

Status of the Pygmy Whitefish (Prosopium coulteri) in Alberta

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PREFACE

Every five years, the Fisheries and Wildlife Management Division of Alberta Natural Resources Service reviews the status of wildlife species in Alberta. These overviews, which have been conducted in 1991 and 1996, assign individual species to 'colour' lists 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 primary 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 1996 *Status of Alberta Wildlife* review process, and provides comprehensive current summaries of the biological status of selected wildlife species in Alberta. Priority is given to species that are potentially at risk in the province (Red or Blue listed), that are of uncertain status (Status Undetermined), or which 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 Fisheries and Wildlife Management Division of Alberta Environment, and are intended to provide detailed and up-to-date information which 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 which will assist the Alberta Endangered Species Conservation Committee to identify species that may be formally designated as endangered or threatened under the Alberta 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

Pygmy whitefish (Prosopium coulteri) are a glacial relict species that are known from two watersheds in Alberta. A total of eight specimens have been collected in Alberta: two from Waterton Lake and six from four localities in the upper Athabasca River as far downstream as Whitecourt. In other jurisdictions such as British Columbia and the Northwest Territories, pygmy whitefish are found in cold deep lakes similar to Waterton Lake. The species has also been reported from the Saskatchewan portion of Lake Athabasca. Little is known of the biology of pygmy whitefish in river systems except that they are found in relatively cold, fast mountain streams.

Pygmy whitefish are ranked as S1 in Alberta. The population of pygmy whitefish in Alberta appears to be small and scattered. Knowledge of pygmy whitefish population size, distribution, biology and limiting factors is very limited. The species' rarity in the upper Athabasca River makes this population susceptible to ecological perturbations and habitat degradation.

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INTRODUCTION

Pygmy whitefish (Prosopium coulteri; Eigenmann and Eigenmann 1892), are small, slim whitefish with relatively large scales, a blunt snout and almost cylindrical bodies. Pygmy whitefish have a wide, but disjunct distribution in northern North America. The few specimens that have been found in Alberta have been from Waterton Lake and parts of the upper Athabasca River drainage. It is likely that the main reason the data for pygmy whitefish are so sparse in Alberta is that people have misidentified pygmy whitefish as juveniles of their much more abundant relative, the mountain whitefish (Prosopium williamsoni Girard), which occurs in the same stream habitats. Pygmy whitefish are listed as S1¹ in Alberta (ANHIC 2000). There is no designation for the species by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC 1999) to date, but it has been proposed that the Alberta population be listed as 'vulnerable' (Mackay 1998).

This report summarizes current and historical information on pygmy whitefish in order to update its status in Alberta. Furthermore, identification and description information is provided in an effort to improve identification of pygmy whitefish in the province.

HABITAT

Pygmy whitefish are typically found in the deep parts of deep, cold lakes and in some fast, cold montane streams. Their distribution and preference for cold water suggests that pygmy whitefish are likely a glacial relict species. In the bottom waters of deep cold lakes, pygmy whitefish are spatially separated from lake

whitefish (Coregonus clupeaformis Mitchell) and cisco (Coregonus artedii Lesueur), which appear to occupy a similar niche in shallower water (McCart 1963). In cold, fast moving rivers, pygmy whitefish appear to coexist with, but are much less abundant than, their closest relative, the mountain whitefish.

In lakes, pygmy whitefish are usually found at depths of >6 m. Fish collected in Waterton Lake were caught on the bottom at a depth of about 50 m (Lindsey and Franzin 1972). Similarly, pygmy whitefish collected in the eastern portion of Lake Athabasca (in Saskatchewan) were also from deep water (D. Tripp, pers. comm.). Experts contend that the most successful method of sampling pygmy whitefish in deep lakes in the southern part of their range is with small mesh gill nets set at the bottom of the lake (P. McCart, pers. comm.). In southwestern Alaska, pygmy whitefish were found at all depths from shallow areas near shore to 168 m (Heard and Hartman 1965). At these northern latitudes the species was most common in shallow water. Pygmy whitefish also occur in fast moving montane rivers and streams that are clear or silted (McPhail and Lindsey 1970, Mayhood 1992).

