



**COLUMBIA BASIN
FISH & WILDLIFE
COMPENSATION
PROGRAM**

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**LAKE REVELSTOKE RESERVOIR BULL
TROUT RADIO TELEMTRY
PROGRESS REPORT 2002-2003**

PREPARED BY
K.E. Bray

FOR
Columbia Basin Fish & Wildlife Compensation Program

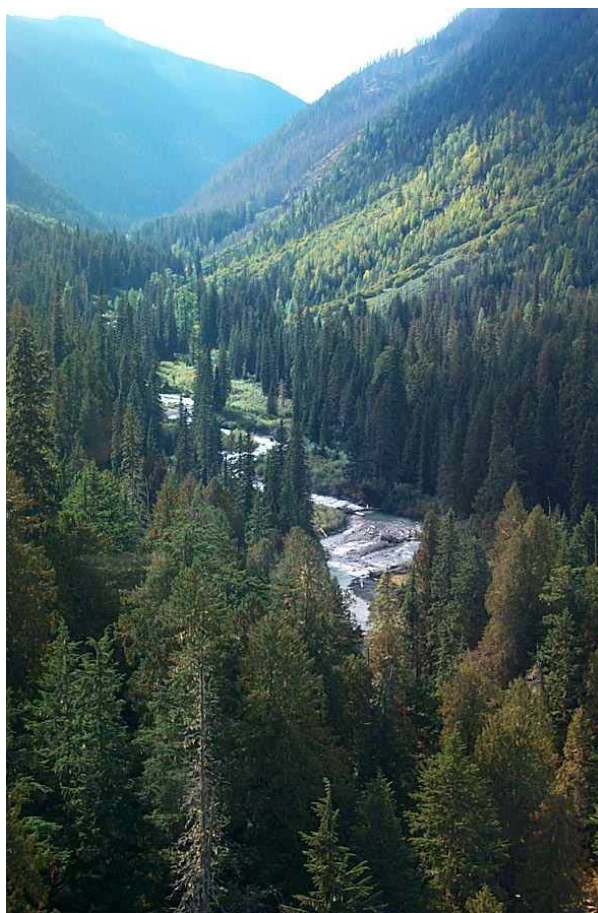
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**Lake Revelstoke Reservoir
Bull Trout Radio Telemetry**

**Progress Report 2002-2003
Year 2**

K. E. Bray



**Columbia Basin Fish and
Wildlife Compensation Program
Revelstoke, B.C.
January 2003**

Executive Summary

Bull trout are well adapted to live in the rugged, glacial environment of the Canadian Columbia River system, occupying the position of top predator in the aquatic food chain. They are, however, especially sensitive to impacts related to human activities, such as logging, hydroelectric development, mining, and urban growth, and are particularly vulnerable to angling. Despite what are considered to be the healthiest bull trout populations within the species' range, British Columbia bull trout were blue-listed in 1994, meaning they are considered vulnerable, and therefore, are afforded special consideration.

The goal of this project is to determine spawning and migratory movements of Lake Revelstoke Reservoir bull trout and identify spawning locations. This information is valuable for managing and protecting adfluvial bull trout by identifying critical habitats and run timing. Radio telemetry is an efficient and cost effective means of determining this kind of information and has been used extensively to determine spawning movements of bull trout. This project represents the final phase in a basin wide plan to investigate bull trout spawning locations and migratory movements in the large Columbia River reservoirs as part of a conservation strategy for the species.

This is the second year's progress report containing preliminary data only; a final report with complete interpretation will be prepared at the end of the project. Due to the sensitive nature of information related to bull trout spawning, staging, and overwintering locations, site specific data are not included in this report and are available once permission has been obtained from the Ministry of Water, Land and Air Protection.

Sixteen bull trout were radio tagged between 7 May and 7 July 2002. Aerial tracking by fixed wing aircraft and using a Lotek SRX-400 receiver began on July 17, 2002, and was conducted every one to two weeks until October 15, 2002. Fourteen fish were tracked to locations in Bigmouth (and its tributaries), Soards, Scrip, Ruddock, Kirbyville, and Birch Creeks, as well as one unnamed creek. All but two of the bull trout tracked into tributaries in 2001 returned in 2002. Of the two not returning, one was a mortality from the fall of 2001 and one has not been located since October 2001. Spawning locations and timing were confirmed in Louis Lee, Scrip, Ruddock, Birch, Mica, and Kirbyville Creeks. Migration timing was fairly consistent among tributaries and between years. Redd site characteristics were measured in different tributaries.

