Lower Belly River Fish Assemblage Activity Report, 2009

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1.0 INTRODUCTION

The Belly River is a major watershed in southwestern Alberta that flows 181 km from the US/Canada international boundary to its confluence with the Oldman River. Historically, the Belly River was presumed to be a cold-water river that supported several cold-water fish species, such as trout and whitefish (English 1995). Since that time it is believed that the cold-water fishery has been restricted to the headwater reaches, as a result of major water withdrawals for domestic and agricultural purposes.

Irrigation is the major consumptive-use responsible for reducing instream flow in the Belly River. To accommodate the region's high water demand, the Belly River is managed as an irrigation water source and supplies water to several water pump stations and three major on-stream water diversions. These water withdrawal devices are the main cause of reduced instream flows in the Belly River. Current water management practices regulate the Belly River withdrawals to maintain a minimum flow requirement of 0.93 m^3/sec.

The minimal flow requirement is a water conservation objective intended to ensure necessary volume and quality of water for the protection of the natural waterbody and its aquatic environment. Prior to 1990, minimal flow requirements were not regulated and the effects of water withdrawal from the Belly River were exacerbated. Following the amendment of Alberta's Water Act, effective January 1990, several water licenses were amended and coordination between water management organizations was established to ensure the Belly River maintains a minimum flow rate (Dave Hunt personal comm.).

Presently, water withdrawals and diversions for irrigation negatively affect stream flow dynamics in the Belly River although things have improved since imposition of minimal flow requirements in 1990. The major limiting factors associated with water withdrawal are habitat loss and increased water temperatures which have decreased the river's capacity to support a cold-water fishery in all sections but the headwaters of the Belly River (English 1995). During critical periods, water withdrawal and diversion are suspected to limit the river's capacity to support any fish population in the lower Belly River.

Few fishery assessments have been conducted on the Belly River and the studies that were conducted in the river are outdated, so the current status of the fishery is uncertain. In 1980, a biological inventory was completed on the Belly River. The objectives of the study were to provide an inventory of fish habitat features and to determine the effect instream flow reduction has on the river's water quality and biological systems. Backpack electrofishing equipment was used to collect fish data at critical periods when limitations to fish habitat were most severe.

It is suspected that the impact of flow reduction on fish populations is greatest in the lower Belly River which is also impacted by the cumulative effects of upstream land-use practices. The Alberta Conservation Association in collaboration with Alberta Sustainable Resource Development – Fish and Wildlife Division, Alberta Environment and Department of Fisheries and Oceans, conducted a fishery assessment to describe the fish assemblage in the lower Belly River. The objectives of the study were to determine the species composition, fish distribution, and abundance, and fish habitat use of the fish population in the lower Belly River. Data collected from this study was compared with results obtained from the 1980 biological inventory.

1.1 Study Area

The lower Belly River flows 71 km from the mouth of the Waterton River downstream to its confluence with the Oldman River. The river is wide, sinuous, and comprised mostly of large pools (65% of the entire stream's surface area)(English 1995). Stream gradient in this reach is the lowest of the entire watershed, averaging 0.123% (English 1995). Substrate within the lower Belly River is highly embedded in pool and run habitats, substrate in riffle habitats consists mostly of gravel and cobble.

Land-use varies considerably throughout the lower Belly River watershed. Minimal anthropogenic impacts were observed in the Blood Indian Reservation, which borders the eastern bank of the river. Development of crop fields, pastureland and residential areas is common along the western bank and has resulted in removal of riparian vegetation and bank instability.

2.0 MATERIALS AND METHODS

Sample sites were identified based on wetted width data and the assessment of suitable boat launch sites during reconnaissance surveys. Site length was determined using Maret and Ott's (2004) recommendations of 50 X average stream wetted width. A total of 14, 2,500-m raft electrofishing sites were systematically positioned along the lower Belly River, separated one site length between one another (2,500 m intervals)(Figure 1). Sites were sampled sequentially, starting immediately downstream from the confluence of the Waterton River.

