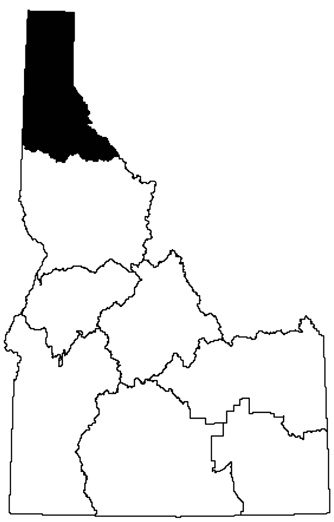
IDAHO DEPARTMENT OF FISH AND GAME
FISHERY MANAGEMENT ANNUAL REPORT

Calvin L. Groen, Director



PANHANDLE REGION
2005

Mark Liter, Regional Fishery Biologist
Joe Dupont, Regional Fishery Biologist
Ned Horner, Regional Fishery Manager

IDFG 09-103
November 2008

TABLE OF CONTENTS

Page

LIST OF TABLES

<u>Page</u>

LIST OF FIGURES

Page

LIST OF APPENDICES

Page

CHAPTER 1: KOKANEE POPULATION STUDIES

ABSTRACT

A midwater trawl is typically used to estimate the kokanee *Oncorhynchus nerka* population in Coeur d'Alene Lake in July. However, due to problems encountered when the trawl caught on the lake bottom of Coeur d'Alene Lake and the time required to secure deepwater divers and retrieve the trawl, no trawling occurred and no population estimate was made in 2005.

A midwater trawl was used to estimate the kokanee population in Spirit Lake in early July. Trawl results indicated a high number of adult kokanee, with the total population of age-3 fish estimated at 94,112 or 21 fish/ha. We estimated 184,819 age-2, 201,926 age-1, and 508,265 age-0 kokanee for a total population estimate of 989,122 fish in 2005. The standing stock of kokanee in Spirit Lake was estimated at 69.8 kg/ha.

We counted a total of 4,961 kokanee spawners at five historic locations along the shoreline of Priest Lake in November. We were unable to survey Upper Priest Lake as low water levels prevented boat traffic from entering the Thorofare. The numbers of kokanee spawners observed at each of the five sites on Priest Lake were as follows; Copper Bay 906, Huckleberry Bay 120, Cavanaugh Bay 916, Hunt Creek beach, 2,961 and Indian Creek beach 58.

Authors:

Mark Liter
Regional Fishery Biologist

Ned Horner
Regional Fishery Manager

OBJECTIVES

1. Evaluate stock status of kokanee in Coeur d'Alene Lake.

2. Evaluate stock status of kokanee in Spirit Lake.

3. Determine shoreline spawning areas used by kokanee and estimate the number of kokanee spawners in Priest and Upper Priest lakes.

INTRODUCTION

Although kokanee are not native, they are one of the most important sport fish species in the Panhandle Region. Kokanee first entered Lake Pend Oreille via the Clark Fork River during the winter flood of 1933 from fish that emigrated from Flathead Lake, Montana. Kokanee were stocked into Flathead Lake in 1916 and were originally from wild stocks from Lake Whatcom, Washington. Once kokanee were established in Lake Pend Oreille, Idaho Department of Fish and Game (IDFG) transplanted them to Coeur d'Alene, Spirit, and Priest lakes in the 1930s. Self sustaining populations were soon established and kokanee fisheries typically provided 50 to 90% of the angling effort in the big north Idaho lakes. Kokanee spawners in north Idaho are classified as "late spawners" typically using shoreline gravel rather than tributary streams and spawn from November through early January. Annual monitoring of kokanee populations is critical to evaluating the status of these important fisheries.

METHODS

Spirit Lake

We used a midwater trawl, as described by Bowler et al. (1979), Rieman and Meyers (1990), and Rieman (1992), to estimate the kokanee *Oncorhynchus nerka* population in Spirit Lake. Five transects were trawled during the dark phase of the moon on July 5, 2005. Trawl transects were selected using a stratified random sample design and were in identical locations (as near as possible) to those used in previous years (Figure 1). Kokanee were measured and weighed, and scales and otoliths were collected from representative length groups for age analysis.

Coeur d'Alene Lake

We typically use a midwater trawl each year to estimate the kokanee population in Coeur d'Alene Lake. However, due to problems encountered when the trawl became caught on the bottom of Coeur d'Alene Lake and the time required to secure deepwater divers and retrieve the trawl, no kokanee trawling was done and no population estimates were made in 2005.

Lengths of kokanee spawners in Coeur d'Alene Lake and mean fecundity were determined by collecting a sample of fish with experimental gillnets on December 1, 2005. The net was set at depths of 3-5 m near Higgins Point for approximately one hour. We typically estimate potential egg deposition (PED) using this mean fecundity estimate multiplied by one half the number of age-3 kokanee estimated by our midwater trawling, however, as mentioned earlier no estimate was made in 2005 due to problems encountered during trawling. The average number of eggs produced per female kokanee was calculated using the following length to fecundity regression (Rieman 1992):

$$Y = 3.98x - 544$$

Where: x =mean length of female kokanee spawners (mm)
Y =mean number of eggs per female

Priest Lake

Lakeshore areas were surveyed to determine the location of kokanee spawning and to quantify the number of spawners. Kokanee spawner counts were conducted in fives historic spawning areas on Priest Lake on November 9, 2005. We were unable to survey Upper Priest Lake as low water levels prevented boat traffic from entering the Thorofare. Surveys were conducted using a boat with two observers standing on the bow while a third person drove the boat contouring the shoreline at a depth of about 3 m. Each observer counted spawners and an average of the two counts was used as the estimate for each of the five sites. Our efforts were concentrated on the area between the Granite Creek delta and Copper Bay, Indian Creek campground and marina, Cavanaugh Bay Marina, Hunt Creek delta and Huckleberry Bay (Figure 2).

RESULTS

Spirit Lake

We estimated a total kokanee population in Spirit Lake of 989,100 fish. Abundance of age-3 kokanee was estimated at 94,000 fish or 21 fish/ha (Table 1). This is the third highest estimate of adult kokanee since trawling began in 1981 and well above the previous 1981-2000 mean of 53,400 age-3 fish. Similarly, age-2 kokanee were estimated at 185,000 fish, which is also the third highest estimate and well above the mean of 101,900 age-2 kokanee. The age-1 kokanee population was estimated at 202,000 compared to a 1981-2000 mean of 142,400 age-1 fish. We estimated there are 508,000 age-0 or fry, which far exceeds the mean of previous years. We estimated the total biomass of kokanee in Spirit Lake at 69.8 kg/ha.

Age-3 kokanee (N=50) ranged from 220 to 250 mm, with a mean size of 234 mm. Age -2 kokanee ranged from 190 to 220 mm and age -1 kokanee ranged from 140 to 180 mm. All age classes were slightly smaller than the year 2000 lengths, the last time Spirit Lake was surveyed. The decrease in size is likely related to the higher densities in 2005.

Coeur d'Alene Lake

In a 50 minute gillnet set on December 1, 2005 we collected 141 kokanee spawners near Higgins Point in Wolf Lodge Bay. Males (82%) outnumbered females, (28%). Female mean length was 359 mm (TL), (N=39). Male mean and modal lengths were 382 and 372 mm respectively, (n=102). Mean length of spawners was comparable to the previous year. Kokanee spawner length in Coeur d'Alene Lake during the past eight years has been larger than they have been since the late 1950s (Figure 3). Mean fecundity was estimated at 885 eggs per female based on a mean female spawner length of 359 mm.

Priest Lake

A total of 4,961 kokanee spawners were counted at five shoreline sites in Priest Lake (Table 2). No kokanee spawner survey was conducted on Upper Priest Lake as lower than usual water levels prevented us from boating through the Thorofare. Mean lengths (TL) of 5 male and 9 female kokanee were 399 and 375 mm (TL) respectively, compared to 367 and 360 mm in 2004 and 398 and 384mm in 2003 (Figure 4). No significant change in mean length has been observed in Priest Lake adult kokanee over the past five years.

Number of kokanee spawners observed at each of the five sites on Priest Lake were as follows; Copper Bay 906, Huckleberry Bay 120, Cavanaugh Bay 916, Hunt Creek beach 2961, and Indian Creek beach 58 (Table 2)

DISCUSSION

Priest Lake

We have been monitoring Priest Lake kokanee spawner numbers since 2001 and the total number of spawners counted did not continue to increase as it has been documented. We counted 4,961 kokanee spawners at five historic sites on Priest Lake compared to 6,117 in 2004, 2,832 in 2003, 1,825 in 2002, and 1,765 in 2001. This slight decrease could be attributed to timing, observer error or other factors. The overall trend continues to be positive and is attributed to timing of winter drawdown. Prior to 2001 water level management had adversely affected spawning success and survival of beach spawned eggs and fry in redds. In 2001 Idaho Water Resources Board (IWRB) and IDFG proposed several amendments to the 1996 kokanee recovery plan suggesting the lake level be lowered starting October 1 in order to reach the 0.0 feet goal at the outlet gauge by November 1. Lower lake levels ensure a higher success rate for kokanee redds because the water is at its lowest level before kokanee initiate spawning. Kokanee spawning activity in Priest Lake peaks in mid-November. Since 2002 Priest Lake has been drafted to near the 0.0 goal on October 31.

Changes in water level management seem to have resulted in a rebounding kokanee population, which until recently has been considered all but extirpated. Granted, these spawner counts are not the most accurate way to evaluate the population and perhaps it is time to re-implement yearly kokanee trawling. Estimates of kokanee numbers, densities and standing crop would be useful in making comparisons to populations in Lake Pend Oreille and Lake Coeur d' Alene and to evaluate future management changes within the Priest Lake population. By re-establishing the long-term population monitoring program (mid-water trawling) in addition to some adaptive management, we may be able to offer anglers limited kokanee angling opportunity again on Priest Lake.

Coeur d'Alene Lake

Trawling results indicate the Coeur d'Alene Lake kokanee population remains below management goals and well below the long-term average. Low densities of kokanee have resulted in larger than average age-3 fish for the past several years. The larger than average age-3 kokanee have resulted in an extremely popular late summer and fall fishery concentrating on the north end of Coeur d'Alene Lake. Our concern is the potential for over harvest of age-3 kokanee. During the 2006 season IDFG will be conducting creel surveys to monitor kokanee harvest and address the potential for reduced bag limits from the current 25 fish limit.

RECOMMENDATIONS

1. Continue to monitor the kokanee population and adjust age-0 Chinook salmon supplementation accordingly.

2. Continue to monitor kokanee spawner numbers on Priest and Upper Priest Lakes and expand surveys to include lower sections of historic spawning tributaries.

LITERATURE CITED

Bowler, B., B.E. Rieman, and V.L. Ellis. 1979. Pend Oreille Lake fisheries investigations. Idaho Department of Fish and Game, Job Performance Report, Project F-73-R-1, Boise.

Rieman, B.E. and D. Meyers. 1990. Idaho Department of Fish and Game. Federal Aid in Fish and Wildlife Restoration, F-73-R-12, Subproject II, Study No.1, Job III. Job Performance Report. Boise.

Rieman, B.E. 1992. Status and analysis of salmonid fisheries: kokanee salmon population dynamics and kokanee salmon monitoring guidelines, F-73-R-14, Subproject II, Study II. Boise.

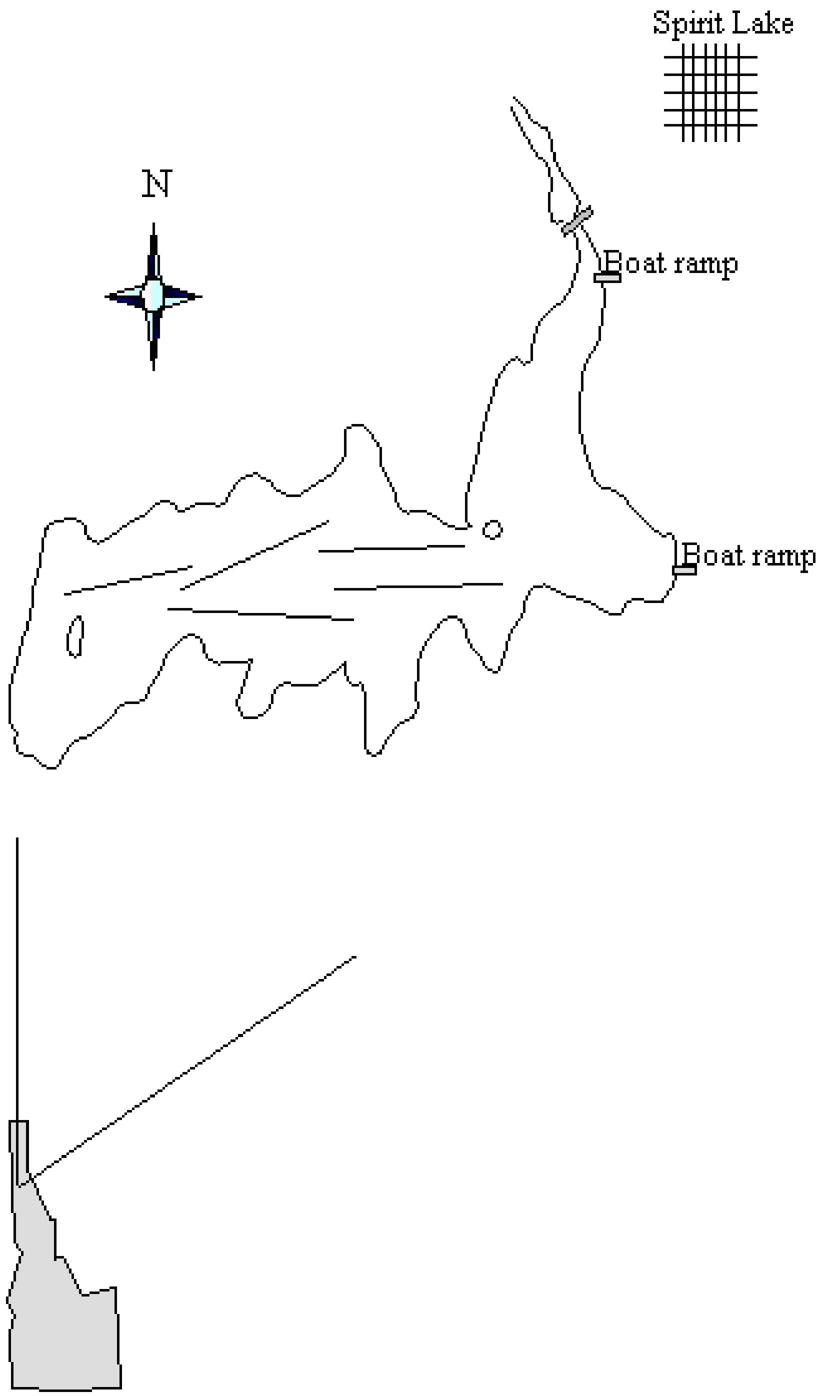


Figure 1. Location of the five midwater trawl transects used to estimate the kokanee population in Spirit Lake, Idaho.

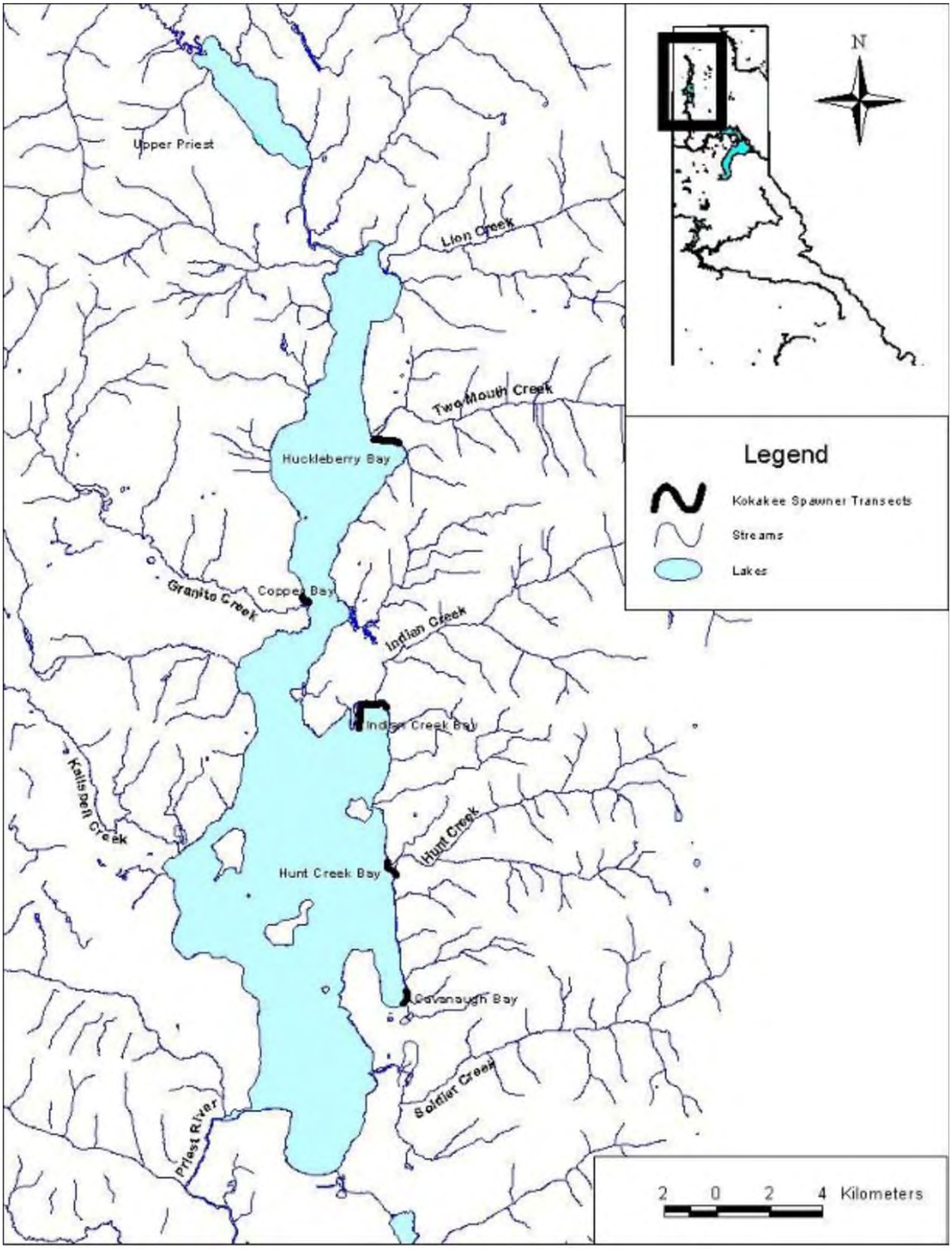


Figure 2. Location of kokanee spawner counts on Priest Lake, Idaho, 2005.

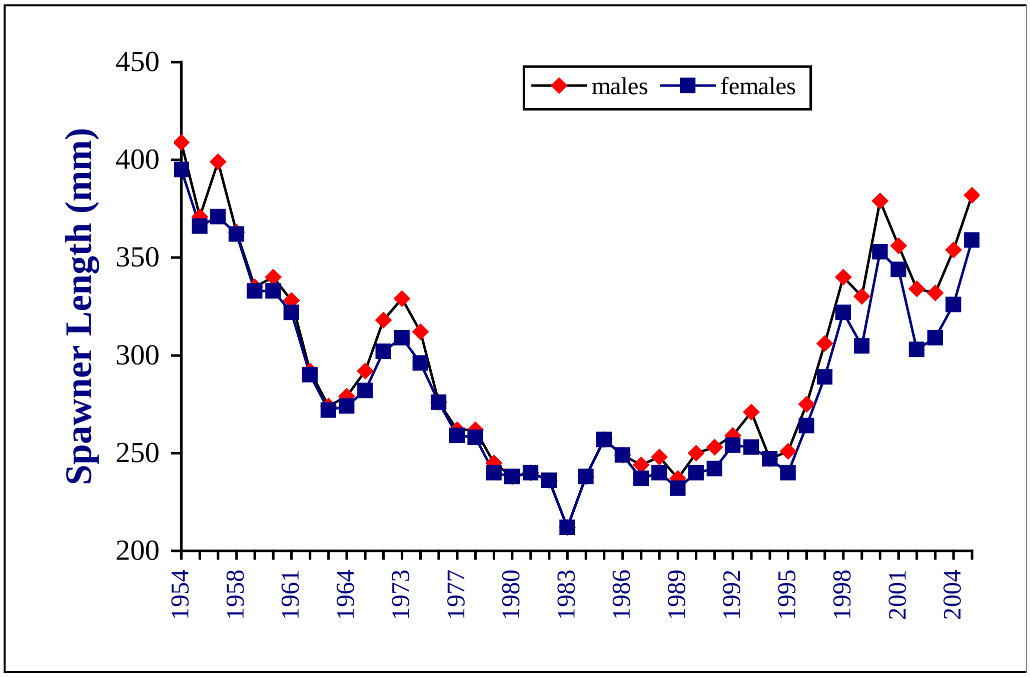


Figure 3. Mean total length of male and female kokanee spawners in Coeur d'Alene Lake, Idaho, from 1954 to 2005. Years where mean lengths were identical between sexes are a result of averaging male and female lengths.

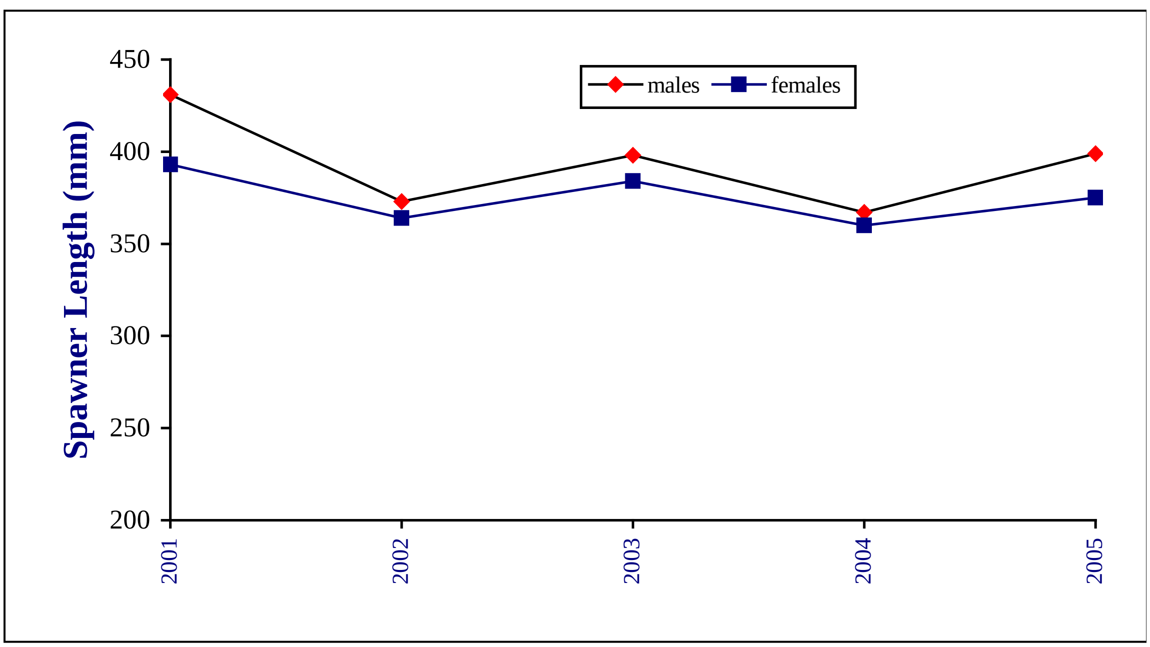


Figure 4. Mean total length of male and female kokanee spawners in Priest Lake, Idaho, 2001—2005.

Table 1. Kokanee population estimates based on midwater trawling from 1981 through 2005 in Spirit Lake, Idaho.

	Age Class					
Year	Age-0	Age-1	Age-2	Age-3	Total	Age-3+/ha
2005	508,000	202,000	185,000	94,000	989,100	21
2000	800,000	73,000	6,800	7,800	901,900	13
1999	286,900	9,700	50,400	34,800	381,800	61
1998	28,100	62,400	86,900	27,800	205,200	49
1997	187,300	132,200	65,600	6,500	391,600	11
1996	--	--	--	--	--	--
1995	39,800	129,400	30,500	81,400	281,100	142
1994	11,800	76,300	81,700	19,600	189,400	34
1993	52,400	244,100	114,400	11,500	422,400	20
1992	--	--	--	--	--	--
1991	458,400	215,600	90,000	26,000	790,000	45
1990	110,000	285,800	84,100	62,000	541,800	108
1989	111,900	116,400	196,000	86,000	510,400	150
1988	63,800	207,700	78,500	148,800	498,800	260
1987	42,800	164,800	332,800	71,700	612,100	125
1986	15,400	138,000	116,800	35,400	305,600	62
1985	149,600	184,900	101,000	66,600	502,100	116
1984	3,300	16,400	148,800	96,500	264,900	168
1983	111,200	224,000	111,200	39,200	485,700	68
1982	526,000	209,000	57,700	48,000	840,700	84
1981	281,300	73,400	82,100	92,600	529,400	162
Previous Mean (1981-2000)	**182,222**	**142,394**	**101,961**	**53,456**	**480,828**	**93**

Fry releases: 1994 - 383,550
1988 - 75,000
1987 - 60,800
1986 - 57,142
1985 - 109,931
1984 - 100,000

Note: No trawling took place from 2001-2004 due to low water preventing us from launching the 33ft trawler.

Table 2. Counts of shoreline spawning kokanee in Priest Lake and Upper Priest Lake, Idaho, 2001- 2005.

Location	**2001**	**2002**	**2003**	**2004**	**2005**
Priest Lake					
Copper Bay	588	549	1237	1584	906
Cavanaugh Bay	523	921	933	1673	916
Huckleberry Bay	200	49	38	359	120
Indian Creek Bay	222	0	0	441	58
Hunt Creek Mouth	232	306	624	2060	2961
Upper Priest Lake					
West Shoreline	10	---[1]	---[1]	---[1]	---[1]
Total	**1775**	**1825**	**2832**	**6117**	**4961**

1 Upper Priest Lake was not included in the spawner counts due to low water in the Thorofare and no access to Upper Priest Lake.

CHAPTER 2: LAKE COEUR D'ALENE CHINOOK SALMON STUDIES

ABSTRACT

We counted 49 Chinook salmon *O. tshawytscha* redds in the Coeur d'Alene River drainage and 10 in the St. Joe River. All redds were left undisturbed to provide natural production. We stocked 26,300 age-0 Chinook salmon at the Carlin Bay Cafe boat ramp in June 2005. Chinook eggs were collected at Garrison Dam National Fish Hatchery, North Dakota, hatched at Cabinet Gorge Hatchery, and were reared at the Nampa Hatchery. All fish were marked with a left ventral fin clip.

Authors:

Mark Liter
Regional Fishery Biologist

Ned Horner
Regional Fishery Manager

INTRODUCTION

Fall Chinook salmon *Oncorhynchus tshawytscha* were introduced into Coeur d'Alene Lake in 1982 as a biological tool to help manage the kokanee *O. nerka* population to provide a yield fishery. The kokanee fishery peaked in 1979 with 578,000 fish harvested but then quickly collapsed by the early 1980s when kokanee became too numerous and stunted. Fall Chinook salmon were chosen as the preferred predator to reduce kokanee numbers for a variety of reasons: their relatively short and determined life cycle compared to other species (lake trout, Kamloops rainbow trout, walleye, brown trout), ability to manage predator/prey numbers, and the benefit provided by a Chinook fishery. Kokanee densities of 30-50 age 3 kokanee/ha provide the highest catch rates for desirable size (280 mm) fish. Chinook management goals call for greater catches of 1.5-9 kg fish rather than fewer but bigger fish. A mix of hatchery and wild Chinook are used to achieve management goals.

METHODS

On October 6, 2005, IDFG personnel used a helicopter to conduct Chinook redd surveys in the Coeur d'Alene River, North Fork Coeur d'Alene River, South Fork Coeur d'Alene River, Little North Fork Coeur d'Alene River and St. Joe River. We estimated the natural production using these redd counts at 4,000 eggs per redd, and a mean egg-to-smolt survival of 10%.

RESULTS

We counted 49 Chinook salmon redds in the Coeur d'Alene River drainage and 10 in the St. Joe River (Table 1). All redds were left undisturbed to provide natural production. Conditions for counting were favorable (clear skies and clear water), and we were able to see most redds easily. Based on redd counts, there was an estimated 4,000 eggs per redd, and a mean egg-to-smolt survival of 10%. We estimated natural smolt production for wild Chinook to be 31,000 fish in 2005.

We stocked 26,300 age-0 Chinook salmon at the Carlin Bay boat ramp in June 2005. Chinook eggs were collected at Garrison Dam National Fish Hatchery, North Dakota, hatched at Cabinet Gorge Hatchery, and reared at the Nampa Hatchery. Mean size was 160 mm and all fish were marked with a left ventral fin clip. The total age-0 hatchery and wild Chinook salmon entering Coeur d'Alene Lake in 2005 was estimated to be about 62,300 fish (Table 2).

DISCUSSION

The 26,300 hatchery Chinook salmon stocked in Coeur d'Alene Lake in 2005 were hatched at Cabinet Gorge Hatchery and reared at the Nampa Hatchery as they were in 2003. The warmer water temperatures of Nampa Hatchery allows for accelerated growth resulting in an average size of 160 mm at time of release. Over the past 22 years we have stocked an average of 31,000 age-0 Chinook salmon in Coeur d'Alene Lake (Table 2). Since 1999 we have obtained Chinook eggs from Big Springs Hatchery, Oregon. Despite being reared to a mean size of 160 mm at Nampa Hatchery, this stock of fish continues to perform poorly relative to returning to the creel.

Angler reports indicate wild Chinook continue to make up the majority of Chinook caught in Coeur d'Alene Lake. During the Lake Coeur d'Alene Anglers Association sponsored Big One Derby, 90% of the fish caught were reported to be of wild origin. An alternate source of Chinook eggs was located and in June 2005 we stocked juvenile Chinook from Lake Sacagawea, North Dakota. These fish have no known disease problems and were stocks obtained from Lake Michigan. The goal is to stock fish that hopefully have more of an innate tendency to spend their entire life cycle in freshwater as opposed to their ocean dwelling counterparts that have a strong desire to migrate to the ocean as smolts.

RECOMMENDATIONS

1. Stock 47,000 age-0 Chinook salmon in 2006 to supplement the estimated 23,000 naturally produced fish, for a combined total of 70,000 age-0 Chinook salmon smolts.

2. Continue to monitor the recovery of the kokanee population and adjust age-0 Chinook salmon supplementation accordingly.

3. Continue to encourage catch-and-keep Chinook salmon fishing.

4. Conduct creel survey during the "Big One" Chinook derby to determine extent of hatchery Chinook contribution to creel.

Table 1. Chinook salmon red counts in the Coeur d'Alene River drainage, St. Joe River, and Wolf Lodge Creek, Idaho, 1990-2005.

Location	1990	91	92	93	94	95	96	97	98	99	2000	2001	2002	2003	2004	2005
Coeur d'Alene River																
Cataldo Miss to S.F. Cd'A R	41	11	29	80	82	45	54	18	11	7	16	18	14	27	24	30
S.F. Cd'A to L.N.F. Cd'A R	10	0	5	11	14	14	13	5	3	5	20	13	10	17	36	7
L.N.F. Cd'A to Steambt Cr	--	2	3	6	1	1	13	6	1	0	3	2	6	2	4	3
Steamboat Cr to steel bridge	--	--	1	0	0	2	0	3	0	0	0	1	0	0	2	0
Steel bridge to Beaver Cr	--	--	--	--	0	0	0	1	0	0	0	0	0	0	0	0
S. F. Cd'A River	--	--	--	--	13	--	4	0	0	0	5	4	3	5	4	8
L.N.F. Cd'A River	--	--	--	--	0	2	0	0	0	0	1	0	0	0	1	1
Coeur d'Alene R Subtotal	51	13	38	97	110	64	84	33	15	12	45	38	33	51	71	49
St. Joe River																
St. Joe City to Calder	4	0	18	20	6	1	59	20	3	0	5	21	14	15	15	7
Calder to Huckleberry C.G.	3	1	1	4	0	0	5	2	1	0	0	15	4	9	3	3
Huckleberry C.G. to Marble Crk	3	0	2	0	1	0	7	2	0	0	0	--	0	3	0	0
Marble Creek to Avery	0	0	0	0	1	0	0	0	2	0	0	--	0	0	0	0
St. Joe River Subtotal	10	1	21	24	8	1	71	24	6	0	5	36	18	27	18	10
Wolf Lodge Creek	--	--	--	--	--	--	--	--	4	5	3	4	0	0	1	1
TOTAL	**66**	**14**	**63**	**121**	**118**	**65**	**155**	**57**	**25**	**17**	**53**	**78**	**51**	**78**	**90**	**59**

Table 2. Number of Chinook salmon stocked and estimated number of naturally produced Chinook salmon entering Coeur d'Alene Lake, Idaho, 1982-2005. The number of Chinook reds is the count from the previous fall.

	Hatchery Produced				Naturally Produced		
Year	Number	Stock	Rearing Hatchery	Fin Clip	Previous year redd counts	Estimated Smolts	Total
1982	34,400	Bonneville	Hagerman	--	--	--	34,400
1983	60,100	Bonneville	Mackay	--	--	--	60,100
1984	10,500	L. Michigan	Mackay	--	--	--	10,500
1985	18,300	L. Michigan	Mackay	Left Ventral	--	--	18,300
1986	30,000	L. Michigan	Mackay	Right Ventral	--	--	30,000
1987	59,400	L. Michigan	Mackay	Adipose	--	--	59,400
1988	44,600	Coeur d'Alene	Mackay	Left Ventral	--	--	44,600
1989	35,400	Coeur d'Alene	Mackay	Right Ventral	--	--	35,400
1990	36,400	Coeur d'Alene	Mackay	Adipose	52	20,800	57,200
1991	42,600	Coeur d'Alene	Mackay	Left Ventral	70	28,000	70,600
1992	10,000	Coeur d'Alene	Mackay	Right Ventral	14	5,600	15,600
1993	0	--	--	--	63	25,200	25,200
1994	17,300	Coeur d'Alene	Nampa	Adipose	100	40,000	57,300
1995	30,200	Coeur d'Alene	Nampa	Left Ventral	100	40,000	70,200
1996	39,700	Coeur d'Alene	Nampa	Right Ventral	65	26,000	65,700
1997	12,600	Coeur d'Alene	Nampa	Adipose	84	33,600	46,200
1998	52,300	Priest Rapids	Cabinet G.	Left Ventral	57	22,800	75,100
1999	25,500	Big Springs	Cabinet G.	Right Ventral	25	10,000	35,500
2000	28,000	Big Springs	Nampa	Adipose	17	6,800	34,800
2001	0	--	--	--	53	21,200	21,200
2002	41,000	Big Springs	Nampa	Left Ventral	78	31,200	72,200
2003	44,800	Big Springs	Nampa	Right Ventral	51	20,400	65,200
2004	46,000	Big Springs	Nampa	Adipose	78	31,000	77,000
2005	26,300	Garrison Dam	Nampa	Left Ventral	90	36,000	62,300

CHAPTER 3: LOWLAND LAKE SURVEYS

ABSTRACT

We conducted lowland lake surveys on Robinson, Brush, Dawson, Perkins, and Smith Lakes in 2005 with the objective of determining the extent of illegal northern pike *Esox lucius* introductions in local lakes. This was done following our discovery of northern pike in Bonner Lake in 2004 and an observation of a northern pike by a local conservation officer in Perkins Lake. No northern pike were captured.

Gamefish species comprised 91% of the fish captured by number and 84% by weight during our April, 2005 lake survey of Robinson Lake. Warmwater fish (largemouth bass *Micropterus salmoides*, bluegill *Lepomis macrochirus*, pumpkinseed *L.gibbosus* and, black crappie *Pomoxis nigromaculatus)* comprised 98% of the game fish captured. Hatchery rainbow trout *Oncorhynchus mykiss* and brook trout *Salvelinus fontinalis* made up 2% of the gamefish by number and weight. Robinson Lake has a large number of quality (150 mm) and preferred (200 mm) bluegill with PSD and RSD-200 values of 66 and 38 respectively.

Largemouth bass, bluegill and rainbow trout were the only species captured in Brush Lake. Bluegill ranged from 56 to 235 mm with a high number of quality (150 mm) and preferred (200 mm) bluegill with PSD and RSD-200 values of 54 and 22 respectively.

Yellow perch *Perca flavescens* comprised the most abundant species by number (47% of sample) and the second most abundant species by weight in Dawson Lake. One tiger muskie *Esox masquinongy* x *Esox lucius* was captured. This fish was just short of legal harvestable size (1000 mm) with a total length of 960 mm and a weight of 6.6 kg. This is similar to 1992 when two sub-legal tiger muskie were collected.

Yellow perch comprised the most abundant species by number and weight (47% and 59%, respectively) in Perkins Lake. Yellow perch ranged from 123 to 305 mm with a mean total length of 240 mm. Yellow perch condition, as indexed by relative weight (Wr) was above average for all size classes. Largemouth bass ranged from 73 to 445 mm in length and proportional stock density (PSD; Anderson 1980) was 12.

Species composition in Smith Lake consisted of largemouth bass, channel catfish *Ameirus punctatus*, brown bullhead *Ictalurus nebulosus* and hatchery rainbow trout. Largemouth bass comprised the most abundant species by number and weight (80% and 60%, respectively). Smith Lake is managed under the new Family Fishing Waters regulations with a year-round season and no length limits.

There have been numerous changes in the fish community in Hayden Lake over the last 14 years. Hayden Lake was surveyed to evaluate the status of smallmouth bass *Micropterus dolomieui*. Smallmouth bass were introduced in Hayden Lake in 1983 and 1985 and based on our sampling efforts are now the most abundant species in the lake comprising 26% of our sample. Nine northern pike were captured in 2005 ranging from 340-670 mm. During a 1993 lake survey no northern pike were captured. The illegal introduction of northern pike and stocking of smallmouth by IDFG are probably responsible for the significant changes in the fish populations in Hayden Lake.

Authors:
Mark Liter, Regional Fishery Biologist
Ned Horner, Regional Fishery Manager

INTRODUCTION

Six Panhandle Region lakes including Robinson, Brush, Dawson, Perkins, Smith and Hayden were surveyed in 2005 using the IDFG Lowland Lakes Survey Methodology. We attempt to survey lowland lakes at approximately five-year intervals with the objective being to assess fish communities and the quality of the fisheries. Many lowland lakes in the Region are stocked and these surveys also provide us with an opportunity to evaluate the current stocking rate and stocking frequency. Additionally, we were interested in determining the extent of illegal northern pike *Esox lucius* introductions in lakes in the proximity of Bonner Lake following our discovery of northern pike there in 2004.

METHODS

As outlined in the IDFG Standard Lowland Lakes Survey Manual we used two trap nets, two floating and two sinking gillnets set overnight, and one hour of electrofishing effort on each lake, except Hayden Lake. Because of its size we used eight trapnets, five floating, two sinking gillnets and three hours of electrofishing on Hayden Lake. Hayden Lake was netted May 16-18 and electrofished the nights of May 17-18.

Brush Lake was netted and electrofished on the night of April 11. Dawson Lake was netted and electrofished on the night of April 4. Perkins Lake was netted and electrofished on the night of April 20. Robinson Lake was netted and electrofished on the night of April 14. Smith Lake was netted and electrofished on the night of April 26. We used a Smith-Root SR-16 electrofishing boat to assess fish populations. Electrofishing was conducted at night concentrating our efforts along the shoreline and attempting to collect all species. Gillnets and trapnets were set perpendicular to shore at dusk and retrieved the following morning.

After capture, fish were identified, weighed, and measured to the nearest millimeter. Length and weight data for warmwater species were then used to estimate relative weight (Wr) or a measure of “plumpness” of fish (Blackwell et al. 2000). Largemouth bass *Micropterus salmoides* lengths were also used to estimate proportional stock density (PSD; Anderson 1980) or the percentage of fish >300 mm (Anderson 1980) and relative stock density (RSD) or the percentage of fish >400 mm.

Estimates were used to compare fish populations against stock density index ranges for balanced fish populations (Willis et al. 1993). In addition, condition of fish was indexed using relative weight (Wr), represented by the equation:

$$Wr=(W/Ws) * 100$$

Where W is the weight of an individual fish and Ws is a length-specific standard weight resultant of a weight:length regression representative of the species:

$$\log_{10}(Ws) = a' + b * \log_{10}(L)$$

Where a′ is the intercept and b is the slope and L is the total length of the individual fish. Values were calculated by 10 mm length categories and missing values were estimated. Mean Wr values of 100 indicate ecological and physiological optimals.

ROBINSON LAKE

Study Area

Robinson Lake is a shallow, eutrophic, 24 ha natural lake located in northeastern Boundary County, 2.5 km south of the Canadian border (Figure 1). The U.S. Forest Service (USFS) operates a fee campground facility on the southwestern side of the lake and a free boat launch on the northeastern side of the lake.

Robinson Lake provides both cold- and warmwater fisheries. Six to ten thousand catchable rainbow *Oncorhynchus mykiss* trout have been stocked annually since the 1980s. Fingerling brook trout *Salvelinus fontinalis* were stocked in 1995 and 1997. Gillion Creek supports some natural reproduction of brook trout (Fredericks and Horner 1998). Largemouth bass and pumpkinseed *Lepomis gibbosus* provided the warmwater fishery until 1989, when bluegill *L. macrochirus* were stocked.

Robinson Lake is somewhat “U-shaped” with two distinct habitat types connected by a narrow gap (Figure 1). The larger portion is shallow (mean depth 2 m, max depth approximately 3 m), macrophyte covered, and provides extensive littoral habitat. The northwestern portion of the lake is deeper (maximum depth approximately 7 m) with macrophyte cover restricted to the shoreline (Fredericks and Horner 1998). Large woody debris provides extensive cover around the shoreline of Robinson Lake.

Prior to the 1930s inflow was limited to springs and local runoff. Because of the mean depth and extensive macropyte growth, and lack of significant flow, the lake was subject to winter kill during extended periods of ice cover. Additionally, summer water temperatures limited coldwater fish habitat to a small portion of the lake. In the 1930s IDFG excavated a water diversion from Gillion Creek to provide supplemental inflow. The project was a success, providing improved trout habitat and winter survival; however, during summer periods of thermal stratification, trout habitat is restricted to a limited range of depths (5-6 m) in the northwestern portion of the lake (Fredericks and Horner 1998).

The current regulation for bass on Robinson Lake provides a catch and release period from January 1 to June 30 and a catch and keep season from July 1 through December 31. Daily bags and possession limit for bass is 2 fish, none under 16”. Robinson Lake is managed under statewide general bag and possession limits for all other species and is managed as “Electric Motors Only” lake under IDFG fishing regulations.

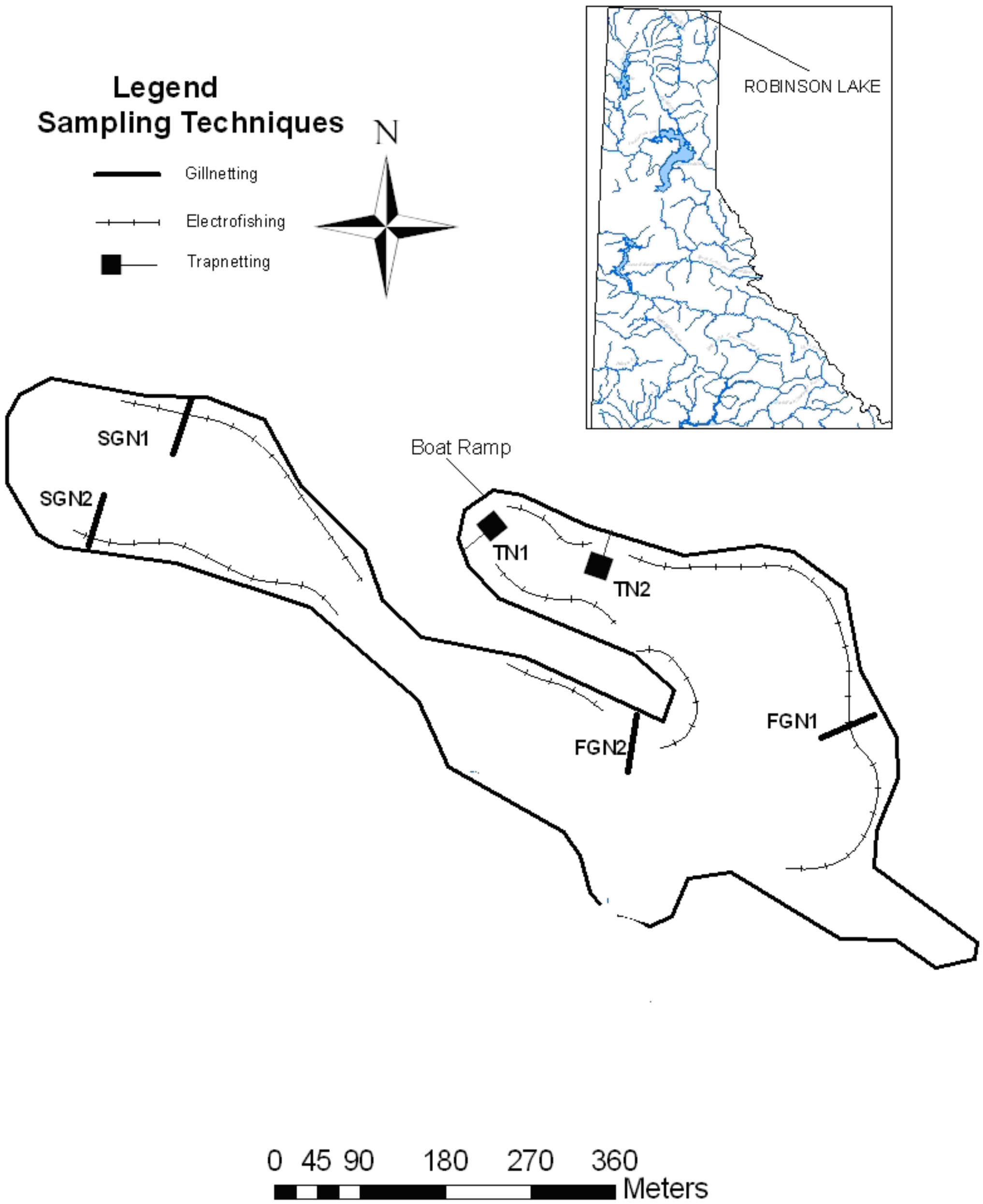


Figure 1. Map of Robinson Lake, Idaho showing gill net and trap net locations and electrofishing transects used during April, 2005 lowland lake survey.

RESULTS

Gamefish species composition included largemouth bass, bluegill, pumpkinseed, rainbow trout, brook trout, and black crappie *Pomoxis nigromaculatus*. Nongame species composition included longnose sucker *Catostomus catostmus*, largescale sucker *C. macrocheilus* and brown bullhead *Ameirus nebulosus*. Gamefish species comprised 91% of the fish captured by number and 84% by weight. Warmwater fish (largemouth bass, bluegill, pumpkinseed, and black crappie) comprised 98% of the game fish captured. Hatchery rainbow trout and brook trout made up 2% of the gamefish by number and weight.

Bluegill comprised the most abundant species by number (40% of sample) (Figure 2) and the second most abundant by weight (27%) (Figure 3). Robinson Lake was last surveyed in 1997 when bluegill comprised 20% of the sample by number. Bluegill ranged in length from 45-216 mm (Figure 4). Robinson Lake has a very large number of quality (150 mm) and preferred (200 mm) bluegill with PSD and RSD-200 values of 66 and 38 respectively. Bluegill condition, as indexed by relative weight (Wr) ranged from 93 to 115 for bluegill from 80 to 210 mm.

We collected 118 largemouth bass (24% of the total sample) per combined unit of sampling effort. Largemouth bass ranged from 59 to 526 mm in length (Figure 5) and comprised 41% of the sample by weight (Figure 3). Proportional stock density (PSD; Anderson 1980) (percentage of fish >300mm) was 14 and RSD-400 (percentage of fish >400 mm) was 7.

Pumpkinseed was the third most abundant species captured comprising 28% of the sample by number and 14% by weight (Figure 3). Pumpkinseed ranged from 34 to 206 mm long.

Six rainbow trout were captured comprising 1% of the sample by number and weight. Rainbow trout were presumed to be of hatchery origin and stocked as catchables. Rainbow trout ranged from 230 to 290 mm. We also captured four brook trout ranging in length from 238 to 331 mm.

Nongame species collected included largescale sucker, longnose sucker, and brown bullhead. Non-game fish species comprised 8% of the sample by number and 16% by weight (Figure 3).

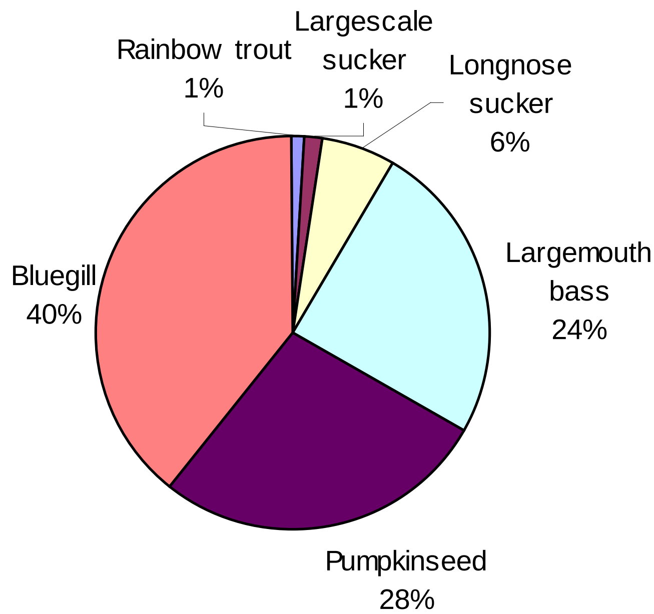


Figure 2. Relative abundance, by number, of all species collected during lowland lake survey of Robinson Lake, Idaho, April 2005. Brown bullhead, black crappie, and brook trout contributed less than 1% to the total catch.

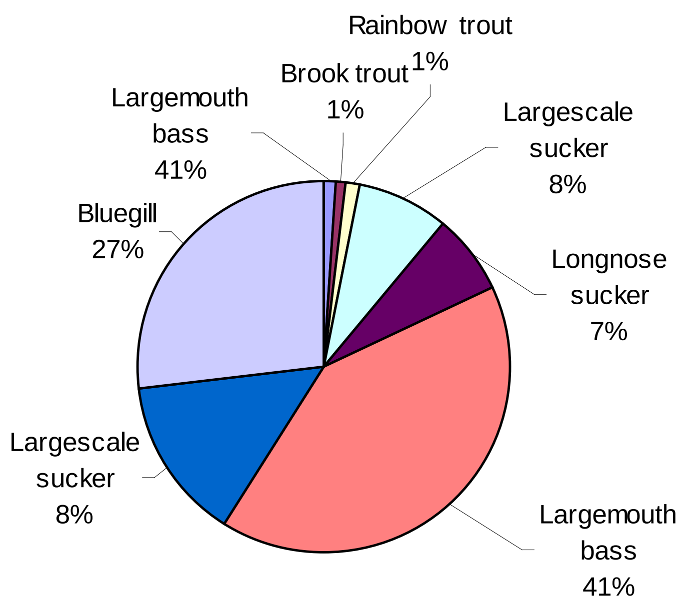


Figure 3. Relative abundance, by weight, of all species collected during lowland lake survey of Robinson Lake, Idaho, April 2005. Black crappie contributed less than 1% to the total catch.

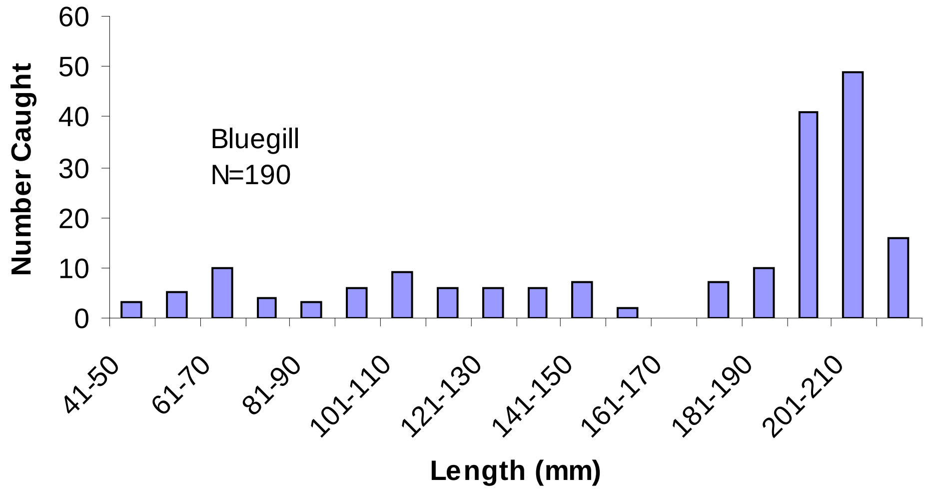


Figure 4. Length frequency of bluegill collected during lowland lake survey of Robinson Lake, Idaho, April, 2005.

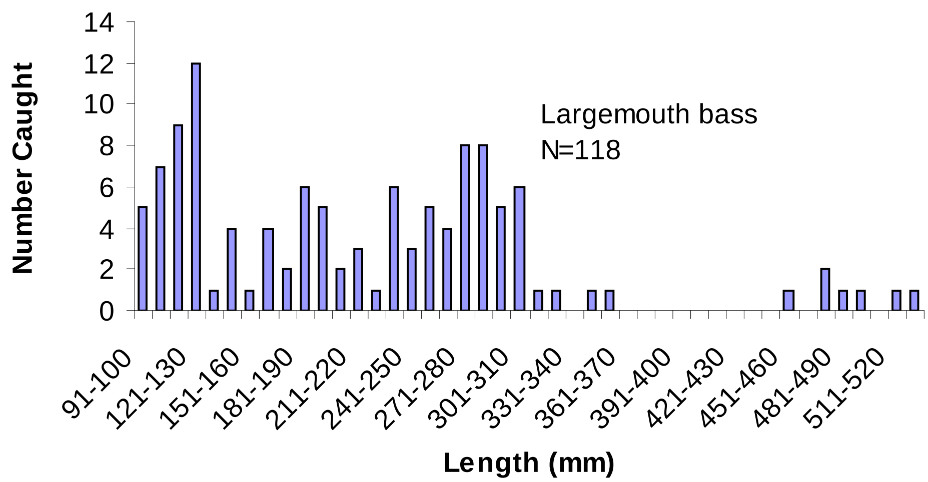


Figure 5. Length frequency of largemouth bass collected during lowland lake survey of Robinson Lake, Idaho, April, 2005.

DISCUSSION

Bluegill were introduced in Robinson Lake in 1989 when 408 adults were stocked. Angler reports indicate that bluegill continue to provide a quality fishery with fish ranging from 200-250 mm in the creel. In 2005 bluegill were the most abundant species captured making up 40% of our sample compared to 27% in a similar survey in 1997, the last time Robinson Lake was surveyed. Number of larger fish also increased since our 1997 survey. In 1997 the number of quality size bluegills >150 mm; (PSD) was 30 and the RSD-200 was only one. In 2005 the PSD improved to 65 and RSD-200 improved to 38. Relative weight of Robinson Lake bluegills ranged from 93 to 115 for bluegill from 80 to 210 mm. The high condition factor of Robinson Lake bluegill may be a function of seasonal dynamics as sampling occurred in April. Pope and Willis (1996) concluded that spring female spawners typically had the highest conditions in the spring just prior to spawning.

BRUSH LAKE

Study Area

Brush lake is an 11.8 ha natural lake located in northeastern Boundary County, and is surrounded by USFS land (Figure 6). An earth-filled dam washed out in 1955 resulting in a loss of one meter of depth in Brush Lake. In the early 1970s IDFG proposed to rebuild the dam to re-establish lake levels and improve trout habitat but controversy with local landowners relative to water rights disputes resulted in no action to rebuild. The shoreline is forested, relatively steep, and rocky. The USFS maintains an overnight camping facility and boat ramp on the south end of the lake.

Brush Lake was renovated in 1950 to eliminate abundant populations of redside shiners *Richardsonius balteatus* and suckers *Catostomus spp*. The lake is currently stocked with 5,000 triploid rainbow trout and low densities of kokanee *Oncorhynchus nerka* fry when available. Bluegill were introduced in 1989 when 238 adults were stocked. Brook trout were stocked in 1995 and 1997. Brush Lake was last surveyed in 1997.

Brush Lake has a maximum depth of 7 m and a mean depth of 3.8 m. Based on a mid-summer dissolved oxygen (D.O.) profile, Fredericks (1998) classified Brush Lake as eutrophic.

Brush Lake is managed under statewide general bag and possession limits which includes being open all year and a 6 bass limit with none under 12”. The current regulation for trout on Brush Lake is 6 trout, no size limit. Brush Lake is managed as an “Electric Motors Only” lake under IDFG fishing regulations.

RESULTS

The catch per unit effort of combined sampling was 361 fish with an estimated total weight of 47 kg compared to the 1997 survey with identical effort when 327 fish were collected totaling 32.93 kg.

Gamefish species comprised 100% of the fish captured as species composition consisted of largemouth bass, bluegill and rainbow trout. Warmwater fish (largemouth bass and bluegill) composed 95% of the game fish captured by number and 86% by weight (Figures 7 & 8). Hatchery rainbow trout made up 5% of the gamefish by number and 14% by weight.

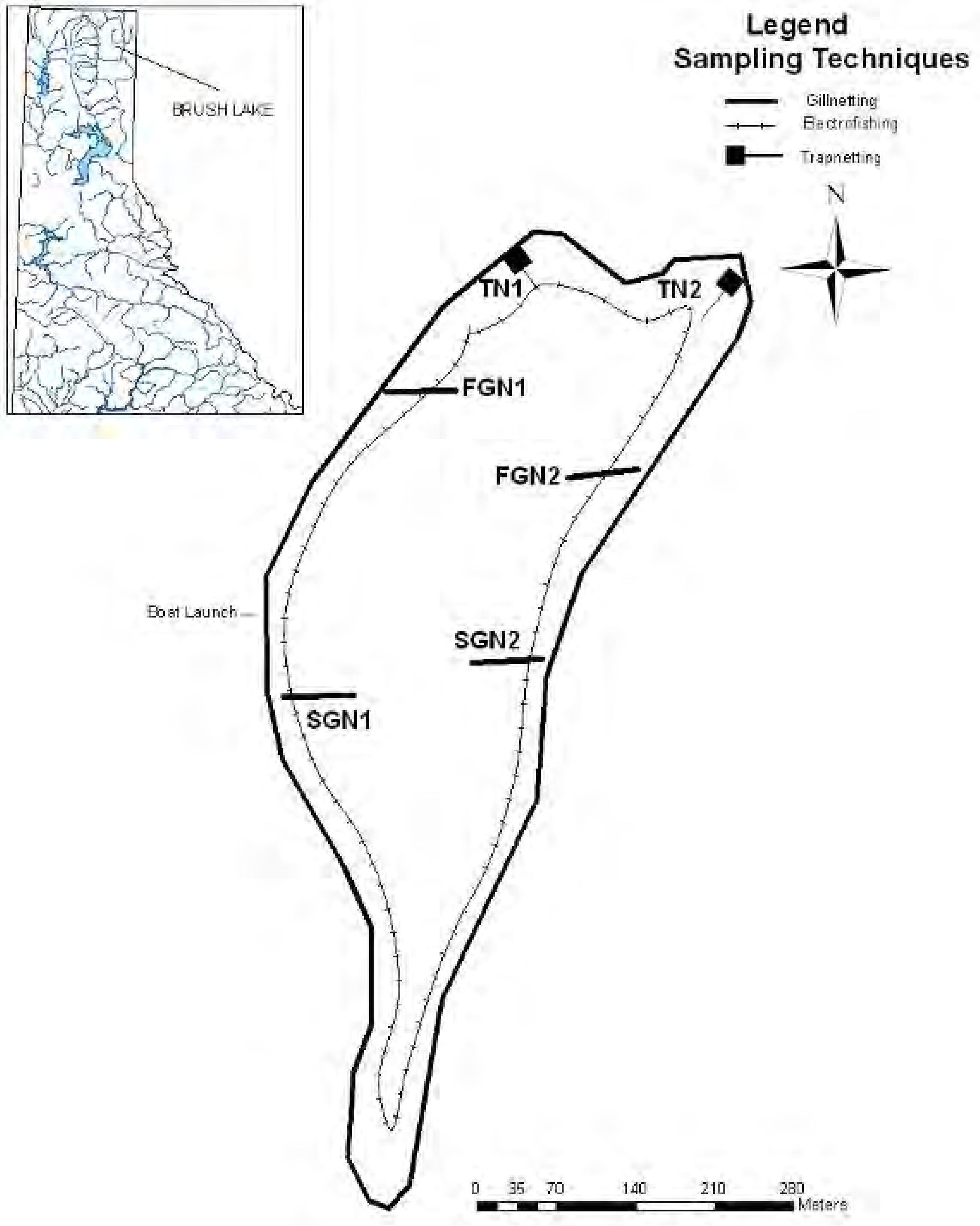


Figure 6. Map of Brush Lake, Idaho showing gill net and trap net locations and electrofishing transects used during April, 2005 lowland lake survey.

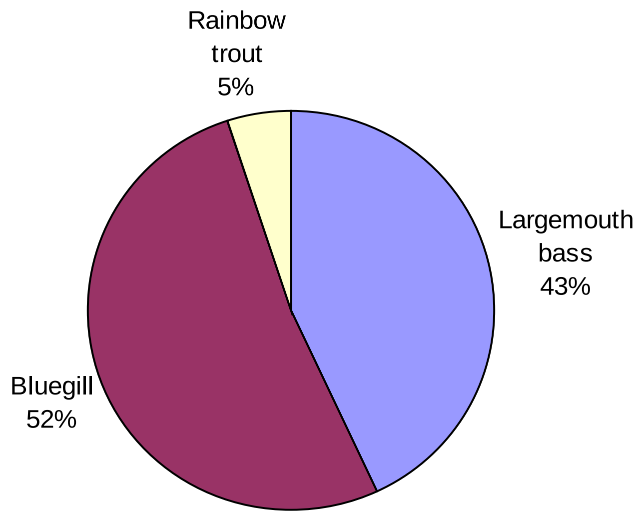


Figure 7. Relative abundance, by number, of all species collected during the lowland lake survey of Brush Lake, Idaho, April 2005.

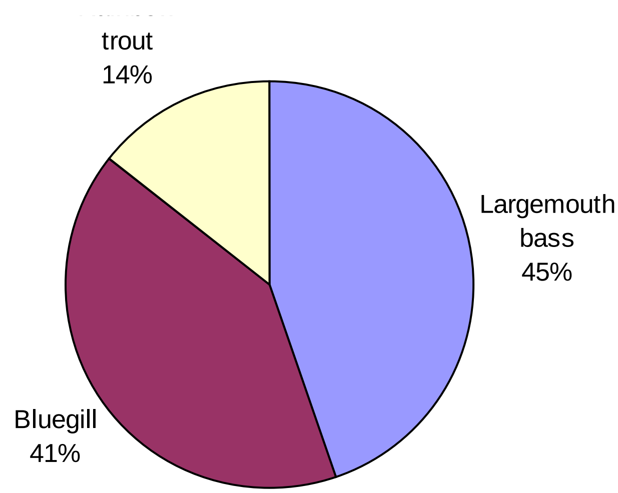


Figure 8. Relative abundance, by weight, of all species collected during the lowland lake survey of Brush Lake, Idaho, April 2005.

Bluegill was the most abundant species collected by number (52%) compared to 65% during the 1997 lake survey. Bluegill comprised 41% of the sample by weight compared to 38.5% by weight in the 1997 survey. Bluegill ranged from 56 to 235 mm (Figure 9) with a high number of quality (150 mm) and preferred (200 mm) bluegill with PSD and RSD-200 values of 54 and 22 respectively. Bluegill condition, as indexed by relative weight (Wr) was very good. Relative weight of Brush Lake bluegills ranged from 106 to 125 for bluegill from 80 to 235 mm long.

We collected 156 largemouth bass, 43% of the total sample by number and 45% by weight per combined unit of sampling effort. Largemouth bass ranged from 60 to 419 mm in length with only two fish greater than 300 mm (Figure 10). Proportional stock density (PSD; Anderson 1980) was very low at 1 illustrating the very low percentage of quality size (>300 mm) bass. During the 1997 survey, PSD was reported at 9.

Nineteen rainbow trout were captured comprising 5% of the sample by number and 14% by weight. Rainbow trout were presumed to be of hatchery origin and stocked as catchables. Rainbow trout ranged from 270 to 382 mm.

DISCUSSION

As in the 1997 lake survey largemouth bass, bluegill and rainbow trout were the only species collected in Brush Lake. Relative to other lakes in this study bass are abundant but the length frequency suggests that mortality of bass over 12 inches may be fairly high. We collected 156 largemouth bass; however, only 2 fish were over 300 mm (12 inches). Largemouth bass relative weights were slightly above average indicating the lack of larger fish is not related to stunting but rather to high fishing mortality.

Fredericks (1998) reported a lack of large bluegills in the 1997 survey and speculated that this was likely the result of a young population and size structure would likely improve as the population ages. Today Brush Lake is probably the best bluegill fishery in the Panhandle Region. Bluegill comprised 52% of the sample by number, ranging from 56 to 235 mm in length (Figure 8) with a high number of quality and preferred size bluegills. Relative weights of bluegill in Brush Lake were also very good.

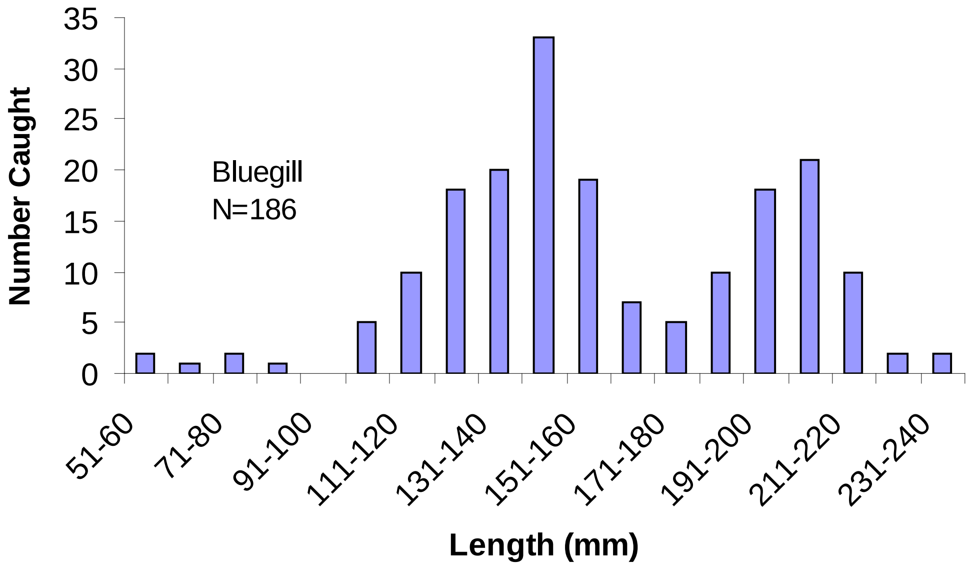


Figure 9. Length frequency of bluegill collected during lowland lake survey of Brush Lake, Idaho, April 2005.

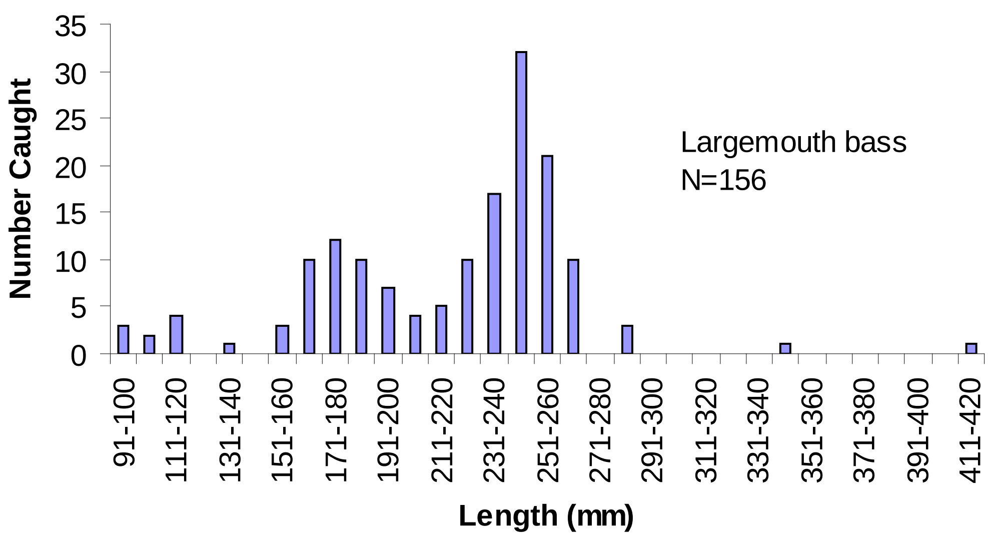


Figure 10. Length frequency of largemouth bass collected during lowland lake survey of Brush Lake, Idaho, April 2005.

DAWSON LAKE

Study Area

Dawson Lake is a 14.2 ha natural lake located approximately 6.5 km north of Moyie Springs, Idaho (Figure 11). Dawson Lake and the surrounding upland area (200 acres total) were purchased by IDFG in 1970. IDFG maintains a free boat launch and a pre-cast cement restroom on the northeastern side of the lake.

Dawson Lake has a maximum depth of 5.5 m and a mean depth of 4 m with an extensive littoral area.

