Summary of the Third Year of Bull Trout (*Salvelinus confluentus*) Radio Telemetry in the Salmo River Watershed

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EXECUTIVE SUMMARY

In the summer of 1999 and 2000 a total of twenty bull trout were implanted with radio tags in the Salmo River watershed to determine the life-history and habitat use of the population. The specific objectives of the project were to identify major spawning, summering and overwintering areas, as well as to provide data on migration and spawning timing. A secondary objective was to determine if there was a migration to, or from, Seven Mile Reservoir by radio tagged bull trout. This report summarizes the third fall and winter of the radio tracking program.

During the project a total of five spawning areas were identified in the Salmo River watershed and included Clearwater Creek, the upper Salmo River, Sheep Creek, Stagleap Creek and the South Salmo River. Some of the fish that migrated into the South Salmo River spawned in the United States of America. The project also identified major overwintering areas in the mainstem Salmo River between 0.00 and 47.00 km. All overwintering areas were associated with deep pool, large woody debris, or boulder. Of the twenty tagged bull trout, only one made a downstream migration to the mouth of the Salmo River. However this fish was not tracked in the reservoir proper, and this further suggests that the population is a fluvial population.

ACKNOWLEDGEMENTS

Funding for the project was provided by the Columbia-Kootenay Fisheries Renewal Partnership and the Columbia Basin Trust. BC Hydro (Castlegar) also contributed funding to this work. The successful completion was made possible only as a result of the co-operation of a large number of organizations and individuals within the following organizations.

Columbia-Kootenay Fisheries Renewal Partnership and Columbia Basin Trust

Bill Green and Kenton Andreashuk provided comments on the project, while Jaime Christales provided administrative assistance.

BC Hydro

BC Hydro supplied the radio tags that were utilized for the study and provided equipment, personnel, and monies for tracking flights over the study period. Specifically Ric Olmsted, Gary Birch and Dave Wilson were instrumental in providing funds and expertise for the project, with Ric providing assistance with fish capture. Dean den Biesen also assisted in the field. Without the commitment of funds from BC Hydro over the past several years, much of the recent fisheries work would not have been undertaken in the watershed. These projects have not only benefited BC Hydro, but the community and government managers as well. I thank the company for their continued interest in the bull trout population.

BC Ministry of Water, Land and Air Protection

The Ministry of Water, Land and Air Protection provided tracking equipment and personnel to aid in the completion of the project. Specifically John Bell assisted with fish capture and tracking. Colin Spence provided equipment for the fixed station. Albert Chirico ensured collection permits were put in place to allow fish capture. Jay Hammond and Bob Lindsay provided insight into project requirements and management issues.

Salmo Watershed Streamkeepers Society

Community volunteers that are members of the Salmo Watershed Streamkeepers Society assisted with various components of the project. Peter Neil, Art Field, Alice Nellestijn, Alice Kuzma, Doug Ellis, Brian Henderson, Mike van Wijk, Darcy Torrans, the Maloney family, the Spilker family, and Bill and June Stockdale have all been instrumental in aspects of this work over the past three years. The dedication of my friend Gerry Nellestijn to the watershed and its bull trout population has also been a key factor in ensuring the success of this project. His contributions go well beyond those usually given by a volunteer organization. I praise him for his commitment.

Frank Communications Inc.

Alice Nellestijn produced maps and data sheets that were utilized for the study and ensured that collected data was safely stored and entered into the tracking database. She also produced a poster display that was shown at Fisheries Renewal meetings and open houses within the community. She's an all around great gal.

Baxter Environmental

Jeremy Baxter provided technical assistance with all aspects of this project, and also managed not to scream at me too much when he should have. John Hagen also assisted with some of this work, and provided useful commentary on management and conservation concerns regarding this population.

Seattle City Power and Light

Seattle City Power and Light provided an additional ten radio tags for use in the study if they were required.

Columbia Basin Fish and Wildlife Compensation Program

Equipment was provided by the Columbia Basin Fish and Wildlife Compensation Program.

Geosense Consulting Ltd.

Graham Smith provided mapping logistics.

Kokanee Helicopters

Duncan Wassick ensured aerial tracking could be undertaken.

