IDENTIFICATION OF BULL TROUT POPULATIONS IN THE McLEOD, WILDHAY, BERLAND AND MUSKEG RIVER SYSTEMS, ALBERTA

Prepared for:

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Calgary, Alberta;

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EXECUTIVE SUMMARY

Fishery investigations were conducted to: identify streams that provide important spawning and rearing habitat for bull trout in the McLeod, Wildhay, Berland and Muskeg River sub-basins; and assess techniques used by Hildebrand (1985) to identify potential spawning habitat for bull trout in the McLeod, Wildhay and Berland River sub-basins.

Backpack electrofishing surveys were conducted at 69 sites in 51 streams in the McLeod (15 sites in 11 streams), Wildhay (12 sites in 10 streams), Berland (24 sites in 18 streams) and Muskeg (18 sites in 12 streams) River sub-basins. Sampling was conducted between August 10 and October 2, 1993. Electrofishing surveys generally involved a single pass through each study reach; however, population estimates using a three-pass removal method were conducted in Mary Gregg Creek (McLeod River sub-basin), Rock Creek (Wildhay River sub-basin) and two sites in Mahon Creek (Muskeg River sub-basin).

Fish were captured in 49 of the 51 streams sampled. Bull trout were captured in 34 streams. Catch per unit effort (CPUE) of bull trout during electrofishing surveys, in decreasing order, was highest in the Muskeg (0.44 bull trout/minute; n = 260), Berland (0.20 bull trout/minute; n =140), McLeod (0.13 bull trout/minute; n = 54) and Wildhay (0.12 bull trout/minute; n = 50) River sub-basins. Although streams that were expected to provide important spawning and rearing habitat for bull trout were targeted during the study, CPUE during electrofishing surveys was higher for rainbow trout than for bull trout in the McLeod, Wildhay and Berland River sub-basins.

Several streams with important rearing habitat were found in each sub-basin. For example, CPUE exceeded 25 bull trout/km in: Mary Gregg and upper MacKenzie creeks (McLeod River sub-basin); the South Wildhay River and upper Rock Creek (Wildhay River sub-basin); the Little Berland, North Berland and South Berland rivers and Pope and upper Moon creeks (Berland River sub-basin); and Veronique, Chapman, Mahon, Isaac and lower Lone Teepee creeks (Muskeg River sub-basin).

Other species of sportfish captured during the study (brook trout, brown trout, cutthroat trout, Arctic grayling, mountain whitefish, northern pike and burbot) generally were not abundant or widespread. One brook trout X bull trout hybrid was captured in Lone Teepee Creek, a tributary of the Muskeg River.

No adult bull trout or bull trout larger than 275 mm FL were captured in the McLeod River system. Except for one ripe male [282 mm fork length (FL)] captured in upper Rock Creek, no adult bull trout were captured in Wildhay River system. Four adult bull trout, two ripe males (313 and 521 mm FL) and two females (460 and 494 mm FL), were captured in the Berland River system. One of these females was observed with at least two other similarly sized bull trout in a large pool in the Berland River approximately 3 km downstream of the mouth of Big Creek. The largest bull trout captured in the McLeod, Wildhay and Berland River sub-basins, whose sex could not be determined externally, was 335 mm FL.

Most adult bull trout (21 females and 32 males in total) were captured in the Muskeg River sub-basin (19 females and 29 males). Bull trout from the Muskeg River system whose sex could not be determined externally were as large as 345 mm (FL). Male bull trout ranged between 259 and 550 mm (FL). Females ranged between 347 and 458 mm (FL). The majority of adults captured in the Muskeg River system were captured in Mahon Creek (19 females and 27 males).

Ripe bull trout were first captured on August 28 when one male and one female (both ripe) were caught

in Mahon Creek. Another ripe male was captured in Unnamed tributary LK884 672 (Muskeg River sub-basin) on August 31. The capture of ten ripe females and 24 ripe males (59% and 100% of females and males, respectively, captured that day) in Mahon Creek on September 9 indicates the spawning season was well underway by that date. The latest that adult males were captured which were not ripe was on August 26 (Little Berland River) and September 10 (Mahon Creek). The latest date that ripe bull trout were captured was on September 24. This was a female captured by angling in a pool in the mainstem Berland River and was also the only adult bull trout captured after September 15.

Redd surveys were conducted along the North Wildhay and Wildhay rivers and Rock Creek (Wildhay River sub-basin), the Little Berland River (Berland River sub-basin), and the Muskeg River and Chapman and Mahon creeks (Muskeg River system). In addition to redds observed during these surveys, redds were also incidently observed during electrofishing surveys. Bull trout redds were observed in MacKenzie Creek (n = 2; McLeod River sub-basin), Rock Creek (n = 1; Wildhay River system), the Little (n = 17) and North (n = 1) Berland rivers, and Mahon (n = 12) and Isaac (n = 1) creeks (Muskeg River system). Bull trout were observed on redds as early as September 8 and as late as September 17.

Measurement and visual estimates for selected habitat parameters were collected from 23 redds. Redds were observed in a wide range of stream widths (range 1.7 to 17.0 m), but the majority were observed in areas where stream widths were between 3.0 and 7.5 m wide. The majority of redds were also closely associated with cover. Nine were within 1.0 m from cover and eight of these were associated with an undercut bank. Another seven redds were from 1.0 to 5.0 m from cover. Among the seven redds observed more than 5.0 m from the nearest available cover, woody debris was the dominant cover type. Bull trout redds were found in slow currents. The maximum velocity above the redds was 0.54 m/sec and the average velocity was 0.31 m/sec.

Although evidence of spawning activity was collected at two sites that Hildebrand (1985) identified as having moderate, or moderate to high, potential for bull trout spawning habitat [redds were found near Site R3 (Rock Creek) and B1 (North Berland River); and one ripe male was captured near Site B1], several factors prevent a conclusive assessment of Hildebrand's methods. For example, the number of Hildebrand's sites where bull trout spawning activity was confirmed in 1993 is small. The two studies were also conducted eight years apart and low CPUE results for bull trout were obtained from several streams in 1993 that Hildebrand (1985) rated as having common or abundant populations; consequently, redd surveys were not conducted along the streams that contained these sites [e.g., Drinnan and Anderson creeks (McLeod River system), and Beaver, Cabin and lower Moon creeks (Berland River system)]. Instead, redd survey efforts were concentrated in streams where higher CPUE results were obtained [e.g., Muskeg River based on Boag and Hvenegaard's (1985) results and 1993 CPUE results in the Little Berland River and Mahon Creek].

A ripe bull trout male was also captured in upper Rock Creek near Hildebrand's (1985) Site R1 which he rated as having low to moderate potential for bull trout spawning. The capture of a single ripe male near this site, however, does not provide sufficient evidence to evaluate Hildebrand's (1985) rating.

In addition to identifying streams with important spawning habitat, CPUE data suggests there are also several other streams within the study area where future bull trout redd surveys would be warranted (e.g., Mary Gregg, upper Rock, upper Moon, Pope, Veronique and Chapman creeks and the South Berland and South Wildhay rivers). It may be possible to more accurately assess Hildebrand's methods if after redd surveys document where spawning occurs, Hildebrand's (1985) methods are applied. However, the use

of thermal infrared remote-sensing technology may provide an alternative to some of the methods used by Hildebrand (1985) to identify potential bull trout spawning habitat.

At each sample site investigators also recorded stream habitat conditions. Examining these data and CPUE results suggest the relative abundance of juvenile bull trout decreases with increased levels of fine sediments. Consequently, future studies designed to provide a better understanding of the relationship between streambed composition and juvenile bull trout densities within the study area would be useful.

Roundcroft Creek, a direct tributary of the Athabasca River, was added to the study after Fisheries Management Division staff indicated a desire to verify a report that documented a high relative abundance of bull trout in the stream (Zallen 1984). However, only brook trout (n = 80) and rainbow trout (n = 108) were captured at the site which suggests the bull trout identified by Zallen (1984) may have been brook trout that were misidentified.

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1.0 INTRODUCTION

1.1 General

Concern about declining bull trout (*Salvelinus confluentus*) populations in streams along the Eastern Slopes led Alberta Fish and Wildlife Division (F&W) to commission a study in 1985 to identify the status, and potential spawning areas, of bull trout in the McLeod, Wildhay, Berland and Pembina River systems (Hildebrand 1985). All of these river systems drain into the Athabasca River.

Hildebrand (1985) incorporated a review of available fishery and hydrology information and interviews with local F&W staff, and bull trout anglers, to identify streams that provided important spawning and rearing habitat for bull trout. He incorporated this information with aerial surveys to locate ice-free areas during the winter and identify potential spawning habitats. It was suspected that bull trout selected areas with groundwater inflow to spawn and that the groundwater inflow prevented these areas from becoming ice-covered during winter (Hildebrand 1985). After open reaches with potential spawning habitat were identified in streams thought to contain self-sustaining bull trout populations, ground surveys were used in an attempt to confirm spawning activity. Although Hildebrand (1985) identified ten tributaries (including headwater reaches of some mainstem rivers) that contained populations where bull trout were considered common or abundant in three of the river systems (McLeod, Wildhay and Berland rivers), he was unable to confirm bull trout spawning activity during field investigations. Hildebrand (1985) recommended follow-up field investigations to:

1) confirm bull trout spawning use; and
2) assess the feasibility of winter aerial surveys to locate bull trout spawning areas.

Prior to the present study, these follow-up surveys had not been conducted. However, subsequent fisheries investigations in part of Hildebrand's (1985) study area have been conducted. For example, fishery investigations were conducted in 1992 in the Wildhay River, and in the mouths of some selected tributaries, to describe the fishery resources (RL&L 1993). Including reaches where repeated electrofishing surveys were conducted, over 80 km of river were examined by RL&L (1993). However, recapture rates were low and population estimates could not be calculated for sportfish. Twenty bull trout were captured during the entire study, of which seven exceeded the 40 cm total length (TL) minimum size limit regulation for bull trout that existed when the study was conducted. Low stream productivity and angler over-harvest were identified as the primary factors limiting bull trout production in the system.

Recent investigations in the Muskeg River, a tributary of the Smoky/Peace River system, suggest that juvenile bull trout are common or abundant throughout a significant portion of the mainstem Muskeg River (Boag and Hvenegaard 1993). However, only two of the 433 bull trout captured during these investigations were larger than 40 cm fork length (FL) (range 35-438 mm FL) and little is known about the status of the Muskeg River's adult bull trout population.

"Alberta's Bull Trout Management and Recovery Plan" indicates identification of critical habitats for all life stages of bull trout, but particularly spawning and rearing habitats, is necessary (Berry 1994). Identifying such habitats is required to ensure critical habitats are protected from land-use activities that may have detrimental impacts. Locating critical habitats is also important to help monitor population trends. For example, redd counts are commonly used to identify spawning habitats and to monitor population trends for bull trout (e.g., Pratt 1985; Fraley and Shepard 1989; Johnson 1991; Rees 1992; Rieman and McIntyre 1993; Allan 1994; and Stelfox and Egan 1994).

Although Hildebrand (1985) identified several areas in the McLeod, Wildhay and Berland River systems that were considered to have high to medium potential for bull trout spawning, confirmation of the methods employed, and potential spawning sites identified, by Hildebrand (1985) was required. Fisheries

Management Division (FMD) staff suggested the low abundance of bull trout may limit opportunities to identify and describe spawning habitats in the Athabasca River system and that better opportunities may exist in the Muskeg River system (C. Hunt, FMD, Edson, pers. comm.).

1.2 Objectives

The purpose of the study was to:

- locate bull trout spawning and rearing habitats in the McLeod, Berland, Wildhay and Muskeg River systems; and
- assess the potential of Hildebrand's (1985) techniques to identify potential bull trout spawning areas in the McLeod, Berland and Wildhay River systems.

The objectives of the study were to:

- assess areas identified by Hildebrand (1985) with high to medium potential for bull trout spawning and to assess the use of aerial reconnaissance surveys during ice-conditions to identify potential bull trout spawning areas. Assessing spawning potential would rely on:
  i) electrofishing surveys to document the presence and relative abundance of bull trout; and
  ii) redd surveys to identify spawning locations;
- sample fish populations in other selected tributaries to confirm the presence of juvenile or spawning bull trout;
- conduct redd surveys along streams, or stream reaches, where sampling indicated juvenile bull trout were abundant and spawning activity was likely;
- describe general stream habitat conditions of sample reaches; and
- describe habitat parameters associated with bull trout redds.

1.3 Study Area

The study area is located in Fisheries Management Area 4 and includes the McLeod, Wildhay, Berland and Muskeg sub-basins (Figure 1). The McLeod, Wildhay and Berland rivers are major tributaries of the Athabasca River system. The Muskeg River is a major tributary of the Smoky/Peace River drainage. Major regional centres within the study area include Edson, Hinton and Grande Cache (estimated populations 7,323, 9,341 and 3,842, respectively; AMA 1994).

1.3.1 McLeod River sub-basin

The McLeod River (Figure 2) originates at an elevation of 1,800 m above sea level (masl) in the Nikanssin Mountain Range on the eastern boundary of Jasper National Park (JNP) (Wallace and McCart 1984). The McLeod River flows for approximately 390 km before draining into the Athabasca River near the town of Whitecourt, Alberta (elevation: 600 masl). The study area was confined to the sub-basin upstream of the confluence of the Embarras and McLeod rivers (Figure 2). Fish species known to occur in the study area are listed in Table 1.

1.3.2 Wildhay/Berland River sub-basin

Hereafter, the Wildhay/Berland River sub-basin collectively refers to the areas drained by the Berland and Wildhay rivers, and their tributaries. The Wildhay River sub-basin describes the area drained by the Wildhay River and its tributaries. The Berland River sub-basin refers exclusively to the area within the Wildhay/Berland River sub-basin minus the Wildhay River sub-basin. The Wildhay/Berland River sub-basin (Figure 3) borders the northeastern boundary of JNP and drains an area of 5,750 km^2 (Wallace and McCart 1984).

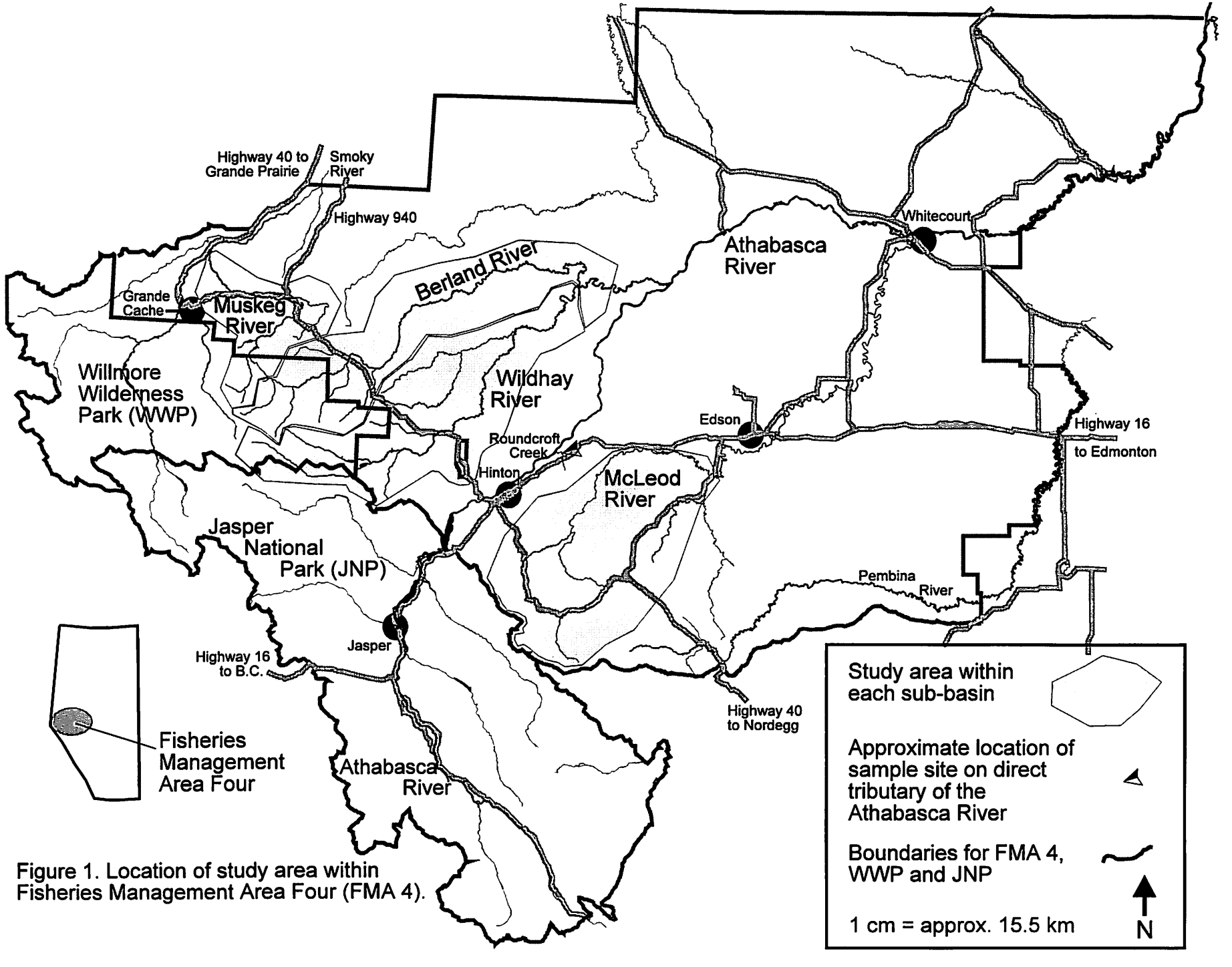

Figure 1. Location of study area within Fisheries Management Area Four (FMA 4).

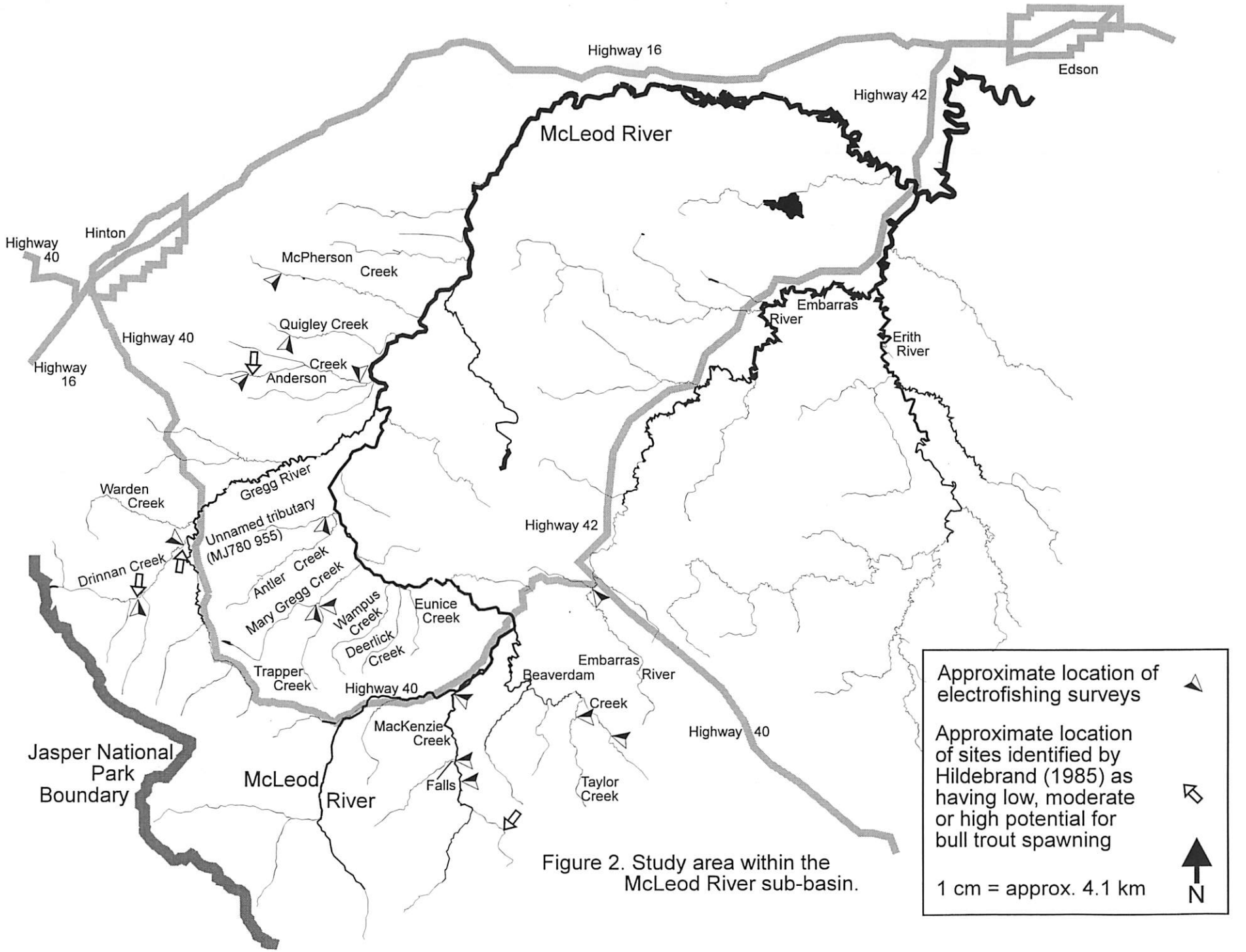

Figure 2. Study area within the McLeod River sub-basin.

Table 1. Species of fish known to occur in lotic environments within study area. (Sources: Wallace and McCart 1984; Nelson and Paetz 1992; Boag and Hvenegaard 1993; and Hunt et al. 1994).

Common name	Abbreviations* for common name	Scientific name	McLeod River sub-basin	Wildhay/Berland River sub-basin	Muskeg River sub-basin
bull trout	BLTR	*Salvelinus confluentus*	1	1	1
brook trout	BKTR	*Salvelinus fontinalis*	2	2	6
brown trout	BNTR	*Salmo trutta*	2	4	NR
rainbow trout	RNTR	*Oncorhynchus mykiss*	1	1	6
cutthroat trout	CTTR	*Oncoryhchus clarki*	NR	5	NR
Arctic grayling	ARGR	*Thymallus arcticus*	1	1	7
mountain whitefish	MNWH	*Prosopium williamsoni*	1	1	7
northern pike	NRPK	*Esox lucius*	1	1	NR
burbot	BURB	*Lota lota*	1	1	7
white sucker	WHSC	*Catostomus commersoni*	3	3	NR
longnose sucker	LNSC	*Catostomus catostomus*	3	3	8
longnose dace	LNDC	*Rhinichthys cataractae*	3	3	9
northern redbelly dace	NRDC	*Phoxinus eos*	3	3	NR
pearl dace	PRDC	*Margaricus margarita*	3	3	9
lake chub	LKCH	*Couesius plumbeus*	3	3	9
trout perch	TRPR	*Percopsis omiscomaycus*	3	3	9
brook stickleback	BRST	*Culaea inconstans*	3	3	9
spoonhead sculpin	SPSC	*Cottus ricei*	3	3	9
slimy sculpin	SLSC	*Cottus cognatus*	NR	NR	9
finescale dace	FNDC	*Phoxinus neogaeus*	10	10	NR
pygmy whitefish	PGWH	*Prosopium coulteri*	10	10	NR

* - Abbreviations from MacKay et al. 1990
1 - Indigenous sportfish species
2 - Introduced sportfish species
3 - Non-sportfish species
4 - Introduced sportfish species only known to occur in the Jarvis Creek watershed, Wildhay River sub-basin
5 - Introduced sportfish species only known to occur in the Rock Creek watershed, Wildhay River sub-basin
6 - Sportfish species introduced above Muskeg Falls
7 - Indigenous sportfish species not known to occur above Muskeg Falls
8 - Non-sportfish species introduced above Muskeg Falls
9 - Non-sportfish species not known to occur above Muskeg Falls
10 - Species are known to occur in the Athabasca River and some of its direct tributaries
NR - Not previously recorded as occurring in sub-basin

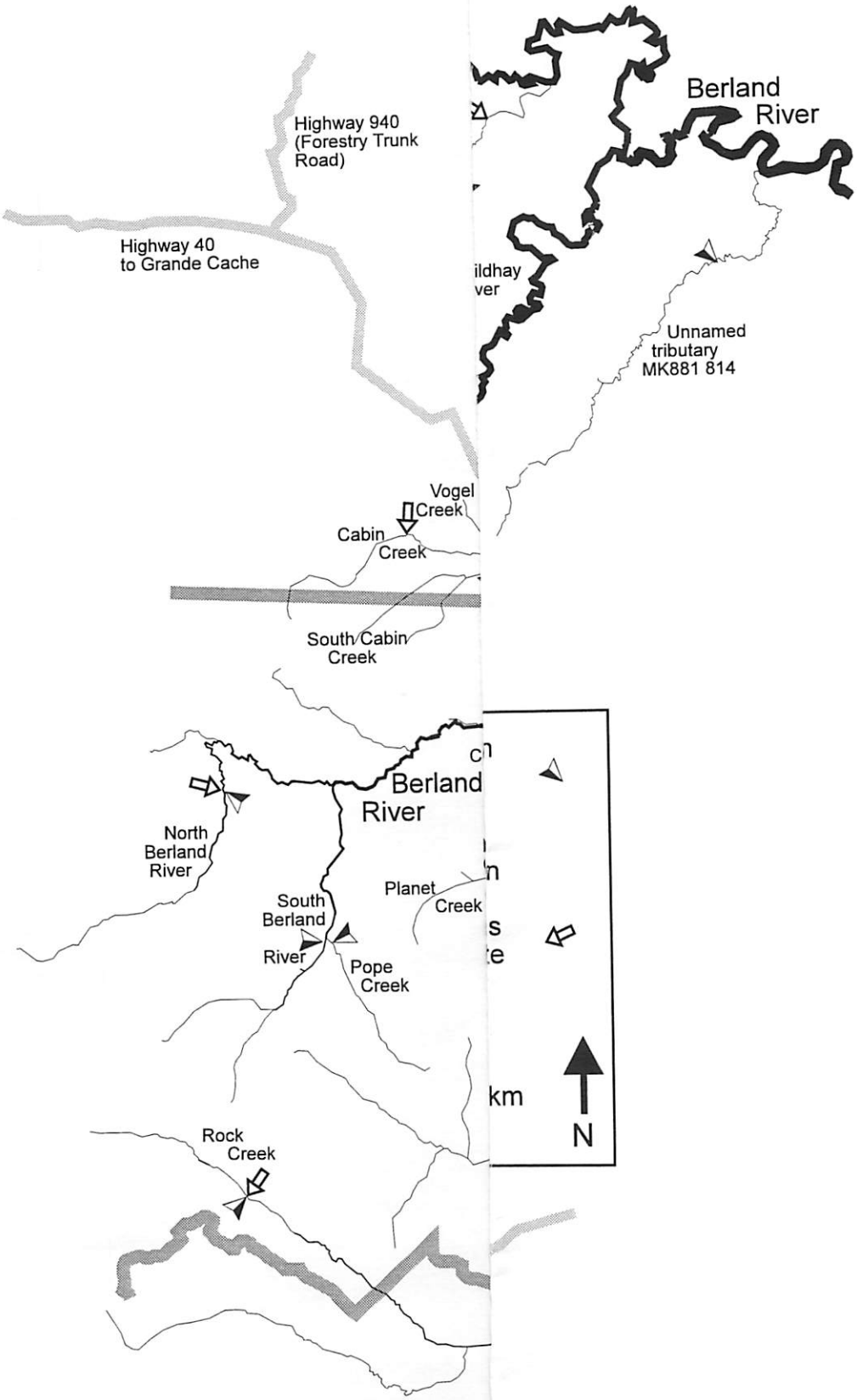

Figure 3. Study a
Wildhay/Berland

The Berland River originates in the Persimmon, Hoff and Berland Mountain ranges at an elevation of 2,270 masl in the eastern portion of the Willmore Wilderness Park (WWP). The Berland River flows for approximately 165 km before draining into the Athabasca River approximately half-way between the towns of Hinton and Whitecourt. (Wallace and McCart 1984)

The confluence of the Berland River with its major tributary, the Wildhay River, occurs approximately 29 km upstream (elevation: 908 masl) of the Berland River's mouth into the Athabasca River (elevation: 842 masl). The Wildhay River, and its tributaries, drain the southern 2,745 m^2 of the Wildhay/Berland River sub-basin (Wallace and McCart 1984). The Wildhay River originates in the Bosche, Starlight, Persimmon and Berland Mountain ranges and drains the southeastern corner of WWP. One of its tributaries, Rock Creek, originates in WWP and flows through JNP for approximately 20 km before re-entering WWP approximately 5 km upstream of Rock Lake. The Wildhay River system also drains William A. Switzer Provincial Park.

In addition to the fish species listed as occurring in the system in Table 1, lake trout (*Salvelinus namaycush*) are native to Rock Lake and have been introduced to Jarvis Lake (Hunt et al. 1994). Both of these lakes are in the Wildhay River sub-basin.

1.3.3 Muskeg River sub-basin

The Muskeg River originates at an elevation of approximately 1900 masl in WWP in the Persimmon Mountain Range. The Muskeg River flows for approximately 100 km before draining into the Smoky River (elevation: 915 masl) approximately 20 km north of the town of Grande Cache (Figure 4).

Muskeg Falls are located approximately 22 km upstream of the confluence of the Muskeg and Smoky rivers and present a natural barrier to upstream fish movement. Historically, fish populations in the Muskeg River, and tributaries draining into the river, upstream of Muskeg Falls consisted exclusively of bull trout (Haugen 1965 in Boag and Hvenegaard 1993). However, several species have been introduced above the falls. Native and introduced fish species that occur within the system are listed in Table 1.

1.3.4 Sample site locations and method of access

The approximate location of each sample site where electrofishing surveys were conducted in the McLeod, Wildhay/Berland and Muskeg River sub-basins is illustrated in Figures 2, 3 and 4, respectively. Approximate Universal Transverse Mercator (UTM) coordinates for sample sites are included in Appendix I (Table I-1). UTM coordinates were determined by identifying the approximate location of sites on National Topographic System maps (scale 1:50,000).

Locations of some electrofishing surveys were selected because they were identified by Hildebrand (1985) as providing habitat conditions conducive to bull trout spawning and rearing. These sites were in: Drinnan (MJ615 881 and MJ658 927) and Anderson (MK714 068) creeks in the McLeod River system; the North Wildhay (MK185 249) and South Wildhay (MK249 227) rivers and Rock Creek (LK896 273 and MK123 206) in the Wildhay River system; and Cabin (MK088 584), Moon (MK107 580 and MK038 440) and Beaver (MK730 809) creeks and the North Berland River (LK880 472) in the Berland River system. Approximate locations of sites identified by Hildebrand (1985) as providing low, moderate or high potential for bull trout spawning habitat in the McLeod and Wildhay/Berland River sub-basins are shown in Figures 2 and 3, respectively. Locations of electrofishing surveys in the Muskeg River sub-basin, and others in the McLeod and Wildhay/Berland River sub-basins, were selected using existing information that suggested these streams may provide important spawning or rearing habitat for bull trout.

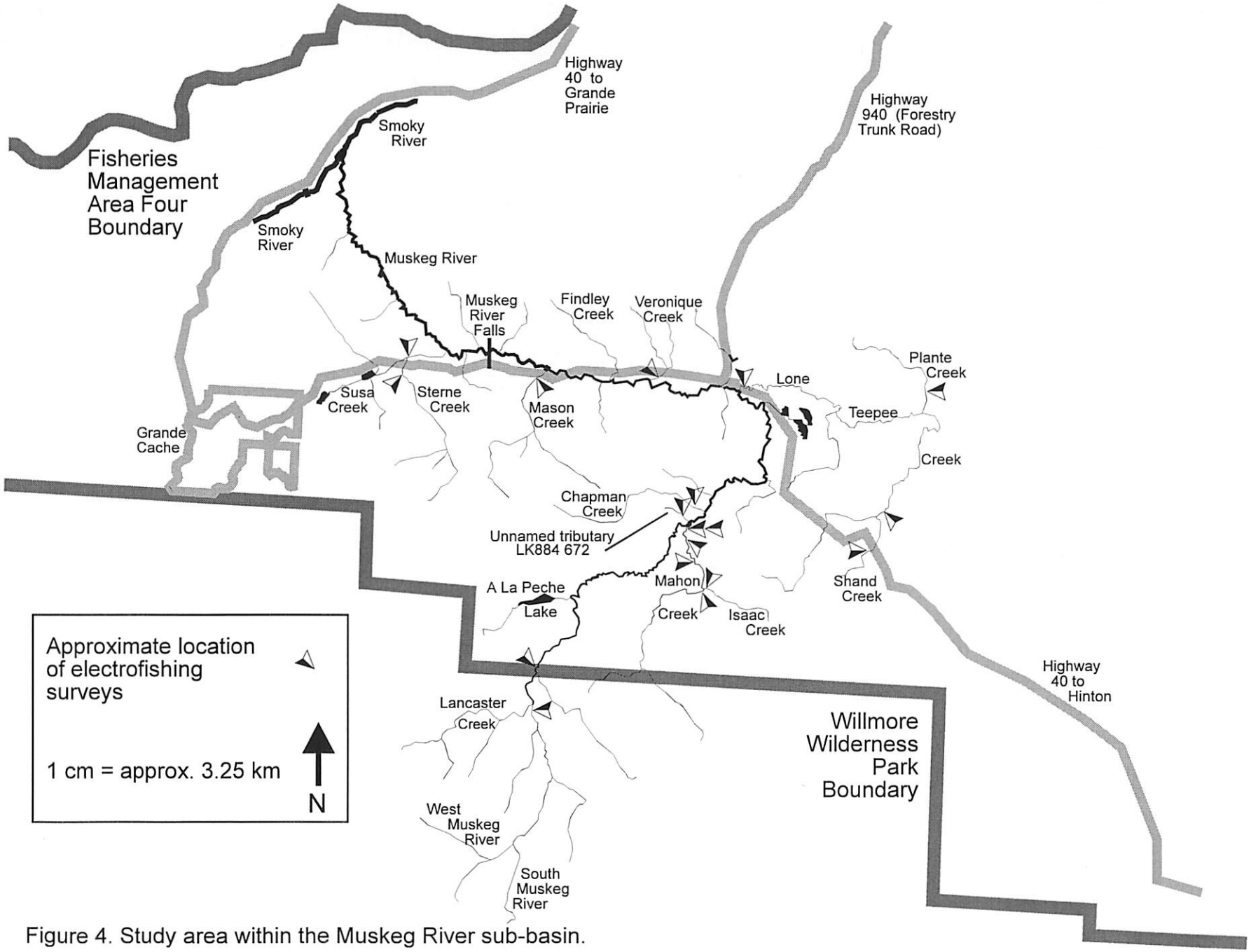

Figure 4. Study area within the Muskeg River sub-basin.

Redd surveys were conducted to determine the presence of bull trout spawning activity in several stream reaches. Stream reaches where redd surveys were conducted were generally selected after electrofishing surveys indicated juvenile bull trout were relatively abundant in a particular stream. Other criteria used to select where redd surveys were conducted were the: abundance of juvenile bull trout documented in recent fishery reports; suspected presence of groundwater inflow; and suspected quality or presence of bull trout spawning habitat as determined from Hildebrand (1985) or previous observations. Difficulty in accessing a particular stream reach also affected where redd surveys were conducted.

Methods of accessing sample sites for electrofishing and redd surveys varied. Sites less than 1.0 km from a highway or road were generally accessed by hiking. More remote sites were generally accessed via All-Terrain-Vehicle (ATV). However, sites within WWP were accessed via ATV to the park boundary and then by hiking. The mouths of several tributaries, and one side channel, of the Berland River were reached by floating the river downstream from Highway 40 in an inflatable raft. An inflatable raft was also used to access Rock Creek immediately upstream from Rock Lake. Four sites in WWP (North and South Berland rivers and Pope and upper Rock creeks) were accessed by helicopter.

1.3.5 Other

Unnamed tributary MK763 306, locally known and hereafter referred to as Roundcroft Creek, is a direct tributary of the Athabasca River. It was added to the study during discussions with FMD staff. After reviewing a report prepared for industry that indicated relatively high numbers of bull trout existed in Roundcroft Creek (Zallen 1984), FMD indicated a desire to verify the report (R. Hawryluk, FMD, Edson, pers. comm.). Roundcroft Creek and the approximate location of the study site (MK766 293) are shown in Figure 1.

Eunice Creek, a tributary of the McLeod River, where annual bull trout population estimates were conducted from 1971 to 1985 (excluding 1984) (Hunt et al. 1994) was originally intended to be included as one of the study streams. The last population estimate in 1985 indicated Eunice Creek contained 688 $\pm$ 230 bull trout/km and that bull trout represented 80% of the sportfish in the stream. However, Eunice Creek was removed from the study after FMD staff sampled Eunice Creek in 1993 and only captured four bull trout during two electrofishing passes in a 300 m reach (R. Hawryluk and D. Hildebrandt, FMD, Edson, pers. comm.).

Hildebrand (1985) discussed the status of bull trout in a tributary of the Berland River (Unnamed tributary MK484 787), unofficially called Jessie Creek. Hunters camped near the mouth of this stream indicated it is also locally known as Grizzly Creek.

2.0 METHODS

2.1 Assessment of distribution and abundance of fish species

2.2.1 Backpack electrofishing surveys

Backpack electrofishing surveys were conducted using two, three or four man crews equipped with either a Smith-Root Model 15 POW, or a Smith-Root Model 7, Backpack Electrofisher. The Model 15, capable of producing Programable Output Waveforms (POW), was used at the majority of sites. The two electrical outputs used by crews using the Model 15 (Table 2) are called *"gated bursts of pulses"* and were designed to minimize injuries to fish (L. Carscanden, Smith-Root Inc., WA, pers. comm.). The Model 7 was not capable of producing POW's, but produces waveforms which have traditionally been used in Alberta. Electrical outputs used by crews operating the Model 7 Electrofisher are also shown in Table 2.

All electrofishing surveys were conducted while wading in an upstream direction. Electrofishing crews attempted to capture all observed fish with dipnets. Whenever possible, representative stream reaches of 300 m, or greater, were chosen as sample sites. Average stream width was determined by recording stream widths at 30 m intervals and calculating the mean.

Most backpack electrofishing surveys employed a single-pass through the sample reach. The relative abundance of fish at each reach was determined by calculating the catch per unit effort (CPUE) (i.e., number of fish captured per number of active seconds expended electrofishing; number of fish captured per unit stream length; and number of fish captured per unit area). Block nets were not used at sites where single-pass electrofishing surveys were conducted.

Population estimates using the removal method were conducted at four sites [two sites in Mahon Creek (Muskeg River system), one site in Rock Creek (Berland River system), and one site in Mary Gregg Creek (McLeod River system)]. Obtaining population estimates involved installing block nets at the upper and lower limits of the sample reach. After block nets were installed, a series of three electrofishing passes were conducted. Each pass involved thoroughly electrofishing the entire sample reach. Fish captured during each pass were kept in separate live wells until they were processed. After three passes, block nets were removed and captured fish were processed and released. Maximum-likelihood population estimates were calculated using Micro-Fish 3.0, a computer software program (Van Deventer and Platts 1989).

Table 2: Electrical outputs used during electrofishing surveys

Smith-Root Model 15 POW Electrofisher

Voltage range	Pulse width	Time between pulses	Number of pulses in bursts
300-400 v	1 ms	2 ms	3
300-400 v	1 ms	2 ms	4

Smith-Root Model 7 Electrofisher

Voltage range	Range of pulse widths	Range of frequencies
300-500	5-7 ms	50-70 Hz

2.2.2 Fish processing

Processing captured fish involved anaesthetizing them with 2-phenoxy-ethanol and recording their: species; FL to nearest mm; live wet weight; sex and sexual condition (when possible); visual presence of electrofishing induced injury (e.g., bruising); and general condition or unusual remarks (e.g., presence of floy anchor tags, or physical injury). The natural total length (TL) (to nearest mm) of captured bull trout was also recorded. Live wet weights were measured using an electronic balance. One electronic balance was capable of measuring to the nearest gram; the other could measure to the nearest two grams. Sex and sexual condition of sexually mature fish (i.e., adults) were determined from the expulsion of gametes or by external sexual dimorphisms (e.g., presence of kype on males). All bull trout in excess of 140 mm were tagged with Visible Implant (VI) tags (Northwest Marine Technology, Inc, Shaw Island, WA). Tagged fish were also permanently marked by clipping their adipose fin. After processing, fish were placed in a basin of clean water to recover from the anesthetic before being released.

Captured fish were generally identified to their species level. However, some non-sportfish were only identified to their genus (e.g., sculpins - *Cottus* spp.). The species of some captured fish could not be positively identified but it was obvious these fish were *Salvelinus* spp. as they shared external morphological and pigmentation characteristics similar to both bull trout and brook trout. These fish were classified as suspected bull trout X brook trout hybrids. One of primary features used to identify suspected hybrids was the coloration of dorsal and caudal fins. Similar to criteria described by Markle (1992), specimens with uniformly coloured dorsal and caudal fins were considered bull trout; specimens with dark (black) and light coloured banding of the dorsal fin were identified as brook trout; and specimens with a black spotted dorsal fin were classified as suspected hybrids.

One suspected hybrid captured in Lone Teepee Creek, Muskeg River system, was sacrificed. It was sent to W. Roberts at the Department of Zoology, University of Alberta, who conducted an X-ray examination of its skeletal structure to confirm its species (see Section 3.1.2).

2.2.3 Redd surveys

Redd surveys involved navigating stream reaches that appeared to provide suitable bull trout spawning habitat. Generally, redd surveys were conducted by wading the stream in an upstream direction. However, redd surveys in the Wildhay River and portions of Rock Creek involved floating in an inflatable raft. Incidental observations of redds were also made during electrofishing surveys. When redds were observed during electrofishing surveys, activating the electroshocker within a 5 m radius of the redd was avoided as electrofishing can negatively affect survival of recently deposited trout eggs (Dwyer et al. 1993).

Individual redds were identified by literature descriptions (Hunter 1973; Reiser and Wesche 1977; Allan 1980; Graham et al. 1981; Brewin 1991) that described their: location within the stream (i.e., habitat type and depth); distinctive shape and size; and clean silt- and algal-free appearance. The presence and behaviour of bull trout over, or in the immediate vicinity of, suspected redds was also used to assist with identification of redds. In areas where redd superimposition was suspected to have occurred, only redds that displayed all the distinctive characteristics where included in the redd count. Sites that appeared to be redds constructed in 1993, but lacked one or more of the distinctive features used to identify redds were recorded as "possible redds".

