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Steven M. Huffaker, Director

2005 PANHANDLE REGION
LITTLE NORTH FORK CLEARWATER FISHERY ASSESSMENT

By

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LITTLE NORTH FORK CLEARWATER FISHERY ASSESSMENT

2005 ANNUAL PERFORMANCE REPORT

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.

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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 Little North Fork Clearwater River, with over 25 km of the river accessible only by trail and another 25 km of the river with no 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 in this fishery. 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. Nowhere 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.

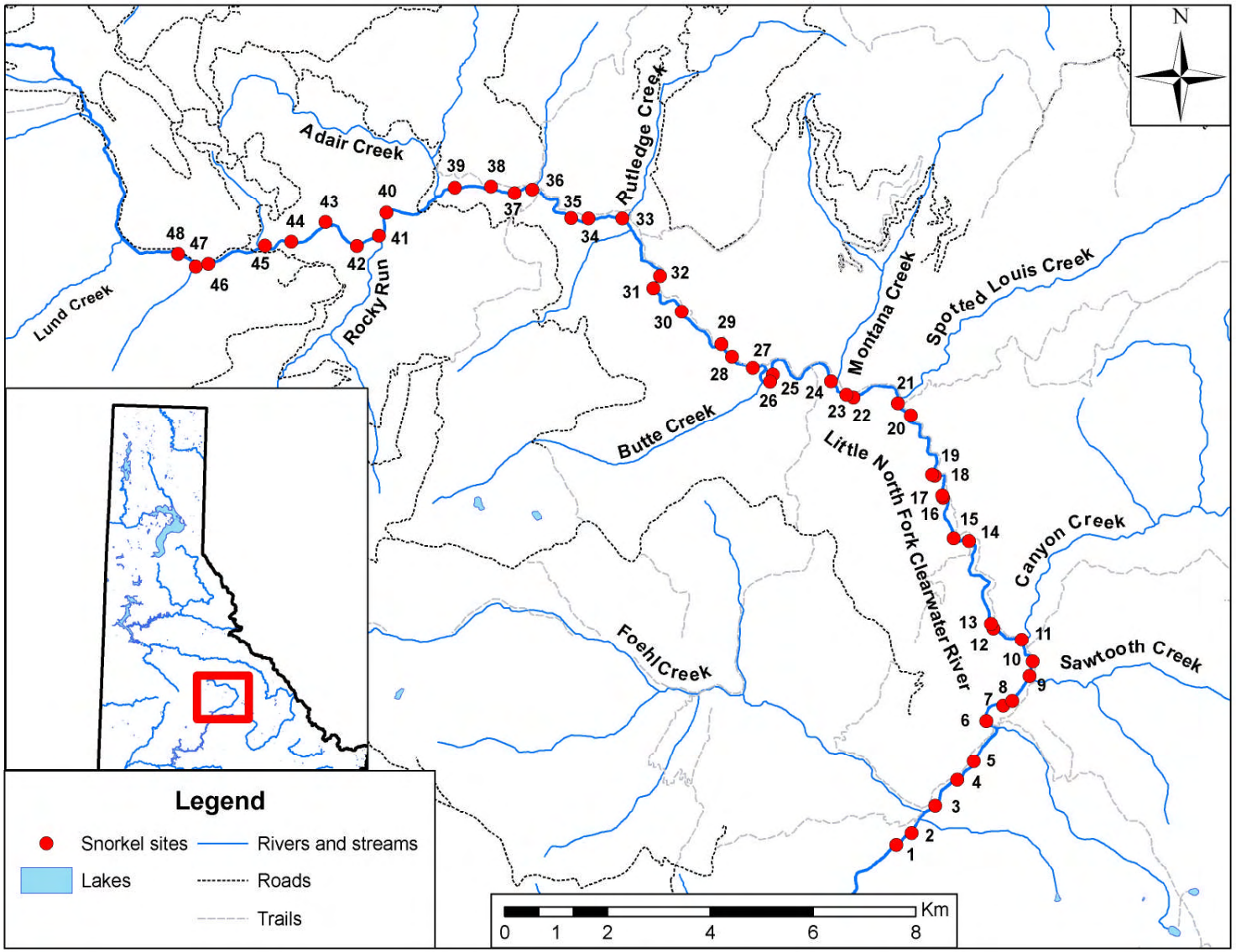


Figure 1. Location of transects snorkeled in the Little North Fork Clearwater River, Idaho, on August 15-18, 2005.

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% to 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 5.5ºC to 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*, Paiute sculpin *C. beldingii*, 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

Little North Fork Clearwater River Snorkel Surveys

We used snorkel surveys to evaluate trends in fish abundance in the Little North Fork Clearwater River. Thirty-five snorkel 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 snorkel 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 snorkel 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 fish 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 *Cottus sp*, 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) 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).

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 to 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

Little North Fork Clearwater River Snorkel Surveys

We snorkeled 48 transects in the Little North Fork Clearwater River from August 15 to 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 in 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.

			Cutthroat trout			Mountain whitefish		Rainbow trout		Bull trout	
			Number counted		Density	Number	Density	Number	Density	Number	Density
Reach	Transect 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)
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).

Reach	Transect Number	Cutthroat trout				Mountain whitefish		Rainbow trout		Bull trout	
		Area (m^2)	Number counted ≥300mm	Number counted All sizes	Density (No./100 m^2)	Number counted	Density (No./100 m^2)	Number counted	Density (No./100 m^2)	Number counted	Density (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.

Stream Reach	Transect Number	All sizes 1997	All sizes 2002	All sizes 2005	≥300 mm 1997	≥300 mm 2002	≥300 mm 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.

Stream Reach	Transect Number	Rainbow Trout 1997	Rainbow Trout 2002	Rainbow Trout 2005	Mountain Whitefish 1997	Mountain Whitefish 2002	Mountain Whitefish 2005	Bull Trout 1997	Bull Trout 2002	Bull Trout 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 rate 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 was calculated based on an 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 it 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 fishermen 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 to 300 mm (Figure 3). About 67% (128 out 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 and 15 were very similar to what was observed while snorkeling between August 15 and 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, larger 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.

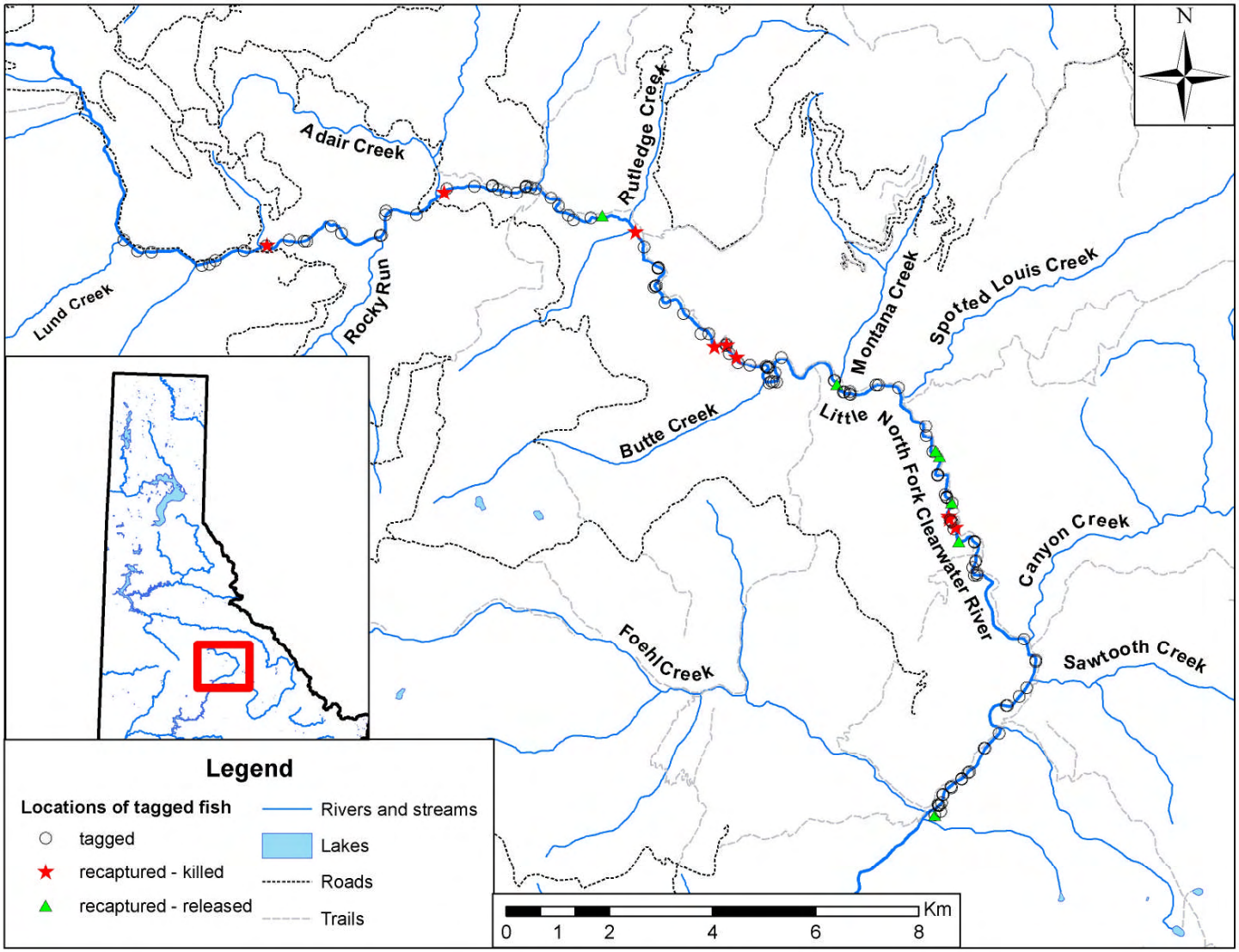


Figure 2. Locations of where cutthroat trout and rainbow trout were T-bar Floy tagged (July 6-15, 2005) and recaptured for an angler exploitation study in the Little North Fork Clearwater River, Idaho.

