COSEWIC
Assessment and Status Report

on the

Plains Sucker
Pantosteus jordani

Saskatchewan-Nelson River population
Missouri population

and the

Cordilleran Sucker
Pantosteus bondi

in Canada

Plains Sucker – Saskatchewan – Nelson population – SPECIAL CONCERN
Plains Sucker – Missouri population – THREATENED
Cordilleran Sucker – THREATENED
2022

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:

COSEWIC. 2022. COSEWIC assessment and status report on the Plains Sucker *Pantosteus jordani*, Saskatchewan-Nelson River population and Missouri population and the Cordilleran Sucker *Pantosteus bondi* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. xxii + 68 pp. (https://www.canada.ca/en/environment-climate-change/services/species-risk-public-registry.html).

Previous report(s):

COSEWIC. 2010. COSEWIC assessment and status report on the Mountain Sucker *Catostomus platyrhynchus* (Saskatchewan - Nelson River populations, Milk River populations and Pacific populations) in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. xvii + 54 pp. (https://www.canada.ca/en/environment-climate-change/services/species-risk-public-registry.html).

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.

Production note:
COSEWIC would like to acknowledge Doug Watkinson and Dr. Mark Poesch for writing the status report on the Plains Sucker, *Pantosteus jordani*, Saskatchewan-Nelson River population and Missouri population, and the Cordilleran Sucker, *Pantosteus bondi,* in Canada, prepared under contract with Environment and Climate Change Canada. This report was overseen and edited by Dr. Nicholas Mandrak, Co-chair of the COSEWIC Freshwater Fishes Specialist Subcommittee.

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Également disponible en français sous le titre Évaluation et Rapport de situation du COSEPAC sur le Meunier des plaines (*Pantosteus jordani*), population de la rivière Saskatchewan et du fleuve Nelson et population de la rivière Missouri et le Meunier de la cordillère (*Pantosteus bondi*) au Canada.

Cover illustration/photo:
Plains Sucker - Photograph by Doug Watkinson.

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COSEWIC
Assessment Summary

Assessment Summary – December 2022

Common name
Plains Sucker - Saskatchewan-Nelson River population

Scientific name
Pantosteus jordani

Status
Special Concern

Reason for designation
This population of small freshwater fish is found in the northern portion of a broader distribution of this species across prairie Canada. It has a widespread, but patchy, distribution within the Saskatchewan River drainage across five tributaries in Alberta and Saskatchewan. Habitats in these tributaries are likely undergoing continued decline in quality, related to declines in water quality and quantity as a result of water-use management and climate change. If these threats are not managed effectively, the species may have greater risk of extinction.

Occurrence
Alberta, Saskatchewan

Status history
The Mountain Sucker (*Catostomus platyrhynchus*) was originally assessed by COSEWIC as a single unit and designated Not at Risk in April 1991. Split into three populations in November 2010: "Milk River populations" unit (Threatened), "Pacific populations" unit (Special Concern), and "Saskatchewan - Nelson River populations" unit (Not at Risk). In December 2022, the species formerly considered Mountain Sucker was split into two separate species, Plains Sucker (*Pantosteus jordani*) (2 populations) and Cordilleran Sucker (*Pantosteus bondi*). The original 2010 "Saskatchewan - Nelson River populations" unit of Mountain Sucker is now known as Plains Sucker, Saskatchewan-Nelson population, and was designated Special Concern in December 2022.

Assessment Summary – December 2022

Common name
Plains Sucker - Missouri population

Scientific name
Pantosteus jordani

Status
Threatened

Reason for designation
This population of small freshwater fish is found in the southern portion of a broader distribution of this species across prairie Canada. In Canada, its range is limited to two locations in the Milk River drainage of southern Alberta and Saskatchewan, where its distribution is restricted and has declined in recent years. Actual population size and trend are unknown. Habitat in this river drainage is undergoing continued decline in quality, related to declines in water quality and quantity as a result of water-use management and climate change.

Occurrence
Alberta, Saskatchewan

Status history
The Mountain Sucker (*Catostomus platyrhynchus*) was originally assessed by COSEWIC as a single unit and designated Not at Risk in April 1991. Split into three populations in November 2010: "Milk River populations" unit (Threatened), "Pacific populations" unit (Special Concern), and "Saskatchewan - Nelson River populations" unit (Not at Risk). In December 2022, the species formerly considered Mountain Sucker was split into two separate species, Plains Sucker (*Pantosteus jordani*) (2 populations) and Cordilleran Sucker (*Pantosteus bondi*). The original 2010 "Milk River populations" unit of Mountain Sucker is now known as Plains Sucker, Missouri population, and was designated Threatened in December 2022.

Assessment Summary – December 2022

Common name
Cordilleran Sucker

Scientific name
Pantosteus bondi

Status
Threatened

Reason for designation
In Canada, this small freshwater fish has a limited and patchy distribution within the North Thompson, lower Fraser, and Similkameen river drainages in British Columbia. It has a relatively small area of occupancy and number of locations. Population size and trend are unknown for this poorly-sampled species. Habitats in these drainages are undergoing continued decline in quality, related to declines in water quality and quantity as a result of water-use management and climate change, particularly in the Similkameen River drainage.

Occurrence
British Columbia

Status history
The Mountain Sucker (*Catostomus platyrhynchus*) was originally assessed by COSEWIC as a single unit and designated Not at Risk in April 1991. Split into three populations in November 2010: "Milk River populations" unit (Threatened), "Pacific populations" unit (Special Concern), and "Saskatchewan - Nelson River populations" unit (Not at Risk). In December 2022, the species formerly considered Mountain Sucker was split into two separate species, Plains Sucker (*Pantosteus jordani*) (2 populations) and Cordilleran Sucker (*Pantosteus bondi*). The original 2010 "Pacific populations' unit of Mountain Sucker is now known as Cordilleran Sucker and was designated Threatened in December 2022.

COSEWIC
Executive Summary

Plains Sucker
Pantosteus jordani

Saskatchewan-Nelson River population
Missouri population

and the

Cordilleran Sucker
Pantosteus bondi

Wildlife Species Description and Significance

Plains Sucker (*Pantosteus jordani*) and Cordilleran Sucker (*Pantosteus bondi*), formerly considered a single species (Mountain Sucker, *Catostomus platyrhynchus*), were separated into two species based on molecular data. Molecular data also suggest that *Pantosteus* (mountain suckers), previously considered a subgenus of *Catostomus*, should be elevated to genus level. The two species are morphologically indistinguishable. They are small (usually < 250 mm fork length) and have a subterminal mouth with characteristic “fleshy bumps” (papillae) on the lips. The body is elongate, cylindrical, and somewhat compressed caudally. These sucker species are poorly studied in Canada; however, their zoogeographic history and evolution is a topic of interest for evolutionary research. Although edible, they are too small to be of economic importance and have never been an important human food or sport fish.

Distribution

The Canadian distribution of the Plains Sucker occurs in two National Freshwater Biogeographic Zones (NFBZ), that is, the Saskatchewan-Nelson River and Missouri biogeographic zones. The Cordilleran Sucker occurs in the Pacific biogeographic zone.

The Plains Sucker is distributed in the upper Missouri river drainages from the Black Hills of South Dakota and the Cypress Hills of Saskatchewan to western Wyoming, Montana, and Alberta, and in the upper Saskatchewan drainage in Saskatchewan from near the Cypress Hills westward to the east slope of the Rocky Mountains in Alberta.

The Cordilleran Sucker occurs in the Columbia River drainage in Washington, Oregon, Nevada, Idaho, and British Columbia, and in the Fraser River drainage in British Columbia.

Habitat

Lotic habitat with moderate gradient and cool water temperatures appears to correspond to specific habitat requirements for the genus *Pantosteus.* The distribution of *Pantosteus* species is limited almost exclusively to streams at intermediate elevations and to streams on the Great Plains in drainages with cool groundwater inputs. These suckers are generally found in higher abundances in areas with coarser substrates.

Biology

Very little published information is available regarding the biology of Plains and Cordilleran suckers in Canada and limited knowledge has been obtained elsewhere. The only life-history information on the Plains Sucker comes from populations present in the Great Plains region of the United States, and life-history information on the Cordilleran Sucker is available from British Columbia. Growth in Plains and Cordilleran suckers is typically slow, and they attain a maximum size of 232 mm. These fish are typically mature at 3 to 5 years of age. Spawning generally occurs in riffles in June or July. The number of eggs increases with fish size and is typically <4,000. No nest is built; the eggs are scattered over the substrate.

Plains and Cordilleran suckers are adapted to eat filamentous algae and diatoms, but they also consume invertebrates.

Population Sizes and Trends

Population size and trend information for Plains and Cordilleran suckers is limited mainly to presence or catch per unit effort data, particularly in Canada, and there are no targeted abundance estimates that can be used to examine temporal trends for these species. Given the increasing taxonomic certainty, it is possible that re-examination of some museum collections could reveal new distributional information for Plains and Cordilleran suckers. In addition, the Cordilleran Sucker has a highly disjunct distribution within the Pacific National Freshwater Biogeographic Zone. It is possible that incomplete sampling and identification problems have contributed to the disjunct distribution described for the Cordilleran Sucker.

There have been no temporal surveys of the abundance of Plains and Cordilleran suckers across their range in Canada. Neither species is widely distributed or abundant in Canada.

Recent sampling has confirmed that the Plains Sucker still occupies most of their historical distribution. A total of 578 new collection records have occurred since the last COSEWIC assessment when the species was considered the Mountain Sucker. In the Saskatchewan-Nelson drainage, 408 collection records represent 4,278 fish and, in the Missouri drainage, 170 records represent 306 fish. This sampling has confirmed Plains Sucker persists throughout most of their range in the Saskatchewan-Nelson and the Missouri drainages, although records from downstream portions of the Red Deer and South Saskatchewan rivers and Swift Current Creek are absent in the last 20 years.

The Cordilleran Sucker has had only three collections made since the species was last assessed by COSEWIC as the Mountain Sucker, all of them made in the Similkameen River in 2017.

Threats and Limiting Factors

The distribution and evolution of suckers in the genus *Pantosteus* is closely associated with mountains, where they are adapted to cool waters, swift currents, and rocky substrates. In the case of Plains and Cordilleran suckers, there appears to be no single, imminent threat to particular populations. Rather, threats are multifaceted, likely cumulative, and involve the degradation and elimination of habitat or habitat quality over the medium to long term. The influence of these anthropogenic factors will be affected by the degree of range fragmentation that characterizes the species' natural distribution. The threats to the Plains Sucker differ depending on the DU. For the Saskatchewan-Nelson population, the threats include domestic and urban wastewater, agricultural and forestry effluents, climate change and severe weather, dams and water management/use, invasive non-native/alien species/diseases, roads and railroads, utility and service lines, and recreational activities. The threats to the Plains Sucker, Missouri population, include climate change and severe weather, dams and water management/use, agricultural and forestry effluents, invasive non-native/alien species/diseases, and roads and railroads. Threats to the Cordilleran Sucker include domestic and urban wastewater, agricultural and forestry effluents, climate change and severe weather, dams and water management/use, other ecosystem modifications, invasive non-native/alien species/diseases, roads and railroads, utility and service lines, and fishing and harvesting of aquatic resources.

Protection, Status and Ranks

The NatureServe conservation status has not been updated to reflect the new taxonomy for the *Pantosteus* suckers: the Plains and Cordilleran suckers are still considered to be Mountain Sucker. Global, national, state and provincial statuses will likely change for the Plains and Cordilleran suckers, given their reduced distributions in most jurisdictions.

The Mountain Sucker was assessed by COSEWIC in 2010 and designated Special Concern for the Pacific population, Not at Risk for the Saskatchewan - Nelson River population, and Threatened for the Milk River population. The Mountain Sucker is ranked G5 globally, and N5 in both Canada and the United States.

The Mountain Sucker (likely Plains Sucker) is ranked Secure (S5) in Montana, Wyoming, and Alberta, Vulnerable (S3) in South Dakota, Critically Imperilled (S1) in Saskatchewan, and Presumed Extirpated (SX) in Nebraska.

The Mountain Sucker (likely Cordilleran Sucker) is ranked Apparently Secure (S4) in Idaho and Oregon, Imperilled/Vulnerable (S2S3) in Washington, Vulnerable (S3) in Nevada, and Vulnerable (S3?) in British Columbia.

Some populations of Mountain Sucker are protected under the *Species at Risk Act* (SARA): the Milk River population (Missouri River population) was listed as Threatened in 2017; the Pacific population of Mountain Sucker was listed as Special Concern in 2017; and the Saskatchewan-Nelson River population is not listed under SARA.

TECHNICAL SUMMARY
Plains Sucker – Saskatchewan-Nelson River population (DU1)

Pantosteus jordani

Plains Sucker – Saskatchewan – Nelson population

Meunier des plaines - Population de la rivière Saskatchewan et du fleuve Nelson

Range of occurrence in Canada (province/territory/ocean): Alberta, Saskatchewan

Demographic Information

Generation time (usually average age of parents in the population; indicate if another method of estimating generation time indicated in the IUCN guidelines (2011) is being used)	5 years
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, whichever is longer up to a maximum of 100 years]	Unknown, insufficient sampling
[Observed, estimated, inferred, or suspected] percent [reduction or increase] in total number of mature individuals over the last [10 years, or 3 generations, whichever is longer up to a maximum of 100 years].	Unknown, insufficient sampling
[Projected or suspected] percent [reduction or increase] in total number of mature individuals over the next [10 years, or 3 generations, whichever is longer up to a maximum of 100 years].	Unknown, insufficient sampling
[Observed, estimated, inferred, or suspected] percent [reduction or increase] in total number of mature individuals over any period [10 years, or 3 generations, whichever is longer up to a maximum of 100 years], including both the past and the future.	Unknown, insufficient sampling
Are the causes of the decline a. clearly reversible and b. understood and c. ceased?	Not applicable
Are there extreme fluctuations in number of mature individuals?	Unknown

Extent and Occupancy Information

Estimated extent of occurrence (EOO)	All observations 180,561 km²
Index of area of occupancy (IAO)	All observations 7,280 km² (continuous)
Is the population "severely fragmented" i.e., is >50% of its total area of occupancy in habitat patches that are (a) smaller than would be required to support a viable population, and (b) separated from other habitat patches by a distance larger than the species can be expected to disperse?	a. Unknown b. No

Number of “locations”* (use plausible range to reflect uncertainty if appropriate)	>20 locations within the five larger drainages (North Saskatchewan, South Saskatchewan, Red Deer, Bow, and Oldman) Based on the threats: domestic and urban wastewater and agricultural and forestry effluents.
Is there an [observed, inferred, or projected] decline in extent of occurrence?	No
Is there an [observed, inferred, or projected] decline in index of area of occupancy?	No
Is there an [observed, inferred, or projected] decline in number of subpopulations?	No
Is there an [observed, inferred, or projected] decline in number of “locations”*?	No
Is there an [observed, inferred, or projected] decline in [area, extent and/or quality] of habitat?	Yes, inferred. Quality of habitat.
Are there extreme fluctuations in number of subpopulations?	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 subpopulation)

Subpopulations (give plausible ranges)	**N Mature Individuals**
Total	Unknown

Quantitative Analysis

Is the probability of extinction in the wild at least [20% within 20 years or 5 generations whichever is longer up to a maximum of 100 years, or 10% within 100 years]?	Analysis not conducted.

* See Definitions and Abbreviations on COSEWIC website for more information on this term.

Threats (direct, from highest impact to least, as per IUCN Threats Calculator)

Was a threats calculator completed for this species? Yes Overall (medium) 9. Pollution (medium) 9.1. Domestic and urban wastewater (medium) 9.3. Agricultural and forestry effluents (medium) 11. Climate change and severe weather (medium-low) 7.2. Dams and water management/use (medium-low) 8. Invasive non-native/alien species/diseases (medium-low) 4. Transportation and service corridors (medium-low) 4.1. Roads and railroads (medium-low) 4.2. Utility and service lines (low) 6.1. Recreational activities (low)

Rescue Effect (immigration from outside Canada)

Status of outside population(s) most likely to provide immigrants to Canada.	Unknown. This species has not been assessed by NatureServe
Is immigration known or possible?	No
Would immigrants be adapted to survive in Canada?	Yes
Is there sufficient habitat for immigrants in Canada?	Yes
Are conditions deteriorating in Canada?[+]	Yes
Are conditions for the source (i.e., outside) population deteriorating?	No
Is the Canadian population considered to be a sink?	No
Is rescue from outside populations likely?	No

Data Sensitive Species

Is this a data sensitive species?	No

Status History

The Mountain Sucker (*Catostomus platyrhynchus*) was originally assessed by COSEWIC as a single unit and designated Not at Risk in April 1991. Split into three populations in November 2010: "Milk River populations" unit (Threatened), "Pacific populations" unit (Special Concern), and "Saskatchewan - Nelson River populations" unit (Not at Risk). In December 2022, the species formerly considered Mountain Sucker was split into two separate species, Plains Sucker (Pantosteus jordani) (2 populations) and Cordilleran Sucker (*Pantosteus bondi*). The original 2010 "Saskatchewan - Nelson River populations" unit of Mountain Sucker is now known as the Plains Sucker, Saskatchewan-Nelson population, and was designated Special Concern in December 2022.

[+] See Table 3 (Guidelines for modifying status assessment based on rescue effect).

Status and Reasons for Designation:

Status: Special Concern	**Alpha-numeric codes:** Not Applicable
Reasons for designation: This population of small freshwater fish is found in the northern portion of a broader distribution of this species across prairie Canada. It has a widespread, but patchy, distribution within the Saskatchewan River drainage across five tributaries in Alberta and Saskatchewan. Habitats in these tributaries are likely undergoing continued decline in quality, related to declines in water quality and quantity as a result of water-use management and climate change. If these threats are not managed effectively, the species may have greater risk of extinction.	

Applicability of Criteria

Criterion A (Decline in Total Number of Mature Individuals): Not applicable. Population size and trends are unknown.
Criterion B (Small Distribution Range and Decline or Fluctuation): Not applicable. Small IAO (discrete IAO = 1,472 km²) and inferred continuing decline in habitat quality. However, not known to be severely fragmented, occurs at well over 10 locations, and does not undergo extreme fluctuations.
Criterion C (Small and Declining Number of Mature Individuals): Not applicable. Population estimate is unknown.
Criterion D (Very Small or Restricted Population): Not applicable. Number of mature individuals, IAO, and number of locations all exceed thresholds; population is not prone to effects of human activities or stochastic events within a very short period.
Criterion E (Quantitative Analysis): Not applicable. Analysis not conducted.

