Report on Non-Sportfish Abundance and Migration Patterns in the Salmo River: Winter 1999 to Summer 2000

Report Prepared For:
Columbia-Kootenay Fisheries Renewal Partnership and Columbia Basin Trust
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PREAMBLE AND EXECUTIVE SUMMARY

In 1999 the Salmo Watershed Streamkeepers Society (SWSS) felt that it was necessary to begin to address local concerns that non-sportfish abundance was increasing in the Salmo River watershed. Linked to this was the suspicion in the local community that non-sportfish intrusion from Seven Mile Reservoir was the cause in the perceived decline in rainbow trout and bull trout populations in the system. The following report is our attempt to start to understand the biology, and possible impacts, of the non-sportfish community in the Salmo River watershed.

This report documents the seasonal abundance and migration patterns of non-sportfish species (suckers and northern pikeminnow) in the Salmo River below the town of Salmo. We documented upstream movements of suckers into the river from late June to mid July 2000. The presence of Floy tagged suckers in the upper river confirmed that non-sportfish do migrate upstream of the previously constructed fish barrier. It also appears that these species migrate out of the mainstem Salmo River in early December. We discuss the results of our project within the scope of possible effects on sportfish populations, and make recommendations as to areas for future study.

ACKNOWLEDGEMENTS

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Columbia-Kootenay Fisheries Renewal Partnership and Columbia Basin Trust

Funding for this project ($4,300) was provided by the Columbia-Kootenay Fisheries Renewal Partnership and Columbia Basin Trust. Bill Green provided comments on the project, while Jaime Christales provided administrative assistance.

BC Hydro

BC Hydro provided equipment, personnel, and monies for additional help with this project.

BC Ministry of Environment, Lands and Parks

The Ministry of Environment, Lands and Parks provided assistance during snorkel swims. Specifically John Bell assisted with swims and data collection. Jay Hammond provided insight into project requirements and management issues.

Salmo Watershed Streamkeepers Society (SWSS)

Community volunteers that are members of SWSS assisted with various components of the project. Peter Neil dedicated a significant amount of volunteer time to complete swims and collect data. Alice Nellestijn assisted with project management and sampling logistics. Alice Kuzma assisted with project management. The Maloney family assisted with project logistics, and provided additional data on tagged sucker observations as a result of frequent snorkel swims near their property at Swift Creek.

Baxter Environmental

Jeremy Baxter and John Hagen assisted with swims and data collection. Robyn Roome assisted with administration. Thomas Baxter smiled during all times the report was being written.

Aquatic Resources Ltd.

Dan Gebhart assisted with swims and data collection.

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1.0 INTRODUCTION

With the construction of Seven Mile Dam, and the raising of Seven Mile Reservoir, high gradient sections of the lower Salmo River were impounded (Envirocon 1975). The consensus of the professional community of biologists at the time was that the impounding of this section allowed non-sportfish species access into the mainstem Salmo River. It was felt that mitigative measures were needed to limit the possible impact of non-sportfish on the remaining sportfish community in the Salmo River watershed, as chinook salmon (*Oncorhynchus tshawytscha*) and steelhead (*O. mykiss*) populations had already been extirpated. As such, a manmade barrier was constructed by BC Hydro to prevent further migration of non-sportfish into the upper river. Recently it has been suggested that at high water levels the barrier may not be functioning as it was intended, and that a new route may have opened around the structure (Gary Birch, Fisheries Biologist, BC Hydro, Castlegar, B.C.; personal communication).

Based on this new information, the Salmo Watershed Streamkeepers Society applied for funding from the Columbia-Kootenay Fisheries Renewal Partnership to study the non-sportfish community in the Salmo River. For this project, snorkel surveys were used as a methodology to identify the relative abundance and migration timing of non-sportfish in the mainstem Salmo River above the constructed fish barrier. The main objectives of this study were to:

1. determine the species composition and relative abundance of non-sportfish in the mainstem Salmo River throughout the year;
2. determine if there are seasonal migrations of non-sportfish within the mainstem Salmo River;
3. determine whether the Salmo River non-sportfish barrier is effectively working;
4. identify possible impacts of non-sportfish species on the sportfish species within the Salmo River watershed; and
5. promote community stewardship for the fisheries resources of the watershed.

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 5th 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 2nd and 3rd order tributaries (including Apex Creek, Clearwater Creek, Hall Creek, Barrett Creek, Ymir Creek, Porcupine Creek, Erie Creek, and Hidden Creek) and two 4th 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.