Water Survey of Canada

Gordon Corcoran provided discharge data.

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1.0 INTRODUCTION

This project marks the third year of radio telemetry work conducted on the bull trout population of the Salmo River watershed. Initial studies in 1999/2000 involved tagging ten bull trout in the mainstem Salmo River and tracking the fish to their spawning and overwintering locations (Baxter and Nellestijn 2000). In addition migration and spawning timing were identified during the study. The results of the first year of study suggested that there was no use of Seven Mile Reservoir by the radio tagged bull trout. Spawning locations were identified in Clearwater Creek, Sheep Creek, the South Salmo River, Stagleap Creek, and the upper Salmo River.

In the summer of 2000 a second year of telemetry work was initiated, primarily in an attempt to tag bull trout in the mainstem Salmo River below the South Salmo River confluence or in the South Salmo River. This was the main focus of the tagging effort as it was felt that bull trout radio tagged below the confluence or in the South Salmo River had the highest probability of possibly having migrated from Seven Mile Reservoir. In short, it was felt by a number of biologists that a second year of tagging effort was warranted to collect more data from the bull trout that were already radio tagged, and to further address the potential for reservoir use. No new spawning areas were identified in the fall of 2000, and one of the ten additionally tagged fish made a downstream post-spawning migration to the mouth of the Salmo River (Baxter 2001a).

The main objectives of the initial two year study were to:

1. identify spawning areas (mainstem and tributary) within the watershed;
2. expand knowledge about the biology (migration timing, spawning timing, repeat spawning, spawning site fidelity) and habitat use (summering, spawning, and overwintering);
3. determine whether individuals within the Salmo River bull trout population utilize Seven Mile Reservoir for overwintering, or any other part of their life-history;
4. collect data that could be used in future conservation and enhancement opportunities;
5. promote community stewardship for the fisheries resources of the watershed; and

6. provide data that could be utilized in a management plan for the species in the watershed.

Funding was provided in 2001/2002 to conduct periodic tracking of the previously tagged bull trout during the spawning and overwintering period in order to provide a third year of data during spawning time. This report summarizes the results of this third year of tracking data.

2.0 METHODS

2.1 Study Site

The Salmo River rises from the Selkirk Mountains 12 km southeast of Nelson, B.C. (Figure 1). The river progresses 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^{th} order stream, and has a total drainage basin area of roughly 123,000 ha.

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 (ICH) zone, while areas in the higher elevations are found within the Englemann Spruce-Subalpine Fire (ESSF) zone. The Salmo River has a total of eight 2^{nd} and 3^{rd} order tributaries (including Apex Creek, Clearwater Creek, Hall Creek, Barrett Creek, Ymir Creek, Porcupine Creek, Erie Creek, and Hidden Creek) and two 4^{th} 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 $m^3 \cdot sec^{-1}$, with mean monthly minimum and maximum values of 7.5 and 128.5 $m^3 \cdot sec^{-1}$, respectively. Runoff reaches a peak in May, with the highest flows between April and July each year.