CONSERVATION BIOLOGY

Very little is known about the life history of pygmy whitefish in Alberta. One reason for this lack of knowledge is that pygmy whitefish are easily confused with the young of their close relatives, the mountain whitefish, in river populations, and the round whitefish (Prosopium cylindraceum Pallas), in northern lakes. However, even when experts have gone looking for pygmy whitefish in the upper Athabasca River or Lake Athabasca, only a few were found despite considerable effort (D. Mayhood, P. McCart, and B. Shelast, pers. comm.). The accurate identification of pygmy whitefish is therefore essential to the

¹ See Appendix 1 for definitions of selected status designations

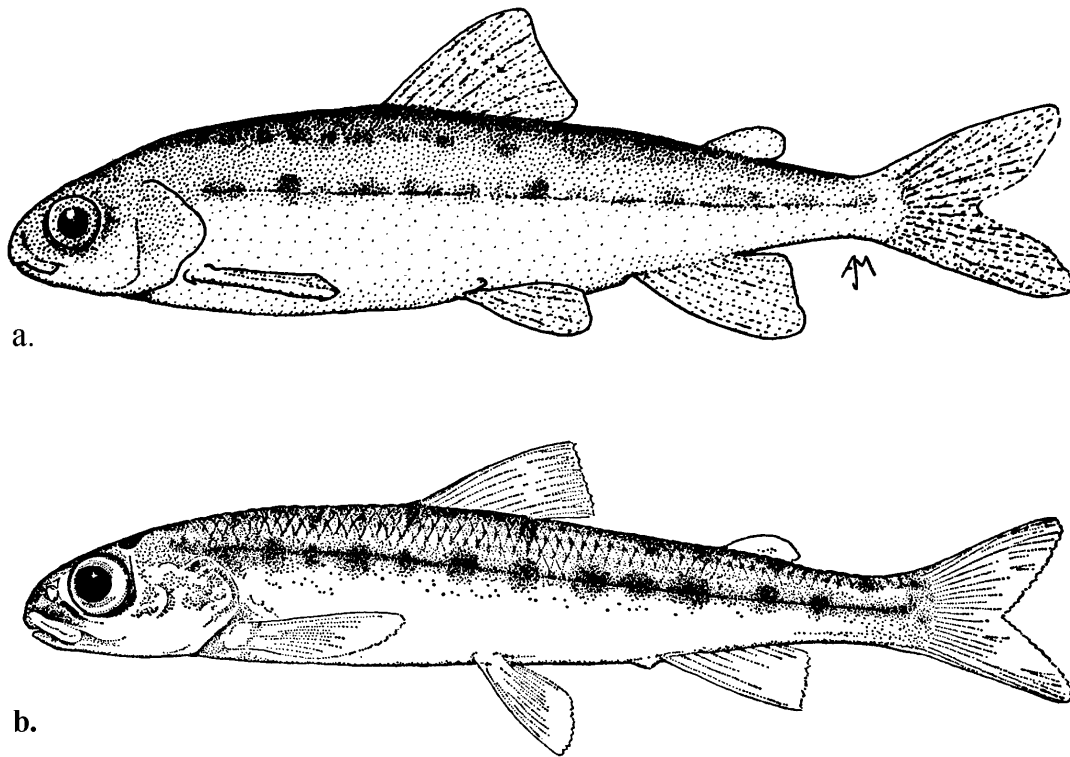


Figure 1. Drawings of pygmy whitefish from (a) Nelson and Paetz (1992) and (b) Scott and Crossman (1973).

acquisition of knowledge on their distribution and life history in Alberta.

Pygmy whitefish are small (maximum size 65-260 mm) and slim with relatively large scales, a blunt snout and almost cylindrical bodies (Figure 1). In cross section, the depth of the body is less than twice its width (Scott and Crossman 1973). The head is longer than the body depth and the diameter of the eye is larger than the snout length (Scott and Crossman 1973). Pygmy whitefish have 50-70 scales along the lateral line that contain sensory pores and 13-33 pyloric caeca (finger-like projections at the junction of the stomach and small intestine; McPhail and Lindsey 1970). The maximum length reported is 26.2 cm fork length² (FL) measured in British Columbia (McCart 1963), but in most waters pygmy whitefish only reach 10 to 14 cm total length³. Individuals that are less than 10-12 cm total

length have 7-14 distinct dark round to oval markings on the sides along the lateral line as well as 12-14 similar spots along the middle back. The oval markings along the sides are similar to the dark markings, called 'parr marks', which are found along the sides of many juvenile salmonids. These markings, together with the species' small size as adults, can lead to misidentification of pygmy whitefish as juveniles of other whitefish species. During the spawning season, both sexes develop nuptial tubercles (hard, calcified bumps) on the head, back, sides and pectoral fins (Weisel and Dillon 1954). At the same time, the ventral fins of both sexes become