Tracking at the Mica tailrace will continue periodically through the winter and probably one flight will be conducted in March 2003 to look for fish distribution and possible overwintering locations in the reservoir. Aerial and ground tracking will continue until all tags are deactivated. Should there be any radio tags recovered with significant life in them, they will likely be re-deployed in new fish in 2003.

Acknowledgments

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Cover Photo: Ruddock Creek

Introduction

Listed as vulnerable, of special concern, threatened, or extirpated throughout most of its range, the bull trout (*Salvelinus confluentus*) has become a focus of investigation and conservation efforts over the last decade. Once pilloried as an insatiable predator of more desirable fish species and killed for a bounty, the bull trout is now recognised as an important top level piscivore and a valued char species endemic to the Pacific Northwest.

Bull trout are well adapted to live in the rugged, glacial environments of the Canadian Columbia River system. They are, however, especially sensitive to impacts related to human activities, such as logging, hydroelectric development, mining, and urban growth, and are particularly vulnerable to angling. Despite what are considered to be the healthiest bull trout populations within the species' range, British Columbia bull trout were blue-listed in 1994, meaning they are considered vulnerable, and therefore, are afforded special consideration.

The goal of this project is to determine spawning and migratory movements of Lake Revelstoke Reservoir bull trout and identify spawning locations. This information is valuable for managing and protecting adfluvial bull trout by identifying critical habitats and run timing. Radio telemetry is an efficient and cost effective means of determining this kind of information and has been used extensively to determine spawning movements of bull trout in the Columbia basin (e.g. O'Brien 1999; Baxter and Nellestijn 2000; Oliver 2000; Bray and Mylechreest, in prep.) and other remote environments.

This project represents the final phase in a basin wide plan to investigate bull trout spawning locations and migratory movements in the large Upper Columbia River reservoirs as part of a conservation strategy for the species. The Duncan, Arrow, and Kinbasket Reservoir projects are either complete or are nearing completion.

This project is cooperatively funded by Downie Street Sawmills Ltd., Louisiana Engineered Forest Products Ltd., Revelstoke Community Forest Corporation, and the Columbia Basin Fish and Wildlife Compensation Program (CBFWCP). The CBFWCP is a joint initiative between BC Hydro and the BC Government and arises out of BC Hydro's obligations with respect to fish and wildlife under its water licences for existing Columbia River dams. The CBFWCP's mandate is to conserve and enhance fish and wildlife habitat and populations that have been affected by construction of BC Hydro projects.

As this is the second year of a four year project this progress report contains preliminary data only. A final report with complete interpretation will be prepared at the end of the project. As much of the introductory information and methodology was reported on in the first year (Bray 2001), this report focuses on results only. Due to the sensitive nature of information related to bull trout spawning, staging, and overwintering locations, site specific data are not included in this report and are available once permission has been obtained from the Ministry of Water, Land and Air Protection.

Methods

Bull trout were captured by angling from May 7 – July 7, 2002. Fish were angled at the following locations: Mica tailrace, the upper reservoir, and various locations in the lower reservoir including: Downie Arm, Carnes Creek, LaForme Creek, and the Revelstoke Dam forebay. Capture effort was deliberately distributed throughout the reservoir to reduce bias and increase chances of fish entering all tributaries. The lower reservoir is known to be a difficult place to capture bull trout and successful radio tagging of nine fish from this area is testament to the great effort put in by volunteer anglers.

Methods for surgery, recovery, and tracking are described in Bray (2001). A red VI Alpha (Visible Implant Alpha-Numeric) tag was inserted in the clear tissue surrounding the eye to allow for external identification of individual fish. During spawning surveys, redd site characteristics were measured (e.g. length and width of redds; depths at nose, pit, and tail sections; nose section velocities) and location with respect to stream banks and pools/riffles and substrate sizes were noted.

Temperature loggers were redeployed in several tributaries in spring 2002 and new units were set at known spawning locations during fall surveys. Loggers are recording a year's worth of temperature data, therefore, no temperature information is available for this report.