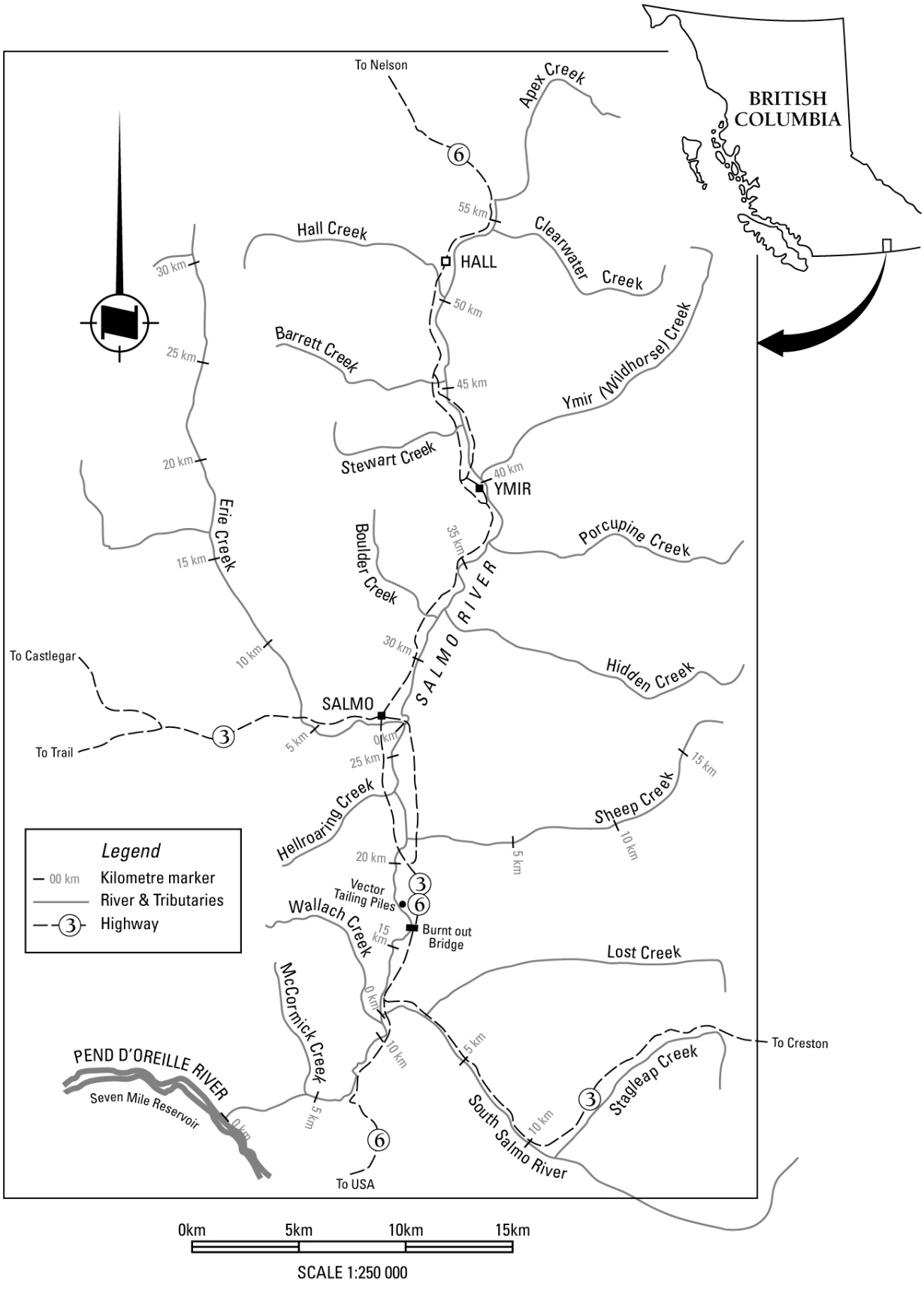

Figure 1. The Salmo River watershed study area.

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

Gazetted Name	Stream Length (km)	Area (ha)
Salmo River	60	123,000
Geographic Information		
Approximate distance and direction to the nearest town, city or landmark	12 km southeast of Nelson, B.C.	
MWALP Region	4	
MWALP 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	

2.2 Fish Capture and Tagging

2.2.1 Bull Trout Tagged in 1999

In 1999, bull trout in the Salmo River watershed were captured by angling. Capture primarily occurred in the mainstem Salmo River from early-July to the end of July, and continued again on August 31 with one fish being captured in a tributary (Clearwater Creek). The mainstem Salmo River was sampled from the town of Ymir to the South Salmo River confluence (roughly 60% of the available mainstem river habitat). Capture effort was focussed primarily on the mainstem Salmo River above the South Salmo River confluence, and not in Seven Mile Reservoir, for a number of reasons.

The primary reason was that it was felt that the timing of sampling effort would coincide with the upstream spawning migration of bull trout, and it would be an effective use of time and effort to sample above the South Salmo River confluence. The secondary reason was that fisheries work on Seven Mile Reservoir in 1994 and 1995 had failed to sample a large number of bull trout (R.L.&L. 1995) suggesting that the population was possibly a fluvial (mainstem overwintering) population and not an adfluvial (reservoir overwintering) population. The report also suggested that sampling efficiency would by higher in the Salmo River than in the reservoir. Effort was also limited to the areas above

the South Salmo River confluence due to access restrictions and the limited mainstem fish habitat (large pools) available below this point.