² measured from the tip of the snout to the base of the fork in the tail

³ measured from the tip of the snout to the longest point on the caudal fin when the caudal fin is in the natural position

orange (Heard and Hartman 1965).

The feature that distinguishes Prosopium species from ciscos is the position of the mouth, which is posterior to the tip of the snout. Prosopium species can be distinguished from Coregonus species by the single flap between the nostrils (Figure 2a) and the ventral notch in the adipose eyelid (Figure 2b).

Pygmy whitefish are most likely to be confused with the mountain whitefish in western Alberta and with the round whitefish in the Lake Athabasca region of northeastern Alberta (see Appendix 2). The main external features that distinguish pygmy whitefish from these other Prosopium species are its rather elongate head, relatively large eye (Figure 2c), relatively blunt snout (Figure 2c), and relatively small adipose fin (Figure 3). Along with the dark markings on the sides and back, these identification features are most useful in the field to distinguish pygmy whitefish from mountain whitefish.

Little is known of the general biology of pygmy whitefish in Alberta. There is almost no information in the literature concerning the biology of riverine populations of pygmy whitefish. Most of the information below has been drawn from existing literature on lake populations.

Like other members of their genus, pygmy whitefish are fall spawners. Spawning has been reported in November or December for populations in Glacier National Park in Montana (Schultz 1941, Weisel and Dillon 1954), Lake Superior (Eschmeyer and Bailey 1955), British Columbia (McCart 1965) and in southwestern Alaska (Heard and Hartman 1965). In Alberta, one of two males collected in early October in the lower Snake Indian River was in spawning condition (Mayhood 1992). This indicates that spawning may occur

earlier in the Athabasca River population than has been recorded elsewhere. In Alaska, pygmy whitefish from Brooks Lake moved into the Brooks River and spawned there at night beginning in early November (Heard and Hartman 1965). Similar spawning behaviour was observed in Montana where pygmy whitefish moved into inlet streams of Bull Lake from mid-December to January and Flathead Lake in late November and December (Weisel et al 1973).

Pygmy whitefish mature at an early age and at a small size. Males mature at age one or two and from 60 to 80 mm whereas females mature at age one to three and from 70 to 228 mm (Heard and Hartman 1965, McCart 1965). The northern populations and populations from relatively colder waters mature at a smaller size and younger age than southern populations. In Brooks Lake in Alaska, both males and females matured at age one or two and males matured as small as 58 mm and females as small as 61 mm (Heard and Hartman 1965). However, in southern populations males are mature by age two and at 81-130 mm (Weisel and Dillon 1954, Eschmeyer and Bailey 1955, Weisel et al. 1973) and females mature from age two to three and at 97-228 mm (Weisel and Dillon 1954, Eschmeyer and Bailey 1955, Weisel et al. 1973). The only sexually mature male collected in Alberta was 86 mm FL (Mayhood 1992).

Fecundity records range from 200 eggs for a 90-mm FL female to 1000 eggs for a 150-mm FL female (Heard and Hartman 1965). The diameter of mature eggs has been measured as 2 mm in Lake Superior (Eschmeyer and Bailey 1955) and 2.4 mm in Alaska (Heard and Hartman 1965).