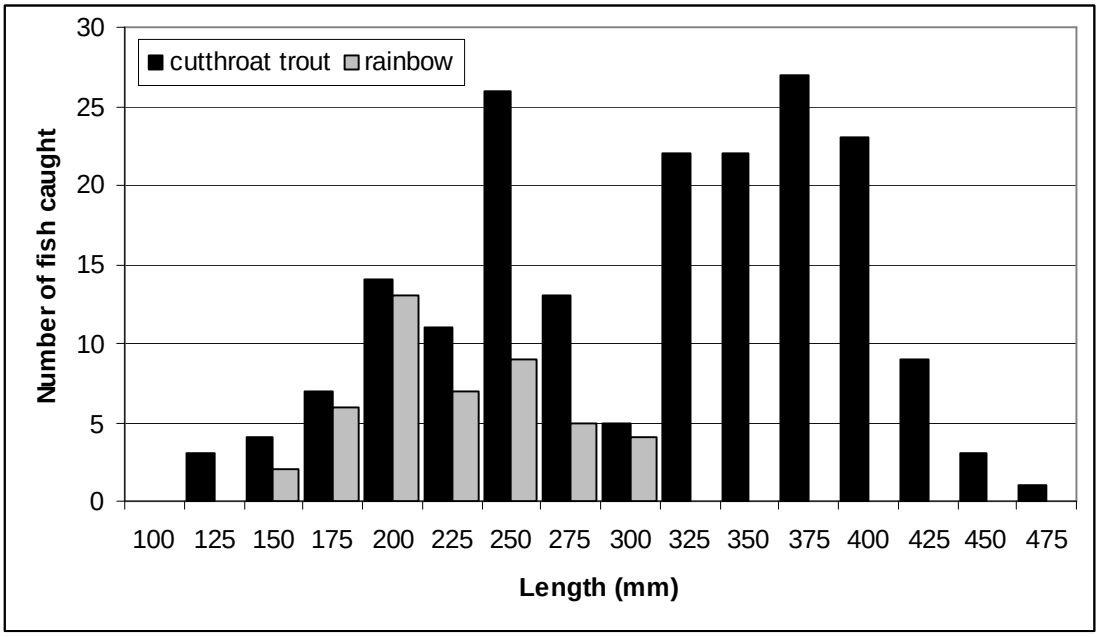
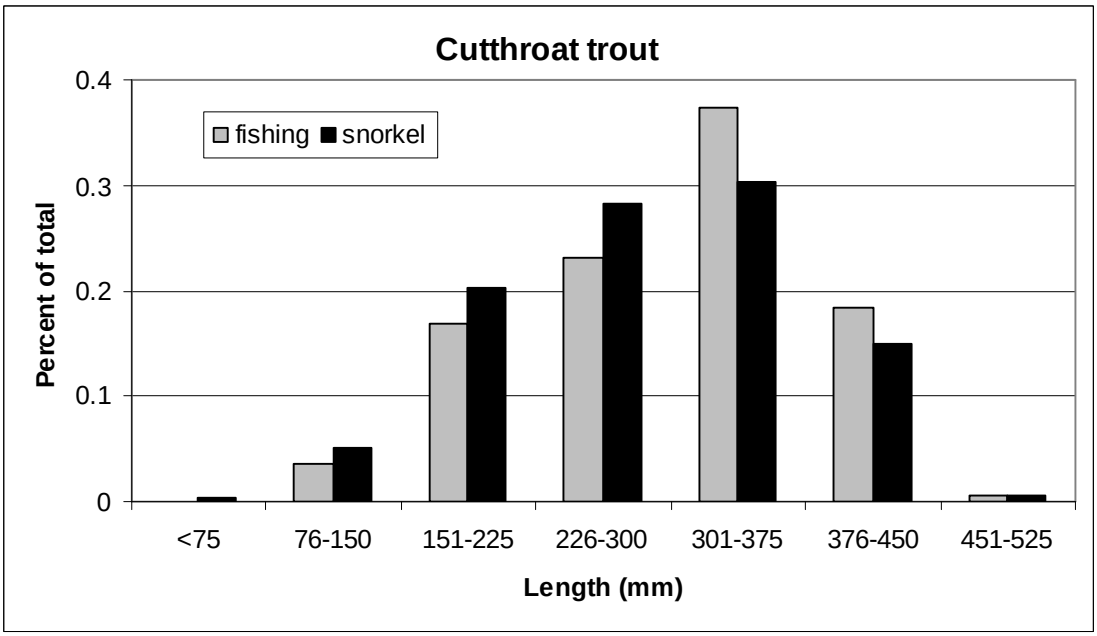


Figure 3. Numbers and lengths of cutthroat trout and rainbow trout caught by two fishermen over a five day period (July 6-15, 2005) in the Little North Fork Clearwater River, Idaho.



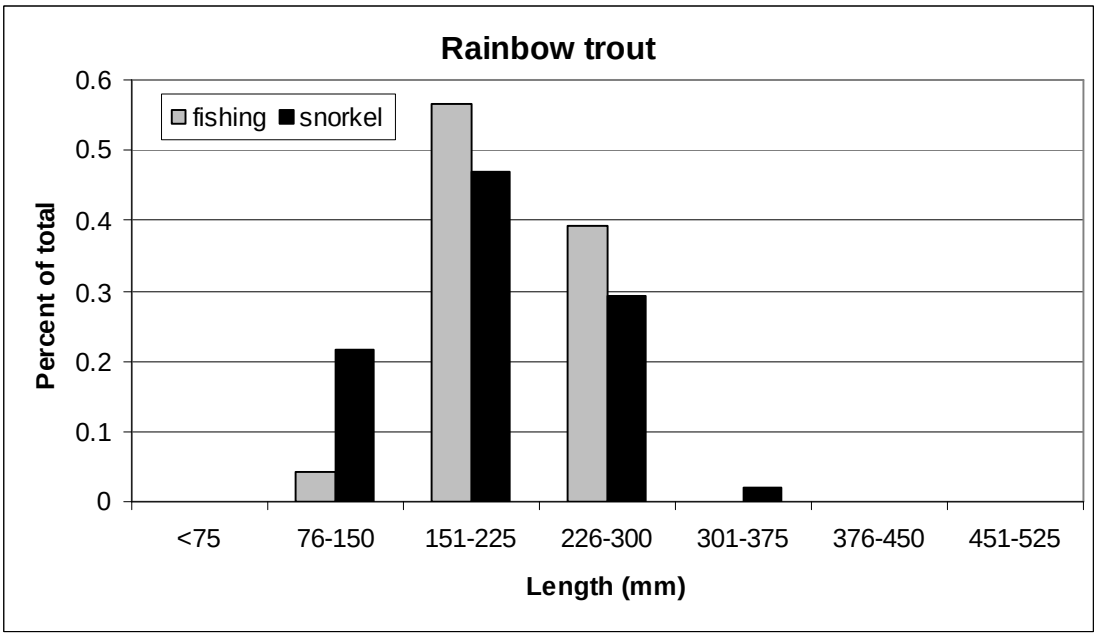
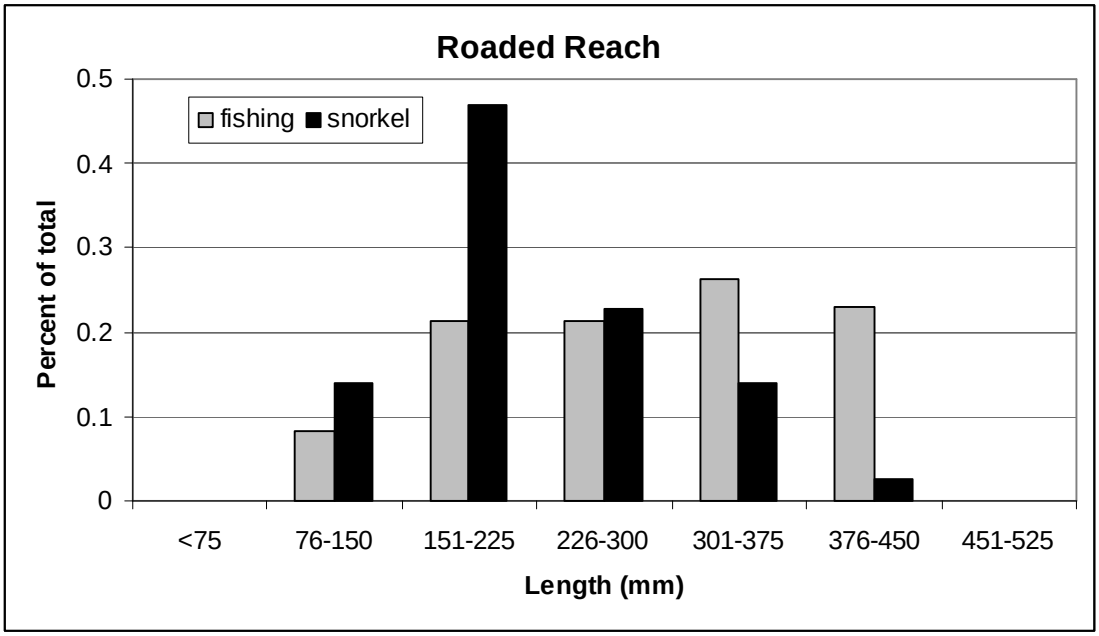


Figure 4. The lengths of cutthroat trout and rainbow trout caught while fishing (July 6-15, 2005) compared to what was observed during snorkel surveys (August 15-19, 2005) in the Little North Fork Clearwater River, Idaho.