In 1989 IDFG selected Dawson Lake for new warmwater fish introductions. Channel catfish *Ictalurus punctatus*, tiger muskie *Esox masquinongy* x *Esox lucius,* and bluegill were stocked. Channel catfish were stocked from 1989 to 1993 (2,000/yr). Tiger muskie were stocked from 1989 to present with 35 to 110 fish stocked per year, depending on availability. In 1990 *Gammurus* shrimp were introduced in an attempt to provide additional food for fish.

Dawson Lake was last surveyed in 1992 to evaluate the success of warmwater introductions. The combined sampling effort during the survey included identical effort with gillnets and trapnets, however, their effort included only 0.65 units of electrofishing effort. This is mentioned because of comparisons made between the 1992 and 2005 surveys.

Dawson Lake is managed under statewide general bag and possession limits which include open all year and a 6 bass limit with none under 12”. The current regulation for trout on Dawson Lake is 6 trout, no size limit. Dawson Lake is also managed as “Electric Motors Only” under IDFG fishing regulations.

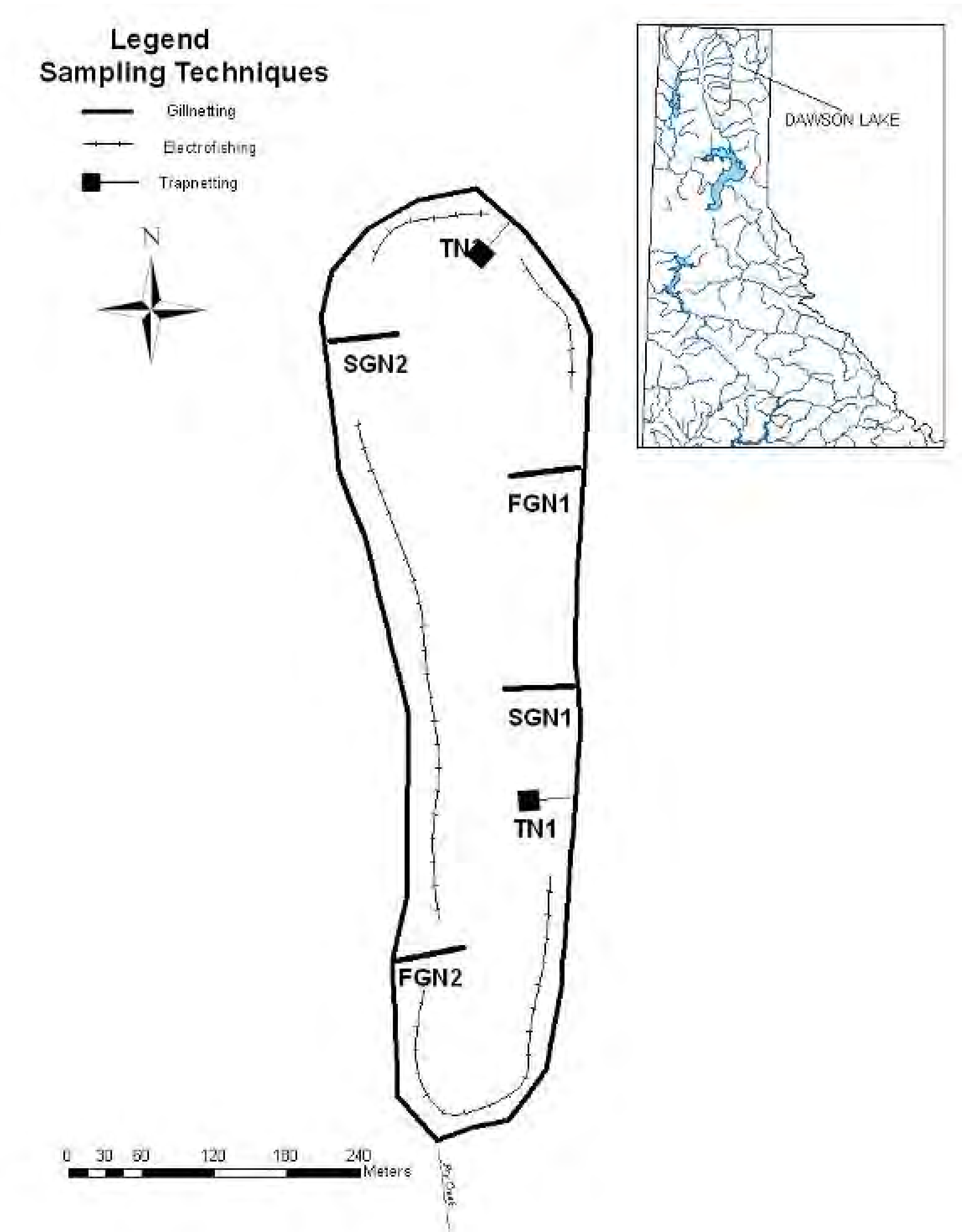


Figure 11. Map of Dawson Lake, Idaho showing gill net and trap net locations and electrofishing transects used during April 2005 lowland lake survey.

RESULTS

In addition to the most recent species introductions in 1989, there remains a good population of largemouth bass, black crappie, and yellow perch. Gamefish species were the only species captured. One tiger muskie and no channel catfish were captured in our 2005 survey.

Yellow perch comprised the most abundant species by number (47% of sample) and the second most abundant species by weight (20%; Figures 12 & 13). This is a marked increase from 1992 when yellow perch made up only 14% of the sample. Yellow perch lengths ranged from 110 to 260 mm (Figure 14). Yellow perch condition, as indexed by relative weight (Wr) was fair. Relative weight of yellow perch in Dawson Lake ranged from 93 to 96 for fish from 80 to 230 mm long.

Largemouth bass was the second most abundant species collected (48) comprising 17% of the total sample by number and 38% by weight per combined unit of sampling effort. This is a slight decrease from the 1992 survey when largemouth bass made up 25 % of the sample. Largemouth bass ranging from 60 to 470 mm in length were captured (Figure 15). Proportional stock density (PSD; Anderson 1980) was 29 and RSD-400 was 14. Relative weights for largemouth bass in Dawson Lake were below average ranging from 87 to 95 for bass ranging from 80 to 330 mm long.

Bluegill was the third most abundant species collected in 2005. Bluegill comprised 12% of the sample by number compared to 10% in 1992. Bluegill ranged in length from 110 to 210 mm. Relative weights of bluegill in Dawson Lake were slightly above average for fish less than 150 mm and below average for bluegill greater than 150 mm.

One tiger muskie was captured in the sampling effort. This fish was just short of legal harvestable size (1000 mm) with a total length of 960 mm and a weight of 6.6 kg. This is similar to 1992 when two sub-legal muskie were collected.

Black crappie comprised only 13% of the sample by number and 11% of the sample by weight, a marked decline from the 1992 survey when black crappie comprised 40% of the sample by number.

DISCUSSION

In 1989 IDFG selected Dawson Lake for new warmwater fish introductions. The results of our 2005 lake survey indicate warmwater species compose 100% of the species composition. The introduction of bluegill appears to be a success and is providing year-round angling opportunity. Abundance of bluegill captured during our lake survey was almost identical to the 1992 survey and bluegill relative weighs were near average.

Channel catfish were introduced in 1989 and have been stocked three years since at a rate of 2,000, 75-152 mm fish/year. During the 1992 lake survey only one channel catfish was captured and we did not capture any in our 2005 survey. It appears this introduction is a failure and any future plans to stock Dawson Lake with channel catfish should be reconsidered.

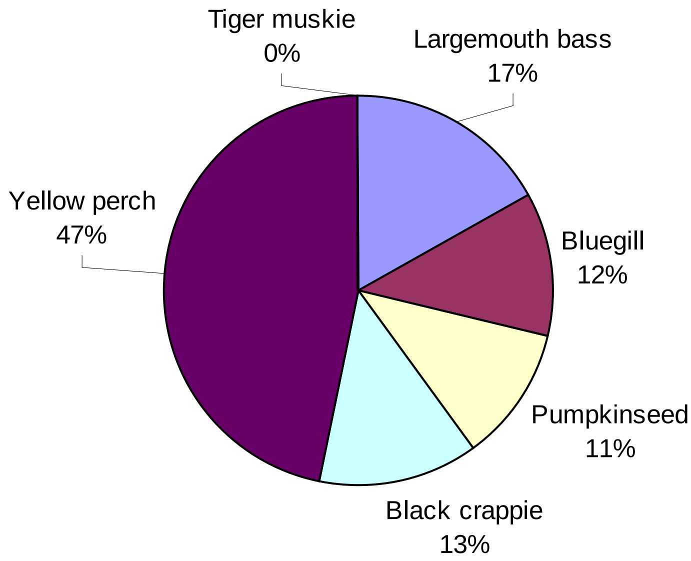


Figure 12. Relative abundance, by number, of all species collected during the lowland lake survey of Dawson Lake, Idaho, April 2005.

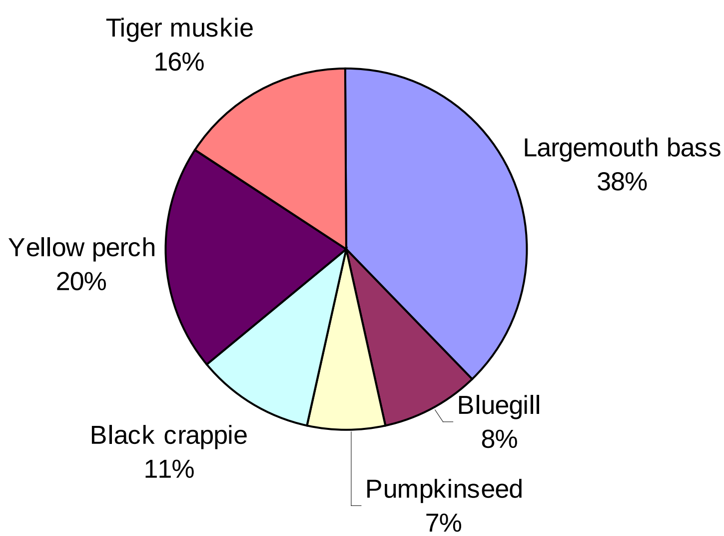


Figure 13. Relative abundance, by weight, of all species collected during the lowland lake survey of Dawson Lake, Idaho, April 2005.

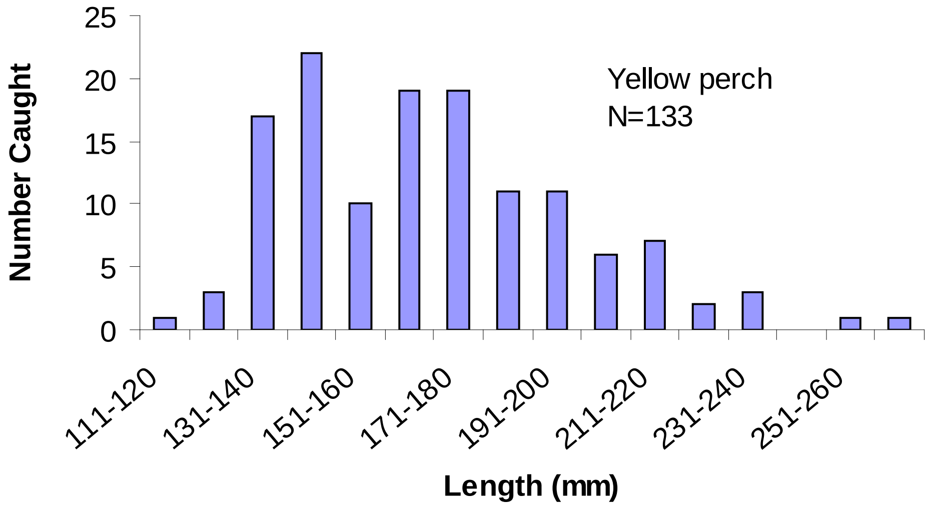


Figure 14. Length frequency of yellow perch collected during the lowland lake survey of Dawson Lake, Idaho, April, 2005.

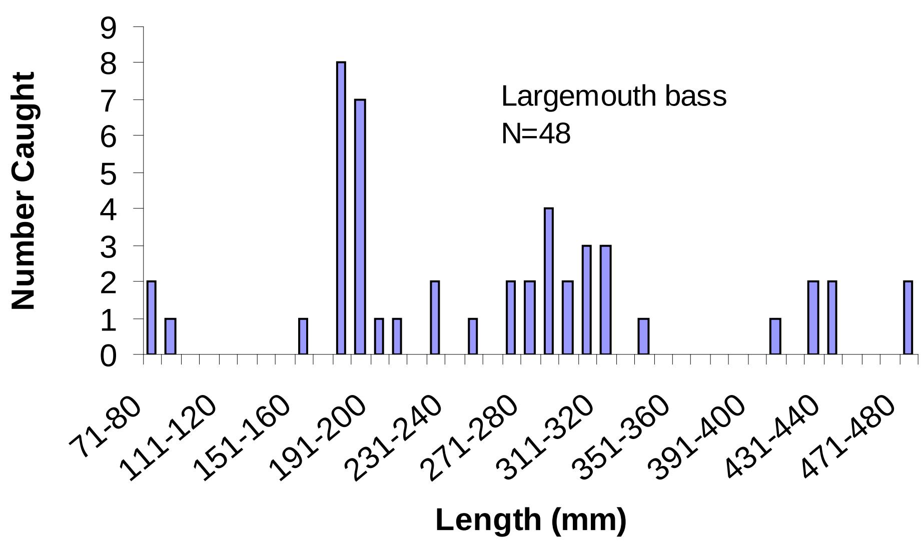


Figure 15. Length frequency of largemouth bass collected during the lowland lake survey of Dawson Lake, Idaho, April 2005.

Tiger muskies were also introduced in Dawson Lake in 1989. During the 1992 lake survey, two tiger muskie were captured and only one was captured in 2005. Stocking rates have not been consistent as they are based on availability and a consistent source of quality fish has not been identified. Survival of tiger muskies seems to be proportionate to size. We attempt to stock larger fingerlings (>300 mm) to reduce predation by bass and other pike. Tiger muskies attract intensive fishing pressure and there are few caught and released once they reach legal size (40 in). A consistent source of disease free tiger muskie needs to be identified and stocking continued due to the popularity and uniqueness of this fishery.

PERKINS LAKE

Study Area

Perkins Lake is located approximately 4.5 mi northeast of Moyie Springs, Idaho (Figure 16). No public docks or boat ramp exist, however, small boats are able to launch from the edge of the county road. Perkins Lake was treated in 1955 and 1968 for stunted sunfish, however, treatment failed to keep sunfish under control. A wide variety of warmwater and salmonid fishes have been stocked in Perkins Lake over the years. Largemouth bass were introduced in 1972 when 8 hook-and-line caught bass from Dawson Lake were transplanted. Brook trout were initially stocked in Perkins Lake in 1956. Perkins Lake was stocked with 2,000 to 30,000 brook trout fry or fingerlings each year from 1969 to 1998. Splake (brook trout x lake trout) were introduced in 1990 and stocked at a rate of 500 fingerlings per year for three years. In 1972 12 anglers caught crappie, probably from Dawson Lake, and these were planted in Perkins Lake. In 1972 and again in 1996, 2,000-13,000 cutthroat trout fry and fingerlings were stocked in Perkins Lake.

Little fish population data exists for Perkins Lake. A limited gill net survey in 1987 reported mean length of largemouth bass was small (220 mm) and did not reach the 12 in. minimum size harvest limit; however, mean size of pumpkinseeds and black crappie were quite good in comparison to those of other lakes (Horner et al. 1987). No mention of any salmonid species was made in the 1987 report.

Perkins Lake is managed under statewide general bag and possession limits which include being open all year and a 6 bass limit with none under 12”. The current regulation for trout on Perkins Lake is 6 trout, no size limit. Perkins Lake is also managed as “Electric Motors Only” under IDFG fishing regulations.

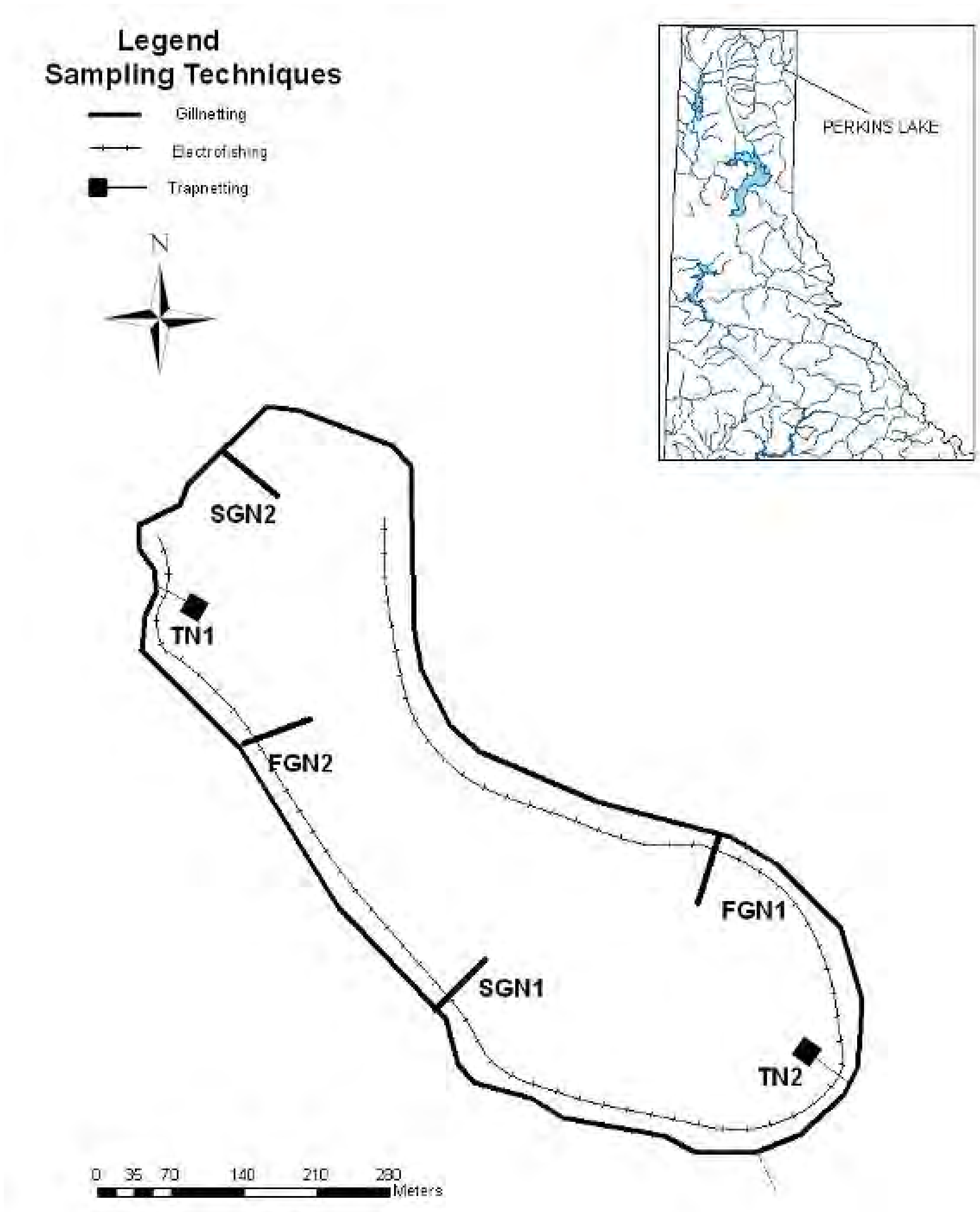


Figure 16. Map of Perkins Lake, Idaho, showing gillnet and trapnet locations and electrofishing transects used during 2005 lake survey.

RESULTS

Yellow perch comprised the most abundant species by number and weight (47% and 59%, respectively; Figures 17 and 18). Yellow perch ranged from 123 to 305 mm in length with a mean total length of 240 mm (Figure 19). Yellow perch condition, as indexed by relative weight (Wr) was above average for all size classes. Relative weight of yellow perch in Perkins Lake ranged from 115 to 104 for yellow perch from 80 to 300 mm long.

Largemouth bass was the second most abundant species collected (N=157) comprising 23% of the total sample by number and weight per combined unit of sampling effort. Largemouth bass ranged from 73 to 445 mm in length (Figure 20). Proportional stock density (PSD; Anderson 1980) was 12. Relative weights for largemouth bass in Dawson Lake were near average ranging from 142 to 85 for bass 80 to 330 mm long.

A total of 73 black crappie were captured in 2005, ranging from 111 to 320 mm with a mean length of 192 mm (Figure 21). No salmonid species were captured during our 2005 lake survey.

DISCUSSION

The yellow perch length frequency was heavily skewed with the majority of fish greater than 200 mm long, and few fish under 180 mm. This may be a function of predation by largemouth bass. Perkins Lake is managed under statewide general bag and possession limits which include open all year and a 6 bass limit with none under 12”. The population structure is similar to Robinson, Brush, Smith and other Boundary County lakes and suggests that fishing mortality may be fairly high and largemouth bass survival beyond the 12 inch minimum size limit is poor. A second possible explanation for the heavily skewed length frequency is the tendency of yellow perch to exhibit inconsistent year classes from year to year. Yellow perch spawn in early spring and do not construct any sort of nest. The eggs when deposited can be cast ashore by wind and waves and lost, therefore, weather conditions in the 8-10 days following spawning can dictate year class strength on yellow perch.

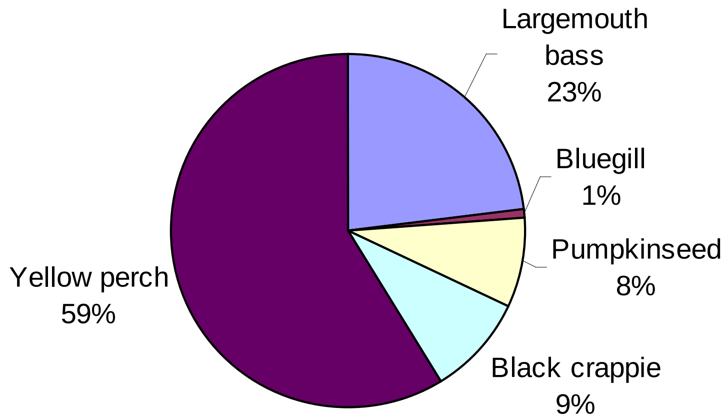


Figure 17. Relative abundance, by number, of all species collected with gill nets, trap nets and electrofishing during lowland lake survey of Perkins Lake, Idaho, 2005. Brook trout and brown trout contributed less than 1% to the total catch.

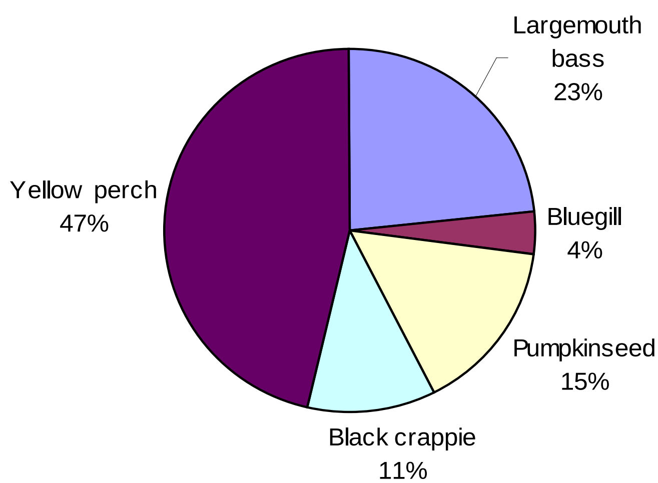


Figure 18. Relative abundance, by weight, of all species collected during the lowland lake survey of Perkins Lake, Idaho, 2005. Brook trout and brown trout contributed less than 1% to the total catch.

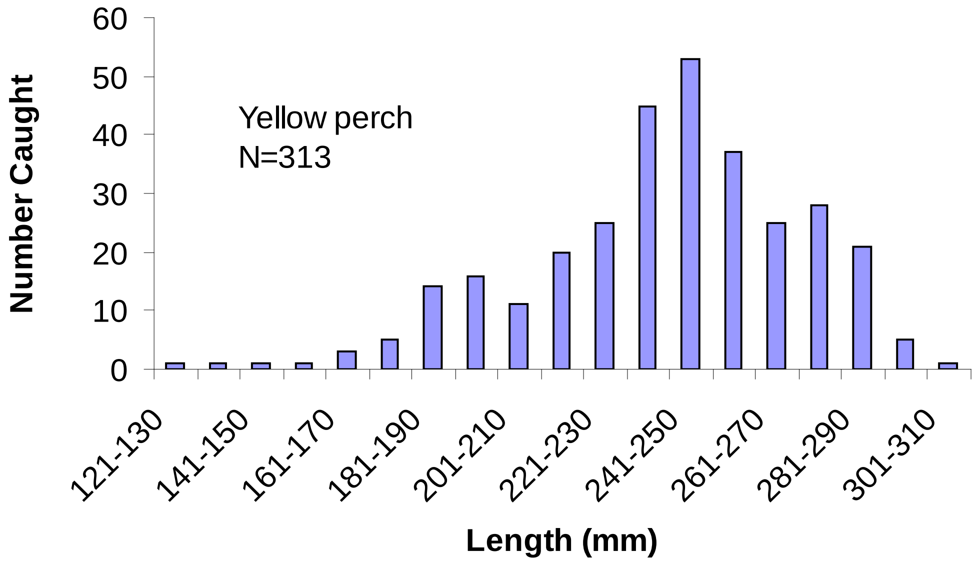


Figure 19. Length frequency of yellow perch collected during the lowland lake survey of Perkins Lake, Idaho, 2005.

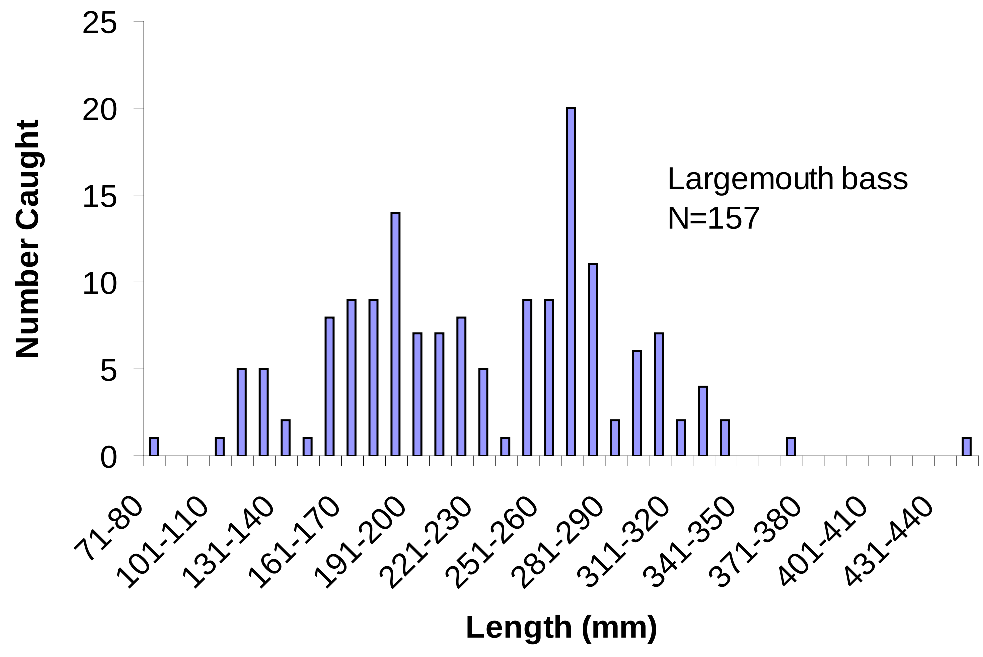


Figure 20. Length frequency of largemouth bass collected during the lowland lake survey of Perkins Lake, Idaho, April 2005.

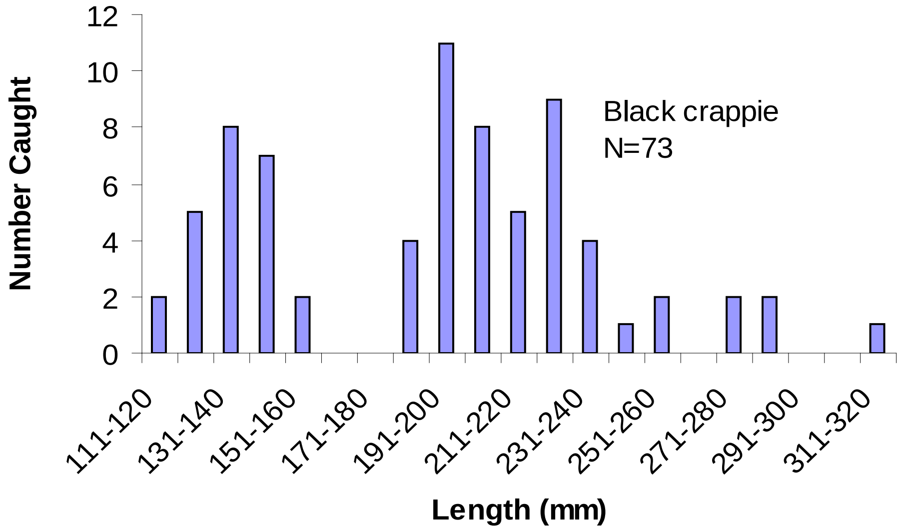


Figure 21. Length frequency of black crappie collected during the lowland lake survey of Perkins Lake, Idaho, April 2005.

SMITH LAKE

Study Area

Smith Lake is located approximately 8 kilometers north of Bonners Ferry, Idaho (Figure 22) nestled in rolling, timbered hills. The USFS developed a camping and picnic area including a boat launch and fishing dock. Smith Lake is one of a series of small lakes located about 300 m above the Kootenai Valley floor at an elevation of 914 m. The lake has a surface area of 15.4 ha, a maximum depth of 11 m, and a mean depth of 6.7 m. The south end of the lake has a small area of marl bottom with extensive growths of aquatic vegetation while the remainder to the lake shoreline is mud or sand.

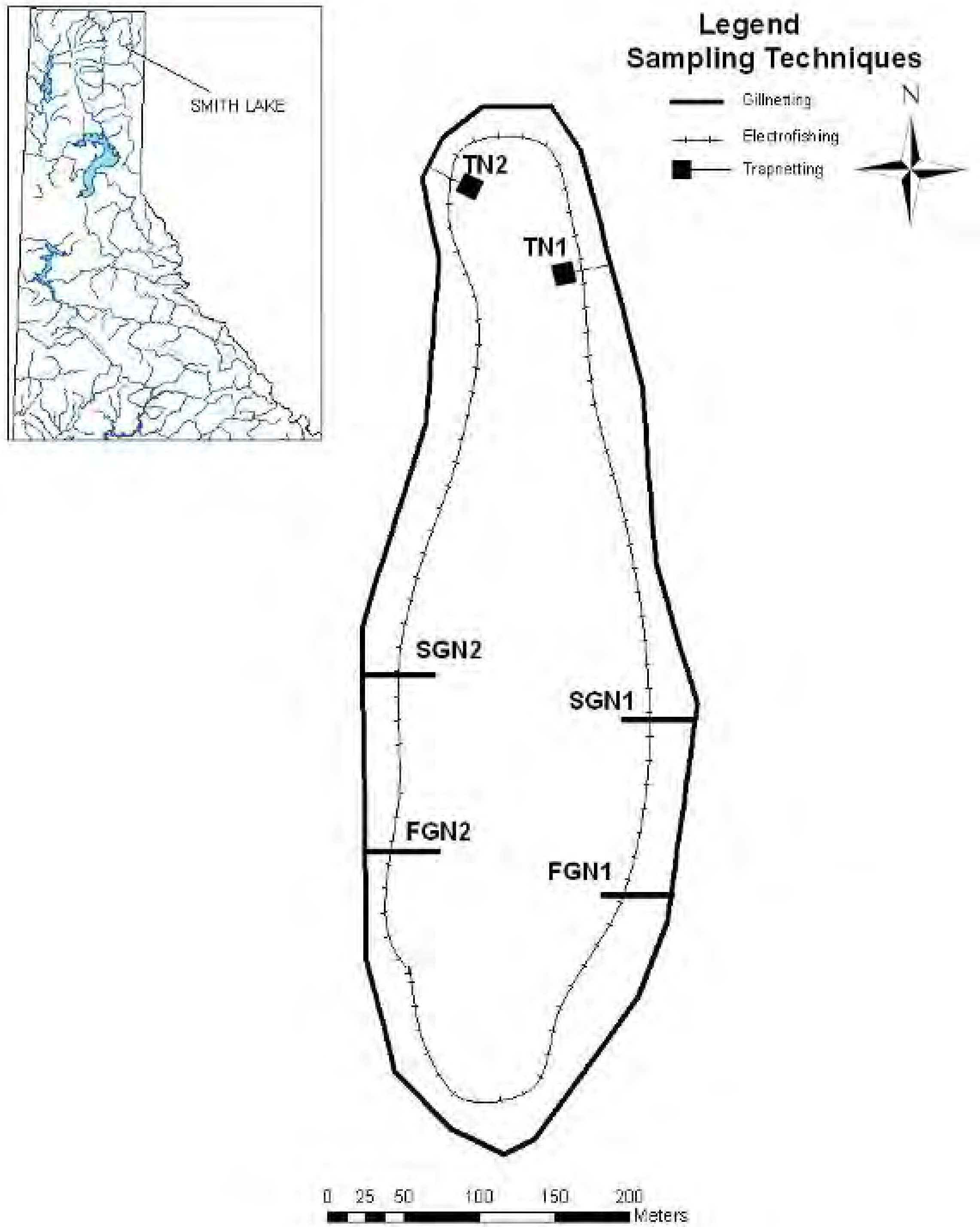


Figure 22. Map of Smith Lake, Idaho, showing gillnet and trapnet locations and electrofishing transects used during 2005 lake survey.

From 1950 through 1979, utilization of the water resource found in Smith Lake satisfied both industrial and public recreational use. An irrigation ditch transported surface water from Smith Lake to implement the growth of hops in the valley. Around 1980 a 10" siphon line, extending into the lake was constructed to transport additional water to hops fields. In recent years summer drawdown has resulted in the boat dock and ramp becoming unusable during late summer.

The first fish survey mentioned in IDFG records dates back to July 1950. At that time Smith Lake was found to contain small largemouth bass and pumpkinseed and a few but large yellow perch. Smith Lake was treated in 1950 with the intent being to remove stunted warmwater fish and restock with salmonids. The lake was surveyed using gill nets in 1983 with rainbow trout, largemouth bass and bullheads being the only species reported.

IDFG stocking records dating back to 1967 indicate extensive fish stocking in Smith Lake over the years. Various stocks of rainbow trout including domestic Kamloops, Eagle Lake, Hayspur triploid, Hayspur rainbow, Mt. Lassen, Trout Lodge triploid and several unspecified stocks of rainbow have been stocked since 1967. Rainbow trout stocking rates varied from 3,000 to 8,000 fingerlings per year. Westslope cutthroat were stocked from 1989 to present at rates ranging from 150 to 10,000 fingerlings each year. Late and early spawning kokanee have been stocked in Smith Lake through most of the 1980s, continuing today. Kokanee have been stocked most years since 1982 at a rate of 1,000 to 5,000 fry each year with an occasional stocking of 1,000 fingerlings.

Smith Lake is managed under Family Fishing Waters regulations with a year-round season. Family Fishing Waters were established in response to angler requests for more family-oriented fishing opportunities and simplified rules. All Family Fishing Waters in the state have a six fish limit for trout, bass, walleye and pike with no length limits. There is no bag limit for other species. Smith Lake is also managed as "Electric Motors Only" under IDFG fishing regulations."

RESULTS

Gamefish species comprised 100% of the fish captured in Smith Lake. Species composition consisted of largemouth bass, channel catfish, brown bullhead and hatchery rainbow trout. Largemouth bass comprised the most abundant species by number (N=253) and weight (80% and 60%, respectively). Hatchery rainbow trout were the second most abundant species collected (N=65) comprising 20% of the total sample by number and 35% of the sample by weight per combined unit of sampling effort. One 495 mm channel catfish was captured. Stocking records for Smith Lake do not include channel catfish (Figures 23 and 24).

Largemouth bass collected were small ranging from 111 to 271 mm with a mean total length of 198 mm (Figure 25). Proportional stock density (PSD; Anderson 1980) was 0; however, relative weights for largemouth bass in Smith Lake were near average ranging from 144 to 96 for bass ranging from 110 to 250 mm long.

Rainbow trout were presumed to be of hatchery origin and stocked as catchables. Rainbow trout ranged from 192 to 437 mm with a mean length of 266 mm (Figure 26).

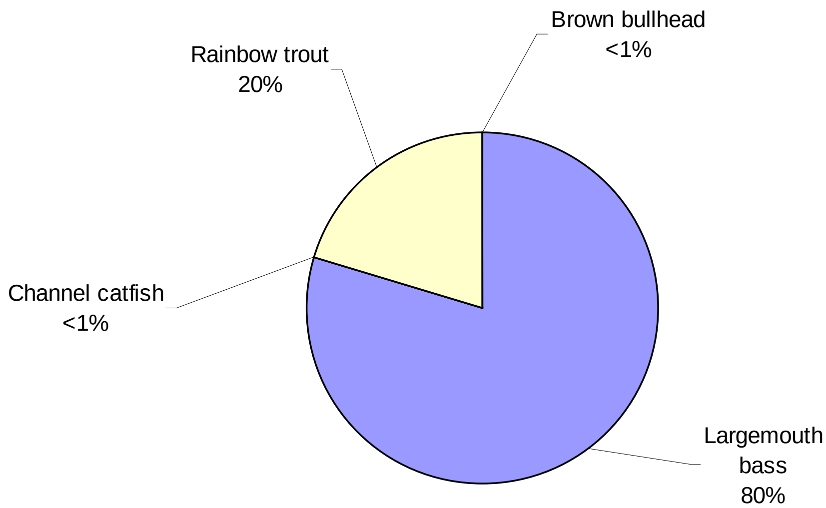


Figure 23. Relative abundance of all species collected, by number, during the lowland lake survey of Smith Lake, Idaho, April 2005.

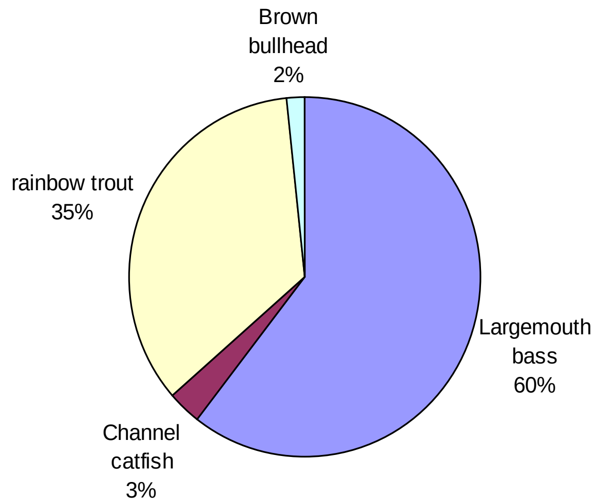


Figure 24. Relative abundance of all species collected, by weight, during the lowland lake survey of Smith Lake, Idaho, April 2005.

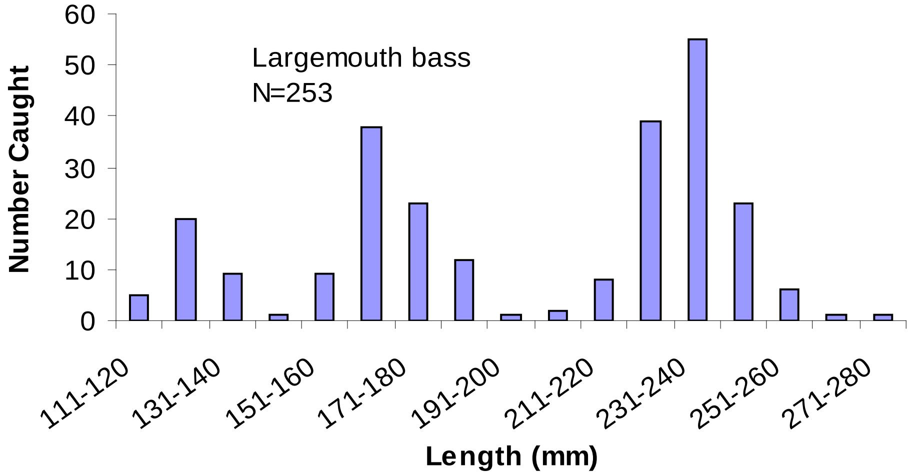


Figure 25. Length frequency of largemouth bass collected during the lowland lake survey of Smith Lake, Idaho, April 2005.

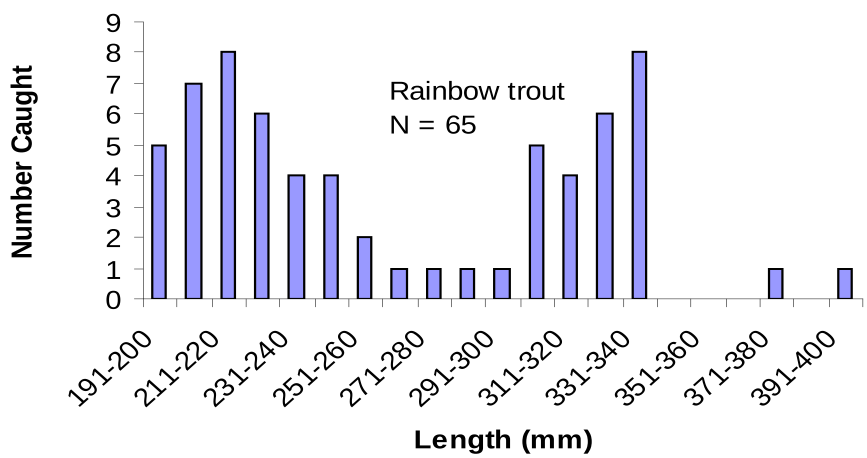


Figure 26. Length frequency of rainbow trout collected during the lowland lake survey of Smith Lake, Idaho, April 2005.

DISCUSSION

Relative to other lakes in this study, largemouth bass are abundant but the length frequency suggests that mortality of bass over 12 inches may be fairly high. Condition as indicated by relative weight was average, indicating that growth is not an issue, rather fishing pressure under Family Fishing Waters regulations is causing a lack of larger bass. Under the new Family Fishing Waters regulation anglers can harvest six bass with no size restrictions. During the 2005 survey, the largest largemouth bass captured was 271 mm.

HAYDEN LAKE

Study Area

Hayden Lake is located 8 kilometers north of the city Coeur d'Alene, Idaho (Figure 27). The western and southern shorelines are bordered by the cities of Dalton Gardens, Hayden, and Hayden Lake, Idaho. Hayden Lake has a surface area of approximately 1520 ha at summer level, a maximum depth of 65 m, and a mean depth of 46 m. The entire shoreline is private property and approximately 90% of the shoreline is developed. Hayden creek is the largest tributary and historically supported significant runs of wild rainbow and cutthroat trout. The outlet of Hayden Lake is located at the southern corner of the lake and only flows during spring high water. Public access is limited on Hayden Lake as only two public boat ramps exist (Figure 26).

IDFG stocking records dating back to 1967 indicate extensive fish stocking has occurred in Hayden Lake over the years. Many strains of rainbow trout have been stocked over the years. Westslope cutthroat trout have been stocked since 1994 at a rate of 8,000 to 65,000 per year. Kokanee were stocked in 1989. Coho salmon were introduced from 1969-1973, and splake were stocked from 1990 through 1993. Smallmouth bass were introduced in 1985-86. Northern pike and walleye *Sander vitreum* were stocked illegally into Hayden Lake.

Hayden Lake is managed as a quality warmwater and coldwater fishery. The current regulations for bass on Hayden Lake provides a catch and release period from January 1 to June 30 and a catch and keep season from July 1 through December 31. Daily bags and possession limit for bass is 2 fish none between 12" and 16". Black crappie limits in Hayden Lake are 15 in possession, none under 10". The current regulation for trout on Hayden Lake provides a catch and release period from December 1 to the last Friday in April and a catch and keep season from the last Saturday in April to November 30 with no trout under 14". There are no size restrictions or possession limits for northern pike.

RESULTS

Gamefish species composition included largemouth bass, smallmouth bass, pumpkinseed, black crappie, yellow perch, rainbow trout and northern pike. Nongame species composition included brown bullhead and tench *Tinca tinca*. Gamefish species comprised 77% of the fish captured by number and 69% by weight (Figures 28 and 29).

Smallmouth bass comprised the most abundant species by number (26% of sample) (Figure 28) and the third most abundant species by weight (19%) (Figure 29). Smallmouth bass ranged in length from 44 to 458 mm with a mean length of 207 mm (Figure 30). Smallmouth bass condition, as indexed by relative weight (Wr) was very good. Relative weight of smallmouth bass in Hayden Lake was from 98 to 152 for bass from 90 to 330 mm long.

We collected 101 largemouth bass (11% of the total sample) per combined unit of sampling effort. Largemouth bass ranged from 24 to 545 mm in length (Figure 31) and comprised 23% of the sample by weight (Figure 29). Proportional stock density (PSD; Anderson 1980) was 52 and RSD-400 was 7. Largemouth bass condition, as indexed by relative weight (Wr) was good. Relative weight of largemouth bass in Hayden Lake ranged from 94 to 119 for bass from 80 to 420 mm long.

Yellow perch comprised 10% of our catch comprising 10% of the sample by number and 1% by weight (Figure 28 and 29). Yellow perch ranged from 109 to 200 mm (Figure 32).

A total of 71 black crappie were captured in 2005 ranging from 110 to 300 mm with a mean length of 201 mm (Figure 33). Condition of black crappie as indexed by relative weight (Wr) was very good. Relative weight of black crappie in Hayden Lake ranged from 107 to 116 for fish from 80 to 290 mm, and was highest (138) for crappie 90-100 mm long.

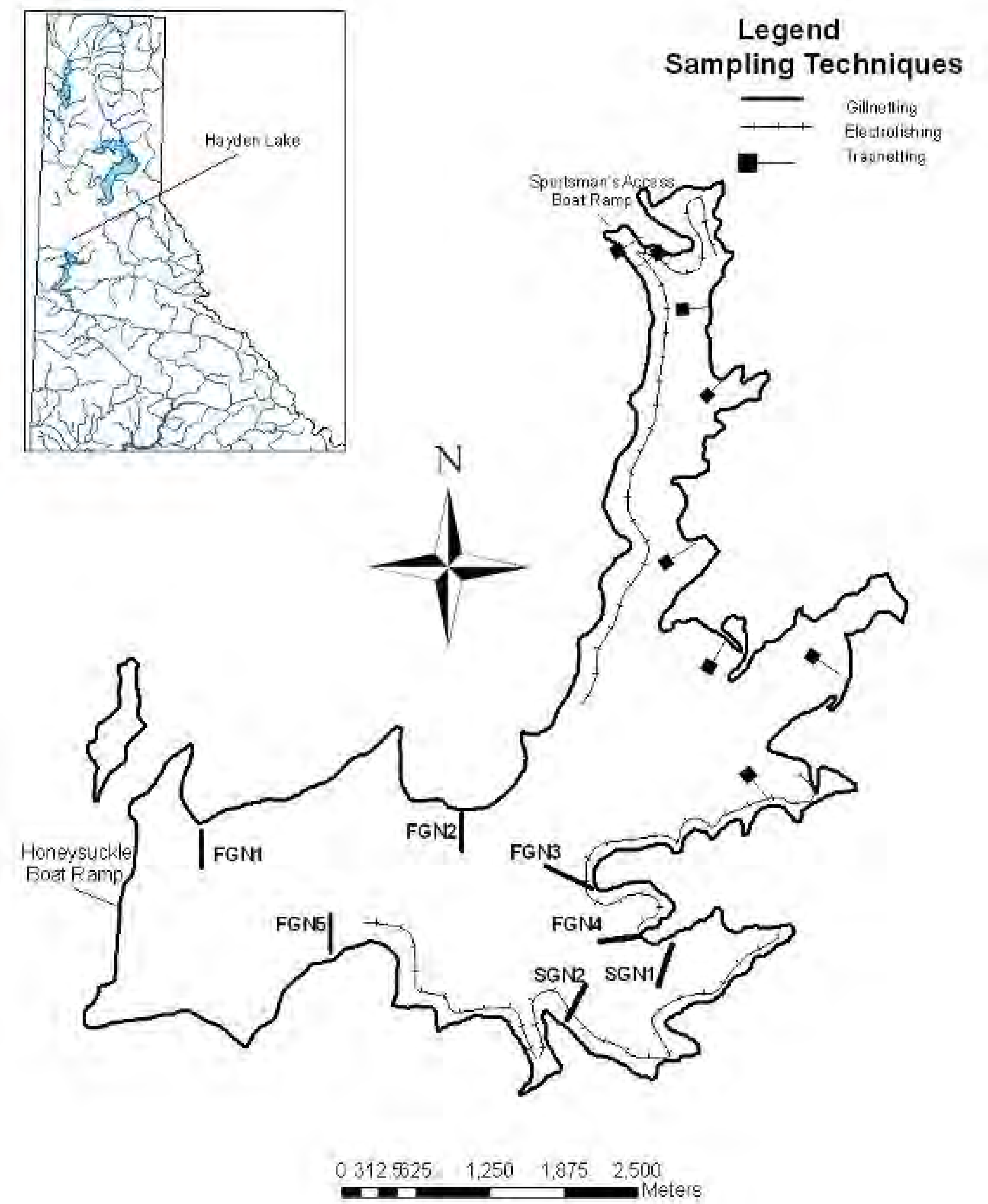


Figure 27. Map of Hayden Lake, Idaho, showing gillnet and trapnet locations and electrofishing transects used during April 2005 lake survey.

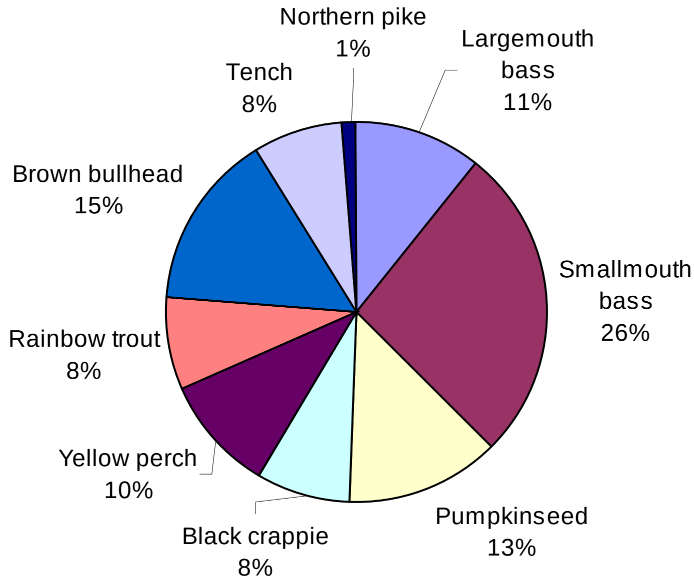


Figure 28. Relative abundance of all species collected, by number, during the lowland lake survey of Hayden Lake, Idaho, April 2005.

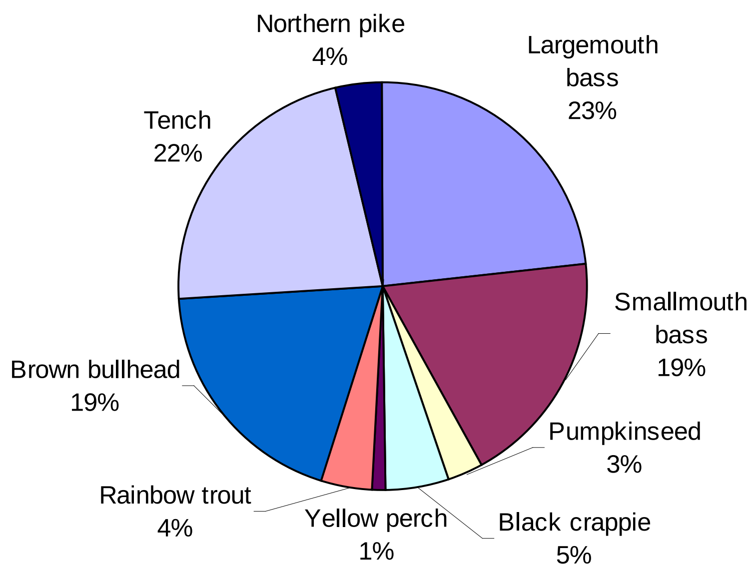


Figure 29. Relative abundance of all species collected, by weight, during the lowland lake survey of Hayden Lake, Idaho, April 2005.

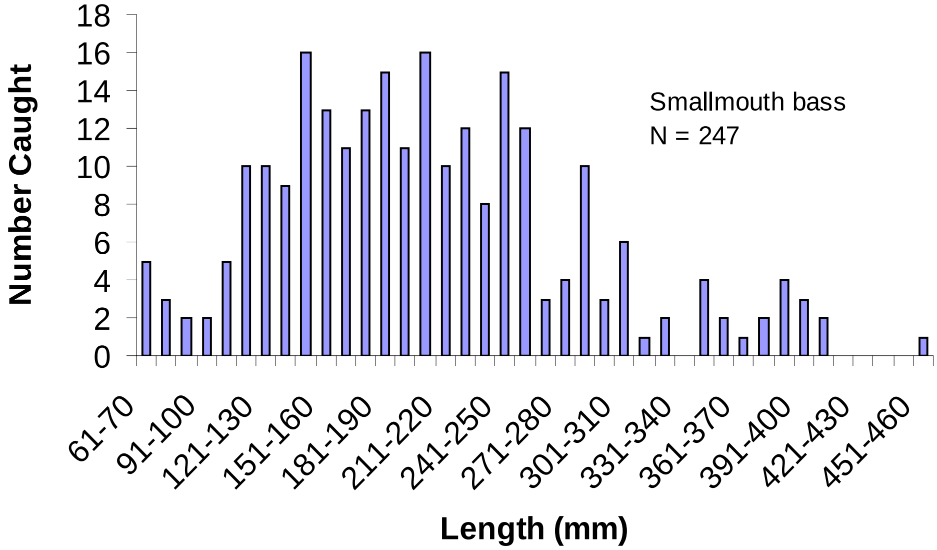


Figure 30. Length frequency of smallmouth bass collected during the lowland lake survey of Hayden Lake, Idaho, April 2005.

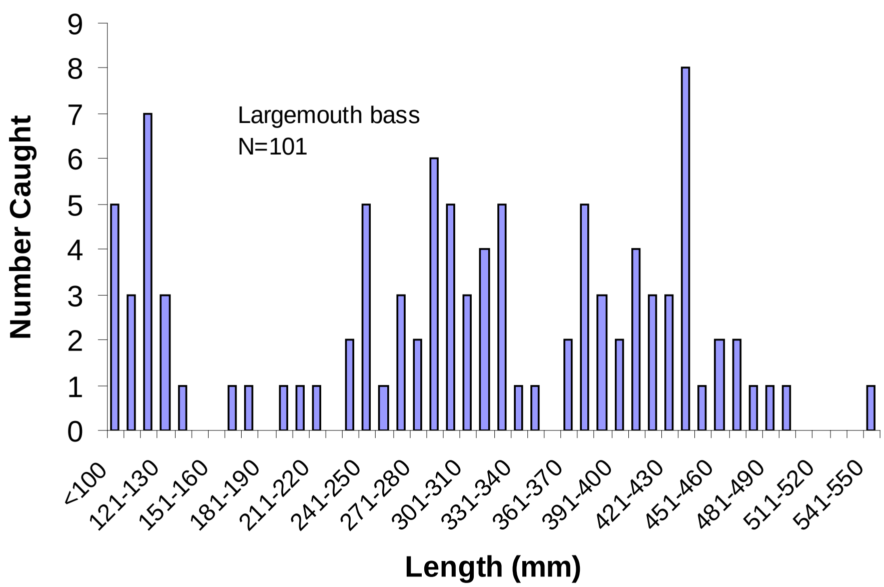


Figure 31. Length frequency of largemouth bass collected during the lowland lake survey of Hayden Lake, Idaho, April 2005.

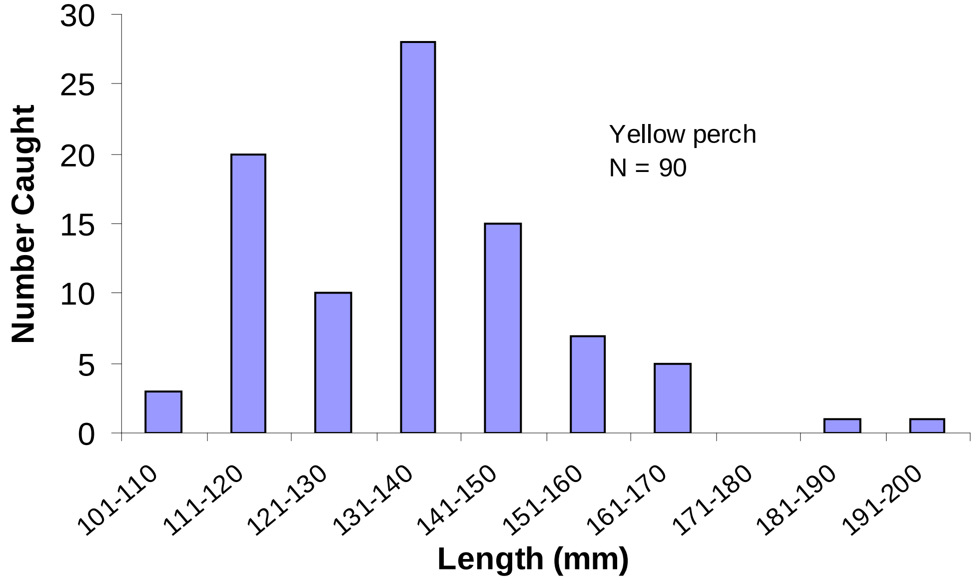


Figure 32. Length frequency of yellow perch collected during the lowland lake survey of Hayden Lake, Idaho, April 2005.

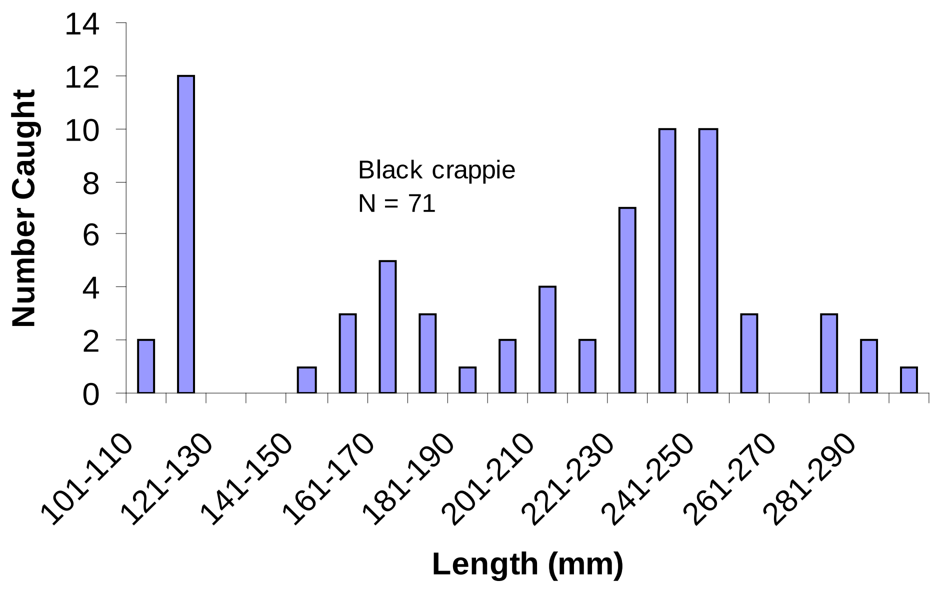


Figure 33. Length frequency of black crappie collected during the lowland lake survey of Hayden Lake, Idaho, April 2005.

DISCUSSION

Hayden Lake was last surveyed in 1993 and several comparisons to that survey are made here. It should be mentioned that although the three gear types (gill nets, trap nets, electrofishing) were used in both surveys, about twice the effort was used during our 2005 survey.

There have been numerous changes in the fish community in Hayden Lake over the last 14 years. The most obvious difference noted when comparing the two surveys is the dramatic increase in the number of smallmouth bass. Smallmouth bass were the most abundant species by number (26%) and the third most abundant species by weight (19%) in 2005. During the 1993 Hayden Lake survey smallmouth bass comprised <1% of the sample by number. During the 1993 survey the largest smallmouth bass captured was 305 mm compared to 458 mm in 2005. Hayden Lake smallmouth bass condition, as indexed by relative weight (Wr) was very good. Relative weight of smallmouth bass in Hayden Lake ranged from 152 to 98 for bass from 90 to 330 mm long.

Another obvious change in relative abundance and one that has been confirmed by anglers in recent years is with yellow perch. Yellow perch comprised only 10% of our catch in 2005. During the 1993 Hayden Lake survey yellow perch comprised 47% of species captured. Other noticeable changes in the Hayden Lake fish community between the 1993 survey and the 2005 survey include: During the 1993 survey largemouth bass comprised <2% of the sample compared to 11% in 2005. Nine northern pike were captured in 2005 ranging from 340-670 mm. During the 1993 survey no northern pike were captured.

The illegal introduction of northern pike and stocking of smallmouth by IDFG are probably responsible for the significant changes in the fish populations in Hayden Lake. The abundant weed beds and relatively stable water levels in Hayden Lake during the spring likely contribute to the expanding northern pike population. Idaho state fisheries management direction provides no protection for northern pike: year round fishing opportunity and maximum harvest are encouraged. The ice fishery, as short as it is seems to be keeping the population somewhat in check. In the two month long ice fishing season during the winter of 1995-96, over 1,900 pike were harvested.

The impact northern pike are having on trout in Hayden Lake is difficult to assess. Up to 350,000 fingerling and catchable rainbow and cutthroat trout are stocked each year. Pike prefer soft, fusiform fish like trout. Research on Coeur D'Alene Lake in 1992 indicated cutthroat trout made up 20% of the pike diet on a year-round basis while yellow perch were the most important prey item numerically (Rich 1992). Increasing northern pike and smallmouth bass populations will likely result in less perch, crappie and trout in the future. Future regulations should consider removing bag and size restrictions on smallmouth bass in Hayden Lake.

LITERATURE CITED

Anderson, R.O. 1980. Proportional stock density (PSD) and relative weight (Wr) :interpretive indices for fish populations and communities. In: Practical Fisheries Management: More with Less in the 1980s. (Gloss, S. and B. Shupp, Eds.) pp.27-33. Ithaca, NY: New York Chapter American Fisheries Society.

Blackwell, B.G., M. L. Brown, and D. W. Willis. 2000. Relative weight (Wr) status and current use in fisheries assessment and management. Reviews in Fisheries Science 8 (1): 1-44.

Fredericks J. and N.J. Horner. 1998. Annual fisheries management performance report 1997. Idaho Department of Fish and Game. Federal Aid in Sportfish Restoration. F-71-R-22. Fishery Management Report, Boise.

Horner, N.J., L. D. LaBolle, and C.A. Robertson. 1987. Regional fishery management investigations. Idaho Department of Fish and Game. Federal Aid in Fish and Wildlife Restoration. F-71-R-12. Job Performance Report, Boise.

Nelson, V.L., J.A. Davis, and N.J. Horner. 1993. Regional fishery management investigations. Idaho Department of Fish and Game. Federal Aid in Fish and Wildlife Restoration. F-71-R-18. Job Performance Report, Boise.

Pope, K.L., and D.W. Willis. 1996. Seasonal influences on freshwater fisheries sampling data. Review in Fisheries Science, 4: 57-73.

Rich, B.A. 1992. Population dynamics, food habits, movement and habitat use of northern pike in the Coeur D'Alene Lake system, Idaho. Idaho Department of Fish and Game. Federal Aid in Fish and Wildlife Restoration, F-73-R-14, Subproject No. V1, Study No 3, Job Completion Report, Boise.

CHAPTER 4: UPPER PRIEST LAKE BULL TROUT RESTORATION

ABSTRACT

We used gillnets to capture and remove lake trout *Salvelinus namaycush* from Upper Priest Lake in June and August 2005. A total of 875 lake trout were removed in two netting efforts. Standardized catch ranged from 0.72 to 1.21 fish/hr/100 m^2 of net with no apparent trend or evidence of depletion. Mean catch rate throughout the 2005 effort was 0.94 fish/hr/100 m^2 compared to 0.98 fish/hr/100 m^2 in 2003 and 1.8 fish/hr/100 m^2 in 2001. Size of lake trout ranged from 215 to 906 mm (TL), with a mean size of 484 mm. We incidentally netted 13 bull trout *S. confluentus* during the lake trout netting efforts and one known bull trout mortality occurred. The ratio of bull trout to lake trout was 1:67 in 2005 compared to 1:41 in 2003 and 1:10 in 1997.

Authors:

Mark Liter
Regional Fishery Biologist

Ned Horner
Regional Fishery Manager

INTRODUCTION

It has been well documented that introduced lake trout have the tendency to suppress other native and nonnative species through predation and or competition (Donald and Alger 1993, Fredenberg 2002, Hansen et al. 2007 in Press). Historically native bull trout provided a trophy fishery in Upper Priest Lake with an annual catch of 1,800 fish in the 1950s (Bjornn 1957). Bull trout *S. confluentus* harvest was eliminated at the Priest Lakes in 1984, but no positive response in the fishery ensued (Mauser et al. 1988). The bull trout population in Priest Lake is considered functionally extinct while the population in Upper Priest Lake is severely depressed (DuPont et al. 2006).

Native westslope cutthroat trout were also historically abundant in Priest Lakes with 30 fish limits common in the 1940s (Mauser et al 1988). Over harvest, interspecific and intraspecific competition, and degradation of spawning habitat all caused the decline of cutthroat trout in the Priest Lakes. Harvest of cutthroat was eliminated in 1988.

In Upper Priest Lake the lake trout population appears to have grown rapidly in the past 25 years. Lake trout were not known to be present in Upper Priest Lake until the mid-1980s at which time they were thought to have migrated from Priest Lake (Mauser 1986). In 1998 the lake trout population in Upper Priest Lake was estimated at 859 fish (Fredericks 1999). Since 1998, in an effort to reduce threats to dwindling bull trout and cutthroat trout populations, IDFG has been using gill nets to reduce lake trout abundance in Upper Priest Lake. Between 150 and 1,100 lake trout have been removed annually from Upper Priest Lake.

METHODS

Lake trout were removed from Upper Priest Lake using eight 91.4 x 2.4 m experimental, monofilament, sinking gillnets with three panels of 2.5, 3.8, and 5.1 cm mesh. Sampling occurred during June 20-23 and August 8-11, 2005. Gillnets were set throughout the lake and were moved based on catch rates at a particular site and the discretion of the netting crew. Nets were set during daylight hours only and were pulled every 45-60 minutes in a concerted effort to avoid incidental bull trout captures. Gillnets were set perpendicular to shore at depths ranging from 20 to 33 m. We standardized catch to a unit of sampling effort (fish/hr/100 m^2 of gillnet) to allow comparison with previous netting efforts. Netted lake trout were measured, examined for tags and killed. All processed lake trout were filleted and given to various food banks throughout north Idaho for distribution to the indigent.

RESULTS

We netted and removed a total of 875 lake trout in the two gillnetting efforts in 2005. We saw little evidence that the lake trout population had been significantly reduced by past gillnet efforts as catch rates were comparable to catch rates the past few years. Standardized catch ranged from 0.72 to 1.21 fish/hr/100 m^2 during the June and August efforts, respectively. Mean catch rate throughout the 2005 effort was 0.94 fish/hr/100 m^2 of gillnet compared to 0.98 fish/hr/100 m^2 in 2003, and 1.8 fish/hr/100 m^2 in 2001 (Figure 1). Size of lake trout ranged from 215 to 906 mm (TL), with a mean size of 484 mm, compared to 508 mm in 2001 and 439 mm in 1998 (Figure 2).

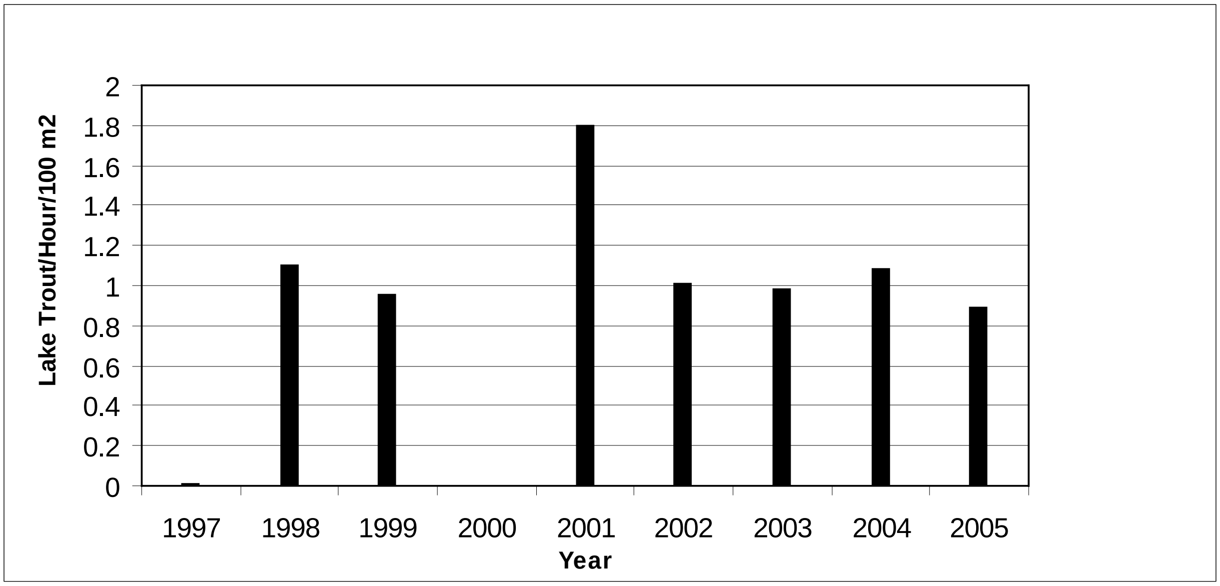


Figure 1. Catch rate of lake trout caught by gill nets in Upper Priest Lake, Idaho from 1997 through 2005.

