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Information in support of a recovery potential assessment of Mountain Sucker (*Catostomus platyrhynchus*), Milk River populations (Designatable Unit 2)

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Foreword

This series documents the scientific basis for the evaluation of aquatic resources and ecosystems in Canada. As such, it addresses the issues of the day in the time frames required and the documents it contains are not intended as definitive statements on the subjects addressed but rather as progress reports on ongoing investigations.

Research documents are produced in the official language in which they are provided to the Secretariat.

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ABSTRACT

In Canada, the Milk River system populations of Mountain Sucker (*Catostomus platyrhynchus*) are distributed in southwestern Saskatchewan and west in the Milk and North Milk rivers in southern Alberta. They appear to be disjunct from their conspecifics elsewhere in Canada. In November 2010, the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) assessed these populations of Mountain Sucker as a separate designatable unit (DU2) and assigned them a designation of Threatened. While there is no evidence to suggest that the Milk River populations have declined in abundance since the species was first identified there, COSEWIC considers this small, bottom-dwelling freshwater fish to be at risk due to its small area of occupancy and number of locations (eight). These conditions make Mountain Sucker particularly susceptible to habitat loss and degradation from altered flow regimes and drought that climate change is expected to exacerbate.

The Milk River populations of Mountain Sucker will be considered for legal listing under the *Species at Risk Act* (SARA). In advance of making a listing decision, Fisheries and Oceans Canada (DFO) has undertaken a Recovery Potential Assessment (RPA) that summarizes our current understanding of the distribution, abundance, and population trends of Mountain Sucker in DU2, along with recovery targets and times. Identification of threats to both the sucker and its habitat, and measures to mitigate these impacts, are also reported. This information may be used to inform the development of recovery documents, and to support decision-making with regards to the issuance of permits, agreements and related conditions under the SARA.

Information à l’appui de l’évaluation du potentiel de rétablissement du meunier des montagnes (Catostomus platyrhynchus), populations de la rivière Milk (unité désignable 2)

RÉSUMÉ

Au Canada, l'aire de distribution des populations de meunier des montagnes (*Catostomus platyrhynchus*) du réseau hydrographique de la rivière Milk comprend le sud-ouest de la Saskatchewan et, à l'ouest, les rivières Milk et North Milk dans le sud de l'Alberta. Ces populations semblent être isolées des populations conspécifiques ailleurs au Canada. En novembre 2010, le Comité sur la situation des espèces en péril au Canada (COSEPAC) a évalué ces populations de meunier des montagnes en tant qu'unité désignable distincte (UD2) et les a désignées comme étant menacées. Même si rien ne semble indiquer un déclin de l'abondance des populations de la rivière Milk depuis que l'on a attesté la présence de cette espèce dans la rivière pour la première fois, le COSEPAC considère ce petit poisson de fond comme étant en péril en raison de sa petite aire de répartition et du nombre d'emplacements (huit). Ces conditions rendent le meunier des montagnes particulièrement vulnérable aux pertes et aux dégradations d'habitat causées par la modification des régimes d'écoulement et des sécheresses que le changement climatique pourrait exacerber.

Les populations de meunier des montagnes de la rivière Milk seront à l'étude pour une inscription juridique en vertu de la *Loi sur les espèces en péril* (LEP). Avant de prendre une décision concernant l'inscription, Pêches et Océans Canada (MPO) a entrepris une évaluation du potentiel de rétablissement (EPR) qui résume les connaissances actuelles à propos de l'aire de répartition, de l'abondance et des tendances des populations du meunier des montagnes de l'UD2 ainsi que les cibles et les calendriers de rétablissement. L'évaluation fait également état des menaces qui pèsent sur le meunier et son habitat et de mesures pouvant atténuer leurs répercussions. Ces renseignements peuvent servir de base à l'élaboration de documents relatifs au rétablissement et aider à la prise de décisions en ce qui a trait à l'émission de permis, aux ententes et aux conditions connexes conformément à la LEP.

SPECIES INFORMATION

Scientific Name – *Catostomus platyrhynchus*
Common Name – Mountain Sucker
Range in Canada

DU1 Saskatchewan-Nelson River populations (Alberta and Saskatchewan)
DU2 Milk River populations (Alberta and Saskatchewan)
DU3 Pacific populations (British Columbia)

Current COSEWIC Status and Year of Designation

DU1 – Not at Risk, 2010
DU2 – Threatened, 2010
DU3 – Special Concern, 2010

COSEWIC Reason for Designation for DU2 (Milk River populations) – "This small freshwater fish is limited to the Milk River basin of southern Alberta and Saskatchewan. It has a small area of occupancy and number of locations (8) that make it particularly susceptible to habitat loss and degradation from altered flow regimes and drought that climate change is expected to exacerbate." (COSEWIC 2010)
Canada *Species at Risk Act* – No schedule, no status
Alberta *Wildlife Act* – No status
Saskatchewan *Wildlife Act* – No status

BACKGROUND

The Mountain Sucker (*Catostomus platyrhynchus* Cope 1874) is a small bottom-dwelling freshwater fish (Figure 1) that is relatively widespread throughout the western mountainous regions and westernmost Great Plains of North America. The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) recently identified three DUs of Mountain Sucker in Canada:

DU1 Saskatchewan-Nelson River populations, DU2 Milk River populations, and DU3 Pacific populations). This document evaluates the potential for recovery of Mountain Sucker in DU2.

Figure 1. Mountain Sucker. Used with permission of D. Watkinson.

TAXONOMY

The taxonomic history of Mountain Sucker is described in COSEWIC (2010). The current taxonomy of Mountain Sucker is generally accepted (Scott and Crossman 1998; Nelson et al. 2004).

Smith (1966) defined three populations of Mountain Sucker based on intraspecific morphological and geographic variation. The first definable population is that of the Missouri River and Columbia River drainages, including populations from the Saskatchewan River, but excluding those from above the falls of the Snake River. The second population is that from the Great Basin and upper Snake River. The third is from the upper Colorado River drainage. Smith (1966) suggested that these populations may warrant subspecies designation based on their distinctions. However, the morphological variation between these populations does not significantly exceed that found within populations (Smith 1966). This morphological variability prevents clear taxonomic resolution between conspecific species, and most notably the resolution between the subgenera *Pantosteus* and *Catostomus* (Smith 1966).

Mountain Sucker in the Missouri drainage originated in the western Wyoming area and later spread eastward and northward in the late Pliocene to early Pleistocene (Love et al. 1963; Smith 1966). Mountain Sucker in the upper Missouri, Milk, and Saskatchewan rivers drainages presumably survived glaciation in a Missouri refugium (Cross et al. 1986; Minckley et al. 1986). Genetic work by Smith and Koehn (1971) and Smith (1992) did not resolve the taxonomic status although Moyle (2002) suggested that molecular data could result in the emergence of several distinct taxa. McPhail (2007) suggested Mountain Sucker might be several species occurring in disjunct distributional pockets across the Continental Divide, which should be investigated further.

Mitochondrial and nuclear DNA sequencing data from Mountain Sucker provide evidence of at least four divergent lineages across the species' global range (Taylor and Gow 2008). These lineages include the upper Missouri drainage (North Milk and Frenchman rivers) in Alberta and Saskatchewan, South Saskatchewan drainage (Willow Creek) in Alberta, the lower Columbia/Fraser systems (lower and upper Fraser and Willamette rivers), and the upper Snake River (above Shoshone Falls). Three of these lineages occur in Canada: two within the Missouri and Saskatchewan rivers and one within the Columbia/Fraser drainage (Taylor and Gow 2008). The fourth lineage appears to be endemic to the Snake River drainage where morphologically and genetically distinctive Mountain Sucker occur below Shoshone Falls (McPhail 2007; Taylor and Gow 2008).

COSEWIC determined three DUs for Mountain Sucker in Canada. Each DU represents one of three major phylogenetic lineages in Canada with an average mtDNA sequence divergence of about 5% (range: 3.5% to 8.2%). Additionally, each DU is found in a different National Freshwater Biogeographic Zone (COSEWIC 2010): (1) Saskatchewan-Nelson in Alberta and Saskatchewan, (2) Missouri in Alberta and Saskatchewan, and (3) Pacific in British Columbia. Each of the three zones represents natural disjunctions with no possibility of natural dispersal since the end of the last glaciation. One specimen from the Missouri zone was genetically similar to specimens from Lee Creek of the Saskatchewan-Nelson zone (Taylor and Gow 2008), which may have resulted from linkage of the Missouri and Saskatchewan-Nelson watersheds via the St. Mary River diversion. Mountain Sucker in the Missouri zone is part of a fauna that is found in the only Canadian drainage system that eventually flows to the Gulf of Mexico (via its connections with the Mississippi River). The loss of populations that comprise each DU would result in an extensive gap in the range of the species in Canada. The three DUs are named after the zones in which they are found: Saskatchewan-Nelson River populations (DU1), Milk River populations (DU2), and Pacific populations (DU3).

SPECIES BIOLOGY AND ECOLOGY

There has been very little research directed at understanding the biology of Mountain Sucker in Canada. Scott and Crossman (1998) summarized the information for Canadian populations. However, most of the information on the species in the COSEWIC status report (COSEWIC 2010) comes from United States of America (U.S.) populations (Smith 1966; Hauser 1969; Wydoski and Wydoski 2002; Belica and Nibbelink 2006; Dauwalter et al. 2008). It is unknown to what extent the life history of the Canadian populations in DU2 mirrors those in the U.S. Recent scientific sampling has been undertaken in North Milk and Milk rivers in Alberta, and Battle Creek and Frenchman River tributaries in Saskatchewan (DFO, unpubl. data) although this sampling did not usually target Mountain Sucker.

Morphology

Suckers, in general, are medium-sized subcylindrical fishes with ventral, subterminal, protrusible, large-lipped mouths characteristic of the family *Catostomidae* (Scott and Crossman 1998). Mountain Sucker is a small catostomid with an elongate subcylindrical body somewhat compressed caudally (Figure 1). Mountain Sucker typically range from 127 to 152 mm total length (TL) as adults (Sigler and Miller 1963). The Royal Ontario Museum (ROM) records include a 232 mm TL male Mountain Sucker collected in Alberta in 1964 (ROM 25919). Detailed descriptions of Mountain Sucker can be found in Smith (1966); Carl et al. (1967); Nelson and Paetz (1992); and Scott and Crossman (1998).

Principle species characteristics include a fleshy, broad (approximately 50% of head length), and rounded snout. The mouth is large and ventral with lips that often exceed the width of the head, and that have large papillae except on the anterolateral corners and outer face of the upper lip (Smith 1966). There is a distinct notch at each corner of the mouth between the upper and lower lip (Smith 1966; Nelson and Paetz 1992) and a cartilaginous sheath on the lower jaw (Scott and Crossman 1998). There are no teeth in the mouth and the pharyngeal teeth are flat and comb-like. There are 23 to 37 gill rakers on the external row of the first arch and 31 to 51 on the internal row (Smith 1966; Scott and Crossman 1998). Cycloid scales cover the body and are crowded toward the head. They usually number 75–92 (ranging between 60 and 108) in the lateral line. Mountain Sucker has a two-chambered swim bladder, moderately reduced (Smith 1966; Scott and Crossman 1998). Post-Weberian vertebrae usually number 40–43 (ranging between 38–44), however, specimens from the Milk River and North Saskatchewan River system appear to have larger numbers (ranging between 43 and 48; Nelson and Paetz 1992). The peritoneum is dark and the long coiled intestine is six times standard length and occasionally 10 coils (Smith 1966). There are no pyloric caeca. An average of 10 (8-13) soft dorsal rays, nine pelvic rays and 15 pectoral rays are typical. The pelvic fins are located in line with the middle of the base of the dorsal fin with a well-developed axillary process. The pectoral fins are long whereas the caudal fin is not particularly long or deeply forked. The anal fin has seven rays (COSEWIC 2010). It is possible that fish from the same river system may show differences related to current such as the width and shape of the caudal peduncle (Smith 1966).

Mountain Sucker adults are a dark green to grey or brown dorsally and laterally, finely speckled with black, and are a light yellow colour ventrally (Nelson and Paetz 1992). They have a darker contrasting lateral band, typically from snout to tail (Nelson and Paetz 1992) and/or three dorsal/lateral blotches (McPhail 2007). The lateral line is complete, but not prominent. Fins generally have little colour.

Both sexes develop secondary sex characteristics during the breeding season. Breeding males typically develop a rosy (orange to deep red) midlateral stripe that is absent or faint in females (McPhail 2007). Fins may become more coloured. Breeding males develop small nuptial tubercles over their entire body; larger tubercles may develop on the lower lobe of the caudal fin, the dorsal surface of paired fins and on the anal fin (Scott and Crossman 1998). Breeding females may also have nuptial tubercles although they are usually smaller and fewer than on males (Smith 1966; Hauser 1969; Scott and Crossman 1998).

A black peritoneum is visible from external examination of Mountain Sucker juveniles (Scott and Crossman 1998). Snyder (1983) provides a description (and key) of larvae and young juveniles.

Mountain Sucker can be distinguished from other catostomids, except the Bridgelip Sucker (*Catostomus columbianus*), by the incomplete cleft of the lower lip. The pronounced and deep notches at the corners of the mouth, the absence of papillae on the anterior vertical surface of the lips and lower scale and fin ray counts distinguish it from the Bridgelip Sucker (Smith 1966; Carl et al. 1967).

