



## **Bull Trout Studies in the Salmo River Watershed: 2001**

Report Prepared For:

BC Hydro  
Kootenay Generation Area  
601 18<sup>th</sup> Street  
Castlegar, B.C.  
V1N 4A2

Report Prepared By:

James Baxter  
Baxter Environmental  
209 Second Street  
Nelson, B.C.  
V1L 2K9

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## EXECUTIVE SUMMARY

This report summarizes the results of bull trout monitoring in the Salmo River watershed in 2001 by BC Hydro. Work conducted in 2001 included index swims and spawner and redd counts. In total, one initial watershed wide survey and six index section surveys were conducted. Bull trout were present in high densities in early summer within the surveyed section, but had begun their upstream spawning migrations by the end of July. In total, 28 redds and 92 spawners were enumerated in 2001. As previously documented, bull trout spawners and redds were observed in Sheep Creek, Clearwater Creek and the upper section of the Salmo River. We also observed mature bull trout and redds in Stagleap Creek and the South Salmo River. Sheep Creek was the area of the highest concentration of spawning activity, followed by the upper Salmo River, Clearwater Creek, and the South Salmo River watershed. In general, the swimming observer saw more bull trout and redds than the bank observer in all streams that were surveyed. These differences were significant for both fish ( $P < 0.001$ ) and redds ( $P = 0.003$ ).

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## INTRODUCTION

BC Hydro has taken a proactive role in monitoring the bull trout (*Salvelinus confluentus*) population of the Salmo River watershed over the past five years in response to facility upgrades at the Seven Mile Dam (see Baxter et al. 1998; Baxter 1999; Baxter and Nellestijn 2000; Baxter 2001a; Baxter 2001b). Over the past four years, the projects (focussing on bull trout) that BC Hydro has undertaken, or provided funding for, have included:

- juvenile density and distribution studies through electroshocking;
- water temperature and water chemistry monitoring;
- adult abundance monitoring through snorkel surveys;
- adult escapement monitoring through redd counts; and
- identification of adult movement, life-history and spawning sites through radio telemetry.

In 2001, BC Hydro continued studies in the watershed, specifically focussing on monitoring the abundance of adult bull trout in the drainage and contributing to an ongoing bull trout radio telemetry project. The specific objectives of the work in 2001 were to:

- conduct adult abundance surveys (snorkel surveys, and redd surveys) to monitor the status of the spawning population of bull trout in the watershed; and
- contribute funding towards aerial tracking flights of radio tagged bull trout in the watershed.

This report summarizes the results of the adult abundance surveys, while the third year of radio tracking results will be summarized in a separate report.



## STUDY AREA AND BACKGROUND

The Salmo River rises from the Selkirk Mountains 12 km southeast of Nelson, B.C. (Figure 1). The river flows in a southerly direction for approximately 60 km from its origin to the confluence with the Pend d'Oreille River (Seven Mile Reservoir). Geographic information is summarized in Table 1. The system is a 5<sup>th</sup> order stream, and has a total drainage basin area of roughly 123,000 ha.

**Table 1. Summary of geographic information for the Salmo River study area.**

Gazetted Name	Stream Length (km)	Area (ha)
Salmo River	60	123,000
<b>Geographic Information</b>		
Approximate distance and direction to the nearest town, city or landmark	12 km southeast of Nelson, B.C.	
MELP Region	4	
MELP Management Unit	4-8	
DFO District	Interior South East (#30)	
Ministry of Forests Region	Nelson	
Ministry of Forests District	Kootenay Lake	
NTS Base Map Reference	82 F/3 and 82 F/6	