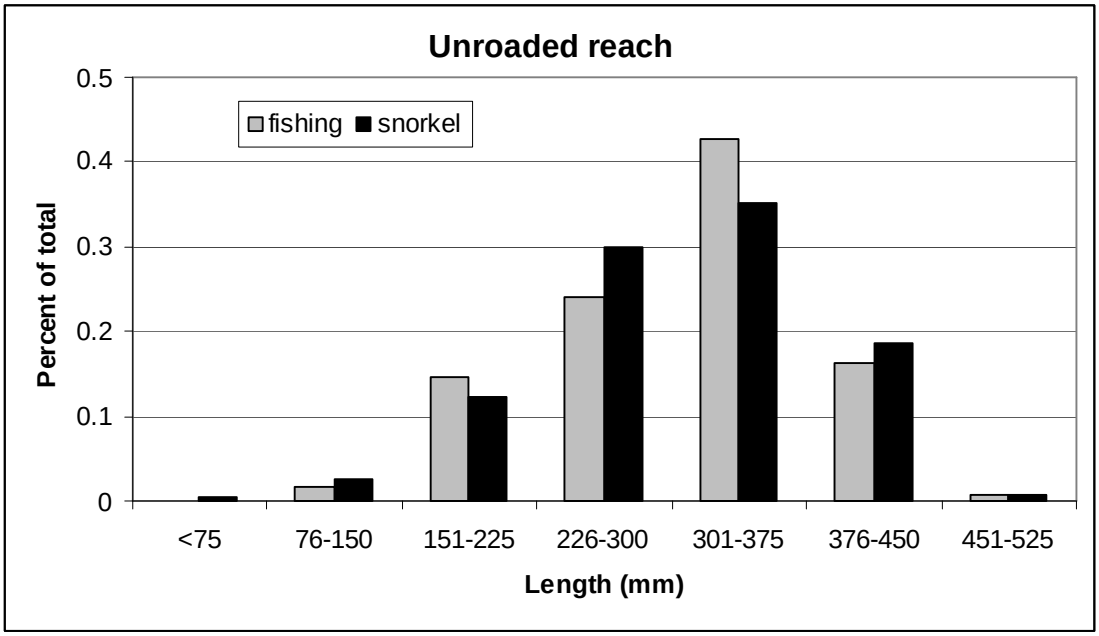


Figure 5. The lengths of cutthroat trout caught while fishing (July 6-15, 2005) compared to what was observed during snorkel surveys (August 15-19, 2005) in the roaded and unroaded reaches of the Little North Fork Clearwater River, Idaho.

DISCUSSION

Little North Fork Clearwater River Snorkel 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 densities 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 Panhandle (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 than 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 can not explain for this difference as exploitation appeared low (0.13) and 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 snorkel 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 Dworshak 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 trout of any size. 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 that in 2005, 56% of the recaptured fish were killed, whereas in 2002, 33% of the recaptured fish were killed. It is 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.

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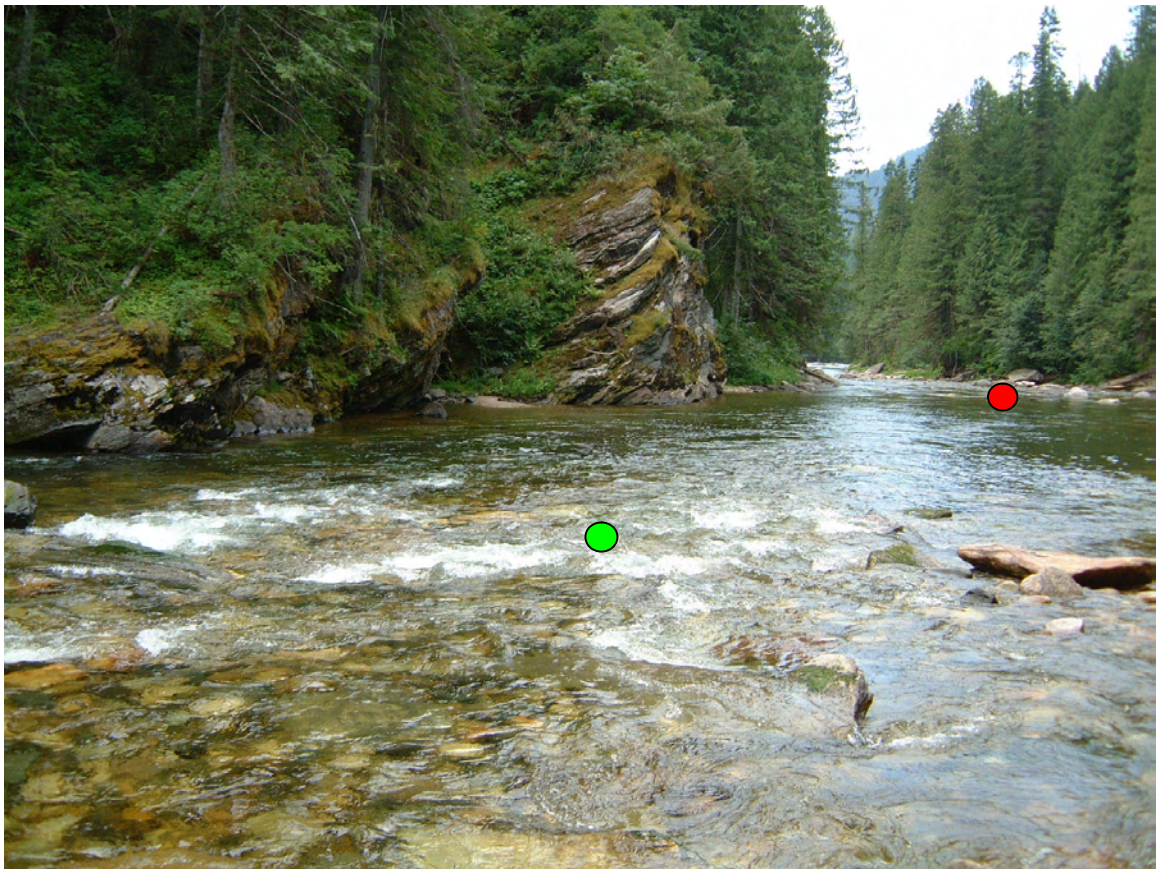
Appendix A. Habitat features collected while conducting snorkel surveys on the Little North Fork Clearwater River, Idaho, during August 15-19, 2005.

Reach	Transect	GPS (UTM11 NAD27) Easting	Northing	Date	Habitat Type	Dominant Cover	% cover	Max Depth (m)	Tem (˚C)	Time	Length (m)	Average Width	Area (m^2)
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

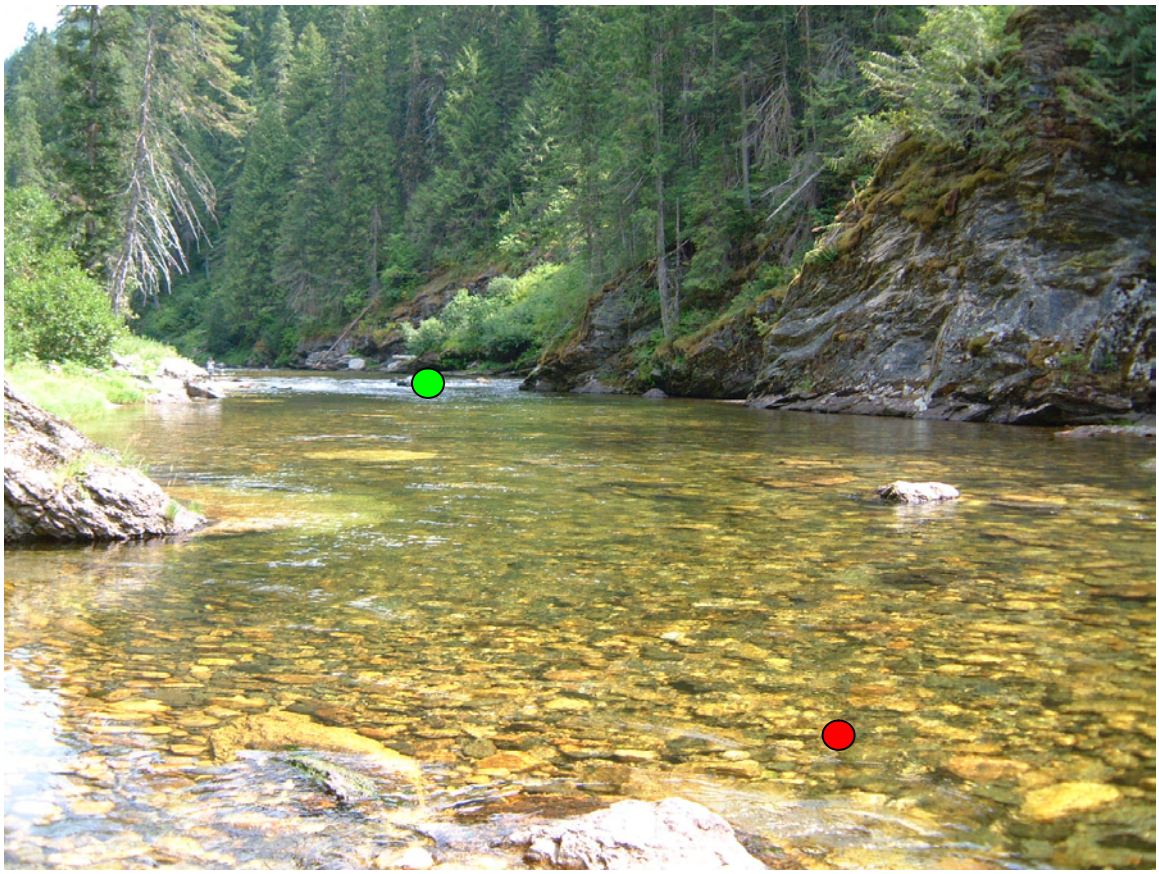
Appendix A (continued).