Growth and Reproduction

Smith (1966) and Hauser (1969) describe much of what is known about the life cycle and reproductive strategies of Mountain Sucker. Mountain Sucker usually spawn in riffles adjacent to pools of swift to moderate mountain streams usually beginning in late spring to early summer (May to July). The spawning season is spatially influenced by both latitude and altitude, generally being later in more northern latitudes or at higher elevations (Wydoski and Wydoski 2002). Mature Mountain Sucker females in spawning condition have been collected with ovaries containing mature eggs and small recruitment eggs (Hauser 1969). Hickling and Rutenburg (1936) considered this to be indicative of a short definite spawning season. In Montana, maximum egg development occurred during the last week of June and decreased by August, suggesting that spawning occurred in late June and early July when water temperatures were between 11 and 19°C (Hauser 1969). This is consistent with Scott and Crossman's (1998) suggestion of spawning when water temperatures are between 10.5–18.8°C. Mountain Sucker has multiple years of spawning. If there is a year when spawning success is compromised there is the potential for successful spawning in a subsequent year.

Similar to other fishes, Mountain Sucker fecundity is related to length and age, with older and larger females bearing more eggs (Scott and Crossman 1998) although this varies among watersheds (Cannings and Ptolemy 1998). In Montana, Hauser (1969) estimated the number of eggs ranged from 990 (131 mm TL female from Flathead Creek) to 3,710 (184 mm TL female from the East Gallatin River). Wydoski and Wydoski (2002) found the average fecundity for 20 females was 2,087 eggs (range: 1,239–2,863 eggs, standard error (SE) = 123.6) in Lost Creek Reservoir, Utah.

Mature eggs are translucent yellow in colour and are usually between 1.5–2.2 mm in diameter (Hauser 1969). The eggs are demersal and likely adhesive and are deposited along the stream bed; no nest is built (Scott and Crossman 1998) and no parental care is likely given. The incubation period has not been determined, but is probably in the range (8–14 days) of other suckers (Stewart 1926; Geen et al. 1966; Scott and Crossman 1998).

Mountain Sucker generally grows slowly in cool mountain streams. During mid-summer, newly hatched larvae (approximately 8.5 mm in length) are thought to stay in the gravel until they are 10 mm in length (Smith 1966; McPhail 2007) after which they drift into nursery habitats. Exogenous feeding begins once the larvae reach approximately 13 mm (McPhail 2007). Fry have been collected in shallow, low current habitats in streams and along shorelines in reservoirs and lakes (Belica and Nibbelink 2006). These fry may reach 30 to 36 mm TL by mid-September (Scott and Crossman 1998). The time of first annulus formation is approximately June of the year following hatching at approximately 49 mm (ranging between 38–60 mm; Hauser 1969) Growth is greatest during the first year and decreases until the third year after which growth increments are uniformly small. Hauser (1969) provides mean TL at age and an equation for the length-weight relationship. The largest Mountain Sucker captured in the Milk River in 2007 was approximately 188 mm TL (DFO, unpubl. data).

In general, female Mountain Sucker tend to be longer than males of the same age, and usually live longer, males to about seven years, females at least nine years (Geen et al. 1966; Harris 1962; Hauser 1969; Raney and Webster 1942). Mature female Mountain Sucker typically range from 90 to 175 mm and males from 64 to 140 mm (Smith 1966; Hauser 1969). In the Milk River watershed the smallest mature female examined was 78 mm TL while the smallest mature male was 65 mm TL (DFO, unpubl. data).

Age at maturity varies across the species' range. Smith (1966) reported some Mountain Sucker reached maturity at the end of the second or occasionally the first year. In Utah, Wydoski and Wydoski (2002) reported 90% of males were mature by their second year, and all were mature by their third year. Some females (28%) were mature at the end of their second year, 91% were mature by the end of their third year, and all females were mature by their fourth year. Males typically matured as early as age two and all by the age four (Hauser 1969). McPhail (2007), reported typical ages of maturity in British Columbia as four and five years for males and females, respectively. Fluctuations in environmental conditions between localities may influence larvae development (McCormick et al. 1977), and early maturing fish are likely the faster growing fish of an age group (Alm 1959).

Ecological Role / Food Habits

The Mountain Sucker is an ecologically specialized periphyton scraper that uses the horny edges of its jaws to scrape algae off rocks (Carl et al. 1967). Diatoms, *Closterium*, and filamentous algae species compose the majority of their diet (Hauser 1969). Invertebrates are secondary diet items (Smith 1966). Mountain Sucker is a link between primary producers and higher level consumers in the aquatic food chain (Wydoski and Wydoski 2002). Small Mountain Sucker may be preyed on by many other species, including birds, mammals, and fishes (Scott and Crossman 1998). Stream-dwelling salmonids such as Cutthroat Trout (*Oncorhynchus clarkii*), Rainbow Trout (*Oncorhynchus mykiss*), Brook Trout (*Salvelinus fontinalis*), and Brown Trout (*Salmo trutta*) are important predators (Goettl and Edde 1978; Erman 1986; Wydoski and Wydoski 2002) as are other large predatory species like Walleye (*Sander vitreus*) and Northern Pike (*Esox lucius*) in regions where their distributions overlap.

Dispersal and Migration

Little information is available on the movements of Mountain Sucker in Canada. In Montana, Hauser (1969) found that in late winter and early spring larger adults were usually found adjacent to pools in moderate current (0.5 m/sec) and at depths of 1 to 1.5 m. During spawning these same sized fish were most abundant in riffle areas below pools. After spawning they moved back into deep pools. They usually used areas with bank cover and often formed small schools separate from other catostomids. Smaller fish tend to be found around obstructions in areas of moderate current, but retreat to deeper areas if disturbed (Hauser 1969). In Utah, Decker and Erman (1992) observed short-term seasonal changes in distributions mostly with movements from pool habitat to riffles during the spawning season. In their study, they found no evidence for long distance movements of Mountain Sucker. Wydoski and Wydoski (2002) found that Mountain Sucker in Lost Creek would migrate between reservoir and stream habitat to spawn. This is similar to other western reservoirs containing Mountain Sucker where they require a tributary stream with suitable habitat to spawn successfully. How far they travel to find suitable spawning habitat is unknown.

Interspecific Interactions

Mountain Sucker is associated with other fish assemblages throughout their distribution, including salmonids, cyprinids, catostomids, and cottids (Moyle and Vondracek 1985). Fish communities from the Milk River watershed (Table 1a), Battle Creek tributaries (Table 1b) and the Frenchman River tributaries (Table 1c) include both native and introduced species. The Mountain Sucker is sympatric with other catostomid species such as White Sucker (*C. commersonii*), Longnose Sucker (*C. catostomus*), Tahoe Sucker (*C. tahoensis*), Utah Sucker (*C. ardens*), and Bridgelip Sucker in parts of its range, and hybrids between Mountain Sucker and these species have been recorded (Smith 1966). Although Bridgelip Sucker and Mountain Sucker both occur in the North Thompson, Similkameen, and Columbia rivers, hybrids have not been reported from these systems (Smith 1966). It has been reported that the two hybridize in British Columbia although Bridgelip Sucker is found more often in lakes than in streams (R. Carveth, pers. comm., cited in Campbell (1992)).

Hybridization is a concern with maintaining populations of this species. Mountain Sucker have hybridized with Longnose Sucker and White Sucker (Hubbs et al. 1943), with possible hybrids with Bridgelip Sucker also being observed (McPhail 2007). The potential rates of hybridization could be influenced by environmental disturbances. Hybrids of White Sucker and Longnose Sucker are seldom observed in natural systems, but are commonly observed in the disturbed environments of reservoirs in Alberta (Nelson 1973; Stelfox 1987). Habitat disturbance has been suggested as a factor in increasing the potential for hybridization (Seehausen et al. 1997; Taylor et al. 2006; Behm et al. 2010).

Competition with other catostomids might limit range expansion, but this is probably due to physical barriers. Mountain Sucker is more highly specialized in its algae-eating diet and habitat requirements than White or Longnose suckers or other species of *Pantosteus* where the ranges overlap (see Smith 1966; Hauser 1969; Scott and Crossman 1998). Competition among sympatric catostomid species has been suggested to lead to geographic variation in characteristics such as growth, feeding efficiency, body size, and swimming mechanics (Dunham et al. 1979). However, Hauser (1969) found that Mountain Sucker will form exclusive schools, separate from other suckers. This in conjunction with their highly specialized feeding would likely reduce direct competition between sucker species.

Competitive interactions between Mountain Sucker and other species have not been studied. However, because of their small size (generally less than 200 mm TL), they are particularly vulnerable to large piscivorous fish predators (e.g., Northern Pike, Yellow Perch, Walleye and salmonids) throughout their lives (Wydoski and Wydoski 2002).

Adaptability

Mountain Sucker in DU2 inhabits a wide range of stream habitats in isolated populations. They are subjected to periodic natural disturbances such as fires, droughts, and floods. The species is adapted to the fluctuating environments of higher-gradient streams of variable hydrology (Smith 1966; Dunham et al. 1979). It is a multi-year spawning species that lives to perhaps nine years of age in some locations, allowing the species to survive poor spawning years and to take advantage of ideal conditions as they occur (Belica and Nibbelink 2006).

Table 1a. Fish species that occur in the Milk River watershed

Common Name	Scientific Name
Black Crappie*[a]	*Pomoxis nigromaculatus*
Brassy Minnow	*Hybognathus hankinsoni*
Brook Stickleback	*Culaea inconstans*
Burbot	*Lota lota*
Fathead Minnow	*Pimephales promelas*
Flathead Chub	*Hybopsis gracilis*
Iowa Darter	*Etheostoma exile*
Lake Chub	*Couesius plumbeus*
Lake Whitefish*[a]	*Coregonus clupeaformis*
Longnose Dace	*Rhinichthys cataractae*
Longnose Sucker	*Catostomus catostomus*
Mountain Sucker	*Catostomus platyrhynchus*
Mountain Whitefish	*Prosopium williamsoni*
Northern Pike*	*Esox Lucius*
Northern Redbelly Dace	*Phoxinus eos*
Rainbow Trout*[a]	*Oncorhynchus mykiss*
Sauger	*Sander canadensis*
Spottail Shiner*[b]	*Notropis hudsonius*
Rocky Mountain Sculpin (or St. Mary or Eastslope sculpin)	*Cottus sp.*
Stonecat	*Noturus flavus*
Trout-perch*	*Percopsis omiscomaycus*
Western Silvery Minnow	*Hybognathus argyritis*
White Sucker	*Catostomus commersonii*
Walleye*	*Sander vitreus*
Yellow Perch*	*Perca flavescens*

* introduced species
[a] Stash 2001
[b] Montana Fish, Wildlife and Parks

Table 1b. Fish species that occur in the Battle Creek area tributaries.

Common Name	Scientific Name
Brook Stickleback	*Culaea inconstans*
Brook Trout*	*Salvelinus fontinalis*
Brown Trout*	*Salmo trutta*
Burbot	*Lota lota*
Common Carp*	*Cyprinus carpio*
Fathead Minnow	*Pimephales promelas*
Iowa Darter	*Etheostoma exile*
Lake Chub	*Couesius plumbeus*
Longnose Dace	*Rhinichthys cataractae*
Mountain Sucker	*Catostomus platyrhynchus*
Northern Pike*	*Esox Lucius*
Northern Redbelly Dace	*Phoxinus eos*
Pearl Dace	*Margariscus margarita*
Rainbow Trout*	*Oncorhynchus mykiss*
Shorthead Redhorse	*Moxostoma macrolepidotum*
White Sucker	*Catostomus commersonii*

* introduced species

Table 1c. Fish species that occur in the Frenchman River tributaries.

Common Name	Scientific Name
Black Bullhead	*Ameiurus melas*
Brassy Minnow	*Hybognathus hankinsoni*
Brook Stickleback	*Culaea inconstans*
Brook Trout*	*Salvelinus fontinalis*
Brown Trout*	*Salmo trutta*
Burbot	*Lota lota*
Common Carp*	*Cyprinus carpio*
Fathead Minnow	*Pimephales promelas*
Flathead Chub	*Platygobio gracilis*
Iowa Darter	*Etheostoma exile*
Lake Chub	*Couesius plumbeus*
Longnose Dace	*Rhinichthys cataractae*
Mountain Sucker	*Catostomus platyrhynchus*
Northern Redbelly Dace	*Phoxinus eos*
Northern Pike*	*Esox Lucius*
Pearl Dace	*Margariscus margarita*
Shorthead Redhorse	*Moxostoma macrolepidotum*
Stonecat	*Noturus flavus*
Walleye*	*Sander vitreus*
White Sucker	*Catostomus commersonii*
Yellow Perch*	*Perca flavescens*

* introduced species

ASSESSMENT

HISTORIC AND CURRENT DISTRIBUTION AND TRENDS

Mountain Sucker range is generally associated with mountainous freshwater streams in western North America, although it extends east to the Cypress Hills in the Canadian prairies (Figure 2). Mountain Sucker is found in streams of the Great Basin in Utah, Nevada, and California; the North Fork Feather River, California; headwaters of the Green River in Utah, Colorado, and Wyoming; parts of the Columbia River drainage in Wyoming, Idaho, Washington, Oregon, and British Columbia; Fraser River drainage, British Columbia; upper Saskatchewan River drainage, Alberta; Milk River drainage, Alberta, Montana, and Saskatchewan; upper Missouri River drainage, Montana, and Wyoming, and the Black Hills, South Dakota (Smith 1966). It may also occur in White River and may have occurred in the Niobrara River, although Nebraska does not currently include Mountain Sucker in its list of fishes (Nebraska Game and Parks). The Mountain Sucker in northern regions likely represents a glacial relict derivative that has occupied the Missouri, Columbia, South Saskatchewan, and Fraser rivers since at least the last glaciation. Mountain Sucker is believed to have been moving northward with the retreating ice front from Missouri and Cascadia refugia (Hocutt and Wiley 1986). In the past, Mountain Sucker probably went unrecorded because of the lack of directed surveys, the inaccessibility of much of the habitat, and because of the confusion in the taxonomy of the genus and subgenus, which subsequently has been resolved to some extent by Smith (1966).

