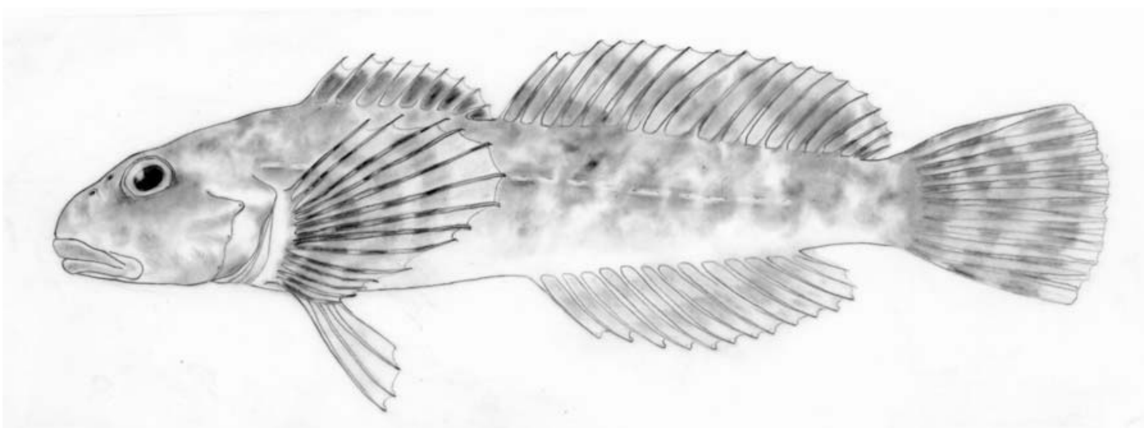
COSEWIC
Assessment and Status Report

on the

Rocky Mountain Sculpin
Cottus sp.

Westslope Populations

in Canada



SPECIAL CONCERN
2010

COSEWIC
Committee on the Status
of Endangered Wildlife
in Canada

COSEPAC
Comité sur la situation
des espèces en péril
au Canada

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

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COSEWIC acknowledges J.D. McPhail for writing the provisional status report on the Rocky Mountain Sculpin, *Cottus* sp., prepared under contract with Environment Canada. The contractors' involvement with the writing of the status report ended with the acceptance of the provisional report. Any modifications to the status report during the subsequent preparation of the 6-month interim and 2-month interim status reports were overseen by Eric Taylor, Freshwater Fishes Specialist Subcommittee Co-chair.

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Rocky Mountain Sculpin—Photo by D.L McPhail.

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COSEWIC
Assessment Summary

Assessment Summary – April 2010

Common name
Rocky Mountain Sculpin - Westslope populations

Scientific name
Cottus sp.

Status
Special Concern

Reason for designation
This small freshwater fish is restricted to a small number of locations (nine) within the Flathead River basin in southeastern British Columbia. It is sedentary as an adult and is particularly susceptible to habitat degradation from road building and associated use.

Occurrence
British Columbia

Status history
Designated Special Concern in April 2010.

COSEWIC
Executive Summary

Rocky Mountain Sculpin
Cottus sp.

Westslope Populations

Wildlife species nformation

The Rocky Mountain Sculpin (*Cottus* sp.) is an as yet unnamed member of a distinctive evolutionary group of sculpins (the “Uranidea”) that occurs in both eastern and western North America. The westslope DU is found only in the Flathead River which originates in the extreme southeastern corner of British Columbia. The Rocky Mountain Sculpin reaches a maximum total length of about 110 mm. Sculpins are bottom-dwelling fishes whose body shape tapers from a relatively large head and pectoral fins to a narrow caudal (tail) fin area. The Rocky Mountain Sculpin is distinguished from other sculpins by a relatively short head, the presence of small “bumps” on the head, and a lack of small, hair-like projections (“prickles”) on the body.

Distribution

The Rocky Mountain Sculpin occurs on both sides of the Continental Divide. In Canada, the eastslope (Alberta) DU is present in the upper parts of the St. Mary and Milk rivers. The species also occurs in most of the headwaters of the Missouri River drainage in eastern Montana and northwestern Wyoming. West of the Continental Divide, the westslope DU occurs in the lower 28 km of the Flathead River in British Columbia (BC), Canada, but is also found in intermountain Montana in the North and Middle forks of the Flathead River, and in the Whitefish River (a Flathead River tributary in Montana). The linear distribution in the Montana portion of the Flathead River is about 160 km. The extent of occurrence of the westslope DU is 270 km^2 and the IAO based on a 2x2 km grid is 148 km^2 and on a 1x1 km grid is 78 km^2.

Habitat

During the day in the summer and fall, this stream-dwelling species typically shelters in riffles and runs with moderate surface velocities and loose rock substrates. It is active at night, but little is known about either its nocturnal or winter habitat use.

Biology

The Rocky Mountain Sculpin in the westslope DU are relatively short-lived. Their maximum lifespan is about seven years, but most individuals live less than five years. Sexual maturity in females is reached in two to three years and in males in two years. Spawning in the Flathead River occurs in the early summer (June and July). The males excavate a nest under rocks, may mate with several females, and guard the eggs. The eggs are large (about 2.5 mm in diameter), and take about 3-4 weeks to hatch at temperatures above 7.0ºC. Westslope DU Rocky Mountain Sculpin forage on the larvae and nymphs of aquatic insects. The species is sedentary and, as adults, rarely moves more than 50 m.

Population sizes and trends

Although there are no quantitative data on the numbers of westslope Rocky Mountain Sculpins in BC, the population appears to be stable. This stability is inferred from their distribution: they are still found at the sites where they were first collected over 50 years ago.

Threats and limiting factors

The westslope DU may be limited by either water temperature or a combination of water temperature and competitive interactions with Slimy Sculpin. Sedimentation from road construction, maintenance, and increasing ATV use is an important threat to habitat quality. A potential threat to the westslope DU is resource development. The Flathead Valley has major coal deposits and substantial gold mining opportunities. The valley has a history of proposals for coal mines, coal-bed methane projects, and gold mines. Typically, these mega-projects involve major environmental alterations—road building, railroad extensions, town site developments, open pit mines, and huge over-burden dump sites. Although these projects are presently only potential developments, they could threaten the existence of the westslope DU Rocky Mountain Sculpin.

Special significance

The limited distribution of the westslope DU (e.g., restricted to the last relatively pristine major watershed in southeastern BC) makes it a special component of the Canadian freshwater fish fauna. Further, there are estimated to be 2,365 species of freshwater fishes in Canada and the continental United States. Many of these species have similar distribution patterns, and this has allowed biogeographers to develop a system of continent-wide biogeographic zones. The distribution of the Rocky Mountain Sculpin, however, is unique in that no other freshwater fish has a similar distribution. Also, within the Flathead Valley there appear to be at least five separate (independent?) zones where the Slimy Sculpin and the Rocky Mountain Sculpin come in contact and apparently hybridize. Such a large number of replicate hybrid zones in this small area could be a treasure for scientific studies in evolutionary biology.

Existing protection, status, and ranks

The Fish Habitat section of the *Fisheries Act* provides some general protection for all fishes in the British Columbia portion of the Flathead River. In addition, a provincial park (Akamina-Kishinena Park) on the southeastern edge of the Flathead Valley provides some protection for the headwaters of one tributary stream, Kishinena Creek. Also, in 2004, the BC government created a 38,000 ha no coal-staking reserve in the lower Flathead Valley. This reserve protects about half of the westslope DU of the Rocky Mountain Sculpin from coal development.

A previous COSEWIC assessment of the westslope Rocky Mountain Sculpin (treated as part of the Shorthead Sculpin) assigned a threatened status in November 1983. A reassessment in 2001 did not include the westslope DU so it was not included with Shorthead Sculpin as a Schedule 1 *SARA*-listed species upon proclamation of *SARA*. Also, a COSEWIC assessment in 2005 of the eastslope (Alberta) DU assigned this species a threatened status under the common name “Eastslope Sculpin. The Westslope DU of the Rocky Mountain Sculpin was re-examined and designated as Special Concern by COSEWIC in April 2010.

TECHNICAL SUMMARY

Westslope DU of the Rocky Mountain Sculpin

Cottus sp.
Rocky Mountain Sculpin chabot des montagnes Rocheuses populations du versant ouest
Range of occurrence in Canada:
The westslope Designatable Unit is restricted to the lower 28 km of the Flathead River in southeastern 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(2008) is being used)	3 yrs
Is there an [observed, inferred, or projected] continuing decline in number of mature individuals?	Unknown, but species is still relatively easy to collect in historical sites
Estimated percent of continuing decline in total number of mature individuals within [5 years or 2 generations]	Unknown, but species is still relatively easy to collect in historical sites
[Observed, estimated, inferred, or suspected] percent [reduction or increase] in total number of mature individuals over the last [10 years, or 3 generations].	Unknown, but species is still relatively easy to collect in historical sites
[Projected or suspected] percent [reduction or increase] in total number of mature individuals over the next [10 years, or 3 generations].	Unknown
[Observed, estimated, inferred, or suspected] percent [reduction or increase] in total number of mature individuals over any [10 years, or 3 generations] period, over a time period including both the past and the future.	Unknown, but species is still relatively easy to collect in historical sites
Are the causes of the decline clearly reversible and understood and ceased?	NA
Are there extreme fluctuations in number of mature individuals?	Unknown, but probably not because the species is still relatively easy to collect in historical sites

Extent and Occupancy Information

Estimated extent of occurrence	270 km²
Index of area of occupancy (IAO) (Always report 2x2 grid value; other values may also be listed if they are clearly indicated (e.g., 1x1 grid, biological AO)).	2X2= 148 km² 1X1= 78 km²