In total ten bull trout were tagged, and the methodology for radio tagging is presented in Baxter and Nellestijn (2000). Radio tags used during the first year of study were manufactured by Lotek Engineering in Newmarket Ontario. The tags used were model MCFT-3A (16 mm diameter, 50 mm length, 6.2 g weight in water, operation life >680 days), and were digitally coded tags transmitting on frequency 149.520.

2.2.2 Bull Trout Tagged in 2000

In 2000, bull trout in the Salmo River watershed were captured by two methods; angling and the use of fish fence operated on the South Salmo River (Baxter 2001b). All bull trout were radio tagged using the methodology outlined in Baxter and Nellestijn (2000). Radio tags used in this second year of study were also manufactured by Lotek Engineering. The tags used were model MCFT-3A (16 mm diameter, 50 mm length, 6.2 g weight in water, operation life >680 days; n=9) and model MCFT-3EM (11 mm diameter, 49 mm length, 4.3 g weight in water, operation life >399 days; n=1). The tags were digitally coded transmitting on frequencies 149.700 and 149.620.

In the mainstem, capture occurred between the mouth and the town of Ymir. In total five bull trout were tagged in the mainstem Salmo River from mid-June to mid-July. Two and three bull trout were tagged below and above the South Salmo River confluence, respectively. An additional five bull trout were tagged as outmigrating kelts from the South Salmo River between September 21 and October 17 2000 (see Baxter 2001b).

2.3 Tracking

In the third year tracking was carried out by aerial monitoring in a helicopter (A-STAR). In total three tracking surveys were carried out. I used a Lotek SRX-400 receiver in conjunction with a single two element Yagi antennae for all aerial tracking, and during

tracking the location of each fish was noted as a description (river location) and UTM co-ordinate.

3.0 RESULTS

3.1 Fish Capture and Tagging

3.1.1 Bull Trout Tagged in 1999

In 1999, A total of ten bull trout were implanted with radio tags of which nine fish were captured in the mainstem Salmo River between km 15 and km 30 (from the mouth), and one fish was sampled in a spawning tributary (Clearwater Creek). The date, capture location, sex, length (cm), radio tag code, and Floy tag number for each fish is summarized in Table 2. The average length of bull trout sampled was 57.0 cm, and catch per unit effort averaged 0.44 bull trout per angler day.

Table 2. Summary data of bull trout captured in the Salmo River watershed and implanted with radio tags in 1999.

Date	Capture Location (km)	Sex	Length (cm)	Code	Floy Tag #
07/15/99	Salmo River (18.45)	F	58.0	51	P-24025
07/07/99	Salmo River (17.25)	F	59.5	54	P-24004
07/15/99	Salmo River (23.05)	M	60.0	56	P-24007
07/11/99	Salmo River (25.25)	F	60.5	58	P-24005
07/17/99	Salmo River (21.05)	F	56.0	60	P-24022
07/07/99	Salmo River (25.25)	F	53.0	61	P-24003
08/31/99	Clearwater Creek (3.80)	F	54.0	65	W-C00148
07/11/99	Salmo River (17.85)	F	52.0	67	P-24006
07/11/99	Salmo River (18.45)	F	50.0	68	P-24024
07/09/99	Salmo River (23.05)	M	67.0	70	P-24002

3.1.2 Bull Trout Tagged in 2000

In 2000, an additional ten bull trout were implanted with radio tags of which five fish were captured in the mainstem Salmo River, and five fish were sampled as outmigrating kelts from the South Salmo River (see Baxter 2001b). The date, capture location, sex, length (cm), radio tag code, and Floy tag number for each fish is summarized in Table 3. The average length of bull trout sampled was 56.0 cm. Catch per unit effort averaged 0.53 bull trout per day.

Table 3. Summary data of bull trout captured in the Salmo River watershed and implanted with radio tags in 2000.

