks. All percent measurements were categorized into one of the following ratings: 0 for absent, 1 for 1-10%, 2 for 10%-25%, 3 for 25%-50%, 4 for 50%-75%, and 5 for greater than 75%.

Results from 2000 comprise the second full year of a multiyear inventory effort and the first year focusing inventory efforts on YCT; thus, analysis in this report is limited to descriptive statistics, correlation analysis, simple regressions, and *t*-tests. A full analysis of the data on YCT will be made after the 2002 field season when the inventory phase for YCT is scheduled to be completed. Raw data in Appendix B is for the Portneuf and Teton river drainages only. For this report, we calculated mean values for each physical stream characteristic within a subbasin and tested their influence on the mean values of salmonid density, biomass, and species richness with linear regression analysis. We used *t*-tests to assess differences in physical stream characteristics between sites with and without YCT.

RESULTS

Teton River Drainage

Ninety sites were surveyed in the Teton River drainage, of which 53 were on public land and 37 were on private property. Twenty-five sites were either dry or contained too little water to sample fish or measure habitat. Of the sixty-five sites sampled for fish and habitat, 15% were 1st order, 40% were 2nd order, 37% were 3rd order, and 8% 4th order. Reaches sampled in the Teton River drainage averaged 1986 m in elevation, 3.4% in map gradient, 2.9 m in width, and 262 µS/cm in conductivity (Table 4). Stream substrate was comprised mostly of gravel, cobble, and fine sediment.

Fifty-three sites contained salmonids, of which YCT, brook trout, and rainbow trout or hybrids were present at 72, 91, and 9% of the sites, respectively. Of the 38 sites that contained YCT, 11% also contained rainbow trout or hybrids (Figure 12). Non-game fish species were relatively absent, occurring in only 32% of the sites that contained fish. Mottled sculpin were the most common non-game fish, occurring at 32% of the fish-bearing sites and only in Canyon, Game, Horseshoe, Moody, N. Leigh, and Trail creeks and their tributaries. For a complete list of fish distribution, see Appendix B. The only statistically significant difference between sites with and without YCT in the Teton River drainage was in stream elevation (Table 5). In contrast, a number of statistical differences were detected between sites with and without mottled sculpin. Mottled sculpins were found at sites with a lower gradient, less riffle habitat, and more run and scour pool habitat; these sites were in lower elevation, higher order reaches of stream (Table 6).

Trout density averaged 0.15/m² for fish >100 mm TL and 0.26/m² for fish <100 mm TL. There was a strong relationship between the number of fish captured in the first pass and the corresponding multi-pass abundance estimate for both fish size categories (Figure 13). Several stream variables were correlated with trout density and species richness (Table 7), but none of the relationships were particularly strong.

Portneuf River Drainage

Seventy-nine sites were surveyed in the Portneuf River drainage, of which 44 were on public land and 35 were on private property. Fifteen sites were either dry or contained too little water to sample fish or measure habitat. Of the sixty-four sites sampled for fish and habitat, 26% were 1^{st} order, 53% were 2^{nd} order, 16% were 3^{rd} order, and 5% 4^{th} order. On average, reaches sampled in the Portneuf River drainage were slightly lower in elevation and higher in conductivity and stream shading than reaches sampled in the Teton River drainage (Table 4).

Forty-five sites contained salmonids, of which YCT, brook trout, and rainbow trout or hybrids were present at 91, 20, and 38%, respectively. Of the 41 sites that contained YCT, 37% also contained rainbow trout or hybrids. Twenty-seven sites contained non-game fish species, comprising 56% of the fish-bearing sites. Mottled sculpin were the most common non-game fish, occurring at 46% of the fish-bearing sites. In contrast to YCT distribution in the Teton River drainage, there were numerous differences in stream attributes between sites with and without YCT in the Portneuf River (Table 8). Sites that contained YCT were wider, contained more riffle and less run habitat, were lower in conductivity, and had more cobble and boulder substrate and less fine substrate than sites where YCT were absent. Mottled sculpins were found at higher order, wider, deeper, lower gradient sites that were less shaded than sites where mottled sculpins were absent (Table 9).

Trout density averaged 0.15/m² for fish >100 mm TL and 0.13/m² for fish <100 mm TL. As with the Teton River drainage, there was a strong relationship in the Portneuf River drainage between the numbers of fish captured in the first pass and the corresponding multi-pass abundance estimate for both fish size categories (Figure 13). Again, several stream variables were correlated with trout density and species richness in the Portneuf River drainage (Table 10), but only a few were particularly strong.

DISCUSSION

There were few consistencies between the Portneuf and Teton river drainages in the relationships between YCT presence/absence or trout abundance and the stream characteristics. Variables that most strongly affected YCT presence/absence and trout abundance in the Portneuf River drainage (percentage of turbulent fastwater and scour pool habitat, percentage of cobble and boulder substrate, and average depth) were not the same as for the Teton River drainage (elevation, average width, maximum depth). We also found few consistencies with results from this year and results from analysis of redband trout and bull trout data collected in 1999 (Meyer 2000). The lack of concurrence between species is not surprising considering the differences in the environments they inhabit (Pratt 1982; Kruse 1998; Zoellick 1999). The disparate results between the Portneuf and Teton river drainages could be due in part to the preliminary nature of the analysis performed to date. For example, analysis was done on trout density, not YCT density, and cutthroat trout made up only 36% of the total number of salmonids caught in the Portneuf and Teton river drainages combined. Also, discrete variables (e.g., land ownership, land use, angling pressure, etc.) have not been included in the analysis to date.

Nevertheless, our preliminary analysis does demonstrate the importance of some variables. In the Teton River drainage, the only variable that appeared to affect YCT presence/absence was elevation, with a lower elevation increasing the likelihood of YCT being present. This is opposite existing evidence of the current distribution of most native salmonids in the Pacific Northwest, in which distribution becomes restricted to high elevation, headwater areas (Rieman and McIntyre 1995; Young 1995). As in previous years, we found evidence that overhanging vegetation was inversely related to YCT presence/absence, salmonid density, and biomass. Watson and Hillman (1997) and Hawkins et al. (1983) also found a negative relationship between overhanging vegetation and abundance and presence/absence of salmonids. It is generally accepted that overhanging vegetation is an important component of trout habitat in small streams, and that as overhanging vegetation increases, so does trout standing stock (Hunt 1976; Wesche et al. 1987). That water depth, stream width, and stream order were directly related to species richness indicates that fish production was more diverse where slower velocity, lower gradient habitat prevailed. Such conditions in the Rocky Mountains have been previously shown to influence species richness in a positive manner (Rahel and Hubert 1991).

There was much more consistency between drainages in the factors that influenced the presence/absence of mottled sculpins. In both the Teton and Portneuf river drainages, mottled sculpins were more prevalent at sites that were deeper, wider, had deeper pools, lower gradient, and less shading. In the Teton River drainage, this translated into sites where elevation was much lower, but in the Portneuf River drainage, elevation did not matter. Hawkins et al. (1983) also found that sculpins were more abundant without riparian shading. Analysis of factors that influenced mottled sculpin abundance at our study sites has not been performed to date.

Average density of trout >100 mm TL (0.15 fish/m^2) in the Teton and Portneuf river drainages is well above the average (0.05 fish/m^2) for trout >60 mm TL in the native range of YCT in northwest Wyoming (Kruse et al. 1998), probably due to geologic conditions. In comparison, average density reported by Platts and McHenry (1988) for the Rocky Mountain and Intermountain ecoregions, in which the Teton and Portneuf river drainages reside, was 0.55 trout/m^2 and 0.40 trout/m^2 respectively, but their results were obtained primarily from pristine or lightly altered streams only and apparently included trout of all sizes. Average density at our sites, including all trout, was 0.35 fish/m^2.

The distribution of YCT in the Teton and Portneuf river drainages YCT appears to be relatively widespread, occurring in 58% and 64%, respectively, of the sites with enough water to sample fish and habitat. Nevertheless, that exotic trout are absent from only 30% of the sites where YCT occur in these drainages calls for additional monitoring and active management actions to reduce the threat that non-native trout may pose to the long-term persistence of YCT in Idaho.

ACKNOWLEDGMENTS

The authors wish to thank Michael Colvin, Steve Elle, Brad Farner, Seth Naman, Timothy Ricks, Winthrop Taylor, and Nikki Warburton for field assistance, and Steve Elle and Win Taylor for data summarization. This project was fully funded by Bonneville Power Administration. Dan Schill, Jim Capurso, and Steve Yundt provided comments and suggestions which helped to improve the manuscript.

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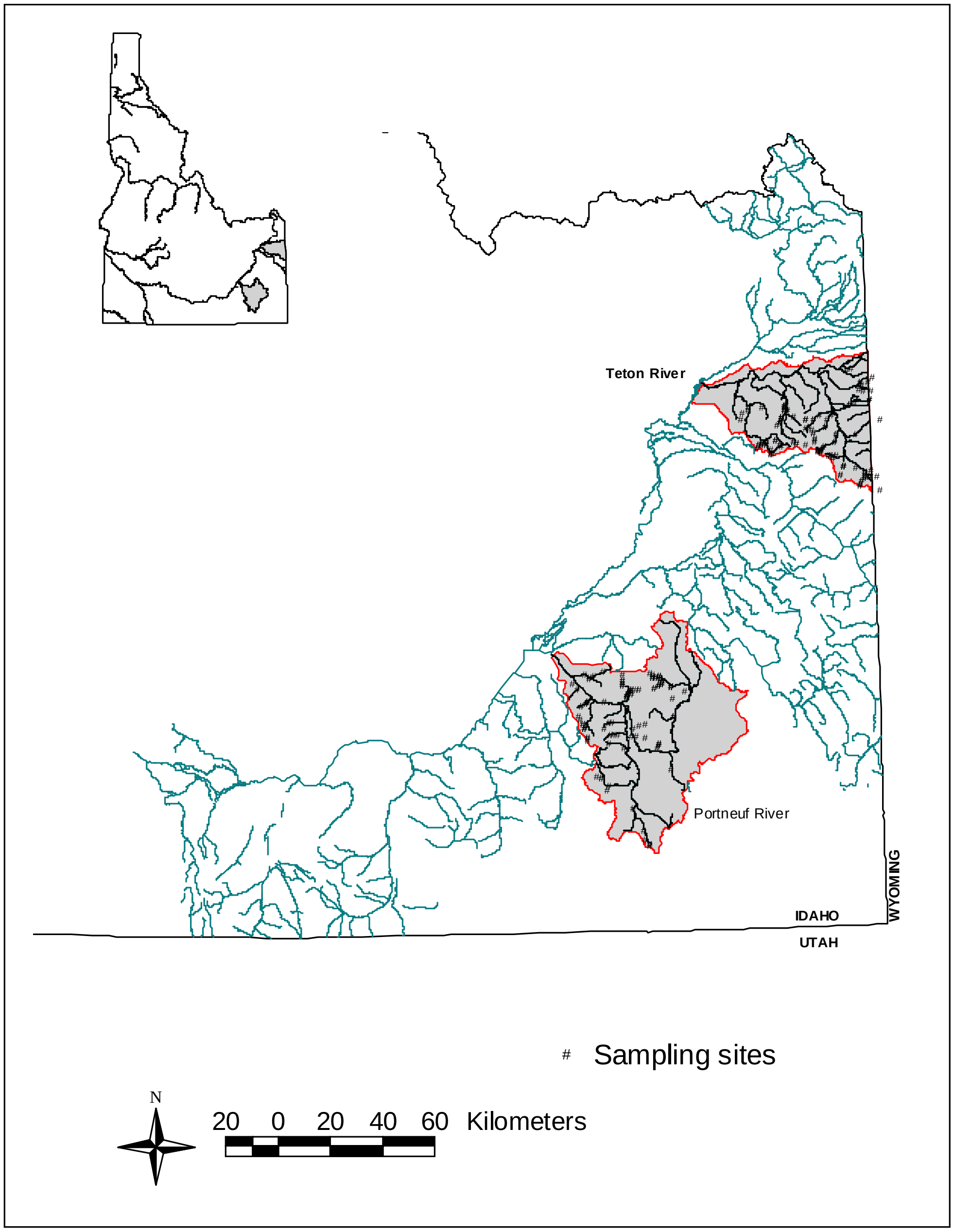

Figure 11. Distribution of sampling locations in the Teton and Portneuf river drainages sampled in 1999 in Idaho.