TECHNICAL SUMMARY
Plains Sucker – Missouri population (DU2)

Pantosteus jordani

Plains Sucker – Missouri population

Meunier des plaines - Population de la rivière Missouri

Range of occurrence in Canada (province/territory/ocean): Alberta, Saskatchewan

Demographic Information

Generation time (usually average age of parents in the population; indicate if another method of estimating generation time indicated in the IUCN guidelines (2011) is being used)	5 years
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, whichever is longer up to a maximum of 100 years]	Unknown, insufficient sampling
[Observed, estimated, inferred, or suspected] percent [reduction or increase] in total number of mature individuals over the last [10 years, or 3 generations, whichever is longer up to a maximum of 100 years].	Unknown, insufficient sampling
[Projected or suspected] percent [reduction or increase] in total number of mature individuals over the next [10 years, or 3 generations, whichever is longer up to a maximum of 100 years].	Unknown, insufficient sampling
[Observed, estimated, inferred, or suspected] percent [reduction or increase] in total number of mature individuals over any period [10 years, or 3 generations, whichever is longer up to a maximum of 100 years], including both the past and the future.	Unknown, insufficient sampling
Are the causes of the decline a. clearly reversible and b. understood and c. ceased?	Not applicable
Are there extreme fluctuations in number of mature individuals?	Unknown

Extent and Occupancy Information

Estimated extent of occurrence (EOO)	All observations 13,026 km²
Index of area of occupancy (IAO)	All observations 436 km² (discrete) 1,056 km² (continuous)
Is the population “severely fragmented” i.e., is >50% of its total area of occupancy in habitat patches that are (a) smaller than would be required to support a viable population, and (b) separated from other habitat patches by a distance larger than the species can be expected to disperse?	a) Unknown b) No

Number of "locations"[*] (use plausible range to reflect uncertainty if appropriate)	2 Milk River (Alberta) Frenchman River (Saskatchewan) Based on the impacts of the threat climate change and severe weather.
Is there an [observed, inferred, or projected] decline in extent of occurrence?	No
Is there an [observed, inferred, or projected] decline in index of area of occupancy?	No
Is there an [observed, inferred, or projected] decline in number of subpopulations?	No
Is there an [observed, inferred, or projected] decline in number of "locations"*?	No
Is there an [observed, inferred, or projected] decline in [area, extent and/or quality] of habitat?	Yes, inferred. Quality of habitat
Are there extreme fluctuations in number of subpopulations?	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 subpopulation)

Subpopulations (give plausible ranges)	**N Mature Individuals**
Total	Unknown

Quantitative Analysis

Is the probability of extinction in the wild at least [20% within 20 years or 5 generations whichever is longer up to a maximum of 100 years, or 10% within 100 years]?	Analysis not conducted.

Threats (direct, from highest impact to least, as per IUCN Threats Calculator)

Was a threats calculator completed for this species? Yes Overall (high-medium) 11. Climate change and severe weather (high-medium) 7.2. Dams and water management/use (medium-low) 9.3. Agricultural and forestry effluents (low) 8. Invasive non-native/alien species/diseases (low) 4.1. Roads and railroads (low)

[*] See Definitions and Abbreviations on COSEWIC website for more information on this term.

Rescue Effect (immigration from outside Canada)

Status of outside population(s) most likely to provide immigrants to Canada.	Unknown. This species has not been assessed by NatureServe
Is immigration known or possible?	Possible, not confirmed
Would immigrants be adapted to survive in Canada?	Yes
Is there sufficient habitat for immigrants in Canada?	Yes
Are conditions deteriorating in Canada[+]?	Yes
Are conditions for the source (i.e., outside) population deteriorating?	Yes
Is the Canadian population considered to be a sink?	No
Is rescue from outside populations likely?	No

Data Sensitive Species

Is this a data sensitive species?	No

Status History

The Mountain Sucker (*Catostomus platyrhynchus*) was originally assessed by COSEWIC as a single unit and designated Not at Risk in April 1991. Split into three populations in November 2010: "Milk River populations" unit (Threatened), "Pacific populations" unit (Special Concern), and "Saskatchewan - Nelson River populations" unit (Not at Risk). In December 2022, the species formerly considered Mountain Sucker was split into two separate species, Plains Sucker (*Pantosteus jordani*) (2 populations) and Cordilleran Sucker (*Pantosteus bondi*). The original 2010 "Milk River populations" unit of Mountain Sucker is now known as Plains Sucker, Missouri population, and was designated Threatened in December 2022.

Status and Reasons for Designation:

Status: Threatened	**Alpha-numeric codes:** B1ab(iii)+2ab(iii); D2

Reasons for designation:
This population of small freshwater fish is found in the southern portion of a broader distribution of this species across prairie Canada. In Canada, its range is limited to two locations in the Milk River drainage of southern Alberta and Saskatchewan, where its distribution is restricted and has declined in recent years. Actual population size and trend are unknown. Habitat in this river drainage is undergoing continued decline in quality, related to declines in water quality and quantity as a result of water-use management and climate change.

Applicability of Criteria

Criterion A (Decline in Total Number of Mature Individuals): Not applicable. Population size and trends are unknown.
Criterion B (Small Distribution Range and Decline or Fluctuation): Meets Threatened, B1ab(iii)+2ab(iii). Small EOO (13,026 km²) and IAO (continuous IAO = 1,056 km²) are below thresholds, and the population is (a) known to exist at only 2 locations and (b) experiencing continuing inferred decline in (iii) quality of habitat.

[+] See Table 3 (Guidelines for modifying status assessment based on rescue effect).

Criterion C (Small and Declining Number of Mature Individuals): Not applicable. Population estimate is unknown.
Criterion D (Very Small or Restricted Population): Meets Threatened, D2. Number of mature individuals unknown but restricted; population occurs at only 2 locations and is prone to effects of human activities or stochastic events within a very short period.
Criterion E (Quantitative Analysis): Not applicable. Analysis not conducted.

TECHNICAL SUMMARY - Cordilleran Sucker

Pantosteus bondi

Cordilleran Sucker

Meunier de la cordillère

Range of occurrence in Canada (province/territory/ocean): British Columbia

Demographic Information

Generation time (usually average age of parents in the population; indicate if another method of estimating generation time indicated in the IUCN guidelines (2011) is being used)	5 years
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, whichever is longer up to a maximum of 100 years]	Unknown, insufficient sampling
[Observed, estimated, inferred, or suspected] percent [reduction or increase] in total number of mature individuals over the last [10 years, or 3 generations, whichever is longer up to a maximum of 100 years].	Unknown, insufficient sampling
[Projected or suspected] percent [reduction or increase] in total number of mature individuals over the next [10 years, or 3 generations, whichever is longer up to a maximum of 100 years].	Unknown, insufficient sampling
[Observed, estimated, inferred, or suspected] percent [reduction or increase] in total number of mature individuals over any period [10 years, or 3 generations, whichever is longer up to a maximum of 100 years], including both the past and the future.	Unknown, insufficient sampling
Are the causes of the decline a. clearly reversible and b. understood and c. ceased?	Not applicable
Are there extreme fluctuations in number of mature individuals?	Unknown

Extent and Occupancy Information

Estimated extent of occurrence (EOO)	All observations 29,267 km²
Index of area of occupancy (IAO)	All observations 88 km² (discrete) 1,028 km² (continuous)
Is the population “severely fragmented” i.e., is >50% of its total area of occupancy in habitat patches that are (a) smaller than would be required to support a viable population, and (b) separated from other habitat patches by a distance larger than the species can be expected to disperse?	a. Unknown b. No

Number of “locations”* (use plausible range to reflect uncertainty if appropriate)	7 locations Threats are localized, therefore, there are 7 locations (includes each tributary in which Cordilleran Sucker is present in the North Thompson River, Similkameen River, and lower Fraser River). Based on the impacts of the threats: domestic and urban wastewater and agricultural and forestry effluents.
Is there an [observed, inferred, or projected] decline in extent of occurrence?	No
Is there an [observed, inferred, or projected] decline in index of area of occupancy?	No
Is there an [observed, inferred, or projected] decline in number of subpopulations?	No
Is there an [observed, inferred, or projected] decline in number of “locations”*?	No
Is there an [observed, inferred, or projected] decline in [area, extent and/or quality] of habitat?	Yes, inferred. Quality of habitat.
Are there extreme fluctuations in number of subpopulations?	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 subpopulation)

Subpopulations (give plausible ranges)	**N Mature Individuals**
Total	Unknown

Quantitative Analysis

Is the probability of extinction in the wild at least [20% within 20 years or 5 generations whichever is longer up to a maximum of 100 years, or 10% within 100 years]?	Analysis not conducted.

* See Definitions and Abbreviations on COSEWIC website for more information on this term.

Threats (direct, from highest impact to least, as per IUCN Threats Calculator)

Was a threats calculator completed for this species? Yes Overall (medium) 9. Pollution ((medium) 9.1. Domestic and urban wastewater (medium) 9.2. Agricultural and forestry effluents (medium) 11. Climate change and severe weather (medium-low) 7. Natural system modifications (medium-low) 7.2. Dams and water management/use (medium-low) 7.3. Other ecosystem modifications (medium-low) Invasive non-native/alien species/diseases 4. Transportation and service corridors (low) 4.1. Roads and railroads (low) 4.2. Utility and service lines (low) 5.4. Fishing and harvesting aquatic resources (low)

Rescue Effect (immigration from outside Canada)

Status of outside population(s) most likely to provide immigrants to Canada.	Unknown. This species has not been assessed by NatureServe
Is immigration known or possible?	No. Threats are similar on the US portion of the Similkameen River, and habitat area is restricted by a dam, so immigration is likely limited. Not possible in the lower Fraser or North Thompson River drainages.
Would immigrants be adapted to survive in Canada?	Yes
Is there sufficient habitat for immigrants in Canada?	Yes
Are conditions deteriorating in Canada?+	Yes
Are conditions for the source (i.e., outside) population deteriorating?	Yes
Is the Canadian population considered to be a sink?	No
Is rescue from outside populations likely?	No

Data Sensitive Species

Is this a data sensitive species?	No

+ See Table 3 (Guidelines for modifying status assessment based on rescue effect).

Status History

The Mountain Sucker (*Catostomus platyrhynchus*) was originally assessed by COSEWIC as a single unit and designated Not at Risk in April 1991. Split into three populations in November 2010: "Milk River populations" unit (Threatened), "Pacific populations" unit (Special Concern), and "Saskatchewan - Nelson River populations" unit (Not at Risk). In December 2022, the species formerly considered Mountain Sucker was split into two separate species, Plains Sucker (*Pantosteus jordani*) (2 populations) and Cordilleran Sucker (*Pantosteus bondi*). The original 2010 "Pacific populations" unit of Mountain Sucker is now known as Cordilleran Sucker and was designated Threatened in December 2022.

Status and Reasons for Designation:

Status: Threatened	**Alpha-numeric codes:** B2ab(iii)
Reasons for designation: In Canada, this small freshwater fish has a limited and patchy distribution within the North Thompson, lower Fraser, and Similkameen river drainages in British Columbia. It has a relatively small area of occupancy and number of locations. Population size and trend are unknown for this poorly-sampled species. Habitats in these drainages are undergoing continued decline in quality, related to declines in water quality and quantity as a result of water-use management and climate change, particularly in the Similkameen River drainage.	

Applicability of Criteria

Criterion A (Decline in Total Number of Mature Individuals): Not applicable. Population size and trends are unknown.
Criterion B (Small Distribution Range and Decline or Fluctuation): Meets Threatened, B2ab(iii). Small IAO (continuous IAO = 1,028 km^2); 7 locations; inferred continuing decline in habitat quality.
Criterion C (Small and Declining Number of Mature Individuals): Not applicable. Population estimate is unknown.
Criterion D (Very Small or Restricted Population): Not applicable. Number of mature individuals unknown; 7 locations. Not thought to be prone to effects of human activities or stochastic events within a very short period.
Criterion E (Quantitative Analysis): Not applicable. Analysis not conducted.

PREFACE

In the last species assessment (COSEWIC 2010b), the Mountain Sucker was assessed as a single species, *Catostomus platyrhynchus* (Cope 1874), distributed in the Saskatchewan-Nelson, Missouri, and Pacific National Freshwater Biogeographic zones (NFBZ). In that assessment, it was noted by Moyle (2002), McPhail (2007), and Taylor and Gow (2008) that taxonomic research on the species using molecular data might result in the emergence of several distinct taxa across the Continental Divide and that further research was required. Subsequently, Unmack *et al.* (2014) concluded that the fishes considered to be “mountain suckers” (*Pantosteus*, sometimes considered a subgenus of *Catostomus*) included several species that have deep genetic divergences among allopatric sister lineages, with the total diversity in the group being 11 species. The fish species formerly considered the Mountain Sucker was separated into two allopatric species, the Plains Sucker (*Pantosteus jordani*) and the Cordilleran Sucker (*Pantosteus bondi*). Unmack *et al.* (2014) compared molecular data with morphological and paleontological data for the proposed species of *Pantosteus*, tested hypotheses of their monophyly, used these data for phylogenetic inferences of sister-group relationships, and estimated timing of divergence events of identified lineages. They concluded that *Pantosteus* and *Catostomus* were, in fact, reciprocally monophyletic, in contrast with morphological data, and subsequently suggested that the subgenus *Pantosteus* should be elevated to genus.

Where suitable and sufficient information exists, information for the two species is discussed separately in the sections that follow.

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
(2022)

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.

Environment and Climate Change Canada
Canadian Wildlife Service

Environnement et Changement climatique Canada
Service canadien de la faune

Canada

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

COSEWIC Status Report

on the

Plains Sucker
Pantosteus jordani

Saskatchewan-Nelson River population
Missouri population

and the

Cordilleran Sucker
Pantosteus bondi

in Canada

2022

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WILDLIFE SPECIES DESCRIPTION AND SIGNIFICANCE

Name and Classification

Kingdom: Animalia
Phylum: Chordata
Class: Actinopterygii
Order: Cypriniformes
Family: Catostomidae

Scientific name: *Pantosteus jordani* (Evermann 1893)

Common names:
English: Plains Sucker
French: meunier des plaines

Scientific name: *Pantosteus bondi* (Smith et al. 2013)

Common names:
English: Cordilleran Sucker
French: meunier de la cordillère

Scientific and common names recently adopted by Joint AFS/ASIH Names Committee (Mandrak pers. comm. 2021).

Morphological Description

The following account is largely based on descriptive material provided by Carl *et al.* (1967), Hauser (1969), Nelson and Paetz (1992), and McPhail (2007), and some characteristics apply to both Plains and Cordilleran suckers. Plains and Cordilleran suckers are morphologically similar to the Mountain Sucker (*P. platyrhynchus*), with which they were formerly grouped (Unmack *et al.* 2014).

Plains and Cordilleran suckers have an elongated cylindrical body, that is somewhat compressed caudally. These suckers are dark green to grey or brown in colour, usually with fine black spotting, and the ventral surface is pale yellow to white.

Plains and Cordilleran suckers have fine cycloid scales and usually have 70–90 lateral-line scales. Both usually have 10–11 dorsal rays, with a range of 9–12 possible. The anal fin typically has 7 rays; the pectoral fins are long, typically with 15 rays; the pelvic fins usually have 9 rays and are located in line with the middle of the base of dorsal fin. The caudal fin is short and slightly forked. The snout is broad and heavy, eyes are small, mouth large and ventral, edge of the lower jaw having a sharp-edged cartilaginous sheath, and lower lip has the shape of paired "wings." The mouth is distinctive compared to the mouth of the other two sympatric fine-scaled suckers in Canada, the Longnose Sucker (*Catostomus catostomus*) and the Bridgelip Sucker (*P. columbianus;* formerly *C.*

columbianus). 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 the Plains and Cordilleran suckers from the Bridgelip Sucker (Carl *et al.* 1967). Positive identification differentiating them from the Bridgelip Sucker can also be made on dead specimens by peeling back the skin on the head and checking for a fontanelle; it is absent or reduced to a narrow slit on the Cordilleran Sucker and is well developed on the Bridgelip Sucker (McPhail 2007). *Pantosteus* species can be distinguished from other members of the family Catostomidae by the incomplete cleft of the lower lip.

Plains and Cordilleran suckers have no teeth in the mouth and the pharyngeal teeth are flat and comb-like. The peritoneum is black or dusky; the intestine is long with 6–10 coils anterior to the liver, and there are no pyloric caeca. A two-chambered swim bladder is present, but reduced in size, the slender posterior chamber extending to about the point of origin of the pelvic fins. Juveniles and most adults have three dark bars across the dorsal surface.

Breeding males of Plains and Cordilleran suckers develop a rosy orange mid-lateral stripe that is absent or faint in females, although the stripe can also be faint in males in turbid water. Breeding males develop tubercles on their anal and caudal fins (tubercles on the lower caudal fin are noticeably larger than those on the upper lobe). Additionally, males develop weak tubercles on the dorsal and ventral surface of the pectoral fins and scattered over most of the body. Tubercles are absent or only weakly developed in females.

Plains Sucker

The Plains Sucker has formerly been referred to as either *C. jordani* or *C. platyrhynchus* (Smith 1966). Nelson and Paetz (1992) give an account of the species description in Alberta, combining fish from both the Saskatchewan and Missouri river drainages, which is summarized here. The largest known specimen is a male (232 mm total length [TL]) collected in Alberta in 1964 (ROM 25919). There are 23–37 gill rakers on the external row of the first arch and 31–51 on the internal row (Nelson and Paetz 1992). Scales above the lateral line usually number 15–20 with about 23 around the caudal peduncle. Vertebral number ranges from 43 to 48 (mean 46) (Nelson and Paetz 1992).

Cordilleran Sucker

McPhail (2007) gives an account of the species description in British Columbia, which is summarized here. Cordilleran Suckers in British Columbia are usually <250 mm fork length (FL). Typically, adult females are larger than males. Similar to other suckers, the size and shape of some fins differ between the sexes, with the anal and lower lobe of the caudal fin noticeably longer in mature males than in females. The posterior edge of the pelvic fins is squared off in males with all rays about equal length, whereas the fins are bluntly pointed in females.

The gill rakers number 29–37 in the external row and 35–57 in the internal row of the first arch; lateral line scales 70–91, pre-dorsal scales 41–58 (mean 48); post-Weberian vertebrae number 40–44 (Smith *et al.* 2013).

The distal process of the dentary is wide and robust, and the proximal process of the dentary is shorter than in other species in the *Platyrhynchus* group; hyomandibula narrow, with a large sphenotic condyle and a broader, more robust posterodorsal tip than in the Plains Sucker (Smith *et al.* 2013). The opercular bone is tall and narrow, the width is 0.51–0.57 of the overall height (the ratio is 0.57–0.61 in other *Platyrhynchus* species); depth of caudal peduncle is usually 9% of standard length (usually 1% higher in other *Platyrhynchus* species); and caudal rays are pigmented, inter-radial membranes with few or no melanophores (usually immaculate in other *Platyrhynchus* species) (Smith *et al.* 2013).

Population Spatial Structure and Variability

Unmack *et al.* (2014) suggest that the *P. platyrhynchus* group originated 14.5 million years ago and diversified over the last 6.9 to 4.8 million years ago into four species: *P. bondi* in the Columbia drainage, *P. jordani* in the upper Missouri drainage, *P. lahontan* in the Lahontan drainage, and *P. platyrhynchus* in the Bonneville drainage, Upper Snake River, and the Green River. This diversification period corresponds to a time of major volcanic and tectonic activity in the Columbia region (Tolan *et al.* 2009). These lineages probably began in pre-Columbia River drainages, where the three oldest *Pantosteus* fossils were recovered (Unmack *et al.* 2014). All except *P. jordani* differentiated in the Northern Great drainage; *P. jordani,* in the Yellowstone region, now in the headwaters of the Missouri River, which at that time drained to Hudson Bay (Unmack *et al.* 2014).

