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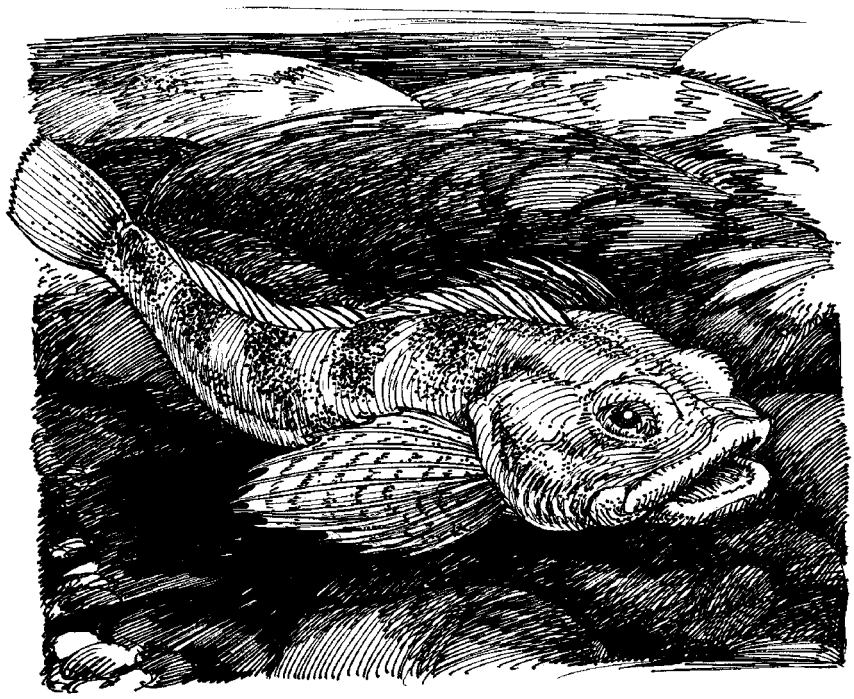
RESOURCE DATA AND SPECIES AT RISK SECTION

Status of the St. Mary Shorthead Sculpin (provisionally *Cottus bairdi punctulatus*) in Alberta



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Alberta Conservation Association

Alberta
SUSTAINABLE RESOURCE DEVELOPMENT

Status of the St. Mary Shorthead Sculpin (provisionally *Cottus bairdi punctulatus*) in Alberta

Prepared for:
Alberta Sustainable Resource Development (SRD)
Alberta Conservation Association (ACA)

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PREFACE

Every five years, the Fish and Wildlife Division of Alberta Sustainable Resource Development reviews the general status of wildlife species in Alberta. These overviews, which have been conducted in 1991 (*The Status of Alberta Wildlife*), 1996 (*The Status of Alberta Wildlife*) and 2000 (*The General Status of Alberta Wild Species 2000*), assign individual species "ranks" that reflect the perceived level of risk to populations that occur in the province. Such designations are determined from extensive consultations with professional and amateur biologists, and from a variety of readily available sources of population data. A key objective of these reviews is to identify species that may be considered for more detailed status determinations.

The Alberta Wildlife Status Report Series is an extension of the general status exercise, and provides comprehensive current summaries of the biological status of selected wildlife species in Alberta. Priority is given to species that are *At Risk* or *May Be At Risk* in the province, that are of uncertain status (*Undetermined*), or that are considered to be at risk at a national level by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC).

Reports in this series are published and distributed by the Alberta Conservation Association and the Fish and Wildlife Division of Alberta Sustainable Resource Development. They are intended to provide detailed and up-to-date information that will be useful to resource professionals for managing populations of species and their habitats in the province. The reports are also designed to provide current information that will assist Alberta's Endangered Species Conservation Committee in identifying species that may be formally designated as *Endangered* or *Threatened* under Alberta's *Wildlife Act*. To achieve these goals, the reports have been authored and/or reviewed by individuals with unique local expertise in the biology and management of each species.

EXECUTIVE SUMMARY

The St. Mary shorthead sculpin (*Cottus* sp.) is a small freshwater sculpin species found only in the St. Mary and Milk river systems. The taxonomy of this fish remains unresolved. For the purposes of this report, the name St. Mary shorthead sculpin will be used to refer to this species in Alberta. However, the most recent genetic and morphological findings suggest that the St. Mary shorthead sculpin is not a representative of the shorthead sculpin (*Cottus confusus*) species, but rather an unrecognized taxon within the western group of mottled sculpins (*C. bairdi*), provisionally called *C. bairdi punctulatus*. Furthermore, these findings indicate that the St. Mary shorthead sculpin is similar to the sculpins found in the Flathead River system in British Columbia, as well as those found in the upper Missouri River in Montana. Regardless of taxonomy, the St. Mary shorthead sculpin has an extremely limited distribution in Alberta and is vulnerable to extirpation through habitat alterations and loss. Information on population size and trends in Alberta is limited.

The St. Mary shorthead sculpin appears to be locally abundant where it is present, but its distribution has changed in the Milk River system since it was first observed in the 1960s. In the Milk River mainstem, its distribution appears to have expanded downstream over time, although it remains absent in the furthest downstream sections. However, it appears to have been extirpated in the upper Milk River since it was documented there in the mid-1980s. No changes have been observed in its distribution in the St. Mary River, where it is currently found only above the St. Mary Reservoir. Water removal, diversions and reservoirs associated with irrigation, in combination with the frequent droughts of southern Alberta, have likely had the greatest impact on population size and distribution over time and will continue to be the greatest threats to the existence of the St. Mary shorthead sculpin in Alberta.

The St. Mary shorthead sculpin is currently considered *May Be At Risk* by the *General Status of Alberta Wild Species 2000* (Alberta Sustainable Resource Development 2001). However, it has not been evaluated nationally by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). Further studies are needed to resolve the taxonomy of the St. Mary shorthead sculpin. In addition, baseline information on population size and distribution should be established and estimated regularly to monitor the status of the St. Mary shorthead sculpin in Alberta. Regardless, this genetically distinct sculpin represents an important component of the genetic diversity found in the western mottled sculpin complex and deserves a high level of protection.

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INTRODUCTION

The St. Mary shorthead sculpin (*Cottus* sp.) is a small freshwater sculpin species inhabiting only the St. Mary and Milk rivers in Alberta. Significant confusion remains with respect to the taxonomy of this Alberta species. For the purposes of this report, the name St. Mary shorthead sculpin will be used to refer to the species found in the St. Mary and Milk rivers in Alberta because this is the name currently used by biologists in the province. However, more recent evidence strongly suggests that this fish is an unrecognized taxon within the western *Cottus bairdi* complex (Troffe 1999, Peden 2000b, D. McPhail, pers. comm., D. Neely, pers. comm.), and should not be confused with the species of shorthead sculpin (*C. confusus*) found elsewhere. Most recent morphological and genetic data suggest that the St. Mary shorthead sculpin is the same species as that found in the Flathead River in British Columbia, as well as the one found in the upper Missouri River system (Troffe 1999, Peden 2000b, D. McPhail, pers. comm., D. Neely, pers. comm.), and is closely allied with the Rocky Mountain sculpin, *C. bairdi punctulatus* (Troffe 1999), described by Bajkov (1927) and Schultz (1941) based on specimens collected from both slopes of the Rocky Mountain region and from Glacier National Park in Montana, respectively. Provisionally, the St. Mary shorthead sculpin, along with the Flathead populations, should be identified as *C. bairdi punctulatus* (Peden 2000b, Troffe 1999, D. McPhail, pers. comm.).

Regardless of taxonomy, the St. Mary shorthead sculpin has an extremely limited distribution in Alberta. Its presence in the St. Mary River above the St. Mary Reservoir and in the Milk River appears to be limited in part by its preference for cooler water temperatures and clean rocky substrates (Paetz 1993). Within these systems, it is the only sculpin species present. Where the St. Mary shorthead sculpin is found, it is considered locally abundant. The greatest threat to its existence is the availability of adequate water flow associated with water removal and diversions for irrigation, in combination with the frequent drought conditions experienced in southern Alberta.

In Alberta, the St. Mary shorthead sculpin is listed as *May Be at Risk** in the *General Status of Alberta Wild Species 2000* (Alberta Sustainable Resource Development 2001). Nationally, the Columbia mottled sculpin (*C. bairdi hubbsi*) in British Columbia has been designated as *Special Concern* by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) since 2000 (COSEWIC 2002). However, no national designation has been provided for the St. Mary shorthead sculpin.

The intent of this report is to summarize current and historical information on the St. Mary shorthead sculpin in order to help determine the status of this species in Alberta. Information on biology and habitat requirements will be summarized from reports on the St. Mary shorthead sculpin where possible; however, where such information is unavailable, references on *C. bairdi* and the closely related *C. confusus* have been used.

SPECIES INFORMATION**

1. Species Identification. **-** The St. Mary shorthead sculpin belongs to the genus *Cottus*, a freshwater representative of the predominantly marine Cottidae family (Scott and Crossman 1973). The morphology of sculpins is distinct, reflecting the bottom-dwelling nature of this family. They are large-headed and heavy-bodied fish with a body that tapers from the head to the tail, and lack an air bladder (Peden 2000b). The dorsal and pelvic fins have protective spines (Scott and Crossman 1973). The maximum fork

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* See Appendix 1 for definitions of selected status designations.

