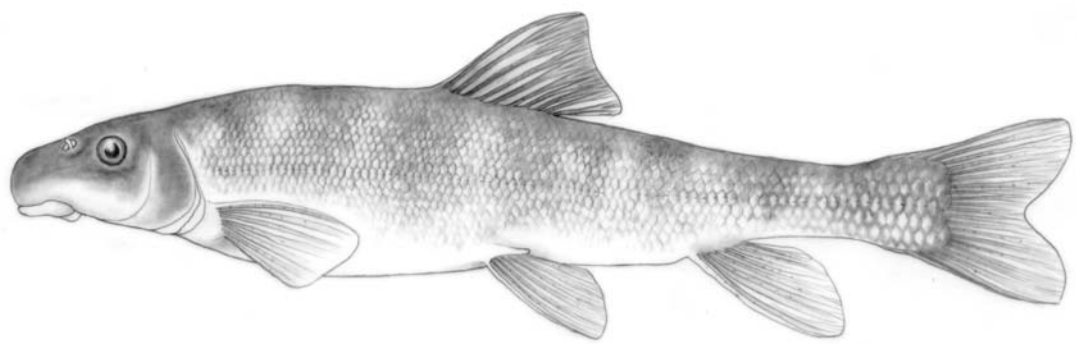
COSEWIC
Assessment and Status Report

on the

Mountain Sucker
Catostomus platyrhynchus

Saskatchewan - Nelson River Populations
Milk River Populations
Pacific Populations

in Canada



Saskatchewan - Nelson River Populations - NOT AT RISK
Milk River Populations - THREATENED
Pacific Populations - SPECIAL CONCERN
2010

COSEWIC
Committee on the Status
of Endangered Wildlife
in Canada

COSEPAC
Comité sur la situation
des espèces en péril
au Canada

COSEWIC status reports are working documents used in assigning the status of wildlife species suspected of being at risk. This report may be cited as follows:

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Campbell,E.Rhonda.1991 Status Report on the Mountain Sucker *catostomus platyrhynchus* in Canada. Committee on the Status of Endangered Wildlife in Canada.Ottawa.43 pp.

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Également disponible en français sous le titre Évaluation et Rapport de situation du COSEPAC sur le meunier des montagnes (*Catostomus platyrhynchus*) Populations de la rivière Milk, populations du Pacifique et la populations des rivières Saskatchewan et Nelson au Canada.

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COSEWIC
Assessment Summary

Assessment Summary – November 2010

Common name
Mountain Sucker - Saskatchewan - Nelson River populations

Scientific name
Catostomus platyrhynchus

Status
Not at Risk

Reason for designation
This small freshwater fish is relatively widespread in the Saskatchewan River drainage across many tributaries both in Alberta and Saskatchewan. Threats to the populations are relatively localized and not of imminent concern to the species' persistence across its range.

Occurrence
Alberta, Saskatchewan

Status history
The species was considered a single unit and designated Not at Risk in April 1991. Split into three populations in November 2010. The "Saskatchewan - Nelson River populations" unit was designated Not at Risk in November 2010.

Assessment Summary – November 2010

Common name
Mountain Sucker - Milk River populations

Scientific name
Catostomus platyrhynchus

Status
Threatened

Reason for designation
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.

Occurrence
Alberta

Status history
The species was considered a single unit and designated Not at Risk in April 1991. Split into three populations in November 2010. The "Milk River populations" unit was designated Threatened in November 2010.

Assessment Summary – November 2010

Common name
Mountain Sucker - Pacific populations

Scientific name
Catostomus platyrhynchus

Status
Special Concern

Reason for designation
This small freshwater fish has a patchy distribution within the North Thompson, lower Fraser and Similkameen river drainages in British Columbia. It has a small area of occupancy and number of locations within each of these areas. It is likely that habitat quality will continue to decline over about 40% of its Canadian range owing to increased water extraction in the Similkameen River drainage that climate change is expected to exacerbate.

Occurrence
British Columbia

Status history
The species was considered a single unit and designated Not at Risk in April 1991. Split into three populations in November 2010. The "Pacific populations" unit was designated Special Concern in November 2010.

COSEWIC
Executive Summary

Mountain Sucker
Catostomus platyrhynchus

Saskatchewan - Nelson River Populations
Milk River Populations
Pacific Populations

Wildlife species description

The Mountain Sucker, also commonly known as the Northern Mountain Sucker or the Plains Sucker, is a small (usually < 250 mm fork length) bottom-oriented fish of the western mountainous regions and westernmost Great Plains of North America. The Mountain Sucker has a sub-terminal mouth with characteristic “fleshy bumps” (papillae) on the lips. The body is elongate, cylindrical and somewhat compressed caudally. Molecular genetic data and the distribution of Mountain Suckers among three National Freshwater Biogeographic Zones (NFBZ) identify three designatable units (DU) in Canada (Saskatchewan-Nelson DU, Missouri DU and Pacific DU).

Distribution

The Mountain Sucker is found in the Columbia, Fraser, Saskatchewan, and upper Missouri river systems of Canada. In the United States, it occurs in the Green, upper Columbia, Yakima, upper Sacramento, and upper Missouri river systems, in the Lahontan and Bonneville basins, and in tributaries of the Colorado River as far south as Utah. Information on the distribution, abundance, and life history of the species is limited, but it appears to be less abundant in the northern parts of the range, particularly in British Columbia and Washington.

Habitat

Mountain Suckers are associated with the cool waters of higher gradient reaches of mainly small rivers typified by moderate current and gravel to cobble substrates. They occasionally occur in lakes, reservoirs, and large rivers. Their distribution and evolution is closely related to the geological history of the aquatic habitats of mountainous areas.

Biology

The biology of the species in Canada remains largely unknown and only two comprehensive studies have been completed in the United States. Spawning occurs in late spring or early summer. The fecundity of the Mountain Suckers collected ranged from 990 to 3,710 eggs in Flathead Creek and East Gallatin River, Montana, respectively, and between 1,239 to 2,863 eggs for 20 females in Lost Creek Reservoir, Utah. Eggs usually hatch within 8 to 14 days (similar to other suckers), and the young of the year reach 30 to 64 mm total length by their first September. Conflicting information regarding age to maturity exists; but the consensus is that males mature before females, also typical of many other sucker species. During the breeding season, both sexes exhibit secondary sexual characteristics such as small “bumps” (tubercles) on the fins. The diet consists of a variety of food items including plankton, small invertebrates, and microscopic organic matter scraped off rocks.

Population sizes and trends

Although locally abundant at certain localities, Mountain Suckers are not abundant in most Canadian waters where they are at the northern fringe of their range. Quantitative data on abundance trends are lacking. The species does, however, continue to exist in areas where it was first observed over 40 years ago.

Threats

Habitat loss and degradation associated with expansion of agricultural, commercial and industrial land use, resource (including water) extraction, and the introduction of aquatic invasive species are suspected to have deleterious effects on the persistence of this species. The greatest risks to Mountain Suckers are in south-central British Columbia and southern Alberta and Saskatchewan where existing threats, particularly in terms of water availability, may be exacerbated by climate change.

Special significance of the species

The Mountain Sucker is not a well known member of the Canadian aquatic fauna. The taxonomy of the species and the genus is of considerable interest relative to the evolutionary affinities of *Pantosteus* and *Catostomus* and the zoogeographic history of these fishes in relation to tectonic and postglacial processes of dispersal and range expansion.

Existing protection and other status designations

The *Fisheries Act* provides general protection for the Mountain Sucker and its habitats. No species-specific measures, however, are in place for the protection of Mountain Suckers in Canada. As more information becomes available from field surveys and re-examination of museum collections, it may be determined that the Mountain Sucker is more widely distributed and abundant in Canada than previously thought. Many authors indicate relatively few and scattered records of occurrence, but where populations are found, it often is abundant. In the United States, several states (Washington, South Dakota, California, Colorado, and Nebraska) have ranked the Mountain Sucker as Vulnerable (S3) to Critically Imperiled (S1). In Canada, this species is designated as Vulnerable (S2S3) in British Columbia, Critically Imperiled (S1) in Saskatchewan, and Apparently Secure (S4) in Alberta. It is currently listed as Not at Risk under the SARA (1991 assessment as a single DU); however, it is currently COSEWIC-assessed (November 2010) as Data Deficient (Saskatchewan-Nelson River populations), Threatened (Milk River populations) and Special Concern (Pacific populations).

TECHNICAL SUMMARY – DU1 – Saskatchewan-Nelson Populations

Catostomus platyrhynchus

Mountain Sucker — Meunier des montagnes

Saskatchewan-Nelson River populations — Populations des rivières Saskatchewan et Nelson

Range of occurrence in Canada: (Saskatchewan – Nelson NFBZ) Saskatchewan River Drainage of Alberta and Saskatchewan

Demographic Information

Generation time (average age of parents in the population)	2-3 yr
Is there an [observed, inferred, or projected] continuing decline in number of mature individuals?	Unknown, but probable
Estimated percent of continuing decline in total number of mature individuals within [5 years or 2 generations].	Unknown
[Observed, estimated, inferred, or suspected] percent [reduction or increase] in total number of mature individuals over the last 10 years.	Unknown
[Projected or suspected] percent [reduction or increase] in total number of mature individuals over the next 10 years.	Unknown
[Observed, estimated, inferred or suspected] percent [reduction or increase] in total number of mature individuals over any 10 year period, over a time period including both the past and the future.	Unknown
Are the causes of the decline clearly reversible and understood and ceased?	Not Applicable
Are there extreme fluctuations in number of mature individuals?	No

Extent and Occupancy Information

Estimated Extent of Occurrence (EO)	177,701 km²
Index of Area of Occupancy (IAO) 2 X 2 km overlaid grid	4,552 km^2
Is the total population severely fragmented?	No
Number of “locations*”	~39
Is there an [observed, inferred, or projected] continuing decline in extent of occurrence?	Unknown
Is there an [observed, inferred, or projected] continuing decline in index of area of occupancy?	Unknown
Is there an [observed, inferred, or projected] continuing decline in number of populations?	No, but one (Swift Current Creek) may be extirpated
Is there an [observed, inferred, or projected] continuing decline in number of locations?	Unknown
Is there an [observed, inferred, or projected] continuing decline in [area, extent and/or quality] of habitat?	Yes, declines due to resource extraction activities and medium- to longer-term decline owing to climate change and effects on water availability.
Are there extreme fluctuations in number of populations?	No
Are there extreme fluctuations in number of locations*?	No
Are there extreme fluctuations in extent of occurrence?	No
Are there extreme fluctuations in index of area of occupancy?	No

Number of mature individuals (in each population)

Population	N Mature Individuals
North Saskatchewan River Red Deer River Bow River Oldman River South Saskatchewan River Swift Current Creek	Unknown
Total	Unknown

Quantitative Analysis

Probability of extinction in the wild is at least [20% within 20 years or 5 generations, or 10% within 100 years].	Not Conducted (necessary data not available)

Threats (actual or imminent, to populations or habitats)

Variable depending on population; habitat deterioration due to human land use is the major threat, and by inference from reports on other species in the same ecosystem the following are threats:

Immediate

- Low flows and high water temperatures resulting from drought and surface water extractions
- Land use changes owing to resource extraction

Potential

- Surface and ground water extraction
- Low flows and high water temperatures resulting from drought exacerbated by climate change
- Livestock and agricultural uses of the floodplain
- Drought

Rescue Effect (immigration from outside Canada)

Status of outside population(s)? **CAN**: Immigration from DU2 and DU3 not possible **USA: G5** (Idaho, Montana = S5)	
Is immigration known or possible?	Unlikely
Would immigrants be adapted to survive in Canada?	Probably
Is there sufficient habitat for immigrants in Canada?	Probably
Is rescue from outside populations likely?	No

Current Status

COSEWIC: NAR (2010)

Recommended Status and Reasons for Designation

Recommended Status: Not at Risk	**Alpha-numeric code:** N/A
Reasons for Designation: This small freshwater fish is relatively widespread in the Saskatchewan River drainage across many tributaries both in Alberta and Saskatchewan. Threats to the populations are relatively localized and not of imminent concern to the species' persistence across its range.	

Applicability of Criteria

Criterion A: Not applicable. No decline information.
Criterion B: Not applicable. Exceeds all criteria.
Criterion C: Not applicable. No population sizes estimated, probably exceeds thresholds.
Criterion D: Not applicable. Populations sizes unknown and exceeds D2 criterion.
Criterion E: Not conducted (necessary data not available).

TECHNICAL SUMMARY – DU2 – Milk River Populations

Catostomus platyrhynchus

Mountain Sucker — meunier des montagnes

Milk River populations — Populations de la rivière Milk

Range of occurrence in Canada: (Alberta – Missouri NFBZ) Milk River of Alberta and Saskatchewan

Demographic Information

Generation time (average age of parents in the population)	2-3 yr
Is there an [observed, inferred, or projected] continuing decline in number of mature individuals?	Unknown
Estimated percent of continuing decline in total number of mature individuals within [5 years or 2 generations].	Unknown
[Observed, estimated, inferred, or suspected] percent [reduction or increase] in total number of mature individuals over the last 10 years.	Unknown
[Projected or suspected] percent [reduction or increase] in total number of mature individual's over the next 10 years.	Unknown
[Observed, estimated, inferred or suspected] percent [reduction or increase] in total number of mature individuals over any 10 year period, over a time period including the past and the future.	Unknown
Are the causes of the decline clearly reversible and understood and ceased?	Not Applicable
Are there extreme fluctuations in number of mature individuals?	Possibly during drought conditions

Extent and Occupancy Information

Estimated Extent of Occurrence (EO)	13,006 km^2
Index of Area of Occupancy (IAO) 2 X 2 km overlaid grid	1,056 km^2
Is the total population severely fragmented?	No
Number of "locations*": Milk River mainstem North Milk River Battle Creek Conglomerate Creek Nine Mile Creek Belanger Creek (may be extirpated) Caton Creek Lonepine Creek	8
Is there an [observed, inferred, or projected] continuing decline in extent of occurrence?	Unknown
Is there an [observed, inferred, or projected] continuing decline in area of occupancy?	No
Is there an [observed, inferred, or projected] continuing decline in number of populations?	Unknown
Is there an [observed, inferred, or projected] continuing decline in number of locations?	No, but one (Belanger Creek) may be extirpated.

Is there an [observed, inferred, or projected] continuing decline in [area, extent and/or quality] of habitat?	Probably. Decline in habitat quality owing to water diversion and associated changes in sedimentation (St. Mary River). Droughts expected to continue from effects of climate change.
Are there extreme fluctuations in number of populations?	Unknown
Are there extreme fluctuations in number of locations*?	No
Are there extreme fluctuations in extent of occurrence?	No
Are there extreme fluctuations in index of area of occupancy?	Probably, during drought conditions

Number of mature individuals (in each population)

Population	**N Mature Individuals**
Milk River North Milk River Battle Creek Conglomerate Creek Nine Mile Creek Belanger Creek Caton Creek Lonepine Creek	Unknown
Total	Unknown

Quantitative Analysis

Probability of extinction in the wild is at least [20% within 20 years or 5 generations, or 10% within 100 years].	Not Conducted

Threats (actual or imminent, to populations or habitats)

Immediate

- Decreased habitat quality from water diversion (anoxia and sedimentation)
- Habitat loss and degradation due to canal shutdown during maintenance, human land use, livestock in streams

Potential

- Surface and ground water extraction
- Low flows and high water temperatures resulting from drought exacerbated by climate change
- Dam and reservoir construction
- Livestock and agricultural uses of the floodplain

Rescue Effect (immigration from outside Canada)

Status of outside population(s)? Unlikely **Can** DU1, DU3 – immigration from these DUs not possible **USA: G5** (Idaho, Montana = S5)	
Is immigration known or possible?	No
Would immigrants be adapted to survive in Canada?	Probably
Is there sufficient habitat for immigrants in Canada?	Probably
Is rescue from outside populations likely?	No

Current Status

COSEWIC: – Threatened (2010)

Status and Reasons for Designation

Status: Threatened	Alpha-numeric code: B1ab(iii)+2ab(iii)
Reason for Designation: 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.	

Applicability of Criteria

Criterion A: Not applicable. No decline information.
Criterion B: Meets Threatened B1 (EO < 20,000 km²) and B2 (IAO < 2,000 km²), sub-criterion (a) (< 10 locations), and b(iii), inferred continuing decline in habitat area and quality from operations of the St. Mary Canal, droughts and climate change.
Criterion C: Not applicable. No population sizes estimated, probably exceeds thresholds.
Criterion D: Not applicable. Population sizes unknown and minimum criteria for D2 exceeded.
Criterion E: Not conducted (data not available).