The following habitat parameters were recorded from bull trout redds that displayed all of the distinctive characteristics: maximum stream depth; stream depth at midstream; wetted stream width; stream velocity and depth above pit; total length of redd; stream depth at tailspin of redd; visual estimate of substrate composition at stream cross-section one metre upstream and downstream of redd; visual estimate of substrate composition within the redd; distance of redd from nearest bank; distance of redd from nearest

cover; nearest cover type(s); stream gradient; and stream temperature above the substrate of the redd (nearest 0.5° C). Length, width and depth measurements were measured to the nearest 0.5 cm, or to the nearest 0.25 inch and converted to metric. Locations and definitions of redd measurements (e.g., pit, tailspin, maximum water depth in pit) are described by Reiser and Wesche (1977). Stream velocity above the pit was measured with a Pygmy Gurley Meter (Model 625) at 6/10 of the pit depth. Visual estimates of substrate composition were determined for substrate sizes listed in Table 3. The nearest cover types included: boulder cover; overhanging vegetation; woody debris; aquatic vegetation and undercut banks. Boulder cover for spawning adults was defined as the percent of the total wetted surface area immediately downstream of boulders (diameter 300 mm or greater) that adult fish could utilize for cover. Overhanging cover was determined by the percent of the total wetted surface area that was overhung by streamside vegetation (live or dead plant material within 1 m of the water surface). Woody debris cover was defined as the percent of the total wetted surface area that woody debris (diameter 150 mm of greater) provided cover for fish. Aquatic vegetation cover and undercut banks were defined as the percent of the total wetted surface area of the stream that each component covered. Stream gradient was determined over a 20-30 m distance with a large Abney Clino/Level (accuracy: ± 1%).

Redd superimposition (Beard and Carline 1991) complicated positive identification of some individual redds. Habitat parameters of redds where nearby superimposition was apparent were not collected. Wading in areas where superimposition was apparent was avoided because egg survival can be negatively impacted by wading on redds (Roberts and White 1992).

Table 3. Criteria used to estimate percent substrate composition* .

Substrate type	Code	Substrate diameter range (mm)	
		minimum	maximum
Fines	1	0	2
Small gravel	2	3	25
Large gravel	3	26	100
Rock	4	101	300
Boulder	5	301+	
Bedrock	6	(solid rock underlying superficial deposits)	

*Classification system developed by author

2.2.4 Description of lotic habitats at sample sites

A general description of the physical habitat was recorded at each reach where backpack electrofishing surveys were conducted. The method of describing habitat conditions were designed to collect data on important habitat parameters in an efficient manner. The length, and width every 30 m (to the nearest 0.5 cm), of each sample site was measured with a 100 m measuring tape. The pool:riffle:run:rapid ratio of each sample site was recorded by measuring the length of each pool, riffle, run and rapid and then calculating the percent of each habitat type within the total length of the sample reach. Definitions of these habitat types are found in RL&L (1993); however, pool and flat habitat types as defined by RL&L 1993 were grouped together as pool habitat. Visual estimates were recorded of the: percent composition of substrate types (Table 3); and percent composition of cover types. Stream gradient at each sample reach was obtained by using a large Abney Clino/Level (accuracy: ± 1%) to measure the gradient at a minimum of three locations (length of each location generally ranged between 20 and 40 m) and then calculating the average gradient. Stream temperatures (to nearest 0.5° C) were also collected.

The percent composition of substrate types was determined by visually estimating the percentage of each substrate type (Table 3) within each 30 m reach. Estimates from all crew members were recorded and used to calculate the average percent composition of each substrate type in the entire sample reach.

The percent composition of cover types was determined by crew members visually estimating the percentage of the stream's surface area for each cover type within each 30 m reach and then the mean for each cover type throughout the sample reach was calculated. The types of cover recorded were: boulder cover; overhanging vegetation; woody debris; aquatic vegetation; garbage; and undercut banks. Overhanging vegetation, woody debris, aquatic vegetation, and undercut banks are described in Section 2.2.3. Because juvenile salmonids utilize cobble substrates for concealment cover, similar to Schrader and Grisswold (1992), large clean cobbles (diameter 100 mm of greater) with interstitial spaces available for concealment cover were added to the definition of boulder cover in Section 2.2.3. Garbage cover was defined as the percent of the total wetted surface area that was covered with refuse (i.e., litter, rubber tires, manufactured lumber, etc.)

To help identify potential relationships between recorded habitat parameters and CPUE of bull trout, habitat data were grouped into four categories based on CPUE of bull trout at sample sites (0.0, from 0.1 to 9.9, from 10.0 to 24.9, and 25.0 or more, bull trout/km). These four categories were selected because they closely resembled criteria used by Rhude and Stelfox (1994) and Brewin (1994) to characterize bull trout populations; they used 0.0 (extirpated or absent during sampling), from 0.1 to 10.0 (incidental or remnant), and greater than 10 (self-sustaining), bull trout/km to characterize bull trout populations.

3.0 RESULTS

3.1 Electrofishing surveys in the McLeod, Wildhay, Berland and Muskeg River sub-basins

3.1.1 General

Electrofishing surveys were conducted at 69 sites in 51 streams in the McLeod (15 sites in 11 streams), Wildhay (12 sites in 10 streams), Berland (24 sites in 18 streams), and Muskeg (18 sites in 12 streams, but two sites in Mahon Creek overlapped and shared the same downstream limit) River sub-basins. The date, number of active seconds expended while electrofishing, number of people in electrofishing crew, stream temperature during sampling, stream length, and model of Electrofisher used is provided in Appendix I (Table I-1). Sampling was conducted between August 10 and October 2, 1993. Raw data for individual fish from each sample site in the McLeod, Wildhay, Berland and Muskeg River sub-basins are provided in Appendix III (Table III-1, III-2, III-3 and III-4, respectively).

The Tri-Creeks watershed (Eunice, Deerlick and Wampus creeks) in the McLeod River sub-basin was included in the study area. However, FMD conducted population estimates in these three streams during 1993 and field crews assisted FMD during population estimates in Wampus and Deerlick creeks. Results from these populations estimates are available from FMD (Edson).

3.1.2 Presence of fish species

Species of fish captured during electrofishing surveys are presented in Table 4. Because only a single sample site was examined in most streams, the results only document those species confirmed to be present in each stream or river. The failure to capture species that have been previously documented in a specific stream does not necessarily indicate the species' absence.

Fish were captured in 49 of the 51 streams sampled (Table 4). Rainbow trout were the most widely distributed species and were found in 42 streams and at 54 of the 69 sites where electrofishing surveys were conducted (Table 5).

Bull trout were captured in 34 of the 51 streams sampled (including the Berland River where one bull trout was captured by angling) (Table 4) and at 43 of the 69 sites where electrofishing surveys were conducted (Table 5). Except in the McLeod River sub-basin, the number of streams containing bull trout was similar to the number of streams containing rainbow trout. Bull trout, however, were seldom found in tributaries that drain into the mainstem rivers at lower elevations. For example, no bull trout were captured in: the Embarras River, Quigley and McPherson creeks (McLeod River system); Pinto, Hightower and Twelve Mile creeks (Wildhay River system); in Unnamed tributary MK881 814, Beaver Creek and its Unnamed tributary MK692 799 and Unnamed tributary MK484 787 (Berland River system); and Susa Creek (Muskeg River system). With the exception of these streams, there were only four other streams [Unnamed tributary MJ780 955, Beaverdam and Taylor creeks (McLeod River sub-basin) and Mason Creek (Muskeg River sub-basin)] where fish were captured, but bull trout were not.

A suspected bull trout X brook trout hybrid was captured in Lone Teepee Creek, Muskeg River sub-basin. Except for one suspected hybrid captured in Wampus Creek while assisting FMD obtain a population estimate, this was the only suspected hybrid captured during the study. The suspected hybrid from Lone Teepee Creek was confirmed to be a hybrid based on an X-ray examination of its skeletal structure (pers. comm., W. Roberts, University of Alberta, Edmonton).

3.1.3 Relative abundance of fish species

Within sub-basins, the relative abundance of bull trout was lowest in the McLeod River drainage and highest in the Muskeg River drainage (Table 5). Although streams that were suspected to be important to

Table 4. Species of fish captured in streams and rivers in the McLeod, Wildhay, Berland and Muskeg River sub-basins during sampling between August 10 and October 2, 1993.

	Fish species present						
Tributary or river	Bull trout	Rainbow trout	Brook trout	Mountain whitefish	Cottus spp.	Burbot	Other
McLeod River sub-basin	**X**	**X**	**X**	**X**	**X**	**X**	
Embarras River			X		X		
Quigley Creek		X					
McPherson Creek		X					
Anderson Creek	X	X				X	
Drinnan Creek	X	X	X				
Unnamed tributary MJ780 955		X					
Mary Gregg Creek	X	X					
Trapper Creek	X	X					
Beaverdam Creek		X			X	X	
Taylor Creek		X					
MacKenzie Creek	X	X	X	X			
Wildhay River sub-basin	**X**	**X**	**X**	**X**	**X**	**X**	ARGR, LNSC, CTTR & NRPK
Pinto Creek		X			X	X	ARGR
Hightower Creek		X			X		ARGR & LNSC
Twelve Mile Creek		X					
Moberly Creek	X	X	X			X	
Paradise Creek							NO FISH CAPTURED
South Wildhay River	X						
Collie Creek	X	X					
Mumm Creek	X						
Rock Creek	X	X		X	X	X	CTTR & NRPK
North Wildhay River	X	X		X			

Table 4 (cont.).

Tributary or river	*Fish species present* Bull trout	Rainbow trout	Brook trout	Mountain whitefish	Cottus spp.	Burbot	Other
Berland River sub-basin	**X**	**X**		**X**	**X**	**X**	**LNSC**
Unnamed tributary MK881 814		X					
Beaver Creek		X			X	X	
Unnamed tributary MK692 799		X			X	X	LNSC
Unnamed tributary MK484 787		X			X		
Berland River side channel (MK442 796)	X (1)	X		X	X		
Big Creek	X	X		X	X	X	
Little Berland River	X	X		X			
Fox Creek	X	X		X		X	
Evans Creek	X	X					
Broad Creek	X	X					
Cabin Creek	X	X		X			
Hendrickson Creek	X	X					
Vogel Creek	X	X		X	X		
South Cabin Creek	X	X				X	
Moon Creek	X	X					
North Berland River	X			X			
South Berland River	X			X			
Pope Creek	X			X			
Muskeg River sub-basin	**X (2)**	**X**	**X**	**X (3)**	**X**		**LNSC**
Susa Creek		X			X		
Sterne Creek	X	X		X (3)	X		
Muskeg River sub-basin (above falls)	**X (2)**	**X**	**X**				**LNSC**
Mason Creek		X					
Veronique Creek	X	X					
Lone Teepee Creek	X (2)	X	X				LNSC
Plante Creek	X	X	X				
Shand Creek							NO FISH CAPTURED
Chapman Creek	X	X					
Unnamed tributary LK884 672	X	X					
Mahon Creek	X	X					
Issac Creek	X						
Muskeg River above A La Peche Lake	X	X					

ARGR=Arctic grayling; LNSC=longnose sucker; CTTR=cutthroat trout; NRPK=northern pike; X=present. Species abbrev. from MacKay et al. 1

1 - Although no bull trout were caught while electrofishing the side channel, one was caught about 3 km below the mouth of Big Creek by anglin

2 - One suspected bull trout X brook trout hybrid was captured in Lone Teepee Creek.

3 - Although no mountain whitefish were captured, two fresh mountain whitefish carcasses were observed along the stream.

Table 5. Catch per unit effort (CPUE) in terms of number of sportfish captured per active time of electrofishing in the McLeod, Wildhay, Berland and Muskeg River sub-basins and Roundcroft Creek.

Sub-basin	Species	Total number of fish captured	CPUE (#/minute)	Number of sample sites where captured
McLeod River sub-basin	brook trout	29	0.07	3
(n = 15 sample sites)	bull trout	54	0.13	7
	rainbow trout	238	0.59	13
	mountain whitefish	12	0.03	1
	burbot	3	0.01	2
Wildhay River sub-basin	Arctic grayling	4	0.01	2
(n = 12 sample sites)	brook trout	37	0.12	1
	bull trout	50	0.16	8
	cutthroat trout	2	0.01	1
	rainbow trout	73	0.24	8
	mountain whitefish	6	0.02	3
	burbot	3	0.01	2
	northern pike	4	0.01	1
Berland River sub-basin	bull trout	140	0.20	15
(n = 24 sample sites)	rainbow trout	162	0.24	19
	mountain whitefish	36	0.05	11
	burbot	14	0.02	6
Muskeg River sub-basin	brook trout	147	0.25	3
(n = 17 sample sites)	bull trout	260	0.44	13
	rainbow trout	193	0.33	13
	bull trout X brook trout hybrid	1	0.00	1
Roundcroft Creek	brook trout	80	1.74	1
(n = 1 sample site)	rainbow trout	108	2.36	1

spawning and rearing bull trout were targeted in this study, CPUE for rainbow trout was higher than for bull trout in the McLeod, Wildhay and Berland River sub-basins. Other species of sportfish captured during the study generally were not abundant (Table 5) or widespread (Table 4 and 6a-d). Because streams that were suspected to provide important bull trout rearing or spawning were targeted and many streams were not sampled or were only sampled at a single location, CPUE listed for each species in Table 4 may not necessarily be indicative of their relative abundance throughout the sub-basin.

The relative abundance of fish captured at individual sample reaches in the McLeod, Wildhay, Berland and Muskeg River sub-basins are presented in Table 6a, b, c and d, respectively. At sites where more than one electrofishing pass was completed (i.e., sites where population estimates using the removal method were conducted), only the first electrofishing pass was used to calculate CPUE. The CPUE of bull trout (number captured per active minute of electrofishing) obtained at each sample site in the McLeod and Wildhay (Figure II-1), and Berland and Muskeg (Figure II-2), River systems is illustrated graphically in Appendix II.

Among all sites the highest relative abundance of bull trout (fish/minute) was recorded at two sites in Mahon Creek, a tributary of the Muskeg River (Table 6a-d). These sites were separated by a beaverdam that created an impassable barrier to upstream migration. CPUE of bull trout above the beaverdam was 1.5 fish/minute. Approximately 1/3 of the bull trout (20 of 59 bull trout captured) captured at this site were less than 65 mm FL and assumed to be young-of-the-year (YOY). However, no bull trout greater than 200 mm FL were captured at this site. Below the beaverdam, CPUE was 1.4 bull trout/minute. A population estimate involving three electrofishing passes was conducted at this site (see Section 3.1.4). During the three passes a total of 80 bull trout, mostly adults, were captured; ten were shorter than 65 mm FL and 42 were longer than 200 mm FL.

The highest relative abundance of bull trout among sub-basins within the Athabasca River Basin was recorded in the Little Berland River (Table 6c). This site (MK172 479) was approximately 400 m below an impassible barrier to fish. The barrier was located approximately 1.8 km upstream from Highway 40 and several bull trout redds were observed immediately below the barrier (see Section 3.2). This barrier was the result of the Little Berland River cutting a new channel around a log jam and the formation of 1-1.5 m waterfalls at both the upstream and downstream ends of the new channel. The new channel was between 300 and 500 m long (visual estimate). The composition of substrates in the area suggested natural erosion processes would reduce the height of, or remove the, impassable barriers by the next spawning season.

Although the high relative abundance of juvenile and YOY bull trout (204.4 bull trout/ha) which were captured above the impassible barrier in Mahon Creek suggests impassible barriers may help provide refuge habitat for small bull trout from large predatory adults, results from the Little Berland River do not support this argument as the relative abundance of non-adult bull trout was higher below the impassible barrier (141.2 bull trout/ha) than above it (40.1 and 23.9 bull trout/ha at two different sites).

3.1.4 Population estimates

Populations estimates conducted in Mary Gregg Creek (McLeod River system), Rock Creek (Wildhay River system) and two sites in Mahon Creek (Muskeg River system) are presented in Table 7. The population estimate in Mary Gregg Creek was 433 bull trout/ha (range 182-780 fish/ha) and all bull trout were non-adults (range 124-187 mm FL). Rainbow trout, and not bull trout, were the dominant species in the sample by a 4.4 to 1 ratio. Sampling in Mary Gregg Creek was delayed until the end of the study because turbid conditions were prevalent when the stream was visited in late August. Turbid conditions were also prevalent during the October 2 population estimate and restricted visibility into the stream to 30-45 cm. Poor visibility in the stream likely contributed to this site having the lowest capture probability among the four sites where population estimates were conducted.

Table 6a. Relative abundance of species of fish captured at individual sample sites in the McLeod River sub-basin during 1993. Abbreviations for fish species are defined in Table 1.

Location	Universal Transverse Mercator location	Sample date	Species captured **	No. of fish caught	CPUE (#/min.)	CPUE (#/km)	CPUE (#/ha)
Embarass River	MJ995 911	Aug. 17	BKTR	2	0.07	6.67	9.45
(50 m*** above Highway 40 bridge)	MJ995 911	Aug. 17	Cottus spp.	3	0.10	10.00	14.17
	MJ995 911	Aug. 17	All species	5	0.17	16.67	23.62
McPherson Creek (50 m*** above service road bridge)	MK822 133	Oct. 1	RNTR	9	0.33	25.71	243.90
Quigley Creek (300 m *** above roadcrossing)	MK738 104	Oct. 1	RNTR	10	0.49	33.33	59.40
Anderson Creek	MK793 067	Sept. 30	BURB	2	0.07	7.02	13.68
(approximately 1.6 km above mouth)	MK793 067	Sept. 30	RNTR	49	1.60	171.93	335.15
	MK793 067	Sept. 30	All species	51	1.66	178.95	348.83
Anderson Creek (near Site A1*) (approximately 12 km above mouth into McLeod River)	MK714 068	Aug. 11	BLTR	1	0.05	3.70	10.06
Drinnan Creek (near Site D1*)	MJ658 927	Aug. 11	RNTR	4	0.10	12.50	14.12
(50 m*** above Warden Creek Road bridge)	MJ658 927	Aug. 11	BLTR	2	0.05	6.25	7.06
	MJ658 927	Aug. 11	BKTR	19	0.49	59.38	67.09
	MJ658 927	Aug. 11	All species	25	0.65	78.13	88.28
Drinnan Creek (near Site D2*)	MJ615 881	Aug. 10	RNTR	1	0.04	3.33	3.23
(approximately 7.5 km above mouth into Gregg River)	MJ615 881	Aug. 10	BLTR	3	0.11	10.00	9.69
	MJ615 881	Aug. 10	All species	4	0.14	13.33	12.92
Unnamed Creek MJ780 955 (known as Nice Neat creeks) (50 m*** above Tri-Creeks Road)	MJ777 952	Oct. 2	RNTR	25	1.13	100.00	272.48
Mary Gregg Creek (first run for population estimate)	MJ768 879	Oct. 2	BLTR	10	0.31	33.33	60.72
(50 m*** above bridge; above mouth of Trapper Creek)	MJ768 879	Oct. 2	RNTR	51	1.59	170.00	309.65
	MJ768 879	Oct. 2	All species	61	1.90	203.33	370.37

Table 6a (cont.).

Location	Universal Transverse Mercator location	Sample date	Species captured **	No. of fish caught	CPUE (#/min.)	CPUE (#/km)	CPUE (#/ha)
Trapper Creek	MJ771 878	Oct. 2	BLTR	2	0.07	6.67	13.28
(300 m*** above mouth into Mary Gregg Creek)	MJ771 878	Oct. 2	RNTR	19	0.63	63.33	126.16
	MJ771 878	Oct. 2	All species	2	0.07	6.67	13.28
Beaverdam Creek	NJ013 779	Sept. 30	BURB	1	0.04	3.33	5.43
(70 m**** below road; 15.1 km SE of Hwy 40)	NJ013 779	Sept. 30	Cottus spp.	2	0.08	6.67	10.86
	NJ013 779	Sept. 30	RNTR	18	0.71	60.00	97.72
	NJ013 779	Sept. 30	All species	21	0.82	70.00	114.01
Taylor Creek	MJ985 798	Sept. 30	RNTR	2	0.12	6.67	11.49
(70 m*** above road; 10.8 km SE of Hwy 40)							
MacKenzie Creek	MJ895 819	Aug. 18	BKTR **	8	0.17	26.67	13.16
(75 m*** above mouth into McLeod River)	MJ895 819	Aug. 18	RNTR **	10	0.21	33.33	16.44
	MJ895 819	Aug. 18	All species	18	0.38	60.00	29.60
MacKenzie Creek	MJ888 755	Oct. 1	MNWH	12	0.38	40.00	41.37
(20 m*** above mouth of Little MacKenzie Creek)	MJ888 755	Oct. 1	BLTR	7	0.22	23.33	24.13
	MJ888 755	Oct. 1	RNTR	20	0.63	66.67	68.94
	MJ888 755	Oct. 1	All species	39	1.23	130.00	134.44
MacKenzie Creek	MJ892 744	Oct. 1	BLTR	29	0.82	95.08	72.14
(approximately 1.5 km above 1.5-2.0 m falls)	MJ892 744	Oct. 1	RNTR	20	0.56	65.57	49.75
	MJ892 744	Oct. 1	All species	49	1.38	160.66	121.89

* - Reach near site was identified by Hildebrand (1985) as having low, moderate or high potential for bull trout spawning.
** - Some of the fish captured at the site were ripe (i.e., gametes were easily extracted from).
*** - Describes approximate location of lower limit of sample reach.
**** - Describes approximate location of upper limit of sample site
CPUE - catch per unit effort; NR - not sampled; SE - southeast; Hwy - Highway

Table 6b. Relative abundance of species of fish captured at individual sample sites in the Wildhay River sub-basin during 1993. Abbreviations for fish species are defined in Table 1.

Location	Universal Transverse Mercator locations	Sample date	Species captured **	No. of fish caught	CPUE (#/min.)	CPUE (#/km)	CPUE (#/ha)
Pinto Creek	MK457 585	Sept. 28	ARGR	1	0.05	3.51	2.52
(approx. 2.0 km above confluence with Hightower Creek)	MK457 585	Sept. 28	BURB	1	0.05	3.51	2.52
	MK457 585	Sept. 28	RNTR	2	0.11	7.02	5.04
	MK457 585	Sept. 28	Cottus spp.	3	0.16	10.53	7.56
	MK457 585		All species	7	0.38	24.56	17.63
Hightower Creek	MK455 602	Sept. 28	ARGR	3	0.13	10.00	6.50
(200 m*** above mouth into Pinto Creek)	MK455 602	Sept. 28	LNSC	1	0.04	3.33	2.17
	MK455 602	Sept. 28	RNTR	7	0.31	23.33	15.17
	MK455 602	Sept. 28	Cottus spp.	3	0.13	10.00	6.50
	MK455 602		All species	14	0.63	46.67	30.34
Twelve Mile Creek (50 m*** above Hwy 40 culvert)	MK411 347	Sept. 29	RNTR	27	1.79	180.00	396.48
Moberly Creek	MK325 346	Sept. 26	BLRT	1	0.04	3.23	4.37
(approx. 1.7 km NW on Moberly Tower Road from RLR)	MK325 346	Sept. 26	BKTR **	37	1.35	119.35	161.51
	MK325 346	Sept. 26	BURB	1	0.04	3.23	4.37
	MK325 346	Sept. 26	RNTR	12	0.44	38.71	52.38
	MK325 346	Sept. 26	All species	51	1.86	164.52	222.62
Paradise Creek (250 m*** above mouth)	MK288 352	Sept. 29	No fish captured		0.00	0.00	0.00
South Wildhay River (near Site W3*) (about 9 km above Wildhay River and 0.8 km above log cabins)	MK249 227	Sept. 26	BLTR	12	0.55	34.29	51.40
Collie Creek	MK255 295	Aug. 12	BLTR	1	0.04	3.70	5.59
(20 m*** above RLR bridge)	MK255 295	Aug. 12	RNTR	15	0.58	55.56	83.92
	MK255 295	Aug. 12	All species	16	0.62	59.26	89.52
Mumm Creek (approx. 2.5 km above RLR)	MK185 281	Sept. 29	BLTR	3	0.12	10.00	17.83

Table 6b (cont.).

Location	Universal Transverse Mercator locations	Sample date	Species captured **	No. of fish caught	CPUE (#/min.)	CPUE (#/km)	CPUE (#/ha)
Rock Creek (near Site R3*)	MK123 206	Sept. 27	BLTR	1	0.03	1.92	1.93
(175 m**** from JNP boundary; about 4.5 km above Rock Lake)	MK123 206	Sept. 27	BURB	1	0.03	1.92	1.93
	MK123 206	Sept. 27	MNWH	2	0.05	3.85	3.85
	MK123 206	Sept. 27	NRPK	4	0.11	7.69	7.70
	MK123 206	Sept. 27	RNTR	1	0.03	1.92	1.93
	MK123 206	Sept. 27	Cottus spp.	1	0.03	1.92	1.93
	MK123 206	Sept. 27.	All species	10	0.27	19.23	19.25
Rock Creek (near Site R1*: first run for population estimate)	LK896 273	Sept. 15	BLTR **	22	0.73	70.97	85.92
(approximately 6.25 linear km below Summit Cabin)	LK896 273	Sept. 15	CTTR	2	0.07	6.45	7.81
	LK896 273	Sept. 15	MNWH	1	0.03	3.23	3.91
	LK896 273	Sept. 15	All species	25	0.83	80.65	97.63
North Wildhay River (near Site W1*)	MK185 249	Aug. 12	BLTR	8	0.20	19.51	18.25
(150 m*** above mouth of Rock Creek)	MK185 249	Aug. 12	MNWH	3	0.07	7.32	6.84
	MK185 249	Aug. 12	RNTR	4	0.10	9.76	9.13
	MK185 249	Aug. 12	All species	15	0.37	36.59	34.22
North Wildhay River	MK153 263	Sept. 29	BLTR	2	0.06	6.67	7.15
(approx. 1 km m below WWP boundary)	MK153 263	Sept. 29	RNTR	5	0.14	16.67	17.86
	MK153 263	Sept. 29	All species	7	3.26	23.33	25.01

* - Reach near site was identified by Hildebrand (1985) as having low, moderate or high potential for bull trout spawning.
** - Some of the fish captured at the site were ripe (i.e., gametes were easily extracted from).
*** - Describes approximate location of lower limit of sample reach.
**** - Describes approximate location of upper limit of sample site
CPUE - catch per unit effort; NR - not sampled; NW - northwest; Hwy - Highway
WWP - Willmore Wilderness Park; JNP - Jasper National Park
RLR - Rock Lake Road, gravel road from Highway 40 to Rock Lake

Table 6c. Relative abundance of species of fish captured at individual sample sites in the Berland River sub-basin during 1993. Abbreviations for fish species are defined in Table 1.

Location	Universal Transverse Mercator locations	Sample date	Species captured **	No. of fish caught	CPUE (#/min.)	CPUE (#/km)	CPUE (#/ha)
Unnamed tributary MK881 814	MK850 762	Sept. 28	Burbot	2	0.05	6.67	7.82
(200 m**** below Willow A Road)	MK850 762	Sept. 28	LNSC	3	0.08	10.00	11.74
	MK850 762	Sept. 28	RNTR	7	0.19	23.33	27.39
	MK850 762	Sept. 28	Sculpin	4	0.11	13.33	15.65
	MK850 762	Sept. 28	All species	16	0.43	53.33	62.60
Beaver Creek (near Site B1*)	MK730 809	Aug. 21	BURB	1	0.04	3.17	3.37
(100 m*** above bridge on Beaver Creek Road)	MK730 809	Aug. 21	RNTR	2	0.07	6.35	6.73
	MK730 809	Aug. 21	Cottus spp.	10	0.36	31.75	33.66
	MK730 809	Aug. 21	All species	13	0.46	41.27	43.76
Unnamed tributary MK692 799 (approx. 5 km above mouth)	MK677 762	Sept. 28	RNTR	18	0.77	60.00	240.96
Unnamed tributary MK484 787 (known as Jessie or Grizzly Creek)	MK482 788	Sept. 26	RNTR	1	0.04	3.33	4.08
(250 m*** above mouth into Berland River)	MK482 788	Sept. 26	Cottus spp.	3	0.12	10.00	12.24
	MK482 788	Sept. 28	All species	4	0.17	13.33	16.32
Berland River side channel	MK442 796	Sept. 25	MNWH	1	0.04	3.51	3.64
(200 m**** below mouth of Horse Creek)	MK442 796	Sept. 25	RNTR	3	0.12	10.53	10.92
	MK442 796	Sept. 25	Cottus spp.	2	0.08	7.02	7.28
	MK442 796	Sept. 25	All species	6	0.24	21.05	21.84
Big Creek	MK260 671	Sept. 24	MNWH	2	0.07	6.56	6.31
(300 m*** above mouth into Berland River)	MK260 671	Sept. 24	RNTR	9	0.30	29.51	28.40
	MK260 671	Sept. 24	Cottus spp.	8	0.26	26.23	25.24
	MK260 671	Sept. 24	All species	19	0.63	62.30	59.96
Big Creek	MK142 636	Sept. 18	BLTR	3	0.11	10.53	16.32
(approx. 8 km above confluence with Tom Creek)	MK142 636	Sept. 18	BURB	1	0.04	3.51	5.44
	MK142 636	Sept. 18	RNTR	3	0.11	10.53	16.32
	MK142 636	Sept. 18	All species	7	0.26	24.56	38.08

Table 6c (cont.).

Location	Universal Transverse Mercator locations	Sample date	Species captured **	No. of fish caught	CPUE (#/min.)	CPUE (#/km)	CPUE (#/ha)
Little Berland River	MK189 543	Sept. 23	MNWH	5	0.14	12.66	10.94
(300 m*** above mouth into Berland River)	MK189 543	Sept. 23	RNTR	17	0.47	43.04	37.20
	MK189 543	Sept. 23	All species	22	0.61	55.70	48.14
Little Berland River	MK172 479	Aug. 26	BLTR	33	0.97	110.00	141.21
(approx. 1.5 km above Highway 40)	MK172 479	Aug. 26	MNWH	21	0.62	70.00	89.86
	MK172 479	Aug. 26	RNTR	2	0.06	6.67	8.56
	MK172 479	Aug. 26	All species	54	1.64	186.67	231.07
Little Berland River	MK158 428	Aug. 26	BLTR	13	0.63	43.33	40.12
(approx. 300 m**** below mouth of Evans Creek)	MK158 428	Aug. 26	RNTR	1	0.05	3.33	3.09
	MK158 428	Aug. 26	All species	14	0.67	46.67	43.21
Little Berland River	MK132 423	Sept. 17	BLTR	5	0.18	16.67	23.88
(500 m*** above confluence with Broad Creek)	MK132 423	Sept. 17	RNTR	3	0.11	10.00	14.33
	MK132 423	Sept. 17	All species	8	0.29	26.67	38.20
Fox Creek	MK177 524	Sept. 29	BLTR	1	0.04	3.33	5.71
(50 m*** above old bridge site; approx. 0.7 km above mouth)	MK177 524	Sept. 29	BURB	4	0.15	13.33	22.83
	MK177 524	Sept. 29	MNWH	6	0.23	20.00	34.25
	MK177 524	Sept. 29	RNTR	15	0.58	50.00	85.62
	MK177 524	Sept. 29	All species	26	1.01	86.67	148.40
Fox Creek	MK163 493	Aug. 20	BURB	4	0.17	13.79	24.90
(approx. 500 m below railroad tracks)	MK163 493	Aug. 20	MNWH	1	0.04	3.45	6.22
	MK163 493	Aug. 20	All species	5	0.21	17.24	31.12
Evans Creek	MK155 427	Sept. 16	BLTR	9	0.34	24.66	57.75
(500 m*** above mouth into Little Berland River)	MK155 427	Sept. 16	RNTR	11	0.41	30.14	70.58
	MK155 427	Sept. 16	All species	20	0.75	54.79	128.32

Table 6c (cont.).

Location	Universal Transverse Mercator locations	Sample date	Species captured **	No. of fish caught	CPUE (#/min.)	CPUE (#/km)	CPUE (#/ha)
Broad Creek	MK133 422	Sept. 17	BLTR	3	0.18	10.91	45.45
(300 m*** above mouth into Little Berland River)	MK133 422	Sept. 17	RNTR	1	0.06	3.64	15.15
	MK133 422	Sept. 17	All species	4	0.24	14.55	60.61
Cabin Creek (near Site C1*)	MK088 584	Aug. 13	BLTR	2	0.07	6.35	6.57
(50 m*** above Highway 40 bridge)	MK088 584	Aug. 13	MNWH	1	0.03	3.17	3.29
	MK088 584	Aug. 13	RNTR	13	0.43	41.27	42.72
	MK088 584	Aug. 13	All species	16	0.53	50.79	52.58
Hendrickson Creek	MK087 602	Aug. 25	BLTR	1	0.04	3.28	11.27
(approximately 3 km above mouth into Cabin Creek)	MK087 602	Aug. 25	RNTR	11	0.42	36.07	123.94
	MK087 602	Aug. 25	All species	12	0.46	39.34	135.20
Vogel Creek	MK057 595	Aug. 25	BLTR	1	0.04	3.03	3.49
(approx. 1 km above mouth into Cabin Creek)	MK057 595	Aug. 25	MNWH	6	0.24	18.18	20.95
	MK057 595	Aug. 25	RNTR	5	0.20	15.15	17.46
	MK057 595	Aug. 25	Cottus spp.	1	0.04	3.03	3.49
	MK057 595	Aug. 25	All species	13	0.51	39.39	45.38
South Cabin Creek	MK012 592	Sept. 16	BLTR	1	0.04	3.33	4.59
(approx. 1.5 km above mouth into Cabin Creek)	MK012 592	Sept. 16	BURB	2	0.08	6.67	9.18
	MK012 592	Sept. 16	RNTR	10	0.39	33.33	45.91
	MK012 592	Sept. 16	All species	13	0.51	43.33	59.69
Moon Creek (near Site M2*) (approx. 2.5 km above mouth)	MK107 580	Aug. 14	RNTR	11	0.30	36.67	27.63
Moon Creek (near Site M1*) (approx. 1 km above WWP boundary)	MK038 440	Sept. 13	BLTR	32	0.59	76.19	92.58
North Berland River (near Site B1*)	LK880 472	Sept. 15	BLTR **	19	0.56	63.33	53.85
(2.5 km above Sunset Creek)	LK880 472	Sept. 15	MNWH	1	0.03	3.33	2.83
	LK880 472	Sept. 15	All species	20	0.59	66.67	56.69

Table 6c (cont.).

Location	Universal Transverse Mercator locations	Sample date	Species captured **	No. of fish caught	CPUE (#/min.)	CPUE (#/km)	CPUE (#/ha)
South Berland River	LK933 404	Sept. 15	BLTR	8	0.32	26.67	35.46
(100 m*** above mouth of Pope Creek)	LK933 404	Sept. 15	MNWH	10	0.40	33.33	44.33
	LK933 404	Sept. 15	All species	18	0.71	60.00	79.79
Pope Creek	LK935 404	Sept. 15	BLTR	9	0.40	30.00	49.34
(250*** above mouth into South Berland River)	LK935 404	Sept. 15	MNWH	1	0.04	3.33	5.48
	LK935 404	Sept. 15	All species	10	0.44	33.33	54.82

* - Reach near site was identified by Hildebrand (1985) as having low, moderate or high potential for bull trout spawning.
** - Some of the fish captured at the site were ripe (i.e., gametes were easily extracted from).
*** - Describes approximate location of lower limit of sample reach.
**** - Describes approximate location of upper limit of sample site
CPUE - catch per unit effort; NR - not sampled; lat. - latitude long. - longitude; WWP - Willmore Wilderness Park.

Table 6d. Relative abundance of species of fish captured at individual sample sites in the Muskeg River sub-basin during 1993. Abbreviations for fish species are defined in Table 1.

Location	Universal Transverse Mercator locations	Sample date	Species captured **	No. of fish caught	CPUE (#/min.)	CPUE (#/km)	CPUE (#/ha)
Susa Creek	LK711 773	Aug. 29	RNTR	16	0.42	46.38	63.10
(20 m**** below confluence with Sterne Creek)	LK711 773	Aug. 29	Cottus spp.	24	0.63	69.57	94.65
	LK711 773	Aug. 29	All species	40	1.04	115.94	157.74
Sterne Creek	LK707 765	Aug. 22	BLTR	2	0.05	6.67	10.13
(500 m*** above Highway 40)	LK707 765	Aug. 22	RNTR	1	0.02	3.33	5.07
	LK707 765	Aug. 22	Cottus spp.	9	0.22	30.00	45.59
	LK707 765	Aug. 22	All species	12	0.29	40.00	60.79
Mason Creek (30 m*** above Highway 40)	LK795 766	Aug. 22	RNTR **	12	0.52	41.38	76.63
Veronique Creek	LK871 768	Aug. 23	BLTR	12	0.40	40.00	97.32
(50 m**** below Highway 40)	LK871 768	Aug. 23	RNTR **	50	1.68	166.67	405.52
	LK871 768	Aug. 23	All species	62	2.08	206.67	502.84
Lone Teepee Creek	LK907 762	Aug. 30	Unknown trout	8	0.22	29.09	31.01
(70 m*** above mouth; impassible beaver dam****)	LK907 762	Aug. 30	BKTR	3	0.08	10.91	11.63
	LK907 762	Aug. 30	BLTR	7	0.20	25.45	27.14
	LK907 762	Aug. 30	LNSC	16	0.45	58.18	62.03
	LK907 762	Aug. 30	RNTR	50	1.40	181.82	193.84
	LK907 762	Aug. 30	All species	84	2.35	305.45	325.64
Lone Teepee Creek	MK005 683	Aug. 24	BLXBK	1	0.03	3.51	7.69
(50 m**** below old bridge crossing)	MK005 683	Aug. 24	RNTR	1	0.03	3.51	7.69
	MK005 683	Aug. 24	BKTR **	138	3.70	484.21	1061.87
	MK005 683	Aug. 24	All species	140	3.75	491.23	1077.25
Plante Creek	MK033 756	Aug. 23	BKTR **	6	0.19	20.00	65.79
(50 m**** below Smokey Mainline Road	MK033 756	Aug. 23	BLTR	1	0.03	3.33	10.96
	MK033 756	Aug. 23	RNTR **	36	1.14	120.00	394.74
	MK033 756	Aug. 23	All species	43	1.36	143.33	471.49
Shand Creek (50 m*** above Highway 40)	MK001 658	Aug. 24	No fish captured		0.00	0.00	0.00

Table 6d (cont.).

Location	Universal Transverse Mercator locations	Sample date	Species captured **	No. of fish caught	CPUE (#/min.)	CPUE (#/km)	CPUE (#/ha)
Chapman Creek	MK898 692	Aug. 28	BLTR	12	0.58	40.00	120.48
(30 m**** below railroad culvert)	MK898 692	Aug. 28	RNTR	3	0.15	10.00	30.12
	MK898 692	Aug. 28	All species	15	0.73	50.00	150.60
Unnamed Tributary LK884 672	LK885 676	Aug. 31	BLTR **	16	0.80	53.33	177.78
(50 m**** below impassible culvert under railroad tracks)	LK885 676	Aug. 31	RNTR	2	0.10	6.67	22.22
	LK885 676	Aug. 31	All species	18	0.90	60.00	200.00
Mahon Creek	LK887 671	Aug. 28	BLTR **	14	0.61	38.89	42.27
(70 m*** above mouth into Muskeg River)	LK887 671	Aug. 28	RNTR	2	0.09	5.56	6.04
	LK887 671	Aug. 28	All species	16	0.70	44.44	48.31
Mahon Creek (first run for population estimate)	LK887 671	Sept. 6	BLTR	37	0.77	91.36	99.30
(70 m*** above mouth into Muskeg River)	LK887 671	Sept. 6	RNTR	2	0.04	4.94	5.37
	LK887 671	Sept. 6	All species	39	0.81	96.30	104.67
Mahon Creek (first run for population estimate)	LK885 663	Sept. 9	BLTR **	49	1.40	158.06	183.37
(impassible beaver dam 70 m**** below railroad tressel)	LK885 663	Sept. 9	RNTR	13	0.37	41.94	48.65
	LK885 663	Sept. 9	All species	62	1.78	200.00	232.02
Mahon Creek (approx. 2 km below mouth of Issac Creek)	LK894 647	Sept. 10	BLTR	59	1.50	196.67	204.44
Mahon Creek (300 m*** upstream of mouth of Isaac Creek)	LK905 627	Sept. 10	BLTR **	11	0.44	34.92	45.29
Isaac Creek (100 m*** above mouth into Mahon Creek)	LK898 633	Sept. 10	BLTR **	24	0.92	85.71	210.08
Muskeg River	LK794 582	Sept. 7	BLTR	12	0.18	20.00	14.98
(sample site straddled WWP boundary)	LK794 582	Sept. 7	RNTR	5	0.07	8.33	6.24
	LK794 582	Sept. 7	All species	17	0.25	28.33	21.22
Muskeg River (500 m*** above Lancaster Creek)	LK793 553	Sept. 8	BLTR	4	0.18	13.33	16.46

** - Some of the fish captured at the site were ripe (i.e., gametes were easily extracted from).
*** - Describes approximate location of lower limit of sample reach.
**** - Describes approximate location of upper limit of sample site
CPUE - catch per unit effort; NR - not sampled; WWP - Willmore Wilderness Park; BLXBK - bull trout X brook trout hybrid.

Table 7. Maximum-likelihood population estimates in Mahon, Rock and Mary Gregg creeks. Population estimates and confidence intervals (CI) for individual species are calculated as the percentage of each species among total fish captured at individual sample sites. Population estimates and CI for individual species are rounded to whole numbers.