The raft electrofisher consisted of a 12' Zodiac Raft outfitted with a bow-mounted aluminum electrofishing platform, a 2.5 hp Honda generator, a Smith-Root 5.0 GPP control box, side-mounted cathode dropper arrays and two front-mounted anode booms equipped with dropper arrays. One member of the two-person electrofishing crew activated the electrical current and netted immobilized fish from the bow of the boat, as the second member oared the raft and controlled electrofisher power settings. A second raft contained a support crew which conducted backpack electrofishing surveys and assisted with fish sampling.

To optimize sampling coverage, raft electrofishing was conducted floating downstream in a zig-zag pattern. Immobilized fish were captured using a dip net and placed in a live-well where they were left to revive. Fork length (mm), total length (mm), and weight (g) were obtained from each fish. When catches of a species at one site exceeded 20 fish, a random subsample of 20 fish was sampled and the remaining fish were tallied. All fish were released back into the river following sampling. Habitat measurements included wetted width (m), rooted width (m) and maximum depth (m). Fish sampling and habitat measurements occurred at 500-m intervals within each site.

Backpack electrofishing equipment was used to sample wadeable side channels in the river. Side channels within a raft electrofishing site were sampled using a Smith-Root backpack model 12A electrofisher. Electrofishing was conducted in an upstream direction throughout the entire length of the side channel. All fish captured were sampled, enumerated and included as an individual site. A total of three backpack electrofishing sites were completed along the lower Belly River.