Results

A total of 44 bull trout were radio tagged in 2001 and 2002, including 38 new tags and 6 tags recovered from mortalities. Twenty-four fish have been tagged from the closed area of the reservoir (between Mica Dam and Bigmouth Creek), 10 from the upper open fishery (Scrip to Downie) and 9 from the lower open fishery (Downie and south). Sizes ranged from 443mm to 822mm (Figure 1) and 850g to 9900g. Data on individual fish are included in Appendix I.

Spawning Movements

Similar to last year, fish were tracked to locations in Bigmouth (and its tributaries), Soards, Scrip, Ruddock, Kirbyville, and Birch Creeks, as well as one unnamed creek. One fish was also located once in Carnes Creek although it is not considered to have spawned. Spawning locations and timing were confirmed in Louis Lee, Scrip, Ruddock, Birch, and Kirbyville Creeks. Although no radio tagged fish were tracked into Mica Creek, spawning was confirmed during the course of another project. Migration timing was fairly consistent among tributaries and between years. All but two of the bull trout tracked into tributaries in 2001 returned in 2002. Of the two not returning, one was a mortality from the fall of 2001, the other was last located in the Mica tailrace in October 2001 and has not been located since. Only 2 fish (both males) switched tributaries between years, one of these remaining in the same watershed (i.e., switched to a different tributary in the same drainage area).

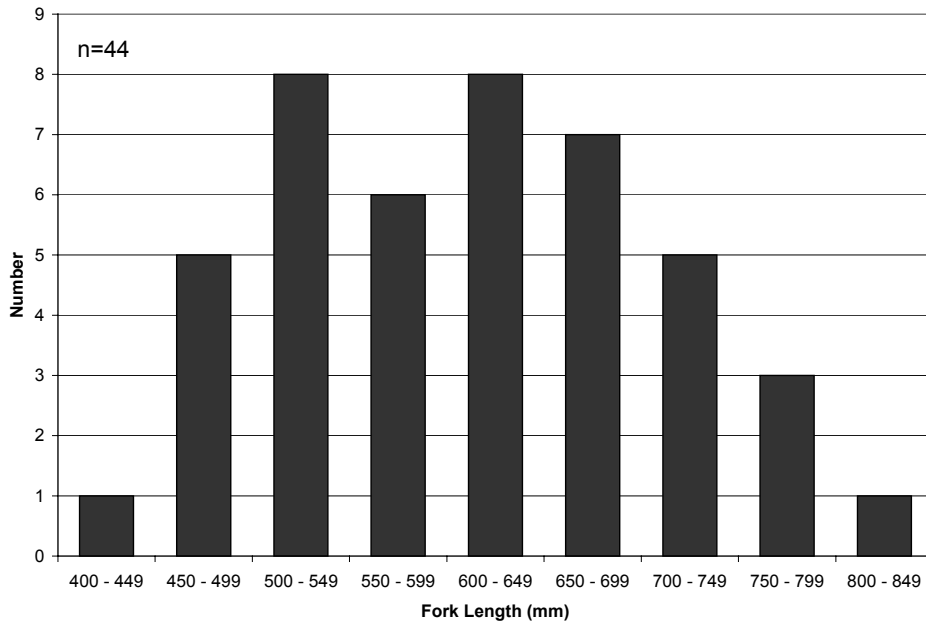


Figure 1. Length frequency of radio tagged bull trout in Lake Revelstoke Reservoir, 2001-2002.

Radio tagged fish in Lake Revelstoke Reservoir displayed a similar pattern of immigration, residence, and emigration as shown from other Columbia River reservoir telemetry studies (O'Brien 1999; Bray and Mylechreest in prep) and from 2001 data (Table 1). Fish were generally ascending tributaries at a rate of 0.2 – 1.2 km/day and exiting at a rate of 1 - 4 km/day. Spawning movements corresponded with mean daily stream temperatures of 6.2 - 12 °C and seasonal timing around the fall equinox when daylight approaches 12 hours. This year it was particularly noticeable that males remained at spawning locations longer than females. In some surveys conducted after the spawning peak, only single, male fish were observed. This observation was substantiated by radio tag location data.