Table 4. Means of stream attributes from sites sampled in the Teton and Portneuf river drainages in southeast Idaho in 2000.

	Teton River drainage		Portneuf River drainage	
Variable	Mean	Range	Mean	Range
Map elevation (m)	1986	1753 - 2256	1675	1439 - 2121
Conductivity (µS/cm)	262	20 - 578	306	26 - 848
Map gradient (%)	3.4	0.3 - 10.4	3.5	0.4 - 9.9
Avg. width (m)	2.9	0.8 - 7.2	2.6	0.5 - 11.3
Channel unit composition				
% turbulent fastwater	61.5	14.8 - 100	63.0	0 - 100
% nonturbulent fastwater	12.7	0 - 79.3	20.3	0 - 100
% scour pool	21.8	0 - 81.1	12.0	0 - 44.3
% dammed pool	4.8	0 - 48.5	4.9	0 - 100
Substrate percentage ratings				
fines	2.0	0 - 5.0	2.0	0 - 5.0
sand	1.3	0 - 2.9	1.1	0 - 2.9
gravel	2.7	0.9 - 3.9	2.5	0 - 5.0
cobble	2.1	0 - 4.0	1.8	0 - 4.0
boulder	0.8	0 - 3.1	0.9	0 - 3.1
Trout cover percentage ratings				
LWD	0.8	0 - 2.5	0.5	0 - 2.1
Boulder	0.3	0 - 1.9	0.3	0 - 1.8
Undercut bank	0.5	0 - 2.5	0.7	0 - 2.0
Macrophytes	0.1	0 - 3.1	0.3	0 - 2.9
Overhanging vegetation	0.9	0 - 3.0	1.5	0 - 4.0
Morphological percentage ratings				
Stream shading	1.6	0 - 4.1	2.7	0 - 5.0
Ustable banks	0.7	0 - 3.3	1.0	0 - 3.9

Table 5. Comparison of stream characteristics at sites with and without Yellowstone cutthroat trout in the Teton River drainage, Idaho.

	With cutthroat trout		Without cutthroat trout		
Variable	Mean	95% CI	Mean	95% CI	*P*-value
Max. depth (m)	0.31	0.04	0.25	0.05	0.10
Avg. depth (m)	0.10	0.02	0.09	0.02	0.22
Avg. maximum pool depth (m)	0.40	0.06	0.33	0.07	0.10
Avg. width (m)	3.2	0.6	2.4	0.6	0.07
% fines rating	1.9	0.4	2.1	0.5	0.54
% sand rating	1.2	0.3	1.5	0.3	0.13
% gravel rating	2.6	0.2	2.8	0.3	0.30
% cobble rating	2.3	0.4	1.9	0.4	0.26
% boulder rating	0.8	0.3	0.7	0.3	0.62
LWD cover rating	0.7	0.2	1.0	0.2	0.12
Rock cover rating	0.4	0.2	0.3	0.2	0.38
Undercut bank cover rating	0.6	0.2	0.5	0.2	0.53
Macrophyte cover rating	0.1	0.1	0.3	0.3	0.16
Overhanging vegetation cover rating	0.9	0.2	1.0	0.3	0.37
Stream shading rating	1.5	0.3	1.7	0.4	0.40
Ustable banks rating	0.7	0.3	0.6	0.4	0.75
stream order 1:24,000	2.5	0.2	2.2	0.4	0.14
Map gradient (%)	3.3	0.9	3.6	1.0	0.60
% turbulent fastwater	56.9	7.2	65.7	11.1	0.16
% nonturbulent fastwater	15.0	6.6	9.4	7.1	0.25
% scour pool	23.7	5.3	15.1	6.6	0.26
% dammed pool	4.4	2.7	5.4	4.1	0.67
Total pool percentage	28.2	5.2	24.5	7.7	0.40
Conductivity (µS/cm)	254	42	273	54	0.58
Map elevation	6432	127	6636	168	0.05

Table 6. Comparison of stream characteristics at sites with and without mottled sculpin in the Teton River drainage, Idaho.

Variable	With mottled sculpin		Without mottled sculpin		
	Mean	95% CI	Mean	95% CI	*P* -value
Max. depth (m)	0.34	0.06	0.26	0.04	0.03
Avg. depth (m)	0.13	0.02	0.09	0.01	< 0.01
Avg. maximum pool depth (m)	0.47	0.09	0.33	0.05	< 0.01
Avg. width (m)	4.0	0.8	2.4	0.4	< 0.01
% fines rating	2.3	0.6	1.8	0.4	0.15
% sand rating	1.2	0.4	1.3	0.2	0.59
% gravel rating	2.4	0.3	2.8	0.2	0.03
% cobble rating	2.1	0.7	2.1	0.3	0.99
% boulder rating	1.0	0.5	0.7	0.2	0.16
LWD cover rating	0.6	0.3	0.9	0.2	0.08
Rock cover rating	0.4	0.3	0.3	0.1	0.49
Undercut bank cover rating	0.6	0.2	0.5	0.2	0.67
Macrophyte cover rating	0.3	0.4	0.1	0.1	0.21
Overhanging vegetation cover rating	0.6	0.2	1.0	0.2	0.05
Stream shading rating	1.4	0.5	1.7	0.3	0.21
Ustable banks rating	1.1	0.5	0.5	0.2	0.01
stream order 1:24,000	2.7	0.4	2.3	0.3	0.05
Map gradient (%)	1.9	1.1	4.0	0.7	< 0.01
% turbulent fastwater	40.0	11.0	67.8	6.3	< 0.01
% nonturbulent fastwater	27.3	12.6	7.5	4.0	< 0.01
% scour pool	30.1	8.8	18.9	4.5	0.02
% dammed pool	2.6	3.1	5.6	2.8	0.24
Total pool percentage	32.7	9.6	24.5	4.8	0.09
Conductivity (µS/cm)	289	44	254	41	0.36
Map elevation	6088	128	6668	100	< 0.01

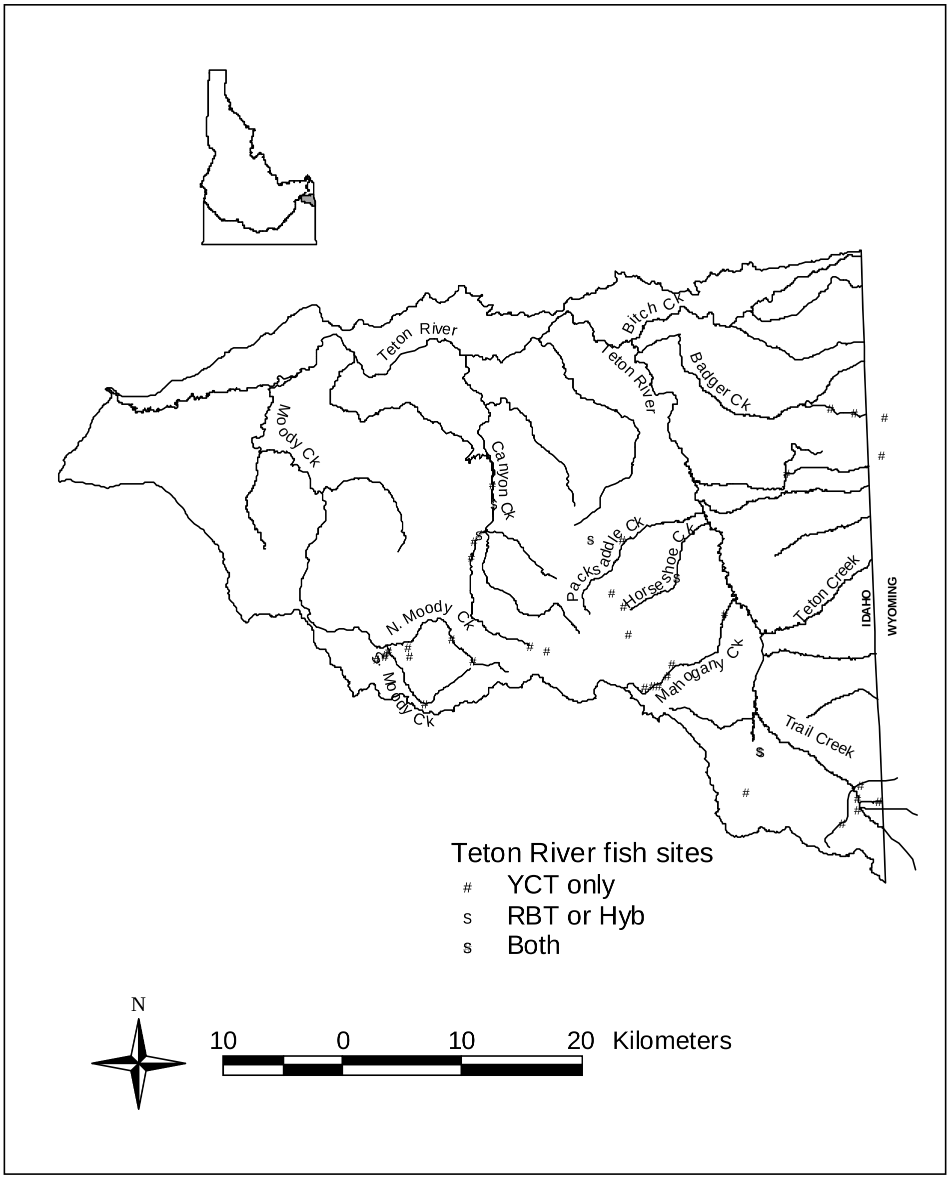

Figure 12. Distribution of sites containing Yellowstone cutthroat trout (YCT), rainbow trout (RBT), or cutthroat x rainbow hybrids (Hyb), and both sampled in 2000 in the Teton River drainage in Idaho.