**See glossary in Appendix 2 for definitions of the following terms used in this section: fork length, vomerine teeth, palatine teeth, papillae, preopercular spines, lateral line pores and endemic.

length recorded for the St. Mary shorthead sculpin in Alberta is 114 mm from the Milk River (R.L.&L. 2002). A more detailed morphological description is contained in the following section, because this information is integral to the taxonomy of the specimens found in Alberta.

2. Taxonomic Issues. **-** The taxonomy of the St. Mary shorthead sculpin is complex and remains unresolved. It was first recognized as the mottled sculpin, *C. bairdi* Girard, in the late 1960s (summarized by Nelson and Paetz 1992) but was later described as the shorthead sculpin, *C. confusus*, based on morphological studies (Roberts 1988). The most recent genetic and morphological findings suggest that the St. Mary shorthead sculpin is actually an unrecognized taxon within the western *C. bairdi* complex, provisionally called *C. bairdi punctulatus* (Troffe 1999, Peden 2000b, D. McPhail, pers. comm., D. Neely, pers. comm.).

The mottled sculpin (*C. bairdi*) and the shorthead sculpin (*C. confusus*) are morphologically distinct from other sculpins in Canada based on several features (summarized in Peden 2000a). These features include the following: (1) no prickles covering the entire body (i.e., only found behind the pectoral fin); (2) two pores rather than one on the chin; (3) well-developed pelvic fin rays; (4) vomerine and palatine teeth; (5) 11-15 anal fin rays and 13-16 pectoral fin rays; and (6) an upper preopercular not strongly hooked. However, the two species are very difficult to differentiate from one another visually, and a combination of several morphological features is required to distinguish them in western Canada. Large shorthead sculpins do not have papillae on the top of their heads (Peden 2000b). In general, they have fewer pectoral fin rays (13 versus 15), reduced preopercular spines (2 versus 3), and fewer lateral line pores (average of 23-25 versus 27-29) than mottled sculpins (Peden 2000b). A live specimen of the shorthead sculpin is noticeably more slender, often uniformly dark and appears smooth in texture with a shorter head (Peden 2000b). In addition, the lateral line of the shorthead sculpin does not extend into the base of the tail fin (i.e., does not usually reach the fin rays) (Peden 2000b). In comparison, the mottled sculpin is broader across the gill area and mottled in pigment with more visible papillae on the top of the head of larger specimens (Peden 2000b).

Significant variation for these morphological features also exists within western mottled sculpins throughout their range, making the classification of specific populations of these sculpins even more difficult. Two forms of mottled sculpins have been described in western Canada, including the Columbia mottled sculpin, *C. bairdi hubbsi*, which is endemic to the Columbia Basin, and a Rocky Mountain form most closely allied with the Rocky Mountain sculpin, *C. bairdi punctulatus* Gill (Troffe 1999). A recent morphological study on western Canadian mottled sculpins described populations from the Flathead River in British Columbia and the St. Mary River as the Rocky Mountain form (Troffe 1999). The Rocky Mountain form is distinguished from the Columbia Basin form based on several morphological features (Troffe 1999). The Columbia Basin form has a complete lateral line with an average of 29 ± 3 pores, and prickles are present behind the pectoral fin. In contrast, the lateral line of specimens from the Flathead and St. Mary rivers is not complete, with an average of 22 ± 3 pores, and prickles behind the pectoral fin are absent (Troffe 1999).

In terms of genetic characterization, a large geographic and molecular genetic gap separates western and eastern groups of mottled sculpin *C. bairdi*, and the eastern groups appear to be monophyletic (i.e. evolved from one group) (D. Neely, pers. comm.). However, the genetic relationships among western *C. bairdi* and *C. confusus* populations are unresolved. Peden (2000b) used allozyme variation to demonstrate that the Flathead River population of sculpins was actually an unrecognized Canadian taxon,

which he provisionally named *C. bairdi punctulatus*, distinct from the Columbia mottled sculpin, *C. bairdi hubbsi* (Bailey and Dimick 1949, McAllister and Lindsey 1961, McPhail 2001). This supports the morphological results by Troffe (1999). Most recently, higher resolution molecular genetic results (based on variation in cytochrome *b* and the control region genes found in the mitochondrial DNA) demonstrated that the Flathead population of sculpins appears to be genetically similar to the St. Mary River (Alberta) and upper Missouri River populations in Montana (D. McPhail, pers. comm.). In addition, these results demonstrated that the Columbia mottled sculpin was quite distinct from the sculpins from the Flathead and St. Mary systems (D. McPhail, pers. comm.). Again, this work supports the morphological work by Troffe (1999). In a parallel genetic study of western *Cottus* species in the United States, at least five taxa within the *C. bairdi* complex are believed to occur (D. Neely, pers. comm.). The upper Missouri River population (and therefore most likely the St. Mary/Milk and Flathead populations) appears to be a sister taxon to the diverse western *C. bairdi* group but as yet undescribed (D. Neely, pers. comm.). Unfortunately, the Canadian and American data sets have yet to be combined. In addition, none of the recent morphological work by Troffe (1999) or genetics work has incorporated any Milk River specimens. Therefore, it is assumed based on the earlier morphological data (e.g., Roberts 1988) that the population in the Milk River is the same species as the St. Mary River population.

In conclusion, it remains to be seen how pooling the U.S. and Canadian data will help resolve the western *C. bairdi* and *C. confusus* groups. This work is now in progress but the results were unavailable in time for this report (D. Neely, pers. comm.). However, all researchers currently pursuing the taxonomic questions regarding these taxa concur that the Flathead/St.Mary-Milk and upper Missouri sculpins appear to represent an unrecognized taxon, provisionally called *C. bairdi punctulatus* (Troffe 1999, Peden 2000b, D. McPhail, pers. comm., D. Neely, pers. comm.).

HABITAT

1. Features. **-** Sculpins are nocturnal and tend to remain under cover (usually rocks) during daylight hours (McPhail 2001). Mottled sculpins are found in moderately cool streams with riffle habitat, rocky or gravel substrate and weak to fast currents (Peden 2000b). An older study by Bailey (1952) on the Rocky Mountain sculpin (*C. bairdi punctulatus*) in southwestern Montana also found these fish to be most abundant in riffle habitat where rubble and boulders were predominant and provided refuge. However, they were usually absent from pools where bottoms were entirely sand or clay (Bailey 1952). Little information is available regarding temperature preferences for western mottled sculpins, but shorthead sculpin populations were found to inhabit streams with spring and summer temperatures averaging 15°C (range 8°C-12°C) in Oregon (Bond 1963), and in streams with summer temperatures of 12°C to 18°C and winter temperatures of 0°C to 4°C in British Columbia (Peden 2000b).

The only study describing spawning habitat was for the Rocky Mountain sculpin in southwestern Montana (Bailey 1952). Nests consisted of holes under rocks that ranged from 0.12 m to 0.38 m in diameter. Eggs were usually attached to rocks, but other substrates including aquatic vegetation, wood and other debris were also utilized (Bailey 1952). Water depth of nests was over 0.3 m, and surface water velocities ranged from 0 m/s to 1.6 m/s.

Since the 1960s, a number of studies on the St. Mary and Milk rivers have described the habitat features of the St. Mary shorthead sculpin. Willock (1969) stated that the colder temperatures and increased water clarity in the upper Milk River accounted for the presence of species such as the St. Mary shorthead sculpin. These characteristics are associated with higher

rainfall, higher elevation and gradient, more vegetation and less erosion because of the presence of more resistant sandstone substrate in the upstream reaches of the Milk River compared to further downstream reaches (Willock 1969). In particular, Willock (1969) stated that water temperature was the single most important factor affecting sculpin distribution in the Milk River. In addition, he found that sculpins were most numerous in sections of the Milk River with little or no current, and were at least as common at creek mouths as in the mainstem proper. Similarly, Paetz (1993) noted that sculpins in the North Milk River and the St. Mary River were most common in silt-free rocky substrate near the stream margin where currents were slower, whereas no sculpins were found in the main river current. In Lee Creek (a tributary of the St. Mary River), sculpins appeared to prefer the slightly silty stream margins where currents were slower, compared to the mid-creek section, which was silt-free but had higher velocity (Paetz 1993). Paetz (1993) also noted that sculpins used areas where instream sedges and bankside shrubs trailed in the slower current in the lower Milk River if rocky substrates and cobbles were absent, particularly near the Town of Milk River. Other habitats utilized consisted of debris anchored by an obstruction such as a root in the streambed. Clayton and Ash (1980) noted that the St. Mary shorthead sculpin appeared to prefer clean substrates, but lower numbers were also found in quiet pools with silty substrate.