Is the total population severely fragmented?	No
Number of "locations*" *The nine locations and the reasoning behind their selection are given below. 1) The Flathead River plus Harvey Creek are considered one location because the Harvey Creek site is within < 50 m of the Flathead River and any coal development would affect the whole mainstem and Harvey Creek. 2) Cabin and Howell creeks are treated as two locations because the main threat to Howell Creek (gold mining) is upstream of the confluence of Howell and Cabin creeks. Couldrey, Burnham, Commerce, Middlepass, Sage, and Kishinena creeks are each treated as distinct locations.	9
Is there an [observed, inferred, or projected] continuing decline in extent of occurrence?	No
Is there an [observed, inferred, or projected] continuing decline in index of area of occupancy?	No
Is there an [observed, inferred, or projected] continuing decline in number of populations? Population structure is unknown	Probably not
Is there an [observed, inferred, or projected] continuing decline in number of locations?	No
Is there an [observed, inferred, or projected] continuing decline in [area, extent and/or quality] of habitat?	No
Are there extreme fluctuations in number of populations? Population structure is unknown	Probably not
Are there extreme fluctuations in number of locations*?	No
Are there extreme fluctuations in extent of occurrence?	No
Are there extreme fluctuations in index of area of occupancy?	No

Number of Mature Individuals (in each population)

Population	N Mature Individuals
Population structure is unknown. There are an estimated 16 site occurrences in Canada (Figure 3)	Unknown
Assuming limited dispersal, possible populations are: mainstem Flathead River, Harvey Creek, Sage Creek, Commerce Creek, Middlepass Creek, Cabin Creek, Burnham Creek, Couldrey Creek, Kishinena Creek, Howell Creek.	
Total	Unknown

Quantitative Analysis

Probability of extinction in the wild is at least [20% within 20 years or 5 generations, or 10% within 100 years].	Unknown

Threats (actual or imminent, to populations or habitats)

Actual:

- Sedimentation from road construction and maintenance, and increasing ATV activity.

Potential:

- Threats include large scale open-pit coal mining, coal-bed methane extraction, open pit gold mining, associated road construction, logging.

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* See definition of location in O&P manual.

Rescue Effect (immigration from outside Canada)

Status of outside population(s)? Status of outside population(s)? Secure: the North Fork of the Flathead River in Montana forms the western boundary of Glacier National Park in the US	
Is immigration known or possible?	Not documented, but there are no known barriers between Canadian and US populations in the Flathead River
Would immigrants be adapted to survive in Canada?	Yes
Is there sufficient habitat for immigrants in Canada?	No if the BC population remains stable. Yes if the BC population declines
Is rescue from outside populations likely? Adults appear to be sedentary and juveniles tend to move downstream so rescue of upstream Canadian populations from downstream potential US source populations is possible, but unlikely at least over the short term.	Unknown, but possible

Current Status

COSEWIC: The westslope DU was assessed as threatened in 1984 (as part of the more widely distributed Shorthead Sculpin (*Cottus confusus*)). The westslope DU was excluded, however, in a subsequent re-assessment of Shorthead Sculpin in 2001. The eastslope DU was assessed as threatened (COSEWIC 2005). The westslope DU of the Rocky Mountain Sculpin was re-examined and designated as Special Concern by COSEWIC in April 2010.

Additional Sources of Information:

Recommended Status and Reasons for Designation

Recommended Status: Special Concern	**Alpha-numeric code:** NA
Reasons for designation: This small freshwater fish is restricted to a small number of locations (nine) within the Flathead River basin in southeastern British Columbia. It is sedentary as an adult and is particularly susceptible to habitat degradation from road building and associated use.	

Applicability of Criteria

Criterion A: Not applicable. No quantitative data on trends in population sizes.
Criterion B: Not applicable. Although EO is < 5,000 km², IAO 1x1 < 500 km², and the number of locations < 10 (9), there is no evidence of continuing declines or of fluctuations in any of the indices to support sub-criteria b(i-v) or c(i-iv), respectively.
Criterion C: Not applicable. No estimates of past or present population sizes available.
Criterion D: Not applicable. Population sizes unknown and distribution exceeds criterion.
Criterion E: Not available.

COSEWIC HISTORY

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

COSEWIC MANDATE

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

COSEWIC MEMBERSHIP

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

DEFINITIONS
(2010)

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

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

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

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

Environment Canada / Environnement Canada
Canadian Wildlife Service / Service canadien de la faune

Canada

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

COSEWIC Status Report

on the

Rocky Mountain Sculpin
Cottus sp.

Westslope Populations

in Canada

2010

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Figure 2. The geographic distribution of the westslope DU of the Rocky Mountain Sculpin, *Cottus* sp., in British Columbia and adjacent intermountain Montana 9

Figure 3. The distribution of the westslope DU of the Rocky Mountain Sculpin, *Cottus* sp., in British Columbia. The black circles indicate Rocky Mountain Sculpin(s). 15

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Table 1. Genetic distances among the sculpins discussed in the text. The distances are uncorrected and based on 1140 base pairs of cytochrome *b* sequences (mitochondrial DNA, McPhail unpublished data)........................... 5

WILDLIFE SPECIES INFORMATION

Name and classification

Kingdom:	Animalia
Phylum:	Chordata
Class:	Actinopterygii
Order:	Scorpaeniformes
Family:	Cottidae
Scientific name:	*Cottus* sp.

Common names:
English
(for the species): Rocky Mountain Sculpin (Nelson, J.S., pers. com.).
(for the Designatable unit): Rocky Mountain Sculpin Westslope populations

French
(for the species): Chabot des montagnes Rocheuses.
(for the Designatable unit): Chabot des montagnes Rocheuses populations du versant ouest.

Taxonomic history

Common name

Confusion about the “official” common name of the Rocky Mountain Sculpin is inextricably tangled with confusion about the species’ taxonomic history; however, some variant of the name “Rocky Mountain Sculpin” has been used for this species for at least 70 years. Schultz (1941) called the sculpins on both sides of the Continental Divide in Glacier National Park (Montana) the Rocky Mountain Bullhead, and Weisel (1957) referred to this species in the Flathead River, Montana, as the Rocky Mountain Mottled Sculpin. The first use of “Eastslope Sculpin” as a common name for this species was in an unpublished Ph.D. thesis (Neely 2002). Later, the name “Eastslope Sculpin” was used as a provisional common name in a status report on the eastslope designatable unit (DU, COSEWIC 2005). At the time, however, there was confusion about whether the sculpins in southwestern Alberta and southeastern BC were the same, or different, species. Once it became clear (see Table 1 and below) that the sculpins on both sides of the Continental Divide were the same species, the common name “Eastslope Sculpin” was deemed inappropriate (because the fish occurs on both sides of the Continental Divide) and the older common name, Rocky Mountain Sculpin, was resurrected. Still, the sixth edition (2004) of the American Fisheries Society’s *Common and Scientific Names of Fishes from the United States, Canada, and Mexico* does not recognize either “Eastslope Sculpin” or “Rocky Mountain Sculpin” as the “official” common name for this species. Nonetheless, the chairman of the American Fisheries Society Common Names Committee is confident (Dr. J.S. Nelson, pers. com. 2009) that the official common name will be Rocky Mountain Sculpin in the next edition of the

Common and Scientific Names of Fishes. Consequently, the appropriate common name for the species is Rocky Mountain Sculpin, and the appropriate names for the two Canadian DUs are the eastslope DU and the westslope DU.

Table 1. Genetic distances among the sculpins discussed in the text. The distances are uncorrected and based on 1140 base pairs of cytochrome *b* sequences (mitochondrial DNA, McPhail unpublished data)*.

	1)	2)	3)	4)	5)	6)	7)	8)
1) *C. bairdii*	-----							
2) AlbertaRMS	0.038	-----						
3) MontanaRMS	0.038	**0.000**	-----					
4) FlathdRMS	0.038	**0.000**	**0.000**	-----				
5) Shorthead	0.048	0.033	0.033	0.033	-----			
6) SlimyCol	0.035	0.023	0.024	0.024	0.036	-----		
7) SlimyUM	0.044	0.023	0.024	0.024	0.037	0.027	-----	
8) *Leptocottus*	0.082	0.080	0.080	0.080	0.082	0.081	0.084	-----

* *Leptocottus* is a marine genus of sculpin (Kinziger *et al*. 2005). *Cottus bairdii* is the "real" Mottled Sculpin from Ontario; the eastslope Rocky Mountain Sculpin DU is represented by two samples: (AlbertaRMS) from the St. Mary River a South Saskatchewan drainage, and MontanaRMS from Ruby Creek, an upper Missouri drainage stream in Montana; the westslope Rocky Mountain Sculpin DU (FlatheadRMS) is Sage Creek (Flathead River); the Shorthead Sculpin (*C. confusus*) is from Beaver Creek near Trail, BC; slimyCol is the Columbia form of *Cottus cognatus* from above the barriers on Koch Creek (Slocan system), and slimyUM is *C. cognatus* from an upper Mississippi tributary in Wisconsin (Genbank AF549120, Kinziger and Wood 2003). The genetic distances between the eastslope and westslope DUs of Rocky Mountain Sculpins are highlighted in bold face.