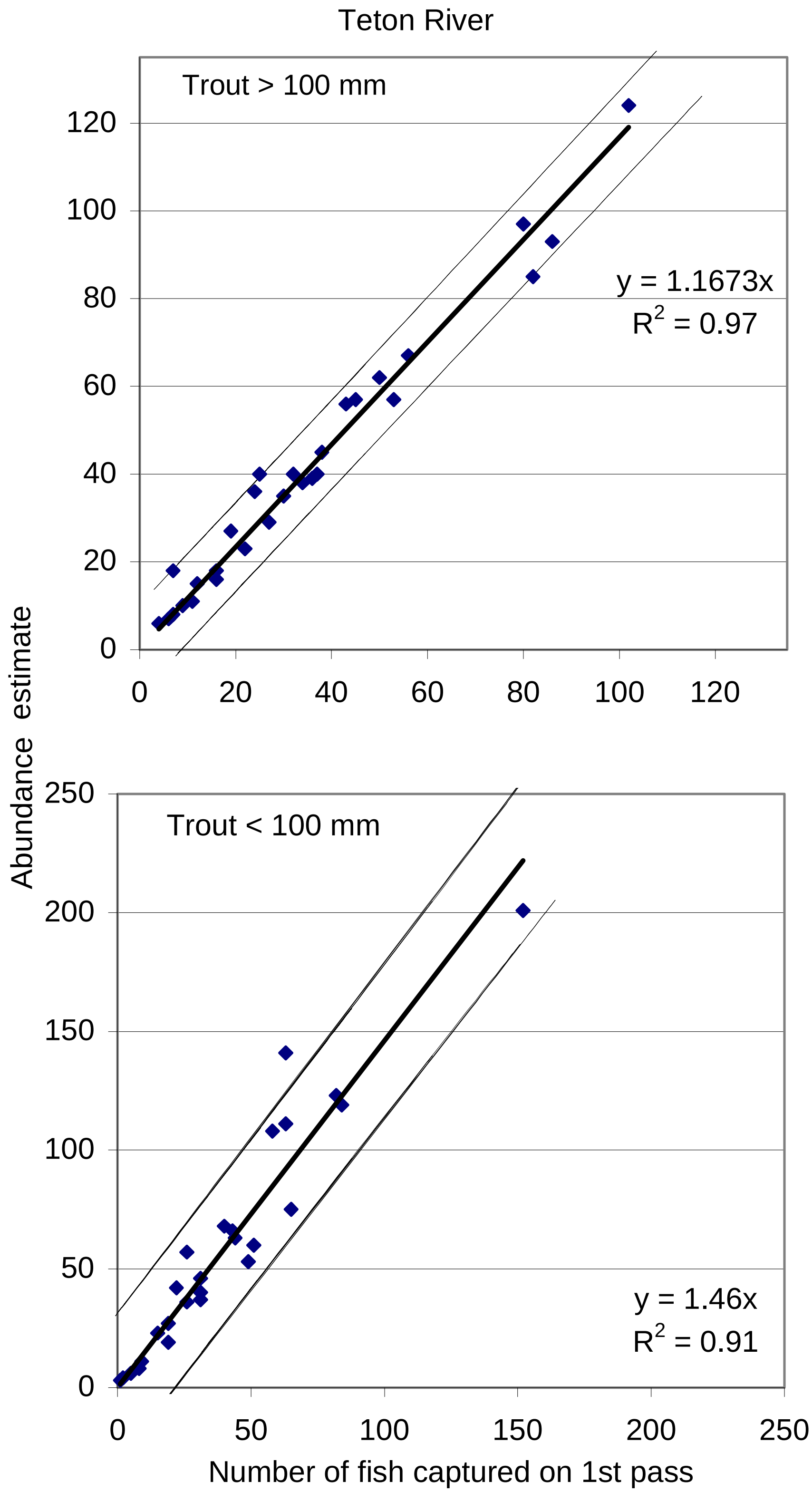

Figure 13. The relationship between the first pass and the corresponding abundance estimate of age-0 and age-1+ salmonids from the Teton River tributaries in 2000. Outer lines are 95% prediction limits.

Table 7. Correlations between stream attributes and trout density and species richness for sites in the Teton River drainage, Idaho.

	Trout density (fish/m²)					
	< 100 mm TL		> 100 mm TL		Species richness	
Variable	*r*	*P*-value	*r*	*P*-value	*r*	*P*-value
Max. depth (m)	-0.31	0.04	-0.28	0.05	0.41	< 0.01
Avg. depth (m)	-0.35	0.01	-0.26	0.06	0.40	< 0.01
Avg. maximum pool depth (m)	-0.29	0.06	-0.23	0.11	0.43	< 0.01
Avg. width (m)	-0.37	0.01	-0.36	0.01	0.44	< 0.01
% fines rating	0.09	0.81	-0.39	< 0.01	0.12	0.36
% sand rating	0.11	0.56	-0.19	0.17	-0.02	0.86
% gravel rating	0.20	0.17	-0.10	0.48	-0.18	0.16
% cobble rating	-0.18	0.27	-0.30	0.03	0.01	0.92
% boulder rating	-0.24	0.17	-0.09	0.51	0.06	0.63
LWD cover rating	-0.12	0.33	0.02	0.90	-0.19	0.13
Rock cover rating	-0.15	0.46	-0.07	0.60	0.01	0.96
Undercut bank cover rating	-0.24	0.11	-0.12	0.41	0.11	0.39
Macrophyte cover rating	-0.14	0.29	-0.06	0.66	0.06	0.61
Overhanging vegetation cover rating	0.23	0.10	-0.03	0.84	-0.17	0.17
Stream shading rating	0.01	0.77	-0.07	0.61	-0.19	0.12
Ustable banks rating	0.08	0.74	-0.04	0.80	0.24	0.05
stream order 1:24,000	-0.15	0.38	0.07	0.61	0.25	0.05
Map gradient (%)	0.21	0.14	-0.03	0.85	-0.29	0.02
% turbulent fastwater	-0.03	0.99	-0.14	0.32	-0.43	< 0.01
% nonturbulent fastwater	-0.15	0.23	-0.10	0.48	0.33	< 0.01
% scour pool	0.18	0.23	0.24	0.08	0.32	< 0.01
% dammed pool	0.11	0.46	0.20	0.15	-0.10	0.41
Total pool percentage	0.23	0.13	0.33	0.02	0.25	0.04
Conductivity (µS/cm)	-0.03	0.78	0.11	0.44	0.11	0.40
Map elevation	0.01	0.74	-0.27	0.05	-0.55	< 0.01

Table 8. Comparison of stream characteristics at sites with and without Yellowstone cutthroat trout in the Portneuf River drainage, Idaho.

	With cutthroat trout		Without cutthroat trout		
Variable	Mean	95% CI	Mean	95% CI	*P*-value
Max. depth (m)	0.11	0.02	0.09	0.03	0.23
Avg. depth (m)	2.89	0.44	1.90	0.93	0.03
Avg. maximum pool depth (m)	0.41	0.07	0.33	0.15	0.21
Avg. width (m)	0.32	0.04	0.28	0.10	0.37
% fines rating	1.6	0.4	2.9	0.8	< 0.01
% sand rating	1.0	0.2	1.1	0.4	0.82
% gravel rating	2.6	0.3	2.3	0.7	0.48
% cobble rating	2.4	0.3	0.7	0.4	< 0.01
% boulder rating	1.1	0.3	0.3	0.3	< 0.01
LWD cover rating	0.5	0.1	0.4	0.2	0.32
Rock cover rating	0.4	0.1	0.1	0.1	0.01
Undercut bank cover rating	0.6	0.1	0.9	0.2	0.04
Macrophyte cover rating	0.2	0.1	0.4	0.4	0.08
Overhanging vegetation cover rating	1.3	0.3	2.0	0.5	0.02
Stream shading rating	2.7	0.4	2.7	0.5	0.99
Ustable banks rating	1.0	0.3	1.0	0.5	0.91
stream order 1:24,000	2.1	0.2	1.7	0.4	0.03
Map gradient (%)	3.7	0.7	3.2	1.1	0.37
% turbulent fastwater	71.9	7.1	45.7	16.9	< 0.01
% nonturbulent fastwater	9.6	5.4	40.7	17.9	< 0.01
% scour pool	14.0	3.8	8.3	5.1	0.07
% dammed pool	4.5	4.1	5.4	9.0	0.84
Total pool percentage	18.5	5.3	13.6	9.6	0.33
Conductivity (µS/cm)	267	37	385	81	< 0.01
Map elevation	5451	140	5548	224	0.43

Table 9. Comparison of stream characteristics at sites with and without mottled sculpin in the Portneuf River drainage, Idaho.

	With mottled sculpin		Without mottled sculpin		
Variable	Mean	95% CI	Mean	95% CI	*P*-value
Max. depth (m)	0.34	0.06	0.28	0.06	0.17
Avg. depth (m)	0.13	0.03	0.09	0.02	0.01
Avg. maximum pool depth (m)	0.49	0.1	0.33	0.07	0.01
Avg. width (m)	3.4	0.7	2.0	0.5	< 0.01
% fines rating	2.0	0.6	2.1	0.5	0.90
% sand rating	1.1	0.2	1.0	0.2	0.73
% gravel rating	2.3	0.5	2.6	0.4	0.29
% cobble rating	2.1	0.5	1.6	0.4	0.11
% boulder rating	1.1	0.4	0.7	0.3	0.10
LWD cover rating	0.4	0.2	0.5	0.2	0.48
Rock cover rating	0.3	0.2	0.3	0.1	0.71
Undercut bank cover rating	0.7	0.2	0.7	0.2	0.85
Macrophyte cover rating	0.4	0.2	0.2	0.2	0.28
Overhanging vegetation cover rating	1.2	0.4	1.8	0.3	0.02
Stream shading rating	2.2	0.6	3.0	0.4	0.02
Ustable banks rating	1.3	0.5	0.9	0.3	0.19
stream order 1:24,000	2.5	0.3	1.7	0.2	< 0.01
Map gradient (%)	2.4	0.6	4.2	0.8	< 0.01
% turbulent fastwater	65.6	9.3	60.4	11.7	0.53
% nonturbulent fastwater	14.0	8.1	25.0	11.8	0.53
% scour pool	14.1	6.1	10.6	3.4	0.27
% dammed pool	6.2	7.1	4.0	5.1	0.61
Total pool percentage	20.4	8.7	14.6	5.8	0.25
Conductivity (µS/cm)	285	58	323	53	0.34
Map elevation	5425	215	5522	142	0.42