TECHNICAL SUMMARY – DU3 – Pacific Populations

Catostomus platyrhynchus
Mountain Sucker — Meunier des montagnes
Pacific populations — Populations du Pacifique
Range of occurrence in Canada: (BC) Pacific National Freshwater Biogeographic Zone: Columbia, Thompson and Fraser River populations.

Demographic Information

Generation time (average age of parents in the population)	4-5 yr
Is there an [observed, inferred, or projected] continuing decline in number of mature individuals?	Unknown
Estimated percent of continuing decline in total number of mature individuals within [5 years or 2 generations].	Unknown
[Observed, estimated, inferred, or suspected] percent [reduction or increase] in total number of mature individuals over the last 10 years.	Unknown
[Projected or suspected] percent [reduction or increase] in total number of mature individuals over the next 10 years.	Unknown
[Observed, estimated, inferred or suspected] percent [reduction or increase] in total number of mature individuals over any 10 year period, over a time period including the past and the future.	Unknown
Are the causes of the decline clearly reversible and understood and ceased?	Not Applicable
Are there extreme fluctuations in number of mature individuals?	Possibly during drought conditions

Extent and Occupancy Information

Estimated Extent of Occurrence (EO)	27,652 km^2
Index of Area of Occupancy (IAO) 2 X 2 km overlaid grid (Fraser R. = 168 km^2, North Thompson = 352 km^2, Similkameen R. = 316 km^2)	836 km^2
Is the total population severely fragmented?	No
Number of locations: North Thompson River (@ Clearwater, BC) North Thompson River North Thompson River: Heffley Creek Lower Fraser River (@ Harrison River mouth) Lower Fraser River (between Agassiz and Hope, BC) Similkameen River: Blind Creek Similkameen River: Tulameen River Similkameen River: Wolfe Creek Similkameen River: mainstem	9
Is there an [observed, inferred, or projected] continuing decline in extent of occurrence?	Unknown
Is there an [observed, inferred, or projected] continuing decline in area of occupancy?	No
Is there an [observed, inferred, or projected] continuing decline in number of populations?	No
Is there an [observed, inferred, or projected] continuing decline in number of locations?	No
Is there an [observed, inferred, or projected] continuing decline in [area, extent and/or quality] of habitat?	Stable overall, but likely decline in Similkameen River populations
Are there extreme fluctuations in number of populations?	No
Are there extreme fluctuations in number of locations*?	No

Are there extreme fluctuations in extent of occurrence?	No
Are there extreme fluctuations in index of area of occupancy?	No (possibility during drought conditions in Similkameen River drainage)

Number of mature individuals (in each population)

Population	N Mature Individuals
North Thompson River Lower Fraser River Similkameen River	Unknown
Total	Unknown

Quantitative Analysis

Probability of extinction in the wild is at least [20% within 20 years or 5 generations, or 10% within 100 years].	Not Conducted (data not available)

Threats (actual or imminent, to populations or habitats)

Variable depending on population; habitat loss and degradation due to human land use, livestock in streams, fragmentation by small dams, and water use.

Immediate

- Low flows and high water temperatures resulting from drought and surface water extractions (Similkameen River)
- Introduced species and gravel extraction (lower Fraser River)
- Toxic waste from mining activity (Similkameen River)

Potential

- Surface and ground water extraction (Similkameen River)
- Low flows and high water temperatures resulting from drought exacerbated by climate change (Similkameen River)
- Dam and reservoir construction.(Similkameen River)

Rescue Effect (immigration from outside Canada)

Status of outside population(s)? Unlikely **CAN:** Immigration from DU1 and DU2 not possible **USA: G5** (Washington S2S3)	
Is immigration known or possible?	Unlikely
Would immigrants be adapted to survive in Canada?	Probably
Is there sufficient habitat for immigrants in Canada?	Probably
Is rescue from outside populations likely?	No

Current Status

COSEWIC: Special Concern (2010)

Status and Reasons for Designation

Status: Special Concern	**Alpha-numeric code:** N/A
Reason for Designation: This small freshwater fish has a patchy distribution within the North Thompson, lower Fraser and Similkameen river drainages in British Columbia. It has a small area of occupancy and number of locations within each of these areas. It is likely that habitat quality will continue to decline over about 40% of its Canadian range owing to increased water extraction in the Similkameen River drainage that climate change is expected to exacerbate.	

Applicability of Criteria

Criterion A: Not applicable. No decline data.
Criterion B: Meets Threatened B2 (IAO < 2,000 km²), sub-criterion (a) (< 10 locations), but not (b) or (c) (no inferred continuing decline in habitat area or quality or populations across the majority of its distribution).
Criterion C: Not applicable. No information on population sizes or decline.
Criterion D: Not applicable. No information on population sizes (D1) or exceeds criterion (D2).
Criterion E: Not conducted (data unavailable).

PREFACE

The Mountain Sucker (*Catostomus platyrhynchus*) is a small fish found in mountain streams, and rarely lakes, in the Saskatchewan, Milk, Columbia, and Fraser river drainages. The Mountain Sucker was first assessed by COSEWIC in 1991 as Not at Risk. Since this assessment, new collections of Mountain Sucker associated with surveys of species at risk in the Milk River and adjacent portions of the South Saskatchewan River were made by Fisheries and Ocean Canada from 2005 to 2008. Phylogeographic analyses of these and other collections have resolved deep evolutionary subdivisions within the species in Canada and the recognition of three designatable units (DUs). In addition, new survey information accumulated for Mountain Sucker in areas encompassing two of the DUs (Saskatchewan – Nelson and Missouri DUs) has resulted in new occurrence records and a better understanding of habitat use and distribution.

COSEWIC HISTORY

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) was created in 1977 as a result of a recommendation at the Federal-Provincial Wildlife Conference held in 1976. It arose from the need for a single, official, scientifically sound, national listing of wildlife species at risk. In 1978, COSEWIC designated its first species and produced its first list of Canadian species at risk. Species designated at meetings of the full committee are added to the list. On June 5, 2003, the *Species at Risk Act* (SARA) was proclaimed. SARA establishes COSEWIC as an advisory body ensuring that species will continue to be assessed under a rigorous and independent scientific process.

COSEWIC MANDATE

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) assesses the national status of wild species, subspecies, varieties, or other designatable units that are considered to be at risk in Canada. Designations are made on native species for the following taxonomic groups: mammals, birds, reptiles, amphibians, fishes, arthropods, molluscs, vascular plants, mosses, and lichens.

COSEWIC MEMBERSHIP

COSEWIC comprises members from each provincial and territorial government wildlife agency, four federal entities (Canadian Wildlife Service, Parks Canada Agency, Department of Fisheries and Oceans, and the Federal Biodiversity Information Partnership, chaired by the Canadian Museum of Nature), three non-government science members and the co-chairs of the species specialist subcommittees and the Aboriginal Traditional Knowledge subcommittee. The Committee meets to consider status reports on candidate species.

DEFINITIONS
(2010)

Wildlife Species	A species, subspecies, variety, or geographically or genetically distinct population of animal, plant or other organism, other than a bacterium or virus, that is wild by nature and is either native to Canada or has extended its range into Canada without human intervention and has been present in Canada for at least 50 years.
Extinct (X)	A wildlife species that no longer exists.
Extirpated (XT)	A wildlife species no longer existing in the wild in Canada, but occurring elsewhere.
Endangered (E)	A wildlife species facing imminent extirpation or extinction.
Threatened (T)	A wildlife species likely to become endangered if limiting factors are not reversed.
Special Concern (SC)*	A wildlife species that may become a threatened or an endangered species because of a combination of biological characteristics and identified threats.
Not at Risk (NAR)**	A wildlife species that has been evaluated and found to be not at risk of extinction given the current circumstances.
Data Deficient (DD)***	A category that applies when the available information is insufficient (a) to resolve a species' eligibility for assessment or (b) to permit an assessment of the species' risk of extinction.

* Formerly described as "Vulnerable" from 1990 to 1999, or "Rare" prior to 1990.

** Formerly described as "Not In Any Category", or "No Designation Required."

*** Formerly described as "Indeterminate" from 1994 to 1999 or "ISIBD" (insufficient scientific information on which to base a designation) prior to 1994. Definition of the (DD) category revised in 2006.

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The Canadian Wildlife Service, Environment Canada, provides full administrative and financial support to the COSEWIC Secretariat.

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in Canada

2010

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WILDLIFE SPECIES INFORMATION

Name and classification

Class:	Actinopterygii
Order:	Cypriniformes
Family:	Catostomidae
Genus:	*Catostomus*
Subgenus:	*Pantosteus*
Scientific name:	*C. platyrhynchus*
Common names:	
English	Mountain Sucker
French	Meunier des montagnes

The Mountain Sucker, *Catostomus platyrhynchus* (Cope 1874), also commonly known as the Northern Mountain Sucker or Plains Sucker, was once known as *Pantosteus jordani,* Evermann 1893. The suckers in the former genus *Pantosteus are* small fishes (usually less than 300 mm fork length, FL) of the mountainous regions of western North America. Eight species had been recognized in *Pantosteus* (Bailey *et al.* 1960), but Smith (1966) reviewed the taxonomy of the group and recognized *Pantosteus* as a subgenus of the genus *Catostomus.* Smith's (1966) revision [which reduced the previously recognized eight species to five, and added an additional species, the Bridgelip Sucker (*Catostomus columbianus*)] does not completely resolve the taxonomic issues in relation to generic status between *Pantosteus* and *Catostomus*, but is generally accepted (Scott and Crossman 1998; Nelson *et al.* 2004). McPhail (2007) suggested, however, that what is now known as *Catostomus platyrhynchus* may in fact be several species occurring in disjunct distributional pockets across the Continental Divide and this idea warrants study.

Morphological description

Mountain Suckers are small catostomids that typically range from 127 to 152 mm total length (TL) as adults (Sigler and Miller 1963). Smith (1966) indicated a maximum size in the order of 175 mm standard length (SL), although Hauser (1969) reported an individual of 226 mm TL, and the Royal Ontario Museum (ROM) records include a 232 mm male collected in Alberta in 1964 (ROM 25919). The following account is largely based on descriptive material provided by Sigler and Miller (1963), Smith (1966), Carl *et al.* (1967), and Scott and Crossman (1998). The body is elongate, cylindrical and somewhat compressed caudally (Figure 1). The snout is broad and heavy, the eyes are small, the mouth large and ventral, the edge of the lower jaw having a sharp-edged cartilaginous sheath and the lower lip has the shape of paired “wings”. There are pronounced notches at the corners of the mouth (at the point of lateral connection of the upper and lower lips) and an incomplete medial cleft to the lower lip, which is markedly convex anteriorly, with three to five rows of large, round papillae covering the base. The upper lip is large and the outer surface lacks papillae; 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. The peritoneum is black or dusky; the intestine is long with six to 10 coils anterior to the liver and there are no pyloric caeca. A two-chambered swimbladder is present, but is reduced in size, the slender posterior chamber extending to about the point of origin of the pelvic fins. Post-Weberian vertebrae number 38 to 44, usually 40 to 43. Cycloid scales cover the body, usually crowded towards the head; the lateral line is complete and straight, the number of scales varying from 60 to 108 throughout the range (79-89 in British Columbia, BC). There is one dorsal fin with eight to 13 soft rays (10 or 11 in BC); the caudal fin is not long or deeply forked; the anal fin has seven rays; the pelvic fins are located well back in line with the middle of the base of the dorsal fin, usually with nine rays and a well developed axillary process; the pectoral fins are long, typically with 15 rays.

Figure 1. Mountain Sucker, *Catostomus platyrhynchus* (115 mm FL), collected October 3, 2006 (49.09026° N, 112.39883° W). Photo used by permission from D. Watkinson (Fisheries and Oceans Canada, Winnipeg).

Dorsally, these fish are dark green to grey or brown in colour, usually finely sprinkled with black and the ventral surface is pale yellow to white. The lateral line is not prominent, but there usually is a dark green to black lateral band and/or five dorsal blotches of fine black pigment on the sides. The fins are virtually colourless, although a faint red or yellow tinge may be evident. Young fish have three dark vertical bars on the sides and a black peritoneum, which may be observed in external observation. Snyder (1983) provides a description (and key) of larvae and young juveniles.

Breeding fish develop an orange to deep red lateral band and the fin rays may become more heavily pigmented. Breeding males also develop minute nuptial tubercles on the entire body surface; larger tubercles may be found on the lower lobe of the caudal fin, the dorsal surface of paired fins and on the anal fin. Nuptial tubercles also may be found on breeding females but these usually are smaller and less abundant than on males (Smith 1966; Hauser 1969; Scott and Crossman 1998).

This species can be distinguished from other catostomids, except the Bridgelip Sucker, 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). Smith (1966) indicated that fish from the same river system may show differences in such characters as width and shape of the caudal peduncle related to current flow.

Smith (1966) distinguished two major groupings of *Catostomus platyrhynchus*: those in the Great Basin drainages (an expansive system of closed drainages occurring primarily in Utah, Nevada, and California) and upper Snake River above Shoshone Falls (south-central Idaho) and those in the Columbia, Missouri and Saskatchewan rivers drainages. These two fairly distinct groups appeared to have resulted from a long period of isolation. The morphological distinctions within the groups, however, were as large as between the two major groupings resulting in the designation of all of the populations as *C. platyrhynchus*. Mountains provide the primary barriers isolating populations of this species, giving rise to a great deal of morphological variability within and between populations. This has made the taxonomy of the group and the resolution of generic status difficult (see Smith 1966 for details).

Populations in the Missouri River drainage are more similar morphologically to populations of the Green, Snake, Columbia, and Sevier rivers and may have inhabited the western Wyoming area for a long period of time, the eastward and northward spread occurring in the late Pliocene to early Pleistocene epochs (Love *et al.* 1963; Smith 1966). Those of the upper Missouri, Milk, and Saskatchewan river drainages may represent postglacial derivatives that presumably survived glaciation in a Missouri refugium (Cross *et al.* 1986; Minckley *et al.* 1986). Smith and Koehn (1971) and Smith (1992) contributed additional biochemical genetic information, but it did not alter the conclusions of Smith (1966). Moyle (2002) suggested that the taxonomic study of the species using molecular data might result in the emergence of several distinct taxa (see below and Taylor and Gow 2008).

Catostomus platyrhynchus is distributed throughout the entire Columbia River system, including the Snake River basin (McPhail and Lindsey 1986). The relationships of Mountain Sucker within the Snake River are, however, complicated in that populations below Shoshone Falls on the Snake River are more similar to those of the Missouri River system, while those above the falls have more affinity with populations of the Great Basin (Smith 1966). In the Columbia River system, the species occurs in sparse, scattered localities as morphologically differentiated forms in different parts of the system, implying that barriers to gene flow exist (Smith 1966; McPhail and Lindsey 1986). Populations of the Fraser River system are probably postglacial derivatives from ancestral Columbia River Mountain Sucker (Smith 1966; McPhail and Lindsey 1986; Taylor and Gow 2008).

Spatial population structure and variability

Mitochondrial DNA sequence data from Mountain Sucker collected from the upper Missouri drainage (Milk River) in Alberta and Saskatchewan, from the South Saskatchewan drainage (Willow Creek) in Alberta, the lower Columbia/Fraser systems (lower and upper Fraser and Willamette rivers) and from the upper Snake River above Shoshone Falls provide evidence of at least four highly divergent lineages across the species' global range (known as clades A-D), three of which occur in Canada: two lineages (clades C and D) within the upper Missouri/upper Saskatchewan rivers, and one (clade B) within the Columbia/Fraser drainage (Figure 2; Taylor and Gow 2008). The fourth lineage (clade A) appears to be endemic to the Snake River drainage in the US (Taylor and Gow 2008). The distinctions were supported by more limited nuclear DNA sequencing (Taylor and Gow 2008) and corroborate morphological data used to suggest the existence of distinctive Mountain Suckers above and below Shoshone Falls in the Snake River (discussed in McPhail 2007). Previously, however, there has been no indication of distinctions between fish east and west of the Continental Divide such as known for some other fishes with similar distributions (e.g., Lake Chub (*Couesius plumbeus*), and Brassy Minnow (*Hybognathus hankinsoni*), (E.B. Taylor unpublished data; Taylor and Gow 2008).