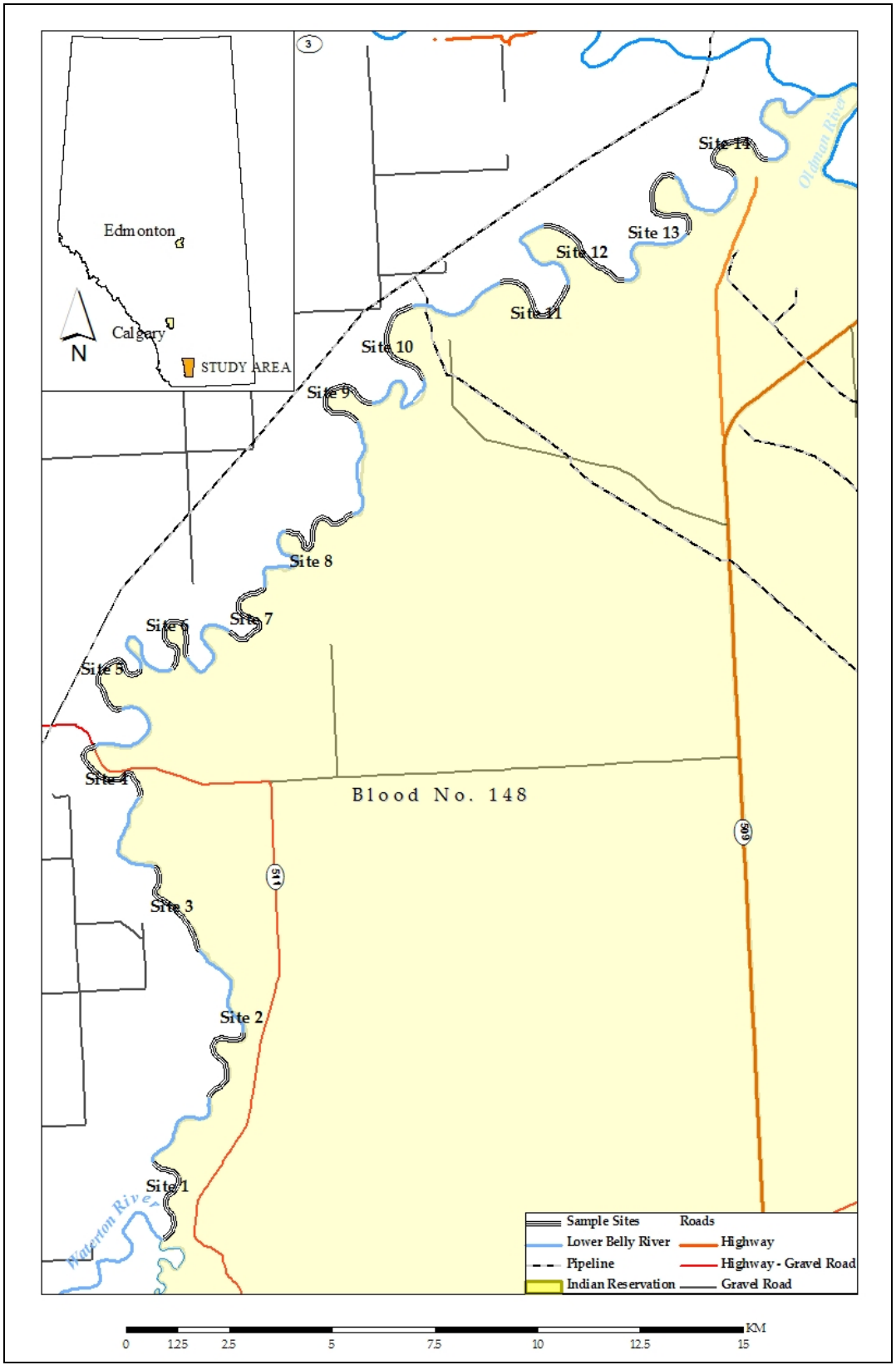

Figure 1. Study area and sample locations of the lower Belly River, 2009.

3.0 RESULTS

3.1 Fish Assemblage

Of the 35.5 km of stream sampled, a total of 1,176 fish were captured from 8 May to 22 May, 2009. The raft electrofishing catch totaled 990 fish and the backpack electrofishing catch 186 fish. A total of 17 fish species were observed during 2009; ten species less than observed in the lower Belly River during 1980 (Appendix 1).

Fish species that were present in 2009 but absent in the lower Belly River during 1980 include: Walleye (*Stizostedion vitreum*), Rainbow Trout (*Oncorhyncus mykiss*), Brown Trout (*Salmo trutta*), Mountain Sucker (*Catostomus platyrhynchus*), Silver Redhorse (*Moxostoma anisurum*), Emerald Shiner (*Notropis atherinoides*), Spoonhead Sculpin (*Cottus ricei*) and Lake Chub (*Couesius plumbeus*). Rainbow Trout and Mountain Sucker were captured in 1980 but were only observed in the upper Belly River, upstream of the Mountain View irrigation diversion. Sauger (*Sander canadensis*) was the only fish species captured in the lower Belly River during 1980 that was absent in 2009.

Of the 1,176 fish captured, 70% (n = 823) of the catch was of non-sportfish while the remaining 30% (n = 353) were sportfish. Mountain Whitefish (*Prosopium williamsoni*) made up 26% of the sportfish catch, as the remaining 4% of the catch comprised of sportfish and included Brown Trout, Rainbow Trout, Northern Pike (*Esox lucius*), Walleye and Burbot (*Lota lota*). Sucker species were observed to be the most abundant non-sportfish group captured (39%) including White Sucker (*Catostomus commersonii*), Shorthead Redhorse (*Moxostoma macrolepidotum*), Longnose Sucker (*Catostomus catostomus*), Mountain Sucker, and Silver Redhorse (Figure 2). The remaining 31% of the non-sportfish catch consisted of six different cyprinid species, in which Longnose Dace (*Rhinichthys cataractae*) was the most common cyprinid species followed by Emerald Shiner, Trout Perch (*Percopsis omiscomaycus*), Lake Chub, Spoonhead Sculpin and Spottail Shiner (*Notropis hudsonius*).