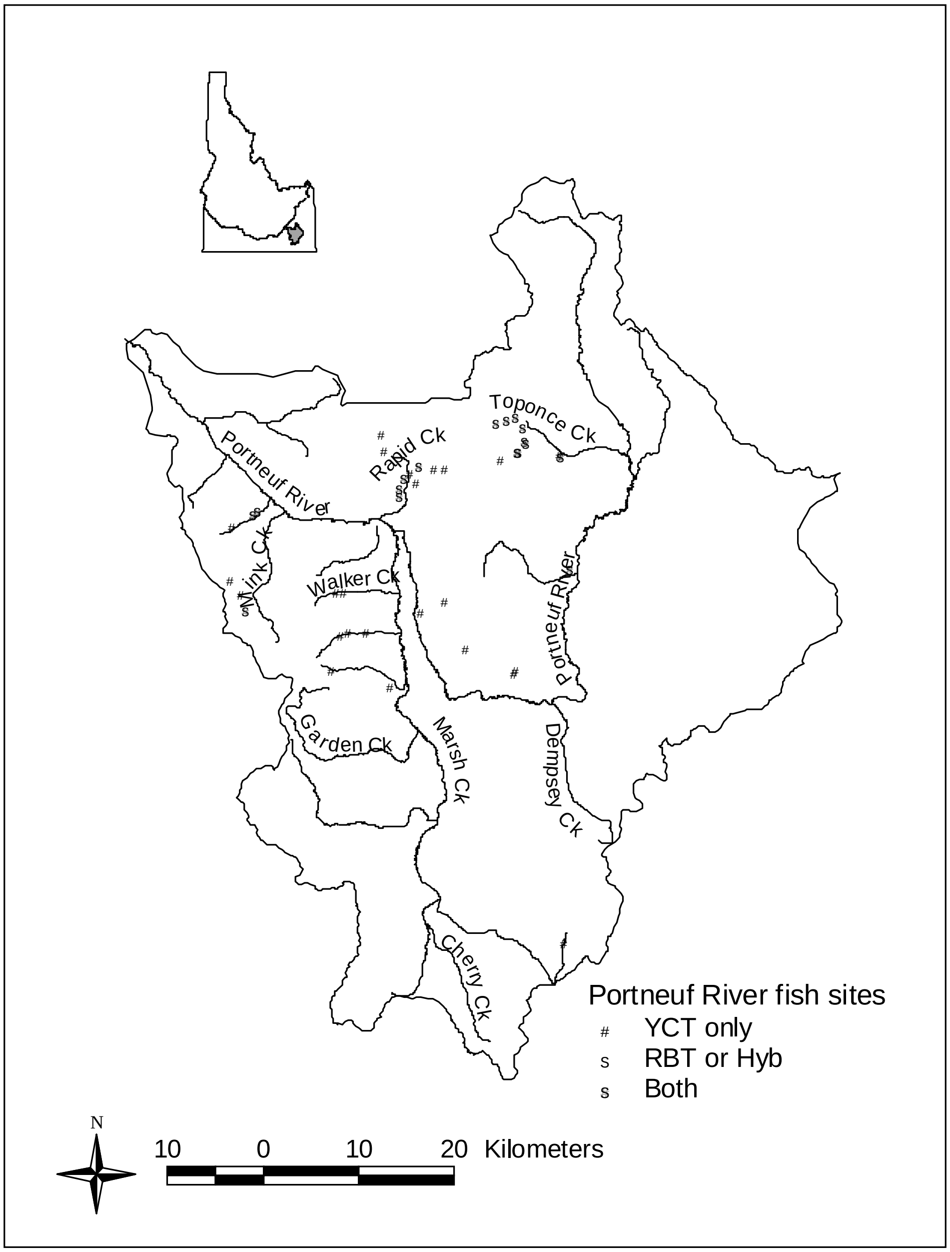

Figure 14. Distribution of sites containing Yellowstone cutthroat trout (YCT), rainbow trout (RBT), or cutthroat x rainbow hybrids (Hyb), and both sampled in 2000 in the Portneuf River drainage in Idaho.

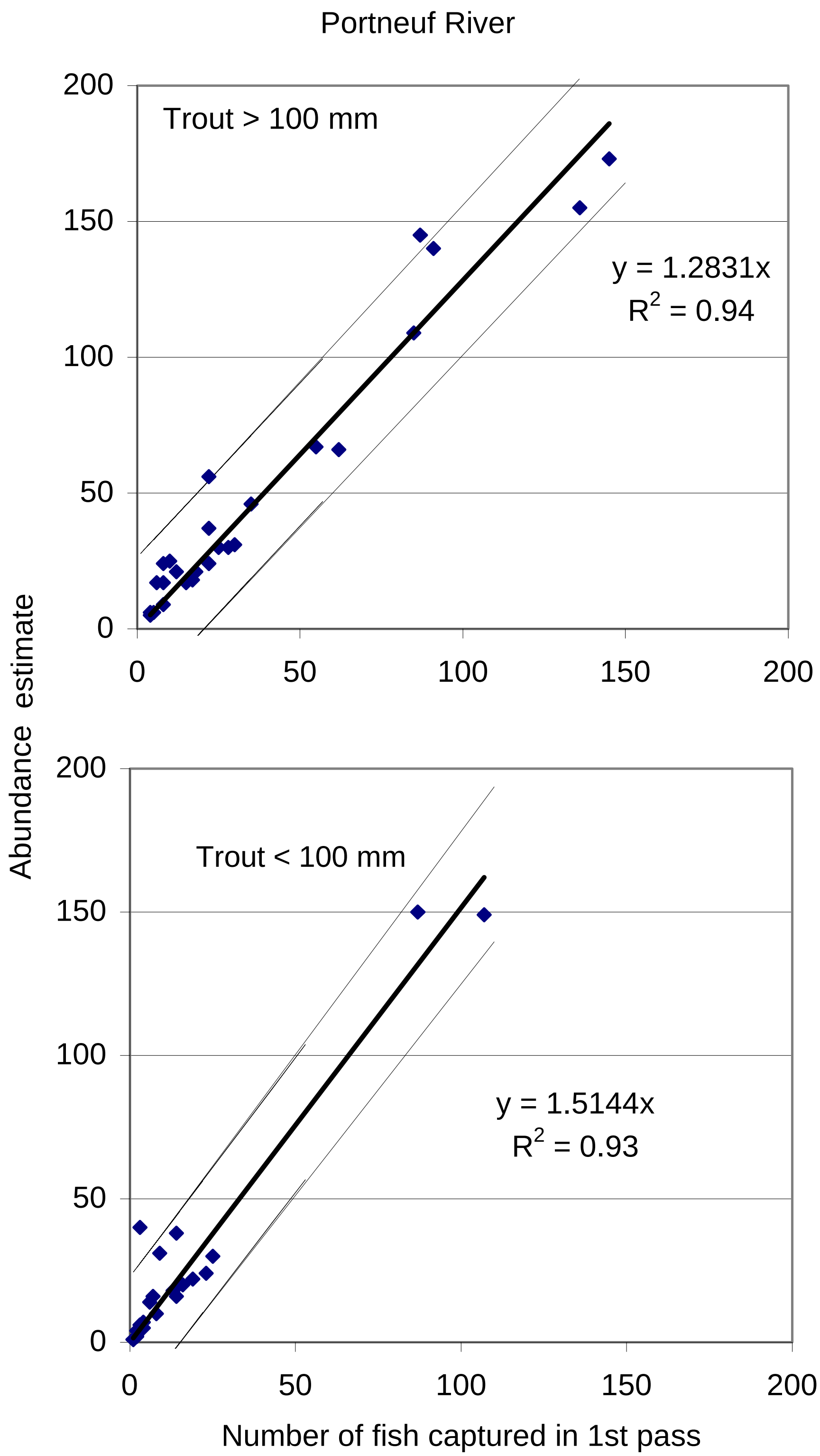

Figure 15. The relationship between the first pass and the corresponding abundance estimate of age-0 and age-1+ salmonids from the Portneuf River tributaries in 2000. Outer lines are 95% prediction limits.

Table 10. Correlations between stream attributes and trout density and species richness for sites in the Portneuf River drainage, Idaho.

	Trout density (fish/m²)					
	< 100 mm TL		> 100 mm TL		Species richness	
Variable	*r*	*P-value*	*r*	*P-value*	*r*	*P*-value
Max. depth (m)	-0.29	0.06	-0.18	0.25	0.21	0.10
Avg. depth (m)	-0.20	0.20	-0.03	0.86	0.34	0.01
Avg. maximum pool depth (m)	-0.28	0.09	-0.17	0.29	0.36	0.01
Avg. width (m)	-0.25	0.10	-0.19	0.20	0.38	< 0.01
% fines rating	0.11	0.49	0.21	0.17	-0.16	0.20
% sand rating	0.27	0.08	0.18	0.24	0.10	0.42
% gravel rating	0.07	0.67	-0.02	0.90	-0.02	0.89
% cobble rating	-0.34	0.02	-0.26	0.09	0.42	< 0.01
% boulder rating	-0.28	0.06	-0.26	0.08	0.29	0.02
LWD cover rating	-0.21	0.47	-0.07	0.67	0.03	0.80
Rock cover rating	-0.20	0.20	-0.21	0.18	0.16	0.20
Undercut bank cover rating	-0.09	0.55	-0.05	0.75	-0.25	0.05
Macrophyte cover rating	-0.13	0.42	-0.07	0.64	-0.06	0.62
Overhanging vegetation cover rating	-0.06	0.68	-0.03	0.84	-0.33	0.01
Stream shading rating	< 0.01	0.99	-0.10	0.50	-0.09	0.49
Ustable banks rating	0.11	0.49	0.05	0.73	< 0.01	0.99
stream order 1:24,000	-0.02	0.89	-0.05	0.72	0.51	< 0.01
Map gradient (%)	0.12	0.43	0.14	0.36	-0.15	0.24
% turbulent fastwater	-0.34	0.03	-0.32	0.04	0.18	0.15
% nonturbulent fastwater	0.28	0.07	0.17	0.28	-0.31	0.01
% scour pool	0.36	0.02	0.30	0.05	0.27	0.03
% dammed pool	-0.11	0.50	0.08	0.59	0.04	0.74
Total pool percentage	0.19	0.21	0.29	0.06	0.21	0.09
Conductivity (µS/cm)	-0.05	0.76	0.01	0.99	-0.25	0.05
Map elevation	0.11	0.47	0.26	0.09	-0.19	0.14

APPENDICES

Appendix A. Description of the physical characteristics assessed at each site sampled in the upper Snake River basin during 1999.

Variable	Description
Rosgen stream type	Based on Rosgen's (1994) stream classification system of A through G.
Stream order	First-order streams are defined as the first solid blue line on USGS 1:24,000 USGS maps, second order streams form below the junction of two first-order streams, etc.
Water temperature	Instantaneous measurement (°C) at the time of sampling.
Gradient	Expressed as the percent of drop in water surface elevation per unit of channel length. Measured with hand-level at survey site or with a map wheel on a 1:24,000 USGS map.
Dominant riparian vegetation	Recorded separately for both sides of the stream as the type of vegetation making up the majority (>50%) of the stream margin riparian community. Options are; 1) non-vegetated, 2) grasses or forbs, 3) shrubs, 4) trees (including any woody material such as willows or alders).
Conductivity	Instantaneous measurement (µS/cm at 25°C) at the time of sampling.
Land use activity	One of twelve classifications to characterize the dominant land use practice in the reach. Options include; 1) agriculture, 2) forest fire, 3) young trees, 4) second-growth trees, 5) old-growth trees, 6) partial cut timber, 7) active timber harvest, 8) light grazing, 9) heavy grazing, 10) mining, 11) no use, 12) undetermined.
Streamflow conditions	One of six categories to characterize what type of streamflow is occurring during sampling. Options include; 1) dry, 2) puddled, 3) low, 4) moderate, 5) high, 6) bankfull.
Valley bottom type	One of five categories to indicate the shape of the valley bottom. Options include; 1) flat bottom, 2) v-shaped, 3) trough-like, 4) box canyon, 5) u-shaped.
Sinuosity	One of four categories to characterize the amount of curvature in the stream meanders. Options include; 1) low, 2) moderate, 3) high, 4) braided.
Angling pressure	One of three categories that indicate the level of anticipated angling pressure, ranging from low to medium to high. Observations are based on road accessibility and a visual assessment of angling

Appendix B. Compiled data from sites sampled in the Teton and Portneuf river drainages in 2000 in Idaho.