Pygmy whitefish appear to be quite flexible in their diet. The diet of lacustrine pygmy whitefish is best known. These populations

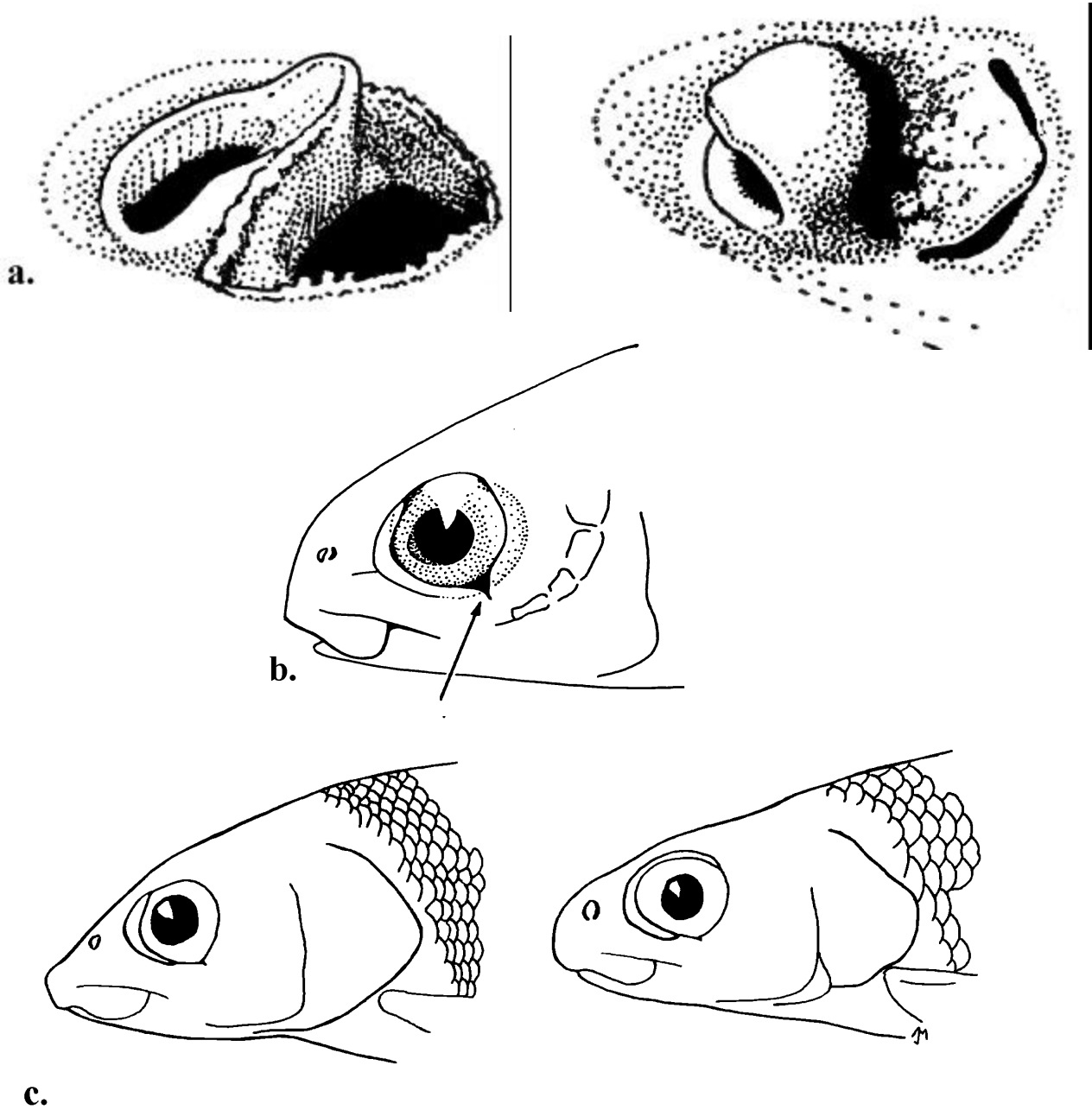
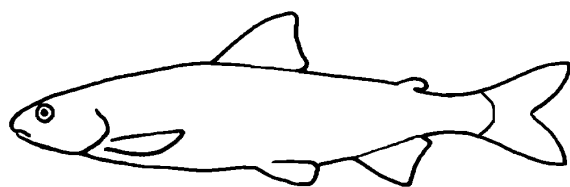


Figure 2. External anatomical features that help distinguish pygmy whitefish from other coregonids: (a) single nasal flap between nostrils of Prosopium species (left) and two nasal flaps found in other coregonids (from McPhail and Lindsey 1970); (b) ventral notch in adipose eyelid of Prosopium species (from McPhail and Lindsey 1970); (c) profile of head of a mountain whitefish (left) and pygmy whitefish (right) (from Nelson and Paetz 1992).