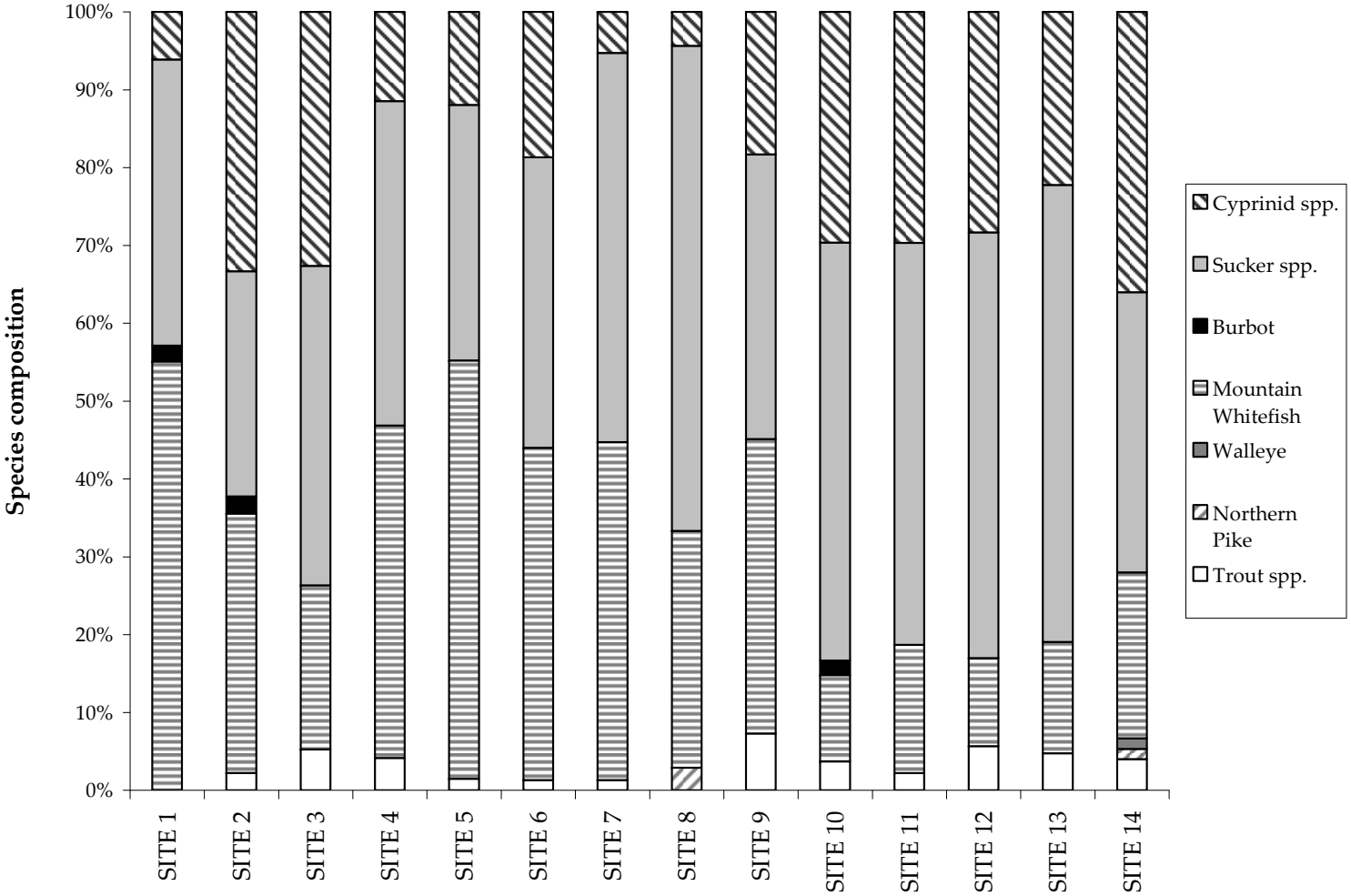

Figure 2. Composition of the raft electrofishing catch (excluding Lake Chub, n = 25) at sites throughout the lower Belly River during May 2009.

Species composition showed little variation throughout the lower Belly River (Table 1). Brown Trout, Mountain Whitefish, and most sucker and cyprinid species were common at each site.

3.2 Sportfish Species

Brown Trout was the most abundant and widely distributed trout species observed at all but two sites along the lower Belly River (Table 1). Brown Trout were common in large pools with cover, such as woody debris and/or undercut banks. Rainbow Trout were also common in large pools with cover.