Date	Capture Location (km)	Sex	Length (cm)	Code	Floy Tag #
06/27/00	Salmo R (7.30)	M	40.0	9	G-0499, G-0500
06/28/00	Salmo R (11.80)	F	51.0	80	G-0906, G-0907
07/16/00	Salmo R (32.25)	F	45.0	84	G-0001, G-0002
07/18/00	Salmo R (39.90)	F	65.0	76	G-0004, G-0005
07/18/00	Salmo R (24.40)	F	56.5	77	G-0903, G-0904
09/21/00	South Salmo R (0.85)	F	57.5	78	B-0424, B-0423
09/28/00	South Salmo R (0.85)	F	63.0	83	B-0401, B-0402
10/10/00	South Salmo R (0.85)	M	59.5	82	B-0407, B-0408
10/11/00	South Salmo R (0.85)	M	65.5	79	B-0409, B-0410
10/17/00	South Salmo R (0.85)	M	59.5	85	B-0411, B-0412

3.2 Tracking

3.2.1 Spawning Locations

The spawning locations of bull trout radio tagged in 1999 over the past three years are summarized in Table 4, while spawning locations of bull trout radio tagged in 2000 over the past two years are summarized in Table 5. In the first year of the study repeat spawning was 80%, while in the second year it was 85%. Site fidelity was 87.5% in the first year, and 100% in the second year.

Table 4. Summary data of spawning locations in 1999, 2000, and 2001 of bull trout captured in the Salmo River watershed and implanted with radio tags in 1999.

Code	Sex	1999 Spawning Location (km)	2000 Spawning Location (km)	2001 Spawning Location (km)
51	F	Sheep Creek (6.15)	Did not spawn	Not found
54	F	South Salmo River (11.05)	Salmo River (37.10)	South Salmo River (11.30)
56	M	South Salmo River (16.75)	South Salmo River (16.55)	Sheep Creek (?)
58	F	South Salmo River (12.20)	South Salmo River (13.75)	South Salmo River (11.05)
60	F	Salmo River (53.80)	Salmo River (55.35)	Not found
61	F	Sheep Creek (7.55)	Sheep Creek (7.20)	Not found
65	F	Clearwater Creek (3.80)	Clearwater Creek (0.95)	Clearwater Creek (?)
67	F	Stagleap Creek (0.85)	Stagleap Creek (0.85)	Not found
68	F	Clearwater Creek (3.80)	Did not spawn	Not found
70	M	Salmo River (54.70)	Salmo River (54.50)	Not found

Table 5. Summary data of spawning locations in 1999, and 2000 of bull trout captured in the Salmo River watershed and implanted with radio tags in 2000.

Code	Sex	2000 Spawning Location (km)	2001 Spawning Location (km)
9	M	Did not spawn	Not found
80	F	South Salmo River (17.00)	South Salmo River (16.55)
84	F	Did not spawn	Clearwater Creek (1.00)
76	F	Salmo River (54.75)	Salmo River (54.75)
77	F	Clearwater Creek (2.90)	Clearwater Creek (2.90)
78	F	South Salmo River (?)	South Salmo River (16.55)
83	F	South Salmo River (?)	South Salmo River (10.00)
82	M	South Salmo River (?)	Did not spawn
79	M	South Salmo River (?)	Stagleap Creek (0.85)
85	M	South Salmo River (?)	South Salmo River (17.05)

3.2.2 Overwintering Habitat Locations

The overwintering locations of bull trout radio tagged in 1999 over the past three years are summarized in Table 6, while overwintering locations of bull trout radio tagged in 2000 over the past two years are summarized in Table 7. In all cases where there is sufficient overwintering data, locations were identified in the mainstem Salmo River. Although it is likely that the batteries had died in the fish that were tagged in 1999 and thus no overwintering locations were available for 2002, it is surprising that only three overwintering locations were identified in 2002 for fish that were tagged in the summer of 2000.

Table 6. 1999, 2000, and 2001 overwintering locations of bull trout radio tagged in 1999.