Pygmy Whitefish



Round Whitefish



Mountain Whitefish

Figure 3. Profiles of pygmy whitefish and other Prosopium species (from Nelson and Paetz 1992). Note large adipose fin on mountain whitefish and relatively slimmer body of pygmy whitefish.

feed on planktonic and benthic invertebrates. In four British Columbia lakes, the most important food items were small cladocerans, the larvae and pupae of midges and Chaoborus larvae (McCart 1965). In Alaska, the major food organisms were crustacean zooplankton and insects. The crustaceans included several cladocerans (Daphnia, Bosmina and Holopedium) and copepods (Cyclops and Diaptomus; Heard and Hartman 1965). The major insects eaten were dipterans (mainly Chironomidae) and plecopteran nymphs (Heard and Hartman 1965). In western Montana, pygmy whitefish fed on Cladocera as well as chironomid larvae and pupae (Weisel et al. 1973). The major food organisms in Lake

Superior were Pontoporeia, a benthic crustacean, but ostracods were also consumed (Eschmeyer and Bailey 1955).

Little is known about the parasites of pygmy whitefish. The only record of parasites are from populations in western Montana that harboured cysts of the myxobolid parasite (Henneguya zschokkei Gurley) in their muscles (Mitchell 1989).

DISTRIBUTION

1. Alberta. - There are only a small number of deep, cold lakes in Alberta in which one could expect to find pygmy whitefish: Waterton Lake, in which they have been found (Figure 4), Cold Lake and Lake Athabasca. There is no record of pygmy whitefish from Cold Lake in spite of considerable fishing effort over several years (W. Roberts, pers. comm.). Records exist from the deep, eastern end of Lake Athabasca in Saskatchewan (P. McCart and D. Tripp, pers. comm.), thus, there is a reasonable expectation that they also occur in the Alberta portion of the lake. Lake Athabasca is not as deep on the Alberta side, which may limit suitable habitat for pygmy whitefish, but little or no effort has been devoted to collecting them there.

In the upper Athabasca River drainage pygmy whitefish have been found in Solomon Creek where it drains into the Athabasca River northwest of Hinton, in the Snake Indian River near where it drains into the Athabasca River in Jasper National Park (Mayhood 1980, 1992), and in the Athabasca River between the Snaring and Snake Indian Rivers (R. L. & L. Environmental Services 1995; Figure 4). Most recently pygmy whitefish were found in the Athabasca River at Whitecourt (Nelson and Shelast 1998). Pygmy whitefish have been reported from localities very close to Alberta. The species has been reported from the Peace River in British Columbia downstream of the



Figure 4. Locations of collections of pygmy whitefish in Alberta (see Appendix 3 for details).

present location of the Bennett Dam (McCart 1965) but has not been reported from the Peace River in Alberta. Pygmy whitefish are also found in Moose and Yellowhead Lakes in eastern British Columbia just west of Jasper National Park (McCart 1970).

The pygmy whitefish from Waterton Lake appear to be genetically distinct from the two major known stocks in British Columbia and Lake Superior (Lindsey and Franzin 1972). The pygmy whitefish from the lower Snake Indian River may differ from other stocks as

well (Mayhood 1992, Nelson and Shelast 1998).

2. Other Areas. - Pygmy whitefish have a wide but disjunct distribution in northern North America, extending from the Columbia basin in the northwestern United States through western and northwestern Canada and Alaska and in Lake Superior (Figure 5). In Canada, pygmy whitefish are widespread in British Columbia and have been reported from the Yukon Territory, Great Bear Lake in the Northwest Territories (Nelson and Paetz 1992),



Figure 5. Distribution of the pygmy whitefish in North America.

Lake Superior, and the eastern portion of Lake Athabasca in Saskatchewan. Pygmy whitefish have also been reported from the Chukchi Peninsula in Russia (Chereshnev and Skopets 1992). The species likely had a continuous distribution during the late Pleistocene but became disjunct after the retreat of the Wisconsin glaciation (Eschmeyer and Bailey 1955).