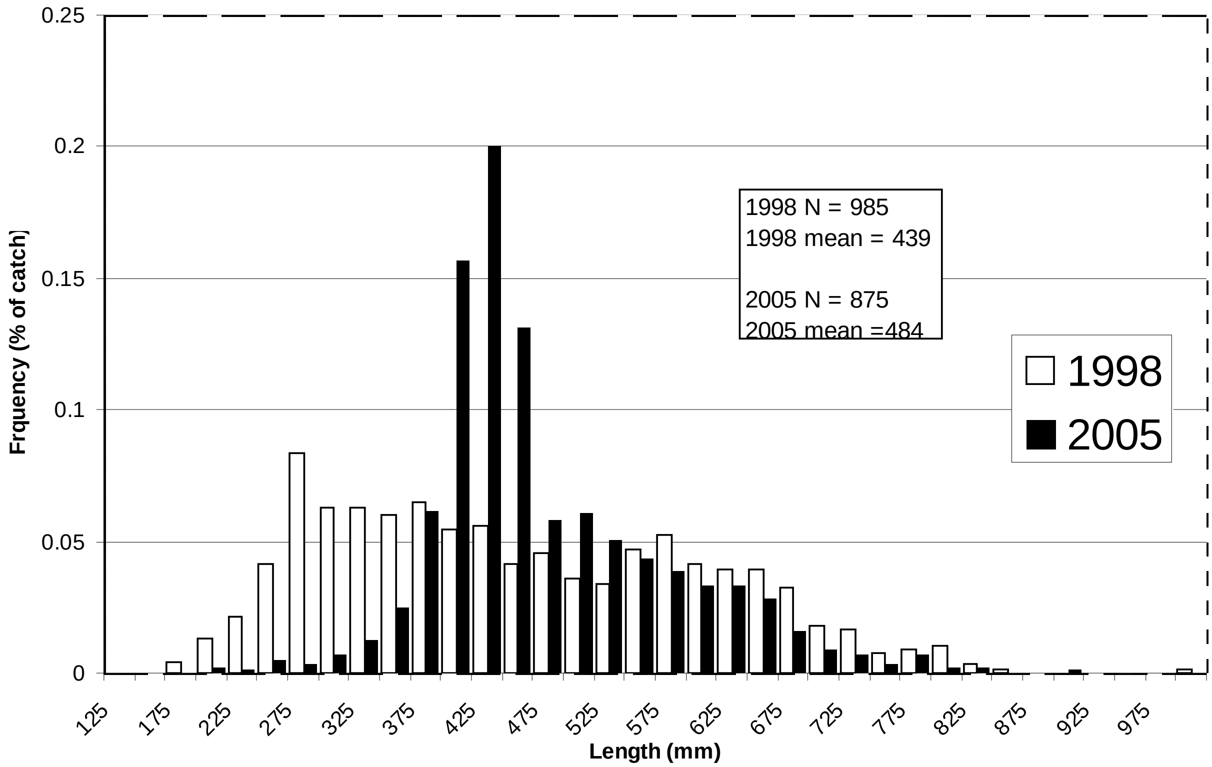


Figure 2. Frequency (%) of lake trout in each 25 mm length class caught in Upper Priest Lake, Idaho in gill nets from June 20-23 and August 8-11, 2005.

We incidentally netted 13 bull trout during the two lake trout netting efforts with one known bull trout mortality occurring. Bull trout ranged in size from 375-700 mm. The bull trout:lake trout ratio was 1:67 compared to 1:21 in 1999 and 1:10 in 1997 (Figure 3).

By-catch is typically insignificant in Upper Priest Lake gill netting. In addition to lake trout and bull trout we captured 8 largescale sucker *Catostomus macrocheilus*, 6 westslope cutthroat trout , 8 mountain whitefish *Prosopium williamsoni*, and one kokanee *Oncorhynchus nerka* in our two gill net efforts. Cutthroat trout range from 320-425 mm, mountain whitefish ranged from 233-365 mm, and the one kokanee captured measured 250 mm TL.

DISCUSSION

In 2005, we saw little evidence that the lake trout population had been significantly reduced by our previous efforts. Gillnet catch rates in 2005 were comparable to catch rates in 2004 and 2003. We saw no evidence of shifting size structure due to high exploitation the previous years. The bull trout:lake trout ratio was 1:67, comparable to the previous few years but down significantly when compared to the late 1990s when lake trout removal began in Upper Priest Lake (Figure 3). It appears that our yearly gillnetting efforts are not reducing the lake trout population in Upper Priest Lake, however, gillnetting seems to be preventing the lake trout population from increasing and it is encouraging to see the bull trout:lake trout ratio improve or at least remain stable. We continue to explore funding options for permanent installation of strobe lights to reduce upstream migration of lake trout from Priest Lake to Upper Priest Lake and recommend annual removal of lake trout until such funding is unavailable or until it is determined that the bull trout population has reached a level were it is no longer viable.

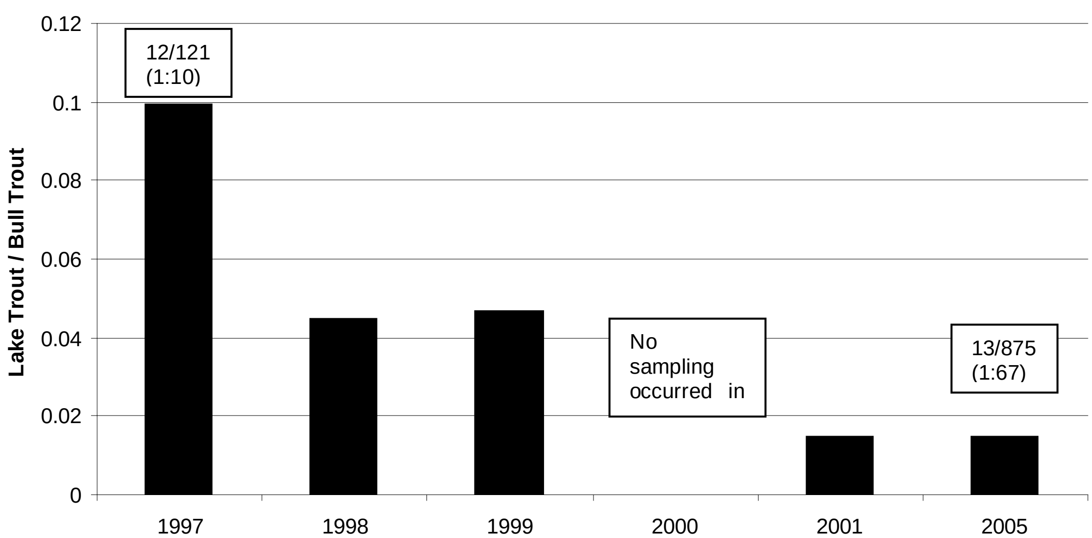


Figure 3. Lake trout to bull trout ratio caught in gill nets in Upper Priest Lake, Idaho from 1997 through 2005.

RECOMMENDATIONS

1. Pursue funding for permanent strobe light installation, an electric weir or pound net as a means of minimizing lake trout immigration into Upper Priest Lake.

2. Work with the USFS and IDL to define permitting and public concern.

3. Continue annual removal of lake trout from Upper Priest Lake until a means of minimizing lake trout immigration is identified and funded.

CHAPTER 5: ST. JOE RIVER AND COEUR D'ALENE RIVER SURVEYS

ABSTRACT

In August 2005, a total of 28 transects in the St. Joe River and 44 transects in the North Fork Coeur d'Alene River system were snorkeled to estimate trout and mountain whitefish *Prosopium williamsoni* abundance and their approximate size distribution. Mean densities of age one and older westslope cutthroat trout *Oncorhynchus clarkii lewisi* were 1.61 fish/100 m^2 in the St. Joe River and 0.76 fish/100 m^2 in the North Fork Coeur d'Alene River system. Both rivers showed increasing trends in abundance of cutthroat trout following the declines observed after the 1996 and 1997 flood events and had reached or exceeded what was observed before the floods. Densities of cutthroat trout ≥300 mm in length were 0.54 fish/100 m^2 in the St. Joe River and 0.21 fish/100 m^2 in the North Fork Coeur d'Alene River.

Densities of mountain whitefish were 1.37 fish/100 m^2 in the St. Joe River and 3.34 fish/100 m^2 in the North Fork Coeur d'Alene River during 2005. Both rivers showed increasing trends in abundance of mountain whitefish following the declines observed after the 1996 and 1997 flood events.

Three rainbow trout *O. mykiss* were observed in the St. Joe River whereas 279 (0.19 fish/100 m^2) were observed in the North Fork Coeur d'Alene River during 2005. Rainbow trout were observed upstream of Prospector Creek in the St. Joe River for the first time since 1998 when they were stocked there. In the North Fork Coeur d'Alene River all the rainbow trout were observed in the downstream reaches where limited harvest is allowed. Rainbow trout were not stocked into any rivers or streams in the Panhandle Region since 2003. Consequently, these fish were either holdovers from earlier stockings or are offspring from natural reproduction.

Four bull trout *Salvelinus confluentus* were observed in the St. Joe River in 2005, similar to 2004. This is the most bull trout that were observed while snorkeling since 1977. This coincided with a record high number of bull trout redds counted in the St. Joe watershed during 2005.

Authors:

Joe DuPont
Regional Fishery Biologist

Ned Horner
Regional Fishery Manager

INTRODUCTION

Westslope cutthroat trout *Oncorhynchus clarkii lewisi* are a highly sought after game fish native to northern Idaho attracting anglers from around the United States. The popularity of cutthroat trout stems from their eagerness to take a dry fly, their beautiful appearance and the pristine environment they inhabit. In northern Idaho, the major cutthroat trout fisheries occur in many of the larger rivers and streams that drain the rugged landscape. During 1996, over 60,000 hours of fishing effort was estimated to have occurred on the St. Joe and Coeur d'Alene rivers, two of the more popular rivers for cutthroat trout fishing in the Panhandle Region (Fredericks et al. 1997). Evidence suggests fishing pressure for cutthroat trout has continued to increase in the Panhandle Region (Fredericks et al. 1997).

In the early 1900s, many considered the streams and rivers in northern Idaho to be some of the finest trout streams in America. The local newspaper of St. Maries, Idaho frequently reported catches of seven to nine-pound trout, and trips where anglers caught 50-100 cutthroat trout averaging three to five pounds in a few hours (Rankel 1971). By the 1960s, cutthroat trout abundance had declined in many rivers in the Idaho Panhandle and studies were initiated to determine why these declines had occurred and what could be done to restore the fishery (Mallet 1967; Dunn 1968; Rankel 1971; Bowler 1974; Lewynsky 1986). This research found that declines in the fishery were largely a response to overharvest in the St. Joe River and a combination of over harvest, habitat degradation, and toxic mine wastes in the Coeur d'Alene River (Rankel 1971; Bowler 1974; Lewynsky 1986; Rabe et al. 1970; Mink et al. 1971). As efforts were made to correct the reasons for the decline in the fishery, it was necessary to monitor trends in fish numbers to evaluate how successful recovery efforts were. Transects were set up in the St. Joe and Coeur d'Alene rivers that have been snorkeled on a regular basis (Rankel 1971; Bowler 1974). Fish counts in these trend transects were successful in documenting how changes in fishing regulations and/or habitat have influenced cutthroat trout densities.

Transects were established in the St. Joe River in 1969 and in the Coeur d'Alene River in 1973. The long term trend data sets collected from these snorkel transects are very important in documenting how changes in fishing regulations, habitat and weather patterns influence trends in fish populations. To ensure this data is collected in a consistent manner in the future and to increase the ease of locating the snorkel sites, this report clearly describe the techniques used to collect the data, the time when snorkeling should occur, and the locations of the transects. The goal of this report is to evaluate the status of the fishery in the St. Joe River and North Fork Coeur d'Alene River system and assess how changes in fishing regulations, habitat, and weather patters have influenced the fishery.

OBJECTIVES

1. Estimate salmonid density and trends in abundance in snorkeling transects in the St. Joe and North Fork Coeur d'Alene rivers and evaluate how changes in fishing regulations, habitat, and weather patterns have influenced the fishery.

2. Describe the methods used when conducting snorkel surveys at established trend sites.

3. Compile existing historic data from past snorkel surveys conducted on the St. Joe River and North Fork Coeur d'Alene River system.

STUDY SITES

St. Joe River

Twenty-eight snorkel transects (SJ01-SJ28) were established in the St. Joe River during 1969 by selecting sites that were considered good cutthroat trout habitat (Rankel 1971). These transects spanned from Avery upstream to Ruby Creek, a distance of about 76 river km. Due to channel shifting and changes in stream habitat, two of the original transects (SJ24 and SJ25) were moved about 50-100 m downstream to reaches that had similar characteristics to what historically occurred upstream. Six additional transects (SJ29-SJ35) were added between Avery and Calder (39 km of river) during 1993 (Nelson et al. 1996). These transects were selected based on fish holding capabilities, access, and permanence for future study. All combined, a total of 35 snorkel transects occur in the St. Joe River spanning a total of 115 km of river (Figure 1). Coordinates for the location of each of these transects are displayed in Appendix A and photographs (taken in 2002 or 2003) of each of the samples locations are displayed in Appendix B. These photos not only show a picture of each transect, but also depict where snorkeling should stop and end and the approximate length of stream that should be snorkeled. Photos of the original transects taken in 1969 can be viewed in DuPont et al. (In Press a), and provide a good comparison of if and how the sites have changed over the years. During 2005 we only snorkeled transects SJ01-SJ28 due to poor visibility in the lower stream reaches (SJ29-35).

North Fork Coeur d'Alene River

Thirty-eight snorkeling transects in the North Fork Coeur d'Alene River system were initially established in 1973 by selecting sites that were considered good cutthroat trout habitat (Bowler 1974). Twenty-three of these transects were in the North Fork Coeur d'Alene River (85 river km), 10 were in the Little North Fork Coeur d'Alene River (36 river km), and five were in Tepee Creek (8 river km). Some of the transect locations have been changed over the years as the river has shifted positions and pools have filled in. Modified transect boundaries were selected based on closeness and similarity to original site, access, and permanence for future study. Transects that have changed locations from their original location in the North Fork Coeur d'Alene River system include TP01, NF17, NF20 and NF23, LNF02, LNF04. During 2002, three additional transects (LNF10, LNF12 and LNF 13) were added to the Little North Fork Coeur d'Alene River in the catch-and-release area bringing the number of transects in this area to five. This was accomplished to better evaluate whether differences in fish densities occurred between the catch-and-release and harvest areas of the Little North Fork Coeur d'Alene River. Two temporary snorkeling transects (TP R1 & TP R2) were established during 2002 in the upstream portion of Tepee Creek where the U.S. Forest Service had completed some extensive stream restoration in 2001. These sites were added to evaluate how fish densities respond to this restoration over time. This brings the total number of transects that were snorkeled in the Coeur d'Alene River basin during 2005 to 43, which spans about 138 km of river (Figure 2). Thirteen sites were on the Little North Fork Coeur d'Alene River, seven were on Tepee Creek, and 23 on the North Fork Coeur d'Alene River. Coordinates for the location of each of these transects are displayed in Appendix A and photographs (taken in 2002 through 2004) of each of the locations are displayed in Appendix C. These photos not only show a picture of each transect, but also depict where snorkeling should stop and end and the approximate length of stream that should be snorkeled. Photos of the original transects taken in 1973 can be viewed in DuPont et al. (In Press a), and provide a good comparison of if and how the sites have changed over the years.

The actual names of the Coeur d'Alene River transects have changed many times since 1973. By 2002, some river reaches had transect numbers that increased as you moved upstream whereas in other reaches the numbers increased as you moved downstream. Because of this confusion, the transect numbers were changed in 2003 so that they all increased from the mouth upstream. Hopefully, this will eliminate confusion and prevent any changes in the numbering scheme in the future.

METHODS

Field Work

The methods described below were used during 2005 to evaluate trends in fish abundance in the St. Joe River and North Fork Coeur d'Alene River system. We suggest these techniques be followed when conducting snorkeling surveys on any river or large stream in the Panhandle Region to ensure data is collected in a consistent manner. This consistency is important if we wish to effectively evaluate the status of the fishery and how changes in fishing regulations, habitat, and weather patterns have influenced it.

The snorkeling technique used at each transect was based on sightability and transect width. Our intent was to be reasonably certain that all fish in the transect were visible to the divers and few or no fish were overlooked. In the wider transects or in more turbid water where one diver could not easily see fish across the river, two divers were used, one on each side of the river. Divers began at the upstream end of the transect and snorkeled downstream, as the size of the rivers generally precluded upstream counts. When snorkeling in pairs we tried to remain parallel with each other and the snorkeler counted only those fish that passed. This prevents double counting of fish that often spook out in front of one snorkeler and then swim past the other. In areas where pocket water was the dominant habitat or shallow, turbulent water limited visibility, transects were snorkeled upstream. In these habitats, the snorkeler often moves too fast through the reach to make accurate counts. In addition, when the stream channel was <10 m in width, the transect was snorkeled upstream. Often when snorkeling narrow channels fish will spook downstream leading to low counts. Where woody debris or boulders were common, the snorkeler would often have to swim around them to ensure all fish were counted. We periodically duplicated counts using different divers to check for accuracy. If noticeable differences occurred in fish counts or estimates of fish length between snorkelers, discussions as to why this happened were made and then the transect was re-snorkeled.

When snorkeling in fairly calm water, we have found that it is best to remain fairly motionless and near the surface. Too much motion can spook fish downstream, even out of the survey area. Snorkeling near the stream edge or away from where most of the fish are holding can also significantly reduce spooking fish downstream. It's also important to snorkel to the very end of the transect, which typically should be the tail-out of a pool, glide or run. We have often observed large numbers of fish moving downstream in-front of snorkelers until they reach the end of the transect (tail-out). At this point, fish will often swim back upstream past the snorkelers to access deeper water. If the snorkeler did not swim to the end of the reach, these fish would remain at the end of the transect and go uncounted. For this reason, no transect should end in the middle of a pool, run or glide.

Repeated snorkel surveys throughout the days at the same site has revealed that when water temperatures are ≤12°C cutthroat trout will often seek cover under substrate or large woody debris making them difficult to observe while snorkeling. For this reason, on colder days it is recommended to snorkel the larger more downstream snorkel transects earlier in the day and the more upstream smaller stream reaches later in the day when water temperatures warm up.

Estimates of fish abundance were limited to age 1+ fish (>75 mm), as summer counts for young of the year fishes are typically unreliable. Most YOY cutthroat trout will be smaller than 80 mm during surveys in July and occupy the shallow stream margins where snorkeling is less effective (Thurow 1994). All observed fish were recorded for each transect by species in 75 mm length groups. Prior to snorkeling, each observer practiced guessing the lengths of plastic pipes to ensure accurate estimates of fish lengths were made. Throughout the snorkel surveys we periodically held these practice sessions to maintain our accuracy.

After completing fish counts, we measured the length and width of each transect with a rangefinder to determine the surface area (m^2) surveyed. At least four width measurements should be taken to get an average stream width of the transect surveyed. Do not rely on lengths and widths collected from previous surveys as stream channels and flow will change from year to year and we do not always snorkel the exact same reach. Characteristics of the transects were also recorded at each site. This type of information could help explain why changes in counts occur over time. Transect characteristics collected included: habitat type, maximum depth, amount and type of available cover, water temperature and visibility (see Appendix D for data sheets we used). Research by Thurow (In Review) has found that the accuracy of snorkel counts can vary from year to year based on water temperature, flow and visibility. They suggest correction factors should be developed based on these variables to make counts more comparable from year to year. To accomplish this, periodic efforts in the future should be made to calculate actual population estimates (mark/recapture efforts) for particular snorkel reaches. Over time differences between actual population estimates from snorkel counts can be modeled using temperature, flow and visibility to develop a correction factor. Visibility should be measured by having a snorkeler move away from shore to the point they can not see it any more. At this point someone on shore should measure the distance between the snorkeler and shore using a range finder. Temperature can be measured using a hand held thermometer and flows can be downloaded off the internet from the nearest gauging station.

In an effort to accurately locate and duplicate snorkel surveys in the future, transect locations were recorded as waypoints using a Global Positioning System (Garmin GPSmap76S). In addition, photographs of each site were taken with permanent landmarks in the photo including starting and ending points of each transect. Prior to conducting the snorkel surveys, the most up-to-date coordinates should be downloaded into a GPS unit and used to navigate to the site. Once near the transect, the most recent photos should be used to locate the exact starting and stopping points to snorkel.

Periodically, channel shifting, bedload movement, and/or blow outs will alter a site so that it does not represent the original transect (changed from a pool to a riffle) or it does not occur anymore (dry channel). Many of the transects were originally selected because they represented good habitat for particular fish species (cutthroat trout and/or bull trout). When a transect changes drastically from what it once was, continuing to conduct counts at this site may lead to low density estimates, which could lead to false assumptions about the fishery. Consequently, when a transect changes substantially so that it does not represent its original characteristics, a new transect should be selected. Old photographs and habitat descriptions should be evaluated before a decision to move the transect is made. New transects should be selected based on the following conditions, which are listed in their order of importance: 1) closeness to original transect, 2) similarity to original site, 3) access (avoid posted private property), and 4) permanence for future study (avoid areas where the channel appears to be shifting constantly).

The North Fork Coeur d'Alene River system was snorkeled during the first week in August whereas the St. Joe River was snorkeled the second week in August. These are the same dates these rivers have been consistently snorkeled over time.

Data Analysis

Fish counts for each transect were converted to density (fish/100 m^2) to standardize the data and make it possible to compare counts within the watershed as well as to other watersheds. Average densities of each salmonid species (all sizes) and for cutthroat trout ≥300 mm were calculated for the entire St. Joe River and North Fork Coeur d'Alene River system as well as for different stream reaches within each watershed (roadless vs. roaded, catch-and-release vs. limited harvest, upstream vs. downstream etc). These averages were calculated by summing the total number of fish counted in a particular reach or stream and dividing it by the total area snorkeled. It is important to note that this is not the same as calculating an average from the density recorded at each snorkel transect within a particular reach or stream. The densities of these fishes were added to the long-term data set to evaluate their trends in abundance (see Appendices H and I for historic data). This was accomplished by graphing the average fish density over time. Attempts were made to assess why trends were occurring by evaluating when changes in fishing regulations, known climatic events (floods, droughts or extreme cold), habitat improvement projects, and factors causing habitat degradation occurred.

From 1970 to 1990 the average stream width and length of each transect snorkeled in the St. Joe River was not recorded. During these years, attempts were made to snorkel the exact same reaches as were set up in 1969. For this reason, the same area that was snorkeled in 1969 was also used for calculating fish densities from 1970 to 1990.

To evaluate whether densities of cutthroat trout differed between the different stream reaches in the St. Joe River and North Fork Coeur d'Alene River system we conducted an analysis of variance (ANOVA) on the density of fish in each of the transect sites. We used a p-value ≤0.10 to denote when a significant difference in density occurred between stream reaches. This value is often used to show significance when evaluating fish and wildlife populations for management purposes (Peterman 1990; Johnson 1999; Anderson et al. 2000). When an ANOVA showed that a significant difference ($p \leq 0.10$) in cutthroat trout density occurred between the stream reaches, we used Fisher's Least-Significant Difference (LSD) Test to evaluate which stream reaches differed significantly. Fisher's LSD Test was chosen for this analysis as this test tends to maximize the power which increases the ability to show statistically significant differences with low sample sizes (Milliken and Johnson 1992).

RESULTS

St. Joe River

Twenty-eight transects were snorkeled in the St. Joe River from August 9-11, 2005. A total of 914 cutthroat trout, 3 rainbow trout *Oncorhynchus mykiss*, 4 bull trout *Salvelinus confluentus* and 778 mountain whitefish *Prosopium williamsoni* were counted (Table 1). Cutthroat trout were observed in all of the 28 sites we snorkeled and were the most abundant species observed. Densities of cutthroat trout (all size classes) at these transects ranged from

0.21 to 8.44 fish/100 m^2 with an overall average of 1.61 fish/100 m^2 (Table 1 and Table 2). About 33 percent of the cutthroat trout observed were estimated to be ≥300 mm in length and their overall density was calculated to be 0.54 fish/100 m^2 (Table 1 and Table 3).

Analysis of variance (ANOVA) testing indicated that significant differences (p value = 0.052) in density of cutthroat trout occurred between stream reaches in the St. Joe River (Figure 3). Fisher's LSD test (Table 4) showed that there were significantly higher densities of cutthroat trout in the reach between Prospector Creek to Red Ives Creek than both the reach upstream (Redd Ives to Ruby Creek) and downstream (N.F. St. Joe to Prospector Creek). When we evaluated only cutthroat trout ≥300 mm, ANOVA testing indicated significant differences (p value = 0.011) in densities also occurred between stream reaches (Figure 3). Again, Fisher's LSD test (Table 4) showed that there were significantly higher densities of cutthroat trout in the reach between Prospector Creek to Red Ives Creek than the both the reach upstream (Redd Ives to Ruby Creek) and downstream (N.F. St. Joe to Prospector Creek).

Since 1969, transects in the St. Joe River have been snorkeled from the North Fork St. Joe River to Ruby Creek. Plotting the average density of cutthroat trout in this reach of river shows how cutthroat trout abundance has changed over the years in response to changes in fishing regulations, extreme climatic events, and fish stocking. The lowest density of cutthroat trout (all sizes) was observed (0.27 fish/100 m^2) the first year these transects were snorkeled in 1969. In 1971, the observed density of cutthroat trout (all sizes) increased to 0.52 fish/100 m^2 (Figure 5). This increase coincides with a change in fishing regulations from a 15 fish limit for the entire river to where only 3 fish ≥13 inches could be kept each day upstream of Prospector Creek (Table 5). From 1971 to 1977 the density of cutthroat trout (all sizes) continued to increase to the point where densities in 1977 (1.60 fish/100 m^2) were about six times higher that what was observed in 1969 (Table 2 and Figure 4). From 1977 to 1980, cutthroat trout densities dropped to 0.88 fish/100 m^2, a 45% decline (Figure 4). The coldest winter recorded in St. Maries since 1950 was in the winter of 1978-1979 (Figure 5) which coincides with this decline. Fishing regulations became more restrictive during this time (Table 5) and extreme flow events were not observed (Figure 6). Following 1980, cutthroat trout densities increased to all time highs (~ 1.7 fish/100 m^2) and remained there until 1990 (Figure 4 and Table 2). From 1990 to 1994, cutthroat trout densities dropped to 1.18 fish/100 m^2, a 45% decline (Figure 4 and Table 2). The third coldest winter recorded in St. Maries since 1950 occurred in the winter of 1992-1993 (Figure 5) which coincides with this decline. No changes in fishing regulations or extreme flow events occurred during this time period (Table 4 and Figure 6). Following 1993, cutthroat trout densities increased to an all time high in 1995 (1.99 fish/100 m^2) and remained near there until 1997.

When we evaluated trends that occurred for cutthroat trout ≥300 mm in length during this same time period (1969-1997), the trend was different that what was observed for all sizes of fish. From 1969 to 1977 the density of cutthroat trout ≥300 mm declined to the point where none were counted between 1974 and 1977 (Table 3 and Figure 4). Increases in the densities of cutthroat trout ≥300 mm in length were first observed in 1979. This increase in density occurred two years after a significant change in fishing regulations in 1977 (changed from 10 fish to 6 fish harvest with no more than 2 over 16 inches downstream of Prospector Creek; Table 5). By 1982, the density of cutthroat trout ≥300 mm had increased to 0.15 fish/100 m^2 and they represented about 9% of all cutthroat trout (Table 5 and Figure 4). A noticeable increase in densities of cutthroat trout ≥300 mm were observed again after 1988 when fishing regulations changed so that upstream of Prospector Creek all cutthroat trout had to be released and downstream of Prospector Creek only 1 fish over 14 inches could be harvested each day (Table 5 and Figure 4). By 1990 about 31% of the cutthroat trout were ≥300 mm. Densities of cutthroat trout ≥300 mm remained near this level until 1997.

A sharp decline in cutthroat trout density (all sizes and ≥300 mm) was observed in 1997 and in 1998 (Figure 4). This is attributed to two significant flood events that occurred. During February 1996 the second highest peak flow event since 1950 occurred and was followed in 1997 by the second highest mean annual flow year since 1950 (Figure 6). Following this decline, cutthroat trout densities increased steadily. The 2005 cutthroat trout density (all sizes) was close to what was observed pre-floods and densities of cutthroat trout ≥300 mm had reached the point where only once before were higher densities ever observed (Table 2 and 3 and Figure 4).

Mountain whitefish were counted in 27 of the 28 transects snorkeled during 2005 and were the second most numerous fish observed (Table 1). The highest density of mountain whitefish (1.83 fish/100 m^2) was observed in the reach between the North Fork St. Joe River and Prospector Creek (Table 6). The overall mean density of mountain whitefish we observed during 2005 (1.37 fish/100 m^2) was similar to what was observed in 2004 (Table 6 and Figure 7). Mountain whitefish experienced a similar decline in density as cutthroat trout following the floods of 1996 and 1997. Mountain whitefish densities have rebounded since the floods and were similar in 2005 as was typically observed pre-floods (Table 6 and Figure 7).

Three rainbow trout were counted during 2005. Two of the rainbow trout were observed upstream of Prospector Creek where rainbow trout had not been seen since 1998 (Table 7). Rainbow trout densities have steadily declined since 1969 (Table 7 and Figure 7) and correlate closely to the number of fish stocked on an annual basis (Figure 8).

In 2005, four bull trout were counted in snorkel transects. This is the same number of bull trout counted in 2004 which is the highest counted since 1977 (Figure 9).

North Fork Coeur d'Alene River

Forty-three transects were snorkeled in the North Fork Coeur d'Alene River system from August 2-4, 2005. A total of 1,106 cutthroat trout, 279 rainbow trout, 2 brook trout *Salvelinus fontinalis,* and 4,873 mountain whitefish were counted (Table 8). Cutthroat trout were observed in 38 of the 43 transects snorkeled. Densities of cutthroat trout (all size classes) in these transects ranged from 0.00 to 3.53 fish/100 m^2 with an overall average of 0.76 fish/100 m^2 (Table 8). About 27% of the cutthroat trout observed were estimated to be ≥300 mm in length and their overall density was calculated to be 0.21 fish/100 m^2.

Analysis of variance (ANOVA) testing indicated that significant differences (p value = 0.051) in density of cutthroat trout occurred between stream reaches in the North Fork Coeur d'Alene River system (Figure 10). Fisher's LSD test showed that cutthroat trout densities in stream reaches within the catch-and-release areas were typically significantly higher than densities in streams reaches in the limited harvest areas (Table 9 and Figure 10). When we evaluated only cutthroat trout ≥300 mm, ANOVA testing also showed that there were significant differences (p value <0.001) in densities between stream reaches (Figure 10). Fisher's LSD test (Table 9) showed that cutthroat trout densities in stream reaches in the catch-and-release areas of the North Fork Coeur d'Alene River were significantly higher than densities in all other stream reaches (Table 9 and Figure 10).

Transects in the North Fork Coeur d'Alene River system have been snorkeled since 1973. Plotting the average density of cutthroat trout in various reaches of this river over time shows how cutthroat trout abundance has changed in response to changes in fishing regulations, extreme climatic events, and fish stocking. The lowest average densities of cutthroat trout (all sizes) observed in transects located on the main North Fork Coeur d'Alene River occurred between 1973 and 1981. During this period, significant changes in fishing regulations occurred (1975 – 1977) in which the entire Coeur d'Alene River basin changed from essentially a 15 fish limit for cutthroat trout to a 6 fish limit in the lower half of the basin and a 3 fish limit (none <13 inches) upstream of the Yellow Dog Creek in the North Fork and upstream of Laverne Creek in the Little North Fork (Table 5). Starting in 1988, cutthroat trout densities (all sizes) in the North Fork Coeur d'Alene River steadily increased until 1997 to the point where densities were about double what was observed between 1972 and 1981 (Figure 11 and Table 10). This initial increase in cutthroat trout density coincided with significant changes in the fishing regulation in 1986 and 1988 where upstream of Yellow Dog Creek and Laverne Creek it was catch-and-release for cutthroat trout and downstream of these streams 1 fish >14 in could be harvested. This same trend was not observed when we evaluated only those cutthroat trout ≥300 mm in length (Figure 11 and Table 11). From 1973 to 1981, the observed density of cutthroat trout ≥300 mm in length increased from 0.01 fish/100m^2 to 0.05 fish/100m^2. However, from 1981 to 1996 the observed density of cutthroat trout ≥300 mm fluctuated some but never increase above 0.08 fish/100 m^2 despite the significant changes in fishing regulations that occurred during this time. In 1996, about 11% of the cutthroat trout observed were ≥300 mm in length.

A noticeable decline in cutthroat trout densities (all sizes and ≥300 mm) were observed in the main North Fork Coeur d'Alene River during 1997 and in 1998 (Figure 11 and Tables 10-11). No changes in fishing regulations occurred around this time. However, during February 1996, the second highest peak flow event since 1950 occurred and was followed in 1997 by the third highest mean annual flow year since 1950 (Figure 12). Following this decline, densities of cutthroat trout (all sizes) increased steadily. In fact, the density of cutthroat trout (all sizes) in 2005 was the highest ever recorded. From 1998 to 2002 densities of cutthroat trout ≥300 mm in length increased slowly but remained low (<0.06 fish/100 m^2 and represented about 16% of the cutthroat trout observed (Figure 11 and Tables 10-11). From 2002 to 2005 densities of cutthroat trout ≥300 mm increased dramatically to the point were record high counts were observed in each succeeding year and about 27% of the cutthroat trout observed in 2005 were ≥300 mm in length (Figure 11 and Tables 10-11).

From 1973 to 2005, there have been three different winters (78-79, 84-85 and 92-93) where the average air temperature in Kellogg, Idaho was <-3.5°C (Figure 6). Winter air temperatures <-3° C in St. Maries, Idaho coincided with drops in cutthroat trout densities the following summer. This was not observed in the North Fork Coeur d'Alene River.

Trends in cutthroat trout densities have been quite different for the Little North Fork Coeur d'Alene River. For the most part, densities of cutthroat trout (all sizes and ≥300 mm) declined from 1973 to 1995 (Figure 11 and Table 10 and 11). From 1996 to 2005 densities (all sizes) increased steadily to the point where record high densities were observed in 2005 (0.56 fish/100 m^2). Densities of cutthroat trout ≥300 mm fluctuated near zero from 1994 to 2002, and then increased sharply in 2003 when record high densities (0.07 fish 100 m^2) were observed. These record high densities were broken in 2004 (0.08 fish 100/m^2) and 2005 (0.10 fish 100/m^2) and cutthroat trout ≥300 mm represented about 18% of the fish in 2005 (Figure 11 and Table 11).

During 2005, an average density of 0.48 cutthroat trout/100 m^2 (all size classes combined) and 0.04 cutthroat trout/100 m^2 for fish ≥300 mm were observed in the rehabilitated sites on Tepee Creek. These densities were lower than any other stream reach we surveyed except the lower Little North Fork Coeur d'Alene River system (Tables 10 and 11). Densities of cutthroat trout have fluctuated greatly in the rehabilitated area since we first started snorkeling them in 2002.

Mountain whitefish were observed in 19 snorkeling transects in the North Fork Coeur d'Alene River system in 2005 and densities ranged from 0.00 to 25.01 fish/100 m^2 with a mean density of 3.3 fish/100 m^2 (Table 8). The highest densities of mountain whitefish were observed in the lower North Fork Coeur d'Alene River, with few observed upstream of Tepee Creek or in the Little North Fork Coeur d'Alene River (Tables 8 and 12). The average density of mountain whitefish observed in the North Fork Coeur d'Alene River has fluctuated greatly since 1973 (Table 12 and Figure 13). Low densities of mountain whitefish (1980-81, 1993 and 1997; Figure 14) were observed the year following cold winters (winters of 1978-79, 1984-85, 1992-1993; Figure 5), or extreme flow events (1996 and 1997; Figure 13). Densities of mountain whitefish rebounded within two or three years to densities observed prior to their decline (Figure 13). Mountain whitefish densities have remained at >2.3 fish/100 m^2 in the North Fork Coeur d'Alene River since it recovered from the floods of 1996 and 1997 and reached a record high in 2005.

Rainbow trout were observed in 16 snorkeling transects during 2005 (Table 8). Every one of the rainbow trout were observed in the most downstream reaches where harvest is allowed (Tables 8 and 13). Densities of rainbow trout observed at each transect ranged from 0.00 to 2.80 fish/100 m^2, with an overall average density of 0.19 fish/100 m^2. About 20% of the trout observed in all the transects we snorkeled were rainbow trout, and in the downstream reaches where limited harvest is allowed, 31% of the observed trout were rainbow trout. Of the 279 rainbow trout observed, 97 (35%) were estimated to be ≥300 mm in length. Between 1991, and 2005 the average density of rainbow trout has remained relatively constant in the North Fork Coeur d'Alene River system (Table 13 and Figure 13), despite decreased stocking within the basin (Figure 14). No rainbow trout have been stocked into any flowing waters in the Panhandle Region since 2003.

St. Joe River versus the North Fork Coeur d'Alene River System

The catch-and-release areas in both the St. Joe River and North Coeur d'Alene River systems have been snorkeled consistently since 1993 allowing direct year to year comparisons in density of cutthroat trout. From 1993 to 1997 cutthroat trout densities (all transects combined) were about two to four times higher (excluding 1994) in the St. Joe River than the North Fork Coeur d'Alene River system (Figure 15). After 1997, declines in cutthroat trout densities were observed in both rivers, although declines were greatest in the St. Joe River. In 1998, the overall density of cutthroat trout observed in the snorkeling transects in the St. Joe River and North Fork Coeur d'Alene River system was very similar. After 1998, cutthroat trout densities in both the St. Joe River and the North Fork Coeur d'Alene River system began increasing and not until 2003 (2004 for cutthroat trout ≥300 mm) did densities of cutthroat trout in the St. Joe River began exceeding those seen in the North Fork Coeur d'Alene River system by more than 40% (Figure 15). Densities of cutthroat trout ≥300 mm in length were at or near all time highs in the catch-and-release areas in both the St. Joe River and North Fork Coeur d'Alene River system in 2005.

The average densities of cutthroat trout (all size classes) in the St. Joe River (1.61 fish/100 m^2) were more than two times higher than what was observed in the North Fork Coeur d'Alene River system (0.76 fish/100 m^2) during 2005. The most downstream transects (29-35) in the St. Joe River were not snorkeled in 2005, which consistently have the lowest cutthroat trout densities in this river. Exclusion of these sites will result in a higher overall density estimate in the St. Joe River. Cutthroat trout densities between the rivers were significantly different based on a T-test evaluation (p value <0.001). Analysis of variance (ANOVA) testing indicated that the average density of cutthroat trout (all sizes) were significantly different (p value = 0.003) between three stream reaches in the St. Joe River and seven stream reaches in the North Fork Coeur d'Alene River system. The highest average densities of cutthroat trout (all size classes) tended to be observed in the catch-and-release areas with the highest densities occurring in the Prospector reach of the St. Joe River and upstream of Tepee Creek in the North Fork Coeur d'Alene River (Figure 16). Fisher's LSD testing showed that there were significantly higher densities of cutthroat trout (all size classes) in the Prospector reach of the St. Joe River than any of the other stream reaches in the St. Joe River or North Fork Coeur d'Alene River system (Table 14).

The density of cutthroat trout ≥300 mm observed in the St. Joe River (0.54 fish/100 m^2) transects was about 2.5 times higher that what was observed in the North Fork Coeur d'Alene River system (0.21 fish/ 100 m^2) during 2005. Again, exclusion of the most downstream snorkeling sites in the St. Joe River results in a higher overall density estimate. The densities of cutthroat trout ≥300 mm in the St. Joe River and North Fork Coeur d'Alene River system were significantly different based on a T-test evaluation (p value <0.001). Analysis of variance (ANOVA) testing also indicated that the average densities of cutthroat trout ≥300 mm were significantly different (p value <0.001) between three stream reaches in the St. Joe River and seven stream reaches in the North Fork Coeur d'Alene River system. The highest average densities of cutthroat trout ≥300 mm were observed in the catch-and-release areas with the highest densities occurring in the Prospector reach of the St. Joe River and upstream of Tepee Creek in the North Fork Coeur d'Alene River (Figure 16). Fisher's LSD testing showed that there were significantly higher densities of cutthroat trout ≥300 mm in the Prospector reach of the St. Joe River and upstream of Tepee Creek in the North Fork Coeur d'Alene River than about any of the other stream reaches in the St. Joe River or North Fork Coeur d'Alene River (Table 14).

DISCUSSION

<u>Cutthroat trout</u>

St. Joe River

Cutthroat trout densities have increased markedly in the St. Joe River since snorkeling counts were first initiated in 1969. Early research indicated the depressed cutthroat trout fishery was a result of over-fishing (Mallet 1967; Dunn 1968; Rankel 1971). As a result, fishing regulations were changed in 1971 from a 15 fish limit (no size restriction) for the entire river to where only 3 fish ≥330 mm (13 inches) could be kept each day upstream of Prospector Creek. From 1971 to 1977 the density of cutthroat trout (all size classes) counted at the snorkel transects more than tripled and was attributed to changes in the fishing regulations (Johnson and Bjornn 1975). Claims were made that more restrictive regulations had improved the fishing (Johnson and Bjornn 1978). However, when we evaluated this snorkel data, we also looked at how the density of cutthroat trout ≥300 mm changed. What we found is that for the most part, the density of cutthroat trout ≥300 mm declined after the regulations were changed. In fact, between 1974 and 1977 not one cutthroat trout ≥300 mm was observed during the snorkel surveys. It appears that survival of cutthroat trout ≥330 mm decreased, during this time period, because harvest was focused on a limited number of large fish. Prior to the 13 inch minimum size limit, the same fisherman may have kept smaller fish to eat. Apparently, fishing pressure was high enough that once cutthroat trout reached the legal size (330 mm) they were cropped off. Talking to fisherman who fished during this period, it was uncommon to catch a legal sized fish (≥330 mm), although you would catch numerous smaller fish throughout the day. Because it was difficult to catch a cutthroat trout ≥330 mm, fishermen would often be forced to kill fish close to the minimum length if they wanted fish to eat (Joe DuPont, IDFG, Personal Communication). So, although the overall catch rate for cutthroat trout increased, it appears the catch rate for fish ≥330 mm probably decreased up until 1977.

This analysis shows the importance of being thorough when evaluating trend data. A closer look at this trend data actually portrayed a different picture than was originally claimed to have occurred. Originally, we claimed that the changes in fishing regulations in 1971 improved the cutthroat trout fishery in the St. Joe River. Changes in the fishing regulations were effective in rebuilding and maintaining a wild cutthroat trout population, but it didn't appear to lead to an increase in the abundance of legal sized fish (≥330 mm) for the first six years.

It wasn't until after 1977 when we actually started seeing an increase in the density of legal sized fish (≥330 mm) in the St. Joe River. After 1977, it appeared that densities of smaller (<300 mm) cutthroat trout had increased (~ 6 fold increase from 1969 to 1977) to the point that fishermen were not able to crop off all the fish recruiting to a legal size (≥330 mm). From 1977 to 1982 densities of cutthroat trout ≥300 mm increased steadily from 0.0 to 0.15 fish/100 m^2 and represented 9% of all the cutthroat trout observed during snorkel surveys. Changes in fishing regulations also occurred during 1977, reducing the number of fish that could be harvested downstream of Prospector Creek from essentially 10 fish to 6 fish, only 2 >16 inches.

In 1988, major changes occurred to the fishing regulations for the St. Joe River. Upstream of Prospector Creek all cutthroat trout had to be released and downstream of Prospector Creek only 1 fish over 14 inches could be harvested each day. These changes in the fishing regulations didn't lead to increases in the overall density of cutthroat trout in the St. Joe River; however, it did appear to result in significant increases in the density of cutthroat trout ≥300 mm. In 1990 the density of cutthroat trout ≥300 mm peaked out at 0.57 fish/100 m^2, over a five fold increase from what was observed ten years earlier in1980. In 1990, 31% of all the fish observed were ≥300 mm in length. Densities of cutthroat trout remained near this level until 1997. It appeared that the cutthroat trout population had already reached its carrying capacity and the regulation changes resulted in a more desirable fishery for larger fish, but not increased numbers of fish. This data show how restrictive fishing regulations must be to protect larger cutthroat trout in heavily fished systems. Appreciable numbers of cutthroat trout ≥300 mm were not observed in the St. Joe River until the regulations were set to catch-and-release in the upstream reaches and a 1 fish >14 in daily harvest in the downstream reaches. Most cutthroat trout in the St. Joe River migrate upstream into the catch-and-release areas in the summer to avoid high water temperatures (Hunt and Bjornn 1992; Fredericks et al. 2002a). In doing so, most fish are protected by catch-and-release regulations throughout the summer. Cutthroat trout are considered an easy fish to catch (Trotter 1987) which may be a result of evolving in unproductive waters where aggressive feeding must occur to obtain adequate food supplies (Rieman and Apperson 1989). In addition, Dwyer (1990) found that westslope cutthroat trout were the easiest to catch of three different subspecies of cutthroat trout. Lewynski (1986) found that cutthroat trout are significantly more vulnerable to angling than rainbow trout. When exposed to similar fishing regulations, higher catch rates of cutthroat trout could lead to a dominance of rainbow trout where they occupy the same waters (Lewynski 1986). The aggressive feeding habits that cutthroat trout display may indicate why such restrictive fishing regulations must occur to sustain desirable numbers of larger cutthroat trout in heavily fished waters.

Between 1977 and 1997, two noticeable declines (40-50% decrease) in the density in cutthroat trout were observed (1979 and 1993). Both of these declines occurred the year after unusually cold winters (winters of 1978-1979 and 1992-1993). Others have also found winter to be a major period of fish mortality based largely on the severity of the winter and subsequent losses of stored energy (Reimers 1963; Hunt 1969; Whitworth and Strange 1983). High fish mortality during periods of extreme cold have been attributed to frazil ice (Tack 1938), loss of or destruction of habitat through anchor ice formation and hanging ice dams (Maciolek and Needham 1952; Brown 1999; Brown et al. 2000), and depletion of energy reserves (Cunjack and Power 1987; Shuter and Post 1990). Long extended cold periods appear to have the most impact on smaller fish (Shuter and Post 1990; Meyer and Griffith 1997). Shutter and Post (1990) claim that smaller fish tend to be less tolerant of starvation conditions because they exhaust their energy stores sooner. However, following the winter of 1992-93, declines in density of cutthroat trout ≥300 mm in the St. Joe River were similar to what was observed for fish <300 mm. Often during intense cold periods ice dams form potentially backing up water for miles. When these ice dams break they can scour the river bottom and damage riparian vegetation (Beltaos 1995). Presumably these types of events would have impacts on all sizes of fish. We're not aware if this type of event happened during the winter of 1992-93.

A dramatic decline (55% decline) in cutthroat trout density was also observed in 1997 and 1998 in the St. Joe River. In all likelihood, the decrease in cutthroat trout density in 1998 was a delayed response to the large flood events that occurred during the winter of 1996 and spring of 1997 and not a factor of changes in fishing pressure, fishing regulations or unusually cold winter temperatures. Floods have been found to impact fish populations through increases in bedload movement, changes in channel morphology, silting of spawning gravel, and scouring or filling of pools and riffles (Swanston 1991; Pearson et al. 1992; Abbott 2000; DeVries 2000). Large swings in cutthroat trout densities are not uncommon in Idaho rivers and have even been documented in wilderness rivers (Selway & Middle Fork Salmon) where fishing pressure and habitat degradation are usually not issues (Dan Schill, IDFG, Personal Communication). The decline in cutthroat trout abundance following the flood was more pronounced for cutthroat trout ≥300 mm as densities were about four times as high prior to the flood as they were following the flood in 1997.

Densities of cutthroat trout in the St. Joe River increased following 1998. In fact, the average density of cutthroat trout (all sizes combined) that were observed in 2005 in the St. Joe River was about what was observed before the floods (1.61 fish/100 m^2). In fact, the actual density of cutthroat trout in 2005 was probably higher than observed due to decreased visibility. Warm water temperatures coupled with low flows likely resulted in increased algae growth in the river making smaller fish more difficult to see while snorkeling. Densities of cutthroat trout ≥300 mm increased steadily after the floods to the point where we observed the second highest densities ever recorded in 2005. We attribute the steady increase in cutthroat trout density following 1998 to a series of mild winters and an absence of extreme flow events and general adherence by the public to the fishing regulations.

Changes in the fishing regulations for the St. Joe River in 2000 increased the catch-and-release zone by about 20 km so that it extended from the confluence of the North Fork St. Joe River to the headwaters. The remainder of the river was managed with a slot limit where all cutthroat trout between 203 and 406 mm had to be released. Previously, fish over 356 mm could be harvested. We believe these more restrictive regulations on cutthroat trout also contributed to rapid improvement in fish densities since the floods.

The highest densities of cutthroat trout (all size classes and fish ≥300 mm) in 2005 were observed upstream of Prospector Creek. This section of river has been catch-and-release since 1988, whereas the section of river between the North Fork St. Joe River and Prospector Creek has been catch-and-release for cutthroat trout since 2000. Differences in fishing regulations may explain some of the reason why differences in densities occurred between these sections of river. However, more than likely, the reason we see higher densities of cutthroat trout upstream of Prospector Creek is that the upper reaches of the St. Joe River maintain water temperatures throughout the summer that are more suitable to cutthroat trout than occurs downstream of Prospector Creek. Cutthroat trout in the St. Joe River have been documented to move from downstream of the North Fork St. Joe River to upstream of Prospector Creek during the summer primarily in response to temperature increases (Hunt and Bjornn 1992; Fredericks et al. 2002a). This information is substantiated by our snorkeling data, as during the warmest years the highest densities of cutthroat trout were observed the farthest upstream. For example in 2004 (very warm summer), the highest densities of cutthroat trout were observed upstream of Red Ives Creek (most upstream reach) whereas in 2005 (a cooler summer than 2004) the highest densities were observed downstream, between Prospector Creek and Red Ives Creek.

The change in fishing regulations do appear to be making a difference in the fishery as we observed the highest densities ever of cutthroat trout ≥300 mm between the between the North Fork St. Joe River and Prospector Creek in 2005. This reach of stream has been managed as catch-and-release since 2000. For the 12 years prior to this (1988-1999), 1 fish >14 inches could be harvested a day. This data once again show just how restrictive fishing regulations must be to result in improvements in numbers of larger cutthroat trout.

During snorkeling surveys, it appeared that more large cutthroat trout >380 mm were seen where access to the river was difficult. These were areas that involved considerable hiking or climbing down steep rocky slopes to get to the river from the road. The habitat did not appear to differ greatly in stream reaches that had easy access versus difficult access. Probably the greatest difference between these reaches is that sites with easy road access received more fishing pressure. Assuming this is true, these findings suggest that hooking mortality, illegal harvest or a combination of the two are having an impact on the number of larger fish in the St. Joe River in areas with easy road access. Research on the Coeur d'Alene River suggests that areas with easy road access suffer higher levels of illegal fish harvest (DuPont et al. In Press c.). Many of pools snorkeled near the road appear to be fished almost every day. Schill et al (1986) found in the Yellowstone River (catch-and-release regulations) that cutthroat trout were captured on average about 10 times a year resulting in an annual fishing mortality of about 3%.

North Fork Coeur d'Alene River System

From 1973 to 1997 an increasing trend in cutthroat trout density (all sizes combined) was apparent in the North Fork Coeur d'Alene River system. Increases in cutthroat trout densities were believed to occur from a combination of more restrictive fishing regulations, improvements in tributary habitat, and reductions in heavy metals (DuPont et al. In Press b). In 1998, a decline in cutthroat trout densities was observed and by 2000 the density dropped to 33% lower than was observed in 1997. In all likelihood, the decrease in cutthroat trout density in 1998 was a delayed response to the large flood events that occurred during the winter of 1996 and spring of 1997 and not a factor of changes in fishing pressure, fishing regulations, or unusually cold winters. As mentioned before, floods have been found to impact fish populations through increases in bedload movement, changes in channel morphology, silting of spawning gravel, and scouring or filling of pools and riffles (Swanston 1991; Pearson et al. 1992; Abbott 2000; DeVries 2000). Densities of cutthroat trout increased steadily since 1998 to the point where an all time high was observed in 2005. We did record a big spike in cutthroat trout density in 2001 that appeared out of place. Closer evaluation of this data revealed that inexperienced snorkelers collected this data and that they skipped several sites on the North Fork Coeur d'Alene River where low densities are typically observed and did not snorkel the entire length of all transects. For this reason we believe this data is misleading and is not reported. This shows the importance of using trained snorkelers and making every effort to duplicate techniques and areas snorkeled as has occurred in the past.

Declines in densities of cutthroat trout were not observed throughout the North Fork Coeur d'Alene River system following unusually cold winters as was observed in the St. Joe River. However, when we examine cutthroat trout densities in the upstream catch-and-release areas the two lowest densities recorded (1980 and 1993) occurred following unusually cold winters. These same drops were not observed in both years in the limited harvest areas. This may suggest two things. First, water temperatures in the higher elevation transects get colder during winter, and consequently, cutthroat trout using these areas may experience higher mortality following unusually cold winters. Others have reported winter to be a major period of fish mortality based largely on the severity of the winter and subsequent losses of stored energy (Reimers 1963; Hunt 1969; Whitworth and Strange 1983). Second, better overwinter habitat occurred in the downstream reaches. Work by DuPont et al. (In Press c) has found that there are more deep, slow pools accompanied by wide floodplains in the downstream transects than the upstream transects, habitat characterized by many as good overwinter habitat (Thurow 1976; Lewynsky 1986; Bjornn and Reiser 1991; Hunt and Bjornn 1992; Schmelterling 2001).

Snorkeling surveys in the North Fork Coeur d'Alene River system showed quite a different pattern when we evaluated only cutthroat trout ≥300 mm in length. Densities increased from 1973 to 1980, but from 1980 to 2002 densities appeared static. Based on telemetry work on cutthroat trout ≥300 mm, a combination of factors appeared to be playing a role in their suppression including non-compliance with fishing regulations, degraded or loss of cold water refugia, degraded or loss of over-winter habitat, and degraded summer rearing habitat (DuPont et al. In Press c). However, from 2002 to 2005, density of cutthroat trout ≥300 mm increased more than four-fold in both the North Fork Coeur d'Alene and Little North Fork Coeur d'Alene rivers to the point that they were the highest ever recorded since these transects were first snorkeled in 1973. These findings are very promising and suggest that survival of larger cutthroat trout is improving. A series of mild winters (1998-2004) and a lack of flood events may have increased survival of these larger adult fish. In fact, the warmest seven consecutive winters on record in Kellogg was from 1998-2004. Future surveys will indicate whether this increase in the number of large cutthroat trout is a temporary or long-term trend and how average or below average winter temperatures will effect cutthroat trout densities.

The highest densities of cutthroat trout in the North Fork Coeur d'Alene River system were observed in the catch-and-release areas upstream of Yellow Dog Creek and in the Little North Fork Coeur d'Alene River upstream of Laverne Creek. Similar percentages of pool and run habitat occurred in the catch-and-release areas as the limited harvest areas, although the depths of pools and runs tended to be deeper than in the limited harvest areas (DuPont et al. In Press c). Studies in the St. Joe River (Hunt and Bjornn 1992; Fredericks et al. 2002a) found that cutthroat trout tend to move upstream during summer, likely in search of cooler water temperatures. However, DuPont et al. (In Press b) found in the Coeur d'Alene River basin that many cutthroat trout migrated downstream of catch-and-release areas after spawning and did not migrate upstream during warm summer months. In addition, relatively high densities of cutthroat trout (444 to 521 fish/km) were found to occur in the free flowing reach of the Coeur d'Alene River (downstream of the South Fork) with about half of these fish >250 mm (Fredericks et al. 2002 b, 2003). These findings suggest that habitat or upstream migrations towards cooler temperatures cannot explain the higher densities of fish in the catch-and-release areas.

It is believed that angling pressure has increased in the North Fork Coeur d'Alene River system, and it is likely that fishing mortality on cutthroat trout is having an impact on areas where limited harvest is allowed (downstream of Yellow Dog Creek and Laverne Creek). New fishing regulations implemented in 2000 (release all cutthroat trout between 8 and 16 inches where previously fish over 14 inches could be harvested) should limit the impacts that fishing would have on this fishery. However, work conducted by DuPont et al. (In Press c) suggests that high fishing pressure coupled with illegal harvest is suppressing the cutthroat trout fishery in many of the limited harvest areas. On the North Fork Coeur d'Alene River downstream of Prichard Creek, annual exploitation was estimated at 69% for cutthroat trout ≥300 mm during 2003 – an area where a harvest fishery was traditionally provided by stocking of rainbow trout. Snorkeling surveys in 2005 show that densities of smaller cutthroat trout (<150 mm) were 1.4 times higher in catch-and-release (C&R) areas than in the limited harvest (LH) area. This difference in cutthroat trout density between the LH and C&R areas increases as fish size increases. For example, densities of cutthroat trout <225 mm were 1.6 times higher in the C&R area than the LH area, 1.9 times higher for cutthroat trout <300 mm, 2.5 times higher for fish >300 mm, 2.4 times higher for fish >375 mm and 18.0 times higher for fish >450 mm. It appears that although both the C&R and LH areas start with similar densities of small cutthroat trout, higher mortality rates in the LH area are resulting in significantly lower densities once they reach desirable sizes for fishermen to catch.

Exploitation may not be the only reason lower densities of cutthroat trout occur in the LH area than the C&R area. Rainbow trout could play a role as they represent about 31% of the trout in the LH area and <1% in the C&R area. Rainbow trout have been found to displace cutthroat trout in many areas through competition and hybridization (Behnke 1992). Cutthroat trout are known to be hybridizing with rainbow trout in the Coeur d'Alene River system (DuPont et al. In Press d). However, it appears that despite a long history of rainbow trout stocking, there are likely some reproductive isolating mechanisms helping to limit hybridization and introgression between these two species (either pre- or post- isolating mechanisms) in the Coeur d' Alene River system (DuPont et al. In Press d). Starting in 2003, no rainbow trout were stocked in any free flowing waters in the Panhandle Region of Idaho. Not surprisingly, this cessation of stocking corresponded with declines in the densities of rainbow trout observed from 2003 to 2005. Cutthroat trout densities on the other hand increased in the LH area from 2003 to 2005 and for the first time since 1993 were significantly higher than rainbow trout (Figure 17). We can't say for certain that this increase in cutthroat trout densities is due to not stocking rainbow trout because we also observed an increase in cutthroat trout densities in C&R areas suggesting that other factors are playing a role. Angler harvest can give an advantage to rainbow trout over cutthroat trout. Cutthroat trout are considered an easy fish to catch (Trotter 1987) and Lewynski (1986) found that cutthroat trout are significantly more vulnerable to angling than rainbow trout. When exposed to similar fishing regulations, higher catch rates of cutthroat trout could lead to a dominance of rainbow trout where they occupy the same waters (Lewynski 1986). Fishing regulations since 2000 allowed a daily harvest of six rainbow trout of any size whereas only 2 cutthroat trout (none between 8 and 16 inches) could be harvested in the LH area. If anglers comply with the fishing regulations, exploitation should not be a reason that leads to a dominance of rainbow trout over cutthroat trout in the LH area.

Telemetry work conducted by DuPont et al. (In Press c) in the Coeur d'Alene River watershed found that larger cutthroat trout are grouping in areas where colder water occurs during warm summer months. One of these areas where fish concentrated during the heat of the summer was located at snorkel transect NF01-slough. This particular backwater had water temperatures around 2°C cooler than the main river channel when it was snorkeled during 2005. The second highest density of cutthroat trout in all the LH area was observed at this particular site (1.70 fish/100 m^2). The warmer the water temperature, the more the cutthroat trout appear to congregate in this cold water sanctuary. The summer of 2003 was an unusually hot year (water temperatures were 5°C cooler in the slough than the main river), and cutthroat trout densities were 2.34 fish/100 m^2 in this slough - the highest cutthroat trout density of all the transects snorkeled at that time.

Two temporary snorkel transects (R1 & R2) were established during 2002 in the upstream portion of Tepee Creek where the U.S. Forest Service had completed some extensive stream restoration in 2001. These sites were added to evaluate how fish densities respond to this restoration over time. Cutthroat trout densities have fluctuated greatly in these rehabilitation sites since we first started snorkeling them, which may indicate that unstable habitat conditions occur in this reach. Since its creation, some stream channel shifting has occurred. We expect this to continue until willows and other shrubs take hold and begin to stabilize the banks in this area.

St. Joe River versus the North Fork Coeur d'Alene River System

From 1993 to 1997 cutthroat trout densities were usually two to three times higher in the C&R area of the St. Joe River than what was observed in the C&R area of the North Fork Coeur d'Alene River. However, after the flood and higher water events in 1996 and 1997, declines in cutthroat trout densities were observed. Declines in density were much greater in the St. Joe River than in the North Fork Coeur d'Alene River system. We believe the reason the decline was greater in the St. Joe River has to do with the difference in geomorphology. The St. Joe River has a steeper gradient and the river is more confined between the sidewalls with little to no floodplain. During flood events on the St. Joe River, there are few areas for the river to spread out and, and consequently, the water picks up speed and energy. If a flood event occurs during the winter when cutthroat trout are struggling to conserve their energy and there are few areas to evade high flows, mortality could be significant. The 1996 flood occurred during the winter. The North Fork Coeur d'Alene River system has many areas with wide floodplains where flood water can spread out, thus reducing its energy. Cutthroat trout in the North Fork Coeur d'Alene River system have been found to move to areas with wider floodplains during winter (DuPont et al. In Press c). These floodplains can provide refugia where fish can avoid fast, turbulent water that will quickly rob them of their winter energy reserves (Brown et al. 2001; DuPont et al. In Press c).

In 1998, the densities of cutthroat trout observed were actually higher in the C&R area of the North Fork Coeur d'Alene River system than the C&R area of the St. Joe River (0.89 fish/100 m^2 vs. 0.79 fish/100 m^2 respectively). After 1998, the densities of cutthroat trout increased at a faster rate in the St. Joe River than in the North Fork Coeur d'Alene River system. The faster recovery of cutthroat trout in the St. Joe River may suggest that factors such as lower habitat quality are suppressing the cutthroat trout numbers in the North Fork Coeur d'Alene River system. Findings by DuPont et al. (In Press c) indicate that many of the pools and runs in the C&R area of the North Fork Coeur d'Alene River system are shallower than cutthroat trout prefer. Locals claim that pools have become shallower or have filled in with sediment in the C&R areas of the North Fork Coeur d'Alene River system when logging and road building increased (1960-1980). Fishing mortality could also be an issue, although it would have to be illegal harvest as these comparisons are between the C&R areas. Schill and Kline (1995) reported that illegal harvest of cutthroat trout in 1993 was low (<3% of anglers) in the C&R areas of both the St. Joe and North Fork Coeur d'Alene rivers, although slightly higher in the

North Fork Coeur d'Alene River. DuPont et al. (In Press c) also reported that illegal harvest in C&R areas of the North Fork Coeur d'Alene River system was low. Densities of cutthroat trout ≥300 mm in length have reached or were near all time highs in the catch-and-release areas in both the St. Joe River and North Fork Coeur d'Alene River system in 2005, although densities were about 44% higher in the St. Joe River.

Mountain Whitefish

Our snorkel surveys showed that mountain whitefish densities had remained fairly steady in the St. Joe River from 1969 until 1997, when a fairly significant decline was documented. In all likelihood, the decrease in mountain whitefish densities in 1997 was a response to the large flood events that occurred during 1996 and 1997. Since these flood events, mountain whitefish densities have rebounded and are now about what was observed before the floods. The series of mild winters from 1998 to 2003 likely played a large role in this rapid recovery. In addition, bag limits for mountain whitefish were reduced from 50 fish to 25 fish in 2000, which may also have helped speed up the recovery of this fishery.

Based on our snorkel surveys, the density of mountain whitefish in the North Fork Coeur d'Alene River system had gone through a series of ups and downs since 1973. Many of the down years occur immediately after unusually cold winters (1979-1980; 1992-1993) or flood events (1996). Despite drops in density by 75% to 85%, the whitefish population typically bounced back in about three years. Since 2000, the average whitefish density has remained relatively high in the North Fork Coeur d'Alene River and reached all time highs in 2005. Since 1997 there have not been any unusually cold winters or flood events.

Snorkel observations indicated that mountain whitefish densities in the North Fork Coeur d'Alene River system were about 2.5 times higher than what was observed in the St. Joe River during 2005. Most mountain whitefish in the North Fork of the Coeur d'Alene River system were observed in the large, deep pools and runs in the more downstream transects. The lower St. Joe River (downstream of the North Fork) was not snorkeled in 2005, which has habitat more similar to where higher densities of mountain whitefish were observed in the North Fork Coeur d'Alene River system. Interestingly, in 2003, when the lower St. Joe River was last snorkeled, this is where the lowest density of mountain whitefish was observed

Rainbow Trout

Rainbow trout were observed in the limited harvest areas in the North Fork Coeur d'Alene River system and just three transects in the St. Joe River during 2005. Rainbow trout were not stocked into any rivers or streams in the Panhandle Region after 2002. Consequently, these fish were either holdovers from earlier stockings or are offspring from natural reproduction.

In the LH area of the North Fork Coeur d'Alene River, about 30% of the trout were rainbow trout in 2005. Based on these snorkeling surveys and other work conducted in the North Fork Coeur d'Alene River system, it appears that a naturally reproducing rainbow trout population exists in the North Fork Coeur d'Alene River downstream of Shoshone Creek and downstream of Laverne Creek in the Little North Fork Coeur d'Alene River. Others have also found introduced rainbow trout to be more abundant in the lower reaches of streams where cutthroat trout occur (Paul and Post 2001; Sloat et al. 2005). Some have suggested that the ability of rainbow trout to survive prolonged exposure to temperatures >20˚C and to grow over a wider range of temperatures helps explain why rainbow trout are often located in the lower reaches of streams and cutthroat trout in the upper reaches (Bear et al. 2005). Where the warmest water temperatures occur in the North Fork Coeur d'Alene River system (between transects 8-13) is not where the highest densities of rainbow trout occurred. Although water temperature certainly influences the distribution of rainbow trout, other factors obviously play a role. Differences in geomorphology within the North Fork Coeur d'Alene River system may also be influencing the distribution of rainbow trout. The further upstream you go in North Fork Coeur d'Alene River system the more canyon-like, the steeper the grade, and well developed floodplains are infrequent. Cutthroat trout that spend the summer in the upstream reaches of the North Fork migrate to areas (often >15 km downstream) where the river is slower, deeper and has a wider floodplain to overwinter (DuPont et al. In Press b). Cutthroat trout evolved over thousands of year to develop these migrations to maximize their survival. Introduced rainbow trout do not have this adaptation and may explain why they are not found in the upstream reaches. Moller and VanKirk (2003) found that rainbow trout in the South Fork Snake River appear to have a competitive advantage over Yellowstone cutthroat trout *O. clarkii bouvieri* where flows were less flashy (lower peak flows and higher low flows). They speculate these types of flows provide better rearing conditions for first year rainbow trout that occur in the main river. The wider floodplains that occur in the lower reaches of the North Fork Coeur d'Alene River system likely moderate flows by dispersing flows across the floodplain during high flow periods and releasing groundwater during low periods. The area with the widest and most intact floodplain occurs downstream of the South Fork Coeur d'Alene River in the Coeur d'Alene River. Rainbow trout represent about 10% of the trout species in this reach of river (Fredericks et al. 2003), whereas they represent over 30% of the trout species upstream of the South Fork Coeur d'Alene River. Water temperatures and fishing mortality are lower downstream of the South Fork Coeur d'Alene River than upstream (DuPont et al. In Press c). Likely a combination of water temperature, geomorphology, and fishing pressure all play a role in the distribution and abundance of rainbow trout in the North Fork Coeur d'Alene River.

The apparent difference in survival of rainbow trout in the St. Joe River versus the North Fork Coeur d'Alene River system probably has to do with a difference in geomorphology. As mentioned earlier, the St. Joe River is more canyon like, has a steeper grade, and fewer floodplain areas than occurs in the North Fork Coeur d'Alene River system. Consequently, for rainbow trout to survive throughout a year in the St. Joe River they would have to go through a more complex and longer migration than they would in the North Fork Coeur d'Alene River. Many cutthroat trout that spend the summer upstream of Avery in the St. Joe River migrate over 50 km downstream to overwinter near Calder where the river is slower, deeper, and has a wider floodplain (Hunt and Bjornn 1992; Fredericks et al. 2002b). Cutthroat trout evolved over thousands of year to adapt to this type of migration in the St. Joe River to maximize their survival. Introduced rainbow trout in the St. Joe River lack this adaptation and this explains whey they do not exist upstream of Avery. In the North Fork Coeur d'Alene River system, especially in the limited harvest areas, cutthroat trout migrate <5 km between summer and winter habitat (DuPont et al. In Press c). These types of migrations would be more realistic for an introduced rainbow trout.