A detailed habitat evaluation for the St. Mary shorthead sculpin was conducted in 2000-2001 in the St. Mary and Milk river systems (R.L.&L. 2002). Some variability in habitat selection appeared to be drainage-specific and dependent on habitat type availability, as well as water levels. In general, sculpins were present predominantly in shallow runs and riffles, as well as run/boulder gardens (see glossary, Appendix 2). A statistical analysis of microhabitat characters found that rather than being associated with a particular type or range of character values, the St. Mary shorthead sculpin appeared to be more of a generalist (R.L.&L. 2002). However, water depths in capture locations tended to be shallow (range 0.05-0.42 m, mean of 0.19 m), and velocities were low (range 0-0.6 m/s, mean of 0.22 m/s). Silt depths tended to be low (range 0.0-0.02 m deep), rock was the predominant cover type (10%-40%), turbidity was low (range 0-5%), and substrate consisted mainly of gravel and cobble (R.L.&L. 2002).

Little information is available regarding habitat features associated with any life history stage for the St. Mary shorthead sculpin. Spawning, rearing and feeding habitats are not believed to be limited throughout the St. Mary River or the upstream sections of the Milk River where sculpins are found (R.L.&L. 2002). Interestingly, Willock (1969) noted a disproportionately large number of young sculpins in muddy areas with little gradient in the Milk River, suggesting that these areas might be used for rearing. A similar observation was made by Bailey (1952), who noted that some small specimens of Rocky Mountain sculpin were found in quiet waters near the shore. He proposed that these small sculpins could stir up clouds of silt for cover. Overwintering habitat is also believed to be well represented in both river systems, provided that adequate water flow is available (R.L.&L. 2002).

2. Trends. **-** The greatest alterations to sculpin habitat in the St. Mary and Milk rivers are related to water diversions, reservoirs and water removal for irrigation. These factors, in combination with the frequent droughts experienced in southern Alberta, seriously affect the availability of sculpin habitat. The construction of the St. Mary Reservoir, completed in 1951 (T. Clayton, pers. comm.), significantly altered the type of habitat available to fish species in the St. Mary River (see Figure 1 in Distribution section for dam location). Currently, St. Mary shorthead sculpins are not known to be present in the reservoir or downstream of the reservoir (W. Roberts, pers. comm., T. Clayton, pers. comm.).

Although it is not known whether they once inhabited these sections, future expansion into downstream habitats is not possible because of the presence of the dam. Furthermore, the absence of sculpins in the reservoir suggests that conditions (i.e., temperature regimes and bottom type) here are unfavourable.

The biggest alteration to habitat in the Milk River occurred 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. 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. Before the construction of the dam, the Milk River was probably a typical small prairie stream, possibly intermittent in times of drought, and generally less turbid (Willock 1969). Although the volume of water may have increased downstream of the canal outflow in the North Milk River, this has become a highly managed flow, which may be turned off temporarily or prematurely during the open water months if canal repairs are required. This occurrence, in combination with the drought conditions common to this region, can result in the severe reduction in the availability of sculpin habitat in the Milk River. In addition, the ongoing removal of water in Montana from the upper Milk River, which is above the confluence with the North Milk River, may be partly responsible for the disappearance of sculpins in this upstream section of the mainstem (Paetz 1993). In 2000-2001, the upper Milk River was dry during the summer and fall sampling seasons (R.L.&L. 2002). In fact, this section is often dry during the summer months (T. Clayton, pers. comm.). Any use of this section of river by sculpins is at most temporary. Similarly, the tributaries of the North Milk River are considered ephemeral, and are dry to damp most of the year under average conditions (T. Clayton, pers. comm.).

No other major changes to habitat have been observed since the construction of the St. Mary Reservoir. Instead, the availability of habitat, particularly overwintering habitat in the Milk River, is highly variable from year to year and dependent on adequate water flows. The combination of severe drought conditions and water flow management associated with the St. Mary Canal can lead to extremely low flow conditions, as observed in the late summer and fall of 2000 and 2001 (R.L.&L. 2002). A potential threat to existing sculpin habitat in the Milk River is the recurring proposal to construct a dam on the Milk River upstream of the Town of Milk River for irrigation purposes. Such a dam would flood approximately 19 km of the North Milk River and 11 km of the Milk River mainstem (R.L.&L. 1987), resulting in approximately 10.5% of existing habitat being lost above the dam, as well as possible effects downstream of the dam (Paetz 1993), such as altered flow, turbidity and temperature levels.

In terms of re-colonization potential, the St. Mary irrigation canal is a probable source of migrants from the upper St. Mary River in Montana to the North Milk River on an annual basis. The suspected eastward expansion of sculpins in the Milk River since the species was first documented in the 1960s (see Distribution section) suggests that the St. Mary shorthead sculpin is capable of expanding into new habitat, particularly into downstream areas. In contrast, Peden (2000b) claimed that genetic differences between mottled sculpin populations in British Columbia, in combination with a relatively sedentary lifestyle, suggest that dispersal is slow and movement among streams is limited. Given this information, re-colonization of an extirpated population in the North Milk River by annual immigration through the canal from the St. Mary River is probable and could happen relatively quickly (i.e., within an estimated 10 years). However, re-colonization of the Milk River mainstem from the North Milk River would likely be a slower process (i.e., 10 or more years), based on previous reports documenting changes in distribution (Willock 1969, Clayton and Ash 1980). Natural re-colonization of the Milk River

from the upper Missouri system in Montana is not possible given the absence of sculpins in the Milk River downstream of the international border and the presence of six or more impassable dams (Stash 2001). Similarly, natural re-colonization of the St. Mary River from the North Milk River would likely be impossible given the design of the St. Mary Canal (T. Clayton, pers. comm.).

CONSERVATION BIOLOGY

1. Life History. **-** Life history information for the St. Mary shorthead sculpin is extremely limited, and much of the information available is based on a limited number of studies of *C. bairdi* populations from other western systems. The only study to specifically describe the life history of the St. Mary shorthead sculpin in Alberta was conducted by Roberts (1988).

Roberts (1988) noted that all *Cottus* species in Alberta, including the St. Mary shorthead sculpin, spawned during the late spring. Specifically, he observed male sculpins protecting eggs in Lee Creek, a tributary of the St. Mary River, during mid-May when the water temperature was 15°C (Roberts 1988). He noted that only gravid females (no males were observed protecting nests) were observed in the St. Mary River mainstem when the water temperature was 7.5°C, suggesting a threshold temperature triggering spawning somewhere between 7.5°C and 15°C.

The spawning season for *Cottus* species is highly variable and may range from February to August, depending on location (summarized by Bailey 1952). A fairly detailed study on spawning ecology was conducted for Rocky Mountain sculpin in southwestern Montana by Bailey (1952). In general, males arrived earlier than females at the breeding sites, and were ripe earlier. In addition, these males were considered highly polygamous, usually spawning with 1.5 to 4 females, but sometimes up to 12 females. Single egg clusters are deposited by the female *C. bairdi* on or under rocks, and a single male remains near the nest site for up to several weeks during oviposition, incubation and early embryo stages (Peden 2000a, Bailey 1952). Rather than behaving as guards of these nest sites, Bailey (1952) believed that these males kept the nests clean of silt and other debris. Finally, the study of Rocky Mountain sculpin in southwestern Montana found that more than one female might use a particular nest site (Bailey 1952).

The fecundity of sculpin specimens collected from the Milk and St. Mary rivers generally ranged from 100 to 250 eggs, although one large female (80.7 mm total length; see glossary, Appendix 2) contained 354 eggs (Roberts 1988). Peden and Hughes (1984) noted a female of 53 mm (standard length; see glossary, Appendix 2) with 128 eggs and a female of 99 mm (standard length) with 690 eggs from the Flathead River. Eggs of the St. Mary shorthead sculpin likely hatch within 2 to 3 weeks, depending on temperature (Roberts 1988). Young of the year were 30-40 mm in total length by the end of their first summer, and yearlings achieved a length of at least 50 mm (Roberts 1988). These data are similar to data from the Flathead River, where young of the year were on average 37.0 mm standard length by late summer (Hughes and Peden 1984). In the Flathead River, one-year-old males were on average 64.4 mm in standard length and one-year-old females were 48.6 mm in standard length by October (Hughes and Peden 1984). Growth of shorthead sculpins in Big Lost River in Idaho was approximately 10 to 20 mm per year (Gasser et al. 1981).

For the St. Mary shorthead sculpin, both sexes are believed to be sexually mature at the age of 23 months, although no specimens have been aged (Roberts 1988). The only mature two-year-old female collected from the Flathead River was 71.4 mm in standard length (Hughes and Peden 1984). The smallest mature female examined from the Milk or St. Mary rivers was 52.3 mm in total length, but age was not estimated (Roberts 1988). These observations are consistent with data collected for *C. confusus*

and *C. bairdi* elsewhere. The youngest age of first maturation for *C. confusus* in British Columbia is probably 2 years, with the smallest standard length recorded at 42 mm for a mature female (Peden 2000b). Similarly, all specimens of Rocky Mountain sculpin in southwestern Montana found to be sexually mature were at least 2 years old and 57 mm in total length (Bailey 1952).