POPULATION SIZE AND TRENDS

1. Alberta. - The population of pygmy whitefish in Alberta appears to be small and scattered. A total of eight fish have been collected from five locations in Alberta (Figure 4). The records of pygmy whitefish from Alberta consist of two fish collected from Waterton Lake (Lindsey and Franzin 1972) and six fish collected from the upper Athabasca River: two from the Snake Indian River at its confluence with the Athabasca River in Jasper National Park (Mayhood 1980); one from the Athabasca River between the Snaring and Snake Indian Rivers (R. L. & L. Environmental Services 1995); one from Solomon Creek near its confluence with the Athabasca River northwest of Hinton, and two from the Athabasca River near Whitecourt (Nelson and Shelast 1998). The specimens of pygmy whitefish collected from the Athabasca River drainage were collected along with a relatively large number of young and adult mountain whitefish.

Too few pygmy whitefish have been collected in Alberta to establish any firm data on population size or trends for the province. Their relatively widespread occurrence along the upper Athabasca River indicates that a viable population exists there. The low numbers of individuals collected in the Athabasca River reflects a very small number of pygmy whitefish relative to the number of mountain whitefish of similar size collected at

the same sites (Mayhood 1980, B. Shelast, pers. comm.). Mayhood (1992) collected 420 adult and 38 juvenile mountain whitefish in the same general area as two pygmy whitefish.

Few pygmy whitefish have been recorded from the two lakes that overlap Alberta's provincial boundary: Waterton Lake in the southwest and Lake Athabasca in the northeast. Although the number of pygmy whitefish recorded from these lakes is sparse, the sampling effort has been equally sparse. Indeed, no pygmy whitefish have been collected from the Alberta portion of Lake Athabasca, but there is a reasonable expectation that they occur there (see 'Distribution' section, above). Nevertheless, the populations in Waterton Lake and Lake Athabasca are likely small.

2. Other Areas. - Even in habitats where they are known to occur, pygmy whitefish are not common. Most of the documented range of pygmy whitefish occurs in British Columbia and extends to the northwest through southwestern Yukon and Alaska. They are generally found in areas and habitats that have experienced little human impact. Populations in these areas are likely stable although all the data available are from individual populations that been studied only once. The populations for which data are available are from Lake Superior (Eschmeyer and Bailey 1955), central British Columbia (McCart 1963), southeastern Alaska (Heard and Hartman 1965) and the Flathead Lake area of Montana (Weisel et al. 1973). There are no recent data for any of these populations, however, indications are that throughout their range pygmy whitefish are rarely common. In Lake Superior, Eschmeyer and Bailey (1955) caught an average maximum of 37 fish per 10 minutes of trawling. In two British Columbia lakes, the maximum catch rate was 0.929 pygmy whitefish per net hour (McCart 1963). In Flathead Lake in Montana, pygmy whitefish were considered abundant

when they made up 4.8% of the total fish catch (Weisel et al. 1973). Pygmy whitefish appear to be more abundant in the Naknek River system in Alaska than anywhere else they have been studied (Heard and Hartman 1965). Using a beach seine⁴ which ranged from 33 to 43 m long, Heard and Harman (1965) caught up to 964 pygmy whitefish in a single haul and using a 2.6 m wide, 0.6 m deep otter trawl⁵, towed for less than 1000 m and caught 1567 pygmy whitefish.

LIMITING FACTORS

Pygmy whitefish occur in two distinct habitat types: deep water of cold deep lakes and fast cold rivers. Their use of deep water locations make pygmy whitefish relatively isolated from human disturbance. The populations in Waterton Lake and Lake Athabasca may not be large but they are well buffered from direct human disturbance. However, these populations may be affected by the warming that has occurred since the last ice age. The effects of warmer water temperatures have not been studied but warmer water may force pygmy whitefish to compete with other species in habitats previously unused by sympatric species such as mountain whitefish. Stocking with non-native stocks may also negatively affect pygmy whitefish. Stocking of non-native fish has occurred in both Waterton Lake and the Athabasca River during this century.