Species	Number of fish caught	Percentage of all fish captured	Population estimate #/km	Population estimate #/ha	Lower 95% CI* #/km	Lower 95% CI* #/ha	Upper 95% CI #/km	Upper 95% CI #/ha	Capture Probability	Capture Probability Standard Error	Lower 95% CI	Upper 95% CI
Mahon Creek (405 m long site: LK887 671) September 6, 1993												
bull trout**	75	92.6	261	283	185	201	357	395				
rainbow trout	6	7.4	21	23	15	16	29	32				
Total fish	81	100.0	281	306	200	217	385	427	0.336	0.094	0.149	0.523
Mahon Creek (310 m long site: LK885 663) September 9, 1993												
bull trout***	80	80.8	300	347	258	299	346	402				
rainbow trout	19	19.2	71	83	61	71	82	95				
Total fish	99	100.0	371	430	319	370	428	497	0.478	0.071	0.337	0.619
Rock Creek (310 m long site: LK896 273) September 15, 1993												
bull trout**	22	88.0	133	155	119	138	160	186				
cutthroat trout	2	8.0	12	14	11	13	15	17				
mountain whitefish	1	4.0	6	7	5	6	7	8				
Total fish	25	100.0	152	176	135	157	182	211	0.512	0.105	0.301	0.723
Total fish												
Mary Gregg Creek (300 m long site: MJ768 879) October 2, 1993												
bull trout****	30	18.5	238	433	100	182	428	780				
rainbow trout	132	81.5	1046	1906	440	802	1883	3432				
Total fish	162	100.0	1283	2340	540	985	2310	4212	0.166	0.081	0.007	0.326

* - calculated CI was less than number of fish captured at the site, so lower CI was set at the number of fish captured;
** - one of the captured bull trout was an adult
*** - 41 of 80 bull trout captured were adults
**** - no adult bull trout were captured

The population estimate in Rock Creek was conducted upstream of JNP. At this site the population estimate was 155 bull trout/ha (range 138-186 bull trout/ha). Bull trout were the dominant species captured at this site (22 of 25 fish). Since 21 of the 22 bull trout captured at this site were non-adults (range 97-280 mm FL), the population estimate for non-adults was 148 fish/ha (range 132-178 fish/ha). This was also the only site where cutthroat trout (2 of 25 total fish) were captured.

The two sites in Mahon Creek where population estimates were conducted were less than 1.5 km apart. Several days after the first population estimate, a large concentration of suspected adult bull trout were observed below an impassable beaver dam and upstream from where the first population estimate occurred. Although the results of the second population estimate were likely influenced by large adults congregating below the beaver dam, three electrofishing passes were made to collect information related to FL and maturity from adult bull trout. Immediately below the impassable beaver dam, 51% (41 of 80) of the captured bull trout were adults (i.e., fish whose sex could be determined externally by expulsion of gametes or external sexual dimorphisms) and 48% (38 of 80) were less than 200 mm FL. In contrast, at the site further downstream, 1% (1 of 75) were adults and 93% (70 of 75) were less than 200 mm (FL). Rainbow trout and bull trout were captured at both sites but bull trout were the dominant species in both samples.

3.1.5 Fish in spawning condition

The capture of fish in spawning condition can be useful to identify stream reaches that may provide spawning habitat. In addition to bull trout, brook trout and rainbow trout in spawning condition were captured at some sites.

Bull trout in spawning condition were captured: in upper Rock Creek (September 15; Wildhay River system); in the North Berland (September 15) and Berland (approximately 3 km below the mouth of Big Creek; September 24) rivers; and at several sites in Mahon Creek (August 28 and September 9 and 10), Unnamed tributary LK884 672 (August 31) and Isaac Creek (September 10) (Muskeg River system). Ripe females were only captured in the two sample reaches in Mahon Creek below the impassible beaver dam (September 10) and by angling in the Berland River approximately 3 km below the mouth of Big Creek.

Ripe bull trout were first captured in Mahon Creek on August 28 (one male and one female, both ripe). Another ripe male was captured in Unnamed tributary LK884 672 (Muskeg River sub-basin) on August 31. The capture of ten ripe females (59%) and 24 ripe males (100%) in Mahon Creek on September 9 indicates the spawning season was well underway by that date. The latest that males were captured which were not ripe was on August 26 (Little Berland River) and September 10 (Mahon Creek); however, it could not be determined whether these two males had yet to spawn or were already spent. The latest that any ripe bull trout were captured was on September 24. This was a female captured in a pool in the mainstem of the Berland River and was the only adult bull trout captured after September 15.

Ripe rainbow trout males were captured in the McLeod (MacKenzie Creek on August 18) and Muskeg (Mahon, Plante and Veronique creeks on August 22, 23 and 23, respectively) River sub-basins (Table 6a-d). These fish were captured several months after rainbow trout spawning was expected to have been completed. At two of the sites where ripe rainbow trout males were captured, brook trout males in spawning condition were also captured (MacKenzie and Plante creeks). Although no ripe females of either species were captured at these sites, capturing ripe males of both species at the same location suggests indiscriminate matings between the two species is a possibility. Buss and Wright (1957) reported limited fertility among rainbow trout X brook trout hybrids.

Brook trout in spawning condition were also captured in Moberly (Wildhay River system: September 26),

Lone Teepee (Muskeg River system: August 24) and Roundcroft (Athabasca River system: September 30) creeks. Among sites where ripe brook trout were captured, ripe females were captured in Moberly and Roundcroft creeks.

3.1.6 Fork length distributions

Fork length distributions of bull trout captured in the McLeod, Wildhay, Berland and Muskeg River sub-basins are illustrated in Figure 5. No adult bull trout or bull trout larger than 275 mm were captured in the McLeod River system. Except for one ripe male (282 mm FL) captured in upper Rock Creek (LK896 273), no adult bull trout were captured in Wildhay River system.

Four adult bull trout were captured in the Berland River system. Two of these were ripe males that were 313 and 521 mm (FL). One female (494 mm FL) captured by angling on September 24 was observed with at least two other similar sized bull trout in a large pool approximately 3 km downstream of the mouth of Big Creek. The other female was 460 mm FL and was captured in the Little Berland River on August 26. The largest bull trout from the Berland River system whose sex could not be determined was 335 mm FL.

The majority of adult bull trout were captured in the Muskeg River sub-basin (19 females and 29 males). Bull trout whose sex could not be determined were as large as 345 mm (FL). Male bull trout ranged between 259 and 550 mm (FL). Females ranged between 347 and 458 mm (FL).

Fork length distributions for other species captured during the present study are illustrated in figures found in Appendix II. Fork length distributions of male, female and sex unknown rainbow trout captured in the McLeod, Wildhay, Berland and Muskeg River sub-basins are illustrated in Figure II-3. The fork length distribution of rainbow trout captured in Roundcroft Creek are illustrated in Figure II-4. Fork length distributions for male, female and sex unknown brook trout captured in the McLeod, Wildhay, and Muskeg River sub-basins and Roundcroft Creek are illustrated in Figure II-5. No brook trout were captured in the Berland River system.

3.1.7 Relationship between fork length and total length among bull trout

Because scientific reports generally report lengths of salmonids in units of FL, but angling regulations in Alberta refer to TL of captured fish, it is useful to determine equations that can be used to convert FL to the TL. The FL:TL relationships for bull trout that both FL and TL were recorded from in the McLeod, Wildhay, Berland and Muskeg River sub-basins are illustrated in Appendix II (Figure II-6). The linear equations describing the relationship between FL (mm) and TL (mm) for bull trout and results of a test of significance (SAS 1990) (H_o: No significant differences exist between the slopes of the equation and a straight line) are:

Equation 1 (McLeod River sub-basin)
TL = -2.036 + (1.074 X FL); $n = 68$ $t = 111.04$ $p = 0$ $r^2 = 0.9979$

Equation 2 (Wildhay River sub-basin)
TL = -0.334 + (1.060 X FL); $n = 56$ $t = 220.40$ $p = 0$ $r^2 = 0.9995$

Equation 3 (Berland River sub-basin)
TL = 1.545 + (1.043 X FL); $n = 91$ $t = 321.00$ $p = 0$ $r^2 = 0.9992$

and

Equation 4 (Muskeg River sub-basin)
TL = 2.000 + (1.040 X FL).; $n = 281$ $t = 1090.20$ $p = 0$ $r^2 = 0.9997$

A regression analysis using the General Linear Models Procedure (SAS 1990) determined there were significant differences between the fork length:total length relationships among sub-basins ($n = 496$, $F_{3,488} = 9.75$, $p = 0.0001$, $r^2 = 0.9996$).

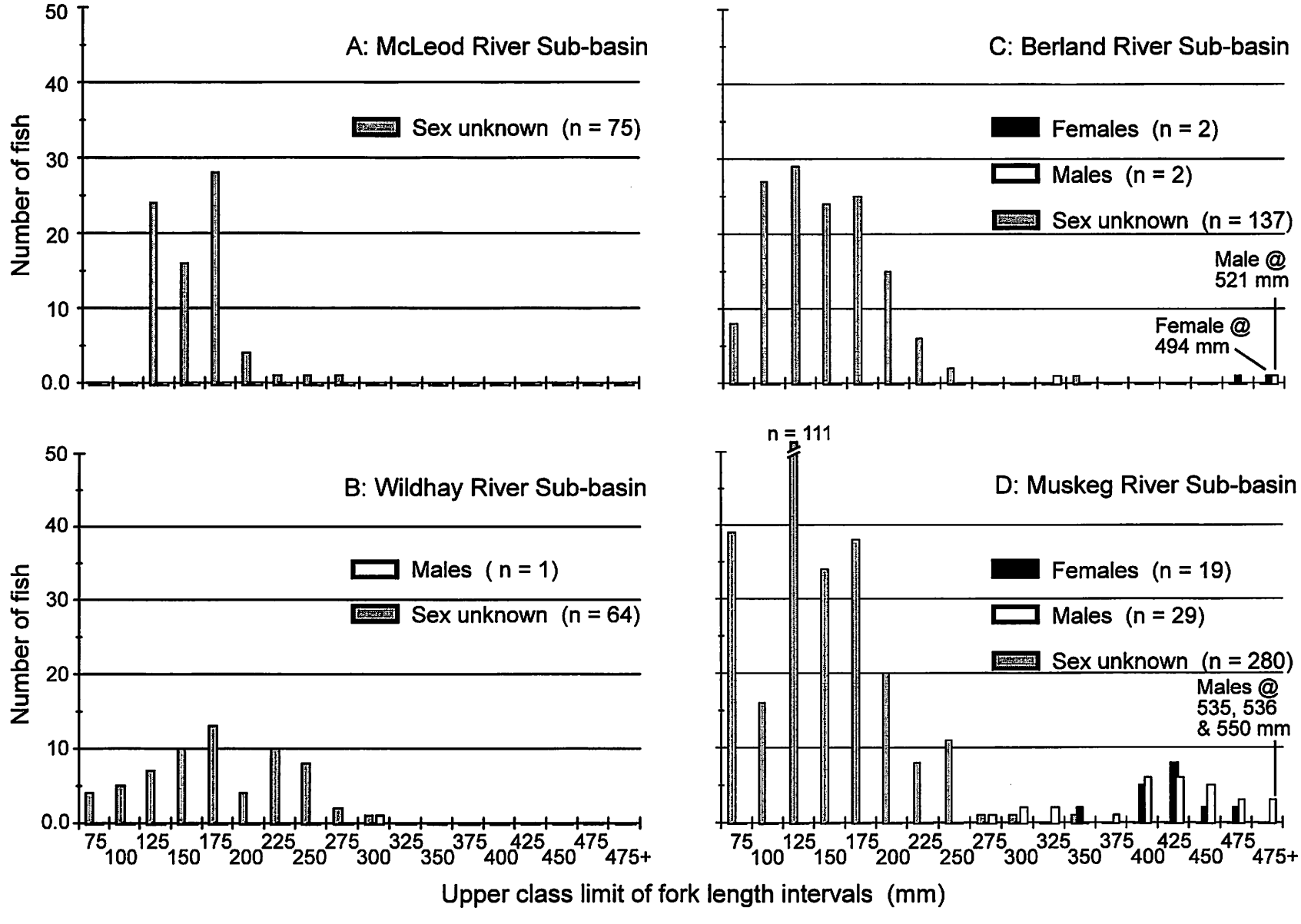

Figure 5. Fork length distributions of male, female and sex unknown bull trout captured in the McLeod, Wildhay, Berland and Muskeg River sub-basins during electrofishing surveys from August 10 to October 2, 1993.

3.1.8 Relationship between fork length and weight among juvenile bull trout

The relationship between fork length and weight among non-adult bull trout captured in the McLeod, Wildhay, Berland and Muskeg River sub-basins between August 10 and October 2, 1993, is illustrated in Appendix II (Figure II-7). The equations describing the linear relationship between FL (mm) and wet weight (g) for non-adult bull trout and results of a test of significance (SAS 1990) (H_o: No significant differences exist between the slopes of the equation and a stright line) are:

Equation 5 (McLeod River sub-basin)

$Log_{10}\ of\ weight = -5.4072 + (3.1772 \times Log_{10}\ of\ FL);\ n = 75\ \ t = 47.56\ \ p = 0.0001\ \ r^2 = 0.5936$

Equation 6 (Wildhay River sub-basin)

$Log_{10}\ of\ weight = -4.6163 + (2.8366 \times Log_{10}\ of\ FL);\ n = 64\ \ t = 80.12\ \ p = 0.0001\ \ r^2 = 0.6566$

Equation 7 (Berland River sub-basin)

$Log_{10}\ of\ weight = -5.2343 + (3.1011 \times Log_{10}\ of\ FL);\ n = 128\ \ t = 89.39\ \ p = 0\ \ r^2 = 0.5896$

and

Equation 8 (Muskeg River sub-basin)

$Log_{10}\ of\ weight = -4.7432 + (2.8683 \times Log_{10}\ of\ FL).\ n = 276\ \ t = 167.27\ \ p = 0\ \ r^2 = 0.7724$

A regression analysis using the General Linear Models Procedure (SAS 1990) determined there were significant differences between the fork length:weight relationships among sub-basins (n = 543, $F_{3,535} = 18.84$, p = 0.0001, $r^2 = 0.8349$).

3.2 Redd surveys

The location and dates of redd surveys as well as the approximate locations of observed redds are provided in Figure 6, 7 and 8. Survey lengths, UTM coordinates of the upstream and downstream limits, and number of redds observed during redd surveys are listed in Appendix I (Table I-2). In addition to these redds, redds were also incidently observed during electrofishing surveys. Although accessing sample sites sometimes resulted in wading and conducting redd surveys along significant reaches of some streams, no attempt was made to estimate the locations and lengths of these casual redd surveys; consequently, these casual surveys were not included in Table I-2. Although a redd survey had been planned along A La Peche Creek, a beaverdam and the resulting conditions in this low gradient stream resulted in the cancellation of this redd survey.

The first redd was observed on September 8 in Mahon Creek (Muskeg River system). September 17 was the last day that any bull trout were observed on redds. This occurred in the Little Berland River.

Measurements and visual estimates for selected habitat parameters were collected from 23 redds (Table 8). Habitat parameters were collected from 12 redds in the Muskeg River sub-basin (n = 11 in Mahon Creek; n = 1 in Isaac Creek). Approximate locations of these redds are mapped in Figure 6. The redd in Isaac Creek was located within the sample reach where the electrofishing survey was conducted.

Seventeen bull trout redds were observed in the Little Berland River (Figure 7). Habitat measurements were collected from ten of these redds. Habitat measurements were not collected from seven of the fourteen redds located within a 200 m reach approximately 2.0 km above Highway 40. This was because redd superimposition in the area immediately adjacent to these redds appeared obvious; consequently, wading in the immediate area was avoided to prevent damaging incubating eggs in redds that were indistinguishable. This 200 m reach was also located immediately downstream of an impassible barrier caused from the river cutting a new channel.

The only other redd recorded in the Berland River system was located in the North Berland River. It was observed immediately downstream from the electrofishing sample site. This electrofishing site was near a

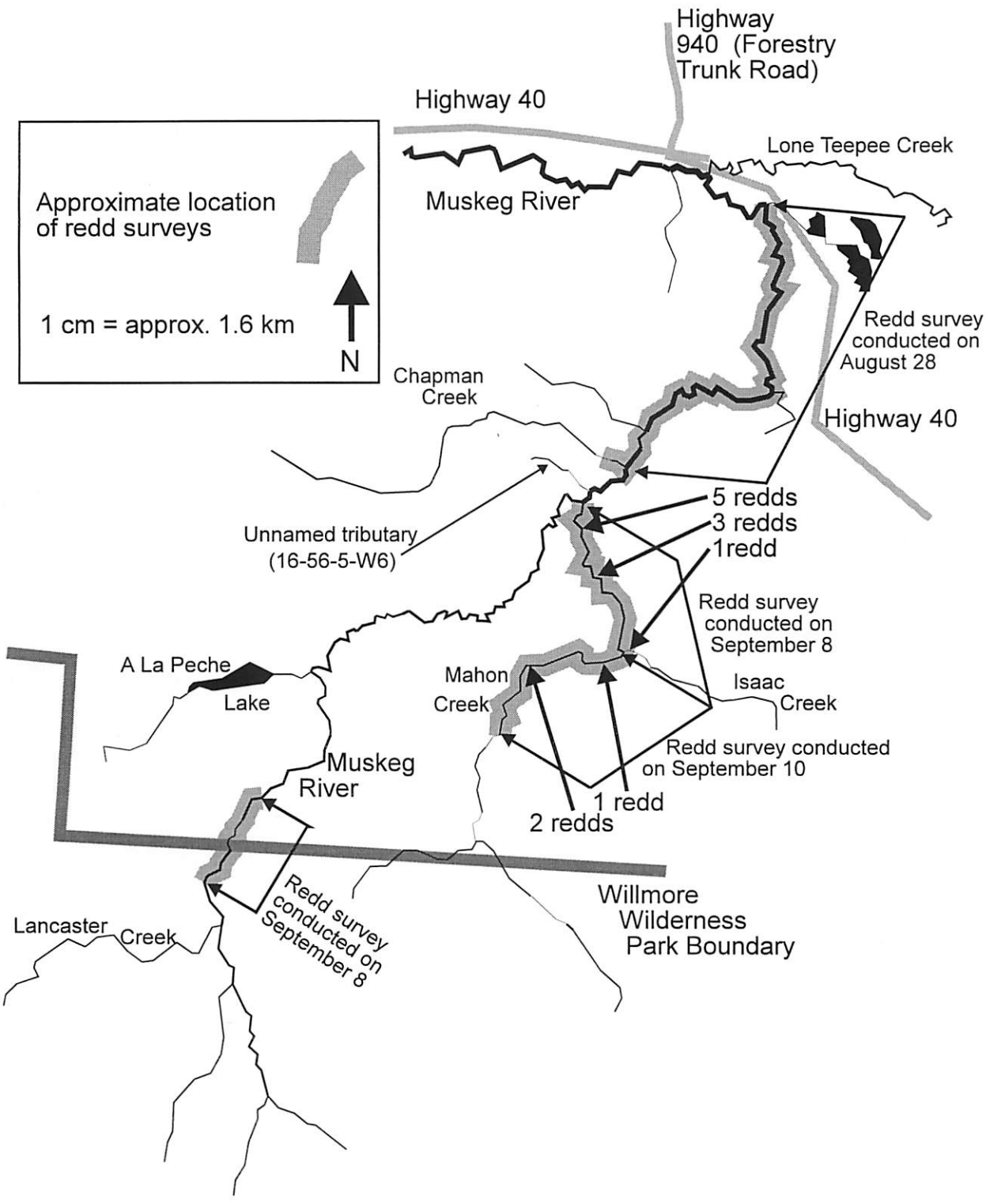

Figure 6. Locations of redd surveys, and approximate locations of distinct bull trout redds observed, in the Muskeg River sub-basin.

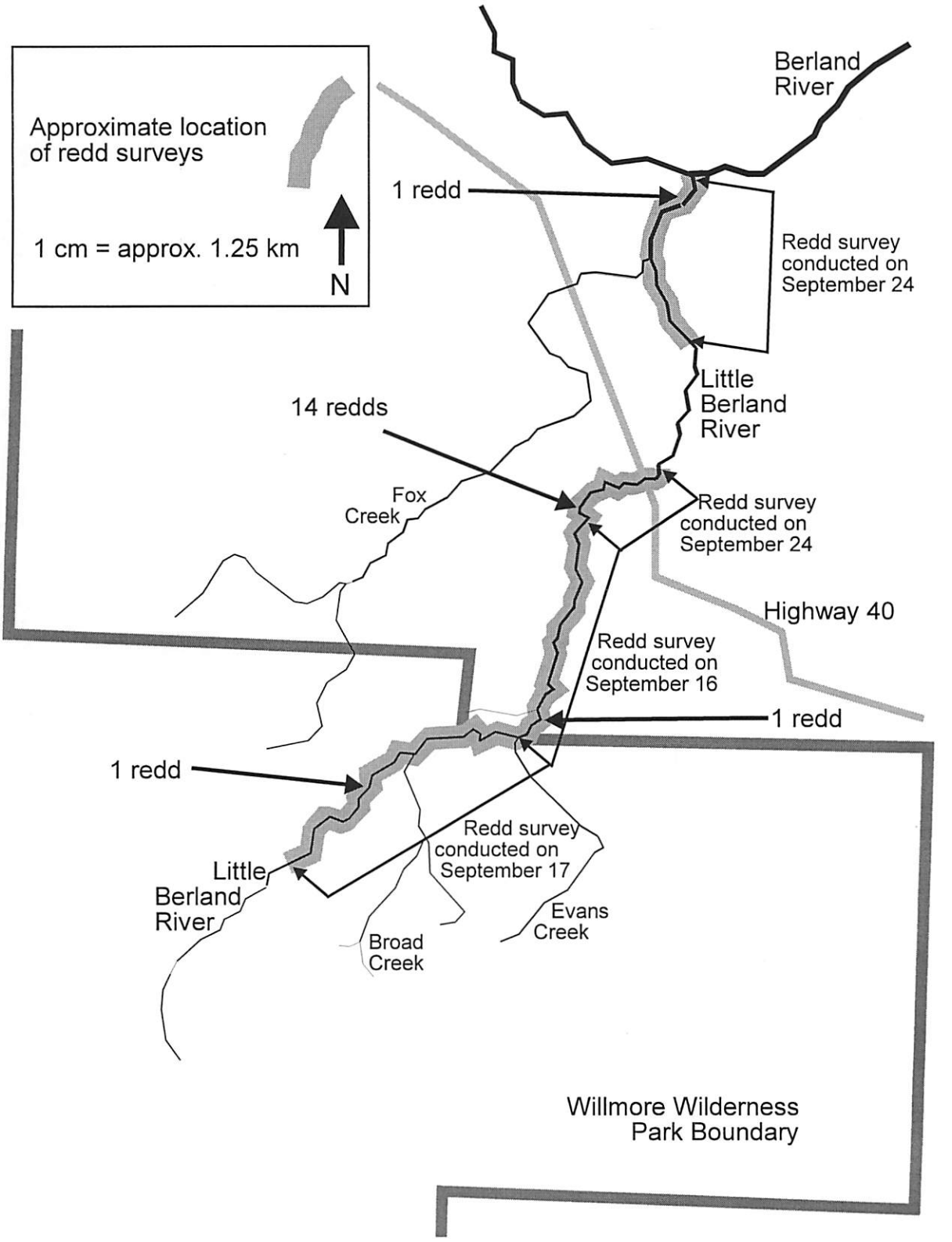

Figure 7. Locations of redd surveys, and approximate locations of distinct bull trout redds observed, along the Little Berland River.

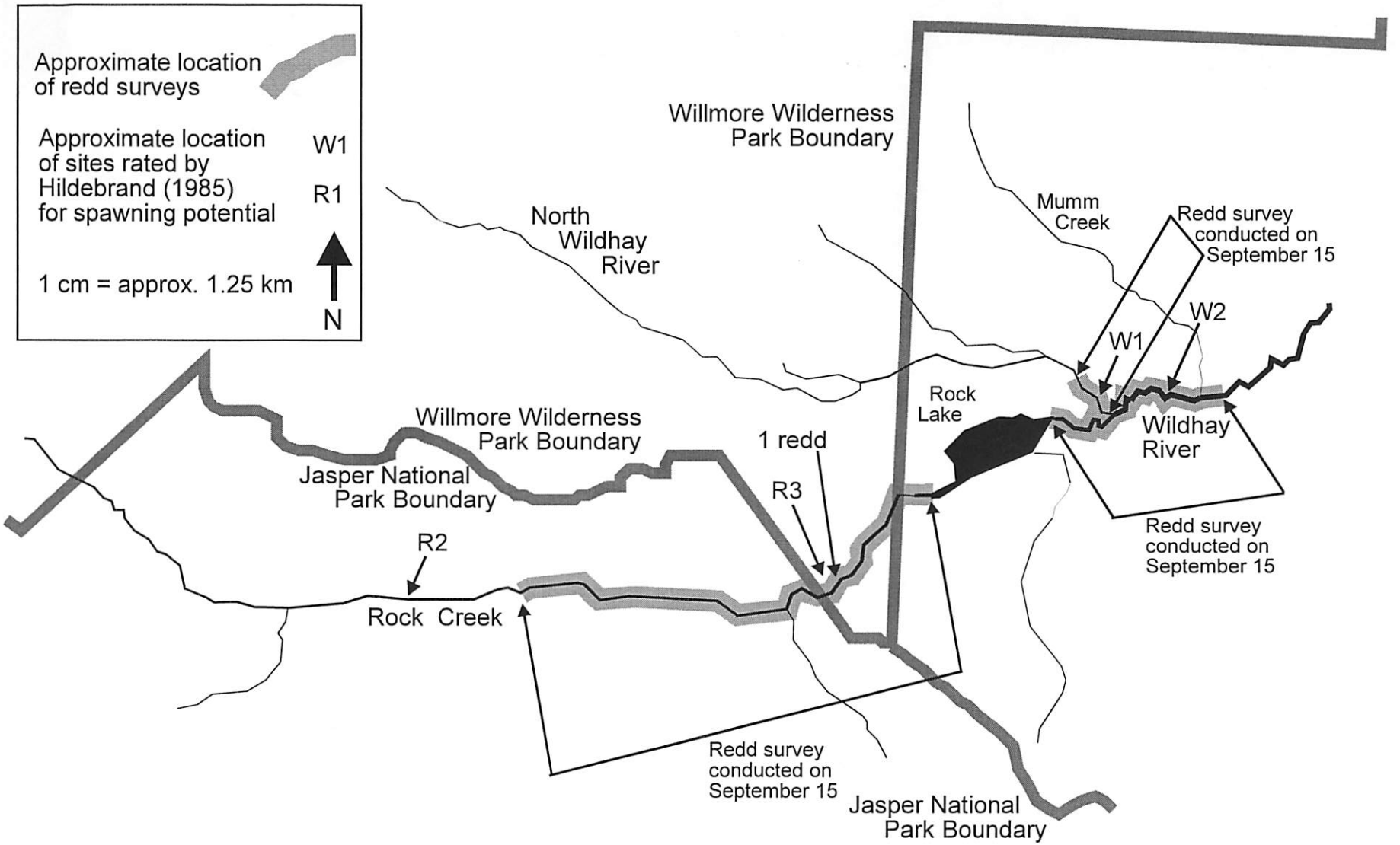

Figure 8. Locations of redd surveys, and approximate locations of distinct bull trout redds observed, in the Wildhay River sub-basin.

Table 8. Habitat parameters measured and visually estimated at observed bull trout redds in the Berland, Wildhay and Muskeg River sub-basins during September 8 - 27, 1993 (n = 23 redds).

Stream habitat parameters measured at 23 observed bull trout redds.

	Mean	Minimum	Maximum	Median
Stream width at redd (m)	6.99	1.70	17.02	6.55
Stream depth at midstream (cm)	28.2	10.2	67.5	27.3
Maximum stream depth (cm)	44.9	17.1	100.3	44.5
Distance of redd from bank (m)	1.1	0.0	4.0	1.1
Maximum water depth in pit (cm)	40.0	17.1	73.7	36.8
Depth of tailspin (cm)	25.4	6.4	57.2	22.9
Total length of redd (m)	1.73	0.81	2.64	1.73
Distance from cover (m)	5.27	0.00	31.00	1.75
Stream gradient (percentage)	0.8	0.00*	1.5	0.75
Stream temperature (Celcius)	5.8	0.0	8.5	8
Stream velocity at 6/10 depth above pit (m/sec	0.31	0.04	0.54	0.29

* - No measurable gradient

Nearest type of cover to observed redds.

Cover type	% of redds (n = 9) less than 1 m from cover	% of redds (n = 7) within 1 to 5 m from cover	% of redds (n = 6) more than 5 m from cover
Undercut bank	88.9	71.4	42.9
Large and/or small woody debris	50.0	57.1	71.4
Overhanging cover	50.0	42.9	14.3
Boulder	0.0	14.3	14.3

Visual estimation of substrate composition within observed redds (see Table 3 for substrate diameters).

	Mean % composition of all redds	Minimum % composition of all redds	Maximum % composition of all redds	Median % composition of all redds
Fines	10	0	50	5
Small gravel	58	5	90	55
Large gravel	24	5	70	20
Cobble	8	0	25	7
Boulder	0	0	5	0

Visual estimation of substrate composition at stream cross-section within 1 m above and below redd (see Table 3 for substrate diameters).

	Mean % composition of all redds	Minimum % composition of all redds	Maximum % composition of all redds	Median % composition of all redds
Fines	15	3	60	10
Small gravel	24	5	60	20
Large gravel	31	10	50	25
Cobble	26	5	50	25
Boulder	4	0	20	1

site that Hildebrand (1985) identified with medium to high potential for bull trout spawning. This site was accessed via helicopter and because the other crew had the necessary equipment, redd measurements were not collected from this redd.

A redd was observed in Rock Creek, Wildhay River system, near a site identified by Hildebrand (1985) as having medium to high potential for bull trout spawning (Figure 8). Measurements from this redd were included in Table 8.

Two redds were observed in the sample reach of the electrofishing survey in MacKenzie Creek, McLeod River system, approximately 1.5 km above the falls. Two depressions that resembled redds, but lacked one or more distinctive features, were also observed in the immediately adjacent area. Because redd superimposition may have made nearby redds indistinguishable, and wading on redds can damage incubating embryoes, habitat measurements were not collected from the two distinct redds found in MacKenzie Creek.

Redds were found in a wide range of stream widths (Table 8). Two redds were found in side channels where the stream widths were less than 2.0 m; these side channels were also less than 10.0 m long. Five redds were located in reaches where stream widths exceeded 10.0 m. However, the majority of redds were observed in areas where stream widths were between 3.0 and 7.5 m wide. For 14 of 23 redds observed, the maximum stream depth at the stream cross-section was located in the pit of the redd.

The majority of redds were closely associated with cover. Nine redds were less than 1.0 m from cover. Eight of these were associated with an undercut bank. Another seven redds were located within 1.0 and 5.0 m from cover. Seven redds were found more than 5.0 m from the nearest available cover; among these redds woody debris was the dominant cover type. Bull trout redds were found in slow currents. The maximum velocity above the redds was 0.54 m/sec and the average velocity was 0.31 m/sec.

In addition to the previously described bull trout redds, depressions were occasionally observed in the stream substrate that resembled redds but lacked one or more of the distinctive characteristics used to identify redds. Because these depressions may have been bull trout redds that either were becoming partially covered with silt or lost their distinctive shape as a result of later spawning bull trout constructing overlapping redds (i.e., superimposed), these depressions were recorded as "possible redds". Locations and numbers of "possible redds" are listed in Appendix I (Table I-3).

3.3 Confirmation of spawning activity near sites identified by Hildebrand (1985) as having low, moderate or high potential for bull trout spawning

Redd surveys were conducted at several sites identified by Hildebrand (1985) as having potential bull trout spawning habitat (Table 9). However, because low CPUE of bull trout (10 bull trout/km or less) were obtained during electrofishing surveys, redd surveys were not conducted at some sites that Hildebrand (1985) identified as having high, moderate or low potential for bull trout spawning (Table 9). A redd survey was also not conducted near Site B1 (Hildebrand 1985) in the North Berland River. However, spawning activity was confirmed near Site B1 when it was accessed via helicopter to conduct an electrofishing survey. One distinct and one "possible redd" were observed within the 300 m sample reach and one ripe male was captured during the electrofishing survey.

CPUE results near two sites identified by Hildebrand (1985) with low (Site M1 in Moon Creek) and moderate to high (Site W3 in the South Wildhay River) suggests that redd surveys near these sites would be warranted. However, time constraints and difficult access prevented crews from returning to these sites and conducting redd surveys.

Evidence of bull trout spawning activity was collected at three sites that had been examined by Hildebrand (1985). Redds were observed near sites in the North Berland River (B1) and Rock Creek (R3) that Hildebrand (1985) identified as having medium to high potential for bull trout spawning. One ripe male bull trout was captured during the electrofishing survey near Site B1 (North Berland River). Another ripe male was captured during electrofishing near Site R1 (Rock Creek) which Hildebrand (1985) indicated had low to moderate potential for bull trout spawning.

Although no evidence of spawning activity was observed in 1993 near Site W1 in the North Wildhay River which had moderate potential for bull trout spawning (Hildebrand 1985), the high relative abundance of bull trout between 55-80 mm (FL) (seven of the eight bull trout captured at the site) suggests spawning may occur in the area. However, no redds were observed in a 1.2 km reach of the North Wildhay River or in a 5.3 km reach of the Wildhay River immediately below the confluence of the North Wildhay River and Rock Creek. Two sites evaluated by Hildebrand (1985), W1 and W2, were located within these two reaches.

Table 9. Catch per unit effort (CPUE) of bull trout and confirmation of bull trout spawning activity at sites identified by Hildebrand (1985) as having low, moderate or high potential for bull trout spawning.

Sites identified by Hildebrand (1985) as high, moderate or low potential for bull trout spawning* (code assigned to site)	Rating assigned by Hildebrand (1985)	CPUE of bull trout in 1993 (fish/km)	Redd(s) observed during present study near site identified Hildebrand (1985)	Bull trout in spawning condition captured near Hildebrand's (1985) site
McLeod River sub-basin				
Drinnan Creek (D1)	Moderate	6.25	NRS	No
Drinnan Creek (D2)	Moderate	10.00	NRS	No
Anderson Creek (A1)	Moderate	3.70	NRS	No
Wildhay River sub-basin				
Rock Creek (R1)	Low - Moderate	70.97	NRS[1]	Yes[2]
Rock Creek (R2)	Low - Moderate	NS[3]	No	NS
N. Wildhay River (W1)	Moderate	19.51	No	No
Rock Creek (R3)	Moderate - High	1.92	Yes	No
S. Wildhay River (W3)	Moderate - High	34.29	NRS	No
Wildhay River (W2)	High	NS	No	NS
Berland River sub-basin				
Moon Creek (M1)	Low	76.19	NRS	No
Cabin Creek (C1)	Moderate - High	6.35	NRS	No
Beaver Creek (B1)	Moderate - High	0.00	NRS	No
N. Berland River (B1)	Moderate - High	63.33	Yes[1]	Yes[2]
Moon Creek (M2)	Moderate - High	0.00	NRS	No

* - Only sites examined during both studies are included
1 - During spawning season only the reach within electrofishing survey reach was examined for redds
2 - One ripe male was captured at both of these sites on September 15, 1993
3 - Stream conditions were not conducive to a backpack electrofishing survey
N. - North S. - South NS - Not sampled NRS - a redd survey was not conducted

3.4 Electrofishing surveys in Roundcroft Creek

An electrofishing survey was conducted in a 300 m reach of Roundcroft Creek on September 30. Raw data for individual fish captured in Roundcroft Creek is provided in Appendix III (Table III-5). Eighty brook trout, including four ripe females and 22 ripe males, and 108 rainbow trout were captured, but no bull trout were captured at this site. Fork length distributions for the rainbow trout and brook trout are presented in Appendix II (Figure II-4 and II-5), respectively.

3.5 Relationship between aquatic habitat and CPUE

Results of recorded habitat parameters at individual sample sites are presented in Appendix I (Table I-4). When these data were grouped into four categories based on the CPUE of bull trout at sample sites (0.0, from 0.1 to 9.9, from 10.0 to 24.9,and 25.0 or more, bull trout/km: Table 10), most of the measured habitat parameters appear to have little influence on CPUE. For example, neither mean stream width, percent gradient, or the pool:riffle:run:rapid ratio appear to have an obvious relationship with CPUE of bull trout.

However, an examination of Table 10 suggests that one of the measured habitat parameters may influence the relative abundance of bull trout (i.e., visual estimate of percent fines). At sites where CPUE was 0.0, and from 0.1 to 9.9, bull trout/km, the mean estimated percent fines was 23.5% and 15.7%, respectively, and the maximums were 62.8% and 60.0%, respectively. In contrast, at sites where CPUE of bull trout were from 10.0 to 24.9, and 25.0 or more, bull trout/km, the mean percent fines was 9.6% and 9.8%, respectively. The maximum percent fines at sites where CPUE of bull trout was from 10.0 to 24.9 fish/km was less than the mean percent fines at sites where no bull trout were captured. The maximum percent fines at sites where CPUE was 25+ bull trout/km was only slightly greater than the mean percent fines at sites where no bull trout were captured. Because only CPUE and visual estimates of substrate composition were obtained, no tests were performed to identify a definite relationship between percent fines and juvenile bull trout density. However, the results indicate further research into this possible relationship would be warranted.

Comparisons between mean percent cover at sample sites and CPUE, reveal CPUE was generally higher at sites where percent cover was less (Table 10). However, because only CPUE data is available and capture probabilities at most sample sites are not known, it is impossible to determine whether a relationship between CPUE and percent of instream cover exist. This is because as instream cover becomes more abundant, refuge areas also become more abundant and the latter may be lead to lower capture probabilities during electrofishing (i.e., more abundant refuge habitat helps fish avoid capture). For example, in Fox Creek (MK163 493) woody debris was estimated to provide cover to 35.9% of the sample reach; this high ratio of instream cover may have contributed to a lower capture probability and the failure to capture bull trout at the site.

Several remote sites along streams in the Berland and Muskeg River sub-basins were visited but not sampled. Locations of these sites are provided in Table I-1. Several Berland River tributaries were examined with insufficient flow near their mouths to justify an electrofishing survey (i.e., Horse, Olson, Packrat, Smith and Stalk creeks). On September 24, Packrat Creek had an impassable beaverdam at its mouth and only marginal flow through the beaverdam. Beaverdams were also present at the mouths of Olsen and Smith creeks. Flow was not observed from Olsen Creek. The streambed in Smith Creek was dry and completely moss-covered. Beaverdams were also present at the mouth of Lancaster Creek, a tributary of the upper Muskeg River.

Table 10. Mean, maximum, minimum, median and standard deviations of habitat parameters examined at sample sites where the CPUE was 0.0, from 0.1 to 9.9, from 10.0 to 24.9, and 25.0 or more bull trout/km.

Location	Substrate composition						Percent cover composition							Pool:riffle:run:rapid ratio			
	Mean % Fines	Mean % Small Gravel	Mean % Large Gravel	Mean % Cobble	Mean % Boulder	Mean % Bedrock	Boulder	Over-hanging vege-tation	Under-cut banks	Woody debris	Aquatic vege-tation	Mean stream width (m)	% grad-ient	Pool (%)	Riffle (%)	Run (%)	Rapid (%)
Sites where no bull trout (0.0 bull trout/km) were captured (n = 25)																	
Mean	23.5	12.7	20.9	29.7	12.6	0.7	13.8	14.0	4.9	10.3	1.2	7.6	1.1	26.0	4.9	17.3	1.3
Minimum	3.5	1.5	5.8	12.0	0.0	0.0	0.6	0.4	0.2	0.4	0.0	1.2	0.2	6.7	0.0	0.0	0.0
Maximum	62.8	24.5	33.9	44.8	32.9	5.9	45.3	46.6	47.3	35.9	14.8	20.1	2.0	75.0	81.5	69.2	13.7
Median	19.2	11.2	21.8	31.2	12.6	0.0	12.5	9.3	3.1	7.4	0.0	6.1	1.0	18.3	64.0	13.3	0.0
Standard deviation	15.9	6.1	7.4	9.6	9.6	1.5	10.2	12.9	8.8	9.4	3.1	4.5	0.5	18.4	22.3	15.7	3.5
Sites where CPUE was from 0.1 to 9.9 bull trout/km (n = 14 for most parameters; n = 12 for stream gradient and pool:riffle:run:rapid ratio)																	
Mean	15.7	14.7	21.6	30.4	17.0	0.7	18.7	10.4	5.0	6.2	1.2	6.9	1.3	19.7	58.7	17.1	5.2
Minimum	5.2	0.2	1.2	18.5	1.0	0.0	1.9	2.6	0.2	0.4	0.0	2.9	0.5	3.0	28.4	0.0	0.0
Maximum	60.0	26.2	35.8	51.9	38.6	5.0	48.3	32.2	27.5	16.8	15.5	10.7	2.5	36.5	84.1	49.5	41.3
Median	11.7	15.0	22.1	28.2	18.6	0.0	17.1	8.2	3.0	5.4	0.0	3.4	0.3	17.5	53.7	11.2	0.0
Standard deviation	13.8	6.0	7.9	8.2	10.5	1.4	14.1	7.7	6.8	4.6	4.0	2.5	0.6	9.8	16.2	15.7	11.8
Sites where CPUE was from 10.0 to 24.9 bull trout/km (n = 9 sites)																	
Mean	9.6	14.4	22.4	34.2	18.5	0.8	19.3	13.2	2.4	4.3	0.0	7.3	1.3	12.6	70.6	11.3	5.7
Minimum	2.5	5.4	12.4	19.0	0.7	0.0	3.6	1.9	0.2	0.5	0.0	2.4	0.5	3.7	43.7	0.0	0.0
Maximum	20.0	28.0	35.5	64.4	33.0	3.9	41.0	70.0	4.8	15.9	0.1	13.3	2.2	22.8	95.3	29.7	27.8
Median	9.2	14.1	22.1	32.5	24.0	0.0	20.4	6.6	2.2	3.8	0.0	7.0	1.3	10.4	81.0	6.3	0.0
Standard deviation	5.7	6.2	6.8	6.8	10.6	1.2	12.1	20.5	1.6	4.5	0.0	3.1	0.5	6.6	18.8	10.8	9.7
Sites where CPUE was 25.0 or more bull trout/km (n = 16 for most parameters; n = 15 for stream gradient))																	
Mean	9.8	15.0	23.8	36.6	13.9	1.0	19.7	9.0	2.4	5.7	0.3	7.5	1.5	15.1	65.5	15.2	3.0
Minimum	3.6	7.3	10.3	12.6	0.1	0.0	6.9	1.2	0.2	0.2	0.0	3.0	0.8	2.9	42.5	0.0	0.0
Maximum	26.4	28.9	38.1	57.7	40.7	5.5	43.0	24.9	3.8	21.6	4.2	13.2	4.3	40.0	93.9	34.5	11.0
Median	7.8	14.0	25.8	34.0	11.1	0.0	12.6	5.5	2.8	4.0	0.0	8.0	1.2	14.7	64.2	11.0	2.0
Standard deviation	5.9	6.2	7.6	11.5	10.2	1.8	12.3	7.3	1.1	5.3	1.0	2.8	0.9	9.1	14.6	10.9	3.4

4.0 DISCUSSION

4.1 Distribution and abundance of juvenile bull trout

Because sampling efficiency can vary between sites, it is generally not possible to make accurate conclusions concerning the abundance of fish from CPUE results. However, observations concerning the relative abundance and distribution of fish are possible from CPUE information. Collecting CPUE information can also be a cost effective method to help identify areas where future research or inventory investigations should concentrate.