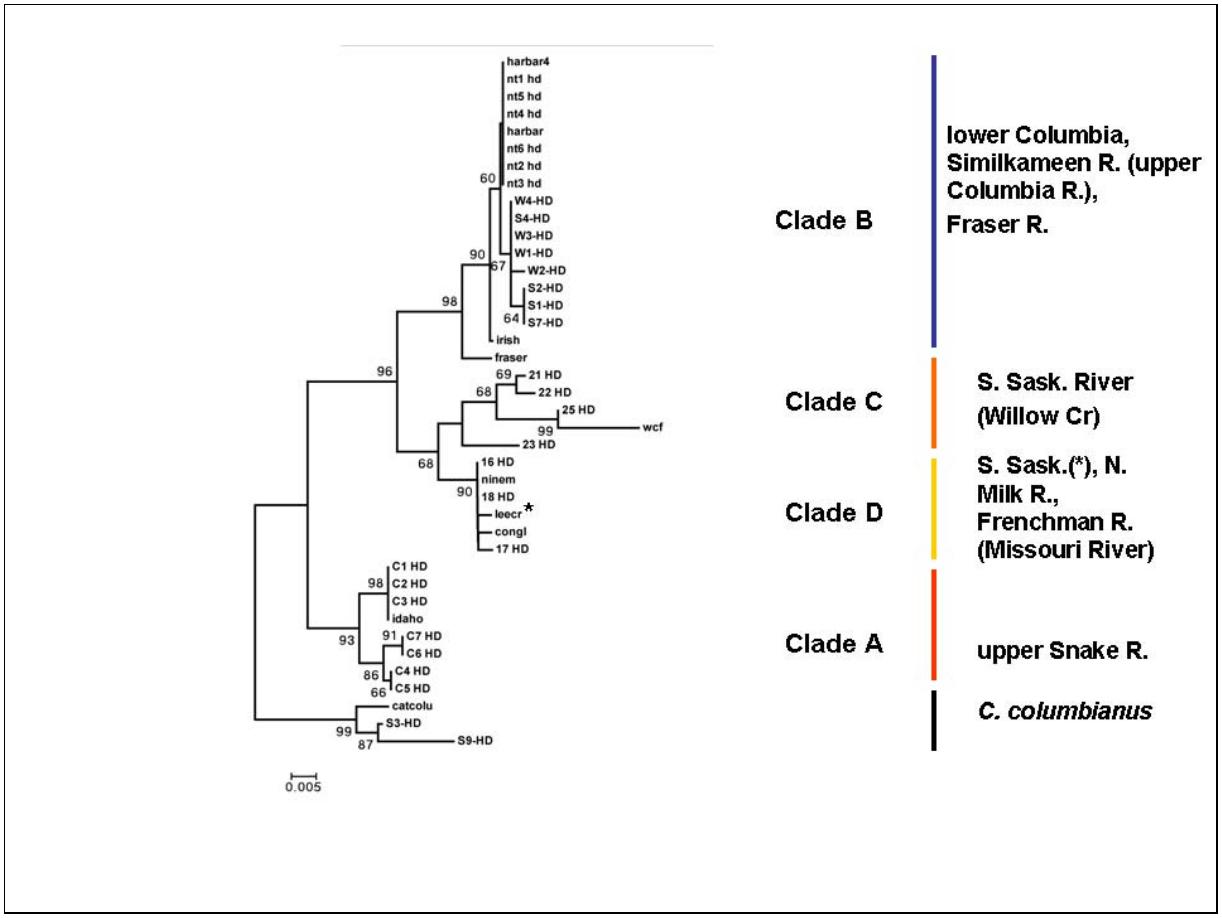

Figure 2. Consensus tree from replicate Neighbour-Joining analyses of sequence divergence estimates among cytochrome b haplotypes of *Catostomus*. Each haplotype represents the DNA sequence of a single fish. The tree is rooted with a sequence from *C. columbianus*. Numbers at branch points are bootstrap support levels from 1,000 pseudoreplications (updated from Taylor and Gow 2008 and McPhail, unpubl. data). Clade C is found in DU 1, clade D in DU 2 (except for one specimen marked with a "*" which is from DU1), and clade B is found in DU 3. "harbar" = Harrison Bar (lower Fraser River), "fraser" = lower Fraser River, "nt" = North Thompson River, "S" = Similkameen River, "W" = Wolfe Creek (Similkameen River), "Irish" = Irish Bend, Columbia River, "21-25" and "wcf" = Willow Creek (South Saskatchewan River), "16-17" = North Milk River, "ninem" = Nine Mile Creek (Milk River), "congl" = Conglomerate Creek (Milk River), "leecr" = Lee Creek (South Saskatchewan River), "18" = Frenchman River (Missouri River), "C" = Portneuf River (upper Snake River, Idaho), "Idaho" = upper Snake River (Idaho).

Designatable units

Designatable units within the Mountain Sucker were considered in light of COSEWIC's "discreteness" and "significance" criteria (COSEWIC 2008b). The Mountain Sucker comprises three DUs in terms of discreteness. First, in Canada the species is comprised of three major phylogeographic lineages as described above (see below and Figure 2). Second, the species is distributed across three National Freshwater Biogeographic Zones (NFBZs); the Saskatchewan-Nelson and Missouri NFBZs in Alberta and Saskatchewan and the Pacific NFBZ in BC (COSEWIC 2008b). All represent natural disjunctions with no possibility of natural dispersal at least since the end of the last glaciation. Interestingly, two of the phylogeographic lineages are apparently endemic to separate NFBZs (clade B in the Pacific, clade C in the South Saskatchewan) while the third Canadian lineage (clade D) is found mostly in the Missouri NFBZ (one specimen within clade D is from Lee Creek of the Saskatchewan-Nelson NFBZ, Figure 2).

These distinctions within Mountain Suckers also meet the significance criterion for identifying DUs for at least three reasons. First, the genetic lineages are distinct from each other by between 3.5 to 8.2% sequence divergence in mtDNA (with an average of about 5%). The range of divergences probably represents at least 2 million years of separation and is at levels comparable with many interspecific comparisons in freshwater fishes and other taxa (Taylor and Gow 2008). By way of comparison, the Bridgelip Sucker and Mountain Sucker differ from each other at the same sequence by an average of about 8.5% (Taylor and Gow 2008). While sample sizes are small (23 in total), there is a marked concordance between mtDNA lineage and NFBZ; there is only one case of a haplotype of one lineage shared across two NFBZ (Figure 2). Second, the Mountain Suckers in the Missouri NFBZ are 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). Third, the loss of populations that comprise each DU would result in an extensive gap in the range of the species in Canada. For these reasons, the Mountain Sucker will be discussed and assessed as three DUs named after the NFBZ in which they are found: Saskatchewan-Nelson populations (DU1), Milk River populations (DU2), and Pacific populations (DU3). Where suitable and sufficient information exists, DUs are discussed separately in the sections that follow.

Special significance

The Mountain Sucker is not a well known member of the Canadian aquatic fauna. It has, at a minimum, three phylogeographically isolated groups in its Canadian distribution. The magnitude of genetic differences found among these groups, and between the Canadian populations and those of the Great Basin, indicate that further research is required to assess possible distinct species (or subspecies) designation for the groups. The taxonomy of the species and the genus is of considerable interest in recognizing the evolutionary affinities of *Pantosteus* and *Catostomus*. The zoogeographic history of these fishes and their relation to geologically mediated evolutionary processes provide fertile ground for future research (Taylor and Gow 2008).

The Mountain Sucker, although edible, is too small to be of economic importance and has never been an important human food or sport fish. In the United States (U.S.), it often is used as a bait fish and has been used as food for furbearing mammals (Scott and Crossman 1998). The parasitology of Mountain Sucker is not well enough known to understand its role as a vector of parasitism for its predators.

DISTRIBUTION

Global range

The range of *Catostomus platyrhynchus* is confined mainly to freshwater in mountainous regions in western North America (Figure 3), although it extends east to the Cypress Hills in the Canadian prairies. Smith (1966) reported that Mountain Suckers occur 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; White River and perhaps at one time in the Niobrara River, Nebraska (Nebraska, however, does not currently include Mountain Sucker in its list of fishes, NEGFD 2010). It is endemic to the Missouri, Columbia, South Saskatchewan, and Fraser rivers and has probably occupied these systems since at least the last period of glaciation, moving northward with the retreating ice front from Missouri and Cascadia refugia (see Hocutt and Wiley 1986 for more details on zoogeography and phylogeny). 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).

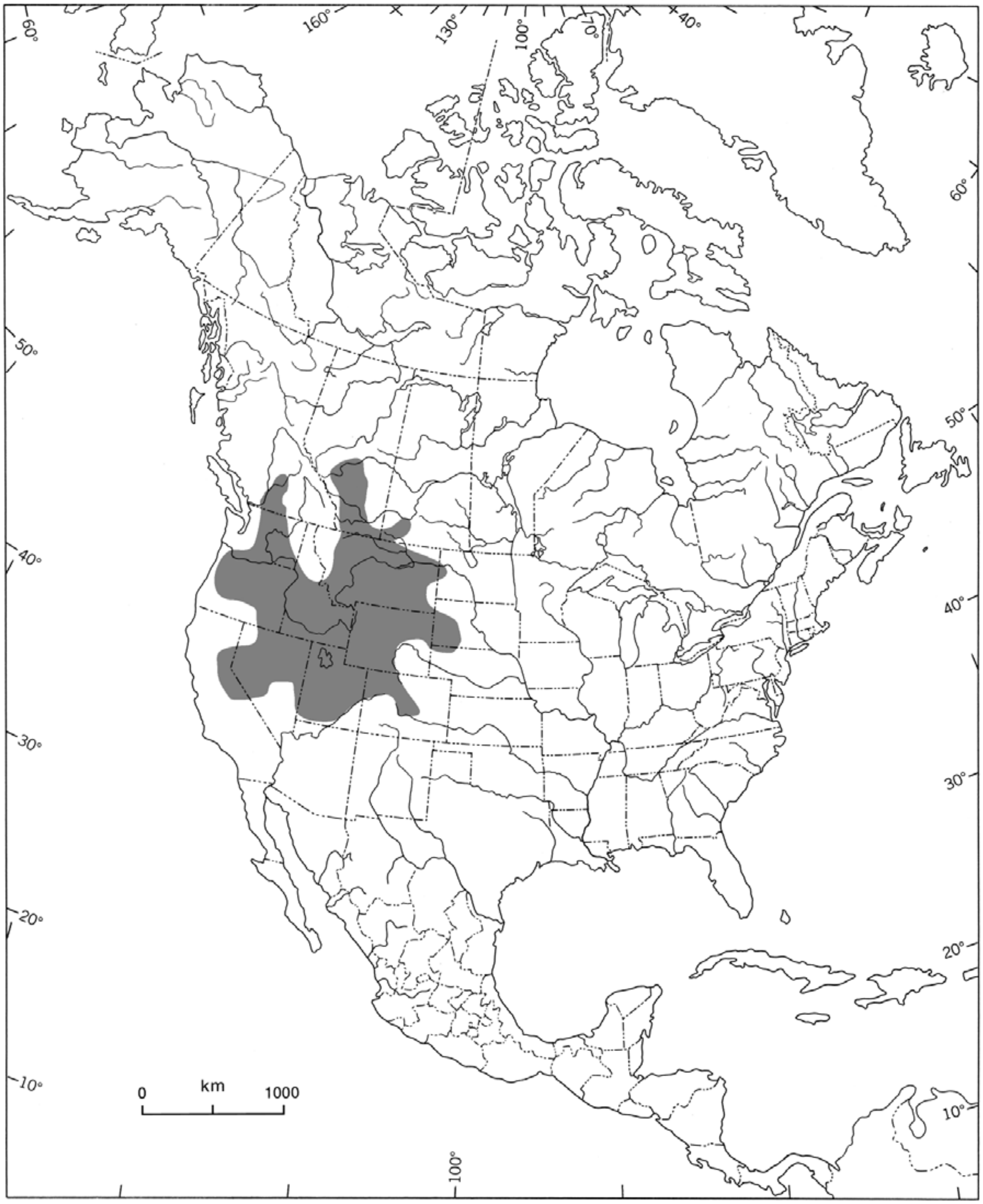

Figure 3. The distribution of the Mountain Sucker in North America. From Atton and Merkowsky (1983), Nelson and Paetz (1992), McPhail (2007), and NatureServe (2008).

Canadian range

The Mountain Sucker is the most widely distributed member of the subgenus *Pantosteus* (Hauser 1969), but it was virtually unknown in Canada until 1947 when Dymond (1947) first recorded the species from the Cypress Hills region of southwestern Saskatchewan (SK). There is a previous mention by Eigenmann (1895) of *Catostomus griseus* [synonymous with *Catostomus platyrhynchus* (Smith 1966)] from Swift Current Creek in SK, as well as a 1928 University of Michigan Museum of Zoology record (UMMZ 164907) from Willow Creek, SK, near the border between SK and Montana (Smith 1966). The Mountain Sucker was first recorded in Alberta in 1955 (Scott 1957) and in BC in 1959 (Carl *et al.* 1959). Paetz and Nelson (1970), however, stated that the species was first taken in Alberta by R.B. Miller and C. Ward in 1950, from the North Fork, Milk River. About 5-10% of the global range of the Mountain Sucker occurs in Canada (Figure 3).

The species has been reported from the Milk River drainage in 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 (Figures 3 and 4) (Scott 1957; Reed 1959; Willock 1969a; Atton and Merkowsky 1983; McCulloch *et al.* 1994; Scott and Crossman 1998; Franzin and Watkinson 2003-2004 unpubl. data, 2007). It is estimated that over 50% of the Canadian range, but less than 10% of its North American range, is in Alberta. In BC, the Mountain Sucker has been reported from the Similkameen River and several of its tributaries, (Columbia River system), from the North Thompson River, and from the lower Fraser River (downstream of Hope, BC, Figure 3 and 5) (Carl *et al.* 1967; Scott and Crossman 1998, McPhail 2007). There is also an unconfirmed record from near the confluence of the Salmo and Pend d'Oreille rivers (Columbia River drainage) some 200 km east of the nearest confirmed records in the Similkameen River (Baxter *et al.* 2003). Given the presence of the morphologically similar Bridgelip Sucker in the Pend d'Oreille River (McPhail 2007) this latter occurrence of the Mountain Sucker should probably be treated with some caution. Scott and Crossman (1998) suggested that "nowhere is it abundant or widely distributed" in Canada.

Extent of occurrence and area of occupancy

DU1 Saskatchewan-Nelson Populations

To assist in defining the number of locations in the absence of detailed information on dispersal, occupied sites separated by a gap of 10 km or more of any aquatic habitat that is not known to be occupied, or by dispersal barriers (dams, natural migration barriers), are taken to be independent (NatureServe 2008). If dispersal between such sites is rare or impossible, and a single threatening event would not rapidly affect all individuals across sites, then they were considered as distinct locations as per COSEWIC (2008b) guidelines. Data on the extent of movement of the relatively small-bodied Mountain Sucker are not available, but tagging data from related species indicates that while most adults are relatively sedentary, at least over the short term (~ 1 year), they may make movements of up to 60 kilometres (e.g., Dauble 1986). Considering these issues, and in the absence of any identifiable and plausible single threatening event, there are probably at least 39 locations in DU1 (Figure 4, Appendix 1). The extent of occurrence (EO) was estimated to be about 177,701 km^2 (Polygon Estimate; see COSEWIC 2008b). The index of area of occupancy (IAO), based on 2 x 2 km overlaid grid was 4,552 km^2 (2,576 km^2 on a 1 x 1 km grid)

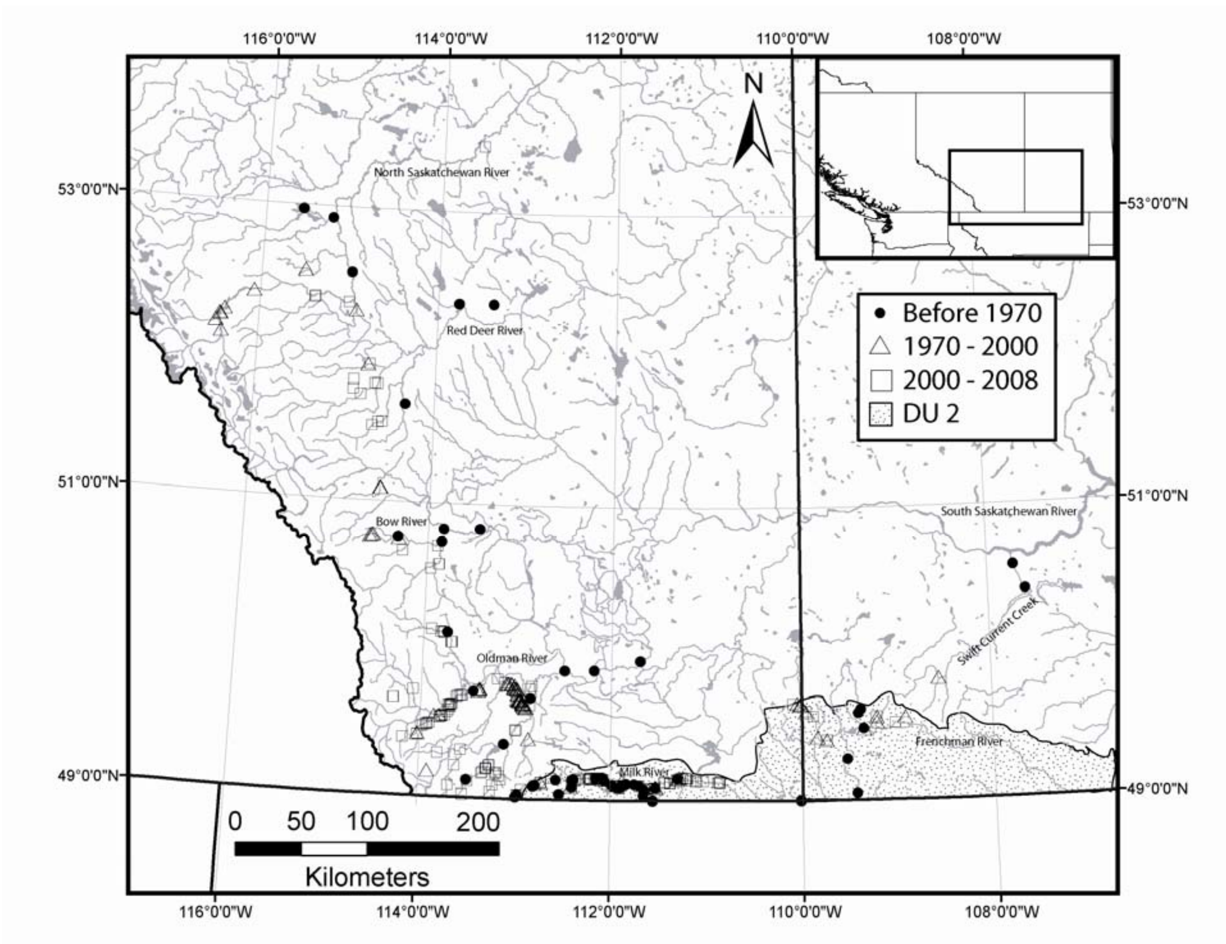

Figure 4. DU 1 and 2 point distribution of the Mountain Sucker in Alberta and Saskatchewan, with DU 2 indicated by stippling.