Scientific name

The Rocky Mountain Sculpin's status as a biological species has been confused with at least three other taxa with attendant complications for its taxonomy. Although, in the past, the Rocky Mountain Sculpin was called the Mottled Sculpin it is not *C. bairdii.* Rather, The Mottled Sculpin is an eastern North American species while the Rocky Mountain Sculpin is a western member of a distinctive sculpin lineage, the Uranidea (Kinziger *et al.* 2005). The Uranidea consists of a group of sculpins that evolutionarily are more closely related to one another (a "clade") than they are to sculpins in other groups. The Mottled Sculpin (*Cottus bairdii*) is also a member of the Uranidea and, at one time or another, most of the western members of this clade were viewed as either conspecific with *C. bairdii* or as a subspecies of *C. bairdii* (Bailey and Bond 1963; Brown 1971; COSEWIC 2001). Thus, the Rocky Mountain Sculpin's taxonomic history is as convoluted as the history of its common name. Also, in the past, the name "Rocky Mountain Sculpin" was used for a different western North American member (*Cottus punctulatus*) of the Uranidea. *Cottus punctulatus* was originally described by Gill (1861) from the headwaters of the Green River in Wyoming (Colorado drainage system); however, outside the Colorado River drainage, it is not always clear to what biological species the name was applied. For example, Bajkov (1927) recorded a sculpin with palatine teeth from the Athabasca and Maligne rivers near Jasper, Alberta, as *C. punctulatus*. Nelson and Paetz (1992) argue, however, that the identity of Bajkov's sculpin is uncertain and, although the only member of the Uranidea in this area (the Slimy Sculpin, *Cottus cognatus*) normally lacks palatine teeth, some Slimy Sculpins in Alberta apparently have palatine teeth. Consequently, they suggested that Bajkov's sculpin might have been a Slimy Sculpin with palatine teeth. Later, Schultz (1941) used the common name "Rocky Mountain Bullhead" for sculpins from streams on both sides of the Continental Divide in Glacier National Park, Montana, and he identified them as *C. punctulatus*. Because these records are from within the geographic range of the species now known as the Rocky Mountain Sculpin, Schultz's sculpins probably were this undescribed species (Neely 2002). More recently, Bailey (1952), Weisel (1957), and Brown (1971) treated *C. punctulatus* as either a subspecies of *Cottus bairdii* (*C. bairdii punctulatus*) or as conspecific with *C. bairdii*. *Cottus punctulatus* is not listed in the most recent edition of the American Fisheries Society list of the common names of fishes (Nelson *et al.* 2004); however, Neely (2002) argues that *C. punctulatus* is a valid species, but that its range is restricted to the northern headwaters of the Green River in Wyoming. Consequently, it is unlikely that any of the records of *C. punctulatus* from Canada (southwestern Alberta and southeastern BC) are valid. Neely (2002) used the common name "Colorado Sculpin" for *C. punctulatus*.

The eastslope DU of the Rocky Mountain Sculpin (Saint Mary and Milk rivers) was the subject of an *Alberta Wildlife Status Report* and provisionally identified as *Cottus bairdi punctulatus* (Pollard 2004): however, a later Assessment and Status Report (COSEWIC 2005) referred to this sculpin as the "Eastslope" Sculpin, *Cottus* sp. In May 2005 the eastslope DU was designated as threatened by COSEWIC. Given the recent assessment and status designation of the eastslope populations, the present report deals only with the westslope DU of the Rocky Mountain Sculpin, and the eastslope populations in Alberta, and in upper Missouri tributaries in Montana and Wyoming, are discussed only in the section on Designatable Units.

In BC and intermountain Montana (Montana west of the Continental Divide), the taxonomic history of the Westslope DU Rocky Mountain Sculpin in the Flathead River system is similar to that of the eastslope DU; however, it is slightly complicated by the presence of a superficially similar sculpin—the Slimy Sculpin—in the Flathead River. Because the Montana Fisheries Information System does not distinguish between sculpin species, this uncertainty creates problems in constructing distribution maps outside Canada. Consequently, the locations on the distribution maps in this report are only for sites where there is little doubt about the species identification of individual occurrences.

In 1941, Schultz reported the Rocky Mountain Sculpin (as *Cottus punctulatus*) from seven sites tributary to the North Fork of the Flathead River and seven sites tributary to the Middle Fork of the Flathead River. In 1961, McAllister and Lindsey reported a sculpin from the Flathead River in BC as *Cottus* sp. and suggested that it might be an undescribed species. In 1963, Bailey and Bond described a new species, *Cottus confusus*, from the Salmon River (a Snake River tributary in Idaho). In their description of this species, and its geographic range, they included morphometric and meristic data from nine sites on the North Fork of the Flathead River (two from BC and seven from Montana) as well as two sites from the Middle Fork of the Flathead River. The common name they suggested for this new species was the Shorthead Sculpin.

In 1984, Hughes and Peden published data on the morphology and ecology of the westslope DU of the Rocky Mountain Sculpin under the name *C. confusus*. Later, however, Peden *et al.* (1989) argued that the Flathead sculpin probably was not *C. confusus*, and Cannings and Ptolemy (1998) listed the BC Flathead specimens as *C. bairdii*. Recently, molecular sequencing has started to clarify sculpin systematics, and in a comprehensive study of the western North American sculpin species that belong to the Uranidea clade, Neely (2002) concluded that the *C. bairdii*-like sculpins on both the eastslope (southern Alberta, eastern Montana, and northwestern Wyoming) and westslope (Flathead system in BC and intermountain Montana) of the Rocky Mountains were all the same undescribed species. Data from unpublished molecular studies support the conclusion (see Table 1 and Taylor and Gow 2008) that the Rocky Mountain Sculpin is a species distinct from both the eastern North American *C. bairdii* and the western North American Columbia Sculpin (*C. hubbsi*) and Shorthead Sculpin (*C. confusus*). Neely (2002) provides a diagnosis of this new species, a description of its geographic range, and a manuscript scientific name. Under the International Rules of Zoological Nomenclature, however, this scientific name cannot be used until it is formally published. Thus, for now, although we do know that the Rocky Mountain Sculpin is a species distinct from the Mottled (*C. bairdii*), Shorthead (*C. confusus*) and Colorado (*C. punctulatus*) sculpins, the scientific name of the Rocky Mountain Sculpin in the Flathead River in BC is back to where it started with McAllister and Lindsey (1961) as *Cottus* sp.

Morphological description

<u>Diagnosis</u>

The Rocky Mountain Sculpin westslope DU is usually separated spatially from the Slimy Sculpin (*Cottus cognatus*) in the Flathead River; however, their distributions overlap at some sites in the upper portions of the river, 24-28 km upstream of the US border (see Figure 1, 2). Morphologically, the Rocky Mountain Sculpin is distinguished from the Slimy Sculpin by the presence of palatine teeth (absent in *C. cognatus*) and the absence of axillary scales (present in *C. cognatus*).

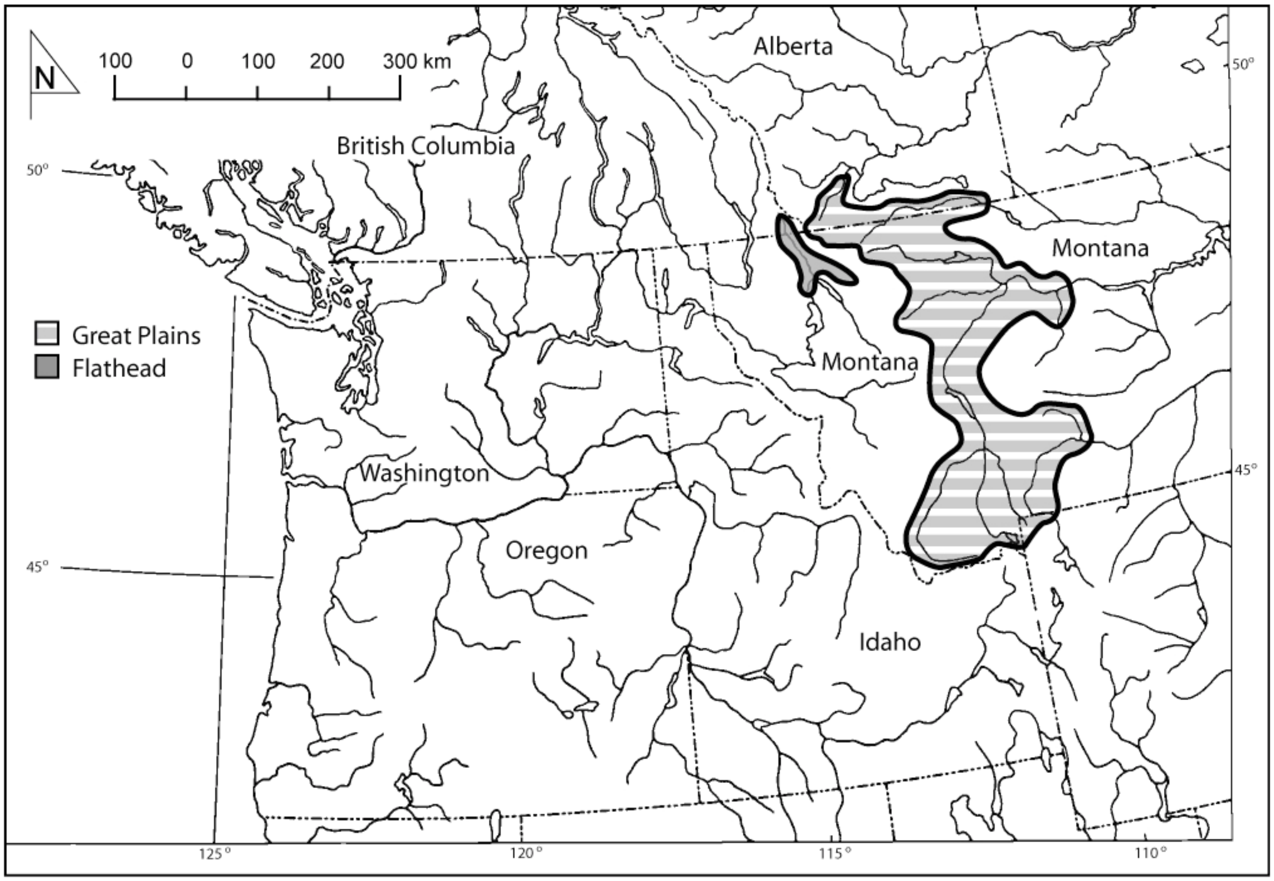

Figure 1. The global distribution of the Rocky Mountain Sculpin, *Cottus* sp. On the legend, Great Plains refers to the eastslope DU in Alberta (St. Mary and Milk rivers) and adjoining populations in the upper Missouri system in the US Flathead refers to the westslope DU and adjoining populations in the US portion of the Flathead River.