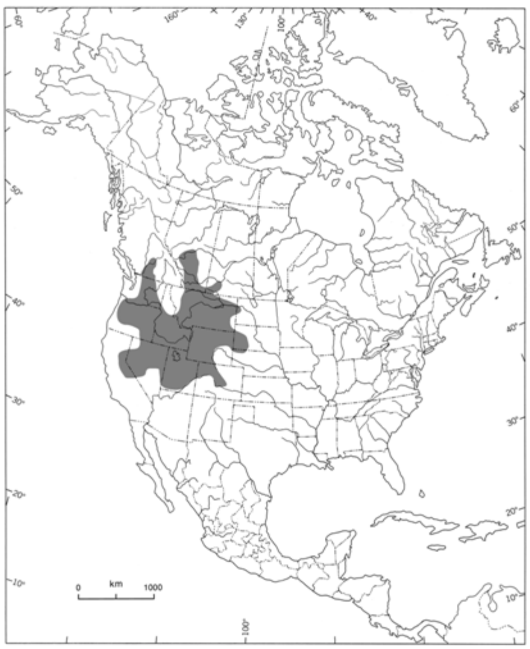

Figure 2. The distribution of the Mountain Sucker in North America (from Atton and Merkowsky (1983), Nelson and Paetz (1992), McPhail (2007), and NatureServe (2008)).

In Canada, Mountain Sucker is not abundant or widely distributed (Scott and Crossman 1998) and its Canadian range is only a small portion (5-10%) of the global range (Figure 2). The first records for the species are from the Cypress Hills region of southwestern Saskatchewan in Belanger and Battle creeks (Figure 3). In Alberta, the Mountain Sucker was first collected in 1950 from the North Milk River (Nelson and Paetz 1992).

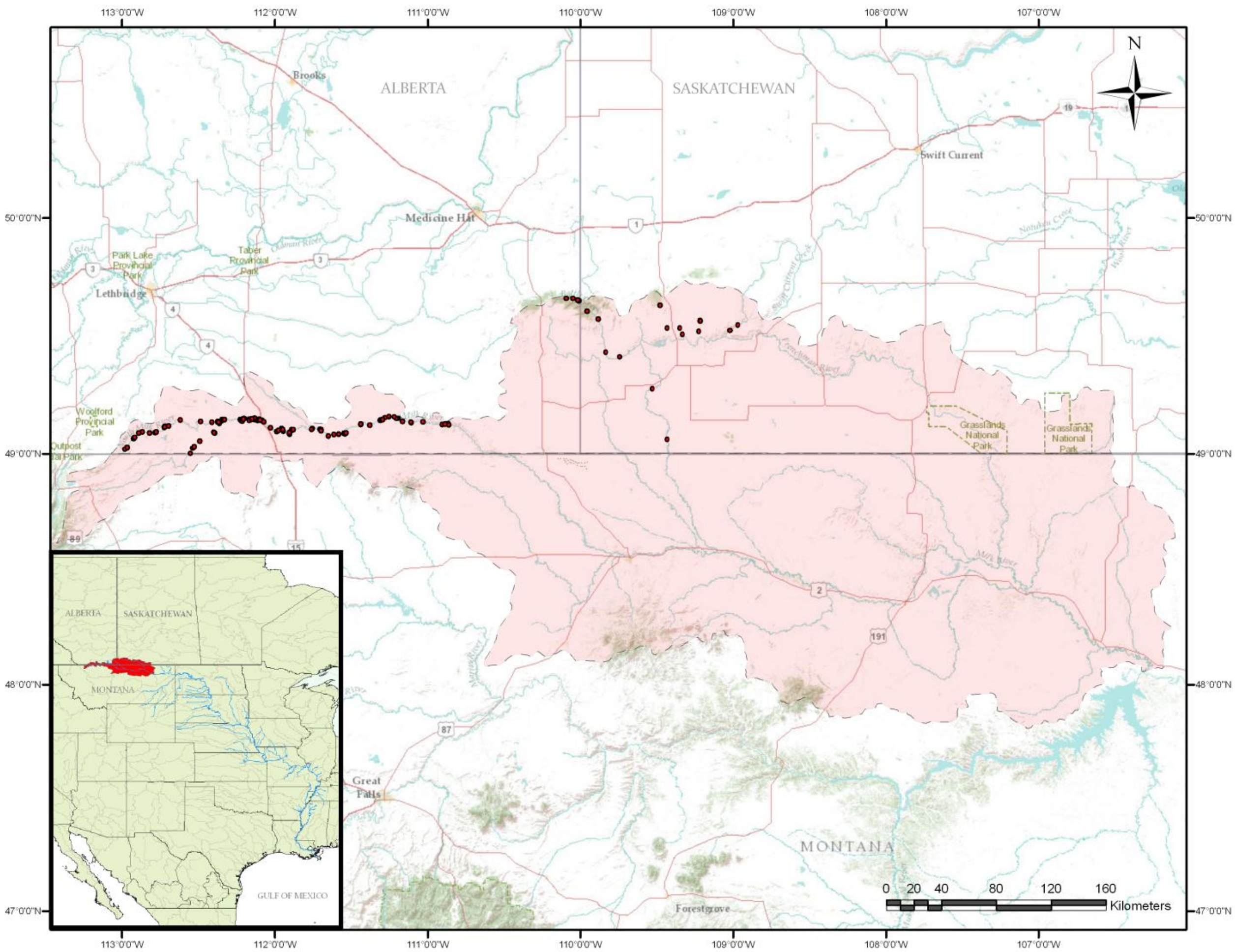

Figure 3. Species occurrence of Mountain Sucker, Milk River watershed populations in Alberta and Saskatchewan. Distribution records are from the Alberta Environment and Sustainable Resource Development (AESRD) Fisheries and Wildlife Management Information System as of October 2011, McCulloch et al. (1994), reports from Atton and Merkowsky (1983), and DFO (unpubl. data as of October 2011).

Mountain Sucker has been reported from the Milk River drainage, including the Cypress Hills region of Alberta and southwestern Saskatchewan, west in southern Alberta to the Waterton Lakes area, and north along the foothills of the Rocky Mountains in streams of the South Saskatchewan River system to the North Saskatchewan River (Scott 1957; Reed 1959; Willock 1969a; Atton and Merkowsky 1983; McCulloch et al. 1994; Scott and Crossman 1998; Franzin and DFO unpubl. data). It is estimated that over 50% of the Canadian range is in Alberta. It has also been recorded in British Columbia from the Similkameen River (Columbia River system), North Thompson River, and lower Fraser River (downstream of Hope) and some of their tributaries (Carl et al. 1967; Scott and Crossman 1998; McPhail 2007). There has also been an unconfirmed report of Mountain Sucker as far as 200 km east of the Similkameen River near the confluence of the Salmo and Pend d'Oreille rivers (Columbia River drainage; Baxter el al. 2003) although this could be the morphologically similar Bridgelip Sucker that occurs in the Pend d'Oreille River.

In DU2, Mountain Sucker has been recorded from at least 20 geographically distinct sampling sites which COSEWIC grouped into eight waterbodies (North Milk River, Milk River, Battle

Creek, Nine Mile Creek, Belanger Creek, Lonepine Creek, Caton Creek and Conglomerate Creek) and within the Canadian portion of the Missouri River watershed (COSEWIC 2010). As there is no genetic evidence for population structuring, the locations were grouped into three separate areas: Milk River system (North Milk and Milk rivers) in Alberta; Battle Creek tributaries (Battle and Nine Mile Creeks) in Saskatchewan and just into southern Alberta; and the Frenchman River tributaries (Belanger, Lonepine, Caton and Conglomerate creeks) in Saskatchewan. Although referred to as populations in this document, this is not intended to imply that Mountain Sucker in the three areas are necessarily genetically distinct. In Montana, there are six impassable dams between the Fresno Reservoir and the confluence of the Milk and Missouri rivers that prevent any upstream dispersal of Mountain Sucker and potential rescue for the Milk River populations (Stash 2001; COSEWIC 2008). The eight locations of Mountain Sucker in DU2 are separated by barriers between the Milk and North Milk rivers to the west and the remaining locations to the east, thereby preventing gene flow (Figure 3). In general, the many disjunctions within the natural range of the Mountain Sucker suggest there are inherent limitations to inter-locality dispersal, suggesting only recovery effort from nearby areas would be possible.

Milk River drainage

The Milk River is a northern tributary of the Missouri-Mississippi Basin, flowing north from Montana into Alberta, then eastward through the southern portion of the province, and south back into Montana (Figure 4) before joining the Missouri River, and subsequently the Mississippi River. There are few communities in the Milk River Basin in Canada. The Milk River flows between the heights of the Cypress and Sweetgrass hills, and meanders through the Foothills Fescue, Mixedgrass, and Dry Mixedgrass subregions of the Grassland Natural Region (Natural Regions Committee 2006; Milk River Watershed Council Canada 2008). In portions of the system it flows within the confines of a defined valley with limited road access. The surrounding land is used primarily for cattle grazing. The lower reaches of the Milk River are shallow and turbid, without significant aquatic vegetation due to the highly mobile stream bed (DFO, unpubl. data). Brief periods of high runoff typically can occur in late March and April from snowmelt and in June and July from intense rain storms (McLean and Beckstead 1980). A more detailed description of the Milk River drainage is provided in Willock (1969b).

Habitat in the Milk River from the Montana border to the confluence with the North Milk River is dominated by gravel with a moderate gradient, it transitions to silt and sand substrate and low gradient for the lower 140 river km.

The Milk River’s seasonal flow regimes have been severely impacted since 1917 as water is diverted from the St. Mary River in Montana to augment flows in the Alberta portion of the North Milk and Milk rivers from late March or early April through late September or mid-October (ISMMRAMTF 2006). Summer flows prior to augmentation ranged from 1 to 2 m^3/s in the North Milk River to between 2 and 10 m^3/s at the Milk River’s eastern crossing of the international border (McLean and Beckstead 1980). Flows in the Milk River at the Town of Milk River now range from 10 to 20 m^3/s from May to September, and average 15 m^3/s between June and August. Concentration of suspended sediment in the water increases, and with it the turbidity further downstream in the Milk River (Spitzer 1988). Turbidity levels tend to decline over the augmentation period despite flows that remain fairly constant. The diversion of water into the Milk River is actively managed at the St. Mary Diversion Dam in Montana in response to major runoff events to prevent or reduce erosion, scouring and risk of canal failure, and to optimize use of the water for irrigation.

The diversion of water from the St. Mary River is terminated in late September to mid-October, and the North Milk and Milk rivers revert to natural flows for the remainder of the winter season

(ISMMRAMTF 2006), albeit within a somewhat modified river channel (McLean and Beckstead 1980; Milk River Watershed Council Canada 2008). Ramping down of the diverted flow occurs over approximately a week, with flows in the river declining over the next several weeks. The decline is most rapid in upstream reaches of the river where the gradient is highest. The average flow rate over the period 1912 to 2006 at the Town of Milk River, was less than 2 m^3/s in November and February, and less than 1 m^3/s in December and January (WSC 2011).

Upstream from its confluence with the North Milk River to the Montana Border, surface flow in the Milk River will occasionally stop in July or August, and may last until March. This results in isolated pools. The Milk River mainstem east of Aden Bridge dries up less frequently; most recently in 1988 and 2001.

The Mountain Sucker is widespread within the Canadian portion of the North Milk and Milk rivers (DFO, unpubl. data). Mountain Suckers have not been observed in smaller tributaries of the Milk River as most are ephemeral in nature, especially those of the North Milk River (T. Clayton, pers. comm.). Upstream of the Canada/U.S. border in Montana, this species is occasionally found in the St. Mary River and associated tributaries above and below the St. Mary diversion (J. Mogen, pers. comm.) so there may be potential for rescue effect into the Milk River system from the St. Mary River. The Fresno Reservoir is the first barrier to upstream movement on the Milk River (a distance of about 75 river km downstream of the Alberta/Montana border), limiting possible rescue efforts from downstream of the reservoir. Furthermore, surface flow in the Milk River can decrease to zero in the lower reach upstream of the Fresno Reservoir (e.g., from September 2001 to February 2002) and the reservoir can be reduced to as little as 4% of its capacity (COSEWIC 2008). Therefore the potential for re-colonization from both upstream and downstream sections in the Milk River system is limited.

Battle Creek drainage

The upper reaches of Battle Creek span the southern Alberta-Saskatchewan border and are contained within Cypress Hills Interprovincial Park (Figure 5). It flows south through southwestern Saskatchewan and into Montana where it joins the Milk River. The cool headwaters of Battle Creek are spring-fed and derived from the Cypress Hills.

Sampling for Mountain Sucker in the Battle Creek tributaries has been very limited (Atton and Merkowsky 1983). It is estimated that approximately 40 Mountain Sucker have been collected there since 1905 (COSEWIC 2010). COSEWIC (2010) reported two Mountain Sucker collected by Jacques Whitford AXYS in 2007.

Frenchman River drainage

The Frenchman River extends 340 km from the Cypress Hills, Saskatchewan, to its confluence with the Milk River in northern Montana (Christiansen and Sauer 1988). The river is contained within the Frenchman Valley, formed by glacial meltwater that flowed between the glacier to the south and Cypress Hills and Wood Mountain upland to the north (Christiansen 1979). The valley is approximately 100 m deep and up to 3 km wide. It is characterized by channel sand and gravel (Christiansen and Sauer 1988).