Reach	Transect	GPS (UTM11 NAD27) Easting	Northing	Date	Habitat Type	Dominant Cover	% cover	Max Depth (m)	Temp (˚C)	Time	Length (m)	Average Width	Area (m^2)
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

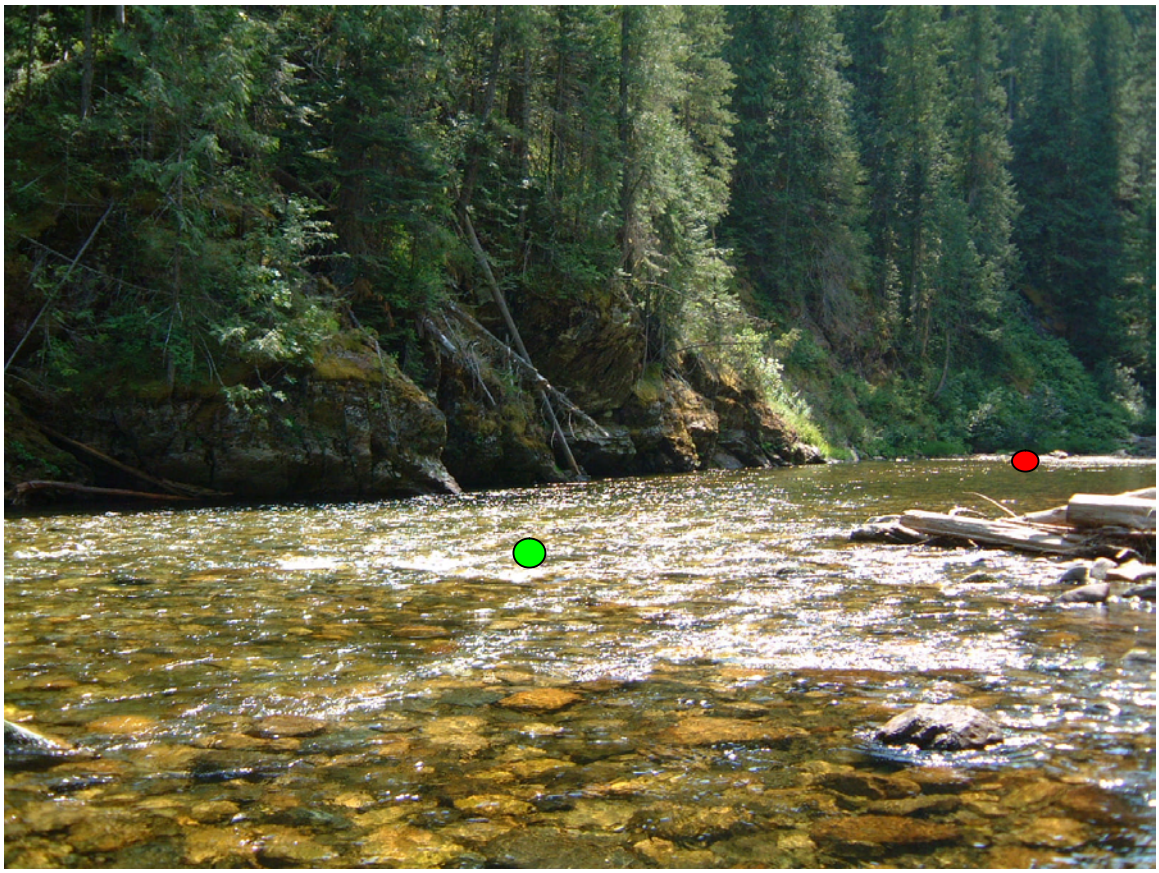
Appendix B. Photographs depicting locations of transects, starting (green dot) and stopping (red dot) points and approximate distance of stream to snorkel in the Little North Fork Clearwater River, Idaho. These photos were taken in 2002.



Transect 01 (top looking down)



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



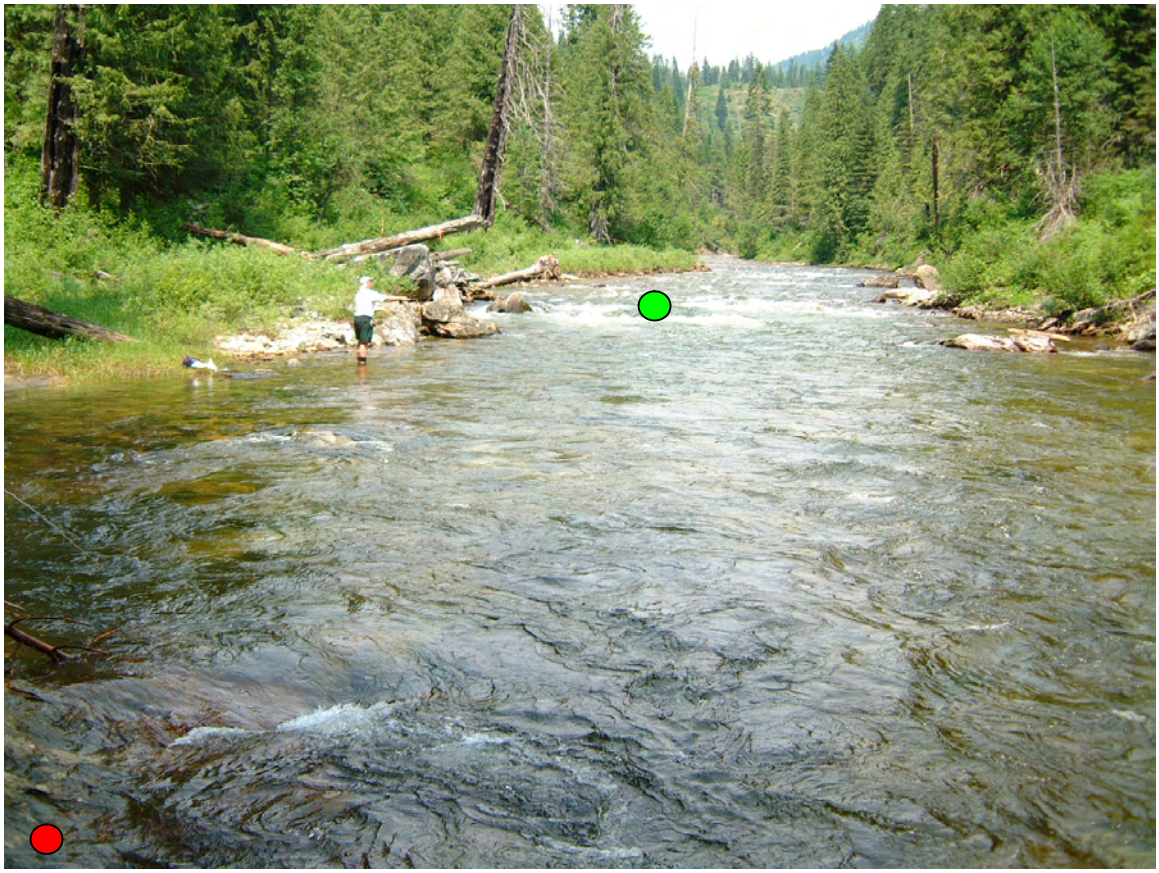
Transect 02
First large pool downstream of Foehl Ck. 48m

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.