<u>DU2 Missouri (Milk River) Populations</u>

The Mountain Sucker is widespread within the Canadian portion of the Milk River and its tributaries and has been recorded from at least 20 geographically distinct areas estimated to comprise eight locations (Figure 4; Appendix 2). The EO was estimated to be about 13,006 km^2, and the IAO, based on 2 X 2 km overlaid grid was 1,056 km^2 (or 595 km^2 using a 1 x 1 km grid).

DU3 Pacific (Fraser, Thompson and Columbia River) Populations

The Mountain Sucker has a broadly disjunct distribution among the lower Fraser, North Thompson and Similkameen (Columbia River drainage) rivers (Figure 5). There are at least nine geographically distinct collection records that probably constitute nine locations (Figure 5, Appendix 3). The EO was estimated to be about 27,652 km^2, and the IAO, based on 2 X 2 km overlaid grid was 836 km^2 (or 484 km^2 using a 1 x 1 km grid).

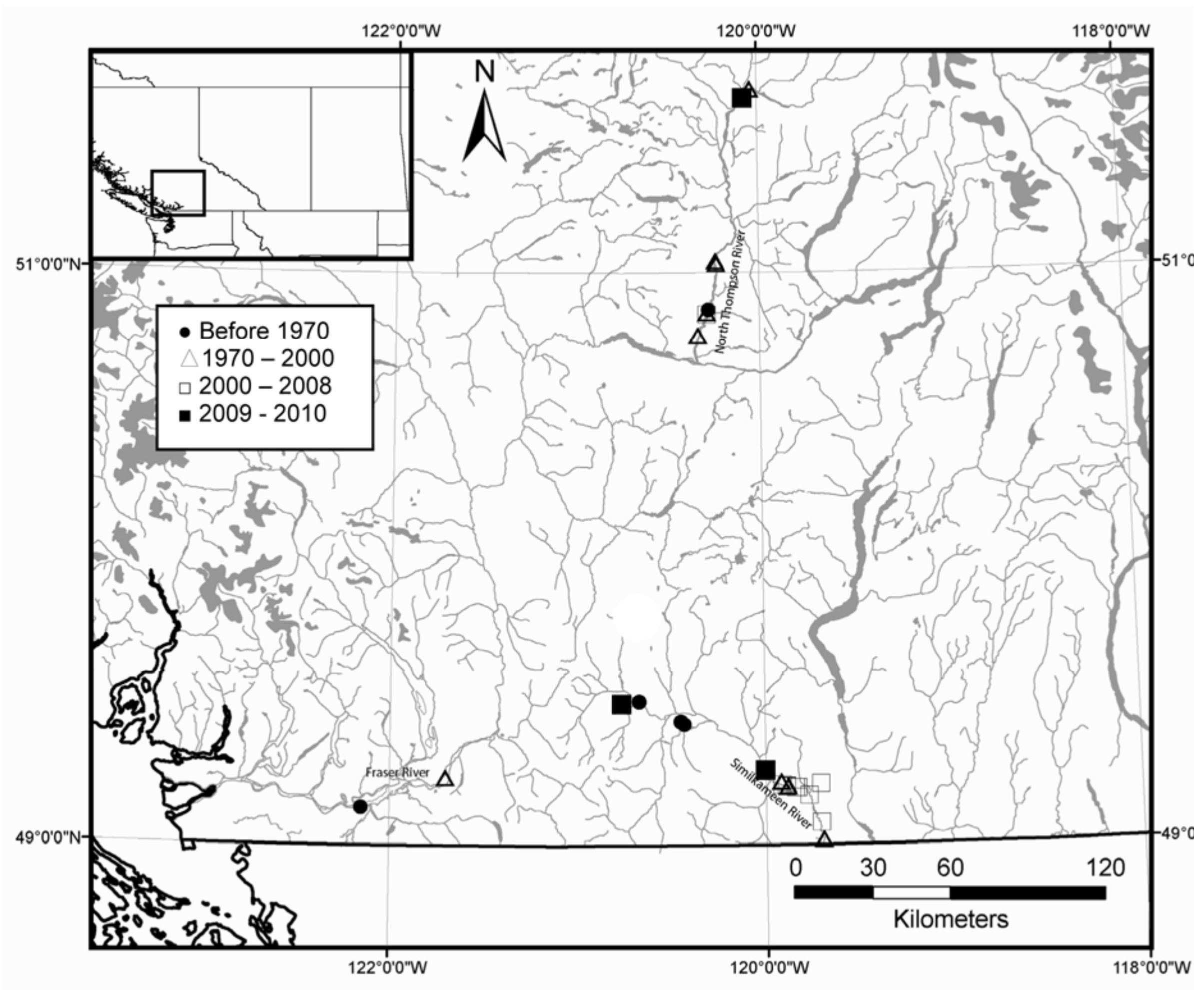

Figure 5. DU 3 point distribution of the Mountain Sucker in British Columbia.

HABITAT

Habitat requirements

Little information is available for this species from Canada, but collection records indicate habitat characteristics similar to those reported in northern parts of the range in the U.S. These fish usually are found in smaller streams at elevations from as little as 20 m above sea level to greater than 800 m in elevation. Franzin and Watkinson (2003-04 unpubl. data) collected Mountain Suckers in Saskatchewan from streams that were from about 2 - 10 metres in width and <1 m depth with moderate velocities (0.2 - 0.5 m/s), over substrates ranging from mud, sand, gravel, cobble, and boulders. They also may occur in large rivers such as the lower Fraser River in BC where it is about one kilometre wide (McPhail 2007). Water conditions vary from clear to roiled or turbid; daytime water temperature at collection sites ranges from 10 to 28°C in summer and near 0°C in winter (see Reed 1959 for water conditions at collection sites in SK). Fish not actively spawning are found along the shoreline, usually associated with cover (Wydoski and Wydoski 2002). Vegetation found at collection sites included pondweeds (*Potamogeton* sp), muskgrass (*Chara* sp), algae, and cress (*Nasturtium* spp.); although macroscopic vegetation was not always present (Smith 1966).

The occurrence of Mountain Sucker in lakes and larger streams is rare, but they are known to occur in the Yellowstone River in Wyoming, Lower Green River, Wyoming, and Bear Lake, Idaho/Utah (Smith 1966). Pierce (1966) noted that this species was usually more abundant below a warm spring. Underwater observations by Decker (1989) indicated that Mountain Suckers were most often associated with the bottom in small groups, in areas of cover. Spawning Mountain Suckers used riffle areas below pools, returning to deeper pools after spawning. Young fish (20 - 35 mm) preferred areas with moderate current at depths of 15 to 40 cm and usually were found close to an obstruction such as a large rock or submerged log. Fingerlings (35 - 135 mm) seem to prefer intermittent side channels with very little discharge and abundant aquatic vegetation at depths of 15 to 50 cm, but also were found in deeper pools (Smith 1966). Larger fish were found at the margins of runs, retreating to deeper water if disturbed, much the same as observed for White Sucker (*Catostomus commersoni*) (Stewart 1926; Decker and Erman 1992; Wydoski and Wydoski 2002). In a study of the species in Montana, Hauser (1969) observed that they were found in areas of moderate velocity (0.5 m/sec) adjacent to pools with bank cover at depths of 1 - 1.5 m. Substrate composition of occupied habitats varied greatly, with cobbles being the most common. They often occurred near the transitions between pools and runs, and riffle habitats were rarely used except for spawning. The habitat requirements of this species in Canada require research.

Habitat trends

Little specific information is available on changes in habitat area or quality across most of the range of the Mountain Sucker in Canada. Their limited distribution in BC and SK makes them vulnerable to habitat disruption (Wydoski and Wydoski 2002, McPhail 2007; Franzin and Watkinson, unpublished data) but their persistence in some locations is perhaps indicative of their adaptability to a broad range of habitat conditions.

South Saskatchewan-Nelson Populations (DU1)

The major changes to habitat within DU1 have been with respect to continued commercial, residential, agricultural, and industrial growth of major urban centres in central and southern Alberta (Edmonton, Calgary and Lethbridge). Major developments that have likely reduced the extent and/or quality of habitat within DU1 include impoundments such as the Oldman River Dam (completed in 1992) and the St. Mary Flume (which diverts water from the St. Mary River Reservoir to other areas for irrigation), although there are no data specific to the effects of such developments on Mountain Sucker. Given that southern Alberta and SK, in particular, are subject to periods of drought, conserving the Mountain Sucker in DU1 is likely dependent on maintaining flows and riparian habitat.

Missouri Populations (DU2)

As with populations in DU1, the most significant changes to Mountain Sucker habitat within DU2 have been associated with irrigation needs. For instance, in 1917, the St. Mary Canal (a diversion project distinct from the St. Mary Flume described for DU1 above) was completed in Montana to divert water from the St. Mary River (South Saskatchewan River drainage) to the North Milk River (Missouri River drainage) for augmentation of irrigation, usually from March to October of each year. The water in the Milk River (and St. Mary River) is shared by Canada and the U.S. via the order in the Boundary Waters Treaty, but during the augmentation period Canada must leave the majority of that water for the U.S. Before the construction of the 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). Since the construction of the St. Mary Canal, no major losses or changes in habitat have occurred. Rather, the availability of habitat is highly variable from year to year, and mainly dependent on adequate water flows, particularly in the late summer and fall, and during the over-wintering period.

Southern Alberta and Saskatchewan are susceptible to extreme drought conditions during the summer, and naturally low flows at this time of year and may be more common given predicted changes in aquatic ecosystems associated with global climate change (Poff *et al.* 2002). Such natural events may be exacerbated by the seasonal operation of the St. Mary Canal, associated increased erosion and sedimentation, and its occasional shutdown, as well as by water removal for irrigation in tributary streams (Pollard 2003). In 2001, the August, October, and December discharges were 50%, 7% and 6% of historical values, respectively, and the October and December rates in 2002 were 11% and 20%, respectively. Such low flows could seriously limit over-wintering habitat, and in fact, during the late fall and winter of 2001/2002 the lower Milk River dried up completely, except for a number of isolated pools (R.L. & L. 2002a,b). This threat, however, is mitigated to some extent in that the withdrawals for irrigation are regulated, but there are still temporary diversion licences issued for non-irrigation uses (Milk River Fish Species at Risk Recovery Team 2008). In addition, there appears to be at least some capacity for fishes influenced by these winter 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 lower portions of the river during droughts.

Pacific Populations (DU3)

In general, habitat area and quality has probably remained relatively stable in portions of the lower Fraser and North Thompson rivers where Mountain Suckers are located. Populations in these areas are relatively remote from major habitat perturbations and fish collected before the 1970s have been collected in the same general areas more recently (Figure 5). By contrast, populations within the Similkameen River system have probably suffered some habitat loss or alteration from industrial, commercial, residential, and agricultural developments. For instance, the copper mine area near Princeton, BC, has contributed silt to the river since 1923. Over the years, a succession of companies operated mines in this general area and there is a proposal for a new open pit mine on Copper Mountain. Further, there are several smaller mines adjacent to the Tulameen River, an upstream tributary of the Similkameen River.

Habitat protection/ownership

The *Fisheries Act* provides Fisheries and Oceans Canada (DFO) with powers, authorities, duties and functions for the conservation and protection of fish and fish habitat (as defined in the *Fisheries Act*) essential to sustaining commercial, recreational and Aboriginal fisheries. The *Fisheries Act* contains provisions that can be applied to regulate flow needs for fish, fish passage, killing of fish by means other than fishing, the pollution of fish-bearing waters, and harm to fish habitat. The recent Auditor-General of Canada’s (2009) report, however, has indicated that the *Fisheries Act* has not generally been effective at protecting fish habitat owing to inadequate administration and enforcement. Environment Canada has been delegated administrative responsibilities for the provisions dealing with regulating the pollution of fish-bearing waters while the other provisions are administered by DFO. Within DU2, the Mountain Sucker shares habitats in the Milk River with various other fishes such as the Western Silvery Minnow (*Hybognathus argyritus*). The Western Silvery Minnow is listed as Threatened under *SARA* and the associated Milk River Fish Species at Risk Recovery Team has prepared a recovery document (Milk River Fish Species at Risk Recovery Team 2007) which contains descriptions of recovery actions which should also benefit the Mountain Sucker.

BIOLOGY

Very little is known of the biology of the species in Canada and limited knowledge has been obtained elsewhere. Most of the information available on the species has been summarized by Smith (1966) and Scott and Crossman (1998). Most of the following was obtained from these sources as well as from Hauser (1969), Wydoski and Wydoski (2002) and a recent USDA Forest Service Conservation Assessment (Belica and Nibbelink 2006). It is unfortunate that the only robust life history information we have on Mountain Sucker comes from populations in the Great Plains in the U.S. (Hauser 1969, Wydoski and Wydoski 2002). It is unknown how similar the life history of the Canadian populations is to the life history of the populations in the Great Plains.

Life cycle and reproduction

The specific timing of spawning is related to both latitude and altitude, being later in more northern latitudes and at higher elevations. Spawning occurs in late spring or early summer when water temperature is above 10.5°C [average range 10.5 - 18.8°C, Scott and Crossman (1998)]. Spawning usually takes place in riffle areas adjacent to pools of swift to moderate mountain streams (see Smith 1966 for a summary of spawning times at various locations). The translucent, yellow eggs average 1.5 - 2.2 mm in diameter, and are demersal and adhesive (Hauser 1969; Scott and Crossman 1998). No nest is built, the eggs are scattered over the substrate. The incubation period has not been recorded, but probably is in the range of 8 - 14 days as reported for other suckers (Stewart 1926; Geen *et al.* 1966; Scott and Crossman 1998). Hauser (1969) reported spawning in southern Montana to occur in late June and early July and the earliest dates that fry were seen were 21 June in the Flathead Creek (water temperature 17 - 19^{o}C) and 18 July in the East Gallatin River (water temperature 11 - 19^{o}C).

Fecundity is related to fish length and age; older and larger fish bear more eggs. This can vary among watersheds (Cannings and Ptolemy 1998). In Montana, Hauser (1969) estimated the number of eggs ranged from 990 (for a 131 mm female from Flathead Creek) to 3,710 (for a 184 mm female from the East Gallatin River). A Lost Creek Reservoir, Utah study by Wydoski and Wydoski (2002), found the average fecundity for 20 females was 2,087 eggs (range: 1239 - 2,863 eggs, standard error (SE) = 123.6). Small recruitment eggs (those that have not filled out for spawning) also may be found in the ovary providing further evidence of a short spawning season for this species; Hickling and Rutenburg (1936) demonstrated that a marked difference in size between mature and recruitment eggs indicates a short spawning season.