Elevation in the basin ranges from 564 meters at its confluence to 2,343 meters at the height of land. Within this elevation range, the system comprises two biogeoclimatic zones (Braumandl and Curran 1992). At lower elevations, the valley lies within the Interior Cedar-Hemlock zone, while areas in the higher elevations are found within the Englemann Spruce-Subalpine Fir zone. The Salmo River has a total of eight 2<sup>nd</sup> and 3<sup>rd</sup> order tributaries (including Apex Creek, Clearwater Creek, Hall Creek, Barrett Creek, Ymir Creek, Porcupine Creek, Erie Creek, and Hidden Creek) and two 4<sup>th</sup> order tributaries (Sheep Creek and the South Salmo River) (Figure 1). The Water Survey of Canada maintains a gauging station on the Salmo River near the town of Salmo (Anonymous 1977). Mean annual discharge in the Salmo River (1949-1976) was 32.5 m<sup>3</sup>·sec<sup>-1</sup>, with mean monthly minimum and maximum values of 7.5 and 128.5 m<sup>3</sup>·sec<sup>-1</sup>, respectively. Runoff reaches a peak in May, with the highest flows between April and July each year. In addition to bull trout, many other fish species are distributed in the watershed. These include rainbow trout (*Oncorhynchus mykiss*), eastern brook trout (*S. fontinalis*), mountain whitefish (*Prosopium williamsoni*), largescale sucker (*Catostomus macrocheilus*), longnose sucker (*C. catostomus*), northern pikeminnow (*Ptychocheilus oregonensis*), longnose dace (*Rhinichthys cataractae*), redbside shiner (*Richardsonius balteatus*), and slimy sculpin (*Cottus cognatus*) (Sigma Engineering Ltd. 1996). Natural populations of steelhead trout (*O. mykiss*) and chinook salmon (*O. tshawytscha*) have been extirpated from this system due to hydroelectric development on the lower Columbia and Pend d'Oreille rivers.