No longevity information is available for mottled sculpins, but shorthead sculpins in British Columbia are not thought to live beyond 5 years of age and probably breed annually (Peden 2000b). Shorthead sculpin females from Big Lost Creek, Idaho were also observed to breed annually (Gasser et al. 1981).

2. Diet. - Sculpins are mainly nocturnal foragers, but foraging behaviour is somewhat dependent on the species. A recent study found that shorthead sculpins in the Columbia River system tended to remain in the fast water areas during the night, where they foraged on drifting insects on the upstream side of rocks (McPhail 2001). In general, food habits appear to be similar for *C. bairdi* and *C. confusus* (Peden 2000b). Aquatic insect larvae appear to make up the majority of the diet, but mollusks, fish, and even sculpin eggs may also contribute (Bailey 1952, Peden 2000b, Paetz 1993). Similarly, Bailey (1952) found that the diet of *C. bairdi punctulatus* in Montana was made up almost exclusively (99.7%) of bottom-dwelling aquatic insects, although snails, clams, water mites, sculpin eggs and fish made up the remaining 0.3%.

3. Movement. - It is unlikely that mottled or shorthead sculpins migrate extensively throughout the year, as surveys found specimens of both species at the same sites in British Columbia during spring, summer, fall and winter sampling (Peden 2000b). Similarly, Peden and Hughes (1984) did not find either juvenile or adult shorthead sculpin to undergo extensive migrations. Furthermore, Peden (2000b) noted that the home range was less than 5 m^2 for mottled sculpins in British Columbia. An older study by Bailey (1952) found that, over a one-year period, the maximum dispersal by tagged *C. bairdi punctulatus* in Montana was only approximately 143 m. Finally, genetic differences among small tributaries within streams (based on allozyme electrophoresis) suggested virtually no movement (or at least gene flow) among *C. confusus* populations in tributaries 10 km or more apart in British Columbia, and similar small-scale differences were noted for *C. bairdi* (Peden 2000b). Although no information for the St. Mary shorthead sculpin exists regarding movement, in all likelihood these fish would demonstrate similar behaviour patterns to those observed in the above studies.

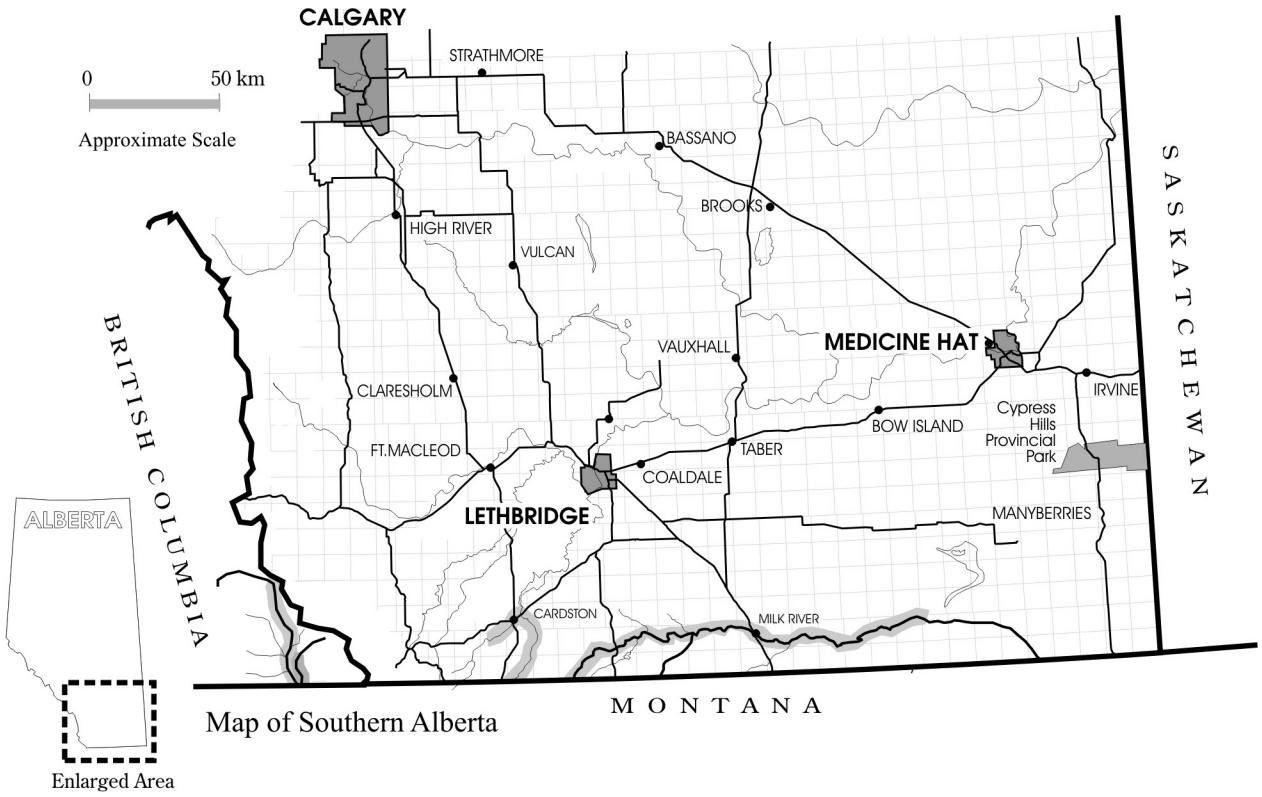
DISTRIBUTION

1. Alberta. - The zoogeography of the St. Mary shorthead sculpin is complex, and theories regarding glacial refugia (see glossary, Appendix 2) and dispersal routes vary. The disjunct distribution of *C. bairdi* in western North America suggests that this species survived in two refugia (i.e., Missourian and Mississippian), as well as in the Atlantic Refugium (Bailey and Allum 1962, Crossman and McAllister 1986). The extent of ice coverage during the last glaciation period (which began approximately 18 000 years ago) of the Pleistocene epoch is somewhat uncertain, but it is believed that much of Alberta was covered, with possibly some ice-free areas occurring in southern Alberta (summarized in Nelson and Paetz 1992). Nelson and Paetz (1992) suggested that during that last deglaciation period various post-glacial connections between the Oldman (e.g., St. Mary River) and the Milk drainages may have permitted movement from the Missouri drainage to the Saskatchewan system. Movement of the St. Mary shorthead sculpin from the Missouri drainage could have occurred during this time. Willock (1969) proposed that the isolated occurrence of the St. Mary shorthead sculpin

outside of the Missouri system in the St. Mary River reflects a post-glacial arrival here, probably occurring fairly recently. An alternative view is that the St. Mary shorthead sculpin may have entered the Milk River system from the St. Mary River through the irrigation canal system in Montana (Nelson and Paetz 1992, Paetz 1993, W. Roberts, pers. comm.). This movement may happen annually and could stimulate the apparent downstream expansion of sculpins observed in the Milk River over a recent 20-year span (Paetz 1993). Several other upper Milk River fish species are also found in the St. Mary River (T. Clayton, pers. comm.). Given this observation, and the unresolved taxonomy of the St. Mary shorthead sculpin, it is impossible to determine whether the sculpin expanded from the St. Mary River to the Milk River or from the Milk River into the St. Mary River. Crossman and McAllister (1986) proposed that the present-day occurrence of species such as the mottled sculpin might depend on the availability of deeper, colder water habitat rather than be explained just based on refugia. Therefore, the current distribution of the St. Mary shorthead sculpin may be explained by its preference for colder waters upstream, in addition to movement by way of irrigation canals and reservoirs and post-glacial dispersal.

Extensive fish sampling since the 1960s has delineated a fairly well-defined distribution range for the St. Mary shorthead sculpin in Alberta. The St. Mary shorthead sculpin was first identified (as *C. bairdi*) in the Milk River in 1966 (University of Alberta Zoology Museum record 3771). Its presence in Alberta appears to be limited to the St. Mary River above the reservoir and to the North Milk River and Milk River mainstem, except for the furthest downstream section (i.e., lowermost 85 km in Alberta) (Roberts 1988, Nelson and Paetz 1992, Paetz 1993; see Figure 1). This distribution is primarily within the Dry Mixedgrass, as well as the Mixedgrass and Foothills Fescue Subregions of Alberta (ANHIC 2002a). The Dry Mixedgrass Subregion is considered the driest area in the province, with the warmest summers, cold winters and extreme variability in the amount of annual precipitation (ANHIC 2002a). The earliest published study within the Milk River found the St. Mary shorthead sculpin only in the upper reaches of the North Milk River and at the international border in the upper Milk River above the confluence with the North Milk River (Willock 1969). A later study also documented the presence of sculpins at three locations in the upper Milk River (Clayton and Ash 1980). In 1986, a survey documented the sculpin throughout the North Milk River as far downstream as a site approximately 100 km upstream of the international border and at one upstream site in the upper Milk River (R.L.&L. 1987). Paetz (1993) confirmed the sculpin's presence in the North Milk River and mainstem, but for the first time noted an absence in the upper Milk River. He believed that the sculpins in the Alberta portion of the upper Milk River had been extirpated as a result of the depletion of water flows south of the international border in Montana. Water withdrawal for irrigation is unregulated there (T. Clayton, pers. comm.). Furthermore, comparisons of the earliest work (Willock 1969) with work conducted in 1979 (Clayton and Ash 1980) suggest that sculpins occurred some 130 km further downstream in the later study.