Non-sportfish species known to occur in the watershed include largescale sucker (*Catostomus macrocheilus*), longnose sucker (*C. catastomus*), northern pikeminnow, formerly northern squawfish (*Ptychocheilus oregonensis*), longnose dace (*Rhinicthys cataractae*), redside shiner (*Richardsonius balteatus*), and slimy sculpin (*Cottus cognatus*) (Sigma Engineering Ltd. 1996).

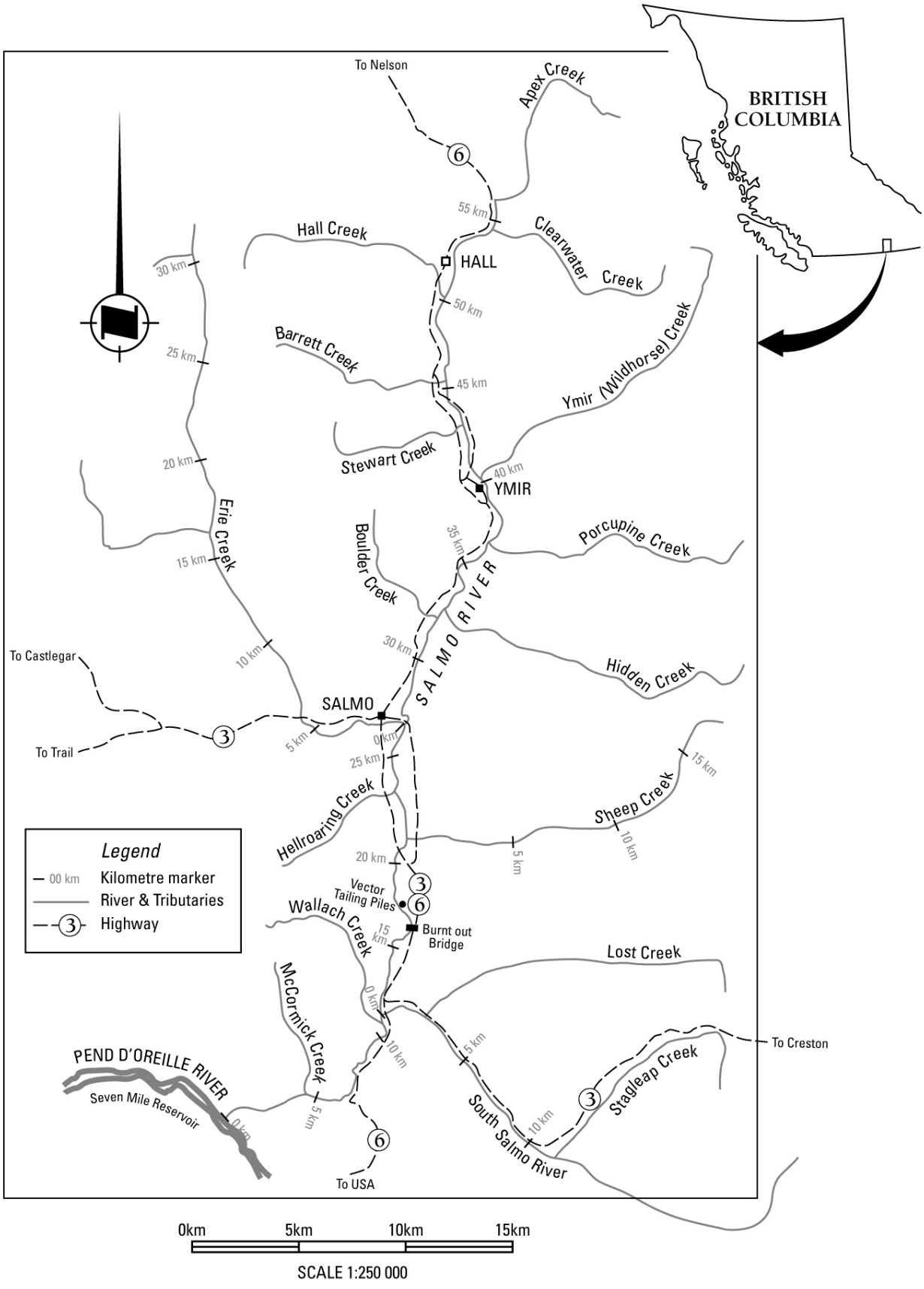

Figure 1. The Salmo River watershed study area.