Little is known about the biology of riverine stocks of pygmy whitefish in Alberta or

elsewhere. Few observations have been made concerning the biology of riverine populations, but it is likely that mountain whitefish are formidable competitors with pygmy whitefish in rivers. The riverine stocks of pygmy whitefish in the upper reaches of the Athabasca River basin are sympatric with mountain whitefish (Mayhood 1992). One of the limiting factors for pygmy whitefish in the Athabasca River may be their ability to compete with mountain whitefish. Where pygmy whitefish have been collected in the upper Athabasca River, they have been out numbered by one or two orders of magnitude by mountain whitefish. This indicates that both species occupy spatially overlapping habitats and that pygmy whitefish are less successful in these habitats than mountain whitefish. Any additional environmental stresses such as habitat degradation or increases in water temperature may result in decreased competitive ability by pygmy whitefish.

The Athabasca River watershed is impacted by a variety of industrial developments including logging, oil and gas exploration and development, and mining. While it is not known how sensitive pygmy whitefish are to this type of habitat degradation, Mayhood (1992) believes that damage to rearing habitat in Jasper National Park has affected the pygmy whitefish in the Snake Indian River.

STATUS DESIGNATIONS

1. Alberta. - The pygmy whitefish is not listed under the provincial Wildlife Act and because they do not currently include fish species, the pygmy whitefish is not included in the provincial colour lists. The Alberta Natural Heritage Information Centre ranks the pygmy whitefish as S1 based on the few known localities in the province (ANHIC 2000; see Appendix 1 for an explanation of ranks).

⁴ Beach seines are long mesh nets that are set as far from shore as possible and are pulled to shore in the littoral zone. The nets often have a funnel or bag in the middle where all the fish that are captured accumulate.

⁵ Otter trawl nets are similar to beach seines, and are dragged along the bottom of lakes (or the ocean); they are kept on the bottom by 'otter boards' which pull the net down and out as it is towed behind the collection boat.

2. Other Areas. - Pygmy whitefish do not have any special protection in Canada other than the general protection provided by the Fisheries Act. In the United States pygmy whitefish are listed as a species of 'special concern' in Wisconsin and Washington (Johnson 1987). Pygmy whitefish are considered to be 'rare' in Jasper National Park (Mayhood 1992). According to the Nature Conservancy's Natural Heritage Program criteria (The Nature Conservancy 1999), the pygmy whitefish is globally ranked as G5 meaning the species is 'secure'. It is ranked as S2 in Washington and S4 in Montana (The Nature Conservancy 1999).

RECENT MANAGEMENT IN ALBERTA

No specific management for pygmy whitefish has occurred in Alberta. The low numbers and restricted distribution of pygmy whitefish in Alberta prompted the Fisheries and Wildlife Management Division of Alberta Environment to commission a study of their status and to make a recommendation with regard to their protection. This study recommended that pygmy whitefish be considered 'vulnerable' in Alberta (Mackay 1998).

SYNTHESIS

The two populations of pygmy whitefish that are known to occur in Alberta are isolated from one another and appear to be small. The

Waterton Lake population occurs in a national park and is relatively isolated from direct human disturbances. Introduced species are a threat to this population but the risk of extirpation of pygmy whitefish from Waterton Lake is small. The Athabasca River population outside of Jasper National Park appears to be small and widely scattered. This population is also subject to competition from introduced species but industrial activity in the upper Athabasca River makes the risk of extirpation to this population considerably greater than in Waterton Lake.

Little is known about the size of the Athabasca River population, their population dynamics, or their biology. The few pygmy whitefish collected in the upper Athabasca River after vast sampling effort suggests that this population of pygmy whitefish is relatively small and requires some measure of protection. This stock of pygmy whitefish may also be biologically distinct from other stocks. Only a small portion of the Athabasca River stock has the protection of Jasper National Park. Given their apparently small numbers and the potential for habitat disturbance in the upper Athabasca River basin, this population of pygmy whitefish could be significantly impacted by habitat degradation. The first step in protecting pygmy whitefish should be a study focussing on the distribution, biology, limiting factors and habitat requirements of pygmy whitefish in Alberta with a particular emphasis on the Athabasca River population.

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APPENDIX 1. Definitions of selected legal and protective designations.