Most recent assessments have found that the St. Mary shorthead sculpin is widely distributed throughout most of the North Milk River and Milk River mainstem, except for the lowermost section (0-85 km upstream of the international border) where it is absent (R.L.&L. 2002) (Figure 1). This is consistent with earlier studies (Clayton and Ash 1980, R.L.&L. 1987, Paetz 1993), suggesting that the distribution in these sections has not changed in recent years, with the exception of the upper Milk River above the confluence with the North Milk River. Studies in 2000-2001 found this section of the Milk River dry as a result of severe drought conditions and the operation of the St. Mary Canal (R.L.&L. 2002), reflecting findings similar to Paetz (1993).



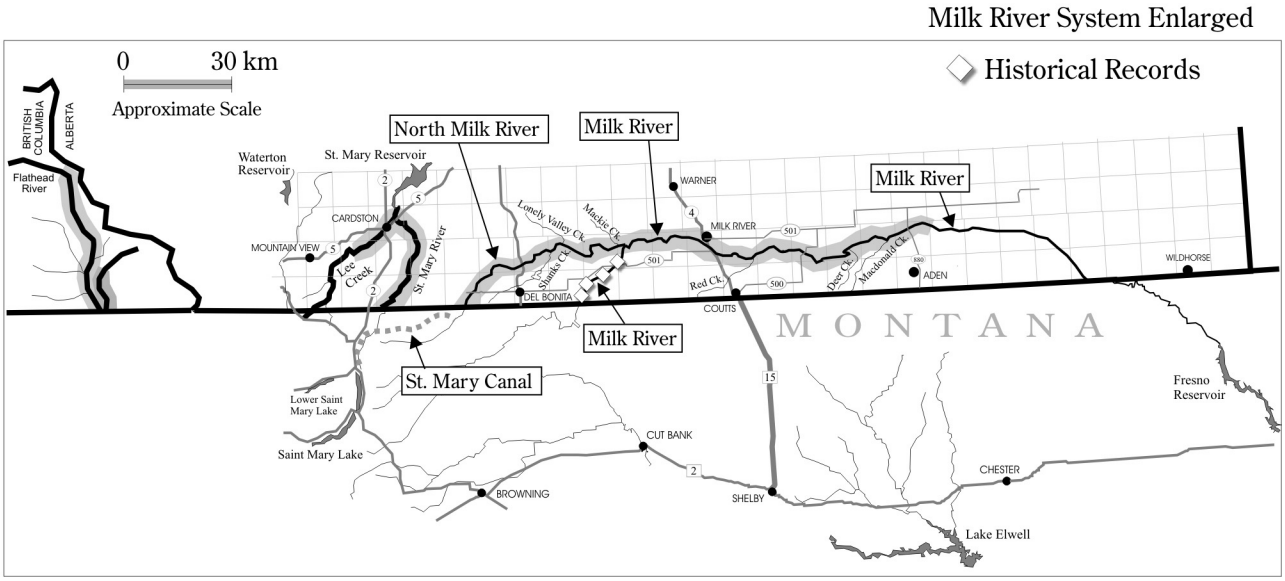


Figure 1. Distribution of the St. Mary shorthead sculpin in Alberta. Shaded gray line indicates distribution based on recent surveys conducted in the St. Mary and Milk Rivers (R.L.&L. 2002, P&E 2002), as well as on earlier studies (R.L.&L. 1987, Paetz 1993) where they agree with the most recent work. Open diamonds indicate sites in the upper Milk River where sculpins were found by Willock (1969), Clayton and Ash (1980) and R.L.&L. (1987) but not in the more recent surveys. Map modified from R.L.&L. (2002). The inset also illustrates the Flathead River population that appears to be the same taxon as the St. Mary shorthead sculpin. Note that distributional information for these sculpins in the upper Missouri system was not available at the time this report was produced.

With regards to the St. Mary River, provincial fisheries catch records prior to 1980 did not document any St. Mary shorthead sculpins downstream of the St. Mary Reservoir (summarized in Paetz 1993). Paetz (1993) confirmed the sculpin's presence in the St. Mary River above the reservoir and in the lower 10 km of Lee Creek. He also noted its absence in the St. Mary River downstream of the reservoir and in upper Lee Creek, as well as the Belly, Waterton and Oldman rivers. Similarly, the St. Mary shorthead sculpin has not been observed in the reservoir (T. Clayton, pers. comm., W. Roberts, pers. comm.). The St. Mary Reservoir is likely a major obstacle to downstream dispersal of sculpins in the St. Mary River (Paetz 1993). Paetz (1993) suggested that the absence of sculpins downstream of the reservoir reflected a relatively recent movement of the St. Mary shorthead sculpin into Alberta waters. However, it has also been suggested that the St. Mary shorthead sculpin likely did occur downstream of the reservoir before its construction and that current habitat conditions (e.g., silty substrate) have resulted in its extirpation here (W. Roberts, pers. comm.). Unfortunately, no historical records are available to support either hypothesis. The recent studies conducted in 2000 also found the St. Mary shorthead sculpin to be common throughout the entire section of the St. Mary River above the St. Mary Reservoir to the international border (R.L.&L. 2002) (Figure 1). However, in Lee Creek, a major tributary of the St. Mary River, distribution was limited to the lower sections, with the uppermost extent found 6 km upstream of the settlement of Cardston (R.L.&L. 2002).

Overall, the St. Mary shorthead sculpin occupies approximately 80 km of stream in the St. Mary system and 220 km of stream in the Milk River in Alberta (Paetz 1993). However, habitat availability within these lengths can vary significantly depending on water flow, particularly in the Milk River, where availability disappears during periods of extreme drought when certain sections are completely dry. Some changes in distribution appear to have occurred in the Milk River since the 1960s, with significant downstream expansion in the mainstem, and extirpation in the upper Milk River as a result of the consistent lack of adequate water flow. In contrast, no changes in distribution are apparent in the St. Mary River, but the possibility exists that sculpins were present downstream of the reservoir before its construction.

No genetic or movement data are available to describe population substructure or the number of genetically discrete populations that may exist in Alberta. However, some postulations can be made based on other studies and knowledge of the river systems. Peden (2000b) noted fairly small-scale differences among populations for both mottled and shorthead sculpins in British Columbia, suggesting little gene flow even among small tributaries within a drainage. In addition, Bailey (1952) noted very little movement for tagged *C. bairdi punctulatus* in Montana over a period of one year. Conservatively, Alberta probably contains at least two genetically distinct populations of St. Mary shorthead sculpin: one in the St. Mary River immediately upstream of the St. Mary reservoir, and one in the Milk River system that is similar to the St. Mary River in Montana upstream of the St. Mary Canal intake. Some movement of larvae from the upper St. Mary River in Montana to the furthest downstream section immediately above the reservoir is possible but probably limited, allowing for some genetic isolation. The St. Mary Canal becomes operational during the spring high flows and it is at this time that some sculpin larvae are likely drawn downstream through the canal into the North Milk River, resulting in an annual influx of genetic material (Paetz 1993, T. Clayton, pers. comm.).

In addition, population substructure within the two river systems is probable. For example, the sculpin population in Lee Creek may be distinct from the downstream section of the St. Mary

River mainstem. Lee Creek always contains some water (T. Clayton, pers. comm.) and can support sculpins year-round. However, there is no apparent reason for sculpin movement from the St. Mary River mainstem upstream into Lee Creek, although the furthest downstream section of the St. Mary River may receive low numbers of migrants from Lee Creek. Therefore, some isolation between the two areas is possible. In the Milk River system, it is probable that some genetic isolation between the North Milk River and downstream sections of the Milk River mainstem exists, given the distances involved. However, it is highly unlikely that the Milk River mainstem above the confluence with the North Milk River supports a distinct population because this section regularly dries up. Instead, any sculpins found here probably represent the North Milk River population.

2. Other Areas. - The mottled sculpin (*C. bairdi*) has a wide but discontinuous distribution in North America, and is represented by two geographically isolated groups separated by the Great Plains, where it is absent. The eastern group ranges from at least the Tennessee River system in Georgia and Alabama to Labrador on the north, west to the Great Lakes basin. In eastern Canada, the mottled sculpin is found in discontinuous locations in Labrador, Ungava Bay in Quebec west to the Hudson Bay drainages, through the St. Lawrence-Great Lake system and in the James and Hudson Bay drainages of most of Ontario to southern Manitoba (Scott and Crossman 1973, Lee 1980) (Figure 2).

The distribution of the western group from the Rocky Mountains to the Pacific coast is discontinuous and unclear, particularly in the United States (A. Peden, pers. comm.). In western Canada, two distinct forms of mottled sculpin have been identified: (1) the Columbia mottled sculpin, *C. bairdi hubbsi*, originally described by Bailey and Dimick (1949); and (2) the Rocky Mountain form found in southeastern British Columbia and southwestern Alberta.