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.	
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	

Sportfish known to occur in the Salmo River watershed include rainbow trout (*O. mykiss*), westslope cutthroat trout (*O. clarki lewisi*), bull trout (*Salvelinus confluentus*), eastern brook trout (*S. fontinalis*), and Rocky Mountain whitefish (*Prosopium williamsoni*).

2.2 Sampling Design

For this study, observations made during repetitive snorkel surveys over the year were utilized to estimate the distribution, relative abundance, and migration timing of non-sportfish in the mainstem Salmo River. The river was surveyed by a crew of 2-5 swimmers depending on water levels, with the swimmers aligning themselves perpendicular to stream flow to ensure adequate coverage of the stream. Each swimmer reported the total number of each non-sportfish and sportfish species observed in the section of the mainstem that was surveyed. Generally counts were recorded every 200 to 250 m at known locations.

In the summer of 2000 swimmers also looked for Floy tags that had been placed into sucker species and northern pikeminnow below the non-sportfish barrier on the lower Salmo River. This was done to document movements of non-sportfish above the barrier.

3.0 RESULTS

In total six surveys were conducted on the mainstem Salmo River between November 1999 and late July 2000 (Table 2). Except for the survey in mid December 1999, the surveys all started downstream of the town of Salmo at the end of Lagoon road, and were carried out for a minimum distance of 10.1 km (Table 2). Few non-sportfish species were observed in the upper sections of our survey area, suggesting that sucker and northern pikeminnow distribution is likely limited to mainstem areas downstream of Erie Creek.

Table 2. Summary of dates, locations, visibility, and number of swimmers on non-sportfish snorkel surveys in the Salmo River.

Survey Date	Start Location	End Location	Total Distance	Visibility	Number of Swimmers
Nov 4 99	27.35 km	17.25 km	10.10 km	5 m	3
Dec 12 99	17.25 km	12.15 km	5.10 km	5 m	2
Jun 22 00	27.35 km	11.55 km	15.70 km	1 m	3
Jun 30 00	27.35 km	16.85 km	10.50 km	2 m	5
Jul 7 00	27.35 km	16.85 km	10.50 km	3 m	5
Jul 17 00	27.35 km	16.85 km	10.50 km	4-5 m	3

A summary of the total number of each fish species observed during the surveys is found in Table 3. The observations during the surveys suggested that there is an early summer upstream migration of sucker species (SU) and, to a lesser extent, northern pikeminnow (NPM) into the upper Salmo River, and an early winter downstream migration of the species from the area that was surveyed (Table 3, Figure 2). The density of sucker species on the July 17 200 swim was 19.5 fish per km, while the density of northern pikeminnow was 0.3 fish per km. During the surveys rainbow trout (RB), bull trout (BT), eastern brook trout (EB), and Rocky Mountain whitefish (MWF) were also observed. On July 17 2000, two Floy tagged suckers were observed during the survey. These fish had been tagged in late June by BC Hydro contract biologists at the mouth of the Salmo River. The tagging location was below the constructed non-sportfish barrier, and identified that these species successfully migrate above the supposed barrier. One

other Floy tagged sucker was observed above the barrier in early August by an SWSS member.

Table 3. Summary of the number of fish species observed during non-sportfish snorkel surveys in the Salmo River.

	Total Number Observed					
Species	**Nov 4 99**	**Dec 12 99**	**Jun 22 00**	**Jun 30 00**	**Jul 07 00**	**Jul 17 00**
SU	43	0	13	80	179	205
NPM	0	0	0	0	0	3
MWF	0	0	3	3	2	2
EBT	0	0	0	0	0	0
<30 cm	0	0	0	0	2	6
>30 cm	8	0	0	2	4	6
BT	0	0	0	0	0	0
<30 cm	1	0	0	4	0	5
>30 cm	22	2	6	17	26	19
RB	0	0	0	0	0	0
<30 cm	10	10	5	33	58	268
>30 cm	34	8	23	31	107	147