Mountain Sucker has not been reported in the Frenchman River proper, however specimens have been collected from various tributaries including Belanger, Lonepine, Caton and Conglomerate creeks (COSEWIC 2010). Belanger and Lonepine creeks are presumed to support Mountain Sucker based on historical records (Atton and Merkowsky 1983). However, recent sampling failed to find Mountain Sucker in Belanger and Lonepine creeks (DFO, unpubl. data). Mountain Sucker was recently captured in both Caton and Conglomerate creeks (DFO, unpubl. data).

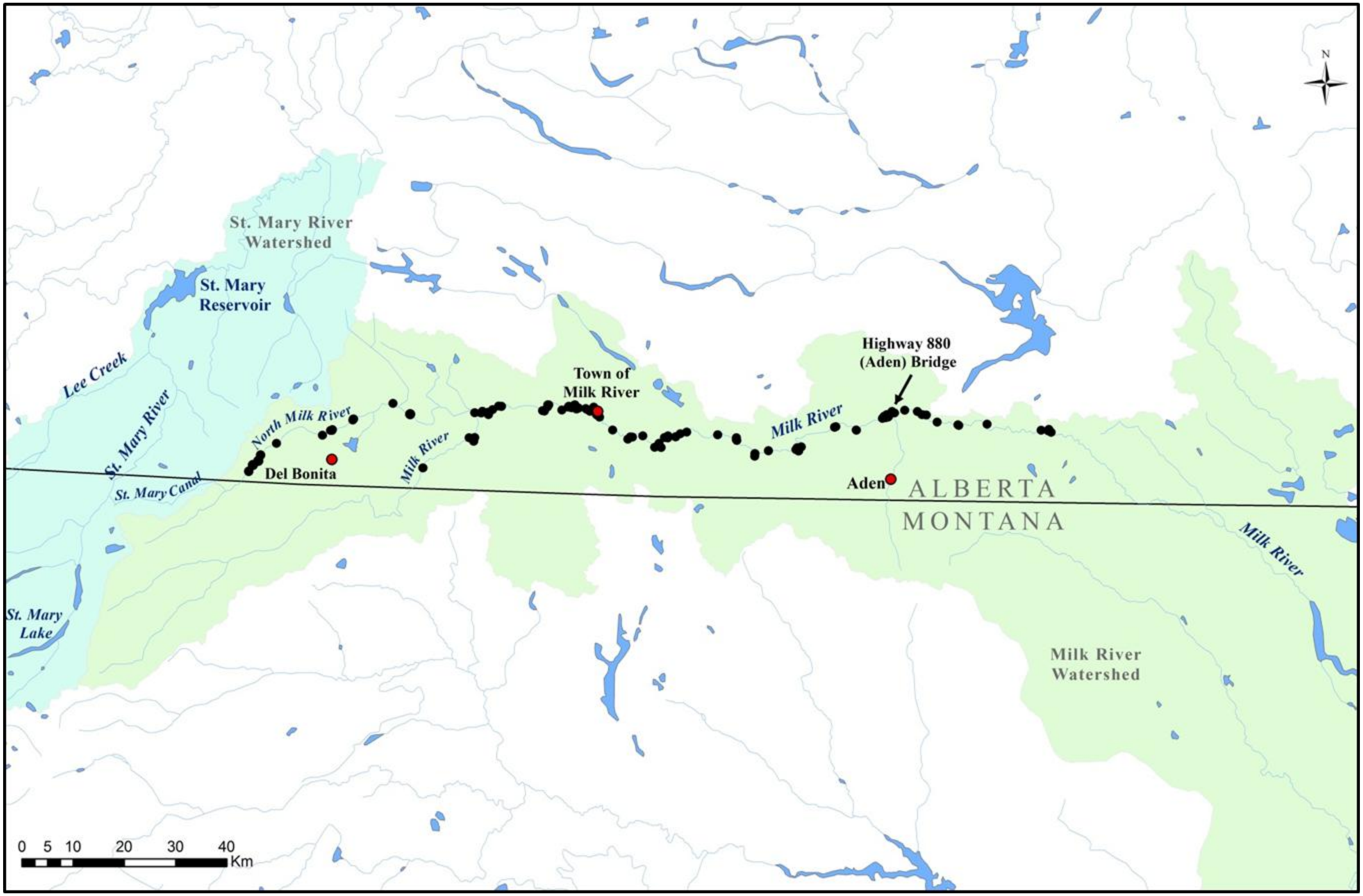

Figure 4. Distribution of Mountain Sucker in the Milk River drainage in Alberta.

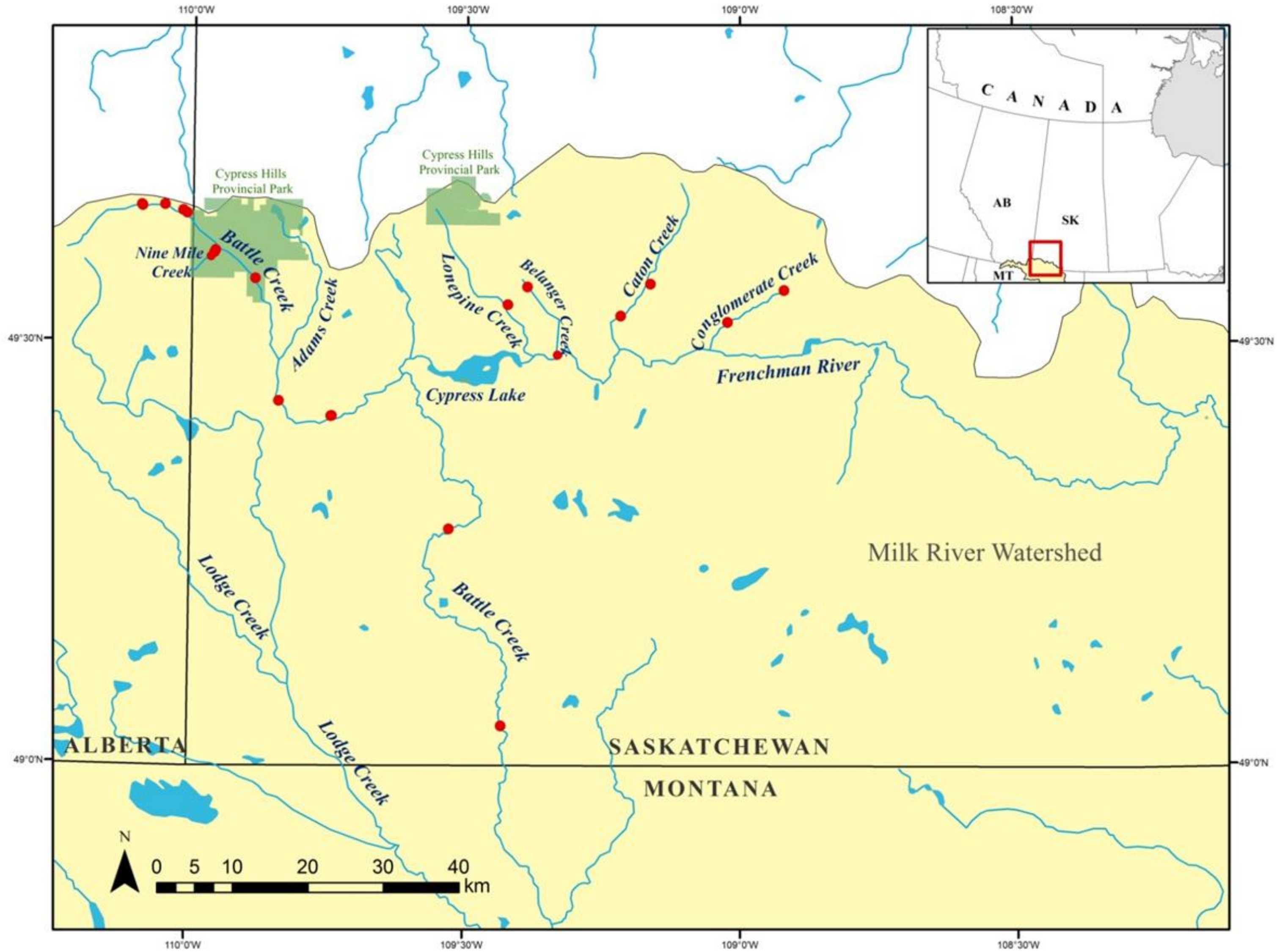

Figure 5. Distribution of Mountain Sucker in the Battle Creek and Frenchman River drainages. Distribution records for lower Battle Creek, Lonepine Creek and upper Belanger Creek are from before 1970.

HISTORIC AND CURRENT ABUNDANCE AND TRENDS

Population size and trend information for Mountain Sucker are limited mainly to presence and absence data, particularly in Canada. Previously, Mountain Suckers probably went unrecorded because of the lack of directed surveys, the inaccessibility of much of the habitat and because of the confusion in the taxonomy which has been resolved to some extent by Smith (1966). Given increasing taxonomic certainty, it is possible that re-examination of some museum collections could reveal new distributional information for Mountain Sucker.

There have been no targeted abundance estimates to examine temporal trends for this species although there is evidence that Mountain Sucker has declined in abundance in parts of its range (Decker 1989; Patton et al. 1998; Belica and Nibbelink 2006; Schultz and Bertrand 2012). Historically, in some parts of its range in the U.S. Mountain Sucker were abundant enough to be used as a bait fish and, in some states, it has been used in the manufacture of pet food and as food for furbearing animals in fur farming operations (Sigler and Miller 1963). It appears to be less abundant in the northern parts of the range (Scott and Crossman 1998) and in Washington it is considered to be a species of special concern (Johnson 1987).

Four studies, three in the Black Hills National Forest, South Dakota (Isaak et al. 2003; Dauwalter et al. 2008; Schultz and Bertrand 2012) and one in an eastern California stream (Moyle and Vondracek 1985), provide density estimates for Mountain Sucker based on a closed-population, removal-estimator method and estimated mean densities from 428 to 1,262 fish/ha ranging from 0 fish/ha at multiple sites to one site with 8,344 fish/ha.

The variation in estimates of Mountain Sucker may relate to localized fish movements. For example, Wydoski and Wydoski (2002) observed a spawning run of a reservoir population of Mountain Sucker into a tributary stream, finding hundreds of Mountain Sucker in the tributary during the spawning period and few after spawning ended. The variability in relative abundance of Mountain Sucker related to movements was also observed in Sagehen Creek, California where snorkeling surveys were conducted every two weeks during summer in a 1.2 km section of stream immediately above a reservoir (Decker 1989; Decker and Erman 1992). Prior to the observed peak abundance of 37 mountain sucker on August 2, few to no mountain sucker were observed in the 1.2 km segment (Decker 1989). The peak abundance was maintained through August 16 when 34 Mountain Sucker were observed in the 1.2 km segment (Decker 1989). However, by September 22 Mountain Sucker were again absent from the stream segment (Decker 1989). Mountain Sucker was thought to inhabit the reservoir downstream before and after spawning (Decker and Erman 1992).

In Canada, Scott and Crossman (1998) suggested that Mountain Sucker is neither widely distributed nor abundant. Within DU2, there are three drainages in which this species occurs: Milk River, Battle Creek and Frenchman River. To assess the status of these three Mountain Sucker populations, each was ranked in terms of its abundance (Relative Abundance Index) and trajectory (Population Trajectory). The Relative Abundance Index was assigned as Extirpated, Low, Medium, High, or Unknown. Sampling parameters considered included gear used, area sampled, sampling effort, and whether the study was targeting Mountain Sucker. The number of individual Mountain Sucker caught during each sampling period was then considered when assigning the Relative Abundance Index. The Relative Abundance Index is a relative parameter in that the values assigned to each population are relative to the most abundant population. In the case of Mountain Sucker, all populations were assigned an Abundance Index relative to the population in the Milk River system. Catch-data from populations sampled using different gear types were assumed to be comparable when assigning the Relative Abundance Index.

The Population Trajectory was assessed as Decreasing, Stable, Increasing, or Unknown for each population based on the best available knowledge about the current trajectory of the population. The number of individuals caught over time for each population was considered. Trends over time were classified as Increasing (an increase in abundance over time), Decreasing (a decrease in abundance over time) and Stable (no change in abundance over time). If insufficient information was available to inform the Population Trajectory, the population was listed as Unknown.

The Relative Abundance Index and Population Trajectory values were then combined in the Population Status matrix (Table 2) to determine the Population Status for each population. Each Population Status was subsequently ranked as Poor, Fair, Good, Unknown, or Extirpated (Table 3).

Milk River drainage

Mountain Sucker is reported to be common in the Milk River watershed, Alberta (Willock 1969a; Henderson and Peter 1969) and extending into the central plains. The most recent collections in the Milk River (DFO, unpubl. data) suggest that Mountain Sucker remain abundant with catches as high as 157 in a single seine haul thus the relative abundance index is ranked High (Table 3). Current sampling is not directly comparable to historic records so population trend was assessed by comparing the proportion of Mountain Sucker in the catch relative to the combined abundance of common species whose population trajectory is expected to remain relatively stable over time. The proportion of Mountain Sucker in the total catch of Fathead Chub, Lake Chub, Longnose Dace, White Sucker and Mountain Sucker from 2000 to 2010 in the North Milk and Milk rivers was compared with sampling from 1969. Willock (1969b) reported that in 1969 Mountain Sucker numbered 1,194 or 12.4% of the total catch of 9,614 Fathead Chub, Lake Chub, Longnose Dace, White Sucker and Mountain Sucker. From 2000 to 2010, in the same waterbody, Mountain Sucker numbered 2,816 or 12.7% of the total 22,131 Fathead Chub, Lake Chub, Longnose Dace, White Sucker and Mountain Sucker captured. (T. Clayton, unpubl. data). Based on these data, it would appear that the proportion of Mountain Sucker to other common fishes in the Milk and North Milk rivers in Alberta has remained remarkably unchanged over this period so population trajectory is categorized as Stable (Table 3), resulting in a population status of Good.