When Unmack *et al.* (2014) established what is now considered the current taxonomy for *Pantosteus*, they did not include any specimens from the Canadian portion of the Columbia or Missouri drainages, and no specimens at all from the Fraser and Saskatchewan drainages. One can assume that the results for the Columbia and Missouri drainages in the United States likely apply to the Canadian portion of the distribution, given the similar postglacial colonization by other fish species. Although the Fraser and Saskatchewan drainages are left unresolved, an earlier study by Taylor and Gow (2008) allows some conclusions to be drawn regarding these drainages. Note that given the use of a single gene, very small sample sizes, and the unpublished status of this study, these results should be interpreted with caution. Taylor and Gow (2008) used mitochondrial DNA sequence data from what is now considered *Pantosteus* (Unmack *et al.* 2014) collected from the upper Missouri drainage (Milk River) in Alberta and Saskatchewan, the South Saskatchewan drainage (Willow Creek) in Alberta, the lower Columbia/Fraser drainages (lower and upper Fraser and Willamette rivers), and the upper Snake River above Shoshone Falls. The results provide evidence of at least four highly divergent lineages across the genus' global range (known as clades A-D), three of which occur in Canada: two lineages (clades C and D) within the upper Saskatchewan/upper Missouri rivers, and one (clade B) within the Columbia/Fraser drainage (Figure 1; Taylor and Gow 2008). The fourth lineage (clade A) appears to be endemic to the Snake River drainage in the USA (Taylor and Gow 2008). Subsequently, Unmack *et al.* (2014) concluded that two species occur in the upper Snake drainage (clade A), *P. virescens* and *P. platyrhynchus*. The clade B grouping identified with Columbia and Fraser rivers supports the Fraser River drainage as very likely being the Cordilleran Sucker (*P. bondi).* The clade D grouping included only Missouri drainage fish, with the exception of one specimen from Lee Creek. Given the drainage connections to the American portion of the Missouri where Unmack *et al.* (2014) did include specimens, clade D is very likely the Plains Sucker, *P. jordani*. Clade C was the Saskatchewan River (Willow Creek) by themselves, although most closely related to clade D (Missouri drainage). Therefore, there is some uncertainty as to whether these fish are Plains Suckers or a different species. The grouping of at least one of the fish from Lee Creek (Saskatchewan drainage) in clade D and the close relationship to clade D might suggest that these differences are derived more recently in the last 10,000 years, and that the clades are the same species, the Plains Sucker; however, the provenance of the Lee Creek specimen (n=1) is in question because of the limited sampling data associated with the specimen.

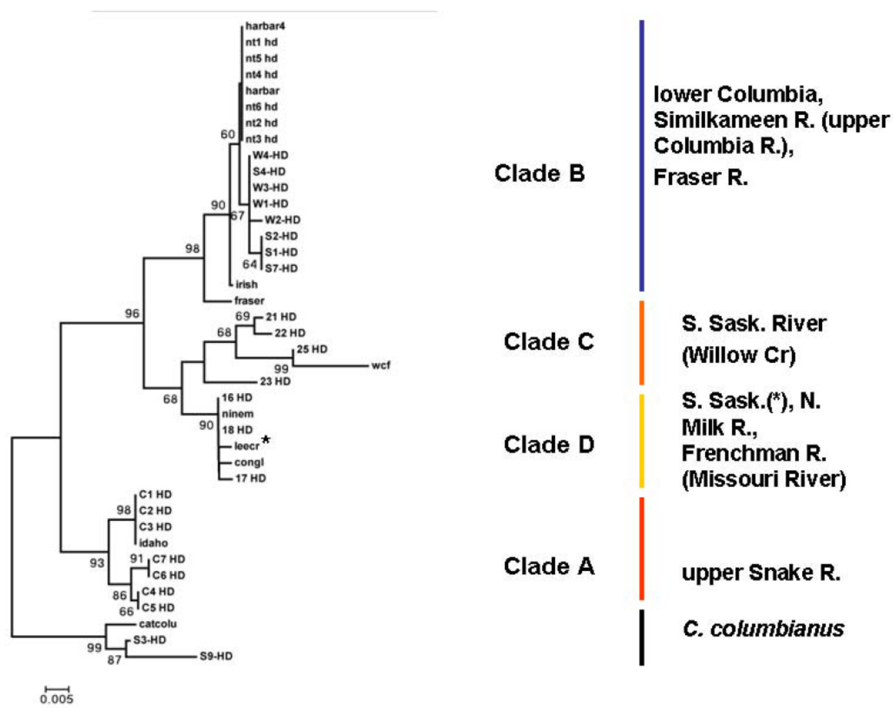

Figure 1. Consensus tree from replicate Neighbour-Joining analyses of sequence divergence estimates among cytochrome b haplotypes of *Catostomus platyrhynchus* (now *Pantosteus* spp.) (Unmack *et al.* 2014). Each haplotype represents the DNA sequence of a single fish. The tree is rooted with a sequence from *C. columbianus*. Numbers at branch points are bootstrap support levels from 1,000 pseudoreplications (updated from Taylor and Gow 2008; McPhail 2008 unpubl. data). *P. jordani* is represented by Clade C (DU 1) and clade D (DU 2, except for one specimen marked with a "*" which is in DU 1). *P. bondi* is represented by clade B. "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

Plains Sucker

Designatable units within the Plains Sucker were considered in light of COSEWIC's "discreteness" and "significance" criteria (COSEWIC 2020).

Discreteness

The Plains Sucker comprises two DUs in terms of discreteness as the species is distributed across two NFBZs; the Saskatchewan-Nelson and Missouri NFBZs in Alberta and Saskatchewan. This represents a natural disjunction, and no possibility of natural dispersal between the NFBZs has existed since the end of the last glaciation.

Significance

The populations in the two DUs are located in unique physical (waterbody type and size) and ecological (e.g., fish community, climate, elevation, vegetation) habitats, likely resulting in local adaptation and representing evolutionary significance.

The population found in the Saskatchewan-Nelson NFBZ in Alberta occupies higher gradient rivers and creeks typically at higher elevations with adjacent riparian forest, which are more speciose and have cooler water temperatures.

The Missouri River population (Missouri NFBZ) is found in the Milk River drainage in Alberta and Saskatchewan. In Alberta, the Milk River drainage is characterized by a lower elevation and gradient and has limited riparian forest and cool to warm water temperatures. In Saskatchewan, the species is found in Battle Creek and its tributaries, as well as in Frenchman River tributaries: both of these drainages are direct tributaries of the Milk River. The habitat is unique in the surrounding area, as the drainages originate in the Cypress Hills, an area of higher elevation above the surrounding Great Plains. The creeks that Plains Suckers occupy in Saskatchewan are small; they feature riparian forest in the Cypress Hills and more limited areas of forest in downstream reaches. The creeks are generally characterized by a higher gradient and cooler water with connectivity to ground water; some creeks are ephemeral, with fish persisting in isolated pools. No Plains Sucker collections have been made in the Frenchman River. Plains Suckers co-occur with >30 species in the Saskatchewan-Nelson NFBZ and <17 species in the Missouri NFBZ.

The Battle and Frenchman rivers are direct tributaries of the Milk River, but are located downstream of Fresno Dam, an impassible structure that prevents the upstream movement of fish. The lower reaches of the Milk, Battle, and Frenchman rivers likely all exceed the thermal tolerance of the Plains Sucker or are unacceptable habitat, as no records of the species exist in the lower reaches. This means that the populations in these drainages are separated by >200 km of river. This has likely precluded genetic exchange within the Missouri NFBZ since the modern drainages were formed at least 6,000 ybp (~1,200 generations).

In Canada, the species is comprised of two major phylogeographic lineages as described above. While sample sizes are small (23 in total), there is a marked concordance between mtDNA lineage, representing deep intraspecific phylogenetic divergence, and NFBZ; there is only one case of a haplotype of one lineage shared across two NFBZs (Figure 1). As noted above, these results should be interpreted with caution given the use of a single gene, very small sample sizes (n=1 for Lee site), and the unpublished status of this study. The Plains Sucker in the Missouri NFBZ is part of a fauna found in the only Canadian drainage that eventually flows to the Gulf of Mexico (via its connections with the Mississippi River).

The genetic differentiation of the Saskatchewan-Nelson River and Milk River populations and their occurrences in unique habitats that have been isolated for ~10,000 years represent distinctiveness and significance, respectively, and justify the recognition of two designatable units (see COSEWIC 2020) that have been on an independent evolutionary trajectory for an evolutionarily significant period of time. For these reasons, the Plains Sucker will be discussed and assessed as two DUs named after the NFBZ in which they are found: Saskatchewan-Nelson population (DU1) and Missouri population (DU2). Where suitable and sufficient information exists, DUs are discussed separately in the sections that follow.

<u>Cordilleran Sucker</u>

The Cordilleran Sucker is found only in the Pacific NFBZ, and there is no known population substructure and no evidence of further discreteness and significance. Therefore, no designatable units are recognized within this species.

Special Significance

The Plains and Cordilleran suckers are not well-known members of the Canadian fish fauna. As shown in Unmack *et al.* (2014), the zoogeographic history of these fishes and their relation to geologically mediated evolutionary processes make them an interesting case study for determining significance and discreteness (Taylor and Gow 2008).

Although edible, these suckers have never been an important human food or sport fish. In the United States, *Pantosteus* species are often used as a baitfish and have been used as food for domestic fur-bearing mammals (Scott and Crossman 1998). The parasitology of these suckers is not known well enough to understand their role as a vector of parasitism for their predators.

DISTRIBUTION

Global Range

Plains Sucker

The Plains Sucker is distributed in the upper Missouri river drainage in Canada and the United States, from the Black Hills of South Dakota and the Cypress Hills of Saskatchewan, to western Wyoming, Montana, and Alberta, and from the upper Saskatchewan drainage in Saskatchewan near the Cypress Hills, west to the east slope of the Rocky Mountains in Alberta (Figure 2) (Unmack *et al.* 2014). Pleistocene fossils exist from western Kansas (Smith *et al.* 2013).

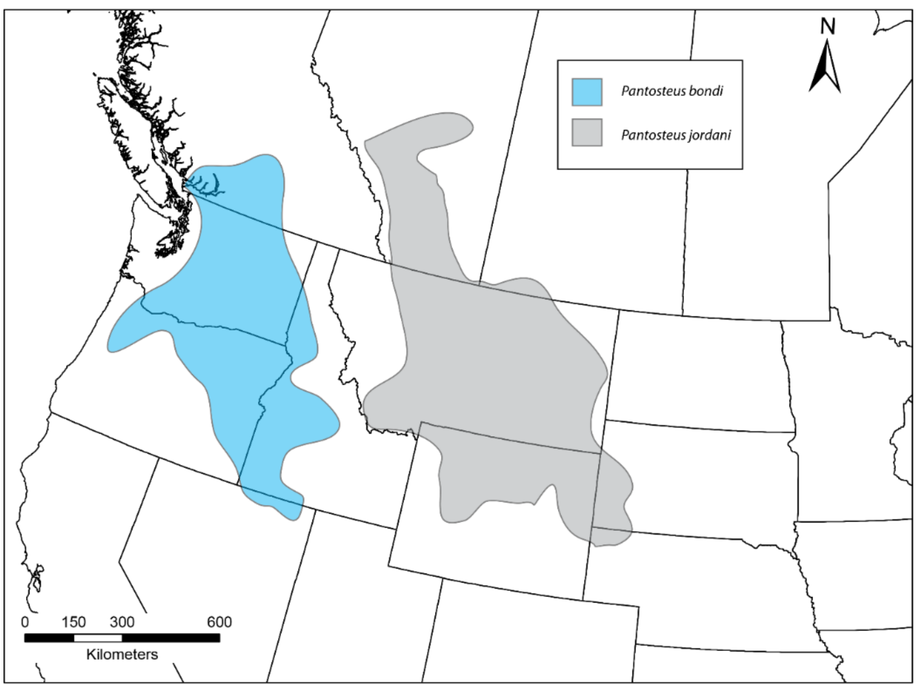

Figure 2. Global distribution of Cordilleran (*P. bondi*) and Plains (*P. jordani*) suckers (modified from: Nelson and Paetz 1992; McPhail 2007; Page and Burr 2011; Unmack *et al.* 2014).

Cordilleran Sucker

The Cordilleran Sucker occurs in the Columbia River drainage in Washington, Oregon, Nevada, Idaho, and British Columbia (Unmack *et al.* 2014), and in the Fraser River drainage in British Columbia (McPhail 2007).

Canadian Range

Plains Sucker

The species has been collected in the Milk River drainage (Missouri NFBZ) in the Cypress Hills region of Alberta and in 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 drainage to the North Saskatchewan River Saskatchewan-Nelson NFBZ) (Figure 3, Appendix 1, Appendix 2) (Scott 1957; Reed 1959; Willock 1969a; Atton and Merkowsky 1983; McCulloch *et al.* 1994; Scott and Crossman 1998).

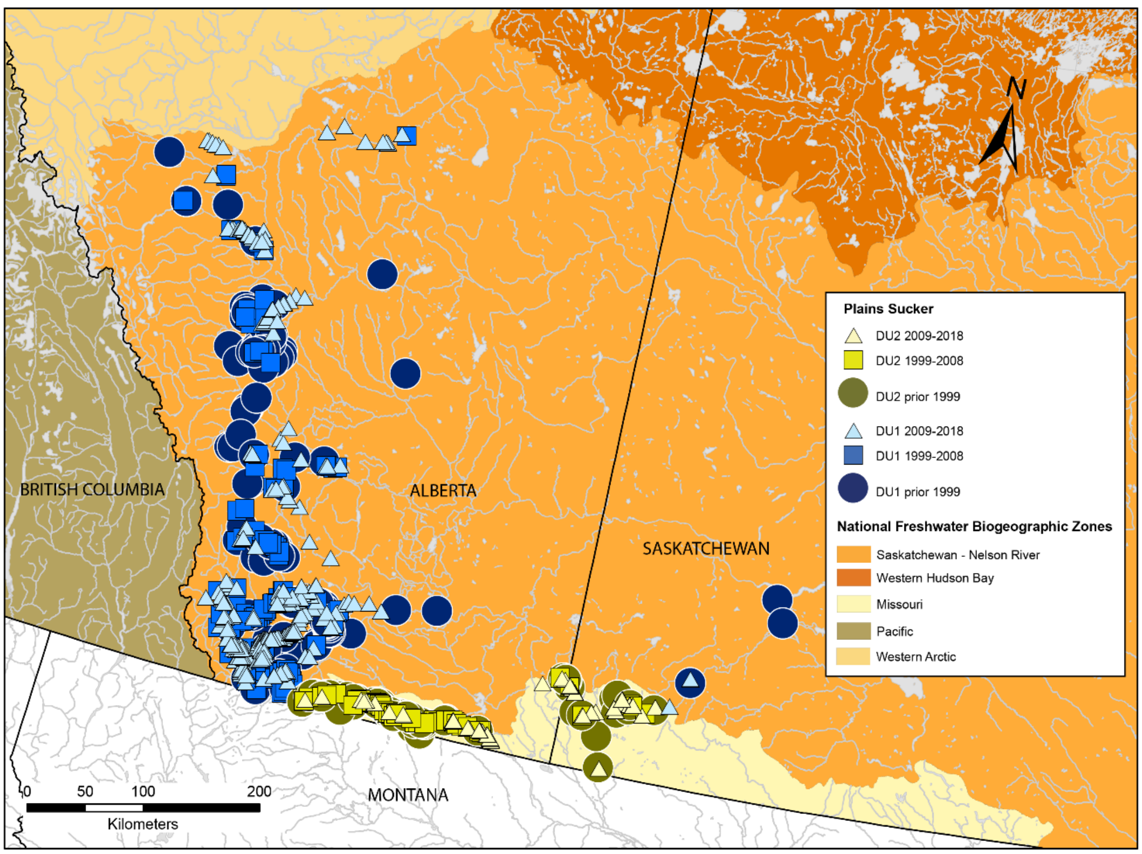

Figure 3. Canadian distribution of the Plains Sucker (*P. jordani*) in the Saskatchewan-Nelson (DU1) and Missouri (DU2) drainages.

Cordilleran Sucker

The Cordilleran Sucker has been reported from the Similkameen River and several of its tributaries (Columbia River drainage), the North Thompson River (Fraser River drainage), and the lower Fraser River (downstream of Hope, British Columbia, Figure 4, Appendix 3) (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 Suckers in the Pend d'Oreille River, McPhail (2007) noted this occurrence of Cordilleran Sucker should be treated with some caution. Additionally, the specimen was recorded to have a fork length of 374 mm, which is 140 mm larger than the largest known specimen in Canada. The fish was released so the specimen is not available for confirmation. Therefore, given the evidence, this record should not be considered valid, and in this document it is excluded from the species' known range.

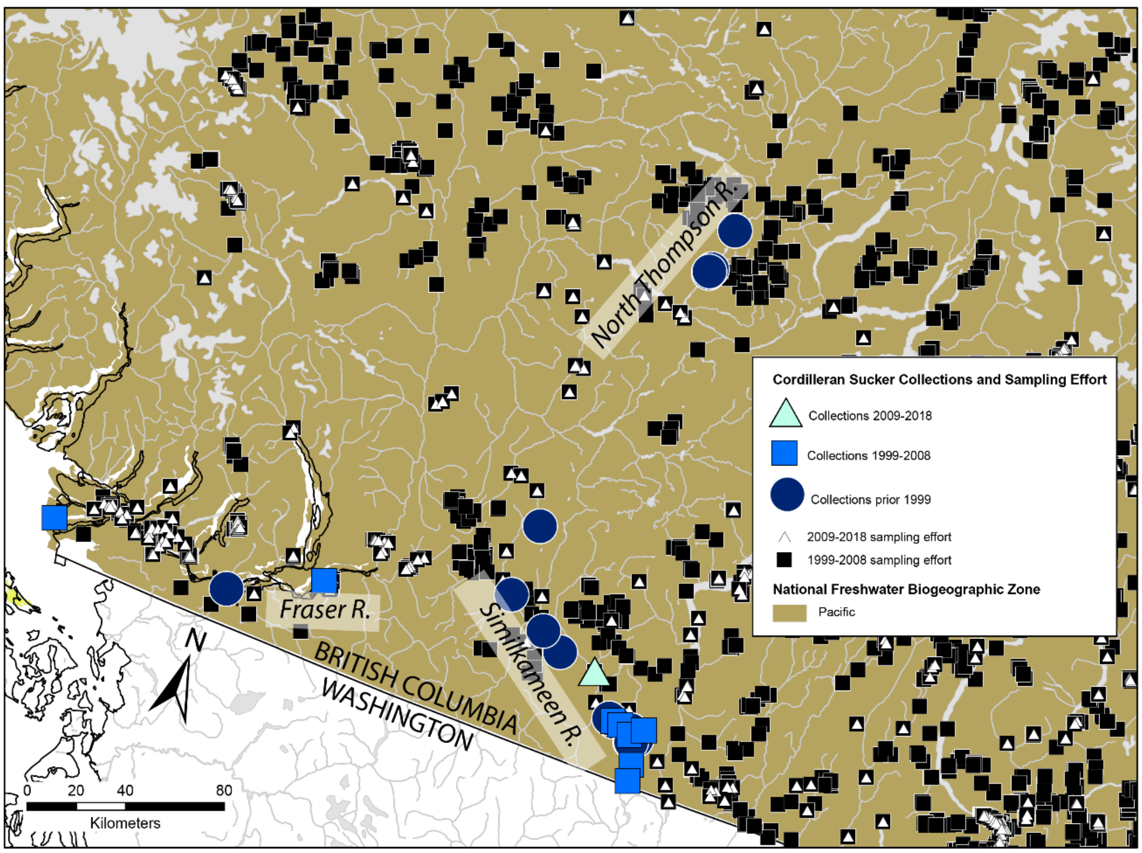

Figure 4. Canadian distribution of the Cordilleran Sucker (*P. bondi*) showing all sampling effort reported to the British Columbia Conservation Data Centre (electrofishing, seining, minnow trap, observation, dip netting) for the last 20 years. Most of the sampling effort was likely non-targeted for Cordilleran Sucker.

Extent of Occurrence and Area of Occupancy

Plains Sucker

DU1 Saskatchewan-Nelson Population

In the last species assessment, the extent of occurrence (EOO) was estimated to be about 177,701 km² (polygon estimate) and the IAO based on a 2 × 2 km (continuous) overlaid grid was 4,552 km^2. The EOO is 143,105 km^2 (2009–2018), 65,636 km^2 (1999–2008), and 180,561 km^2 (overall) (Appendix 1). The Index of Area of Occupancy (IAO), based on 2 × 2 km (continuous) overlaid grid is 5,104 km^2 (2009–2018), 4,372 km^2 (1999–2008), and 7,260 km^2 (overall) (Appendix 1).