Stream Location ID #	Subbasin	Streamname	Streamsite	Sample Date	UTM East	UTM North	Stream order (1:24,000)	Stream order (1:100,000)	Map Elevation	Land ownership	Reach length (m)
131	PORTNEUF RIVER	Middle Fork Toponce Creek	Site 1	10/19/00	413356	4747518	2	2	5910	public	69
132	PORTNEUF RIVER	Pebble Creek	Site 1	10/20/00	417743	4732645	3	3	5270	Private	207
133	PORTNEUF RIVER	South Fork Toponce Creek	Upper site Schill 1987	10/19/00	412687	4744985	3	2	6080	public	100
134	PORTNEUF RIVER	South Fork Toponce Creek	Lower site Schill 1987	10/19/00	412865	4745074	3	2	6116	public	113
135	PORTNEUF RIVER	Toponce Creek	Schill 1987 lower site	10/20/00	422537	4742865	4	3	5340	private	180
136	PORTNEUF RIVER	Toponce Creek	Schill 1986 site 2	10/20/00	417202	4744450	4	3	5520	public	80
180	PORTNEUF RIVER	Robbers Roost Creek	Lower	7/11/00	401983	4728848	1	1	4940	Public	68
181	PORTNEUF RIVER	South Fork Hawkins Creek	Upper	7/20/00	391648	4705445	1	1	5260	Public	93.2
182	PORTNEUF RIVER	Inman Creek	Upper	6/25/00	404954	4743644	2	2	5640	Public	66
183	PORTNEUF RIVER	Webb Creek	Lower	6/24/00	400611	4742771	2	2	4880	Private	97
184	PORTNEUF RIVER	Webb Creek	Middle	6/25/00	401279	4743259	2	2	4960	Private	108
185	PORTNEUF RIVER	Inman Creek	Middle	6/25/00	403958	4743675	2	2	5480	Public	87.2
186	PORTNEUF RIVER	Inman Creek	Lower	6/24/00	402022	4742317	2	2	5120	Public	86
187	PORTNEUF RIVER	Mink Creek	Only	6/22/00	383564	4729654	2	2	5310	Public	82
188	PORTNEUF RIVER	West Fork Mink Creek	Middle	6/27/00	382061	4732909	2	2	5760	Public	78
189	PORTNEUF RIVER	West Fork Mink Creek	Upper	6/27/00	381549	4733947	1	1	6120	Public	102
190	PORTNEUF RIVER	West Fork Mink Creek	Lower	6/27/00	383071	4731412	2	2	5350	Public	75
191	PORTNEUF RIVER	South Fork Mink Creek	Upper	6/23/00	384671	4724794	1	1	5800	Public	94.4
192	PORTNEUF RIVER	Webb Creek	Upper	6/25/00	402345	4744067	2	2	5200	Private	94
193	PORTNEUF RIVER	Rapid Creek	Lower	6/25/00	400198	4740931	3	3	4750	Private	107
194	PORTNEUF RIVER	Rapid Creek	Upper	6/25/00	400235	4741701	3	3	4800	Private	109
195	PORTNEUF RIVER	North Fork Rapid Creek	Middle	6/26/00	398488	4747496	2	1	5200	Private	95.5
196	PORTNEUF RIVER	North Fork Rapid Creek	Lower	6/26/00	398722	4745819	2	2	5120	Private	102
197	PORTNEUF RIVER	North Fork Rapid Creek	Upper	6/26/00	398691	4749840	2	1	5440	Private	28
198	PORTNEUF RIVER	Walker Creek	Lower	6/23/00	393982	4731199	1	1	5390	Public	100
199	PORTNEUF RIVER	Walker Creek	Middle	6/23/00	393127	4731241	1	1	5520	Public	107
200	PORTNEUF RIVER	Walker Creek	Upper	7/6/00	391270	4728978	1	1	6780	Public	0
201	PORTNEUF RIVER	South Fork Mink Creek	Middle	6/25/00	384423	4725933	1	1	5800	Public	86.4
202	PORTNEUF RIVER	South Fork Mink Creek	Lower	6/23/00	384371	4726117	1	1	5800	Public	98
203	PORTNEUF RIVER	Gibson Jack Creek	Upper	6/26/00	382425	4738434	2	2	5280	Public	92
204	PORTNEUF RIVER	Gibson Jack Creek	Middle	6/24/00	384615	4739475	2	2	4820	Private	113
205	PORTNEUF RIVER	Gibson Jack Creek	Lower	6/24/00	385165	4739904	2	2	4720	Private	99
206	PORTNEUF RIVER	North Fork Pocatello Creek	Lower	6/26/00	387787	4749642	2	2	5050	Private	89
207	PORTNEUF RIVER	Toponce Creek	Upper	7/8/00	417094	4744658	4	3	5520	Public	86
208	PORTNEUF RIVER	Middle Fork Toponce Creek	Upper	7/8/00	410589	4748112	2	2	6270	Public	100
209	PORTNEUF RIVER	Middle Fork Toponce Creek	Middle	7/7/00	411718	4748348	2	2	6020	Public	69.2
210	PORTNEUF RIVER	Middle Fork Toponce Creek	Lower	7/7/00	412715	4748660	2	2	5960	Public	85
211	PORTNEUF RIVER	South Fork Toponce Creek	Upper	7/9/00	410930	4744365	3	2	6200	Public	108
212	PORTNEUF RIVER	South Fork Toponce Creek	Middle	7/9/00	413643	4746010	3	2	6010	Public	107.5
213	PORTNEUF RIVER	South Fork Toponce Creek	Lower	7/9/00	413536	4746205	3	2	5995	Public	94
214	PORTNEUF RIVER	East Bob Smith Creek	Upper	7/10/00	411793	4722377	2	1	5360	Public	87
215	PORTNEUF RIVER	East Bob Smith Creek	Middle	7/11/00	411582	4722163	2	1	5360	Public	81.6
216	PORTNEUF RIVER	East Bob Smith Creek	Lower	7/12/00	411178	4721135	2	1	5120	Private	90
217	PORTNEUF RIVER	Robbers Roost Creek	Upper	7/21/00	406924	4730590	1	1	6400	Public	70
218	PORTNEUF RIVER	Robbers Roost Creek	Middle	7/11/00	404587	4729842	1	1	5560	Public	100
219	PORTNEUF RIVER	Goodenough Creek	Lower	7/12/00	398516	4721188	2	2	4720	Private	100
220	PORTNEUF RIVER	Goodenough Creek	Upper	7/12/00	392382	4723100	1	1	6040	Public	100
221	PORTNEUF RIVER	Yellow Dog Creek	Lower	7/20/00	389313	4709804	1	1	5225	Public	99
222	PORTNEUF RIVER	Yellow Dog Creek	Middle	7/20/00	389144	4709936	1	1	5240	Private	100
223	PORTNEUF RIVER	Yellow Dog Creek	Upper	7/20/00	387456	4710605	1	1	5400	Private	100
224	PORTNEUF RIVER	Bell Marsh Creek	Lower	7/12/00	396108	4726928	2	2	5120	Private	97.2
225	PORTNEUF RIVER	Bell Marsh Creek	Middle	7/6/00	394255	4726981	2	2	5560	Public	93
226	PORTNEUF RIVER	Bell Marsh Creek	Upper	7/6/00	393438	4726787	2	2	5640	Public	83
227	PORTNEUF RIVER	UNNAMED trib. To NF Toponce Cr.	Upper	7/8/00	409445	4749840	1	1	6960	Public	88.2
228	PORTNEUF RIVER	UNNAMED trib. To NF Toponce Cr.	Middle	7/8/00	410577	4749189	1	1	6400	Public	63
229	PORTNEUF RIVER	Cherry Creek	Lower	7/20/00	404811	4689136	2	2	5178	Private	83.5
230	PORTNEUF RIVER	Cherry Creek	Upper	7/21/00	405524	4685467	2	2	5560	Public	100.8
234	PORTNEUF RIVER	City Creek	Only	6/27/00	380937	4744600	0	0	4800	Public	0
235	PORTNEUF RIVER	Middle Fork Cherry Creek	Lower	7/21/00	407055	4683539	2	2	5990	Public	96
236	PORTNEUF RIVER	Middle Fork Cherry Creek	Upper	7/21/00	407082	4683021	2	2	6150	Public	100
237	PORTNEUF RIVER	Dempsey Creek	Only	7/20/00	416028	4712622	3	0	5480	Public	100.3
238	PORTNEUF RIVER	South Fork Hawkins Creek	Lower	7/20/00	391854	4706911	1	1	5080	Private	92.4
239	PORTNEUF RIVER	Valvehouse Draw	Only	6/22/00	384122	4730632	2	2	5280	Public	0
240	PORTNEUF RIVER	Harkness Creek	Only	7/21/00	406587	4724854	1	1	5600	Public	85.4
241	PORTNEUF RIVER	Pocatello Creek	Lower	6/22/00	384025	4750139	3	3	4660	Private	0
242	PORTNEUF RIVER	Pocatello Creek	Upper	6/26/00	385826	4749092	3	3	4850	Private	50
243	PORTNEUF RIVER	North Fork Pocatello Creek	Upper	6/26/00	391395	4751069	2	2	5441	Private	30
244	PORTNEUF RIVER	King Creek	Only	10/20/00	417842	4739870	2	1	5500	Private	78.5
401	PORTNEUF RIVER	Birch Creek	Lower	8/23/01	400813	4698110	1	3	4800	Private	0
402	PORTNEUF RIVER	McNabb Creek	Only	8/10/01	398755	4746156	0	1	5150	Private	0
403	PORTNEUF RIVER	Black Rock Canyon	Only	8/10/01	391581	4739507	0	3	4600	Private	0
404	PORTNEUF RIVER	South Fork Pocatello Creek	Only	8/10/01	386234	4748319	1	2	5000	Private	0
405	PORTNEUF RIVER	Trail Creek	Only	8/10/01	379487	4746980	0	2	4600	Private	0
406	PORTNEUF RIVER	Twomile Creek	Upper	8/10/01	403369	4725793	2	2	5200	Private	0
407	PORTNEUF RIVER	Twomile Creek	Lower	8/10/01	401713	4725971	2	2	4900	Private	0

Appendix B. Continued.