Caution needs to be exercised when making comparisons (e.g., relative abundance, species composition) with CPUE data between sub-basins, between sample sites, and between sample dates. For example, for the present study the following sampling biases should be recognized:

a) the majority of sampling was conducted in tributaries as opposed to mainstem rivers which may have favoured the capture of rearing bull trout and resident rainbow trout;

b) sampling may not be representative of entire sub-basins (e.g., some streams were not sampled and many streams longer than 5 km contained only one sample site);

c) sites that were not conducive to backpack electrofishing were not sampled;

d) the failure to employ blocking nets at sites where only single-pass electrofishing surveys were conducted likely influenced the capture of species such as Arctic grayling and mountain whitefish that flee when frightened (C. Hunt, FMD, pers. comm.); and

e) sampling occurred from August 10 to October 2 which is also when spawning bull trout would be expected to be in tributaries that provide spawning habitat.

The failure to capture species, or a particular life-history stage, during the present study that have been previously documented in a particular stream does not necessarily indicate their absence. In addition to the timing of sampling, the method and effort during sampling, existing habitat conditions and other factors can influence capture results of electrofishing surveys. For example, during the present study bull trout were captured in 34 of the 51 streams sampled and at 43 of the 69 sites where electrofishing surveys were sampled (Section 3.1.2). Within one of the sample sites where bull trout were not captured [i.e., upstream sample site in Lone Teepee Creek (MK005 683)], a juvenile bull trout was subsequently captured by angling on August 20, 1995 (K. Brewin, unpublished data). Additionally, bull trout were not captured during the present study in both McPherson Creek and Unnamed tributary MJ780 955 (McLeod River sub-basin), but bull trout have subsequently been captured in these streams by the Foothills Model Forest Fisheries Inventory Crew (pers. comm., J. Traynor, Foothills Model Forest, to K. Brewin, December 17, 1996).

CPUE data (10 or more bull trout/km) have been used to characterize bull trout populations as self-sustaining (Rhude and Stelfox 1994; Brewin 1994). Based on the same criteria, results from the present study suggest self-sustaining bull trout populations occurred at 4 of 15 (26.7%), 4 of 12 (33.3%) and 10 of 24 (41.7%) sample sites in the McLeod, Wildhay and Berland River systems, respectively. In the Muskeg River system, 12 of 18 sites had CPUE results that exceeded 10 bull trout/km. However, five of these 12 sites were located in Mahon Creek.

During the present study relatively few bull trout were captured in tributaries within two km of the mainstem Wildhay River. RL&L (1993) conducted electrofishing surveys in the mainstem Wildhay River and in several direct tributaries near their mouths. They reported the mainstem Wildhay River only supported remnant populations of bull trout and that it appeared to provide limited rearing habitat for bull trout. They also captured low numbers of juvenile bull trout in tributaries near their mouths into the river. However, results from the present study indicate the relative abundance of bull trout exceeded 10 fish/km in the North and South Wildhay rivers, and Mumm and upper Rock creeks.

Electrofishing surveys to obtain CPUE information were conducted in the Muskeg River at three sites below, and six sites above, Muskeg Falls during the summer and fall, 1992 by Boag and Hvenegaard (1993). They found juvenile bull trout were common or abundant in several reaches of the river, but were most abundant at their two upper most sample sites. Based on FL data supplied by Boag and Hvenegaard 1993 and Equation #4 (this report), Boag and Hvenegaard (1993) only captured two adult bull trout and eleven (2.5%) that were above, the legal size limit at the time of the survey (400 mm TL). In contrast, 40 of the bull trout captured during the present study were larger than 400 mm TL, and 48 were positively identified as adults.

Several factors help to explain the increased ratios of adult bull trout and individuals larger than 400 mm (TL) captured in the Muskeg River system in 1993. Although both studies employed backpack electrofishing equipment, Boag and Hvenegaard (1993) sampled the mainstem river below A La Peche Creek and sampling during the present study occurred in tributaries and the mainstem river above A La Peche Creek; consequently, sample sites examined by Boag and Hvenegaard (1993) were likely deeper and wider which may have affected their ability to capture large bull trout with backpack electrofishing equipment. Boag and Hvenegaard's (1993) fall sampling period (September 1 to 12) also closely coincided with dates when adult bull trout were captured and observed spawning in Mahon Creek in 1993 (August 28 to September 10); consequently, the low percentage of adult bull trout captured by Boag and Hvenegaard (1993) may have been influenced by spawning adults having migrated from the mainstem river into spawning tributaries. It is also important to note that although more adults and more bull trout over 400 mm TL were captured during the present study, the majority (85.4% and 85.0% of the adults, and individuals larger than 400 mm TL, respectively) were captured in a single sample site immediately below a large beaver dam in Mahon Creek.

This explanation about how the timing of Boag and Hvenegaard (1993) surveys may have contributed to the low numbers of adults that they captured in the mainstem river also has important implications on the present study. The timing of electrofishing surveys conducted during the present study (August 10 to October 2) occurred during, or near, the bull trout spawning season. Consequently, because adult bull trout were likely congregated in spawning tributaries, results from the present study likely show greater ratios of adult fish in some tributaries than normally occur at other times of the year.

Long term population trend data for juvenile bull trout in the McLeod River sub-basin are available for Eunice Creek from 1971 to 1985 (Sterling 1987 in Hunt et al. (1994). Serving as a hydrological control basin for the Tri-Creeks study, the Eunice Creek watershed was protected from most industrial activities from 1967 to 1985 and has been closed to angling since 1966 (Hunt et al. 1994). During 1971 to 1985 population estimates varied from a low of 3 ($\pm$0) bull trout/km in 1983 to a high of 688 ($\pm$230) bull trout/km in 1985. However, a two pass removal electrofishing survey by FMD in 1993 resulted in a bull trout population estimate of 21 fish/km (lower and upper 95% CI - 13 and 56 bull trout/km, respectively) (FMD files, Edson). The results for Eunice Creek from 1971 to 1985, and from 1993, indicate juvenile bull trout populations in the McLeod River sub-basin experience considerable variability. FMD's 1993 survey indicates that bull trout numbers in Eunice Creek were well below the 15 year mean from 1971 to 1985 (147 $\pm$ 60 bull trout/km) in 1993.

Among streams in the McLeod River sub-basin that were sampled during the present study, previous electrofishing surveys in Anderson, Drinnan, Mary Gregg and MacKenzie creeks revealed population estimates or CPUE exceeded 10 bull trout/km (Watters 1974, Hills 1983, Hildebrandt 1986, all in Hunt et al. 1994, and Seidel 1983, respectively). Results from the present study suggest bull trout are likely still common or abundant in reaches of three of these streams (Drinnan, Mary Gregg and MacKenzie creeks). The two sites in Drinnan Creek that were examined in 1993 produced catch rates of 6.25 and 10.00 bull

trout/km while 53 bull trout/km were present during a 1983 electrofishing survey (Hills 1983 in Hunt et al. 1994). CPUE of juvenile bull trout in MacKenzie Creek was 0.00 fish/km immediately above the mouth of the stream (MJ895 819), 26.67 fish/km immediately below the falls (MJ888 755) and 95.08 fish/km approximately 1.5 km above the falls (MJ892 744). In contrast, Seidel (1983) reported the CPUE of bull trout in MacKenzie Creek was 45 fish/km and that they comprise 27% of the 106 fish captured at the site. At the two sample sites examined in Anderson Creek, only one bull trout was captured at the upper site (MK174 068: CPUE = 3.70 bull trout/km) and no bull trout were captured at the lower site (MK793 067). In 1974 an electrofishing survey in Anderson Creek resulted in CPUE results of 31 bull trout/km (Watters 1974 in Hunt et al. 1994). The 1993 population estimate for bull trout in Mary Gregg Creek (238 bull trout/km; Table 7) was higher than recorded during previous population estimates conducted in the stream (0 bull trout/km in 1977; 30 + 20 bull trout/km in 1986) (Mentz 1978 and Hildebrandt 1986, respectively, summarized in Hunt et al. 1994). Similar to previous population estimates from Mary Gregg Creek, rainbow trout were the dominant species. In contrast to 1977 and 1986, no brook trout were captured in Mary Gregg Creek in 1993.

During the present study bull trout were not caught in any streams within the McLeod River system where Hunt et al's (1994) review did not indicate they had been previously documented.

Among Wildhay River tributaries listed in Hunt et al.'s (1994) summary that were sampled during the present study, Rock and Collie creeks were the only streams where previous electrofishing surveys revealed population estimates or CPUE exceeded 10 bull trout/km. During the present study CPUE exceeded 10 bull trout/km in the South Wildhay and lower North Wildhay (one of two sites) rivers, as well as Mumm and upper Rock (one of two sites) creeks. In Collie Creek where previous population estimates were 13 $\pm$ 6 (Watters 1974 in Hunt et al. 1994) and 15 $\pm$ 7 (Hills 1984 in Hunt et al. 1994) bull trout/km, a one pass electrofishing survey in 1993 resulted in capturing only one bull trout in a 270 m reach of the stream (CPUE = 3.70 bull trout/km). The South Wildhay River was the only tributary examined during the present study where bull trout were captured, but was not included by Hunt et al. (1994) as a stream where bull trout had been captured during previous surveys. However, Hildebrand (1985) interviewed a local Fish and Wildlife officer, and a local angler, and rated the status of bull trout in the South Wildhay River as common and abundant.

Among streams in the Berland River sub-basin that were sampled during the present study, previous electrofishing surveys revealed population estimates or CPUE exceeded 10 bull trout/km in the Little Berland River and Moon Creek (Hominiuk 1985 in Hunt et al. 1994 and Hominiuk 1986, respectively). During the present study CPUE exceeded 10 bull trout/km in the Little Berland (three of four sites), North Berland and South Berland rivers as well as Big (one of two sites), Evans, Broad, Pope, and upper Moon creeks. Streams where bull trout were captured during the present study, but were not listed in Hunt et al. (1994) as streams where bull trout had been documented during previous studies included: the South Berland River and Vogel, South Cabin and Pope creeks. However, based on an interview with a local guide/outfitter, Hildebrand (1985) listed the status of bull trout in Pope Creek, a tributary of the South Berland River, as common.

Among streams in the Muskeg River sub-basin, Lone Teepee and Plante creeks were the only streams where previous electrofishing surveys revealed population estimates or CPUE that exceeded 10 bull trout/km (Hawryluk 1974 in Hunt et al. 1994 and Hildebrandt 1983). During the present study, CPUE of bull trout in lower Lone Teepee Creek was 25.46 fish/km, but the upstream sample site (MK005 683) was dominated by brook trout (CPUE = 484.21 fish/km). The only bull trout captured at the upstream site was a bull trout X brook trout hybrid. However, a bull trout (about 25 cm FL) was captured within the same reach by angling on August 20, 1995 (K. Brewin, unpublished data). A suspected bull trout X brook trout hybrid was also

captured in Plante Creek in 1982 (Hildebrandt 1983). During the present study CPUE of bull trout at the sample site in Plante Creek was 3.33 fish/km and bull trout were dominated by rainbow trout and brook trout. Electrofishing surveys in 1993 resulted in CPUE results or populations estimates that exceeded 10 bull trout/km in: Veronique, lower Lone Teepee, Chapman, Mahon (all four sites), and Isaac creeks as well as the Muskeg River above A La Peche Lake (both sites) and Unnamed tributary LK884 672. Among sample sites in the mainstem river, or in tributaries upstream of Muskeg Falls, CPUE of bull trout was greater than 10 fish/km at all except four of the sample sites (Mason, Plante, Shand and upper Lone Teepee creeks). Streams where bull trout were captured but were not identified by Hunt et al. (1994) as streams where bull trout had previously been documented were: Unnamed tributary LK884 672 and Mahon and Isaac creeks.

Results from the present study suggest the relative abundance of juvenile bull trout may decrease with increased levels of fine sediments. Other investigators have also reported juvenile bull trout densities are negatively impacted by increased levels of fine sediments (e.g., Shepard et al. 1984). Shepard et al. (1984) suggested because bull trout seek cover in the substrate during the summer (Griffiths 1979, Oliver 1979 and Pratt 1980), *"any loss of interstitial space or streambed complexity through the deposition of fine sediment would result in loss of summer habitat"*. He also implied that descriptions of winter habitat use by stream salmonids suggests utilizing the substrate for concealment cover would be common among overwintering juvenile bull trout and that increased levels of fine sediments would lower the quality of overwintering habitat. Most juvenile salmonids become nocturnal and seek cover in the substrate during the day when stream temperatures fall below 10° C (e.g., rainbow trout - Campbell and Neuner 1985, Smith 1992; brown trout - Heggenes et al. 1993; chinook salmon - Emmett and Convey 1990; bull trout - P. James, Central WA University, Ellensburg, WA, pers. com.; cutthroat trout - Wilson et al. No Date). The negative relationship between increased accumulations of fine sediments and fry recruitment among salmonids has also been well documented (e.g., Chapman 1988; Shepard et al. 1984). Consequently, future studies designed to provide a better understanding of the relationship between streambed composition and juvenile bull trout densities within the study area would be useful. It would also be useful to monitor streambed composition in important bull trout spawning and rearing streams in order to assess relationships between streambed composition and land management activities.

Although only a limited number of stream crossings along the Canadian National Railroad (CNR) line from Grande Cache to Brule were visited, two CNR culverts had created 1 m drops (approximately). These drops were impassable to upstream migrating fish in the Muskeg River system (Chapman Creek and Unnamed tributary LK884 672). One ripe male bull trout was captured immediately below the culvert on Unnamed tributary LK884 672. There were also several culverts under Highway 40 (see Table I-1) that were restricting upstream passage. Efforts to restore fish passage upstream of problem culverts are needed.

4.2 Adult populations

Bull trout in Alberta generally do not mature until age five or six (Berry 1994). Although in some systems bull trout do not reach sexual maturity until they are larger than 400 mm (TL) (e.g., Lower Kananaskis Lake, Stelfox and Egan 1994), all bull trout larger than 400 mm TL (n = 38) that were captured during the present study were mature adults. Male (n = 32) and female (n = 21) bull trout captured during the study ranged between 259 and 550 mm (FL) and 347 and 494 mm (FL), respectively. Among mature males captured, 12.5% were less than 300 mm (FL) and 31.3 % were between 300 and 400 mm (FL). Among mature females captured, none were less than 300 mm (FL), but 33.3% were between 300 and 400 mm (FL). The largest fish captured that was not sexually mature was 345 mm FL.

Studies conducted in streams draining the Eastern Slopes indicate some male and female bull trout will mature before 259 mm and 347 mm (FL), respectively, which were the lengths of the shortest sexually

mature bull trout captured during the present study. In Quirk Creek and the upper Elbow River, Bow River sub-basin, mature males and females as small as 143 mm and 263 mm (FL), respectively, have been documented (Tripp et al. 1979); 21 of the 26 mature males and all of the 17 mature females captured in Quirk Creek and the Elbow River were less than 259 and 347 mm (FL), respectively. In the Brazeau River sub-basin, Pisces (1993) captured mature male bull trout (n = 5; range 245-285 mm FL) that were as small as, or smaller than, some captured during the present study. Pisces (1993) did not capture female bull trout smaller than 400 mm (FL) (n = 4; range 441-492 mm) but this may have been influenced by his small sample size.

The majority of adult bull trout captured during the present study were from the Muskeg River system. Existing age-length frequency information for Muskeg River bull trout are summarized by Boag and Hvenegaard (1993). If age-length relationships developed by Boag (1987), who used scales to age bull trout, are applied to bull trout captured in 1993, the results suggest the smallest mature male (259 mm FL) and female (347 mm FL) bull trout captured in the Muskeg River system in 1993 were approximately age four and five, respectively. The same criteria suggest the largest bull trout from the Muskeg River system whose sex could not be determined (345 mm) was approximately age five. Boag and Hvenegaard (1993), however, explained that comparisons between their data and Boag's (1987) suggested using scales to age bull trout may result in under-estimating their actual age.

The failure to capture any fish larger than 550 mm suggests most adult bull trout were harvested shortly after they reached the 400 mm (TL) minimum size limit. This minimum size regulation was in effect until April 1, 1995, when a province-wide no harvest regulation for bull trout was implemented (Berry 1994).

4.3 Spawning activity

During the present study several important spawning streams were identified. Redd surveys indicate that the Little Berland River and Mahon Creek are important spawning streams in the Berland and Muskeg River systems, respectively. Observations of redds and/or the capture of ripe bull trout indicates MacKenzie Creek (McLeod River sub-basin), Rock Creek (Wildhay River sub-basin), North and South Berland rivers, and Isaac Creek and Unnamed tributary LK884 672 (Muskeg River sub-basin) also provide spawning habitat for bull trout. The relative abundance or densities of juvenile bull trout captured suggest the following streams provide important rearing, and potentially spawning, habitat for bull trout: Mary Gregg Creek (McLeod River system); the North and South Wildhay rivers (Wildhay River system); upper Moon Creek (Berland River system); and Veronique and Chapman creeks (Muskeg River system). Redd surveys in all of these streams would be useful to monitor population trends of bull trout in these systems.

The capture of one bull trout female in spawning condition, and observations of at least two more similar sized bull trout, on September 24 in the Berland River downstream of the mouth of Big Creek, suggests the mainstem river, or nearby side channels may also provide spawning habitat for bull trout. This possibility requires additional study.

Hildebrand (1985) listed the status of bull trout in Unnamed tributary MK484 787 (known as Jessie and Grizzly Creek) as abundant. He also interviewed a local angler who suggested the lower reaches of the stream provide spawning habitat for bull trout. However, silt accumulations observed during the present study, the failure to capture bull trout during electrofishing and descriptions of the lower reaches of the stream by hunters camped near the mouth of the stream, suggest bull trout likely do not still spawn in the lower reaches of the stream.

Hildebrand (1985) listed the status of bull trout in Packrat Creek (Berland River sub-basin) as abundant. He also referenced a local trapper who indicated the lower reaches of Packrat Creek provided "*excellent*

fishing" for bull trout and that it also had "*suspected spawning*". However, when Packrat Creek was examined on September 24, it had an impassable beaverdam at its mouth and only marginal flow through the beaverdam.

4.4 Use of aerial surveys to identify potential bull trout spawning areas

Although evidence of spawning activity was collected at two sites that Hildebrand (1985) identified as having moderate, or moderate to high, potential for bull trout spawning habitat [i.e.: redds were found near Site R3 (Rock Creek) and B1 (North Berland River); and one ripe male was captured near Site B1], several factors prevent a conclusive assessment of Hildebrand's methods. For example, the number of these sites where bull trout spawning activity was confirmed in 1993 is small. The two studies were also conducted several years apart and low CPUE results for bull trout were obtained from several streams in 1993 that Hildebrand (1985) rated as having common or abundant populations; consequently, redd surveys were not conducted along these streams if low CPUE results were obtained [e.g., Drinnan and Anderson creeks (McLeod River system) and Beaver, Cabin and lower Moon creeks (Berland River system)]. Instead, redd survey efforts were concentrated in streams where recent surveys provided relatively high CPUE results [e.g., Boag and Hvenegaard's (1985) surveys in the Muskeg River results, and 1993 surveys in the Little Berland River and Mahon Creek].

A ripe bull trout male was also captured in upper Rock Creek near Hildebrand's (1985) Site R1 which he rated as having low to moderate potential for bull trout spawning. The capture of a single ripe male near this site, however, does not provide sufficient evidence to evaluate Hildebrand's (1985) rating. For example, even though this male was ripe, it is not known whether it was captured while migrating to, or from, its spawning grounds.

Winter aerial observations of the Little Berland River revealed five open-water reaches (Hildebrand 1985). The bull trout redd that was observed in the Little Berland River approximately 700 m from the mouth of the river was near one of these open water reaches. The reach where this redd was found was also identified by Hildebrand (1985) as an area with locally higher groundwater yield areas, primarily with sand/gravel lithology and which provided suitably-sized gravels for spawning. The reach immediately below an impassable barrier on the Little Berland River where 14 distinct bull trout redds were observed was slightly downstream of another open-water area observed by Hildebrand (1985). However, the presence of the impassable barrier, which was caused by the recent movement of the main channel and was likely not present in 1985, prevents attributing the spawning activity to the open-water reach (i.e., source of groundwater inflow) that was observed in 1985.

Furthermore, although evidence of bull trout spawning activity was found in some areas identified by Hildebrand (1985) as having potential spawning habitat, these results may be biased by the limited lengths of some reaches where redds were observed. For example, although one redd was observed in the 300 m reach where the electrofishing survey was conducted in the North Berland River, this was the only Reach of the North Berland River that was examined.

Results from 1993 suggest there are several streams within the study area where the relative abundance of bull trout, and observations of redds or possible redds, warrants redd surveys. It may be possible to more accurately assess Hildebrand's methods if redd surveys are used to document spawning habitat along these streams and then Hildebrand's methods are applied on streams where redd surveys indicate spawning activity is occurring. These streams are listed in paragraph 1, Section 4.3.

Remote-sensing technology to detect instream temperature gradients, however, may provide an alternative to Hildebrand's methods (i.e., using winter aerial surveys and hydrology reviews to identify areas of

groundwater inflow and potential bull trout spawning areas). Remote-sensing technology could be used to detect areas with groundwater inflow by locating reaches with warmer stream temperatures immediately before or during ice conditions. Whiting (1976) briefly discussed the potential use of airborne thermal infrared sensing to detect groundwater sources in ice-covered streams. Thermal video frame scanners (TVFS) have also been used with light aircraft to develop thermal maps with 1° C intervals along the surface of highways prone to icing during winter (Stove et al. 1987). The same system can also be modified to have a minimum resolvable temperature difference of 0.1° C. Although the pros and cons of this, and other systems, would need to be examined, TVFS's should be given consideration as alternative methods of detecting areas with groundwater inflow. In addition to helping identify potential bull trout spawning areas, this technology may also be useful for identifying overwintering habitat. Brown (1994) reported areas with groundwater inflow provide important refugia for overwintering stream salmonids during frazil ice conditions.

4.5 Roundcroft Creek

Although a report prepared by industry indicated Roundcroft Creek may provide important rearing habitat for bull trout (Zallen 1984), bull trout were not captured in the same general area during the present study; however, brook trout and rainbow trout were abundant. In contrast, brook trout were not reported in the survey by Zallen (1984). These contrasting results suggest the bull trout reported by Zallen (1984) may have been brook trout that were misidentified.

5.0 RECOMMENDATIONS

1) The assessment of Hildebrand's (1985) methods to identify potential bull trout spawning habitat was inconclusive. In order to obtain an accurate assessment of Hildebrand's (1985) methods, it would be desirable to conduct redd surveys to identify areas where bull trout spawning occurs and then repeat Hildebrand's (1985) methods on streams where bull trout spawning activity is documented.

However, alternative methods to those used by Hildebrand (1985) to identify areas with groundwater inflow may exist. For example, the use of thermal infrared remote-sensing technology to identify instream temperature gradients and locate areas with groundwater inflow may provide an alternative. This technology could also be used to help identify groundwater inflow that contributes to providing critical overwintering habitats.

2) Ripe female bull trout were observed as early as August 28. Ten of 17 females captured on September 9 were ripe. Bull trout were observed on redds as late as September 17, but no bull trout were found on, or in the immediate vicinity of redds observed on September 24 (n = 15) and 27 (n = 2). These data suggest that although redd surveys could begin as early as approximately September 10, surveys conducted before September 20 (approximately) may result in missing redds which are constructed towards the end of the spawning season.

Consequently, selecting dates for future redd surveys will be dependent on the purpose of the redd surveys. For example, if the purpose is to document streams or stream reaches that provide important spawning habitat, then a one-time survey along each stream between September 10 and September 20 may be sufficient. However, if the purpose is to count individual redds and use the data to monitor population trends, then a series of surveys along each stream would probably be more appropriate (e.g., three surveys approximately 10-12 days apart beginning in late August-early September).

3) A number of streams that provide important rearing and/or spawning habitat for bull trout in the study area were identified. This database should be maintained and expanded.

Results from the present study suggest the following streams provide important rearing and/or spawning habitat for bull trout: MacKenzie and Mary Gregg creeks (McLeod River sub-basin); the North and South Wildhay River and Rock Creek (Wildhay River sub-basin); upper Moon and the North, South and Little Berland rivers (Berland River sub-basin); and Veronique, Chapman and Mahon creeks and Unnamed tributary LK884 672 (Muskeg River system). Opportunities to develop long-term monitoring programs (e.g., redd surveys, and sampling programs to monitor changes in species composition, length/age class distributions and densities) in these streams should be examined. Identifying, or developing, low-impact sampling techniques should be emphasized during the design of any fishery research/inventory projects within the study area.

4) *"Alberta's bull trout management and recovery plan"* indicates that unobstructed migration routes for bull trout moving between spawning, rearing and overwintering habitats need to be maintained (Berry 1994). This strategy has several implications within the study area: a) spawning migrations in Mahon Creek, Muskeg River system, were obstructed by beaver dams; and b) several culverts under roads (e.g., Highway 40 from Hinton to Grande Cache) and railroads (e.g., railway from Grande Cache to Jasper) were observed that provided impassable barriers to fish. The importance of Mahon Creek as a spawning stream suggests a beaver management strategy that provides bull trout access to upstream spawning habitats may be warranted. Efforts to examine opportunities to correct and/or replace problem culverts should also be pursued.

Although it may take an enormous amount of volunteer effort before corrective actions are undertaken by the government agencies or industries who installed these problem culverts, local Trout Unlimited Canada volunteers are encouraged to initiate contact with these groups and begin discussions towards having problem culverts corrected.

5) Results from the present study suggest the relative abundance of juvenile bull trout may be directly related to accumulations of fine sediments. Consequently, it would be useful to: develop a better understanding of the relationship between streambed composition and juvenile bull trout densities; monitor streambed composition in streams that provide important spawning and rearing habitat for bull trout within the study area; and examine the effects that various land-use activities and mitigation strategies have on local bull trout populations. These activities would be useful to help develop strategies that minimize the impacts of land management activities.

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7.0 APPENDIX I: ADDITIONAL TABLES

Abbreviations used in Appendix I

NR - Not recorded
BLTR - bull trout
BKTR - brook trout
RNTR - rainbow trout
BURB - burbot
MNWH- mountain whitefish
CTTR - cutthroat trout
NRPK - northern pike
ARGR - Arctic grayling
LNSC - longnose sucker
UKN - unknown
M - male
F - female
Immat - immature
I - immature
Mat - mature

Abbreviation for fish species from MacKay et al. (1990)

Table I-1. Sample site locations and date, model of electrofisher and electrofishing effort in the McLeod, Wildhay, Berland and Muskeg River sub-basins, and Roundcroft Creek, between August 10 and October 2, 1993 (* - active electrofishing time during first of 3 electrofishing passes in the same sample sit

Tributary or river	Stream code	1993 sample date	Universal Transverse Mercator location of sample site	Length of sample reach (m)	Stream temp. during sample	Electro-fishing effort (sec.)	No. in electo-fishing crew	Model of electro-shocker used	Additional comments
McLeod River sub-basin									
Embarras River	A-60-090	Aug 17	MJ995 911	270	12.0	1780	2	15-B	
McPherson Creek	A-60-200	Oct 1	MK822 133	350	NR	1613	2	15-B	
Quigley Creek	A-60-210	Aug 17	MK738 104	300	4.0	1213	2	15-B	
Anderson Creek	A-60-220	Sept 30	MK793 067	285	5.0	1840	3	15-B	
Anderson Creek	A-60-220	Aug 11	MK714 068	270	7.0	1260	2	15-B	Near Site A1 (Hildebrand 1985)
Drinnan Creek	A-60-240-30	Aug 11	MJ658 927	320	8.0	2315	2	15-B	Near Site D1 (Hildebrand 1985)
Drinnan Creek	A-60-240-30	Aug 10	MJ615 881	300	6.0	1665	2	15-B	Near Site D2 (Hildebrand 1985)
Unnamed tributary MJ780 955	A-60-270-10	Oct 2	MJ777 952	250	3.0	1329	2	15-B	Also known as Nice Creek and Neat Creek
Mary Gregg Creek	A-60-280	Oct 2	MJ768 879	300	NR	1928*	2	7	
Trapper Creek	A-60-280-10	Oct 2	MJ771 878	300	4.5	1804	2	15-B	
Wampus Creek	A-60-290								Assisted Fish and Wildlife Services with population estimate.
Deerlick Creek	A-60-300								Assisted Fish and Wildlife Services with population estimate.
Beaverdam Creek	A-60-330	Sept. 30	NJ013 779	300	6.5	1531	2	7	
Taylor Creek	A-60-330-30	Sept. 30	MJ985 798	300	6.0	997	2	7	
MacKenzie Creek	A-60-340	Aug 18	MJ895 819	300	12.0	2880	2	15-B	
MacKenzie Creek	A-60-340	Oct 1	MJ888 755	300	6.0	1901	2	7	Immediately below 1.5-2.0 m waterfall
MacKenzie Creek	A-60-340	Oct 1	MJ892 744	305	7.0	2133	2	7	Approximately 1.5 km above 1.5-2.0 m waterfall

Number of streams sampled = 13
Number of sites sampled = 17

Wildhay River sub-basin (North Wildhay River and Rock Creek join approx. 2 km below Rock Lake to form the Wildhay River.)									
Pinto Creek	A-130-10-10	Sept 28	MK457 585	285	NR	1108	2	7	
Hightower Creek	A-130-10-10-10	Sept 28	MK455 602	300	7.0	1344	2	7	
Twelve Mile Creek	A-130-10-40	Sept 29	MK411 347	150	6.0	903	2	7	Culvert under Highway 40 likely prevents upstream fish migration.
Moberly Creek	A-130-10-50	Sept 26	MK325 346	310	NR	1646	2	7	
Paradise Creek	A-130-10-60	Sept 29	MK288 352	280	4.0	549	2	7	
South Wildhay River	A-130-10-67	Sept 26	MK249 227	300	NR	1311	2	7	Near Site W3 in Hildebrand (1985)
Collie Creek	A-130-10-70	Aug 12	MK255 295	270	7.5	1555	2	15-B	
Mumm Creek	A-130-10-72	Sept 29	MK185 281	300	4.0	1519	2	15-B	Above reach where only flow is subsurface
North Wildhay River	A-130-10-80	Aug 12	MK185 249	300	7.0	2455	2	15-B	Near Site W1 in Hildebrand 1985)
North Wildhay River	A-130-10-80	Sept 29	MK153 263	300	5.0	2069	2	15-B	
Rock Creek	A-130-10-80	Sept 27	MK123 206	520	8.0	2200	3	15-B	Upper limit of sample site 75 m downstream of JNP boundary; near site R3 in Hildebrand (1985)
Rock Creek	A-130-10-80	Sept 15	LK896 273	310	6.5	1809*	4	15-B	Near Site R1 in Hildebrand (1985)

Number of streams sampled = 10
Number of sites sampled = 12

Table I-1. (cont.)

Tributary or river	Stream code	1993 sample date	Universal Transverse Mercator location of sample site	Length of sample reach (m)	Stream temp. during sample	Electro-fishing effort (sec.)	No. in electo-fishing crew	Model of electro-shocker used	Additional comments
Berland River sub-basin									
Unnamed tributary MK881 814	A-130-007	Sept 26	MK850 762	300	4.0	2208	3	15-B	
Beaver Creek	A-130-020	Aug 21	MK730 809	315	14.0	1688	2	15-B	Near Site B1 in Hildebrand (1985)
Unnamed tributary MK692 799	A-130-020-10	Sept 28	MK677 762	300	4.0	1400	3	15-B	
Unnamed tributary MK484 787	A-130-045	Sept 26	MK482 788	300	6.0	1451	3	15-B	Called Grizzly Creek by hunters in the area; likely the same stream refered to as Jessie Creek in Hildebrand (1985)
Berland River (side channel)	A-130	Sept 25	MK442 796	285	NR	1524	3	15-B	Side channel immediately below Horse Creek
Horse Creek	A-130-050	Sept 25	MK435 799						Not sampled
Packrat Creek	A-130-060	Sept 24	MK295 743						Not sampled
Smith Creek	A-130-070	Sept 24	MK298 730						Not sampled
Olson Creek	A-130-080	Sept 24	MK260 679						Not sampled
Big Creek	A-130-090	Sept 24	MK260 671	305	4.0	1817	3	15-B	
Big Creek	A-130-090	Sept 18	MK142 636	285	1.5	1619	3	15-B	
Little Berland River	A-130-100	Sept 23	MK189 543	395	3.0	2149	3	15-B	
Little Berland River	A-130-100	Aug 26	MK172 479	300	5.0	2047	2	15-B	
Little Berland River	A-130-100	Aug 26	MK158 428	300	4.0	1247	2	15-B	
Little Berland River	A-130-100	Sept 17	MK132 423	300	4.5	1629	2	15-B	
Fox Creek	A-130-100-10	Sept 29	MK177 524	300	7.0	1551	2	7	
Fox Creek	A-130-100-10	Aug 20	MK163 493	290	12.0	1439	2	15-B	
Evans Creek	A-130-100-20	Sept 16	MK155 427	365	6.5	1599	2	15-B	
Broad Creek	A-130-100-30	Sept 17	MK133 422	275	4.5	996	2	15-B	
Cabin Creek	A-130-110	Aug 13	MK088 584	315	8.0	1818	2	15-B	Near Site C1 in Hildebrand (1985)
Hendrickson Creek	A-130-110-20	Aug 25	MK087 602	305	7.0	1566	2	15-B	
Vogel Creek	A-130-110-25	Aug 25	MK057 595	330	7.0	1529	2	15-B	
South Cabin Creek	A-130-110-30	Sept 16	MK012 592	300	4.0	1543	2	7	
Moon Creek	A-130-120	Sept 13	MK038 440	420	3.5	3233	2	15-B	Near Site M1 in Hildebrand (1985)
Moon Creek	A-130-120	Aug 14	MK107 580	300	7.0	2185	2	15-B	Near Site M2 in Hildebrand (1985)
Stalk Creek	A-130-125	Aug 24	MK054 525						Not sampled
North Berland River	A-130-135	Sept 15	LK880 472	300	3.5	2034	2	15-B	Near Site B1 in Hildebrand (1985)
South Berland River	A-130-135	Sept 15	LK933 404	300	4.0	1517	2	7	
Pope Creek	A-130-135-10	Sept 15	LK935 404	300	4.0	1359	2	Both	

Number of streams sampled = 18
Number of sites sampled = 24

Table I-1. (cont.)

Tributary or river	Stream code	1993 sample date	Universal Transverse Mercator location of sample site	Length of sample reach (m)	Stream temp. during sample	Electro-fishing effort (sec.)	No. in electo-fishing crew	Model of electro-shocker used	Additional comments
Muskeg River sub-basin									
Muskeg River	S-70	Sept 7	LK794 582	600	8.5	4039	4	15-B	
Muskeg River	S-70	Sept 8	LK793 553	300	10.0	2094	2	15-B	
Susa Creek	S-70-10	Aug 29	LK711 773	345	8.0	2298	2	15-B	
Sterne Creek	S-70-20	Aug 22	LK707 765	300	8.0	2470	2	15-B	
Mason Creek	S-70-30	Aug 22	LK795 766	290	8.0	1398	2	15-B	
Veronique Creek	S-70-50	Aug 23	LK871 768	300	9.0	1787	3	15-B	Culvert under Highway 40 likely prevents upstream fish migration.
Lone Teepee Creek	S-70-60	Aug 30	LK907 762	275	9.0	2141	3	15-B	Impassible beaver dam at upper limit of sample site
Lone Teepee Creek	S-70-60	Aug 24	MK005 683	285	6.0	2240	4	15-B	Impassible beaver dam at upper limit of sample site
Plante Creek	S-70-60-20	Aug 23	MK033 756	300	7.5	1895	4	15-B	
Shand Creek	S-70-60-30	Aug 24	MK001 658	300	NR	752	2	15-B	Culvert under Highway 40 likely prevents upstream fish migration.
Chapman Creek	S-70-70	Aug 28	LK898 692	300	9.0	1241	2	15-B	Culvert under railway tracks likely prevents upstream fish migration.
Unnamed tributary LK884 672	S-70-74	Aug 31	LK885 676	300	8.0	1200	2	15-B	Culvert under railway tracks likely prevents upstream fish migration.
Mahon Creek	S-70-75	Aug 28	LK887 671	360	8.0	1369	2	15-B	Same location as site sampled on Sept. 6.
Mahon Creek	S-70-75	Sept 6	LK887 671	405	9.0	2879*	4	15-B	Same location as site sampled on Aug. 28.
Mahon Creek	S-70-75	Sept 9	LK885 663	310	8.0	2094*	4	15-B	Beaver dam likely prevents upstream migration
Mahon Creek	S-70-75	Sept 10	LK894 647	300	5.5	2353	4	15-B	
Mahon Creek	S-70-75	Sept 10	LK905 627	315	6.5	1487	2	15-B	
Isaac Creek	S-70-75-5	Sept 10	LK898 633	280	7.0	1568	2	15-B	
Lancaster Creek	S-70-90	Sept 8	LK787 553						Not sampled
Number of streams sampled = 11									
Number of sites sampled = 18 (two of the 18 sites in Mahon Creek shared the same downstream limit)									
Direct tributaries of the Athabasca River									
Roundcroft Creek	A-191	Sept 30	MK766 293	300	7.0	2752	2	7	
Number of streams sampled = 1									
Number of sites sampled = 1									

Table I-2. Location, date and approximate length of redd surveys conducted in the Wildhay, Berland and Muskeg River sub-basins.

Waterbody	Date	Lower limit of survey (UTM)	Upper limit of survey (UTM)	Estimated survey length	No. of distinct redds observed during survey
Wildhay River sub-basin					
North Wildhay River	September 13	MK186 248	MK183 255	1.2 km	0
Wildhay River	September 13	MK175 247	MK205 252	5.3 km	0
Rock Creek	September 27	MK152 237	MK063 207	13.5 km	1
Berland River sub-basin					
Little Berland River	September 16	MK168 472	MK158 428	6.75 km	1
Little Berland River	September 17	MK158 428	MK111 401	9.0 km	1
Little Berland River	September 24	MK198 547	MK192 505	3.5 km	1
Little Berland River	September 24	MK184 483	MK168 472	2.25 km	14
Muskeg River sub-basin					
Muskeg River	August 28	LK917 758	LK897 680	19.5 km	0
Chapman Creek	August 28	LK897 680	LK890 683	1.1 km	0
Muskeg River	September 7	LK799 592	LK800 570	2.75 km	0
Mahon Creek	September 8	LK886 672	LK896 633	8.25 km	8
Mahon Creek	September 10	LK896 633	LK865 613	5.5 km	3

* - upstream limit was an impassible beaverdam, but no redds were observed immediately below the beaverdam.

Table I-3. Locations and dates of observations in the McLeod, Wildhay, Berland and Muskeg River systems that were identified as "possible redds".

River Sub-basin	Tributary	Location	Date	Number of possible redds
McLeod	MacKenzie Creek	In 300 m reach where electrofishing survey was conducted (near MJ892 744)	Oct. 1	2
Berland	Little Berland River	Between mouth of Fox Creek and the Little Berland River's mouth into Berland River	Sept. 24	6
		In 200 m reach <2 km above Highway 40; same reach where 14 redds were observed	Sept. 24	10
		In reach above mouth of Evans Creek that was surveyed on Sept. 17 (see Figure 7)		
	North Berland River	Immediately below reach where electrofishing survey was conducted (near LK880 472)	Sept. 15	1
	South Berland River	In 300 m reach where electrofishing survey was conducted (lower limit: LK933 404)	Sept. 15	1
Muskeg	Mahon Creek	Approximately above mouth of Mahon Creek into Muskeg River	Sept. 10	1
		Within a 250 m reach downstream of beaver dam at LK885 663	Sept. 10	5
		Within 500 m downstream of mouth of Isaac Creek	Sept. 10	2

Table I-4 Habitat conditions at individual sample sites examined in the McLeod, Wildhay, Berland and Muskeg River basins, and Roundcroft Creek, during August 13 to October 2, 1993.