Growth is slow in cool mountain streams and growth rate varies between streams (Hauser 1969). Some fry that measure 9 mm in July may reach 30 to 36 mm by mid-September. Ninety-five percent had formed the first otolith annulus by mid-June of the following year at about 38 to 60 mm average length (Hauser 1969; Scott and Crossman 1998). Growth is greatest during the first year, but the rate of growth decreases until the third year. After the third year the growth increment is small but constant. Hauser (1969) provided mean total length (TL) for various ages and an equation for the length-weight relationship. Mountain Sucker adults range from about 127 to 152 mm in TL (Sigler and Miller 1963). Smith (1966) indicated that maximum size is in the order of 175 mm standard length (SL). Hauser (1969), however, reported an individual of 226 mm TL, and the Royal Ontario Museum (ROM) records include a 232 mm male collected in Alberta in 1964 (ROM 25919).

Hauser (1969) noted that females tend to be larger than males and live longer, males living to about seven years of age and females to at least nine years. This relationship is true for most catostomids (Raney and Webster 1942; Harris 1962; Geen *et al.* 1966). Smith (1966) indicated that maturity was reached at the end of the second, and, in some cases, the first year of life. In Montana, however, Hauser (1969) found some females mature by age three and all females by age five. Some males matured by age two and all were mature by age four. In Utah, Wydoski and Wydoski (2002) reported that 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. McPhail (2007), however, reported typical ages of maturity of four and five years for males and females, respectively, in BC. Early maturing fish are likely the faster growing fish of an age group (Alm 1959). Mature females range from 90 to 175 mm and males from 64 to 140 mm (Smith 1966; Hauser 1969). Both sexes develop secondary sex characteristics during the breeding season (see Description above).

Predation

Mountain Suckers are an important part of the food chain, forming the link between primary producers and higher level consumers. Small Mountain Suckers may be preyed upon by many other species, including birds, mammals, and other fishes, particularly salmonids (Cutthroat Trout (*Oncorhynchus clarkii*), Rainbow Trout (*Oncorhynchus mykiss*), and introduced Brook Trout (*Salvelinus fontinalis*) and Brown Trout (*Salmo trutta*) (Goettl and Edde 1978; Erman 1986; Wydoski and Wydoski 2002), and by other large predatory species like Walleye (*Sander vitreus*) and Northern Pike (*Esox lucius*). Larger fish and spawning adults may be taken by larger fish predators, fish-eating birds and mammals (Scott and Crossman 1998). The Mountain Sucker diet consists of plankton, small invertebrates, and microscopic organic matter scraped off rocks.

Physiology

No information is available regarding the physiology of this species.

Dispersal and migration

Little information is available on the movements of this species in Canada. In Utah, Decker and Erman (1992) found no evidence of seasonal migration upstream from a reservoir. Hauser (1969) indicated that adults move from deeper pools in late winter and spring to areas adjacent to pools in moderate current (0.5 m/sec) and at depths of 1 to 1.5 m with rubble bottoms. During spawning, a fish may move into riffle areas and then return to deeper pools with bank cover, where they often are found in 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).

Interspecific interactions

The only parasite previously listed for the species was the trematode *Posthodiplostomum minimum* (Hoffman 1967). Evans *et al.* (1976), Heckman and Palmieri (1978) and Palmieri *et al.* (1977), however, found metacercariae of the eye fluke, *Diplostomum spathaceum*, to be widespread in Mountain Suckers and other fishes in Utah. The relative scarcity of parasites listed for the species probably reflects the degree to which studies have been carried out for the Mountain Sucker rather than a low incidence of parasitism.

In many parts of the range, the Mountain Sucker is sympatric with other catostomids such as White Sucker, Longnose Sucker (*C. catostomus*), Tahoe Sucker (*C. tahoensis*), Utah Sucker (*C. ardens*), and Bridgelip Sucker, and hybrids between Mountain Sucker and these species have been recorded (Smith 1966). Although Mountain Sucker is sympatric with Bridgelip Sucker in the North Thompson, Similkameen, and Columbia rivers, Smith (1966) indicated that hybrids between the two were not known. There is, however, some evidence that the two do hybridize to some extent, although the Bridgelip Sucker is found more often in lakes than in streams in BC, and associations of the two are apparently not as common as for other catostomids (R. Carveth pers. comm., cited in Campbell (1992)). Hauser (1969) found that Mountain Suckers formed exclusive schools, separate from other suckers.

Competition with other catostomids could be limiting range expansion, but this is more probably due to physical barriers. Mountain Sucker is more highly specialized in its feeding 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). Dunham *et al.* (1979) have shown that competition with other sympatric catostomids leads to geographic variation in characteristics such as growth, feeding efficiency, body size, and swimming mechanics.

Adaptability

Mountain Suckers inhabit a wide range of stream habitats in isolated populations subjected to periodic natural disturbances such as fires, droughts, and floods. The species is adapted to these 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).

POPULATION SIZES AND TRENDS

Search effort

Population size and trend information on this species is limited mainly to presence and absence data, particularly in Canada and there have been no targeted abundance estimates to examine temporal trends for this species. 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 of the genus and subgenus (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 Suckers. In addition, the species has a peculiar and highly disjunct distribution within the Pacific National Freshwater Biogeographic Zone (e.g., in the Fraser River, North Thompson River, and Similkameen River). While intervening areas have been well sampled for commercial and game species (e.g., Pacific salmon and trout, *Oncorhynchus* spp.), targeted surveys for other species are uncommon and during surveys for Pacific salmon and trout, non-target species like suckers are typically not identified to species. Thus, it is possible that incomplete sampling and identification problems could contribute to the disjunction within the Pacific DU.

Abundance

Temporal surveys of the abundance of the Mountain Sucker across its range in Canada have not been completed, but it is one of the more widely distributed species within the *Pantosteus* group of suckers (Figure 3). In some parts of its range in the U.S. it is abundant enough to be readily available 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 some jurisdictions it is considered to be a species of special concern, e.g., Washington (Johnson 1987). This species is abundant in some streams of the Great Basin. For example, Goettl and Edde (1978) found the Mountain Sucker to be one of the most abundant and widespread fishes in a Colorado stream. Two studies provide density estimates of the Mountain Sucker, one in the Black Hills National Forest, South Dakota (Isaak *et al.* 2003) and the other in an eastern California stream (Moyle and Vondracek 1985). These estimates were based on closed-population, removal-estimator methodologies and generated estimated mean densities of from 428 to 1,262 fish/ha.

In Canada, Scott and Crossman (1998) suggested that the species was neither widely distributed nor abundant. Alberta is the only province where Mountain Sucker is known to be modestly abundant where found (see also Appendix 1).

<u>DU1 Saskatchewan-Nelson Populations</u>

Collection records of the University of Alberta Museum of Zoology (UAMZ), Alberta's Fisheries Management Information System (FMIS) and the National Museum of Natural Sciences (NMNS) indicate that as many as 354 specimens were collected at a site in Alberta during surveys, although it was more common to find less than 20 individuals at a given site (e.g., Appendix 1). Most NMNS records, however, were from Willock's (1969a) intensive survey of the Milk River (see below) and the last confirmed collection in Swift Current Creek was by Reed in 1962 (Atton and Merkowsky 1983). In 2003-2004, Swift Current Creek appeared to be highly eutrophic, with the majority of the stream bed covered in filamentous algal mats and no Mountain Suckers were observed (Franzin and Watkinson unpubl. data, 2007).

<u>DU2 Missouri (Milk River) Populations</u>

Willock (1969a) stated that Mountain suckers were common in the Milk River drainage of Alberta and may be the only fish species found in the pseudo-alpine habitat of the Sweetgrass Hills. Henderson and Peter (1969) found Mountain Suckers to be abundant and widely dispersed in southern Alberta, extending into the central plains. Collections in Saskatchewan by McCulloch *et al.* (1994) found the Mountain Sucker in Battle, Caton, and Conglomerate creeks. Franzin and Watkinson (unpubl. data) sampled fish in southwestern Saskatchewan in 2003 and 2004 and found Mountain Suckers in Battle, Conglomerate, Caton, and Nine Mile creeks, but not in Belanger Creek. The last reported collection made in Belanger Creek was by B. Christensen in

1967 (Atton and Merkowsky 1983). The most recent collections in the Milk River (Watkinson, unpubl. data, 2007, Appendix 2) found Mountain Sucker to remain abundant there with catches as high as 157 in a single seine haul.

DU3 Pacific Populations

McPhail (2007) indicated that Mountain Sucker has a scattered distribution in BC, but that the species is modestly abundant in the three local areas where it is found: the gravel deposition area in the lower Fraser River (downstream of Hope, BC), the North Thompson River from near Heffley Creek north to Clearwater, BC, and in the Similkameen River system from the U.S. border and upstream to just beyond Princeton, BC (Appendix 3).

Fluctuations and trends

Literature abundance reports are too limited to provide an estimation of the fluctuations and population trends for the Mountain Sucker. Canadian studies of fish distributions that report Mountain Sucker in samples are not sufficient to provide more than continued presence (or occasionally relative abundance) at most sites sampled in past decades in all of SK, Alberta, and BC. Within DU1, the species was present in Swift Current Creek, SK in the 1950s (Reed 1959) and in Belanger Creek in 1983 (B. Christensen in Atton and Merkowsky 1983), but were not detected at those collection sites in a survey directed at Mountain Suckers in 2003-04 (Franzin and Watkinson unpubl. data). Within DU1 and DU2, Mountain Suckers remain abundant in some locations in the Saskatchewan and Milk river drainages in Alberta. Within DU3, McPhail (2007) reported that Mountain Sucker continue to be moderately abundant in three locations in BC, in the lower Fraser, the North Thompson, and the upper Similkameen rivers where they have been known to occur for years. Because we do not have density estimates at any Canadian sites, one can only say that the species persists in most tertiary watersheds where they had been detected decades ago. Indeed, historical collection records from the Royal BC Museum and the University of British Columbia Fish Collection were used to sample the Similkameen River in the summer of 2009, using electroshocking and small seines (E. Taylor, University of British Columbia, unpubl. data, 2009). While suckers were found at most of these historical sites, many were Largescale (*Catostomus macrocheilus*) and Bridgelip suckers; over two days sampling, only nine confirmed Mountain Suckers were collected.

Erman (1986) found that while the Mountain Sucker previously was one of the most abundant suckers in Sagehen Creek, California, it became exceedingly rare after the construction of a reservoir altered habitats. Conversely, because of a scarcity of records in large collections in the Willamette River system of Oregon in the 1940s and its abundance in a 1952 survey, Bond (1953) suggested that the Mountain Sucker may have been a recent invader into that watershed. This suggests that the species may be able to respond rapidly to availability of suitable habitat and this could lead to fluctuating populations in watersheds with climate-driven variations in discharge.

Decker and Erman (1992) found that the Mountain Sucker exhibited seasonal fluctuations in Sagehen Creek, California. The presence of breeding tubercles associated with the peak of abundance suggested that fluctuations were linked with spawning migrations. This observation suggests that estimates of trends in Mountain Sucker abundance based on point-in-time samples at single locations should be considered with caution.

Rescue effect

Most populations occur in pockets isolated from other potential rescue populations. Within DU1, exceptions include the North and South Saskatchewan and Red Deer rivers of Alberta where riverine habitats still are largely interconnected in spite of some flood control and irrigation dams and weirs. In Saskatchewan, the potential for rescue of isolated populations from adjacent populations is unlikely given that the species occupies limited areas of habitat in quite small, well-separated, headwater streams. Within DU2, there is some potential for rescue among the interconnected locations within the Milk River. Although the Mountain Sucker is widespread in this river south of the Canada/U.S. border in Montana, rescue is only possible upstream of the Fresno Reservoir (a distance of about 30 km) where there are no barriers to migration. Within DU3, there are far fewer dams in the Thompson and Fraser river systems and none on the mainstem of these rivers, but many tributaries have natural impassable barriers, small dams or weirs, stream crossings and culverts potentially isolating small species like the Mountain Sucker. For the Similkameen River populations, there are no barriers between the section above Squanti Falls in Washington State and the Canadian portion of the Similkameen River. Thus, recolonization of the lower Similkameen River is possible from downstream populations in the U.S. (for about 30 km). There is, however, an active proposal for a new hydroelectric dam just south of the Canada-U.S. border at Shanker’s Bend. If the dam is constructed and fish passage facilities that can accommodate small fishes are not provided, this potential source of re-colonists will be lost. In general, the many disjunctions within the natural range of the Mountain Sucker suggest there are inherent limitations to inter-locality dispersal, which suggests that any rescue effect, except from nearby areas, would be highly unlikely.

THREATS AND LIMITING FACTORS

Across the scattered range of the Mountain Sucker there appears to be no single, imminent threat to particular populations or assemblages of populations. Rather, threats are multifaceted, likely cumulative, and involve the degradation and elimination of habitat or habitat quality over the medium-long term from industrial and commercial development, resource extraction, urbanization, water extraction and other changes associated with agriculture (e.g., changes to riparian habitat), artificial migration barriers, climate change, and to a lesser extent invasive species. The influence of these anthropogenic factors will be affected by the extensive degree of range fragmentation that characterizes the species' natural distribution. Similar conclusions were reached for Mountain Sucker within the U.S. (Goettl and Edde 1978; Erman 1986; Campbell 1992; Decker and Erman 1992; Wydoski and Wydoski 2002; Belica and Nibbelink 2006).

Saskatchewan-Nelson Populations (DU1)

Water use, drought and climate change

Water withdrawal for irrigation for farming and ranching is the fourth largest consumptive use of water in Canada and over 70% of irrigation withdrawals occur in southern Alberta and SK (COSEWIC 2008a,c). Total water withdrawals have almost doubled since the 1950s, principally in response to increased agricultural demand (Dash 2008).

Although Canada is considered to have abundant fresh water (Gleick 2002), there is regional variability in supply. Southern Alberta, lying in the shadow of the Rocky Mountains, has relatively low annual rates of precipitation, and is one of the driest parts of the country (Schindler and Donahue 2006). Additionally the area is subject to periodic drought, which will likely increase in frequency and severity from climate change (MEA 2005 and see below). Archaeological evidence (see Schindler and Donahue 2006) suggests that severe and long-lasting droughts (lasting several decades) are not uncommon to the western prairies. The droughts of the 1930s and the more recent warmer temperatures and lower precipitation from 1998 to 2004 were mild compared to droughts of the 18th and 19th centuries. Despite the apparently milder historic conditions of the 20th century, average annual evapotranspiration exceeded average precipitation during this time (Schindler and Donahue 2006). Annual precipitation has decreased by 14-24% in the southern prairies since the 1890s, while at the same time the area has experienced warming of 1-4º C, most of which has occurred since the 1970s (Schindler and Donahue 2006).

Long-term trends in flows of the major rivers of the area of DU1 have been determined (Déry and Wood 2005; Rood *et al.* 2005; Barnett *et al.* 2005). These analyses, however, do not reflect trends during seasons of peak water demand, i.e., the summer months of May through August, when agricultural and urban use is at a maximum. Warmer water temperatures, lower oxygen levels and low flows adversely affect the colder water organisms that inhabit the rivers and reproduce in the spring or fall (Schindler and Donahue 2006). Although annual flows in major drainages of the southwestern prairies have shown modest declines during the 20th century (Déry and Wood 2005; Rood *et al.* 2005), Schindler and Donahue (2006) have demonstrated that current summer flows are 20-84% lower than they were in the early 20th century. The longer-term trend for many rivers in southern Alberta over the summer is “stressed” or reduced below natural levels (Alberta SOE 2008). Damming, water withdrawals, and warming temperatures are attributed as causes of the decline. Watersheds without dams and/or water withdrawals showed less decline (20-30%), while those where impoundments and large-scale water withdrawals exist showed larger declines (40-80%) depending on the scale of impact (Schindler and Donahue 2006). Support of agriculture in these regions depends on reservoirs that trap spring snowmelt from the eastern Rocky Mountains and only about 20% of the runoff is returned to the rivers (e.g., St. Mary River Reservoir and see Schindler and Donahue 2006).

Most climate models predict further warming of 1-2º C and slight increases in precipitation by the end of the 21st century (CCIS 2007). The forecasted increases are much lower than the predicted increase of 55% in evapotranspiration due to rising temperatures. The southern prairies are likely to be much drier (Schindler and Donahue 2006), and there will be less snowmelt to capture in the reservoirs. As a result, it may become increasingly difficult to maintain current summer flow regimes and fish habitat, which could also exacerbate the threats imposed by existing levels of water use and drought. The information summarized above suggests that both the extent and quality of aquatic habitat of Mountain Suckers within DU1 will likely decline from increasing frequency and severity of droughts and water temperature increases.