Table 2. The Population Status Matrix combines the Relative Abundance Index and Population Trajectory rankings to establish the Population Status for each Mountain Sucker population in DU2. The resulting Population Status has been categorized as Extirpated, Poor, Fair, Good, or Unknown.

		Population Trajectory			
		Increasing	**Stable**	**Decreasing**	**Unknown**
Relative Abundance Index	**Low**	Poor	Poor	Poor	Poor
	Medium	Fair	Fair	Poor	Poor
	High	Good	Good	Fair	Fair
	Unknown	Unknown	Unknown	Unknown	Unknown
	Extirpated	Extirpated	Extirpated	Extirpated	Extirpated

Table 3. Relative Abundance Index, Population Trajectory and Population Status of Mountain Sculpin in the three drainages where they are known to occur in DU2. The level of Certainty associated with the Relative Abundance Index and Population Trajectory rankings is based on quantitative analysis (1), CPUE or standardized sampling (2) or expert advice (3). Population Status results from an analysis of both the Relative Abundance Index and Stock Trajectory. Certainty assigned to each Stock Status is reflective of the lowest level of certainty associated with either initial parameter (Relative Abundance Index, or Population Trajectory.)

Population	Relative Abundance Index	Certainty	Population Trajectory	Certainty	Population Status	Certainty
Milk River drainage[1]	High	2	Stable	3	Good	3
Battle Creek drainage[2]	Low	2	Unknown	3	Poor	3
Frenchman River drainage[3]	Low-Medium	2	Unknown	3	Poor	3

[1] North Milk River and the Milk River below the confluence
[2] Battle and Nine Mile creeks
[3] Belanger, Lonepine, Caton and Conglomerate creeks

Battle Creek drainage

Only ‘presence/absence” of Mountain Sucker was noted historically in the Battle Creek drainage and current sampling is limited. McCulloch et al. (1994) collected Mountain Sucker in Battle Creek. In 2003 and 2004, DFO (unpubl. data.) captured Mountain Sucker in Battle and Nine Mile creeks. An average of 0.12 fish/min. were caught based on 5,133 s of shocking effort. The relative abundance index is Low and population trajectory is Unknown, resulting in a population status of Poor.

Frenchman River drainage

Only “presence/absence” was noted historically in the Frenchman River drainage and current sampling is limited. McCulloch et al. (1994) collected Mountain Sucker in Caton and Conglomerate creeks. In 2003 and 2004, DFO (unpubl. data.) captured Mountain Sucker in Caton and Conglomerate creeks, but not in Belanger or Lonepine creeks. The last reported collection made in Belanger Creek was by B. Christensen in 1983 (Atton and Merkowsky 1983). Mountain Suckers are at best moderately abundant in Caton Creek (2.8 fish/min) and are still present in Conglomerate Creek (one specimen collected in September 2004; DFO, unpubl. data), supporting a relative abundance index of Low to Medium for the Frenchman drainage. These recent collections also suggest that the Frenchman River tributaries have a higher catch rate than the Battle Creek tributaries (Table 3; DFO, unpubl. data). Regardless, the population trajectory of Mountain Sucker in the Frenchman River tributaries is Unknown, resulting in a population status of Poor.

HABITAT REQUIREMENTS

In Canada, no systematic surveys have been made to characterize habitat used by Mountain Sucker (McPhail 2007) and most surveys are dependent on casual field observations. This species is often found in higher-gradient streams with variable hydrology and other fluctuating environmental conditions (Smith 1966; Dunham et al. 1979). Dauwalter and Rahel (2008) report Mountain Sucker occurrence is influenced through complex and cumulative interactions between stream permanence, stream slope, stream order, and elevation. They suggest that Mountain Sucker are more likely to be present in perennial streams, and in larger, higher gradient streams at higher elevations but in smaller, lower gradient streams at lower elevations. They have been found in streams at elevations from as low as 20 m above sea level to greater than 800 m (COSEWIC 2010).

In Alberta and Saskatchewan DFO (unpubl. data) has collected Mountain Sucker at 100 sites. They generally inhabit clear, cool mountain streams ranging from 2 to 40 m in width. However, they do appear to be tolerant of a variety of water conditions that vary from turbid to clear (McPhail 2007) with Secchi disk measurements ranging from 0.14 to >2 m DFO (unpubl. data). Daytime water temperature at collection sites in Alberta and Saskatchewan have been recorded as high as 21.2°C DFO (unpubl. data). Typical water temperatures in British Columbia are 15 to 20°C (McPhail 2007) and as high as 28°C in the U.S. (Smith 1966). The Alberta and Saskatchewan collections were made in 0.1-1.4 m of water (mean = 0.49 m) and velocities of 0 to 1.98 m/s (mean = 0.66 m/s), and elsewhere in up to 2.4 m of water (Evermann 1893; see Smith 1966 regarding a collection by R.M. Bailey). Substrates in Alberta and Saskatchewan range from silt to boulder, with the majority collections dominated by gravel (43%) and cobble (32%). Underwater observations indicate that Mountain Sucker associate with the substrate and typically form small groups near areas of cover (Decker 1989). In the U.S., Mountain sucker have been collected with aquatic vegetation at collection sites which included pondweeds (*Potamogeton* sp), muskgrass (*Chara* sp.), algae, and cress (*Nasturtium* spp.); although macroscopic vegetation is sometimes absent altogether (Smith 1966). Mountain Sucker rarely occur in lakes (Smith 1966; Snyder 1983; Wydoski and Wydoski 2002).

Young-of-the-Year (YOY) and Juveniles

Young-of-the-year (YOY) Mountain Sucker (20–35 mm) have been collected in moderate currents, often retreating behind an obstacle (e.g., rocks, submerged logs) at depths of 15–40 cm (Hauser 1969). Young fish are commonly found in shallow (<20 cm) embayments and blind side-channels associated with mid-channel gravel bars (McPhail 2007). Juvenile fish are usually found in shallower (<1 m) and slower (<0.5 m/s) water than adults (McPhail 2007).

Adults

Larger fish are often found at the margins of runs, retreating to deeper water when disturbed, much the same as observed for White Sucker (*Catostomus commersonii*) (Stewart 1926; Decker and Erman 1992; Wydoski and Wydoski 2002). Adult Mountain Sucker (>130 mm) in British Columbia occur in small creeks to extremely large rivers (up to 1 km across) in water where velocities were typically 0.7 m/sec (McPhail 2007). Depending on the system, depths can be variable, >1.5 m in some systems (McPhail 2007). In the Milk River, 53 adult Mountain Sucker have been collected during boat electrofishing surveys. The depth ranged from 0.1 to 1.4 m (mean = 0.63 m), velocity of 0 to 1.98 m/s (mean = 0.99 m/s) and substrate was dominated by gravel (46%) and cobble (33%).

Spawning

In Utah spawning occurs in late May to late June and peaked in early June with water temperatures ranged from 9°C to 11°C (Wydoski and Wydoski 2002). During spawning, adults are most abundant in riffle areas below pools, retreating to deep pools and associated bank cover after spawning (Hauser 1969) or near the transitions between pools and runs (Wydoski and Wydoski 2002). The majority of spawning took place in 0.1 to 0.3 m of water with velocities of 0.06 to 0.20 m/s (Wydoski and Wydoski 2002).

Overwintering

There is very limited information available on the overwintering distribution and habitat of Mountain Sucker. In Alberta, in most winters Chinook[1] wind events result in open water in the rivers, thereby reducing the likelihood of anoxic conditions and possible winter kill. Winter conditions in the Battle and Frenchman drainages are unknown.

Milk River drainage

Droughts are not an infrequent occurrence in the Milk River watershed and the species that occur there may have adapted to such conditions by adopting a broad tolerance to various habitat conditions. DFO (unpubl. data) has collected Mountain Sucker at 59 sites in the Milk and North Milk rivers. Water depths ranged from 0.1-1.4 m (mean = 0.56 m), velocity from 0 to 1.98 m/s (mean = 0.77 m/s), Secchi disk readings from 0.14 to 0.7 m (mean = 0.52 m) and substrate from silt to boulder with gravel (38%) and cobble (27%) dominating.

Battle Creek drainage

Mountain Sucker has been collected in Battle Creek as well as from Nine Mile Creek, a tributary to Battle Creek. DFO (unpubl. data) collected Mountain Sucker at three sites where stream widths were 5–10 metres, depths were <0.5 m with moderate velocities, over substrates that were predominantly gravel and cobble, and Secchi disk measurements were 0.5 m.

Frenchman River drainage

Mountain Sucker has not been collected in the Frenchman River proper, but it is presumed to connect the populations that inhabit its tributaries (specifically Belanger, Lonepine, Caton and Conglomerate creeks). In those tributaries, Mountain Sucker has been collected at two sites in riffle pools dominated by gravel and cobble where water depth was <1 m and Secchi disk measurements ranged from 0.2 to 0.5 m (DFO, unpubl. data).

RESIDENCE

SARA defines residence as “a dwelling-place, such as a den, nest or other similar area or place, that is occupied or habitually occupied by one or more individuals during all or part of their life cycles, including breeding, rearing, staging, wintering, feeding or hibernating”. Residence is interpreted by DFO as being a *constructed* place (e.g., a spawning redd). Mountain Sucker is not known to change its physical environment or invest in a structure during any part of its life cycle, therefore no biological feature of this species meets the SARA definition of residence as interpreted by DFO.

[1] Adiabatic warming of air moving down the eastern slopes of the Canadian Rockies and across the foothills and the Western prairies produces warm winds that are referred to as Chinook winds. In winter, a strong Chinook wind can produce a dramatic rise in air temperature for a few hours or days.

THREATS TO SURVIVAL AND RECOVERY

Across the range of the Mountain Sucker there appears to be multiple and possibly cumulative threats to Mountain Sucker populations. The creation of impoundments has been implicated in the degradation and loss of habitat for other catostomids (Cooke et al. 2005). This results from fragmentation, sedimentation (Patton et al. 1998), and modifications of flow and drought (Schultz and Bertrand 2012; Dauwalter and Rahel 2008), and ultimately may isolate populations or otherwise make them more susceptible to extirpation (Belica and Nibbelink 2006). Impoundments have also led to interactions with introduced species, particularly salmonids (Moyle and Vondracek 1985; Decker and Erman 1992).

It is important to note that one threat may directly affect another, or threats may interact with each other and it is difficult to quantify these interactions. Therefore, each threat is discussed independently.

To assess the status of threats with respect to Mountain Sucker in DU2, each threat was ranked in terms of its Threat Likelihood, Threat Impact and Threat Level on a population basis, and overall effect on the species in terms of its Spatial Extent and Temporal Extent. Definitions for these terms are presented in Table 4. Threat Likelihood was rated as Known, Likely, Unlikely or Unknown, and the Threat Impact was rated as High, Medium, Low or Unknown for each population (Table 5).). If no information was available on the Threat Impact at a specific location, the highest level of impact for all sites was applied as a precautionary approach. The level of Certainty associated with each rating was identified on the basis of causative studies, correlative studies or expert opinion (Table 5). The Threat Likelihood and Threat Impact ratings for each population were subsequently combined in the Threat Level Matrix (Table 6) resulting in the final Threat Level for each population (Table 7). The Spatial Extent of each threat was categorized as Widespread or Local and the Temporal Extent as either Chronic or Ephemeral (Table 8).

Habitat Loss/Degradation

Drought

Despite Canada having abundant fresh water (Gleick et al. 2002), there is regional variability in supply. Multi-year droughts have been observed in the Great Plains of southern Alberta and Saskatchewan during the 1930s, 1980s, and 21st century (Marchildon et al. 2007). Lying in the shadow of the Rocky Mountains is the Palliser Triangle characterized by little annual precipitation, high moisture loss due to winter Chinooks (warm dry wind), frequent summer heat waves, and limited suitability for agriculture (Marchildon et al. 2007). This region is one of the driest parts of the country (Schindler and Donahue 2006), and continuing trends in reduced snow pack in the Rocky Mountains suggest that the frequency of drought conditions will increase (Rood et al. 2005). The likelihood of occurrence of this threat was rated as Known for the three drainages.

The impact of this threat to Mountain Sucker will depend on the severity and duration of the drought. Droughts are a frequent occurrence in the Milk River watershed and the species that occur there may be adapted to such conditions by adopting a broad tolerance to various habitat conditions. Throughout the southern prairies annual precipitation has decreased by 14-24% since the 1890s, and has sustained warming of 1-4º C, most of which has occurred since the 1970s (Schindler and Donahue 2006). During extreme drought conditions (e.g., 1988 and 2001-2002) the surface flow of the Milk River east of the Aden Bridge and upstream of the confluence with the North Milk River was virtually eliminated in the fall and winter due to severe drought conditions, and the lower river was reduced to a series of standing pools (WSC 2011; RL&L Environmental Services Ltd 2002). Overwintering habitat is most likely to be threatened. Natural drought conditions alone may seriously stress Mountain Sucker populations, but the combination with other anthropogenic stresses could compound the severity of drought effects significantly. However, there appears to be at least some capacity for fishes influenced by these droughts to persist; a post-drought survey conducted in 2002 found Mountain Suckers in the Milk River (P&E Environmental Consultants Ltd. 2002), which suggests that they may be able to find refuge in the river during droughts. Similarly, the presence of Mountain Suckers in Battle Creek and the Frenchman River tributaries after multi-year droughts demonstrate their resilience to shifts in environmental conditions. Lethal thresholds to such conditions and at different developmental stages have not yet been established, though are presumed to be surpassed.