Location	Universal Transverse Mercator location	Substrate composition						Percent cover composition						Mean stream width (m)	% gradient	Pool:riffle:run:rapid ratio			
		Mean % Fines	Mean % Small Gravel	Mean % Large Gravel	Mean % Cobble	Mean % Boulder	Mean % Bedrock	Boulder	Over-hang	Under-cut banks	Woody debris	Gar-bage	Aquatic vege-tation			Pool (%)	Riffle (%)	Run (%)	Rapid (%)
Roundcroft Creek	MK766 293	8.2	13.7	23.1	39.7	15.2	0.2	19.8	20.8	1.3	17.8	0.0	0.0	2.63	2.0	23.3	76.7	0.0	0.0
McLeod River sub-basin																			
Embarass River	MJ995 911	36.6	6.7	14.4	18.3	23.4	0.6	21.6	6.1	2.7	0.4	0.0	0.0	7.84	1.7	16.7	68.9	10.7	3.7
Quigley Creek	MK738 104	37.5	3.3	8.4	17.9	32.9	0.0	12.5	30.3	47.3	4.6	0.0	0.0	1.23	0.7	75.0	0.0	25.0	0.0
McPherson Creek	MK822 133	26.0	24.5	31.8	17.5	0.3	0.0	5.1	5.9	8.4	5.7	0.0	2.3	4.81	0.2	63.4	31.4	5.1	0.0
Anderson Creek	MK793 067	9.3	11.6	25.2	41.3	12.6	0.0	16.5	9.9	3.0	20.2	0.0	0.0	5.13	1.0	24.2	73.0	2.8	0.0
Anderson Creek	MK714 068	11.1	18.7	31.7	31.8	6.7	0.0	7.3	32.2	9.9	14.2	0.1	0.0	3.68	1.3	12.2	84.1	3.7	0.0
Drinnan Creek	MJ658 927	31.0	18.0	28.7	18.5	3.9	0.0	2.4	9.3	7.3	8.1	0.0	0.0	8.85	NR	NR	NR	NR	NR
Drinnan Creek	MJ615 881	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	10.32	2.5	NR	NR	NR	NR
Unnamed tributary MJ780 955	MJ777 952	10.6	13.8	26.9	35.3	13.4	0.0	14.7	46.6	1.6	20.6	0.0	0.1	3.67	1.0	12.4	75.6	12.0	0.0
Mary Gregg Creek	MJ768 879	26.4	28.9	25.7	12.6	5.9	0.5	8.2	18.8	3.7	11.9	0.0	0.0	5.49	1.0	40.0	53.3	6.7	0.0
Trapper Creek	MJ771 878	11.3	19.8	22.8	24.0	19.5	2.8	18.0	14.2	0.2	2.9	0.0	0.0	5.02	0.7	22.3	66.0	11.7	0.0
Beaverdam Creek	NJ013 779	36.0	22.3	22.1	18.0	1.7	0.0	3.2	3.7	4.8	0.8	0.0	2.0	6.14	1.0	27.7	36.7	35.7	0.0
Taylor Creek	MJ985 798	49.0	9.5	13.1	19.6	9.0	0.0	5.3	6.7	3.4	2.6	0.0	0.0	5.80	1.0	18.0	44.7	37.3	0.0
MacKenzie Creek	MJ895 819	12.8	13.9	22.0	26.0	23.9	1.5	25.6	11.2	0.8	3.3	0.0	0.0	20.27	1.5	6.7	61.7	20.0	11.7
MacKenzie Creek	MJ888 755	9.3	16.9	22.1	22.2	25.8	3.9	25.6	2.6	1.0	0.6	0.0	0.0	9.67	1.7	22.8	43.7	8.4	27.8
MacKenzie Creek	MJ892 744	8.1	22.5	27.2	32.9	9.3	0.0	11.2	1.7	1.7	3.7	0.0	0.0	13.18	1.0	14.1	76.4	9.5	0.0
Wildhay River sub-basin																			
Pinto Creek	MK457 585	22.8	8.4	15.3	30.9	17.8	4.7	18.2	0.4	0.2	7.2	0.0	0.0	13.93	1.0	30.9	48.8	20.4	0.0
Hightower Creek	MK455 602	14.2	10.4	17.6	33.3	18.5	5.9	16.8	2.8	0.9	2.5	0.0	0.0	15.38	1.0	12.3	73.3	14.3	0.0
Twelve Mile Creek	MK411 347	4.6	12.4	18.0	39.3	25.8	0.0	19.4	30.0	2.4	13.3	0.0	0.0	4.54	1.5	16.7	73.3	10.0	0.0
Moberly Creek	MK325 346	13.2	19.4	24.5	39.6	3.4	0.0	10.4	7.0	0.8	16.8	0.0	0.0	7.39	0.5	36.5	48.7	15.2	0.0
Paradise Creek	MK288 352	19.8	17.1	13.2	19.4	30.5	0.2	30.6	28.9	1.5	11.9	0.0	0.0	2.50	2.0	18.9	77.5	3.7	0.0
South Wildhay River	MK249 227	9.0	12.7	21.5	34.3	20.9	1.7	23.6	8.4	0.8	4.5	0.0	0.0	6.67	1.0	16.0	74.6	9.4	0.0
Collie Creek	MK255 295	7.6	12.5	23.2	35.7	21.1	0.0	47.2	7.7	3.2	6.3	0.0	0.0	6.62	2.5	NR	NR	NR	NR
Mumm Creek	MK185 281	4.6	10.4	19.5	32.5	33.0	0.0	41.0	1.9	0.2	1.4	0.0	0.0	5.61	1.0	3.7	95.3	1.0	0.0
Rock Creek	MK123 206	10.6	26.2	35.8	26.5	1.0	0.0	1.9	2.8	1.7	4.7	0.0	0.0	9.99	1.0	31.0	45.7	23.3	0.0
Rock Creek	LK896 273	19.9	21.4	38.1	20.6	0.1	0.0	6.9	2.7	3.3	1.1	0.0	0.0	8.26	0.8	5.8	51.6	22.6	0.0
North Wildhay River	MK185 249	16.9	28.0	35.5	19.0	0.7	0.0	3.6	7.5	3.7	5.1	0.0	0.0	10.69	1.0	21.0	49.8	29.7	0.0
North Wildhay River	MK153 263	5.8	10.7	17.0	27.3	38.6	0.7	27.0	3.0	0.6	1.4	0.0	0.0	9.33	0.8	5.3	53.3	0.0	41.3

Table I-4 (cont.)

Location	Universal Transverse Mercator location	Substrate composition						Percent cover composition						Mean stream width (m)	% gradient	Pool:riffle:run:rapid ratio			
		Mean % Fines	Mean % Small Gravel	Mean % Large Gravel	Mean % Cobble	Mean % Boulder	Mean % Bedrock	Boulder	Over-hang	Under-cut banks	Woody debris	Gar-bage	Aquatic vege-tation			Pool (%)	Riffle (%)	Run (%)	Rapid (%)
Berland River sub-basin																			
Unnamed tributary MK881 814	MK850 762	62.8	4.3	11.3	19.5	2.1	0.0	4.4	13.8	4.6	10.5	0.0	7.0	8.52	0.5	70.0	16.7	13.3	0.0
Beaver Creek	MK730 809	47.1	1.5	5.8	38.4	7.3	0.0	8.9	9.3	4.2	8.3	0.0	14.8	9.43	0.8	10.5	20.3	69.2	0.0
Unnamed tributary MK692 799	MK677 762	51.0	16.8	18.5	12.0	1.8	0.0	8.3	42.3	4.8	12.8	0.0	0.0	2.49	0.8	35.0	65.0	0.0	0.0
Unnamed tribuary MK484 787	MK482 788	17.9	9.9	26.7	36.6	8.9	0.0	6.7	4.7	5.0	11.5	0.0	0.0	8.17	0.8	43.0	27.3	15.7	0.0
Berland River side channel	MK442 796	20.5	10.9	32.7	33.7	2.3	0.0	2.7	3.5	4.6	8.3	0.0	0.0	9.64	0.3	30.2	50.9	18.9	0.0
Big Creek	MK142 636	20.0	9.9	19.9	26.3	24.0	0.0	20.4	15.7	4.7	5.0	0.0	0.1	6.45	0.5	20.3	50.5	29.1	0.0
Big Creek	MK260 671	19.2	8.7	18.5	38.7	15.0	0.0	11.6	5.6	3.8	4.6	0.0	0.0	10.39	0.3	16.4	32.8	50.8	0.0
Little Berland River	MK189 543	3.5	8.4	21.2	44.8	19.5	2.3	11.2	3.1	3.8	3.1	0.0	0.0	11.57	0.7	7.6	81.5	10.9	0.0
Little Berland River	MK172 479	6.0	7.5	15.4	55.1	16.0	0.0	7.4	1.2	3.0	12.7	0.0	0.0	7.79	1.7	15.3	58.3	19.0	7.3
Little Berland River	MK158 428	5.9	8.0	10.3	57.7	17.1	1.1	9.9	5.2	3.8	0.2	0.0	0.0	10.80	1.3	19.0	52.3	24.0	4.7
Little Berland River	MK132 423	3.2	16.4	26.1	28.8	24.4	1.3	34.9	9.2	2.2	1.4	0.0	0.0	6.98	1.3	7.3	81.0	6.3	5.3
Fox Creek	MK177 524	12.2	17.5	21.4	25.8	23.1	0.0	16.2	3.6	2.8	0.4	0.0	0.0	5.84	1.0	16.3	62.3	21.3	0.0
Fox Creek	MK163 493	32.8	18.9	23.1	25.3	0.0	0.0	0.6	9.7	3.1	35.9	0.0	1.2	5.45	1.5	32.1	54.4	13.4	0.0
Evans Creek	MK155 427	7.6	14.1	23.8	38.9	13.9	1.8	21.1	6.6	2.9	0.5	0.0	0.0	4.27	1.7	10.4	84.7	4.9	0.0
Broad Creek	MK133 422	11.3	10.0	13.8	37.5	27.5	0.0	12.5	70.0	4.8	3.8	0.0	0.0	2.40	1.0	9.8	85.1	5.1	0.0
Cabin Creek	MK088 584	19.4	15.2	24.2	32.7	8.5	0.0	18.3	2.6	3.6	2.6	0.0	0.9	9.66	1.5	27.6	54.0	18.4	0.0
Hendrickson Creek	MK087 602	60.0	0.2	1.2	21.8	16.9	0.0	3.7	7.5	27.5	4.6	0.0	15.5	2.91	NR	24.2	28.4	47.4	0.0
Vogel Creek	MK057 595	6.8	7.3	15.4	51.9	17.7	1.0	10.8	8.8	4.2	1.8	0.0	1.1	8.68	0.8	3.0	43.0	48.5	4.8
South Cabin Creek	MK012 592	13.5	12.5	18.0	29.0	27.0	0.0	19.7	16.1	2.6	8.4	0.0	0.0	7.26	1.5	10.0	79.3	10.7	0.0
Moon Creek	MK107 580	10.4	23.3	33.9	26.4	5.8	0.1	12.6	4.9	1.3	4.3	0.0	0.0	13.27	1.5	11.7	64.4	10.7	13.7
Moon Creek	MK038 440	4.2	10.7	16.9	40.8	22.1	5.5	43.0	3.5	1.1	1.0	0.0	0.0	8.23	1.8	16.9	72.4	0.0	10.7
North Berland River	LK880 472	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	11.76	1.3	6.7	83.3	10.0	0.0
South Berland river	LK933 404	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	7.52	2.0	2.8	86.1	11.1	0.0
Pope Creek	LK935 404	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	6.08	1.3	2.7	90.7	0.0	6.7
Muskeg River sub-basin																			
Susa Creek	LK711 773	8.8	8.3	28.3	44.4	10.0	0.4	0.6	9.7	3.1	36.9	0.0	1.2	7.35	1.3	12.8	75.1	8.7	3.5
Sterne Creek	LK707 765	5.2	13.2	19.5	35.2	26.8	0.0	48.3	15.9	0.8	6.2	0.0	0.0	6.58	2.5	18.7	81.3	0.0	0.0
Mason Creek	LK795 766	12.6	17.9	21.8	31.2	15.4	1.3	45.3	8.6	2.8	3.7	0.0	0.0	5.40	2.0	18.3	73.1	8.6	0.0
Veronique Creek	LK871 768	10.4	10.9	15.6	30.5	27.4	5.3	27.7	8.7	2.4	21.6	0.1	0.0	4.11	3.0	31.7	42.5	25.8	0.0
Lone Teepee Creek	LK907 762	14.9	12.1	27.9	41.9	3.2	0.0	10.0	14.9	2.9	3.8	0.0	0.0	9.38	1.3	17.1	48.4	34.5	0.0
Lone Teepee Creek	MK005 683	13.8	20.4	29.3	35.4	1.1	0.0	23.9	32.7	3.3	7.4	0.7	0.1	4.56	1.1	15.4	68.8	15.8	0.0
Plante Creek	MK033 756	12.7	14.8	18.9	25.4	23.2	5.0	31.2	15.4	4.7	9.1	0.0	0.0	3.04	1.5	20.7	58.7	5.0	15.7
Shand Creek	MK001 658	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Chapman Creek	MK898 692	3.6	15.2	28.6	39.5	12.9	0.0	2.9	22.1	0.2	7.6	0.0	0.0	3.32	4.3	9.0	79.7	6.7	4.7
Unnamed tributary LK884 672	LK885 676	6.2	15.6	27.8	30.7	19.8	0.0	39.7	13.9	1.7	5.5	0.0	0.0	3.00	NR	8.0	89.0	3.0	0.0
Mahon Creek	LK887 671	5.1	19.1	35.9	35.8	4.1	0.0	11.7	5.5	3.2	4.4	0.0	0.0	9.20	1.7	9.2	70.0	12.5	8.3
Mahon Creek	LK885 663	7.6	7.3	23.4	54.5	7.3	0.0	8.2	2.9	2.7	4.2	0.0	4.2	8.62	0.8	10.3	57.1	29.7	2.9
Mahon Creek	LK905 627	11.7	20.4	25.9	33.8	6.7	1.5	13.6	4.1	3.6	2.7	0.0	0.0	7.71	1.0	9.5	57.1	30.2	3.2
Mahon Creek	LK894 647	9.4	20.2	28.3	33.4	9.3	0.0	28.0	5.5	1.6	3.4	0.0	0.0	9.62	1.3	16.7	71.7	6.7	5.0
Isaac Creek	LK898 633	6.1	8.2	13.2	31.8	40.7	0.0	37.1	24.9	3.5	3.3	0.0	0.0	4.08	1.2	2.9	93.9	2.1	1.1
Muskeg River	LK794 582	11.2	18.9	28.9	38.0	2.5	0.6	7.3	2.4	0.8	15.9	0.0	0.0	13.35	1.5	11.5	88.5	0.0	0.0
Muskeg River	LK793 553	2.5	5.4	12.4	64.4	15.4	0.0	7.8	3.3	1.3	4.8	0.0	0.0	8.10	2.2	6.7	57.0	17.6	18.6

NR - Not recorded

8.0 APPENDIX II: ADDITIONAL FIGURES

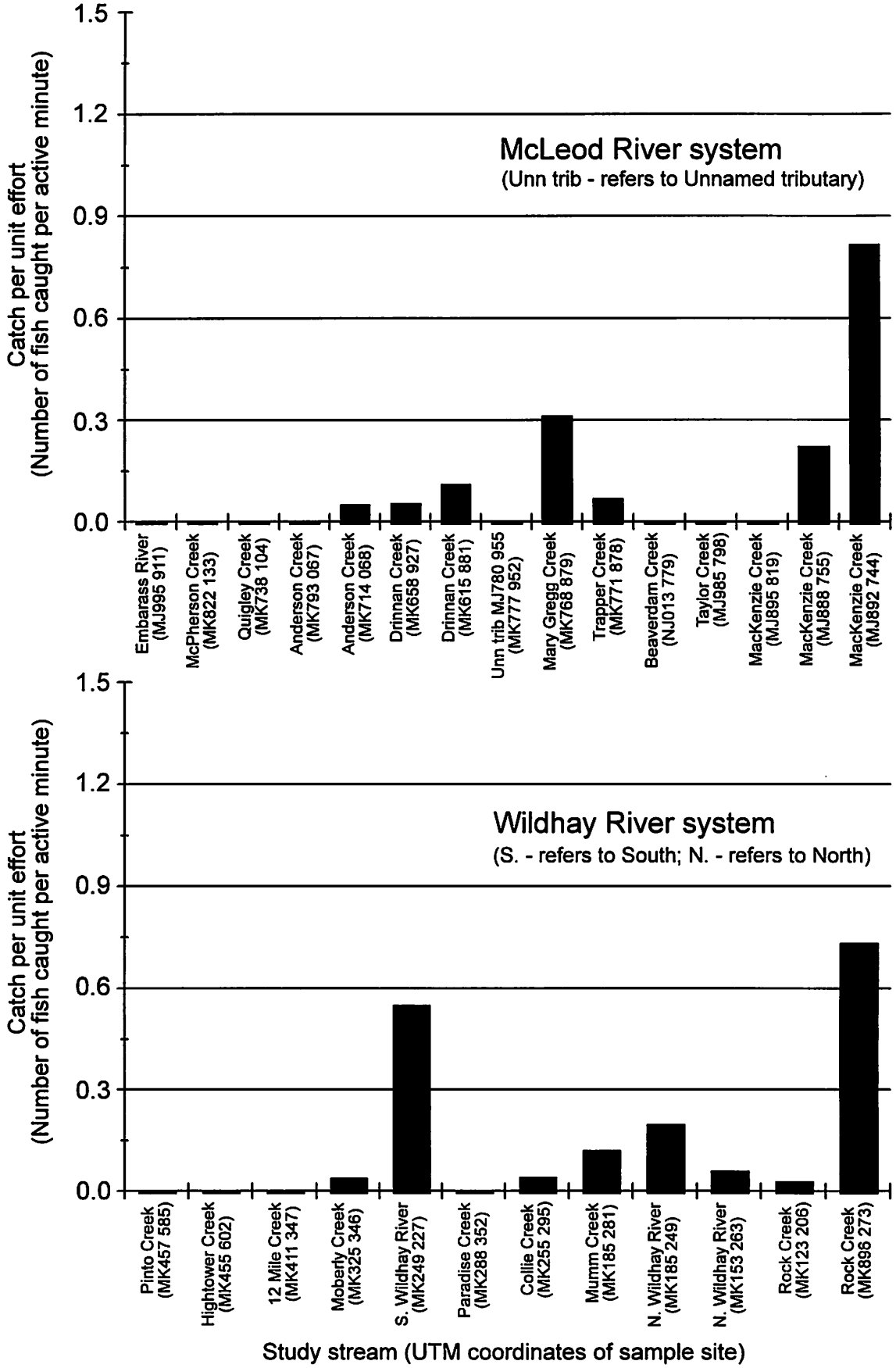

Figure II-1. Catch per unit effort of bull trout during electrofishing surveys in the McLeod and Wildhay River systems from August 10 to October 2, 1993.

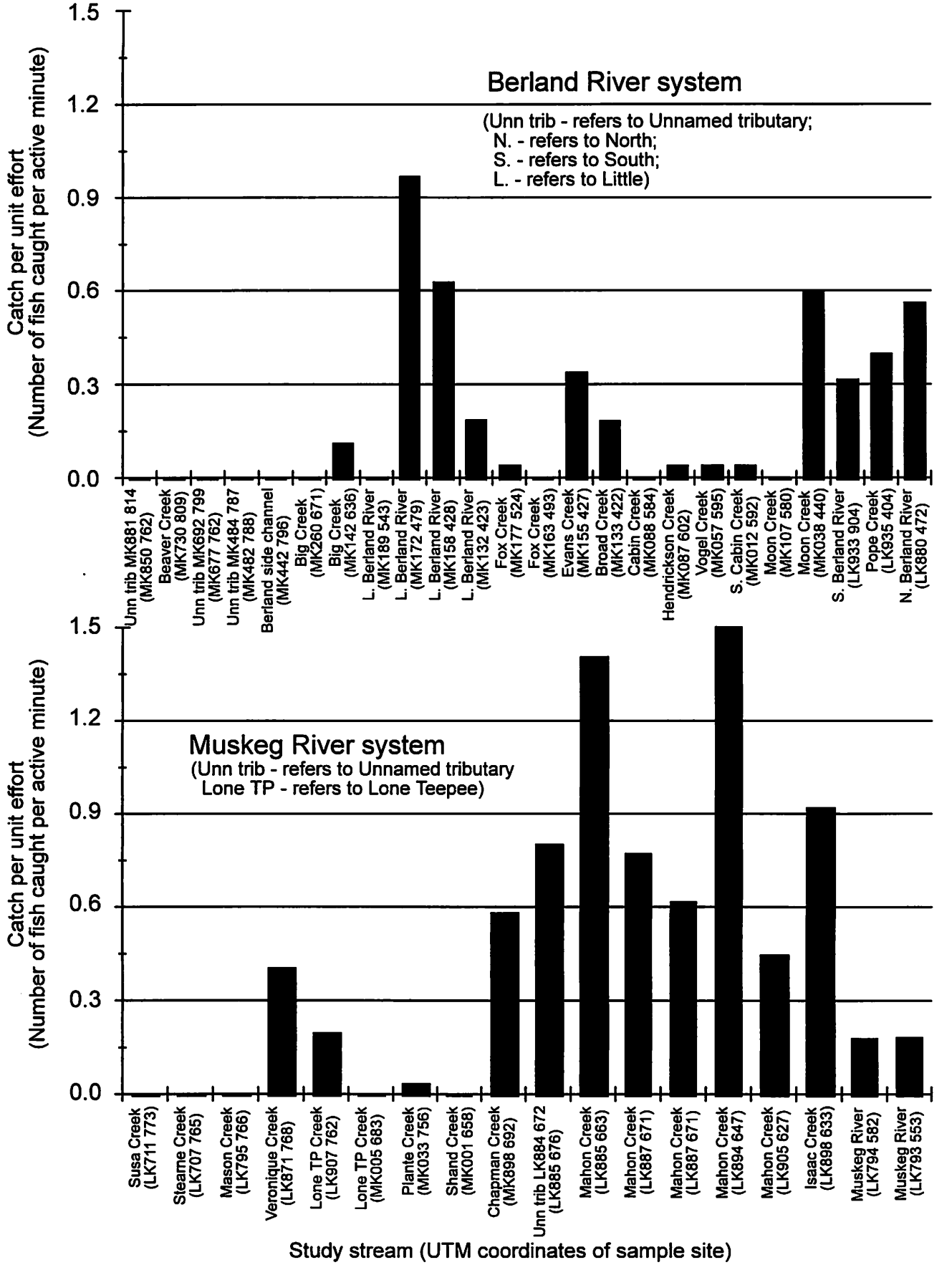

Figure II-2. Catch per unit effort of bull trout during electrofishing surveys in the Berland and Muskeg River systems from August 10 to October 2, 1993.

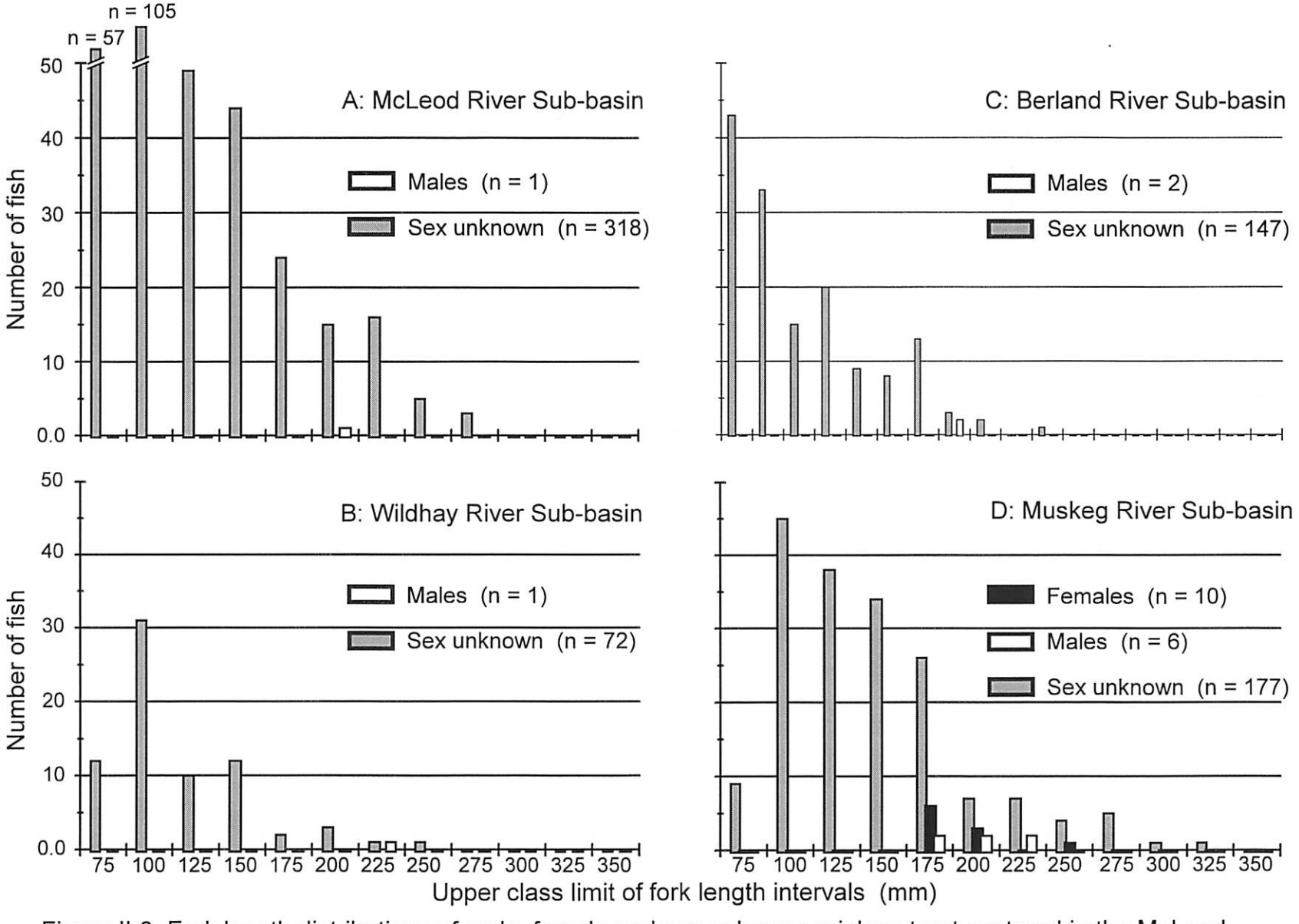

Figure II-3. Fork length distributions of male, female and sex unknown rainbow trout captured in the McLeod, Wildhay, Berland and Muskeg River sub-basins during electrofishing surveys from August 10 to October 2, 1993.

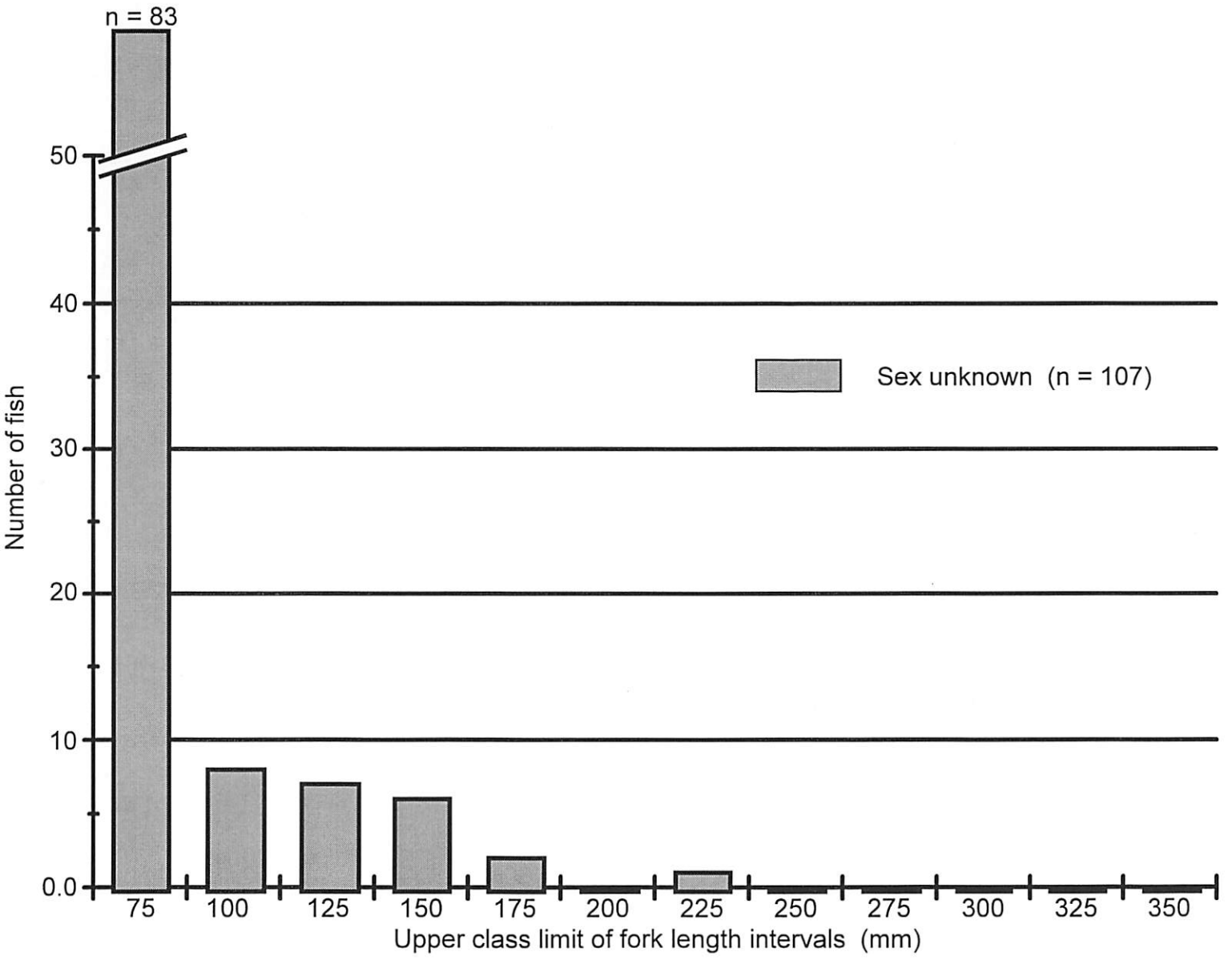

Figure II-4. Fork length distributions of all rainbow trout captured during electrofishing in Roundcroft Creek on September 30, 1993.

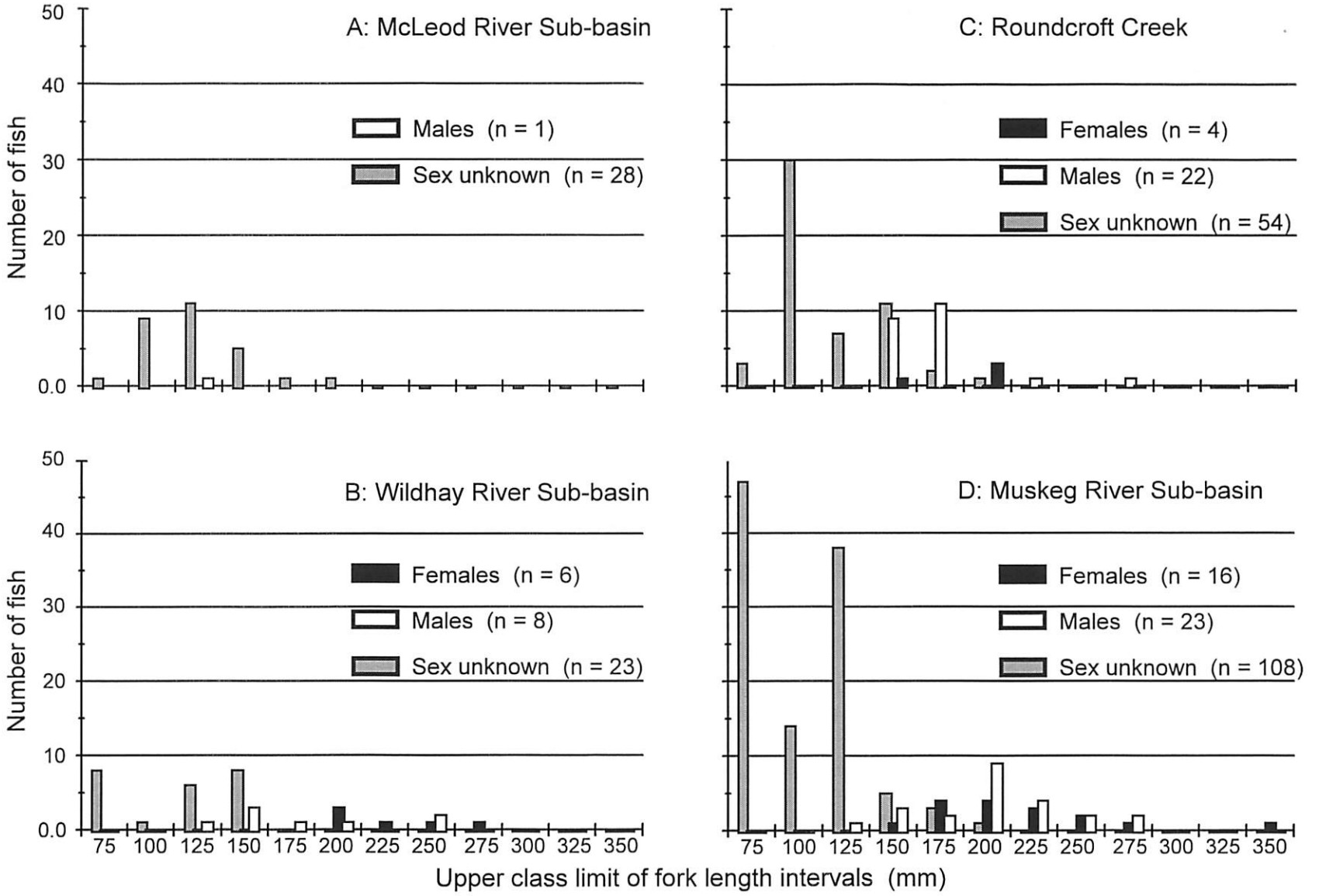

Figure II-5. Fork length distributions of male, female and sex unknown brook trout captured in the McLeod, Wildhay and Muskeg River sub-basins and Roundcroft Creek during electrofishing surveys from August 10 to October 2, 1993.

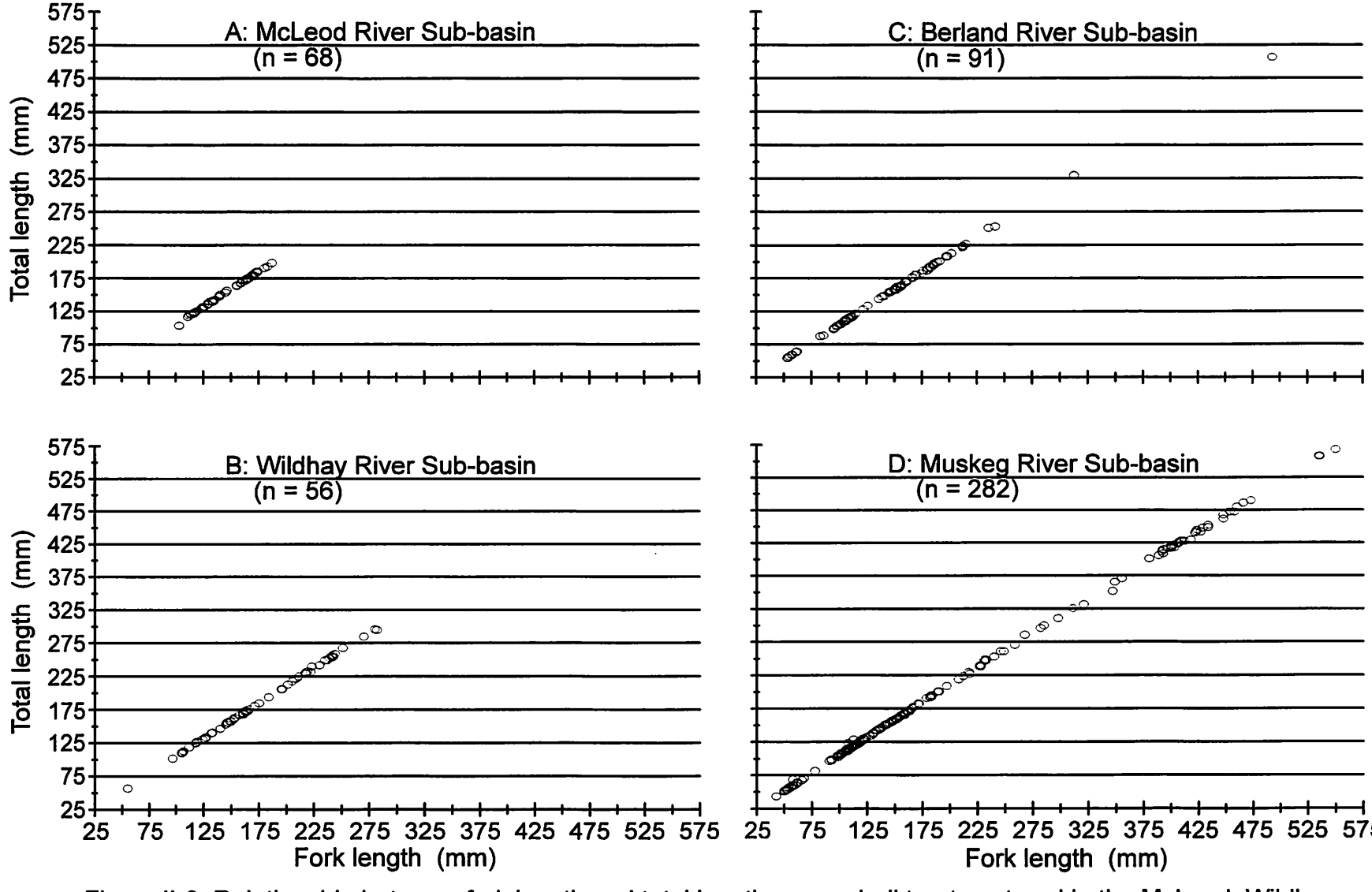

Figure II-6. Relationship between fork length and total length among bull trout captured in the McLeod, Wildhay, Berland and Muskeg River sub-basins from August 10 to October 2, 1993.

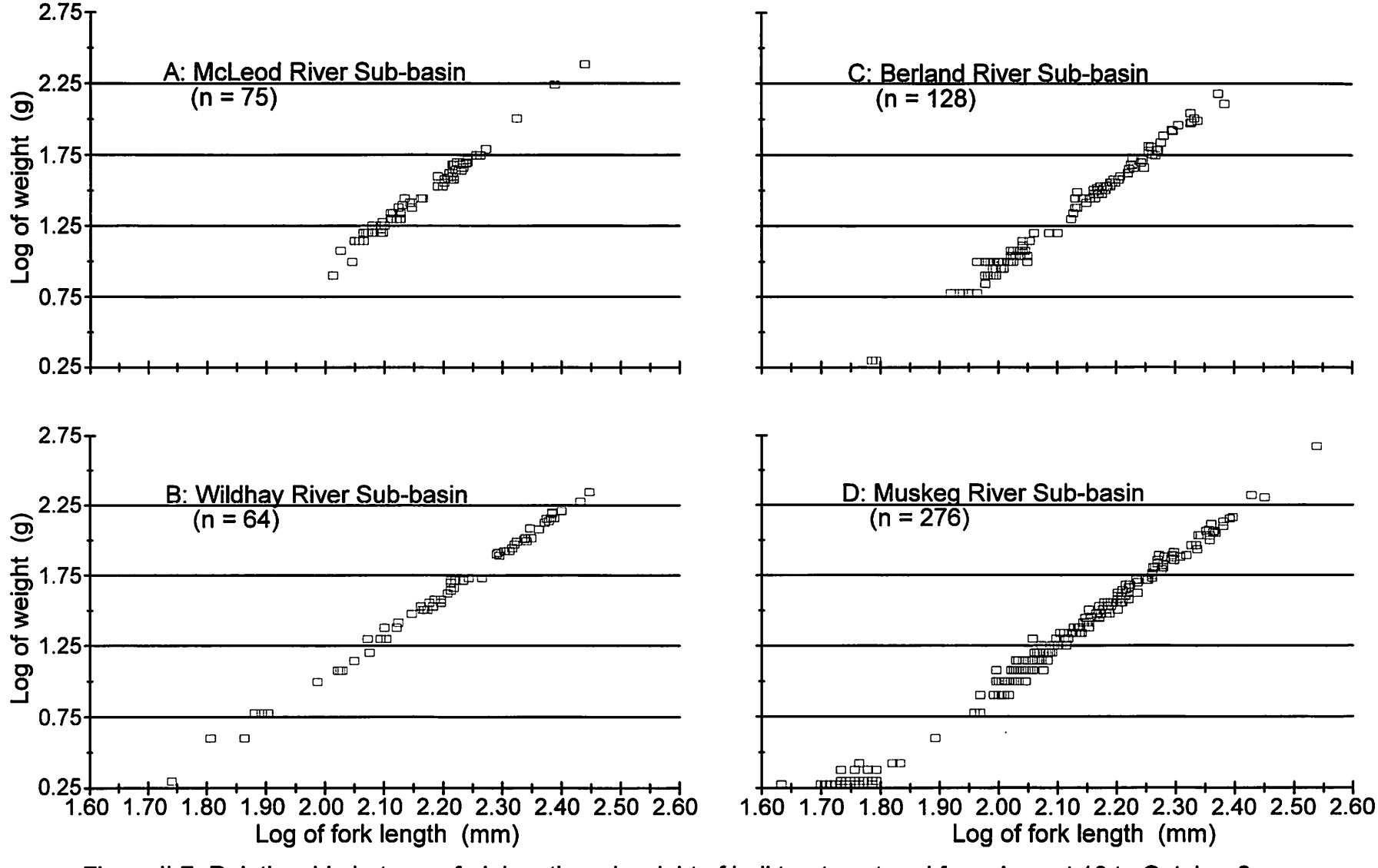

Figure II-7. Relationship between fork length and weight of bull trout captured from August 10 to October 2, 1993, whose sex could not be determined using external methods.

9.0 APPENDIX III: RAW DATA COLLECTED FROM INDIVIDUAL FISH

Abbreviations used in Appendix I

NR - Not recorded
BLTR - bull trout
BKTR - brook trout
RNTR - rainbow trout
BURB - burbot
MNWH- mountain whitefish
CTTR - cutthroat trout
NRPK - northern pike
ARGR - Arctic grayling
LNSC - longnose sucker
UKN - unknown
M - male
F - female
Immat - immature
I - immature
Mat - mature

Abbreviation for fish species from MacKay et al. (1990)

Table III-1. Raw data from fish captured in the McLeod River sub-basin.

Running Order	Sample Date	Species	Tag number	Fork length (mm)	Total length (mm)	Weight (g)	Sex	Sexual condition	Additional comments
Drinnan Creek (MJ615 881)									
1	Aug. 10	RNTR		229		132			
2	Aug. 10	BLTR		129		22			
3	Aug. 10	BLTR		136		28			
4	Aug. 10	BLTR		275		244			
Also found one dead bull trout (245 mm) along bank									
	Aug. 10	BLTR		245		176			Found dead along bank; thought to be dead less than 24 hours; full of aquatic and terrestrial invertebrates.
Drinnan Creek (MJ658 927)									
1	Aug. 11	BKTR		141		28			
2	Aug. 11	BKTR		197		88			Electrofishing burns/bruising present
3	Aug. 11	BKTR		151		34			
4	Aug. 11	BKTR		117		14			
5	Aug. 11	BKTR		141		30			
6	Aug. 11	BKTR		127		22			
7	Aug. 11	BKTR		92		8			
8	Aug. 11	BKTR		104		8			
9	Aug. 11	BKTR		143		32			
10	Aug. 11	BKTR		88		8			
11	Aug. 11	BKTR		102		10			
12	Aug. 11	BKTR		86		6			
13	Aug. 11	BKTR		97		10			
14	Aug. 11	BKTR		94		8			
15	Aug. 11	RNTR		95		8			
16	Aug. 11	RNTR		160		46			
17	Aug. 11	RNTR		48		2			
18	Aug. 11	BLTR		158		34			
19	Aug. 11	BKTR		144		28			
20	Aug. 11	BKTR		105		12			
21	Aug. 11	BKTR		93		8			
22	Aug. 11	BKTR		102		10			
23	Aug. 11	RNTR		64		4			
24	Aug. 11	BKTR		83		6			
25	Aug. 11	BLTR		106		12			
Anderson Creek (MK714 068)									
1	Aug. 11	BLTR		211		102			
Embarass River (MJ995 911)									
1	Aug. 17	Cottid spp.			127	26	Unknown		
2	Aug. 17	Cottid spp.			63	46	Unknown		
3	Aug. 17	Cottid spp.			71	6	Unknown		
4	Aug. 17	BKTR		101		10			
5	Aug. 17	BKTR		61		4			

Table III-1 (cont.)