A total of 3 Northern Pike and 3 Burbot were captured throughout the lower Belly River. The largest Northern Pike was captured at the lowest site (site 14) in the Belly River, approximately 3,000 m from the confluence with the Oldman River (Table 2). It is likely that this fish travelled upstream from the Oldman River. A Walleye was also captured at the last site and it too was likely a migrant from the Oldman River. Northern Pike, Walleye and Burbot were all observed to occupy deep run sections.

Mountain Whitefish was the most common sport fish species in the lower Belly River and was only observed in riffle and pool sections. Juvenile Mountain Whitefish were observed in shallow riffle sections, while larger mature Whitefish were observed in pools downstream of riffle sections.

Table 1. Electrofishing catch summary of all sites sampled on the lower Belly River during May 2009.

	Sportfish						Non-sportfish											
	Trout species		Other sportfish species				Sucker species					Cyprinid species						
	BNTR	RNTR	NRPK	BURB	WALL	MNWH	SHRD	SLRD	WHSC	LNSC	MNSC	TRPR	EMSH	SPSH	SPSC	LNDC	LKCB	Total
SITE 1	-	-	-	1 (2.0)	-	27 (55.1)	5 (10.2)	-	5 (10.2)	7 (14.3)	1 (2.0)	2 (4.1)	-	-	-	1 (2.0)	-	49
SITE 2	1 (2.2)	-	-	1 (2.2)	-	15 (33.3)	-	-	10 (22.2)	3 (6.7)	-	8 (17.8)	5 (11.1)	-	-	2 (4.4)	-	45
SITE 3	4 (4.2)	1 (1.1)	-	-	-	20 (21.1)	1 (1.1)	-	19 (20.0)	18 (19.0)	1 (1.1)	1 (1.1)	21 (22.1)	-	-	9 (9.5)	-	95
SITE 4	4 (4.2)	-	-	-	-	41 (42.7)	14 (14.6)	-	17 (17.8)	4 (4.2)	5 (5.2)	2 (2.1)	3 (3.1)	-	-	6 (6.3)	-	96
SITE 5	1 (1.5)	-	-	-	-	36 (53.7)	5 (7.5)	1 (1.5)	8 (11.9)	3 (4.5)	5 (7.5)	2 (3.0)	2 (3.0)	-	-	4 (6.0)	-	67
SITE 6	1 (1.3)	-	-	-	-	32 (42.7)	7 (9.3)	-	16 (21.3)	4 (5.3)	1 (1.3)	3 (4.0)	10 (13.3)	-	-	1 (1.3)	-	75
SITE 7	1 (1.3)	-	-	-	-	33 (43.4)	16 (21.1)	-	13 (17.1)	8 (10.5)	1 (1.3)	-	2 (2.6)	-	-	2 (2.6)	-	76
SITE 8		-	2 (2.9)	-	-	21 (30.4)	11 (15.9)	-	25 (36.2)	2 (2.9)	5 (7.3)	1 (1.5)	-	-	-	2 (2.9)	-	69
SITE 9	4 (4.9)	2 (2.4)	-	-	-	31 (37.8)	17 (20.7)	-	9 (11.0)	4 (4.9)	-	6 (7.3)	4 (4.9)	-	-	5 (6.1)	-	82
SITE 10	2 (3.7)	-	-	1 (1.9)	-	6 (11.1)	6 (11.1)	-	15 (27.8)	8 (14.8)	-	4 (7.4)	9 (16.7)	1 (1.9)	-	2 (3.7)	-	54
SITE 11	2 (2.2)	-	-	-	-	15 (16.5)	15 (16.5)	-	17 (18.7)	11 (12.1)	4 (4.4)	3 (3.3)	-	-	1 (1.1)	23 (25.3)	-	91
SITE 12	3 (5.7)	-	-	-	-	6 (11.3)	11 (20.8)	-	13 (24.5)	4 (7.6)	1 (1.9)	2 (3.8)	3 (5.7)	-	-	10 (18.9)	-	53
SITE 13	3 (4.8)	-	-	-	-	9 (14.3)	20 (31.8)	-	13 (20.6)	2 (3.2)	2 (3.2)	2 (3.2)	6 (9.5)	-	-	6 (9.5)	-	63
SITE 14	3 (4.0)	-	1 (1.3)	-	1 (1.3)	16 (21.3)	14 (18.7)	-	3 (4.0)	9 (12.0)	1 (1.3)	3 (4.0)	-	-	-	24 (32.0)	-	75
Site 6B	3 (2.1)	-	-	-	-	-	-	-	2 (1.4)	-	11 (7.7)	3 (2.1)	-	-	-	99 (69.2)	25 (17.5)	143
Site 11B	1 (4.3)	-	-	-	-	-	-	-	5 (21.8)	1 (4.3)	-	-	-	1 (4.3)	-	15 (65.3)	-	23
Site 12B	1 (5.0)					1 (5.0)			3 (15.0)							15 (75.0)		20
Total	**34 (2.9)**	**3 (0.3)**	**3 (0.3)**	**3 (0.3)**	**1 (0.1)**	**309 (26.1)**	**142 (12.1)**	**1 (0.1)**	**193 (16.4)**	**89 (7.6)**	**38 (3.2)**	**42 (3.6)**	**65 (5.5)**	**1 (0.1)**	**1 (0.1)**	**226 (19.1)**	**25 (2.1)**	**1176**
	37 (3.3)		**3 (0.3)**	**3 (0.3)**	**1 (0.1)**	**309 (26.1)**	**463 (39.4)**					**360 (30.6)**						
	353 (30.0)						**823 (70.0)**											