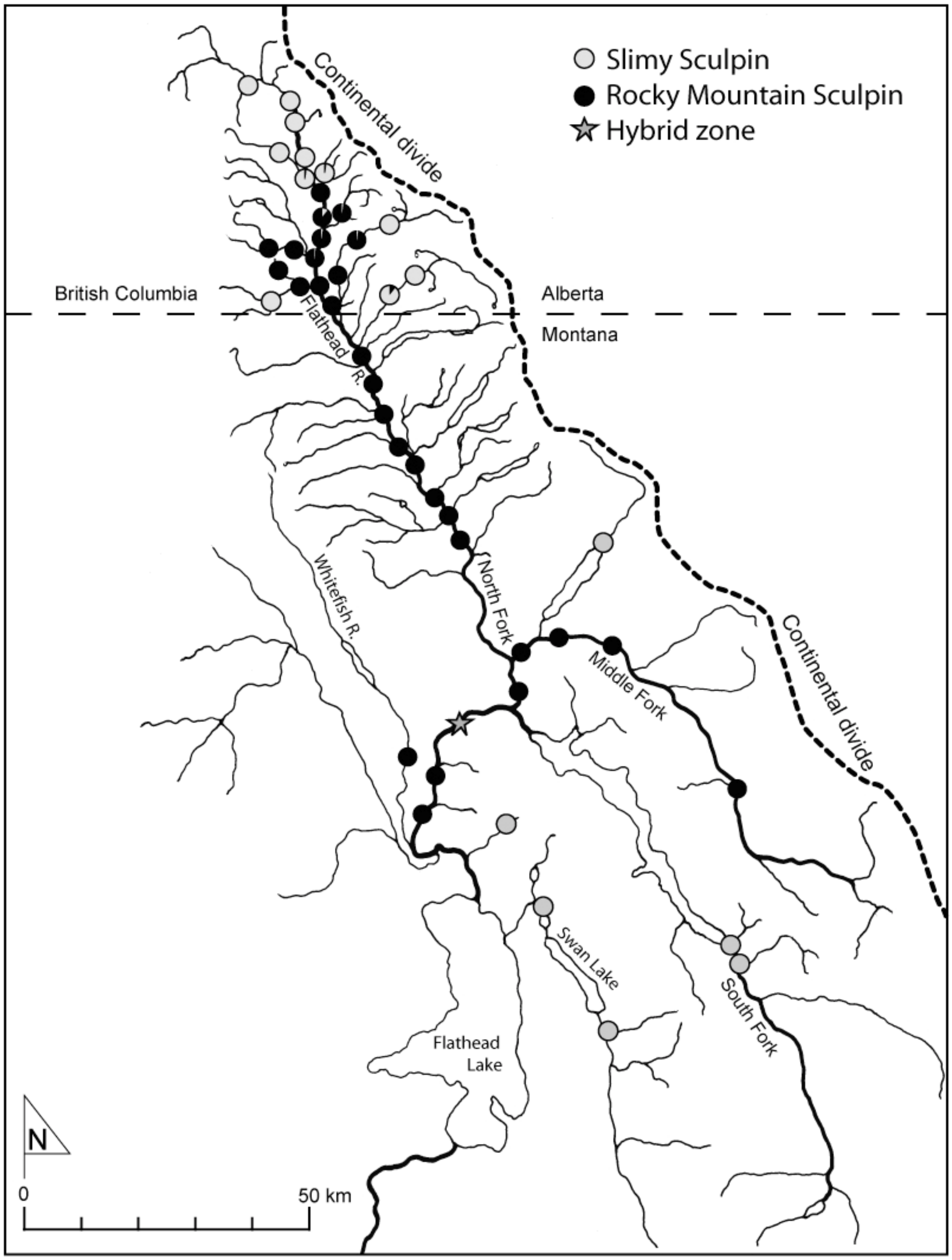

Figure 2. The geographic distribution of the westslope DU of the Rocky Mountain Sculpin, *Cottus* sp., in British Columbia and adjacent intermountain Montana. The black circles indicate Rocky Mountain Sculpin(s), the grey circles indicate Slimy Sculpin(s), and in the circles (pie charts) that contain both black and grey, the proportions of black and grey represent the proportions of the two species at that site. The grey star indicates the hybrid zone in Montana. The map is modified from Zimmerman and Wooten (1981), and Hughes and Peden (1984).

Description

The following description of the westslope DU of the Rocky Mountain Sculpin is based on specimens from the Flathead River in British Columbia but, presumably, it also fits specimens of this species from the Flathead River system in the intermountain region of Montana. In general body shape, the westslope DU of the Rocky Mountain Sculpin resembles most other sculpins in the genus *Cottus* (see cover illustration). Head length (HL) goes 3.1-4.4 times into standard length (SL), mouth width goes 4.2-6.0 times into SL, and the caudal peduncle depth goes 12.7-15.0 times into SL. There are two median chin pores and usually a single postmaxillary pore. The first and second dorsal fins usually are weakly conjoined, with 8 or 9 spines in the first dorsal fin and 17-19 rays in the second dorsal fin. There are 12-14 (usually 13 or 14) anal rays and 13-15 (usually 14) pectoral rays. Pelvic fins have 1 spine and 4 rays. The lateral line is incomplete and has 20-25 pores. The pectoral axial is usually without prickles but occasionally there are 1, or rarely 2, axial prickles. Palatine teeth are present but are not connected to the vomerine tooth patch. The occipital region usually is covered with small, fleshy papillae (nubbles).

Colouration is variable but the back usually is dark (brown or olive) with slightly darker, indistinct saddles under the soft dorsal fin, and the lower flanks usually are pale. In breeding males the first dorsal fin is black with a yellow or orange edge and the body often is black. In non-breeding adults the first dorsal fin has two dark spots (one anterior and one posterior) that usually are partially coalesced.

Spatial population structure and variability

Allozymes

Two allozyme studies are available on sculpins in the Flathead River: one study is from the BC portion of the river, and the other from the Montana portion of the river. The BC study (COSEWIC 2001) summarizes data from a manuscript attributed to Ruth Withler (Department of Fisheries and Oceans) and Alex Peden (Royal BC Museum); the Montana study is published (Zimmerman and Wooten 1981). The focus of the BC study was on the relationships among the sculpins in western Canada that were formerly known either as *Cottus bairdii* or as subspecies of *Cottus bairdii* (i.e., the eastslope and westslope DUs of the Rocky Mountain Sculpin, and two putative subspecies of *Cottus bairdii*). At the time, the eastslope and westslope DUs of the Rocky Mountain Sculpin were thought to be *C. b. punctulatus*, and the sculpins in the Columbia, Kettle and Similkameen rivers were thought to be *C. b. hubbsi*. The analysis in the COSEWIC (2001) status report supports the view that the eastslope and westslope DUs represent the same species: Nei's genetic distances between the westslope DU and the eastslope DU ranged from 0.03 to 0.05. The same analysis found evidence of hybridization between the Rocky Mountain Sculpin and the Slimy Sculpin at the upstream end of the contact zone between the two species.

The Montana study was directed primarily at distinguishing Rocky Mountain Sculpins (in their study referred to as the shorthead sculpin, *C. confusus*) from Slimy Sculpins. With the exception of one site below the confluence of the North and Middle forks of the Flathead River just downstream of the Hungry Horse Dam on the Middle Fork, there were five loci with fixed differences between the Rocky Mountain Sculpin and the Slimy Sculpin. The authors interpreted the one site where the normally fixed alleles were polymorphic as a narrow hybrid zone, and suggested that the hybridization was a result of the disturbance of the natural hydrographic and temperature regimes below the dam. Taylor and Gow (2008), however, reported one hybrid in their study of genetic variation in these two species in Canadian portions of the Flathead River which suggests that hybrid zones may also form naturally.

Mitochondrial DNA

Genetic distances (Table 1) based on 1,140 base pair sequences of the cytochrome *b* gene were calculated for Rocky Mountain Sculpin from the eastslope DU (St. Mary River, Alberta), northeastern Montana (Ruby Creek), and the westslope DU in the Flathead River system (Howell and Sage creeks, BC) and compared to those of several other species. The sequence differences between the Rocky Mountain Sculpin populations on the east and west sides of the Continental Divide are small (Table 1) and typical of populations that have diverged postglacially (e.g., genetic distances of less than 0.5%). In contrast, the genetic distances between Slimy and Rocky Mountain sculpins are large (>3%) and typical of species that diverged 2-3 million years ago. In addition, Taylor and Gow (2008) examined mitochondrial and nuclear DNA sequences from a further 11 Rocky Mountain Sculpin sampled from the eastslope and westslope DUs and reported virtually identical results; 0-0.21% mtDNA divergence between Rocky Mountain Sculpin DUs and 3.5-3.7% between Rocky Mountain and Slimy sculpins, and up to 7% compared to sculpins outside the *bairdii* group. Genetic distances among recognized *Cottus* species that are based on mitochondrial sequences typically range from 2.5-6.0% (Yokoyama and Goto 2005; Yokoyama *et al.* 2008). Further, both eastslope and westslope DUs shared identical s7 intron (nuclear DNA) sequences that were distinguished from the Slimy Sculpin by 17 base substitutions and a 150 base pair deletion in the latter species (Taylor and Gow 2008).