The stream reaches in the North Fork Coeur d'Alene River system with the lowest cutthroat trout densities (limited harvest areas) had the highest densities of rainbow trout during 2005. If we combine the densities of these two species, the average trout density in the limited harvest reaches was not far below what we saw in the catch-and-release areas (0.86 fish/100m^2 vs. 1.23 fish/100 m^2). This may suggest that rainbow trout are limiting cutthroat trout numbers in the lower river reaches. Rainbow trout have been known to outcompete and hybridize with cutthroat trout in many rivers (Behnke 1992). Past snorkel surveys indicate that rainbow trout numbers have decreased in the North Fork Coeur d'Alene River, although their decline has been minimal since 2003. The initial decline was likely a response from when rainbow trout stopped being introduced into all flowing waters within the Panhandle Region starting in 2003. The current fishing regulations allow six rainbow trout of any size to be harvested from the Coeur d'Alene River. These regulations do not appear to be causing the abundance of rainbow trout to decline, although they may be keeping the rainbow trout population from increasing. These regulations may be causing the size of the rainbow trout to decline as fishermen regularly comment on how the size of the rainbow trout they catch has become much smaller over the years. Continual monitoring of this fishery should reveal population trends in rainbow trout and their potential impact on cutthroat trout in the lower North Fork and Little North Fork Coeur d'Alene rivers.

In the St. Joe River, only three rainbow trout were observed and indicate very little natural reproduction and overwinter survival is occurring upstream of the North Fork. Two of the rainbow trout were observed upstream of Prospector Creek for the first time since 1998 when they were stocked there. The observance of rainbow trout upstream of Prospector Creek could be a result of the mild winters that have occurred over the past seven years. If current weather patterns continue, warmer water temperatures could allow rainbow trout populations to spread upstream (Fausch et al. 2006; McMahon 2006, Weigel et al. 2003)

Bull Trout

Four bull trout were observed in the St. Joe River in 2005. This is the most bull trout that were observed while snorkeling since 1977. Although it's difficult to speculate on trends in bull trout abundance based on such low numbers, it does coincide with a record high number of bull trout redds counted in the St. Joe watershed during 2005 (redd counts were initiated in 1992).

RECOMMENDATIONS

1. Continue to monitor cutthroat trout abundance in the St. Joe and North Fork Coeur d'Alene Rivers through snorkel surveys.

2. Evaluate fishing mortality of cutthroat trout in the North Fork Coeur d'Alene River using reward tags.

3. Assess whether rainbow trout are having an impact on cutthroat trout in the North Fork Coeur d'Alene River.

LITERATURE CITED

Abbott, A.M. 2000. Land management and flood effects on the distribution and abundance of cutthroat trout in the Coeur d'Alene River basin, Idaho. Masters Thesis, University of Idaho. Moscow, Idaho.

Anderson, D.R., and K.P. Burnham, and W.L. Thompson. 2000. Null Hypothesis Testing, Prevalence, and an Alternative. Journal of Wildlife Management 64:912-923.

Bear, B.A., T.E. McMahon, and A.V. Zale. 2005. Thermal requirements of westslope cutthroat trout. Final report to the Wild Fish Habitat Initiative, Montana Water Center at Montana State University-Bozeman and Partners to Fish and Wildlife Program, U.S. Fish and Wildlife Service. Bozeman, Montana.

Behnke, R.J. 1992. Native trout of western North American. American Fisheries Society, Monograph 6. Bethesda, Maryland.

Beltaos, S. (Editor). 1995. River Ice Jams. Highlands Ranch, Colorado. Water Resources Publications.

Bjornn T.C., and D.W. Reiser. 1991. Habitat requirements of salmonids in streams. Pages 83-139 in W.R. Meehan, editor. Influences of forest and rangeland management on salmonid fishes and their habitats. American Fisheries Society Special Publication 19.

Bowler, B. 1974. Coeur d'Alene River Study. Idaho Department of Fish and Game, Federal Aid in Fish Restoration, F-53-R-9, 1974 Job Performance Report, Boise.

Brown, R.S. 1999. Fall and early winter movements of cutthroat trout, Oncorhynchus clarki, in relation to water temperature and ice conditions in Dutch Creek, Alberta, Environmental Biology of Fishes 55:359-368.

Brown, R.S., G. Powers, S. Beltaos, and T.A. Beddow. 2000. Effects of hanging ice dams on winter movements and swimming activity of fish. Journal of Fish Biology 57:1150-1159.

Brown, R.S., G. Power, and S. Beltaos. 2001. Winter movements and habitat use of riverine brown trout, white sucker and common carp in relation to flooding and ice break-up. Journal of Fish Biology 59:1126-1141

Cunjak, R.A., and G. Power. 1986. Winter habitat utilization by stream resident brook trout Salvelinus fontinalus and brown trout Salmo trutta. Canadian Journal of Fisheries and Aquatic Sciences 43:1970-1981.

DeVries, P.E. 2000. Scour in low gradient gravel bed streams: Patterns, processes, and implications for the survival of salmonid embryos. Doctorate Dissertation. University of Washington. Seattle, Washington.

Dunn, C. 1968. St. Joe River Creel Census – 1968. Idaho Cooperative Fishery Unit, Completion Report, University of Idaho, Moscow, Idaho.

DuPont, J., M. Liter, and N. Horner. In Press a. Regional fisheries management investigations. Idaho Department of Fish and Game, Federal Aid in Fish Restoration, F-71-R-27, Job c-1, 2002 Job Performance Report, Boise, Idaho.

DuPont, J., M. Liter, and N. Horner. In Press b. Regional fisheries management investigations. Idaho Department of Fish and Game, Federal Aid in Fish Restoration, F-71-R-29, Job c-2, 2004 Job Performance Report, Boise, Idaho

DuPont, J., M. Liter, and N. Horner. In Press c. Regional fisheries management investigations. Idaho Department of Fish and Game, Federal Aid in Fish Restoration, F-71-R-29, Job c-3, 2004 Job Performance Report, Boise, Idaho

DuPont, J., M. Liter, and N. Horner. In Press d. Regional fisheries management investigations. Idaho Department of Fish and Game, Federal Aid in Fish Restoration, F-71-R-29, Job c-5, 2004 Job Performance Report, Boise, Idaho

Dwyer, W.P. 1990. Catchability of three strains of cutthroat trout. North American Journal of Fisheries Management. 10:458-461.

Fausch, K.D., B.E. Rieman, M.K. Young, and J.B. Dunham. 2006. Strategies for conserving native salmonid populations at risk from nonnative fish invasions: tradeoffs in using barriers to upstream movement. General Technical Report RMRS-GTR-174. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station.

Fredericks, J., J. Davis, N. Horner, and C. Corsi. 1997. Regional fisheries management investigations, Idaho Department of Fish and Game, Federal Aid in Fish Restoration, F-71-R-21 Job c, 1996 Job Performance Report, Boise, Idaho.

Fredericks, J., J. Davis, N. Horner, and C. Corsi. 2002a. Regional fisheries management investigations, Idaho Department of Fish and Game, Federal Aid in Fish Restoration, F-71-R-23 Job c, 1998 Job Performance Report, Boise, Idaho.

Fredericks, J., M. Liter, N. Horner, and C. Corsi. 2002b. Regional fisheries management investigations, Idaho Department of Fish and Game, Federal Aid in Fish Restoration, F-71-R-24 Job c, 1999 Job Performance Report, Boise, Idaho.

Fredericks, J., M. Liter, N. Horner, and C. Corsi. 2003. Regional fisheries management investigations, Idaho Department of Fish and Game, Federal Aid in Fish Restoration, F-71-R-25 Job c, 2000 Job Performance Report, Boise, Idaho.

Hunt, R.L. 1969. Overwinter survival of wild fingerling brook trout in Lawrence Creek, Wisconsin. Journal of the Fisheries Research Board of Canada 26:1473-1483.

Hunt, J.P. and T.C. Bjornn. 1992. Catchability and vulnerability of westslope cutthroat trout to angling and movements in relation to seasonal changes in water temperature in northern Idaho rivers. Job Completion Report, Project F-71-R-13, Boise, Idaho.

Johnson, T.H., and T.C. Bjornn. 1975. Evaluation of angling regulations in management of cutthroat trout. Idaho Department of Fish and Game, Job Performance Report, F-59-R-6, Boise, Idaho

Johnson, T.H., and T.C. Bjornn. 1978. The St. Joe River and Kelly Creek cutthroat trout populations: an example of wild trout management in Idaho. Pages 39-47 in J.R. Moring, editor. Proceedings of the Wild Trout – Catchable Trout Symposium. Oregon Department of Fish and Wildlife. Eugene, Oregon.

Johnson, D.H. 1999. The Insignificance of Statistical Significance Testing. Journal of Wildlife Management 63:763-772.

Lewynsky, V.A. 1986. Evaluation of special angling regulations in the Coeur d'Alene River trout fishery. Masters Thesis, University of Idaho. Moscow, Idaho.

Maciolek, J.A., and P.R. Needham. 1952. Ecological effects of winter conditions on trout and trout foods in Covict Creek, California, 1951. Transactions of the American Fisheries Society 81:202-2217.

Mallet, J.L. 1967. St. Joe River fisheries investigations. Idaho Department of Fish and Game, St. Joe Creel Census Studies, 1967, Boise, Idaho.

McMahon, T.E. B.A. Bear, and A.V. Zale. 2006. Comparative thermal preferences of westslope cutthroat trout and rainbow trout. Final Report to the Wild Fish Habitat Initiative, Montana Water Center, Montana State University, Bozeman, Montana.

Meyer, K.A. and J.S. Griffith. 1997. First-winter survival of rainbow trout and brook trout in the Henrys Fork of the Snake River, Idaho. Canadian Journal of Zoology. 75(1):59-63.

Milliken, G.A. and D.E. Johnson. 1992. Analysis of messy data, Volume I: Designed Experiments. Chapman and Hall London UK.

Mink, L.L., R.E. Williams, and A.T. Wallace. 1971. Effects of industrial and domestic effluents on the Coeur d'Alene River basin. Idaho Bureau of Mines and Geology. Pamphlet 140. Moscow, Idaho.

Moller, S. and R. VanKirk. 2003. Hydrologic Alteration and its effect on trout recruitment in the South Fork Snake River. Project Completion Report for the Idaho Department of Fish and Game. Boise, Idaho.

Nelson, L., J. Davis, and N. Horner. 1996. Regional fisheries management investigations, Idaho Department of Fish and Game, Federal Aid in Fish Restoration, F-71-R-18, Job c, 1993 Job Performance Report, Boise, Idaho.

Paul, A.J., and J.R. Post. 2001. Spatial distribution of native and nonnative salmonids in streams of the eastern slopes of the Canadian Rocky Mountains. Transactions of the American Fisheries Society 133:427-433.

Peterman, R.M. 1990. Statistical power can improve fisheries research and management. Canadian Journal of Fisheries and Aquatic Sciences 47:2-15.

Pearson, T.N., W. L. Hiram and G.A. Lamberti. 1992. Influence of habitat complexity on resistance to flooding and resilience of stream fish assemblies. Transactions of the American Fisheries Society 121:427-436.

Rabe, F.W. and C.W. Sappington. 1970. Biological productivity of the Coeur d'Alene rivers as related to water quality. Water Resources Research Institute. Technical Completion Report, Project A-024-IDA. University of Idaho. Moscow, Idaho.

Rankle, G.L. 1971. An appraisal of the cutthroat trout fishery of the St. Joe River. Masters Thesis, University of Idaho, Moscow, Idaho.

Reimers, N. 1963. Body condition, water temperature, and overwinter survival of hatchery-reared trout in Covict Creek, California. Transactions of the American Fisheies Society 92:39-46.

Rieman, B.E. and K.A. Apperson. 1989. Status and analysis of salmonid fisheries: westslope cutthroat trout synopsis and analysis of fishery information. Idaho Department of Fish and Game Project F-73-R-11, Subproject No. II, Job No. 1. Boise, Idaho.

Schill, D.J., J.S. Griffith, and R.E. Gresswell. 1986. Hooking mortality of cutthroat trout in a catch-and-release segment of the Yellowstone River, Yellowstone National Park. North American Journal of Fisheries Management. 6:226-232.

Schill, D.J. and P.A. Kline. 1995. Use of Random Response to Estimate Angler Noncompliance with Fishing Regulations. North American Journal of Fisheries Management 15:721-731.

Schmetterling, D.A. 2001. Seasonal movements of fluvial westslope cutthroat trout in the Blackfoot River, Montana. North American Journal of Fisheries Management 21:507-520.

Shutter B.J. and J.R. Post. 1990. Climate, population viability, and the zoogeography of temperate fishes. Transactions of the American Fisheries Society 119:314-336.

Sloat, M.R., B.B. Shepard, and R.G. White. 2005. Influence of stream temperature on the spatial distribution of westslope cutthroat trout growth potential within the Madison River basin, Montana. North American Journal of Fisheries Management 25:225-237.

Swanston, D.N. 1991. Natural processes. American Fisheries Society Special Publication 19:139-179.

Tack, E. 1938. Trout mortality from the formation of suspended ice crystals. Progressive Fish-Culturalist 37:26.

Thurow, R.F. 1976. The effects of closure to angling on cutthroat trout populations in tributaries of the St. Joe River, Idaho. Masters Thesis. University of Idaho, Moscow, Idaho.

Thurow, R.F. 1994. Underwater methods for study of salmonids in the Intermountain West. General Technical Report. INT-GTR-307. Ogden, UT: USDA Forest Service, Intermountain Research Station, Boise, Idaho.

Thurow, R.F., J.T. Peterson, and J.W. Guzevich. In Review. Utility and validation of day and night snorkel counts for estimating bull trout abundance in 1st to 3rd order streams. North American Journal of Fisheries Management.

Trotter, P.C. 1987. Cutthroat, native trout of the west. Colorado Associated University Press. Boulder Colorado.

Weigel, D.E, J.T. Peterson, and P. Spruell. 2003. Introgressive hybridization between native cutthroat trout and introduced rainbow trout. Ecological Applications 13:38-50.

Whitworth, W.E., and R.J. Strange. 1983. Growth and production of sympatric brook and rainbow trout in an Appalachian stream. Transactions of the American Fisheries Society 112:469-475.

Table 1. Number and density (fish/100 m^2) of fish observed while snorkeling transects in the St. Joe River, Idaho, during August 9-11, 2005. Transects 29-35 (area that allows limited harvest) were not snorkeled due to low visibility.

Reach	Transect Number	Habitat Type	Length (m)	Average Width (m)	Area (m2)	Cutthroat Trout Numbers Counted <300mm	≥300mm	All sizes	Cutthroat Trout Density (No./100 m^2)	Rainbow Trout Counted	Bull Trout Counted	Whitefish Number Counted	Whitefish Density (No./100 m^2)
N.F. St. Joe River to Prospector Creek.	SJ01	Riffle	55	37.25	2,049	7	7	14	0.68	1	0	14	0.68
	SJ02	Pool	131	23.50	3,079	81	28	109	3.54	0	0	264	8.58
	SJ03	Pool	90	13.00	1,170	12	3	15	1.28	0	0	22	1.88
	SJ04	Pool	84	12.75	1,071	10	3	13	1.21	0	0	14	1.31
	SJ05	Run	150	25.33	3,800	4	4	8	0.21	0	0	24	0.63
	SJ06	Pool	175	30.60	5,355	9	10	19	0.35	0	0	18	0.34
	SJ07	Pool	145	28.20	4,089	14	4	18	0.44	0	0	21	0.51
Prospector Creek. To Red Ives Creek	SJ08	Pool	161	22.50	3,623	29	12	41	1.13	0	0	45	1.24
	SJ09	Pool	82	24.00	1,968	7	11	18	0.91	0	0	5	0.25
	SJ10	Pool	265	21.75	5,764	23	21	44	0.76	0	0	36	0.62
	SJ11	Pool	59	23.50	1,387	20	13	33	2.38	0	0	23	1.66
	SJ12	Pool	138	22.25	3,071	25	16	41	1.34	0	1	86	2.80
	SJ13	Run	110	24.60	2,706	24	12	36	1.33	0	0	3	0.11
	SJ14	Pool	91	17.50	1,593	41	19	60	3.77	1	0	25	1.57
	SJ15	Pool	114	13.75	1,568	29	20	49	3.13	0	0	12	0.77
	SJ16	Pool/Riffle	79	12.00	948	59	21	80	8.44	1	0	5	0.53
	SJ17	Pool	135	11.75	1,586	29	21	50	3.15	0	1	27	1.70
	SJ18	Pool	95	13.75	1,306	48	35	83	6.35	0	0	38	2.91
	SJ19	Run	41	16.60	681	36	5	41	6.02	0	0	4	0.59
	SJ20	Run	70	17.20	1,204	17	9	26	2.16	0	0	8	0.66
	SJ21	Pool	48	18.50	888	8	4	12	1.35	0	0	6	0.68
	SJ22	Pool	70	21.60	1,512	18	10	28	1.85	0	0	20	1.32
Red Ives Creek to Ruby Creek	SJ23	Run	42	13.67	574	5	3	8	1.39	0	0	1	0.17
	SJ24	Run	56	16.00	896	16	1	17	1.90	0	0	6	0.67
	SJ25	Run	69	18.20	1,256	12	3	15	1.19	0	0	4	0.32
	SJ26	Run	70	20.20	1,414	8	1	9	0.64	0	0	0	0.00
	SJ27	Pool	76	20.17	1,533	15	9	24	1.57	0	2	40	2.61
	SJ28	Run	45	12.40	558	3	0	3	0.54	0	0	7	1.25
Total	28 Sites	--	2,746	--	56,645	609	305	914	1.61	3	4	778	1.37

Table 2. Average density (fish/100 m^2) of all sizes of cutthroat trout counted by reach during snorkeling evaluations from 1969 to 2005 in the St. Joe River, Idaho.

Reach	1969	1970	1971	1972	1973	1974	1975	1976	1977	1979	1980	1982	1989
Calder to North Fork St. Joe	--	--	--	--	--	--	--	--	--	--	--	--	
N.F. St. Joe to Prospector Cr.	0.01	0.00	0.07	0.04	0.01	0.11	0.08	--	0.04	0.08	0.12	0.03	0.18
Prospector Cr. to Red Ives Cr.	0.25	0.31	0.58	0.59	0.76	1.40	1.53	3.59	1.72	1.63	1.50	2.93	2.44
Red Ives Cr. to Ruby Cr.	1.38	1.39	2.07	2.63	2.55	5.01	6.12	1.89	4.62	3.14	1.46	3.31	2.41
All transects - entire river	--	--	--	--	--	--	--	--	--	--	--	--	
Avery to Ruby Creek	0.27	0.29	0.52	0.58	0.63	1.23	1.40	3.10	1.60	1.11	0.88	1.68	1.43

Reach	1990	1993	1994	1995	1996	1997	1998	2000	2001	2002	2003	2004	2005
Calder to North Fork St. Joe	--	0.07	0.23	0.16	0.14	0.15	0.09	--	0.22	0.11	0.11	--	--
N.F. St. Joe to Prospector Cr.	0.22	0.47	0.33	0.79	0.33	0.18	0.12	0.46	0.52	0.52	0.80	0.50	0.95
Prospector Cr. to Red Ives Cr.	2.79	2.13	1.66	2.56	2.42	2.79	1.05	1.11	1.38	1.46	2.01	1.76	2.15
Red Ives Cr. to Ruby Cr.	4.05	1.17	1.39	2.58	2.57	1.13	1.44	1.06	1.19	0.93	1.76	2.03	1.22
All transects - entire river	--	0.79	0.76	1.19	1.06	1.09	0.50	--	0.80	0.64	0.90	--	--
Avery to Ruby Creek	1.82	1.30	1.18	1.99	1.77	1.74	0.79	0.88	1.02	1.00	1.51	1.29	1.61

[a] Transects SJ01-SJ12 were not snorkeled.
[b] Transects SJ01-SJ04 were not snorkeled.
[c] Transect locations differed this year from other years.

Table 3. Average density (fish/100 m^2) of cutthroat trout ≥300 mm counted by reach during snorkeling evaluations from 1969 to 2005 in the St. Joe River, Idaho.

Reach	1969	1970	1971	1972	1973	1974	1975	1976	1977	1979	1980	1982	1989
Calder to North Fork St. Joe	--	--	--	--	--	--	--	--	--	--	--	--	--
N.F. St. Joe to Prospector Cr.	0.01	0.00	0.00	0.00	0.00	0.00	0.00	--	0.00	0.00	0.01	0.00	0.02
Prospector Cr. to Red Ives Cr.	0.02	0.02	0.02	0.00	0.10	0.00	0.00	0.00	0.00	0.07	0.12	0.23	0.44
Red Ives Cr. to Ruby Cr.	0.12	0.11	0.00	0.00	0.17	0.00	0.00	0.00	0.00	0.17	0.47	0.40	0.81
All transects - entire river	--												
Avery to Ruby Creek	0.03	0.02	0.01	0.00	0.06	0.00	0.00	0.00	0.00	0.05	0.11	0.15	0.30

Reach	1990	1993	1994	1995	1996	1997	1998	2000	2001	2002	2003	2004	2005
Calder to North Fork St. Joe	--	0.02	0.05	0.02	0.03	0.00	0.01	--	0.02	0.00	0.02	--	--
N.F. St. Joe to Prospector Cr.	0.09	0.08	0.02	0.05	0.07	0.01	0.01	0.12	0.04	0.07	0.17	0.20	0.29
Prospector Cr. to Red Ives Cr.	0.95	0.69	0.46	0.40	0.56	0.16	0.08	0.24	0.20	0.30	0.20	0.68	0.77
Red Ives Cr. to Ruby Cr.	0.88	0.72	0.47	0.70	0.76	0.13	0.26	0.18	0.11	0.24	0.41	0.95	0.27
All transects - entire river		0.26	0.20	0.19	0.25	0.06	0.05	--	0.10	0.12	0.13	--	--
Avery to Ruby Creek	0.57	0.43	0.31	0.33	0.43	0.11	0.08	0.19	0.13	0.19	0.21	0.52	0.54

[a] Transects SJ01-SJ12 were not snorkeled.
[b] Transects SJ01-SJ04 were not snorkeled.
[c] Transect locations differed this year from other years.

Table 4. Fishers Least Significant Difference Test matrices showing pairwise comparison probabilities of cutthroat trout densities (all sizes and ≥300 mm) between three stream reaches in the St. Joe River, Idaho during 2005. Shaded cells indicate which stream reaches had significantly different ($p \leq 0.10$) cutthroat trout densities.

All sizes

	N.F. St. Joe	Prospector	Red Ives
N.F. St. Joe	1.000		
Prospector	0.038	1.000	
Red Ives	0.920	0.061	1.000

Cutthroat trout ≥300 mm

	N.F. St. Joe	Prospector	Red Ives
N.F. St. Joe	1.000		
Prospector	0.015	1.000	
Red Ives	0.855	0.013	1.000

Table 5. History of fishing regulations for cutthroat trout in the St. Joe River and Coeur d'Alene River, Idaho from 1941 to 2005.

St. Joe River			
Year	CdA Lake to N.F. St Joe	N.F. St. Joe to Prospector Cr.	Prospector Cr. to headwaters
1941-1945	15 lbs plus 1 fish - not to exceed 25 fish		
1946-1950	10 lbs plus 1 fish - not to exceed 20 fish		
1951-1954	7 lbs plus 1 fish - not to exceed 20 fish		
1955-1970	7 lbs plus 1 fish - not to exceed 15 fish		
1971	7 lbs plus 1 fish - not to exceed 15 fish		3 fish, none <13 inches
1972-1975	7 lbs plus 1 fish - not to exceed 10 fish		3 fish, none <13 inches
1976	10 fish, only 5 >12 inches and 2 >18 inches		3 fish, none <13 inches
1977-1987	6 fish, only 2 >16 inches		3 fish, none <13 inches
1988-1999	1 fish, none <14 inches		Catch-and-release
2000-2005	2 fish, none between 8"-16"	Catch-and-release	

Coeur d'Alene River			
Year	CdA Lake to Yellow Dog Creek	Yellow Dog Creek to headwaters (NF CdA)	Laverne Creek to headwaters (LNF CdA)
1941-1945	15 lbs plus 1 fish - not to exceed 25 fish		
1946-1950	10 lbs plus 1 fish - not to exceed 20 fish		
1951-1954	7 lbs plus 1 fish - not to exceed 20 fish		
1955-1971	7 lbs plus 1 fish - not to exceed 15 fish		
1972-1974	7 lbs plus 1 fish - not to exceed 10 fish		
1975	7 lbs plus 1 fish - not to exceed 10 fish	3 fish, none <13 inches	
1976	10 fish, only 5 >12 inches & 2 >18 inches	3 fish, none <13 inches	
1977-1985	6 fish, only 2 >16 inches	3 fish, none <13 inches	
1986-1987	6 fish, only 2 >16 inches	Catch-and-release	3 fish, none <13 inches
1988-1999	1 fish, none <14 inches	Catch-and-release	
2000-2005	2 fish, none between 8"-16"	Catch-and-release	

Table 6. Average density (fish/100 m^2) of mountain whitefish counted by reach during snorkeling surveys from 1969 to 2005 in the St. Joe River, Idaho.

Reach	1969	1970	1971	1972	1973	1974	1975	1976	1977	1979	1980	1982	1989
Calder to N.F. St Joe River	--	--	--	--	--	--	--	--	--	--	--	--	--
NF St Joe to Prospector Cr.	0.86	0.90	0.98	0.24	1.09	0.95	1.08	--[a]	--[b]	1.09	0.77	--[d]	0.70
Prospector Cr. to Red Ives Cr.	1.24	1.16	1.12	0.82	3.72	1.33	0.97	0.71[a]	0.23[c]	1.69	1.20	--[d]	2.17
Red Ives Cr. to Ruby Cr.	1.83	1.32	1.89	2.26	1.39	2.28	2.45	1.14	1.56	2.79	1.27	0.94[d]	1.32
Average for all sites	--	--	--	--	--	--	--	--	--	--	--	--	--
NF St Joe to Ruby Creek	1.14	1.06	1.14	0.73	2.29	1.27	1.19	0.84[a]	0.34[b,c]	1.54	1.01	0.11[d]	1.42

Reach	1990	1993	1994	1995	1996	1997	1998	2000	2001	2002	2003	2004	2005
Calder to N.F. St Joe River	--	0.60	0.18	0.34	0.88	0.44	0.10	--	1.25[e]	0.33	0.80	--	--
NF St Joe to Prospector Cr.	1.13	0.40	2.12	1.29	1.03	0.27	1.39	0.51	0.33	0.75	2.38	1.11	1.83
Prospector C. to Red Ives Cr.	2.01	2.11	0.65	1.67	1.02	0.47	0.80	0.55	1.22	1.22	1.87	1.59	1.15
Red Ives Cr. to Ruby Cr.	2.22	0.66	1.03	1.73	1.60	0.35	0.38	0.47	0.56	0.37	1.12	0.99	0.93
Average for all sites	--	0.95	0.75	1.03	1.01	0.41	0.60	--	0.92[e]	0.68	1.47	--	1.37
NF St Joe to Ruby Creek	1.65	1.20	1.19	1.56	1.11	0.39	0.94	0.53	0.79	0.92	1.98	1.33	1.37

[a] Transects SJ01-SJ12 were not snorkeled.
[b] Transects SJ01-SJ04 were not snorkeled.
[c] Transects SJ05-SJ16 were only evaluated for presence/absence.
[d] Transects SJ01-SJ25 were only evaluated for presence/absence.
[e] Transect locations differed this year from other years.

Table 7. Average density (fish/100 m^2) of rainbow trout counted by reach during snorkeling evaluations from 1969 to 2005 in the St. Joe River, Idaho.

Reach	1969	1970	1971	1972	1973	1974	1975	1976	1977	1979	1980	1982	1989
Calder to N.F. St Joe River	--	--	--	--	--	--	--	--	--	--	--	--	--
NF St Joe to Prospector Cr.	0.07	0.13	0.25	0.25	0.16	0.44	0.86	--[a]	0.01[b]	0.14	0.10	0.18	0.28
Prospector Cr. to Red Ives Cr.	0.25	0.94	0.82	0.05	0.09	0.18	0.47	0.00[a]	0.04	0.04	0.27	0.01	0.00
Red Ives Cr. to Ruby Cr.	0.11	0.41	0.04	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Average for all sites	--	--	--	--	--	--	--	--	--	--	--	--	--
NF St Joe to Ruby Creek	0.16	0.52	0.48	0.14	0.11	0.27	0.59	0.00[a]	0.02[b]	0.08	0.16	0.09	0.12

Reach	1990	1993	1994	1995	1996	1997	1998	2000	2001	2002	2003	2004	2005
Calder to N.F. St Joe River	--	0.14	0.10	0.21	0.20	0.03	0.15	--	0.23[c]	0.04	0.03	--	--
NF St Joe to Prospector Cr.	0.43	0.15	0.10	0.07	0.37	0.06	0.46	0.00	0.00	0.01	0.00	0.01	0.00
Prospector C. to Red Ives Cr.	0.10	0.01	0.05	0.01	0.03	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.01
Red Ives Cr. to Ruby Cr.	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Average for all sites	--	0.10	0.08	0.11	0.17	0.02	0.16	0.00	0.06[c]	0.02	0.01	--	--
NF St Joe to Ruby Creek	0.23	0.07	0.06	0.03	0.14	0.02	0.17	0.00	0.00	0.00	0.00	0.00	0.01

[a] Transects SJ01-SJ12 were not snorkeled.
[b] Transects SJ01-SJ04 were not snorkeled.
[c] Transect locations differed this year from other years.

Table 8. Number and density (fish/100 m²) of fish observed while snorkeling transects in the North Fork Coeur d'Alene River system, Idaho, during August 2-4, 2005.

Reach	Transect #	Habitat Type	Area (m^2)	Cutthroat trout: Number counted ≥300mm	Cutthroat trout: Number counted all sizes	Cutthroat trout: Density (fish/100 m^2)	Rainbow Trout: Number Counted	Rainbow Trout: Density (fish/100 m^2)	Brook Trout Counted	Mountain whitefish: Number Counted	Mountain whitefish: Density (fish/100 m^2)
Lower North Fork Coeur d'Alene (Limited Harvest Allowed)	NF-01	Pool	4,954	4	14	0.28	66	1.33	0	540	10.90
	NF-01 (slough)	Slough	1,000	5	17	1.70	28	2.80	0	250	25.01
	NF-02	Pool	8,633	5	22	0.25	42	0.49	0	370	4.29
	NF-03	Pool	10,440	9	56	0.54	30	0.29	0	560	5.36
	NF-04	Pool	10,261	9	62	0.60	27	0.26	0	550	5.36
	NF-05	Pool	8,349	2	31	0.37	18	0.22	0	95	1.14
	NF-06	Pool	5,749	2	26	0.45	18	0.31	0	330	5.74
	NF-07	Pool	5,829	5	50	0.86	5	0.09	0	500	8.58
	NF-08	Pool	4,589	35	111	2.42	2	0.04	0	90	1.96
	NF-09	Pool	8,311	33	106	1.28	5	0.06	0	145	1.74
	NF-10	Pool/Glide	6,696	30	83	1.24	11	0.16	0	480	7.17
	NF-11	Run	7,616	5	7	0.09	3	0.04	0	0	0.00
	NF-12	Glide	5,623	4	7	0.12	0	0.00	0	0	0.00
	NF-13	Run	2,370	0	0	0.00	0	0.00	0	0	0.00
N. F. Cd'A (Catch-and-Release)	NF-14	Pool	3,625	8	33	0.91	0	0.00	0	60	1.66
	NF-15	Pool	2,603	14	50	1.92	0	0.00	0	310	11.91
	NF-16	Run	3,297	4	4	0.12	0	0.00	0	0	0.00
	NF-17	Pool	9,520	75	161	1.69	0	0.00	0	400	4.20
	NF-18	Pool	1,275	5	32	2.51	0	0.00	0	130	10.20
	NF-19	Pool/Run	583	4	15	2.57	0	0.00	0	0	0.00
	NF-20	Pool	731	5	5	0.68	0	0.00	0	0	0.00
	NF-21	Pool	810	6	19	2.35	0	0.00	0	0	0.00
	NF-22	Pool	931	7	17	1.83	0	0.00	0	0	0.00
	NF-23	Run	436	2	6	1.38	0	0.00	0	0	0.00
Tepee Creek (Catch-and-Release)	TP-01	Pool	1,560	0	17	1.09	0	0.00	0	6	1.04
	TP-02	Run	2,860	2	5	0.17	0	0.00	0	0	0.00
	TP-03	Pool	1,380	1	2	0.14	0	0.00	0	0	0.00
	TP-04	Run	1,311	1	1	0.08	0	0.00	0	0	0.00
	TP-05	Pool	1,293	0	20	1.55	0	0.00	0	30	1.71
	TP R1	Pool/Riffle	1,148	0	5	0.44	0	0.00	0	0	0.00
	TP R2	Pool/Riffle	1,148	1	6	0.52	0	0.00	0	0	0.00

Table 8. Continued.

Reach	Transect #	Habitat Type	Area (m²)	Cutthroat trout: Number counted ≥300mm	Cutthroat trout: Number counted all sizes	Cutthroat trout: Density (fish/100 m²)	Rainbow Trout: Number Counted	Rainbow Trout: Density (fish/100 m²)	Brook Trout Counted	Mountain whitefish: Number Counted	Mountain whitefish: Density (fish/100 m²)
L.N.F. Cd'A (Limited Harvest Allowed)	LNF-01	Run	574	0	5	0.87	7	0.50	1	0	0.00
	LNF-02	Glide	3,776	5	7	0.19	12	0.82	0	0	0.00
	LNF-03	Pool	2,420	0	0	0.00	3	0.18	0	7	0.42
	LNF-04	Pool/glide	1,680	4	7	0.42	0	0.00	0	0	0.00
	LNF-05	Pool	1,751	0	0	0.00	2	0.19	0	20	1.95
	LNF-06	Pool/Run	1,879	0	0	0.00	0	0.00	0	0	0.00
	LNF-07	Pool	1,027	0	3	0.29	0	0.00	0	0	0.00
	LNF-08	Pool	1,410	2	8	0.57	0	0.00	0	0	0.00
L.N.F. Cd'A (Catch-and-Release)	LNF-09	Riffle/Run	1,464	0	0	0.00	0	0.00	0	0	0.00
	LNF-10	Pool/Run	1,651	5	43	2.60	0	0.00	1	0	0.00
	LNF-11	Pool	1,104	4	39	3.53	0	0.00	0	0	0.00
	LNF-12	Pool/Run	1,027	0	1	0.10	0	0.00	0	0	0.00
	LNF-13	Run	1,112	1	3	0.27	0	0.00	0	0	0.00
Total	43 sites	--	145,805	304	1,106	0.76	279	0.19	2	4,873	3.34

Table 9. Fishers Least Significant Difference Test matrices showing pairwise comparison probabilities of cutthroat trout densities (all sizes and ≥300 mm) between seven stream reaches in the North Fork Coeur d'Alene River watershed, Idaho, during 2005. Shaded cells indicate which stream reaches had significantly different (p ≤0.10) cutthroat trout densities. Stream reaches labeled by bold text occurred in limited harvest areas.

All sizes

	SF - Prich	**Prich-YD**	YD-Tepee	Tepee-JC	**LNF lower**	LNF upper	Tepee
SF CdA– Prichard Cr	1.000						
Prich-Yellow Dog Cr	0.717	1.000					
YD Cr-Tepee Cr	0.152	0.108	1.000				
Tepee Cr-Jordan Cr	0.039	0.030	0.541	1.000			
LNF lower	0.316	0.601	0.024	0.004	1.000		
LNF upper	0.239	0.168	0.810	0.396	0.044	1.000	
Tepee Creek	0.811	0.911	0.133	0.038	0.519	0.204	1.000

≥300 mm

	SF – Prich	**Prich-YD**	YD-Tepee	Tepee-JC	**LNF lower**	LNF upper	Tepee
SF CdA– Prichard Cr	1.000						
Prich-Yellow Dog Cr	0.678	1.000					
YD Cr-Tepee Cr	0.017	0.070	1.000				
Tepee Cr-Jordan Cr	0.000	0.000	0.035	1.000			
LNF lower	0.335	0.210	0.002	0.000	1.000		
LNF upper	0.985	0.696	0.030	0.000	0.407	1.000	
Tepee Creek	0.299	0.193	0.003	0.000	0.845	0.357	1.000

Table 10. Average density (fish/100 m^2) of all size classes of cutthroat trout counted in reaches of the North Fork Coeur d'Alene River (N.F. Cd'A), Little North Fork Coeur d'Alene River (L.N.F. Cd'A), and Tepee Creek, Idaho, during snorkeling evaluations from 1973 to 2005.

River section	1973	1980	1981	1988	1991	1993	1994	1995	1996	1997	1998	2000	2001	2002	2003	2004	2005
N.F. Cd'A - S. F. Cd'A to Prichard Cr.	0.06	0.02	0.02	0.05	0.18	0.56	0.31	0.47	0.51	0.35	0.32	0.41	--	0.28	0.41	0.60	0.65
N.F. Cd'A - Prichard Cr to Yellowdog Cr.	0.05	0.00	0.02	0.02	0.14	0.08	0.28	0.19	0.06	0.44	0.41	0.13	--	0.49	0.30	0.33	0.66
N.F. Cd'A - Yellowdog Cr to Tepee Cr.	0.24	0.31	0.28	1.10	1.18	0.35	1.70	1.57	1.71	1.70	0.63	0.63	--	0.54	0.78	0.88	1.38
N.F. Cd'A - Tepee Cr. to Jordan Cr.	1.48	0.68	0.74	0.46	0.11	0.27	1.31	0.46	1.17	1.87	1.18	1.49	1.02	2.40	1.22	1.27	1.78
L.N.F. Cda - Mouth to Laverne Cr.	0.33	0.04	0.02	0.10	0.09	0.18	0.03	0.04	0.12	0.22	0.39	0.36	0.28	0.13	0.30	0.22	0.21
L.N.F. Cda - Laverne Cr. to Deception Cr.	0.79	1.03	1.95	0.90	0.66	0.03	0.47	0.22	0.90	0.00	0.65	0.79	0.12	0.98	0.69	0.97	1.35
Tepee Creek	0.00	0.14	0.43	0.12	0.24	0.19	0.12	0.13	0.02	0.45	1.24	0.25	0.24	0.84	0.44	0.85	0.54
Entire N.F. Cd'A River	0.13	0.10	0.11	0.33	0.32	0.35	0.54	0.53	0.63	0.69	0.44	0.38	--	0.43	0.47	0.58	0.82
Entire L.N.F. Cd'A River	0.38	0.15	0.24	0.27	0.20	0.15	0.13	0.09	0.35	0.17	0.45	0.45	0.25	0.31	0.39	0.44	0.56
All Transects	0.20	0.11	0.14	0.31	0.30	0.31	0.43	0.42	0.50	0.57	0.49	0.38	--	0.44	0.46	0.58	0.76
All limited harvest areas	0.10	0.02	0.02	0.04	0.15	0.32	0.25	0.31	0.28	0.35	0.36	0.28	--	0.29	0.36	0.45	0.59
All catch-and-release areas	0.51	0.41	0.53	0.81	0.76	0.25	0.94	0.72	0.90	1.08	0.89	0.65	--	0.89	0.73	0.92	1.23
Tepee Creek Rehab Area	--	--	--	--	--	--	--	--	--	--	--	--	--	0.87	0.00	1.09	0.48

Table 11. Average density (fish/100 m^2) of cutthroat trout ≥300 mm in length counted in reaches of the North Fork Coeur d'Alene River (N.F. Cd'A) Little North Fork Coeur d'Alene River (L.N.F. Cd'A), and Tepee Creek Idaho, during snorkeling evaluations from 1973 to 2005.

River section	1973	1980	1981	1988	1991	1993	1994	1995	1996	1997	1998	2000	2001	2002	2003	2004	2005
N.F. Cd'A - S. F. Cd'A to Prichard Cr.	0.00	0.02	0.01	0.01	0.01	0.08	0.01	0.01	0.04	0.00	0.00	0.01	--	0.01	0.10	0.13	0.13
N.F. Cd'A - Prichard Cr to Yellowdog Cr.	0.00	0.00	0.00	0.01	0.03	0.02	0.04	0.01	0.01	0.01	0.03	0.01	--	0.04	0.09	0.09	0.24
N.F. Cd'A - Yellowdog Cr to Tepee Cr.	0.02	0.12	0.04	0.08	0.13	0.04	0.31	0.07	0.14	0.11	0.02	0.07	--	0.12	0.21	0.25	0.52
N.F. Cd'A - Tepee Cr. to Jordan Cr.	0.07	0.35	0.20	0.23	0.06	0.23	0.37	0.29	0.30	0.21	0.18	0.38	0.09	0.44	0.24	0.43	0.69
L.N.F. Cda - Mouth to Laverne Cr.	0.02	0.02	0.00	0.05	0.05	0.06	0.00	0.00	0.01	0.00	0.00	0.04	0.00	0.00	0.05	0.04	0.08
L.N.F. Cda - Laverne Cr. to Deception Cr.	0.18	0.37	0.18	0.09	0.00	0.03	0.00	0.00	0.05	0.00	0.00	0.06	0.00	0.11	0.15	0.18	0.16
Tepee Creek	0.00	0.03	0.43	0.06	0.18	0.08	0.09	0.09	0.00	0.08	0.08	0.05	0.04	0.22	0.16	0.34	0.05
Entire N.F. Cd'A River	0.01	0.05	0.02	0.04	0.04	0.06	0.08	0.03	0.07	0.03	0.02	0.04	--	0.05	0.12	0.15	0.24
Entire L.N.F. Cd'A River	0.03	0.05	0.02	0.06	0.04	0.06	0.00	0.00	0.02	0.00	0.00	0.04	0.00	0.02	0.07	0.08	0.10
All Transects	0.01	0.05	0.04	0.05	0.04	0.06	0.06	0.03	0.06	0.03	0.02	0.04	--	0.06	0.12	0.15	0.21
All limited harvest areas	0.00	0.01	0.01	0.01	0.02	0.06	0.02	0.01	0.02	0.00	0.01	0.02	--	0.01	0.09	0.10	0.15
All catch-and-release areas	0.04	0.17	0.15	0.10	0.11	0.07	0.20	0.10	0.12	0.10	0.06	0.11	--	0.18	0.19	0.28	0.37
Tepee Creek Rehab Area	--	--	--	--	--	--	--	--	--	--	--	--	--	0.05	0.00	0.04	0.04

Table 12. Average density (fish/100 m^2) of all size classes of mountain whitefish counted in reaches of the North Fork Coeur d'Alene River (N.F. Cd'A), Little North Fork Coeur d'Alene River (L.N.F. Cd'A), and Tepee Creek, Idaho, during snorkeling evaluations from 1973 to 2005.

River section	1973	1980	1981	1988	1991	1993	1994	1995	1996	1997	1998	2000	2001	2002	2003	2004	2005
N.F. Cd'A - S. F. Cd'A to Prichard Cr.	0.75	1.47	0.18	3.09	6.59	0.45	2.42	2.53	5.54	0.69	1.05	7.38	4.36	2.91	6.46	4.90	5.49
N.F. Cd'A - Prichard Cr to Yellowdog Cr.	0.46	0.02	0.12	0.03	1.25	0.29	0.65	0.11	1.13	0.56	0.58	0.23	0.20	0.32	0.83	0.73	2.04
N.F. Cd'A - Yellowdog Cr to Tepee Cr.	3.19	1.18	1.71	1.09	5.52	1.07	2.60	1.65	5.05	1.45	3.57	2.90	4.00	2.13	2.98	3.16	4.43
N.F. Cd'A - Tepee Cr. to Jordan Cr.	0.00	0.00	0.00	0.11	0.00	0.00	1.33	2.41	1.12	0.00	2.80	0.13	0.97	0.65	0.14	0.60	0.00
L.N.F. Cda - Mouth to Laverne Cr.	0.00	0.35	0.00	0.00	0.00	0.06	0.00	0.00	2.68	0.00	0.20	0.36	1.09	0.91	0.04	0.01	0.19
L.N.F. Cda - Laverne Cr. to Deception Cr.	0.59	0.01	0.12	0.03	0.00	0.00	0.00	0.00	1.88	0.00	0.02	0.00	0.04	0.03	0.00	0.00	0.00
Tepee Creek	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.63	1.04	0.43
Entire N.F. Cd'A River	1.00	0.80	0.39	1.21	4.07	0.46	1.86	1.70	3.52	0.72	1.35	3.46	3.43	2.33	3.95	3.06	4.21
Entire L.N.F. Cd'A River	0.52	0.01	0.11	0.02	0.00	0.00	0.00	0.00	1.34	0.00	0.02	0.00	0.03	0.02	0.03	0.01	0.13
All Transects	0.87	0.65	0.33	0.96	3.18	0.37	1.35	1.26	3.03	0.52	1.00	2.78	2.49	1.85	3.18	2.52	3.40
All limited harvest areas	0.60	0.63	0.15	1.12	3.29	0.32	1.42	1.37	3.28	0.51	0.70	3.21	2.59	2.02	3.70	2.74	3.75
All catch-and-release areas	1.77	0.71	0.95	0.64	2.86	0.52	1.14	0.97	2.61	0.53	1.93	1.53	2.20	1.35	1.73	1.93	2.43
Tepee Creek Rehab Area	--	--	--	--	--	--	--	--	--	--	--	--	--	0.00	0.00	0.00	0.00

Table 13. Average density (fish/100 m^2) of all size classes of rainbow trout counted in reaches of the North Fork Coeur d'Alene River (N.F. Cd'A), Little North Fork Coeur d'Alene River (L.N.F. Cd'A), and Tepee Creek, Idaho, during snorkeling evaluations from 1973 to 2005.

River section	1973	1980	1981	1988	1991	1993	1994	1995	1996	1997	1998	2000	2001	2002	2003	2004	2005
N.F. Cd'A - S. F. Cd'A to Prichard Cr.	0.35	0.45	0.59	3.15	0.22	0.04	0.16	0.61	0.50	0.75	0.42	1.06	0.76	0.52	0.46	0.48	0.39
N.F. Cd'A - Prichard Cr to Yellowdog Cr.	0.48	0.12	0.46	0.14	0.20	0.01	0.08	0.14	0.02	0.12	0.06	0.03	0.11	0.00	0.01	0.08	0.06
N.F. Cd'A - Yellowdog Cr to Tepee Cr.	0.03	0.21	0.34	0.03	0.04	0.00	0.00	0.02	0.25	0.01	0.01	0.01	0.14	0.00	0.00	0.00	0.00
N.F. Cd'A - Tepee Cr. to Jordan Cr.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L.N.F. Cda - Mouth to Laverne Cr.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.27	0.09	0.17
L.N.F. Cda - Laverne Cr. to Deception Cr.	1.39	0.55	1.25	1.60	0.99	0.22	0.45	0.02	0.09	0.24	0.54	0.35	0.18	0.46	0.02	0.02	0.00
Tepee Creek	0.12	0.06	0.18	0.05	0.03	0.00	0.00	0.00	0.62	0.00	0.00	0.00	0.00	0.13	0.00	0.00	0.00
Entire N.F. Cd'A River	0.33	0.26	0.47	1.00	0.17	0.02	0.11	0.37	0.25	0.40	0.24	0.43	0.50	0.34	0.23	0.22	0.22
Entire L.N.F. Cd'A River	1.25	0.49	1.13	1.27	0.80	0.18	0.34	0.02	0.24	0.19	0.43	0.28	0.15	0.39	0.21	0.07	0.11
All Transects	0.46	0.29	0.56	0.99	0.27	0.04	0.14	0.28	0.22	0.32	0.27	0.38	0.39	0.33	0.21	0.19	0.19
All limited harvest areas	0.59	0.34	0.66	1.49	0.35	0.05	0.19	0.37	0.25	0.46	0.35	0.51	0.51	0.43	0.29	0.29	0.27
All catch-and-release areas	0.03	0.12	0.21	0.02	0.03	0.00	0.00	0.01	0.16	0.00	0.00	0.00	0.06	0.02	0.00	0.00	0.00
Tepee Creek Rehab Area	--	--	--	--	--	--	--	--	--	--	--	--	--	0.00	0.00	0.00	0.00

Table 14. Fishers Least Significant Difference Test matrix of pairwise comparison probabilities of cutthroat trout densities (all size classes and >300 mm) between seven stream reaches in the North Fork Coeur d'Alene River basin and four from the St. Joe River basin, Idaho, during 2005. Shaded cells indicate which stream reaches had significantly different (p ≤0.10) cutthroat trout densities.

All size classes

	North Fork Coeur d'Alene River Reaches							St. Joe River Reaches			
	SF-Prich	Prich-YD	YD-Tepee	Tepee-JC	LNF lower	LNF upper	Tepee	Calder	NF St. Joe	Prospector	Red Ives
SF-Prich	1.000										
Prichard-YD	0.820	1.000									
YD-Tepee	0.362	0.305	1.000								
Tepee-JC	0.183	0.161	0.700	1.000							
LNF lower	0.526	0.742	0.145	0.061	1.000						
LNF upper	0.456	0.381	0.880	0.592	0.195	1.000					
Tepee	0.881	0.944	0.339	0.182	0.684	0.420	1.000				
Calder	--	--	--	--	--	--	--	--			
NF St. Joe	0.590	0.486	0.679	0.408	0.252	0.802	0.534	--	1.000		
Prospector	0.000	0.001	0.035	0.097	0.000	0.022	0.001	--	0.004	1.000	
Red Ives	0.512	0.424	0.784	0.499	0.216	0.907	0.468	--	0.891	0.010	1.000

>300 mm

	North Fork Coeur d'Alene River Reaches							St. Joe River Reaches			
	SF-Prich	Prich-YD	YD-Tepee	Tepee-JC	LNF lower	LNF upper	Tepee	Calder	NF St. Joe	Prospector	Red Ives
SF-Prich	1.000										
Prichard-YD	0.842	1.000									
YD-Tepee	0.237	0.374	1.000								
Tepee-JC	0.022	0.056	0.298	1.000							
LNF lower	0.642	0.544	0.114	0.007	1.000						
LNF upper	0.993	0.851	0.282	0.037	0.690	1.000					
Tepee	0.616	0.528	0.131	0.012	0.925	0.657	1.000				
Calder	--	--	--	--	--	--	--	--			
NF St. Joe	0.425	0.608	0.652	0.118	0.214	0.475	0.234	--	1.000		
Prospector	0.000	0.000	0.007	0.134	0.000	0.000	0.000	--	0.000	1.000	
Red Ives	0.620	0.799	0.499	0.081	0.355	0.652	0.361	--	0.793	0.000	1.000

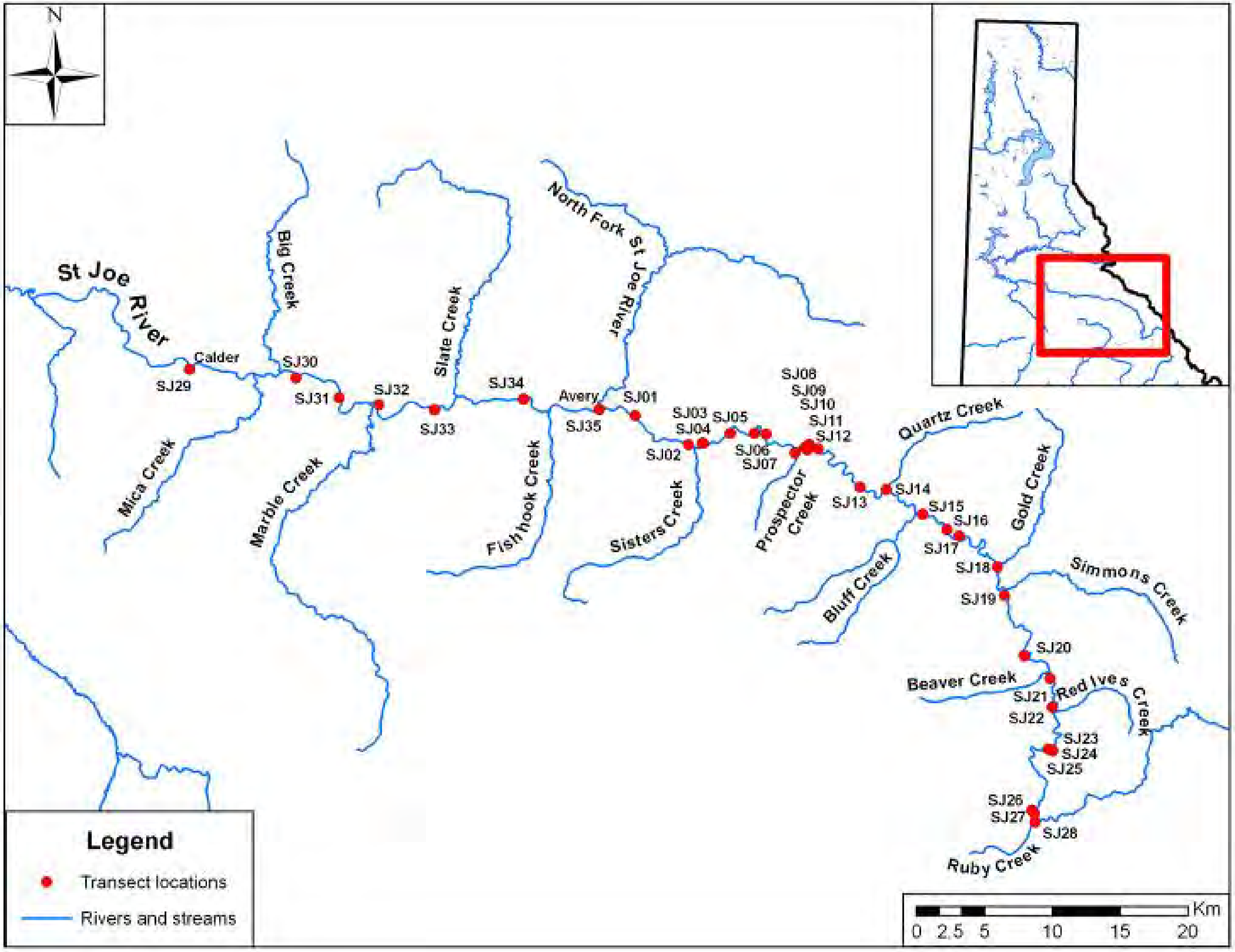


Figure 1. Location of snorkeling transects on the St. Joe River, Idaho. Only transects 1-28 were snorkeled, during August 9-11, 2005.

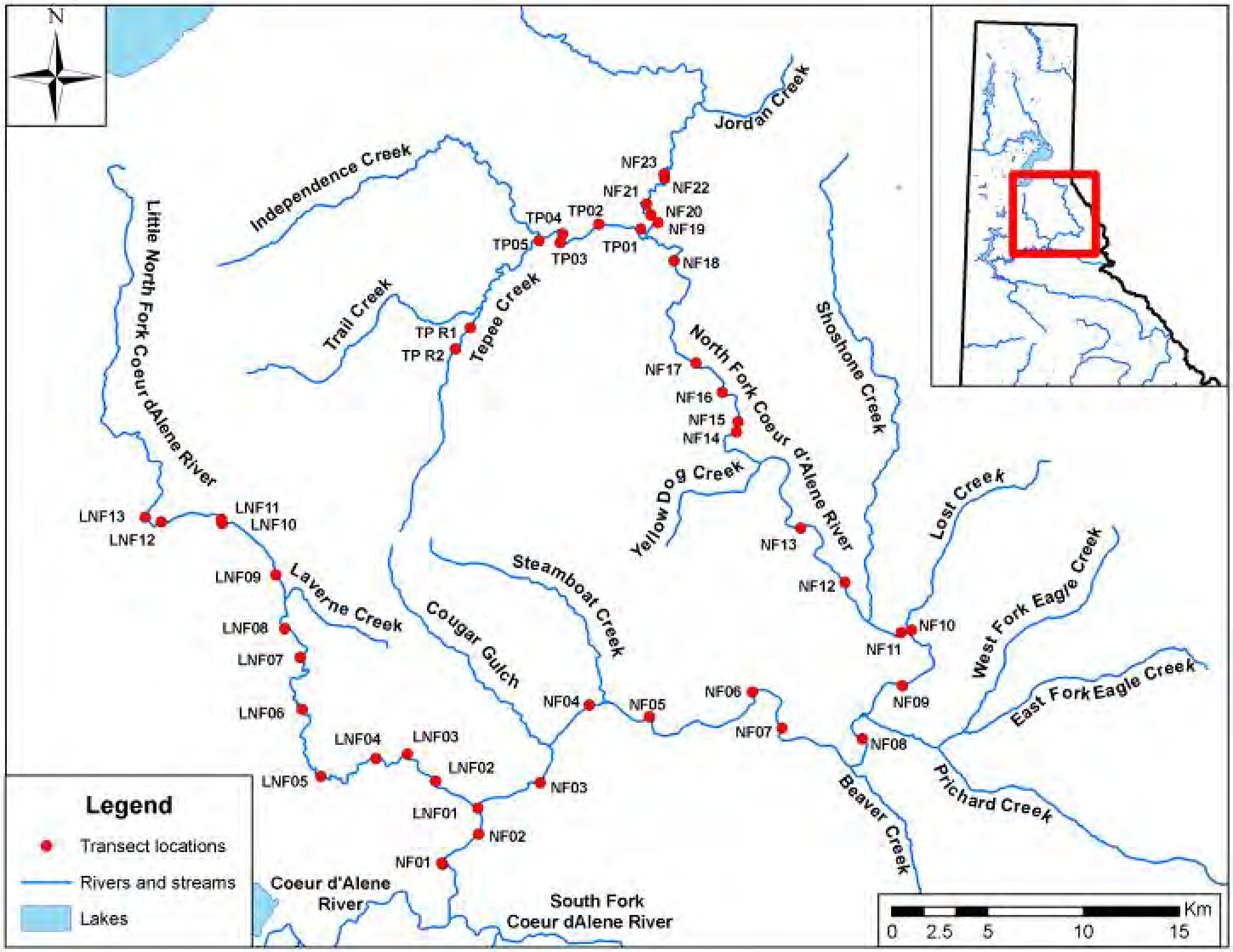
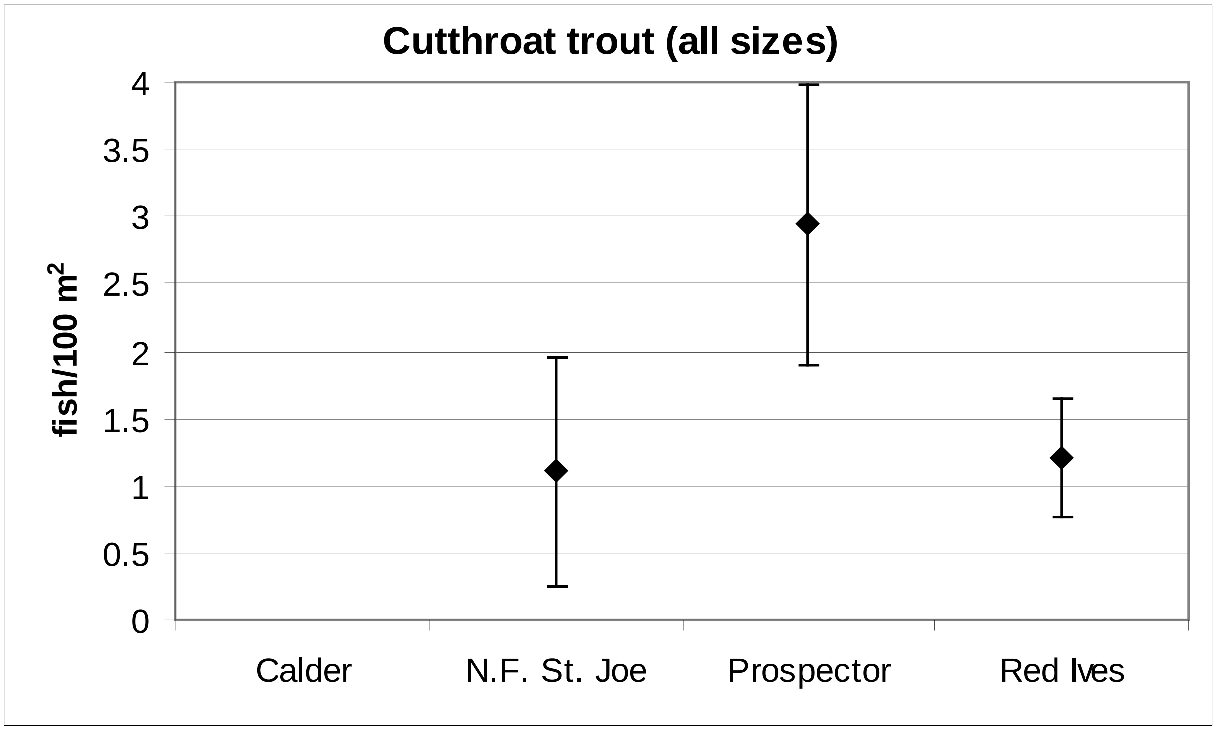


Figure 2. Location of 43 transects snorkeled on the Coeur d’Alene River, Idaho, during August 2-4, 2005.



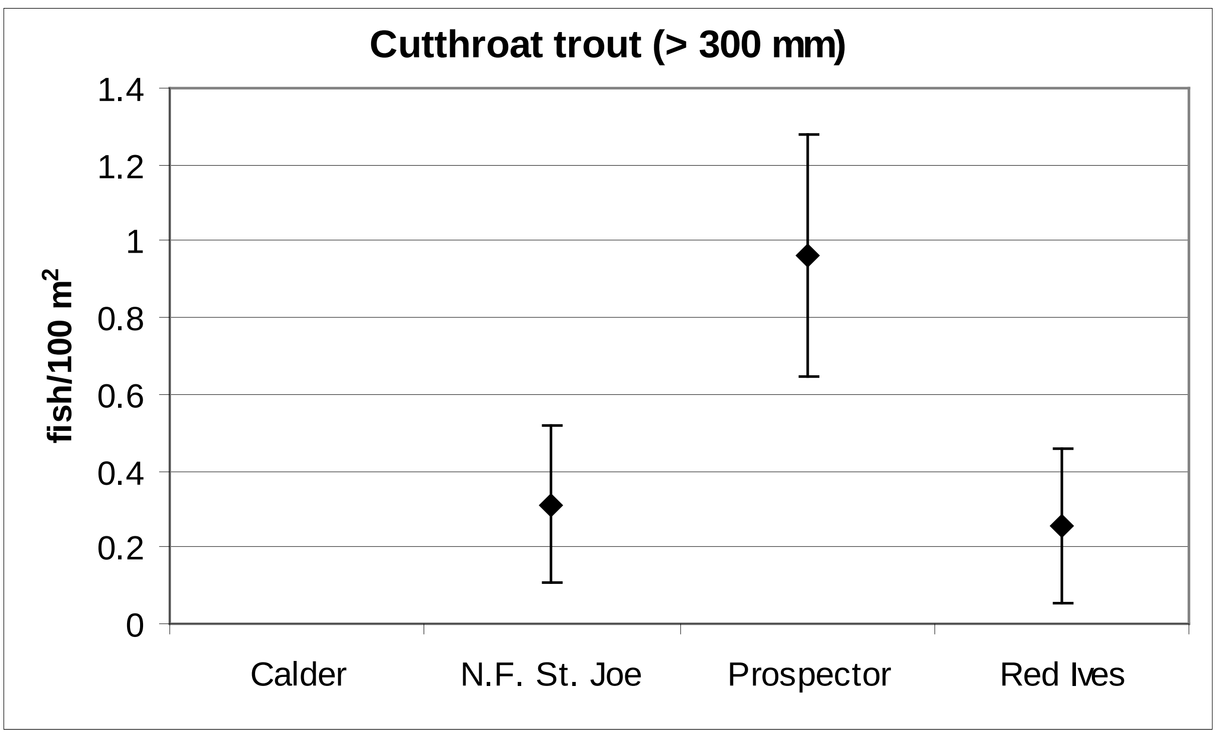
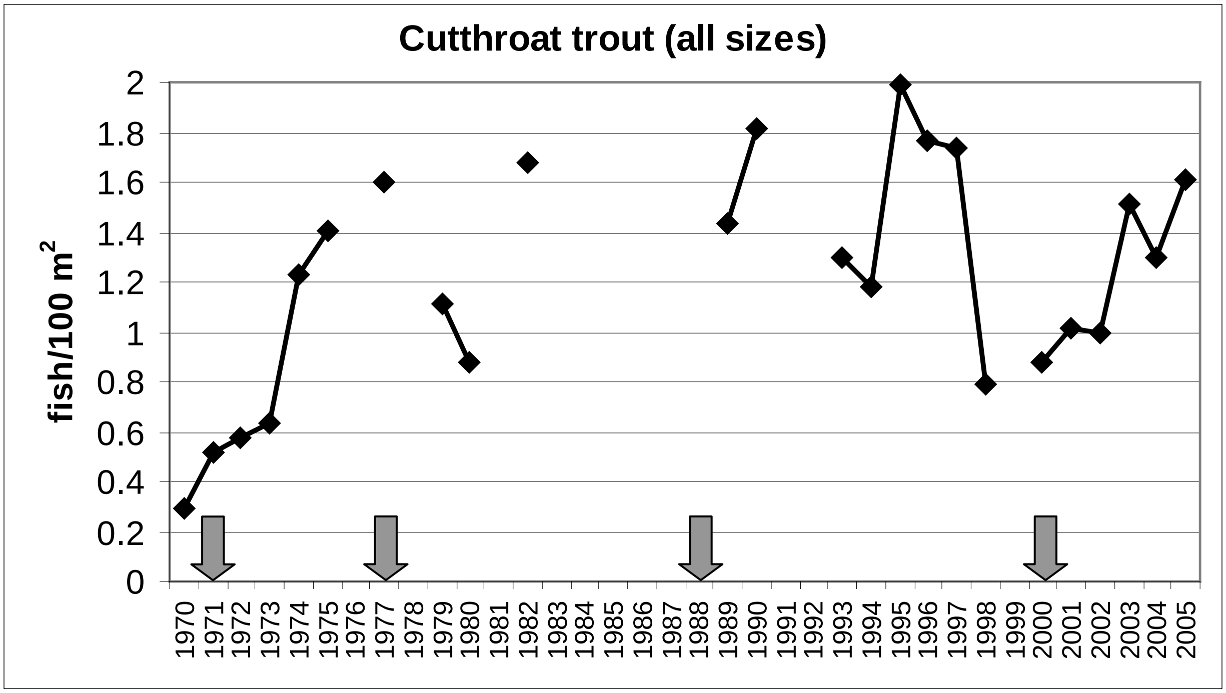


Figure 3. Average cutthroat trout density and 90% confidence intervals (all sizes and only those ≥300 mm) determined from snorkeling three different reaches in the St. Joe River, Idaho, during 2005.



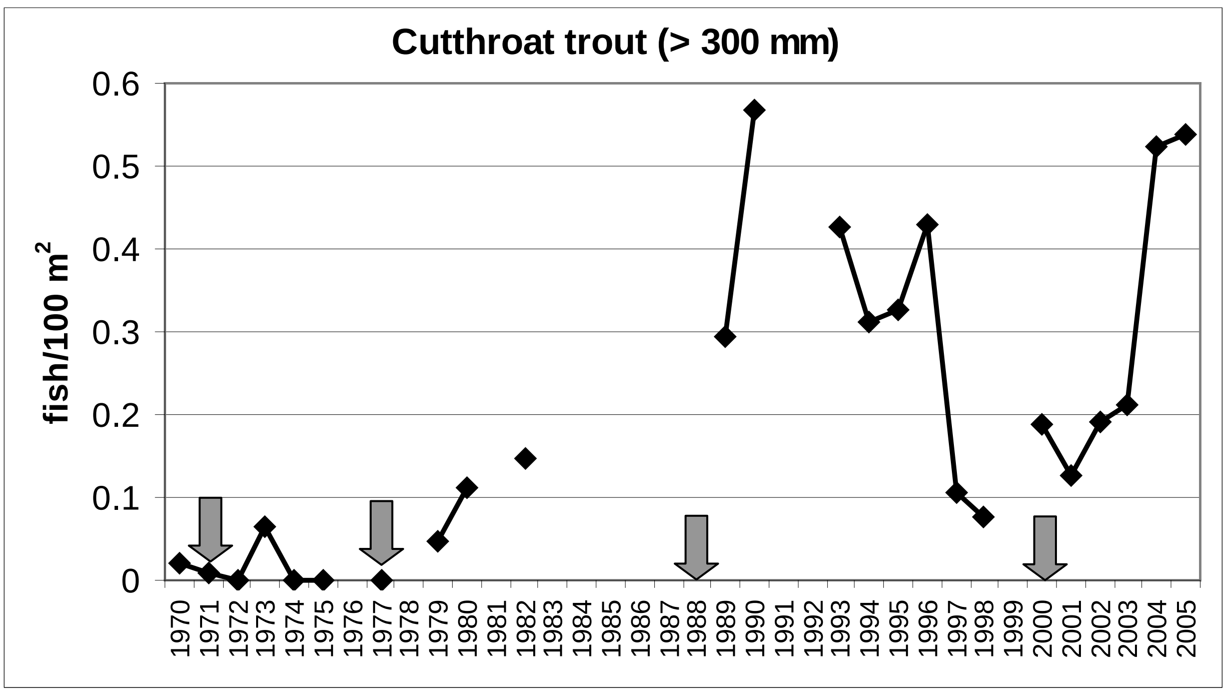


Figure 4. Average density (fish/100 m2) of all size classes of cutthroat trout and cutthroat trout ≥300 mm observed while snorkeling the St. Joe River, Idaho, between the North Fork St. Joe River and Ruby Creek from 1969 to 2005. Arrows signify when significant changes occurred in cutthroat trout fishing regulations. Refer to Table 5 to see how regulations changed in these years.