DU2 Missouri Population

In the last species assessment, the EOO was estimated to be about 13,006 km², and the IAO, based on a 2 × 2 km (continuous) overlaid grid was 1,056 km². The EOO is 12,032 km^2 (2009–2018), 7,889 km^2 (1999–2008), and 13,026 km^2 (overall) (Appendix 2). The index of area of occupancy (IAO), based on a 2 × 2 km (continuous) overlaid grid, is 908 km^2 (2009–2018), 624 km^2 (1999–2008), and 1,060 km^2 (overall) (Appendix 2).

Cordilleran Sucker

Cordilleran Sucker has a broad and disjunct distribution among the lower Fraser River (Fraser River drainage) and North Thompson River (Fraser River drainage), and Similkameen (Columbia River drainage) rivers (Figure 4, Appendix 3). The EOO is 4 km^2 (2009–2018), 5,312 km^2 (1999-–2008), and 29,267 km^2 (overall) (Appendix 3). The Index of Area of Occupancy (IAO), based on a 2 × 2 km (continuous) overlaid grid is 4 km^2 (2009–2018), 146 km^2 (1999–2008), and 1,028 km^2 (overall) (Appendix 3).

Search Effort

Plains Sucker

The first collection of the Plains Sucker was made in 1916, northeast of Calgary, Alberta (Canadian Museum of Nature Fish Collection, CMNFI 1958-0187.2, coordinates not specified). A total of 1,233 collection records are documented for the species. A total of 578 new records have been collected since the last COSEWIC assessment when the species was considered Mountain Sucker. In the Saskatchewan-Nelson, there are 408 collection records, which represent 4,278 fish, and in the Missouri drainage, there are 170 records representing 306 fish. This sampling has confirmed the Plains Sucker persists throughout most of its range in the Saskatchewan-Nelson and the Missouri drainages, although no records have been collected from downstream portions of the Red Deer and South Saskatchewan rivers and Swift Current Creek in the last 20 years. Sampling effort in Alberta (electrofishing, seining, minnow trap, observation) has been extensive in the last 20 years (Figure 5). Although sampling effort data were not available for Saskatchewan, it is likely that limited sampling has occurred in the Swift Current Creek in the last 20 years.

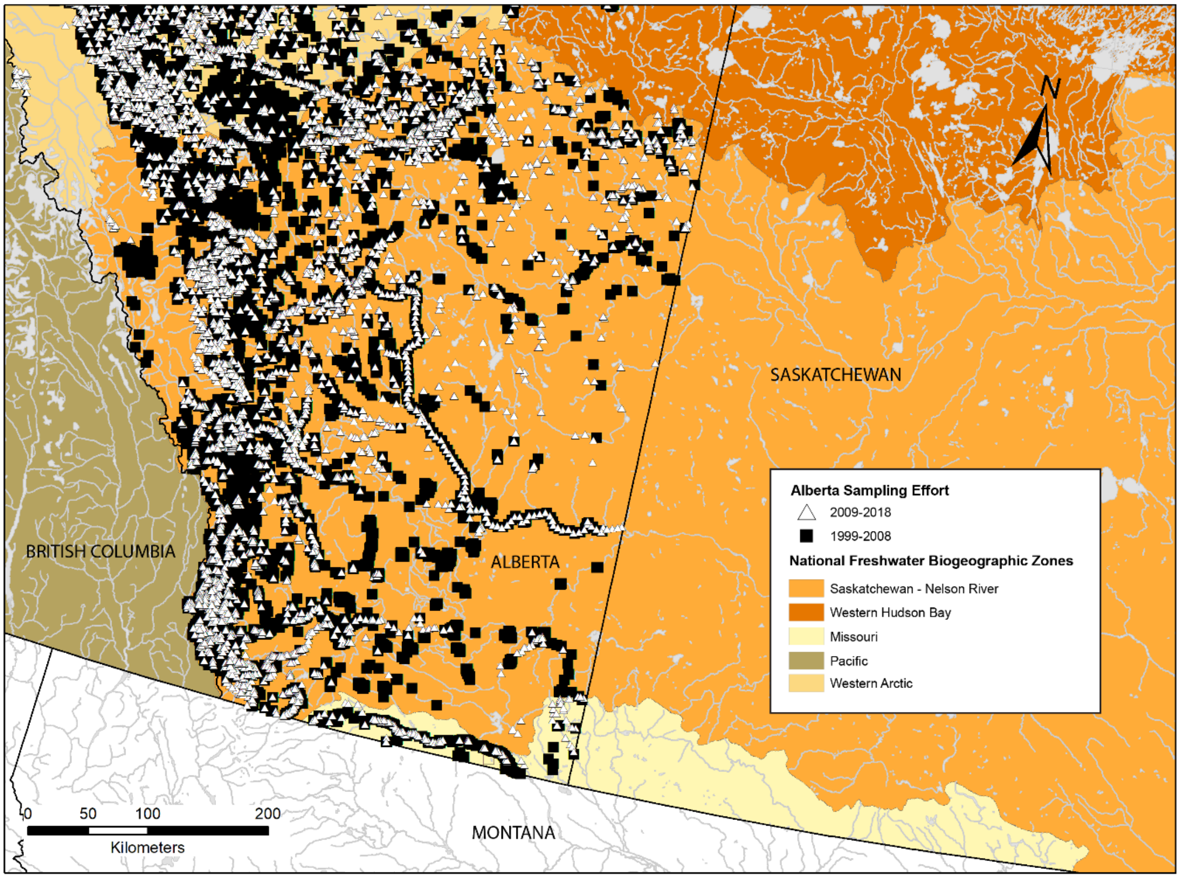

Figure 5. Fish sampling effort in Alberta (electrofishing, seining, minnow trap, observation), 1999–2008 and 2009–2018.

Cordilleran Sucker

The first collections of Cordilleran Sucker were made in 1948 in Taylor Lake, British Columbia (University of British Columbia, UBC590417). Only 28 documented collections have been made in Canada. The only three collections made since the species was last assessed by COSEWIC as Mountain Sucker (COSEWIC 2010b) were made in the Similkameen River drainage in 2017. The majority of the collection records (22 of 28) are from the Similkameen drainage. Collections have not been reported in the North Thompson or Fraser drainages since 1997 and 2000, respectively. Only limited sampling efforts conducted using methods that might document Cordilleran Sucker (electrofishing, seining, minnow trap, observation, dip netting) in British Columbia (Figure 4) have taken place in the North Thompson and Similkameen drainages in the last 20 years. In the lower Fraser drainage, sampling has occurred in the last 20 years, but few collections have been reported (Figure 4). The lack of collections in the last few decades is cause for concern and creates uncertainty about the current distribution and the population status of the species.

HABITAT

Habitat Requirements

Genus *Pantosteus* suckers generally occupy lotic habitat with a moderate gradient and cool water temperatures, typically <22°C (Watkinson unpubl. data; Unmack *et al.* 2014). Their distribution is limited almost exclusively to streams at intermediate elevations and to drainages on the Great Plains with cool groundwater inputs. Generally, a higher abundance of these species is associated with coarser substrates (Pollock *et al.* 2017; Macnaughton *et al.* 2019) (details are provided below).

<u>Plains Sucker</u>

In Alberta, Plains Sucker is associated with streams in the foothills and adjacent plains (Nelson and Paetz 1992) and in Saskatchewan, in groundwater-fed streams near the Cypress Hills. Little published habitat information is available for this species from Canada. Collection records indicate habitat characteristics similar to those reported in northern parts of the American range. For example, in Saskatchewan the Plains Sucker was found in streams about 2–10 m in width and <1 m depth with moderate velocities (0.2–0.5 m/s), over substrates ranging from silt, sand, gravel, cobble, and boulders (Pollock *et al.* 2017; Macnaughton *et al.* 2019). In a study of the species in Montana, Hauser (1969) observed that Plains Suckers were found adjacent to pools in areas with bank cover and moderate velocities (0.5 m/s) at depths of 1–1.5 m. Plains Sucker soften occurred near the transitions between pools and runs, and riffle habitats were rarely used except for spawning. The substrate composition of occupied habitats varied greatly, with cobbles being the most common substrate. Pollock *et al.* (2017 unpubl. report) found generally that the highest abundances in Saskatchewan occurred at sites with the largest average substrate size and low embeddedness score, and no cattle use.

Water conditions can vary from clear to turbid; daytime water temperature at collection sites ranges from 10°C to 28°C in summer and near 0°C in winter (see Reed 1959 for water conditions at collection sites in Saskatchewan). The persistence of Plains Suckers in ephemeral streams with groundwater influence in Saskatchewan near the Cypress Hills is perhaps indicative of their adaptability to a broad range of habitat conditions.

In higher elevation streams in the Black Hills of South Dakota, the Plains Sucker was more likely to be found in larger streams with higher gradients. However, at lower elevations, around the periphery of the Black Hills National Forest, the species was more likely to be found in smaller, low-gradient streams (Dauwalter and Rahel 2008). Larger high-gradient streams at higher elevations are likely to have the cool and clear water conditions the Plains Sucker prefers (Baxter and Stone 1995). However, at lower elevations, these same larger streams become warmer and more turbid (Williamson and Carter 2001; Carter *et al.* 2005). At low elevations, cool, clear water may only be present in perennial tributary streams with suitable gradients (Dauwalter and Rahel 2008) as these streams may have shading and increased spring flows (Vannote *et al.* 1980). As streams flow out onto the Northern Great Plains, even smaller tributaries become warm and turbid. This suggests that local-scale habitat conditions influence the occurrence of Plains Suckers (Dauwalter and Rahel 2008). These habitat requirements explain why in this geographic region, the Plains Sucker is found only in streams in or near the Black Hills (Bailey and Allum 1962). This also likely applies to the Saskatchewan distribution of the species.

No quantitative spawning habitat information is available for the Plains Sucker, but Hauser (1969) found that during the spawning season, Plains Suckers were most abundant in riffle areas below pools. Further research is required into the specific habitat requirements of this species in Canada.

Cordilleran Sucker

In British Columbia, the Cordilleran Sucker is only found in lotic habitats, in streams of various sizes, from small streams to the lower Fraser River, which is 1 km wide (McPhail 2007). These drainages vary considerably in annual discharge, water clarity, temperature, and primary productivity. In the Fraser River, in late summer and fall adult fish tend to occupy channels along gravel bars, often on the lee side, at depths <1.5 m and water velocity <0.7 m/s. In the Similkameen and North Thompson rivers, in summer adult fish are most commonly present in water >1.5 m deep, such as glides, and pools (McPhail 2007).

Juveniles in the Fraser River occupy similar habitats to adults; however, these streams are typically shallower (<1 m) and have slower water velocity (<0.5 m/s) (McPhail 2007). Juveniles in the North Thompson and Similkameen rivers are often found where small tributaries enter the main rivers (McPhail 2007).

Young-of-year Cordilleran Suckers in the Fraser River are typically found in shallow (<20 cm) embayments and blind channels associated with mid-river gravel bars and are relatively rare in similar habitat along the river's edges. Similarly, they aggregate out of the main channel in warm water (15–20°C) in shallow embayments, near the mouth of tributary streams in the North Thompson and Similkameen rivers (McPhail 2007).

Habitat Trends

Changes in habitat are incremental and cumulative and difficult to summarize as specific trends for Plains and Cordilleran Suckers. There has been no identifiable large habitat modification within the range of Plains and Cordilleran suckers since the last species assessments. The availability of suitable in-stream habitat varies considerably from year to year depending on the hydrological conditions (Environment and Climate Change Canada 2019).

Plains Sucker

The habitat in the Saskatchewan-Nelson drainage continues to be impacted by flow modifications, roads, forestry, forest fires, oil and gas activities, agriculture, and a growing human population. The Missouri drainage habitat continues to be impacted by flow modifications, roads, forest fires, agriculture, and a growing human population. In some reaches, the riparian habitat in which the Plains Sucker occurs has been reduced by agriculture and residential development.

The greatest alterations to Plains Sucker habitat are related to dams and reservoirs, water diversions, and water removal for irrigation. There are 17 dams or hydropower plants in the range of the species in the Saskatchewan-Nelson drainage. This includes the following hydro plants: Horseshoe (1911), Ghost (1929), Glenmore Dam (1932), Cascade (1942), Barrier (1947), Rundle (1951), Spray (1951), Three Sisters (1951), Bearspaw (1954), Pocaterra (1955), Interlakes (1955), Brazeau (1965), Bighorn (1972), Belly River (1991), Oldman Dam (1991), St. Mary Dam (1992), and the Taylor (2000). These facilities alter the natural hydrograph of the associated drainage and, depending on how they are operated, they may seriously affect the availability of Plains Sucker habitat. In addition, facilities built on the river channel form a complete barrier to upstream movement and create reservoirs that are not used as habitat by Plains Sucker.

In the Missouri drainage, the North Milk and Milk rivers were significantly altered after 1917, when the St. Mary Canal was constructed in Montana to divert water from the St. Mary River to the North Milk River for irrigation purposes. The canal diverts water typically from April to September, increasing the water volume in the North Milk River and the Milk River proper. Before the diversion was constructed, the Milk River was probably a typical small prairie stream with low turbidity and intermittent flows (Willock 1969a). The Milk River above the confluence of the North Milk River is sometimes be reduced to isolated pools without surface flow (Environment and Climate Change Canada 2019; gauge 11AA025) and the occurrence and survival of the Plains Sucker in this reach of the river would be dependent on sufficient ground water. Similarly, tributaries of the North Milk and Milk rivers in Canada are ephemeral (Environment and Climate Change Canada 2019; gauges 11AA029, 11AA028, 11AA037, 11AA038).

Cordilleran Sucker

The habitat of the Cordilleran Sucker has continued to change in the last decade. It continues to be impacted by roads, forestry, forest fires, a growing human population, flow modifications, and agriculture.

Residential and agricultural development is mostly restricted to the Fraser River valley and has resulted in a limited area of riparian habitat within which the Cordilleran Sucker is distributed. Forestry occurs throughout the range of the species but does not typically occur adjacent to reaches where the species is found.

BIOLOGY

Little published information is available on the biology of either species in Canada and limited knowledge has been obtained elsewhere. The only life-history information we have on the Plains Sucker comes from populations in the Great Plains of the United States (Hauser 1969) and the Cordilleran Sucker information is available from British Columbia (McPhail 2007). It is not known how similar the life history of the Canadian populations is to that of populations in Montana. The species is adapted to eat filamentous algae and diatoms thanks to the cartilaginous sheath in its mouth, but it also consumes some invertebrates (Nelson and Paetz 1992).

Life Cycle and Reproduction

Plains Sucker

Growth is slow in cool mountain streams, and growth rates vary between streams (Hauser 1969). Some fry that measure 9 mm in July may reach 30–36 mm by mid-September. Ninety-five percent of fry had formed the first otolith annulus by mid-June of the following year at an average length of about 38–60 mm (Hauser 1969). 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) noted that females tend to be larger than males and live longer, with males living to about 7 years of age and females to 9 years. This relationship is true for most catostomids (Raney and Webster 1942; Harris 1962; Geen *et al.*1966). Hauser (1969) provided mean total length (TL) for various ages and an equation for the length-weight relationship. Hauser (1969) reported an individual with a TL of 226 mm, and the Royal Ontario Museum (ROM) records include a 232 mm male collected in Alberta in 1964 (ROM 25919).

The specific timing of spawning is related to both latitude and altitude, being later in more northern latitudes and at higher elevations. Hauser (1969) reported that in southern Montana spawning occurs in late June and early July, and the earliest dates that fry were seen were June 21 in the Flathead Creek (water temperature 17–19°C) and July 18 in the East Gallatin River (water temperature 11–19°C). In Montana, Hauser (1969) reported that they mature by age 3 and all females by age 5. Some males matured by age two and all were mature by age four. 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. In the Black Hills, Breeggemann *et al.* (2014) found that ~50% of females were mature by age 3 and almost all were mature by age 5. The smallest mature male and female were 95 mm and 101 mm TL, respectively (Breeggemann *et al.* 2014). The number of eggs varied with fish size and age. The numbers of mature eggs per female ranged from 990, for a specimen 131 mm in length, to 3,710, for one 184 mm in length. Small recruitment eggs (those that have not filled out for spawning) may be found in the ovary (Hickling and Rutenburg 1936), suggesting a short spawning season. The translucent, yellow eggs average 1.5–2.2 mm in diameter and are demersal and adhesive (Hauser 1969). 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 to 14 days as reported for other suckers (Stewart 1926; Geen *et al.* 1966).

Cordilleran Sucker

McPhail (2007) reported typical ages of maturity of 4 and 5 years for males and females, respectively, in British Columbia.

Physiology and Adaptability

The lethal thermal maximum for Plains Suckers from the Black Hills is 34.0°C at 25°C acclimation, 33.2°C at 22.5°C acclimation, and 32.9°C at 20°C (Schultz and Bertrand 2011). Sublethal effects would be expected below these temperatures.

The Plains Sucker is a stronger swimmer than the White Sucker (*Catostomus commersonii*) and Longnose Sucker (*C. catostomus*) (Underwood *et al.* 2014), indicating that they may be better competitors where they co-occur in fast flowing streams.

Dispersal and Migration

Little information is available on the movements of Plains or Cordilleran Suckers in Canada. 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 hard bottoms. During spawning, 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

In many parts of the range, the Plains Sucker is sympatric with other catostomids such as the White Sucker and Longnose Sucker. The Cordilleran Sucker is sympatric with the Bridgelip Sucker, Largescale Sucker (*Catostomus macrocheilus*), and Longnose Sucker throughout their range. There is some evidence that the Cordilleran Sucker may hybridize with the Bridgelip Sucker; however, the Bridgelip Sucker is found more often in lakes than in streams in British Columbia, 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 the Plains Sucker formed exclusive schools, separate from other sucker species.

Competition with other catostomids could be limiting range expansion, but the distribution of the Plains and Cordilleran suckers is more probably due to physical and physiological barriers. The Plains Sucker and the Cordilleran Sucker are more highly specialized in their feeding and habitat requirements than the White Sucker, Longnose Sucker, or Bridgelip Sucker where the ranges overlap (see Hauser 1969; Scott and Crossman 1998). Dunham *et al.* (1979) showed that competition with other sympatric catostomids has led to geographic variation in characteristics such as growth, feeding efficiency, body size, and swimming mechanics.

The only parasite previously listed for the Mountain Sucker was the trematode *Posthodiplostomum minimum* (Hoffman 1967). The relative scarcity of parasites listed for the species probably reflects the degree to which studies have been conducted rather than a low incidence of parasitism.

POPULATION SIZES AND TRENDS

Sampling Effort and Methods

Population size and trend information on the Plains and Cordilleran Suckers is limited mainly to presence and absence or catch per unit effort data, particularly in Canada, and no targeted abundance estimates have been calculated to examine temporal trends for this species. Previously, *Pantosteus* suckers probably went unrecorded because of a lack of targeted surveys, inaccessibility of much of the habitat, and confusion over the taxonomy of the genus and subgenus (resolved just recently by Unmack *et al.* [2014]). Given the increasing taxonomic certainty, it is possible that a re-examination of some museum collections could reveal new distributional information for the Plains and Cordilleran Suckers. In addition, the species has a peculiar and highly disjunct distribution within the Pacific National Freshwater Biogeographic Zone (e.g., Fraser, North Thompson, Similkameen rivers). While other areas in British Columbia have been well sampled for commercial and game species (e.g., *Oncorhynchus* spp.), targeted surveys for other species are uncommon. and during surveys for Pacific salmons, non-target species like suckers are typically not identified to species. Thus, it is possible that incomplete sampling and identification problems may partially explain the disjunct distribution for the Cordilleran Sucker.