Running Order	Sample Date	Species	Tag number	Fork length (mm)	Total length (mm)	Weight (g)	Sex	Sexual condition	Additional comments
MacKenzie Creek (MJ895 819)									
1	Aug. 18	RNTR		74		4			Did not recover from anaesthetic
2	Aug. 18	RNTR		131		24			
3	Aug. 18	RNTR		176		58	M	Ripe	
4	Aug. 18	RNTR		97		10			
5	Aug. 18	RNTR		82		6			
6	Aug. 18	RNTR		103		12			
7	Aug. 18	RNTR		88		8			
8	Aug. 18	RNTR		116		18			
9	Aug. 18	RNTR		71		4			
10	Aug. 18	RNTR		81		4			
11	Aug. 18	BKTR		104		14	M	Ripe	
12	Aug. 18	BKTR		97		6			
13	Aug. 18	BKTR		114		16			
14	Aug. 18	BKTR		112		14			
15	Aug. 18	BKTR		117		16			
16	Aug. 18	BKTR		104		12			
17	Aug. 18	BKTR		107		12			
18	Aug. 18	BKTR		83		6			
Beaverdam Creek (NJ013 779)									
1	Sept. 30	RNTR		158		40			
2	Sept. 30	RNTR		125		24			
3	Sept. 30	RNTR		112		12			
4	Sept. 30	RNTR		86		8			
5	Sept. 30	RNTR		126		20			
6	Sept. 30	RNTR		125		20			
7	Sept. 30	RNTR		124		24			
8	Sept. 30	RNTR		112		14			
9	Sept. 30	RNTR		111		14			
10	Sept. 30	RNTR		113		16			
11	Sept. 30	RNTR		96		10			Electrofishing burns/bruising present
12	Sept. 30	RNTR		109		16			
13	Sept. 30	RNTR		53		NR			Electrofishing burns/bruising present
14	Sept. 30	RNTR		48		NR			
15	Sept. 30	RNTR		44		NR			Electrofishing burns/bruising present
16	Sept. 30	RNTR		43		NR			
17	Sept. 30	RNTR		40		NR			
18	Sept. 30	RNTR		54		NR			
19	Sept. 30	Cottid spp.			58	2			
20	Sept. 30	Cottid spp.			53	2			
21	Sept. 30	BURB			67	2			
Taylor Creek (MJ985 798)									
1	Sept. 30	RNTR		131		24			
2	Sept. 30	RNTR		133		24			

Table III-1 (cont.)

Running Order	Sample Date	Species	Tag number	Fork length (mm)	Total length (mm)	Weight (g)	Sex	Sexual condition	Additional comments

Anderson Creek (MK793 067)

Fish #	Date	Species	Tag #	Fork L	Total ln	Weight	Sex	Cond.	Remarks
1	Sept. 30	RNTR		135		30			
2	Sept. 30	RNTR		98		9			
3	Sept. 30	RNTR		95		9			
4	Sept. 30	RNTR		84		5			
5	Sept. 30	RNTR		104		11			
6	Sept. 30	RNTR		87		6			
7	Sept. 30	RNTR		92		8			
8	Sept. 30	RNTR		88		6			
9	Sept. 30	RNTR		50		2			
10	Sept. 30	RNTR		51		1			
11	Sept. 30	RNTR		49		1			
12	Sept. 30	RNTR		52		1			
13	Sept. 30	RNTR		47		1			
14	Sept. 30	RNTR		45		1			Mortality
15	Sept. 30	RNTR		54		1			
16	Sept. 30	RNTR		50		1			
17	Sept. 30	RNTR		203		90			
18	Sept. 30	RNTR		106		13			
19	Sept. 30	RNTR		52		1			
20	Sept. 30	RNTR		46		1			
21	Sept. 30	RNTR		56		1			
22	Sept. 30	RNTR		47		1			
23	Sept. 30	RNTR		41		1			
24	Sept. 30	RNTR		48		1			
25	Sept. 30	RNTR		111		15			
26	Sept. 30	RNTR		88		6			
27	Sept. 30	BURB			72	2			
28	Sept. 30	RNTR		55		1			
29	Sept. 30	RNTR		86		7			
30	Sept. 30	RNTR		120		18			
31	Sept. 30	RNTR		97		9			
32	Sept. 30	RNTR		76		4			
33	Sept. 30	RNTR		100		10			
34	Sept. 30	RNTR		138		27			
35	Sept. 30	RNTR		100		11			
36	Sept. 30	RNTR		44		1			
37	Sept. 30	RNTR		95		9			
38	Sept. 30	RNTR		48		1			
39	Sept. 30	RNTR		218		134			
40	Sept. 30	RNTR		139		36			
41	Sept. 30	RNTR		165		48			
42	Sept. 30	RNTR		128		27			
43	Sept. 30	RNTR		111		13			
44	Sept. 30	RNTR		46		1			
45	Sept. 30	RNTR		90		8			

Table III-1 (cont.)

Running Order	Sample Date	Species	Tag number	Fork length (mm)	Total length (mm)	Weight (g)	Sex	Sexual condition	Additional comments
Anderson Creek (MK793 067) (cont.)									
46	Sept. 30	RNTR		50		1			
47	Sept. 30	RNTR		94		9			
48	Sept. 30	RNTR		99		11			
49	Sept. 30	RNTR		58		3			
50	Sept. 30	RNTR		55		1			
51	Sept. 30	BURB			133	13			
MacKenzie Creek (MJ888 755)									
1	Oct. 1	RNTR		226		140			
2	Oct. 1	MNWH		180		64			
3	Oct. 1	MNWH		147		30			
4	Oct. 1	RNTR		135		28			
5	Oct. 1	RNTR		109		12			
6	Oct. 1	RNTR		196		106			
7	Oct. 1	RNTR		105		16			
8	Oct. 1	RNTR		106		16			
9	Oct. 1	RNTR		87		8			
10	Oct. 1	RNTR		81		6			
11	Oct. 1	RNTR		83		6			
12	Oct. 1	RNTR		89		6			
13	Oct. 1	MNWH		186		66			
14	Oct. 1	MNWH		173		56			
15	Oct. 1	MNWH		131		18			
16	Oct. 1	RNTR		87		8			
17	Oct. 1	RNTR		86		8			
18	Oct. 1	RNTR		96		12			
19	Oct. 1	RNTR		87		8			
20	Oct. 1	RNTR		71		4			
21	Oct. 1	RNTR		161		46			
22	Oct. 1	MNWH		170		60			
23	Oct. 1	MNWH		132		28			
24	Oct. 1	MNWH		118		16			
25	Oct. 1	MNWH		132		24			
26	Oct. 1	MNWH		145		32			
27	Oct. 1	BLTR		117	123	16			
28	Oct. 1	BLTR		134	142	20			
29	Oct. 1	BLTR		111	117	10			
30	Oct. 1	BLTR	YB3	165	175	48			
31	Oct. 1	BLTR	YB1	145	154	28			
32	Oct. 1	BLTR	YB4	140	151	26			
33	Oct. 1	BLTR	YB5	146	157	28			
34	Oct. 1	RNTR		81		6			
35	Oct. 1	RNTR		97		10			
36	Oct. 1	RNTR		225		138			
37	Oct. 1	RNTR		92		12			
38	Oct. 1	MNWH		130		24			
39	Oct. 1	MNWH		132		24			

Table III-1 (cont.)

Running Order	Sample Date	Species	Tag number	Fork length (mm)	Total length (mm)	Weight (g)	Sex	Sexual condition	Additional comments
MacKenzie Creek (MJ892 744)									
1	Oct. 1	RNTR		175		66			Electrofishing burns/bruising present
2	Oct. 1	RNTR		265		244			Electrofishing burns/bruising present
3	Oct. 1	RNTR		72		6			Electrofishing burns/bruising present
4	Oct. 1	RNTR		197		86			
5	Oct. 1	RNTR		264		244			Electrofishing burns/bruising present
6	Oct. 1	RNTR		93		8			Electrofishing burns/bruising present
7	Oct. 1	RNTR		80		6			
8	Oct. 1	BLTR		116	123	14			
9	Oct. 1	BLTR		116	123	16			
10	Oct. 1	BLTR		117	124	16			
11	Oct. 1	BLTR		114	121	14			
12	Oct. 1	BLTR		124	131	16			
13	Oct. 1	BLTR	YB7	170	179	46			
14	Oct. 1	BLTR	YB9	159	169	38			
15	Oct. 1	BLTR	YC0	163	173	38			
16	Oct. 1	BLTR	YC1	164	173	42			
17	Oct. 1	BLTR		120	127	16			
18	Oct. 1	BLTR		124	130	16			
19	Oct. 1	RNTR		239		184			
20	Oct. 1	RNTR		210		120			
21	Oct. 1	RNTR		209		130			
22	Oct. 1	RNTR		93		8			
23	Oct. 1	RNTR		92		8			
24	Oct. 1	RNTR		135		26			Electrofishing burns/bruising present
25	Oct. 1	RNTR		91		8			
26	Oct. 1	RNTR		109	116	12			
27	Oct. 1	BLTR	YC2	155	164	34			
28	Oct. 1	BLTR	YC3	155	165	40			
29	Oct. 1	RNTR		259		246			Caudal may have been previously clipped
30	Oct. 1	RNTR		223		148			Electrofishing burns/bruising present
31	Oct. 1	RNTR		86		6			
32	Oct. 1	RNTR		90		8			
33	Oct. 1	BLTR		112	120	14			
34	Oct. 1	BLTR		116	122	14			
35	Oct. 1	BLTR		114	122	14			
36	Oct. 1	BLTR		133	141	24			
37	Oct. 1	RNTR		80		6			
38	Oct. 1	BLTR	YC4	162	172	42			
39	Oct. 1	BLTR	YC5	167	176	50			
40	Oct. 1	BLTR		124	131	18			
41	Oct. 1	BLTR		116	122	14			
42	Oct. 1	BLTR		118	125	16			
43	Oct. 1	BLTR		129	136	20			
44	Oct. 1	BLTR		126	132	18			
45	Oct. 1	BLTR		120	127	18			
46	Oct. 1	BLTR		120	127	16			
47	Oct. 1	BLTR		139	148	26			
48	Oct. 1	BLTR	YC6	140	149	24			
49	Oct. 1	BLTR		103	104	8			

Table III-1 (cont.)

Running Order	Sample Date	Species	Tag number	Fork length (mm)	Total length (mm)	Weight (g)	Sex	Sexual condition	Additional comments
Mary Gregg Creek: Pass #1 of 3 passes (MJ768 879)									
1	Oct. 2	RNTR		92		8			
2	Oct. 2	RNTR		82		5			
3	Oct. 2	RNTR		85		5			
4	Oct. 2	RNTR		93		8			
5	Oct. 2	RNTR		213		116			
6	Oct. 2	RNTR		223		153			
7	Oct. 2	RNTR		160		41			
8	Oct. 2	RNTR		120		19			
9	Oct. 2	RNTR		87		6			
10	Oct. 2	RNTR		153		37			
11	Oct. 2	RNTR		77		4			
12	Oct. 2	RNTR		78		4			
13	Oct. 2	RNTR		76		5			
14	Oct. 2	RNTR		77		5			
15	Oct. 2	BLTR	ZA2	164	174	40			
16	Oct. 2	BLTR		125	133	19			
17	Oct. 2	RNTR		75		4			
18	Oct. 2	RNTR		171		62			
19	Oct. 2	RNTR		87		8			
20	Oct. 2	RNTR		85		7			
21	Oct. 2	RNTR		210		98			
22	Oct. 2	RNTR		201		91			
23	Oct. 2	RNTR		136		25			
24	Oct. 2	RNTR		109		13			
25	Oct. 2	RNTR		82		5			
26	Oct. 2	RNTR		80		5			
27	Oct. 2	RNTR		78		4			
28	Oct. 2	RNTR		186		63			
29	Oct. 2	RNTR		80		6			
30	Oct. 2	RNTR		72		6			
31	Oct. 2	RNTR		125		20			
32	Oct. 2	RNTR		91		10			
33	Oct. 2	RNTR		120		17			
34	Oct. 2	RNTR		168		63			
35	Oct. 2	RNTR		35					
36	Oct. 2	BLTR		124	132	17			
37	Oct. 2	BLTR	ZA3	163	172	39			
38	Oct. 2	BLTR		124	130	16			
39	Oct. 2	BLTR		134	140	22			
40	Oct. 2	BLTR	ZA4	161	171	39			
41	Oct. 2	RNTR		144		35			
42	Oct. 2	RNTR		139		27			
43	Oct. 2	RNTR		150		34			
44	Oct. 2	RNTR		118		18			
45	Oct. 2	RNTR		133		24			
46	Oct. 2	RNTR		180		74			

Table III-1 (cont.)

Running Order	Sample Date	Species	Tag number	Fork length (mm)	Total length (mm)	Weight (g)	Sex	Sexual condition	Additional comments
Mary Gregg Creek: Pass #1 of 3 passes (MJ768 879) (cont.)									
47	Oct. 2	RNTR		138		28			
48	Oct. 2	RNTR		79		6			
49	Oct. 2	BLTR	ZA5	173	185	49			
50	Oct. 2	BLTR		125	130	16			
51	Oct. 2	BLTR	ZA6	164	174	38			
52	Oct. 2	RNTR		111		14			
53	Oct. 2	RNTR		175		56			
54	Oct. 2	RNTR		208		95			
55	Oct. 2	RNTR		203		94			
56	Oct. 2	RNTR		149		30			
57	Oct. 2	RNTR		129		22			
58	Oct. 2	RNTR		129		20			
59	Oct. 2	RNTR		113		17			
60	Oct. 2	RNTR		106		13			
61	Oct. 2	RNTR		83		6			
Mary Gregg Creek: Pass #2 of 3 passes (MJ768 879) (cont.)									
1	Oct. 2	RNTR		95		9			
2	Oct. 2	RNTR		175		56			
3	Oct. 2	RNTR		192		94			
4	Oct. 2	RNTR		161		50			
5	Oct. 2	RNTR		220		142			
6	Oct. 2	RNTR		138		25			
7	Oct. 2	RNTR		116		11			
8	Oct. 2	RNTR		84		4			
9	Oct. 2	RNTR		71		1			
10	Oct. 2	RNTR		68		3			
11	Oct. 2	RNTR		80		5			
12	Oct. 2	RNTR		82		5			
13	Oct. 2	BLTR	ZK8	170	181	44			
14	Oct. 2	BLTR	ZK9	166	176	44			
15	Oct. 2	BLTR	ZL0	165	175	38			
16	Oct. 2	BLTR	ZL1	171	179	50			
17	Oct. 2	RNTR		165		44			
18	Oct. 2	RNTR		83		7			
19	Oct. 2	RNTR		79		6			
20	Oct. 2	RNTR		211		95			
21	Oct. 2	RNTR		157		38			
22	Oct. 2	RNTR		140		32			
23	Oct. 2	RNTR		128		20			
24	Oct. 2	RNTR		122		19			
25	Oct. 2	RNTR		118		21			
26	Oct. 2	RNTR		167		47			
27	Oct. 2	RNTR		133		24			
28	Oct. 2	RNTR		129		20			
29	Oct. 2	RNTR		73		6			

Table III-1 (cont.)

Running Order	Sample Date	Species	Tag number	Fork length (mm)	Total length (mm)	Weight (g)	Sex	Sexual condition	Additional comments
Mary Gregg Creek: Pass #2 of 3 passes (MJ768 879) (cont.)									
30	Oct. 2	RNTR		71		5			
31	Oct. 2	BLTR		135	143	25			
32	Oct. 2	RNTR		65		3			
33	Oct. 2	RNTR		83		7			
34	Oct. 2	RNTR		230		136			
35	Oct. 2	RNTR		117		19			
36	Oct. 2	RNTR		93		7			
37	Oct. 2	RNTR		158		44			
38	Oct. 2	RNTR		162		44			
39	Oct. 2	RNTR		74		4			
40	Oct. 2	RNTR		175		70			
41	Oct. 2	RNTR		82		7			
42	Oct. 2	RNTR		80		5			
43	Oct. 2	BLTR	ZL2	174	186	52			
44	Oct. 2	BLTR	ZL3	187	199	62			
45	Oct. 2	BLTR	ZL4	183	193	56			
46	Oct. 2	BLTR	ZL5	168	179	48			
47	Oct. 2	RNTR		127		21			
48	Oct. 2	RNTR		131		21			
49	Oct. 2	RNTR		161		43			
50	Oct. 2	RNTR		120		17			
51	Oct. 2	RNTR		130		23			
52	Oct. 2	RNTR		90		9			
53	Oct. 2	RNTR		121		18			
54	Oct. 2	BLTR	ZL6	180	191	56			
55	Oct. 2	BLTR	ZL7	180	191	56			
56	Oct. 2	BLTR	ZL8	169	180	48			
57	Oct. 2	BLTR	ZL9	164	174	48			
58	Oct. 2	BLTR	ZA0	174	185	50			
Mary Gregg Creek: Pass #3 of 3 passes (MJ768 879) (cont.)									
1	Oct. 2	RNTR		182		68			
2	Oct. 2	RNTR		87		8			
3	Oct. 2	RNTR		133		28			Electrofishing burn/bruising present
4	Oct. 2	RNTR		140		26			
5	Oct. 2	RNTR		127		24			
6	Oct. 2	RNTR		90		10			Electrofishing burn/bruising present
7	Oct. 2	RNTR		151		36			
8	Oct. 2	RNTR		136		24			
9	Oct. 2	RNTR		114		16			
10	Oct. 2	RNTR		94		10			
11	Oct. 2	RNTR		74		4			
12	Oct. 2	RNTR		66		4			
13	Oct. 2	RNTR		86		8			
14	Oct. 2	RNTR		82		6			
15	Oct. 2	RNTR		72		6			

Table III-1 (cont.)

Running Order	Sample Date	Species	Tag number	Fork length (mm)	Total length (mm)	Weight (g)	Sex	Sexual condition	Additional comments
Mary Gregg Creek: Pass #3 of 3 passes (MJ768 879) (cont.)									
16	Oct. 2	BLTR		129	137	22			
17	Oct. 2	RNTR		190		86			
18	Oct. 2	RNTR		180		82			
19	Oct. 2	RNTR		125		24			
20	Oct. 2	RNTR		80		6			
21	Oct. 2	RNTR		129		26			
22	Oct. 2	RNTR		140		28			
23	Oct. 2	RNTR		124		20			
24	Oct. 2	BLTR	YC7	170	181	44			
25	Oct. 2	RNTR		192		90			
26	Oct. 2	RNTR		186		78			
27	Oct. 2	RNTR		81		6			
28	Oct. 2	RNTR		83		6			
29	Oct. 2	RNTR		173		58			
30	Oct. 2	RNTR		109		12			
31	Oct. 2	RNTR		114		12			
32	Oct. 2	RNTR		86		8			
33	Oct. 2	RNTR		71		4			
34	Oct. 2	BLTR	YC8	171	183	46			
35	Oct. 2	RNTR		122		18			
36	Oct. 2	RNTR		83		4			
37	Oct. 2	RNTR		90		8			
38	Oct. 2	RNTR		81		6			
39	Oct. 2	RNTR		82		8			
40	Oct. 2	RNTR		76		4			
41	Oct. 2	BLTR		132	141	20			
42	Oct. 2	BLTR	YD1	164	175	42			
43	Oct. 2	BLTR	YD2	159	168	36			
Quigley Creek (MK738 104)									
1	Oct. 1	RNTR		218		102			
2	Oct. 1	RNTR		172		67			
3	Oct. 1	RNTR		176		75			
4	Oct. 1	RNTR		173		59			
5	Oct. 1	RNTR		61		2			
6	Oct. 1	RNTR		51		1			
7	Oct. 1	RNTR		111		12			
8	Oct. 1	RNTR		49		1			
9	Oct. 1	RNTR		163		52			
10	Oct. 1	RNTR		130		24			
McPherson Creek (MK822 133)									
1	Oct. 1	RNTR		199		101			Electrofishing burn/bruising present
2	Oct. 1	RNTR		59		3			
3	Oct. 1	RNTR		79		5			
4	Oct. 1	RNTR		216		113			

Table III-1 (cont.)

Running Order	Sample Date	Species	Tag number	Fork length (mm)	Total length (mm)	Weight (g)	Sex	Sexual condition	Additional comments
McPherson Creek (MK822 133) (cont.)									
5	Oct. 1	RNTR		75		5			
6	Oct. 1	RNTR		80		5			
7	Oct. 1	RNTR		78		5			
8	Oct. 1	RNTR		65		3			
9	Oct. 1	RNTR		70		2			
Unnamed tributary MJ780 955 (MJ777 952)									
1	Oct. 2	RNTR		231		153			
2	Oct. 2	RNTR		112		15			
3	Oct. 2	RNTR		80		7			
4	Oct. 2	RNTR		137		32			
5	Oct. 2	RNTR		115		15			
6	Oct. 2	RNTR		179		66			
7	Oct. 2	RNTR		130		22			No spots
8	Oct. 2	RNTR		98		11			
9	Oct. 2	RNTR		94		8			
10	Oct. 2	RNTR		130		22			
11	Oct. 2	RNTR		92		8			
12	Oct. 2	RNTR		97		9			
13	Oct. 2	RNTR		81		7			
14	Oct. 2	RNTR		130		23			
15	Oct. 2	RNTR		108		13			
16	Oct. 2	RNTR		83		6			
17	Oct. 2	RNTR		116		17			
18	Oct. 2	RNTR		136		27			
19	Oct. 2	RNTR		112		NR			Scale malfunctioned; no weights recorded
20	Oct. 2	RNTR		134		NR			Scale malfunctioned; no weights recorded
21	Oct. 2	RNTR		117		NR			Scale malfunctioned; no weights recorded
22	Oct. 2	RNTR		102		NR			Scale malfunctioned; no weights recorded
23	Oct. 2	RNTR		72		NR			Scale malfunctioned; no weights recorded
24	Oct. 2	RNTR		115		NR			Scale malfunctioned; no weights recorded
25	Oct. 2	RNTR		48		NR			Scale malfunctioned; no weights recorded
Trapper Creek (MJ771 878)									
1	Oct. 2	RNTR		89		6			
2	Oct. 2	RNTR		102		11			
3	Oct. 2	RNTR		178		69			
4	Oct. 2	RNTR		138		27			
5	Oct. 2	RNTR		100		10			
6	Oct. 2	RNTR		185		84			
7	Oct. 2	RNTR		132		24			
8	Oct. 2	RNTR		76		4			
9	Oct. 2	RNTR		137		29			
10	Oct. 2	RNTR		140		31			
11	Oct. 2	RNTR		91		9			
12	Oct. 2	RNTR		91		9			

Table III-1 (cont.)

Running Order	Sample Date	Species	Tag number	Fork length (mm)	Total length (mm)	Weight (g)	Sex	Sexual condition	Additional comments
Trapper Creek (MJ771 878)									
13	Oct. 2	RNTR		90		8			
14	Oct. 2	RNTR		88		7			
15	Oct. 2	RNTR		83		7			
16	Oct. 2	RNTR		68		3			
17	Oct. 2	RNTR		93		8			
18	Oct. 2	RNTR		77		5			
19	Oct. 2	RNTR		73		3			
20	Oct. 2	BLTR		130	140	22			
21	Oct. 2	BLTR		118	125	16			

Table III-2. Raw data from fish captured in the Wildhay River sub-basin.

Running Order	Sample Date	Species	Tag number	Fork length (mm)	Total length (mm)	Weight (g)	Sex	Sexual condition	Additional comments
North Wildhay River (MK185 249)									
1	Aug. 12	RNTR		186		76			Electrofishing burn/bruising present
2	Aug. 12	RNTR		129		26			
3	Aug. 12	RNTR		112		18			Electrofishing burn/bruising present
4	Aug. 12	RNTR		109		12			
5	Aug. 12	MNWH		61		2			
6	Aug. 12	MNWH		59		2			
7	Aug. 12	MNWH		59		2			
8	Aug. 12	BLTR		78		6			
9	Aug. 12	BLTR		64		4			
10	Aug. 12	BLTR		64		4			
11	Aug. 12	BLTR		73		4			
12	Aug. 12	BLTR		80		6			
13	Aug. 12	BLTR		76		6			
14	Aug. 12	BLTR		76		6			
15	Aug. 12	BLTR		197		78			
Collie Creek (MK255 295)									
1	Aug. 12	BLTR		157		36			
2	Aug. 12	RNTR		207		102	M		
3	Aug. 12	RNTR		69		6			
4	Aug. 12	RNTR		144		34			
5	Aug. 12	RNTR		107		14			
6	Aug. 12	RNTR		116		10			
7	Aug. 12	RNTR		83		6			
8	Aug. 12	RNTR		78		6			
9	Aug. 12	RNTR		81		6			
10	Aug. 12	RNTR		73		4			
11	Aug. 12	RNTR		142		28			
12	Aug. 12	RNTR		124		20			
13	Aug. 12	RNTR		81		6			
14	Aug. 12	RNTR		95		8			Mortality
15	Aug. 12	RNTR		93		8			Mortality
16	Aug. 12	RNTR		97		8			Mortality
Rock Creek: Pass #1 of 3 passes (LK896 273)									
1	Sept. 15	CTTR		326		418			Appeared to have tumor/lesion above vent
2	Sept. 15	CTTR		284		294			Hooking injury to right mandible
3	Sept. 15	MNWH		187		76			
4	Sept. 15	BLTR	NC3	251	268	162			
5	Sept. 15	BLTR	NC4	282	295	226	M	Ripe	
6	Sept. 15	BLTR		97	102	10			
7	Sept. 15	BLTR	NC5	163	172	50			
8	Sept. 15	BLTR	NC6	270	285	190			
9	Sept. 15	BLTR	NC7	145	153	34			
10	Sept. 15	BLTR		132	140	24			
11	Sept. 15	BLTR	NC8	237	250	143			

Table III-2 (cont.)

Running Order	Sample Date	Species	Tag number	Fork length (mm)	Total length (mm)	Weight (g)	Sex	Sexual condition	Additional comments
Rock Creek: Pass #1 of 3 passes (LK896 273) (cont.)									
12	Sept. 15	BLTR	NC9	150	158	36			
13	Sept. 15	BLTR	ND0	235	250	134			
14	Sept. 15	BLTR	ND1	147	156	32			
15	Sept. 15	BLTR		118	125	20			
16	Sept. 15	BLTR		119	127	16			
17	Sept. 15	BLTR	ND2	196	206	82			
18	Sept. 15	BLTR		126	132	24			
19	Sept. 15	BLTR	ND3	209	222	94			
20	Sept. 15	BLTR	ND4	161	170	42			
21	Sept. 15	BLTR	ND5	211	225	98			
22	Sept. 15	BLTR	ND6	207	221	88			
23	Sept. 15	BLTR	ND7	230	242	120			
24	Sept. 15	BLTR	ND8	205	218	84			
25	Sept. 15	BLTR	ND9	280	296	222			
Rock Creek: Pass #2 of 3 passes (LK896 273)									
1	Sept. 15	MNWH		183		72			
2	Sept. 15	BLTR		124	131	20			
3	Sept. 15	BLTR		133	141	26			
4	Sept. 15	CTTR		290		304			
5	Sept. 15	BLTR	NE0	166	176	52			
6	Sept. 15	BLTR	NE1	244	259	144			
7	Sept. 15	BLTR	NE2	239	253	138			
8	Sept. 15	BLTR	NE3	201	213	84			
9	Sept. 15	BLTR	NE6	146	156	32			
10	Sept. 15	BLTR	NE4	195	206	80			
Rock Creek: Pass #3 of 3 passes (LK896 273)									
1	Sept. 15	CTTR		317		382			
2	Sept. 15	BLTR	ZH7	223	240	104			
3	Sept. 15	BLTR		106	111	12			
4	Sept. 15	BLTR	ZH5	140	147	30			
5	Sept. 15	BLTR	ZH6	149	158	32			
6	Sept. 15	BLTR	ZH8	163	173	44			
7	Sept. 15	BLTR	not tagged	153	163	38			
8	Sept. 15	BLTR	ZH9	218	230	104			
South Wildhay River (MK249 227)									
1	Sept. 26	BLTR		107	113	12			
2	Sept. 26	BLTR		112	119	14			
3	Sept. 26	BLTR		55	57	2			Electrofishing burn/bruising present
4	Sept. 26	BLTR		105	110	12			
5	Sept. 26	BLTR	YA4	163	174	52			Electrofishing burn/bruising presemt
6	Sept. 26	BLTR	YA7	171	181	52			
7	Sept. 26	BLTR	YA8	161	168	42			
8	Sept. 26	BLTR	YA9	175	185	54			
9	Sept. 26	BLTR		127	134	20			
10	Sept. 26	BLTR	YA5	157	167	38			
11	Sept. 26	BLTR	YB0	152	161	34			
12	Sept. 26	BLTR	YA2	165	173	46			

Table III-2 (cont.)

Running Order	Sample Date	Species	Tag number	Fork length (mm)	Total length (mm)	Weight (g)	Sex	Sexual condition	Additional comments
Moberly Creek (MK325 346)									
1	Sept. 26	BKTR		242	113	158	F	Mature	
2	Sept. 26	BKTR		237		172	M	Ripe	Electroshocking burn/bruising present
3	Sept. 26	RNTR		226		130			
4	Sept. 26	BKTR		235		134	M	Ripe	
5	Sept. 26	BKTR		198		96	F	Very ripe	
6	Sept. 26	BKTR		175		70	M	Ripe	Deformed spinal column
7	Sept. 26	BKTR		128		22			Electrofishing burn/bruising present
8	Sept. 26	BKTR		139		28			
9	Sept. 26	BKTR		132		24			
10	Sept. 26	BKTR		126		18			
11	Sept. 26	BKTR		127		20			
12	Sept. 26	BKTR		56		2			
13	Sept. 26	BKTR		64		2			
14	Sept. 26	BKTR		99		12			
15	Sept. 26	BKTR		54		2			
16	Sept. 26	RNTR		94		10			
17	Sept. 26	BLTR	YA3	184	194	54			
18	Sept. 26	RNTR		212		128			
19	Sept. 26	RNTR		86		8			
20	Sept. 26	RNTR		90		8			
21	Sept. 26	RNTR		87		8			Electrofishing burn/bruising present
22	Sept. 26	RNTR		93		8			
23	Sept. 26	BKTR		222		112	F	Mature	
24	Sept. 26	BKTR		63		2			
25	Sept. 26	BKTR		192		78	F	Mature	Electrofishing burn/bruising present
26	Sept. 26	BKTR		135		26	M	Ripe	
27	Sept. 26	BKTR		121		20			
28	Sept. 26	BKTR		130		24			
29	Sept. 26	BKTR		184		66	M	Ripe	
30	Sept. 26	BKTR		141		32	M	Ripe	
31	Sept. 26	BKTR		130		22			
32	Sept. 26	BKTR		252		184	F	Mature	Electrofishing burn/bruising present
33	Sept. 26	BKTR		182		70	F	Mature	
34	Sept. 26	BKTR		116		18	M	Ripe	Left operculum partially missing
35	Sept. 26	BKTR		109		12			Predator wound on belly
36	Sept. 26	BKTR		110		12			
37	Sept. 26	BKTR		111		14			
38	Sept. 26	BKTR		58		2			
39	Sept. 26	RNTR		135		24			
40	Sept. 26	RNTR		88		8			Electrofishing burn/bruising present
41	Sept. 26	BKTR		43		NR			
42	Sept. 26	BKTR		56		NR			
43	Sept. 26	BKTR		52		NR			
44	Sept. 26	BKTR		117		20			
45	Sept. 26	BKTR		126		24	M	Ripe	
46	Sept. 26	BKTR		114		14			
47	Sept. 26	BKTR		126		26			Left operculum partially gone
48	Sept. 26	RNTR		98		10			

Table III-2 (cont.)

Running Order	Sample Date	Species	Tag number	Fork length (mm)	Total length (mm)	Weight (g)	Sex	Sexual condition	Additional comments
Moberly Creek (MK325 346)									
49	Sept. 26	RNTR		100		12			
50	Sept. 26	RNTR		96		10			
51	Sept. 26	BURB			208	60			
Rock Creek (MK123 206)									
1	Sept. 27	RNTR		193	113	78			
2	Sept. 27	MNWH		64		3			
3	Sept. 27	MNWH		76		5			
4	Sept. 27	BLTR	ZK2	219	233	99			
5	Sept. 27	Burbot			223	70			
6	Sept. 27	sculpin			81	7			
7	Sept. 27	NRPK		116		12			Sacrificed and sent as a specimen to museum (U of A, Dept. of Zool.)
8	Sept. 27	NRPK		141		23			Sacrificed and sent as a specimen to museum (U of A, Dept. of Zool.)
9	Sept. 27	NRPK		112		9			Sacrificed and sent as a specimen to museum (U of A, Dept. of Zool.)
10	Sept. 27	NRPK		162		29			Sacrificed and sent as a specimen to museum (U of A, Dept. of Zool.)
Hightower Creek (MK455 602)									
1	Sept. 28	RNTR		147		38			
2	Sept. 28	RNTR		141		30			
3	Sept. 28	RNTR		124		20			
4	Sept. 28	RNTR		113		14			
5	Sept. 28	RNTR		129		22			
6	Sept. 28	RNTR		111		16			
7	Sept. 28	RNTR		98		8			
8	Sept. 28	ARGR		77		4			
9	Sept. 28	ARGR		78		4			
10	Sept. 28	ARGR		81		4			
11	Sept. 28	LNSC		123		16			
12	Sept. 28	Cottid spp.			107	12			
13	Sept. 28	Cottid spp.			91	8			
14	Sept. 28	Cottid spp.			93	8			
Pinto Creek (MK457 585)									
1	Sept. 28	RNTR		97		8			
2	Sept. 28	RNTR		98		12			
3	Sept. 28	ARGR		135		24			
4	Sept. 28	Cottid spp.			91	8			
5	Sept. 28	Cottid spp.			58	2			
6	Sept. 28	Cottid spp.			88	8			
7	Sept. 28	BURB			586	1116			

Paradise Creek (MK288 352)

NO FISH CAPTURED

Table III-2 (cont.)

Running Order	Sample Date	Species	Tag number	Fork length (mm)	Total length (mm)	Weight (g)	Sex	Sexual condition	Additional comments
North Wildhay River (MK153 263)									
1	Sept. 29	RNTR		78		6			
2	Sept. 29	RNTR		74		6			Electroshocking burn/bruising present on left side
3	Sept. 29	RNTR		33		NR			
4	Sept. 29	RNTR		80		7			
5	Sept. 29	RNTR		129		23			
6	Sept. 29	BLTR	ZK3	242	257	158			
7	Sept. 29	BLTR	ZK4	217	230	102			
Mumm Creek (MK185 281)									
1	Sept. 29	BLTR	ZK5	241	255	144			
2	Sept. 29	BLTR	ZK6	242	254	156			
3	Sept. 29	BLTR	ZK7	222	232	122			
Twelve Mile Creek (MK411 347)									
1	Sept. 29	RNTR		122		18			
2	Sept. 29	RNTR		153		46			
3	Sept. 29	RNTR		132		26			
4	Sept. 29	RNTR		187		8			Electrofishing burn/bruising present
5	Sept. 29	RNTR		136		24			
6	Sept. 29	RNTR		144		32			
7	Sept. 29	RNTR		136		26			
8	Sept. 29	RNTR		94		10			
9	Sept. 29	RNTR		90		8			
10	Sept. 29	RNTR		92		8			Electrofishing burn/bruising present
11	Sept. 29	RNTR		84		6			
12	Sept. 29	RNTR		161		46			
13	Sept. 29	RNTR		118		14			Part of right operculum missing
14	Sept. 29	RNTR		76		6			
15	Sept. 29	RNTR		96		8			
16	Sept. 29	RNTR		77		6			
17	Sept. 29	RNTR		82		6			
18	Sept. 29	RNTR		79		4			
19	Sept. 29	RNTR		78		6			
20	Sept. 29	RNTR		44		NR			
21	Sept. 29	RNTR		45		NR			
22	Sept. 29	RNTR		58		4			
23	Sept. 29	RNTR		42		NR			
24	Sept. 29	RNTR		43		NR			
25	Sept. 29	RNTR		46		NR			
26	Sept. 29	RNTR		47		NR			
27	Sept. 29	RNTR		44		NR			

Table III-3. Raw data from fish captured in the Berland River sub-basin.

Running Order	Sample Date	Species	Tag number	Fork length (mm)	Total length (mm)	Weight (g)	Sex	Sexual condition	Additional comments
Cabin Creek (MK088 584)									
1	Aug. 13	MNWH		227		134			
2	Aug. 13	RNTR		90		6			
3	Aug. 13	RNTR		168		48			
4	Aug. 13	RNTR		158		48			
5	Aug. 13	RNTR		127		22			
6	Aug. 13	RNTR		118		18			
7	Aug. 13	RNTR		132		22			
8	Aug. 13	RNTR		96		8			
9	Aug. 13	RNTR		80		6			
10	Aug. 13	RNTR		76		6			
11	Aug. 13	RNTR		80		6			
12	Aug. 13	RNTR		93		10			
13	Aug. 13	RNTR		80		6			
14	Aug. 13	RNTR		222		136			
15	Aug. 13	BLTR		175		48			
16	Aug. 13	BLTR		201		74			
Moon Creek (MK107 580)									
1	Aug. 14	RNTR		220		108			Mortality
2	Aug. 14	RNTR		78		6			
3	Aug. 14	RNTR		93		10			
4	Aug. 14	RNTR		82		6			
5	Aug. 14	RNTR		72		4			
6	Aug. 14	RNTR		80		6			
7	Aug. 14	RNTR		79		6			
8	Aug. 14	RNTR		73		6			
9	Aug. 14	RNTR		92		8			
10	Aug. 14	RNTR		55		2			
11	Aug. 14	RNTR		155		38			
Fox Creek (MK163 493)									
1	Aug. 20	MNWH		119		14			
2	Aug. 20	BURB			195	46			
3	Aug. 20	BURB			192	36			
4	Aug. 20	BURB			171	30			
5	Aug. 20	BURB			195	42			
Beaver Creek (MK730 809) (cont.)									
1	Aug. 21	RNTR		72		6			
2	Aug. 21	RNTR		70		6			
3	Aug. 21	Cottid spp.			69	4			
4	Aug. 21	Cottid spp.			79	4			
5	Aug. 21	Cottid spp.			87	6			
6	Aug. 21	Cottid spp.			92	8			
7	Aug. 21	Cottid spp.			103	12			
8	Aug. 21	Cottid spp.			101	12			
9	Aug. 21	Cottid spp.			104	12			
10	Aug. 21	Cottid spp.			106	14			
11	Aug. 21	Cottid spp.			102	12			

Table III-3 (cont.)

Running Order	Sample Date	Species	Tag number	Fork length (mm)	Total length (mm)	Weight (g)	Sex	Sexual condition	Additional comments
Beaver Creek (MK730 809)									
12	Aug. 21	Cottid spp.			103	12			
13	Aug. 21	BURB			145	14			
Hendrickson Creek (MK087 602)									
1	Aug. 25	RNTR		176		58			
2	Aug. 25	RNTR		195		80			
3	Aug. 25	RNTR		228		160	M	Spent	
4	Aug. 25	RNTR		238		154			
5	Aug. 25	RNTR		202		90			
6	Aug. 25	RNTR		256		202			Posterior half of dorsal fin missing
7	Aug. 25	RNTR		215		120			
8	Aug. 25	RNTR		203		106			
9	Aug. 25	RNTR		225		138			
10	Aug. 25	RNTR		190		76			
11	Aug. 25	RNTR		241		166			
12	Aug. 25	BLTR	XB3	218		98			
Vogel Creek (MK057 595)									
1	Aug. 25	BLTR	XB4	335		344	M?		
2	Aug. 25	RNTR		112		14			
3	Aug. 25	RNTR		98		10			
4	Aug. 25	RNTR		234		160			
5	Aug. 25	RNTR		89		8			
6	Aug. 25	MNWH		174		54			
7	Aug. 25	MNWH		171		48			
8	Aug. 25	MNWH		165		46			
9	Aug. 25	RNTR		121		22			
10	Aug. 25	MNWH		132		22			
11	Aug. 25	MNWH		120		16			
12	Aug. 25	MNWH		122		16			
13	Aug. 25	Cottid spp.			115	16			
Little Berland River (MK158 428)									
1	Aug. 26	BLTR		92		10			
2	Aug. 26	BLTR		45		N/R			
3	Aug. 26	BLTR		110		12			
4	Aug. 26	BLTR		98		10			
5	Aug. 26	BLTR		105		12			
6	Aug. 26	BLTR	XB5	145		32			
7	Aug. 26	BLTR		135		28			
8	Aug. 26	BLTR	XB6	143		28			
9	Aug. 26	BLTR	XB7	149		32			
10	Aug. 26	BLTR	XB8	152		34			
11	Aug. 26	BLTR	XB9	161		40			
12	Aug. 26	BLTR	XC0	150		32			
13	Aug. 26	BLTR	XC1	148		32			
14	Aug. 26	RNTR		139		30			

Table III-3 (cont.)