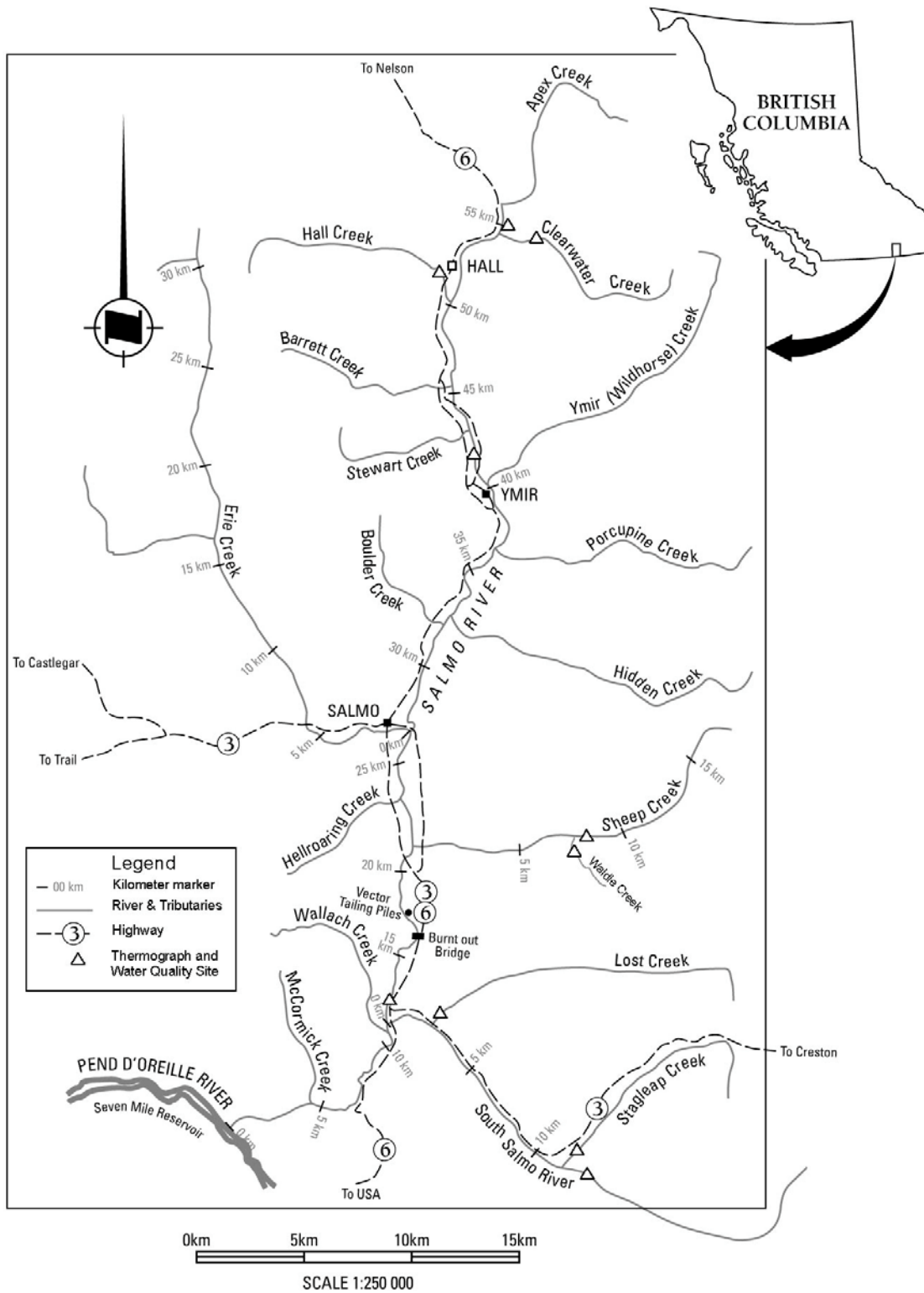


Figure 1. The Salmo River watershed study area.

## METHODS

### **Snorkel Surveys**

For this component of the study, observations were made during one initial distribution survey of the mainstem Salmo River in early summer, and during repetitive snorkel surveys in an index section over the summer in the mainstem Salmo River below the town of Salmo. During each sampling the river was surveyed by a crew of 2-5 swimmers (depending on water levels), and an appropriate number of swimmers aligned themselves perpendicular to stream flow to ensure adequate coverage of the stream. Each swimmer reported the total number of bull trout and other species observed in the section of river that was surveyed. Generally, counts were recorded every 200 to 250 m at known locations. This work was carried out in conjunction with a rainbow trout study being undertaken in the watershed. Using sightability estimates derived from the ongoing rainbow trout work, I expanded the count data to give a representation of how many bull trout (>30 cm) may have actually been in the section that was surveyed by snorkeling. Swims occurred from mid-June to the end of July.

### **Redd Counts**

Bull trout redds were enumerated in September in the main spawning locations that were identified or suspected from previous work. The areas surveyed were Clearwater Creek, Sheep Creek, the upper mainstem of the Salmo River, Stagleap Creek and the upper South Salmo River. A two person crew walked (one person) and swam (one person) sections of the stream looking for spawning fish on redds or the presence of redds. Bull trout redds were easily identified as recently disturbed areas of clean sorted substrate, and had a typical pit and mound associated with the disturbance. The total number of redds and the sex and estimated length of each observed bull trout were recorded during each survey. Surveys were carried out between September 17 and 25. A comparison between observations made by the bank observer and the swim observer was made to determine what method may actually provide a better estimate.

## RESULTS

### Snorkel Surveys

In total, one initial watershed wide survey and six index section surveys were conducted. A summary of the total number of each fish species observed during the surveys is presented in Table 2. The observations during the surveys suggested that bull trout (BT) were present in high densities in early summer within the surveyed section, but had begun their upstream spawning migrations by the end of July (Table 2). During the surveys, rainbow trout (RB), eastern brook trout (EB), sucker (SU), northern pikeminnow (NPM), and mountain whitefish (MW) were also observed (Table 2).

**Table 2. Summary of the number of fish species observed during snorkel surveys in the Salmo River in 2001.**

Survey no.	Survey date	Section	RB observed					BT	EB	MW	SU	NPM
			0-20cm	20-30cm	30-40cm	40-50cm	50+cm					
1		total				146	37	0	34	56	0	
2	28-Jun-01	index	161	64	73	55	7	16	1	4	47	5
3	04-Jul-01	index	287	147	77	35	6	18	12	6	62	0
4	06-Jul-01	index	195	135	96	42	9	26	4	4	181	0
5	16-Jul-01	index	388	135	69	38	8	10	5	3	169	28
6	18-Jul-01	index	277	136	92	41	9	1	3	2	180	25
7	30-Jul-01	index	528	161	93	49	13	10	14	4	135	32

The sightability of rainbow trout on each snorkel survey showed no increasing trend as water levels dropped and visibility increased (Table 3). Using these sightability estimates, the expanded counts of bull trout (>30 cm) are presented in Table 3.