( ) parenthesis indicate the species percent composition (%) for each electrofishing site
B denotes backpack electrofishing sites

Table 2. Biological data obtained from all sport fish captured in the lower Belly River during May 2009 (mean ± SD).

Species	n	Fork length range (mm)	Fork length average (mm)	Weight range (g)	Weight average (g)
Brown Trout	34	110 - 490	285.6 ± 129.4	16 - 1250	379.1 ± 373.7
Rainbow Trout	3	203 - 235	218.0 ± 16.1	83 - 140	108.7 ± 28.9
Walleye	1	553	-	900	-
Northern Pike	3	527 - 745	604.7 ± 121.7	1044 - 3150	1762 ± 1202.3
Mountain Whitefish	309	93 - 379	173.7 ± 65.8	8 - 667	94.3 ± 119.6
Burbot	3	501 - 686	596.3 ± 92.6	747 - 1500	1123.5 ± 532.5

Size-class distributions of both the Brown Trout and Mountain Whitefish catch were uneven (Figure 3). Only four size classes of Brown Trout were observed. In comparison to Brown Trout, a more continuous distribution of fish sizes in the Mountain Whitefish catch was observed, likely due to the greater sample size (Figure 4).

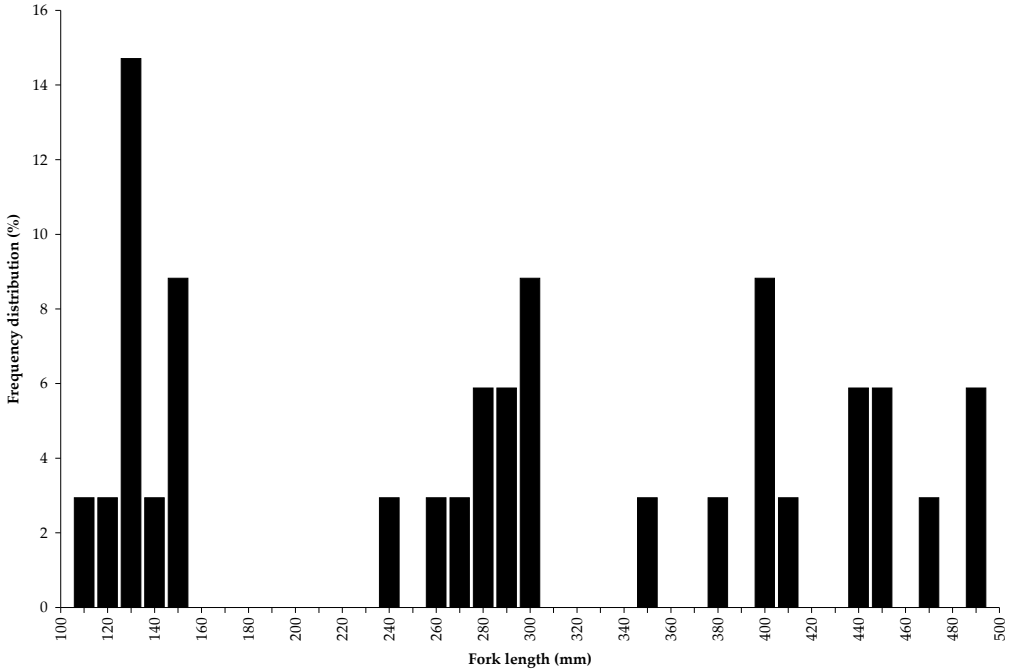

Figure 3. Fork length frequency of Brown Trout captured in the lower Belly River during May 2009 (n = 34).

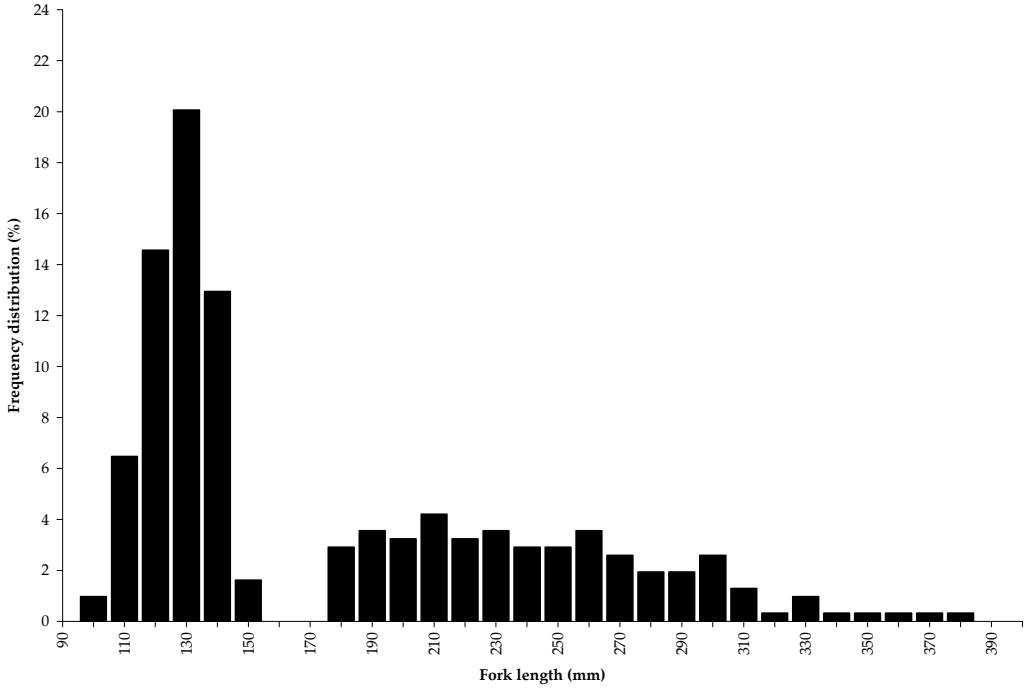

Figure 4. Fork length frequency of Mountain Whitefish captured in the lower Belly River during May 2009 (n = 309).

3.3 Non-sportfish Species

Shorthead Redhorse, White Sucker and Longnose Suckers were common in deep run and pool sections. Mountain Sucker was the only sucker species observed occupying shallow run and riffle sections. Most adult suckers were observed in large groups and were presumed to be congregating to spawn, particularly Shorthead Redhorse. Most Cyprinid species were common in shallow areas along the margins of riffle and run sections. Spoonhead Sculpin and Longnose Dace were both present in shallow riffle sections and were occasionally found along the river margins. Lake Chub were only observed in wadeable side channels.

3.4 Cool-water Fish versus Cold-water Fish

Cool-water fish species were greater in abundance and more widely distributed than cold-water fish species (Table 1). It is apparent that the lower Belly River supports a greater proportion of cool-water fish than cold-water fish and is likely a result of instream flow reduction. A reduction in flow volume, at critical times decreases cold-water habitat availability and increases the likelihood of a change in fish assemblage.