The Columbia mottled sculpin is found only in the western Columbia River system. Specifically, it has been noted in a few systems in southern British Columbia, including the Similkameen River (below Similkameen Falls), Kettle River (below Cascade Falls), various streams tributary to the Columbia River in the region of Princeton, and Tulameen River as well as the lower Kootenay River below Bonnington Dam (Peden 2000a) (Figure 2). South of the international border, the distribution of the Columbia mottled sculpin is much less well known. It was originally described in the Columbia River system in Washington and Idaho (Bailey and Dimick 1949).

The Rocky Mountain sculpin, *Cottus bairdi punctulatus*, was originally noted in the Athabasca River system in Alberta (Bajkov 1927) and in the Flathead and upper Missouri River systems in Montana (Schultz 1941). As discussed earlier in this report, recent genetic and molecular studies indicate that a Rocky Mountain form of mottled sculpin straddles the Continental Divide. In Canada, the only other known population that appears to share the same taxon as the St. Mary shorthead sculpin in Alberta occurs in the Flathead River in British Columbia (Troffe 1999, Peden 2000b, D. McPhail, pers. comm.) (Figure 1). Other closely related populations in the United States are found in the upper Missouri River system in Montana and Wyoming (D. Neely, pers. comm.). Interestingly, the Milk, St. Mary and Missouri populations of sculpins on the eastern slopes of the Rocky Mountains are separated from the Flathead population of sculpins on the western side by the Continental Divide (Peden 2000a). This may not be surprising given that the geological evidence suggests that portions of the South Saskatchewan River, including the St. Mary River and portions of the Flathead River, shared post-glacial drainage connections with the upper Missouri River drainage during the retreat of the last glacier approximately 10 000-13 000 years ago (Troffe 1999).

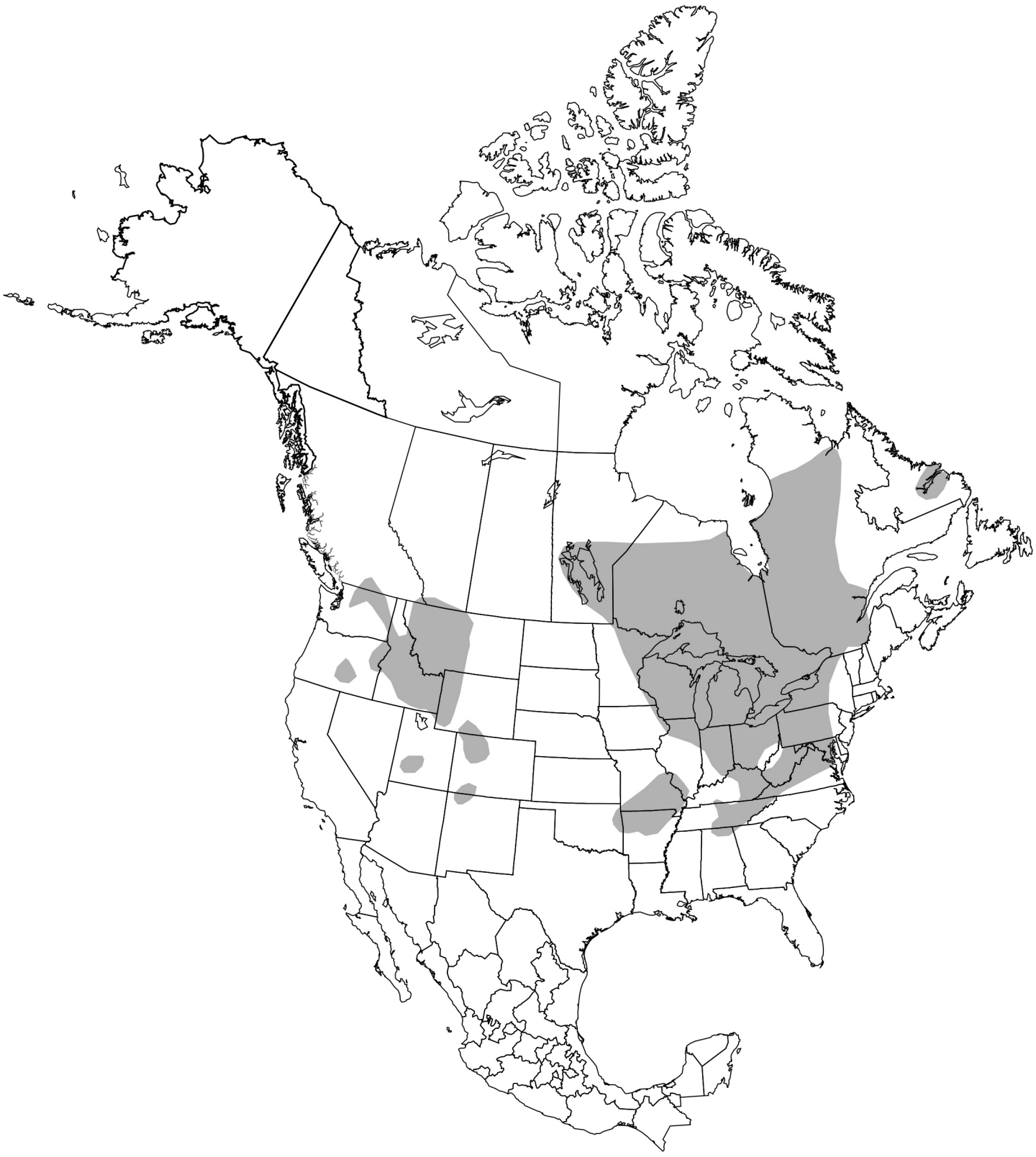


Figure 2. Distribution of mottled sculpins (*Cottus bairdi*) in North America. This distribution includes the Columbia mottled sculpin, (*C. bairdi hubbsi*) and is based on Lee (1980) and Peden (2002b).

In the western United States, proposed taxa within the *C. bairdi* complex are found in the Snake River (upstream of Shoshone Falls), specifically the Bonneville Basins, the Malheur Basin in Oregon, and the Colorado River basin (D. Neely, pers. comm.). In addition, disjunct populations are also found in Arizona, New Mexico, Nevada and Missouri (Lee 1980, Peden 2000a) (Figure 2).

The only likely source of gene flow between the St. Mary shorthead sculpin in Alberta and populations outside of the province is from the most upstream section of the St. Mary River mainstem that flows through Montana. This section probably provides a regular influx of larvae to the St. Mary River mainstem in Alberta, as well as the North Milk River via the St. Mary Canal.

POPULATION SIZE AND TRENDS

1. Alberta. - To date, no studies have provided a quantitative estimate of population size for the St. Mary shorthead sculpin. However, various studies have measured relative abundance. The St. Mary shorthead sculpin is considered locally abundant where it is found in Alberta (R.L.&L.1987, 2002). Surveys in 2000 and 2001 found that the St. Mary shorthead sculpin had the highest or second highest relative abundance of all fish species encountered in the Milk and St. Mary rivers where they were found, although abundance was dependent on season sampled (R.L.&L. 2002) (Table 1). In these surveys of the Milk River, the highest abundance values for sculpins were observed in the North Milk River and decreased downstream to where they were absent in the lowest section of the Milk

Table 1. Percent composition of St. Mary shorthead sculpin relative to other fish species encountered in the Milk River and St. Mary River systems over time.

Year	Season	System	Sample Size	% Total Composition	Reference
1966-67	May-Oct.	Milk River	155	1.1	Willock 1969
1979-80	Nov.	Milk River	214	43.7	Clayton and Ash 1980
1986	Jul.-Oct.	Milk River	1009	4.8	R.L.&L. 1987
2000	Aug.	Milk River	38	4.2	R.L.&L. 2002
2000	Oct.	Milk River	276	11.8	R.L.&L. 2002
2001	July	Milk River	0	0	R.L.&L. 2002
2001	Oct.	Milk River	118	1.8	R.L.&L. 2002
2002	Oct.	N. Milk River	59	37.1	P&E 2002
2000	Aug.	St. Mary	89	21.4	R.L.&L. 2002
2000	Oct.	St. Mary	57	51.8	R.L.&L. 2002
2001	Oct.	St. Mary	85	73.9	R.L.&L. 2002
2000	Aug.	Lee Creek	33	2.9	R.L.&L. 2002
2001	Oct.	Lee Creek	17	22.4	R.L.&L. 2002

River mainstem (R.L.&L 2002). A similar pattern was observed in earlier surveys (R.L.&L. 1987), and is likely due to higher abundance of suitable spawning and rearing habitat in the upper reaches (R.L.&L. 1987). In contrast, sculpins were evenly distributed throughout the St. Mary River. In Lee Creek, they were present in the lower section as far upstream as 6 km above Cardston. These assessments of abundance were conducted before the extreme drought conditions experienced particularly for the Milk River in fall 2001. However, limited surveys in October 2002 did not indicate a noticeable change in abundance (P&E 2002). These latter surveys were conducted to evaluate fish populations in the Milk River and were concentrated mainly in the furthest downstream section of the Milk River (i.e., from the international border to 57 km upstream), as well as in the lower North Milk River and at the confluence of the Milk River/North Milk River. Similar to previous studies, the results of these surveys found sculpins to be absent in the furthest downstream section of the Milk River to the international border (P&E 2002). However, in the upstream section, the St. Mary shorthead sculpin was the most abundant fish species encountered.