As data on specific locations of bull trout spawning, staging, and overwintering could be used to cause significant harm to populations through illegal or over harvesting, this information is subject to a confidentiality policy by the Ministry of Water, Land and Air Protection (MWLAP). Any person or company having a demonstrated need for these data can apply to the MWLAP to have the information released. In order to keep this a publicly available document, any data that could be used to identify specific bull trout locations have been omitted, but are available as a separate appendix.

Table 1. Immigration, residence, and emigration timing per tagged fish and tributary for 2002. Timing is based on closest actual tracked date, and therefore, is only an estimate.

Code	Tributary	# Days of Immigration (maximum)	# Days of Residence	# Days of Emigration	Repeat?
4	Kirbyville	22	55	?	Yes*
38	Ruddock	23	33	<9	No
14	Ruddock	30	18	<9	No
25	Scrip	52	<7	<7	Yes
36	Scrip	37	23	<7	Yes
26	Unnamed	?	>23	<12	Yes
11	Soards	?	48	?	Yes
18	Birch	30	19	<8	Yes
19	Bigmouth	37	<13	?	No
13	Bigmouth Louis Lee	30	18	<9	No
29	Bigmouth Louis Lee	>38	27	~7	Yes
17	Bigmouth Louis Lee	14	21	~7	No
10	Bigmouth Louis Lee	44	8	<13	Yes
22	Bigmouth Big Fish	59	>20	~7	Yes*
Mean		35	24	9	
Range		14 - 59	8 - 55	8 - 13**	

*may not have been a spawner in 2001

**values are on the high side due to frequency of tracking

Other Migratory Movements and Tracking Results

Several bull trout did not enter tributaries to spawn, but were located during the tracking season. Radio tag signals can be received only if the fish are in sufficiently shallow water (at least <10 m deep); therefore, fish that retreat to the colder water depths of the reservoir would not be found. Certain individuals were usually located only at the Mica tailrace, sometimes only when water levels and discharge were low. Many bull trout appear to return to the Mica tailrace following spawning, probably to take advantage of kokanee congregating there. Although some bull trout entered tributaries they may not have been considered to be spawners. This is either because they spent such a brief period in the stream or from their location in the tributary. For example, one fish was found 7 kms up Carnes Creek, but by the next flight one week later it had left the tributary, a period that is usually too short for a spawning migration. Another fish remained a short distance upstream in Bigmouth Creek but never moved any further upstream. One fish that remained in this lower section for several weeks in 2001 was tracked to spawning grounds much farther upstream in the watershed in 2002.

Redd Site Characteristics

Several redd sites measurements, including length, width, depth, and, in some cases, velocity, were taken in Scrip, Ruddock, and Kirbyville Creeks, where conditions permitted (i.e., no fish on redds and good water clarity). Also noted were redd distances from banks and location with respect to pools/riffles. Redds exhibited a mean length of 2.3m, a mean width of 1.3m, and mean depths of 29cm, 33cm, and 19cm, for nose, pit, and tail sections respectively. Water velocity at the nose section ranged from 0.20m/s to 0.52m/s with a mean of 0.37m/s. Redds were always located in low gradient sections although the stream itself could be a high gradient, step-pool type. Redds are most often located at the tail-out of pools and/or close to a bank to provide cover for spawning fish.

Spawning locations were also closely related to sections of tributary which run through low gradient, wetland type areas that may provide a groundwater source. Other char species, such as eastern brook trout (*Salvelinus fontinalis*), select for areas of groundwater upwelling to maintain ice free conditions throughout the incubation period. These low gradient zones are common in the upper reaches of west side tributaries (Monashee Range); however, only some of these streams are accessible beyond the first few kilometres.

Future Work

Tracking at the Mica tailrace will continue periodically through the winter and probably one flight will be conducted in March 2003 to look for fish distribution and possible overwintering locations in the reservoir. Tags have a minimum life of 870 days, therefore, new tags implanted in 2002 should be active until 2004, allowing us to track fish through three spawning seasons. Aerial and ground tracking will continue until all tags are deactivated. Should there be any radio tags recovered with significant life in them, they will likely be re-deployed in new fish in 2003.

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- O'Brien, D.S. 1999. The Duncan River Bull Trout Telemetry Project (1995-1997). Prepared for the Columbia Basin Fish and Wildlife Compensation Program, Nelson, BC. 132 pp.
- Oliver, G.G. 2000. Kinbasket Reservoir Bull Trout Radio Telemetry Study; 1999 Tributary Use Summary. Prepared for Ktunaxa-Kinbasket Tribal Council.