Summary of genetic studies

With one exception, the allozyme data indicates that there are only minor (interpopulation) differences among the samples from the eastslope and westslope populations of Rocky Mountain Sculpin. The exception is a sample from a Missouri tributary in Montana. The genetic distance (allozymes) of this sample from the other Rocky Mountain Sculpin samples was 0.10 (Zimmerman and Wooten 1981). It is important to put this genetic distance estimate in perspective. First, Nei's genetic distances of 0.10 or less are typical of those found among fish populations within circumscribed geographic regions (Avise 1994). Second, Nei's genetic distance assumes allozymes are selectively neutral, but the frequency of alleles at any locality can reflect founder effects, genetic drift, or a response to local selection. In contrast, differences in mitochondrial haplotypes do indicate phyletic divergence and the mitochondrial differences between the westslope and eastslope DUs (including an upper Missouri tributary, Ruby Creek, from eastern Montana) are small (typically < 0.5%).

Consequently, the genetic evidence argues that the Rocky Mountain Sculpin in southwestern Alberta and southeastern BC are not only the same species but also that the depth of their divergence is consistent with a postglacial separation of the two DUs. Nonetheless, an allozyme study (COSEWIC 2001) did detect a slight divergence between the westslope DU and the eastslope DU; however, the divergence between two eastslope populations (one in Alberta and one in Montana) is twice as large (0.10) as the divergence (0.05) between the two Canadian DUs. Thus, both the allozyme and mitochondrial evidence argue for a relatively recent connection between the Flathead and upper Missouri rivers. One possibility is Summit Lake in Marias Pass, Montana. Historically, this lake had two outlets—Bear Creek that flowed west into the Flathead system, and Summit Creek that flowed east into the upper Missouri system. Apparently, this two-way connection was severed during the construction of the Great Northern Railroad (Schultz 1941). There is no evidence that the Rocky Mountain Sculpin actually used this specific dispersal route; however, this documented postglacial connection does establish that, within the known range of the Rocky Mountain Sculpin, postglacial drainage connections across the Continental Divide did exist.

Designatable units

COSEWIC guidelines provide three criteria that may be considered to establish whether an entity is discrete. 1) Genetic evidence (e.g., inherited morphological or behavioural traits, and genetic markers). 2) Substantive range disjunctions that limit the possibility of recolonization from one entity to another, and 3) populations occupying different eco-geographic units (e.g., different ecozones or biogeographic zones). Two of these criteria indicate that the westslope (BC) populations of Rocky Mountain Sculpin satisfy the “discrete” criterion: 1) there is a clear, albeit small, range disjunction (the westslope and eastslope DUs are on opposite sides of the Continental Divide), and 2) the westslope DU occupies a different National Freshwater Biogeographic Zone, NFBZ (Pacific NFBZ) than does the Eastslope DU (Saskatchewan-Nelson NFBZ and the Milk River NFBZ). Although the available genetic evidence indicates that the existing range disjunction is postglacial, this disjunction now prevents gene flow between the DUs on opposite sides of the Continental Divide. The significance of this discreteness rests on the distinct character of the watersheds within the different NFBZ that the Rocky Mountain Sculpin occupy in the two DUs. The Westslope DU is found in a single watershed (the Flathead River) within the Rocky Mountains with a distinct biogeoclimatic character and a distinct suite of potential predators and competitors that can be expected to have led to potential local adaptations or other unique biological characters. For instance, Slimy Sculpins are present in the Flathead River system, but not within the range of the eastslope DU. This sympatry between two species in the westslope DU has led to hybridization between the two species (Taylor and Gow 2008, see also Zimmerman and Wooten 1981 for westslope US populations). Second, the loss of the westslope DU would result in a substantial reduction in the range of the Rocky Mountain Sculpin—they would be lost from the westslope of the Continental Divide in Canada.

In summary, designating the westslope (BC) population of the Rocky Mountain Sculpin as a separate Designated Unit is justified by the complete separation of the eastslope and westslope populations, and the presence of the westslope population in a different (Pacific) NFBZ, and the evolutionary, ecological, and distributional significance of this discreteness. Consequently, the following discussion focuses on the westslope DU except when no data are available on the westslope DU but there is appropriate information on populations from the east side of the Rocky Mountains. In such cases, the sources of the information are clearly identified.

Special significance

The Rocky Mountain Sculpin (*Cottus* sp.) is an undescribed western member of the Uranidea sculpin clade. It has a limited distribution in both Canada and the United States. In Canada it is found in the St. Mary and Milk river systems on the southeastern flanks of the Rocky Mountains in Alberta and, west of the Continental Divide in BC, it occurs only in the lower 28 km of the Flathead River. East of the Continental Divide in the US, this species occurs in most headwaters of the Missouri River system but its range does not extend far out onto the Great Plains (Figure 1). West of the Continental Divide it is confined to the North and Middle forks of the Flathead River in BC and Montana (Figure 2). Thus, its distribution is not only limited but is also unique—no other of the estimated 2,365 freshwater fish species in Canada and the continental US (Nelson *et al.* 2004) has a similar geographic distribution.

The species is also of scientific interest. Its unique distribution provides an opportunity to document divergence rates among sculpin populations in similar environments but on different sides of the Continental Divide. Additionally, for the westslope DU, the distribution of sculpins within the Flathead system—Slimy Sculpin in the upper river and the upper portions of tributary streams, and Rocky Mountain Sculpin in the lower part of the main river and lower reaches of tributary streams—provide a replicated series of undisturbed contact zones. Such contact zones are of great significance in attempts to understand the ecology and evolution of species coexistence (e.g., Jiggins and Mallet 2000).

Nationally, as a genetically distinct species with a limited Canadian distribution, the Rocky Mountain Sculpin is an important component of our biological heritage. For the westslope DU, its distribution is unlike that of any other BC fish—restricted to the last relatively pristine large watershed in southeastern BC. This makes it a special component of the BC freshwater fish fauna.

DISTRIBUTION

Global range

The Rocky Mountain Sculpin is endemic to both the east and west slopes of the Rocky Mountains. Its global EO (Extent of Occurrence) is estimated (by the polygon method) to be 10,200 km^2 (Figure 1). The westslope DU is confined to the Flathead River system draining the western slope of the Rocky Mountains. It is present in the North and Middle forks of the Flathead River, but is absent from the river's South Fork, and from Flathead Lake and northwest Montana (Figure 2). The westslope DU's global EO is estimated to be about 1,300 km^2 (about 10% of the global EO of the species). The difference in the extent of the species' range on the two sides of the Rocky Mountains, as well as the lack of major genetic differences between the Rocky Mountain Sculpins on either side of the Continental Divide (see below), suggest that the colonization of the Flathead River is a Holocene event. Additionally, these data suggest that colonization proceeded in an east–west direction; from the unglaciated portions of the upper Missouri River system into the glaciated Flathead drainage system.

Canadian range

Although the Rocky Mountain Sculpin occurs on both sides of the Continental Divide, its Canadian range is not large. On the west side of the Rocky Mountains, the westslope DU occupies about 28 km of the lower Flathead River. In addition, it occurs in the lower reaches of the following Flathead River tributaries: Kishinena, Sage, Couldrey, Burnham, Howell, Cabin, Commerce, Middlepass (Haig), and Harvey creeks. Of the nine lower Flathead tributaries known to contain westslope Rocky Mountain Sculpin, two are tributaries to larger creeks: Couldrey Creek is a tributary of Burnham Creek, and Cabin Creek is a tributary of Howell Creek. In Canada, the EO of the westslope DU is estimated to be 270 km^2 (compared to 2,600 km^2 for the eastslope DU). The IAO of the westslope DU is estimated to be 148 km^2 using a 2x2 km grid and 78 km^2 when using a 1x1 km grid overlay. In the Flathead River, westslope Rocky Mountain Sculpins are the only sculpin found in the first 10 km of the mainstem upstream of the US border. From about 10 km up to about 24 km above the border, westslope Rocky Mountain Sculpin are still the numerically dominant sculpin in the mainstem; however, the frequency of Slimy Sculpins (*C. cognatus*) gradually increases in the upstream direction. At about 24 km there is a relatively abrupt increase in the frequency of Slimy Sculpins, and by about 28 km above the border the Slimy Sculpin is the only sculpin species found in the mainstem. Thus, in the main river, Slimy Sculpins completely replace westslope Rocky Mountain Sculpins over a distance of about 4 km (Figure 3). The westslope DU has been collected from 16 sites within the Flathead River drainage (Figure 3). These sites constitute an estimated ten populations: the mainstem Flathead River and nine tributary streams (Figure 3) and an estimated nine distinct locations. Two sites, the mainstem Flathead River and Harvey Creek are considered a single location because the latter collection site is within 50 m of the mainstem Flathead River and possible mining developments would affect the entire mainstem Flathead River and the Harvey Creek site (see **Threats and Limiting Factors** section below).