Road-building, resource extraction, impoundments, and development

Southwestern Alberta is an area of intense and increasing residential, industrial, and commercial development. One of the major alterations to aquatic habitat of the Mountain Sucker in this area was the construction of the Oldman River Dam in 1992 that created some fragmentation and altered flow regimes above and below the impoundment (Arc Wildlife Services 2004). In addition, there has been extensive road-building in many watersheds (such as the Castle-Carbondale River drainage) to facilitate logging, oil and gas extraction, and domestic grazing that have resulted in significant concern as to the cumulative impacts of such developments (e.g., Arc Wildlife Services 2004). The human population within the Red Deer River drainage (Figure 4) of this area grew by 47% between 2001 and 2006 owing to growth of the natural resources sector (typically oil and gas developments) with an increasing tendency towards urbanization although agriculture still is the single largest use of land in terms of area (Red Deer River Watershed Alliance 2009). Concentrations of human developments in this area are associated with a declining trend in water quality in some areas of the watershed owing to increased detections of pesticides, some metals, bacteria, and phosphorus (Red Deer River Watershed Alliance 2009).

Missouri (Milk River) Populations (DU2)

Water use and climate change

Habitat loss, either through degradation or fragmentation, is a serious threat to the survival of many fishes in the Milk River system that constitutes the range of DU2, particularly the Western Silvery Minnow and Eastslope Sculpin (*Cottus* sp., COSEWIC 2005, 2008c). The Milk River Fish Species at Risk Recovery Team (2007) identified a number of existing or potential activities related to water use contributing to this threat, including: 1) changes in flow associated with the diversion, 2) canal maintenance, 3) water storage projects, 4) groundwater extraction, and 5) surface water extraction.

For example, Dash (2008) indicates that total water withdrawals have almost doubled since the 1950s, principally in response to agricultural demands. Water levels in the Milk River aquifer declined by over 30 m between the 1950s and 1980s, and ongoing data collection indicates that water levels continue to drop. The greatest changes to habitat in the Milk River have been associated with irrigation needs. In 1917, the St. Mary Canal was completed in Montana to divert water from the St. Mary River to the North Milk River for irrigation purposes. In most years, the canal diverts water from March to October, increasing the water volume in the North Milk River and the Milk River proper. The water in the Milk River (and St. Mary River) is shared by Canada and the U.S. via the order in the Boundary Waters Treaty. During the augmentation period in the Milk River in Canada (March to October), Canada must leave the majority of that water for the U.S., so it is not available as irrigation water in Canada. According to the agreement, the U.S. is able to use the Milk River in Canada simply for conveyance of water (COSEWIC 2008c).

Before the construction of the diversion, the Milk River was probably a typical small prairie stream, possibly intermittent in times of drought, and generally less turbid. The even-flowing waters now observed in the lower Milk River in Alberta were probably mainly restricted to downstream of the international border before the diversion was constructed. 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 and associated increased erosion and subsequent sedimentation in Alberta (Willock 1969b).

Presently, the availability of habitat is highly variable from year to year and is mainly dependent on adequate water flows, particularly in the late summer and fall, as well as during the over-wintering period (see **Habitat trends** section). This severity of drought conditions in southern Alberta is not uncommon (Pollard 2003) and may be more common given predicted changes in aquatic ecosystems associated with global climate change (Poff *et al.* 2002; Schindler and Donahue 2006). Given that the Milk River is situated in one of the most arid regions of Canada, continuing trends in reduced snow pack in the Rocky Mountains suggest that the frequency of drought conditions will increase (Rood *et al.* 2005). These conditions could be exacerbated by increasing water requirements for irrigation. This may prevent populations from expanding and the higher temperatures that accompany the summer drought may expose all fish species to increased risk, which may be exacerbated by ongoing maintenance of the St. Mary Canal that results in closures of the canal for extended periods (i.e., water supplementation via the canal is reduced at these times). Furthermore, south of the international border, the Milk River can go completely dry to 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 2008c). Therefore, limited re-colonization potential from upstream and downstream sections in the system exists. Downstream of the Fresno Reservoir in Montana, six more impassible dams upstream of the confluence with the Missouri River prevent any upstream dispersal and potential rescue of Canadian populations (Stash 2001; COSEWIC 2008c).

Impoundments

The feasibility of developing a dam on the Milk River upstream of the Town of Milk River continues to be investigated. The potential impacts on species like Mountain Sucker (and also Western Silvery Minnow, and Eastslope Sculpin) involve altered flow regimes and associated changes to temperature and physical habitat. Elsewhere in the Great Plains, modifications to habitat, particularly those associated with impoundments, have become a serious limiting factor for some fishes (e.g., the Western Silvery Minnow, Cross *et al*. 1986). These impoundments alter habitat type, stimulate introductions of exotic species (e.g., predatory salmonids) and alter flow regimes, sediment loads, and microbiota (small, often microscopic organisms), resulting in streams that are generally narrower, less turbid, less subject to discharge and temperature variations and less productive (Cross *et al*. 1986; Quist *et al.* 2004).

Pacific Populations (Fraser, Thompson and Columbia River, DU3)

The waters of the Pacific NFBZ are home to several freshwater fishes that are listed as species at risk under *SARA*: including Salish Sucker (COSEWIC 2002), Umatilla Dace (COSEWIC 2010), Nooksack Dace (COSEWIC 2007b), Speckled Dace (COSEWIC 2006), Shorthead Sculpin (COSEWIC 2001), and Columbia Sculpin (COSEWIC 2000). These other species and the Mountain Sucker have small and/or patchy geographic distributions and apparently low population densities which can make them especially vulnerable to disturbances (Rosenfeld 1996).

Water availability, use, and climate change

A significant threat to riffle habitat specialists like the Mountain Sucker is water diversion during low-flow months, particularly in areas where drought-like conditions are common such as the Similkameen River. This river and its tributaries occur in the Northern Cascade Ranges Ecoregion (COSEWIC 2006), a region characterized by some of the warmest, driest summers in BC and of low, normal unit runoff. The problem of normal summer low flows has become increasingly accentuated by increasing draws on water for urban, agricultural and industrial needs in the watershed.

In addition to the loss of riffle habitat, low-flow conditions can result in elevated water temperatures, reduced dilution potential and degraded water quality (waste discharge), reduced dissolved oxygen levels, and increased vulnerability to terrestrial and aquatic predators. In the winter, low-flow conditions can increase the risk of freezing and low dissolved oxygen levels (COSEWIC 2006). Tennant (1976) described 20% mean annual discharge (MAD) as the generic threshold at which depth and velocity in riffles are adequate for fish and aquatic insects; below 10% MAD the depth, velocity and width of riffles were described as severely degraded, and regarded as poor or minimum habitat for fish and wildlife (Tennant 1976; Annear *et al.* 2004). Environment Canada's HYDAT water survey data (EC 2009) suggests that almost all streams in this ecoregion are highly sensitive to any water withdrawal outside a short spring period when snowmelt increases discharge significantly. During summer low flows, the Similkameen River mainstem and tributaries fall below 20% MAD, the threshold at which key habitat features such as riffles begin to disappear (EC 2009). Winter conditions are not much better and some of the tributaries (e.g., Keremeos Creek), have almost no summer flow (<1% mean annual discharge) (EC 2009). Not only does this reduction in water result in degradation and loss of riffle habitat; it also results in increased water temperatures and reduced dissolved oxygen, reduction in habitat connectivity and increased exposure to predators by concentration of prey species of fish in smaller areas. Both provincial and federal fisheries agencies have expressed concerns that low water flows combined with high temperature are causing excessive stress, reduced rearing capacity, and mortality in fish residing in tributaries of the Columbia River drainage, including the Similkameen River (Pearson *et al.* 2008).

A recent analysis of climate change indicators suggests that the Northern Cascade Ranges Ecoregion of BC has seen an estimated 1.5 - 2.0^{o}C increase in annual temperature over the past century with increases occurring in all seasons, and this trend is predicted to continue (Rodenhuis *et al.* 2007). Also observed was a reduction in the average amount of snow on the ground on April 1 (Snow Water Equivalent or SWE) over the past 50 years in many areas of southern BC, depending on elevation and average temperature. Given that snowmelt runoff contributes 50 - 80% of total flow in snowmelt-dominated rivers like the Similkameen River, this variable will affect baseflow levels significantly. A study comparing water flows in the 1970s to those in the 1980s and 1990s for the Similkameen River basin noted that for later periods the snow melted earlier, summer flows were lower and summer low-flow periods lasted longer (Rae 2005). Combined, these observed trends are expected to lead to increased agricultural growth opportunities (associated with a longer, warmer growing season) which will increase water demands and extend the period of drought conditions already predicted to increase (Rae 2005).

In the lower Fraser River, flows measured at Hope indicate that the date by which one-third and one-half of the annual cumulative flow occurs has advanced by 11 and nine days respectively each century (Aqua Factor Consulting Inc. 2004). Streams in south-central BC show a similar trend with an earlier spring freshet and lower flows in late summer and early fall (Aqua Factor Consulting Inc. 2004). Late summer low-flow periods coincide with peak demand for water withdrawal from wells and streams for irrigation and domestic use. Gravel mining in the lower Fraser River could induce either direct mortality or reduce habitat availability for Mountain Suckers whose distribution includes gravel bars in this area (Figure 5; Rempel and Church 2002).

Channelization and siltation

Vegetated riffle and pool habitats used by Mountain Sucker, are the “high spots” in a stream, and tend to be targeted for removal or alteration in drainage projects. Channelization and drainage work also typically eliminates the shallow marginal pools preferred by young-of-the-year. More than 70% of wetland areas in the Fraser Valley have been drained or altered by infilling (Boyle *et al.* 1997). Furthermore at least 15% of the streams in the Fraser Valley have been paved over or now flow through culverts (DFO 1998) although the extent to which Mountain Sucker use such smaller streams of the lower Fraser Valley is unknown. Many of the remaining streams have been channelized and dredged for flood control and/or irrigation for agriculture. Permitted and un-permitted dredging of ditches and stream channels for flood control and agricultural drainage still occurs annually (Pearson *et al*. 2008). At present, the North Thompson and Similkameen rivers remain relatively intact.

Significant sediment deposition occurs in portions of all watersheds (Pearson 2004). Sedimentation clogs the spaces between substrate particles and inhibits the flow of oxygenated water through the substrate. It is less likely to be a problem for young-of-the-year fish that inhabit shallow pools, but may be a problem for reproduction and feeding (McPhail 2007).

Impoundments and flow regulation

The Columbia River basin has a long history of major hydroelectric development (COSEWIC 2010). Dam construction results not only in fragmentation of habitat, but also in considerable alteration of habitat including connectivity, water temperature, hydrology (flow) and water quality (clarity and sediment loading). Dams can result in increased mortality associated with entrainment, and indirect effects on fish via altered aquatic communities associated with altered hydrologic regime. Artificial changes to flow delivery and temperature cues could affect breeding behaviour, spawning, survival of eggs, and reduced flow may leave some species stranded (McPhail 2001; R.L. & L. 1995; Golder Associates Ltd. 2005). Two dams are proposed for the Similkameen River immediately south of the international border. The first proposal involves ongoing efforts to re-license the Enloe Dam for power production. This dam was constructed on the Similkameen River approximately 30 km downstream of the international border in the early 1900s and decommissioned in 1958. The Enloe Dam east bank redevelopment proposal (submitted in fall 2008) would be a run-of-the-river facility that does not alter the pre-existing conditions at the dam site. As such, it represents a low risk to Mountain Sucker in the Canadian portion of the Similkameen River drainage. The second proposed dam, however, could result in significant habitat loss and degradation to Canadian populations of Mountain Suckers. This proposal involves a dam 2.5 km upstream of the existing Enloe Dam, which could be 80 m in height, and would result in the flooding of 9,000 acres in BC, flooding the river upstream to about Cawston Creek (i.e., ~24 river km in Canada north of the international border) and eliminating much of the existing riverine habitat.

Independent power production (IPP) proposals have increased significantly in BC in recent years due to increasing power demands and an increased interest in developing “clean energy” options. These projects can range widely in magnitude of power generation, as well as potential to impact fish habitat. Independent power production should have minimal impacts to fish if they are adequately designed to meet requirements under the provincial *Water Act* and supporting regulations. They tend to be either run-of-river type projects with no impoundment or at most involve a low weir to ensure adequate water can be diverted to drive power stations. No IPPs are either in operation or approved stages within the range of Mountain Sucker as of 2010 (Independent Power Producers’ Association 2010). There are, however, a number of high-gradient streams within the range of the species that might be suitable.

Toxicity

Mountain Suckers within DU3 are apparently restricted in distribution such that they are susceptible to localized stochastic events. For instance, major rail lines run adjacent to areas of local concentrations of Mountain Sucker within DU3 such that they are susceptible to spills of toxic materials that may occur and result in significant fish kills. While such events are comparatively rare, their effects can be devastating, at least in the short term. For instance, in August of 2005, 40,000 litres of sodium hydroxide spilled into the Cheakamus River in southwestern BC from a train derailment. It has been estimated that the spill killed more than 500,000 fishes from the river (an estimated 90% of the fishes in the river at the time) over a distance of at least 15 km (BC Ministry of Environment 2006). In the lower Fraser River, toxic compounds may eventually enter the mainstem through tributaries that that receive urban storm runoff, contaminated groundwater (e.g. agricultural pesticides and herbicides), direct industrial discharges, sewage treatment plant effluents, aerial deposition, and accidental spills (Hall *et al.* 1991). Concentrations vary over time, and some contaminants, particularly heavy metals, bind to sediments where they may bioaccumulate in aquatic invertebrates and subsequently fish. Data on threshold concentrations for lethal and sub-lethal effects of toxic compounds on most fishes, including Mountain Sucker, are lacking. As a bottom-dwelling species, they may be sensitive to contaminants bound to sediment as well as those in food items and the water column. Monitoring of water quality on the Similkameen River indicated that while drinking water standards were met for the period of 1979-1997, some metal concentrations associated with negative effects on aquatic life were exceeded (Rae 2005). There is also a long history of mining in the immediate vicinity of the mainstem for gold, copper and platinum mostly around the turn of the twentieth century near Hedley, BC, although some limited mining continues (Rae 2005).

Exotic species

Increased predation and competition are likely to result from the introduction of non-native species, and such introductions have been implicated in the extinction of numerous native fishes across North America (Miller *et al.* 1989; Richter 1997; Gido and Brown 1999). The introduction of non-native fish species is extensive in southern BC, including watersheds occupied by Mountain Sucker, particularly in off-channel areas of the lower Fraser River (e.g., Brown Bullhead (*Ameiurus nebulosis*), Bullfrogs (*Rana catesbeiana*), Largemouth Bass (*Micropterus salmoides*), and Smallmouth Bass (*M. dolomieu*) (Taylor 2004; Pearson *et al.* 2008)). Conversion of riverine habitat to lake-like conditions associated with reservoirs often puts native species at a disadvantage, and introduced visual predators such as Largemouth Bass and Smallmouth Bass and Walleye typically flourish (McPhail 2007; Runciman *et al*. 2009). The risk of introduction and establishment of such exotic predators in the Similkameen River system would almost certainly increase if proposed dam developments occur there. All of these species would undoubtedly prey upon various life stages of Mountain Sucker given the opportunity.

Limiting factors

The distribution and evolution of Mountain Suckers is closely associated with mountains, where they are adapted to cool waters, swift currents, and rocky substrates. Mountains also provide the major barriers isolating populations, leading to variation among populations. In addition to the barriers presented by mountains, waterfalls may create barriers that permit only unidirectional gene flow. An example is the waterfall near the mouth of the Similkameen River where the Enloe Dam was constructed. The waterfall naturally isolated Mountain Sucker populations in that watershed from downstream populations before dam construction. Other ecological barriers may occur due to the environmental differences in lower parts of streams where the water is warmer, more sluggish and turbid, and bottom substrates are fine-grained. Intermittent streams also are characteristic of mountainous areas and arid environments like those of southern Alberta and SK. Within a given stream system, zones of alternating flowing water and dry stream bed only a few metres wide may be all that remains of a stream corridor many kilometres long for much of the summer. In winter these conditions may be exacerbated by severe ice conditions and anoxia in isolated pools all affecting population viability to varying degrees. Robust flowing water in the whole corridor may exist only for days or weeks each spring or during large rain events.

ABORIGINAL TRADITIONAL KNOWLEDGE

At the time of writing, there was no Aboriginal Traditional Knowledge available for the Mountain Sucker (Goulet, pers comm., 2009).