Despite an apparent tolerance to drought conditions based on relatively recent collections, the impact of this threat is suggested to be High throughout the range of Mountain Suckers in DU2 due to the frequency of occurrence, fish habitat loss, the implications of lethal effects, and the barriers to movement impeding recovery and recolonization following a disturbance. The overall effect of this threat on Mountain Sucker is Widespread and Chronic.

Anoxia

In DU2, Mountain Sucker is often associated with riffle environments when available so they may have higher oxygen requirements than other species. Diurnal oxygen fluctuations to sub-lethal levels can lead to stress in White Sucker. It appears as though the Mountain Sucker may have some tolerance to fluctuations in dissolved oxygen levels based on recent collections in Alberta and Saskatchewan from ephemeral streams, and sometimes in very low flow systems (DFO, unpubl. data). However, it is not known if these fluctuations in dissolved oxygen cause stress to the fish.

Oxygen depletion under ice during the winter could seriously impact the survival of Mountain Sucker and other fish species. A water quality study by Noton (1980) concluded that the most important water quality parameter potentially not meeting fish needs in the Milk River was dissolved oxygen where concentrations under ice in the lower reach of the river were as low as 1.6 mg/L in January. Possible reasons for reduced oxygen concentrations at this time included an accumulation of organic debris, which might oxidize, or the inflow of anoxic ground water during low flows (Noton 1980). Further evaluation is required. Anoxia is a Known threat in the Milk River drainage system but from outside the known range of Mountain Sucker. Its impact to Mountain Sucker could be High. In the Battle Creek and Frenchman River drainages the likelihood of occurrence of anoxia is Known and its impact is High. The overall effect of Anoxia on Mountain Sucker is Widespread and Chronic.

Changes in flow

In Alberta, and prior to the St. Mary's diversion, the Milk River was probably a typical small prairie stream, possibly intermittent in times of drought, and generally less turbid (Willock 1969b). The significant increase in water volume since the canal went into use is believed to have extensively altered the ecological regime of the Milk River (with the exception of the Milk River upstream of its confluence with the North Milk River). The result has been the creation of a more turbid, higher-flow system in the North Milk and Milk rivers in Alberta (Willock 1969b).

Diverting water from the St. Mary River has reduced the effects of drought in the North Milk and Milk rivers and may have extended the availability of suitable summer habitat for the Mountain Sucker (Willock 1969b). The net effect of this change on the population is unknown. Increased water velocities due to flow augmentation might, for example, adversely affect the species' reproductive success by increasing larval drift downstream into unsuitable habitats such as the Fresno Reservoir (R. Bramblett, pers. comm.). Winter flows in the North Milk and Milk rivers are considered natural (see below) and despite frequent low-flow conditions there is no evidence of fish becoming stranded (T. Clayton, pers. comm.). The likelihood of this happening, however, could increase if the rate at which flows are ramped down increases. In the Milk River drainage, the likelihood of occurrence of Changes in Flow is Known and the overall impact of this threat on Mountain Sucker is High.

In the Saskatchewan drainages, changes in flow are Likely but the threat impact is Medium in both drainages due to the presence of weirs and other control structures as well as the small size of these tributaries. The overall effect of this threat on Mountain Sucker is Widespread and Chronic.

Livestock use of flood plain

Livestock overgrazing of the floodplain is often implicated with destabilization of the stream banks and degradation of the riparian vegetation community. The occurrence of this threat is Known in the Milk River, Battle Creek and Frenchman River drainages and its impact on Mountain Sucker is Low in Alberta but High in Saskatchewan due to the relative difference in size of these waterbodies. The overall effect of Livestock Use of the Flood Plain on Mountain Sucker is Widespread and Chronic.

Dam construction and operation

Particular attention should be paid to any modification of the flow regime. Dams alter habitat types, flow regimes, sediment loads, microbiota and water temperatures, and may also increase the risk of species introductions (Berkamp et al. 2000; Quist et al. 2004). Many of these alterations have been reported in western Mississippi (Cross et al. 1986) and lower Missouri watersheds (Pflieger and Grace 1987) where impoundments have had significant cumulative effects on fish fauna. These historically turbid systems underwent a transition in species abundance that favoured fishes that were not characteristic of turbid water (Pfleiger and Grace 1987; Quist et al. 2004). Indeed, impoundments are often associated with systems that are narrower, less turbid, less subject to fluctuations in temperature and flow, and less productive with less substrate movement (Cross et al. 1986; Pflieger and Grace 1987; Quist et al. 2004). Instream habitats may also change, with the fine substrate typical of large plains streams being replaced by gravel, cobble, and boulder. The effects of winter flow augmentation on Mountain Sucker, through the release of impounded water, are not known at this time.

Dam construction and operation could pose a threat to Mountain Sucker in the Milk River. While there is no proposal at this time, the feasibility of developing a dam on the Milk River upstream of the Town of Milk River has been, and continues to be, investigated. The purposes of a dam would be to improve the security of the water supply for existing withdrawals, and to provide water for the irrigation of additional acres. In reviewing any future proposal, the potential impacts on the Mountain Sucker will need to be thoroughly considered. Battle Creek appears to be unimpeded by reservoirs from its headwaters through to the Milk River, whereas the Frenchman River has at least three primary reservoirs in Canada (Eastend, Huff Lake, and Newton Lake reservoirs). The likelihood of dam construction and operation are Unknown, Likely and Known for the Milk River, Battle Creek and Frenchman River drainages, respectively.

The effect of impoundment on sucker habitat downstream would depend on how water releases are managed. Low flow conditions below a dam on the Milk River would increase the potential for extirpation of sucker populations downstream, and the barrier posed by the reservoir might limit subsequent re-colonization by the upstream population. Dam construction and operation could affect Milk River populations by reducing their range. In reviewing any future dam proposal, the potential impacts on the Mountain Sucker will need to be thoroughly considered. Given the potential for significant impact on Mountain Sucker in the Milk River system, the impact of Dam Construction and Operation there ranges from Medium to High. The impact of this threat on Mountain Sucker ranges from Low to High for the Battle Creek drainage depending on where and how dams might be constructed and operated. Given the current number of dams already present in the Frenchman River drainage the threat impact there ranges from Medium to High. The overall effect of this threat is Widespread and Chronic.

Surface water extraction: irrigation

Water withdrawal for irrigation of crops and ranching is the fourth largest consumptive use of water in Canada of which 70% occurs in southern Alberta and Saskatchewan (COSEWIC 2010). The likelihood of occurrence of this threat is Known for the three river systems.

The use of natural ephemeral habitat by stream-fishes is common, often providing them with flooded side channels and backwaters for spawning, larval-juvenile rearing and foraging habitat, or a means to avoid high flow velocities (Junk et al. 1989; Bayley 1991). Man-made irrigation canals replicate, to some extent, natural ephemeral water systems. However, there is often an increase in fish mortality in irrigation canals due to dewatering at the end of the irrigation season (Roberts and Rahel 2008). Irrigation canals differ from natural ephemeral habitats because changes in water flows in the canals are usually instantaneous and can be dramatic, preventing sufficient reaction time for fish entrained in canals to escape back to the main-stem water system (Beyers and Carlson 1993; Clothier 1954). Additionally, irrigation canals typically have a headgate structure to control water flow that prevents the upstream return of fish during high flow velocities (Roberts and Rahel 2008). Indeed, it was reported that approximately 3,184 Mountain Suckers were entrained in an irrigation canal in Wyoming, and though this species was not specifically targeted, it was acknowledged that irrigation canals can have dramatic negative effects for this and other species (Roberts and Rahel 2008).

While water extraction for irrigation could seriously reduce habitat available for Mountain Sucker, the impact of this threat in the Milk River within Alberta is Low, since only a small proportion of the available flow is withdrawn and these withdrawals are regulated. Extraction of water for irrigation purposes only occurs while flows are augmented, from late-March or early April through to early September or mid-October. During this period about 5% of the total flow is licensed for use in Alberta, most of which (93%) is used for irrigation (T. Clayton, pers. comm.). Water removals under temporary diversion licenses (TDLs) are not included in this total. Water withdrawals for irrigation are terminated or suspended on a priority use basis when the St. Mary diversion is closed for maintenance, or during reduced flow conditions.

In the Milk River basin of southern Saskatchewan, irrigation is the largest surface water use, well ahead of municipal, livestock, industrial and other uses (R. Halliday and Associates 2009). Both Battle Creek and the Frenchman River are known to support water withdrawals for the purpose of irrigation, though they may be greater in the Battle Creek drainage. Water extraction is presumed to have a significant impact on habitat availability for Mountain Suckers so the severity of impact is High for the Battle Creek drainage and ranges from Medium to High for the Frenchman River drainage. The overall effect of this threat is Widespread and Chronic.

Surface water extraction: non-irrigation

Non-irrigation surface water extraction such as water diversion is Known to occur in Battle Creek and the Milk River, and is Likely to occur in the Frenchman River.

In Alberta, Temporary Diversion Licences (TDLs) for non-irrigation purposes are issued throughout the year, including during critical low flow periods (S. Petry, pers. comm.) in contrast to water licenses for irrigation TDLs permits are issued to oil and gas companies, for example, to remove water from the river for activities related to well-drilling. This kind of extraction may occur during the augmented flow period, which would not generally be an issue unless the St.

Mary diversion is prematurely or temporarily closed down. TDLs may be revoked, as they were during the drought conditions in 2001 (S. Petry, pers. comm.). This can also pose a threat to Mountain Sucker habitat during the period of reduced flows in winter. During the flow augmentation period, the Town of Milk River diverts about 0.3% of the total available flow for domestic purposes. The threat to Mountain Sucker of surface water extraction for non-irrigation purposes ranges from Low to High for the North Milk and Milk rivers depending on when the extraction occurs and for how long.

In the Milk River basin of southern Saskatchewan some surface water is used for non-irrigation purposes (R. Halliday and Associates 2009) but the impact of this threat to Mountain Sucker is Low for both the Battle Creek and Frenchman River drainages. The overall effect of this threat is Local and Chronic.

Changes in habitat quality and availability

This threat captures changes to the environment (e.g., substrate and water velocity) at a smaller scale than the Changes in Geomorphology. Increased sediment levels and the resulting changes in substrate composition have been implicated in the decline of Mountain Sucker populations (Patton et al. 1998). The likelihood of occurrence of this threat as a result of high volumes of the water in the Milk River drainage during flow augmentation and low volumes of water in the Battle Creek and Frenchman River drainages is Likely. Although the impact of this threat is Low to Medium, its overall effect on Mountain Sucker is Widespread and Chronic.

Groundwater extraction

Groundwater extraction is known to occur naturally in the Milk rivers, Battle Creek, and the Frenchman River so the likelihood of occurrence of this threat is Known for the three drainages. Grove (1985) reported that the loss of surface water flow to groundwater occurs naturally along an 11 km section of the Milk River from Black Coulee to the Highway 880 crossing in Southern Alberta. The single largest user of groundwater in the Milk River basin in southern Saskatchewan is the oil and industry, mostly for oil recovery (R. Halliday and Associates 2009). Significant extraction of groundwater from non-potable deep aquifers occurs, though it is likely that no one aquifer is used long enough to cause long-term effects. In Alberta, overall water use for conventional oil recovery is declining.

Mountain Sucker and other small fishes may be particularly susceptible to impacts relating to groundwater and surface water flow, especially during the winter and in other low flow conditions. Excessive diversion of groundwater during these times could negatively affect Mountain Sucker habitat. However, the threat impact of groundwater extraction on the Mountain Sucker has not been studied and information is required regarding the species’ overwintering habitats to assess the significance of this threat. The impact of this threat is Low for the three systems and the overall effect is Local and Chronic.

Changes in geomorphology

This threat captures changes at a larger scale than Changes in Habitat Quality and Availability. Nearly 100 years of flow augmentation from the St. Mary diversion has caused changes in channel and floodplain morphology in the North Milk and Milk rivers. Higher flows transport more sediment, and may result in channel incision deeper than historic conditions. Channel incision will likely reduce the frequency of overbank flows thereby reducing lateral connectivity to older secondary channels and oxbows, and the floodplain. Flow augmentation from the Diversion has changed habitat features such as the relative availability of depths, velocities and substrates since historic conditions, and likely has reduced habitat diversity. In the Milk River drainage this threat is Known and its impact ranges from Low to Medium.

In the Battle Creek and Frenchman River drainages the likelihood of occurrence of this threat is Unknown but if this threat was to occur its threat impact would likely be Low because of the relatively low volume of water in these two systems. Given the available information at this time, the overall spatial and temporal extent of this threat is Local and Chronic respectively.

Species Introductions

Non-native and/or invasive species introductions can threaten Mountain Sucker populations through various mechanisms such as predation, competition for resources, hybridization, the introduction of exotic diseases and parasites, and habitat degradation. It is not known what effect species introductions will have on the Mountain Sucker, and would depend upon the species introduced. The degree to which this threat is likely to occur depends on the suitability of sucker habitats to potential invading species. There may be implications of species introductions by U.S. jurisdictions to Mountain Sucker in Canadian waters.