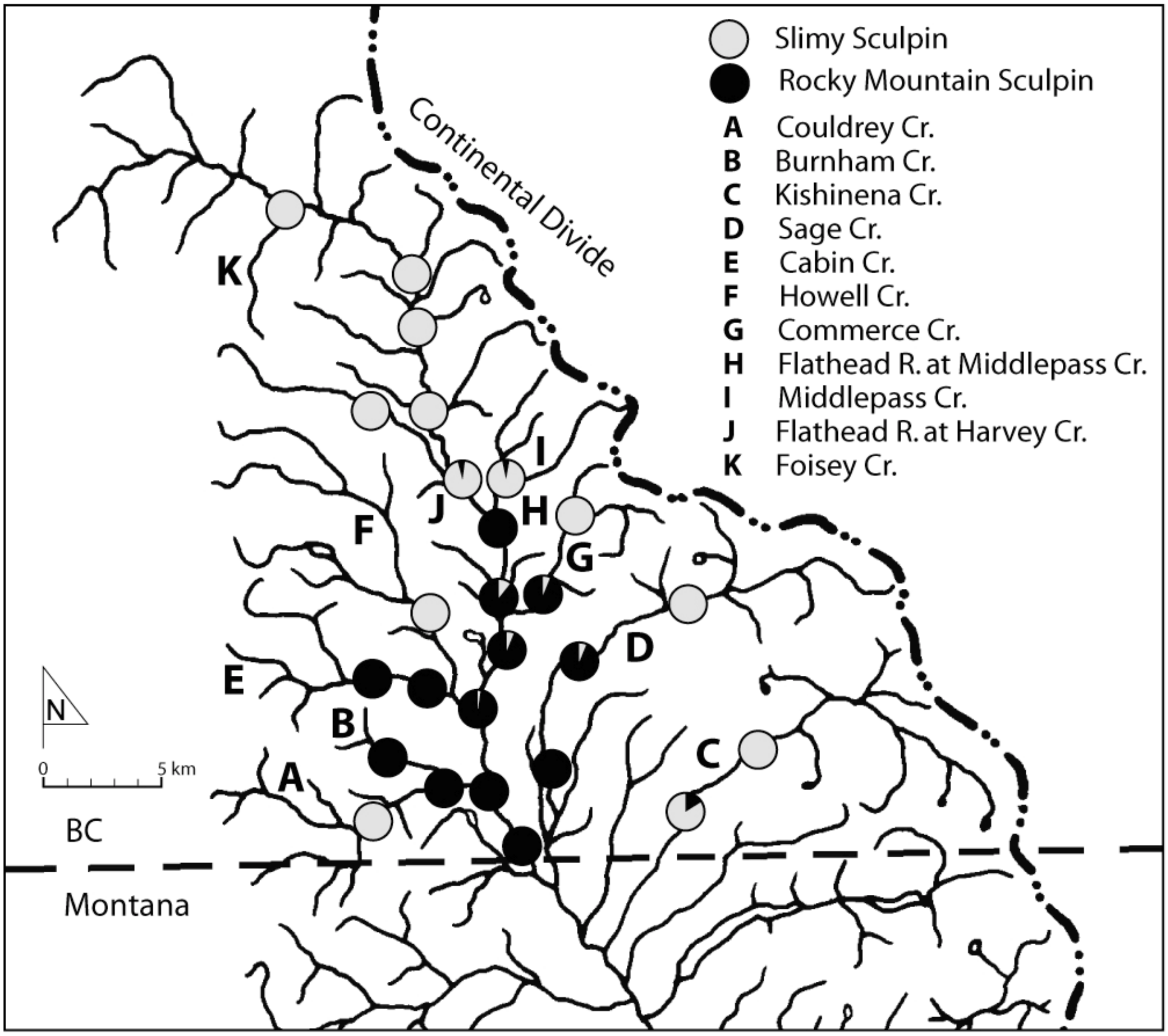

Figure 3. The distribution of the westslope DU of the Rocky Mountain Sculpin, *Cottus* sp., in British Columbia. The Black circles indicate Rocky Mountain Sculpin(s). The grey circles indicate Slimy Sculpin(s), and the black and grey circles represent the proportions of the two species at a site (modified from Hughes and Peden 1984).

HABITAT

Habitat requirements

Little is known about the habitat requirements of the westslope Rocky Mountain Sculpin, and most of the quantitative information that is available pertains to the eastslope (Alberta) DU or US populations on the east side of the Continental Divide. Two studies stand out: Bailey (1952) and R.L.&L. (2002). Bailey's study (published as *C. bairdi punctulatus*) included the West Gallatin River, Prickly Pear Creek, and Wolf Creek (all in the Missouri drainage system in Montana). The R.L.&L. study covers the eastslope (Alberta) DU and included the St. Mary (South Saskatchewan River system) and the Milk (Missouri River system) rivers in Alberta. Both of these studies indicate that Rocky Mountain Sculpins are most abundant in riffle and run habitats containing rocks, rubble, and boulders. In contrast, they are rare in pools and areas with silt or sand substrates. Also, both studies found that this species was most abundant in relatively shallow water (< 20 cm, Bailey 1952; 5-42 cm, R.L.&L. 2002) with low surface velocities (0-0.6 ms^{-1}). Generally, the descriptions of habitat use by Rocky Mountain Sculpins in the westslope DU (Hughes and Peden 1984; Peden and Hughes 1984; McPhail 2007) agree with those described for the eastslope DU from Alberta.

Although these habitat descriptions are useful in locating Rocky Mountain Sculpins, a few caveats are necessary. First, most fluvial sculpins are nocturnal, and the Rocky Mountain Sculpin is no exception. They spend most of the daylight hours sheltering in or on the substrate, and most collections are made during the daylight. Consequently, typical representations of habitat actually are descriptions of the daytime sheltering habitat, and how this equates to habitat use in general is largely unknown. Only a few casual nocturnal observations are available, but in both the St. Mary (eastslope DU) and Flathead (westslope DU) rivers adult Rocky Mountain Sculpins were active at night in quiet water areas < 20 cm deep (McPhail 2007). Second, most observations pertain to adults or subadults and, generally, in sculpins young-of-the-year are segregated from adults by depth and proximity to shore. This segregation is probably driven by predation (adults on young) rather than differences in habitat preference (Freeman and Stouder 1989). Third, no winter habitat observations are available for this species and, in the Flathead Valley where winter air temperatures often are less than - 30ºC, suitable overwintering sites may be crucial to the survival of the westslope DU.

In summary, the available habitat descriptions for this species provide a fairly clear picture of where adults are found during daylight hours in the summer and late fall; however, there is little information on the seasonal habitat requirements of this species or the requirements of different life history stages. Thus, for this species, there is an almost complete lack of the quantitative field observations, enclosure experiments, and laboratory physiological studies that have proven to be indispensable in establishing critical habitat requirements of other stream fishes (e.g., salmonids).

Habitat trends

Although the Flathead River is often cited as the last remaining pristine large river in southeastern BC (Angelo 2008), there has been commercial logging and mining activity in the Flathead Valley since the late 1890s. Nonetheless, the impacts of these small-scale operations on the westslope DU appear to have been minor, but this could change. The BC portion of the Flathead drainage basin is not large (about 1,130 km^2) and several large-scale projects have been proposed, or are in the development stage, in the valley (see **Threats and Limiting Factors**). Cumulatively, these large-scale projects and their associated infrastructure have the potential to change the ecology of the river.

The first collections of Rocky Mountain Sculpins in the Canadian portion of the Flathead River were made in 1955 and a large collection (> 100 sculpins was made in 1957 (UBC Fish Museum records UBC 55-0277 and UBC 57-0327)). These early samples were taken at sites that have been re-collected in the 1980s, 1990s, and in the early 2000s. The sparse biophysical data recorded from the earliest collections corresponds closely to the present biophysical conditions. This suggests that there have been no major changes in the river over the ensuing 53 years. This is in spite of a considerable increase in recent years in the extent of logging, exploratory drilling, and road building in the valley.

Habitat protection/Ownership

Although most of the Flathead Valley is Crown land under provincial jurisdiction, the federal *Fisheries Act* provides general protection for aquatic habitats in the Flathead Valley and, thus, the Rocky Mountain Sculpin. The existing provincial land use plan (ILMB 2009) encourages development in the valley (e.g., timber extraction, coal extraction, mining, and recreational use—hunting, fishing, ATVs, and snowmobiling). Although development is encouraged, all major development proposals are subject to environmental review. In addition, there are protected areas in the valley and also areas with special designations (see the section on **Existing Protection or other Status Designations**). Depending upon the type, magnitude and potential impacts of proposed projects, assessments under the *Canadian Environmental Assessment Act* also may be required; one of the objectives of this Act is to ensure there are no significant environmental impacts.

There is little private ownership in the Flathead Valley. A 9.9 km^2 block—the Flathead Townsite—is owned by the primary forestry company operating in the valley. In 2004, the company signed an agreement with the Nature Conservancy of Canada to abstain from the subdivision and residential development of this property for ten years. In addition, in 2002, the Nature Conservancy purchased the only other private land in the lower valley (a 1 km^2) site near the US border.

BIOLOGY

For an unnamed species, a surprising amount of biological information is available on the Rocky Mountain Sculpin; however, care must be taken in accessing the information because most of it is published under other specific and subspecific names (e.g., Bailey 1952 as *C. bairdii punctulatus*; Hughes and Peden 1984, Peden and Hughes 1984 as *C. confusus*, and McCleave 1964 as *C. bairdii)*. Because the Rocky Mountain Sculpin is the only western member of the Uranidea sculpin clade recorded from the geographic localities where these studies were done, the biological data presented in these studies are assignable to the Rocky Mountain Sculpin. Except for Hughes and Peden (1984) and Peden and Hughes (1984), most of the available biological information on this species pertains to populations on the eastside of the Continental Divide.

Life cycle and reproduction

Spawning period

Like other North American freshwater sculpins, the Rocky Mountain Sculpin spawns in the spring. In BC, the exact time of spawning is unknown; however, in the West Gallatin River in eastern Montana the spawning season spanned all of June (Bailey 1952) and some males were ripe (producing milt) as early as March 25. Water temperatures over this period ranged from 7.8-12.7ºC. In Alberta, Roberts (1988) observed males guarding eggs in mid-May (water temperature 7.5ºC). The natural hydrograph in the Canadian portion of the Flathead River (the westslope DU) starts to rise in April, peaks in May, and begins to decline (but is still high) in June. Unfortunately, no long-term water temperature data are available for the Canadian portion of the river; however, Clint Muhlfeld (US Geological Survey) provided daily temperature data from Flathead Townsite about 60 km upstream of the Canada/US border. The average daily temperature in April 2008 ranged from a minimum of -0.001ºC to a maximum of 0.68ºC. In May the minimum daily average was 0.58ºC and the maximum was 3.38ºC. In June the minimum daily average temperature was 2.3ºC and the maximum (reached June 30) was 9.8ºC, and the average daily temperature did not exceed 6.0ºC until June 21. If 2008 was a typical year, this temperature profile suggests that Rocky Mountain Sculpin in the Canadian portion of the Flathead River probably spawn at least a month later (in late June and July as water levels begin to decline) than the populations east of the Continental Divide.