Stream Location ID #	Subbasin	Streamname	Streamsite	Sample Date	UTM East	UTM North	Stream order (1:24,000)	Stream order (1:100,000)	Map Elevation	Land ownership	Reach length (m)
82	TETON RIVER	South Fork Horseshoe Creek	Upper	9/11/00	475520	4837320	2	1	6980	Public	89
83	TETON RIVER	Garner Creek	Upper	8/8/00	458870	4835066	1	1	6660	public	72.6
84	TETON RIVER	Dry Creek	Middle	8/20/00	490927	4865144	0	2	6240	Public	0
85	TETON RIVER	Dry Creek	Lower	8/20/00	489204	4864610	0	2	6025	Public	0
86	TETON RIVER	South Fork Canyon Creek	Upper	8/10/01	472283	4836025	2	1	7400	public	95
87	TETON RIVER	Badger Creek	300 M below NF & SF confluence				0	3	6300	Private	0
88	TETON RIVER	North Fork Badger Creek	Upper	8/20/00	494119	4859999	1	1	6730	public	
89	TETON RIVER	North Fork Packsaddle Creek	Lower	9/8/00	475516	4846203	2	1	6700	public	78.1
90	TETON RIVER	North Fork Packsaddle Creek	Upper	9/8/00	472855	4846317	1	1	7300	public	65.5
91	TETON RIVER	South Fork Horseshoe Creek	Lower	9/11/00	475745	4838110	2	1	6760	public	90
92	TETON RIVER	South Fork Packsaddle Creek	Middle	9/10/00	472688	4842758	2	1	7200	public	96
93	TETON RIVER	North Fork Horseshoe Creek	Lower	9/11/00	475481	4840631	2	2	6520	public	91
94	TETON RIVER	North Fork Horseshoe Creek	Upper	9/11/00	474526	4841727	2	1	6730	public	103
95	TETON RIVER	Sob Canyon	Lower	9/9/00	477561	4833657	2	1	7000	public	98.5
96	TETON RIVER	Sob Canyon	Upper	9/9/00	476981	4833586	2	1	7160	public	95.2
97	TETON RIVER	Henderson Creek	Lower	9/10/00	482328	4831628	1	1	6400	public	110
98	TETON RIVER	Henderson Creek	Upper	9/10/00	481535	4832029	1	1	6900	public	98.3
99	TETON RIVER	North Fork Badger Creek	Wyoming		498785	4861523	1	1	7275	public	0
100	TETON RIVER	Little Pine Creek	Lower of 2				0	0		Private	0
101	TETON RIVER	Mahogany Creek	Upper	8/5/00	483140	4836674	4	3	6170	private	100
102	TETON RIVER	Mahogany Creek	Middle	8/5/00	483133	4836802	4	3	6150	private	100
103	TETON RIVER	North Fork Mahogany Creek	Alternative	9/21/00	479339	4835459	2	1	6580	public	104
104	TETON RIVER	South Fork Mahogany Creek	Lower	9/21/00	478846	4834572	4	3	6680	public	100
105	TETON RIVER	South Fork Mahogany Creek	Upper	9/9/00	478196	4833104	3	2	6940	public	76
106	TETON RIVER	Mike Harris Creek	Upper	9/21/00	492731	4819938	2	1	7120	public	100
107	TETON RIVER	South Fork Mahogany Creek	Middle	9/9/00	478121	4833630	3	2	6820	public	100
108	TETON RIVER	Mike Harris Creek	Middle middle	9/21/00	493023	4821330	3	2	6800	public	106
109	TETON RIVER	North Moody Creek	Upper		462741	4836078	1	1	6720	public	0
110	TETON RIVER	Mike Harris Creek	Middle	9/21/00	492444	4820436	2	1	7045	public	100
111	TETON RIVER	South Fork Canyon Creek	Middle	8/6/00	468918	4837072	2	2	6760	public	106
112	TETON RIVER	Wildcat Creek	Lower	8/21/00	494196	4858797	0	0	6660	private	0
113	TETON RIVER	Wildcat Creek	Middle	8/21/00	494478	4858798	1	1	6680	private	0
114	TETON RIVER	Wright Creek	Lower	8/5/00	465564	4849924	1	1	5960	private	89.6
115	TETON RIVER	Wright Creek	Upper of 2	8/5/00	468247	4847268	1	1	6900	private	59
116	TETON RIVER	Teton Creek	Upper	8/22/00	491853	4839595	3	2	6100	private	0
117	TETON RIVER	Patterson Creek	Upper	9/10/00	480623	4831607	2	1	6580	public	98.5
118	TETON RIVER	North Moody Creek	Middle	8/4/00	462670	4836302	2	2	6640	public	92
119	TETON RIVER	South Moody Creek	Middle	8/4/00	458530	4832901	3	2	6440	public	76
120	TETON RIVER	South Fork Packsaddle Creek	Lower	9/8/00	473777	4843210	3	2	6815	public	100
121	TETON RIVER	Patterson Creek	Lower	9/10/00	482464	4830496	2	1	6300	Public	101
139	TETON RIVER	South Fork Badger Creek	Upper	8/22/00	495378	4856371	2	2	6510	private	95
140	TETON RIVER	South Fork Badger Creek	Middle	8/20/00	493388	4856861	2	2	6380	private	101
141	TETON RIVER	South Fork Badger Creek	Wyoming	8/20/00	497814	4855922	2	2	6680	private	107.5
142	TETON RIVER	North Fork Badger Creek	Middle	8/20/00	493939	4859759	1	1	6820	public	64
143	TETON RIVER	Game Creek	Upper wyoming	8/22/00	497133	4825581	3	2	6780	public	100.1
144	TETON RIVER	Game Creek	Lower	7/23/00	494741	4824638	3	2	6530	Public	105
145	TETON RIVER	North Leigh Creek	Alternate	8/21/00	489482	4851472	3	2	6160	Private	95.5
146	TETON RIVER	North Leigh Creek	Wyoming	8/21/00	497477	4852610	3	2	6540	Public	102
147	TETON RIVER	Moose Creek	Lower	7/23/00	496174	4823154	3	2	6680	Public	100.2
148	TETON RIVER	Moose Creek	Wyoming	9/12/00	498899	4823045	3	2	6775	Public	95.65
149	TETON RIVER	Teton Creek	Wyoming	8/22/00	501016	4845072	3	2	6600	Public	81.7
150	TETON RIVER	Trail Creek	Lower	7/22/00	494472	4823407	4	3	6400	Private	102
151	TETON RIVER	Trail Creek	Wyoming	8/23/00	499891	4818009	3	3	7040	Public	99.3
152	TETON RIVER	Wildcat Creek	Wyoming	8/21/00	497090	4859591	1	1	7000	Public	100
153	TETON RIVER	Canyon Creek	Lower lower lower	8/18/00	464812	4849674	2	2	5800	Private	99
154	TETON RIVER	Canyon Creek	Lower lower	8/18/00	464882	4851338	3	3	5750	Public	99.3
155	TETON RIVER	Canyon Creek	Middle	8/18/00	463493	4847097	2	2	5900	Private	109.4
156	TETON RIVER	Canyon Creek	Upper	8/18/00	463180	4846646	3	3	5920	Private	102.5
157	TETON RIVER	South Fork Canyon Creek	Lower	8/6/00	467505	4837506	3	2	6680	Public	103
158	TETON RIVER	Canyon Creek	Upper upper	8/19/00	462822	4845267	1	2	5980	Private	103.6
159	TETON RIVER	Fish Creek	Upper	8/3/00	455339	4837059	2	1	5960	Public	89.2
160	TETON RIVER	Fish Creek	Lower	8/3/00	455367	4837132	3	2	5860	Public	82
161	TETON RIVER	Garner Creek	Lower	8/7/00	457270	4837638	2	1	6070	Public	96
162	TETON RIVER	Garner Creek	Middle	8/7/00	457329	4836919	2	1	6200	Public	73
163	TETON RIVER	Horseshoe Creek	Lower	7/23/00	479862	4842760	3	3	6160	Private	103
164	TETON RIVER	Little Pine Creek	Upper	8/22/00	485036	4824243	2	2	6240	Public	76.3
165	TETON RIVER	Mahogany Creek	Lower	7/23/00	483916	4839697	4	3	6020	Private	103
166	TETON RIVER	Mike Harris Creek	Lower	7/22/00	494374	4822501	3	2	6680	Public	84.1
167	TETON RIVER	North Moody Creek	Lower	8/5/00	460921	4838377	2	2	6420	Public	102
168	TETON RIVER	South Moody Creek	Upper	8/4/00	459144	4833023	3	2	6500	Public	100
169	TETON RIVER	South Moody Creek	Lower	8/3/00	455563	4837531	3	2	5900	Public	103
170	TETON RIVER	State Creek	Lower	8/4/00	454560	4836808	2	1	6060	Public	102
171	TETON RIVER	State Creek	Upper	8/4/00	453633	4835692	1	1	6200	Public	93.3
172	TETON RIVER	Warm Creek	Lower	7/24/00	486305	4827779	3	2	6070	Private	109.6
173	TETON RIVER	Warm Creek	Middle	7/24/00	486399	4827596	3	2	6070	Private	92
174	TETON RIVER	Warm Creek	Upper	7/24/00	486563	4827291	3	2	6070	Private	100
380	TETON RIVER	Pony Creek	Lower	8/10/01	465426	4852357	0	2	5940	Private	0
381	TETON RIVER	Unnamed trib to Moody Cr.	Lower	8/10/01	448195	4849322	0	2	5240	Private	0
382	TETON RIVER	Unnamed trib to Moody Cr.	Upper	8/10/01	447746	4847191	0	1	5360	Private	0
383	TETON RIVER	Wright Creek	Lower	8/10/01	464794	4850769	1	1	5810	Private	0
384	TETON RIVER	North Leigh Creek	Middle	8/11/01	491163	4851871	0	2	6200	Private	0
385	TETON RIVER	Spring Creek	Only	8/10/01	461531	4843932	1	1	6160	Private	0
386	TETON RIVER	Long Hollow	Upper	8/10/01	456164	4851032	0	1	5720	Private	0
387	TETON RIVER	Long Hollow	Lower	8/10/01	450866	4851631	0	2	5240	Private	0
388	TETON RIVER	Unnamed trib to Moody Cr. (sec 34)	Only	8/10/01	450803	4850374	0	2	5215	Private	0
389	TETON RIVER	Horseshoe Creek	Middle	8/11/01	480490	4845820	0	3	6019	Private	0
390	TETON RIVER	Horseshoe Creek	Lower	8/11/01	482368	4847410	0	3	5967	Private	0
391	TETON RIVER	Packsaddle Creek	Lower	8/11/01	477987	4847435	3	3	6130	Private	0
392	TETON RIVER	Henderson Creek	Lower	8/11/01	483494	4831734	1	1	6240	Private	0
393	TETON RIVER	Trail Creek	Middle	8/11/01	491073	4826916	4	4	6205	Private	0

Appendix B. Continued.