EXISTING PROTECTION OR OTHER STATUS DESIGNATIONS

The *Fisheries Act* provides Fisheries and Oceans Canada (DFO) with powers, authorities, duties and functions for the conservation and protection of fish and fish habitat (as defined in the *Fisheries Act*) essential to sustaining commercial, recreational and Aboriginal fisheries. The *Fisheries Act* contains provisions that can be applied to regulate flow needs for fish, fish passage, killing of fish by means other than fishing, the pollution of fish-bearing waters, and harm to fish habitat. Environment Canada has been delegated administrative responsibilities for the provisions dealing with regulating the pollution of fish-bearing waters while the other provisions are administered by DFO. The Mountain Sucker was listed as a species of special concern in the State of Washington (Johnson 1987), but not by Jelks *et al.* (2008) for North America. It is currently listed as Not at Risk under the SARA (1991 assessment as a single DU); however, it is currently COSEWIC-assessed (November 2010) as Data Deficient (Saskatchewan-Nelson River populations), Threatened (Milk River populations) and Special Concern (Pacific populations). Globally, the Mountain Sucker is ranked as G5 (NatureServe 2008). It has been evaluated by most of the provinces and states in which it occurs. In Canada, Mountain Sucker has a N4 Heritage rank. It is ranked *Critically Imperiled* (S1) in Saskatchewan, *Vulnerable* (S2S3) in British Columbia, and *Apparently Secure* (S4) in Alberta. In the U.S., the National Heritage Status Rank is N5 (*Secure*). In Nebraska, Colorado, California, and Washington it is ranked as *Critically Impaired* (S1) to *Vulnerable* (S3). In Montana, Oregon, Idaho, Wyoming, and Utah it is ranked either as *Secure* (S5) or *Apparently Secure* (S4). In Nevada, the Mountain Sucker currently is unranked.

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Douglas A. Watkinson obtained B.Sc. (1998) and M.Sc. (2001) degrees from the University of Manitoba. He is a Research Biologist with Fisheries and Oceans Canada in Winnipeg. He has sampled fish in many of the major river systems of the Hudson Bay drainage. His current research focuses on species at risk, aquatic invasive species, and habitat impacts related to changes in river flow. He also is the co-author of the Freshwater Fishes of Manitoba, a comprehensive guide to the fishes of the province.

COLLECTIONS EXAMINED

No collections was examined in preparing this report, but collection records were accessed using the online databases of the University of British Columbia Fish Museum (www.zoology.ubc.ca/~etaylor/nfrg/fishmuseum.html) and the Royal British Columbia Museum (http://www.royalbcmuseum.bc.ca//Collect_Research/Search_Coll.aspx).

Appendix 1. Mountain Sucker collection records in DU 1. Under “No. collected”, “>0” indicates Mountain Sucker were collected, but not enumerated.

Watershed	Site	Collection Date	No. Collected	Sampling Organization
1. Bow River	Bow River	21-Aug-1956	>0	UAMZ ICHTHYOLOGY
	Highwood River	16-Jun-1957	>0	UBC
		29-Jul-2003	10	Pisces Environmental Consulting Services Ltd.
		29-Jul-2003	4	Pisces Environmental Consulting Services Ltd.
		4-Sep-2003	6	Pisces Environmental Consulting Services Ltd.
		8-Sep-2003	2	Pisces Environmental Consulting Services Ltd.
		11-Sep-2003	5	Pisces Environmental Consulting Services Ltd.
		25-Sep-2003	8	Pisces Environmental Consulting Services Ltd.
		2-Oct-2003	3	Pisces Environmental Consulting Services Ltd.
		29-Sep-2007	33	Trout Unlimited Canada
	Jumpingpound Creek	25-Aug-1981	4	Fisheries Management; SERM
		25-Aug-1981	4	Fisheries Management; SERM
	Sheep River	24-Jun-1956	>0	UAMZ ICHTHYOLOGY
		6-Aug-1959	>0	UAMZ ICHTHYOLOGY
		1-Sep-1998	>0	Pisces Environmental Consulting Services Ltd.
		17-Sep-2005	2	Clearwater Environmental Consultants
		31-Aug-2007	354	AMEC Earth and Environmental
	Threepoint Creek	21-Sep-1978	1	Aquatic Environments Ltd.
		21-Sep-1978	1	Aquatic Environments Ltd.
		21-Sep-1978	1	Aquatic Environments Ltd.
2. North Saskatchewan River	Abraham Lake	2-Jul-1972	>0	UAMZ ICHTHYOLOGY
		5-Jul-1973	>0	UAMZ ICHTHYOLOGY
		28-Jul-1973	>0	UAMZ ICHTHYOLOGY
		1970s	>0	UAMZ ICHTHYOLOGY
		1970s	>0	UAMZ ICHTHYOLOGY
	Baptiste River	7-Aug-1998	1	Golder Associates
		7-Aug-1998	1	Golder Associates
	Brazeau River	17-May-1961	>0	UAMZ ICHTHYOLOGY
		30-Jun-1961	>0	UAMZ ICHTHYOLOGY
	Buster Creek	6-Aug-1965	>0	UAMZ ICHTHYOLOGY
	North Saskatchewan River	10-Jun-1972	>0	UAMZ ICHTHYOLOGY
		19-Jun-1972	>0	UAMZ ICHTHYOLOGY
		20-Jun-1972	>0	UAMZ ICHTHYOLOGY
		20-Jul-1972	>0	UAMZ ICHTHYOLOGY
		21-Jul-1972	>0	UAMZ ICHTHYOLOGY
		31-Jul-1972	>0	UAMZ ICHTHYOLOGY
		23-Jul-1973	>0	UAMZ ICHTHYOLOGY
		8-Jul-1974	>0	UAMZ ICHTHYOLOGY
		18-Jul-2007	2	Alberta Conservation Association
		26-Jul-2007	2	Alberta Conservation Association
		26-Jul-2007	1	Alberta Conservation Association
		1970's	>0	UAMZ ICHTHYOLOGY
	Prairie Creek	21-Jun-1999	2	Fisheries Management; SERM
		22-Jun-1999	1	Fisheries Management; SERM
	Whitemud Creek	30-May-2002	>0	EnviroMak Inc.

Watershed	Site	Collection Date	No. Collected	Sampling Organization
3. Oldman River	Beaver Creek	18-May-2005	5	Mainstream Aquatics Ltd.
		1-Aug-2005	12	Mainstream Aquatics Ltd.
		15-Oct-2005	10	Mainstream Aquatics Ltd.
	Belly River	11-Oct-2005	1	Trout Unlimited Canada
		30-Sep-2006	1	Fisheries and Oceans Canada
		6-Sep-2008	16	Royal Alberta Museum
	Chipman Creek	19-Jun-1997	2	Fisheries Management; SERM
	Connelly Creek	21-Jul-2005	1	Clearwater Environmental Consultants
		21-Jul-2005	1	Clearwater Environmental Consultants
	Cottonwood Creek	1-Jul-1971	>0	UAMZ ICHTHYOLOGY
	Drywood Creek	26-Aug-2003	6	Alberta Conservation Association
	Gladstone Creek	14-Aug-2002	1	Alberta Conservation Association
	Kettles Creek	23-Apr-2003	3	Townsend Environmental Consulting
	Lee Creek	13-Aug-2000	9	RL&L Environmental Services Ltd.
		14-Aug-2000	16	RL&L Environmental Services Ltd.
		14-Aug-2000	68	RL&L Environmental Services Ltd.
		19-Aug-2003	1	AMEC Earth and Environmental
		19-Aug-2003	138	AMEC Earth and Environmental
		24-Oct-2004	1	Fisheries and Oceans Canada
		25-Aug-2006	29	Fisheries and Oceans Canada
		25-Aug-2006	11	Fisheries and Oceans Canada
		25-Aug-2006	29	Fisheries and Oceans Canada
		25-Aug-2006	15	Fisheries and Oceans Canada
		26-Aug-2006	14	Fisheries and Oceans Canada
		26-Aug-2006	18	Fisheries and Oceans Canada
		2-Oct-2006	16	Fisheries and Oceans Canada
	Oldman River	4-Aug-1951	>0	UAMZ ICHTHYOLOGY
		16-Jun-1957	>0	CMNFI
		16-Jun-1957	>0	UBC
		5-Jun-1968	>0	UAMZ ICHTHYOLOGY
		16-May-1996	9	RL&L Environmental Services Ltd.
		16-May-1996	3	RL&L Environmental Services Ltd.
		16-May-1996	4	RL&L Environmental Services Ltd.
		16-May-1996	1	RL&L Environmental Services Ltd.
		16-May-1996	1	RL&L Environmental Services Ltd.
		16-May-1996	8	RL&L Environmental Services Ltd.
		16-May-1996	2	RL&L Environmental Services Ltd.
		16-May-1996	3	RL&L Environmental Services Ltd.
		16-May-1996	7	RL&L Environmental Services Ltd.
		16-May-1996	6	RL&L Environmental Services Ltd.
		16-May-1996	5	RL&L Environmental Services Ltd.
		16-May-1996	15	RL&L Environmental Services Ltd.
		16-May-1996	1	RL&L Environmental Services Ltd.
		17-May-1996	2	RL&L Environmental Services Ltd.
		17-May-1996	8	RL&L Environmental Services Ltd.
		17-May-1996	3	RL&L Environmental Services Ltd.
		17-May-1996	2	RL&L Environmental Services Ltd.
		17-May-1996	4	RL&L Environmental Services Ltd.
		17-May-1996	1	RL&L Environmental Services Ltd.
		17-May-1996	5	RL&L Environmental Services Ltd.
		17-May-1996	12	RL&L Environmental Services Ltd.
		17-May-1996	1	RL&L Environmental Services Ltd.

Watershed	Site	Collection Date	No. Collected	Sampling Organization
		17-May-1996	3	RL&L Environmental Services Ltd.
		17-May-1996	1	RL&L Environmental Services Ltd.
		17-May-1996	1	RL&L Environmental Services Ltd.
		17-May-1996	3	RL&L Environmental Services Ltd.
		17-May-1996	8	RL&L Environmental Services Ltd.
		17-May-1996	12	RL&L Environmental Services Ltd.
		17-May-1996	5	RL&L Environmental Services Ltd.
		17-May-1996	1	RL&L Environmental Services Ltd.
		17-May-1996	2	RL&L Environmental Services Ltd.
		17-May-1996	1	RL&L Environmental Services Ltd.
		17-May-1996	2	RL&L Environmental Services Ltd.
		17-May-1996	4	RL&L Environmental Services Ltd.
		17-May-1996	1	RL&L Environmental Services Ltd.
		17-May-1996	3	RL&L Environmental Services Ltd.
		17-May-1996	1	RL&L Environmental Services Ltd.
		18-May-1996	2	RL&L Environmental Services Ltd.
		18-May-1996	12	RL&L Environmental Services Ltd.
		18-May-1996	35	RL&L Environmental Services Ltd.
		18-May-1996	1	RL&L Environmental Services Ltd.
		18-May-1996	1	RL&L Environmental Services Ltd.
		18-May-1996	11	RL&L Environmental Services Ltd.
		18-May-1996	4	RL&L Environmental Services Ltd.
		18-May-1996	1	RL&L Environmental Services Ltd.
		20-Aug-1996	1	RL&L Environmental Services Ltd.
		20-Aug-1996	1	RL&L Environmental Services Ltd.
		21-Aug-1996	2	RL&L Environmental Services Ltd.
		21-Aug-1996	5	RL&L Environmental Services Ltd.
		21-Aug-1996	6	RL&L Environmental Services Ltd.
		21-Aug-1996	2	RL&L Environmental Services Ltd.
		21-Aug-1996	1	RL&L Environmental Services Ltd.
		22-Aug-1996	1	RL&L Environmental Services Ltd.
		22-Aug-1996	1	RL&L Environmental Services Ltd.
		22-Aug-1996	1	RL&L Environmental Services Ltd.
		23-Aug-1996	2	RL&L Environmental Services Ltd.
		23-Aug-1996	2	RL&L Environmental Services Ltd.
		23-Aug-1996	1	RL&L Environmental Services Ltd.
		23-Aug-1996	1	RL&L Environmental Services Ltd.
		23-Aug-1996	1	RL&L Environmental Services Ltd.
		7-Jul-2004	21	University of Lethbridge
		8-Jul-2004	2	University of Lethbridge
		9-Jul-2004	1	University of Lethbridge
		12-Jul-2004	6	University of Lethbridge
		13-Jul-2004	10	University of Lethbridge
		14-Jul-2004	3	University of Lethbridge
		15-Jul-2004	9	University of Lethbridge
		19-Jul-2004	3	University of Lethbridge
		5-Aug-2004	3	University of Lethbridge
		11-Aug-2004	1	University of Lethbridge
		19-Aug-2004	1	University of Lethbridge
		21-Sep-2004	2	Mainstream Aquatics Ltd.
		9-Oct-2004	2	Piikani Friends Along the River
		9-Oct-2004	25	Piikani Friends Along the River

Watershed	Site	Collection Date	No. Collected	Sampling Organization
		13-May-2005	1	Mainstream Aquatics Ltd.
		19-May-2005	1	Mainstream Aquatics Ltd.
		19-May-2005	1	Mainstream Aquatics Ltd.
		29-Jul-2005	1	Mainstream Aquatics Ltd.
		30-Jul-2005	1	Mainstream Aquatics Ltd.
		30-Jul-2005	2	Mainstream Aquatics Ltd.
		31-Jul-2005	1	Mainstream Aquatics Ltd.
		31-Jul-2005	1	Mainstream Aquatics Ltd.
		31-Jul-2005	2	Mainstream Aquatics Ltd.
		1-Aug-2005	1	Mainstream Aquatics Ltd.
		2-Aug-2005	1	Mainstream Aquatics Ltd.
		2-Aug-2005	1	Mainstream Aquatics Ltd.
		5-Aug-2005	1	Mainstream Aquatics Ltd.
		6-Aug-2005	1	Mainstream Aquatics Ltd.
		18-Oct-2005	2	Mainstream Aquatics Ltd.
		14-Oct-2006	22	Peigan Friends Along the River
		27-Mar-2007	20	Mainstream Aquatics Ltd.
		13-Oct-2007	51	Peigan Friends Along the River
		5-Sep-2008	1	Royal Alberta Museum
	Pincher Creek	2-Jul-2003	33	Townsend Environmental Consulting
		15-Mar-2004	1	Townsend Environmental Consulting
		13-Jul-2004	41	Lethbridge Community College
		25-Aug-2004	2	Townsend Environmental Consulting
		21-Sep-2004	35	Lethbridge Community College
		22-Sep-2004	23	Lethbridge Community College
		22-Sep-2004	9	Lethbridge Community College
		23-Sep-2004	20	Lethbridge Community College
		23-Sep-2004	11	Lethbridge Community College
		23-Sep-2004	4	Lethbridge Community College
		3-Aug-2005	5	Mainstream Aquatics Ltd.
		11-Sep-2007	8	Lethbridge Community College
		11-Sep-2007	3	Lethbridge Community College
		11-Sep-2007	5	Lethbridge Community College
		12-Sep-2007	3	Lethbridge Community College
	Pothole Creek	9-Aug-1977	>0	UAMZ ICHTHYOLOGY
	Rolph Creek	15-Jun-2000	1	Pisces Environmental Consulting Services Ltd.
		1-Oct-2006	2	Fisheries and Oceans Canada
	St. Mary River	25-Aug-1966	>0	CMNFI
		26-Jul-1967	>0	CMNFI
		18-Oct-2000	3	RL&L Environmental Services Ltd.
		25-Aug-2006	1	Fisheries and Oceans Canada
		25-Aug-2006	3	Fisheries and Oceans Canada
		1-Oct-2006	36	Fisheries and Oceans Canada
		1-Oct-2006	3	Fisheries and Oceans Canada
		1-Oct-2006	1	Fisheries and Oceans Canada
		2-Oct-2006	1	Fisheries and Oceans Canada
		23-Aug-2007	23	Alberta Environment
		30-Aug-2007	4	Alberta Environment
	unnamed	23-Aug-1967	>0	CMNFI
	Willow Creek	6-Jun-1966	>0	UBC
		30-May-2001	45	Alberta Environment
		30-May-2001	31	Alberta Environment

Watershed	Site	Collection Date	No. Collected	Sampling Organization
		1-Jun-2001	54	Alberta Environment
		3-Jun-2001	22	Alberta Environment
		31-Jul-2001	24	Alberta Environment
		31-Jul-2001	31	Alberta Environment
		2-Aug-2001	159	Alberta Environment
		3-Aug-2001	10	Alberta Environment
		3-Aug-2001	3	Alberta Environment
		9-Oct-2001	8	Alberta Environment
		9-Oct-2001	8	Alberta Environment
		9-Oct-2001	9	Alberta Environment
		10-Oct-2001	18	Alberta Environment
		10-Oct-2001	10	Alberta Environment
		10-Oct-2001	27	Alberta Environment
		11-Oct-2001	1	Alberta Environment
		11-Oct-2001	2	Alberta Environment
		11-Oct-2001	1	Alberta Environment
		5-Jul-2002	37	Pisces Environmental Consulting Services Ltd.
		30-Jul-2002	8	Alberta Environment
		31-Jul-2002	40	Alberta Environment
		1-Aug-2002	19	Alberta Environment
		2-Oct-2002	3	Alberta Environment
		2-Oct-2007	5	Fisheries and Oceans Canada
		2-Oct-2007	25	Fisheries and Oceans Canada
4. Red Deer River	Bearberry Creek	3-Sep-2004	1	Pisces Environmental Consulting Services Ltd.
		13-Sep-2004	1	Pisces Environmental Consulting Services Ltd.
		1-Oct-2004	1	Pisces Environmental Consulting Services Ltd.
		14-Oct-2005	10	Alberta Conservation Association
	Big Prairie Creek	30-Jun-2003	5	Townsend Environmental Consulting
	Blindman River	17-Jun-1956	>0	UAMZ ICHTHYOLOGY
	Dogpound Creek	30-Sep-1959	>0	UAMZ ICHTHYOLOGY
	James River	19-Oct-2006	10	Golder Associates Ltd.
		19-Oct-2006	3	Golder Associates Ltd.
	Little Red Deer River	10-Oct-2001	1	Pisces Environmental Consulting Services Ltd.
	Lower Stony Creek	14-Jul-1982	1	Fisheries Management; SERM
	Red Deer River	17-Jun-1957	>0	UBC
		2-Aug-2000	1	Fisheries Management; SERM
	Silver Creek	23-Oct-2000	1	Pisces Environmental Consulting Services Ltd.
	Smith Creek	16-Aug-2005	12	Alberta Conservation Association
	Walton Creek	4-Aug-2005	17	Alberta Conservation Association
5. Swift Current Creek	Bone Creek	3-Jun-1905	>0	Atton and Merkowsky (1983)
	Swift Current Creek	1957	>0	Atton and Merkowsky (1983)
		1962	>0	Atton and Merkowsky (1983)

Appendix 2. Mountain Sucker collection records in DU 2. Under “No. collected”, “>0” indicates Mountain Sucker were collected, but not enumerated.