Spawning sites

Bailey (1952) described spawning sites in the West Gallatin River as holes under rocks. Presumably, males excavated, or at least, enlarged these holes. The rocks ranged in diameter from 13-38 cm and the surface velocities over nests ranged from 0.0 to 1.4 m s^{-1}. The water depths over the nests were usually >40 cm.

Spawning behaviour

Rocky Mountain Sculpin are estimated to mature at three years of age on average with a maximum reported age of seven years (McPhail 2007). The spawning behaviour of this species has not been recorded; however, spawning activities in other species in this clade have been documented. Typically, males excavate a nest cavity and court females. The courtship is complex and involves rapid changes in male colour, acoustical, and behavioural signals (Savage 1963; Whang and Jannsen 1994). Usually, males spawn with several females. In the West Gallatin River, Bailey (1952) estimated up to five females deposited eggs in a single nest. Males fan and guard the eggs until they hatch.

Fecundity

In sculpins, fecundity varies with female size. In the westslope DU, Peden and Hughes (1984) report a maximum fecundity of 690 eggs. In the eastslope DU (Milk and St. Mary rivers), egg number usually ranges from 100-250 eggs, although exceptionally large females can contain more eggs (e.g., 437 eggs Bailey 1952, and 354 eggs, Roberts 1988).

Incubation period

At water temperatures ranging from 7.8-17.2ºC the eggs take about 3-4 weeks to hatch (Bailey 1952). The eggs are large (about 2.5 mm in diameter). If the Rocky Mountain Sculpin is like other western sculpins that produce large eggs, the larvae probably burrow into the gravel after hatching (at about 6-8 mm) and remain there for about two weeks before they emerge as miniature (about 10 mm total length) versions of the adults (McPhail 2007).

Age structure

Bailey (1952) reported data on the age structure of the West Gallatin River Rocky Mountain Sculpin population. There, they attained an average of 31.4 mm (total length) by the end of their first growing season (October) and did not grow over the winter. By May of the next year they averaged 32.5 mm and towards the end of their second growing season they reached an average of 52.9 mm. At the beginning of their third growing season about 66% of the females reached sexual maturity, and by their fourth growing season all females were mature. The oldest individuals in the population reached age five (their sixth growing season). Generally, the snippets of age structure data available for other populations (e.g., Hughes and Peden 1984 for the westslope DU, and Roberts 1988 for the eastslope DU) agree with those reported by Bailey (1952).

Herbivory/Predation

Although there are no data on the predators of westslope Rocky Mountain Sculpins in the Flathead River, potential predators (e.g., Hooded Mergansers, *Lophodytes cucullatus,* and Bull Trout, *Salvelinus confluentus*) are present within the range of this DU, and in other areas they are known to prey on sculpins. In addition, the presence of young-of-the-year (10-30 mm) sculpins in habitats that segregate them from adults and larger juveniles suggests that cannibalism (common in other sculpins) also occurs in the Flathead River.

Physiology

Although there are no data on the physiology of these sculpins, their distribution on both the east and west sides of the Continental Divide suggests that they are sensitive to temperature. In the westslope DU, they are only present in the warmest parts of the Flathead River system (although competition with Slimy Sculpin also may contribute to this distribution pattern). East of the Rocky Mountains, they extend farther out onto the Great Plains (Figure 1) than most “cool” water species. Again, however, competition from other fish species may affect their distribution.

Dispersal/Migration

The only data available on movements of Rocky Mountain Sculpins are from the US east of the Continental Divide. Bailey (1952) marked 75 Rocky Mountain Sculpins in Prickly Pear Creek (a small tributary of the upper Missouri River), Montana. Over the course of almost a year, 21 marked fish—28%—were recovered, most of them within the first three months of the study. Fifteen of the recaptures were within < 50 m of the point of first capture, and the greatest distance moved was only 145 m. Later, McCleave (1964) studied the movements of Rocky Mountain Sculpins in Trout Creek (a tributary of the East Gallatin River, Montana). Although his sample size was much larger (1,847 marked fish), the results were remarkably similar to Bailey’s. Over the fall and winter (late August to early March) McCleave recaptured 441 of his marked fish (24%). Again, most of the recaptures were made within < 50 m of the original marking site, and the maximum distance moved was 181 m. There was a slight, but consistent, tendency for the movements to be upstream rather than downstream.

Considered together, both these studies suggest that Rocky Mountain Sculpins, once settled, do not migrate far from relatively small home areas; however, neither study examined the movements of young-of-the-year and it is this age group that is most likely to disperse before settling down to a more sedentary life.

Interspecific interactions

<u>Hybridization</u>

In BC, the lower reaches of the Flathead River contain both Slimy and Rocky Mountain sculpins; however, the two species are sympatric for only about 20 km of the mainstem Flathead River (Figure 3). At its upstream end the numerically dominant species is the Slimy Sculpin, while at the downstream end, the numerically dominant species is the Rocky Mountain Sculpin Westslope DU. In between there is a gradual transition in the relative numbers of the two species, and only Rocky Mountain Sculpins occur in the final 5-10 km of the main river above the US border. Morphologically, some specimens—especially those from the upper part of the zone of sympatry—are difficult to identify as either Slimy or Rocky Mountain sculpins. This suggests the possibility that the zone of sympatry is also a hybridization zone. Additionally, there is genetic evidence (COSEWIC 2000) of hybridization between Slimy and Rocky Mountain sculpins in the area of the upstream limit of the Rocky Mountain Sculpin. This may be a natural hybrid zone. Although not as well documented, similar shifts from predominately Rocky Mountain Sculpins to predominately (or exclusively) Slimy Sculpins occur in most streams that are tributary to the lower 20 km of the of the westslope DU (Hughes and Peden 1984).

For about 110 km downstream of the US border, the only sculpin in the mainstem (called the North Fork of the Flathead River in Montana) is the Rocky Mountain Sculpin. The same appears to be true of the lower reaches of the Middle Fork and Whitefish rivers; however, the South Fork and Swan rivers appear to contain only Slimy Sculpins (Figure 2). In contrast to the possible hybrid zones in BC, there is a documented hybrid zone in the North Fork of the Flathead River in Montana, and this hybrid zone appears to be human-made. Based on allozyme data, Zimmerman and Wooten (1981) placed this hybrid zone at just downstream of the confluence of the North and South forks of the Flathead River (Figure 2). Hungry Horse Dam on the South Fork is a short distance above this confluence, and these authors suggest that changes in the thermal and hydrographic regimes downstream of the dam may have disrupted reproductive isolation between the species. Thus, both natural and human-made hybrid zones probably occur within the Flathead drainage basin.

Competitive Interactions

There are no data on competitive interactions between Rocky Mountain and Slimy sculpins in the Flathead system; however, the distribution pattern of the species in both the Canadian and US portions of the drainage basin (Figure 2) suggests that there is an interaction between these species. Whether this interaction is competitive, or a reflection of differences in habitat preferences is unknown; however, in both the mainstem of the North Fork and in tributary streams, there is a shift from Rocky Mountain to Slimy sculpins that is associated with altitude. For the westslope DU, Hughes and Peden (1984) suggested that this transition in species abundance occurs at between 1,300 to 1,400 m. At least two physical factors change with altitude: gradient and temperature. With increasing altitude, either of these factors, or a combination of both, may shift the competitive balance between the species in favour of Slimy Sculpins in the cooler upstream reaches and in favour of Rocky Mountain Sculpins in warmer downstream reaches.

Adaptability

No experimental data are available concerning the short-term adaptation limits (thermal, chemical, and velocity) above which Rocky Mountain Sculpins are unable to cope. Again, however, their limited geographic distribution on the Great Plains (Figure 1) and in the Flathead River (Figure 2) suggests that they are not especially adaptable.

POPULATION SIZES AND TRENDS

Search effort

The only semi-quantitative information on sampling effort in the westslope DU is in Peden and Hughes (1982). They electroshocked a number of riffles in August and reported an average of eight Rocky Mountain Sculpins per 100 seconds of shocking. This rate of capture was nearly half the capture rate (14 per 100 seconds) of Slimy Sculpins in the upstream portions of the river that contain only Slimy Sculpins.

Abundance

The only quantitative assessment of Rocky Mountain Sculpin population densities is from a Montana population east of the Continental Divide. McCleave (1964) made two mark and recapture estimates—a Petersen estimate, and a Schumacher-Eschmeyer estimate—in Trout Creek (Gallatin County, Montana). The estimates gave similar results and ranged from 200-237 sculpins per 47 linear m (154 ft.) of stream. Unfortunately, there are no comparative quantitative data on the abundance of the Rocky Mountain Sculpin Westslope DU. Although the species has been collected sporadically in the Flathead drainage system since 1955, the collections (even from the same site) are not comparable because the collecting techniques and effort differ. For example, one of the earliest (1957) collections in the westslope DU was made with rotenone. Later collections involved electro-shockers of different makes and models, and were made with, and without, stop-nets. Consequently, all that can be inferred about abundance is that the species is still present in the reaches of the Flathead River where it was originally collected and, at these sites, it is still easy to collect.