Code	Sex	1999 Overwintering Location (km)	2000 Overwintering Location (km)	2001 Overwintering Location (km)
51	F	Salmo River (18.45)	Salmo River (19.35)	Not found
54	F	Salmo River (17.75)	Salmo River (36.35)	Not found
56	M	Salmo River (21.05)	Salmo River (21.05)	Not found
58	F	Salmo River (24.00)	Salmo River (25.25)	Not found
60	F	Salmo River (13.15)	Salmo River (16.85)	Not found
61	F	Salmo River (20.00)	Salmo River (24.00)	Not found
65	F	Salmo River (36.35)	Salmo River (36.35)	Not found
67	F	Salmo River (16.85)	Salmo River (12.15)	Not found
68	F	Salmo River (18.45)	Salmo River (18.45)	Not found
70	M	Salmo River (23.05)	Salmo River (24.00)	Not found

Table 7. 2000 and 2001 overwintering locations of bull trout radio tagged in 2000.

Code	Sex	2000 Overwintering Location (km)	2001 Overwintering Location (km)
9	M	Salmo River (5.70)	Not found
80	F	Salmo River (46.45)	Not found
84	F	Salmo River (5.70)	Not found
76	F	Salmo River (25.25)	Not found
77	F	Salmo River (16.85)	Not found
78	F	Salmo River (0.20)	Not found
83	F	Salmo River (16.85)	Not found
82	M	Salmo River (11.80)	Salmo River (10.70)
79	M	Salmo River (32.25)	Salmo River (12.80)
85	M	Salmo River (9.35)	Salmo River (15.40)

Although one radio tagged bull trout was confirmed to have migrated to the mouth of the Salmo River through the use of a fixed telemetry station in 2000, on each occasion the fish was tracked it was found in association with the influence of the Salmo River (i.e., not present in the reservoir proper). As such, it appears that the reservoir is not used as overwintering habitat by adult bull trout.

4.0 DISCUSSION

This summary report concludes the bull trout radio telemetry project in the Salmo River watershed, with a large amount of data being generated from the work. It is likely that all current spawning areas in the watershed have been identified, and during the three years of the program Sheep Creek, Clearwater Creek, the upper Salmo River, Stagleap Creek, and the South Salmo River were all used for spawning. Given the current small size of the population it is possible that other areas may be used if the population grows in the future, but for the time being habitat management and protection should focus on the critical areas that were identified during this study. The telemetry work also identified the significance of multiple spawnings by individual bull trout over successive years, and it may be these multiple spawnings that are necessary for the survival of the population. As the current population size is estimated at approximately 200 spawning bull trout, it is important that a harvest restriction remain in place to attempt to build the population.

I believe that another important aspect that this study has provided is a strong sense of community awareness and education in the Salmo area regarding the status and importance of the bull trout population in the watershed. Given the fact that the watershed contains the last relatively healthy population of bull trout in the lower Pend d'Orielle River system, there is an extreme interest by U.S. fisheries personnel in preserving and studying this population. It is possible that the population may be used for conservation purposes in the future (i.e., U.S. reintroductions), and having this important natural resource in their watershed is a plus for the communities in the area. I think the fact that many of the school children in the area now know a great deal about bull trout is a strong point about this type of work, and hopefully the bull trout in the watershed will benefit from this increased awareness.

One of the major goals of the study was to address the potential use of Seven Mile Reservoir by bull trout. The first two years of telemetry data suggested that there was limited, if any, use of the reservoir (as no fish were tracked there). Although in the winter of 2002 no bull trout were tracked in the reservoir, the fact that only three of the ten functioning tags were tracked to overwintering areas is a concern. The entire Salmo

River mainstem and Seven Mile Reservoir were tracked during the last overwintering flight, and it was expected that more of the tags would have been located. It is possible that the tagged fish that were not tracked were within the reservoir and to deep for a signal to be picked up by the receiver, but to date that remains unproven. We will be undertaking one more flight in the early spring as part of the ongoing rainbow trout work, and we will track bull trout on that flight as well in order to attempt to locate the missing fish. As it currently stands, the belief is that the population resides mainly in the mainstem Salmo River for the majority of the year.

In closing I think this project has been a good model as to how a number of groups can work together for a common goal, and how communities can become involved in their watersheds. In the coming years of reorganization as to the role of government in fisheries management, this type of example may need to be followed in the future to ensure projects are carried out and that informed decisions can be made.

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