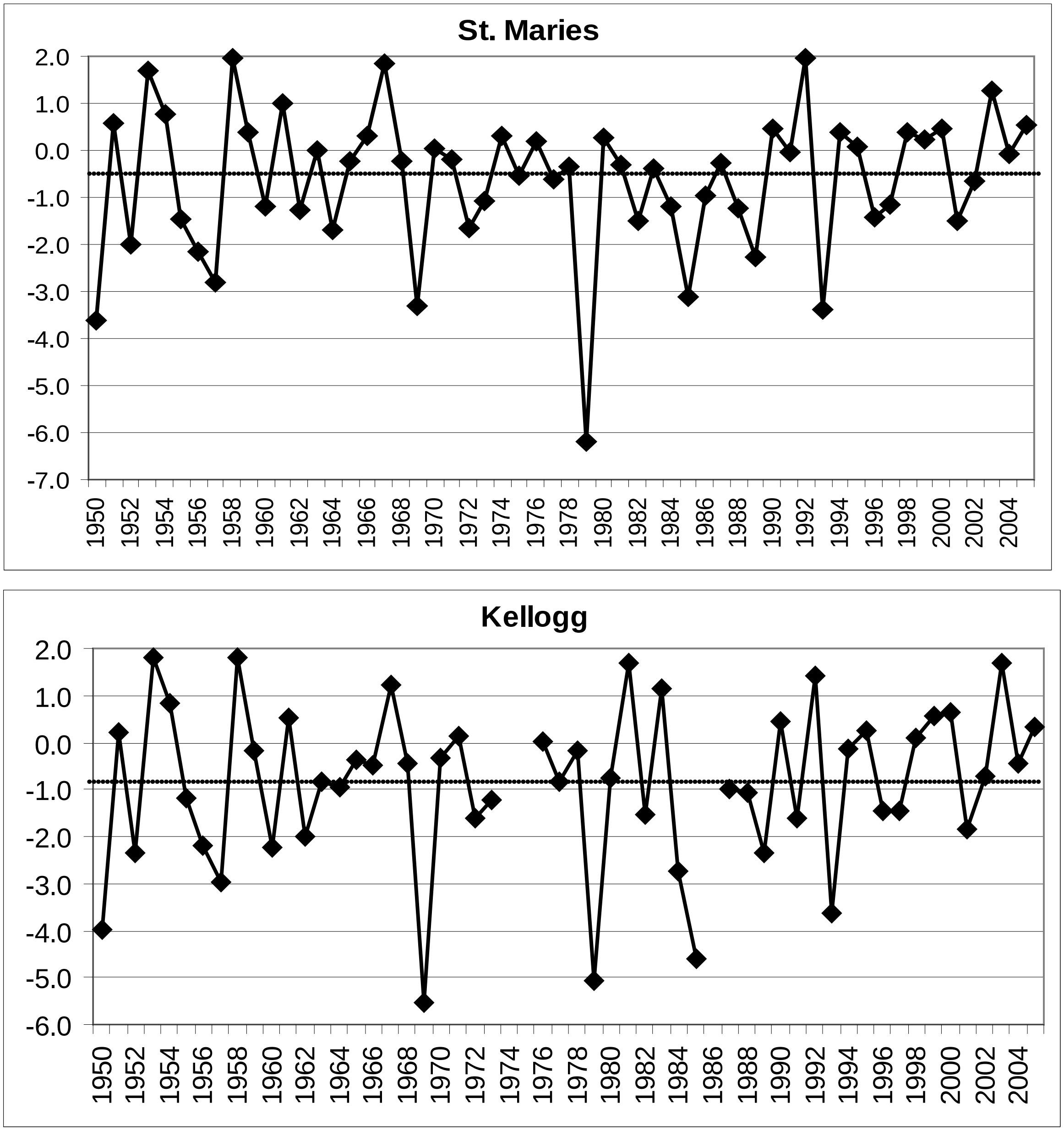


Figure 5. Average air temperature (°C) during winter (Dec-Feb) from 1950 to 2005 in St. Maries and Kellogg, Idaho. The dotted line represents the average winter temperature since 1950.

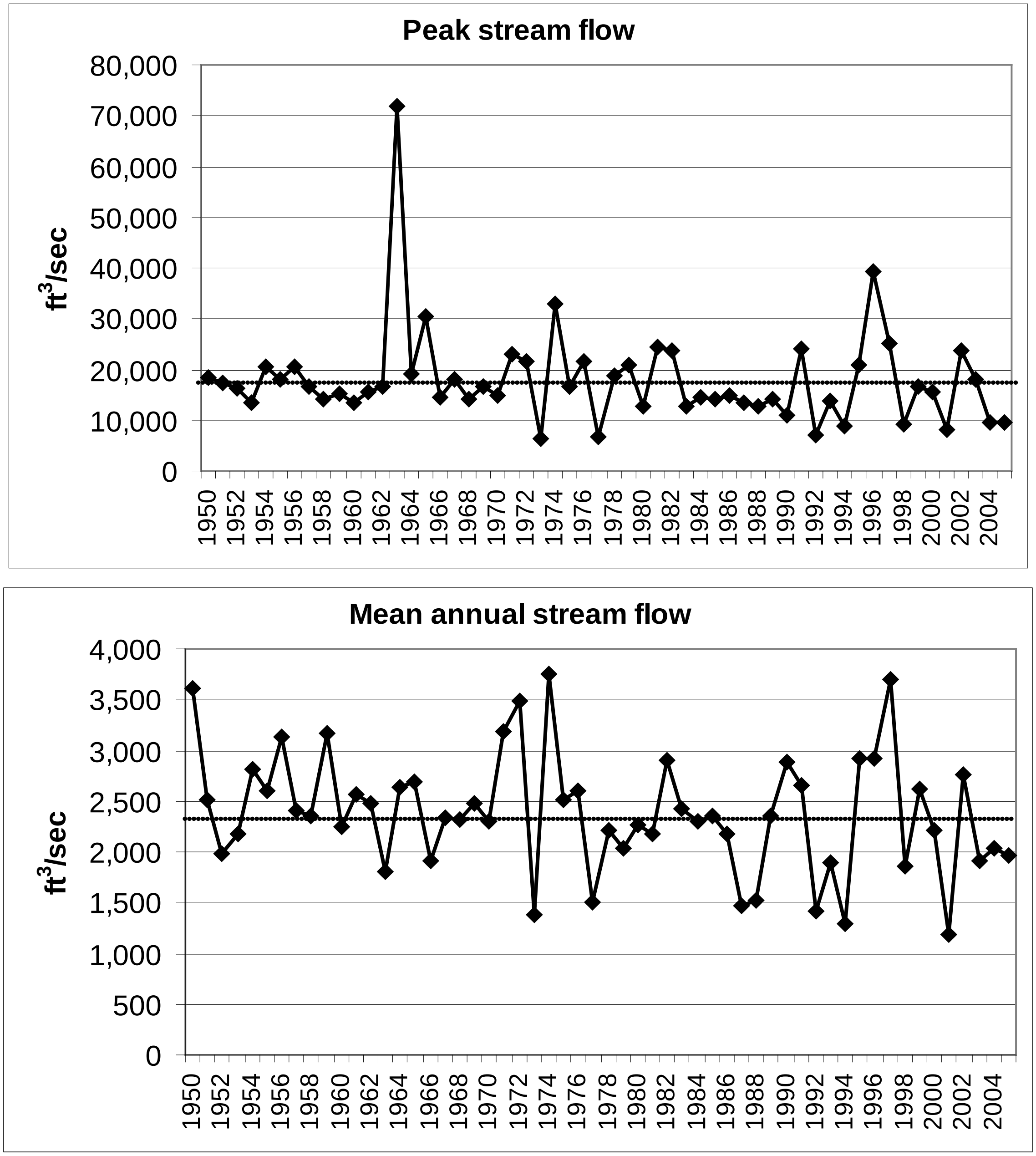


Figure 6. Peak stream flow and mean annual stream flow documented by USGS for the St. Joe River, Idaho, at Calder from 1950 to 2005. The dotted lines indicate the average flow since 1950.

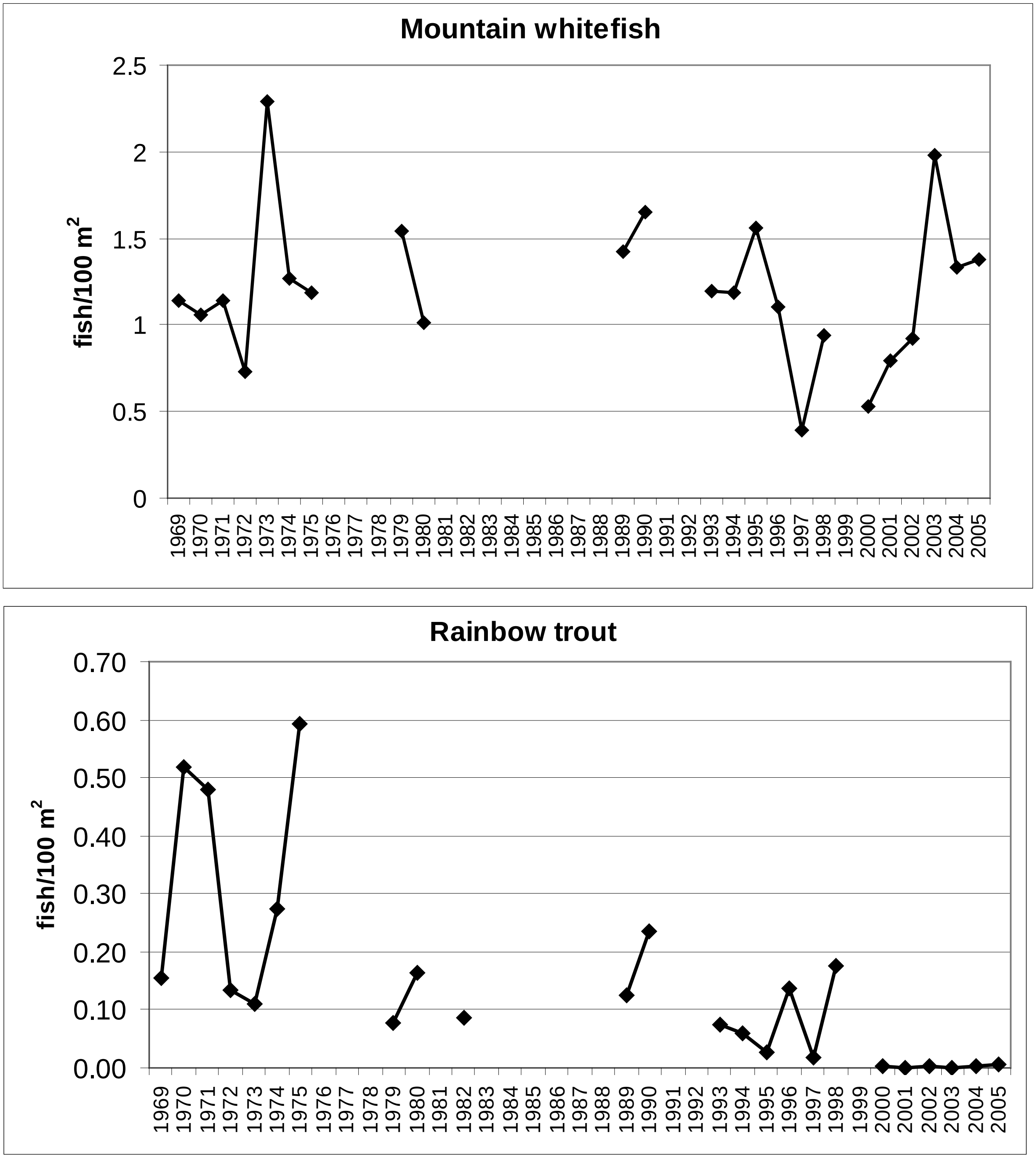


Figure 7. Average density (fish/100 m^2) of mountain whitefish and rainbow trout observed while snorkeling the St. Joe River, Idaho, between the North Fork St. Joe River and Ruby Creek from 1969 to 2005.

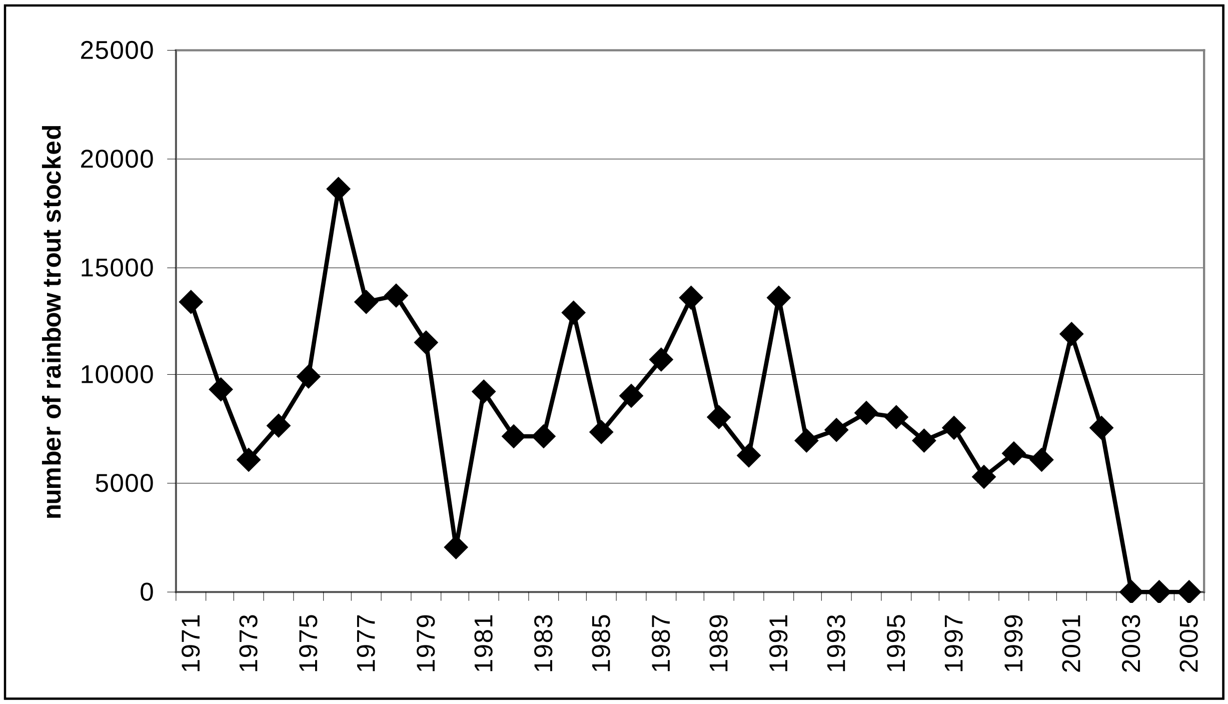


Figure 8. Number of rainbow trout >6 inches in length stocked in the St. Joe River, Idaho, between 1971 and 2005. Prior to 1971, over 170,000 rainbow trout were stocked annually in the St. Joe River.

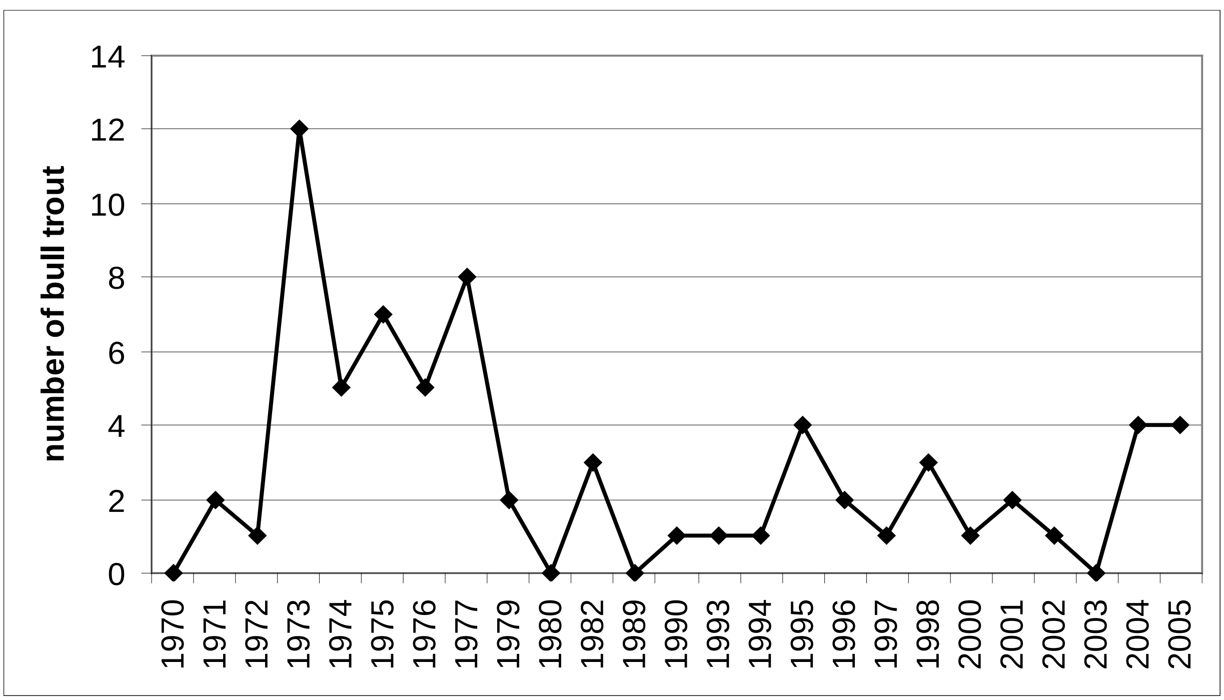


Figure 9. Number of bull trout counted while snorkeling transects in the St. Joe River, Idaho, from 1969 to 2005.

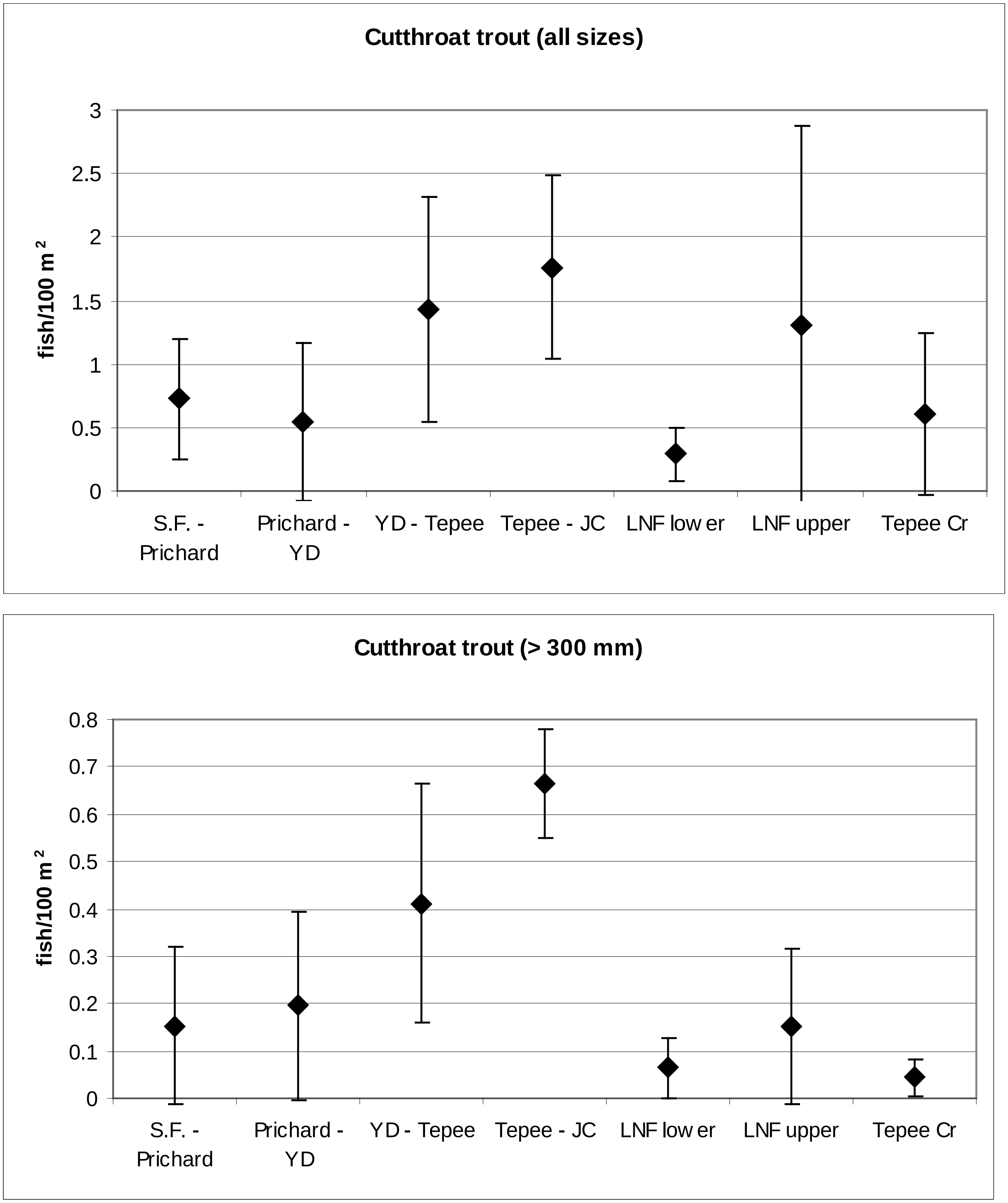
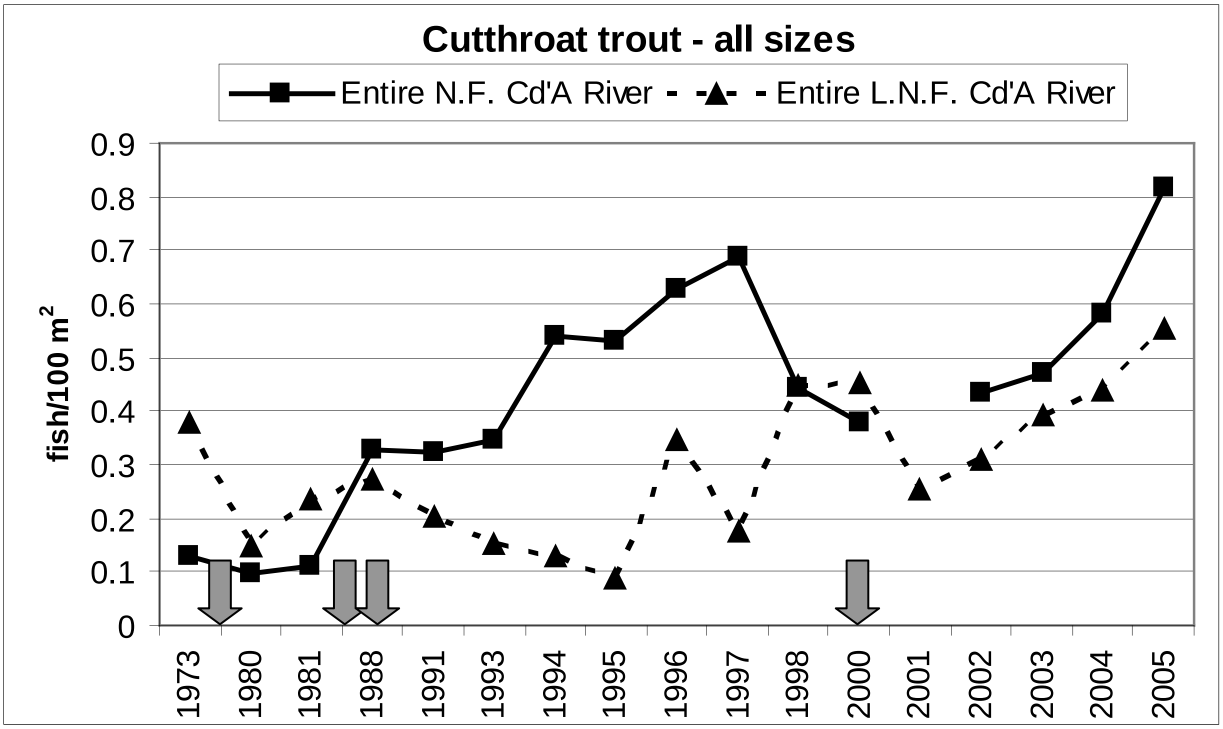


Figure 10. Average density (fish/100 m^2) of cutthroat trout and 90% confidence intervals (all sizes and only fish ≥300 mm) observed while snorkeling transects in seven different reaches in the North Fork Coeur d'Alene River watershed, Idaho, during 2005.



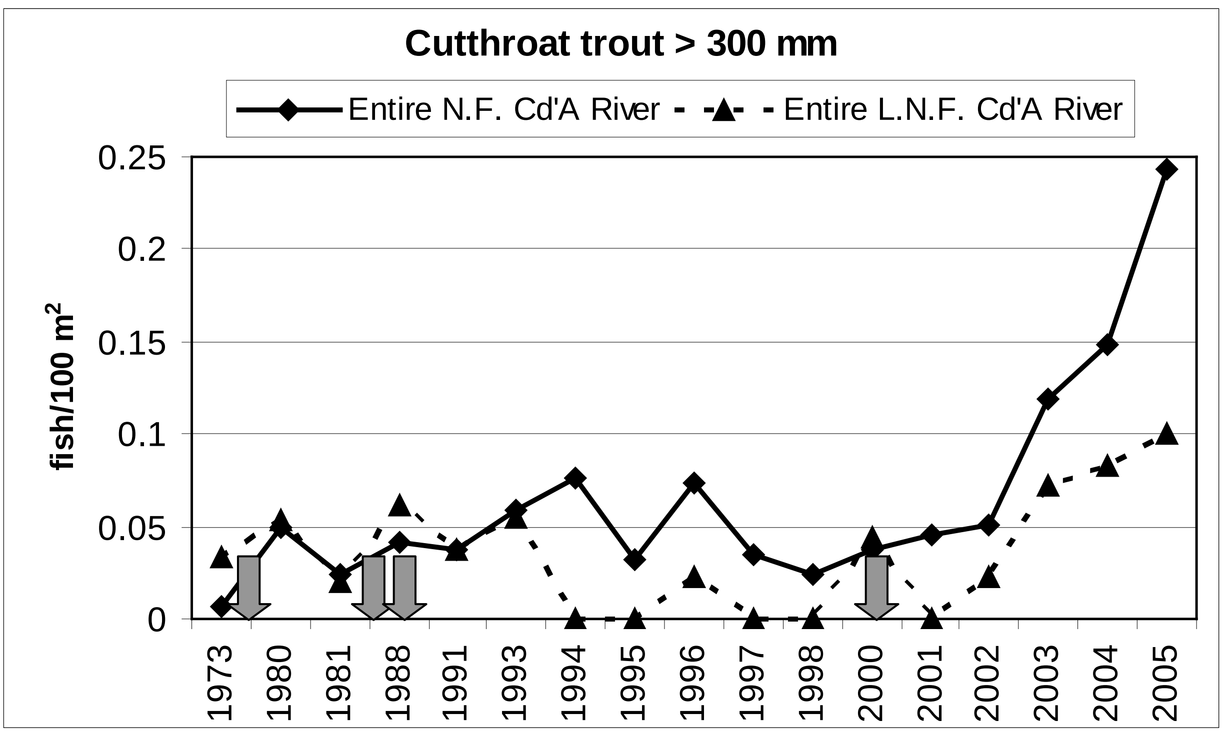


Figure 11. Average density (fish/100 m^2) of all size classes of cutthroat trout and cutthroat trout ≥300 mm observed while snorkeling transects in the North Fork Coeur d'Alene River (N.F. Cd'A) and Little North Fork Coeur d'Alene River (L.N.F. Cd'A), Idaho, from 1973 to 2005. Arrows signify when significant changes occurred in the cutthroat trout fishing regulations. Refer to Table 5 to see how regulations changed in these years.

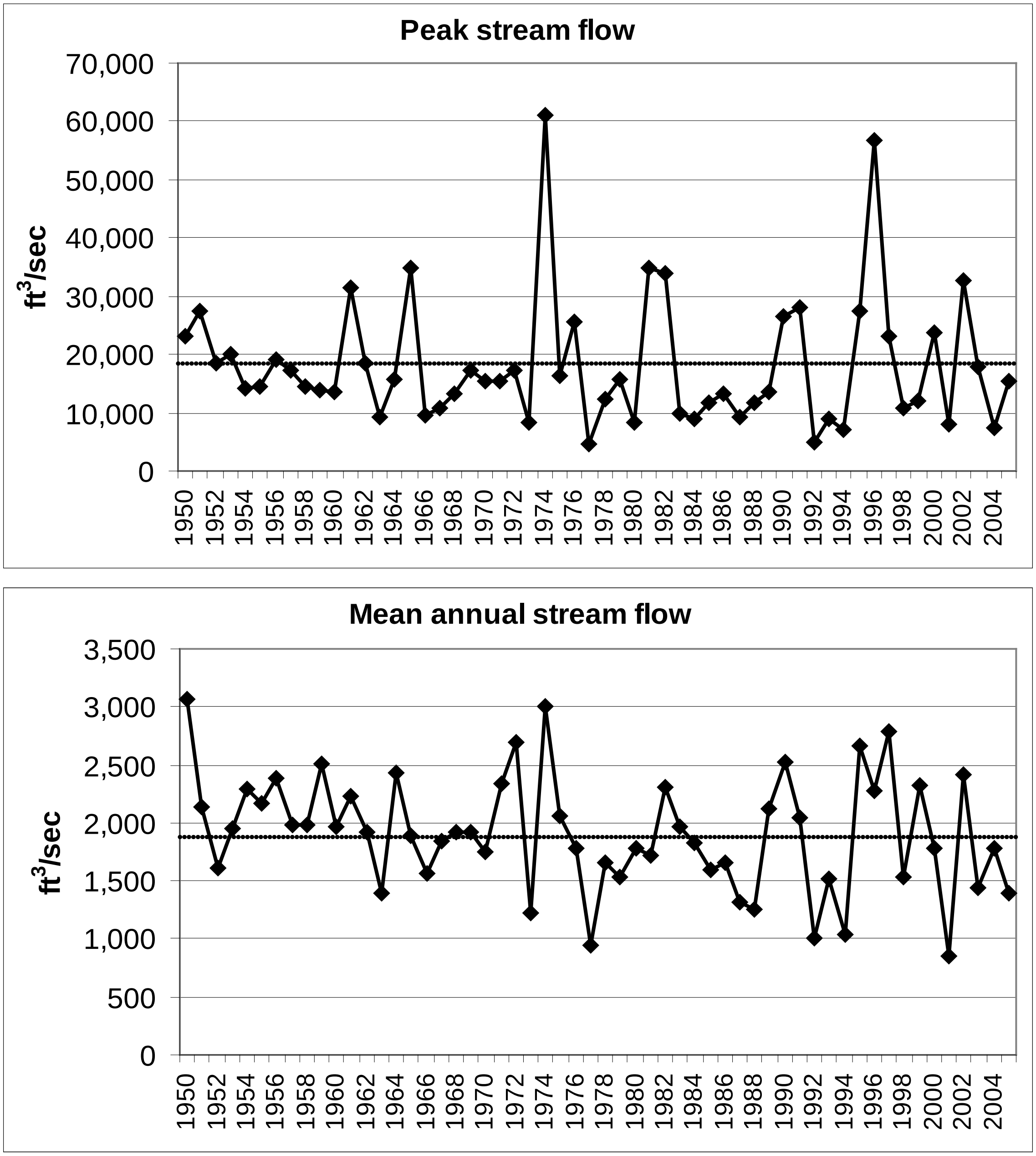
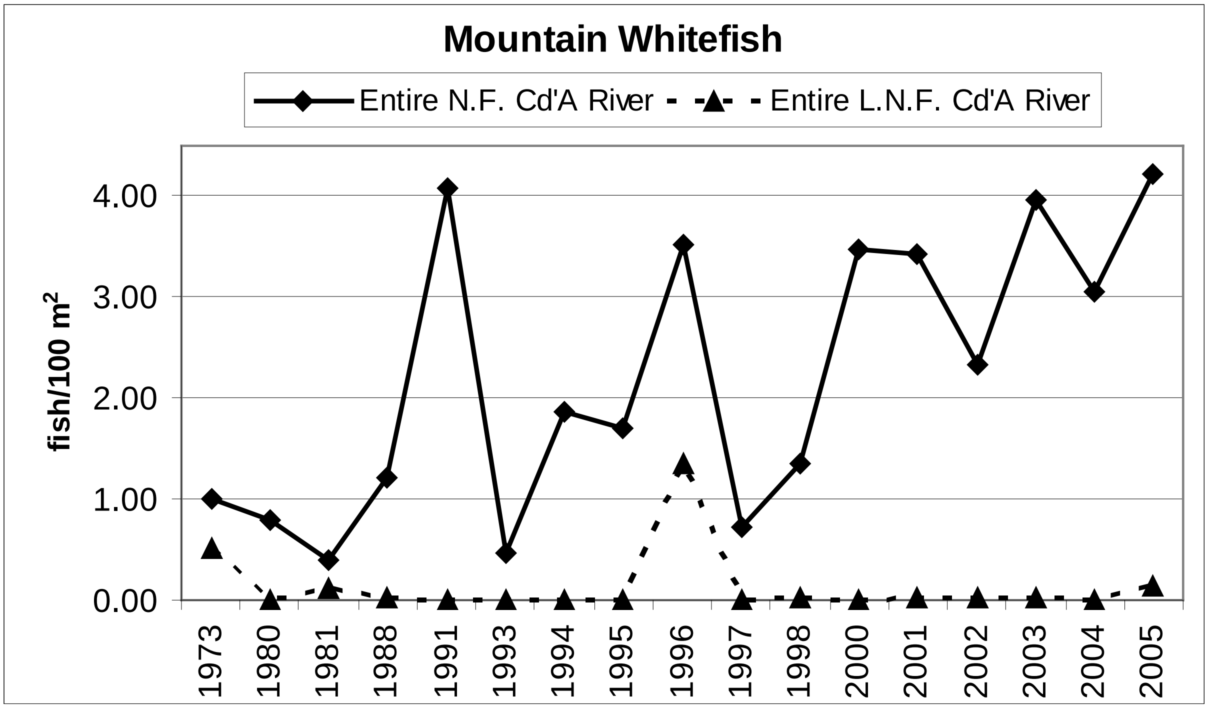


Figure 12. Peak stream flow and mean annual stream flow documented by USGS for the North Fork Coeur d'Alene River, Idaho, at Enaville from 1950 to 2005. The dotted line indicates the average flow since 1950.



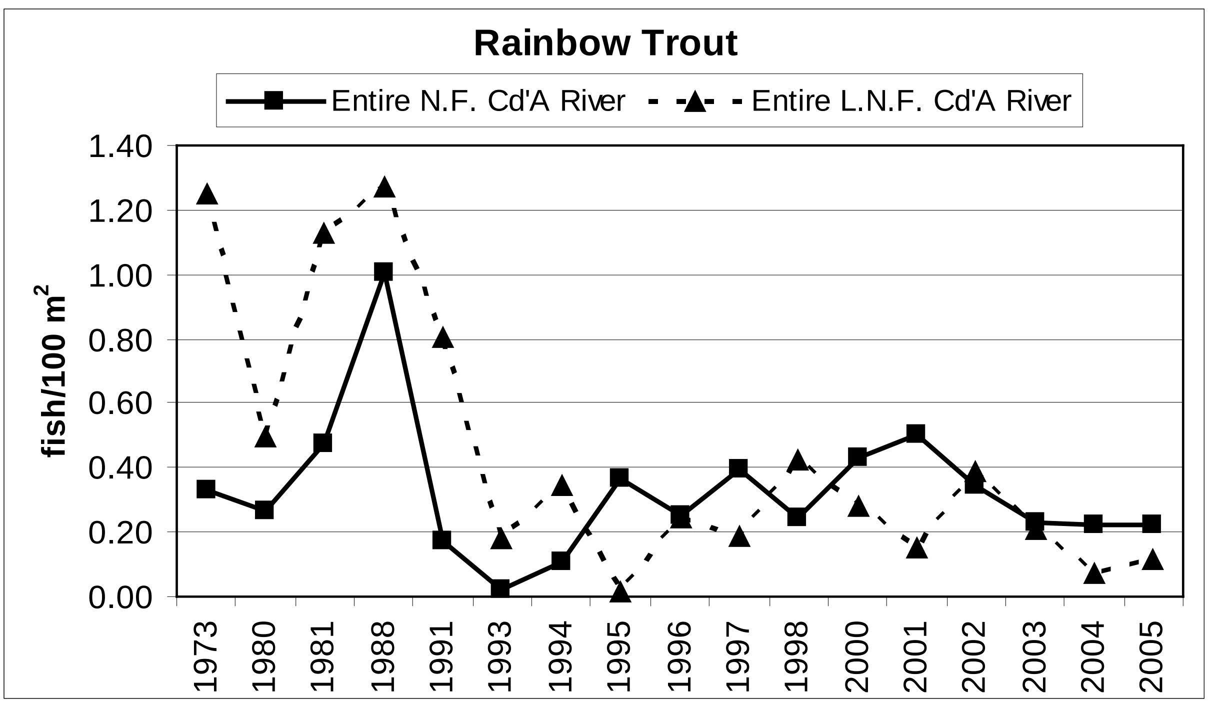


Figure 13. Average density (fish/100 m^2) of mountain whitefish and rainbow trout observed while snorkeling transects in the North Fork Coeur d'Alene River (N.F. Cd'A) and Little North Fork Coeur d'Alene River (L.N.F. Cd'A), Idaho, from 1973 to 2005.

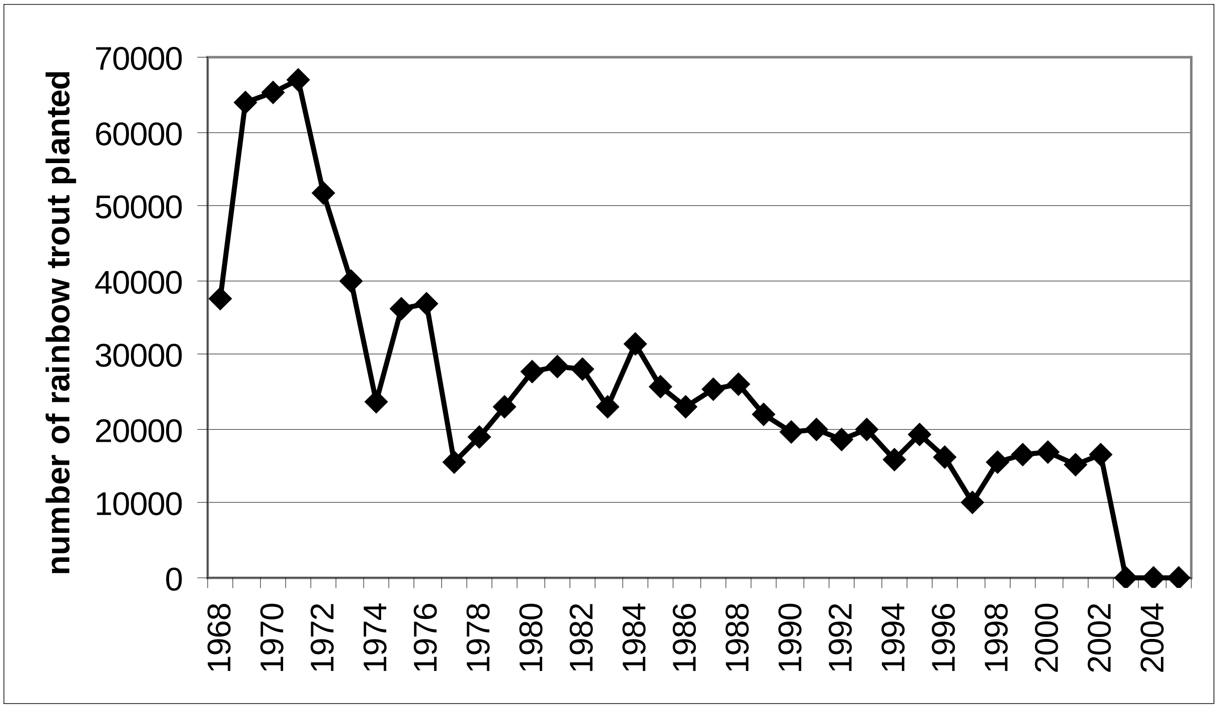
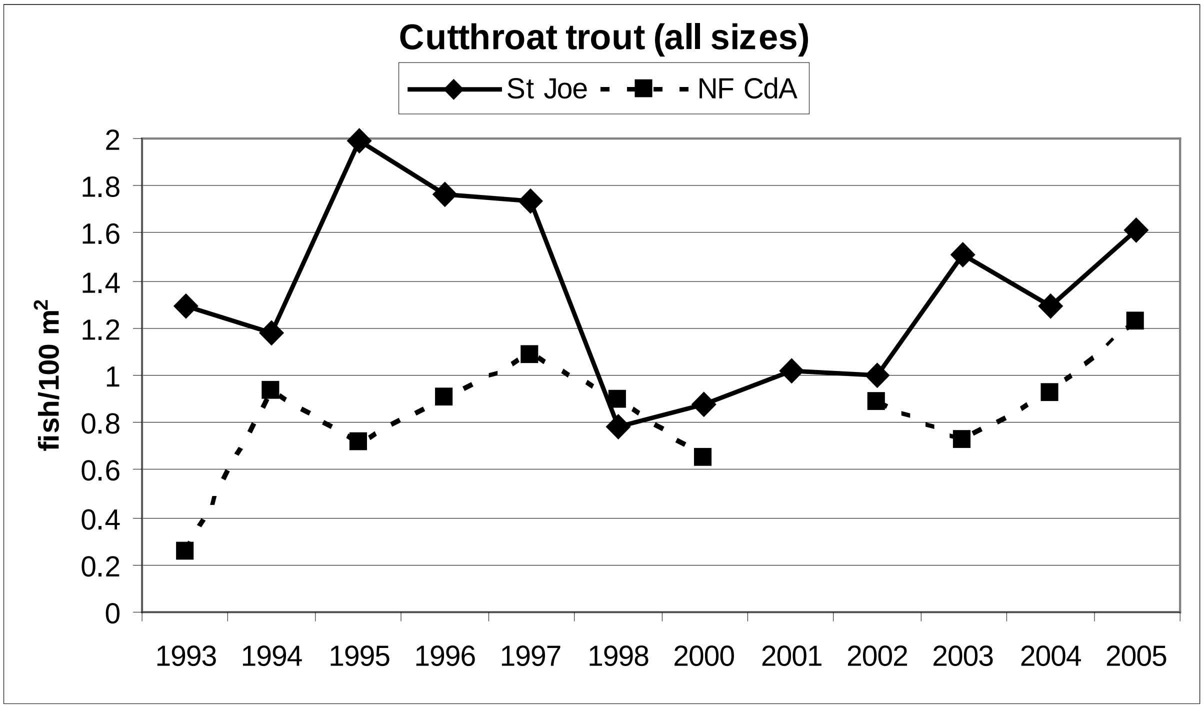


Figure 14. Number of rainbow trout >6 inches in length stocked in the North Fork Coeur d'Alene River system, Idaho, between 1968 and 2005.



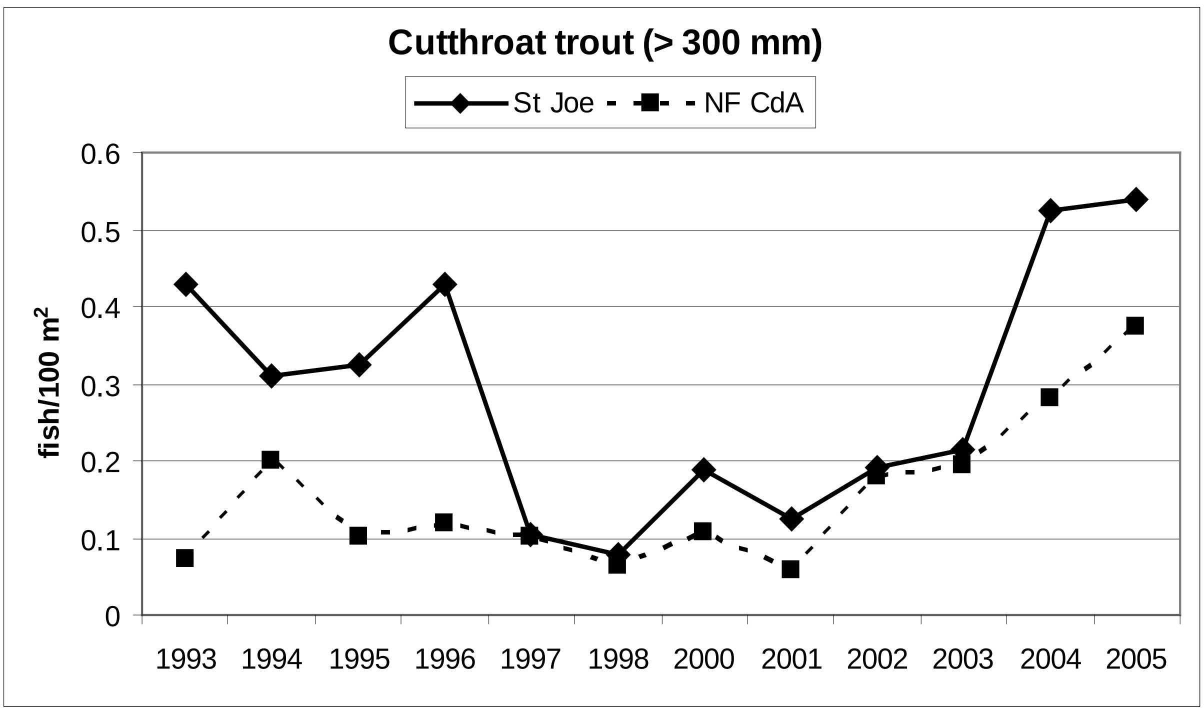
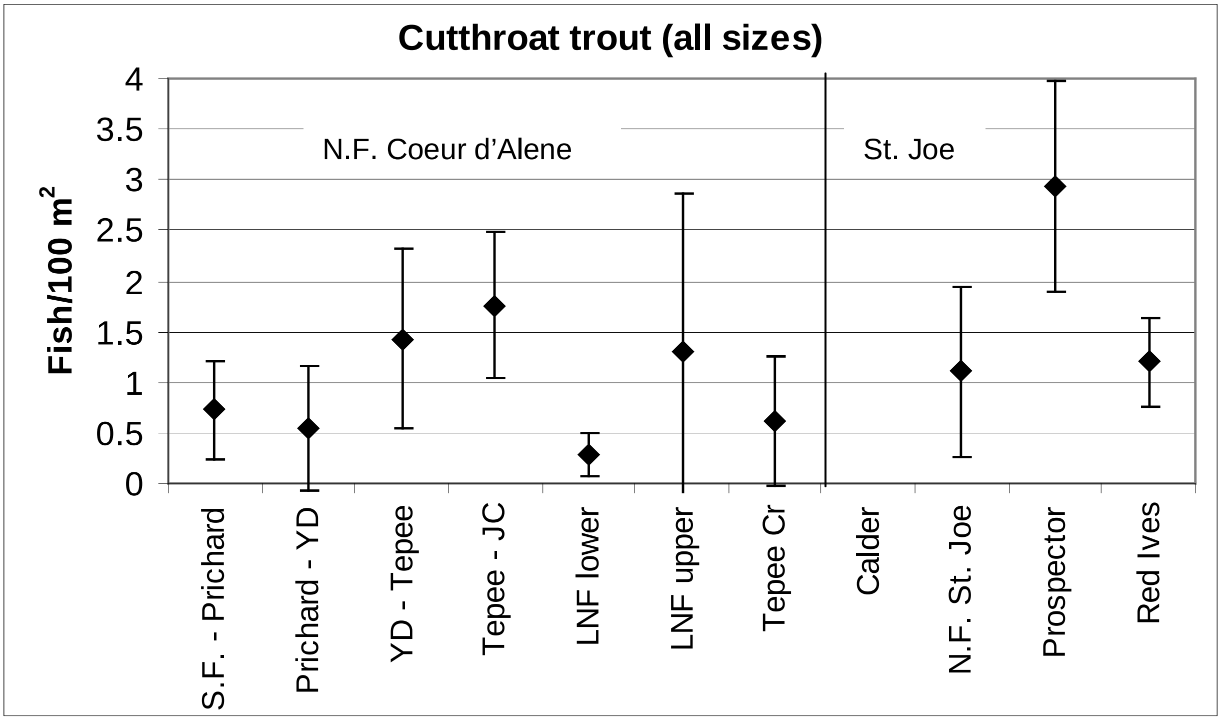


Figure 15. Average density (fish/100 m^2) of cutthroat trout (all sizes and only fish ≥300 mm) observed while snorkeling transects in the catch-and-release areas of the St. Joe River (North Fork St. Joe River to Ruby Creek, 28 transects) and North Fork Coeur d'Alene River system (Upstream of Yellow Dog Creek in the North Fork and upstream of Laverne Creek in the Little North Fork, 20 transects), Idaho from 1993 to 2005.



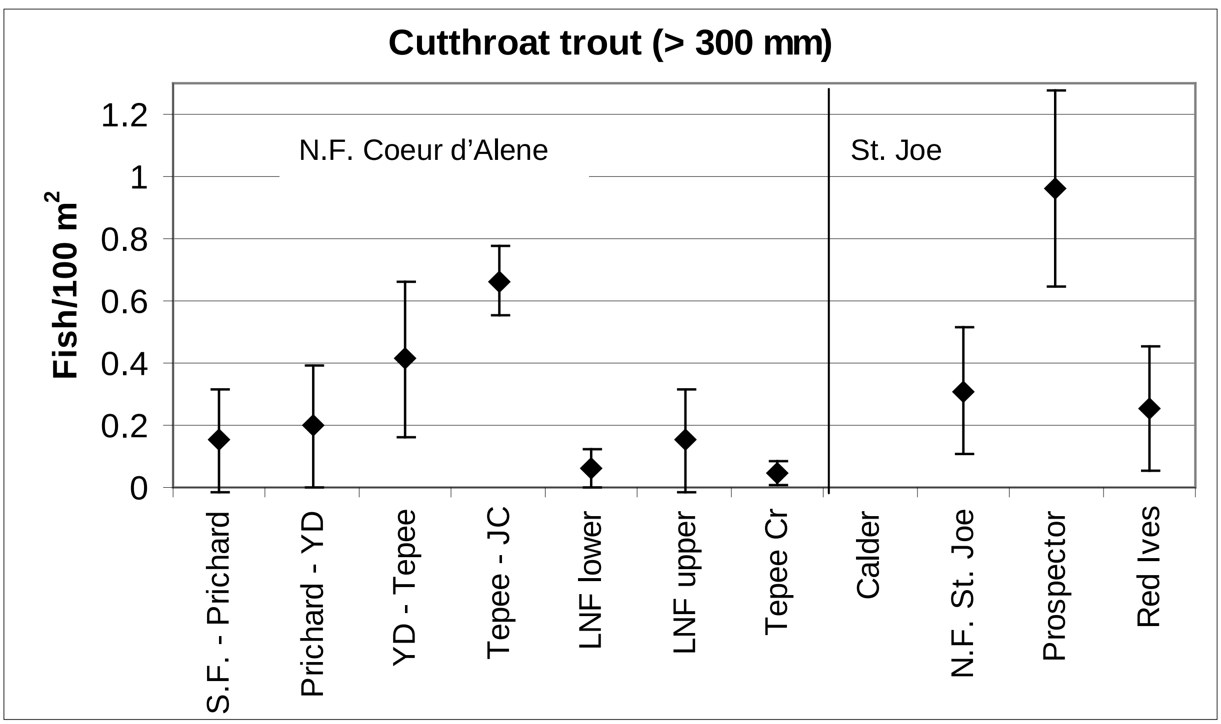


Figure 16. Average density (fish/100 m^2) of cutthroat trout and 90% confidence intervals (all sizes and only fish ≥300 mm) observed while snorkeling seven different reaches in the North Fork Coeur d'Alene River and four different stream reaches in the St. Joe River, Idaho during 2005.

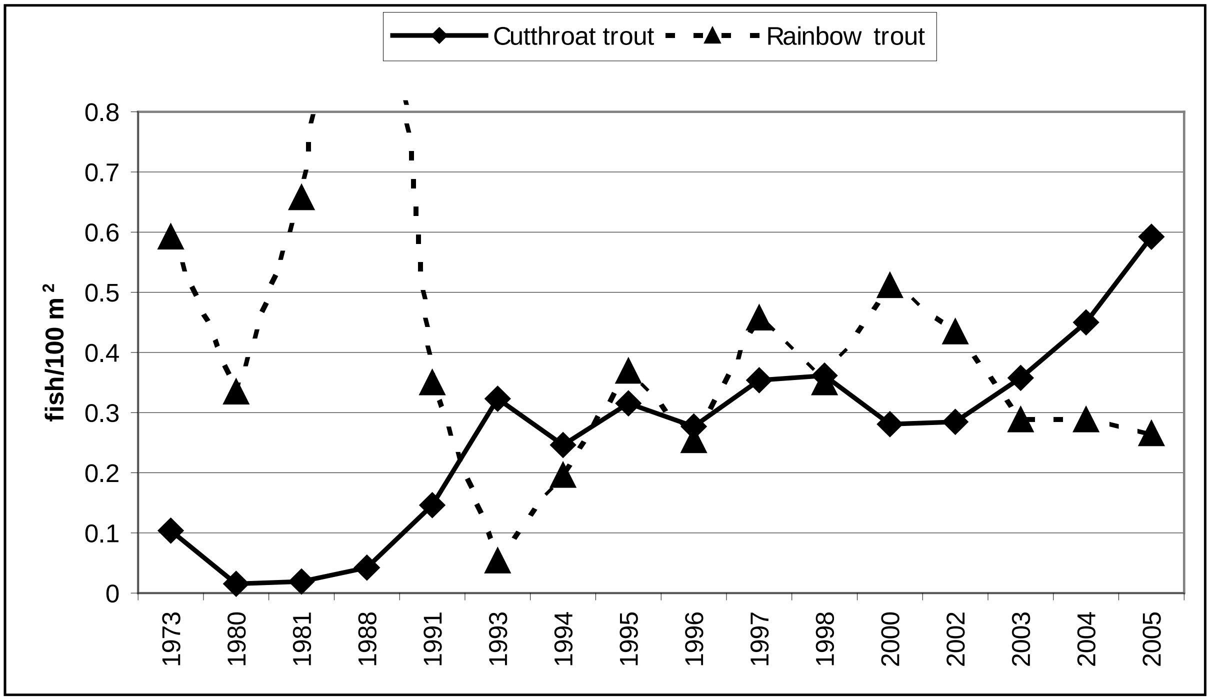


Figure 17. Average densities (fish/100 m^2) of all sizes of cutthroat trout and rainbow trout observed when snorkeling transects in the limited harvest areas of the North Fork Coeur d'Alene River system (downstream of Yellow Dog Creek in the North Fork and downstream of Laverne Creek in the Little North Fork), Idaho, from 1973 to 2005.

Appendix A. Global Position System coordinates for snorkeling sites in the St. Joe River and Coeur d'Alene River, Idaho. Coordinates are in UTM zone 11 projection and the map datum is NAD27 CONUS.

St Joe River

Transect	Easting	Northing	Elevation
SJ01	593640	5233167	2537 ft
SJ02	597654	5231156	2613 ft
SJ03	598667	5231307	2677 ft
SJ04	598754	5231287	2680 ft
SJ05	600706	5232126	2665 ft
SJ06	602449	5232176	2698 ft
SJ07	603341	5232178	2717 ft
SJ08	605527	5230873	2797 ft
SJ09	606547	5231533	2825 ft
SJ10	606244	5231279	2830 ft
SJ11	606405	5231139	2835 ft
SJ12	607181	5231246	2845 ft
SJ13	610394	5228526	2948 ft
SJ14	612324	5228426	3027 ft
SJ15	615062	5226714	3101 ft
SJ16	616902	5225646	3157 ft
SJ17	617807	5225211	3220 ft
SJ18	620731	5223048	3375 ft
SJ19	621318	5220981	3408 ft
SJ20	622945	5216593	3697 ft
SJ21	624887	5214977	3725 ft
SJ22	625161	5212869	3755 ft
SJ23	625310	5209677	3819 ft
SJ24	625195	5209730	3822 ft
SJ25	624990	5209758	3829 ft
SJ26	623940	5205252	3918 ft
SJ27	624125	5205022	3925 ft
SJ28	624201	5204344	3940 ft
SJ29	560751	5235297	2125 ft
SJ30	568595	5234964	2254 ft
SJ31	571823	5233630	2274 ft
SJ32	574772	5233247	2175 ft
SJ33	578901	5233016	2248 ft
SJ34	585397	5234051	2363 ft
SJ35	591008	5233502	2499 ft

Appendix A. Continued.

Coeur d'Alene River

Transect	Easting	Northing	Elevation (ft)
NF01	555457	5270056	2160
NF01(slough)	555417	5270108	2160
NF02	557272	5271703	2175
NF03	560383	5274513	2198
NF04	562779	5278672	2230
NF05	565969	5278176	2250
NF06	571294	5279668	2290
NF07	572903	5277841	2322
NF08	577131	5277444	2375
NF09	579100	5280301	2415
NF10	579457	5283229	2455
NF11	578945	5283082	2462
NF12	575900	5285585	2495
NF13	573482	5288331	2540
NF14	569924	5293197	2638
NF15	569991	5293731	2644
NF16	569114	5295235	2665
NF17	567689	5296719	2688
NF18	566330	5302002	2765
NF19	565415	5303956	2803
NF20	565030	5304362	2818
NF21	564786	5304894	2845
NF22	565683	5306287	2893
NF23	565636	5306508	2900
LNF01	557178	5273053	2175
LNF02	554924	5274377	2202
LNF03	553380	5275727	2222
LNF04	551753	5275453	2243
LNF05	548928	5274398	2283
LNF06	547814	5277858	2352
LNF07	547607	5280546	2420
LNF08	546749	5282037	2470
LNF09	546160	5284827	2520
LNF10	543261	5287400	2622
LNF11	543207	5287617	2628
LNF12	540088	5287366	2717
LNF13	539236	5287576	2748
TP01	564519	5303607	2805
TP02	562306	5303758	2836
TP03	560331	5302731	2869
TP04	560439	5303183	2872
TP05	559224	5302784	2885
TP R1	555828	5298099	3010
TP R2	555090	5296965	3037

Appendix D. Data sheet used when collecting information during snorkeling surveys in the St. Joe River and Coeur d'Alene River, Idaho, during 2005.

IDFG Snorkel Data

Stream: ______________________ **Transect Name/Number:** ______________________

Date:________ Time:________ Temperature: ______ Visibility:________ GPS Datum: ______________

Observers:______________________ No. of Snorkelers:______ GPS Coord: (Easting) ______________

(Northing) ______________

Habitat Type: Pool, Riffle, Run, Glide, Pocket Water Max Depth (m): ______ Dominant Cover / % surface area: ______________

Stream Length (m): ________ Stream Width (m): __ ____ ____ ____ ____ ____ ____ ____

Comments: ____

Length	WCT 1 2	RBT 1 2	BLT 1 2	BRK 1 2	MWF 1 2	LSS 1 2	NPM 1 2	Other
<3"								
3"-6"								
6"-9"								
9"-12"								
12"-15"								
15"-18"								
18"-21"								
>21"								
Total								

Abbreviations: **WCT** = Westslope Cutthroat Trout; **RBT** = Rainbow Trout; **BLT** = Bull Trout; **BRK** = Brook Trout; **MWF** = Mountain Whitefish
MWF = Mountain Whitefish; **LSS** = Large Scale Sucker; **NPM** = Northern Pike Minnow; **RSS** = Redside Shiner; **LND** = Long Nose Dace.

Cover Types: **LWD** (large woody debris > 4"), **SWD** (small woody debris < 4")' **LS** (large substrate), **UB** (undercut banks), **OC** (ovehead cover)

CHAPTER 6: BULL TROUT REDD COUNTS

ABSTRACT

We conducted bull trout *Salvelinus confluentus* redd counts in tributaries of Priest River, Pend Oreille Lake, Kootenai River, St. Joe River, and Little North Fork of the Clearwater River in September and October 2005 to add to the long-term trend data set. These counts were used to estimate spawning run size, help with management strategies, assess restoration activities and evaluate whether federal recovery goals were met in each of the core areas that occur in the Idaho Department of Fish and Game (IDFG) Panhandle Region.

We counted 29 redds in the Upper Priest Lake basin, 940 redds in the Pend Oreille Lake and Priest River drainage, 21 redds in the Kootenai River drainage, 93 redds in the St. Joe River drainage, and 80 redds in the Little North Fork of the Clearwater River drainage. Improving trends in bull trout redd abundance was apparent for the Pend Oreille Lake, Little North Fork Clearwater River and St. Joe River basins whereas a decline in redd numbers was apparent in the Priest Lake basin. Redds have only been counted for four years in Idaho tributaries of the Kootenai River.

Five Federal Bull Trout Recovery core areas occur in the IDFG Panhandle. These are the Priest Lake, Pend Oreille Lake, Kootenai River, Coeur d'Alene Lake and North Fork Clearwater River core areas. Four recovery goals must be met in each of the core areas before bull trout can be considered as recovered. Currently, all four of the federal recovery goals are being met in only the Pend Oreille Lake Core Area. The Kootenai River Core Area may also reach all of its recovery goals once higher flows return to the basin. The Priest Lake and Coeur d'Alene Lake core areas are far from meeting all of their recovery goals and considerable efforts must occur before these bull trout populations can be considered as recovered.

Authors:

Joe DuPont
Regional Fishery Biologist

Ned Horner
Regional Fishery Manager

INTRODUCTION

Bull trout *Salvelinus confluentus* within the Klamath and Columbia River basins were listed as threatened on June 10, 1998 under the Endangered Species Act. As a result of this listing, recovery plans for bull trout in specific geographic areas (recovery units) were developed by experts in the field (USFWS 2002). Each recovery unit is separated into core areas (river or lake basins) and for each core area it describes conditions, defines recovery criteria, and identifies specific recovery actions for bull trout. The Panhandle Region of the Fish and Game encompasses part or all of the following recovery units: Clark Fork River, Kootenai River, Coeur d'Alene Lake Basin, and Clearwater River. Core areas of these recovery units that occur in the Panhandle Region are Priest Lake, Pend Oreille Lake, Kootenai River, Coeur d'Alene Lake, and the North Fork Clearwater River (USFWS 2002).

The overall goal of the Bull Trout Draft Recovery Plan is to ensure the long-term persistence of self-sustaining, complex, interacting groups of bull trout distributed throughout the species' native range so that the species can be delisted (USFWS 2002). To accomplish this goal, the following recovery criteria addressing distribution, abundance, habitat and connectivity were identified.

1. Maintain the current distribution of bull trout and restore their distribution in previously occupied areas.
2. Maintain stable or increasing trends in abundance of bull trout.
3. Restore and maintain suitable habitat conditions for all bull trout life history stages and strategies.
4. Conserve genetic diversity and provide opportunity for genetic exchange.

For core areas that occur within or overlap into the Idaho Department of Fish and Game (IDFG) Panhandle Region, the distribution and abundance recovery criteria will be met when the total number of stable local populations and the total number of adult bull trout have reached the levels indicated in Table 1.

Table 1. Abundance criteria required before bull trout can be considered as recovered in the following basins of Northern Idaho (USFWS 2002).

	Recovery Criteria		
Core Area	Minimum number local of populations that have more than 100 adults	Minimum number of adults in the entire core area.	Trend in abundance
Priest Lake basin	5	1,000	Stable or Increasing
Pend Oreille Lake basin	6	2,500	Stable or Increasing
Kootenai River basin[A]	5	1,000	Stable or Increasing
Coeur d'Alene Lake basin	NA	1,100[B]	Stable or Increasing
North Fork Clearwater River basin[C]	11 (>100 adults not required)	5,000	Stable or Increasing

[A] This core area includes tributaries in Idaho and Montana.
[B] This value is the desired annual spawning escapement - not the total number of adults in the core area. At least 800 must occur in the St. Joe River and 300 in the Coeur d'Alene River.
[C] Only the Little North Fork Clearwater River, a tributary of the North Fork Clearwater River basin, occurs in the Panhandle Region.

Trend recovery criteria will be met when the overall bull trout populations in specified core areas are accepted, under contemporary standards of the time, to be stable or increasing, based on at least 10 years of monitoring data.

Connectivity criteria will be met when migratory forms are present in all local populations and when intact migratory corridors among all local populations in the core area provide opportunity for genetic exchange and diversity.

Bull trout have been found to have a strong fidelity to their natal streams (Spruell et al. 1999), their redds are relatively easy to count (Pratt 1984), and redds are only a measure of the reproductive adults. These attributes make redd counts an appropriate technique for evaluating trends in adult bull trout population strength. In addition, redd counts are relatively quick and inexpensive to conduct when compared to other techniques such as weiring, netting, or electroshocking. For these reasons the status of bull trout populations in each of the core areas will be evaluated through redd counts. Bull trout redds are being counted in each of the core areas in the IDFG Panhandle Region. These counts will allow us to evaluate the status of bull trout in each of the core areas as it pertains to recovery, guide future management decisions, and assess the success of recovery actions.

STUDY SITES

Bull trout redds were counted in tributaries of the Priest River, Pend Oreille Lake, Kootenai River, St. Joe River, and Little North Fork Clearwater River drainages where bull trout are believed to spawn (Figures 1-6). These watersheds make up all or part of five different core areas that occur in the IDFG Panhandle Region (USFWS 2002). These core areas are Priest Lake, Pend Oreille Lake, Kootenai River, Coeur d'Alene Lake and North Fork Clearwater River. The boundary of the Kootenai River and North Fork Clearwater River core areas span outside of the Panhandle Region. Actual streams surveyed were dependent on available time and findings from previous surveys. Streams where no redds had been found over several consecutive years were often not surveyed to save time and/or allow more time to investigate new streams.

OBJECTIVES

1. Quantify bull trout redds and spawning escapement in Priest Lake, Pend Oreille Lake, Kootenai River, Coeur d'Alene Lake and North Fork Clearwater River core areas.

2. Assess whether bull trout abundance in each of the core areas meets recovery criteria outlined in the federal Bull Trout Draft Recovery Plan.

3. Explore new streams to determine if bull trout spawning is occurring there.

METHODS

Bull Trout Spawning Surveys

Bull trout redds were counted in tributaries of the Priest Lake, Priest River, Pend Oreille Lake, Kootenai River, St. Joe River, and Little North Fork of the Clearwater River basins where bull trout were known or believed to occur. Counts in each of these basins were summarized in the core area they occurred in. Redd counts in the Middle Fork East River, North Fork East River and Uleda Creek (tributaries of Priest River) were added to the Pend Oreille Lake Core Area in 2003 when these bull trout were documented to spend their adult life in Pend Oreille Lake (DuPont et al. In Press b). All redds were counted at similar times (September and October) as had occurred previously (DuPont et al., In Press c). Survey techniques and identification of bull trout redds followed the methodology described by Pratt (1984). Research has demonstrated the level of observer training and experience may influence the accuracy of redd counts (Bonneau and LaBar 1997; Dunham et al. 2001). To reduce observer variability in bull trout redd counts, attempts were made to use only those individuals who attended a bull trout redd count training exercise on September 20, 2005. To add to our knowledge on preferred bull trout spawning areas and to help evaluate recovery efforts, the location of redds were recorded on maps and/or GPS units during redd counts. Sections of the Kootenai River and North Fork Clearwater core areas occurred outside the Panhandle Region. Redd count data for these areas were collected from the personnel responsible for conducting these surveys.

To help assess potential limiting factors, any manmade fish passage barriers observed during the redd counts were documented. We also attempted to ascertain who the responsible parties were for the documented barriers.

Data Analysis

To estimate the spawning escapement or population abundance (depending on recovery area) of bull trout in streams, we used Downs and Jakubowski (2003) findings where on average, 2.9 adult bull trout entered tributaries of Lake Pend Oreille for every redd that was counted during annual redd count surveys. We decided to use this adult to redd ratio because this estimation came from one of the core areas in the Panhandle Region and because it is near the mid-point of two commonly used adult to redd ratios used to evaluated bull trout spawning escapement (2.2 adults/redd - Bonar et al. 1997; 3.2 adults/redd - Fraley and Shepherd 1998). Baxter and Westover (1999) and Downs and Jakubowski (2003) found that repeat spawning is common for adfluvial bull trout where 90-100% of the surviving bull trout spawned in consecutive years. For this reason we decided to use the total spawning escapement calculated from redd counts from the Priest, Pend Oreille and Coeur d'Alene Lake core areas as an estimate for the total number of adults that occurred there. We recognize this will give us a conservative estimate, as bull trout in every tributary in the Panhandle do not spawn every year (DuPont et al., In Press b). The one exception to this is for the Little North Fork Clearwater, where research by Schriever and Schiff (2002) found that anywhere from 50-75% of the adult bull trout return to spawning grounds in consecutive years. Consequently, for the Little North Fork Clearwater we multiplied the spawning escapement by 1.33 (75% repeat spawners) to estimate how many adults occurred in the core area. The total number of adult bull trout associated with each tributary and each core area was compared to the criteria specified in the Bull Trout Draft Recovery Plan to determine the status of the different bull trout populations.

To evaluate whether the numbers of adult bull trout in each core area were stable or increasing, we used a linear regression with sample year as the independent variable and the number of redds as the dependent variable. Other studies have used regressions to evaluate whether bull trout populations were stable or increasing; however in each of these cases they either used non-parametric techniques (Rieman and Myers 1997) or converted the redd counts using a $\log_e$ transformation (Maxell 1999). We decided not to convert the data or use non-parametric techniques because we believe it is easier for most individuals to visualize trends and understand how bull trout abundance is changing if the actual redd count data are used (no transformation or ranking of the data). Over time, if it seems other techniques are better suited to evaluate whether bull trout populations are stable or increasing, we will consider changing our form of analysis.

For a simple linear regression, if the slope of the regression line is greater than or equal to zero and 10 or more years of redd count data exists, then a bull trout population can be considered stable or increasing. A significant ($P < 0.10$) slope of the regression line is preferred before one determines that a particular population is stable or increasing; however, a statistically significant relationship is not necessary to come up with this conclusion. As the abundance of individuals in a population reaches its carrying capacity and/or stabilizes (slope of regression line near zero), it is impossible for a significant relationship to occur. When a statistically significant relationship ($P < 0.10$) does not occur, interpretation and professional judgment must be used to determine if the amount of variation seen around a regression line is too great for a particular population to be considered stable or increasing.