Abundance

Temporal surveys of the abundance of Plains Suckers across their range in Canada have not been completed, but the Plains Sucker is one of the more widely distributed *Pantosteus* suckers (Unmack *et al.* 2014). This species is abundant in some streams of the Great Plains. Plains Sucker abundance was positively correlated with periphyton coverage, a food resource in the Black Hills (Schultz *et al.* 2016). Density estimates of the Plains Sucker, in the Black Hills National Forest, South Dakota can be high (428 fish/ha - Isaak *et al.* 2003; 7,000 fish/ha - Bertrand *et al.* 2016). Within the Black Hills of South Dakota, populations of Plains Sucker have declined since the 1960s. There has been a loss of the species from 40% of the historical local range of historically occupied streams (Schultz and Bertrand 2011; Bertrand *et al.* 2016), with densities decreasing by more than 84% (Bertrand *et al.* 2016). In Canada, Scott and Crossman (1998) suggested that the species was neither widely distributed nor abundant.

Plains Sucker

DU1 Saskatchewan-Nelson Population

Collection records of the University of Alberta Museum of Zoology (UAMZ) and Alberta's Fisheries and Wildlife Management Information System (FWMIS) indicate that as many as 850 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). Data from the FWMIS (Table 1) indicate that in Alberta rivers (Belly and Oldman) collections can be variable between years in the same river. The variability of these data may indicate a need for more standardized, regular sampling.

Table 1. Maximum (Max), minimum (Min), mean, and standard error (SE) catch-per-unit-effort (CPUE; fish·min^{-1}) by survey year and waterbody and electro-fishing effort (shocking seconds) by waterbody.

		CPUE (fish·min^{-1})			
Waterbody	**Year**	**Max**	**Min**	**Mean**	**SE**
Belly River	2006	0	0	0	NA
	2008	1.74	0	0.87	1.7
	2009	0.76	0	0.07	0.08
	2010	0.23	0	0.05	0.09
	2012	0.59	0	0.16	0.28
	2018	0.85	0	0.13	0.10
Milk River	2006	2.49	0	0.25	0.20
	2007	0.38	0	0.06	0.04
	2009	0	0	0	0
	2014	0.11	0	0.01	0
North Milk River	2006	1.35	0	0.62	0.62
	2009	0	0	0	0
Oldman River	2006	0	0	0	0
	2007	0.82	0	0.27	0.54
	2008	0.07	0.07	0.07	NA
	2010	0.30	0	0.07	0.08
	2011	0	0	0	0
	2012	0.95	0	0.16	0.07
	2014	0	0	0	0

DU2 Missouri Population

Willock (1969a) stated that the Mountain Sucker was 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 Sucker to be abundant and widely dispersed in southern Alberta, extending into the central plains. Sampling conducted by Fisheries and Oceans Canada (Macnaughton *et al.* 2019) has found fish to be locally abundant in some creeks in Saskatchewan (Table 2). The mean CPUE in Alberta and Saskatchewan (Tables 1 and 2) is similar, with the exception of the high catches observed in Caton Creek, Saskatchewan (Table 2).

Table 2. Median, Maximum (Max), Minimum (Min), Mean, and Standard Error (SE) catch-per-unit-effort (CPUE; fish·min^{-1}) of Plains Sucker surveyed in rivers and creeks in Saskatchewan in 2003, 2004, 2017, and 2018 (Watkinson *et al.* unpublished data) (modified from Macnaughton *et al.* 2019).

	CPUE (fish·min^{-1})				
Waterbody	**Median**	**Max**	**Min**	**Mean**	**SE**
Battle Creek	0.12	0.52	0	0.16	0.12
Belanger Creek	0	0	0	0	0
Caton Creek	1.06	12.20	0	2.98	3.67
Conglomerate Creek	0.09	0.54	0	0.20	0.22
Davis Creek	No catch	NA	NA	0	NA
Fairwell Creek	0	0.26	0	0.08	0.10
Nine Mile Creek	0.20	0.39	0	0.20	0.38
Sucker Creek	No catch	NA	NA	0	NA

<u>Cordilleran Sucker</u>

McPhail (2007) indicated that the Cordilleran Sucker has a scattered distribution in British Columbia, 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, British Columbia), the North Thompson River from near Heffley Creek north to Clearwater, British Columbia, and the Similkameen River drainage, from the American border and upstream to just beyond Princeton, British Columbia.

Fluctuations and Trends

Abundance reports in the literature are too limited to provide an estimation of the fluctuations and population trends for either sucker species. Canadian studies of fish distributions that report Plains and Cordilleran suckers in samples are not sufficient to provide more than ongoing presence data (or occasionally relative abundance) at most sites sampled in past decades in all of Saskatchewan, Alberta, and British Columbia.

Plains Sucker

The Plains Sucker remains abundant in some areas in the Saskatchewan-Nelson and Missouri river drainages in Alberta and Saskatchewan. Recent sampling in Saskatchewan confirmed that the Plains Sucker is extant in the Belanger and Swift Current creeks (Sereda pers. comm. 2019), two creeks without confirmed collections for >20 years and highlighted in the last species assessment as possible range contractions (COSEWIC 2010b). In addition, Pollock *et al.* (2017) collected Plains Sucker in two nearby creeks, Sucker and Davis creeks.

Cordilleran Sucker

McPhail (2007) reported the Cordilleran Sucker as moderately abundant in the three areas in British Columbia where these fish have been known to occur for years (lower Fraser, North Thompson, upper Similkameen rivers). Because density estimates do not exist for any Canadian sites, it can be confirmed that the species persists in tertiary drainages where they have been known to occur for decades. Historical collection site records from the Royal BC Museum and the University of British Columbia Fish Collection were used to select sample sites in the Similkameen River in the summer of 2009 using electroshocking and small seines (Taylor pers. comm. 2009). While suckers were found at most of these historical sites, many were Largescale Suckers and Bridgelip Suckers. Over 2 of days sampling, only nine confirmed Cordilleran Suckers were collected.

Rescue Effect

For both the Plains and Cordilleran suckers, most populations occur in pockets that are isolated from other potential rescue populations in the United States by barriers caused by anthropogenic structures (dams), unsuitable habitat, or unconnected drainages.

Plains Sucker

The Plains Sucker is not known from upstream reaches of the North Milk and Milk rivers in Montana (Holton and Johnson 2003). In addition, the Fresno Reservoir is a barrier to the upstream movement of fish. Therefore, there is only limited rescue potential from downstream sections in the river.

Cordilleran Sucker

Recolonization of the Canadian portion of the Similkameen from the 30 km US portion downstream is possible. However, the many disjunctions within the natural range of the Cordilleran Sucker suggest there are limitations to dispersal and indicate that any rescue effect would be unlikely.

THREATS AND LIMITING FACTORS

Ongoing and potential threats to Plains and Cordilleran Suckers are discussed below by DU and species. Threats are presented in the approximate order of most to least significant threats. To identify the nature and magnitude of threats to the Plains and Cordilleran Suckers, a threats calculator was completed based on the IUCN-CMP (World Conservation Union-Conservation Measures Partnership) unified threats classification system (IUCN and CMP 2006; Salasky *et al.* 2008). The corresponding entry in the Threats Assessment Worksheet is identified for each in parentheses (Appendix 4-6). Threats common to either DU for Plains and Cordilleran Suckers are discussed in full on first mention, with any relevant differences among DUs or species highlighted in subsequent sections.

The distribution and evolution of *Pantosteus* suckers is closely associated with mountains, where they are adapted to cool waters, swift currents, and rocky substrates. The species is adapted to the fluctuating environments of higher gradient streams of variable hydrology (Dunham *et al.* 1979). It is a multi-year spawning species that lives to perhaps 9 years of age in some areas, allowing the species to survive poor spawning years and to take advantage of ideal conditions as they occur (Belica and Nibbelink 2006); this likely provides some population resilience to periodic natural disturbances.

<u>Plains Sucker</u>

Across the range of the Plains Sucker, there appears to be no single, imminent threat. Rather, threats are multifaceted, likely cumulative, and involve the degradation and elimination of habitat or habitat quality over the medium-long term. The influence of these anthropogenic factors will be affected by the degree of range fragmentation that characterizes the species' natural distribution. Similar conclusions were reached for the Plains Sucker within the United States (Belica and Nibbelink 2006). Within the Black Hills of South Dakota, as is the case in some drainages in the Canadian distribution of the species, small disjunct peripheral populations are at greater risk of extirpation than continuous populations at the core of a species range (Hewitt 1996; Bunnell *et al.* 2004). The threats to the Plains Sucker differ depending on the DU. For the Saskatchewan-Nelson population, they include domestic and urban wastewater, agricultural and forestry effluents, climate change and severe weather, dams and water management/use, invasive non-native/alien species/diseases, roads and railroads, utility and service lines, and recreational activities. The threats to the Plains Sucker, Missouri population, include climate change and severe weather, dams and water management/use, agricultural and forestry effluents, invasive non-native/alien species/diseases, and roads and railroads. The threat impact is indicated in parentheses next to the threat header.

(9.1) Domestic and urban wastewater (Medium (Saskatchewan-Nelson population), Negligible (Missouri population))

There are concerns related to sediments and pollution from urban developments, including all roads in the Saskatchewan-Nelson drainage. Many of these roads are used for forestry, oil and gas, and mining. Sediment results in a decrease in structural habitat complexity (Smokorowski and Pratt 2007). It is detrimental to fish diversity and can change species composition as well as fish abundance or biomass within a drainage (Smokorowski and Pratt 2007). Given the habitat requirements of the Plains Sucker, sediment is suspected to be a significant threat; however, direct impacts have not been investigated.

(9.3) Agricultural and forestry effluents (Medium (Saskatchewan-Nelson population), Low (Missouri population))

Agricultural runoff can carry pollutants (farm fertilizers, animal waste, herbicides, and pesticides), sediment (see 9.1 - *Domestic and urban waste*), and nutrient inputs that could negatively affect Plains Sucker habitat. Agriculture is present in all watersheds in which the species is distributed in the Missouri drainage and in many of the lower elevation reaches in the Saskatchewan-Nelson drainage.

Logging and wood harvesting can result in the loss of riparian vegetation, and typically results in increased siltation levels and likely negatively impacts spawning and feeding habitat for the Plains Sucker. Logging and wood harvesting is rare at higher elevations away from higher stream orders within the species range in DU1. No logging occurs within DU2. Direct impacts of agriculture and forestry effluents have not been investigated for this species.

(11) Climate change and severe weather (Medium – Low (Saskatchewan-Nelson population), High – Medium (Missouri population))

Climate change has the potential to impact water availability, temperature, and a broad range of other ecosystem processes (Schindler 2001), and thereby affect the availability and quality of Plains Sucker habitat. Natural recurring conditions, such as droughts and anoxia, can have broad negative effects on Plains Sucker abundance and distribution. Southern Alberta and Saskatchewan can experience extreme drought conditions, particularly during the late summer and early fall. In the lower Milk River, oxygen concentrations under the ice as low as 1.6 mg/L have been recorded, perhaps due to oxidization by organic debris or inflow of anoxic ground water (Noton 1980; RL&L Environmental Services Ltd. 2002). Droughts and heat waves exacerbate these low oxygen levels. The impact of this threat on the Plains Sucker would depend on the severity and duration of the drought but can limit feeding habitat and lower survival by limiting water availability and flow.

Much of the distribution of the Plains Sucker has experienced air temperature warming of 1–4ºC, most of which has occurred since the 1970s (Schindler and Donahue 2006). Most climate models predict further warming of 1–2ºC and slight increases in precipitation by the end of the 21st century (CCIS 2007). The forecast 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 runoff entering reservoirs. As a result, it may become increasingly difficult to maintain current summer flow regimes and fish habitat. This could also exacerbate the threats posed by existing levels of water use and drought. Warming stream temperatures are likely to negatively affect the extent and quality of aquatic habitat used by Plains Suckers within the Saskatchewan-Nelson and the Missouri drainages.

Although Canada is considered to have abundant fresh water (Gleick 2002), there is regional variability in supply. Low-flow conditions can result in the loss of riffle habitat, elevated water temperatures, reduction in habitat connectivity, 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).

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 as a result o climate change. Archaeological evidence (see Schindler and Donahue 2006) suggests that severe and long-lasting droughts (lasting several decades) are not uncommon on 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 the droughts of the 18th and 19th centuries. Despite the apparently milder historical conditions of the 20th century, average annual evapotranspiration exceeded average precipitation during this time (Schindler and Donahue 2006). Annual precipitation has decreased by 14% to 24% in the southern prairies since the 1890s.

Annual flows in major drainages of the southwestern prairies have shown modest declines during the 20th century on an annual basis (Déry and Wood 2005; Rood *et al.* 2005). However, Schindler and Donahue (2006) demonstrated that, when agricultural and urban use is at a maximum, current summer flows are 20% to 84% lower than they were in the early 20th century. 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). The longer-term trend for many rivers in southern Alberta over the summer is toward a “stressed” status or reduced below natural levels (Alberta SOE 2008).

Within a given stream drainage, alternating zones of 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 the Missouri drainage. 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. Increased frequency and severity of droughts are likely to negatively affect the extent and quality of aquatic habitat used by Plains Suckers within the Saskatchewan-Nelson and Missouri drainages.

(7.2) Dams and water management/use (Medium – Low (Saskatchewan-Nelson and Missouri population))

The Plains Sucker is only found in flowing waters throughout its range (Nelson and Paetz 1992; Holton and Johnson 2003). Existing dams and reservoirs, and the construction of new dams and reservoirs would reduce available habitat for the species and limit connectivity in the drainage. Generally, impoundments can alter flow regimes, water temperatures, and sediment load, and thereby fish habitat, microbiota and aquatic communities (Quist *et al.* 2004; Maitland *et al.* 2016). Flow management often produces rivers that are narrower, clearer, more consistent in temperature and flow, and less productive with less substrate movement (Cross *et al.* 1986; Pflieger and Grace 1987; Quist *et al.* 2004). Water released from reservoirs is often withdrawn from near the bottom of the reservoir (hypolimnetic withdrawals), potentially creating cooler water conditions in downstream areas. Artificial changes to flow delivery and temperature could affect cues for breeding behaviour and spawning, and may affect egg survival (McPhail 2001; RL&L 1995; Golder Associates Ltd. 2005). Dams can result in increased mortality associated with entrainment and stranding of eggs and free-swimming life stages, and indirect effects on fishes may occur as a result of changes in aquatic communities associated with the altered hydrologic regime. The predicted effect of an impoundment on Plains Sucker habitat downstream would depend on whether water release is via surface or hypolimnetic release and how water releases are managed.

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 Saskatchewan (COSEWIC 2008, 2017). The water supply for agriculture in these regions depends on reservoirs that trap spring snowmelt from the eastern Rocky Mountains. Only about 20% of the stored runoff is returned to the rivers from the irrigation system (e.g., St. Mary River Reservoir; see Schindler and Donahue 2006). Total water withdrawals have almost doubled since the 1950s, principally in response to increased agricultural demand (Dash 2008).

Damming, water withdrawals, and warming temperatures (see 11 - *Climate change and severe weather*) are implicated in the decline in available flowing water. Drainages without dams and/or water withdrawals showed a smaller decline (20–30%), while drainages with impoundments and large-scale water withdrawals showed larger declines (40–80%) depending on the scale of the impact (Schindler and Donahue 2006).

The 17 dams in the Saskatchewan-Nelson drainage have altered the hydrograph in most larger drainages. The St. Mary Diversion Dam in the United States has decreased the flow in the St. Mary River (DU1), while greatly modifying the natural hydrograph of the North Milk and Milk rivers (DU2) downstream of the confluence of the two rivers. The St. Mary Canal was completed in Montana in 1917 to divert water from the St. Mary River to the North Milk River for irrigation purposes. In most years, the canal diverts water from April to September, 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 USA 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 USA, hence it is not available as irrigation water in Canada. According to the agreement, the USA is able to use the Milk River in Canada for conveyance of water.

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 the area downstream of the international border before the diversion was constructed. The significant increase in water volume since the canal came 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; Veillard *et al.* 2017; Rudolfsen *et al.* 2018). This has resulted in increased turbidity and higher flows in the North Milk and Milk rivers and an associated increase in erosion and subsequent sedimentation in Alberta (Willock 1969b).

In Alberta, temporary diversion licenses (TDLs) for non-irrigation purposes (e.g. oil and gas) are issued throughout the year including (although rarely) during critical low-flow periods (Alberta Rocky Mountain Sculpin Recovery Team 2013). TDLs may be revoked to mitigate impacts of reduced flow on fish habitat during critically low flows (Alberta Rocky Mountain Sculpin Recovery Team 2013). TDLs are more prevalent in the Milk River drainage than the St. Mary River drainage. The greatest changes to habitat in the Milk River (DU2) have been associated with irrigation needs (COSEWIC 2010b).

In Saskatchewan, water use has been stable in the Missouri drainage for several decades, little data is available and no direct connection can currently be made between water use and known impacts to the Plains Sucker. In the Saskatchewan-Nelson drainage, demands on water have increased. Again, given the data that are available, no direct connection can currently be made between water use and known impacts to the Plains Sucker.

(8.1) Invasive non-native/alien species/diseases (Medium – Low (Saskatchewan-Nelson population); Low (Missouri population))

Plains and Cordilleran suckers may constitute an important part of the food chain, forming the link between primary producers and higher-level consumers. Small suckers may be preyed upon by many other species, including birds, mammals, and other fishes such as salmonids and large predatory species like Walleye (*Sander vitreus*) and Northern Pike (*Esox lucius*). Decker and Erman (1992) and, more recently, Dauwalter and Rahel (2008) modelled Plains Sucker occurrence and found that higher densities of large non-native Brown Trout (*Salmo trutta*) >20 cm were associated with lower Plains Sucker occurrence. Dauwalter and Rahel (2008) state that this finding suggests that management of recreational trout fisheries needs to be balanced with Plains Sucker conservation in the Black Hills.

The impact of non-native species on the Plains Sucker is dependent on the suitability of the habitat for invading species. In Montana, stocking of non-native fishes in the St. Mary River began early in the 20th century and continued until mid-century (Marnell 1988; Mogen and Kaeding 2005). The Milk River and its tributaries have not been stocked for more than a decade and unauthorized introductions have not been documented in these drainages. Non-native fishes that have established self-sustaining populations in Canadian reaches of the St. Mary and Milk river drainages include Walleye, Northern Pike, Yellow Perch (*Perca flavescens*), and various trout species (Clements 1973). All these fish species are piscivorous and could impact Plains Sucker abundance via predation.

Blooms of the diatom *Didymosphenia geminata* (Bacillariophyceae), are a potential threat to headwater rivers in Alberta with low turbidity and nutrient levels (Kirkwood *et al.* 2007). These blooms can form dense mats that cover the river bottom, impacting ecosystem structure and function, and negatively affecting other trophic levels. Low dissolved reactive phosphorus has been identified as a primary determinant of these blooms (Kilroy and Bothwell 2012; Bothwell *et al.* 2014). However, it is arguable whether the appearance of these blooms is due to human introductions, or to altered river conditions that promote the proliferation of naturally occurring, sparse populations (Taylor and Bothwell 2014; Bergey and Spaulding 2015). If these algal blooms occur in river habitat occupied by the Plains Sucker, they can alter the available cover, food, and spawning habitats, the consequences of which are unknown. These blooms occur in the St. Mary River, but the impacts are considered to be localized and of short duration, so this threat as a whole is not considered severe (The Alberta Rocky Mountain Sculpin Recovery Team 2013).