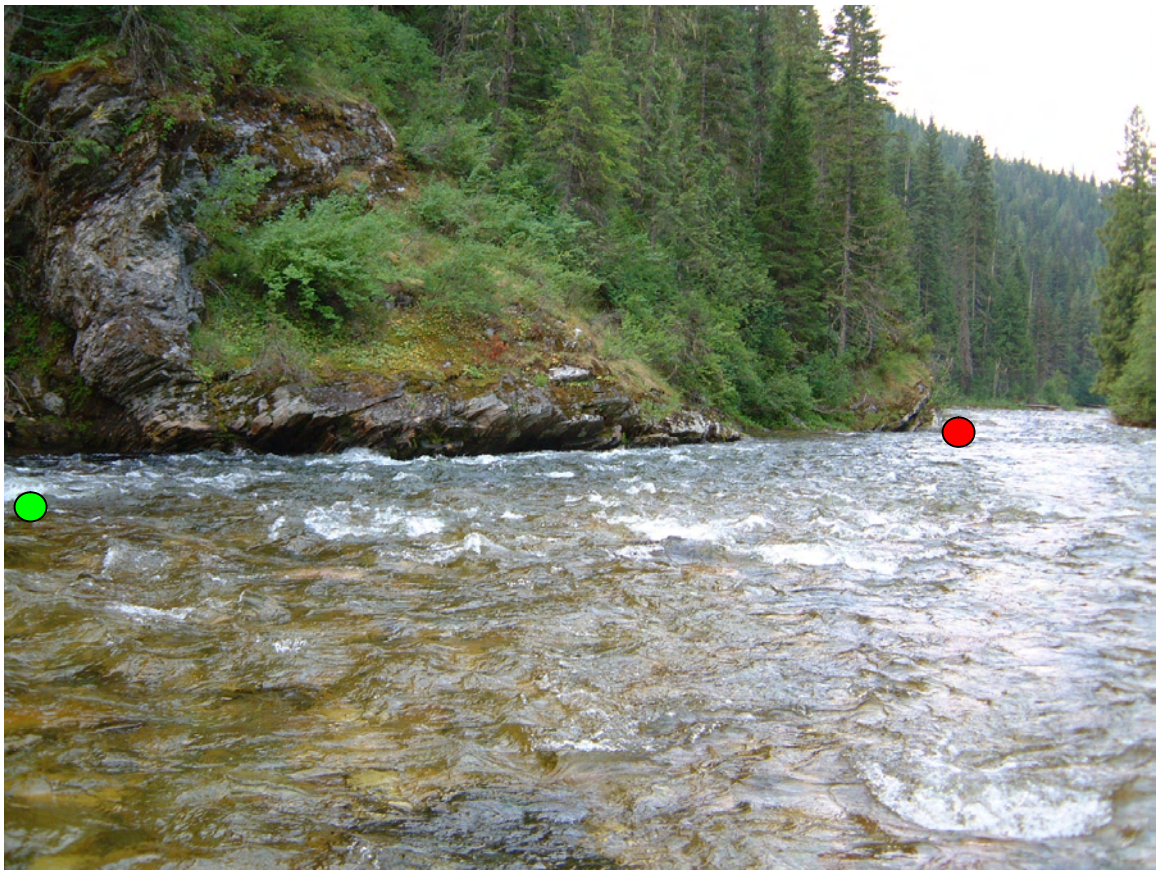
Transect 06

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

Transect 07

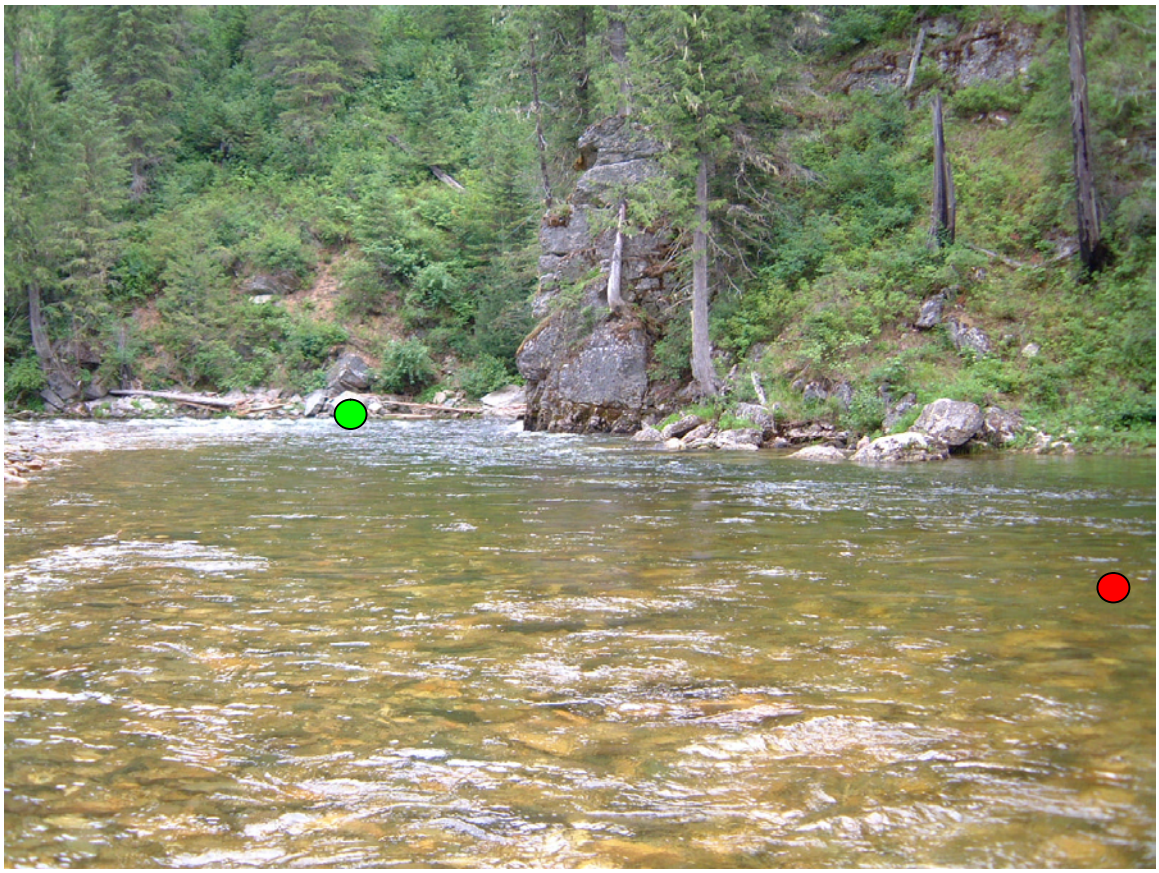
400m upstream of Larkins Ck. 41 m.

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

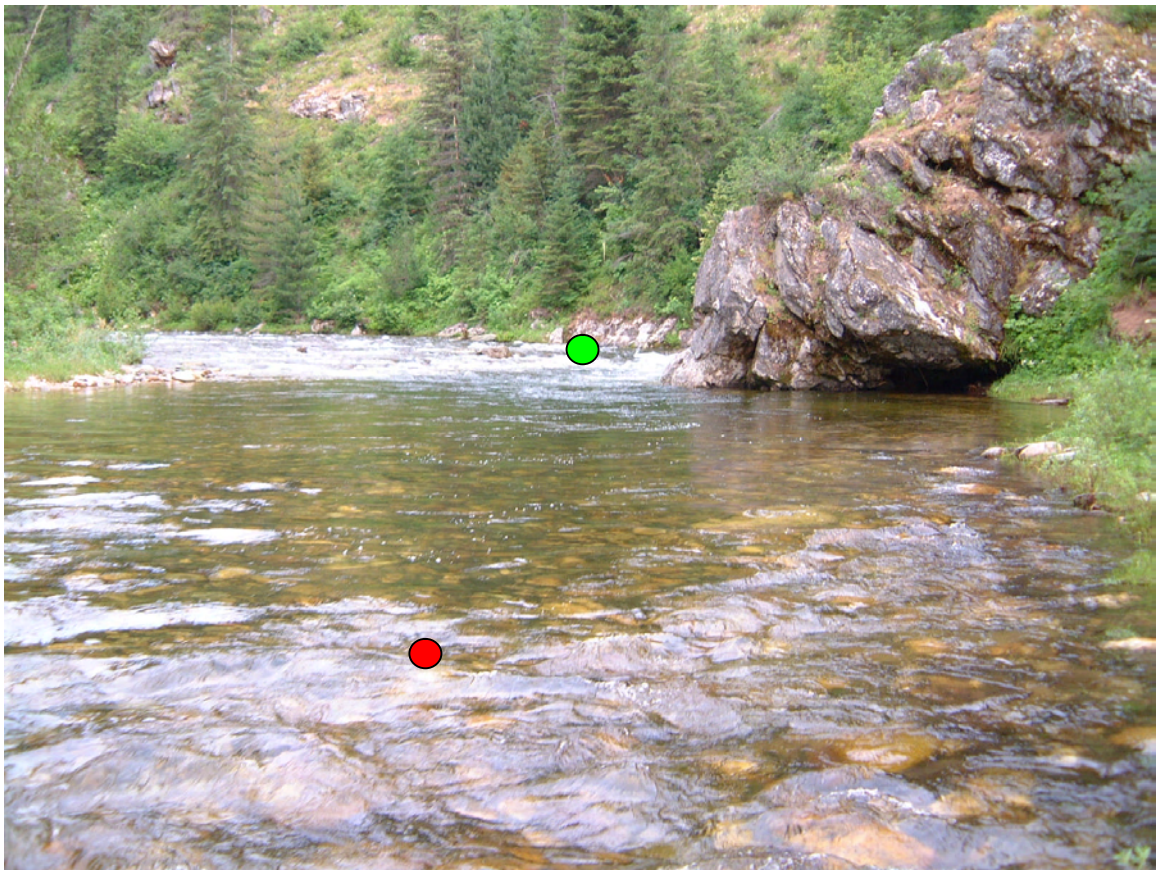


Transect 09

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 outcrop. 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