Trends in population size are difficult to evaluate given the limited information available and the variability in season and location of sampling. Some variation in abundance over time is evident, but these changes do not appear to be consistent (Table 2). For example, fall abundance values based on catch-per-unit-effort (CPUE) (see glossary, Appendix 2) appear to have increased in the upper North Milk River when comparing the results of a survey conducted in 1986 to those of 2000-2001 (R.L.&L. 2002). The most recent fall CPUEs collected in 2002 suggest a slight increase in abundance near the confluence of the North Milk River and in the lower North Milk River (0.5-2.44 fish/min.) compared to sites near the confluence sampled in 1986 (0-0.59 fish/min.) (RL&L 1987, P&E 2002). However, summer 2000 values in the North Milk River are much lower than summer values collected in 1989 by Paetz (1993). Similarly, summer values for the Milk River near the town of Milk River were considerably lower in 2000 compared to 1989 (R.L.&L. 2002). Fall values were similar and low for the lower Milk River in 1986 and 2000 (R.L.&L. 2002). Unfortunately, the most recent surveys in October 2002 did not include sites immediately downstream of the town of Milk River, where sculpins have been noted previously. In the St. Mary River, summer CPUE values appear to have remained relatively stable from 1989 to 2001 (Table 2). In comparison, summer CPUE values in Lee Creek increased considerably from 1989 to 2001 (Table 2).

Estimates of abundance may be influenced by season, as well as water flow conditions and the ability of survey crews to capture fish. In addition, the population size may fluctuate slightly from year to year depending on migration rates through the St. Mary Canal into the Milk River. It is therefore impossible to determine whether the population in the Milk River is stable, declining or increasing. Given the recent drought conditions, the population may have experienced at least a slight decline in numbers even though the most recent catches in October 2002 (P&E 2002) suggest that the sculpins are still one of the most abundant species in the lower North Milk River. There is no evidence to suggest the population in the St. Mary River mainstem has experienced a significant change in numbers, although a significant increase in Lee Creek was observed (RL&L 2002).

2. Other Areas. **-** In 1990, the Flathead River population of mottled sculpins was considered abundant in the lowest portion of the river in British Columbia, although it may have been more limited upstream by competition with another *Cottus* species (Peden 2000a). Similarly, this population, in addition to populations in some tributaries of the Flathead

Table 2. Comparison of catch-per-unit-effort (CPUE) values (fish/minute) for St. Mary shorthead sculpins encountered in the Milk River and St. Mary River systems over time. Method of capture was backpack electrofishing.

Season	System	Location	CPUE (fish/min)	Reference
Oct. 1986	N. Milk River	Overall	0.02 – 1.86	R.L.&L. 1987
Oct. 2000, 2001	N. Milk River	Overall	3.7 – 10.75	R.L.&L. 2002
Summer 1989	N. Milk River	Upper site[1]	4.56	Paetz 1993
Aug. 2000	N. Milk River	Upper site[1]	0.83	R.L.&L. 2002
Oct. 1986	N. Milk River	Confluence	0-0.59	R.L.&L. 1987
Oct. 2002	N. Milk River/ Milk R.	Confluence area[2]	0.50-2.44	P&E 2002
Summer 1989	Milk River	Town of Milk River	3.00	Paetz 1993
Summer 2000	Milk River	Town of Milk River	0.32	Stantec 2000
Aug. 2000	Milk River	Town of Milk River	0.26	R.L.&L. 2002
Oct. 1986	Milk River	Lower section[3]	0 – 2.05	R.L.&L. 1987
Oct. 2000, 2001	Milk River	Lower section[3]	0 – 1.90	R.L.&L. 2002
Summer 1989	St. Mary River	Overall	5.76	Paetz 1993
Aug. 2000	St. Mary River	Overall	2.77 – 8.02	R.L.&L. 2002
Summer 1989	Lee Creek	Cardston	3.60	Paetz 1993
Aug. 2000	Lee Creek	Cardston	16.62	R.L.&L. 2002

[1] Approximately 5 km downstream of international border

[2] Includes four sites collected in the lower North Milk River and one site immediately downstream of the confluence

[3] Sites between the town of Milk River and approximately 90 km upstream of international border

River, was believed to be substantial in size based on collections conducted in 1981 (Peden and Hughes 1984). No new information has become available since that time.

Columbia mottled sculpin numbers in the lower Columbia River in British Columbia were considered low, but no pre-dam estimates of abundance exist for comparison (Peden 2000a). In general, these populations were thought to be relatively healthy, although vulnerable to human development (Peden 2000a).

LIMITING FACTORS

1. Alberta. **-** The St. Mary shorthead sculpin is considered locally abundant, but its range is extremely limited, being restricted to the St. Mary River, upper and mid-Milk River and North Milk River. A comparison of habitats occupied by the sculpin in these systems with habitats elsewhere in the Oldman River system suggests that favourable habitat is available elsewhere (e.g., Upper Belly River, Waterton River above the Waterton Reservoir and the Oldman River mainstem upstream of Fort McLeod) (Paetz 1993). However, expansion into these habitats is blocked by the presence of the St. Mary Reservoir, Waterton Reservoir and dam, and unfavourable conditions downstream of the reservoirs (e.g., low water flows, high summer water temperatures and silted substrate) (Paetz 1993, W. Roberts, pers. comm.).

Under adequate flow conditions, spawning, rearing, feeding and overwintering habitats do not appear to be limiting throughout the St. Mary River above the reservoir, or the Milk River, except in the lower section (R.L.&L. 2002). The main threat to the populations of the St. Mary shorthead sculpin in Alberta appears to be the potential loss of flowing water through impoundment, diversions and water removal, in combination with the frequent drought conditions experienced in southern Alberta (Paetz 1993). Within the Milk River, the removal of water in Montana from the upper section, in combination with the natural low flows, is likely responsible for the lack of favourable habitat conditions (i.e., depleted water flows) and the disappearance of sculpins here. Reduced water flow affects the availability of physical habitat, and it also increases water temperatures during the warm summer months. Indeed, Willock (1969) stated that temperature was the most important factor affecting the distribution of the sculpin in the Milk River. He believed that this was one of the reasons that sculpins only occurred in the upper sections of the north and south branches where temperatures are lower because of increased rainfall and higher elevations.

In addition to the potential impacts to sculpin habitat downstream of impoundments, the habitat alterations associated with an impounded area of a river, such as the St. Mary Reservoir or the proposed reservoir on the Milk River, may be significant. No sculpins have been collected from the St. Mary Reservoir, although sampling has been extremely limited (T. Clayton, pers. comm.). The reservoir has a very limited littoral zone (see glossary, Appendix 2), and water levels fluctuate widely throughout the year (Paetz 1993, T. Clayton, pers. comm.). Other alterations to habitat would likely include elevated summer temperatures in shallow littoral areas, increased silting of substrate and the loss of riffle habitat, none of which are desirable for sculpin habitat (A. Peden, pers. comm.). Finally, the aquatic insect community, which sculpins depend upon for food, would be altered from one suited to flowing water conditions to one suited to lake conditions (T. Clayton, pers. comm.).

2. Other Areas. **-** The Columbia mottled sculpin does not appear to have adapted well to reservoir environments or their downstream effects as only low numbers were found after intensive sampling of reservoirs on the lower Kootenay and Columbia rivers downstream of a large hydro-electric dam in British Columbia (Peden 2000a). These observations suggest limitations associated with reservoir conditions and

unnatural fluctuations in water levels, temperature and flow associated with hydro-electric facilities (Peden 2000a). The Flathead River population of mottled sculpins is considered vulnerable to coal mine development in the Flathead Valley (Peden 2000a). This population may also experience competitive exclusion in upstream sections by *Cottus cognatus* inhabiting colder headwaters (Peden 2000a). No information on limiting factors was available for populations outside of Canada.

STATUS DESIGNATIONS*

1. Alberta. - The St. Mary shorthead sculpin is currently ranked as *May Be At Risk* according to the *General Status of Alberta Wild Species 2000* (Alberta Sustainable Resource Development 2001). However, it is not currently listed under Alberta's *Wildlife Act*. The mottled sculpin (*C. bairdi*) is provincially ranked as *Not Assessed* (Alberta Sustainable Resource Development 2001). The Alberta Natural Heritage Information Centre tracks provincial and global rankings. Provincially, the St. Mary shorthead sculpin is ranked as "S1" (as of April 2000) (ANHIC 2002b).