(4.1) Roads and railroads (Medium - Low (Saskatchewan-Nelson population), Low (Missouri population))

Road crossings can act as barriers to the movement of fishes, fragment habitat, reduce population resilience to environmental disturbance, and increase risks of local extinction (Diebel *et al.* 2015). Additionally, destruction of habitat can result from construction or maintenance projects of various types including road maintenance (e.g., road crossings and culvert insertion) and grade-control of stream banks (Forman and Alexander 1998; Maitland *et al.* 2016). There has been extensive road building in most watersheds in DU1 where the Plains Sucker occurs to facilitate logging, oil and gas extraction, and domestic grazing. This has raised significant concern about the cumulative impacts of such developments (Arc Wildlife Services 2004). In DU2, road development has been more limited as the watershed is dominated by agriculture. The effects of roads and road crossings have not been investigated for the Plains Sucker.

<u>Cordilleran Sucker</u>

The Cordilleran Sucker has a small and patchy geographic distribution and low population densities (McPhail 2007), which may make these fis vulnerable to disturbances. As is the case for the Plains Sucker, there appears to be no single, imminent threat to the Cordilleran Sucker across its range. Threats are multifaceted, likely cumulative, and involve the elimination or degradation of habitat or habitat quality over the medium-long term. Possible threats for the Cordilleran Sucker include domestic and urban wastewater, agricultural and forestry effluents, climate change and severe weather, dams and water management/use, other ecosystem modifications, invasive non-native/alien species/ diseases, roads and railroads, utility and service lines, and fishing and harvesting aquatic resources. The threat impact level is indicated in parentheses next to the threat heading.

(9.1) Domestic and urban wastewater (Medium)

There are concerns related to sediments and pollution from urban developments, including roads (Cooper 2011) in the Pacific drainage (see Plains Sucker 9.1 - *Domestic and urban wastewater* for more details). Direct impacts have not been investigated for Cordilleran Sucker.

(9.3) Agricultural and forestry effluents (Medium)

Agricultural runoff can carry pollutants (farm fertilizers, animal waste, herbicides, and pesticides), sediment, and nutrient inputs that could negatively affect Cordilleran Sucker habitat. Agriculture is present along the rivers in the lower elevation reaches of the Pacific drainage. Forestry is common in the Pacific drainage at higher elevations (see Plains Sucker 9.3 for more details). Direct impacts have not been investigated for the Cordilleran Sucker.

In the lower Fraser River, toxic compounds may eventually enter the mainstem through tributaries that receive urban stormwater runoff, contaminated groundwater (e.g. agricultural pesticides and herbicides), direct industrial discharges, sewage treatment effluents, aerial deposition, and accidental spills (Hall *et al.* 1991). Concentrations vary over time and some contaminants, particularly heavy metals, bind to sediments and may bioaccumulate in aquatic invertebrates and subsequently fishes. Data on threshold concentrations for lethal and sublethal effects of toxic compounds on most fishes, including the Cordilleran Sucker, are lacking.

(11) Climate change and severe weather (Medium - Low)

See Threat 11 - *Climate change and severe weather* for the Plains Sucker for specific impacts. The Similkameen River and its tributaries occur in the Northern Cascade Ranges Ecoregion (COSEWIC 2006), a region characterized by some of the warmest, driest summers in British Columbia and low runoff. Climate change will likely influence the hydrology of the Fraser River drainage, which includes the lower Fraser River and North Thompson River populations. The combined impacts of habitat shifting and droughts can have a potential negative impact on the Cordilleran Sucker.

A recent analysis of climate-change indicators suggests that the Northern Cascade Ranges Ecoregion of British Columbia has seen an estimated 1.5–-2.0°C increase in annual air 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 British Columbia, depending on elevation and average temperature. Given that snowmelt runoff contributes 50% to 80% of total flow in snowmelt-dominated rivers like the Similkameen River, this will affect baseflow levels significantly. A study comparing water flows in the 1970s to those in the 1980s and 1990s for the Similkameen River drainage noted that, in later periods, the snow melted earlier, summer flows were lower and summer low-flow periods lasted longer (Rae 2005). In combination, 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 9 days, each century, respectively (Aqua Factor Consulting Inc. 2004) and is predicted to continue advancing (Morrison *et al.* 2002). Streams in south-central British Columbia show a similar trend, with an earlier spring freshet and lower flows in late summer and early fall (Aqua Factor Consulting Inc. 2004) and a gradual warming trend (Morrison *et al.* 2002; Ferrari *et al.* 2007).

See the Plains Sucker (11.2) for impacts. 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 increased mortality in fish residing in tributaries of the Columbia River drainage, including the Similkameen River (Pearson *et al.* 2008). Late summer low-flow periods coincide with peak demand for water withdrawal from wells and streams for irrigation and domestic use.

(7.2) Dams and water management/use (Medium – Low)

See the Plains Sucker (7.2 - *Dams and water management/use*) for potential impacts. The Columbia River drainage has a long history of major hydroelectric development (COSEWIC 2010a). The Enloe Dam was constructed on the Similkameen River approximately 30 km downstream of the international border in the early 1900s and decommissioned in 1958. No redevelopment has occurred at this dam site and it represents a low risk to the Cordilleran Sucker in the Canadian portion of the Similkameen River drainage. However, it is a barrier to upstream fish passage, therefore limiting migration and rescue effect. There have been proposals to re-license the Enloe Dam for power production. In contrast, there is also interest by conservation groups and the British Columbia provincial government in removing the Enloe Dam.

A potential significant threat to riffle habitat specialists like the Cordilleran Sucker is water diversion during low-flow months, particularly in areas where drought-like conditions are common such as the Similkameen River (see 11 - *Climate change and severe weather*).

(7.3) Other ecosystem modifications (Medium - Low)

See Plains Sucker (7.3 - *Other ecosystem modifications*) for impacts.

(8.1) Invasive non-native/alien species/diseases (Low)

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; Brown *et al.* 2009). The introduction of non-native aquatic species is extensive in southern British Columbia, including drainages occupied by the Cordilleran Sucker, particularly in off-channel areas of the lower Fraser River (e.g., Brown Bullhead (*Ameiurus nebulosus*), Bullfrog (*Lithobates catesbeianus*), Largemouth Bass (*Micropterus salmoides*), Pumpkinseed (*Lepomis gibbosus*), and Smallmouth Bass (*M. dolomieu*) (Taylor 2004; Pearson *et al.* 2008; Tovey *et al.* 2008)). The conversion of riverine habitat to lake-like conditions associated with reservoirs often puts native species at a disadvantage, and allows introduced visual predators such as Largemouth Bass, Smallmouth Bass, and Walleye to flourish (McPhail 2007; Runciman *et al.* 2009). The risk of introduction and establishment of such exotic predators in the Similkameen River drainage would almost certainly increase if proposed dam developments occurred there. All of these species would likely prey upon various life stages of the Cordilleran Sucker.

Juveniles of *Pantosteus* species in central Utah occurred in main channels only in the absence of Brown Trout, but did occur in off-channel habitats when trout were present (Olsen and Belk 2005). The same trend was not noted in adults, which regularly occurred with trout and presumably escaped predation once they reached a larger size (Olsen and Belk 2005). In a second study, a high density of Brown Trout was negatively correlated with the occurrence of Plains Suckers, regardless of age (Dauwalter and Rahel 2008). The available data for the species do not allow these impacts to be assessed.

(4.1) Roads and railroads (Low)

See (4.1 - *Roads and railroads*) Plains Sucker for impacts. At least 15% of the streams in the Fraser Valley have been paved over or now flow through culverts (Fisheries and Oceans Canada 1997). The connectivity of ~1,700 km of stream length in the lower Fraser River has been lost to barriers such as dams, flood control structures, road culverts, and other structures (Finn *et al.* 2021).

(4.1) Utility and service lines (Low)

Pipeline crossings do exist across, upstream, or parallel to habitat occupied by the Cordilleran Sucker (e.g. Trans Mountain pipeline). Under normal operation, pipelines are not considered a threat.

(5.4) Fishing and harvesting aquatic resources (Low)

Recreational fishing is present where Cordilleran Suckers exist, but impacts are likely very limited as bycatch would be expected to be nil.

Number of Locations

Plains Sucker

Based on the threat of habitat siltation from domestic and urban wastewater and agricultural and forestry effluent in the Saskatchewan-Nelson drainage (DU1), there are more than 20 locations of Plains Suckers within the North Saskatchewan, South Saskatchewan, Red Deer, Bow, and Oldman river drainages, as these threats tend to have impacts at the small watershed scale. Plains Sucker distribution within these drainages occurs within numerous smaller drainages (Figure 3).

Based on the threat of climate change and severe weather, there are two locations in the Missouri drainage (DU2): Milk (Alberta) and Frenchman (Saskatchewan) river drainages), as this threat impacts entire drainages.

Cordilleran Sucker

Based on the threat of habitat siltation from domestic and urban wastewater and agricultural and forestry effluent that tend to have impacts at the small watershed scale, each tributary from where it is known should be considered a location; therefore, there are seven locations for the Cordilleran Sucker in Canada.

PROTECTION, STATUS AND RANKS

The NatureServe (2022) conservation status has not been updated to reflect the new taxonomy for the *Pantosteus* suckers: Plains and Cordilleran Suckers are still considered as Mountain Sucker. NatureServe ranks are not necessarily applicable now that several species, formerly considered to be the Mountain Sucker, have been identified (Unmack *et al.* 2014). It is expected that global, national, state and provincial statuses will likely change for Plains and Cordilleran Suckers, given the reduced distributions in some jurisdictions.

Legal Protection and Status

Two DUs of Mountain Sucker were listed under Schedule 1 of the federal *Species at Risk Act* (SARA) in 2017: the Milk River populations were designated Threatened and the Pacific populations, Special Concern.

Non-Legal Status and Ranks

In 2010, the Mountain Sucker was assessed by COSEWIC as Special Concern in British Columbia (Pacific populations), not at risk in Alberta and Saskatchewan in the Saskatchewan-Nelson River populations and Threatened in Alberta and Saskatchewan in the Missouri populations (COSEWIC 2010b).

The Mountain Sucker is ranked G5 globally, and N5 in both Canada and the United States (NatureServe 2022).

The Mountain Sucker (likely the Plains Sucker) is ranked Secure (S5) in Montana, Wyoming, and Alberta, Vulnerable (S3) in South Dakota, Critically Imperilled (S1) in Saskatchewan, and Presumed Extirpated (SX) in Nebraska (NatureServe 2022).

The Mountain Sucker (likely the Cordilleran Sucker) is ranked Apparently Secure (S4) in Idaho and Oregon, Imperilled/Vulnerable (S2S3) in Washington, Vulnerable (S3) in Nevada, and Vulnerable (S3?) in British Columbia (NatureServe 2022).

Habitat Protection and Ownership

Critical habitat for the Mountain Sucker, Milk River populations and the Mountain Sucker, Pacific populations has not been identified under SARA and, hence, is not explicitly protected. As the Mountain Sucker (Saskatchewan-Nelson River populations), assessed as Special Concern by COSEWIC, has not been listed under SARA, the identification and protection of critical habitat is not required.

The *Fisheries Act* provides Fisheries and Oceans Canada (DFO) with powers, authorities, duties and functions for the conservation and protection of fishes and fish habitat (as defined in the *Fisheries* Act). The Act contains provisions that can be enforced to regulate flow needs for fishes, 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 that deal with regulating the pollution of fish-bearing waters, while the other provisions are administered by DFO.

Within the Saskatchewan-Nelson drainage, the Plains Sucker shares habitats in the Milk River with various other fishes such as the Western Silvery Minnow (*Hybognathus argyritis*) (COSEWIC 2017) and the Rocky Mountain Sculpin (*Cottus* sp.). Both these species are listed as Threatened under SARA and have published recovery strategies (Fisheries and Oceans Canada 2012, 2017). There is also an action plan for the Milk and St. Mary rivers (Fisheries and Oceans Canada 2018), which contains descriptions of recovery actions that should also benefit the Plains Sucker where its distribution overlaps with these species in the Milk River drainage. The Cordilleran Sucker is listed under SARA as Special Concern and a management plan has been posted (Fisheries and Oceans Canada 2020).

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AUTHORITIES CONTACTED

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Conservation Data Centre(s) or Natural Heritage Information Centre(s) corresponding to the range of the wildlife species	Gordon Oliphant (British Columbia, CDC), Feb 2, 2019 Shevelle Stephens (Alberta) January 11, 2019 Jeff Keith (Saskatchewan, CDC) Oct 2, 2019
COSEWIC Secretariat for information and instruction on: a) sources of Aboriginal Traditional Knowledge the preparation of distribution maps and the calculation of extent of occurrence, area of occupancy, and index of area of occupancy	Sonia Schnobb, Oct 2, 2019
Recovery team (if one exists)	Christine Lacho, DFO Nov. 18, 2019

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BIOGRAPHICAL SUMMARY OF REPORT WRITER(S)

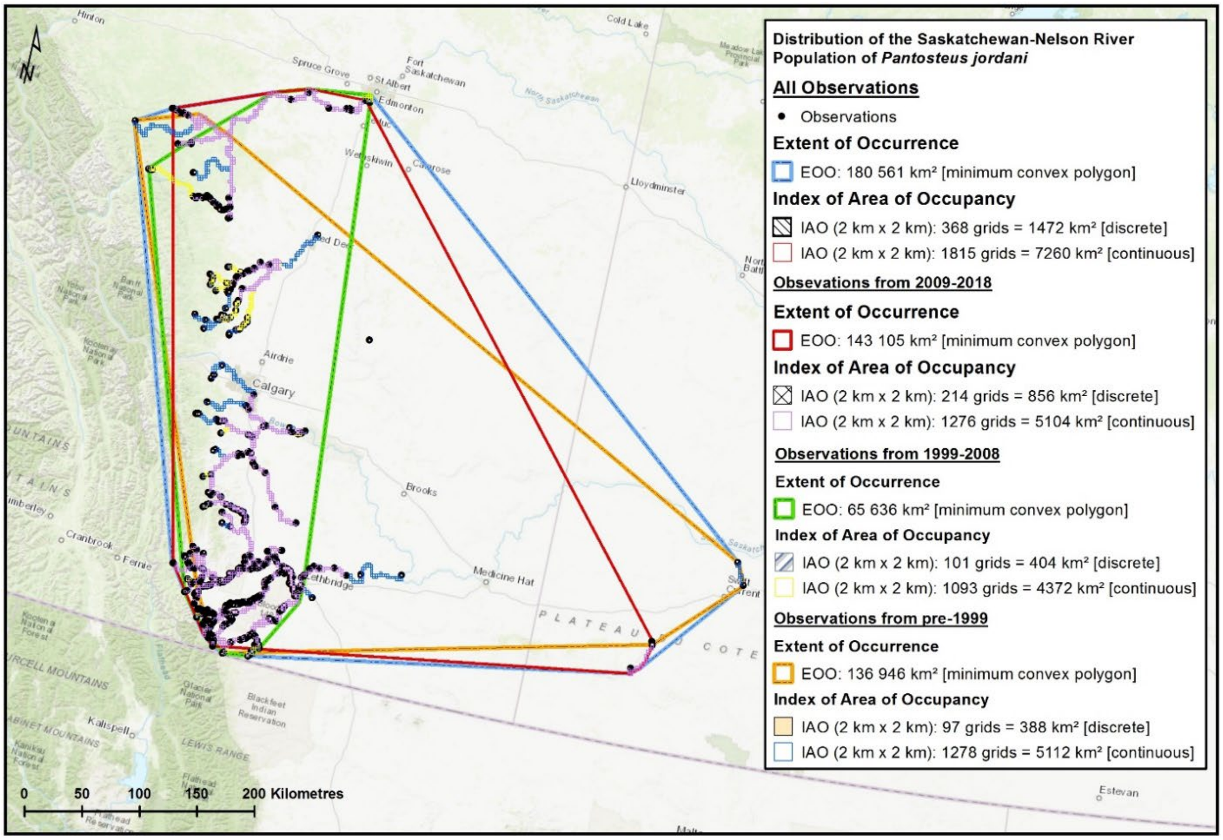
Doug Watkinson is a Research Biologist with Fisheries and Oceans Canada in Winnipeg. He has sampled fish in many of the major river drainages of the Saskatchewan-Nelson and Missouri River drainages where *Pantosteus jordani* are found. His current research focuses on species at risk, habitat impacts, and aquatic invasive species. He has co-written nine COSEWIC species status reports and the field guide, *The Freshwater Fishes of Manitoba*.

Dr. Mark Poesch is an Associate Professor at the University of Alberta in the Department of Renewable Resources. Dr. Poesch sits on the provincial listing bodies for species at risk in Canada, and numerous other inter-governmental committees and non-governmental groups, and is a former president of the Canadian Aquatic Resources Section of the American Fisheries Society, the largest professional group focusing on fishes in Canada. Dr. Poesch has conducted research on freshwater species at risk throughout Canada, including on effects of habitat loss and fragmentation, metal contamination, and invasive species.

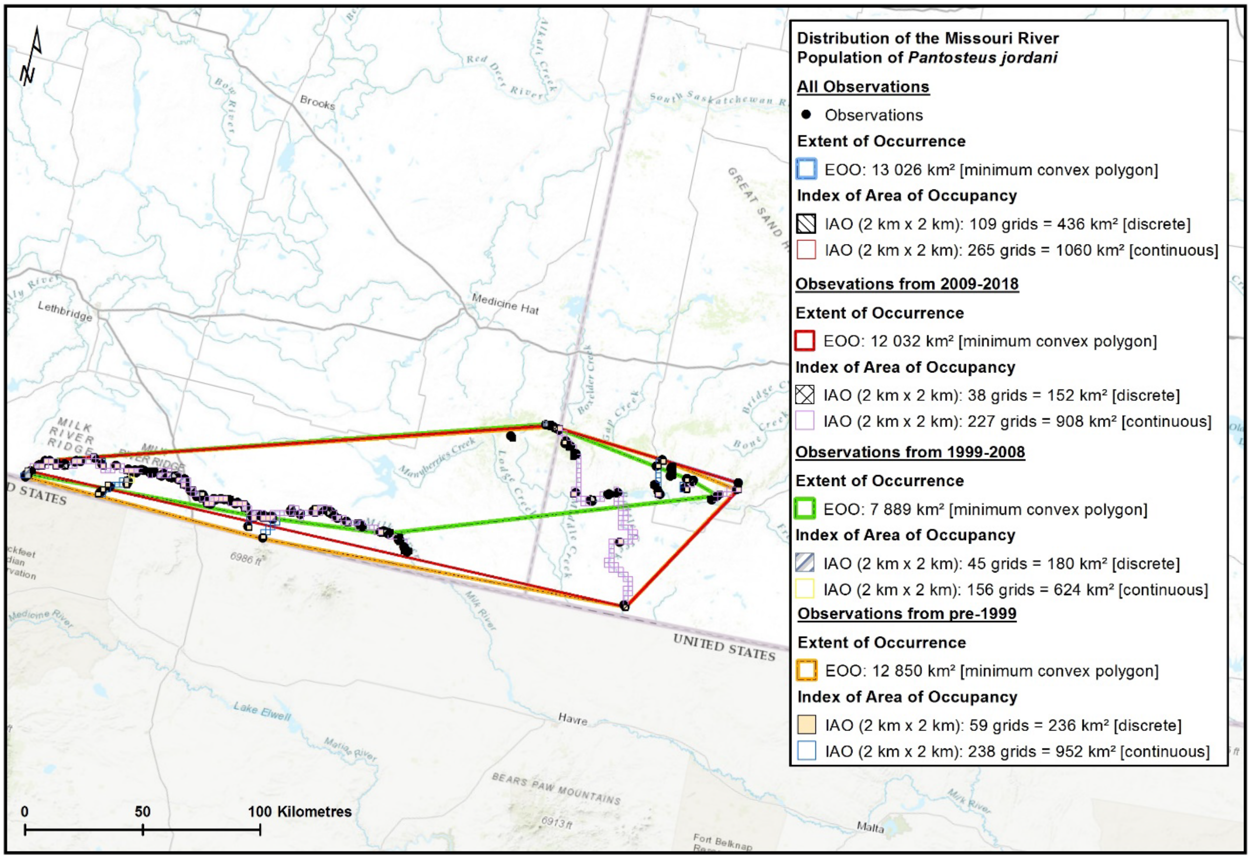
COLLECTIONS EXAMINED

None.