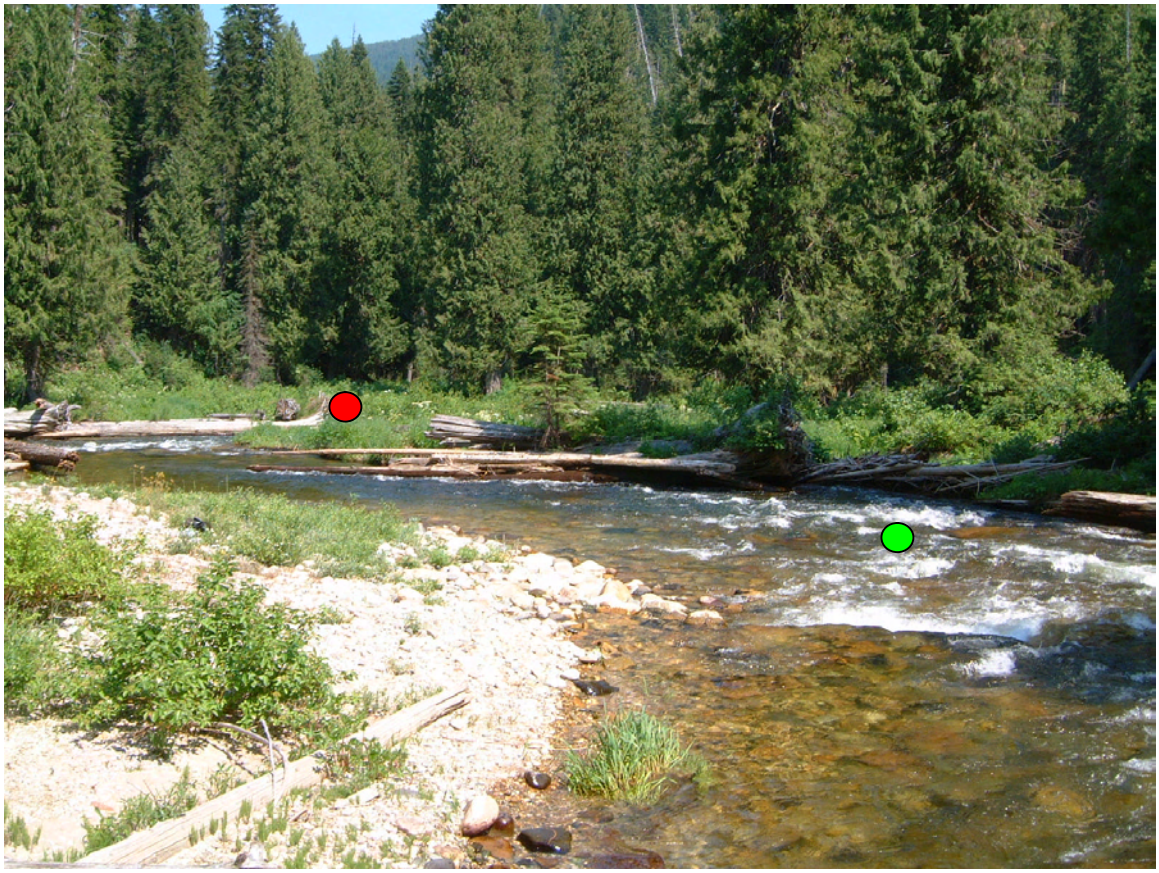
300 m downstream from Spotted Louis Ck. 51m

Transect 21

100m below Spotted Louis Ck. 37m

Transect 22

High gradient pocket water 50m downstream of site 23. Start where overflow joins. 42m