RESULTS

Priest Lake Core Area

A total of 29 bull trout redds were counted in the Upper Priest Lake basin on September 28-29, 2005 (Figure 1 and Table 2). The majority of these redds were counted in Upper Priest River (26 out of 29). Brook trout *S. fontinalis* and their redds have been observed in many of the streams where we conduct redd counts. For this reason, any redds smaller than 350 mm in diameter were not included in the bull trout redd counts. The number of redds counted in 2005 was up from that observed in 2003 (23 redds), but was over 13 times lower than what was counted in 1985 when similar reaches were compared together (Figure 7 and Table 2). Expanding the number of redds observed by 2.9 fish/redd, the spawning escapement of bull trout for the Upper Priest Lake basin is estimated to be 84 fish. This is considerably lower than the recovery goal of 1,000 adults for the Priest Lake Basin (Table 3). A downward trend is evident in the abundance of bull trout in the Priest Lake Core Area, especially if one evaluates redds counted during 1985 and 1986 (Figure 7 and Table 4).

One manmade barrier was noted during our survey that we believe blocks upstream migration of bull trout. This barrier is a U.S. Forest Service culvert located where F.S. Road 1013 crosses Gold Creek (T63N, R5W, Section 17).

Pend Oreille Lake Core Area

A total of 940 bull trout redds were counted in the Pend Oreille Lake Core Area during October 6-20, 2005, of which 580 (62%) were in the six index streams (Trestle, East Fork Lightning, Gold, North Gold, Johnson, and Grouse creeks) (Figure 2 and 3, and Table 5). This is the second lowest percentage of redds that these six index streams have ever represented since these counts began in 1983. This is largely because Trestle Creek, which had consistently been the tributary with the most redds, had relatively low counts (the fourth lowest count ever) whereas many other streams were showing improvements in redd counts (Table 5). Despite the low counts in Trestle Creek, the 940 redds counted in the Pend Oreille Lake Core Area is the highest ever counted since redd surveys began in 1983 (Table 5). Expanding the number of redds observed by 2.9 fish/redd, the spawning escapement of bull trout for Pend Oreille Lake Core Area is estimated to be 2,755 fish (this includes 29 fish passed upstream of Cabinet Gorge Dam) (Table 6). This exceeds the recovery goal of 2,500 adults for the Pend Oreille Lake Core Area (Table 3). Eight tributaries in the Pend Oreille Basin had an estimated spawning escapement of 100 adults or at least 35 redds were counted (Table 5 and 6). The recovery goal states at least six populations with over 100 adults must occur in the Pend Oreille Lake Core Area (Table 3).

When the redd counts were evaluated from 1983 to 2005 (1986, 1988-91 and 1995 were not evaluated) the linear regression showed a slightly positive slope of 1.969 redds/year (Figure 8 and Table 4). However, if we only evaluate that data from 1992 to 2005 (1995 was not evaluated) a significant ($P < 0.001$) positive trend was calculated (28.0 redds/year).

Besides the dams located on the Pend Oreille River (Albeni Falls Dam) and Clark Fork River (Cabinet Gorge Dam, Noxon Rapids Dam and Thompson Falls Dam), several other manmade migration barriers to bull trout are known to occur in the Pend Oreille Lake Core Area. This includes the city water diversion on Strong Creek, the hatchery, and city water diversion on Spring Creek. Currently, spawning and rearing bull trout populations are not known to occur in Strong Creek and Spring Creek. A barrier (old log crossing) on Uleda Creek, which was a total block to upstream movement to bull trout, was blasted out in 2004 by the Idaho Department of Lands (funding was provided by the U.S. Fish and Wildlife Service). Removal of this barrier more than tripled the amount of spawning and rearing habitat in Uleda Creek. Four bull trout redds were counted upstream of this barrier in 2004, although none were located upstream of it in 2005.

In addition to these manmade barriers, excessive bedload deposition has caused channel intermittency on lower Lightning Creek, Rattle Creek, Savage Creek, East Fork Lightning Creek and Granite Creek. We recognize bedload deposition is a natural process; however, we believe past timber management and road construction and maintenance practices have contributed to an increase in the amount of bedload deposition. This in turn is believed to increase the length and duration of the channel intermittency in these streams. Each of these streams support spawning and rearing bull trout populations and in the past over 100 adults historically ascended them. Work occurred on Granite Creek in 2005 to eliminate the intermittent stream reach.

In 2005, all four recovery goals were being met in the Pend Oreille Lake Core Area for the first time since they were developed. This includes an adult bull trout population of over 2500 fish (2755 in 2005), six local populations with over 100 adults (8 in 2005), a stable or increasing population (increasingly significantly in 2005) and efforts were being made to maintain the current distribution of bull trout and restore their distribution in previously occupied areas.

Three different groupings of streams (all streams, index streams and Lightning Creek tributaries) were evaluated separately to help evaluate why we were seeing improvements in the abundance of bull trout between 1992 and 2005. All three showed increasing trends in redd counts since 1992, although the slope for all three was quite different (Table 4). When evaluating all streams combined (21 streams) there has been on average an increase of about 28.0 redds/year (slope). This averaged out to an increase of 1.3 redds/stream every year. The slope for the six index streams was about 12.5 redds/year, which averaged to about an increase of 2.1 redds/stream each year. When evaluating only the Lightning Creek tributaries (7 streams) there has been on average an increase of about 6.6 redds/year. This averaged out to about an increase of 0.9 redds/stream every year.

Kootenai River Core Area

Three tributaries (North Callahan, South Callahan and Boulder creeks) were surveyed on October 11-13, 2005 for bull trout redds in the Idaho portion of the Kootenai River Core Area and a total of 21 redds were counted (Figure 4 and Table 7). This was only the fourth year redds were counted in all three tributaries. The 21 redds counted during 2005 was the second year in a row where declines in bull trout redds were observed. Expanding the number of redds observed by 2.9 fish/redd, the spawning escapement of bull trout for the Idaho portion of the Kootenai River Core Area in 2005 was estimated to be 61 fish.

With only four years of redd counts occurring on the three Idaho, Kootenai River tributaries, trend analysis would be unreliable. The current four year trend is negative, decreasing at a rate of 0.9 redds per year (slope), although this trend is not significant (Table 4 and Figure 9).

In the Montana portion of the Kootenai River Core Area, 184 redds were counted during 2005 (Table 8). This converts (2.9 fish/redd) to an estimated spawning escapement to 534 fish. When combined with the Idaho spawning escapement (61 fish), the total spawning escapement for the Kootenai River Core Area comes out to 595 fish. No corrections were made for fish that do not spawn every year to come up with the total number of adult fish that occur in the Core Area. As a result, the estimated spawning escapement of 595 for the entire Kootenai River Core Area is conservative. The recovery goal is 1,000 fish (Table 3). During 1999, an estimated 664 bull trout occurred in this Montana section of the Core Area. No streams were surveyed in Idaho during this year, but based on the average number of redds counted over the past three years (26 redds), the total number of adult bull trout that occurred in the entire Kootenai River Core Area likely exceeded 700 fish.

In 2005, two local populations (spawning tributaries) were believed to have over 100 adults associated with them in the Kootenai River Core Area. These tributaries include Quartz Creek (206 adults) and O'Brien Creek (235 adults). In 2003, it was estimated that Callahan Creek (North and South Callahan combined) had a spawning escapement of 116 adults. To reach the recovery goal for this core area there must be five populations with over 100 adults associated with it (Table 3). During 1999, five local populations were believed to have had at least 100 adults associated with them, assuming Callahan Creek followed similar trends as was observed in Montana.

Trend analysis (linear regression) of bull trout redds in Montana tributaries that have been counted consistently since 1990 indicate this population is significantly ($P = 0.026$) increasing (Table 4 and Figure 10). However, three consecutive declines in redd counts occurred from 2002 to 2004 before an increase was observed in 2005 (Figure 10). Starting in 1996, bull trout redd counts have been fairly consistent in the streams surveyed. Analysis of this data suggests that since 1996 the bull trout population has increased slightly (Table 4 and Figure 10). Despite the drop in redd counts between 2002-2004, the number of redds in 2005 were higher than what was observed during the mid to early 1990s and a significantly increasing trend was observed (1990-2005) in the trend sites. Based on this information we conclude that the bull trout population in the Kootenai River Core Area is stable or increasing.

Coeur d'Alene Lake Core Area

The IDFG counted 91 redds in the three index stream reaches of the St. Joe River drainage on September 22, 2005 (Table 9 and Figure 5). The U.S. Forest Service surveyed another 10 streams on September 17, 2005 and counted 2 redds bringing the total number of redds counted in the St. Joe River to 93 (Table 9). This is the second consecutive year where record high numbers of redds were counted in the St. Joe River drainage since counts began in 1992. All these redds were counted in five different streams (Medicine Creek, Wisdom Creek, upper St. Joe River, Heller Creek and Red Ives Creek). The 62 redds counted in Medicine Creek (also a record high) represents 67% of all the redds counted in the entire Coeur d'Alene Lake Core Area during 2005. No attempts were made to search for bull trout redds in the Coeur d'Alene River basin. Expanding the number of redds observed by 2.9 fish/redd, the spawning escapement of bull trout for the Coeur d'Alene Lake Core Area was estimated to be 270 fish, which is considerably lower than the recovery goal of 1,100 adults (Table 3).

A slight upward trend (non-significant $P = 0.312$) was calculated in the spawning escapement of bull trout in the Coeur d'Alene Lake Core Area if one evaluates all the streams surveyed (Figure 11 and Table 4). However, many of these streams have not been surveyed consistently and some of the stream reaches were surveyed by individuals inexperienced in counting redds. If we evaluate only those streams that have been consistently surveyed by experienced counters (the three index streams), a significant ($P = .031$) upward trend (increasing by 2.9 redds/year) was evident (Figure 11 and Table 4). Based on this significant increasing trend we concluded that this population is stable or increasing.

Several complete and/or partial barriers occur in streams where we believe bull trout spawning and rearing is occurring. Red Ives Creek has a diversion dam on it within 2 km of the mouth that we believe blocks upstream migration of most bull trout. We have had reports of a few spawning bull trout upstream of the dam, but believe this dam blocks upstream migration of most bull trout. Entente Creek has a culvert barrier just upstream from where bull trout redds have been reported in the past and there appears to be suitable habitat upstream of the culvert. There are culverts that appear to be barriers on Cascade and Bluebells creeks, although juvenile bull trout have been found upstream of them. Other barriers may occur in streams that we believe have the potential to support spawning and rearing bull trout populations.

North Fork Clearwater River Core Area

Bull trout redd surveys were conducted on September 27, 2005 in the upper Little North Fork Clearwater River basin. During this survey, 80 redds were counted, which was an all time high since redd counts were initiated in 1994 (Figure 6 and Table 10). We did not survey Canyon Creek or Buck Creek during 2005 due to their remote location. Five redds were counted in Buck Creek in 2003. Since 2001 we have started evaluating new streams to better assess where bull trout are spawning in the Little North Fork Clearwater River. We have observed that bull trout spawn in many different streams, but not necessarily on a consistent basis (Table 10).

To calculate the spawning escapement of bull trout in the Little North Fork Clearwater River, we first added 10% to the total redd count to account for streams not surveyed in 2005 (Buck Creek represented 10% of the redds in 2003). Then, by expanding this corrected number of redds (88) by 2.9 fish/redd, the spawning escapement of bull trout for the upper Little North Fork Clearwater River was estimated to be 255 fish. The IDFG Clearwater Region counted 111 redds in the North Fork Clearwater River and Breakfast Creek drainages in 2005 (Table 11). Not all streams were surveyed in the North Fork Clearwater River drainage every year due to their remote locations. Based on previous redd counts (Table 11), it is believed that during 2005 about 24% of the redds were not counted due to unsurveyed streams. By adding another 24% to this count, the estimated number of redds was 138. By expanding this corrected number of redds (138) by 2.9 fish/redd, the spawning escapement of bull trout for the North Fork Clearwater River and Breakfast Creek drainages was estimated to be 399 fish. When combined with the upper Little North Fork Clearwater River, this gives us a total spawning escapement of 654 bull trout for the North Fork Clearwater River Core Area. We multiplied the spawning escapement by 1.33 (at least 25% are not repeat spawners), which gives us a total of 870 adult bull trout that occurred in the North Fork Clearwater Core Area during 2005. This is considerably lower than the recovery goal of 5,000 adult bull trout (Table 3).

It is difficult to evaluate the trend in the number of redds counted in the North Fork Clearwater Core Area. This difficulty stems from the irregularity in counting the same stream reaches throughout the years, adding new reaches, and inconsistency in counting redds that were created by resident fish. If we only look at those stream reaches that we have counted consistently in the Little North Fork Clearwater (Lund Creek, Little Lost Lake Creek, Lost Lake Creek and the Little North Fork Clearwater upstream of Lund Creek) a significant ($P < 0.001$) increasing trend was evident (Figure 12 and Table 4). From 2001-2005, the stream reaches we surveyed for redds in the Little North Fork Clearwater River and North Fork Clearwater River was fairly consistent. When we evaluated only this data, an increasing trend (increasing by 17.8 redds/year) was observed (Figure 13 and Table 4). This trend was not significant ($P = 0.176$) largely because it was based on five years of data. As bull trout redd counts continue in a more consistent manner in the Little North Fork Clearwater River and North Fork Clearwater River basins, we will gain a clearer picture of what the trend in bull trout abundance is in this Core Area.

No natural barriers to bull trout migration were identified in the Little North Fork Clearwater River basin. However, the Clearwater Region has identified barriers in the North Fork Clearwater River that are believed to block upstream migration to bull trout in Isabella Creek (unknown cause), Quartz Creek (land slide), and Slate Creek (culvert).

DISCUSSION

Priest Lake Core Area

Bull trout redd counts from 1985 to 2005 indicate the bull trout population in the Upper Priest Lake basin has declined significantly. The number of bull trout spawning in these tributaries appears to be a fraction of what it was historically. Some of the smaller tributaries (Trapper Creek, Lime Creek, Cedar Creek, Bench Creek and Jackson Creek) have not had any redds counted in them for at least two years, where only 10 years ago counts of one to four redds were common. Even in some of the larger tributaries (Gold Creek and Hughes Fork) where 20 or more redds were counted on an annual basis during the 1980s, fewer than three redds were counted annually between 2002 and 2005. Only Upper Priest River has had redd counts of any appreciable number (>20). This information supports work conducted on Upper Priest Lake where bull trout numbers appeared to be declining significantly and only larger bull trout remain (DuPont et al., In Press a). It seems evident that the expanding population of lake trout S. *namaycush* in Upper Priest Lake poses an increasing threat to the adfluvial bull trout population (Fredericks et al. 2002; Donald and Alger 1993). If this is true, we may continue to see even further declines in the bull trout population from Upper Priest Lake. Bull trout redd counts by Mauser (1986) document this very thing on tributaries of Priest Lake where the number of redds observed in tributaries declined from double digits to zero from 1983 to 1985. This decline in redds occurred several years after a crash in the bull trout population was noticed in Priest Lake. These findings add to the urgency for significantly reducing the lake trout population in Upper Priest Lake. Delays in correcting this problem could result in significant losses to, or the extirpation of this bull trout population.

One promising note is that after considerable declines in bull trout redd counts since the 1980s, redd counts have remained relatively steady since 1992, albeit very low. The reason this bull trout population hasn't totally crashed as was observed in Priest Lake may be because intensive gill netting has occurred in Upper Priest Lake since 1997 to remove lake trout. These efforts have removed about 5,000 lake trout at a rate of over 500 lake trout a year trout since 1997 (DuPont et al. In Press d). During 1998, it was estimated that about 75% of the lake trout (912 in all) were removed from Upper Priest Lake, (Fredericks et al. 2002). Unfortunately, lake trout appear to repopulate Upper Priest Lake by migrating up from Priest Lake through the Thorofare (Fredericks et al. 2002). During lake trout removal efforts in Upper Priest Lake in 2003-2005 an increase in the number of bull trout between 300 and 500 mm in length was observed (DuPont et al., In Press d), indicating that juvenile bull trout survival may be increasing as a result of gill netting efforts. Continued lake trout removal and blocking migration of lake trout into Upper Priest Lake is necessary for this bull trout population to persist.

The total bull trout spawning escapement for the Priest Lake Core Area was estimated at 84 fish in 2005. This is considerably lower than the recovery goal of 1,000 adult fish with at least five local populations having over 100 adults. Few of the tributaries of Priest Lake have been surveyed for redds since 1986 when Mauser (1986) documented the collapse of this population. Bull trout are known to still occur in some of the tributaries of Priest Lake (DuPont et al., In Press e), but probably contribute few adult fish to the entire core area. North Indian Creek, one of the few tributaries of Priest Lake where juvenile bull trout occur, was surveyed in 2004, but no redds were located.

The recovery goal of 1,000 adult fish appears to be reasonable for the Priest Lake Core Area, especially since in the early 1970s, annual harvests of over 1,000 bull trout were common with a peak harvest in 1978 of about 2,300 fish (Mauser et al. 1988). However, increases in bull trout numbers in Priest Lake tributaries are unlikely with the thriving lake trout population that occurs in the lake. The best opportunity for restoring a healthy bull trout population is in the Upper Priest Lake basin, where it may be possible to control the lake trout population. Redd counts in 1985 only surveyed about 21% of what we believe is the high quality spawning habitat in the Upper Priest Lake basin. In this survey, 80 redds were counted. If all the high quality habitat were surveyed, about 380 redds would have been counted, assuming they were distributed similarly in the un-surveyed areas. The 380 redds when multiplied by 2.9 (adults/redd) gives us a rough estimate of 1,102 adult fish that occurred in the Upper Priest Lake basin in 1985. To get back to these types of bull trout numbers, the lake trout population must be significantly reduced and maintained at a low level. Any hope of accomplishing this relies on controlling the immigration of lake trout from Priest Lake (Fredericks et al. 2002). We are unsure of what influence the expanding brook trout population in tributaries will have on restoring bull trout in the Upper Priest Lake basin.

One manmade barrier was noted during our survey that we believe blocks upstream migration of bull trout. This barrier is a U.S. Forest Service culvert located where F.S. Road 1013 crosses Gold Creek (T63N, R5W, Section 17). Currently, bull trout habitat below this culvert is not fully utilized, but spawning and rearing habitat should not be artificially limited for this depressed population.

Pend Oreille Lake Core Area

Redd counts in the Pend Oreille Lake Core Area indicated this system has the most abundant and stable bull trout population in northern Idaho and possibly the state. Evaluation of the spawning tributaries since 1983 show the trend as fairly flat, although, when we evaluated only those redd counts since 1992, a significant increasing trend was evident. The 940 redds counted in 2005 was a record high for the Pend Oreille Lake basin and exceeds what was counted in any other core area in the state.

Surveys in Trestle Creek had consistently produced the highest redd counts of all the Lake Pend Oreille tributaries until 2004 and 2005. The number of redds observed in Trestle Creek in 2005 were the fourth lowest observed since redd counts started in 1983. These back to back low counts in Trestle Creek were surprising as they have been consistently high and stable over the years. What makes this even more unusual is these low counts occurred at a time when redd counts are increasing substantially in other streams. One possible reason for the decline in redd counts in Trestle Creek is that many adults returning to Trestle Creek in 2004 and 2005 outmigrated as juveniles during 2000-2003. Flows in northern Idaho were very low during these years. If Trestle Creek was near its carrying capacity during these years, as was suggested by Downs and Jakubowski (2003), then these lower flows could reduce the amount of living space in Trestle Creek as well as the number of bull trout it could support. Another possible explanation for these low counts is a weir with a pit tag reader was installed in Trestle Creek during 2004 and 2005 to help evaluate bull trout survival at different life stages. This weir will be installed when bull trout outmigrate from Trestle Creek in 2006 to see if this makes a difference.

Despite low redd counts in Trestle Creek in 2005, we observed 10 year record high counts in six different tributaries including Lightning Creek, Porcupine Creek, Johnson Creek, Pack River, Grouse Creek, and the Middle Fork East River. In fact, the number of redds observed in non-index tributaries was the highest ever recorded (360 redds – 38% of the redds). This information is very promising as it suggests that the Pend Oreille Lake core area is getting to the point where it will remain stable even if drastic declines occur in tributaries that have been top producers in the past.

Redd counts in the Middle Fork East River and Uleda Creek were added to the Pend Oreille Lake Core Area in 2003 when these bull trout were documented to spend their adult life in Pend Oreille Lake (DuPont et al. In Press b). Redd counts first occurred in the Middle Fork East River basin in 2001; however, only a portion of the area bull trout are known to spawn in were counted. In 2002, the redd counts covered the entire stream reach where bull trout are believed to spawn, but the counts occurred in mid October after brook trout had began spawning, and it was difficult to determine where the bull trout redds were. The first year we believe accurate redd counts were collected was 2003 when all known spawning areas were assessed and counts occurred on September 30 after the bull trout were finished spawning and before brook trout had begun. Future redd counts in the Middle Fork East River drainage should continue to occur near the end of September, two weeks before redd counts occur in the rest of the Pend Oreille Lake Core Area.

The significantly increasing trend in the number of redds counted since 1992 (all streams combined) is believed to be largely a response to changes in fishing regulations in Pend Oreille Lake that occurred in 1994 (harvest changed from 2 to 1 fish) and 1996 (changed to no harvest). If improvements in habitat were the main reason for the increasing trends we would expect to see these increases in only a few tributaries where these habitat improvement projects have occurred. Those streams having high variability in their redd counts typically have unstable and/or degraded habitat conditions (Rieman and Myers 1997) such as Rattle Creek, Grouse Creek, Johnson Creek and the Pack River. However, periodic increases in the number of redds counted in these streams indicate they have the potential to support strong, stable bull trout populations once improvements occur. Those streams where consistently low redd counts have occurred since 1986 (Lightning Creek, Savage Creek, Morris Creek and Porcupine Creek) may require considerable time and money to recover the population and/or they may have little potential to support high numbers of bull trout.

In the Lightning Creek tributaries, the number of bull trout redds has been increasing at a slower rate than other tributaries of Pend Oreille Lake. Habitat in the Lightning Creek tributaries is believed to be degraded and of lower quality than the other bull trout tributaries in Pend Oreille Lake (PBTTAT 1998), suggesting that the abundance of bull trout in Lightning Creek was and continue to be suppressed more by the quality of the habitat than past fishing pressure. Significant efforts to protect and restore habitat in tributaries of Lake Pend Oreille, have been occurring and likely have contributed to the increase in bull trout numbers we have seen since 1992 (Downs and Jakubowski 2003). These types of efforts are necessary to ensure bull trout populations will continue to increase in the Pend Oreille Lake Core Area.

Efforts are also occurring to increase the distribution and/or population strength of bull trout in the Pend Oreille Lake Core Area by addressing manmade barriers. All of the barriers believed to be suppressing bull trout abundance are being evaluated and/or efforts are being taken to correct the problem. For example, a historic stream crossing that occurred about 0.6 km upstream from the mouth of Uleda Creek, a tributary of the Middle Fork East River, was removed in 2004. Removing this barrier more than tripled the amount of available high quality spawning and rearing habitat for bull trout in this stream. Uleda Creek is an important stream in the Middle Fork East River basin for this bull trout population as the highest densities of juvenile bull trout and no brook trout were found to occur there. Removal of this barrier could lead to significant increases in this bull trout population which should start being recognized after one bull trout generation (6-8 years). Work is also occurring to evaluate entrainment and the possibility of creating upstream fish passage over Albeni Falls Dam on the Pend Oreille River (Geist et al. 2004) and Cabinet Gorge Dam on the Clark Fork River (Lockard et al. 2003). Improvements in fish passage at these dams could result in significant increases in the bull trout population in the Pend Oreille Lake Core Area.

Efforts to correct an intermittent stream reach on Granite Creek were initiated in 2005 (Chris Downs, IDFG, personal communication). This intermittent stretch of stream occurred about 1 km upstream from the mouth and has blocked bull trout migration into one of the top bull trout streams in the core area. In past years, bull trout were trapped and transported by this barrier. The hopes are this stream reconstruction will eliminate the intermittency problem.

Intermittent stream reaches are also a problem for bull trout migration on lower Lightning Creek, Rattle Creek, Savage Creek and East Fork Lightning Creek. The U.S. Forest Service halted new road construction and timber harvest in the Lightning Creek watershed in 1984 in an effort to help reverse this problem (Chad Baconrind, US Forest Service, personal communication). A watershed assessment is planned and funded (Avista Corp.) to evaluate what can be done to reduce or eliminate these problems (Chris Downs, IDFG, personal communication).

The biggest threat to the entire bull trout population in the Pend Oreille Lake Core Area is believed to be from lake trout that occur in the lake (LPOBTWAG 1999). Findings from Donald and Alger (1993) suggest that over time bull trout will not persist in the presence of lake trout. Priest Lake and Flathead Lake, Montana have experience dramatic declines in bull trout numbers as lake trout numbers increased (Mauser 1986; Deleray et al. 1999). Work on Pend Oreille Lake indicates the lake trout population is also expanding rapidly (DuPont et al. In Prep). The kokanee population (major prey item for lake trout and bull trout) is a fraction of what it once was and is at risk of collapsing if changes don’t occur soon. If kokanee collapse, we would likely see bull trout declines as occurred in both Priest Lake and Flathead Lake. Plans are currently in progress to reduce lake trout numbers in Lake Pend Oreille through angler incentive programs, trap netting and gillnetting in areas where lake trout congregate especially during the spawning season.

In 2005, all four bull trout recovery goals were being met in the Pend Oreille Lake Core Area for the first time since they were developed and this is the only core area in the Panhandle to do so. This includes an adult bull trout population of over 2,500 fish (2,755 in 2005), six local populations with over 100 adults (8 in 2005), a stable or increasing population (increasingly significantly in 2005) and efforts were being made to maintain the current distribution of bull trout and restore their distribution in previously occupied areas.

After recovery goals are met in the Pend Oreille Lake Core Area for a period of five or more years, we believe the Idaho Fish and Game and U.S. Fish and Wildlife Service should investigate allowing limited harvest of bull trout on Pend Oreille Lake. We believe that allowing limited harvest of bull trout will keep anglers interested and concerned about the species, which inevitably will lead to more support for continued efforts to improve this fishery. Any harvest allowed on this fishery should not exploit weak local populations, or result in not meeting any of the stated recovery goals.

Kootenai River Core Area

North and South Callahan creeks are the only two streams that appear to be important for spawning bull trout in the Idaho portion of the Kootenai River Core Area. Twenty-one redds were counted in both of theses tributaries, which suggests the spawning escapement was 61 adults. Many other streams have been surveyed in Idaho over the years, but bull trout redds were not found in any of them except for a few in Boulder Creek (Jody Walters, IDFG, personal communication). The majority of the bull trout population in the Kootenai River Core Area occurs in Montana. During 2005, 90% of the redds were counted in Montana, and in 2004, 84% of the redds were found to occur there. Although bull trout spawning in Idaho are included in the same core area as fish spawning in Montana, Kootenai Falls appears to separate these fish (O'Brien Creek in Montana is also downstream of the falls). In addition, bull trout upstream and downstream of the falls likely have different life cycles further isolating them. Evidence indicates that fish spawning downstream of the falls in North and South Callahan creeks and O'Brien Creek are mostly adfluvial coming from Kootenay Lake, B.C., Canada (Jody Walters, IDFG, personal communication). The bull trout that spawn upstream of the Falls in Montana (Quartz Creek, Bear Creek, Pipe Creek and West Fisher River) appear to have a fluvial life cycle where they overwinter in Kootenai River (Jody Walters, IDFG, personal communication). Telemetry work has shown that bull trout can navigate Kootenai Falls, but it appears that for the most part, bull trout that spawn below the falls mix very little with bull trout from above the falls. For this reason, we should not necessarily expect to see the same trends in bull trout abundance between these two populations. This is especially true seeing that Canada allows harvest of bull trout in Kootenay Lake whereas it is no harvest in Idaho and Montana.

The total estimate of adult bull trout that occurred in the entire Kootenai River Core Area was 595 fish during 2005. This estimate is believed to be conservative, as during 2005, it was believed that low flows may have blocked or prevented bull trout from entering many of the spawning streams (Mike Hensler, MFWP, personal communication). In fact, the drop in bull trout numbers that were observed from 2002 to 2004 in the Kootenai River watershed may be in response to the drought that occurred over this period (Mike Hensler, MFWP, personal communication).

Entrainment of bull trout from Lake Koocanusa through Libby Dam may be helping to bolster the population of bull trout in the Kootenai River Core Area. Redd counts downstream of Libby Dam more than doubled after the floods of 1996 and 1997. Lake Koocanusa has a thriving bull trout population, and entrainment of these fish through Libby Dam could be high on flood years. To test whether bull trout being entrained over Libby Dam were contributing to the spawning escapement in Montana tributaries, Montana Fish, Wildlife and Parks put radio transmitters in many of the bull trout located just downstream of Libby Dam. During this study, none of the radio tagged bull trout made migrations into known spawning tributaries in Montana (Mike Hensler, MFWP, personal communication). Most of these fish remained near Libby Dam, although some made migrations downstream into Idaho. It's still not clear what role entrainment plays in the population status of bull trout in the Kootenai River Core Area.

Based on our results, it appears that two of the four recovery goals are currently being met in the Kootenai River Core Area (Table 3). Despite this report, we may not be that far from meeting all the bull trout recovery goals for this core area. During 1999, we believe five bull trout populations had spawning escapements over 100 adults which meets the recovery goal, and the spawning escapement for the entire core area was probably over 700 fish (the goal is 1,000 adults). Based on radio telemetry studies, many bull trout located downstream of Libby Dam do not spawn every year, and consequently, many more adults were in the core area than redd counts indicate. Possibly over 1,000 adult bull trout occurred in the core area during 1999 and as the drought cycle ends, it is very likely we will see bull trout numbers bounce back.

Coeur d'Alene Lake Core Area

Redd counts in the Coeur d'Alene Lake Core Area indicate that only the three index streams (Medicine Creek, Wisdom Creek and the upper St. Joe River) located in the upper St. Joe River basin are responsible for producing all or the vast majority of the bull trout in the entire core area (91 of 93 redds). In the past six years, only during 2004 were more than two redds counted outside the three index streams. In the 1930s, most of the major tributaries in the St. Joe River and some in the St. Maries Rivers were documented to have bull trout in them (IDFG 1933). This apparent loss of bull trout populations in so many tributaries makes it critical that we learn more about what the major sources of mortality are and what may be limiting their numbers. Answers to these types of questions may be necessary before appropriate actions can be taken to restore this bull trout population.

All bull trout redds counted in the three index streams during 2005 were within 5.5 km of each other. This puts almost the entire bull trout population in the Coeur d'Alene Lake Core Area at risk from one catastrophic event. Currently, a dense stand of lodgepole pine and large amounts of dead and dying trees occur in this area, which makes it a prime spot for an intense fire. However, when we evaluated the trend in abundance of redds in the three index streams a significant ($P = 0.085$) increasing trend was evident. Couple this with a record high redd count in 2005 and it gives us some confidence that the bull trout populations in the index streams are not in jeopardy of collapsing in the near future.

Redd surveys in Medicine Creek have consistently produced the highest counts in the Coeur d'Alene Lake Core Area, and the 62 redds counted in 2005 was a record high and represented about 67% (62 out of 93) of all the redds counted. It is believed that Medicine Creek is critical to the persistence of bull trout in the Coeur d'Alene Lake Core Area. Ironically, the habitat in Medicine Creek is not unaltered. Several stream segments still remain channelized from mining activities that occurred in the early 1900s. These channelized stream reaches provide poor spawning and rearing habitat. The U.S. Forest Service should investigate the potential for habitat restoration in Medicine Creek.

Currently, only one of the bull trout recovery goals are being met in the Coeur d'Alene Lake Core Area – the population appears to be stable or increasing. Manmade barriers still exist that block bull trout migrations and the adult population size is estimated to be 270 fish. The current recovery plan asks for a stable or increasing population, with full access to potential spawning streams, and at least 1,100 adult spawners, 300 of which must occur in the Coeur d'Alene River watershed. Obviously, considerable efforts must occur before this bull trout population will ever approach the current recovery goal. As efforts to improve this bull trout population occur, the recovery goals should be re-evaluated to determine how realistic they are.

No attempts were made to survey tributaries of the Coeur d'Alene River for bull trout redds, as we are not aware of any data that suggests spawning and rearing populations occur there. Anglers have reported catching bull trout in recent years from the Coeur d'Alene River, although biologists have verified none. Snorkeling surveys are conducted on an annual basis in the Coeur d'Alene River and no bull trout have ever been observed since these surveys began in 1973. Two different anglers indicated they caught bull trout from the South Fork Coeur d'Alene River at the mouth of Bear Creek. Bear Creek is known to have a strong brook trout population and brook trout are often misidentified as bull trout, even by experienced individuals. Fish surveys (electrofishing or snorkeling) should occur in areas where bull trout reports commonly occur to help substantiate their validity.

North Fork Clearwater River Core Area

A record high number of redds (191 total) were counted in the North Fork Clearwater River and Little North Fork Clearwater River during 2005. The number of stream reaches surveyed for bull trout redds has changed over the years and only since 2001 has the number of stream reaches surveyed occurred in a somewhat consistent manner. From 2001 to 2005, an increasing trend has been observed in the number of redds counted in the North Fork Clearwater River and Little North Fork Clearwater River basins. If we combine this data, bull trout redds have been increasing at a rate of about 18 redds/year over about 28 streams. Based on the few years (five) that we have collected consistent data it's difficult to say for certain that the bull trout population in the North Fork Clearwater River Core Area is stable or increasing. However, due to the record high number of redds counted in 2005 and a significant increasing trend in five consistently counted streams in the Little North Fork Clearwater River, we believe that the bull trout population is stable or increasing in the North Fork Clearwater River Core Area.

Increasing numbers of redds in tributaries of the Little North Fork Clearwater River do not appear to be related to improving habitat conditions, as most of these stream are fairly remote and little human activity occurs in them. The improvements in bull trout numbers can probably be attributed to when fishing regulations changed in 1994 from an allowable 2 fish harvest to no harvest on bull trout. A long lived species such as bull trout can easily be exploited especially seeing how large congregations of bull trout can occur in a few pools (DuPont et al. In Press f).

Currently, two of the four recovery goals are being be met in the North Fork Clearwater River Core Area (Table 3). There are around 20 local populations in the recovery area (the goal is 11), and we believe the population is stable or increasing. The two goals not being met are barriers still exist in the North Fork Clearwater River watershed that should be corrected and the estimated adult population size of 870 is well short of the goal of 5,000. Due to the remote nature of this core area many potential spawning tributaries are not surveyed making this population estimate conservative. In addition, in several tributaries of the North Fork Clearwater River, only short stream segments are surveyed further limiting redd counts. However, even if we doubled our adult bull trout estimate (1,740 fish) based on unsurveyed streams we would still be well short of the 5,000 fish recovery goal.

The recovery goal for the entire North Fork Clearwater Core Area (5,000 adults) is twice that of the Pend Oreille Lake Core Area (2,500 adults). The Pend Oreille Lake Core area is believed to support the strongest bull trout population in Idaho. The sterile nature of the streams in the North Fork Clearwater Core Area is believed to limit primary production and in turn fish biomass in many of these tributaries. As a result, we should not expect to see the same number of bull trout as occurs in the Pend Oreille Lake Core Area where many of the spawning tributaries are low elevation spring fed streams, and a large stable lake provides high survival for maturing juveniles and over-wintering adults. We do not believe the recovery goal of 5,000 adults in the North Fork Clearwater River Core Area is realistic. We suggest that this portion of the recovery plan be re-evaluated and a more realistic goal be developed.

RECOMMENDATIONS

1. Continue to monitor bull trout spawning escapement through redd counts in the Priest Lake Pend Oreille Lake, Kootenai River, St. Joe River and Little North Fork Clearwater River watersheds.

2. Using redd counts, continue to evaluate that status of bull trout in each of the core areas that occur in the Panhandle Region.

3. Investigate new streams/stream reaches where bull trout spawning may be occurring.

4. Continue to provide annual training to all people who will be conducting redd counts in the Panhandle Region.

5. Re-work the recovery goals for the State and Federal Recovery Plans for the Pend Oreille Lake Core Area so that they are the same.

6. Discuss with the U.S. Forest Service the feasibility of habitat restoration in Medicine Creek and/or Wisdom Creek.

7. Conduct a survival study on bull trout in the St. Joe River basin to better evaluate what the major limiting factors are.

8. Re-evaluate the recovery goals for the North Fork Clearwater River Core Area.

LITERATURE CITED

Baxter, J.S., and W.T. Westover. 1999. Wigwam River bull trout. Habitat Conservation Trust Fund Progress Report (1998). Fisheries Progress Report K054. British Columbia Ministry of Environment, Cranbrook.

Bonar, S. A., M. Divens and B. Bolding. 1997. Methods for sampling the distribution and abundance of bull trout/dolly varden. Report # RAD97-05. Washington Department of Fish and Wildlife, Olympia.

Bonneau, J.L. and G. LaBar. 1997. Inter-observer and temporal bull trout redd count variability in tributaries of Lake Pend Oreille, Idaho. Department of Fish and Wildlife Resources, University of Idaho, Moscow, Idaho.

Deleray, M., L. Knotek, S. Rumsey, and T. Weaver. 1999. Flathead Lake and River system fisheries status report. Montana Fish, Wildlife and Parks, Kalispell.

Donald, D.B. and D.J. Alger. 1993. Geographic distribution, species displacement, and niche overlap for lake trout and bull trout in mountain lakes. Canadian Journal of Zoology 71:238-247.

Downs, C.C., and R. Jakubowski. 2003. Lake Pend Oreille/Clark Fork River fishery research and monitoring, 2002 Progress Report. Project 5, 2000-2002 Trestle and Twin Creeks bull trout outmigration and Lake Pend Oreille survival study progress report. Avista Corporation. Spokane, Washington.

Dunham J.B., B.E. Rieman, and K. Davis. 2001. Sources and magnitude of sampling error in redd counts for bull trout. North American Journal of Fish Management 21:343-352.

DuPont, J., M. Liter, and N. Horner. In Press a. Regional fisheries management investigations, Idaho Department of Fish and Game, Federal Aid in Fish Restoration, F-71-R-27, Subproject I, Job a, 2002 Job Performance Report, Boise, Idaho.

DuPont J., M. Liter, and N. Horner. In Press b. Regional fisheries management investigations. Idaho Department of Fish and Game, Federal Aid in Fish Restoration, F-71-R-29, Subproject I, Job c-3, 2003 Job Performance Report, Boise, Idaho.

DuPont J., M. Liter, and N. Horner. In Press c. Regional fisheries management investigations. Idaho Department of Fish and Game, Federal Aid in Fish Restoration, F-71-R-29, Subproject I, Job c-2, 2003 Job Performance Report, Boise, Idaho.

DuPont J., M. Liter, and N. Horner. In Press d. Regional fisheries management investigations. Idaho Department of Fish and Game, Federal Aid in Fish Restoration, F-71-R-30, Subproject I, Job a, 2004 Job Performance Report, Boise, Idaho.

DuPont J., M. Liter, and N. Horner. In Press e. Regional fisheries management investigations. Idaho Department of Fish and Game, Federal Aid in Fish Restoration, F-71-R-30, Subproject I, Job c-4, 2004 Job Performance Report, Boise, Idaho.

DuPont J., M. Liter, and N. Horner. In Press f. Regional fisheries management investigations. Idaho Department of Fish and Game, Federal Aid in Fish Restoration, F-71-R-31, Subproject I, Job c-3, 2005 Job Performance Report, Boise, Idaho.

DuPont J., M. Liter, and N. Horner. In Prep. Regional fisheries management investigations. Idaho Department of Fish and Game, Federal Aid in Fish Restoration, F-71-R-31, Subproject I, Job a, 2005 Job Performance Report, Boise, Idaho.

Fraley, J., and B. Shepard. 1998. Life history, ecology, and population status of migratory bull trout (Salvelinus confluentus) in the Flathead Lake and River system, Montana. Montana Department of Fish, Wildlife, and Parks, Kalispell, Montana.

Fredericks, J., J. Davis, N. Horner, and C. Corsi. 2002. Regional fisheries management investigations, Idaho Department of Fish and Game, Federal Aid in Fish Restoration, F-71-R-23, Subproject IV, 1998 Job Performance Report, Boise, Idaho.

Geist D.R., R.S. Brown, A.T. Scholz and B. Nine. 2004. Movement and survival of radio-tagged bull trout near Albeni Falls Dam. Department of the Army Seattle District, Corps of Engineers, Seattle, Washington.

IDFG (Idaho Department of Fish and Game). 1933. Five year fish and game report, St. Joe National Forest. St. Maries, Idaho.

Lockard, L., S. Wilkenson, and S. Skaggs. 2003. Experimental Adult Fish Passage Studies Annual Progress Report - 2002, Fish Passage/Native Salmonid Restoration Program, Appendix C. Report to Avista Corporation, Spokane, Washington. U.S. Fish and Wildlife Service, Creston, Montana and Avista Corporation, Noxon, Montana.

LPOBTWAG (Lake Pend Oreille Bull Trout Watershed Advisory Group). 1999. Lake Pend Oreille bull trout conservation plan. Department of Environmental Quality. Boise, Idaho.

Mauser, G.R. 1986. Enhancement of trout in large North Idaho lakes. Idaho Department of Fish and Game, Job Performance Report, F-73-R-8, Boise, Idaho.

Mauser, G.R., R.W. Vogelsang, C.L. Smith. 1988. Enhancement of trout in large North Idaho lakes. Idaho Department of Fish and Game, Job Performance Report, F-73-R-9, Boise, Idaho.

Maxell, B.A. 1999. A power analysis on the monitoring of bull trout stocks using redd counts. North American Journal of Fisheries Management. 19(3):860-866.

PBTTAT (Panhandle Bull Trout Technical Advisory Team). 1998. Lake Pend Oreille Key Watershed Bull Trout Problem Assessment. Department of Environmental Quality. Boise, Idaho.

Pratt, K.L. 1984. Pend Oreille trout and char life history study. Idaho Department of Fish and Game, Boise, Idaho.

Rieman, B.E., and D.L. Myers. 1997. Use of redd counts to detect trends in bull trout (Salvelinus confluentus) populations. Conservation Biology. 11(4):1015-1018.

Schriever, E., and D. Schiff. 2002. Regional fisheries management investigations, Bull trout life history investigations in the North Fork Clearwater River basin, Idaho Department of Fish and Game, Boise, Idaho.

Spruell, P., B.E. Rieman, K.L. Knudsen, F.M. Utter, and F.W. Allendorf. 1999. Genetic population structure within streams: microsatellite analysis of bull trout populations. Ecology of Freshwater Fish 8:114-121.

USFWS (U.S. Fish and Wildlife Service). 2002. U.S. Fish and Wildlife Service Bull Trout (Salvelinus *confluentus*) Draft Recovery Pan. Portland, Oregon.

Table 2. Description of bull trout redd count transect locations, distance surveyed and number of redds counted in the Priest Lake basin, Idaho, from 1985 to 2005.

Stream	Transect Description	Length (km)	1985	1986	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Upper Priest River	Falls to Rock Cr.	12.5	--	--	--	--	--	--	15	4	15	33	7	7	17	8	5	13
	Rock Cr. to Lime Cr.	1.6	--	--	--	2	1	1	2	0	3	7	0	2	0	0	0	0
	Lime Cr. to Snow Cr.	4.2	12[a]	5[a]	--	3	4	2	8	1	10	9	9	5	1	16	12	3
	Snow Cr. to Hughes Cr.	11.0	--	--	--	0	0	--	0	3	7	4	2	8	3	13	2	10
	Hughes Cr. to Priest Lake	2.3	--	--	--	0	0	--	0	--	--	0	0	--	--	--	--	--
Rock Cr.	Mouth to F.S. trail 308	0.8	--	--	0	0	--	--	2	1	0	--	0	0	0	--	1	0
Lime Cr.	Mouth upstream 1.2 km	1.2	4[b]	1[b]	0	0	--	--	0	2	0	1	0	0	0	0	0	0
Cedar Cr.	Mouth upstream 3.4 km	3.4	--	--	--	0	2	1	0	1	0	0	0	0	0	0	0	0
Ruby Cr.	Mouth to waterfall	3.4	--	--	0	0	--	--	--	0	0	--	--	--	0	--	--	0
Hughes Cr.	Trail 312 to trail 311	2.5	1	17	7	3	2	0	1	4	0	1	0	0	0	1	0	0
	Trail 311 to F.S. road 622	4.0	35[c]	2[c]	2	0	7	1	2	0	0	0	0	0	0	1	2	1
	F.S. road 622 to mouth	7.1	4[d]	0[d]	--	1	--	--	2	3	1	0	2	6	1	0	1	1
Bench Cr.	Mouth upstream 1.1 km	1.1	1	2	0	2	2	0	1	0	0	0	0	0	0	0	0	0
Jackson Cr.	Mouth to F.S. trail 311	2.2	--	--	4	0	0	0	0	0	0	--	--	--	0	0	0	0
Gold Cr.	Mouth to culvert	3.7	24	23	5	2	6	5	3	0	1	1	9	5	2	2	0	1
Boulder Cr.	Mouth to waterfall	2.3	--	--	0	0	0	--	0	0	0	--	0	--	--	--	--	0
Trapper Cr.	Mouth upstream 5.1 km	5.0	--	--	--	4	4	2	5	3	8	2	0	1	0	0	0	0
Caribou Cr.	Mouth to old road crossing	2.6	--	--	--	1	0	0	0	0	0	--	--	--	--	--	--	--
All stream reaches combined		83.8	80[e]	48[e]	18	18	28	12[f]	41	22	45	58	29	34	24	41	23	29
Only those stream reaches evaluated during 1985-6		23.8[g]	80	48	14[h]	11	21[h]	8[f]	17	10	12	12	20	16	4	20	15	6

[a] Redds were counted from Lime Creek to Cedar Creek, which is about 1/2 the distance that is currently counted.
[b] Redds were counted from the mouth to FS road 1013, which is about 1/4 of the distance that is currently counted.
[c] About 2/3 of the distance was counted in 1985 and 1986 that is currently counted.
[d] Redds were counted from FS road 622 to the FS Road 1013, which is about 1/3 of the distance that is currently counted.
[e] Redds were counted in about 1/5 of the stream reaches where they are currently counted.
[f] Observation conditions impaired by high runoff.
[g] During 1985 and 1986 about 15 km of stream was counted.
[h] Two of the sites were not counted

Table 3. The status of bull trout populations during 2005 in each of the core areas that occur in the IDFG Panhandle Region. Core areas highlighted in grey have met all their recovery goals.

Core Area	2005 adult bull trout population estimate	Recovery goal	No. of local populations that have more than 100 adults	Recovery goal	Is this population stable or increasing?	Have 10 or more years of data been collected?	Are there streams that have known manmade barriers that block bull trout migrations?
Priest Lake	84	1000	0	5	no	yes	yes - Gold Creek
Kootenai River	595	1000	2	5	yes	yes	None in Idaho
Pend Oreille Lake	2755	2500	8	6	yes	yes	yes - Clark Fork and Pend Oreille rivers
Coeur d'Alene Lake	270	1100	1	NA	yes	yes	Yes - Red Ives, Entente, Cascade and Bluebell
N.F. Clearwater River	870	5000	20[a]	11[a]	yes	no	Yes – Isabella, Quartz and Slate Creeks

[a] A total of 100 adults or more are not required.

Table 4. Statistics for the linear regression of bull trout redds counted in different watershed in bull trout recovery core areas included in the IDFG Panhandle Region during 2005.

Streams/Core Area	Years evaluated	No. of observations	R value	R square	P value	Slope (Redd Coefficient)	Redd Standard Error
Upper Priest - 1985 sites	1985-2005	13	-0.806	0.649	0.001	-2.673	0.593
Upper Priest - all streams	1996-2005	10	-0.346	0.119	0.328	-1.321	1.269
Kootenai River - Idaho streams	2002-2005	4	-0.122	0.015	0.878	-0.900	5.164
Kootenai River - all MT streams	1996-2005	10	0.025	0.001	0.944	0.394	5.481
Kootenai River - three streams	1990-2005	16	0.554	0.306	0.026	5.081	2.043
Pend Oreille - index streams	1983-2005	21	0.121	0.015	0.602	1.591	3.001
Pend Oreille - index streams	1992-2005	13	0.537	0.288	0.059	12.531	5.943
Pend Oreille - all streams	1983-2005	17	0.097	0.010	0.710	1.969	5.192
Pend Oreille - all streams	1992-2005	13	0.857	0.735	0.000	28.032	5.073
Lightning Creek - all tribs	1992-2005	13	0.755	0.569	0.003	6.559	1.720
St Joe River - index streams	1992-2005	14	0.575	0.331	0.031	2.890	1.224
St Joe River - all streams	1992-2005	14	0.292	0.085	0.312	1.413	1.338
LNF Clearwater - five streams	1996-2005	11	0.960	0.921	0.000	3.306	0.322
LNF Clearwater - all streams	2001-2005	5	0.780	0.608	0.120	8.600	3.988
NF Clearwater - all streams	2001-2005	5	0.633	0.401	0.251	9.200	6.488
NF and LNF Clearwater	2001-2005	5	0.714	0.510	0.176	17.800	10.077

Table 5. Number of bull trout redds counted per stream in the Pend Oreille Lake, Idaho, Core Area, from 1983 to 2005.

Stream	1983[a]	1984	1985	1986[b]	1987	1988	1989	1990	1991[c]	1992	1993	1994	1995[d]	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
CLARK FORK R.	--	--	--	--	--	--	--	--	--	2	8	17	18	3	7	8	5	5	6	7	8	1	--
Lightning Cr.	28	9	46	14	4	--	--	--	--	11	2	5	0	6	0	3	16	4	7	8	8	9	22
East Fork	110	24	132	8	59	79	100	29	--	32	27	28	3	49	22	64	44	54	36	58	38	77	50
Savage Cr.	36	12	29	--	0	--	--	--	--	1	6	6	0	0	0	0	4	2	4	15	7	15	7
Char Cr.	18	9	11	0	2	--	--	--	--	9	37	13	2	14	1	16	17	11	2	8	7	14	15
Porcupine Cr.	37	52	32	1	9	--	--	--	--	4	6	1	2	0	0	0	4	4	0	0	5	10	14
Wellington Cr.	21	18	15	7	2	--	--	--	--	9	4	9	1	5	2	1	22	8	7	7	8	7	6
Rattle Cr.	51	32	21	10	35	--	--	--	--	10	8	0	1	10	2	15	13	12	67	33	37	34	34
Johnson Cr.	13	33	23	36	10	4	17	33	25	16	23	3	4	5	27	17	31	4	34	31	0	32	45
Twin Cr.	7	25	5	28	0	--	--	--	--	3	4	0	5	16	6	10	19	10	1	8	3	6	7
Morris Cr.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1	1	0	7	1	1	3
Strong Creek	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0	--	0	--
NORTH SHORE																							
Trestle Cr.	298	272	298	147	230	236	217	274	220	134	304	276	140	243	221	330	253	301	335	333	361	102	174
Pack River	34	37	49	25	14	--	--	--	--	65	21	22	0	6	4	17	0	8	28	22	24	31	53
Grouse Cr.	2	108	55	13	56	24	50	48	33	17	23	18	0	50	8	44	50	77	18	42	45	28	77
EAST SHORE																							
Granite Cr.	3	81	37	37	30	--	--	--	--	0	7	11	9	47	90	49	41	25	7	57	101	149	132
Sullivan Springs	9	8	14	--	6	--	--	--	--	0	24	31	9	15	42	10	22	19	8	15	12	14	15
North Gold Cr.	16	37	52	8	36	24	37	35	41	41	32	27	31	39	19	22	16	19	16	24	21	56	34
Gold Cr.	131	124	111	78	62	111	122	84	104	93	120	164	95	100	76	120	147	168	127	203	126	167	200
PRIEST RIVER																							
M. F. East River	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	4	8	21	20	48
Uleda Creek	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	3	4	3	7	4
N. F. East River																						1	0
Total 6 index streams[e]	570	598	671	290	453	478	543	503	423	333	529	516	273	486	373	597	541	623	566	691	591	462	580
Total of all streams	814	881	930	412	555	478	543	503	423	447	656	631	320	608	527	726	705	732	710	890	836	781	940

[a] A significant portion of Grouse Creek was not counted.
[b] A significant portion of Rattle Creek and East Fork Lightning Creek were not counted.
[c] Represents partial counts due to early snow fall.
[d] Observation conditions impaired by high runoff.
[e] Index streams include Trestle, East Fork Lightning, Gold, North Gold, Johnson, and Grouse creeks.

Table 6. The estimated number of adult bull trout associated with each tributary where redds were counted in the Pend Oreille Lake Core Area from 1983 to 2005. Stream counts shaded in gray indicate when over 100 adults were estimated to be present. Total counts shaded in gray indicate when the entire population exceeded 2,500 fish.

Stream	1983[a]	1984	1985	1986[b]	1987	1988	1989	1990	1991[c]	1992	1993	1994	1995[d]	1996	1997	1998	1999	2000	2001	2002	2003	2004[d]	2005
CLARK FORK R.	--	--	--	--	--	--	--	--	--	6	23	49	52	9	20	23	15	15	17	20	23	3	0
Lightning Cr.	81	26	133	41	12	--	--	--	--	32	6	15	0	17	0	9	46	12	20	23	23	26	64
East Fork	319	70	383	23	171	229	290	84	--	93	78	81	9	142	64	186	128	157	104	168	110	223	145
Savage Cr.	104	35	84	--	0	--	--	--	--	3	17	17	0	0	0	0	12	6	12	44	20	44	20
Char Cr.	52	26	32	0	6	--	--	--	--	26	107	38	6	41	3	46	49	32	6	23	20	41	44
Porcupine Cr.	107	151	93	3	26	--	--	--	--	12	17	3	6	0	0	0	12	12	0	0	15	29	41
Wellington Cr.	61	52	44	20	6	--	--	--	--	26	12	26	3	15	6	3	64	23	20	20	23	20	17
Rattle Cr.	148	93	61	29	102	--	--	--	--	29	23	0	3	29	6	44	38	35	194	96	107	99	99
Johnson Cr.	38	96	67	104	29	12	49	96	73	46	67	9	12	15	78	49	90	12	99	90	0	93	131
Twin Cr.	20	73	15	81	0	--	--	--	--	9	12	0	15	46	17	29	55	29	3	23	9	17	20
Morris Cr.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	3	3	0	20	3	3	9
Strong Creek	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0	--	0	--
NORTH SHORE																						0	0
Trestle Cr.	864	789	864	426	667	684	629	795	638	389	882	800	406	705	641	957	734	873	972	966	1047	296	505
Pack River	99	107	142	73	41	--	--	--	--	189	61	64	0	17	12	49	0	23	81	64	70	90	154
Grouse Cr.	6	313	160	38	162	70	145	139	96	49	67	52	0	145	23	128	145	223	52	122	131	81	223
EAST SHORE																						0	0
Granite Cr.	9	235	107	107	87	--	--	--	--	0	20	32	26	136	261	142	119	73	20	165	293	432	383
Sullivan Springs	26	23	41	--	17	--	--	--	--	0	70	90	26	44	122	29	64	55	23	44	35	41	44
North Gold Cr.	46	107	151	23	104	70	107	102	119	119	93	78	90	113	55	64	46	55	46	70	61	162	99
Gold Cr.	380	360	322	226	180	322	354	244	302	270	348	476	276	290	220	348	426	487	368	589	365	484	580
PRIEST RIVER																						0	0
M. F. East River	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	12	23	61	58	139
Uleda Creek	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	9	12	9	20	12
N. F. East River	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	3	0
Trap and Transport	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	35	35	35	40	29
Total 6 index streams[e]	1653	1734	1946	841	1314	1386	1575	1459	1227	966	1534	1496	792	1409	1082	1731	1569	1807	1641	2004	1714	1340	1682
Total for all streams	2361	2555	2697	1195	1610	1386	1575	1459	1227	1296	1902	1830	928	1763	1528	2105	2045	2123	2094	2616	2459	2305	2755

[a] A significant portion of Grouse Creek was not counted.
[b] A significant portion of Rattle Creek and East Fork Lightning Creek were not counted.
[c] Represents partial counts due to early snow fall.
[d] Observation conditions impaired by high runoff.
[e] Index streams include Trestle, East Fork Lightning, Gold, North Gold, Johnson, and Grouse creeks.

Table 7. The number of bull trout redds counted per stream in the Idaho section of the Kootenai River Core Area, from 2001 to 2005.

Stream	Length (km)	2001	2002	2003	2004	2005
North Callahan Creek	3.3	--	13	30	17	12
South Callahan Creek	4.3	--	4	10	8	8
Boulder Creek	1.8	2	2	0	0	1
All Streams	9.4	2	19	40	25	21

Table 8. The number of bull trout redds counted per stream in the Montana section of the Kootenai River Core Area from 1990 to 2005.

Stream	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Quartz	76	77	17	89	64	67	47	69	105	102	91	154	62[d]	55	49	71
O'Brien	--	25	24	6	7	22	12	36	47	37	34	47	45	46	51	81
Pipe	6	5	11	6	7	5	17	26	34	36[b]	30	6[a]	11	10	8	2
Bear	--	--	--	--	--	6	10	13	22	36	23	4[c]	17	14	6	3
West Fisher	--	--	--	2	0	3	4	0	8	18	23	1	1	1	21	27
Quartz/O'Brien/Pipe	82	107	52	101	78	94	76	131	186	175	155	207	118	111	108	154
All Streams	82	107	52	103	78	103	90	144	216	229	201	212	136	126	135	184

[a] A human built dam (stacked up cobble) was constructed downstream of the traditional spawning area.

[b] This count includes redds constructed by resident and migratory fish.

[c] Libby Creek was dewatered at the Highway 2 bridge, downstream of Bear Creek spawning sites, during the bull trout spawning run.

[d] A log jam may have been a partial barrier.

Table 9. The number of bull trout redds counted by stream in the St. Joe River basin, Idaho, from 1992 to 2005. Counts shaded in gray are index streams that have been surveyed by the Idaho Department of Fish and Game since 1995. All other stream reaches are counted by the U.S. Forest Service and/or volunteers.

Stream Name	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Aspen Cr.	--	--	--	--	--	--	--	--	--	--	0	--
Bacon Cr.	0	--	--	--	--	--	--	--	--	--	--	--
Bad Bear Cr.	--	0	0	--	--	--	--	--	--	--	--	0
Bean Cr.	14	--	--	0	--	--	--	--	--	--	--	--
Beaver Cr.	2	2	0	0	0	0	1	0	--	0	0	0
Bluff Cr.- East Fork	0	--	--	--	--	--	--	--	--	--	--	--
California Cr.	2	4	0	2	3	0	--	--	0	0	0	0
Copper Cr.	--	--	0	--	0	--	--	--	--	--	0	0
Entente Cr.	--	--	--	--	--	--	--	0	--	--	1	0
Fly Cr.	1	--	--	0	0	0	2	0	--	--	1	0
Gold Cr. Lower mile	--	0	--	--	--	0	--	0	--	--	--	0
Gold Cr. Midde	--	--	--	0	--	--	--	0	--	--	--	--
Gold Cr. Upper	--	2	--	--	1	1	0	--	--	--	--	--
Gold Cr. All	--	--	--	--	--	--	--	--	--	1	0	--
Heller Cr.	0	0	0	0	--	1	0	0	0	--	0	0
Indian Cr.	0	0	--	--	--	--	--	--	--	--	--	--
Medicine Cr	11	33	48	17 [a]	23 [a]	13 [a]	11 [a]	48 [a]	43	16	42	28
Mosquito Cr.	0	--	0	0	4	0	2	--	--	--	--	--
Quartz Cr.	--	--	--	--	--	--	--	--	--	--	0	--
Red Ives Cr.	--	0	1	1	0	1	0	0	0	0	0	0
Ruby Cr.	0	1	--	8	--	--	--	--	--	--	--	--
Sherlock Cr.	0	3	0	2	1	1	0	1	0	--	--	0
Simmons Cr. - Lower	--	0	0	0	--	--	--	--	--	0	--	--
Simmons Cr. - NF to Three Lakes	--	5	0	--	--	--	--	--	--	--	--	--
Simmons Cr. - Three Lakes to Rd 1278	--	3	5	5	0	0	0	0	--	--	--	--
Simmons Cr. - Rd 1278 to Washout	--	0	0	0	1	0	1	0	--	--	--	--
Simmons Cr. - Upstream of Washout	--	0	--	--	--	0	--	--	--	--	--	--
Simmons Cr. - East Fork	--	--	0	--	--	--	--	--	--	--	--	--
St. Joe River - below Tento Creek	--	--	--	--	0	--	--	--	--	--	--	--
St. Joe River - Spruce Tree to St. Joe Ldg.	--	--	--	0	--	--	--	--	--	--	--	--
St. Joe River - St. Joe Ldg to Broken Leg	--	--	--	4	--	--	--	--	--	--	--	--
St. Joe River - Broken Leg Cr upstream	--	--	--	0	--	--	--	--	--	--	--	--
St. Joe River - Bean to Heller Cr.	0	0	--	--	--	--	--	--	--	--	--	--
St. Joe River - Heller to St. Joe Lake	10 [b]	14 [b]	3 [b]	20	14	6	0	10	2	11	3	9
Three Lakes Creek	--	--	--	--	0	--	--	--	--	--	--	--
Timber Cr.	--	0	1	0	--	--	--	--	--	--	--	--
Wampus cr	--	0	0	--	--	--	--	--	--	--	--	--
Washout cr.	--	3	0	0	0	0	--	--	--	--	--	--
Wisdom Cr	1	1	4	5	1 [a]	0	4	11	3	13	9	9
Yankee Bar	1	0	--	--	--	0	--	--	1	0	0	0
Total - Index Streams	22	48	55	42	38	19	15	69	48	40	54	46
Total - All Streams	42	71	62	64	48	23	21	70	49	41	56	46
Number of streams reaches surveyed	16	23	19	21	16	17	12	13	8	9	14	14

[a] These counts differed from what the U.S. Forest Service counted.

[b] These counts did not include from California Creek to Medicine Creek, a reach where bull trout spawning typically occurs.

Table 9 (continued).

Stream Name	2004	2005
Aspen Cr.	--	--
Bacon Cr.	--	--
Bad Bear Cr.	--	--
Bean Cr.	--	--
Beaver Cr.	0	0
Bluff Cr.- East Fork	--	--
California Cr.	0	0
Copper Cr.	0	--
Entente Cr.	--	--
Fly Cr.	0	0
Gold Cr. Lower mile	--	--
Gold Cr. Midde	--	--
Gold Cr. Upper	--	--
Gold Cr. All	0	--
Heller Cr.	7	1
Indian Cr.	--	--
Medicine Cr	52	62
Mosquito Cr.	0	0
Quartz Cr.	--	--
Red Ives Cr.	0	1
Ruby Cr.	--	--
Sherlock Cr.	0	0
Simmons Cr. - Lower	--	--
Simmons Cr. - NF to Three Lakes	--	--
Simmons Cr. - Three Lakes to Rd 1278	--	--
Simmons Cr. - Rd 1278 to Washout	--	--
Simmons Cr. - Upstream of Washout	--	--
Simmons Cr. - East Fork	--	--
St. Joe River - below Tento Creek	--	--
St. Joe River - Spruce Tree to St. Joe Ldg.	--	--
St. Joe River - St. Joe Ldg to Broken Leg	--	--
St. Joe River - Broken Leg Cr upstream	--	--
St. Joe River - Bean to Heller Cr.	--	--
St. Joe River - Heller to St. Joe Lake	9	10
Three Lakes Creek	--	--
Timber Cr.	--	--
Wampus cr	--	--
Washout cr.	--	--
Wisdom Cr	11	19
Yankee Bar	0	0
Total - Index Streams	72	91
Total - All Streams	79	93
Number of streams reaches surveyed	13	11

[a] These counts differed from what the U.S. Forest Service counted.

[b] These counts did not include from California Creek to Medicine Creek, a reach where bull trout spawning typically occurs.

Table 10. Number of bull trout redds counted per stream in the Little North Fork Clearwater River basin, Idaho, from 1994 to 2005. Numbers in parentheses are redds smaller than 300 mm in diameter indicating they were made by resident bull trout.

Stream	Length (km)	1994[a]	1996	1997	1998	1999	2000	2001	2001[b]	2002	2003	2004	2005
Buck Creek	4.8	--	--	--	--	--	--	--	--	--	5	--	--
Canyon Creek	5.5	--	--	--	--	--	--	--	--	--	0	--	--
Butte Creek	1.2	--	--	--	--	--	--	--	5	0	--	--	--
Rutledge Creek	2.9	--	--	--	--	--	--	--	--	--	1	1	6
Rocky Run Creek	4.7	--	--	--	--	--	--	--	--	5	1	3	21
Lund Creek	3.9	0	7	2	2	1	1	13	5	7	7 (1)	5	19
Little Lost Lake Creek	3.9	0	1	1	1	7	3	1	--	2 (4)	4 (3)	15 (1)	1
Lost Lake Creek	3.0	0	0	0	0	--	1	--	--	0	--	1	--
Little North Fork Clearwater River													
1268 Bridge to Lund Cr.	7.0	--	--	--	--	--	--	--	17	6	13	8	16
Lund Cr. to Lost Lake Cr.	3.8	--	--	3	1	9	8	3	12	5 (2)	7	5	11
Lost Lake Cr. to headwaters	5.4	0	2	0	0	--	5	1	--	5	5 (1)	5	6
All reaches surveyed in 2005	31.6	0	10	6	4	17	18	18	39	30 (6)	43 (5)	42 (2)	80

[a] Streams were surveyed between 9/16/1994 and 9/19/1994 - one week earlier than surveys in following years.
[b] These redds were counted by personnel from the Clearwater Region.

Table 11. Number of bull trout redds counted per stream in the North Fork Clearwater River and Breakfast Creek basins, Idaho, from 1994 to 2005. These streams all occur in the IDFG Clearwater Region and were counted by personnel from the Clearwater Region or U.S. Forest Service.

Stream Surveyed	Length (km)	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
North Fork Clearwater River													
Black Canyon		--	--	--	--	--	--	--	--	1	--	--	--
Bostonia Creek	0.6	0	0	0	0	0	4	1	1	1	18	12	15
Boundary Creek	1.6	--	--	--	--	--	--	--	--	--	2	3	10
Collins Creek		--	--	--	--	--	--	--	0	--	--	--	--
Goose Creek	5.6	--	--	--	--	--	--	--	1	0	2	1	12
Hidden Creek		--	--	--	--	--	--	--	--	1	0	--	--
Isabella Creek	4.5	--	--	--	--	--	--	--	--	1	1	0	0
Kelley Creek - North Fork		--	--	--	--	--	--	--	14	--	--	--	--
Lake Creek	3.7	--	--	--	--	--	--	19	7	20	14	5	2
Little Moose Creek		--	--	--	--	--	--	--	0	--	--	--	--
Long Creek	2.9	--	--	--	--	--	--	--	--	5	0	8	10
Moose Creek	2.4	--	--	--	--	--	--	0	0	0	0	--	0
Niagra Gulch	0.8	--	--	--	--	--	--	2	5	6	10	3	4
Orogrande Creek	2.4	--	--	--	--	--	--	--	--	--	--	--	0
Osier Creek		--	--	--	--	--	--	3	0	2	0	--	--
Placer Creek	0.5	3	1	2	2	2	7	4	2	4	6	2	3
Pollock Creek		--	--	--	--	--	--	--	--	--	1	--	--
Quartz Creek	1.6	--	--	--	--	--	--	--	4	0	0	0	0
Ruby Creek		--	--	--	--	--	0	0	--	--	--	--	--
Skull Creek	2.9	--	--	--	--	--	--	--	--	0	6	5	3
Slate Creek	0.2	--	--	--	--	--	--	--	--	?	?	?	3
Swamp Creek	4.3	--	--	--	--	--	--	2	0	1	0	0	2
Upper North Fork	1.6	--	--	--	--	--	--	--	--	--	7	3	6
Vanderbilt Gulch	3.2	--	--	--	--	--	--	--	24	18	13	12	41
Weitas Creek		--	--	--	--	--	--	1	--	--	--	--	--
Windy Creek		--	--	--	--	--	2	--	--	--	--	--	--
Breakfast Creek													
Floodwood Creek		--	--	--	--	--	--	--	--	4	0	0	--
Gover Creek		--	--	--	--	--	--	--	--	--	1	0	--
Stony Creek		--	--	--	--	--	--	--	--	4	0	0	--
Total for all streams	38.8	3	1	2	2	2	13	32	58	68	81	54	111

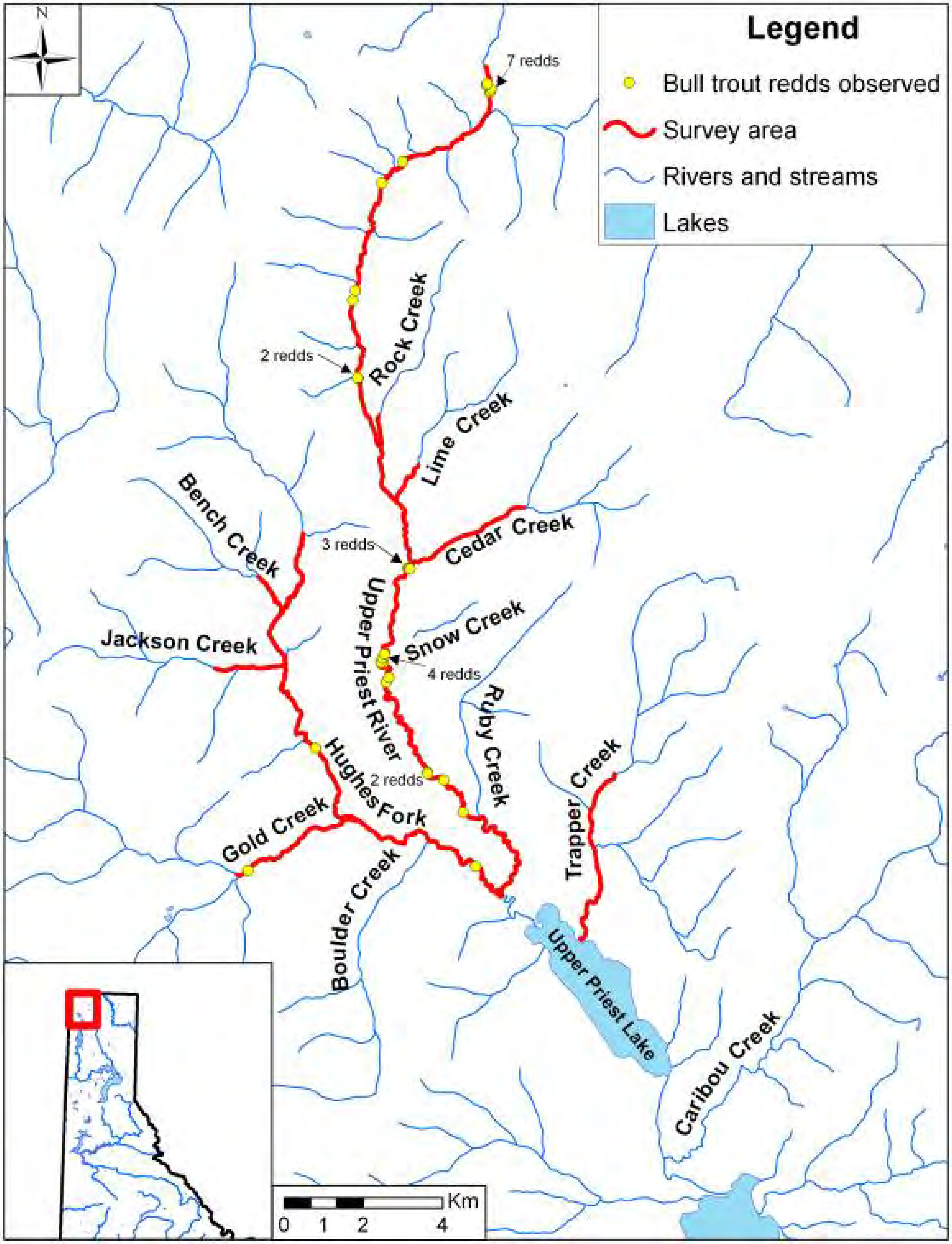


Figure 1. Stream reaches surveyed for bull trout redds in the Upper Priest Lake basin, Idaho, during September 28-29, 2005, and the locations of where redds were observed.