A. Status of Alberta Wildlife colour lists (after Alberta Wildlife Management Division 1996)

Red	Current knowledge suggests that these species are at risk. These species have declined, or are in immediate danger of declining, to nonviable population size
Blue	Current knowledge suggests that these species may be at risk. These species have undergone non-cyclical declines in population or habitat, or reductions in provincial distribution
Yellow	Species that are not currently at risk, but may require special management to address concerns related to naturally low populations, limited provincial distributions, or demographic/life history features that make them vulnerable to human-related changes in the environment
Green	Species not considered to be at risk. Populations are stable and key habitats are generally secure
Undetermined	Species not known to be at risk, but insufficient information is available to determine status

B. Alberta Wildlife Act

Species designated as ‘endangered’ under the Alberta Wildlife Act include those defined as ‘endangered’ or ‘threatened’ by *A Policy for the Management of Threatened Wildlife in Alberta* (Alberta Fish and Wildlife 1985):

Endangered	A species whose present existence in Alberta is in danger of extinction within the next decade
Threatened	A species that is likely to become endangered if the factors causing its vulnerability are not reversed

C. Committee on the Status of Endangered Wildlife in Canada (after COSEWIC 1999)

Extirpated	A species no longer existing in the wild in Canada, but occurring elsewhere
Endangered	A species facing imminent extirpation or extinction
Threatened	A species likely to become endangered if limiting factors are not reversed
Vulnerable	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 not to be at risk
Indeterminate	A species for which there is insufficient scientific information to support status designation

D. 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

E. Natural Heritage Element Rarity Ranks (after The Nature Conservancy 1999)

Global or G-rank: Based on the range-wide status of a species.

Sub-national or S-rank: Based on the status of a species in an individual state or province. S-ranks may differ between states or provinces based on the relative abundance of a species in each state or province.

G1 / S1	Critically imperiled because of extreme rarity (5 or fewer occurrences, or very few remaining individuals), or because of some factor of its biology making it especially vulnerable to extinction
G2 / S2	Imperiled because of rarity (6 to 20 occurrences), or because of other factors demonstrably making it very vulnerable to extinction throughout its range
G3 / S3	Either very rare or local throughout its range, or found locally in a restricted range (21 to 100 occurrences)
G4 / S4	Apparently secure, though it might be quite rare in parts of its range, especially at the periphery
G5 / S5	Demonstrably secure, though it may be quite rare in parts of its range, especially at the periphery

APPENDIX 2. Comparison of some morphological characteristics of three species of the genus Prosopium.

Character	pygmy whitefish <u>Prosopium coulteri</u>	mountain whitefish <u>Prosopium williamsoni</u>	round whitefish <u>Prosopium cylindraceum</u>
Total no. of rakers on gill arch	11-21	19-26	14-21
No. of rakers on lower arm of gill arch	8-13	8-10	9-13
No. of rakers on upper arm of gill arch	3-7	11-15	5-8
Teeth on gill rakers	none	present	present at base
No. of branchiostegal rays	6-9 + 6-9	7-10 + 7-10	6-9 + 7-9
No. of dorsal fin rays	10-12	11-15	11-15
No. pectoral fin rays	13-18	14-18	14-17
No. anal fin rays	10-14	10-13	10-13
No. lateral line scales	50-70	74-90	74-106
No. pyloric caecae	13-33	50-146	50-130
No. of vertebrae	50-55	53-61	62-64
Nuptial tubercles	Both males and females have them on the head, back, sides and paired fins	Only males have them on the sides, not on the head	On sides of males and females; more on the males
Nostril flap	single	single	single

APPENDIX 3. Details of pygmy whitefish collections from Alberta.

No.	Date of Collection	No. of Specimens	Location of Collection	Comments
1	23 June 1966	1	Solomon Creek near confluence with Athabasca River near Hinton	UAMZ 5277
2	13 July 1970	2	Waterton Lake	Lindsey and Franzin 1972
3	4-5 October 1980	2	Snake Indian River, Jasper National Park	UAMZ 7962; Mayhood 1980
4	19 May 1994	1	Athabasca River between Snaring and Snake Rivers	UAMZ 7617
5	9 June 1995	2	Athabasca River near Whitecourt	UAMZ 7945