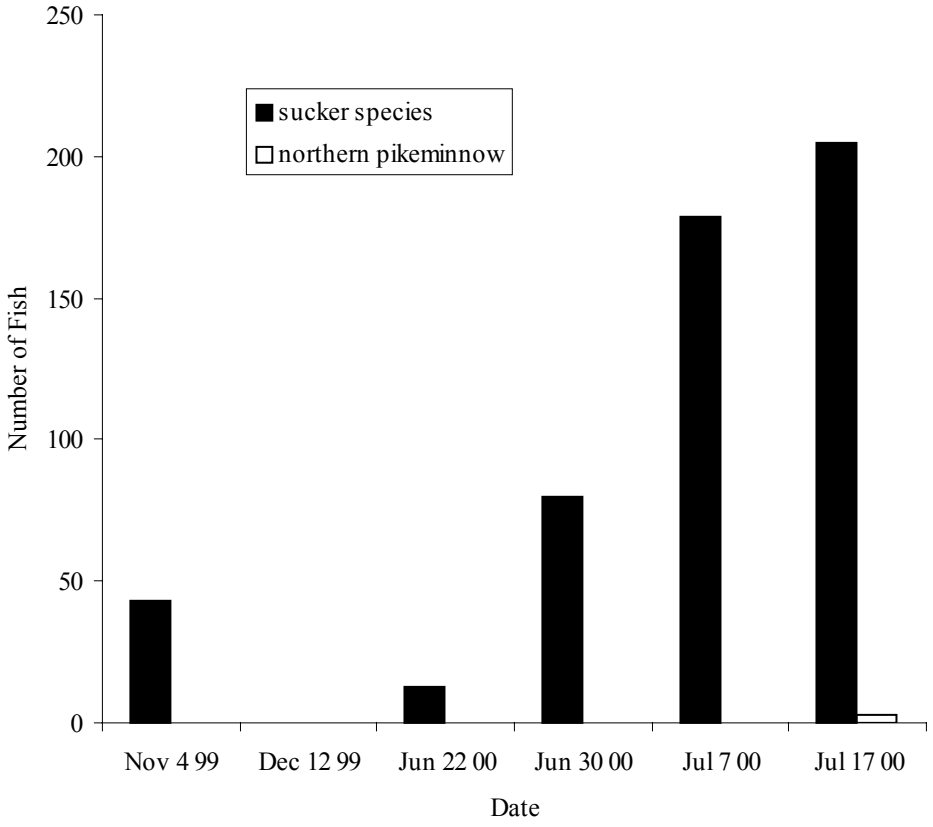

Figure 2. Summary of increases in the number of sucker species and northern pikeminnow observed in the Salmo River during non-sportfish snorkel surveys.

4.0 DISCUSSION

This project demonstrated that there is an upstream migration of non-sportfish (predominantly sucker species) into the upper Salmo River in the early summer, and that these fish can successfully migrate past the barrier constructed by BC Hydro. Although the non-sportfish do migrate into areas of the Salmo River utilized by rainbow trout and bull trout juveniles and adults, it is currently inconclusive as to what the effects of the non-sportfish population is on the sportfish population. Non-sportfish could impact and/or compete with the rainbow trout and bull trout populations at the juvenile and adult life-history stages, and these possibilities warrant further discussion.

It is a preconceived notion of the public that sucker species may feed on the eggs of spawning salmonid species, and that this may limit sportfish production. From previous work in the watershed it is known that bull trout spawn in high gradient tributaries or the upper Salmo River, areas where suckers and northern pikeminnow are not found (Baxter et al. 1998; Baxter 1999; Baxter and Nellistijn 2000). This would suggest that there would be a limited, if any, effect of non-sportfish species on bull trout during spawning or egg development. . Although it is not known where the majority of rainbow trout spawn in the Salmo watershed, it is likely that the fish are also tributary or upper mainstem spawners. This is suggested by the high rainbow trout fry densities in the tributaries of the Salmo River and the upper mainstem, and the fact that in the early summer very low numbers of rainbow trout yearlings are observed in the mainstem Salmo River (James Baxter; personal observations). This again would limit the possible impact that non-sportfish species would have on rainbow trout during spawning or egg development. Also, the data from this study suggests that an upstream migration of sucker species occurs after mid June, and thus sucker species would not be present in high numbers in the mainstem Salmo River during the spawning period of both rainbow trout and bull trout. One final point is that although it has been suggested that suckers impact salmonid populations during spawning, we could find no reference to sucker species or northern pikeminnow predating on eggs during a literature review from 1980 to 2000 from a database that included: *The North American Journal of Fisheries*

Management; *Transactions of the American Fisheries Society*; *The Canadian Journal of Fisheries and Aquatic Sciences*; and *The Canadian Journal of Zoology*.