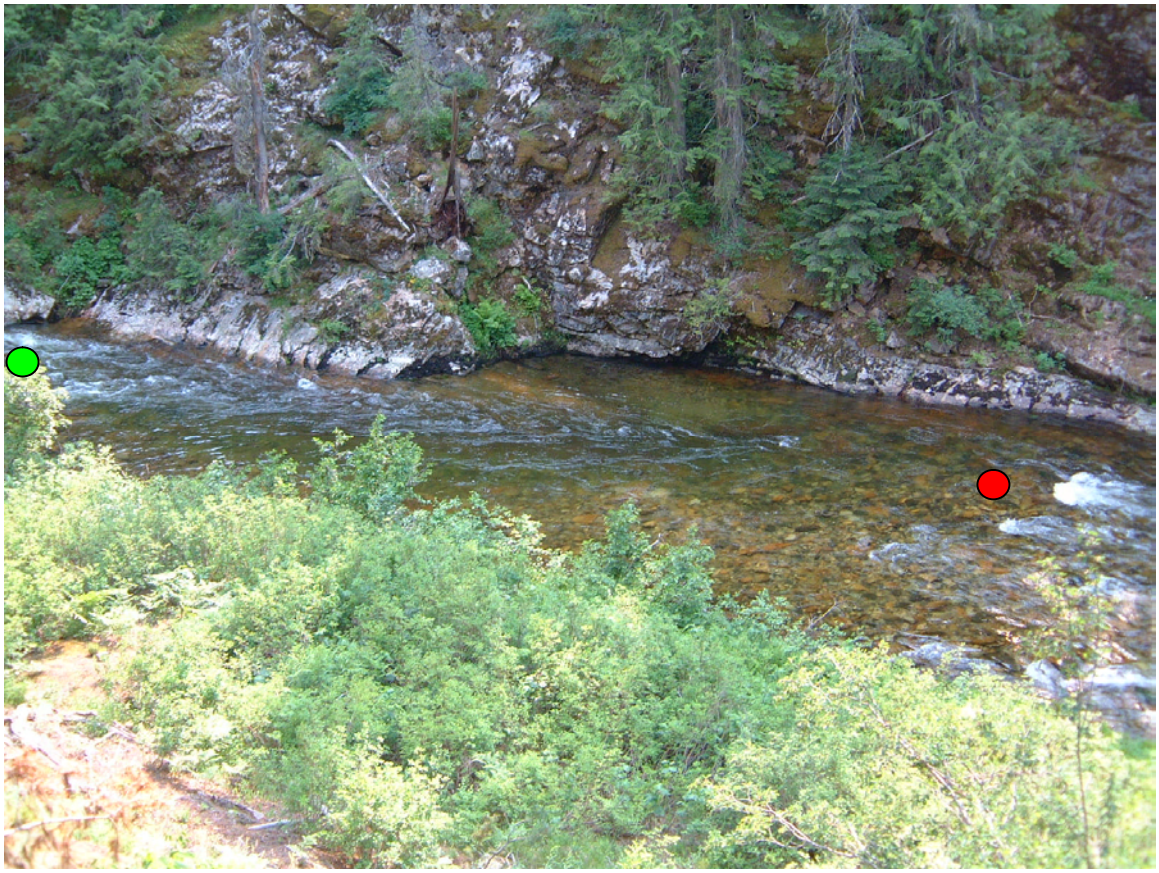


Transect 23

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

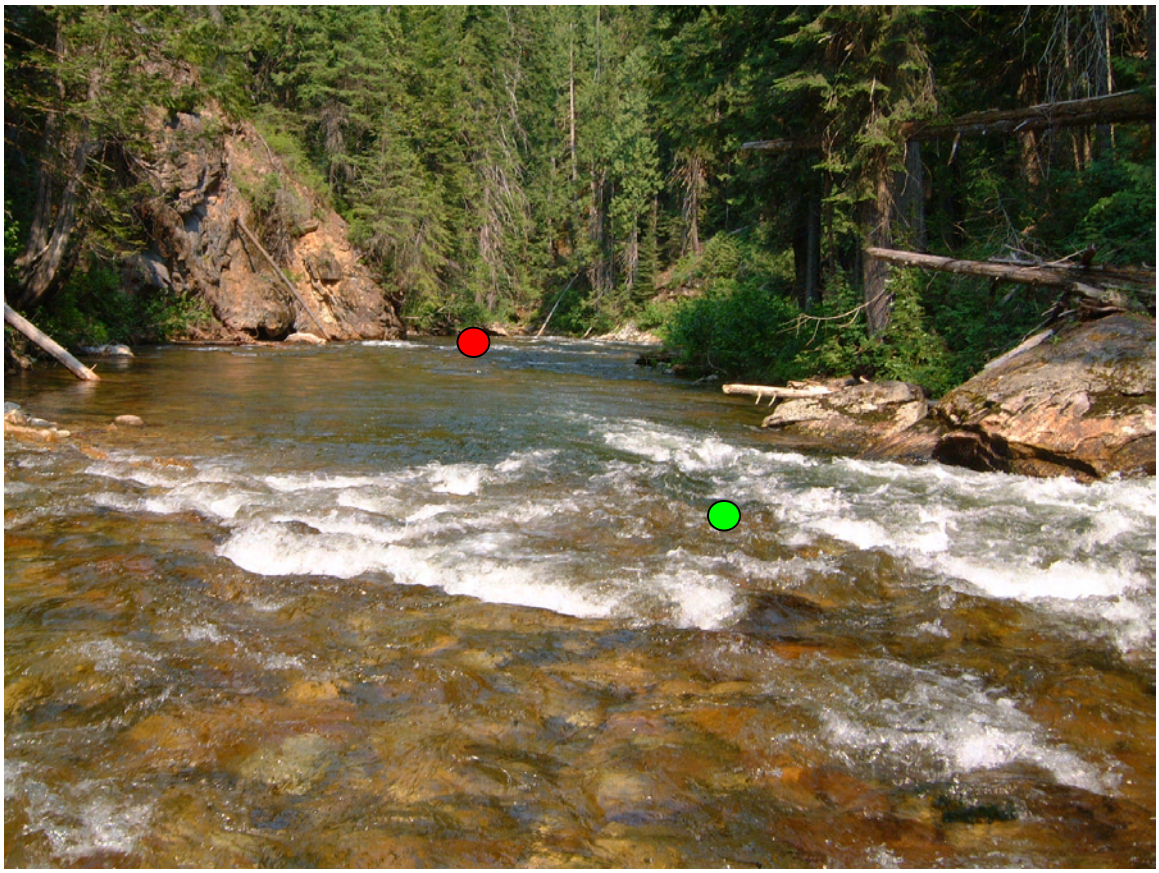
Transect 24

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

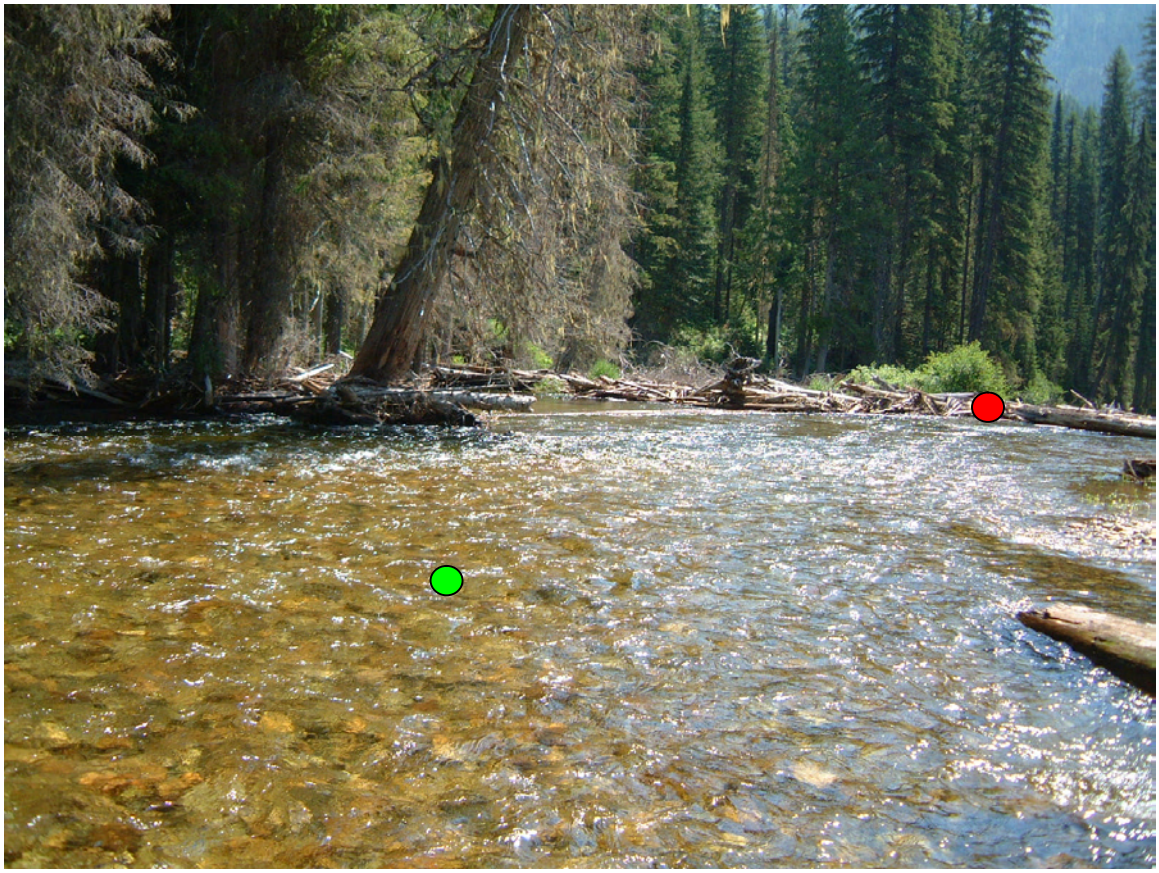
Just downstream of little tributary. 39 m.

Transect 31

150 m above Durham Ck. 29 m.

Transect 32

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



Transect 33

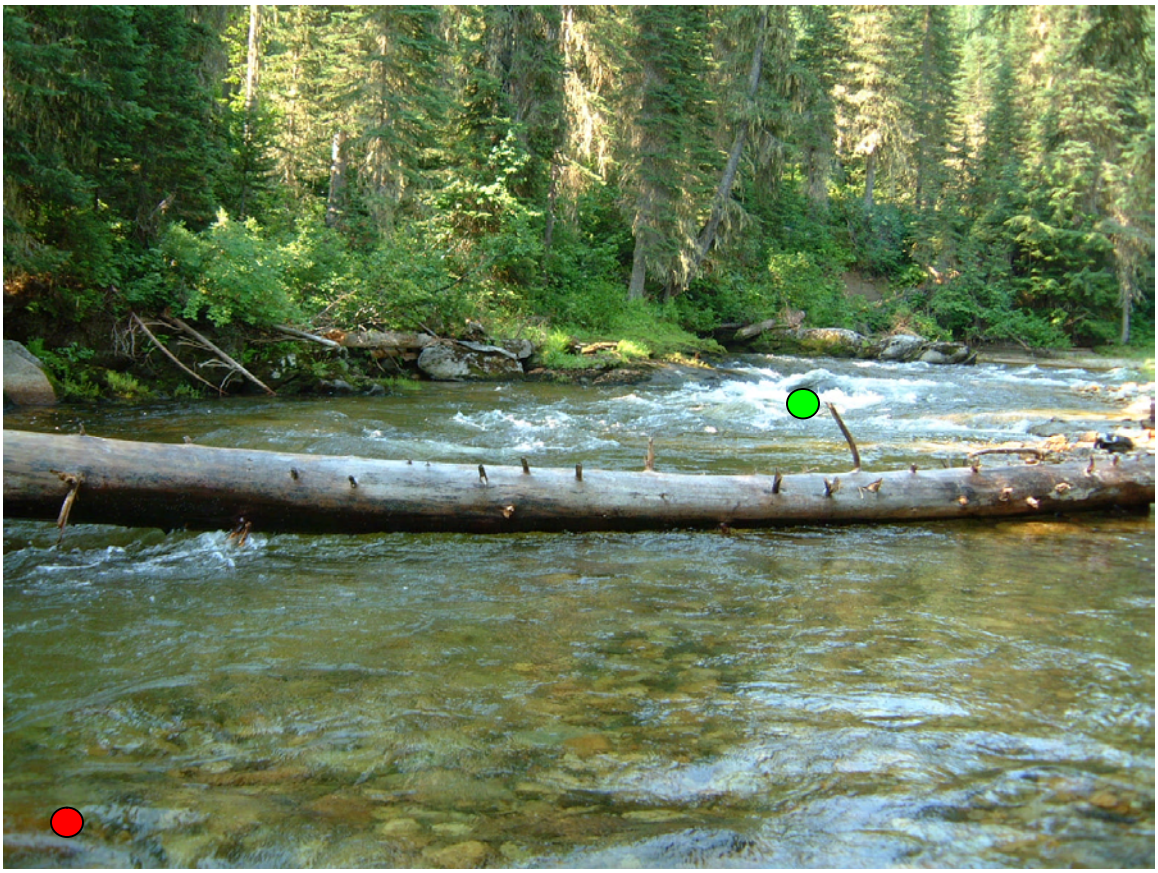
150 m up from Rutledge Creek. Big log jam. 44 m.

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

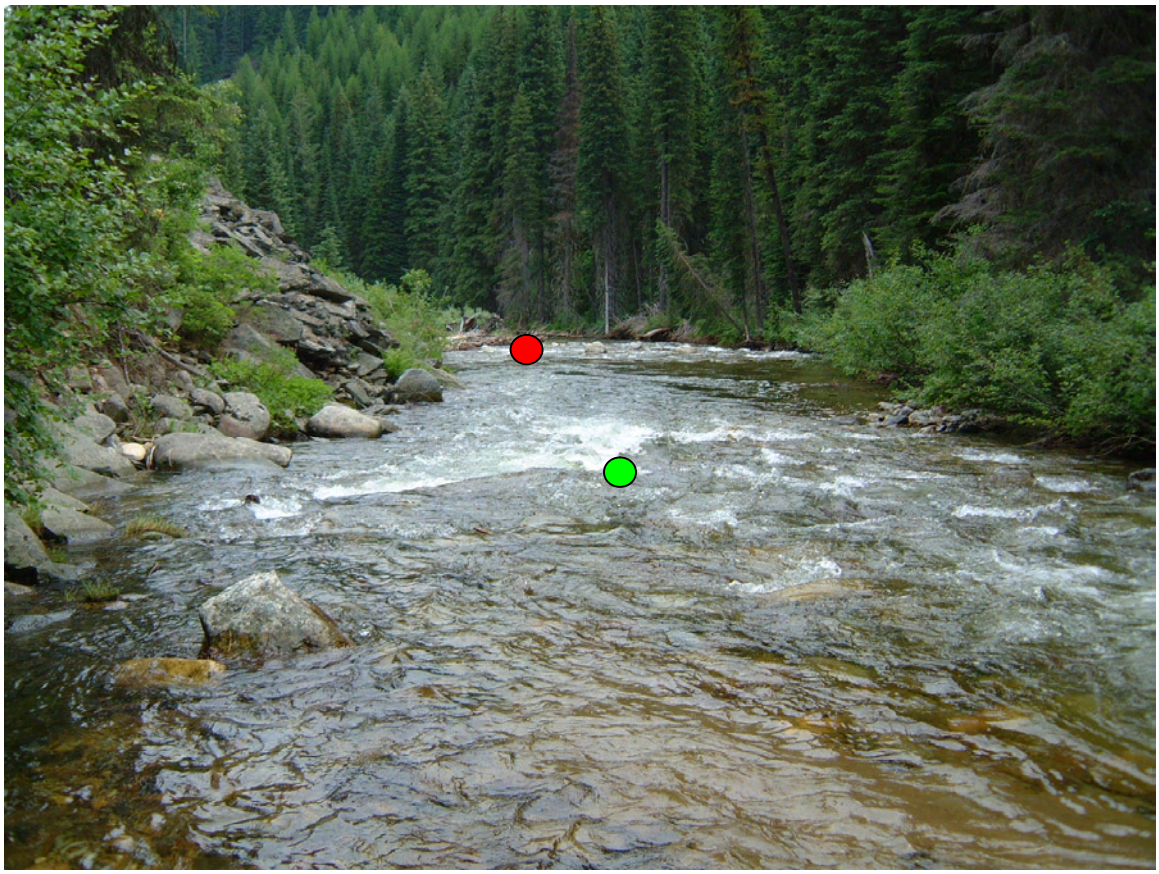
300 m upstream from Polar Ck. Run. 18 m.