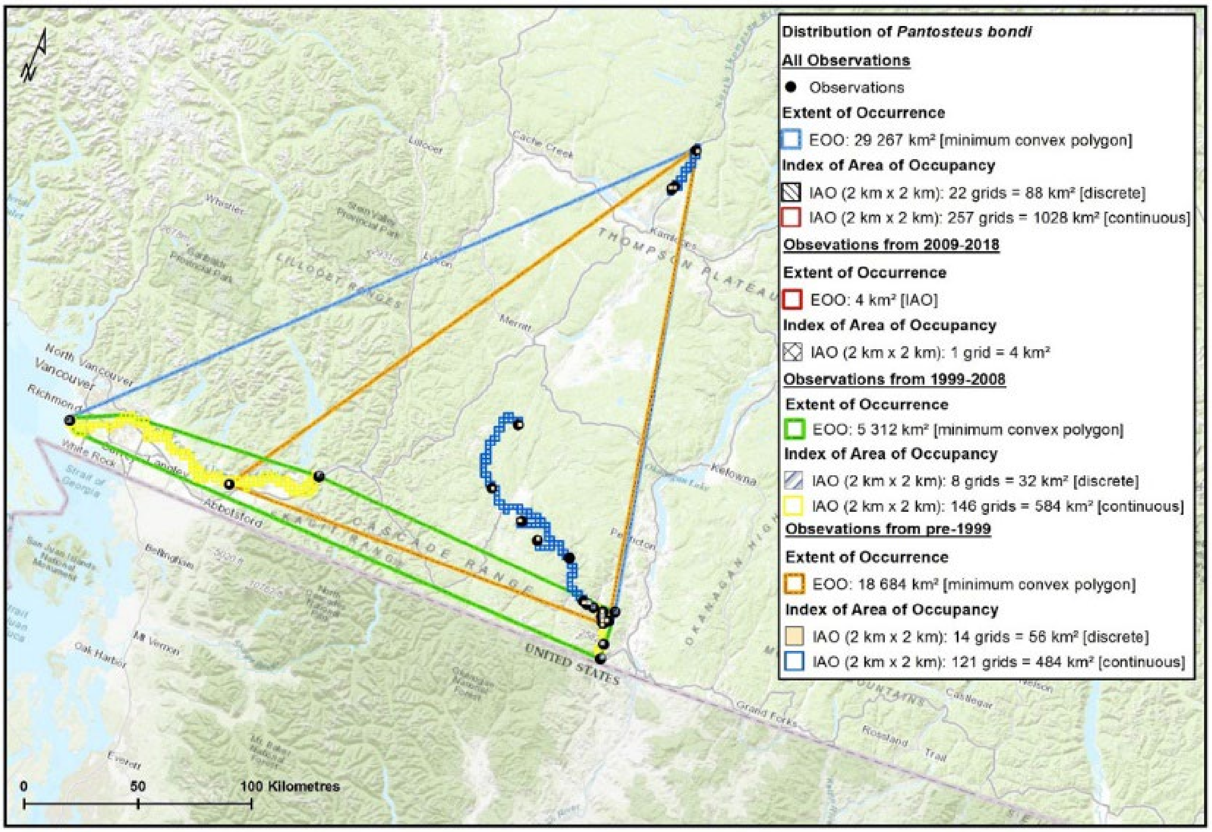
Appendix 1. Estimated Extent of Occurrence (EOO) and Index of Area of Occupancy (IAO) for Plains Sucker (*P. jordani*), Saskatchewan-Nelson populations.



Appendix 2. Estimated Extent of Occurrence (EOO) and Index of Area of Occupancy (IAO) for Plains Sucker (*P. jordani*), Missouri populations.



Appendix 3. Estimated Extent of Occurrence (EOO) and Index of Area of Occupancy (IAO) for Cordilleran Sucker (*P. bondi*) in Canada.



Appendix 4. Threats Assessment Worksheet for the Plains Sucker DU1 (Saskatchewan-Nelson River populations)

Species or Ecosystem Scientific Name	Plains Sucker *Pantosteus jordani* DU 1 (Saskatchewan-Nelson River populations)			
Element ID		**El code**		
Date (Ctrl + ";" for today's date):	11 June 2020			
Assessor(s):	Nicholas Mandrak, Doug Watkinson, Dwayne Lepitzki, Pete Cott, Mark Poesch, Michael Sullivan, Shane Petry, Paul Harper, Eva Enders, Greg Wilson, Ashley Kling, Maggie Boothroyd and Sydney Allen			
References:	draft status report & threats assessment; threats telecon June 11, 2020			

Overall Threat Impact Calculation Help:			**Level 1 Threat Impact Counts**	
	Threat Impact		**high range**	**low range**
	A	Very High	0	0
	B	High	0	0
	C	Medium	5	1
	D	Low	1	5
Calculated Overall Threat Impact:			High	High
Assigned Overall Threat Impact:			**C = Medium**	
Impact Adjustment Reasons:				
Overall Threat Comments			Generation time 5 years therefore timeline for severity and timing is 15 years; N & S SK, Red Deer, Bow, Oldman rivers; Fig. 3 shows separation of 2 DUs for Plains Sucker; no abundance estimates for entire DU or different watersheds; no population trends.	

Threat		**Impact (calculated)**		**Scope (next 10 Yrs)**	**Severity (10 Yrs or 3 Gen.)**	**Timing**	**Comments**
1	Residential & commercial development						
1.1	Housing & urban areas						Development in western Alberta is an area of intense and increasing residential and urban development. Most of the development is downstream of species range. These developments might be expected to modify water quality and quantity. [threats 7.2, 9.1] No directed studies.
1.2	Commercial & industrial areas						These developments might be expected to modify water quality and quantity. [threats 7.2, 9.2] Most of the development is downstream of species range. No directed studies.

Threat		Impact (calculated)		Scope (next 10 Yrs)	Severity (10 Yrs or 3 Gen.)	Timing	Comments
1.3	Tourism & recreation areas						There is limited tourism in the watershed, which would include, hiking, biking, and camping. [threat 6.1] Impacts are likely low. Any expansion of marinas, boat launches directly in sucker habitat?
2	Agriculture & aquaculture		Negligible	Large (31–70%)	Negligible (<1%)	High (Continuing)	
2.1	Annual & perennial non-timber crops						Cropland exists throughout lower portions of the distribution in this DU. Can be row crop and hayland. Impacts are unknown. [irrigation 7.2, pollution 9.3]
2.2	Wood & pulp plantations						NA.
2.3	Livestock farming & ranching		Negligible	Large (31–70%)	Negligible (<1%)	High (Continuing)	Exists throughout lower portions of the distribution in this DU. More dominant than row crops. Impacts are likely low if cattle density is ranching. Impacts may be higher if feedlots. Impacts are unknown. [water withdrawal 7.2; pollution 9.3]. Any trampling by cattle in habitat (fish or eggs)?
2.4	Marine & freshwater aquaculture						NA. Aquaculture activities in the watershed are outside the species range.
3	Energy production & mining		Negligible	Small (1–10%)	Negligible (<1%)	High (Continuing)	
3.1	Oil & gas drilling		Negligible	Small (1–0%)	Negligible (<1%)	High (Continuing)	Oil and gas extraction prevalent, particularly in the northern half of this DU. Spills could have a significant impact. [spills = pollution 9.2]; drilling in aquatic habitat?
3.2	Mining & quarrying		Negligible	Small (1–10%)	Negligible (<1%)	High (Continuing)	There is a history of limited placer gold mining in DU1 in the North Saskatchewan and Red Deer river watersheds. Within DU1, there are also two coal mines, and there are several aggregate mines. No identified impacts, but could expect impacts if the specific habitat or large portions of the watershed are modified or destroyed. There are no studies that link mining impacts to Plains Sucker populations. [pollution 9.2] any expansion directly into aquatic habitat?
3.3	Renewable energy						NA. No known impacts. [run of river 7.2]

Threat		Impact (calculated)		Scope (next 10 Yrs)	Severity (10 Yrs or 3 Gen.)	Timing	Comments
4	Transportation & service corridors	CD	Medium - Low	Restricted (11–30%)	Moderate - Slight (1-30%)	High (Continuing)	
4.1	Roads & railroads	CD	Medium - Low	Restricted (11–30%)	Moderate - Slight (1–30%)	High (Continuing)	There has been extensive road building in most watersheds where the Plains Sucker occurs in DU1 to facilitate logging, oil and gas extraction, and domestic grazing that have resulted in significant concern about the cumulative impacts of such developments. The effects of roads and road crossings have not been investigated for the Plains Sucker.
4.2	Utility & service lines	D	Low	Restricted (11–30%)	Slight (1–10%)	High (Continuing)	Present in the DU.
4.3	Shipping lanes						NA. None known.
4.4	Flight paths						NA. No impact on aquatic species.
5	Biological resource use		Negligible	Negligible (<1%)	Negligible (<1%)	High (Continuing)	
5.1	Hunting & collecting terrestrial animals						NA. Hunting is common, but does not likely impact species.
5.2	Gathering terrestrial plants						NA. This activity is terrestrial and unlikely to impact species.
5.3	Logging & wood harvesting						Extensive logging and wood harvesting within the species range. Direct impacts have not been investigated for this species. Most logging and wood harvesting is at higher elevations away from higher stream orders within the species range in DU1.
5.4	Fishing & harvesting aquatic resources		Negligible	Negligible (<1%)	Negligible (<1%)	High (Continuing)	Recreational fishing is present but impacts are likely very limited considering fisherman are mostly on foot, often fly fishing for salmonids or bait for warmer water species. Bycatch would be expected to be close to 0. Lethal scientific sampling? Use of suckers for bait?
6	Human intrusions & disturbance	D	Low	Pervasive (71–100%)	Slight (1–10%)	High (Continuing)	

Threat		Impact (calculated)		Scope (next 10 Yrs)	Severity (10 Yrs or 3 Gen.)	Timing	Comments
6.1	Recreational activities	D	Low	Pervasive (71–100%)	Slight (1–10%)	High (Continuing)	Off-road and ATV use likely present through the DU. Sedimentation and habitat alteration due to this activity is a minor concern. Hunters and farmers will occasionally cross streams but impact is expected to be minimal.
6.2	War, civil unrest & military exercises						NA. No war, civil unrest or military activity present.
6.3	Work & other activities		Negligible	Restricted (11–30%)	Negligible (<1%)	High (Continuing)	Scientific research directed at other SARA listed species, university research, and consultants working for proponents occurs. This sampling is typically non-targeted for this species. This sampling is not likely to impact population significantly as it is limited in spatial and temporal scope. Non-lethal directed sampling goes here, impact on suckers from other research activities.
7	Natural system modifications	CD	Medium - Low	Pervasive (71–100%)	Moderate - Slight (1–30%)	High (Continuing)	
7.1	Fire & fire suppression						Fire occurs in this DU. It is unknown if fire is detrimental to Plains Sucker population, but would likely depend on fire severity, duration, and size. Water withdrawal for firefighting.
7.2	Dams & water management/use	CD	Medium - Low	Pervasive (71–100%)	Moderate - Slight (1–0%)	High (Continuing)	The 17 dams in DU1 have altered the hydrograph in most larger watersheds. Taken together, damming, water withdrawals, and warming temperatures (see 11) are recognized as the cause of the decline in available water. Temporary diversion licenses (TDLs) for non-irrigation purposes are issued throughout the year. In DU1, demands on water have increased. However, given the available data, no direct connection can currently be made between water use and known impacts to the Plains Sucker.

Threat		Impact (calculated)		Scope (next 10 Yrs)	Severity (10 Yrs or 3 Gen.)	Timing	Comments
7.3	Other ecosystem modifications		Unknown	Small (1–10%)	Unknown	High (Continuing)	The Plains Sucker might be negatively affected by the loss of riparian habitat, which leads to soil erosion and increased sedimentation in riverbeds. There is no evidence of an impact, but there are suspected benefits. The Mountain Pine Beetle may improve available ground water with decreases in transpiration.
8	Invasive & other problematic species & genes	CD	Medium - Low	Pervasive (71–100%)	Moderate - Slight (1–30%)	High (Continuing)	
8.1	Invasive non-native/alien species/diseases	CD	Medium - Low	Pervasive (71–100%)	Moderate - Slight (1–30%)	High (Continuing)	Non-native fish stocking has occurred throughout most of the species range. This is mostly salmonids. Perhaps provincial experts can elaborate on other species in the foothills. The density of large non-native Brown Trout >20 cm had a negative effect on populations.
8.2	Problematic native species/diseases						NA. Not aware of any
8.3	Introduced genetic material						NA. No stocking occurs.
8.4	Problematic species/diseases of unknown origin						NA. None known.
8.5	Viral/prion-induced diseases						NA. None known.
8.6	Diseases of unknown cause						NA. None known.
9	Pollution	C	Medium	Pervasive (71–100%)	Moderate (11–30%)	High (Continuing)	
9.1	Domestic & urban waste water	C	Medium	Pervasive (71–100%)	Moderate (11–30%)	High (Continuing)	Some wastewater in the species range. It is not known if this would impact habitat or the fish directly. Sediments/pollution from urban developments, all roads
9.2	Industrial & military effluents		Unknown	Pervasive (71–100%)	Unknown	High (Continuing)	Some effluent although limited expected in the species range. It is not known if this would impact habitat or the fish directly. Toxic chemical spills, effluent, waterborne

Threat		Impact (calculated)		Scope (next 10 Yrs)	Severity (10 Yrs or 3 Gen.)	Timing	Comments
9.3	Agricultural & forestry effluents	C	Medium	Pervasive (71–100%)	Moderate (11–30%)	High (Continuing)	Considerable amounts of forestry within the species range. Agriculture is present throughout the lower reaches of the DU. Given the type of farming, predominately rangeland near the stream side, there would be limited exposure. It is possible that herbicides could impair algal growth, limiting food availability. The direct impact of forestry and agriculture effluents on populations is unknown.
9.4	Garbage & solid waste						Occur within the watershed closer to urban centres; these are towards the downstream part of the species distribution. Likely limited impact.
9.5	Air-borne pollutants						Wildfires have occurred in the Rocky Mountains with significant impacts on air quality in the last decade. The impact is unknown.
9.6	Excess energy						NA. Noise and light pollution is present, although limited, and unlikely to impact the species.
10	Geological events						
10.1	Volcanoes						NA. No volcanoes occur nearby. Impact unknown.
10.2	Earthquakes/tsunamis						NA. Not in this DU.
10.3	Avalanches/ landslides						Both are possible in this DU. Landslides near waterways would increase in sediment and changes in connectivity.
11	Climate change & severe weather	CD	Medium - Low	Pervasive (71–100%)	Moderate - Slight (1–30%)	High (Continuing)	Temperature increases are more of a concern in this DU
11.1	Habitat shifting & alteration						Much of the distribution of Plains Sucker has experienced warming of 1–4ºC. Warming stream temperatures are likely to affect the extent and quality of aquatic habitat. The Plains Sucker will likely decline from increasing water temperature.

Threat		Impact (calculated)		Scope (next 10 Yrs)	Severity (10 Yrs or 3 Gen.)	Timing	Comments
11.2	Droughts						Drought may be becoming more prevalent across the species range. The longer-term trend for many rivers in southern Alberta over the summer is "stressed" or reduced below natural levels. Natural recurring conditions, such as droughts and anoxia, can have broad negative effects on Plains Sucker abundance and distribution. In winter, these conditions may be exacerbated by severe ice conditions and anoxia in isolated pools all affecting population viability to varying degrees. No studies to support impacts.
11.3	Temperature extremes						Extreme high temperatures (>33°C) or freezing temperatures could result in direct mortality or loss of habitat. Sublethal effects can be expected at the higher temperatures. Habitats that are found are typically <22°C.
11.4	Storms & flooding						Storms and flooding are common throughout the range, but because the impacts are likely limited, and flooding may clean sediment from the main channel, a benefit to the species.
11.5	Other impacts						
Classification of Threats adopted from IUCN-CMP, Salafsky *et al.* (2008).							

Appendix 5. Threats Assessment Worksheet for the Plains Sucker DU2 (Missouri River populations)

Species or Ecosystem Scientific Name	Plains Sucker *Pantosteus jordani* Missouri populations (DU2)			
Element ID		**EI code**		
Date (Ctrl + ";" for today's date):	2020-06-11			
Assessor(s):	Nicholas Mandrak, Doug Watkinson, Dwayne Lepitzki, Pete Cott, Mark Poesch, Shane Petry, Paul Harper, Greg Wilson, Maggie Boothroyd and Sydney Allen			
References:	draft status report & threats assessment; threats telecon June 11, 2020			

Overall Threat Impact Calculation Help:			**Level 1 Threat Impact Counts**	
	Threat Impact		**high range**	**low range**
	A	Very High	0	0
	B	High	1	0
	C	Medium	1	1
	D	Low	3	4
Calculated Overall Threat Impact:			High	High
Assigned Overall Threat Impact:			**BC = High – Medium**	
Impact Adjustment Reasons:			Overall Threat impact adjusted to high-medium as only one threat category had a high impact and a medium impact and the remaining threats were low, negligible, or none.	
Overall Threat Comments			Generation time 5 years therefore timeline for severity and timing is 15 years; Milk (AB) and Frenchman rivers (SK); Fig. 3 (pdf 60) shows separation of 2 DUs for Plains Sucker; no abundance estimates for entire DU or different watersheds; no population trends; this DU previously assessed as TH.	

Threat		**Impact (calculated)**		**Scope (next 10 Yrs)**	**Severity (10 Yrs or 3 Gen.)**	**Timing**	**Comments**
1	Residential & commercial development						
1.1	Housing & urban areas						These developments might be expected to modify water quality and quantity, but development is very limited in DU2 so impacts are not expected. [threats 7.2, 9.1] No directed studies.
1.2	Commercial & industrial areas						These developments might be expected to modify water quality and quantity, but development is very limited in DU2 so impacts are not expected. [threats 7.2, 9.2] No directed studies.
1.3	Tourism & recreation areas						There is limited tourism in the watershed, this would include, hiking, biking, and camping. [threat 6.1] Impacts are likely low.
2	Agriculture & aquaculture		Negligible	Pervasive (71–100%)	Negligible (<1%)	High (Continuing)	

Threat		Impact (calculated)		Scope (next 10 Yrs)	Severity (10 Yrs or 3 Gen.)	Timing	Comments
2.1	Annual & perennial non-timber crops						Cropland exists throughout the DU (perhaps as high as 50%). Can be row crop and hayland. Impacts are unknown.
2.2	Wood & pulp plantations						NA. Limited potential in this DU, if forestry occurs, it is where forests existed.
2.3	Livestock farming & ranching		Negligible	Pervasive (71–100%)	Negligible (<1%)	High (Continuing)	Exists throughout this DU (perhaps as high as 50%). Impacts are likely low if cattle density is ranching. Impacts may be higher if feed lots. Impacts are unknown.
2.4	Marine & freshwater aquaculture						NA. Aquaculture activities in the watershed are outside the species range.
3	Energy production & mining		Negligible	Small (1-10%)	Negligible (<1%)	High (Continuing)	
3.1	Oil & gas drilling		Negligible	Small (1–10%)	Negligible (<1%)	High (Continuing)	Limited gas and even more limited oil extraction in this DU. No expected impacts.
3.2	Mining & quarrying		Negligible	Negligible (<1%)	Negligible (<1%)	High (Continuing)	Quarrying activities in the watershed. No identified impacts, but could expect impacts if the specific habitat or large portions of the watershed are modified or destroyed. There are no studies that link mining impacts to Plains Sucker populations.
3.3	Renewable energy						NA. No known impacts.
4	Transportation & service corridors	D	Low	Small (1–10%)	Moderate - Slight (1–30%)	High (Continuing)	
4.1	Roads & railroads	D	Low	Small (1–10%)	Moderate - Slight (1–30%)	High (Continuing)	Road development is limited as the watershed is dominated by agriculture. Known barrier for one stream (Caton Creek). The effects of roads and road crossing has not been investigated for the Plains Sucker.
4.2	Utility & service lines		Negligible	Negligible (<1%)	Negligible (<1%)	High (Continuing)	Present in the DU, although limited. Do cross waterways so spill is possible.
4.3	Shipping lanes						NA. None known.
4.4	Flight paths						NA. No impact on aquatic species.
5	Biological resource use		Negligible	Negligible (<1%)	Negligible (<1%)	High (Continuing)	
5.1	Hunting & collecting terrestrial animals						NA. Hunting is common, but does not likely impact species.
5.2	Gathering terrestrial plants						NA. This activity is terrestrial and unlikely to impact species.
5.3	Logging & wood harvesting						NA. Limited activity in this DU.