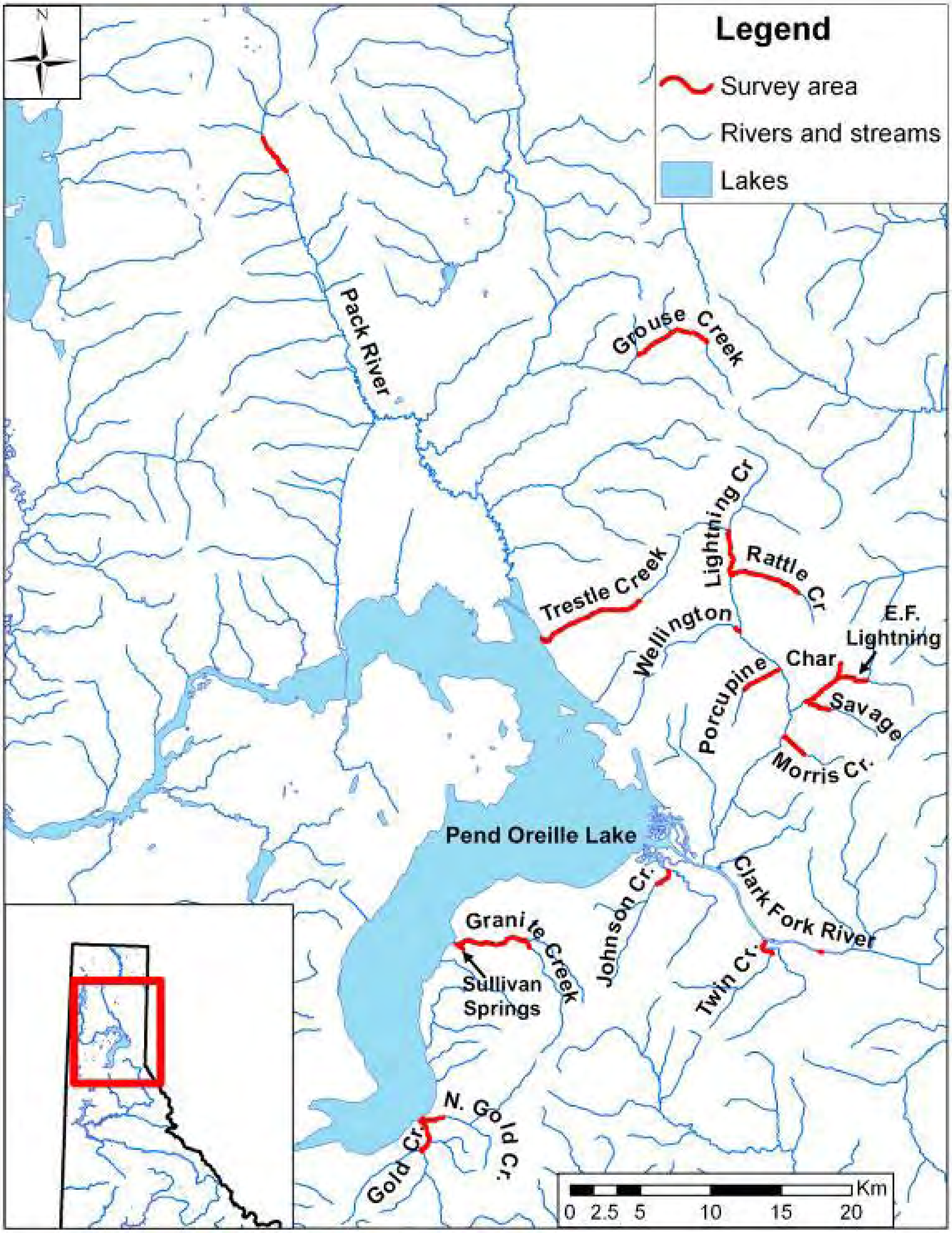


Figure 2. Stream reaches surveyed for bull trout redds in the Pend Oreille Lake basin, Idaho, on October 6-20, 2005.

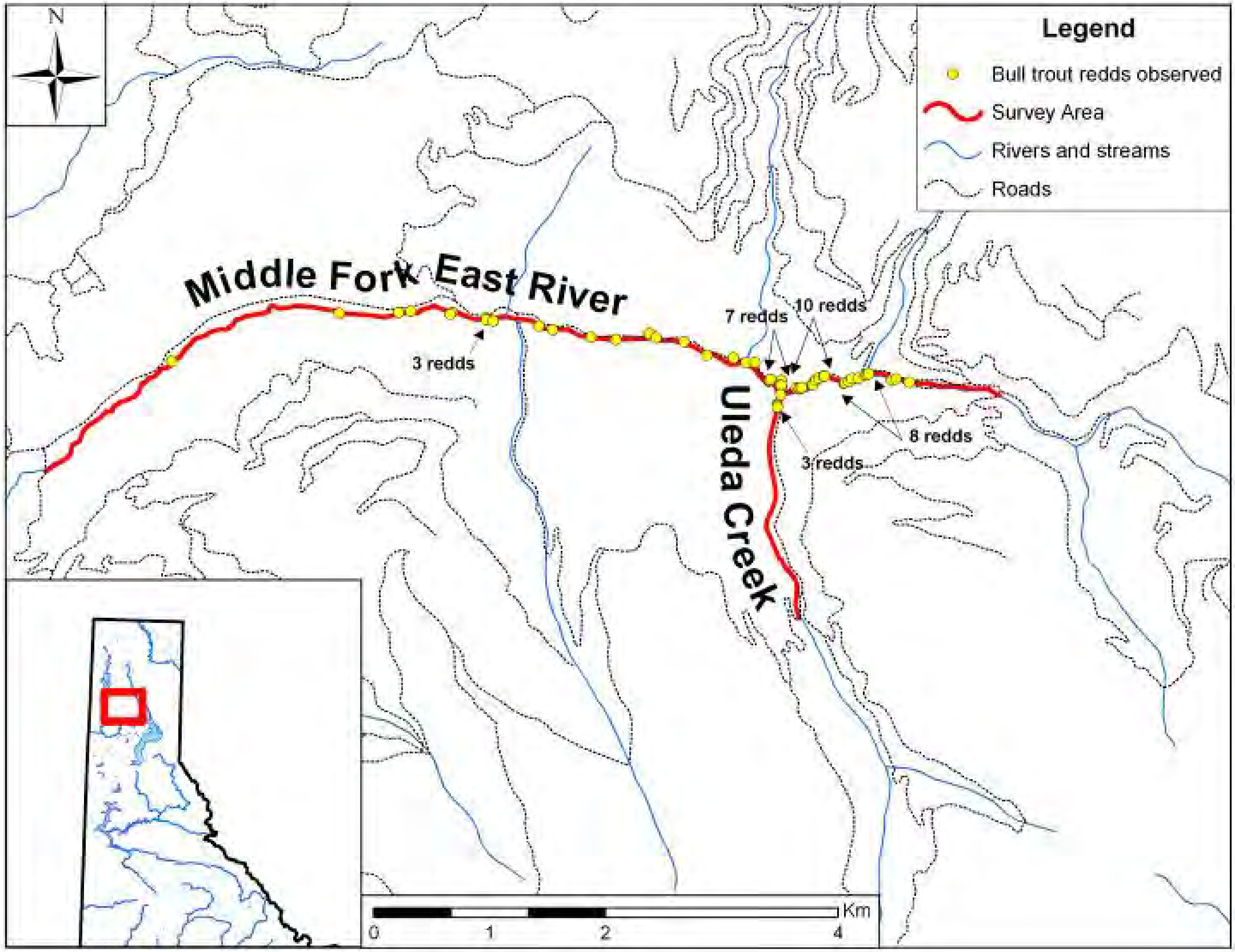


Figure 3. Stream reaches surveyed for bull trout redds in the Middle Fork East River basin, Idaho, on September 27, 2005, and the locations of where redds were observed.

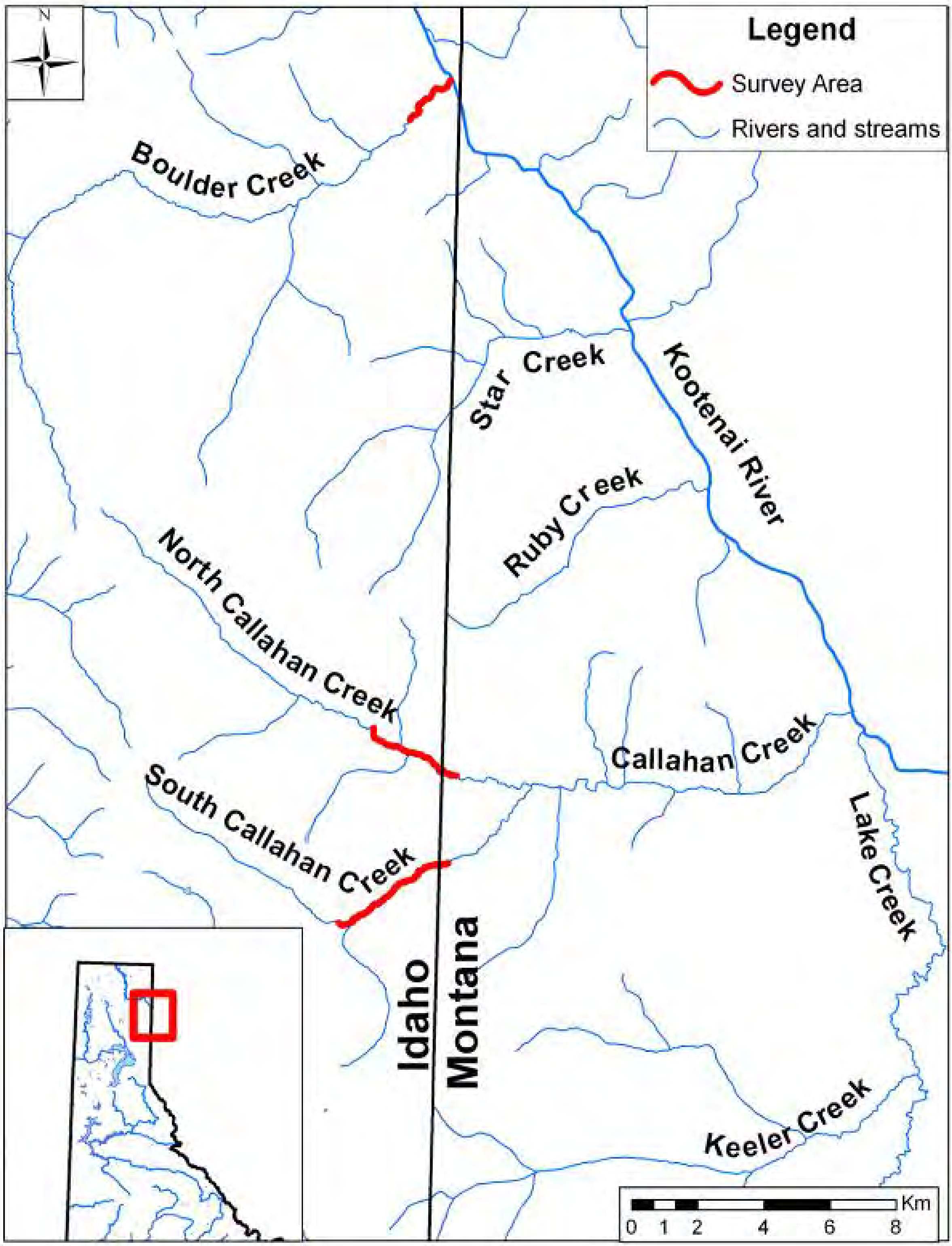


Figure 4. Stream reaches surveyed for bull trout redds in the Kootenai River watershed, Idaho, from October 11-13, 2005.

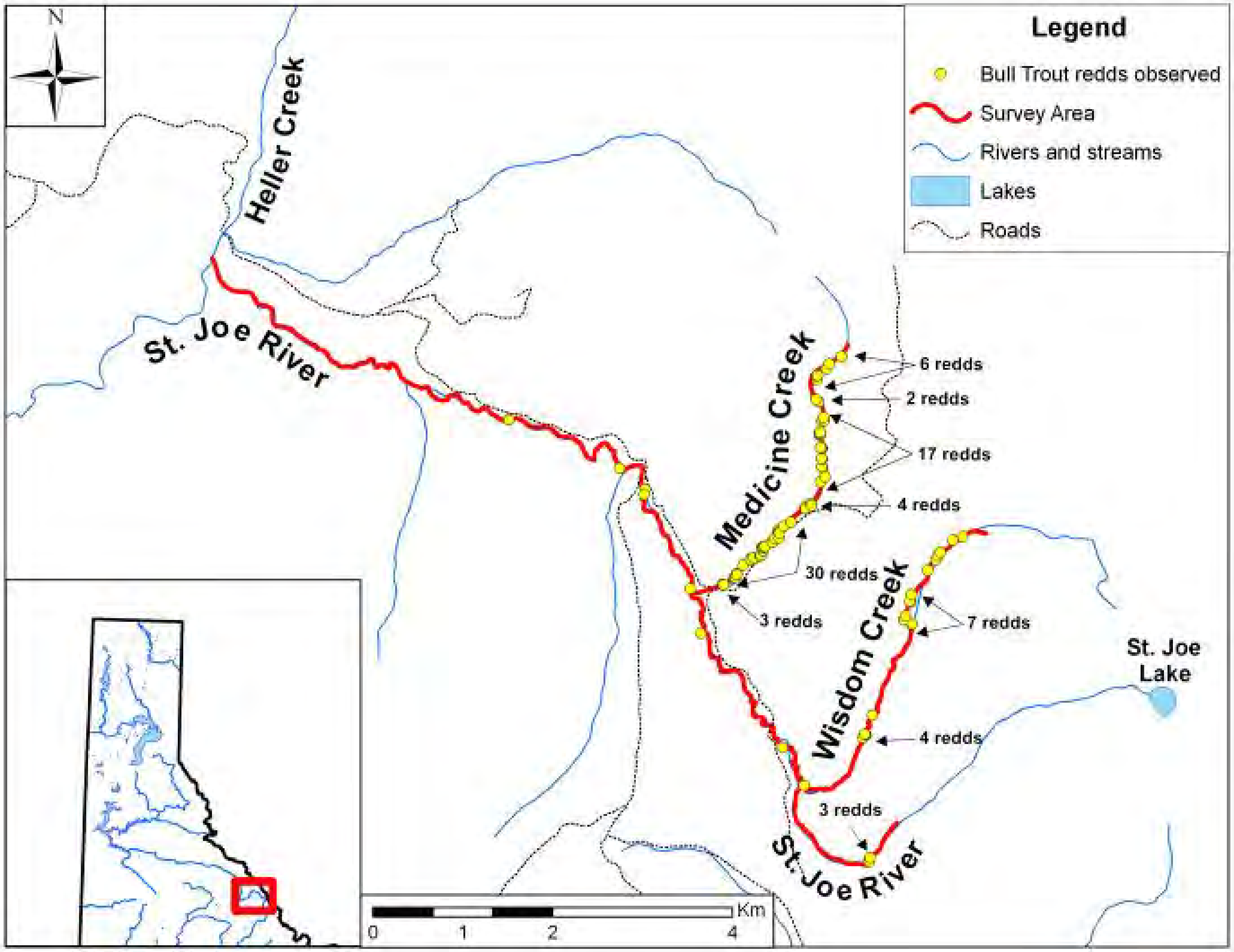


Figure 5. Stream reaches surveyed for bull trout redds in the St. Joe River basin, Idaho, on September 22, 2005, and the locations where redds were observed.

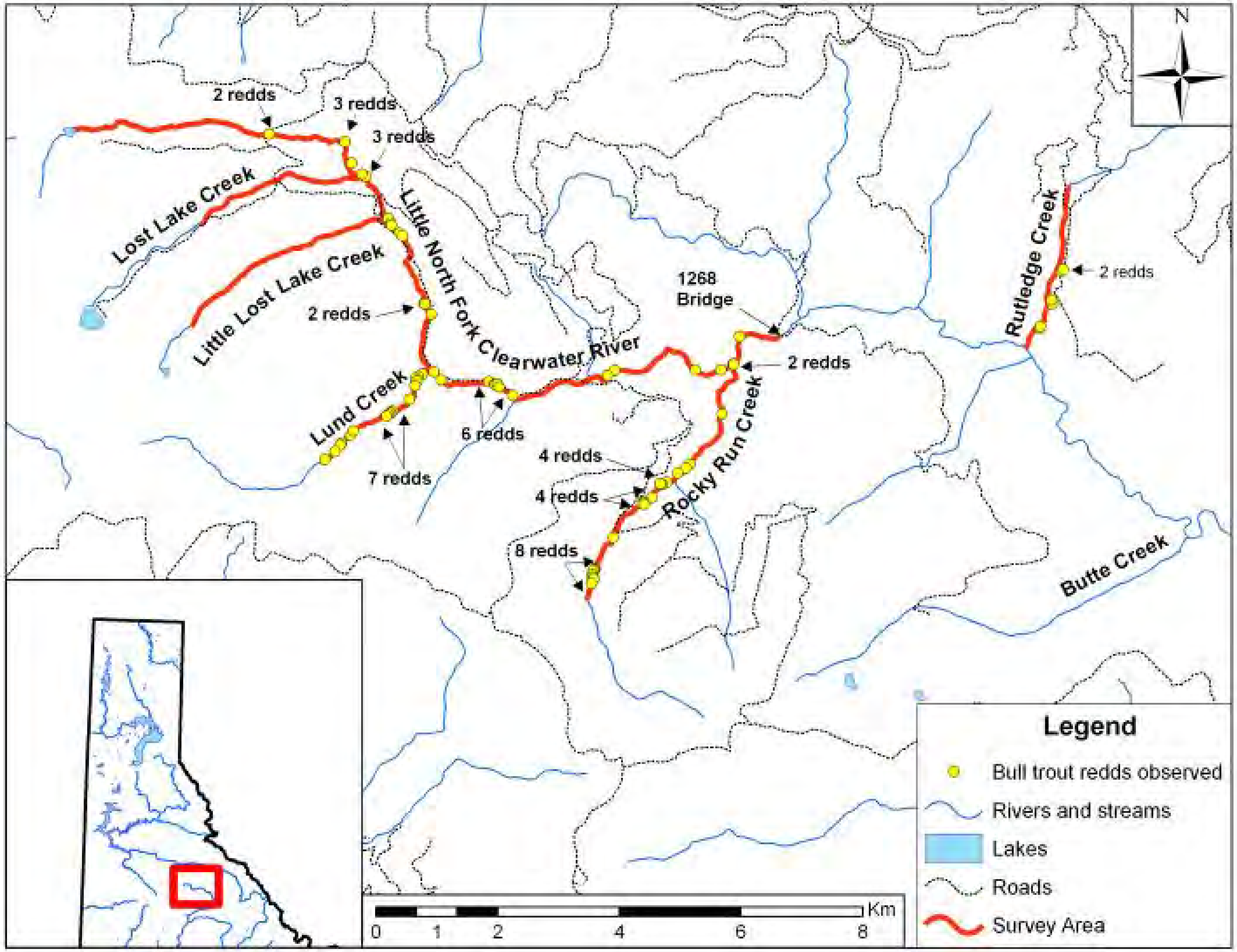


Figure 6. Stream reaches surveyed for bull trout redds in the Little North Fork Clearwater River basin, Idaho, on September 23 2005, and the locations where redds were observed.

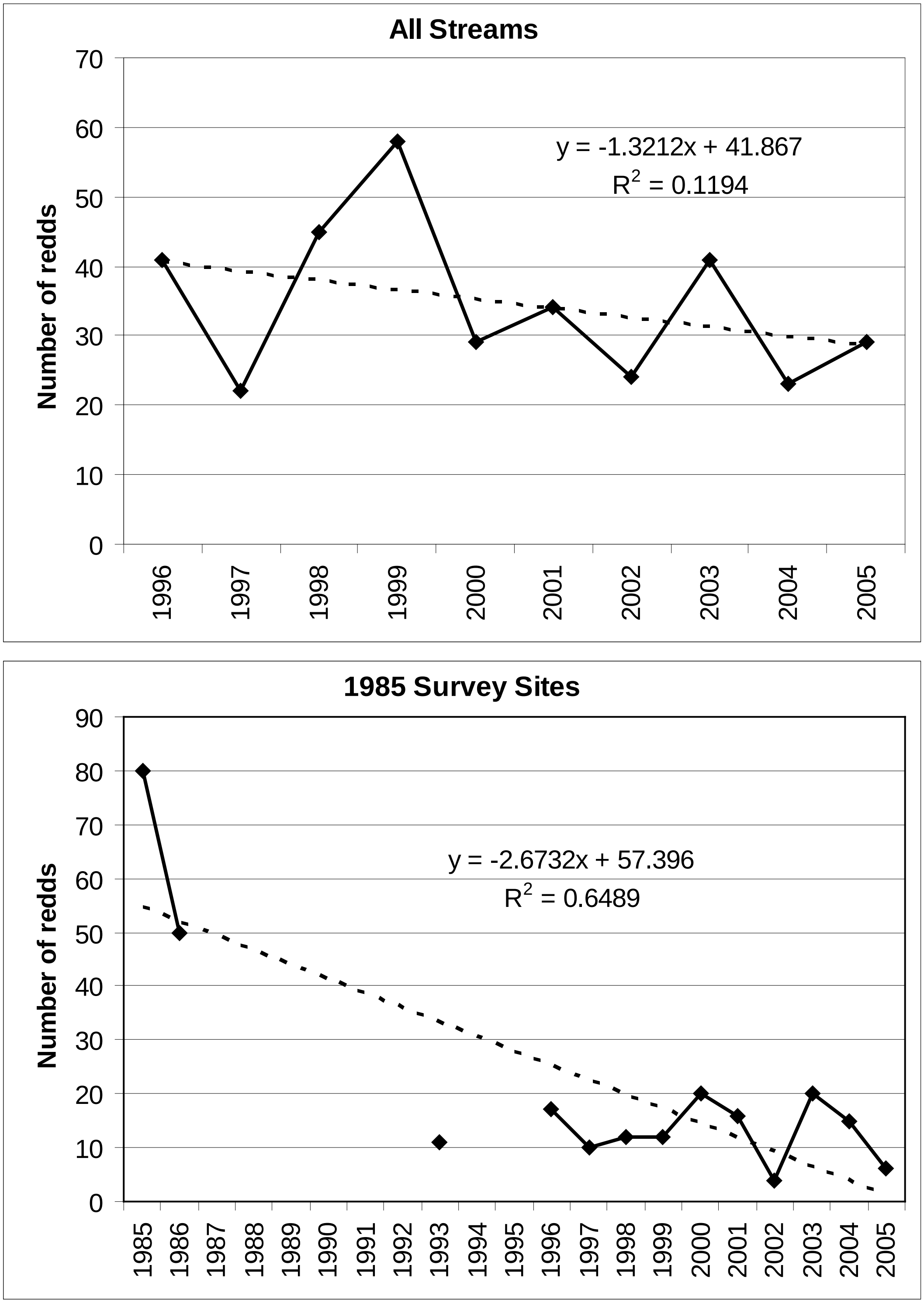
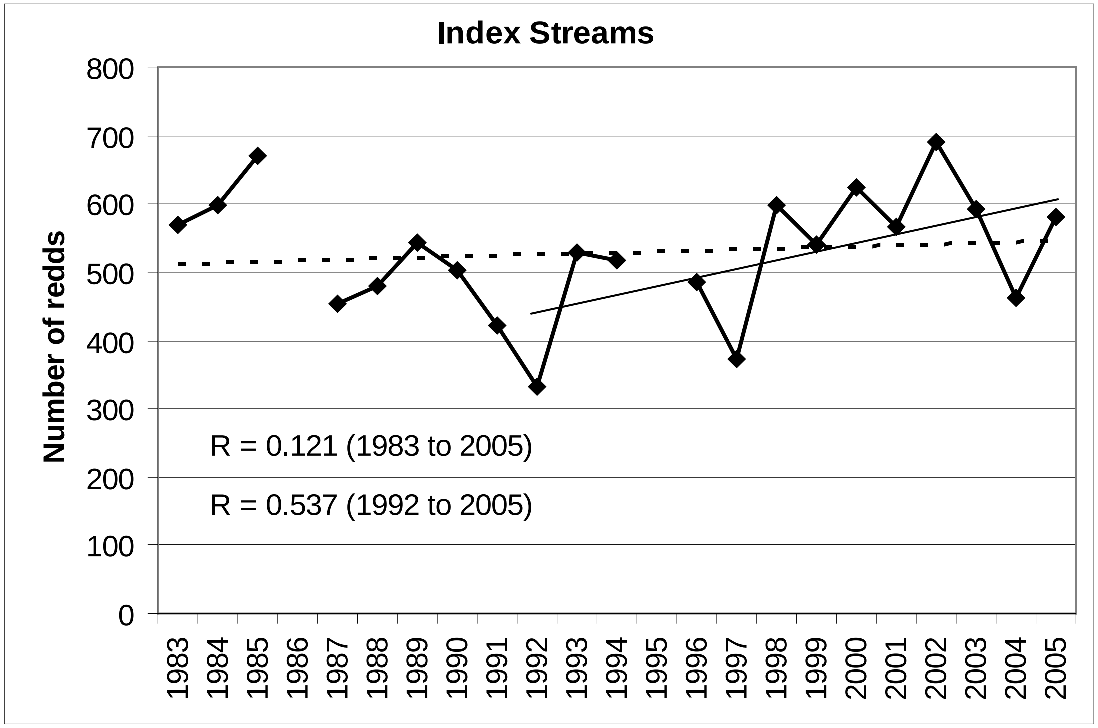


Figure 7. Linear regressions depicting trends in bull trout redd counts (all streams combined and only those sites surveyed during 1985) over time in the Priest Lake Core Area (Upper Priest Lake basin only), Idaho.



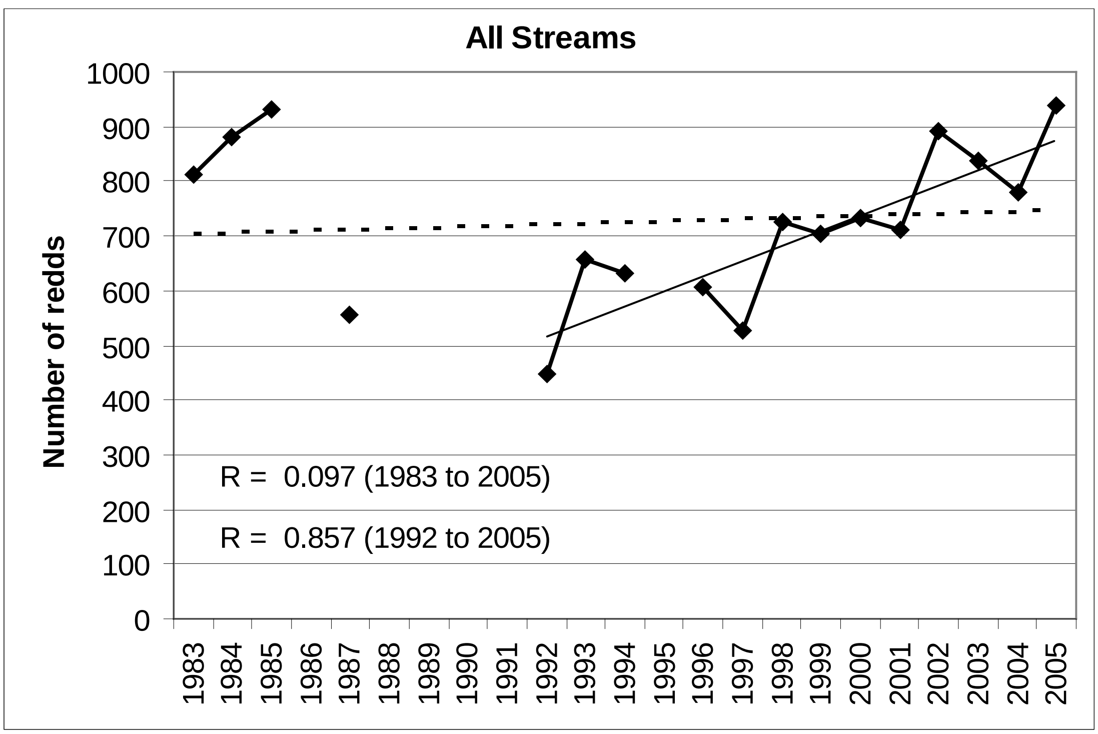


Figure 8. Linear regressions depicting trends in bull trout redd counts (six index streams and all streams combined) over time in the Pend Oreille Lake Core Area, Idaho. Dashed trend lines are for redd counts between 1983 and 2005 whereas solid trend lines are for redd counts between 1992 and 2005.

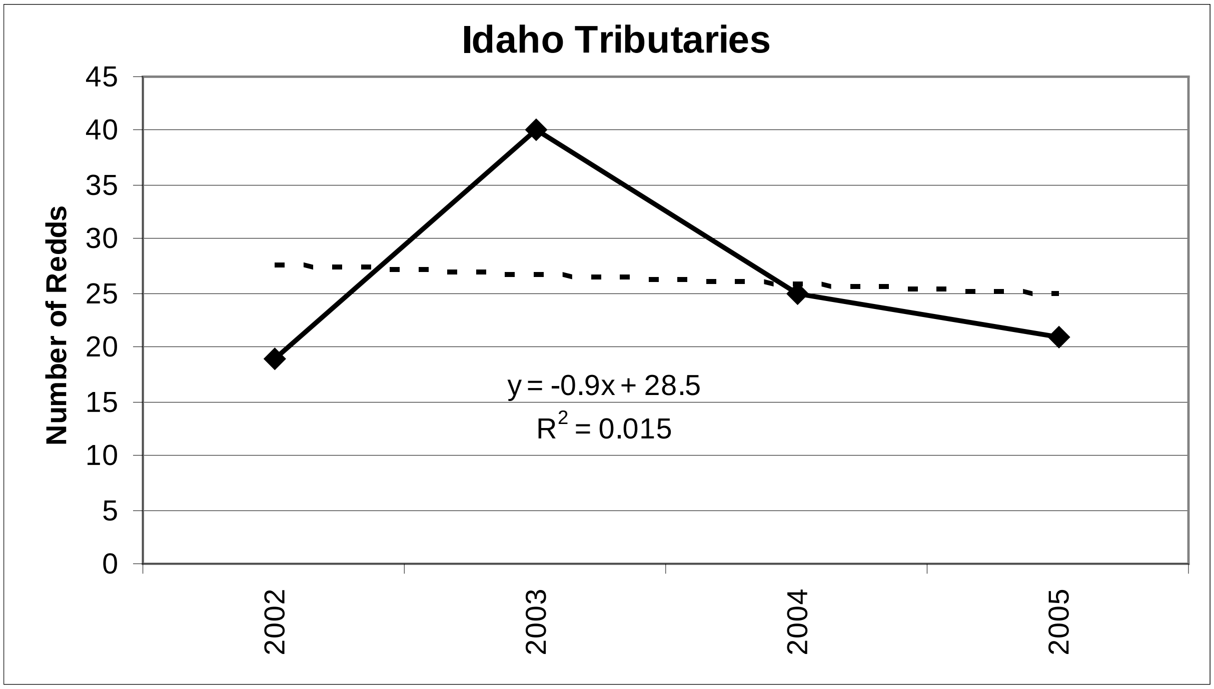
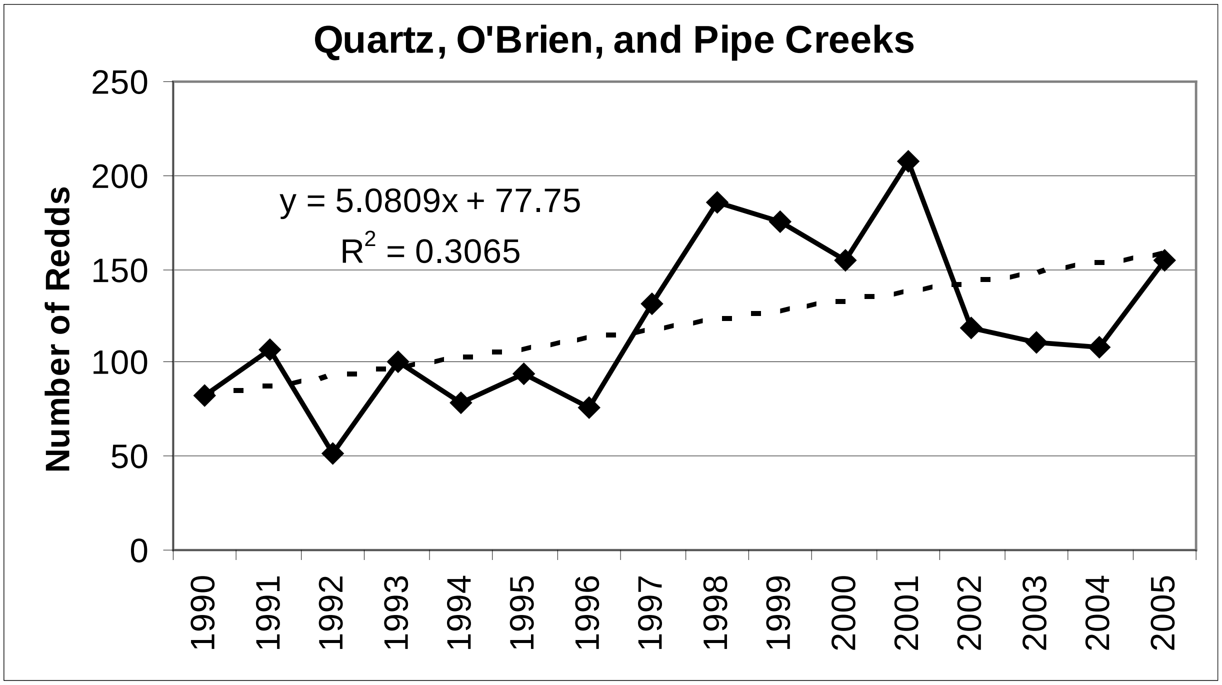


Figure 9. Linear regressions depicting trends in bull trout redd counts in tributaries in the Idaho section of the Kootenai River Core Area.



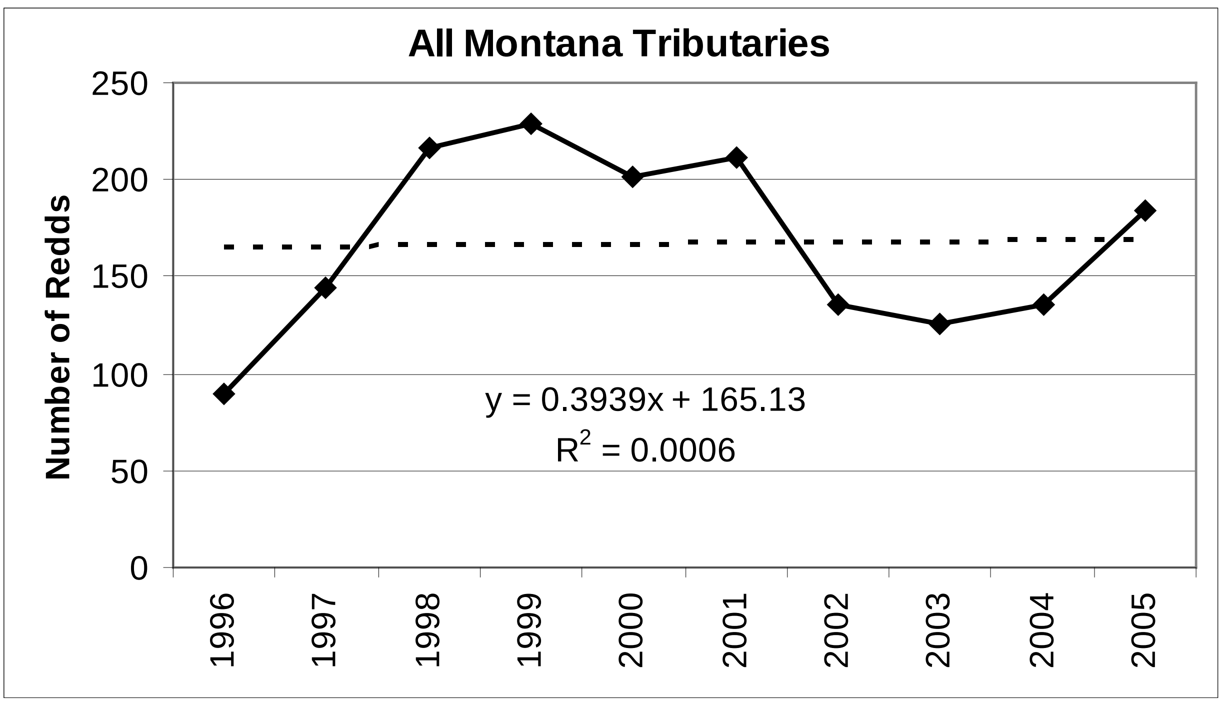


Figure 10. Linear regressions depicting trends in bull trout redd counts in select tributaries (Quartz, O'Brien, and Pipe Creeks) and all tributaries in the Montana section of the Kootenai River Core Area.

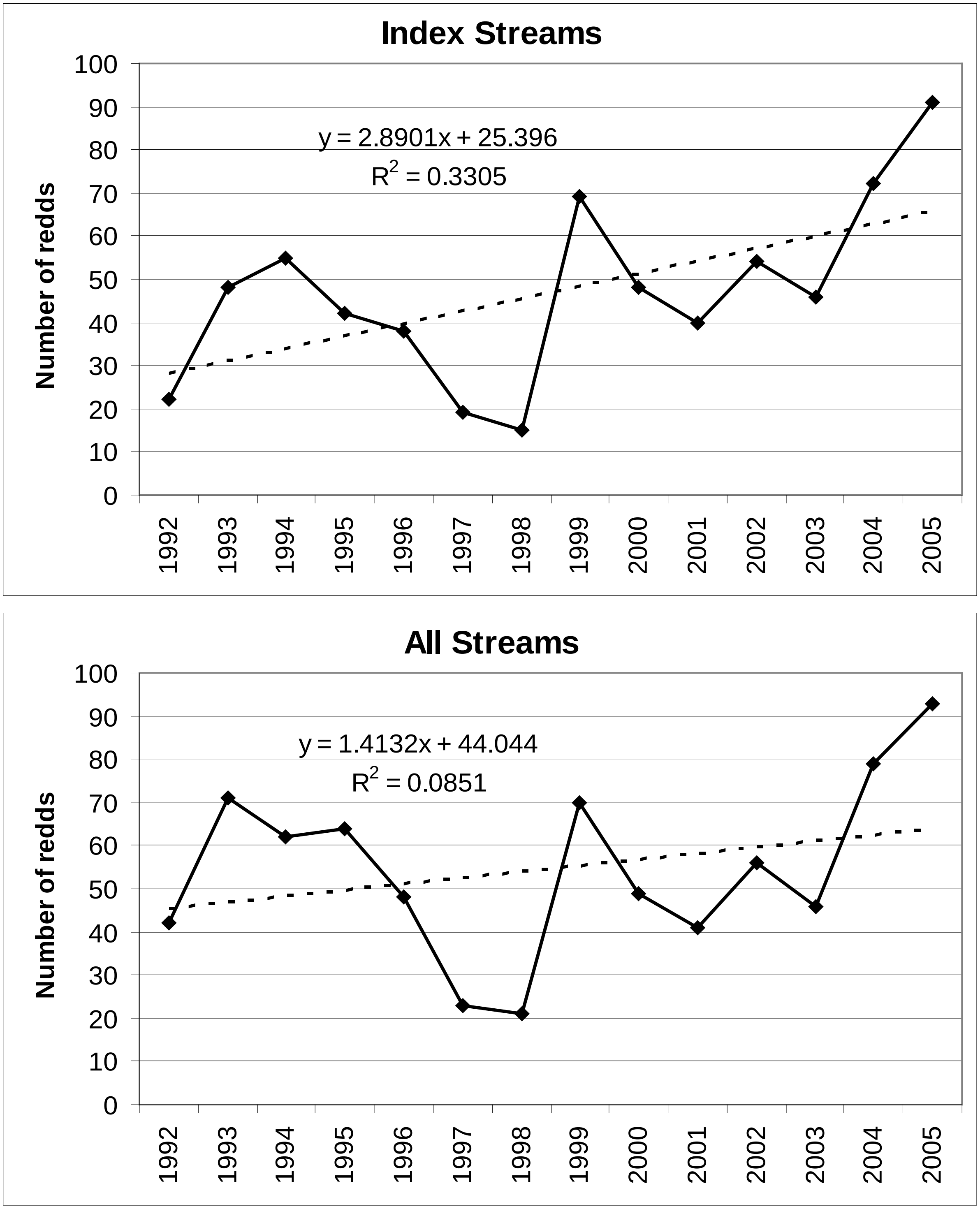


Figure 11. Linear regressions depicting trends in bull trout redd counts (three index streams and all streams combined) over time in the St. Joe River section of the Coeur d'Alene Lake Core Area, Idaho.

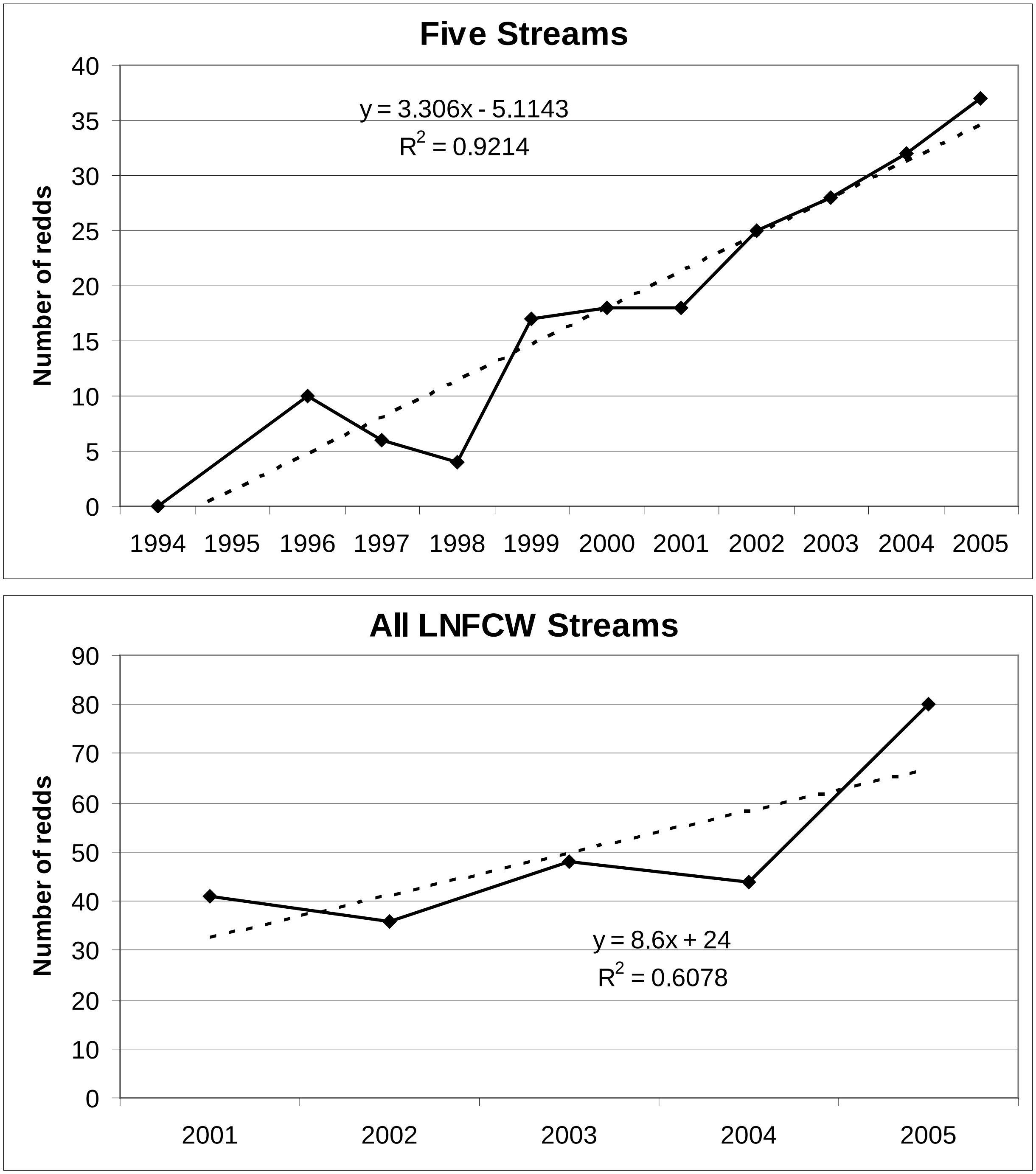
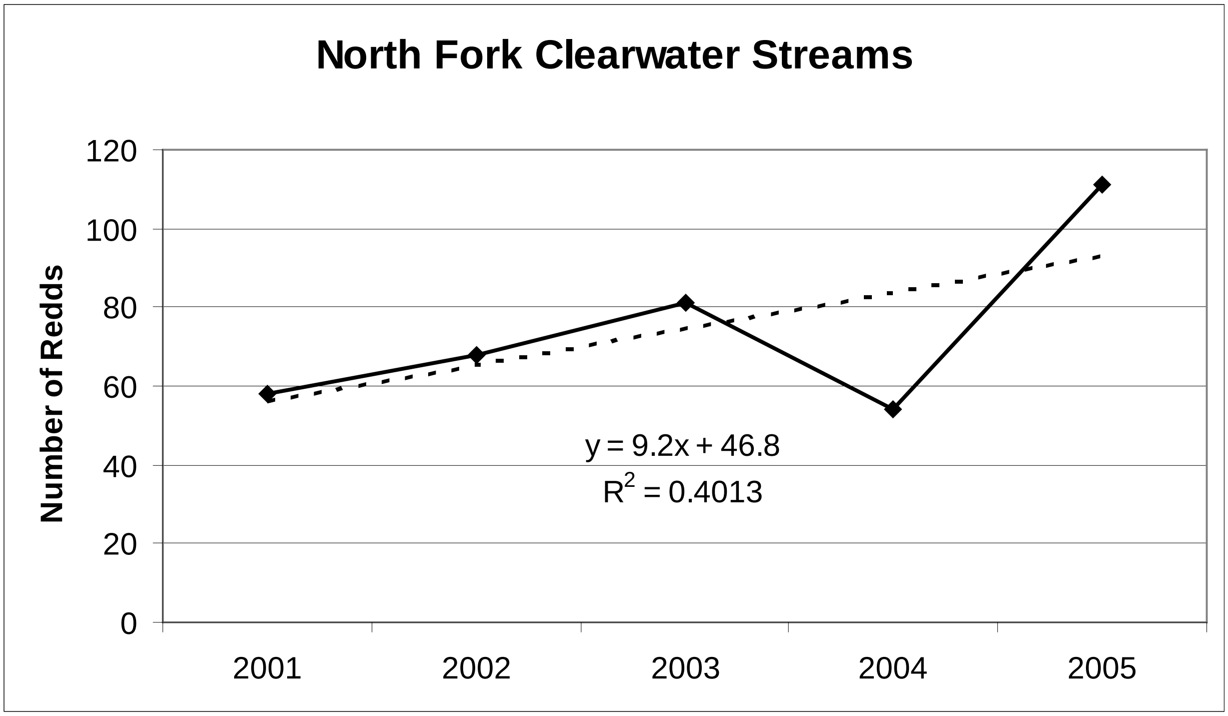


Figure 12. Linear regressions depicting trends in bull trout redd counts (five consistently counted streams and all streams combined) over time in the Little North Fork Clearwater River basin, Idaho.



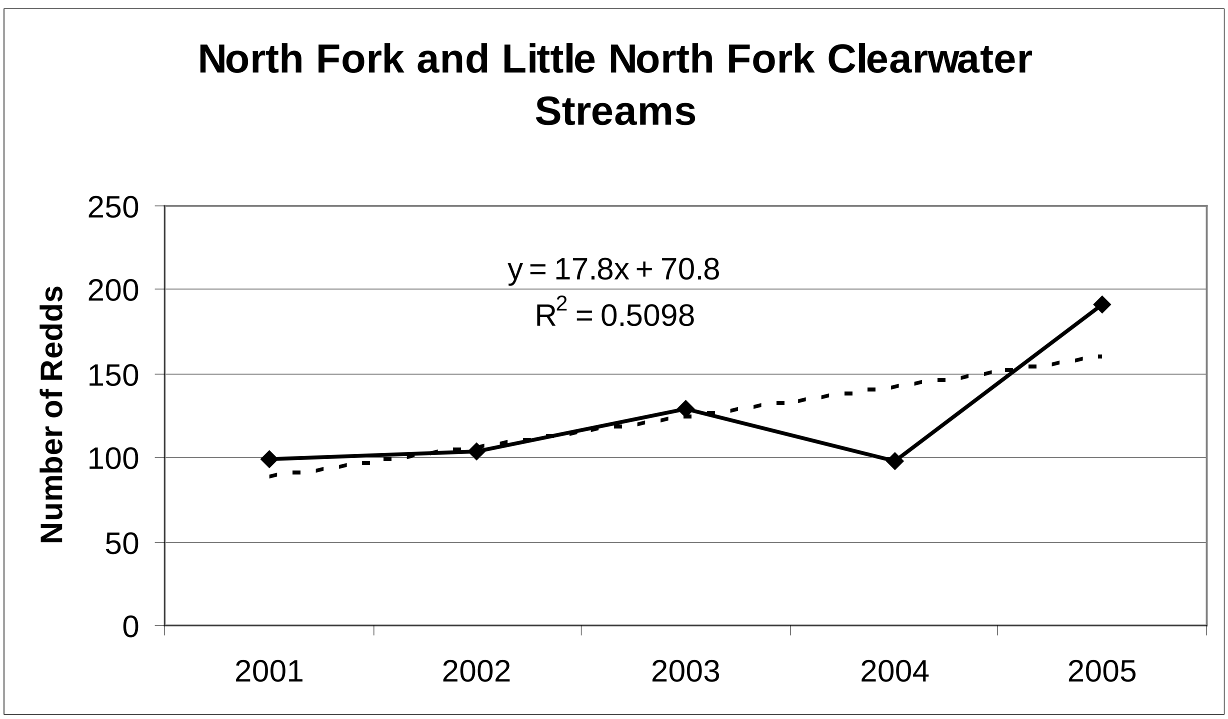


Figure 13. Linear regressions depicting trends in bull trout redd counts from 2001 to 2005 in the North Fork Clearwater River and the Little North Fork Clearwater River, Idaho, combined.

CHAPTER 7: LITTLE NORTH FORK CLEARWATER FISHERY ASSESSMENT

ABSTRACT

We snorkeled 48 transects to evaluate trends in fish abundance in the Little North Fork Clearwater River on August 15-18, 2005. The density of westslope cutthroat trout *Oncorhynchus clarkii* lewisi (1.2 fish/100 m^2), was 33% lower in 2005 than what was observed in 2002. Despite this decline, the density of cutthroat trout ≥300 mm in 2005 was slightly higher than 2002 and represented about 46% of the cutthroat trout we observed. The density of cutthroat trout ≥300 mm (0.53 fish/100 m^2) in the Little North Fork Clearwater River can only be matched by the best years on the St. Joe River. The density of rainbow trout *O. mykiss gairdneri* (0.34 fish/100 m^2) we observed in 2005 was lower than what we observed in either 1997 or 2003. Based on snorkel surveys, rainbow trout rarely exceed 300 mm in length in this system. About 2.2 times as many bull trout *Salvelinus confluentus* were observed during 2005 as 2002. These bull trout were also larger than what was observed in 2002 (85% >375 mm in 2005 versus 55% >375 mm in 2002). The overall mountain whitefish *Prosopium williamsoni* density in 2005 (1.16 fish/100 m^2) was higher than what was observed in 1997 and 2002. Most (86%) of the mountain whitefish observed were ≥300 mm in length.

We marked 129 cutthroat trout, eight rainbow trout, and five rainbow x cutthroat hybrids >250 mm in length in the Little North Fork Clearwater River with Floy T-bar anchor reward tags to evaluate angler exploitation. A total of 23% of these fish were recaptured with 13% being harvested, similar to what was found in past studies in 1997 and 2002.

Authors:

Joe DuPont
Regional Fishery Biologist

Ned Horner
Regional Fishery Manager

INTRODUCTION

The Little North Fork Clearwater River is one of the most remote rivers in the Panhandle Region. This river provides an important fishery for westslope cutthroat trout *Oncorhynchus clarkii lewisi* and habitat for an increasing bull trout *Salvelinus confluentus* population. The Little North Fork Clearwater River is often a destination spot for individuals who want to get away from it all and experience quality trout fishing. Road access to the Little North Fork Clearwater River is limited to the upper portion of the drainage, with over 25 km of the river accessible only by trail and another 25 km of the river without trail access at all. Between 2001 and 2005 the U.S. Forest Service has been upgrading the trail system that provides access to the Little North Fork Clearwater River. These upgrades have improved access to this river, especially motorcycle traffic. Concerns have risen that this improved trail system may increase fishing pressure in the Little North Fork Clearwater River and possibly degrade the quality of this wild cutthroat trout fishery. High fishing pressure has been found to suppress wild cutthroat trout fisheries in the past in Idaho (Rankel 1971; Bowler 1974).

Bull trout within the Klamath and Columbia River Basins are currently listed as threatened under the Endangered Species Act of 1973 (effective July 1998). Fish surveys and redd counts have documented bull trout in much of the Little North Fork Clearwater River basin (Watson and Hillman 1997; Fredericks et al. 2000; U.S. Fish and Wildlife Service 2002; DuPont et al. In Press a and b). Continual monitoring of this bull trout population is important in evaluating trends in their population strength as well as the efficacy of restoration activities.

This study focused on evaluating the population strength of salmonids in the Little North Fork Clearwater River and evaluating long term population trends in abundance. This study also attempted to evaluate exploitation of cutthroat trout and rainbow trout *O. mykiss gairdneri* to determine if changes in the fishing regulations were warranted for any reach of this river.

STUDY SITES

The Little North Fork Clearwater River is located in the southern portion of the Panhandle Region (Figure 1). The study area covers about 34 km of river, extending 1 km downstream from Foehl Creek upstream to Lund Creek. The size of the watershed is about 53,000 hectares in size at the downstream end of study area. Elevations ranged from 740 m at transect 1 to 1,306 m at the mouth of Lund Creek. We divided the study area into a roaded and unroaded reach. The roaded reach extended from Rutledge Creek upstream to Lund Creek (about 12 km in length) and access was considered relatively easy. No where in the roaded reach did one have to hike more than 2.8 km and gain/lose more than 60 m in elevation to reach the river from a road. The unroaded reach extends from Rutledge Creek downstream to 1 km below Foehl Creek (about 23 km in length) and can be accessed by trail only. Travel to the unroaded reach ranged from 2.8 km of trail and a 60 m elevation drop to reach Rutledge Creek to 5 km of trail and a 540 m drop in elevation to reach Foehl Creek.

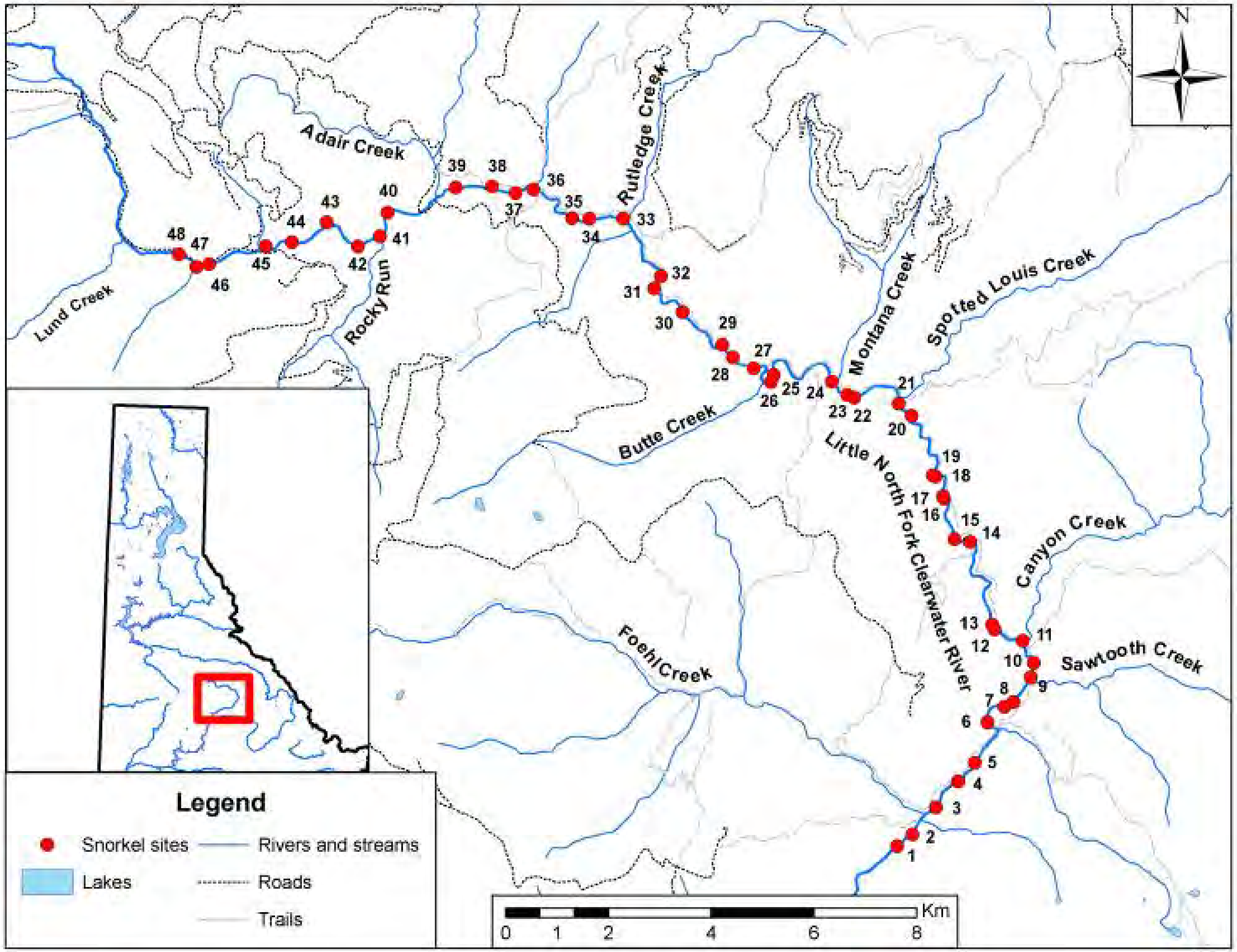


Figure 1. Location of transects snorkeled in the Little North Fork Clearwater River, Idaho, on August 15-18, 2005.

The Little North Fork Clearwater River flows though a confined steep “V” shaped valley. The river displays a dendritic drainage patterns that erodes and branches headward in somewhat random fashion, resulting in slopes with no predominate direction or orientation. Drainage densities and stream frequencies are fairly high, increasing towards the headwaters. The higher the drainage density, the closer the stream channels. This can result in a flashy system as the headwater areas will tend to concentrate water faster due to shorter runoff distances, allowing less time and opportunity for evaporation and channel storage. The gradient along the river typically ranges from 2-4%

Precipitation ranges from 140-165 cm annually, much occurring as snowfall accumulating through the winter months. The area receives significant spring and fall rains, with the summers being relatively dry. However, high intensity, short duration summer rain events are common in the mountainous area. Elevations <1,300 m are prone to winter rain on snow events that can result in intense runoff coupled with mass failures of side slopes. The average annual temperature ranges from 5.5-7.2°C below 1,500 m. Higher elevations can be much cooler.

The majority of the study area is managed by the U.S. Forest Service. Other land managers in the basin are located in the upper third of this watershed and include the Bureau of Land Management, the Idaho Department of Fish and Game, and Forest Capital Partners. Minimal land management occurs on the surrounding grounds except for that owned by Forest Capital Partners. Road access to the Little North Fork Clearwater River is limited to the upper portion of the Little North Fork Clearwater River, with access to over 50 km of the river being by trail or no trail at all.

Historically, the Little North Fork Clearwater, in our study area, supported cutthroat trout, bull trout, mountain whitefish *Prosopium williamsoni*, steelhead, Chinook salmon *O. tshawytscha,* mottled sculpin *Cottus bairdi*, piute sculpin *C. beldingi*, shorthead sculpin *C. confusus* and torrent sculpin *C. rhotheus*. In the downstream reaches of the Little North Fork Clearwater River (outside of our study area) northern pikeminnow *Ptychocheilus oregonensis*, longnose dace *Rhinichthys cataractae*, speckled dace *R. osculus* and largescale sucker *Catostomus macrocheilus* also occurred. Dworshak Dam was constructed on the North Fork Clearwater River in 1973 and has created Dworshak Reservoir which occurs about 22 km downstream of Foehl Creek. Dworshak Dam has inundated about 8 km of the Little North Fork Clearwater River as well as 78 km of the North Fork Clearwater River. No upstream fish passage occurs over Dworshak Dam. As a result, Chinook salmon and steelhead no longer occur in the Little North Fork Clearwater River, although rainbow trout which are believed to be residualized steelhead still occur there. All other native species that historically occurred in the Little North Fork Clearwater are believed to still occur there.

Fish stocking into tributaries and lakes that drain into the Little North Fork Clearwater has been documented as early as the 1930s, and likely occurred earlier. These introductions included cutthroat trout, rainbow trout and brook trout *S. fontinalis* (USFS 1935; Maclay 1940). Stocking of fingerling cutthroat trout directly into the Little North Fork Clearwater River occurred in the 1940s (Maclay 1940), although since 1967 no stocking of any fish has occurred in the river itself. Many species of fish have been stocked into Dworshak Reservoir including rainbow trout, cutthroat trout, bull trout, steelhead, kokanee *O. nerka* and smallmouth bass *Micropterus dolomieui*. Kokanee have been documented to migrate into and spawn in the Little North Fork Clearwater River, and brook trout occur in a couple of the tributaries that flow into Little North Fork Clearwater River in our study area, but none have been documented in the river itself.

OBJECTIVES

1. Estimate salmonid density and trends in abundance in snorkeling transects in the Little North Fork Clearwater River.

2. Evaluate angler exploitation of cutthroat trout and rainbow trout in the Little North Fork Clearwater River.

METHODS

Snorkeling Surveys

We used snorkeling surveys to evaluate trends in fish abundance in the Little North Fork Clearwater River. Thirty-five snorkeling transects were initially established in the Little North Fork Clearwater River in 1997 by systematically selecting transects at approximately 800 m intervals (Fredericks et al. 2000) These transects encompassed an entire pool or run habitat type or a 50 m stretch of riffle/pocket water. During 2002, an additional 13 transects were added to better evaluate the bull trout population and the fishery in the more roaded section of the Little North Fork Clearwater River (upstream of Adair Creek) (DuPont et al, In Press a). These 13 transects were selected based on what was considered good habitat for bull trout and cutthroat trout. The total number of transects that were snorkeled during 2005 was 48 (Figure 1).

In an effort to accurately locate and duplicate snorkeling surveys, transect locations were recorded as waypoints using a Global Positioning System. In addition, photographs of each site were taken with permanent landmarks in the photo including starting and ending points of each transect. Prior to conducting the snorkeling surveys, the most up-to-date coordinates were downloaded into a GPS unit and used to navigate to the site (Appendix A). Once near the transect the most recent photos were used to locate the exact starting and stopping points to snorkel (Appendix B).

The snorkel technique used at each transect was based on sightability, transect width, and depth. Our intent was to be reasonably certain that all fish in the transect were visible to the diver and few or no fish were overlooked. Only one snorkeler was used during these surveys as the water was always clear enough to see across the entire river. Transects were snorkeled in a downstream direction except in pocket water and in transects less than 10 m wide. In areas where pocket water was the dominant habitat or shallow turbulent water limited visibility, transects were snorkeled upstream. In these habitats, the snorkeler often moves too fast through the reach to make accurate counts. In addition, when the stream channel was <10 m in width, the transect was snorkeled upstream. Often when snorkeling narrow channels fish will spook downstream leading to low counts. Where woody debris or boulders were common, the snorkeler would often have to swim around them to ensure all fish were counted. Prior to snorkeling, each observer practiced guessing the lengths of plastic pipes underwater to ensure accurate estimates of fishes' lengths were made. Throughout the snorkel surveys we conducted these practice sessions to maintain our accuracy. We periodically duplicated counts using different divers to check for accuracy and precision. If noticeable differences occurred in fish counts or length estimates between snorkelers, discussions as to why this happened were made and then the transect was re-snorkeled.

When snorkeling in fairly calm water, we found it is best to remain fairly motionless and near the surface. Too much motion can spook fish downstream, even out of the survey area. Snorkeling near the stream edge or away from where most of the fish are holding can also significantly reduce spooking fish downstream. We also snorkeled to the very end of the transect, which typically was the tail-out of a pool or run. We have often observed large numbers of fish moving downstream in-front of snorkelers until they reach the end of the transect (tail-out). At this point, fish will often swim back upstream past the snorkelers to access deeper water. If the snorkeler did not swim to the end of the reach, these fish would remain at the end of the transect and go uncounted. For this reason, no transect ended in the middle of a pool, run, or glide.

Estimates of salmonid abundance were limited to age 1+ fish, as summer counts for young-of-the-year (YOY) cutthroat and rainbow trout are typically unreliable. Most YOY cutthroat trout would be smaller than 80 mm during surveys in August and occupy the shallow stream margins where snorkeling is less effective (Thurow 1994). Fish observations were recorded for each transect by species in 75 mm length groups. Sculpin and other fauna were only counted (length estimates were not made).

After completing fish counts, we measured length and wetted width (at least 4 randomly located measurements) at each transect with a rangefinder to determine the surface area (m^2) surveyed. In addition, at each transect we recorded the habitat type (pool, riffle, run, glide, pocket water), maximum depth, dominant cover type and amount of cover (estimated % of surface area) that occurred in the area snorkeled (Appendix A). These types of measurements can be used to help determine if changes in habitat may be responsible for any future changes in fish density.

Periodically, channel shifting, bedload movement, and/or blow outs will alter a site so that it does not represent the original transect (changed from a pool to a riffle) or it does not occur anymore (dry channel). Many of the transects were selected because they represented good habitat for particular fish species (cutthroat trout and/or bull trout). When a transect changes drastically from what it once was, continuing to conduct counts at this site may lead to low density estimates, which could lead to erroneous conclusions about causes of changes in fish density. Consequently, when a transect changes substantially so that it does not represent its original characteristics, a new transect should be selected. Old photographs and habitat descriptions should be evaluated before a decision to move the transect is made. New transects should be selected based on the following conditions, which are listed in their order of importance: 1) proximity to original transect, 2) similarity to original site, 3) access (avoid posted private property), and 4) permanence for future study (avoid areas where the channel appears to be shifting constantly).

Data Analysis

Fish counts for each transect were converted to density (fish/100 m^2) to standardize the data and make it possible to compare counts within the watershed as well as to other watersheds. Average densities of each salmonid species (all sizes greater than YOY) and for cutthroat trout ≥300 mm were calculated for the entire Little North Fork Clearwater River as well as for designated stream reaches including areas considered to be roadless (downstream of Rutledge Creek – trail access only) or roaded (upstream of Rutledge Creek – road crosses within 3 km). These averages were calculated by summing the total number of fish counted in a particular reach of stream and dividing it by the total area snorkeled. It is important to note that this is not the same as calculating an average from the density recorded at each snorkel transect within a particular reach of stream.. The densities of these fishes were added to the long-term data set to evaluate their trends in abundance.