**Table 3. Sightability estimates, and expanded counts of bull trout during snorkel surveys in the Salmo River in 2001 (using previously radio tagged fish).**

Survey no.	Survey date	Section	Sightability	BT	Expanded Count
1		total	0.375	37	99
2	28-Jun-01	index	0.6875	16	23
3	04-Jul-01	index	0.5	18	36
4	06-Jul-01	index	0.4375	26	59
5	16-Jul-01	index	0.4167	10	24
6	18-Jul-01	index	0.5385	1	2
7	30-Jul-01	index	0.5833	10	17

### Redd Counts

The results of the redd surveys for individual systems are presented in Appendix I. In total, 28 redds and 92 spawners were enumerated in 2001. As previously documented, bull trout spawners and redds were observed in Sheep Creek, Clearwater Creek and the upper section of the Salmo River (Table 4). We also observed mature bull trout and redds in Stagleap Creek and the South Salmo River (Table 4). Sheep Creek was the area of the highest concentration of spawning activity, followed by the upper Salmo River, Clearwater Creek, and the South Salmo River watershed.

**Table 4. Summary of the total number of bull trout and redds observed in the Salmo River watershed in 2001.**

<b>Watercourse</b>	<b>Total Number of Redds</b>	<b>Total Number of Bull Trout</b>
Clearwater Creek	11	23
upper Salmo River	1	23
Sheep Creek	8	29
South Salmo River	7	11
Stagleap Creek	1	6

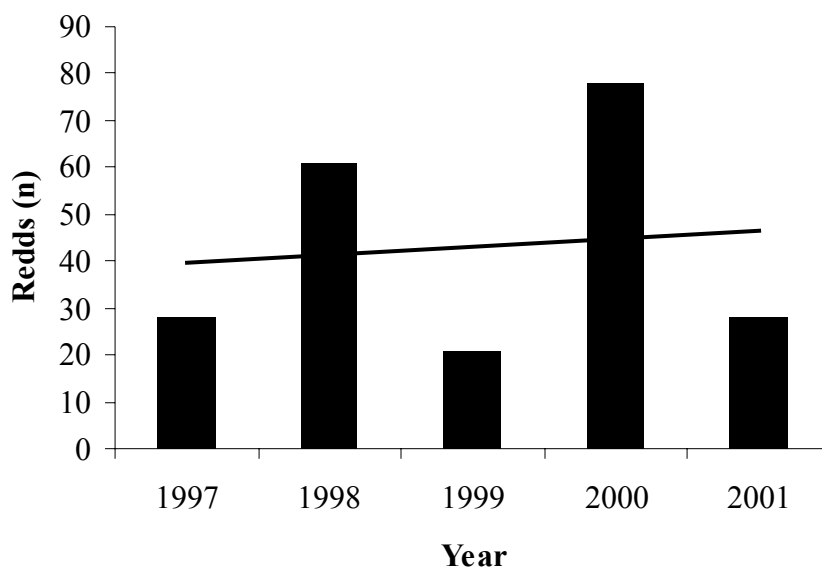
In general, the swimming observer saw more bull trout and redds than the bank observer in all streams that were surveyed (Table 5). These differences were significant for both fish ( $P<0.001$ ) and redds ( $P=0.003$ ).

**Table 5. Summary of differences in the number of bull trout and redds observed in the Salmo River watershed by a bank observer and swim observer in 2001 (SC=Sheep Creek, S=Salmo River, CC=Clearwater Creek, SS=South Salmo River).**