Fluctuations and trends

Without a time-series of population estimates or, at a minimum, a comparable set of collections, population fluctuations and trends cannot be evaluated. Nonetheless, the distribution of the species within BC has not changed since either the earliest (1955) collection, or since the Royal BC Museum survey in 1981 and 1982 (Hughes and Peden 1984; Peden and Hughes 1984). This stable distribution suggests that, in the westslope DU, there probably has not been a major change in Rocky Mountain Sculpin numbers over the last 28-30 years.

Rescue effect

Although Rocky Mountain Sculpins are relatively sedentary (see section on **Dispersal/Migration**), there are no barriers to movement (or gene flow) between the westslope DU in BC and downstream populations in Montana. Thus, in the event of localized fish kills (barring a major catastrophe that affects the entire river) immigrants from tributary streams and from downstream mainstem populations should slowly repopulate any parts of the present BC range of the species. If, however, the physical or chemical environments in the main Flathead River are permanently altered (see section on **Threats and Limiting Factors**), immigrants may fail to establish new populations.

ABORIGINAL TRADITIONAL KNOWLEDGE

Requests have been made for ATK via email in March and August of 2009, but as ATK collection and verification protocols are still being established no information has been obtained.

THREATS AND LIMITING FACTORS

Threats

Existing threats

The most immediate threat to the Flathead River habitat of the Rocky Mountain Sculpin is sedimentation from road building associated with logging and mine development and associated All Terrain Vehicle (ATV) use, especially in the upper valley upstream of the confluence of the Flathead River and McLatchie Creek. The valley bottom sediments are easily eroded and, apparently sedimentation has been a problem in the past (Doug Martin, pers. com., 2008, 2010). Although as yet unquantified, one of the greatest threats to water quality in the Flathead River Valley is from uncontrolled ATV use which is increasing dramatically (Doug Martin, pers. com., 2010).

Potential threats

The Flathead Valley contains significant coal deposits and has a history of major development proposals that blossom and wilt with changes in the international demand for coal. The Sage Creek proposal involved two open pit mines, major road and railroad (76 km of rail bed) construction, and an 85 ha town-site (Peden and Hughes 1982). This development was abandoned during the recession of the early 1980s; however, the properties were purchased in 2004 and are still listed on the company's web site. In addition, a large coal tenure is held within the area of Flathead Townsite. So far, there is no active development proposal for this site. A major coal-bed methane development proposal for the valley produced a public outcry in BC and Montana, and in February 2008 the BC government shelved the Flathead coal-bed methane proposal. Although the coal-bed methane proposal is shelved, it is not necessarily dead and there is a coal-bed methane development in the Elk River Valley located across the height of land east of the Flathead River Valley (Doug Martin, pers. com., 2008, 2010). Coal-bed methane developments generally require large terrestrial infrastructural "footprints" for well situation, access roads, and rights-of-way for pipelines. Construction of such infrastructure can cause run-off and sedimentation in surrounding watersheds. In addition, large amounts of groundwater may be required to be removed (so-called "produced" water) before coal-bed methane can be extracted, which can have negative impacts on the waterflow balance between the surface (i.e. streams) and aquifers (see Vadgama 2008 for a summary). In addition, the water extracted from aquifers during coal-bed methane operations needs to be discharged. The chemical characteristics of the "produced" water typically require that it undergo treatment before it can be discharged to local surface waters, which is an important regulatory issue (see Veil 2002).

At present, there are only two active development proposals in the valley, one for a coal mine and the other for a gold mine. If developed, both mines will involve large open pit operations. The coal mine is in the pre-approval stage (and has been since 2006). The proposed coal mine site is in the Foisey Creek Valley: Foisey Creek is a major headwater stream in the Flathead drainage system (Figure 3). The proposal involves removal of over-burden, the daily extraction of 5,480 tonnes of coal, and upgrading roads (about 40 km). The waste to coal ratio in the first five years of the project is estimated to be 5.8:1. Thus, approximately 38,000 tonnes of waste rock will be dumped every day. Not all the waste will be dumped within the Flathead drainage basin; however, in the early stages of the project most of the dumpsites will drain into Foisey Creek. Toxic levels of selenium leaching into streams are associated with coal development in the adjacent Elk River (Orr *et al*. 2006), located just west of the Flathead River, and, thus, coal development is a potential threat in the Flathead River system.

The proposed open pit gold mine is in the headwaters of another major Flathead tributary: Howell Creek. This proposal is in the early stages and, so far, consists of a series of test drillings and associated access road construction. It is not clear what technology is planned for extracting the gold from the ore but some of the commonly employed methods (e.g., cyanide floatation) are serious potential environmental threats.

Although in the short-term, the present economic downturn probably will halt development for a while, there are still public concerns (on both sides of the border) about potential development in the Flathead Valley. Because of the scale, and number of developments proposed for the Flathead Valley, in 2007 the *Outdoor Recreation Council of British Columbia* listed the Flathead River as the most endangered river in British Columbia. In 2008, however, it was moved to second place on the endangered river list. This downgrade did not stem from a perception that threats to the Flathead River had diminished but, rather, from more immediate threats to the upper Pitt River in southwestern BC (Angelo 2008). In addition, the US organization *American Rivers* ranked the Flathead as #5 of the 10 most endangered rivers in the US, citing the BC resource extraction industry specifically as a threat to downstream areas in the US (American Rivers 2009).

Limiting factors

There are no data on the factors that limit the westslope DU of the Rocky Mountain Sculpin, but inferences from the present distribution suggest that either temperature or competition with Slimy Sculpins limit both the species' distribution and, presumably, its numbers.

EXISTING PROTECTION OR OTHER STATUS DESIGNATIONS

Existing protection

The Fish Habitat section of the *Fisheries Act* provides some general protection for fishes in the BC portion of the Flathead River system. In addition, a previous COSEWIC assessment of the westslope DU of the Rocky Mountain Sculpin (as part of an assessment of *Cottus confusus*) assigned a threatened status in November 1983 (Peden and Hughes 1984). *Cottus confusus* was reassessed in 2001 (COSEWIC 2001), but the westslope DU was not included in this second assessment and thus it was not included on Schedule 1 of *SARA* at proclamation and, therefore, has no legal protection under *SARA*. The westslope DU of the Rocky Mountain Sculpin was re-examined and designated as Special Concern by COSEWIC in April 2010.

At the time of the first assessment there was a specific threat to the portion of the Flathead River occupied by the Rocky Mountain Sculpin. The company proposing the Sage Creek coal development was in the advanced stages of planning for two large open pit coalmines and associated infrastructure. The development was centred about

10 km north of the US border. Presumably, this imminent threat at the time of the 1983 assessment (as a component of the Shorthead Sculpin assessment), as well as the restricted Canadian distribution, contributed to the decision to list the species as threatened. The Sage Creek project was abandoned during the economic recession of the early 1980s, but in 2004 another company purchased the tenure.

In 2004, the BC government announced a 38,000 ha no coal-staking reserve in the lower Flathead Valley. This reserve means that about half of the known distribution of the westslope DU is no longer open to coal mining; however, the coal-staking reserve does not prohibit coal development upstream of the reserve. Recently, however, the BC government announced an agreement with the state of Montana to ban all oil, gas, and coal-bed methane and other mining developments in the upper valley (CPAWS 2010).

A provincial park (Akamina-Kishinena Park) on the southeastern edge of the Flathead Valley may provide some protection. The park covers about 11,000 ha in the Kishinena Creek watershed. Kishinena Creek drains into the Flathead River about 6 km south of the 49^{th} parallel, and the Rocky Mountain Sculpin is known to occur in its lower reaches; however, it is unlikely that this species occurs as far upstream as the park boundary (see discussion under **Canadian Range**). Nevertheless, the presence of the park probably provides some protection from environmental degradation in the Kishinena Creek watershed.

A proposal to fill what is called “the missing piece” in the chain of national parks that straddle the Canada/US border in the Rocky Mountains would align the western boundary of Waterton Lakes National Park with the western boundary of Glacier National Park in the US. This new park would add 247,000 ha to Waterton Lakes National Park—all of it in the Flathead River watershed. Thus, the potential park would protect most of the range of the westslope DU, but as yet there is no indication that the park will be established.

Non-legal status and ranks

The eastslope DU was assessed (under the common name, Eastslope Sculpin) as threatened (D2) by COSEWIC (2005). In BC, the Conservation Data Centre ranks the westslope DU as S2S3 and a species of special concern. Globally, its NatureServe rank is G5NR. The BC and NatureServe ranks, however, were based on the assumption that this species is a subspecies of *C. bairdii* and, consequently, that it is part of an abundant and widely distributed species. This is not the case and, presumably, these rankings will be reassessed when the Rocky Mountain Sculpin is given a formal taxonomic name.

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J. D. McPhail received a BA (English and Biology) from the University of British Columbia in 1957, an M.Sc. (Zoology) from UBC in 1959, and a PhD (Zoology) from McGill University in 1963. He started his career as a University Professor at the University of Washington in 1963 and moved to UBC in 1966. His early research interest was in Arctic freshwater fishes, and in 1970 he coauthored (with Dr. C.C. Lindsey) a book on the *Freshwater Fishes of Northwestern Canada and Alaska*. Throughout his career his major research interest has been the ecology, evolution, and biogeography of freshwater fishes, especially sticklebacks, but also other fishes of the inland waters of northwestern North America. He has published over 100 papers and reports on fishes, and acted as an advisor to the BC provincial government on the native fishes of BC and to BC Hydro on species at risk. In 2007 he published a book entitled *The Freshwater Fishes of British Columbia*.

COLLECTIONS EXAMINED

No collections were examined for this report. Collection records from the UBC Fish Collection are available online at www.zoology.ubc.ca/~etaylor/nfrg/fishmuseum.html.