Threat		Impact (calculated)		Scope (next 10 Yrs)	Severity (10 Yrs or 3 Gen.)	Timing	Comments
5.4	Fishing & harvesting aquatic resources		Negligible	Negligible (<1%)	Negligible (<1%)	High (Continuing)	Recreational fishing is present but impacts are likely very limited considering fisherman are mostly on foot, often fly fishing for salmonids in headwater streams in SK, or mainstem Milk system for Northern Pike and Sauger. Bycatch would be expected to be close to 0.
6	Human intrusions & disturbance		Negligible	Negligible (<1%)	Negligible (<1%)	High (Continuing)	
6.1	Recreational activities		Negligible	Negligible (<1%)	Negligible (<1%)	High (Continuing)	Off-road and ATV use likely present through the DU. Sedimentation and habitat alteration due to this activity is a minor concern. Hunters and farmers will occasionally cross streams but impact is expected to be minimal. [
6.2	War, civil unrest & military exercises						NA. No war, civil unrest or military activity present.
6.3	Work & other activities		Negligible	Negligible (<1%)	Negligible (<1%)	High (Continuing)	Scientific research directed at other SARA listed species, university research, and consultants working for proponents occurs. This sampling is typically non-targeted for this species. It is not likely to impact populations significantly as it is limited in spatial and temporal scope. non-lethal directed sampling goes here, impact on suckers from other research activities.
7	Natural system modifications	CD	Medium - Low	Pervasive (71–100%)	Moderate - Slight (1–30%)	High (Continuing)	
7.1	Fire & fire suppression						Fire may occur in this DU, typically grass fires. It is unknown if fire is detrimental, but would likely depend on fire severity, duration, and size. Water withdrawal for fire fighting.

Threat		Impact (calculated)		Scope (next 10 Yrs)	Severity (10 Yrs or 3 Gen.)	Timing	Comments
7.2	Dams & water management/use	CD	Medium - Low	Pervasive (71–100%)	Moderate - Slight (1–30%)	High (Continuing)	The greatest changes to habitat in the Milk River (DU2) have been associated with irrigation needs. The St. Mary Diversion in the United States has greatly modified the natural hydrograph of the North Milk and Milk rivers. 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. Temporary diversion licenses (TDLs) for non-irrigation purposes are issued throughout the year. In Saskatchewan, water use has been stable in the DU2 for several decades. Irrigation dams are present but mostly downstream of the distribution of the species. Given the available data, no direct connection can currently be made between water use and known impacts to Plains Sucker.
7.3	Other ecosystem modifications		Negligible	Negligible (<1%)	Negligible (<1%)	High (Continuing)	Plains Sucker might be negatively affected by the loss of riparian habitat, which leads to soil erosion and increased sedimentation in riverbeds. There is no evidence of an impact, but there are suspected benefits.
8	Invasive & other problematic species & genes	D	Low	Pervasive (71–100%)	Slight (1–10%)	High (Continuing)	
8.1	Invasive non-native/alien species/diseases	D	Low	Pervasive (71–100%)	Slight (1–10%)	High (Continuing)	Non-native fish stocking has occurred throughout most of the species range. This includes salmonids as well as predatory fish like Northern Pike, Yellow Perch. The density of large non-native Brown Trout >20 cm had a negative effect on populations in the Black Hills (USA).
8.2	Problematic native species/diseases						NA. Not aware of any
8.3	Introduced genetic material						NA. No stocking occurs.
8.4	Problematic species/diseases of unknown origin						NA. None known.
8.5	Viral/prion-induced diseases						NA. None known.
8.6	Diseases of unknown cause						NA. None known.
9	Pollution	D	Low	Pervasive (71–100%)	Slight (1–10%)	High (Continuing)	

Threat		Impact (calculated)		Scope (next 10 Yrs)	Severity (10 Yrs or 3 Gen.)	Timing	Comments
9.1	Domestic & urban waste water		Negligible	Restricted (11–30%)	Negligible (<1%)	High (Continuing)	There is very limited activity in the species distribution. It is not known if this would impact habitat or the fish directly. Sediments/pollution from urban developments, all roads.
9.2	Industrial & military effluents		Unknown	Unknown	Unknown	High (Continuing)	There is very limited activity in the species distribution. It is not known if this would impact habitat or the fish directly. Toxic chemical spills, effluent, waterborne.
9.3	Agricultural & forestry effluents	D	Low	Pervasive (71–100%)	Slight (1–10%)	High (Continuing)	Agriculture is present throughout the DU. Given the type of farming, predominately rangeland near streamside, there would be limited exposure. It is possible that herbicides could impair algal growth, limiting food availability. The direct impact of agriculture effluents on population is unknown.
9.4	Garbage & solid waste						Occur within the watershed, although very rare. Not certain of their proximity to the species distribution. Likely limited impact.
9.5	Air-borne pollutants						Wildfires have occurred nearby in the Rocky Mountains with significant impacts on air quality in the last decade. The impact is unknown.
9.6	Excess energy						NA. Noise and light pollution is present, although limited, unlikely to impact the species.
10	Geological events						
10.1	Volcanoes						NA. No volcanoes occur nearby. Impact unknown.
10.2	Earthquakes/tsunamis						NA. Not in this DU.
10.3	Avalanches/landslides						Limited in scale in this DU to streamside landslides.
11	Climate change & severe weather	BC	High - Medium	Pervasive (71-100%)	Serious - Moderate (11-70%)	High (Continuing)	Increase strength of text in threats related to climate change/drought
11.1	Habitat shifting & alteration						Much of the distribution of Plains Sucker has experienced warming of 1–4ºC. Warming stream temperatures are likely to affect the extent and quality of aquatic habitat. Plains Sucker will likely decline from increasing water temperature.

Threat		Impact (calculated)		Scope (next 10 Yrs)	Severity (10 Yrs or 3 Gen.)	Timing	Comments
11.2	Droughts						Drought may be becoming more prevalent across the species range. The longer-term trend for many rivers in southern Alberta over the summer is “stressed” or reduced below natural levels. Natural recurring conditions, such as droughts and anoxia, can have broad negative effects on Plains Sucker abundance and distribution. In 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 DU2. In winter, these conditions may be exacerbated by severe ice conditions and anoxia in isolated pools all affecting population viability to varying degrees.
11.3	Temperature extremes						Extreme high temperatures (>33°C) or freezing temperatures could result in direct mortality or loss of habitat. Sublethal effects can be expected at the higher temperatures. Habitats that are found are typically <22°C.
11.4	Storms & flooding						Storms and flooding are common throughout the range, but because the impacts are likely limited, and flooding may clean sediment from the main channel, a benefit to the species.
11.5	Other impacts						
Classification of Threats adopted from IUCN-CMP, Salafsky *et al.* (2008).							

Appendix 6. Threats Assessment Worksheet for the Cordilleran Sucker

Species or Ecosystem Scientific Name	Cordilleran Sucker *Pantosteus bondi*		
Element ID		**EI code**	
Date (Ctrl + ";" for today's date):	2020-06-11		
Assessor(s):	Nicholas Mandrak, Doug Watkinson, Dwayne Lepitzki, Pete Cott, Mark Poesch, Michael Sullivan, Shane Petry, Paul Harper, Greg Wilson, Ashley Kling, Maggie Boothroyd and Sydney Allen		
References:	draft status report & threats assessment; threats telecon June 11, 2020		

Overall Threat Impact Calculation Help:			**Level 1 Threat Impact Counts**	
	Threat Impact		**high range**	**low range**
	A	Very High	0	0
	B	High	0	0
	C	Medium	3	1
	D	Low	3	5
Calculated Overall Threat Impact:			High	High
Assigned Overall Threat Impact:			**C = Medium**	
Impact Adjustment Reasons:			Overall Threat impact adjusted to medium as only one threat category had a medium impact and remaining threats medium-low, low, negligible, or none.	
Overall Threat Comments			Generation time 5 years therefore timeline for severity and timing is 15 years; Thompson, Similkameen, lower Fraser: Fig. 6 shows disjunct distribution of Cordilleran Sucker: Fraser and Columbia drainages; no abundance estimates for entire DU or different watersheds; no population trends; SC as Mountain Sucker.	

Threat		**Impact (calculated)**		**Scope (next 10 Yrs)**	**Severity (10 Yrs or 3 Gen.)**	**Timing**	**Comments**
1	Residential & commercial development						
1.1	Housing & urban areas						Development in south British Columbia can be intense in lower Fraser River and is typically at lower elevations near waterways where Cordilleran Sucker are distributed in the Similkameen and North Thomson systems. Concentrations of human developments might be expected to result in declining water quality. [threats 7.2, 9.1]. There is no direct link between housing development and impacts to Cordilleran Sucker.

Threat		Impact (calculated)		Scope (next 10 Yrs)	Severity (10 Yrs or 3 Gen.)	Timing	Comments
1.2	Commercial & industrial areas						Development in south British Columbia can be intense in lower Fraser River and less so near waterways where Cordilleran Sucker are distributed in the Similkameen and North Thomson systems. These developments might be expected to modify water quality and quantity [threats 7.2, 9.2]. Most of the development is downstream of species range. No directed studies.
1.3	Tourism & recreation areas						There is substantial tourism in the watershed, including hiking, biking, and camping, boating and urban tourism. Impacts are likely low.
2	Agriculture & aquaculture		Negligible	Restricted (11-30%)	Negligible (<1%)	High (Continuing)	
2.1	Annual & perennial non-timber crops						Cropland exists throughout lower portions of the three watersheds occupied in this DU. Can be row crops and hayland. Impacts are unknown.
2.2	Wood & pulp plantations						NA. Limited potential in this DU, if forestry occurs, it is where forests existed.
2.3	Livestock farming & ranching		Negligible	Restricted (11-30%)	Negligible (<1%)	High (Continuing)	Exists throughout lower portions of the distribution in this DU. More dominant than row crops. Impacts are likely low if cattle density is ranching. Impacts may be higher if feedlots.
2.4	Marine & freshwater aquaculture						NA. Aquaculture activities in the DU are outside the species range.
3	Energy production & mining		Negligible	Small (1-10%)	Negligible (<1%)	High (Continuing)	
3.1	Oil & gas drilling						NA. None known.
3.2	Mining & quarrying		Negligible	Small (1-10%)	Negligible (<1%)	High (Continuing)	There is a long history of mining in the DU, is unlikely these historical mines to have significant impacts today. Gravel mining in the lower Fraser River could induce either direct mortality or reduce habitat availability for Cordilleran Sucker whose distribution includes gravel bars in this area. There are no studies that link mining impacts to Cordilleran Sucker populations.
3.3	Renewable energy						NA. No known impacts.
4	Transportation & service corridors	D	Low	Small (1-10%)	Moderate - Slight (1–30%)	High (Continuing)	

Threat		Impact (calculated)		Scope (next 10 Yrs)	Severity (10 Yrs or 3 Gen.)	Timing	Comments
4.1	Roads & railroads	D	Low	Small (1–10%)	Moderate - Slight (1–30%)	High (Continuing)	At least 15% of the streams in the Fraser Valley have been paved over or now flow through culverts. In other portions of the DU, development is limited. Cordilleran Suckers are restricted in distribution such that they are susceptible to localized stochastic events. There is no direct evidence of impacts to Cordilleran Sucker populations from roads and railroads.
4.2	Utility & service lines	D	Low	Small (1–10%)	Slight (1-–10%)	High (Continuing)	Present in the DU. Do cross waterways so spill is possible.
4.3	Shipping lanes						NA. None known.
4.4	Flight paths						NA. No impact on aquatic species.
5	Biological resource use	D	Low	Restricted (11–30%)	Slight (1–10%)	High (Continuing)	
5.1	Hunting & collecting terrestrial animals						NA. Hunting is common, but does not likely impact species.
5.2	Gathering terrestrial plants						NA. This activity is terrestrial and unlikely to impact species.
5.3	Logging & wood harvesting						Logging and wood harvesting within the species range in the Similkameen and North Thompson rivers. Lower Fraser valley was historically logged. Most logging and wood harvesting are at higher elevations, away from the known distribution of the species, but this activity is extensive at higher elevations and likely has affects on numerous tributaries. Direct impacts have not been investigated for this species.
5.4	Fishing & harvesting aquatic resources	D	Low	Restricted (11–30%)	Slight (1–10%)	High (Continuing)	Recreational fishing is present but impacts are likely very limited considering bycatch would be expected to be close to 0.
6	Human intrusions & disturbance		Negligible	Pervasive (71–100%)	Negligible (<1%)	High (Continuing)	
6.1	Recreational activities		Negligible	Pervasive (71–100%)	Negligible (<1%)	High (Continuing)	Off-road and ATV use likely rare in this DU within the species range. Sedimentation and habitat alteration due to this activity is a minor concern. Hunters and farmers will occasionally cross streams but impact is expected to be minimal.

Threat		Impact (calculated)		Scope (next 10 Yrs)	Severity (10 Yrs or 3 Gen.)	Timing	Comments
6.2	War, civil unrest & military exercises						NA. No war, civil unrest or military activity present.
6.3	Work & other activities		Negligible	Small (1–10%)	Negligible (<1%)	High (Continuing)	Scientific research directed at other SARA listed species, university research, and consultants working for proponents occurs. This sampling is typically non-targeted for this species. It is not likely to impact populations significantly as it is limited in spatial and temporal scope. Non-lethal directed sampling goes on here, and impact on suckers from other research activities.
7	Natural system modifications	CD	Medium - Low	Pervasive (71–100%)	Moderate - Slight (1–30%)	High (Continuing)	
7.1	Fire & fire suppression						Forest fires can occur. It is unknown if fire is detrimental to Cordilleran Sucker population, but would likely depend on fire severity, duration, and size. Water withdrawal for firefighting.
7.2	Dams & water management/use	CD	Medium - Low	Pervasive (71–100%)	Moderate - Slight (1–30%)	High (Continuing)	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. They tend to be either run-of-river type projects with no impoundment. A potential significant threat to riffle habitat specialists like Cordilleran Sucker is water diversion during low-flow months, particularly in areas where drought-like conditions are common such as the Similkameen River.
7.3	Other ecosystem modifications	CD	Medium - Low	Large (31–70%)	Moderate - Slight (1–30%)	High (Continuing)	Might be negatively affected by the loss of riparian habitat, which leads to soil erosion and increased sedimentation in riverbeds. There is no evidence of an impact, but there are suspected benefits. Sediment from fires and riparian removal.
8	Invasive & other problematic species & genes	D	Low	Restricted (11–30%)	Slight (1–10%)	High (Continuing)	

Threat		Impact (calculated)		Scope (next 10 Yrs)	Severity (10 Yrs or 3 Gen.)	Timing	Comments
8.1	Invasive non-native/alien species/diseases	D	Low	Restricted (11–30%)	Slight (1–10%)	High (Continuing)	The introduction of non-native fish species is extensive in southern BC, including watersheds occupied by Cordilleran Sucker, particularly in off-channel areas of the lower Fraser River (e.g., Brown Bullhead (*Ameiurus nebulosus*), Bullfrog (*Lithobates catesbeianus*), Largemouth Bass (*Micropterus salmoides*), and Smallmouth Bass (*M. dolemieu*). The available data for the species do not allow these impacts to be assessed. Introduced fish may eat the suckers.
8.2	Problematic native species/diseases						NA. Not aware of any
8.3	Introduced genetic material						NA. No stocking occurs.
8.4	Problematic species/diseases of unknown origin						NA. None known.
8.5	Viral/prion-induced diseases						NA. None known.
8.6	Diseases of unknown cause						NA. None known.
9	Pollution	C	Medium	Pervasive (71–100%)	Moderate (11–30%)	High (Continuing)	
9.1	Domestic & urban waste water	C	Medium	Large (31–70%)	Moderate (11–30%)	High (Continuing)	Wastewater occurs in the species range. It is not known if this would impact habitat or the fish directly. Sediments/pollution from urban developments, all roads
9.2	Industrial & military effluents		Unknown	Large (31–70%)	Unknown	High (Continuing)	Effluent occurs within the species range. It is not known if this would impact habitat or the fish directly. Toxic chemical spills, effluent, waterborne spills.
9.3	Agricultural & forestry effluents	C	Medium	Pervasive (71–100%)	Moderate (11–30%)	High (Continuing)	Considerable amount of forestry within the species range. Agriculture exists along the river valleys of all three regions with Cordilleran Sucker. It is possible that herbicides could impair algal growth, limiting food availability. Measured impacts to these populations are not known.
9.4	Garbage & solid waste						Occur within the watershed closer to urban centres, which are towards the downstream portion of the species distribution. Likely limited impact.

Threat		Impact (calculated)		Scope (next 10 Yrs)	Severity (10 Yrs or 3 Gen.)	Timing	Comments
9.5	Air-borne pollutants						Wildfires have had significant impacts on air quality in the last decade. The impact is unknown.
9.6	Excess energy						NA. Noise and light pollution is present, although limited; unlikely to impact the species.
10	Geological events						
10.1	Volcanoes						Volcanoes occur nearby. Impact unknown.
10.2	Earthquakes/ tsunamis						Can occur, impact unknown.
10.3	Avalanches/ landslides						Both are possible in this DU. Landslides near waterways would increase sediment and changes in connectivity.
11	Climate change & severe weather	CD	Medium - Low	Pervasive (71–100%)	Moderate - Slight (1–30%)	High (Continuing)	
11.1	Habitat shifting & alteration						Streams in south-central BC show a similar trend with an earlier spring freshet and lower flows in late summer and early fall and a gradual warming trend. Impacts at this time are not known.
11.2	Droughts						Low water flows, combined with high temperature, are causing excessive stress, reduced rearing capacity, and increased mortality in fish residing in tributaries of the Columbia River drainage, including the Similkameen River. Late summer low-flow periods coincide with peak demand for water withdrawal from wells and streams for irrigation and domestic use. No studies to support impacts.
11.3	Temperature extremes						Extreme high temperatures s(>33°C) or freezing temperature could result in direct mortality or loss of habitat. Sublethal effects can be expected at the higher temperatures. Habitats that they are found in are typically <22°C.
11.4	Storms & flooding						Storms and flooding are common throughout the range, but because the impacts are likely limited, and flooding may clean sediment from the main channel, a benefit to the species.
11.5	Other impacts						

Classification of Threats adopted from IUCN-CMP, Salafsky *et al.* (2008).