Running Order	Sample Date	Species	Tag number	Fork length (mm)	Total length (mm)	Weight (g)	Sex	Sexual condition	Additional comments
Little Berland River (MK172 479)									
1	Aug. 26	BLTR	XC2	521		1358	M		
2	Aug. 26	MNWH		120		16			
3	Aug. 26	MNWH		176		60			
4	Aug. 26	MNWH		136		26			
5	Aug. 26	MNWH		126		20			
6	Aug. 26	MNWH		122		18			Mortality
7	Aug. 26	MNWH		138		24			
8	Aug. 26	MNWH		171		52			
9	Aug. 26	MNWH		135		26			Mortality
10	Aug. 26	MNWH		126		20			
11	Aug. 26	MNWH		143		30			
12	Aug. 26	MNWH		128		18			
13	Aug. 26	MNWH		224		120			
14	Aug. 26	MNWH		147		28			
15	Aug. 26	MNWH		121		16			
16	Aug. 26	MNWH		139		24			
17	Aug. 26	MNWH		129		22			
18	Aug. 26	MNWH		124		18			
19	Aug. 26	MNWH		126		20			
20	Aug. 26	MNWH		131		20			
21	Aug. 26	MNWH		175		54			
22	Aug. 26	MNWH		140		30			
23	Aug. 26	RNTR		162		56			Electrofishing burn/brusing present
24	Aug. 26	RNTR		186		78			
25	Aug. 26	BLTR	XC3	460		924	F		
26	Aug. 26	BLTR		98		8			
27	Aug. 26	BLTR		89		6			
28	Aug. 26	BLTR		141		26			
29	Aug. 26	BLTR		104		10			
30	Aug. 26	BLTR	XC4	177		46			
31	Aug. 26	BLTR	XC5	175		50			
32	Aug. 26	BLTR		96		8			
33	Aug. 26	BLTR		99		8			
34	Aug. 26	BLTR	XC6	146		30			
35	Aug. 26	BLTR		134		22			
36	Aug. 26	BLTR		100		10			
37	Aug. 26	BLTR		98		10			
38	Aug. 26	BLTR	XC7	148		30			
39	Aug. 26	BLTR		135		24			
40	Aug. 26	BLTR		136		24			
41	Aug. 26	BLTR		96		8			
42	Aug. 26	BLTR		98		8			
43	Aug. 26	BLTR		97		10			
44	Aug. 26	BLTR		96		10			
45	Aug. 26	BLTR		95		10			
46	Aug. 26	BLTR		87		6			
47	Aug. 26	BLTR		99		8			
48	Aug. 26	BLTR		101		10			

Table III-3 (cont.)

Running Order	Sample Date	Species	Tag number	Fork length (mm)	Total length (mm)	Weight (g)	Sex	Sexual condition	Additional comments
Little Berland River (MK172 479) (cont.)									
49	Aug. 26	BLTR		97		8			
50	Aug. 26	BLTR		92		6			
51	Aug. 26	BLTR		95		8			
52	Aug. 26	BLTR		109		12			
53	Aug. 26	BLTR		99		8			
54	Aug. 26	BLTR		97		8			
55	Aug. 26	BLTR		133		20			
56	Aug. 26	BLTR	XC8	168		48			
Moon Creek (MK038 440)									
1	Sept. 13	BLTR	NA7	180	187	60			
2	Sept. 13	BLTR	NA6	198	208	83			
3	Sept. 13	BLTR	NA8	157	165	38			
4	Sept. 13	BLTR	NA9	151	160	33			
5	Sept. 13	BLTR	NB0	182	193	64			
6	Sept. 13	BLTR	NB1	155	163	35			
7	Sept. 13	BLTR	NB2	155	162	35			
8	Sept. 13	BLTR	NB3	156	165	36			
9	Sept. 13	BLTR	NB4	149	157	34			
10	Sept. 13	BLTR	NB5	145	154	30			
11	Sept. 13	BLTR	NB6	155	164	36			
12	Sept. 13	BLTR	NB7	152	158	33			
13	Sept. 13	BLTR		139	148	28			
14	Sept. 13	BLTR		102	107	10			
15	Sept. 13	BLTR		109	115	11			
16	Sept. 13	BLTR		99	104	9			
17	Sept. 13	BLTR		102	107	10			
18	Sept. 13	BLTR		110	115	13			
19	Sept. 13	BLTR		95	99	7			
20	Sept. 13	BLTR		101	106	10			
21	Sept. 13	BLTR		104	109	10			
22	Sept. 13	BLTR		99	104	9			
23	Sept. 13	BLTR		98	103	9			
24	Sept. 13	BLTR		106	111	11			
25	Sept. 13	BLTR		107	113	11			
26	Sept. 13	BLTR		112	117	10			
27	Sept. 13	BLTR		112	117	11			
28	Sept. 13	BLTR		96	100	10			
29	Sept. 13	BLTR		106	110	11			
30	Sept. 13	BLTR		101	106	9			
31	Sept. 13	BLTR		105	110	11			
32	Sept. 13	BLTR		102	106	9			

Table III-3 (cont.)

Running Order	Sample Date	Species	Tag number	Fork length (mm)	Total length (mm)	Weight (g)	Sex	Sexual condition	Additional comments
North Berland River (LK880 472)									
1	Sept. 15	MNWH		169		54			
2	Sept. 15	BLTR	NB9	176	187	52			Predator wounds on dorsal anterior of both sides
3	Sept. 15	BLTR	NC0	152	163	32			
4	Sept. 15	BLTR		111	117	12			
5	Sept. 15	BLTR	NC1	213	224	96			
6	Sept. 15	BLTR		108	115	12			
7	Sept. 15	BLTR	NC2	313	330	320	M	Ripe	
8	Sept. 15	BLTR		115	122	16			
9	Sept. 15	BLTR		105	112	10			
10	Sept. 15	BLTR		110	117	14			
11	Sept. 15	BLTR		61	64	2			
12	Sept. 15	BLTR		62	65	2			
13	Sept. 15	BLTR		83	88	6			
14	Sept. 15	BLTR		106	112	12			
15	Sept. 15	BLTR		86	89	6			Lower jaw badly disformed
16	Sept. 15	BLTR		55	57	NR			
17	Sept. 15	BLTR		58	60	NR			
18	Sept. 15	BLTR		57	60	NR			
19	Sept. 15	BLTR		53	55	NR			
20	Sept. 15	BLTR		54	55	NR			
South Berland River (LK933 404)									
1	Sept. 15	MNWH		186		72			
2	Sept. 15	MNWH		214		117			
3	Sept. 15	MNWH		142		30			
4	Sept. 15	MNWH		141		28			
5	Sept. 15	MNWH		129		20			
6	Sept. 15	MNWH		133		28			
7	Sept. 15	MNWH		172		57			
8	Sept. 15	MNWH		178		58			
9	Sept. 15	MNWH		123		17			
10	Sept. 15	MNWH		131		23			
11	Sept. 15	BLTR	ZF0	191	201	77			Electrofishing burn/bruising present
12	Sept. 15	BLTR	ZF1	202	213	91			
13	Sept. 15	BLTR		106	113	12			
14	Sept. 15	BLTR	ZF2	215	227	102			Electrofishing burn/bruising present
15	Sept. 15	BLTR	ZF3	212	224	94			
16	Sept. 15	BLTR	ZF4	169	181	48			
17	Sept. 15	BLTR	ZF5	189	200	69			Electrofishing burn/bruising present
18	Sept. 15	BLTR	ZF6	236	251	152			
Pope Creek (LK935 404)									
1	Sept. 15	BLTR	ZF7	153	162	34			
2	Sept. 15	BLTR	ZF8	160	171	38			
3	Sept. 15	BLTR	ZF9	155	162	34			
4	Sept. 15	BLTR	ZH0	166	177	42			

Table III-3 (cont.)

Running Order	Sample Date	Species	Tag number	Fork length (mm)	Total length (mm)	Weight (g)	Sex	Sexual condition	Additional comments
Pope Creek (LK935 404) (cont.)									
5	Sept. 15	BLTR	ZH1	150	158	30			
6	Sept. 15	BLTR	ZH2	212	222	111			Right operculum damaged
7	Sept. 15	BLTR		122	129	16			Electrofishing burn/bruising present
8	Sept. 15	BLTR	ZH3	167	176	45			
9	Sept. 15	BLTR	ZH4	197	208	84			
10	Sept. 15	MNWH		173		56			
South Cabin Creek (MK012 592)									
1	Sept. 16	BURB			215	65			
2	Sept. 16	BURB			219	64			
3	Sept. 16	BLTR	ZJ0	187	198	61			Electrofishing burn/bruising present
4	Sept. 16	RNTR		242		182	M		
5	Sept. 16	RNTR		202		106			
6	Sept. 16	RNTR		157		42			
7	Sept. 16	RNTR		130		26			
8	Sept. 16	RNTR		124		23			
9	Sept. 16	RNTR		116		18			
10	Sept. 16	RNTR		72		5			
11	Sept. 16	RNTR		118		17			
12	Sept. 16	RNTR		96		10			
13	Sept. 16	RNTR		117		16			
Evans Creek (MK155 427)									
1	Sept. 16	RNTR		80		6			
2	Sept. 16	RNTR		186		78			
3	Sept. 16	RNTR		136		30			
4	Sept. 16	RNTR		86		8			
5	Sept. 16	RNTR		168		66			
6	Sept. 16	BLTR	not tagge	150	159	32			
7	Sept. 16	BLTR	NE7	141	149	26			
8	Sept. 16	BLTR	NE8	158	167	36			
9	Sept. 16	RNTR		224		150			
10	Sept. 16	RNTR		214		128			
11	Sept. 16	RNTR		146		38			
12	Sept. 16	RNTR		149		36			
13	Sept. 16	RNTR		83		6			
14	Sept. 16	RNTR		78		6			
15	Sept. 16	BLTR		106	112	10			
16	Sept. 16	BLTR		113	118	14			
17	Sept. 16	BLTR	NE9	161	171	40			
18	Sept. 16	BLTR	YA0	147	156	30			
19	Sept. 16	BLTR	YA1	146	155	28			
20	Sept. 16	BLTR	NE5	161	170	40			

Table III-3 (cont.)

Running Order	Sample Date	Species	Tag number	Fork length (mm)	Total length (mm)	Weight (g)	Sex	Sexual condition	Additional comments
Little Berland River (MK132 423)									
1	Sept. 17	RNTR		137		34			
2	Sept. 17	RNTR		187		80			
3	Sept. 17	RNTR		201		99			
4	Sept. 17	BLTR		136	144	31			
5	Sept. 17	BLTR	XJ2	186	195	61			
6	Sept. 17	BLTR	XJ3	169	181	53			
7	Sept. 17	BLTR	XJ4	170	181	46			
8	Sept. 17	BLTR	XJ5	180	190	65			
Broad Creek (MK133 422)									
1	Sept. 17	BLTR	XJ6	147	155	33			
2	Sept. 17	BLTR	XJ7	183	191	57			
3	Sept. 17	BLTR	XJ8	175	183	50			
4	Sept. 17	RNTR		198		101			
Big Creek (MK142 636)									
1	Sept. 18	RNTR		69		5			
2	Sept. 18	RNTR		208		129			
3	Sept. 18	RNTR		229		167			
4	Sept. 18	BLTR		126	134	16			
5	Sept. 18	BLTR	ZJ9	198	209	83			
6	Sept. 18	BLTR	ZK0	242	253	129			
7	Sept. 18	Burbot			163	28			
Little Berland River (MK189 543)									
1	Sept. 23	MNWH		129		16			
2	Sept. 23	MNWH		122		18			
3	Sept. 23	MNWH		127		21			
4	Sept. 23	MNWH		133		23			
5	Sept. 23	MNWH		127		22			
6	Sept. 23	RNTR		80		6			
7	Sept. 23	RNTR		167		49			
8	Sept. 23	RNTR		138		30			
9	Sept. 23	RNTR		94		8			
10	Sept. 23	RNTR		72		4			
11	Sept. 23	RNTR		92		7			
12	Sept. 23	RNTR		48		NR			
13	Sept. 23	RNTR		44		NR			
14	Sept. 23	RNTR		45		NR			
15	Sept. 23	RNTR		42		NR			
16	Sept. 23	RNTR		44		NR			
17	Sept. 23	RNTR		42		NR			
18	Sept. 23	RNTR		44		NR			
19	Sept. 23	RNTR		39		NR			
20	Sept. 23	RNTR		36		NR			
21	Sept. 23	RNTR		43		NR			
22	Sept. 23	RNTR		<50		NR			Not processed: lost from sampling bucket when exchanging water

Table III-3 (cont.)

Running Order	Sample Date	Species	Tag number	Fork length (mm)	Total length (mm)	Weight (g)	Sex	Sexual condition	Additional comments
Big Creek (MK260 671)									
1	Sept. 24	RNTR		97		10			
2	Sept. 24	RNTR		93		8			
3	Sept. 24	RNTR		106		16			
4	Sept. 24	RNTR		101		11			
5	Sept. 24	RNTR		257		194			
6	Sept. 24	RNTR		53		NR			
7	Sept. 24	RNTR		51		NR			
8	Sept. 24	RNTR		38		NR			
9	Sept. 24	RNTR		44		NR			
10	Sept. 24	MNWH		99		8			
11	Sept. 24	MNWH		74		4			
12	Sept. 24	Cottid spp.			96	11			
13	Sept. 24	Cottid spp.			85	6			
14	Sept. 24	Cottid spp.			62	3			
15	Sept. 24	Cottid spp.			55	2			
16	Sept. 24	Cottid spp.			53	2			
17	Sept. 24	Cottid spp.			50	2			
18	Sept. 24	Cottid spp.			53	2			
19	Sept. 24	Cottid spp.			57	2			
Berland River side channel (MK442 796)									
1	Sept. 25	MNWH		74		5			
2	Sept. 25	RNTR		53		2			
3	Sept. 25	RNTR		57		3			
4	Sept. 25	RNTR		50		2			
5	Sept. 25	Cottid spp.			62	2			
6	Sept. 25	Cottid spp.			64	2			
Unnamed tributary MK484 787 (MK482 788)									
1	Sept. 26	RNTR		63		3			
2	Sept. 26	Cottid spp.			63	2			
3	Sept. 26	Cottid spp.			61	2			
4	Sept. 26	Cottid spp.			34	1			
Berland River (Mainstem approximately 2 miles below Big Creek)									
1	Sept. 24	BLTR	ZK1	494	507	1108	F	Ripe	Caught by angling on a rapula lure
Unnamed tributary MK881 814 (MK850 762)									
1	Sept. 28	RNTR		222		151			Electrofishing burn/bruising present on dorsal surface
2	Sept. 28	RNTR		160		50			
3	Sept. 28	RNTR		65		2			
4	Sept. 28	RNTR		70		4			
5	Sept. 28	RNTR		68		3			
6	Sept. 28	RNTR		128		21			
7	Sept. 28	RNTR		62		2			
8	Sept. 28	LNSC		97		12			

Table III-3 (cont.)

Running Order	Sample Date	Species	Tag number	Fork length (mm)	Total length (mm)	Weight (g)	Sex	Sexual condition	Additional comments
Unnamed tributary MK881 814 (MK850 762) (cont.)									
9	Sept. 28	LNSC		175		56			
10	Sept. 28	LNSC		63		3			
11	Sept. 28	BURB			160	23			
12	Sept. 28	BURB			90	5			
13	Sept. 28	Cottid spp.			80	4			
14	Sept. 28	Cottid spp.			70	4			
15	Sept. 28	Cottid spp.			62	2			
16	Sept. 28	Cottid spp.			38	1			
Unnamed tributary MK692 799 (MK677 762)									
1	Sept. 28	RNTR		122		20			
2	Sept. 28	RNTR		130		20			
3	Sept. 28	RNTR		120		16			
4	Sept. 28	RNTR		130		22			
5	Sept. 28	RNTR		165		40			
6	Sept. 28	RNTR		70		4			
7	Sept. 28	RNTR		130		24			
8	Sept. 28	RNTR		150		31			
9	Sept. 28	RNTR		115		16			
10	Sept. 28	RNTR		128		22			
11	Sept. 28	RNTR		132		25			
12	Sept. 28	RNTR		140		27			
13	Sept. 28	RNTR		128		20			
14	Sept. 28	RNTR		119		15			
15	Sept. 28	RNTR		139		26			
16	Sept. 28	RNTR		127		22			
17	Sept. 28	RNTR		135		24			
18	Sept. 28	RNTR		112		14			
Fox Creek (MK177 524)									
1	Sept. 29	RNTR		301		320			Electrofishing burn/bruising present
2	Sept. 29	RNTR		182		58			Electrofishing burn/bruising present
3	Sept. 29	RNTR		147		34			
4	Sept. 29	RNTR		104		14			
5	Sept. 29	RNTR		93		8			
6	Sept. 29	RNTR		83		6			
7	Sept. 29	RNTR		103		12			
8	Sept. 29	MNWH		132		18			
9	Sept. 29	MNWH		131		18			
10	Sept. 29	RNTR		44		1			
11	Sept. 29	RNTR		251		188			Electrofishing burn/bruising present
12	Sept. 29	RNTR		196		98			
13	Sept. 29	MNWH		137		22			
14	Sept. 29	MNWH		129		20			
15	Sept. 29	RNTR		38		1			
16	Sept. 29	RNTR		86		6			Mortality

Table III-3 (cont.)

Running Order	Sample Date	Species	Tag number	Fork length (mm)	Total length (mm)	Weight (g)	Sex	Sexual condition	Additional comments
Fox Creek (MK177 524) (cont.)									
17	Sept. 29	RNTR		47		1			
18	Sept. 29	RNTR		46		1			
19	Sept. 29	BLTR	YB2	185	197	56			
20	Sept. 29	MNWH		81		4			
21	Sept. 29	MNWH		130		20			
22	Sept. 29	RNTR		100		10			
23	Sept. 29	BURB			221	56			
24	Sept. 29	BURB			183	28			
25	Sept. 29	BURB			179	32			
26	Sept. 29	BURB			378	266			

Table III-4. Raw data from fish captured in the Muskeg River sub-basin.

Running Order	Sample Date	Species	Tag number	Fork length (mm)	Total length (mm)	Weight (g)	Sex	Sexual condition	Additional comments
Sterne Creek (LK707 765)									
1	Aug. 22	BLTR	XA1	229		130			
2	Aug. 22	RNTR		105		12			
3	Aug. 22	Cottid spp.		58		4	UNK		
4	Aug. 22	Cottid spp.		51		2	UNK		
5	Aug. 22	Cottid spp.		51		2	UNK		
6	Aug. 22	Cottid spp.		43		2	UNK		
7	Aug. 22	Cottid spp.		47		2	UNK		
8	Aug. 22	Cottid spp.		55		2	UNK		
9	Aug. 22	Cottid spp.		55		2	UNK		
10	Aug. 22	Cottid spp.		52		2	UNK		
11	Aug. 22	BLTR	XA0	220		108			
12	Aug. 22	Cottid spp.		105		12	UNK		
Mason Creek (LK795 766)									
1	Aug. 22	RNTR		213		104	M	Ripe	
2	Aug. 22	RNTR		182		74	M	Ripe	
3	Aug. 22	RNTR		89		8			
4	Aug. 22	RNTR		85		8			Electrofishing burn/bruising present
5	Aug. 22	RNTR		84		6			
6	Aug. 22	RNTR		87		8			
7	Aug. 22	RNTR		84		8			
8	Aug. 22	RNTR		70		6			Electrofishing burn/bruising present
9	Aug. 22	RNTR		79		6			
10	Aug. 22	RNTR		82		6			
11	Aug. 22	RNTR		92		10			
12	Aug. 22	RNTR		87		6			Electrofishing burn/bruising present
Veronique Creek (LK871 768)									
1	Aug. 23	RNTR		96		12			
2	Aug. 23	RNTR		92		10			
3	Aug. 23	RNTR		124		20			
4	Aug. 23	RNTR		145		32			
5	Aug. 23	RNTR		164		56	M	Ripe	
6	Aug. 23	RNTR		180		60			
7	Aug. 23	RNTR		159		52			
8	Aug. 23	RNTR		172		60			
9	Aug. 23	RNTR		120		18			
10	Aug. 23	RNTR		149		42			
11	Aug. 23	RNTR		138		30			
12	Aug. 23	RNTR		125		24			
13	Aug. 23	RNTR		112		18			
14	Aug. 23	BLTR		182		58			
15	Aug. 23	BLTR	XA3	225		116			Upper caudal fin damaged
16	Aug. 23	RNTR		135		30			
17	Aug. 23	RNTR		114		16			
18	Aug. 23	RNTR		190		74			

Table III-4 (cont.)

Running Order	Sample Date	Species	Tag number	Fork length (mm)	Total length (mm)	Weight (g)	Sex	Sexual condition	Additional comments
Veronique Creek (LK871 768) (cont.)									
19	Aug. 23	BLTR	XA4	240		126			Bruised surface behind dorsal fin
20	Aug. 23	RNTR		183		62	M	Ripe	
21	Aug. 23	RNTR		123		18			
22	Aug. 23	RNTR		208		114	M	Ripe	
23	Aug. 23	RNTR		160		54			
24	Aug. 23	RNTR		226		114			
25	Aug. 23	BLTR		162		40			
26	Aug. 23	RNTR		163		54			
27	Aug. 23	RNTR		180		62			
28	Aug. 23	RNTR		113		14			
29	Aug. 23	RNTR		183		62			
30	Aug. 23	RNTR		94		10			
31	Aug. 23	RNTR		172		68			
32	Aug. 23	RNTR		187		76			
33	Aug. 23	RNTR		89		8			
34	Aug. 23	RNTR		160		40			
35	Aug. 23	RNTR		121		22			
36	Aug. 23	RNTR		89		8			
37	Aug. 23	BLTR	XA5	198		76			
38	Aug. 23	BLTR	XA6	198		72			
39	Aug. 23	RNTR		193		86			
40	Aug. 23	RNTR		183		70	F		
41	Aug. 23	RNTR		179		68			
42	Aug. 23	RNTR		101		12			
43	Aug. 23	RNTR		95		10			
44	Aug. 23	RNTR		175		60	F		
45	Aug. 23	RNTR		124		20			
46	Aug. 23	RNTR		100		12			
47	Aug. 23	BLTR	XA7	178		52			
48	Aug. 23	RNTR		160		50			
49	Aug. 23	RNTR		175		66	F		
50	Aug. 23	RNTR		128		20			
51	Aug. 23	RNTR		108		14			
52	Aug. 23	BLTR	XA2	166		38			
53	Aug. 23	BLTR	XA8	203		76			
54	Aug. 23	RNTR		139		32			
55	Aug. 23	BLTR	XA9	164		42			
56	Aug. 23	BLTR	XB0	172		42			Wound on RHS
57	Aug. 23	RNTR		139		26			
58	Aug. 23	RNTR		106		12			
59	Aug. 23	RNTR		100		12			
60	Aug. 23	RNTR		113		14			
61	Aug. 23	RNTR		90		8			
62	Aug. 23	BLTR	XB1	345		470			

Table III-4 (cont.)

Running Order	Sample Date	Species	Tag number	Fork length (mm)	Total length (mm)	Weight (g)	Sex	Sexual condition	Additional comments
Plante Creek (MK033 756)									
1	Aug. 23	BKTR		206		104	F	Mature	
2	Aug. 23	RNTR		166		48	F		
3	Aug. 23	RNTR		166		56	F		
4	Aug. 23	RNTR		144		32			
5	Aug. 23	RNTR		166		66			
6	Aug. 23	RNTR		104		10			
7	Aug. 23	RNTR		147		34			
8	Aug. 23	BKTR		93		14	I		
9	Aug. 23	BKTR		141		36	M	Ripe	
10	Aug. 23	BLTR	XB2	182		56			
11	Aug. 23	RNTR		136		28			
12	Aug. 23	RNTR		118		20			
13	Aug. 23	RNTR		120		20			
14	Aug. 23	RNTR		164		52			
15	Aug. 23	RNTR		110		14			
16	Aug. 23	RNTR		146		32			
17	Aug. 23	RNTR		109		14			
18	Aug. 23	RNTR		160		52			
19	Aug. 23	RNTR		154		48	F		
20	Aug. 23	RNTR		164		46	F		
21	Aug. 23	RNTR		183		60	F		
22	Aug. 23	RNTR		155		44			
23	Aug. 23	RNTR		147		36			
24	Aug. 23	RNTR		153		34			
25	Aug. 23	RNTR		142		30			
26	Aug. 23	RNTR		156		34			
27	Aug. 23	RNTR		125		20			
28	Aug. 23	RNTR		134		26			
29	Aug. 23	RNTR		118		16			
30	Aug. 23	RNTR		134		18			
31	Aug. 23	RNTR		112		14			
32	Aug. 23	RNTR		184		62	F		
33	Aug. 23	RNTR		163		48	M	Ripe	
34	Aug. 23	RNTR		158		40			
35	Aug. 23	BKTR		112		18	M	Ripe	
36	Aug. 23	BKTR		89		8	I		upper caudal previously clipped or damaged
37	Aug. 23	RNTR		148		32			
38	Aug. 23	RNTR		181		64			
39	Aug. 23	RNTR		172		42			
40	Aug. 23	RNTR		171		44			
41	Aug. 23	RNTR		117		14			
42	Aug. 23	RNTR		152		34			
43	Aug. 23	BKTR		86		10	I		

Table III-4 (cont.)

Running Order	Sample Date	Species	Tag number	Fork length (mm)	Total length (mm)	Weight (g)	Sex	Sexual condition	Additional comments
Lone Teepee Creek (MK005 683)									
1	Aug. 24	BKTR		205		88	M	Ripe	
2	Aug. 24	BKTR		214		124	M	Ripe	
3	Aug. 24	BKTR		193		90	M	Ripe	
4	Aug. 24	BKTR		56		2	I		
5	Aug. 24	BKTR		185		78	M	Ripe	
6	Aug. 24	BKTR		215		106	F	Mature	
7	Aug. 24	BKTR		239		158	M	Ripe	
8	Aug. 24	BKTR		162		44	F	Mature	
9	Aug. 24	BKTR		182		72	M	Ripe	
10	Aug. 24	BKTR		197		114	M	Ripe	Caudal fin damaged
11	Aug. 24	BKTR		123		18	I		
12	Aug. 24	BKTR		112		18	I		
13	Aug. 24	BKTR		111		16	I		
14	Aug. 24	BKTR		112		16	I		
15	Aug. 24	BKTR		104		12	I		
16	Aug. 24	BKTR		151		40	M	Ripe	
17	Aug. 24	BKTR		104		8	I		Caudal fin damaged
18	Aug. 24	BKTR		128		24	I		
19	Aug. 24	BKTR		119		26	I		
20	Aug. 24	BKTR		172		62	F	Mature	
21	Aug. 24	BKTR		118		16	I		
22	Aug. 24	BKTR		94		10	I		
23	Aug. 24	BKTR		57		2	I		
24	Aug. 24	BKTR		52		2	I		
25	Aug. 24	BKTR		54		2	I		
26	Aug. 24	BKTR		57		2	I		
27	Aug. 24	BKTR		54		2	I		
28	Aug. 24	BKTR		60		2	I		
29	Aug. 24	BKTR		105		14	I		
30	Aug. 24	BKTR		111		14	I		Had a double adipose fin
31	Aug. 24	BKTR		100		10	I		
32	Aug. 24	BKTR		105		14	I		
33	Aug. 24	BKTR		99		14	I		
34	Aug. 24	BKTR		96		12	I		
35	Aug. 24	BKTR		98		14	I		
36	Aug. 24	BKTR		91		10	I		
37	Aug. 24	BKTR		96		8	I		
38	Aug. 24	BKTR		106		14	I		
39	Aug. 24	BKTR		100		12	I		
40	Aug. 24	BKTR		105		16	I		
41	Aug. 24	RNTR		189		78			
42	Aug. 24	BKTR		260		224	M	Mature	
43	Aug. 24	BKTR		228		158	M	Mature	
44	Aug. 24	BKTR		259		214	M	Ripe	
45	Aug. 24	BKTR		185		78	M	Mature	
46	Aug. 24	BKTR		112		14	I		
47	Aug. 24	BKTR		149		40	F	Mature	

Table III-4 (cont.)

Running Order	Sample Date	Species	Tag number	Fork length (mm)	Total length (mm)	Weight (g)	Sex	Sexual condition	Additional comments
Lone Teepee Creek (MK005 683) (cont.)									
48	Aug. 24	BKTR		161		40	M	Ripe	
49	Aug. 24	BKTR		129		22	M	Ripe	
50	Aug. 24	BKTR		122		22	I		
51	Aug. 24	BKTR		105		8	I		
52	Aug. 24	BKTR		116		14	I		
53	Aug. 24	BKTR		139		24	I		
54	Aug. 24	BKTR		192		80	F	Mature	
55	Aug. 24	BKTR		202		100	M	Ripe	
56	Aug. 24	BKTR		129		22	I		
57	Aug. 24	BKTR		106		10	I		
58	Aug. 24	BKTR		110		14	I		
59	Aug. 24	BKTR		103		12	I		
60	Aug. 24	BKTR		103		12	I		
61	Aug. 24	BKTR		104		12	I		
62	Aug. 24	BKTR		98		8	I		
63	Aug. 24	BKTR		119		20	I		Possibly clipped previously
64	Aug. 24	BKTR		124		22	I		
65	Aug. 24	BKTR		163		56	F	Mature	Caudal fin damaged
66	Aug. 24	BKTR		105		14	I		
67	Aug. 24	BKTR		54		1.56	I		
68	Aug. 24	BKTR		57		1.56	I		
69	Aug. 24	BKTR		43		1.56	I		
70	Aug. 24	BKTR		45		1.56	I		
71	Aug. 24	BKTR		54		1.56	I		
72	Aug. 24	BKTR		57		1.56	I		
73	Aug. 24	BKTR		65		1.56	I		
74	Aug. 24	BKTR		48		1.56	I		
75	Aug. 24	BKTR		56		1.56	I		
76	Aug. 24	BKTR		52		1.53	I		
77	Aug. 24	BKTR		55		1.53	I		
78	Aug. 24	BKTR		56		1.53	I		
79	Aug. 24	BKTR		50		1.53	I		
80	Aug. 24	BKTR		54		1.53	I		
81	Aug. 24	BKTR		52		1.53	I		
82	Aug. 24	BKTR		55		1.53	I		
83	Aug. 24	BKTR		61		1.53	I		
84	Aug. 24	BKTR		55		1.53	I		
85	Aug. 24	BKTR		54		1.53	I		
86	Aug. 24	BKTR		50		1.53	I		
87	Aug. 24	BKTR		56		1.53	I		
88	Aug. 24	BKTR		60		1.53	I		
89	Aug. 24	BKTR		59		1.53	I		
90	Aug. 24	BKTR		60		1.53	I		
91	Aug. 24	BKTR		53		1.53	I		
92	Aug. 24	BKTR		55		1.53	I		
93	Aug. 24	BKTR		53		1.53	I		
94	Aug. 24	BKTR		55		1.53	I		

Table III-4 (cont.)

Running Order	Sample Date	Species	Tag number	Fork length (mm)	Total length (mm)	Weight (g)	Sex	Sexual condition	Additional comments
Lone Teepee Creek (MK005 683) (cont.)									
95	Aug. 24	BKTR		53		1.53	I		
96	Aug. 24	BKTR		53		1.53	I		
97	Aug. 24	BKTR		51		1.53	I		
98	Aug. 24	BKTR		56		1.53	I		
99	Aug. 24	BKTR		55		1.53	I		
100	Aug. 24	BKTR		49		1.53	I		
101	Aug. 24	BKTR		44		1.53	I		
102	Aug. 24	BKTR		49		1.53	I		
103	Aug. 24	BKTR		61		1.53	I		
104	Aug. 24	BKTR		56		1.53	I		
105	Aug. 24	BKTR		59		1.53	I		
106	Aug. 24	BKTR		216		124	M	Ripe	
107	Aug. 24	BKTR		243		180	F	Mature	
108	Aug. 24	BKTR		184		78	M	Ripe	
109	Aug. 24	BKTR		221		122	F	Mature	
110	Aug. 24	BKTR		186		80	M	Ripe	
111	Aug. 24	BKTR		185		88	F	Mature	
112	Aug. 24	BKTR		155		36	I		
113	Aug. 24	BKTR		189		80	M	Ripe	
114	Aug. 24	BKTR		178		68	F	Mature	
115	Aug. 24	BKTR		171		60	F	Mature	
116	Aug. 24	BKTR		176		66	M	Ripe	
117	Aug. 24	BKTR		155		42	I		
118	Aug. 24	BKTR		126		26	M	Ripe	
119	Aug. 24	BKTR		112		16	I		
120	Aug. 24	BKTR		115		18	I		
121	Aug. 24	BKTR		99		10	I		
122	Aug. 24	BKTR		107		10	I		
123	Aug. 24	BKTR		113		10	I		
124	Aug. 24	BKTR		101		8	I		
125	Aug. 24	BKTR		113		16	I		
126	Aug. 24	BKTR		101		8	I		
127	Aug. 24	BKTR		114		16	I		
128	Aug. 24	BLTR/BKTR		232		142	M	Immat	Sacrificed; hybrid brook and bull trout; sex determined during autopsie
129	Aug. 24	BKTR		189		84	F	F	
130	Aug. 24	BKTR		180		60	I		
131	Aug. 24	BKTR		151		36	I		
132	Aug. 24	BKTR		116		16	I		
133	Aug. 24	BKTR		120		30	I		
134	Aug. 24	BKTR		119		16	I		
135	Aug. 24	BKTR		129		22	I		
136	Aug. 24	BKTR		110		14	I		
137	Aug. 24	BKTR		149		34	I		
138	Aug. 24	BKTR		100		12	I		
139	Aug. 24	BKTR		122		20	I		
140	Aug. 24	BKTR		49		not weigh	I		

Table III-4 (cont.)

Running Order	Sample Date	Species	Tag number	Fork length (mm)	Total length (mm)	Weight (g)	Sex	Sexual condition	Additional comments
Chapman Creek (LK898 692)									
1	Aug. 28	RNTR		96		10			
2	Aug. 28	RNTR		104		12			
3	Aug. 28	RNTR		97		10			
4	Aug. 28	BLTR		155		36			
5	Aug. 28	BLTR	XC9	187		78			
6	Aug. 28	BLTR	XD0	216		92			Electrofishing burn/bruising present
7	Aug. 28	BLTR	XD1	186		72			
8	Aug. 28	BLTR	XD2	190		66			
9	Aug. 28	BLTR	XD3	191		76			
10	Aug. 28	BLTR	XD4	186		68			
11	Aug. 28	BLTR		142		32			
12	Aug. 28	BLTR		134		24			
13	Aug. 28	BLTR		126		18			
14	Aug. 28	BLTR		125		20			
15	Aug. 28	BLTR		115		14			
Mahon Creek (LK887 661)									
1	Aug. 28	BLTR	XD5	445		888	M	Ripe	
2	Aug. 28	BLTR	XD6	398		678	F	Ripe	
3	Aug. 28	BLTR	XD7	196		74			
4	Aug. 28	BLTR		151		34			
5	Aug. 28	BLTR		113		14			
6	Aug. 28	BLTR		123		16			
7	Aug. 28	BLTR		142		26			
8	Aug. 28	BLTR		100		10			
9	Aug. 28	BLTR		103		10			
10	Aug. 28	BLTR		108		12			
11	Aug. 28	BLTR		104		8			
12	Aug. 28	BLTR		108		12			
13	Aug. 28	BLTR		106		10			
14	Aug. 28	BLTR		116		16			
15	Aug. 28	RNTR		128		20			
16	Aug. 28	RNTR		83		6			
Susa Creek (LK711 773)									
1	Aug. 29	RNTR		46		NR			
2	Aug. 29	RNTR		175		66			
3	Aug. 29	RNTR		234		128			
4	Aug. 29	RNTR		205		96			
5	Aug. 29	RNTR		148		34			
6	Aug. 29	RNTR		129		26			
7	Aug. 29	RNTR		142		36			
8	Aug. 29	RNTR		96		6			
9	Aug. 29	RNTR		128		24			
10	Aug. 29	RNTR		95		8			
11	Aug. 29	RNTR		126		24			

Table III-4 (cont.)

Running Order	Sample Date	Species	Tag number	Fork length (mm)	Total length (mm)	Weight (g)	Sex	Sexual condition	Additional comments
Susa Creek (LK711 773) (cont.)									
12	Aug. 29	RNTR		50		NR			
13	Aug. 29	RNTR		44		NR			
14	Aug. 29	RNTR		43		NR			
15	Aug. 29	RNTR		48		NR			
16	Aug. 29	RNTR		104		NR			
17	Aug. 29	Cottid spp.		99		12	UNK		
18	Aug. 29	Cottid spp.		84		12	UNK		
19	Aug. 29	Cottid spp.		89		8	UNK		
20	Aug. 29	Cottid spp.		85		8	UNK		
21	Aug. 29	Cottid spp.		72		4	UNK		
22	Aug. 29	Cottid spp.		80		8	UNK		
23	Aug. 29	Cottid spp.		62		4	UNK		
24	Aug. 29	Cottid spp.		73		6	UNK		
25	Aug. 29	Cottid spp.		62		4	UNK		
26	Aug. 29	Cottid spp.		51		2	UNK		
27	Aug. 29	Cottid spp.		54		2	UNK		
28	Aug. 29	Cottid spp.		71		2	UNK		
29	Aug. 29	Cottid spp.		63		2	UNK		
30	Aug. 29	Cottid spp.		76		6	UNK		
31	Aug. 29	Cottid spp.		82		6	UNK		
32	Aug. 29	Cottid spp.		58		2	UNK		
33	Aug. 29	Cottid spp.		55		2	UNK		
34	Aug. 29	Cottid spp.		69		4	UNK		
35	Aug. 29	Cottid spp.		64		4	UNK		
36	Aug. 29	Cottid spp.		60		2	UNK		
37	Aug. 29	Cottid spp.		49		2	UNK		
38	Aug. 29	Cottid spp.		57		2	UNK		
39	Aug. 29	Cottid spp.		66		4	UNK		
40	Aug. 29	Cottid spp.		63		4	UNK		
Lone Teepee Creek (LK907 762)									
1	Aug. 30	RNTR		265		184			
2	Aug. 30	RNTR		257		192			
3	Aug. 30	BKTR		254		180	F	Mat	
4	Aug. 30	RNTR		325		374			
5	Aug. 30	BKTR		343		516	F	Mat	
6	Aug. 30	BLTR	XD8	268	286	210			Adipose fin previously clipped but no tag
7	Aug. 30	RNTR		254		172			
8	Aug. 30	RNTR		243		152			
9	Aug. 30	RNTR		172		58			
10	Aug. 30	BLTR	XD9	282	296	202			
11	Aug. 30	RNTR		171		50			
12	Aug. 30	RNTR		142		26			
13	Aug. 30	RNTR		142		28			
14	Aug. 30	RNTR		132		22			
15	Aug. 30	RNTR		104		12			
16	Aug. 30	BLTR	XE1	183	195	64			

Table III-4 (cont.)

Running Order	Sample Date	Species	Tag number	Fork length (mm)	Total length (mm)	Weight (g)	Sex	Sexual condition	Additional comments
Lone Teepee Creek (LK907 762) (cont.)									
17	Aug. 30	BLTR	XE2	246	261	142			
18	Aug. 30	BKTR		239		132	F	Mat	
19	Aug. 30	Unkn trout		48		NR			
20	Aug. 30	LNSC		134		24	I		
21	Aug. 30	LNSC		121		22	I		
22	Aug. 30	LNSC		91		8	I		
23	Aug. 30	LNSC		83		6	I		
24	Aug. 30	Unkn trout		47		NR			
25	Aug. 30	LNSC		132		26	I		
26	Aug. 30	RNTR		74		6			
27	Aug. 30	RNTR		111		14			
28	Aug. 30	RNTR		139		28			
29	Aug. 30	RNTR		197		84			
30	Aug. 30	RNTR		108		12			
31	Aug. 30	RNTR		183		64			
32	Aug. 30	RNTR		147		28			
33	Aug. 30	RNTR		140		24			
34	Aug. 30	Unkn trout		48		NR			
35	Aug. 30	RNTR		126		18			
36	Aug. 30	LNSC		141		34	I		
37	Aug. 30	LNSC		131		28	I		
38	Aug. 30	LNSC		130		24	I		
39	Aug. 30	LNSC		86		6	I		
40	Aug. 30	BLTR		158	168	36			
41	Aug. 30	BLTR	XE3	217	230	86			
42	Aug. 30	RNTR	XE4	97		10			
43	Aug. 30	RNTR		108		12			
44	Aug. 30	RNTR		92		8			
45	Aug. 30	RNTR		84		6			
46	Aug. 30	Unkn trout		51		NR			
47	Aug. 30	Unkn trout		56		NR			
48	Aug. 30	Unkn trout		47		NR			
49	Aug. 30	Unkn trout		49		NR			
50	Aug. 30	Unkn trout		52		NR			
51	Aug. 30	RNTR		44		NR			
52	Aug. 30	RNTR		84		6			
53	Aug. 30	RNTR		97		10			
54	Aug. 30	RNTR		92		10			
55	Aug. 30	RNTR		94		8			
56	Aug. 30	RNTR		107		16			
57	Aug. 30	RNTR		187		68			
58	Aug. 30	RNTR		180		70			
59	Aug. 30	RNTR		93		8			
60	Aug. 30	BLTR	XE5	231	248	114			
61	Aug. 30	LNSC		125		22	I		
62	Aug. 30	LNSC		109		14	I		
63	Aug. 30	RNTR		208		194			

Table III-4 (cont.)

Running Order	Sample Date	Species	Tag number	Fork length (mm)	Total length (mm)	Weight (g)	Sex	Sexual condition	Additional comments
Lone Teepee Creek (LK907 762) (cont.)									
64	Aug. 30	RNTR		163		40			
65	Aug. 30	RNTR		118		16			
66	Aug. 30	RNTR		129		20			
67	Aug. 30	RNTR		195		76			
68	Aug. 30	RNTR		206		88			
69	Aug. 30	RNTR		193		72			
70	Aug. 30	RNTR		134		20			
71	Aug. 30	RNTR		158		42			
72	Aug. 30	RNTR		109		12			
73	Aug. 30	RNTR		133		26			
74	Aug. 30	RNTR		90		6			
75	Aug. 30	RNTR		93		8			
76	Aug. 30	RNTR		114		14			
77	Aug. 30	RNTR		103		10			
78	Aug. 30	RNTR		92		8			
79	Aug. 30	RNTR		98		12			
80	Aug. 30	LNSC		171		51	I		
81	Aug. 30	LNSC		86		6	I		
82	Aug. 30	LNSC		83		4	I		
83	Aug. 30	LNSC		90		8	I		
84	Aug. 30	LNSC		74		2	I		
Unnamed tributary LK884 672 (LK885 676)									
1	Aug. 31	BLTR		116	123	14			
2	Aug. 31	RNTR		99		10			
3	Aug. 31	BLTR		129		20			
4	Aug. 31	BLTR	XE6	164	174	48			
5	Aug. 31	BLTR	XE7	166	177	46			
6	Aug. 31	BLTR	XE8	162	172	42			
7	Aug. 31	BLTR		127	134	22			
8	Aug. 31	BLTR	XE9	159	168	42			
9	Aug. 31	BLTR		115	122	14			
10	Aug. 31	BLTR	XF0	161	171	40			
11	Aug. 31	BLTR	XF1	184	194	64			
12	Aug. 31	BLTR		117	123	14			
13	Aug. 31	BLTR	XF2	198		82			
14	Aug. 31	BLTR	XF3	197	209	78			
15	Aug. 31	BLTR	XF4	171	183	52			
16	Aug. 31	RNTR		76		4			
17	Aug. 31	BLTR	XF5	227	239	118			
18	Aug. 31	BLTR	XF6	409	428	734	M	Ripe	
Mahon Creek (Pass #1 of 3 passes) (LK887 661)									
1	Sept. 6	BLTR		106	112	10			
2	Sept. 6	BLTR		130	138	20			
3	Sept. 6	BLTR		109	116	12			

Table III-4 (cont.)