Section	Diver Fish	Walker	Difference	Diver Redds	Walker Redds	Difference
	Seen	Fish Seen		Seen	Seen	
SC-1	2	0	2	0	0	0
SC-2	3	3	0	1	0	1
SC-3	7	3	4	2	0	2
SC-4	3	3	0	1	0	1
SC-5	2	0	2	2	0	2
SC-6	0	0	0	0	0	0
SC-7	1	0	1	0	0	0
SC-8	1	1	0	0	0	0
SC-9	0	1	-1	0	0	0
SC-10	2	0	2	2	2	0
SC-11	3	1	2	0	0	0
SC-12	4	4	0	0	0	0
SC-13	0	0	0	0	0	0
S-1	1	0	1	1	0	1
S-2	2	0	2	0	0	0
S-3	1	0	1	0	0	0
S-4	4	0	4	0	0	0
S-5	1	0	1	0	0	0
S-6	2	0	2	0	0	0
S-7	4	1	3	0	0	0
S-8	8	8	0	0	0	0
CC-1	3	3	0	2	2	0
CC-2	3	2	1	3	3	0
CC-3	2	0	2	0	0	0
CC-4	2	0	2	0	0	0
CC-5	4	0	4	0	0	0
CC-6	2	0	2	3	3	0
CC-7	1	1	0	2	2	0
CC-8	2	2	0	0	0	0
CC-9	0	1	-1	0	0	0
CC-10	2	2	0	0	0	0
CC-11	1	0	1	0	0	0
CC-12	0	0	0	1	1	0
SS-1	6	3	3	1	0	1
SS-2	0	0	0	0	0	0
SS-3	0	0	0	1	0	1
SS-4	5	1	4	3	1	2
SS-5	1	0	1	0	0	0
SS-6	2	2	0	3	3	0
SS-7	2	0	2	0	0	0
SS-8	1	1	0	0	0	0

## DISCUSSION

As in past years, this year's project has contributed significantly to monitoring of bull trout escapement in the Salmo River watershed. Specifically, monitoring trends in bull trout redd abundance over the five years suggests that there has been a slight increase in the number of spawning bull trout within the watershed in odd years since 1997 (Figure 2). It is likely that a reduction in harvest opportunities for bull trout has allowed the increase to occur.



**Figure 2. The number of bull trout redds constructed at three sites within the Salmo River watershed over the past five years.**

Although not included in surveys during past years, the South Salmo River watershed was identified in 2001 as a major spawning area. This supports the radio telemetry data from 1999 and 2000 (see Baxter and Nellestijn 2000; Baxter 2001b), and identifies the watershed as an area where continued monitoring of spawning activity should occur. I attempted to enumerate bull trout redds in the U.S. portion of the South Salmo River in 2001, but access and transboundary issues limited the survey. U.S. fisheries personnel have identified a good access point now, and future surveys will include surveys in the U.S. section of the river. It is recommended that all spawner and redd surveys continue throughout the Salmo River watershed in future years.

Another result of this years work was the documented advantage the use of a combination team (one person snorkeling and one person walking) had over more traditional streamwalk surveys. During 2001 spawner and redd counts, the swim observer identified significantly more bull trout and redds that would not have otherwise been counted if traditional ground streamwalk surveys were utilized. It is recommended that this technique be used for the annual index redd count program.

The snorkel surveys in the index section of the mainstem Salmo River identified that a large portion of the bull trout population utilizes this section for holding and feeding during the early summer prior to beginning their spawning migrations. It is likely that there will be further reductions to fish harvest in this section as a result of the ongoing rainbow trout project, and these regulation changes may further improve the bull trout population status.



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**Appendix I. Summary data from bull trout redd counts conducted in the Salmo River watershed in 2001.**

### Clearwater Creek

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<b>Date</b>	<b>Location</b>	<b>Number of Redds</b>	<b>Number of Fish</b>
September 18	Falls to mouth	11	10 Males (30-65 cm) 13 Females (45-60 cm)

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### upper Salmo River

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<b>Date</b>	<b>Location</b>	<b>Number of Redds</b>	<b>Number of Fish</b>
September 19	Camp Busk to Barrett Creek	1	9 Males (55-80 cm) 14 Females (55-75 cm)

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### Sheep Creek

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<b>Date</b>	<b>Location</b>	<b>Number of Redds</b>	<b>Number of Fish</b>
September 17	Log jam to Aspen Creek	8	11 Males (30-65 cm) 18 Females (30-80 cm)

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### South Salmo River Watershed

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<b>Date</b>	<b>Location</b>	<b>Number of Redds</b>	<b>Number of Fish</b>
September 21	Stagleap Creek- Power Lines to mouth	1	4 Males (40-70 cm) 2 Females (35-40 cm)
September 21-24	South Salmo River- US Border to 4 km d/s Stagleap Creek	7	5 Males (30-70 cm) 6 Females (40-600 cm)

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