Appendix I – Summary of Radio Tagged Fish Data

Tag Code	Date Caught	Date Tagged	Capture Location	Fork Length (mm)	Weight (g)	Sex	VI Tag #
1	30-May-01	30-May-01	Mica tailrace	561	2125	F	N38
2	04-Jun-01	05-Jun-01	Pitt Creek	548	1650	F	N42
3	15-Jun-01	16-Jun-01	Scrip Creek	691	3850	F	N55
4	18-Jun-01	19-Jun-01	Kirbyville Ck mouth	485	1100	M	N60
5	07-Jul-02	07-Jul-02	Downie	738	5250	F	N82
6	18-Jun-01	19-Jun-01	Kirbyville Lagoon	585	2200	F	N59
7	07-May-02	07-May-02	Downie	648	2700	F	N65
8	06-Jul-02	06-Jul-02	Downie	654	3750	M	N81
9	30-May-01	30-May-01	Mica tailrace	796	6300	M	N40
10	04-Jun-01	05-Jun-01	Pitt Creek	666	3250	F	N41
11	05-Jun-01	06-Jun-01	Pitt Creek	648	3400	M	N46
12	<i>25-Jun-02</i>	<i>26-Jun-02</i>	<i>LaForme Creek</i>	<i>443</i>	<i>850</i>	<i>M</i>	<i>N79</i>
13	<i>31-May-02</i>	<i>31-May-02</i>	<i>Scrip Creek</i>	<i>503</i>	<i>1400</i>	<i>M</i>	<i>N72</i>
14	<i>05-Jun-02</i>	<i>05-Jun-02</i>	<i>Mica tailrace</i>	<i>611</i>	<i>2950</i>	<i>M</i>	<i>N73</i>
15	30-May-02	30-May-02	Scrip Creek	611	2900	M	N71
16	09-May-02	10-May-02	Downie	738	3500	M	N68
17	30-May-01	30-May-01	Mica tailrace	770	6400	M	N39
18	05-Jun-01	05-Jun-01	Pitt Creek	508	1400	M	N43
19	05-Jun-01	06-Jun-01	Pitt Creek	505	1400	F	N48
20	14-Jun-01	14-Jun-01	Mica tailrace	613	3000	M	N50
21	<i>06-Jun-02</i>	<i>06-Jun-02</i>	<i>Mica tailrace</i>	<i>782</i>	<i>6450</i>	<i>M</i>	<i>N76</i>
22	18-Jun-01	19-Jun-01	Kirbyville Lagoon	548	1750	M	N61
23	03-Jul-02	04-Jul-02	Downie	465	950	F	N80
25	31-May-01	01-Jun-01	Pitt Creek	569	1875	F	none
26	05-Jun-01	05-Jun-01	Pitt Creek	575	2300	M	N45
27	05-Jun-01	06-Jun-01	Pitt Creek	490	1150	M	N47
28	<i>06-Jun-02</i>	<i>06-Jun-02</i>	<i>Mica tailrace</i>	<i>822</i>	<i>9900</i>	<i>F</i>	<i>N77</i>
29	16-Jun-01	17-Jun-01	Scrip Creek	551	1700	M	N58
30	27-Jun-01	27-Jun-01	Mica tailrace	676	5050	M	N63
31	16-May-02	16-May-02	Forebay	616	2600	M	N70
32	07-May-02	07-May-02	Downie	492	1175	M?	N67
33	05-Jun-01	05-Jun-01	Pitt Creek	510	1650	F	N44
34	05-Jun-01	06-Jun-01	Pitt Creek	545	1550	F	N49
35	<i>06-Jun-02</i>	<i>06-Jun-02</i>	<i>Mica tailrace</i>	<i>615</i>	<i>3150</i>	<i>F</i>	<i>N78</i>
36	16-Jun-01	16-Jun-01	Scrip Creek	689	3900	F	N56
37	27-Jun-01	27-Jun-01	Mica tailrace	648	3100	M	N64
38	11-May-02	11-May-02	Carnes	520	1550	M	N69
39	05-Jun-02	05-Jun-02	Mica tailrace	711	4900	M	none

italics denote recovered tag