4.0 SUMMARY

Seventeen species of fish were observed in the lower Belly River in 2009, more than documented in 1980. Based on 2009 results, it is evident that the lower Belly River contains a fish assemblage dominated by cool-water fish species. A total of five cold-water fish species were observed but these species were less abundant than cool-water fish species. It is unlikely all of these fish, especially the cold-water species and adult sportfish remain in the lower Belly River year round as flow volumes recede and water temperatures rise drastically during the summer months.

Discrepancies between the 1980 and 2009 study designs makes it difficult to determine if any changes in the fish community have occurred in the lower Belly River since 1980. Sampling during 2009 occurred in the spring when melt water from spring freshet produced moderate flows, while sampling in 1980 occurred in mid-September when flow rates were low and fish habitat was most limited. Electrofishing methods

also differed as both raft and backpack electrofishing equipment was used in 2009; only backpack electrofishing equipment was used in 1980. Raft electrofishing equipment is more efficient in rivers than backpack electrofishing equipment; raft electrofishing equipment generates a greater power output and a larger electric field. Sampling coverage also differed between the two studies. Half of the lower Belly River was sampled in 2009. English (1995) fails to mention the distance sampled while electrofishing in 1980, but it is almost certain to be less than rafted in 2009. Overall these discrepancies make fish community comparisons between studies difficult. The 1980 study likely underestimated the fish community present in the lower Belly River at the time.

Recognizing these limitations, any differences in fish abundance and species composition observed between 2009 and 1980 are likely attributable to the minimum flow requirements implemented in 1990. Effects of low flows on the aquatic environment were more significant in the lower Belly River during 1980, as minimal flow requirements were not regulated and the effects of water withdrawal were more severe. Current minimal flow rates require higher stream flows during critical periods that will subsequently have less effect on fish habitat and therefore support a larger fish community.

5.0 LITERATURE CITED

English, W. 1995. A Biological Inventory of the Belly River. Unpubl. rept. Prepared for Fish and Wildlife Division, Alberta Environmental Protection, Lethbridge, AB. 72 pp.

Maret, T.R., and Ott, D.S. 2004, Assessment of Fish Assemblages and Minimum Sampling Effort Required to Determine Biotic Integrity of Large Rivers in Southern Idaho, 2002: U.S. Geological Survey Water-Resources Investigations Report 03 –4274, 16 p.

6.0 APPENDIX

Appendix 1. Backpack electrofishing catch from Belly River during September, 1980 (English 1995).

Section / Date	Sport fish species		Number	Non-sport fish species	
Lower (Near the mouth)					
08/09/1980	Northern Pike	*Esox lucius*	5	Longnose Sucker	*Catostomus catostomus*
	Burbot	*Lota lota*	n/a	White Sucker	*Catostomus commersoni*
	Mountain Whitefish	*Prospium williamsoni*	23	Shorthead Redhorse	*Moxostoma macrolepidotum*
	Sauger	*Stizostedion canadensis*	3	Spottail Shiner	*Notropis hudsonius*
				Trout Perch	*Percopsis omiscomaycus*
				Longnose Dace	*Rhinichthys cataractae*
Middle (Below UID Weir)					
08/09/1980	Lake Whitefish	*Coregonus clupeaformis*	3	Longnose Dace	*Rhinichthys cataractae*
	Northern Pike	*Esox lucius*	1	Mountain Sucker	*Catostomus platyrhyncus*
	Mountain Whitefish	*Prospium williamsoni*	4	Trout Perch	*Percopsis omiscomaycus*
	Bull Trout	*Salvelinis confluentus*	1		
Headwaters (Below MVID Diversion)					
04/09/1980	Rainbow Trout	*Oncorhynchus mykiss*	12	Mountain Sucker	*Catostomus platyrhyncus*
	Mountain Whitefish	*Prospium williamsoni*	25	White Sucker	*Catostomus commersoni*
	Eastern Brook Trout	*Salvelinus fontinalis*	18		