Stream Location ID #	Rosgen stream type	Map gradient (%)	Streamflow conditions	Conduct-ivity (µS/cm)	Water Temper-ature (°C)	Percent turbulent fastwater	Percent nonturbulent fastwater	Percent scour pool	Percent dammed pool	Avg. width (m)	Max depth (m)	Avg. depth (m)	Percent fines rating	Percent sand rating	Percent gravel rating	Percent cobble rating	Percent boulder rating	Percent bedrock rating
131	B	2.3	Low	136	9	60.44		34.68	4.88	4.36	0.39	0.20	1.46	1.65	1.74	2.66	0.76	0.00
132	C	0.93	Low	237	1	31.83	23.87	44.30		2.33	0.21	0.11	3.81	1.00	1.87	1.62	0.00	0.00
133	C	2.28	Low	295	6	72.23		27.77		2.73	0.32	0.12	3.18	1.07	0.97	2.44	1.32	0.08
134	C	1.73	Low	295	6	11.97	9.75		78.28	7.20	0.62	0.44	4.78	0.90	0.12	0.43	0.22	0.00
135	E	0.43	Low	0	0		100.00			1.72	0.46	0.25	5.00	0.00	0.00	0.00	0.00	0.00
136		0	Moderate	0	0					6.63	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
180	B	7.04	Moderate	265	16	89.78		10.22		2.46	0.35	0.07	1.15	0.85	2.95	2.85	3.10	0.00
181	B	2.42	Moderate	317	12	46.45	35.03	10.15	8.36	1.86	0.19	0.07	2.52	1.62	3.39	0.73	0.59	0.00
182	B	6.84	Moderate	174	15	87.89		12.11		2.29	0.30	0.09	1.00	1.04	2.53	2.88	2.22	0.00
183	B	2.47	Low	103	20	82.76		8.65	8.60	2.81	0.42	0.13	0.75	1.14	3.58	2.91	1.35	0.00
184	B	3.31	Moderate	89	17	75.62	24.38			3.04	0.36	0.13	0.00	1.28	2.50	3.12	1.01	0.00
185	B	4.1	Low	177	11	69.19	2.45	20.65	7.70	2.54	0.26	0.08	0.77	1.11	2.97	2.31	0.70	0.00
186	B	5.74	Moderate	250	12	60.48		25.55	13.97	2.92	0.31	0.10	1.92	1.95	1.69	1.19	1.85	0.00
187	B	3.04	Low	577	18	83.23	13.05	3.71		2.64	0.26	0.08	1.28	1.44	3.94	1.52	0.76	0.00
188	B	5.06	Moderate	396	13	65.67	8.26	26.08		1.39	0.26	0.10	1.11	1.86	3.98	0.94	0.06	0.00
189	E	1.9	Moderate	493	9	94.16		5.84		1.25	0.30	0.09	0.98	1.00	4.66	1.32	1.17	0.00
190	B	2.98	Moderate	420	14	77.73		22.27		2.34	0.29	0.10	1.00	1.46	2.67	2.38	2.01	0.00
191	E	1.6	Moderate	552	11	17.21	82.79			0.87	0.19	0.11	4.52	1.17	0.66	0.14	0.00	0.00
192	B	3.13	Low	87	11	95.30		4.70		2.59	0.36	0.14	0.00	2.00	3.95	3.00	1.00	0.00
193	B	1.64	Moderate	261	18	68.82	31.18			4.36	0.43	0.17	1.41	1.00	1.81	3.64	2.08	0.00
194	B	1.63	Moderate	280	13	64.55	15.33	15.37	4.75	4.06	0.41	0.17	1.25	1.64	2.99	2.83	1.91	0.00
195	E	1.41	Low	373	23	54.19	28.71	17.10		1.83	0.17	0.07	3.20	1.10	2.22	1.55	0.11	0.00
196	E	1.15	Low	452	11	49.31		35.64	15.05	2.88	0.35	0.16	3.86	0.38	2.02	1.55	0.28	0.00
197	E	2.21	Low	352	20		100.00			0.53	0.40	0.03	5.00	0.00	0.00	0.00	0.00	0.00
198	B	3.55	Low	352	16	95.90		2.76	1.33	1.85	0.16	0.03	0.99	0.90	4.24	1.74	0.11	0.00
199	B	4.34	Low	333	18	83.87	4.47	11.66		1.62	0.14	0.04	1.16	1.06	3.08	3.01	0.00	0.00
200		0	Puddled	0	0													
201	E	1.39	Moderate	552	11	4.51	93.39	2.09		1.25	0.25	0.14	5.00	1.00	0.13	0.93	0.00	0.00
202	E	1.34	Moderate	552	11	18.78	81.22			1.50	0.24	0.10	2.82	0.92	1.78	1.18	0.57	0.00
203	B	4.07	Moderate	278	14	78.12		21.88		2.89	0.34	0.10	1.12	1.25	2.82	2.66	2.69	0.00
204	B	4.15	Low	311	11	85.68	6.27		8.04	2.75	0.41	0.14	1.03	2.00	2.92	2.79	2.05	0.00
205	B	3.57	Moderate	302	15	94.65		5.35		2.65	0.38	0.11	1.45	1.55	1.95	1.45	0.95	0.00
206	B	2.05	Low	848	10	43.67	37.37	18.96		2.04	0.30	0.09	3.86	1.00	2.94	0.00	0.00	0.00
207	B	1.1	Moderate	236	18	81.61		18.39		5.17	0.60	0.20	2.00	0.18	3.00	3.18	1.00	0.00
208	B	4.8	Moderate	70	14	91.87		6.03	2.09	2.95	0.29	0.09	0.05	0.99	2.88	3.09	2.10	0.00
209	B	3.48	Low	92	16	15.53	71.86	12.61		1.78	0.17	0.06	1.89	0.57	1.59	3.73	1.81	0.00
210	B	1.34	Moderate	216	12	61.37	38.63			2.84	0.33	0.14	1.71	1.00	1.23	2.33	2.96	0.00
211	E	1.7	Moderate	382	13	61.29		38.71		2.70	0.34	0.15	2.51	0.51	2.46	2.70	0.54	0.00
212	B	1.37	Moderate	439	13	84.57		8.39	7.05	6.72	0.42	0.10	2.27	0.45	2.74	3.59	0.93	0.00
213	B	1.66	Moderate	377	22	52.80	37.24	9.96		3.01	0.40	0.16	2.49	0.85	2.96	1.78	0.69	0.00
214	B	7.68	Moderate	370	10	43.91	15.68	28.57	11.83	3.29	0.46	0.15	3.68	0.36	2.39	0.10	0.00	0.00
215	E	4.81	Moderate	370	9	31.77	54.23	7.42	6.59	1.57	0.32	0.11	3.24	0.76	3.28	0.23	0.23	0.00
216	B	4.82	Moderate	449	9	81.96		14.97	3.06	2.11	0.20	0.06	1.27	0.86	3.40	1.65	0.00	0.00
217	Aa+	12.27	Low	215	9													
218	B	4.43	Moderate	254	10	91.85		8.15		2.25	0.23	0.05	1.09	0.89	3.38	3.16	1.11	0.00
219	E	2.45	Low	131	15	93.28		6.72		1.67	0.19	0.04	2.12	0.46	3.96	2.47	0.00	0.00
220	B	9.9	Moderate	203	8	87.76		12.24		1.31	0.24	0.08	0.33	1.06	2.53	2.76	2.23	0.00
221	E	1.42	Low	512	11		100.00			0.76	0.15	0.07	5.00	0.00	2.00	0.00	0.00	0.00
222	C	1.38	Low	512	11	98.20		1.80		0.88	0.34	0.07	4.76	0.00	2.25	0.00	0.00	0.00
223	C	2.15	Low	426	14		100.00			1.60	0.17	0.05	1.00	2.00	2.00	0.00	0.00	0.00
224	B	5.52	Moderate	173	14	89.43		8.22	2.34	1.29	0.32	0.11	0.05	1.11	2.81	3.41	1.54	0.00
225	B	5.97	Moderate	189	12	100.00				2.59	0.29	0.12	0.00	1.00	3.00	4.00	1.00	0.00
226	B	5.46	Moderate	151	10	82.44		9.49	8.07	2.60	0.34	0.12	0.86	1.73	2.09	2.93	1.48	0.00
227	B	8.65	Moderate	26	10	94.34		4.29	1.37	1.48	0.22	0.03	1.93	2.61	3.02	1.61	2.51	0.00
228	B	8.39	Moderate	103	11	67.66	16.13	8.69	7.52	1.37	0.16	0.06	0.86	1.91	3.69	0.91	0.86	0.00
229	B	2.28	Low	307	18	3.57	63.39	33.04		1.14	0.18	0.08	2.96	0.14	2.91	0.00	0.00	0.00
230	B	6.71	Moderate	207	19	36.40	25.91	37.69		2.04	0.22	0.07	1.65	2.91	2.57	0.00	0.30	0.00
234		0	Low	0	0													
235	B	4.25	Low	236	10	91.06		8.94		1.80	0.17	0.05	1.07	1.12	3.39	2.96	0.00	0.00
236	B	6.2	Moderate	176	10	84.95	6.58	5.33	3.13	1.50	0.20	0.07	0.65	1.51	2.94	3.48	1.30	0.00
237	B	2.75	Low	285	23	66.33		33.67		3.57	0.35	0.10	0.66	1.67	2.89	2.12	0.56	0.00
238	G	2.06	Low	315	17	79.40	20.60			1.46	0.20	0.05	3.21	1.21	3.79	0.00	0.00	0.00
239		0	Puddled	0	0													
240	B	6.32	Low	295	12	69.41		30.59		1.74	0.21	0.06	1.92	0.71	2.65	1.89	0.09	0.00
241		0	Low	0	0													
242		0	Low	0	0													
243		0	Low	0	0													
244	C	2.07	Low	326	7				100.00	11.30	1.24	0.34	5.00	0.00	0.00	0.00	0.00	0.00
401		0	Dry	0	0													
402		0	Puddled	0	0													
403		0	Dry	0	0													
404		0	Puddled	0	0													
405		0	Dry	0	0													
406		0	Puddled	0	0													
407		0	Dry	0	0													

Appendix B. Continued.