Transect 39

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

Transect 40

13 m

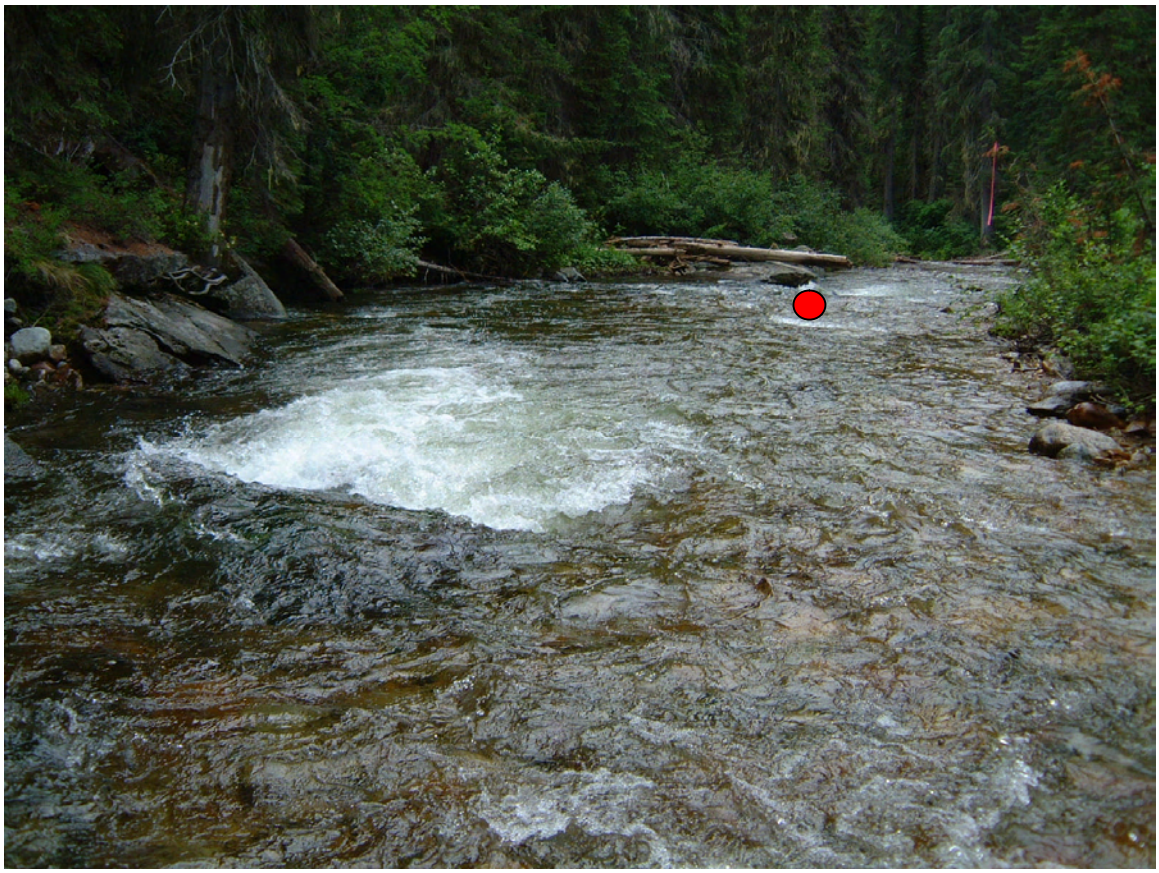


Transect 41

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)

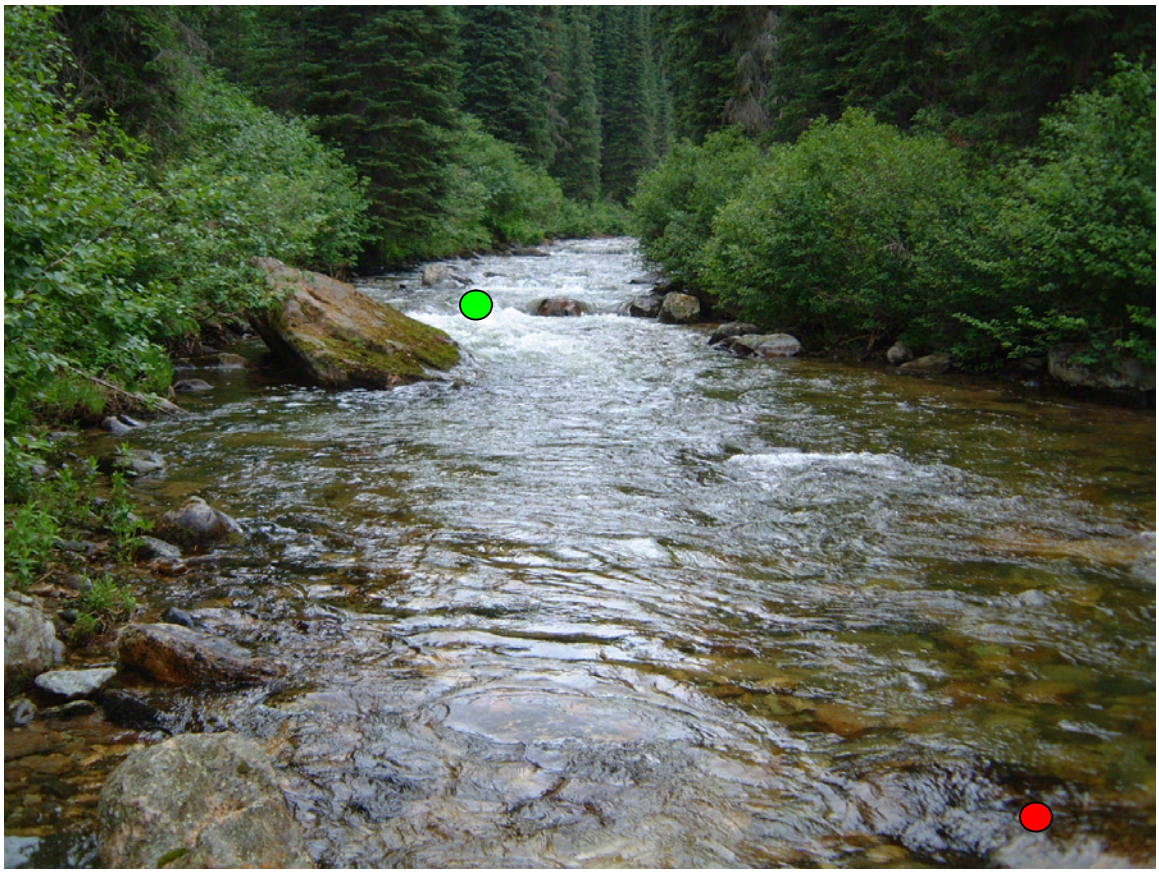
Series of three pools around sharp bend. 75 m.

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.

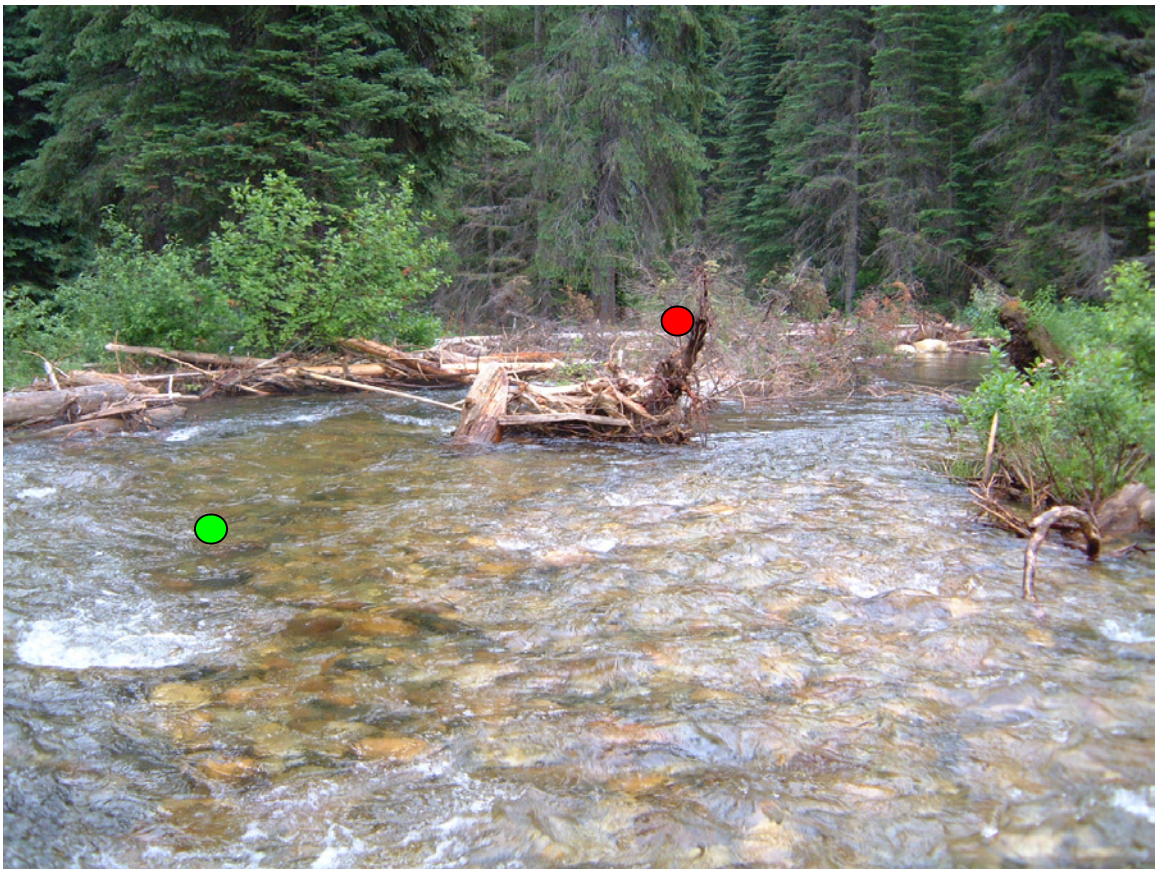


Transect 46

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.

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