2. Other Areas. - The St. Mary shorthead sculpin has not been assessed by COSEWIC (Committee on the Status of Endangered Wildlife in Canada). In British Columbia, the mottled sculpin (*C. bairdi*) is considered a "blue-listed" species, indicating that it is a species of special concern, and is provincially ranked as "S3" (British Columbia Conservation Data Centre 2000). The mottled sculpin is nationally ranked as "N5" in both Canada and the United States (NatureServe Explorer 2002). It is considered "S1" in Delaware and possibly also in New Mexico, but "S2" in four other states (Alabama, Illinois, Iowa and Vermont) and "S3?" in one state (Washington). It is relatively secure (S4, S3S4 or S5) in 18 other states, unranked in three states and considered an exotic in Arizona. Globally, the Nature Conservancy ranked the mottled sculpin as "G5" (as of September 1996) (NatureServe Explorer 2002), the lowest ranking.

The Columbia mottled sculpin in British Columbia (*C. bairdi hubbsi*) received a national *Special Concern* designation by COSEWIC in May 2000 (COSEWIC 2002). Although the known distribution of the Columbia mottled sculpin remains incomplete, it has been given an "S3" ranking in British Columbia and an "S4" ranking in Oregon (NatureServe Explorer 2002). Globally, it is ranked as "G5T4Q" (globally secure, subspecies apparently secure, questions around subspecies taxonomy); more information is required to clarify the taxonomic and geographic scope of this taxon (NatureServe Explorer 2002).

RECENT MANAGEMENT IN ALBERTA

As of 1997, the provincial *Wildlife Act* enables the listing of endangered or threatened fish species. However, the St. Mary shorthead sculpin has not been listed under the *Wildlife Act* to date. In view of its extremely limited distribution in Alberta, a provincial management plan was developed by Paetz (1993) to aid in protecting existing populations. More recently, the Fish and Wildlife Division of Alberta Sustainable Resource Development commissioned surveys in the Milk River (2000 to 2002) to help determine the status of several non-game fish species, including the St. Mary shorthead sculpin, and to provide recommendations with regards to protection (see RL&L 2002, P&E 2002).

SPECIAL SIGNIFICANCE OF THE SPECIES

The St. Mary shorthead sculpin appears to be an unrecognized taxon within the western mottled sculpin complex. Regardless of taxonomy, it has a very limited distribution both provincially within Alberta and nationally, apparently present in only three river systems including the St. Mary and Milk rivers in

Alberta, and the Flathead River system in British Columbia. This genetically distinct sculpin represents an evolutionarily important component of species diversity for fish fauna in Canada and should therefore receive a high level of protection.

The life history and behaviour of the St. Mary shorthead sculpin suggest a relatively sedentary species with limited dispersal. Given this feature and the fact that these sculpins appear to prefer cooler waters and clean substrates, this fish would make an excellent biomonitor of environmental conditions for the rivers in which it resides.

SYNTHESIS

If the most recent taxonomic theories are correct, the St. Mary shorthead sculpin represents a distinct but as yet unrecognized taxon, and the Alberta populations in the St. Mary and Milk river systems are of high conservation value. Regardless of taxonomy, the St. Mary shorthead sculpin has a very limited distribution in Alberta, making it vulnerable to extirpation through habitat degradation and loss in local areas. In particular, sculpins found in the Milk River system and Lee Creek may be negatively affected by the annual operation of the St. Mary Canal and water withdrawal for irrigation. Water use, in combination with the natural drought conditions associated with southern Alberta, may be the biggest threat to the St. Mary shorthead sculpin in Alberta.

The St. Mary shorthead sculpin is considered locally abundant where it occurs in Alberta, but its abundance and distribution appear to fluctuate depending on season, location and water flow conditions. In addition, the number of genetically distinct populations represented in Alberta is unclear. The annual operation of the St. Mary Canal probably allows regular dispersal from the St. Mary River to the Milk River, creating the potential for one-way gene flow. However, some genetic isolation and subpopulation structure likely exist within these systems.

The conservation of the St. Mary shorthead sculpin in Alberta will require a number of actions. Habitat protection guidelines need to be incorporated into irrigation agreements and water sharing arrangements [both within the province and between provincial and state (Montana) governments]. Baseline information on population size and distribution should be established and estimated regularly to provide information on this species' status. The resolution of the genetics of the St. Mary shorthead sculpin will enable managers to put the conservation of these fish into a broader, global context. Research to address this issue is ongoing, but results are currently unavailable. In addition, specimens from the Milk and North Milk rivers should be added to genetic surveys to confirm their relationship with the St. Mary River population. In conclusion, the genetically distinct St. Mary shorthead sculpin should be considered as an evolutionarily important representative of the western mottled sculpin group and given a high level of protection in Alberta.

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Appendix 1. Definitions of selected legal and protective designations.

A. The General Status of Alberta Wild Species 2000 (after Alberta Sustainable Resource Development 2001)

2000 Rank	**1996 Rank**	**Definitions**
At Risk	Red	Any species known to be *At Risk* after formal detailed status assessment and designation as *Endangered* or *Threatened* in Alberta.
May Be At Risk	Blue	Any species that may be at risk of extinction or extirpation, and is therefore a candidate for detailed risk assessment.
Sensitive	Yellow	Any species that is not at risk of extinction or extirpation but may require special attention or protection to prevent it from becoming at risk.
Secure	Green	Any species that is not *At Risk*, *May Be At Risk* or *Sensitive*.
Undetermined	Status Undetermined	Any species for which insufficient information, knowledge or data is available to reliably evaluate its general status.
Not Assessed	n/a	Any species known or believed to be present but which has not yet been evaluated.
Exotic/Alien	n/a	Any species that has been introduced as a result of human activities.
Extirpated/Extinct	n/a	Any species no longer thought to be present in Alberta (*Extirpated*) or no longer believed to be present anywhere in the world (*Extinct*).
Accidental/Vagrant	n/a	Any species occurring infrequently and unpredictably in Alberta, i.e., outside its usual range.

B. Alberta Wildlife Act/Regulation

Species designated as *Endangered* under Alberta's *Wildlife Act* include those listed as *Endangered* or *Threatened* in the Wildlife Regulation.

Endangered	A species facing imminent extirpation or extinction.
Threatened	A species that is likely to become endangered if limiting factors are not reversed.

C. Committee on the Status of Endangered Wildlife in Canada (after COSEWIC 2002)

Extinct	A species that no longer exists.
Extirpated	A species that no longer exists in the wild in Canada, but occurs elsewhere.
Endangered	A species facing imminent extirpation or extinction.
Threatened	A species that is likely to become endangered if limiting factors are not reversed.
Special Concern	A species of special concern because of characteristics that make it particularly sensitive to human activities or natural events.
Not at Risk	A species that has been evaluated and found to be not at risk.
Data Deficient	A species for which there is insufficient scientific information to support status designation.

D. Heritage Status Ranks: Global (G), National (N), Sub-National (S) (after Alberta Natural Heritage Information Centre 2002c)

G1/N1/S1	5 or fewer occurrences or only a few remaining individuals. May be especially vulnerable to extirpation because of some factor of its biology.
G2/N2/S2	6-20 or fewer occurrences or with many individuals in fewer locations. May be especially vulnerable to extirpation because of some factor of its biology.
G3/N3/S3	21-100 occurrences, may be rare and local throughout its range, or in a restricted range (may be abundant in some locations). May be susceptible to extirpation because of large-scale disturbances.
G4/N4/S4	Typically >100 occurrences. Apparently secure.
G5/N5/S5	Typically >100 occurrences. Demonstrably secure.
GX/NX/SX	Believed to be extinct or extirpated, historical records only.
GH/NH/SH	Historically known, may be relocated in future.
GR/NR/SR	Reported, but lacking in documentation

E. United States Endangered Species Act (after National Research Council 1995)

Endangered	Any species which is in danger of extinction throughout all or a significant portion of its range.
Threatened	Any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.

APPENDIX 2. Glossary of terms.

Catch-per-unit-effort (CPUE) – A standard fisheries term that quantifies fish abundance in terms of effort applied to catch fish using a particular sampling methodology

Endemic – Originating from and unique to a particular geographic area

Fork length – The straight length distance from the tip of the snout laterally to the central part of the margin of the tail fin (Nelson and Paetz 1992)

Lateral line pores – A series of pores running along the sides of the body in a line from the gill area to the tail end

Littoral zone – shallow zone around the perimeter of the lake where rooted aquatic vegetation still receives enough sunlight for photosynthesis.

Palatine teeth – paired bone lying in the roof of the mouth with teeth (adapted from Nelson and Paetz 1992)

Papillae – Small fleshy projections (Nelson and Paetz 1992)

Preopercular spines – spines in front of the gill cover

Refugium (glacial) – Ice-free areas that provided habitat for species during glacial periods

Run/boulder gardens – Run habitat is a channel with moderate to high water velocities, but where the water surface remains relatively unbroken. Boulder gardens in run habitat are described as large boulders improving instream cover, depending on flow level (summarized from the stream habitat classification system in R.L.&L. 2002).

Standard length – The straight line distance from the tip of the snout to the end of the hypural plate (tail end of spine) where tail fin can be moved side to side (Nelson and Paetz 1992)

Total length – The straight line distance from the tip of the snout to the extreme end of the tail fin (Nelson and Paetz 1992)

Vomerine teeth – median bone on the roof of the mouth with teeth (adapted from Nelson and Paetz 1992)

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