Stream Location ID #	Rosgen stream type	Map gradient (%)	Streamflow conditions	Conduct-ivity (µS/cm)	Water Temper-ature (°C)	Percent turbulent fastwater	Percent nonturbulent fastwater	Percent scour pool	Percent dammed pool	Avg. width (m)	Max depth (m)	Avg. depth (m)	Percent fines rating	Percent sand rating	Percent gravel rating	Percent cobble rating	Percent boulder rating	Percent bedrock rating
82	A	7.94	Low	313	6	81.88		15.37	2.75	1.52	0.23	0.09	1.49	2.88	3.72	1.50	0.21	0.00
83	B	5.2	Low	337	11	51.46			48.54	0.79	0.11	0.04	3.72	0.71	2.58	1.56	0.00	0.00
84		0	Dry	0	0													
85		0	Dry	0	0													
86	B	5.05	Moderate	214	10	85.89	5.58	3.26	5.26	2.14	0.30	0.08	1.64	1.43	3.20	2.97	2.57	0.00
87		0	Dry	0	0													
88		0.95	Low	0	0													
89	B	6.94	Moderate	79	6	74.60		10.96	14.45	1.64	0.25	0.08	0.41	1.86	3.14	2.73	0.04	0.00
90	A	10.36	Low	74	13	84.38		6.13	9.49	2.59	0.29	0.06	1.16	1.98	2.85	3.49	0.77	0.00
91	B	6.63	Low	299	8	84.49		15.51		2.25	0.26	0.09	1.96	2.47	3.45	2.93	0.17	0.00
92	A	8.1	Low	103	6	68.62		26.40	4.98	1.38	0.18	0.07	1.16	1.33	2.88	2.68	0.73	0.00
93	B	3.93	Low	312	18	43.36		48.05	8.59	1.47	0.25	0.10	3.71	0.00	1.59	1.38	0.34	0.00
94	B	2.16	Low	81	8	21.29	42.51	19.59	16.61	0.99	0.15	0.06	4.37	0.00	1.70	1.02	0.08	0.00
95	A	7.89	Low	277	7	79.62			20.38	2.30	0.34	0.09	0.27	1.51	2.58	3.26	0.00	0.00
96	B	7.64	Moderate	273	6	92.31		7.69		2.23	0.29	0.09	0.70	0.70	3.00	3.48	0.97	0.00
97	B	4.31	Low	312	12	93.92			6.08	1.24	0.11	0.03	2.88	2.55	2.73	0.57	0.33	0.00
98	B	4.47	Low	301	6	96.51		1.47	2.03	0.96	0.12	0.03	3.49	1.00	2.49	0.51	0.00	0.00
99		0	Dry	0	0													
100		0	Puddled	0	0													
101	D	1.8	Low	494	21	100.00				2.52	0.14	0.09	3.00	1.00	2.00	3.00	0.00	0.00
102	D	1.6	Low	494	19	100.00				2.67	0.16	0.04	3.00	1.00	1.00	3.00	0.00	0.00
103	B	2.22	Moderate	578	7	62.96		37.04		1.82	0.25	0.07	2.52	2.81	2.81	0.00	0.00	0.00
104	B	2.32	Low	432	6	66.26		33.74		3.01	0.50	0.11	1.18	1.46	3.21	2.35	0.51	0.00
105	B	6.49	Low	388	8	46.21	34.17	19.61		1.64	0.15	0.05	0.85	2.26	3.08	1.83	0.45	0.00
106	A	9.26	Low	375	5	78.46	6.35	15.19		1.15	0.14	0.04	1.55	2.34	3.65	2.26	0.15	0.00
107	B	6.02	Low	401	8	75.43		24.57		1.43	0.13	0.04	0.62	2.24	2.79	2.63	0.00	0.00
108	B	4.41	Low	276	4	79.18	6.20	8.80	5.82	1.54	0.25	0.07	0.61	1.17	3.29	2.77	0.86	0.00
109		0	Dry	0	0													
110	B	0	Low	369	4	82.51		13.75	3.74	1.85	0.23	0.05	1.12	1.34	3.15	2.54	0.69	0.48
111	B	2.23	Low	204	15	69.49		20.51	10.00	4.06	0.30	0.09	1.32	1.06	2.50	3.05	1.34	0.00
112		0	Dry	0	0													
113		0	Dry	0	0													
114	B	2.57	Low	68	10	65.13	7.74	23.37	3.75	1.42	0.20	0.06	1.73	1.55	2.87	2.63	1.69	0.00
115	B	4.84	Low	58	14	60.82		25.92	13.26	2.49	0.22	0.07	0.99	0.95	2.77	2.86	1.65	0.00
116		0	Dry	0	0													
117	B	4.18	Low	433	9	87.47		10.21	2.33	1.32	0.12	0.04	1.34	2.28	3.90	1.55	0.00	0.00
118	B	4.71	Moderate	86	12	58.30	14.70	26.99		2.60	0.26	0.10	1.33	0.93	3.29	2.43	0.13	0.00
119	B	1.58	Low	264	14	50.00	7.61	42.39		1.85	0.19	0.08	2.35	2.47	3.27	0.00	0.00	0.00
120	B	3.93	Low	190	9	53.76		46.24		1.76	0.21	0.08	1.92	2.16	3.44	1.52	0.37	0.20
121	C	2.26	Low	413	10	34.13	18.32	47.55		1.81	0.21	0.08	3.07	2.19	3.18	0.00	0.00	0.00
139	B	2.16	Moderate	85	13	79.07	20.93			5.93	0.26	0.08	0.07	0.40	2.60	4.00	1.00	0.00
140	C	1.35	Low	88	17	25.91	51.92	22.17		5.33	0.30	0.12	0.79	0.85	3.22	3.52	1.04	0.00
141	B	1.65	Low	96	10	78.12	11.21	10.66		5.81	0.35	0.10	1.00	1.00	3.00	4.00	1.11	0.00
142	B	1.46	Low	35	13	22.34	8.55	55.89	13.22	1.97	0.20	0.13	1.88	1.51	3.52	1.68	0.16	0.00
143	B	3.48	Low	211	11	69.36	9.79	20.85		3.20	0.31	0.11	0.16	0.25	2.60	3.04	2.65	0.20
144	C	8.61	Low	278	18	73.20		26.80		3.32	0.32	0.07	0.34	1.00	2.83	3.50	2.42	0.00
145	B	1.42	Low	341	16	18.95		81.05		2.49	0.39	0.17	2.01	1.28	2.65	0.75	0.00	0.00
146	B	1.78	Moderate	210	12	52.66	17.40	29.93		5.91	0.49	0.20	1.76	1.31	1.90	3.69	1.37	0.00
147	B	1.92	Moderate	261	7	69.79		26.02	4.19	7.21	0.72	0.28	0.13	1.00	1.17	2.38	3.10	0.00
148	B	2.14	Moderate	218	0	74.44		18.45	7.11	5.92	0.50	0.18	1.48	1.88	2.59	3.62	0.81	0.00
149	B	0	Moderate	147	7	90.94			9.06	3.64	0.56	0.17	1.09	1.18	2.82	2.91	1.99	0.00
150	C	5.33	Low	219	14	22.34	77.66			4.74	0.27	0.12	0.78	1.00	2.63	3.14	3.08	0.00
151	B	3.97	Moderate	264	5	90.29		9.71		4.37	0.54	0.18	1.02	2.02	3.82	3.04	0.95	0.00
152	B	1.73	Low	20	7	47.31		41.45		1.04	0.20	0.07	0.63	1.32	3.37	0.60	1.52	0.00
153	B	0.6	Low	384	14	16.97	13.01	46.22	23.80	3.78	0.35	0.14	2.49	1.24	2.16	2.59	1.78	0.00
154	B	0.76	Moderate	318	14	20.94	46.17	32.89		4.12	0.28	0.12	3.28	1.16	2.11	1.85	1.23	0.00
155	C	0.94	Low	183	19	54.78	17.86	27.36		4.40	0.30	0.12	2.00	0.66	2.85	3.22	0.57	0.00
156	B	1.33	Moderate	295	20	23.04	45.08	31.89		5.84	0.38	0.16	2.01	1.15	3.31	2.85	0.43	0.00
157	B	1.42	Moderate	0	11	64.53	12.84	14.50	8.13	4.43	0.43	0.15	1.04	1.27	1.13	3.64	2.22	0.24
158	B	0.76	Low	188	14	43.45	10.16	46.39		3.90	0.37	0.13	2.07	1.07	2.60	3.13	1.21	0.00
159	B	2.16	Low	212	18	61.47	11.52	27.01		2.04	0.19	0.06	1.46	1.34	2.80	1.47	2.44	0.00
160	C	2.51	Low	213	21	61.84	11.94	18.42	7.80	1.92	0.15	0.06	2.91	2.31	2.11	1.68	1.06	0.00
161	C	3.18	Low	0	0	75.50	7.86	13.04	3.61	1.18	0.13	0.05	3.03	0.07	2.63	1.58	1.25	0.00
162	B	3.77	Low	250	13	45.68	5.24	8.17	40.91	1.34	0.14	0.06	3.56	0.79	2.58	1.04	0.52	0.00
163	C	1.2	Moderate	333	18	51.02	27.37	16.49	5.11	2.91	0.37	0.12	2.84	0.28	2.71	1.43	0.00	0.00
164	B	4.83	Puddled	255	14					0.00		0.02	4.00	1.00	2.00	2.00	1.00	0.00
165	E	1.12	Low	407	11	14.76	61.26	23.98		3.51	0.40	0.19	4.74	0.07	1.39	0.72	0.00	0.00
166	B	6.94	Low	393	15	41.03		53.60	5.38	2.09	0.41	0.09	2.73	1.76	3.51	0.00	0.00	0.10
167	B	2.13	Moderate	0	17	68.59		23.45	7.97	2.85	0.27	0.10	1.46	1.13	1.38	3.62	1.05	0.00
168	B	2.72	Low	258	14	65.10	19.09	15.81		1.93	0.20	0.06	1.75	0.69	3.66	2.35	0.48	0.00
169	C	2.04	Low	0	0	49.61	30.14	20.25		2.25	0.20	0.06	2.44	0.27	3.09	2.60	0.78	0.00
170	E	1.45	Low	230	15	82.91		17.09		0.94	0.17	0.06	3.58	1.00	3.30	0.00	0.00	0.00
171	E	2.18	Low	213	19	89.58	7.31	3.11		1.23	0.17	0.06	4.18	0.00	1.72	0.72	0.00	0.00
172	E	0.3	Low	412	12	41.16	30.70	28.14		6.29	0.64	0.17	3.28	2.59	2.23	0.31	0.00	0.00
173	E	0.3	Low	396	14	20.75	45.18	34.06		5.98	0.42	0.17	3.59	2.55	1.85	0.00	0.00	0.00
174	E	0.3	Low	353	18		79.31	20.69		5.41	0.46	0.19	5.00	0.58	0.88	0.00	0.00	0.00
380		0	Dry	0	0													
381		0	Puddled	0	0													
382		0	Dry	0	0													
383		0	Puddled	0	0													
384		0	Dry	0	0													
385		0	Dry	0	0													
386		0	Dry	0	0													
387		0	Dry	0	0													
388		0	Dry	0	0													
389		0	Dry	0	0													
390		0	Dry	0	0													
391		0	Dry	0	0													
392		0	Dry	0	0													
393		0	Dry	0	0													

Appendix B. Continued.

Stream Location ID #	Trout density >100 mm TL (fish/m²)	Trout density <100 mm TL (fish/m²)	Yellowstone cutthroat trout caught	Rainbow trout caught	Brook trout caught	Brown trout caught	Rainbow/ cutthroat hybrids caught	Mottled sculpin caught	Longnose Dace caught	Mountain sucker caught	Mountain whitefish caught	Piute sculpin caught	Redside shiner caught	Speckled dace caught
131	0.22	0.01	13	20			35	30		1				
132	0.06	0.31	165	4				30		1				
133	0.17	0.11	73				1	8						
134	0.21	0.02	181				8	30		5				
135														
136	0.06	0.03	4	1		41		31		28				
180	0.04	0.02	7											
181														
182	0.06	0.03	10											
183	0.10	0.08	32	2			1	41						
184	0.02	0.01	8					38						
185	0.11	0.05	34											
186	0.15	0.00	37					27						
187	0.10	0.01	19				4	28				2		
188	0.06	0.02	8											
189														
190	0.09	0.08	20			1								
191														
192	0.07	0.03	4				17	69						
193	0.04	0.00	12	1		2	1							
194	0.15	0.05	70			9	10	31						
195	0.12	0.01	21					2						
196	0.48	0.05	149					52						
197														
198	0.01	0.00	1											
199	0.02	0.01	4											
200														
201														
202														
203	0.05	0.08	25					31						
204	0.08	0.01	7	3	6		6	67						
205	0.06	0.01	7	2	4		2							
206														
207	0.02	0.01	2			6		71						
208	0.02	0.06	22				1	24						
209	0.14	0.11	13	2			14							
210	0.12	0.14	43				1	15						
211	0.19	0.14	55					36						
212	0.02		15				2	30		8				
213	0.07	0.00	11				5	31						
214	0.26	0.01	38		21									
215	0.23	0.19	29		25									
216	0.05	0.34			50									
217														
218	0.08	0.02	23											
219	0.02	0.07	10											
220	0.19	0.03	25											
221														
222														
223														
224	0.07	0.05	15											
225	0.01	0.02	6											
226	0.03	0.14	26											
227														
228														
229	0.47	0.84			88									
230	0.71	1.54			391									
234														
235	0.90	0.87			296									
236	0.73	0.25			139									
237														
238								10						
239														
240			1											
241														
242														
243														
244														
401														
402														
403														
404														
405														
406														
407														

Appendix B. Continued.

Stream Location ID #	Trout density >100 mm TL (fish/m²)	Trout density <100 mm TL (fish/m²)	Yellowstone cutthroat trout caught	Rainbow trout caught	Brook trout caught	Brown trout caught	Rainbow/ cutthroat hybrids caught	Mottled sculpin caught	Longnose Dace caught	Mountain sucker caught	Mountain whitefish caught	Piute sculpin caught	Redside shiner caught	Speckled dace caught
82	0.03	0.00			3									
83														
84														
85														
86														
87														
88														
89	0.12	1.57	82		124									
90	0.12	1.01	99		34		2							
91	0.02	0.01	1		3									
92		0.02			1									
93	0.30	0.89	107		50									
94	0.22	0.02	20											
95	0.12	0.03	4		23									
96	0.05	0.05	1		20									
97														
98														
99														
100														
101														
102														
103	0.17	0.19	53											
104	0.31	0.19	16		116									
105	0.12	0.23			33									
106														
107	0.13	0.32	4		59									
108	0.11		1		17									
109														
110														
111	0.12	0.35	51		21									
112														
113														
114														
115														
116														
117	0.05	0.31			46									
118	0.09	0.20	15		36									
119	0.11	0.53	8		79	3								
120	0.32	0.63			159									
121	0.28	1.31			208									
139	0.07	0.00	74											
140	0.07	0.00	84											
141	0.10	0.11	125											
142														
143	0.03				11									
144	0.38	0.05	10		117			31						
145	0.15	0.02	1		38			3						
146	0.21	0.23	22		198			6						
147	0.04		2		25									
148	0.17	0.04			116									
149	0.03	0.01			11									
150	0.07	0.02	15		28			30						
151	0.05	0.01			20									
152														
153	0.06	0.02			19		10	15	28					30
154	0.21	0.26	30		141			38	20					20
155	0.11	0.11	36		44		2	30	30					30
156	0.11	0.21	25		151			30	21					20
157	0.09	0.04	44		14									
158	0.14	0.16	59		62			31	30					30
159	0.27	0.42	18		78			30						
160	0.29	0.27	19		66			31						
161	0.35	0.47	28		52									
162	0.41	0.38	3		74									
163	0.19	0.12	16	1	76			72						
164			16		50									
165	0.38	0.22	2		170									
166	0.20	0.72	92		25									
167	0.13	0.22	19		81			98						
168	0.05	0.61			88									
169	0.11	0.94	1		170			70						
170	0.28	0.04	12		14									
171	0.16	0.03			17									
172	0.08	0.03	1	16	42			69			61		12	33
173	0.05	0.05		3	53			53						
174	0.02	0.05			30			55						
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