Fish species

Non-native fish introductions are a prominent causal factor leading to the extinction of fish species in North America (Miller et al. 1989). A list of fish species co-occurring with the Mountain Sucker in the Milk River, Battle Creek, and the Frenchman River are displayed in Tables 1a,b,c, respectively. While some of these species have specific habitat requirements that may not be met throughout all reaches of each river system, others are generalists that might expand their range given the opportunity. For example, it is reported that elevated turbidity levels have less effect on the prey consumption of plains fish species adapted to turbid conditions than that of species not adapted to turbid conditions (Bonner and Wilde 2002). Activities such as water regulation and impoundment that alter these flow regimes and trap sediments, reducing turbidity downstream, can favour sight-feeding exotic piscivores such as bass, perch and salmonids, which historically were absent from these streams (Berkamp et al. 2000; Quist et al. 2004). Indeed, Mountain Sucker have been found in the stomachs of most trout species, but the relative impact of different species on Mountain Sucker has not been assessed (Belica and Nibbelink 2006). In South Dakota, stream rehabilitation was effective in increasing brown trout (*Salmo trutta*) abundance, however this was detrimental to Mountain Sucker populations, reducing them as much as 90% (Glover 1986). Negative effects of salmonid species on the Mountain Sucker suggest that management of recreational trout fisheries needs to be balanced with Mountain Sucker conservation (Dauwalter and Rahel 2008). More spatially explicit information on salmonid abundance would allow managers to understand where these species interact and where recreational fisheries need to be balanced with fish conservation.

The Alberta Fish and Wildlife Division does not plan to introduce sport fish species into the lower Milk River, and is unlikely to in the future (T. Clayton, pers. comm.). The Milk River proper and its tributaries in Alberta have not been stocked for at least 10 years, although Goldsprings Park Pond, an old oxbow of the river with no connection to the mainstem is stocked annually with Rainbow Trout (T. Clayton, pers. comm.). In the Milk River, there are no migration barriers upstream of the Fresno Reservoir in Montana, where Yellow Perch and Walleye were introduced, and illegal fish transfers within the province can be difficult to control. Additionally, the unidirectional movement of fish passing over the St. Mary's Diversion has likely facilitated the expansion of non-native species from the Saskatchewan River watershed into the Milk River. Alternatively, many species of cyprinids and some catostomids commonly used as baitfish have been introduced into waters where Mountain Sucker is known to occur. Whether unauthorized introductions have occurred in the Milk River, Battle Creek, or Frenchman River (e.g., bait fish releases) are unknown.

In southwest Saskatchewan, several streams have been managed since the early 1920s including Battle, Belanger, and Conglomerate creeks (Snook 2004). Rainbow, Brown and Brook Trout have been stocked in Battle Creek's upper reaches since 1924, and has commonly been recorded along the Alberta-Saskatchewan border and the southern boundary of Fort Walsh National Historic Park. Non-native Brown Trout were originally stocked in Belanger and Conglomerate creeks in 1924, and Brook Trout were subsequently stocked in these creeks in 1933 and 1952, respectively. These trout species flourished in abundance over several decades (Snook 2004). Piscivorous salmonid species have been suggested to account for the absence of Mountain Sucker in some Saskatchewan streams (McCulloch et al. 1994). Other piscivorous species, such as Northern Pike in Battle Creek (R. Bramblett pers. comm.), may also contribute to declines in abundance of Mountain Sucker.

The likelihood of occurrence of non-native fish species in the Milk River, Battle Creek and Frenchman River drainages is Known and the impact of this threat on Mountain Sucker ranges from Low to High depending on the species introduced. The overall effect of this threat is Widespread and Chronic.

Other species

Didymosphenia geminata (Bacillariophyceae), a diatom responsible for algal blooms in the clear and nutrient free headwaters of various Alberta rivers, is an emerging threat to fish habitat (Kirkwood et al. 2007). These blooms can create dense algal mats that cover the river bottom, impacting ecosystem structure and function and negatively affecting other trophic levels. The environmental factors and conditions that promote bloom events are not well understood. However, flow regulation by dams may create the stable flow environment preferred by *D. geminata*. It is believed that the transfer of these blooms between watersheds is attributable to the improper cleaning of recreational fishing gear (e.g., fisherman's boots).

If these algal blooms occur in river habitat occupied by the Mountain Sucker they may alter the cover, food, and spawning habitats available to these fish and may displace them from these habitats. The occurrence of these algae in the Milk River below the confluence is Known but its impact on the Mountain Sucker is Unknown.

The Battle Creek and the Frenchman River drainages are currently unaffected by *Didymosphenia geminata*, since there have been no reports in the immediate area, but an introduced species of crayfish (*Orconectes virilis*) has been collected in Battle Creek, Frenchman River and its tributaries, including Conglomerate Creek. Other non-native species, such as bivalve and crustacean assemblages, are unlikely in Battle Creek and Frenchman River (Iain Phillips, pers. comm.). Regardless, the likelihood of Other Species posing a possible threat to Mountain Sucker in Saskatchewan is Known although its impact is thought to be Low. The overall effect of the Introduction of Other Species (i.e., non-fish) is Local and Chronic.

Introduced species of riparian vegetation (e.g., Russian Olive and Salt Cedar), considered noxious weeds in southern Alberta, could have impacts on the Milk River system. The level of threat impact is unknown for these species.

Contaminants and Toxic Substances

Point source contamination

Toxic substances released from storm and sewage water, as well as accidental spills and gas leaks particularly at river and tributary crossings could pose a serious threat to the fish community. The Town of Milk River no longer releases sewage into the Milk River (K. Miller, pers. comm.) and thus is of minimal concern. Although no spills have been documented for the Milk River, Battle Creek, and the Frenchman River the threat likelihood of this threat is Known.

There have been some reports of gas leaks from automobiles that have also occurred in recent years (S. Petry, pers. comm.). Contamination of water from seismic or drilling activities is also a possibility. Uncapped groundwater wells may pose a threat although licensing and well capping have reduced this possibility (Alberta Environment 2001).

The likelihood of occurrence of Point Source Contamination is Known in the Milk River, Battle Creek and Frenchman River drainages. The extent and impact of any damage to the aquatic community including Mountain Sucker would be Low to High, depending on the substance released, the location of spill, time of year (flow augmentation or not), and the potential to mitigate the impacts. Overall, the effect of this threat is Widespread but Ephemeral.

Non-point source contamination

Non-point source contamination includes potential nutrient loading from runoff of agricultural pesticides and fertilizers. There is only 8,000 acres of irrigated cropland found within 50 km of the Town of Milk River, and there is another small section located upstream on the North Milk River near Del Bonita (K. Miller, pers. comm.). The rough terrain along the river valley limits crops from being grown in much of the valley bottom (K. Miller, pers. comm.). The growing season coincides with the flow augmentation from the St. Mary's Diversion diluting any additional inputs of nutrients. Water quality in the Milk River mainstem changes seasonally in response to flow augmentation in the spring and summer, leading to decreases in total dissolved solids, conductivity, and salinity (W. Koning, pers. comm.).

In Saskatchewan, nutrient loading due to agricultural runoff is limited in Battle Creek and Frenchman River systems. The headwaters of Battle Creek are protected by the Cypress Hills interprovincial park, however, nutrient loading in the lower reaches of the river are presumed to be influenced by agricultural runoff. Where Mountain Sucker are distributed in the Frenchman River system most of the land use is strictly rangeland.

The likelihood of occurrence of Non-point Source Contamination is Known in both Alberta and Saskatchewan but its impact on Mountain Sucker is Low in Alberta and Low to Medium in Saskatchewan where there is a combination of farming and ranching activities. Overall, the effect of this threat is Widespread and Chronic.

Other Threats

Fragmentation

The many disjunctions within the natural range of the Mountain Sucker suggest there are limitations to dispersal, that may render any recovery efforts highly unlikely except from nearby areas. The primary natural barriers isolating populations of Mountain Sucker across their geographic distribution are the mountainous divides separating drainage basins (Smith 1966). Additionally, mountain-stream fishes are subject to other natural barriers such as impassable falls that may completely block fish passage to upstream segments of the streams they inhabit or may prevent expansion of a population into high reaches of streams that could potentially support additional species. Also, ecological barriers may exist such as environmental differences in the lower parts of a stream, where waters may be less habitable due to warmer, more turbid, slower flow rates, and/or to unsuitable bottom substrate.

Without reliable abundance estimates of Mountain Sucker in the Milk rivers in Alberta and Battle Creek and the Frenchman River in Saskatchewan it is difficult to know if ecological barriers exist. However, there are clear discrepancies in environmental conditions (such as those listed above) between the headwaters and the lower reaches of the Milk rivers, and these conditions are also presumed to occur in the Battle Creek and Frenchman River tributaries in Saskatchewan.

Man-made barriers are evident throughout the range of DU2 and are of primary importance when considering any recovery strategy of fishes. Localized examples, such as hanging culverts at road crossings (e.g., Caton Creek) and stock watering ponds at the tops of coulees that occur sporadically throughout Alberta and Saskatchewan, do in some instances completely or partially obstruct fish passage, and can either block gene flow or facilitate unidirectional gene flow. Similarly, reservoirs are common barriers to fish passage. A key cause of Mountain Sucker habitat loss is stream impoundment, which results in a decline of Mountain Sucker abundance (Decker 1989; Decker and Erman 1992). Larval survivorship is naturally low for Mountain Sucker. However, larval mortality may be exacerbated in reservoir habitats where food and cover is limited and larvae may encounter increased predation (Belica and Nibbelink 2006). Battle Creek and the Frenchman River join the Milk River in Montana south of the Fresno Reservoir. Battle Creek appears to be unimpeded by reservoirs from its headwaters through to the Milk River although there is a diversion into Cypress Lake and multiple road crossings with culverts. The Frenchman River has at least three primary reservoirs in Canada. On the Milk River downstream of the Fresno Reservoir in Montana, six more impassible dams upstream of the confluence with the Missouri River prevent any upstream dispersal of Milk River populations (Stash 2001; COSEWIC 2008).The efficiency of the these types of barriers are relatively high. Furthermore, when fragmentation occurs, disruptive selection on small breeding stocks of fish may make them particularly vulnerable to subtle environmental perturbations and also may prevent sufficient recruitment to replenish the stock.

In the Milk River drainage the likelihood of occurrence and impact of fragmentation are Unlikely and Low, respectively, whereas in the Battle Creek and Frenchman River drainages they are Likely and Medium. The overall effect of this threat is Widespread and Chronic.

Scientific sampling

Scientific sampling of Mountain Sucker has occurred in the three drainages in the past and may continue in the future so the likelihood of occurrence of this activity is Known. However, the impact of this threat is Low as it usually involves live-sampling and has a high potential for mitigation as it is regulated through the issuance of permits under SARA. The overall effect of this threat is Local and Ephemeral.

Climate change

Climate change can impact water availability, temperature, and a broad range of other issues (Schindler 2001), thereby affecting extent the quality and availability of Mountain Sucker habitat. By the end of the 21st century climate change is predicted to result in a temperature increase of 1-2°C along with a slight increase in precipitation (CCIS 2007). As a result, Schindler and Donahue (2006) suggest that the southern prairies are likely to be much drier with less snow melt collecting in reservoirs. Therefore, it may become increasingly difficult to maintain current summer flow regimes and fish habitat. It is conceivable that Mountain Sucker habitat will decline from increasing frequency and severity of droughts and increasing water temperatures. The effects of climate change on Mountain Sucker populations in DU2 are unclear but as the distribution of this species in Canada is limited, it is particularly susceptible to habitat loss and degradation, which climate change is expected to exacerbate. Climate Change as a threat was not included in the population-specific threats analysis.

Table 4. Definitions of terms used to describe Threat Likelihood, Threat Impact and Certainty as used in Table 5.

Term	Definition
Threat Likelihood	
Known (K)	This threat has been recorded to occur at site X.
Likely (L)	There is a > 50% chance of this threat occurring at site X.
Unlikely (U)	There is a < 50% chance of this threat occurring at site X.
Unknown (UK)	There are no data or prior knowledge of this threat occurring at site X.
Threat Impact	
High (H)	Currently, the threat is jeopardizing the survival or recovery of the population. OR If the threat was to occur, it would jeopardize the survival or recovery of the population.
Medium (M)	Currently, the threat is likely jeopardizing the survival or recovery of the population. OR If threat was to occur, it would likely jeopardize the survival or recovery of the population.
Low (L)	Currently, the threat is unlikely jeopardizing the survival or recovery of the population. OR If threat was to occur, it would be unlikely to jeopardize the survival or recovery of the population.
Unknown (UK)	There is no prior knowledge, literature or data to guide the assessment of the impact if it were to occur.
Certainty (as it relates to Threat Impact)	
1	Causative study
2	Correlative study
3	Expert opinion
Spatial Extent	
Widespread	Threat is likely to affect the majority of stocks (i.e., two or more) at a medium or high level.
Local	Threat is likely to not affect the majority of stocks (i.e., less than two) at a medium or high level.
Temporal Extent	
Chronic	Threat is likely to have a long-lasting or reoccurring effect on the population.
Ephemeral	Threat is likely to have a short-lived or non-recurring effect on the population.

Table 5. Threat Likelihood (TLH) and Threat Impact (TI) for Mountain Sucker in DU2 based on the best available data. The Threat Likelihood was assigned as Known (K), Likely (L), Unlikely (U), or Unknown (UK), and the Threat Impact was assigned as High (H), Medium (M), Low (L), or Unknown (UK). The level of Certainty (C) associated with Threat Likelihood and Threat Impact was based on causative studies (1), correlative studies (2) or expert advice (3).