Watershed	Site	Collection Date	No. Collected	Sampling Organization
1. Milk River	Battle Creek	10-Apr-1905	>0	Atton and Merkowsky (1983)
		16-May-1905	>0	Atton and Merkowsky (1983)
		21-Jun-1993	>0	McCulloch et al. (1994)
		21-Jun-1993	>0	McCulloch et al. (1994)
		18-Apr-1996	1	Fisheries Management; SERM
		25-Apr-1996	8	Fisheries Management; SERM
		26-Apr-1996	3	Fisheries Management; SERM
		27-Apr-1996	1	Fisheries Management; SERM
		28-Apr-1996	1	Fisheries Management; SERM
		29-Apr-1996	1	Fisheries Management; SERM
		1-May-1996	5	Fisheries Management; SERM
		1-May-1996	2	Fisheries Management; SERM
		2-May-1996	1	Fisheries Management; SERM
		3-May-1996	1	Fisheries Management; SERM
		4-May-1996	1	Fisheries Management; SERM
		5-May-1996	2	Fisheries Management; SERM
		6-May-1996	1	Fisheries Management; SERM
		7-May-1996	3	Fisheries Management; SERM
		9-May-1996	1	Fisheries Management; SERM
		23-Sep-2003	3	Fisheries and Oceans Canada
		23-Sep-2003	3	Fisheries and Oceans Canada
		7-May-2008	1	Jacques Whitford AXYS Ltd.
		7-May-2008	1	Jacques Whitford AXYS Ltd.
	Belanger Creek	10-Apr-1905	>0	Atton and Merkowsky (1983)
		5-Jun-1905	>0	Atton and Merkowsky (1983)
		5-Jul-1967	>0	CMNFI
	Caton Creek	16-Jul-1970	>0	CMNFI
		22-Jun-1993	>0	McCulloch *et al.* (1994)
		24-Sep-2003	9	Fisheries and Oceans Canada
		17-Sep-2004	15	Fisheries and Oceans Canada
	Conglomerate Creek	27-Jun-1993	>0	McCulloch *et al*. (1994)
		17-Sep-2004	1	Fisheries and Oceans Canada
	Lonepine Creek	20-May-1905	>0	Atton and Merkowsky (1983)
		22-May-1905	>0	Atton and Merkowsky (1983)
	Milk River	15-Jun-1957	>0	UBC
		2-Aug-1958	>0	UAMZ ICHTHYOLOGY
		18-May-1966	>0	CMNFI
		18-May-1966	>0	CMNFI
		28-May-1966	2	ROM collection
		28-May-1966	>0	CMNFI
		29-May-1966	>0	CMNFI
		29-May-1966	>0	CMNFI
		29-May-1966	>0	CMNFI
		29-May-1966	>0	CMNFI
		29-May-1966	>0	CMNFI
		30-May-1966	>0	CMNFI
		30-May-1966	>0	CMNFI
		1-Jun-1966	>0	CMNFI
		8-Jun-1966	>0	CMNFI

Watershed	Site	Collection Date	No. Collected	Sampling Organization
		9-Jun-1966	>0	CMNFI
		9-Jun-1966	>0	CMNFI
		9-Jun-1966	>0	CMNFI
		12-Jun-1966	>0	CMNFI
		13-Jun-1966	>0	CMNFI
		13-Jun-1966	>0	CMNFI
		14-Jun-1966	>0	CMNFI
		14-Jun-1966	>0	CMNFI
		16-Jun-1966	>0	CMNFI
		16-Jun-1966	>0	CMNFI
		20-Jul-1966	>0	CMNFI
		21-Jul-1966	>0	CMNFI
		21-Jul-1966	>0	CMNFI
		21-Jul-1966	>0	CMNFI
		22-Jul-1966	>0	CMNFI
		22-Jul-1966	>0	CMNFI
		22-Jul-1966	>0	CMNFI
		12-Aug-1966	>0	CMNFI
		12-Aug-1966	>0	CMNFI
		22-Aug-1966	>0	CMNFI
		22-Aug-1966	>0	CMNFI
		23-Aug-1966	>0	CMNFI
		24-Aug-1966	>0	CMNFI
		24-Aug-1966	>0	CMNFI
		3-Jun-1967	>0	CMNFI
		4-Jun-1967	>0	CMNFI
		4-Jun-1967	>0	CMNFI
		12-Jul-1967	>0	CMNFI
		12-Jul-1967	>0	CMNFI
		13-Jul-1967	>0	CMNFI
		13-Jul-1967	>0	CMNFI
		13-Jul-1967	>0	CMNFI
		13-Jul-1967	>0	CMNFI
		13-Jul-1967	>0	CMNFI
		28-Jul-1967	>0	CMNFI
		22-Aug-1967	>0	CMNFI
		22-Aug-1967	>0	CMNFI
		22-Aug-1967	>0	CMNFI
		22-Aug-1967	>0	CMNFI
		22-Aug-1967	>0	CMNFI
		22-Aug-1967	>0	CMNFI
		24-Aug-1967	>0	CMNFI
		28-Aug-1967	>0	CMNFI
		28-Aug-1967	>0	CMNFI
		28-Aug-1967	>0	CMNFI
		28-Aug-1967	>0	CMNFI
		8-Oct-1967	>0	CMNFI
		11-Oct-1967	>0	CMNFI
		28-Oct-1967	>0	CMNFI
		12-May-1971	>0	UAMZ ICHTHYOLOGY
		30-May-1972	>0	UAMZ ICHTHYOLOGY
		31-May-1972	>0	UAMZ ICHTHYOLOGY

Watershed	Site	Collection Date	No. Collected	Sampling Organization
		28-Apr-1973	>0	UAMZ ICHTHYOLOGY
		28-Apr-1973	>0	UAMZ ICHTHYOLOGY
		23-Jul-1974	>0	UAMZ ICHTHYOLOGY
		30-Jun-1976	>0	UAMZ ICHTHYOLOGY
		1-Jul-1976	>0	UAMZ ICHTHYOLOGY
		31-Oct-1979	>0	UAMZ ICHTHYOLOGY
		2-Aug-2000	2	Stantec Consulting Ltd.
		8-Aug-2000	5	RL&L Environmental Services Ltd.
		8-Aug-2000	2	RL&L Environmental Services Ltd.
		9-Aug-2000	2	RL&L Environmental Services Ltd.
		19-Oct-2000	10	RL&L Environmental Services Ltd.
		20-Oct-2000	2	RL&L Environmental Services Ltd.
		20-Oct-2000	3	RL&L Environmental Services Ltd.
		20-Oct-2000	1	RL&L Environmental Services Ltd.
		8-Jul-2005	4	Alberta Conservation Association
		8-Jul-2005	5	Alberta Conservation Association
		12-Jul-2005	6	Alberta Conservation Association
		14-Jul-2005	1	Alberta Conservation Association
		14-Jul-2005	14	Fisheries and Oceans Canada
		20-Jul-2005	5	Alberta Conservation Association
		21-Jul-2005	1	Alberta Conservation Association
		25-Jul-2005	3	Alberta Conservation Association
		3-Aug-2005	1	Alberta Conservation Association
		4-Aug-2005	7	Alberta Conservation Association
		5-Aug-2005	1	Alberta Conservation Association
		5-Aug-2005	2	Alberta Conservation Association
		5-Aug-2005	2	Alberta Conservation Association
		8-Aug-2005	2	Alberta Conservation Association
		10-Aug-2005	1	Alberta Conservation Association
		11-Aug-2005	1	Alberta Conservation Association
		11-Aug-2005	1	Alberta Conservation Association
		11-Aug-2005	2	Alberta Conservation Association
		12-Aug-2005	11	Alberta Conservation Association
		12-Aug-2005	2	Alberta Conservation Association
		23-Aug-2005	1	Alberta Conservation Association
		23-Aug-2005	1	Alberta Conservation Association
		25-Aug-2005	5	Alberta Conservation Association
		29-Sep-2005	1	Alberta Conservation Association
		6-Oct-2005	1	Alberta Conservation Association
		14-Oct-2005	2	Alberta Conservation Association
		14-Oct-2005	1	Alberta Conservation Association
		25-May-2006	1	Fisheries and Oceans Canada
		25-May-2006	144	Fisheries and Oceans Canada
		25-May-2006	157	Fisheries and Oceans Canada
		26-May-2006	23	Fisheries and Oceans Canada
		26-May-2006	13	Fisheries and Oceans Canada
		26-May-2006	3	Fisheries and Oceans Canada
		26-May-2006	50	Fisheries and Oceans Canada
		9-Aug-2006	1	Fisheries Management; SERM
		22-Aug-2006	1	Fisheries and Oceans Canada
		22-Aug-2006	1	Fisheries and Oceans Canada
		22-Aug-2006	1	Fisheries and Oceans Canada

Watershed	Site	Collection Date	No. Collected	Sampling Organization
		22-Aug-2006	1	Fisheries and Oceans Canada
		22-Aug-2006	1	Fisheries and Oceans Canada
		22-Aug-2006	1	Fisheries and Oceans Canada
		22-Aug-2006	1	Fisheries and Oceans Canada
		22-Aug-2006	1	Fisheries and Oceans Canada
		22-Aug-2006	1	Fisheries and Oceans Canada
		23-Aug-2006	1	Fisheries and Oceans Canada
		23-Aug-2006	1	Fisheries and Oceans Canada
		23-Aug-2006	2	Fisheries and Oceans Canada
		23-Aug-2006	1	Fisheries and Oceans Canada
		23-Aug-2006	1	Fisheries and Oceans Canada
		23-Aug-2006	1	Fisheries and Oceans Canada
		23-Aug-2006	1	Fisheries and Oceans Canada
		23-Aug-2006	2	Fisheries and Oceans Canada
		23-Aug-2006	2	Fisheries and Oceans Canada
		23-Aug-2006	3	Fisheries and Oceans Canada
		23-Aug-2006	1	Fisheries and Oceans Canada
		23-Aug-2006	1	Fisheries and Oceans Canada
		23-Aug-2006	1	Fisheries and Oceans Canada
		23-Aug-2006	1	Fisheries and Oceans Canada
		23-Aug-2006	1	Fisheries and Oceans Canada
		23-Aug-2006	1	Fisheries and Oceans Canada
		23-Aug-2006	2	Fisheries and Oceans Canada
		23-Aug-2006	1	Fisheries and Oceans Canada
		23-Aug-2006	1	Fisheries and Oceans Canada
		23-Aug-2006	1	Fisheries and Oceans Canada
		23-Aug-2006	1	Fisheries and Oceans Canada
		23-Aug-2006	1	Fisheries and Oceans Canada
		23-Aug-2006	1	Fisheries and Oceans Canada
		23-Aug-2006	1	Fisheries and Oceans Canada
		23-Aug-2006	1	Fisheries and Oceans Canada
		3-Oct-2006	1	Fisheries and Oceans Canada
		3-Oct-2006	1	Fisheries and Oceans Canada
		3-Oct-2006	30	Fisheries and Oceans Canada
		19-Jun-2007	1	Fisheries and Oceans Canada
		19-Jun-2007	2	Fisheries and Oceans Canada
		20-Jun-2007	1	Fisheries and Oceans Canada
		20-Jun-2007	1	Fisheries and Oceans Canada
		20-Jun-2007	1	Fisheries and Oceans Canada
		20-Jun-2007	1	Fisheries and Oceans Canada
		20-Jun-2007	1	Fisheries and Oceans Canada
		20-Jun-2007	1	Fisheries and Oceans Canada
		20-Jun-2007	2	Fisheries and Oceans Canada
		21-Jun-2007	1	Fisheries and Oceans Canada
	Nine Mile Creek	4-Jun-1905	>0	Atton and Merkowsky (1983)
		15-Sep-2004	4	Fisheries and Oceans Canada
	North Milk River	8-Aug-1950	>0	UAMZ ICHTHYOLOGY
		5-Aug-1955	>0	UAMZ ICHTHYOLOGY
		16-Jun-1966	>0	CMNFI
		16-Jun-1966	>0	CMNFI
		20-Jul-1966	>0	CMNFI
		22-Aug-1966	>0	CMNFI

Watershed	Site	Collection Date	No. Collected	Sampling Organization
		1-Jul-1967	>0	CMNFI
		13-Jul-1967	>0	CMNFI
		1-Jul-1976	>0	UAMZ ICHTHYOLOGY
		9-Aug-1977	>0	UAMZ ICHTHYOLOGY
		18-Oct-2000	1	RL&L Environmental Services Ltd.
		18-Oct-2000	1	RL&L Environmental Services Ltd.
		19-Oct-2000	1	RL&L Environmental Services Ltd.
		19-Oct-2000	3	RL&L Environmental Services Ltd.
		22-Oct-2002	1	P&E Environmental Consultants Ltd.
		22-Oct-2002	1	P&E Environmental Consultants Ltd.
		2-Oct-2006	4	Fisheries and Oceans Canada
		2-Oct-2006	38	Fisheries and Oceans Canada
		2-Oct-2006	21	Fisheries and Oceans Canada

Appendix 3. Mountain Sucker collection records in DU 3. Under “No. collected”, “>0” indicates Mountain Sucker were collected, but not enumerated.

Watershed	Site	Collection Date	No. Collected	Sampling Organization
1. Fraser River	Fraser River	31-Aug-1959	>0	UBC
		30-Oct-1992	>0	RBCM
2. North Thompson River	Heffley Creek	24-Aug-1958	>0	UBC
		27-Aug-1992	>0	RBCM
		24-Sep-1994	>0	RBCM
		25-Sep-1994	>0	RBCM
		26-Sep-1994	>0	RBCM
		27-Sep-1994	>0	RBCM
		29-Nov-1997	>0	UBC
		30-Aug-2006	>0	RBCM
		06-Aug-2010	12	UBC
3. Similkameen River	Blind Creek	30-Aug-2006	>0	RBCM
	Similkameen River	30-Jul-1956	>0	UBC
		18-Jun-1977	>0	RBCM
		13-Sep-1990	>0	RBCM
		21-Oct-1992	>0	RBCM
		25-Oct-1992	>0	RBCM
		26-Oct-2004	>0	RBCM
		19-Jul-2005	>0	RBCM
		19-Jul-2005	>0	RBCM
		19-Jul-2005	>0	RBCM
		29-Aug-2006	>0	RBCM
		29-Aug-2006	>0	RBCM
		29-Aug-2006	>0	RBCM
		09-Aug-2009	7	UBC
	Tulameen River	19-Jul-1958	>0	UBC
	Wolfe Creek	16-May-1956	>0	UBC
		09-Aug-2009	3	UBC