Running Order	Sample Date	Species	Tag number	Fork length (mm)	Total length (mm)	Weight (g)	Sex	Sexual condition	Additional comments
Mahon Creek (Pass #1 of 3 passes) (LK887 661) (cont.)									
4	Sept. 6	BLTR		104	109	10			
5	Sept. 6	BLTR		107	113	10			
6	Sept. 6	BLTR		108	114	12			
7	Sept. 6	BLTR		120	128	16			
8	Sept. 6	BLTR		57	59	2			
9	Sept. 6	BLTR		105	110	10			
10	Sept. 6	BLTR		115	121	14			
11	Sept. 6	BLTR		137	145	22			
12	Sept. 6	BLTR	XH0	152	160	32			
13	Sept. 6	BLTR	XH1	159	169	38			
14	Sept. 6	RNTR		120		18			Recapture from last week
15	Sept. 6	BLTR	XH2	164	174	40			
16	Sept. 6	BLTR	XH3	212	224	92			
17	Sept. 6	BLTR		99	105	10			
18	Sept. 6	RNTR		108		12			
19	Sept. 6	BLTR		113	119	14			
20	Sept. 6	BLTR		106	113	10			
21	Sept. 6	BLTR		100	105	10			
22	Sept. 6	BLTR		57	59	2			
23	Sept. 6	BLTR		106	111	12			
24	Sept. 6	BLTR		116	122	14			
25	Sept. 6	BLTR		101	106	8			
26	Sept. 6	BLTR		102	108	10			
27	Sept. 6	BLTR		116	122	14			
28	Sept. 6	BLTR	XH4	155	164	34			
29	Sept. 6	BLTR		102	107	10			
30	Sept. 6	BLTR		112	118	12			
31	Sept. 6	BLTR		113	120	12			
32	Sept. 6	BLTR		111	117	12			
33	Sept. 6	BLTR	XH8	165	175	42			
34	Sept. 6	BLTR	XH5	162	171	36			
35	Sept. 6	BLTR		62	64	2			
36	Sept. 6	BLTR	XH6	182	193	54			
37	Sept. 6	BLTR	XJ2	153	162	34			
38	Sept. 6	BLTR	XH9	162	172	40			
39	Sept. 6	BLTR	XJ0	179	191	52			Pred. wound on side
Mahon Creek (Pass #2 of 3 passes) (887 661)									
1	Sept. 6	RNTR		116		16			
2	Sept. 6	RNTR		161		42			
3	Sept. 6	BLTR		103	109	10			Burn marks under adipose
4	Sept. 6	BLTR		106	113	10			
5	Sept. 6	BLTR		110	117	14			
6	Sept. 6	BLTR	XJ1	153	162	36			
7	Sept. 6	BLTR		135	143	22			
8	Sept. 6	BLTR	XJ3	172	182	50			
9	Sept. 6	BLTR		106	113	12			

Table III-4 (cont.)

Running Order	Sample Date	Species	Tag number	Fork length (mm)	Total length (mm)	Weight (g)	Sex	Sexual condition	Additional comments
Mahon Creek (Pass #2 of 3 passes) (887 661) (cont.)									
10	Sept. 6	BLTR		117	123	16			
11	Sept. 6	BLTR		120	127	16			
12	Sept. 6	BLTR		119	126	16			
13	Sept. 6	BLTR		108	116	12			
14	Sept. 6	BLTR	XJ4	228	240	100			
15	Sept. 6	BLTR		119	127	16			
16	Sept. 6	BLTR		108	114	12			
17	Sept. 6	BLTR		93	98	8			
18	Sept. 6	BLTR		106	111	10			
19	Sept. 6	BLTR		118	125	14			
20	Sept. 6	BLTR		102	107	8			
21	Sept. 6	BLTR		105	111	10			
22	Sept. 6	BLTR		424	445	652	F	Ripe	Ripe but appears partially spent
23	Sept. 6	RNTR		256		200			
Mahon Creek (Pass #3 of 3 passes) (LK887 661)									
1	Sept. 6	BLTR		111	118	14			
2	Sept. 6	BLTR		102	107	10			
3	Sept. 6	BLTR		107	112	12			
4	Sept. 6	BLTR		114	119	12			
5	Sept. 6	BLTR		109	115	12			
6	Sept. 6	RNTR		73		4			
7	Sept. 6	BLTR		110	117	12			
8	Sept. 6	BLTR	XF7	152	160	30			
9	Sept. 6	BLTR		108	115	12			
10	Sept. 6	BLTR		106	112	12			
11	Sept. 6	BLTR		108	124	14			
12	Sept. 6	BLTR		111	119	14			
13	Sept. 6	BLTR		111	117	12			
14	Sept. 6	BLTR		101	108	10			
15	Sept. 6	BLTR	not tagged	148	156	34			
16	Sept. 6	BLTR	XF9	151	159	36			
17	Sept. 6	BLTR	XF8	147	157	28			
18	Sept. 6	BLTR		NR	NR	NR			Escaped from sampling bucket before being processed
19	Sept. 6	BLTR		NR	NR	NR			Escaped from sampling bucket before being processed
Muskeg River (LK794 582)									
1	Sept. 7	RNTR		89	118	6			Mortality
2	Sept. 7	RNTR		97		8			
3	Sept. 7	RNTR		92		6			
4	Sept. 7	RNTR		91		6			
5	Sept. 7	RNTR		145		30			
6	Sept. 7	BLTR		123	129	18			
7	Sept. 7	BLTR	XJ6	233	248	112			
8	Sept. 7	BLTR		68	71	NR			
9	Sept. 7	BLTR		66	68	NR			

Table III-4 (cont.)

Running Order	Sample Date	Species	Tag number	Fork length (mm)	Total length (mm)	Weight (g)	Sex	Sexual condition	Additional comments
Muskeg River (LK794 582) (cont.)									
10	Sept. 7	BLTR		58	69	NR			
11	Sept. 7	BLTR	XJ8	240	253	136			
12	Sept. 7	BLTR	XJ7	159	167	32			
13	Sept. 7	BLTR	XJ9	232	247	116			
14	Sept. 7	BLTR	XK0	228	238	108			
15	Sept. 7	BLTR	XK1	164	172	40			
16	Sept. 7	BLTR	XK3	249	261	146			
17	Sept. 7	BLTR	XK4	182	192	56			
Muskeg River (LK793 553)									
1	Sept. 8	BLTR		108	113	10			
2	Sept. 8	BLTR		119	124	12			
3	Sept. 8	BLTR		106	112	10			
4	Sept. 8	BLTR		105	110	12			
Mahon Creek (Pass #1 of 3 passes) (LK885 663)									
1	Sept. 9	RNTR		159		42			
2	Sept. 9	RNTR		204		86			
3	Sept. 9	RNTR		80		6			
4	Sept. 9	BLTR	XK4	149	158	30			
5	Sept. 9	BLTR	XK5	154	163	30			
6	Sept. 9	BLTR		58	61	2			
7	Sept. 9	BLTR		58	59	2			
8	Sept. 9	BLTR		59	61	2			
9	Sept. 9	BLTR		106	112	12			
10	Sept. 9	BLTR		93	98	6			
11	Sept. 9	BLTR		98	104	8			
12	Sept. 9	BLTR		105	111	10			
13	Sept. 9	BLTR	XK6	151	160	32			
14	Sept. 9	BLTR	XH5	161	171	36			Recapture from Sept. 6 when lower Mahon Creek was surveyed.
15	Sept. 9	BLTR	XK8	208	219	78			
16	Sept. 9	BLTR		103	NR	NR			
17	Sept. 9	BLTR		96	NR	NR			
18	Sept. 9	BLTR		59	NR	NR			
19	Sept. 9	BLTR		54	NR	NR			
20	Sept. 9	BLTR	XL0	466	486	998	M	Ripe	
21	Sept. 9	BLTR	XK9	410	428	700	F	Ripe	
22	Sept. 9	BLTR	XL1	448	462	786	M	Ripe	Anal fin damaged
23	Sept. 9	BLTR	XL3	473	490	946	M	Ripe	Caudal fin damaged
24	Sept. 9	BLTR	XL4	400	417	592	F	Ripe	
25	Sept. 9	BLTR	XL6	448	468	852	M	Ripe	Caudal fin damaged
26	Sept. 9	BLTR	XL7	422	441	778	F	Ripe	
27	Sept. 9	BLTR	XL8	403	418	686	F	Ripe	
28	Sept. 9	BLTR	XL9	429	448	722	M	Ripe	
29	Sept. 9	RNTR		277		218			
30	Sept. 9	RNTR		233		152	F	Spent	

Table III-4 (cont.)

Running Order	Sample Date	Species	Tag number	Fork length (mm)	Total length (mm)	Weight (g)	Sex	Sexual condition	Additional comments
Mahon Creek (Pass #1 of 3 passes) (LK885 663) (cont.)									
31	Sept. 9	BLTR	NF0	434	449	910	F	Ripe	
32	Sept. 9	BLTR	NF1	434	452	728	M	Ripe	
33	Sept. 9	BLTR	NF2	355	371	408	M	Ripe	Operculum damaged
34	Sept. 9	BLTR	NF3	454	473	888	F	Mature	
35	Sept. 9	BLTR	NF4	392	412	596	M	Ripe	Left pelvic fin damaged
36	Sept. 9	BLTR	XL2	298	311	284	M	Ripe	
37	Sept. 9	BLTR	NF5	393	409	596	F	Mature	
38	Sept. 9	BLTR	NF6	427	442	759	F	Ripe	
39	Sept. 9	BLTR	NF7	400	419	638	M	Ripe	Caudal fin damaged
40	Sept. 9	BLTR	NF8	535	558	1376	M	Ripe	
41	Sept. 9	BLTR	NH1	550	568	1672	M	Ripe	
42	Sept. 9	BLTR	NF9	380	401	478	M	Ripe	Right eye missing
43	Sept. 9	BLTR	NH0	393	415	682	F	Mature	Tagged last year with floy anchor tag #00920
44	Sept. 9	RNTR		215		102			
45	Sept. 9	BLTR	NH2	285	300	222	M	Ripe	Caudal fin damaged
46	Sept. 9	BLTR	NH3	460	480	1000	M	Ripe	Wound on back behind head
47	Sept. 9	RNTR		174		448			
48	Sept. 9	BLTR	NH4	401	420	624	M	Ripe	
49	Sept. 9	BLTR	NH5	418	430	456	F	Mature	
50	Sept. 9	BLTR	NH6	402	422	770	M	Ripe	
51	Sept. 9	BLTR	NH7	400	420	622	M	Ripe	Angling wound on lower right jaw
52	Sept. 9	RNTR		261		182			
53	Sept. 9	BLTR	NH8	349	366	464	F	Mature	
54	Sept. 9	BLTR	NH9	389	406	614	F	Mature	Tagged last year with floy anchor tag #00870
55	Sept. 9	BLTR	HJ1	259	271	172	M	Ripe	
56	Sept. 9	RNTR		237		144			
57	Sept. 9	RNTR		159		38			
58	Sept. 9	RNTR		208		96			Large predator wound between dorsal fin and tail
59	Sept. 9	RNTR		188		66			
60	Sept. 9	RNTR		221		104			
61	Sept. 9	BLTR	HJ0	412	428	686	M	Ripe	
62	Sept. 9	BLTR	HJ2	408	427	680	F	Mature	
Mahon Creek (Pass #2 of 3 passes) (LK885 663)									
1	Sept. 9	RNTR		195		70			
2	Sept. 9	BLTR	NJ4	189	201	62			
3	Sept. 9	BLTR	NJ3	148	157	28			
4	Sept. 9	BLTR		105	111	12			
5	Sept. 9	BLTR	XH9	162	172	44			Recapture from Sept 6 when lower Mahon Creek was surveyed
6	Sept. 9	BLTR	XJ6	146	155	30			
7	Sept. 9	BLTR	NJ8	167	178	48			
8	Sept. 9	BLTR	NJ7	140	150	28			
9	Sept. 9	BLTR		107	114	12			
10	Sept. 9	BLTR		106	111	12			
11	Sept. 9	BLTR		114	121	14			
12	Sept. 9	BLTR		100	106	10			
13	Sept. 9	BLTR	NJ5	397	417	726	M	Ripe	
14	Sept. 9	BLTR	NJ9	536	558	1548	M	Ripe	

Table III-4 (cont.)

Running Order	Sample Date	Species	Tag number	Fork length (mm)	Total length (mm)	Weight (g)	Sex	Sexual condition	Additional comments
Mahon Creek (Pass #3 of 3 passes) (LK885 663)									
1	Sept. 9	RNTR		92		8			
2	Sept. 9	RNTR		84		6			
3	Sept. 9	BLTR		114	122	20			
4	Sept. 9	BLTR		54	55 NR				
5	Sept. 9	BLTR		60	61 NR				
6	Sept. 9	BLTR		62	64 NR				
7	Sept. 9	BLTR		57	58 NR				
8	Sept. 9	BLTR		62	65 NR				
9	Sept. 9	RNTR		76		4			
10	Sept. 9	RNTR		132		22			
11	Sept. 9	BLTR		107	113	14			
12	Sept. 9	BLTR	XH2	163	172	40			Recapture from Sept 6 when lower Mahon Creek was surveyed
13	Sept. 9	RNTR		101		12			
14	Sept. 9	BLTR		118	126	18			Recapture from Sept 6 when lower Mahon Creek was surveyed
15	Sept. 9	BLTR	NK0	152	160	34			
16	Sept. 9	BLTR		99	102	12			
17	Sept. 9	BLTR	XK5	155	165	36			Not counted in pop. est.; caught during 1st run & accidentally released
18	Sept. 9	BLTR	NK1	159	166	40			
19	Sept. 9	BLTR	NK4	407	425	690	F	Ripe	
20	Sept. 9	BLTR	NK5	400	418	724	M	Ripe	Recapture from last year with tag number #00864
21	Sept. 9	BLTR	NK6	321	332	348	M	Ripe	
22	Sept. 9	BLTR	NK7	406	424	682	F	Ripe	
23	Sept. 9	BLTR	NK2	458	473	920	F	Ripe	
24	Sept. 9	BLTR	NK8	347	352	344	F	Partially spent	Sex may be questionable: fish had lesion around vent area.
Mahon Creek (MK905 627)									
1	Sept. 10	BLTR	NL0	311	326	298	M	Ripe	
2	Sept. 10	BLTR		218	227	108			
3	Sept. 10	BLTR	NK9	406	424	746	M	Ripe	
4	Sept. 10	BLTR	NL2	146	155	28			
5	Sept. 10	BLTR	NL1	153	161	34			
6	Sept. 10	BLTR		111	118	14			
7	Sept. 10	BLTR		114	121	14			
8	Sept. 10	BLTR		110	117	12			
9	Sept. 10	BLTR		55	57	2			
10	Sept. 10	BLTR		54	57	2			
11	Sept. 10	BLTR		57	60	2			
Isaac Creek (LK898 633)									
1	Sept. 10	BLTR	NL3	423	443	742	M	Ripe	
2	Sept. 10	BLTR		123	131	18			
3	Sept. 10	BLTR		121	128	14			
4	Sept. 10	BLTR		122	130	16			
5	Sept. 10	BLTR		124	132	18			
6	Sept. 10	BLTR		122	129	16			
7	Sept. 10	BLTR		130	137	18			

Table III-4 (cont.)

Running Order	Sample Date	Species	Tag number	Fork length (mm)	Total length (mm)	Weight (g)	Sex	Sexual condition	Additional comments
Isaac Creek (LK898 633) (cont.)									
8	Sept. 10	BLTR	NL4	142	151	24			
9	Sept. 10	BLTR		115	121	14			
10	Sept. 10	BLTR		93	98	8			
11	Sept. 10	BLTR		113	129	12			
12	Sept. 10	BLTR		115	122	16			
13	Sept. 10	BLTR		111	117	12			
14	Sept. 10	BLTR		78	82	4			
15	Sept. 10	BLTR		113	121	12			
16	Sept. 10	BLTR		121	130	16			
17	Sept. 10	BLTR		119	126	16			
18	Sept. 10	BLTR		107	115	12			
19	Sept. 10	BLTR		78	82	4			
20	Sept. 10	BLTR		130	137	20			
21	Sept. 10	BLTR		116	123	14			
22	Sept. 10	BLTR		129	135	22			
23	Sept. 10	BLTR		120	126	16			
24	Sept. 10	BLTR		117	122	16			
Mahon Creek (LK894 647)									
1	Sept. 10	BLTR		133	142	22			
2	Sept. 10	BLTR		131	139	20			
3	Sept. 10	BLTR		109	114	12			
4	Sept. 10	BLTR		122	129	16			
5	Sept. 10	BLTR		112	119	14			
6	Sept. 10	BLTR		103	109	10			
7	Sept. 10	BLTR		101	108	10			
8	Sept. 10	BLTR		139	148	26			
9	Sept. 10	BLTR		137	146	24			
10	Sept. 10	BLTR		61	63	2			
11	Sept. 10	BLTR	NL5	147	155	28			
12	Sept. 10	BLTR	NL6	153	162	34			
13	Sept. 10	BLTR	NL7	190	201	64			
14	Sept. 10	BLTR		110	116	12			
15	Sept. 10	BLTR		101	107	10			
16	Sept. 10	BLTR		101	106	10			
17	Sept. 10	BLTR	NL8	150	159	32			
18	Sept. 10	BLTR		100	106	10			
19	Sept. 10	BLTR		104	110	10			
20	Sept. 10	BLTR		106	114	10			
21	Sept. 10	BLTR		108	112	10			
22	Sept. 10	BLTR	NL9	148	156	30			
23	Sept. 10	BLTR		101	108	8			
24	Sept. 10	BLTR		136	145	24			
25	Sept. 10	BLTR	NA0	141	151	26			
26	Sept. 10	BLTR		91	97	6			
27	Sept. 10	BLTR		100	106	8			
28	Sept. 10	BLTR		93	99	6			

Table III-4 (cont.)

Running Order	Sample Date	Species	Tag number	Fork length (mm)	Total length (mm)	Weight (g)	Sex	Sexual condition	Additional comments
Mahon Creek (LK894 647) (cont.)									
29	Sept. 10	BLTR		106	114	10			
30	Sept. 10	BLTR		138	147	22			
31	Sept. 10	BLTR		105	111	10			
32	Sept. 10	BLTR	NA1	143	152	28			
33	Sept. 10	BLTR		108	115	12			
34	Sept. 10	BLTR	NA2	145	154	28			
35	Sept. 10	BLTR	NA3	143	152	28			
36	Sept. 10	BLTR		107	113	12			
37	Sept. 10	BLTR		105	111	12			
38	Sept. 10	BLTR		111	116	10			
39	Sept. 10	BLTR		105	111	10			
40	Sept. 10	BLTR	NA4	144	153	28			
41	Sept. 10	BLTR		54	55	NR			
42	Sept. 10	BLTR		57	59	NR			
43	Sept. 10	BLTR		56	58	NR			
44	Sept. 10	BLTR		54	56	NR			
45	Sept. 10	BLTR		51	52	NR			
46	Sept. 10	BLTR		53	55	NR			
47	Sept. 10	BLTR		43	44	NR			
48	Sept. 10	BLTR		51	52	NR			
49	Sept. 10	BLTR		50	52	NR			
50	Sept. 10	BLTR		55	56	NR			
51	Sept. 10	BLTR		52	53	NR			
52	Sept. 10	BLTR		52	54	NR			
53	Sept. 10	BLTR		53	54	NR			
54	Sept. 10	BLTR		58	60	NR			
55	Sept. 10	BLTR		51	52	NR			
56	Sept. 10	BLTR		50	51	NR			
57	Sept. 10	BLTR		56	57	NR			
58	Sept. 10	BLTR		53	55	NR			
59	Sept. 10	BLTR		61	63	NR			

Table III-5. Raw data from fish captured in Roundcroft Creek.

Running Order	Sample Date	Species	Tag number	Fork length (mm)	Total length (mm)	Weight (g)	Sex	Sexual condition	Additional comments
1	Sept 30	RNTR		62		3			
2	Sept 30	RNTR		113		17			
3	Sept 30	RNTR		61		4			
4	Sept 30	RNTR		52		1			
5	Sept 30	RNTR		62		3			Belly swollen
6	Sept 30	RNTR		58		2			
7	Sept 30	RNTR		63		2			
8	Sept 30	RNTR		62		2			
9	Sept 30	RNTR		70		4			
10	Sept 30	RNTR		67		3			
11	Sept 30	RNTR		56		2			
12	Sept 30	RNTR		58		1			
13	Sept 30	RNTR		65		2			
14	Sept 30	RNTR		55		1			
15	Sept 30	RNTR		65		2			
16	Sept 30	RNTR		78		5			
17	Sept 30	RNTR		64		2			
18	Sept 30	RNTR		65		2			
19	Sept 30	RNTR		67		2			
20	Sept 30	RNTR		63		2			
21	Sept 30	RNTR		62		2			
22	Sept 30	RNTR		60		2			Belly swollen
23	Sept 30	RNTR		60		2			
24	Sept 30	RNTR		63		2			
25	Sept 30	RNTR		72		4			
26	Sept 30	RNTR		82		6			
27	Sept 30	RNTR		61		2			
28	Sept 30	Brook		76		4			
29	Sept 30	Brook		78		4			
30	Sept 30	Brook		135		22			
31	Sept 30	Brook		145		33	M	Ripe	
32	Sept 30	Brook		167		45	M	Ripe	
33	Sept 30	Brook		138		25			
34	Sept 30	Brook		136		23			
35	Sept 30	Brook		89		6			
36	Sept 30	Brook		83		7			
37	Sept 30	RNTR		136		30			
38	Sept 30	RNTR		123		18			
39	Sept 30	RNTR		130		24			
40	Sept 30	RNTR		59		2			
41	Sept 30	Brook		85		6			
42	Sept 30	RNTR		71		4			Belly swollen
43	Sept 30	Brook		138		27	M	Ripe	
44	Sept 30	RNTR		58		2			
45	Sept 30	RNTR		58		1			
46	Sept 30	RNTR		69		2			
47	Sept 30	RNTR		70		2			
48	Sept 30	RNTR		56		1			

Table III-5 (cont.)

Running Order	Sample Date	Species	Tag number	Fork length (mm)	Total length (mm)	Weight (g)	Sex	Sexual condition	Additional comments
49	Sept 30	RNTR		76		4			
50	Sept 30	Brook		108		12			
51	Sept 30	Brook		108		8			
52	Sept 30	RNTR		85		6			belly swollen
53	Sept 30	RNTR		58		2			Belly swollen
54	Sept 30	Brook		268		202	M	Ripe	
55	Sept 30	RNTR		60		2			
56	Sept 30	RNTR		153		42			
57	Sept 30	RNTR		168		54			
58	Sept 30	Brook		149		36	M	Ripe	
59	Sept 30	Brook		79		4			
60	Sept 30	RNTR		118		17			Belly swollen
61	Sept 30	RNTR		68		3			
62	Sept 30	Brook		84		6			
63	Sept 30	Brook		70		3			
64	Sept 30	RNTR		58		2			
65	Sept 30	RNTR		54		1			
66	Sept 30	RNTR		71		3			
67	Sept 30	RNTR		64		2			
68	Sept 30	Brook		86		6			
69	Sept 30	RNTR		65		2			Belly swollen
70	Sept 30	RNTR		68		3			
71	Sept 30	RNTR		59		2			
72	Sept 30	RNTR		133		25			
73	Sept 30	RNTR		65		4			
74	Sept 30	RNTR		69		3			
75	Sept 30	Brook		78		4			
76	Sept 30	RNTR		69		3			
77	Sept 30	RNTR		113		18			
78	Sept 30	RNTR		53		2			
79	Sept 30	RNTR		68		3			
80	Sept 30	RNTR		68		3			
81	Sept 30	RNTR		66		3			
82	Sept 30	RNTR		70		3			Belly swollen
83	Sept 30	RNTR		61		2			2 cysts on left side of pectoral region
84	Sept 30	Brook		80		4			
85	Sept 30	RNTR		58		2			Fungus on both sides of body
86	Sept 30	RNTR		55		2			
87	Sept 30	Brook		95		10			
88	Sept 30	Brook		132		21			under developed lower jaw
89	Sept 30	Brook		122		16			
90	Sept 30	RNTR		66		2			
91	Sept 30	RNTR		53		2			swollen belly; sacrificed; had several fish eggs in stomach
92	Sept 30	RNTR		74		4			
93	Sept 30	RNTR		147		34			
94	Sept 30	RNTR		53		1			swollen belly
95	Sept 30	RNTR		64		2			swollen belly
96	Sept 30	RNTR		80		5			

Table III-5 (cont.)

Running Order	Sample Date	Species	Tag number	Fork length (mm)	Total length (mm)	Weight (g)	Sex	Sexual condition	Additional comments
97	Sept 30	Brook		152		40	M	Ripe	
98	Sept 30	RNTR		124		19			
99	Sept 30	Brook		88		6			
100	Sept 30	RNTR		75		4			
101	Sept 30	RNTR		72		4			very swollen belly
102	Sept 30	Brook		89		6			sacrificed; swollen belly; had fish eggs inside stomach
103	Sept 30	RNTR		62		2			
104	Sept 30	RNTR		56		2			swollen belly
105	Sept 30	Brook		98		10			
106	Sept 30	Brook		85		6			
107	Sept 30	Brook		99		9			
108	Sept 30	RNTR		211		107			
109	Sept 30	RNTR		66		3			swollen belly
110	Sept 30	RNTR		63		2			
111	Sept 30	Brook		167		52	M	Ripe	
112	Sept 30	Brook		128		25	M	Ripe	
113	Sept 30	RNTR		65		3			
114	Sept 30	RNTR		68		3			
115	Sept 30	RNTR		64		2			swollen belly
116	Sept 30	RNTR		105		13			
117	Sept 30	RNTR		68		4			swollen belly
118	Sept 30	RNTR		77		5			swollen belly
119	Sept 30	RNTR		62		2			cysts on mid ventral surface
120	Sept 30	RNTR		77		4			
121	Sept 30	RNTR		63		2			
122	Sept 30	Brook		99		8			
123	Sept 30	Brook		151		39			
124	Sept 30	RNTR		64		2			swollen belly
125	Sept 30	Brook		138		29			
126	Sept 30	Brook		134		22			
127	Sept 30	RNTR		131		22			
128	Sept 30	RNTR		73		3			swollen belly
129	Sept 30	RNTR		61		2			swollen belly
130	Sept 30	Brook		114		15			
131	Sept 30	RNTR		75		2			
132	Sept 30	Brook		184		57	F	Ripe	
133	Sept 30	Brook		89		8			
134	Sept 30	RNTR		68		2			
135	Sept 30	Brook		99		8			
136	Sept 30	RNTR		68		3			
137	Sept 30	RNTR		136		24			
138	Sept 30	RNTR		77		3			
139	Sept 30	RNTR		66		3			
140	Sept 30	RNTR		65		2			swollen belly
141	Sept 30	RNTR		123		19			
142	Sept 30	RNTR		68		4			swollen belly
143	Sept 30	RNTR		58		2			swollen belly
144	Sept 30	Brook		202		96	M	Ripe	lesions on lower left side

Table III-5 (cont.)

Running Order	Sample Date	Species	Tag number	Fork length (mm)	Total length (mm)	Weight (g)	Sex	Sexual condition	Additional comments
145	Sept 30	Brook		168		52			
146	Sept 30	Brook		150		39			
147	Sept 30	Brook		179		54			
148	Sept 30	Brook		139		30	M	Ripe	
149	Sept 30	Brook		137		27	M	Ripe	
150	Sept 30	Brook		142		27	M	Ripe	
151	Sept 30	Brook		89		5			
152	Sept 30	RNTR		53		1			
153	Sept 30	RNTR		69		3			mortality; swollen belly w/cysts; fish eggs in stomach
154	Sept 30	Brook		152		39	M	Ripe	
155	Sept 30	Brook		133		26	M	Ripe	
156	Sept 30	RNTR		64		2			
157	Sept 30	RNTR		64		2			
158	Sept 30	Brook		83		5			very swollen belly
159	Sept 30	Brook		187		59	F	Spent	disformed dorsal fin
160	Sept 30	Brook		81		5			
161	Sept 30	Brook		140		27	F	Mat	
162	Sept 30	Brook		90		6			
163	Sept 30	Brook		101		11			
164	Sept 30	Brook		102		10			
165	Sept 30	Brook		90		8			swollen belly
166	Sept 30	Brook		138		31			swollen belly
167	Sept 30	Brook		179		64	F	Ripe	
168	Sept 30	Brook		136		27			
169	Sept 30	Brook		80		5			
170	Sept 30	Brook		69		3			swollen belly
171	Sept 30	Brook		158		42	M	Ripe	
172	Sept 30	Brook		145		29			
173	Sept 30	Brook		173		54	M	Ripe	
174	Sept 30	Brook		168		51	M	Ripe	
175	Sept 30	Brook		152		41	M	Ripe	
176	Sept 30	Brook		154		41	M	Ripe	
177	Sept 30	Brook		154		37	M	Ripe	
178	Sept 30	Brook		90		8			
179	Sept 30	Brook		93		7			
180	Sept 30	Brook		87		6			
181	Sept 30	Brook		68		3			
182	Sept 30	Brook		130		20			
183	Sept 30	RNTR		55		1			
184	Sept 30	Brook		134		26	M	Ripe	
185	Sept 30	Brook		92		7			
186	Sept 30	Brook		154		40	M	Ripe	
187	Sept 30	Brook		124		20			
188	Sept 30	Brook		92		9			swollen belly

10.0 APPENDIX IV: PROJECT PROPOSAL SUBMITTED TO FISHERIES MANAGEMENT ENHANCEMENT PROGRAM AND PROJECT EXPANSION SUBMISSION TO THE FOOTHILLS MODEL FOREST PROGRAM

FISHERIES MANAGEMENT EHANCEMENT PROGRAM (FMEP)
PROJECT SUBMISSION FORM

Project title: Bull trout spawning and rearing evaluation - Edson Region

Purpose: To identify bull trout spawning and rearing habitat in tributaries of the McLeod, Berland and Wildhay rivers and to assess the techniques used during a previous study (Hildebrand 1985) that identified potential bull trout spawning areas by locating ice-free areas during aerial reconnaissance surveys flown during winter conditions.

Objective(s): **1)** Ground-truth potential spawning areas identified by Hildebrand (1985) as having high to medium potential for bull trout to assess the use of aerial reconnaissance surveys during ice-conditions to identify potential bull trout spawning areas. Ground-truthing would rely on redd surveys.
2) Conduct redd surveys along other selected streams in the general area that baseline studies have been conducted on and are known to support bull trout (e.g., Muskeg River and Eunice Creek).
3) As time permits, electrofishing and/or snorkel surveys would be conducted in the mainstem and tributaries of the McLeod, Berland and Wildhay rivers to determine bull trout rearing use and population status in each system. Other tributaries of the Athabasca River in Fisheries Management Area #4 may also be surveyed. Discussions with Alberta Fish and Wildlife Division (F&W) would be held to determine the order of priority for surveying streams.

Description of study area: The study area includes the Berland, Wildhay and McLeod river systems. All three rivers are tributaries of the Athabasca River and are located within Fisheries Management Area #4.

Bull trout (Salvelinus confluentus) are native to many streams and rivers in the eastern slope region of Alberta. Bull trout populations have experienced drastic declines in the 50 years and recently bull trout were placed on a vulnerable species list by the Committee On the Status of Endangered Wildlife In Canada (COSEWIC).

In an attempt to improve the database to effectively manage and protect bull trout populations, F&W in 1985 commissioned R.L.& L. Environ. Serv. Ltd. to examine the status of bull trout and identify potential spawning areas within the Berland, Wildhay and McLeod river systems. Hildebrand (1985), the report generated from that study, employed a review of the existing information, an aerial survey to locate groundwater sources (open-water areas located during ice-conditions) and site-specific habitat evaluations conducted during ice-conditions. Hildebrand (1985) stated the experimental methods "were considered to be effective in terms of identifying, on an overview level, the potential of selected streams for bull trout spawning". Hildebrand (1985), however, was unable to confirm bull trout spawning during field research and consequently recommended additional studies be conducted to confirm spawning activity along reaches of streams identified as having high bull trout spawning potential. Hildebrand (1985) reported "subjective assessments of bull trout abundance (obtained from interviews with local people and government personnel) were often the only basis for determining population status." and recommended that follow-up studies be conducted to provide information on bull trout rearing use and population status. Follow-up studies to confirm bull trout spawning in the areas identified by Hildebrand (1985) have never been conducted. Although there have since been some studies conducted on the watersheds examined in 1985, directed studies specific to bull trout have not been conducted.

Methods: Data Collection - Trutta Environments and Management (Cochrane, Alberta) would be contracted to collect field data and complete the final report. Methods employed during data collection would include bull trout redd, electrofishing and snorkel surveys. Redd surveys would be conducted along selected streams. Physical (*e.g., stream depth, gradient, width, temperature, velocity, substrate, cover type, bank description*) and chemical (*surface water and groundwater: dissolved oxygen, pH, conductivity and alkalinity*) stream parameters would be recorded from redds. Redd surveys would also be conducted on the Muskeg River and Eunice Creek where recent studies have confirmed bull trout are present. Electrofishing and snorkel surveys would be conducted to determine the distribution and abundance of bull trout in selected reaches of the study area. Initial electrofishing surveys would be conducted to determine the relative abundance, presence/absence and fork length distributions of bull trout. Time permitting, follow-up surveys would be conducted to determine bull trout densities. Snorkel surveys would also be conducted in some streams and rivers to determine bull trout densities.

Statistics - Descriptive observations would be employed.

Special equipment - see equipment rentals in appended Detailed Budget.

Timetable - Some field work (electrofishing and snorkel surveys) may be conducted in July, 1993. Redd surveys would be conducted in late Aug., 1993. All field work would be completed by Oct. 31, 1993. Data analysis and report preparation would be completed by in the following 6-8 months.

Benefits: 1) F&W has invested significant funds and resources in winter research projects using aerial surveys to identify potential bull trout spawning areas. A study similar to Hildebrand (1985) was also conducted in the Peace River region near Grande Prairie. However, follow-up research has never been conducted to confirm whether either study successfully identified bull trout spawning habitat. The proposed project would assess the success of Hildebrand (1985) while also helping to evaluate the success of the Grande Prairie study. **2)** Bull trout populations have declined and adult numbers within the proposed study area may be too low to result in redd observations that would determine whether Hildebrand (1985) successfully identified bull trout spawning areas. If this worst-case scenario has occurred, then the combination of the electrofishing, snorkelling and redds surveys would help evaluate of the success of Hildebrand's (1985) methods, and provide information that is needed to effectively manage remnant bull trout populations within the study area. **3)** As a conservation organization TUC is concerned with the current status of bull trout. TUC is committed to work with F&W and other jurisdictions to gain a better understanding of the status and ecology of bull trout in the province. This project would be one component of TUC's program to rehabilitate bull trout populations in Alberta. A list of other bull trout projects TUC is attempting to launch in 1993 has been appended. TUC believes the proposed project would provide information necessary to help members of TUC's proposed bull trout workshop/task force make informed recommendations to government to help rehabilitate bull trout in Alberta. **4)** The funds received for this project would serve a dual purpose of providing critical information to F&W and helping to generate other funds for TUC's bull trout program from other funding sources (e.g., Alberta Environmental Research Trust, and Wildlife Habitat Canada) and corporate sponsors.

Implementation option: Project funds would be administered by TUC.

Involvement (including % cost shared):

	FMEP	$ 41,660.00 (85%)
	TUC	7,400.00 (15%)
Total estimated project value		**$ 49,060.00**

Budget:	**Fiscal year**	
Funds requested from FMEP	July 1, 1993, June 30, 1994	
Manpower		$ N/A
Contract services		27,460.00
Supplies and services		11,475.00
Fixed Assets		N/A
Others (G.S.T.)		2,725.00
	TOTAL	$ 41,660.00

Other Sources of Funds

Project related contributions by Trout Unlimited Canada (e.g., Adminstration, project supervision, etc)	$ 4,900.00

Volunteer contributions

Volunteer labour from the Edmonton Chapter of Trout Unlimited Canada	$ 2,500.00
TOTAL PROJECT COST	**$ 49,060.00**

Expansion of Trout Unlimited Canada's Fishery Inventory Project to Identify Bull Trout Spawning and Rearing Habitat in the McLeod, Wildhay, Berland and Muskeg River Systems

Bull trout are one of only four trout species native to Alberta. The others are westslope cutthroat trout, lake trout and rainbow trout (native only to the Athabasca River system). Although once the most widespread and probably most abundant trout species in the province, it is generally accepted that the distribution and numbers of bull trout has declined dramatically during the last 40-50 years. This decline has resulted in their recognition in 1991 as a "vulnerable species" by the Committee On the Status of Endangered Wildlife In Canada (COSEWIC). In 1987, bull trout were classified as a "species of special concern" by the American Fisheries Society. Although they were formerly distributed throughout most of Alberta, they are now generally confined to streams, lakes and rivers in the mountains and foothills along the western portion of the province.

Out of concern for the status of bull trout in Alberta the Bull Trout Task Force (Alberta) (BTTF) was established in January 1993. The BTTF includes representation from conservation organizations (Trout Unlimited Canada, Alberta Fish and Game Association, Alberta Wilderness Association, Federation of Alberta Naturalists, and Canadian Parks and Wilderness Society), government agencies (Alberta Fish and Wildlife Service, Canadian Parks Service and Department of Fisheries and Oceans), private fishery biologists (Pisces Environmental Consulting Services Ltd.) and academic fishery biologists (Department of Zoology, University of Alberta). The BTTF was established to help facilitate the recovery of bull trout in Alberta.

Being a conservation organization, Trout Unlimited Canada (TUC) is also very concerned about bull trout populations in the province and has initiated several bull trout related projects throughout the range of the species in Alberta during 1993. One of TUC's major projects is in Fisheries Management Area (FMA) #4 that involves identifying bull trout spawning and rearing areas in the McLeod, Wildhay, Berland and Muskeg drainages. Part of the study involves groundtruthing areas identified in a consultants report (R.L. and L Environmental Services) from 1985 as having a high or medium potential for bull trout spawning. The groundtruthing is being performed to confirm whether bull trout spawning may be occurring in these areas. The study also involves conducting electrofishing and redd count surveys in tributaries of the McLeod, Wildhay, Berland and Muskeg river systems to help identify potential bull trout spawning and rearing areas.

The field component of TUC's bull trout project in FMA #4 began in early August 1994. Preliminary results from it and results from other recent bull trout investigations suggest only remnant populations of bull trout may remain in the McLeod and Wildhay river systems. Consequently, because one of the objectives of the TUC study is to identify the spawning requirements of bull trout in foothill streams, TUC is having to focus most of their effort in the Muskeg River system and more remote areas in the Berland and Wildhay River systems (i.e., Willmore Wilderness Area). TUC is attempting to secure additional funding from the Foothill's Model Forest Program that will allow the investigators to examine streams in the McLeod, Wildhay and Berland drainages that flow through the Foothill's

Model Forest Area. The study would provide information that would be very useful to the Model Forest Program. For example, the electrofishing surveys being conducted by TUC's investigators are collecting information relative abundance, absence/presence, weight and length of all fish species captured. Snorkel surveys are also planned but their use will likely be limited. The physical characteristics of stream parameters at observed bull trout redds will also be recorded (i.e., stream depth, gradient, width, temperature, velocity, substrate, cover type, and bank description). Consequently, important baseline data is being collected on several species. Additionally, TUC's study will help identify which streams could provide candidate study areas for future aquatic studies conducted by the Model Forest Program. The information collected by TUC's research team could also provide valuable information to the Model Forest's proposed DSS program.

To date, TUC's study team has examined sites for bull trout spawning and rearing potential in Drinnan, Anderson, Wampus, Deerlick, Collie, Cabin, Moon, MacKenzie, Fox, Beaver, Stern, Mason, Veronique, Plante, Lone Teepee, Shand, Hendrickson, Vogel, Evans, Chapman, Mahon, Susa, and Findley creeks and an unnamed tributary on the Muskeg River as well as in the N. Wildhay, Embarras, Muskeg and Little Berland rivers. Without additional funding, it is expected that the majority of TUC's remaining funding will be used to examine sites where the probability of locating healthy populations is greatest (i.e., in the Willmore Wilderness Area and Muskeg River system). However, TUC is concerned that more investigations need to be conducted to help assess the status of fish populations in McLeod, Wildhay and Berland river systems. The additional funding requested from the Foothills Model Forest program would allow TUC to place more emphasis on streams inside the Model Forest Area and increase the probability of locating potential study sites in this area that may contain healthy populations of bull trout, rainbow trout or other species of fish that may be of interest to the Model Forest Program.

The amount of funding requested from the Model Forest Program is $22,300.00. The expected value of TUC's original project is $49,060.00. If a joint project between TUC and the Model Forest Program can be agreed to, the value of the original project could be used as a contribution towards the Model Forest Program.

Estimated Budget for Expansion of TUC's Fishery Inventory Project to Identify Bull Trout Spawning and Rearing Habitat in the McLeod, Wildhay, Berland and Muskeg River Systems

Salary Expenses

Field	
Biologist (20 field days @ $300/day)	$6,000.00
Technician (20 field days @ $220/day)	$4,400.00
Office (analysis and report writing)	
Biologist (10 man days @ $300/day)	$3,000.00
Technician (4 days @ $220/day)	$880.00

Travel and Away Expenses

Vehicle allowance ($0.25/km)	
1round trip Calgary - Edson @ 900 km/trip	$225.00
travel allowance in field (3000 km)	$750.00
Living allowance (accom. & meals 20 d @ $30/day/pers X 2 pers.)	$1,200.00

Equipment rentals and expenses

All terrain vehicle (Fourtrax) ($1300/month rent & oper. expenses)	$1,300.00
Electroshocker (4 weeks @ $200/week)	$800.00
Canoe (4 weeks @ $85/week)	$340.00
Aerial photographs	$200.00
Visible implant fish tags (500 tags @ $1.20/tag)	$600.00
Photocopying	$300.00
Telephone/fax/courier	$200.00
Fish sampling equipment (1 set for 20 d @ $7.50/d)	$150.00
Incidental expenses	$500.00
Total	$20,845.00
G.S.T.	$1,459.15
Total w/G.S.T.	$22,304.15