It is possible that if non-sportfish spawn in the mainstem Salmo River that there may be competition with juvenile salmonids. However, data from other studies suggests that these fish do not spawn in the mainstem Salmo River. There were no juvenile suckers or northern pikeminnow sampled in 28 closed electrofishing sites in the Salmo watershed in a previous study, and catches of bull trout juveniles were low in areas where adult suckers and northern pikeminnow have been observed (Baxter et. al 1998). The biology of adult rainbow trout, bull trout, and sucker species would also suggest that the impact of the non-sportfish would be limited given the fact that suckers are benthic feeders while rainbow trout are drift feeders and bull trout are piscivores. These suggestions are supported by a study conducted in a California reservoir where brown trout and suckers had a minimal dietary overlap, and where in fact the suckers became prey of the brown trout once they became piscivorous (Marrin and Erman 1982).

It is known that northern pikeminnow are predators on juvenile salmonids (predominantly on salmon species in lakes), and in the United States of America, programs of northern pikeminnow eradication continue to this day (Friesen and Ward 1999). However, a review of the impact of northern pikeminnow on salmonid populations suggested that these fish are not significant predators or competitors with trout in streams, especially where they occur in low densities (Brown and Moyle 1980). Although during this study we have limited data on northern pikeminnow abundance and distribution in the mainstem Salmo River, the results, and results from other studies (Baxter et al. 1998; Baxter 1999), suggest that this species occurs in low abundance in the Salmo River. In all cases where northern pikeminnow have been observed in the mainstem river, they have been heavily associated with woody cover.

One interesting point is that it is currently unclear as to whether or not sucker species and northern pikeminnow have invaded the Salmo River after the raising of Seven Mile Reservoir. We reviewed the data collected from studies that were undertaken pre-raising

of the reservoir, and the data suggests that suckers and pikeminnow were already in the Salmo River above the waterfall on the lower river (Envirocon 1975). If this is the case then these species likely had access to the upper river as well, and could have migrated to the areas where they are currently found. This however brings up another point, in that the construction of Seven Mile Reservoir could have increased the population size of non-sportfish species, and thus supported the movement of more non-sportfish into the Salmo River than previously occurred. This is in fact supported by the observations of local community members who report that the number of suckers present in the river has increased since the formation of Seven Mile Reservoir (Rollie Reed, Salmo Watershed Streamkeepers Society, Salmo, B.C.; personal communication).

In summary it is not known what, if any, impact non-sportfish have on salmonid fish in the Salmo River mainstem. We have documented that these species do migrate into the upper reaches of the river, and that they are migrating past the constructed non-sportfish barrier. Further study may be warranted to determine if these species spawn, and their juveniles rear, in the mainstem river. This would address the concerns about possible competition. One final point that is not known is whether these species actually provide a prey base for piscivorous bull trout in the Salmo River. As previous studies have documented that the majority of radio tagged bull trout reside in the Salmo River for most of the year, it is unknown what their prey base is. Caution should be taken when considering non-sportfish removal projects in the watershed before the complete community ecology picture is known. Thus, it may be important to refine our understanding about the non-sportfish populations in the river before management or habitat enhancement options are considered.

5.0 RECOMMENDATIONS

1. The study has documented that suckers and northern pikeminnow migrate into the upper reaches of the Salmo River. Further understanding of rainbow trout life-history and spawning areas in the watershed is needed to determine if suckers and pikeminnow may be predating or competing with rainbow trout. We recommend that the proposed rainbow trout stock assessment and life-history study be funded and supported to address the above issues.

2. It is likely that suckers and pikeminnow do not predate or compete with bull trout, however it is unknown if these non-sportfish species provide a prey base for the bull trout population. It is recommended that a small study be undertaken on the bull trout population to determine what they are utilizing for food. This could be a non-lethal project that would have minimal effects on the bull trout population, but provide data for a better understanding of sportfish/non-sportfish interactions.

3. Although previous electrofishing data and snorkel survey observations have failed to locate juvenile suckers and northern pikeminnow, an electrofishing program in the lower Salmo River may be warranted to determine if indeed non-sportfish species spawn in the Salmo River above the constructed fish barrier.

4. In conjunction with an ongoing BC Hydro study, this project has documented that suckers migrate upstream of the previously constructed fish barrier. It is recommended that regulatory agency personnel and the community meet to discuss the non-sportfish options that may be put in place after the data from this study and the BC Hydro study are made available. Recreational concerns also need to be considered should a large and higher fish barrier be considered.

5. This study has shown that in conjunction with Floy tagging, snorkel surveys can provide information on fish migration and abundance in a cost-effective manner. It is recommended that further snorkel survey swims be considered to allow annual monitoring of non-sportfish, rainbow trout, and bull trout populations.

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