We compared the densities (by transect) of cutthroat trout, rainbow trout, mountain whitefish *Prosopium williamsoni* and bull trout using a t-test (assumed equal variances) to determine if densities differed between the roaded and unroaded stream reaches. We used a p-value ≤0.10 to denote when a significant difference in density occurred between these two reaches. This value is often used to show significance when evaluating fish and wildlife populations for management purposes (Peterman 1990; Johnson 1999; Anderson et al. 2000). To determine if densities of fishes differed between 2005 and 2002 (previous survey date) we conducted a paired t-test. We used a p-value ≤0.10 to denote when a significant difference in density occurred between the two years.

Angler Exploitation

We tagged cutthroat trout and rainbow trout in the Little North Fork Clearwater River with Floy T-bar anchor reward tags to evaluate angler exploitation. Each reward tag had “Call IDF&G 208-769-1414 on one side and “$10 Reward” with a unique code on the other side. The cutthroat trout and rainbow trout were captured by rod and reel (fly fishing) and tags were placed in all fish ≥250 mm. Tagging occurred from July 6-15, 2005 and attempts were made to capture fish from Lund Creek downstream to 1 km below Foehl Creek. To determine angler exploitation, the number of fish harvested by anglers (determined by tags returns) was divided by the number of fish we tagged. We assumed a 55% reporting rate, which is typical of $10 reward tags (Nichols et al. 1991), and adjusted the return rate accordingly to provide an exploitation estimate. Tag loss was assumed to be 11% based on work conducted on rainbow trout by Mourning et al (1994). When comparing exploitation rates from this study to past years, we applied the same reporting and tag loss rates to the past studies. We used a chi-square goodness-of-fit test (Ott 1988) to evaluate whether fish were harvested from stream reaches (roaded or unroaded) in proportion to where they were tagged. A significant relationship (p-value <0.10) would indicate that more fish were being harvested from one reach than another.

While capturing fish to put reward tags in, we kept track of the size and species of all the fish that were caught. A chi-square goodness-of-fit test was used to determine whether the sizes of fish (cutthroat trout and rainbow trout) captured were similar to what was observed while snorkeling. A significant relationship (p-value <0.10) would indicate that the sizes of fish caught through fishing were not the same size as what was observed while snorkeling. Separate analyses were conducted for the entire river as well as for the roaded and unroaded reaches.

RESULTS

Snorkel Surveys

We snorkeled 48 transects in the Little North Fork Clearwater River during August 15-18, 2005 (Figure 1). A total of 346 cutthroat trout, 102 rainbow trout, 347 mountain whitefish, and 71 bull trout were counted during this survey (Table 1). Cutthroat trout were observed in every transect we snorkeled except four. The average density of cutthroat trout observed in 2005 was 1.16 fish/100 m^2. Mean densities of cutthroat trout were not significantly different (t-test; p = 0.33) between the unroaded downstream reach (1.12 fish/100 m^2), which must be accessed by trail and the roaded upstream reach where the most road access occurs (1.31 fish/100 m^2)

(Table 2). For the entire stream, 46% of the cutthroat trout observed were ≥300 mm in length. Mean density of cutthroat ≥300 mm between unroaded (0.61 fish/100m^2) and roaded (0.22 fish/100m^2) reaches was significantly different (t-test; p = 0.001) (Table 2). The average density of cutthroat trout observed in 2005 (1.16 fish/100 m^2) was 33% lower than what was observed in 2002 (1.75 fish/100 m^2), although this difference was not significantly different (paired t-test; p = 0.31). Densities of cutthroat trout ≥300 mm were similar between 2002 and 2005 (0.46 fish/100 m^2 versus 0.53 fish/100 m^2) (Table 2).

Rainbow trout were observed in 28 of 48 transects we snorkeled, and mean density was significantly different between the unroaded (0.21 fish/100 m^2) and roaded (0.88 fish/100 m^2) reaches (t-test; p = 0.026) (Tables 1 and 3). Only two rainbow trout were observed that were ≥300 mm in length. The overall density of rainbow trout between 2002 and 2005 was significantly different (paired t-test; p <0.001) with greater densities observed in 2002 than 2005 (Table 3).

Mountain whitefish were observed in 26 of the 48 transects we snorkeled, and mean density was significantly different between the unroaded (1.37 fish/100 m^2) and roaded (0.21 fish/100 m^2) reaches (t-test; p = 0.01). About 84% of the whitefish observed were ≥300 mm in length. Bull trout were observed in 19 of the 48 transects we snorkeled, and densities were significantly different between the unroaded (0.10 fish/100 m^2) and roaded (0.78 fish/100 m^2) reaches (t-test; p = 0.09) (Tables 1 and 3). About 86% of the bull trout were >375 mm in length and 45% were >450 mm. The overall density of mountain whitefish and bull trout were higher in 2005 than 2002 (1.2 and 1.9 times respectively), although differences were not significant (paired t-test; p = 0.16 and 0.23 respectively).

Table 1. Number and density (fish/100 m^2) of fishes observed while snorkeling transects in the Little North Fork Clearwater River, Idaho, during August 15-18, 2005.

Reach	Transect Number	Area (m^2)	Cutthroat trout: Number counted ≥300mm	Cutthroat trout: Number counted All sizes	Cutthroat trout: Density (No./100 m^2)	Mountain whitefish: Number counted	Mountain whitefish: Density (No./100 m^2)	Rainbow trout: Number counted	Rainbow trout: Density (No./100 m^2)	Bull trout: Number counted	Bull trout: Density (No./100 m^2)
Downstream of Canyon Creek	1	1,913	7	11	0.6	24	1.3	0	0.0	0	0.0
	2	1,292	8	15	1.2	20	1.5	0	0.0	0	0.0
	3	1,152	3	21	1.8	24	2.1	0	0.0	0	0.0
	4	1,541	4	4	0.3	4	0.3	0	0.0	0	0.0
	5	616	3	14	2.3	5	0.8	2	0.3	0	0.0
	6	1,482	4	5	0.3	0	0.0	0	0.0	0	0.0
	7	1,018	16	33	3.2	70	6.9	0	0.0	2	0.2
	8	150	2	5	3.3	11	7.3	2	1.3	0	0.0
	9	340	0	0	0.0	0	0.0	0	0.0	0	0.0
	10	1,007	5	8	0.8	15	1.5	0	0.0	2	0.2
Canyon Creek to Spotted Louis Creek	11	561	4	7	1.2	15	2.7	0	0.0	1	0.2
	12	912	5	7	0.8	4	0.4	0	0.0	0	0.0
	13	632	3	4	0.6	15	2.4	0	0.0	0	0.0
	14	626	12	15	2.4	10	1.6	0	0.0	1	0.2
	15	1,074	8	9	0.8	1	0.1	1	0.1	0	0.0
	16	469	10	17	3.6	25	5.3	0	0.0	2	0.4
	17	691	0	7	1.0	0	0.0	2	0.3	0	0.0
	18	623	0	4	0.6	0	0.0	2	0.3	0	0.0
	19	629	13	15	2.4	1	0.2	0	0.0	0	0.0
	20	615	4	7	1.1	0	0.0	2	0.3	1	0.2
	21	707	3	4	0.6	25	3.5	2	0.3	1	0.1
Spotted Louis Creek to Rutledge Creek	22	668	0	0	0.0	0	0.0	2	0.3	0	0.0
	23	998	6	11	1.1	12	1.2	3	0.3	1	0.1
	24	546	3	11	2.0	0	0.0	2	0.4	0	0.0
	25	372	4	8	2.2	11	3.0	3	0.8	2	0.5
	26	307	5	8	2.6	3	1.0	2	0.7	2	0.7
	27	625	2	3	0.5	0	0.0	3	0.5	0	0.0
	28	456	2	3	0.7	0	0.0	4	0.9	0	0.0
	29	700	4	5	0.7	8	1.1	4	0.6	1	0.1
	30	389	0	0	0.0	0	0.0	1	0.3	0	0.0
	31	345	5	5	1.5	25	7.3	5	1.5	8	2.3
	32	431	1	1	0.2	0	0.0	7	1.6	0	0.0

Table 1 (continued). Number and density (fish/100 m^2) of fishes observed while snorkeling transects in the Little North Fork Clearwater River, Idaho, during August 15-18, 2005.

			Cutthroat trout			Mountain whitefish		Rainbow trout		Bull trout	
	Transect		Number counted		Density	Number	Density	Number	Density	Number	Density
Reach	Number	Area (m^2)	≥300mm	All sizes	(No./100 m^2)	counted	(No./100 m^2)	counted	(No./100 m^2)	counted	(No./100 m^2)
Rutledge Creek to F.S. Road 1268	33	336	0	1	0.3	0	0.0	11	3.3	0	0.0
	34	265	2	8	3.0	0	0.0	20	7.5	1	0.4
	35	340	1	4	1.2	0	0.0	4	1.2	0	0.0
	36	678	1	7	1.0	3	0.4	5	0.7	0	0.0
	37	297	2	14	4.7	1	0.3	1	0.3	1	0.3
	38	469	2	8	1.7	11	2.3	3	0.6	3	0.6
	39	588	0	9	1.5	0	0.0	4	0.7	1	0.2
Upstream of F.S. Road 1268	40	378	0	1	0.3	0	0.0	2	0.5	1	0.3
	41	350	3	3	0.9	1	0.3	0	0.0	38	10.9
	42	260	0	1	0.4	0	0.0	0	0.0	0	0.0
	43	760	1	12	1.6	3	0.4	0	0.0	2	0.3
	44	406	0	0	0.0	0	0.0	0	0.0	0	0.0
	45	198	0	1	0.5	0	0.0	2	1.0	0	0.0
	46	138	1	5	3.6	0	0.0	1	0.7	0	0.0
	47	344	0	2	0.6	0	0.0	0	0.0	0	0.0
	48	218	0	3	1.4	0	0.0	0	0.0	0	0.0
Total	48 sites	29,911	159	346	1.2	347	1.2	102	0.3	71	0.2

Table 2. Average density (fish/100 m^2) of cutthroat trout counted by snorkeling during 1997, 2002 and 2005 in specific reaches of the Little North Fork Clearwater River, Idaho.

	Transect	All sizes			≥300 mm		
Stream Reach	Number	1997	2002	2005	1997	2002	2005
Downstream of Canyon Creek	1-10	0.27	1.21	1.10	0.11	0.26	0.49
Canyon Creek to Spotted Louis Creek	11-21	0.59	2.79	1.27	0.12	0.94	0.82
Spotted Louis Creek to Rutledge Creek	22-32	0.36	0.95	0.94	0.12	0.32	0.55
Rutledge Creek to F.S. Road 1268	33-39	0.52	2.93	1.71	0.35	0.55	0.27
Upstream of F.S. Road 1268	40-48	--	3.16	0.92	--	0.64	0.16
Unroaded	1-32	0.38	1.51	1.12	0.11	0.44	0.61
Roaded	33-48	0.52	3.06	1.31	0.35	0.60	0.22
All Sites	1-48	0.39	1.75	1.16	0.13	0.46	0.53

Table 3. Average density (fish/100 m^2) of rainbow trout, mountain whitefish and bull trout counted by snorkeling during 1997, 2002 and 2005 in specific reaches of the Little North Fork Clearwater River, Idaho.

	Transect	Rainbow Trout			Mountain Whitefish			Bull Trout		
Stream Reach	Number	1997	2002	2005	1997	2002	2005	1997	2002	2005
Downstream of Canyon Creek	1-10	0.13	0.38	0.04	1.05	1.11	1.65	0.00	0.03	0.04
Canyon Creek to Spotted Louis Creek	11-21	0.98	0.63	0.12	0.80	1.20	1.27	0.03	0.12	0.08
Spotted Louis Creek to Rutledge Creek	22-32	0.58	1.65	0.62	0.30	0.82	1.01	0.00	0.03	0.24
Rutledge Creek to F.S. Road 1268	33-39	1.04	1.10	1.61	0.43	0.43	0.50	0.00	0.43	0.20
Upstream of F.S. Road 1268	40-48	--	0.94	0.16	--	0.21	0.13	--	0.64	1.34
Unroaded	1-32	0.50	0.78	0.21	0.78	1.05	1.37	0.01	0.05	0.10
Roaded	33-48	1.04	1.00	0.88	0.43	0.30	0.32	0.00	0.55	0.78
All Sites	1-48	0.52	0.81	0.34	0.76	0.94	1.16	0.01	0.13	0.24

Angler Exploitation

We marked 129 cutthroat trout, eight rainbow trout, and five rainbow X cutthroat hybrids with reward tags between July 6 and 15, 2005 in the Little North Fork Clearwater River (Table 4). Fish were tagged between Lund Creek and Foehl Creek (Figure 2). Anglers reported recapturing 16 of these fish with nine of these being harvested. All of these fish were reported being caught within about a one month span from July 12 to August 14. Because only one rainbow and no hybrids were reported being caught, all tagged fish were pooled for an overall harvest estimate for trout. Using an 11% tag loss rate and a 55% reporting rate about 18% of the fish were recaptured and 10% of them were harvested (Table 4). Due to reports from other anglers, there was considerable fishing pressure the week before we marked our fish (4th of July Holiday Week). If capture rates were similar during this week as occurred the following two weeks, we could have expected another four tag returns with two being harvested if we had marked our fish earlier. Adding these returns to the total we estimated that 23% of the trout were captured with an annual exploitation rate of about 13%. This exploitation rates is similar to what was observed during 1997 and 2002 (Table 4).

Table 4. Number of cutthroat trout tagged, recaptured and harvested on the Little North Fork Clearwater River, Idaho during 1997, 2002 and 2005. Percent recaptured and angler exploitation were calculated based on a 11% tag loss rate and a 55% reporting rate.

Date	Number Tagged	Number Recaptured	Percent Recaptured	Number Harvested	Annual Exploitation
2005	142	16	18.4%	9	10.3%
2005 (corrected)	142	20	22.9%	11	12.6%
2002	31	6	31.5	2	10.5%
1997	75	--	--	6	13.0%

Based on the general capture locations provided by anglers on where they caught their fish is was difficult to determine how much these fish moved from where they were originally tagged. However, it appears that 13 of them were recaptured within at least 2 km of where they were originally tagged, two of the fish we couldn't tell because of poor capture descriptions and one appeared to move about 5 km downstream from when we captured it on July 15 to when it was recaptured on August 14.

Three of the nine (33%) harvested fish came from the roaded reach whereas 40 of the 142 (28%) fish were tagged from this roaded reach (Figure 2). The amount of harvest that occurred in the roaded and unroaded reaches was not significantly different (chi-square = 0.119; p = 0.74) from where they were tagged indicating fish harvest was uniformly distributed between the two reaches.

While capturing fish to put reward tags in, two fisherman caught 275 fish (190 cutthroat trout, 46 rainbow trout, seven rainbow x cutthroat hybrids, 29 whitefish and three bull trout) over a 5 day period. The cutthroat trout ranged in size from 120 to 455 mm in length whereas rainbow trout ranged in size from 130 mm to 300 mm (Figure 3). About 67% (128 our of 190) of the cutthroat trout caught were >250 mm in length whereas about 22% (10 out of 46) of the rainbow trout were >250 mm in length.

The lengths of the cutthroat trout captured while fishing between July 6-15 were very similar to what was observed while snorkeling between August 15-19 (Figure 4). A non-significant relationship (chi-square; p >0.1) indicates that the cutthroat trout caught fishing were distributed in size similar to what was observed while snorkeling. However, when we compared the lengths of cutthroat trout caught while fishing to what was observed while snorkeling in the roaded and unroaded reaches the findings varied. In the roaded reach, a significant relationship (chi-square; p <0.001) indicates that the cutthroat trout caught fishing were not distributed in size similar to what was observed while snorkeling. This was because more large fish were caught fishing than were observed while snorkeling (Figure 5). In the unroaded reach a non-significant relationship (chi-square; p >0.1) was calculated indicating the size of the cutthroat trout caught fishing were similar to what was observed while snorkeling (Figure 5).

The lengths of rainbow trout captured while fishing tended to be larger than what was observed while snorkeling (Figure 4). A significant relationship (chi-square; p <0.025) indicates that rainbow trout caught fishing were not distributed in size in proportion to what was observed while snorkeling.

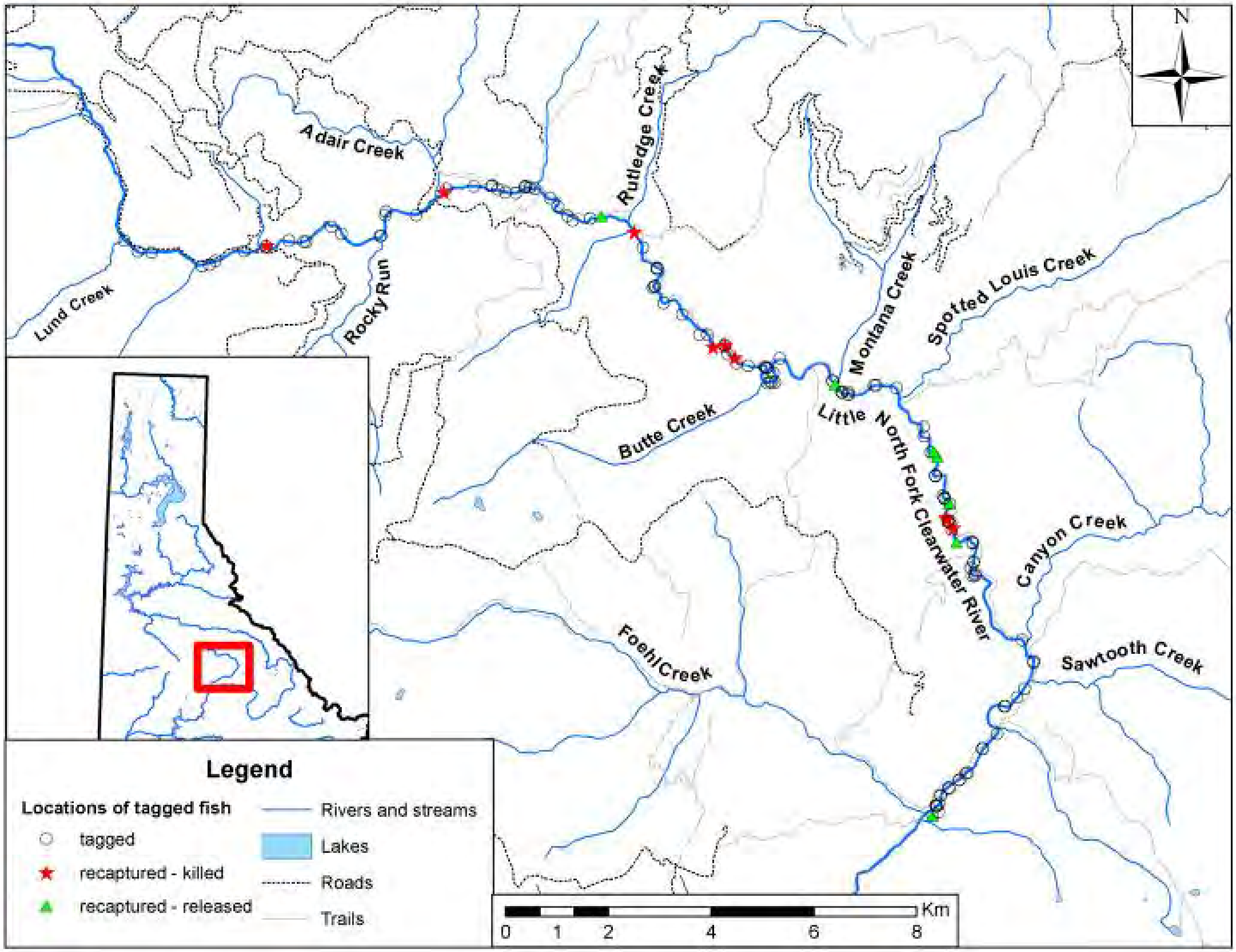


Figure 2. Locations of where cutthroat trout and rainbow trout were T-bar Floy tagged (July 6-15, 2005) and recaptured for an angler exploitation study in the Little North Fork Clearwater River, Idaho.

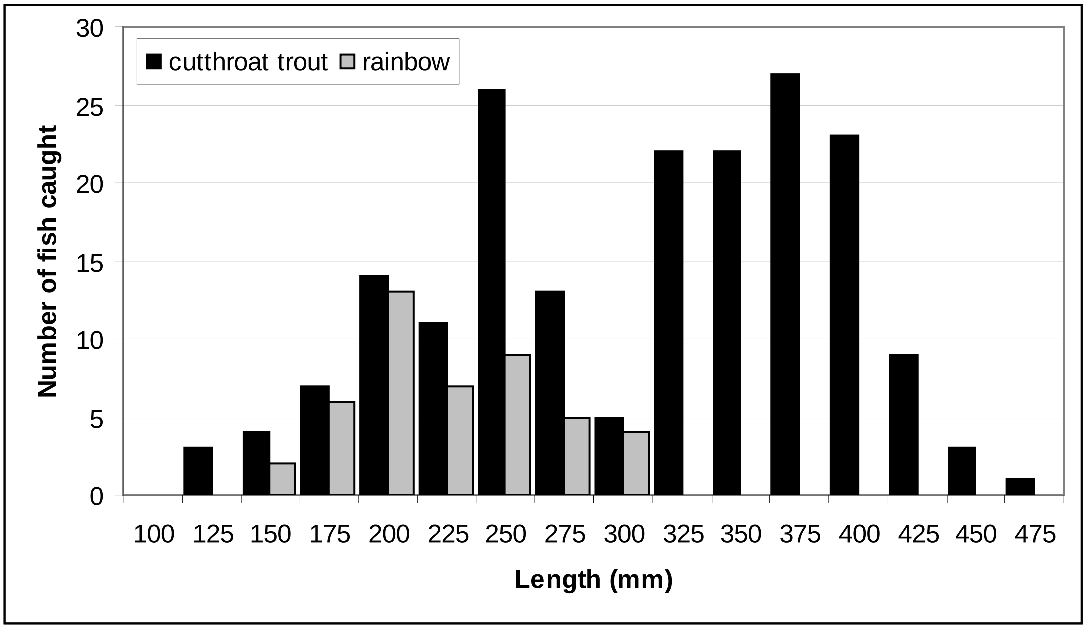
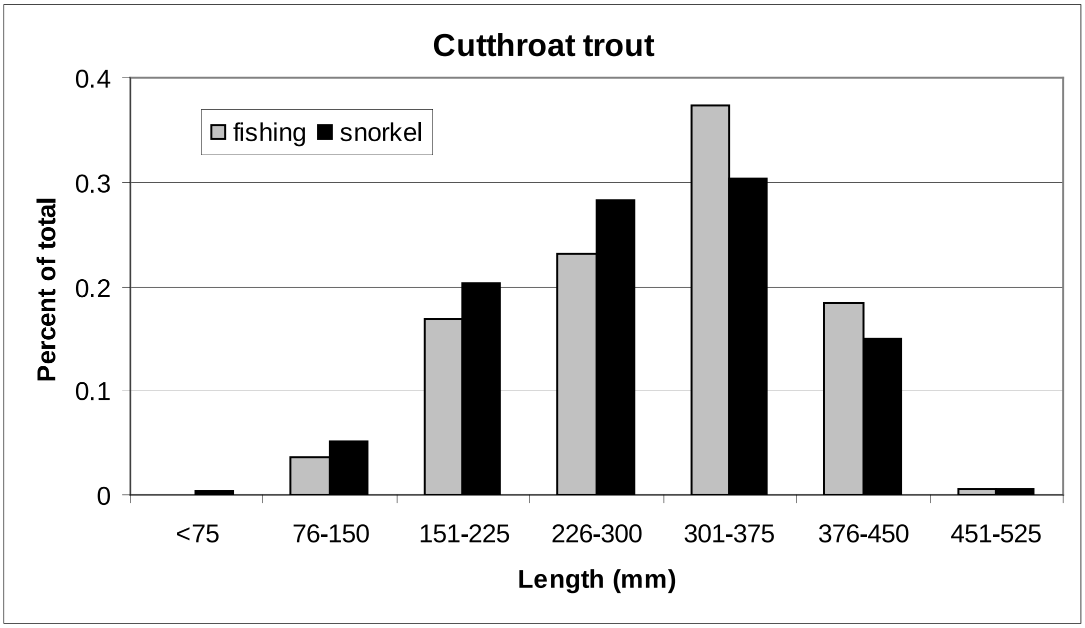


Figure 3. Numbers and lengths of cutthroat trout and rainbow trout caught by two fishermen over a five day period (July 6-15, 2005) in the Little North Fork Clearwater River, Idaho.



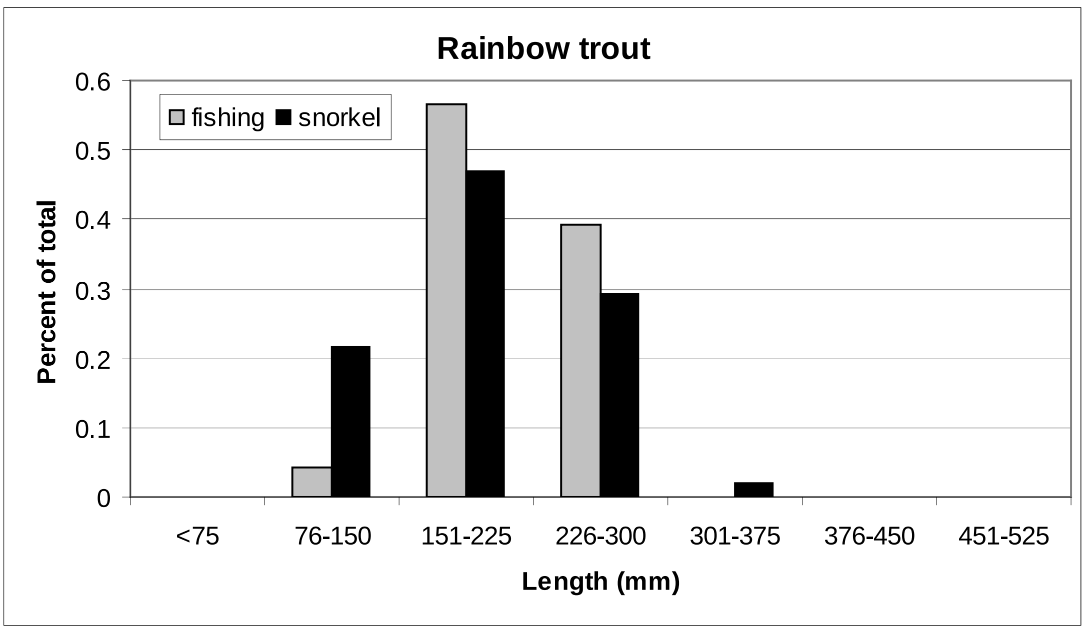


Figure 4. The lengths of cutthroat trout and rainbow trout caught while fishing (July 6-15, 2005) compared to what was observed during snorkel surveys (August 15-19, 2005) in the Little North Fork Clearwater River, Idaho.

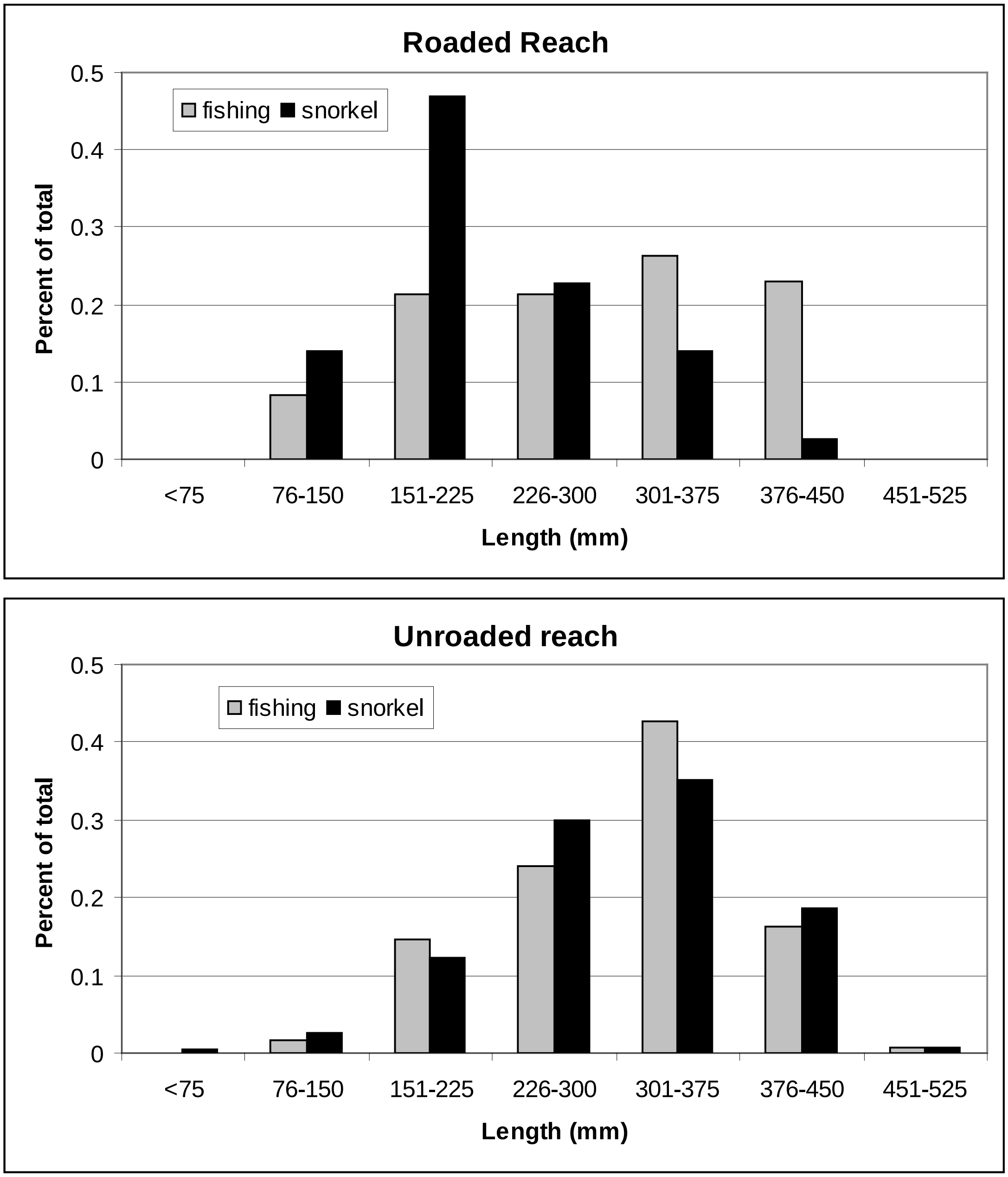


Figure 5. The lengths of cutthroat trout caught while fishing (July 6-15, 2005) compared to what was observed during snorkel surveys (August 15-19, 2005) in the roaded and unroaded reaches of the Little North Fork Clearwater River, Idaho.

DISCUSSION

Snorkeling Surveys

The overall density of cutthroat trout was 33% lower (not significant) in 2005 than what was observed in 2002. Despite this decline, the density of cutthroat trout ≥300 mm observed in 2005 was slightly higher than 2002 (not significant). Thus, the lower densities of fish that were observed in 2005 are related to an absence of smaller fish. The largest difference between the two years was observed in the roaded reach where densites in 2005 were 43% of what was observed in 2002. The concern with the lower abundance of small cutthroat trout is that it may result in fewer large fish in the years to come. It is possible that the high density of large cutthroat trout has reached or is near the carrying capacity of the Little North Fork Clearwater River. The densities of these larger cutthroat trout are as high as we have ever observed in the St. Joe River (DuPont et al. In Press b). If we are at or near the carrying capacity, larger fish may be displacing smaller fish from preferred habitat and decreasing their survival. Numerous studies have shown that larger cutthroat trout will utilize the best habitat displacing smaller fish to less desirable spots (Lewynski 1986; Hunt and Bjornn 1992). If this is the case, smaller fish would fill the place of larger fish as they died off and a decline in the abundance of larger fish may not occur in the future. Unfortunately, a drop in density of cutthroat trout ≥300 mm in 2005 (2.7 times lower than 2002) was also observed in the same reach (upstream roaded reach) we observed the largest decline in densities of the smaller fish which does not support this theory. With fewer adult fish using the upstream reach in 2005, more space should have been available for the smaller fish.

Increasing abundances of juvenile cutthroat trout have been related to declining abundances of juvenile bull trout in tributaries of the IDFG Panhandle Region (DuPont et al. 2004; DuPont et al. In Prep). Presumably, this increase in cutthroat trout abundance is a result less of competition and predation by bull trout. The number of bull trout redds counted in the Little North Fork Clearwater River has more than doubled from 2002 to 2005 (DuPont et al. In Press b). In addition, we observed more that two times as many bull trout in 2005 as 2002 in our snorkel surveys. Most of the bull trout spawning tributaries flow into the upstream roaded reach where the largest declines in cutthroat trout were observed. This is also where most (66%) of the bull trout were observed in our snorkel survey. Surveys in spawning and rearing tributaries would be needed to substantiate whether declines in juvenile cutthroat trout abundance in the tributaries could explain the declines of cutthroat trout densities that were observed in the roaded reach.

Although the overall density of cutthroat trout ≥300 mm was similar between 2005 and 2002, their distribution was quite different. In 2005, the densities of cutthroat trout ≥300 mm were more than twice as high in the unroaded reach as the roaded reach, whereas in 2002 densities were higher in the roaded reach. Angler exploitation cannot explain this difference as exploitation appeared low (0.13) and appeared to be distributed fairly evenly between the roaded and unroaded reaches. The reason for this difference may be due to the low flow conditions that were observed in 2005. These lower flows led to shallow water in the upstream roaded reach which may have initiated downstream movements of larger cutthroat trout to deeper water. Flows were about 33% lower in 2005 than in 2002. This downstream movement is supported by our tagging study in July when flows were higher. During this period we caught a higher percentage of cutthroat trout ≥300 mm than we observed while snorkeling in mid-August.

When we compare the densities of cutthroat trout in the Little North Fork Clearwater River to the St. Joe River and North Fork Coeur d'Alene River, we found them similar to what was observed in the St. Joe River and about 1.4 times higher than what was observed in the North Fork Coeur d'Alene River (Table 5). When we evaluated only those fish ≥300 mm the density was again similar to what was observed in the St. Joe River and about double what was observed in the North Fork Coeur d'Alene River. The densities in the St. Joe River and North Fork Coeur d'Alene River in 2005 were near the highest or the highest that had ever been recorded (DuPont et al. In Press b). This also suggests that the densities of cutthroat trout in the Little North Fork Clearwater River are at a very high level.

Table 5. Average density (fish/100 m^2) of cutthroat trout observed while snorkeling the Little North Fork Clearwater River (LNFCW), St. Joe River (St Joe) and North Fork Coeur d'Alene River (NFCdA), Idaho, during 2005.

	All size classes			≥300 mm		
Stream Reach	LNFCW	St Joe	NFCdA	LNFCW	St Joe	NFCdA
Roaded	1.31	1.69	0.82	0.22	0.58	0.24
Unroaded	1.12	1.22	1.78	0.61	0.27	0.69
All Transects	1.16	1.64	0.82	0.53	0.55	0.24

Since 2002, the density of cutthroat trout has about doubled in the North Fork Coeur d'Alene River and increased by about 64% in St. Joe River. The increase in densities of cutthroat trout ≥300 mm has been even more pronounced as almost a 5 fold increase was observed in the North Fork Coeur d'Alene River and almost a 3 fold increase was observed in the St. Joe River. This increase is largely a result of a rebounding fish population after significant declines were observed following a series of two flood events in 1996 and 1997 (DuPont et al. In Press b). The Little North Fork Clearwater River cutthroat trout fishery appeared to recover more quickly than these two rivers as about a 4.5 fold increase in cutthroat trout density was observed from 1997 to 2002. In 1997, densities of cutthroat trout were lower than what was observed in either the St. Joe or North Fork Coeur d'Alene rivers. The rapid improvement in fish densities between 1997 and 2002 is likely a testament to the good habitat conditions and low fishing pressure that occurs on the Little North Fork Clearwater River.

The density of rainbow trout we observed in 2005 was lower than what we observed in either 1997 or 2002. We are unsure of why this was observed as all other fish species appear to be doing well in the Little North Fork Clearwater River. Presumably, the rainbow trout are descendents of the steelhead that used to ascend this river prior to the construction of the Dworshak Dam and have co-evolved with all the species present. Rainbow trout have been regularly stocked into Dworshak Reservoir ever since it was constructed, although no rainbow with eroded fins have ever been observed in the snorkel surveys. Likely, hatchery rainbow trout would not persist in this section of the Little North Fork Clearwater River. After years of stocking rainbow trout into the St. Joe River and North Fork Coeur d'Alene River, rainbow trout appear to be non-existent in the canyon reaches where the habitat is similar to the Little North Fork Clearwater River (DuPont et al. In Press b). We do not consider misidentification of rainbow trout for cutthroat trout as a reason for the low densities estimates because most snorkelers were biologists with considerable experience in fish identification.

Through the snorkeling surveys and tagging exercise it appears that rainbow trout rarely exceed 300 mm in length in this system. One possible explanation is those rainbow trout that historically did not migrate to the ocean evolved to have a short life span. While capturing fish to place rewards tags in, several of the rainbow trout appeared to be in post-spawn conditions (emaciated and worn tail). Another possibility is that these fish migrate to Dworshak Reservoir as they increase in size. If these rainbow trout do migrate to Dworkshak Reservoir, densities could be influenced by factors in the reservoir.

About 2.2 times as many bull trout were observed during 2005 as 2002. This also correlates closely with bull trout redd counts which increased 2.3 fold from 2002 to 2005 (DuPont et al. In Press b). Continued increases in bull trout could make the Little North Fork Clearwater River a destination spot for bull trout fishing. Many anglers we talked to commented on catching or hooking bull trout, and were excited at the opportunity to catch these larger fish. About 86% of the bull trout were >375 mm in length with about 45% being >450 mm in length. These bull trout were larger than what was observed in 2002 when 55% were >375 mm in length and 33% were >450 mm in length. This is expected as these long lived fish increase in age. Increases in the bull trout numbers are most likely explained by changes in fishing regulations that occurred in 1994 when regulations changed from a two fish limit to no harvest on bull trout. A long lived species such as bull trout can easily be exploited especially seeing how large congregations of fish can occur in a few pools. At one transect we observed 38 different bull trout.

Bull trout densities and numbers were higher in the upstream roaded reach. This most likely is because this is where the coolest water temperatures occurred and because this is where most of the known spawning tributaries were. Measured stream temperatures upstream of Rutledge Creek averaged over 2°C cooler than what was measured downstream of Rutledge Creek. Bull trout spawning typically begins in early September in north Idaho (DuPont et al. In Press b), two weeks after we conducted our survey.

The overall mountain whitefish density in 2005 was higher than what was observed in 1997 and 2002. Most (86%) of the mountain whitefish observed were >300 mm in length as opposed to 46% of the cutthroat trout being >300 mm in length. The size structure of these whitefish are probably close to what we would expect for a unexploited population and may give us some clues as what we could expect for an unexploited cutthroat trout population. The highest densities and numbers of mountain whitefish were observed in the most downstream reaches. This is typical with other rivers in north Idaho where mountain whitefish congregate in stream reaches with the largest pools and warmer water temperatures (DuPont et al., In Press b). If fishing pressure ever increases to the point we must change to catch-and-release regulations to protect cutthroat trout, mountain whitefish could provide an alternative fish for those who wanted to harvest fish to eat.

Angler Exploitation

The fishing regulations for cutthroat trout in the Little North Fork Clearwater River are two fish of any size; the statewide “Wild Trout Water” fishing regulation. The other rivers in the Panhandle Region with wild cutthroat trout include the Coeur d’Alene, St. Joe River and Priest River systems and are either catch-and-release or allow harvest of two fish, none between 8-16 inches. The reason for the more liberal regulations on the Little North Fork Clearwater River is fishing pressure is typically low due to its remote location, with most of the river accessed by trail only. From 2001 through 2005, the U.S. Forest Service has been upgrading the trail system that provides access to the Little North Fork Clearwater River. These upgrades improved access, especially for motorcycle traffic. This improved trail system has raised our concern that fishing pressure may have increased in the Little North Fork Clearwater River and possibly degraded the quality of this wild cutthroat trout fishery.

Our angler exploitation study found that about 23% of the cutthroat trout are caught on an annual basis with the annual exploitation estimate to be around 13%. This exploitation rate is similar to what was found in past studies in 1997 and 2002. Despite the improvements in the trail system, annual exploitation has not appeared to increase in the Little North Fork Clearwater River from 1997 to 2005. In addition, the high densities of cutthroat trout, especially fish ≥300 mm, indicates fishing pressure is not overly suppressing this fishery at this time. Our study also indicates that fishing pressure is fairly evenly distributed between the roaded and unroaded reaches

The trail improvements that occurred along the Little North Fork Clearwater River were quite dramatic, as it appeared that you could drive a four-wheeler down much of the new construction along trail 50. However, the trails that were upgraded in 2001 had decreased in width with dense vegetation growing back along the edges. Downstream of Montana Creek, it appeared that motorcycle traffic had decreased substantially possibly due to this dense vegetation. These trails will likely continue to degrade over time making motorcycle access more difficult until we get to the point where the trails will be upgraded again. Marked improvements in the trail system followed by gradual degradation may be what we can expect along the Little North Fork Clearwater River in the future, pending changes in USFS management direction. Exploitation of cutthroat trout may increase after trail improvements, but more than likely it will be short term and not have large impacts on this fishery. If a dramatic increase in off road vehicle ownership and use occurs, heavy trail use could keep trails more accessible for longer periods of time. Currently, it appears that factors such as severe climatic events (floods or droughts) and possibly catastrophic fires may have a greater impact on this fishery.

Changes in the catch-and-release fishing practices in the Little North Fork Clearwater River could also have an impact on this fishery. We found that about half of the tagged fish that were recaptured by anglers were released. Without catch-and-release practices it is likely this fishery could not be maintained at its current level. One concern between 2005 and 2002 was in 2005, 56% of the recaptured fish were killed, whereas in 2002, 33% of the recaptured fish were killed. It's difficult to say for sure that this difference is real as a low number of returns (6) were collected in 2002. The seeming increase in popularity in fishing the Little North Fork Clearwater River may actually have more of an impact on the fishery than changes in the trail system. Based on phone calls and discussion with anglers, more people appear to be aware of the high quality cutthroat trout fishery this river provides. In addition, it offers one of the few opportunities in the panhandle for anglers to get away from roads and catch an occasional bull trout. Based on the apparent increase in popularity of this fishery, a more frequent monitoring plan (every 2-3 years versus 3-5 years) may be appropriate to ensure the fishing regulations are adequately set to maintain the quality of this fishery.

RECOMMENDATIONS

1. Monitor fish abundance in the Little North Fork Clearwater River through snorkel surveys every 2-3 years.

2. Maintain current fishing regulations on Little North Fork Clearwater River.

3. Survey bull trout spawning tributaries (upstream of Rutledge Creek) to evaluate if changes in juvenile cutthroat trout and bull trout densities have occurred.

LITERATURE CITED

Anderson, D.R., and K.P. Burnham, and W.L. Thompson. 2000. Null Hypothesis Testing, Prevalence, and an Alternative. Journal of Wildlife Management 64:912-923.

Bowler, B. 1974. Coeur d'Alene River Study. Idaho Department of Fish and Game, Federal Aid in Fish Restoration, F-53-R-9, 1974 Job Performance Report, Boise.

DuPont J., M. Liter, and N. Horner. 2004. Regional fisheries management investigations. Idaho Department of Fish and Game, Federal Aid in Fish Restoration, F-71-R-26, Job c, 2001 Job Performance Report, Boise, Idaho

DuPont J., M. Liter, and N. Horner. In Press a. Regional fisheries management investigations. Idaho Department of Fish and Game, Federal Aid in Fish Restoration, F-71-R-27, Job c-1, 2002 Job Performance Report, Boise, Idaho.

DuPont J., M. Liter, and N. Horner. In Press b. Regional fisheries management investigations. Idaho Department of Fish and Game, Federal Aid in Fish Restoration, F-71-R-30, Job c-1, 2005 Job Performance Report, Boise, Idaho.

DuPont J., M. Liter, and N. Horner. In Prep. Priest Lake fisheries management plan. Idaho Department of Fish and Game, Federal Aid in Fish Restoration, 2005 Job Performance Report, Boise, Idaho.

Fredericks, J., Davis, J., N Horner, and C. Corsi. 2000. Regional fisheries management investigation, Idaho Department of Fish and Game, Federal Aid in Fish Restoration, F-71-R-22, Job c, 1997 Job Performance Report, Boise, Idaho.

Hunt, J.P. and T.C. Bjornn. 1992. Catchability and vulnerability of westslope cutthroat trout to angling and movements in relation to seasonal changes in water temperature in northern Idaho rivers. Job Completion Report, Project F-71-R-13, Boise, Idaho.

Johnson, T.H., and T.C. Bjornn. 1978. The St. Joe River and Kelly Creek cutthroat trout populations: an example of wild trout management in Idaho. Pages 39-47 *in* J.R. Moring, editor. Proceedings of the Wild Trout – Catchable Trout Symposium. Oregon Department of Fish and Wildlife. Eugene, Oregon.

Johnson, D.H. 1999. The Insignificance of Statistical Significance Testing. Journal of Wildlife Management 63:763-772.

Maclay, D.J. 1940. Tentative fish management plan, St. Joe National Forest. St. Maries, Idaho.

Mourning, T.E., K.D. Fausch, and C. Gowan. 1994. Comparison of visible implant tags and floy tags on hatchery rainbow trout. North American Journal of Fisheries Management. 14:636-642.

Nichols, J.D., R.J. Blohm, R.E. Reynolds, R.E. Trost, J.E. Hines, and J.P. Bladen. 1991. Band reporting rates for mallards with reward bands of different dollar values. Journal of Wildlife Management 55:119-126.

Ott, L. 1988. An introduction to statistical methods and data analysis, third edition. PWS-Kent Publishing Company. Boston, Massachusetts.

Peterman, R.M. 1990. Statistical power can improve fisheries research and management. Canadian Journal of Fisheries and Aquatic Sciences 47:2-15.

Rankel, G. 1971. St. Joe River cutthroat trout and northern squawfish studies. Idaho Department of Fish and Game, Federal Aid in Fish and Wildlife Restoration, F-60-R-2, Job No. 1, Life History of St. Joe River Cutthroat Trout. Annual Completion Report, Boise.

Thurow, R.F. 1994. Underwater methods for study of salmonids in the Intermountain West. General Technical Report. INT-GTR-307. Ogden, UT: USDA Forest Service, Intermountain Research Station. Boise, Idaho.

USFS (U.S. Forest Service). 1935. Five year fish and game report, St. Joe National Forest. St. Maries, Idaho.

U.S. Fish and Wildlife Service. 2002. Chapter 16, Clearwater River recovery unit, Idaho. 196 p. *In*: U.S. Fish and Wildlife Service Bull Trout (*Salvelinus confluentus*) Draft Recovery Plan. Portland, Oregon.

Watson G. and T.W. Hillman. 1997. Factors affecting the distribution and abundance of bull trout: an investigation at hierarchical scales. North American Journal of Fisheries Management. 17(2):237-252.

Appendix A. Habitat features collected while conducting snorkeling surveys on the Little North Fork Clearwater River, Idaho, during August 15-19, 2005.

Reach	Transect	GPS (UTM11 NAD27) Easting	Northing	Date	Habitat Type	Dominant Cover	% cover	Max Depth (m)	Temp (˚C)	Time	Length (m)	Average Width	Area (m2)
Downstream of Canyon Creek	1	600292	5201856	8/16/2005	Pool	LS	15	1.7	12	930	82	23	1913
	2	600585	5202093	8/16/2005	Pool	LS	15	3.5	12	950	51	25	1292
	3	601033	5202634	8/16/2005	Pool	LS	15	3.0	13	1015	64	18	1152
	4	601431	5203158	8/16/2005	Pool	LS	25	3.0	13	1100	79	20	1541
	5	601746	5203544	8/16/2005	Run/Pool	LS	50	1.0	14	1045	35	18	616
	6	601961	5204351	8/16/2005	Run	LS	5	1.0	16	1255	78	19	1482
	7	602283	5204631	8/16/2005	Pool	LS	5	3.0	14	1550	71	14	1018
	8	602422	5204730	8/16/2005	Riffle	LWD	35	1.2	13	1440	25	6	150
	9	602738	5205220	8/16/2005	Pool	LS	5	1.2		1525	34	10	340
	10	602799	5205527	8/16/2005	Pool	LS	15	1.8	12	1000	69	15	1007
Canyon Creek to Spotted Louis Creek	11	602579	5205936	8/15/2005	Pool	LS	10	3.0	17	1545	33	17	561
	12	602003	5206139	8/16/2005	Pool/Glide	LS	30	2.0	12	0820	76	12	912
	13	601960	5206181	8/16/2005	Pool	LS	15	1.5	11.5	0845	51	12	632
	14	601480	5207825	8/16/2005	Pool/Run	LS	5	3.0	17	1530	54	12	626
	15	601179	5207865	8/16/2005	Pool/Run	LS	10	0.7	16.5	1425	79	14	1074
	16	600945	5208650	8/16/2005	Pool	LS	10	2.0	15	1310	33	14	469
	17	600929	5208693	8/16/2005	Riffle	LS	15	0.5	15	1255	54	13	691
	18	600769	5209065	8/16/2005	Pool/Riffle	LS	15	0.5	13	1110	47	13	623
	19	600715	5209089	8/16/2005	Pool/Run	LS	5	1.5	13	1113	37	17	629
	20	600240	5210228	8/16/2005	Pool/Run	LS	15	1.5	11	1012	58	11	615
	21	600017	5210376	8/16/2005	Pool/Run	LS	10	1.6	11	0925	57	12	707
Spotted Louis Creek to Rutledge Creek	22	599124	5210544	8/17/2005	Riffle	LS	50	0.5	11	0945	53	13	668
	23	598998	5210608	8/17/2005	Pool	LWD	40	1.5	11	1000	82	12	998
	24	598671	5210822	8/17/2005	Pool	LS	15	1.5	11	1035	39	14	546
	25	597548	5210924	8/17/2005	Pool	LS	5	1.8	11	1125	31	12	372
	26	597500	5210780	8/17/2005	Pool	LS	15	1.9	11	1145	26	12	307
	27	597146	5211042	8/17/2005	Run	LS	20	0.9	11.5	1215	53	12	625
	28	596736	5211244	8/17/2005	Pool	LS	10	1.0	11	1320	43	11	456
	29	596743	5211200	8/17/2005	Pool	LS	15	1.0	11.5	1345	70	10	700
	30	595721	5212079	8/18/2005	Run	LS	15	0.7	11.5	1415	36	11	389
	31	595149	5212518	8/17/2005	Pool	LS	5	3.0	11.5	1555	26	13	345
	32	595274	5212760	8/17/2005	Run	LS	50	0.4	11.5	1530	44	10	431

Appendix A. continued.

Reach	Transect	GPS (UTM11 NAD27) Easting	Northing	Date	Habitat Type	Dominant Cover	% cover	Max Depth (m)	Temp (˚C)	Time	Length (m)	Average Width	Area (m2)
Rutledge Creek to F.S. Road 1268	33	594477	5213851	8/17/2005	Run	LWD	30	0.8	12.5	1620	58	6	336
	34	593846	5213809	8/17/2005	Pool	LWD	20	1.0	11	1700	34	8	265
	35	593505	5213821	8/17/2005	Pool	LS	5	1.0	12	1635	34	10	340
	36	592723	5914352	8/17/2005	Pool/Riffle	LS	15	1.7	11.5	1520	55	12	678
	37	592380	5214262	8/17/2005	Pool/Riffle	LWD	10	1.0	12	1435	27	11	297
	38	591919	5214375	8/17/2005	Pool/Riffle	UB	15	1.0	12	1400	46	10	469
	39	591214	5214329	8/17/2005	Pool/Riffle	LWD	15	1.2	11.5	1335	49	12	588
Upstream of F.S. Road 1268	40	589904	5213787	8/18/2005	Pool/Riffle	LS	15	0.6	10	0825	36	11	378
	41	589781	5213330	8/18/2005	Pool	LS	5	1.3	10	0910	35	10	350
	42	589355	5213119	8/18/2005	Pool	LS	5	0.8	10.5	1010	26	10	260
	43	588740	5213537	8/18/2005	Run	LS	25	1.0	11	1105	98	8	760
	44	588077	5213153	8/18/2005	Riffle/Run	LS	40	0.3	10	1030	52	8	406
	45	587572	5213060	8/18/2005	Pool	LS	10	1.4	9.5	945	31	6	198
	46	586464	5212655	8/18/2005	Pool	LS	20	1.6	9	820	19	7	138
	47	586236	5212611	8/18/2005	Riffle	LS	50	0.4	9	905	40	9	344
	48	585904	5212845	8/18/2005	Pool	LWD	80	0.5	8.5	845	30	7	218

Appendix B. Photographs depicting locations of transects, starting (greed dot) and stopping (red dot) points and approximate distance of stream to snorkel in the Little North Fork Clearwater River, Idaho. These photos were taken in 2002.


Transect 01 (top looking down)


Transect 01 (bottom looking up) ¼ mi downstream of Foehl Creek. 83m

Transect 02 First large pool downstream of Foehl Ck. 48m

Transect 03 300m upstream of Foehl Ck. Big pool; start at whitewater. 53 m.


Transect 04 ½ mi upstream of Foehl Ck. Long pool where cedar spans the river. 75 m.


Transect 05 Where trail gets close to trail. Start at log jam. 30 m.


Transect 06   200m upstream of Larkins Ck Just upstream of logjam. 52 m.

Transect 07 400m upstream of Larkins Ck. 41 m.


Transect 08   500 m downstream of Sawtooth Ck. Log jam. 78 m.

Transect 09 200 m upstream from Sawtooth Ck. 32 m.

Transect 10   Pool just downstream of tributary. 70 m.


Transect 11 First pool upstream of Canyon Ck. Big rock outrop. 35 m.

Transect 12 ¼ mile upstream from Canyon Ck. 51 m.

Transect 13   Next pool upstream of transect 12. 58 m.

Transect 14   Big pool easily seen from trail. 150m upstream from Buzzard's Roost trail. 37 m.

Transect 15 Series of undercut rock faces just downstream of where trail crosses rock bluff. 100 m.

Transect 16   Just off of camp area upstream of Culdesac Creek. 30 m.

Transect 17   Pocket water immediately upstream of site 16. 46 m.

Transect 18 Located on sharp bend 2/3 mile above Culdesac Ck. Can see from trail. 36 m.

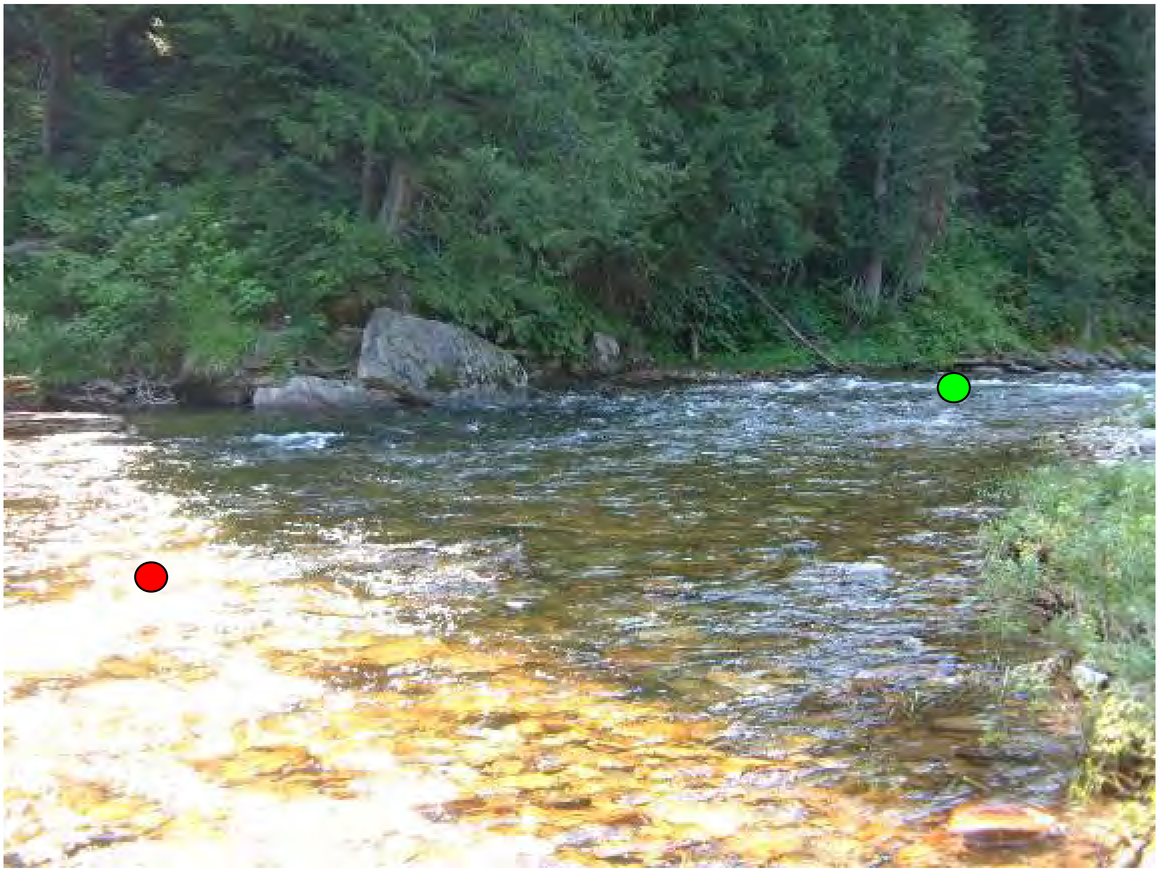

Transect 19 Just upstream from site 18. High gradient pocket water. 30 m.

Transect 20   300 m downstream from Spotted Louis Ck. 51m


Transect 21   100m below Spotted Louis Ck. 37m


Transect 22   Pocket water 50m downstream of site 23. Start where overflow joins. 42m

Transect 23 300 m downstream of Montana Ck. Two pools separated by riffle. 110 m.



Transect 24   150 m upstream of Montana Ck. 24m

Transect 25   Cliffs on both sides of river where river leaves trail. 31m

Transect 26   200 m downstream of Butte Creek. 30 m.

Transect 27   200 m upstream of Big Bend. 52 m.

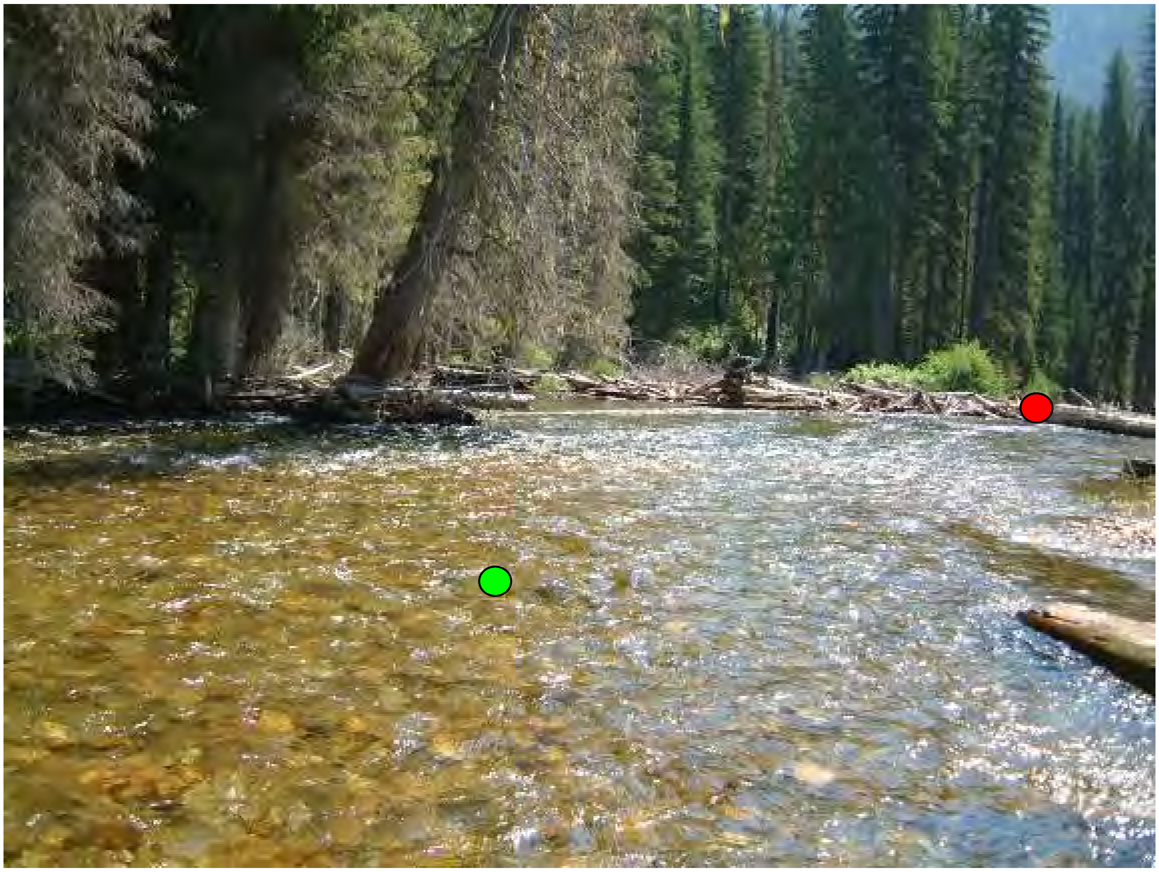

Transect 28   52 m.


Transect 29   Site starts where tributary enters from North. 60 m.


Transect 30   Just downstream of little tributary. 39 m.


Transect 31 150 m above Durham Ck. 29 m.

Transect 32   Take rock slide from trail down to site. Run/pool. 39m.


Transect 33   150 m up from Rutledge Creek. Big log jam. 44 m.

Transect 34 ½ mi upstream of Rutledge. 25 m .

Transect 35 Follow trail until deep bend can be seen. Drop down to river shortly after on game trail. 26 m.

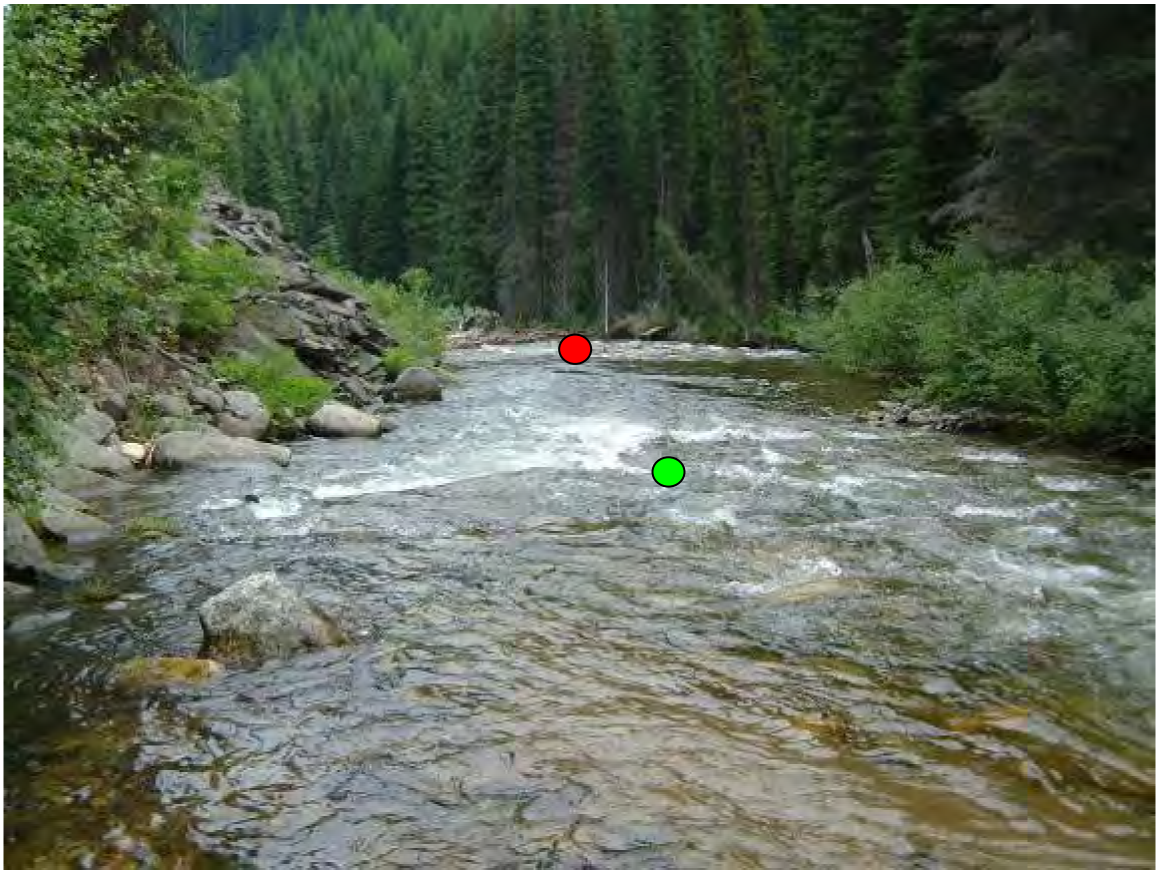
Transect 36 100 m upstream from Twin Ck. 36 m.


Transect 37   300 m upstream of Twin Ck. 15 m.


Transect 38 300 m upstream from Polar Ck. Run. 18 m.


Transect 39 ½ mi down from bridge. River splits and becomes multiple channels. 15 m.

Transect 40 13 m



Transect 41   Just downstream of Rocky Run Ck. 27 m.


Transect 42   400 m upstream of Rocky Run Ck. 20 m.


Transect 43 (downstream section)

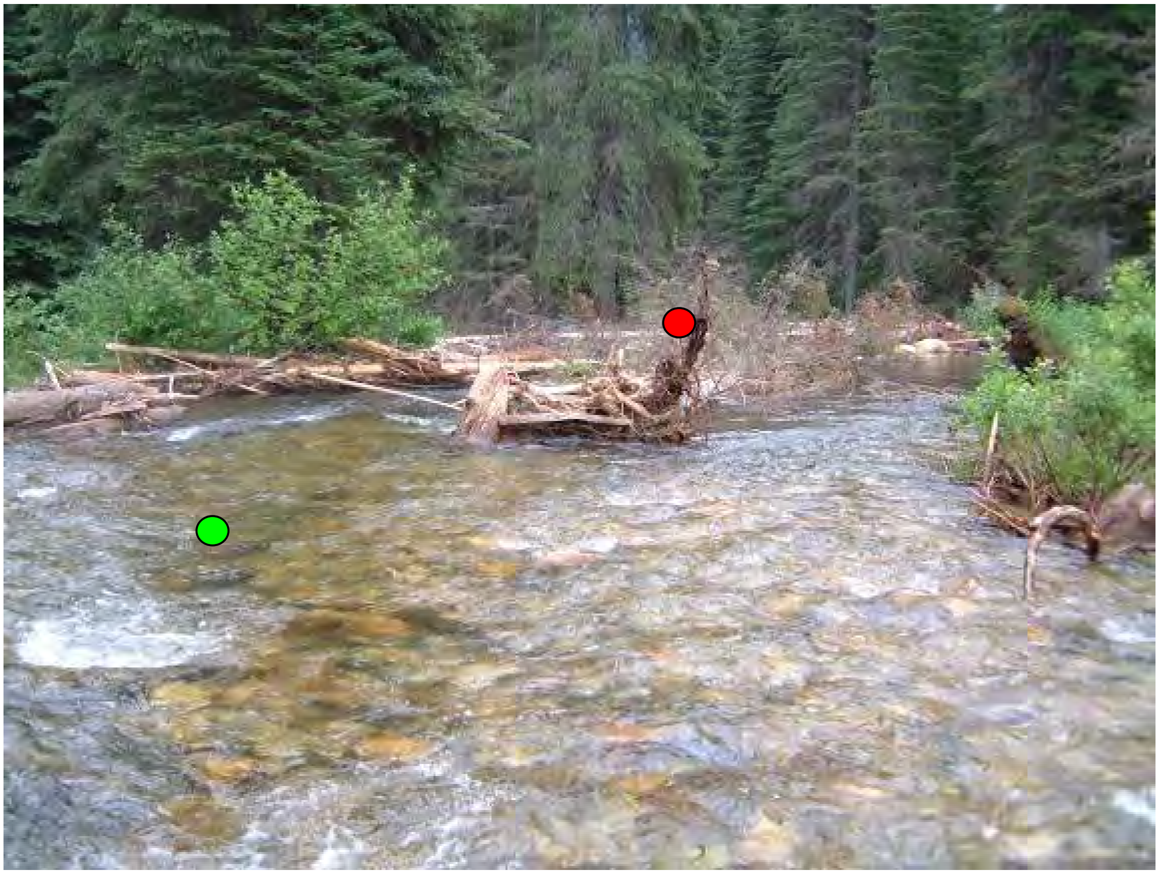
Transect 43 (upstream section)		Series of three pools around sharp bend. 75 m.


Transect 44   Two pools and pocket water where tributary comes in. 43 m.


Transect 45   300 m downstream of bridge just downstream of tributary. 32 m.


Transect 46   300 m downstream of Rocket Ck. Pocket water. 25 m.


Transect 47 Confluence of Rocket Ck. Pocket water. 38 m.


Transect 48 Logjam complex. 25 m.