Threats	**Milk River drainage**			**Battle Creek drainage**			**Frenchman River drainage**		
	TLH	**TI**	**C**	**TLH**	**TI**	**C**	**TLH**	**TI**	**C**
Habitat Loss/Degradation									
Drought	K	H	3	K	H	3	K	H	3
Anoxia	K	H	3	K	H	3	K	H	3
Changes in flow	K	H	3	L	M	3	L	M	3
Livestock use of flood plain	K	L	3	K	H	3	K	H	3
Dam construction and operation	UK	M-H	3	L	L-H	3	K	M-H	3
Surface water extraction: Irrigation	K	L	3	K	H	3	K	M-H	3
Surface water extraction: non-irrigation	K	L-H	3	K	L	3	L	L	3
Changes in habitat quality and availability	L	L-M	3	L	L-M	3	L	L-M	3
Groundwater extraction	K	L	3	K	L	3	K	L	3
Changes in geomorphology	K	L-M	3	UK	L	3	UK	L	3
Species Introductions									
Fish species	K	L-H	3	K	L-H	3	K	L-H	3
Other species	K	UK	3	K	L	3	K	L	3
Contaminants and Toxic Substances									
Point source contamination	K	L-H	3	K	L-H	3	K	L-H	3
Non-point source contamination	K	L	3	K	L-M	3	K	L-M	3
Other Threats									
Fragmentation	U	L	3	L	M	3	L	M	3
Scientific sampling	K	L	3	K	L	3	K	L	3

Table 6. The Threat Level Matrix combines the Threat Likelihood and Threat Impact rankings to establish the Threat Level for each Mountain Sucker population in DU2. The resulting Threat Level has been categorized as Low, Medium, High, or Unknown.

		Threat Impact			
		Low (L)	**Medium (M)**	**High (H)**	**Unknown (UK)**
Threat Likelihood	**Known (K)**	Low	Medium	High	Unknown
	Likely (L)	Low	Medium	High	Unknown
	Unlikely (U)	Low	Low	Medium	Unknown
	Unknown (UK)	Unknown	Unknown	Unknown	Unknown

Table 7. Threat Level for all Mountain Sucker populations in DU2, resulting from an analysis of both the Threat Likelihood and Threat Impact. H=high, M=medium, L=low, UK=unknown.

Threats	Milk River drainage	Battle Creek drainage	Frenchman River drainage
Drought	H	H	H
Anoxia	H	H	H
Changes in flow	H	M	M
Livestock use of flood plain	L	H	H
Fish species introductions	L / M / H	L / M / H	L / M / H
Point source contamination	L / M / H	L / M / H	L / M / H
Dam construction and operation	UK	L / M / H	M / H
Surface water extraction: irrigation	L	H	M / H
Surface water extraction: non-irrigation	L / M / H	L	L
Fragmentation	L	M	M
Changes in habitat quality and availability	L / M	L / M	L / M
Non-point source contamination	L	L / M	L / M
Groundwater extraction	L	L	L
Other species introductions	UK	L	L
Scientific sampling	L	L	L
Changes in geomorphology	L / M	UK	UK

Table 8. Overall effect of threats on Mountain Sucker in DU2.

Threat	Spatial Extent	Temporal Extent
Drought	Widespread	Chronic
Anoxia	Widespread	Chronic
Changes in flow	Widespread	Chronic
Livestock use of flood plain	Widespread	Chronic
Fish species introductions	Widespread	Chronic
Point source contamination	Widespread	Ephemeral
Dam construction and operation	Widespread	Chronic
Surface water extraction: irrigation	Widespread	Chronic
Surface water extraction: non-irrigation	Local	Chronic
Fragmentation	Widespread	Chronic
Changes in habitat quality and availability	Widespread	Chronic
Non-point source contamination	Widespread	Chronic
Groundwater extraction	Local	Chronic
Other species introductions	Local	Chronic
Scientific sampling	Local	Ephemeral
Changes in geomorphology	Local	Chronic

MITIGATION AND ALTERNATIVES

Habitat Loss/Degradation

Many of the threats affecting Mountain Sucker populations are related to habitat loss or degradation. Habitat-related threats have been linked to the Pathways of Effects developed by DFO Fish Habitat Management (FHM). Guidance on generic mitigation measures have been developed for 19 Pathways of Effects for the protection of aquatic species at risk in Central and Arctic region within DFO (Coker et al. 2010), some of which are relevant for the Milk River, Battle Creek and Frenchman River drainages. These mitigation measures should be referred to when considering mitigation and alternative strategies for habitat-related threats. They were developed to mitigate, limit or minimize threats, however since they were not developed to specifically consider species at risk so they may need to be modified for this purpose. Additionally, site-specific mitigations may be warranted and should be discussed with local conservation managers. Table 9 identifies the relevant Pathways of Effects for Mountain Sucker.

Contaminants and Toxic Substances

The DFO mitigation guide (Coker et al. 2010) also provides guidance on generic mitigation measures for Pathways of Effects related to contaminants and toxic substances from point and non-point sources. Table 8 identifies the relevant Pathways of Effects for Mountain Sucker. These measures combined with legislative control/licensing at the provincial and federal levels, public education and developing plans to contain and clean up spills and other releases of pollutants have the potential to mitigate this threat. Alternative measures, such as reductions in pesticides, are market driven.

Table 9. Threats to Mountain Sucker populations in Canada and the Pathways of Effect associated with each threat as per Coker et al. 2010. 1 - Vegetation clearing; 2 – Grading; 3 – Excavation; 5 – Use of industrial equipment; 6 – Cleaning or maintenance of bridges or other structures; 7 – Riparian planting; 8 – Streamside livestock grazing; 9 – Marine seismic surveys; 10 – Placement of material or structures in water; 11 – Dredging; 12 – Water extraction; 13 – Organic debris management; 14 – Wastewater management; 15 – Addition or removal of aquatic vegetation; 16 – Change in timing, duration and frequency of flow; 17 – Fish passage issues; 18 – Structure removal; 19 – Placement of marine finfish aquaculture site .

Threats	Pathways of Effect
Habitat loss and degradation	1, 2, 3, 4, 5, 7, 8, 10, 11, 12, 13, 14, 15, 16, 18
Altered flow regimes	10, 16, 17
Barriers to movement	10, 16, 17
Turbidity and sediment loading	1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 12, 13, 15, 16, 18
Non-point source contamination	1, 4, 7, 8, 11, 12, 13, 14, 15, 16
Point source contamination	1, 4, 5 , 6 ,7 ,11 ,12 ,13 ,14, 15, 16 ,18

Pathways of Effects were not developed for species introductions or other threats, like scientific sampling, so the following specific mitigation measures and alternatives are provided for those types of threats.

Species Introductions

Non-native aquatic vegetation and fish species introduction and establishment have the potential to negatively affect Mountain Sucker populations. Introduced species of riparian vegetation (e.g., Russian Olive and Salt Cedar), may also impact the Milk River system.

Mitigation

- Physically remove non-native species from areas known to be inhabited by Mountain Sucker.
- Monitor systems for exotic species that may negatively affect Mountain Sucker populations directly, or negatively affect their preferred habitat.
- Coordinate with Montana/U.S. agencies to evaluate all introductions of exotic species in the Milk River system.
- Develop a plan to address potential risks, impacts, and proposed actions if monitoring detects the arrival or establishment of an exotic species.
- Introduce a public awareness campaign and encourage the use of existing exotic species reporting systems.
- Carefully consider barrier removal as this may increase the likelihood of species introductions.

Alternatives

- There are no alternatives to unauthorized introductions.
- For authorized introductions use only native species of the same genetic stock.
- For authorized introductions follow the National Code on Introductions and Transfers of Aquatic Organisms for all aquatic organism introductions (DFO 2003).

Other Threats

Scientific sampling

Targeted and incidental harvest of Mountain Sucker may occur while undertaking scientific sampling. It was recognized as a low risk threat.

Mitigation

- Non-lethal sampling
- Sampling under a SARA permit.

Alternatives

- Sample Mountain Sucker in areas where they are not protected (e.g., Montana).

OTHER LIMITING FACTORS FOR POPULATION SURVIVAL OR RECOVERY

The Mountain Sucker populations from Milk River watershed possesses several extrinsic characteristics that make this DU susceptible to extirpation: 1) barriers to gene flow between conspecific sampling locations that limit range expansion and rescue effect, 2) specific temperature and oxygen levels, water velocities, and substrate requirements to ensure positive recruitment and sufficient quantity and quality of habitat, 3) a paucity of information on the species' life-history, and 4) the impacts of non-native fish assemblages on Mountain Sucker populations (e.g., Northern Pike in the Milk rivers, salmonids in Saskatchewan). These limiting factors are key components to conservation management of Mountain Sucker in DU2. The Milk River drainage has been studied the most of the three drainages in DU2 in which Mountain Sucker occur. Habitat data are available for the North Milk and Milk rivers; limited habitat information is available for the Frenchman River and Battle Creek drainages. Conditions in the three areas are very different. There is also a lack of historical data to compare with current material to know if there have been any changes over time.

SOURCES OF UNCERTAINTY

Good management decisions depend on good information and that information is lacking in some key areas for Mountain Sucker.

Populations of Mountain Sucker across Canada have shown genetic differences and geographically discontinuous distributions that are common among species (Taylor and Gow 2008). Treating Mountain Sucker as a single well distributed species would severely underestimate its diversity. It is not known to what extent Mountain Sucker in the lower reaches of the Missouri River are representative of other conspecifics across a broader distribution. This highlights a key missing component to the species' biology, and urgency for a formal taxonomic review.

Moreover, COSEWIC's recognition of Mountain Sucker from the Milk River watershed should be regarded *sensu lato*, as specimens are not restricted to the Milk River but rather found more broadly within the Missouri River drainage. It is not yet known if specimens represent a single or multiple populations. Currently, the Milk River populations of Mountain Sucker encompass eight separate locations in Alberta and Saskatchewan.

The survival or recovery of the Mountain Sucker in Alberta is hindered by a lack of knowledge of the species' biology, taxonomy, life history, and habitat requirements specific to this DU, preventing an accurate evaluation of potential threats. Their response to potentially limiting environmental factors, including temperature extremes, turbidity, and flow are also uncertain. There is an even greater need for more research on Mountain Sucker in Saskatchewan including a better delineation of their range and associated habitat, and movements between and among populations relative to temperature, substrate and physical barriers (e.g., road crossings, dams).

Biology

Very little information is available on some key aspects of the life history and biology of the Mountain Sucker. Studies have not, for example, been conducted to describe the species' reproductive strategy or overwintering requirements. The Mountain Sucker reproductive strategy and its overwintering requirements should be of priority since accurate threat assessments and critical habitat identification depend upon knowledge of the species'. There is also little or no information available on population structure, movements, or early life stages.

Habitat

The specific habitat needs of the Mountain Sucker, particularly for eggs and fry, remain unknown. Overwintering habitats also have not been documented and the relationship between sediment load, turbidity, and the abundance of these fish remains unresolved.

Abundance

To date, there are no reliable abundance estimates for the Mountain Sucker within the Milk River watershed. As such, it is not yet possible to set a conservation population target size, or to confirm whether changes in abundance have occurred. The magnitude of natural variability in population size is also unknown, making it difficult to determine if changes in abundance over the short term are related to natural fluctuations or if there are extrinsic factors leading change in population status. Recent studies have at minimum confirmed their persistence.

Threats

Some potential threats cannot be fully evaluated because detailed information on the stressors and the mechanisms by which they might affect these fish are not well understood. To accurately predict the effects of impoundment, for example, requires better knowledge of how changes in the physical conditions of the river, such as an altered flow regime, may interact with the species given its life history and habitat requirements. Further study of these relationships is warranted.

OTHER CONSIDERATIONS

The North Milk and Milk rivers, Battle Creek, and Frenchman River each cross international boundaries between Canada and the U.S. and as such are subject to their respective jurisdictional laws. Rapid dissemination of information concerning these river systems should be negotiated to alleviate impacts on fish health. In August 2001, following the third year of drought and low water levels, the siphon crossing the St. Mary River (into the Milk River) ruptured and may have significantly affected the local fishes (T. Clayton, pers. comm.). Canada's involvement in remediating the situation was hindered by the U.S. (T. Clayton, pers. comm.).

The 1909 Boundary Waters Treaty (the Treaty), which is administered by the International Joint Commission (IJC), provides principles for Canada and the United States to follow for the management of shared waters including the St. Mary and Milk rivers (ISMMRAMTF 2006; see also Dolan 2007; Halliday and Faveri 2007a,b; Rood 2007). In 1917, the United States constructed a canal to divert water from the St. Mary River in northwestern Montana through the Milk River system, across southern Alberta, to northeastern Montana for irrigation. An average of about 2.08 x 108 m^3 of water has flowed annually through the St. Mary Canal into the North Milk River over the past two decades (U.S. Bureau of Reclamation 2004). In 2003, Montana requested that the Treaty be re-opened to reconsider how the diverted water is apportioned. However, at the time of writing, this issue had not yet been resolved. At present the operating capacity of the St. Mary Canal is about 18.4 m^3/s, significantly less than its original design capacity of 24.1 m^3/s. Montana is considering whether to rehabilitate the aging canal infrastructure and return the canal to its original capacity, or whether to increase its capacity to 28.3 m^3/s (Alberta Environment 2004; U.S. Bureau of Reclamation 2004).

Additionally, there may be implications of species introductions by U.S. jurisdictions to Mountain Sucker in Canadian waters as there is no joint agreement currently in place between Alberta and Montana regarding species introductions in the Milk and St. Mary rivers.

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