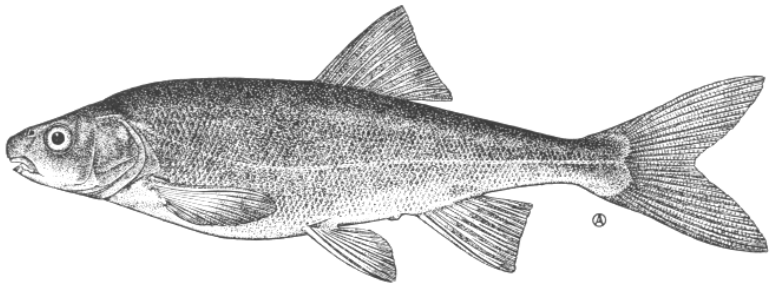
# COSEWIC
# Assessment and Update Status Report

on the

# Chiselmouth
*Acrocheilus alutaceus*

**in Canada**



**NOT AT RISK**
**2003**

**COSEWIC**
COMMITTEE ON THE STATUS OF
ENDANGERED WILDLIFE
IN CANADA

**COSEPAC**
COMITÉ SUR LA SITUATION
DES ESPÈCES EN PÉRIL
AU CANADA

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Rosenfeld, Jordan. 2003. Update COSEWIC status report on the chiselmouth, *Acrocheilus alutaceus,* in Canada. Committee on the Status of Endangered Wildlife in Canada (COSEWIC). Ottawa. 1-22 pp.

Previous report:

Coffie, P.A. 1997. COSEWIC status report on the chiselmouth *Acrocheilus alutaceus,* in Canada. Committee on the Status of Endangered Wildlife in Canada, Ottawa. 13 pp.

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Également disponible en français sous le titre Évaluation et Rapport de situation du COSEPAC sur le bouche coupante (*Acrocheilus alutaceus*) au Canada – Mise à jour.

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Chiselmouth — Drawing by Anker Odum, from Scott and Crossman (1973) by permission of the authors.


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# COSEWIC
# Assessment Summary

**Assessment Summary – May 2003**

**Common name**
Chiselmouth

**Scientific name**
*Acrocheilus alutaceus*

**Status**
Not at Risk

**Reason for designation**
The Canadian distribution of this species is restricted to a few disjunct populations in south-central British Columbia where they are found in low densities, but appear stable and are not subject to any known factors that could put them at risk.

**Occurrence**
British Columbia

**Status history**
Designated Data Deficient in April 1997. Status re-examined and determined to be Not At Risk in May 2003. Last assessment based on an update status report.

# COSEWIC
# Executive Summary

## Chiselmouth
*Acrocheilus alutaceus*

### Species information

Acrocheilus alutaceus (Agassiz and Pickering) is the only living member of it's genus. The common name Chiselmouth (Bouche coupante in french) reflects its square scleritized lower lip.

### Distribution

Chiselmouth occur in the Fraser and Columbia drainage basins in western Canada and the Pacific Northwest United States. Although chiselmouth are abundant throughout their American range, they have a much more limited distribution in British Columbia, and are restricted to the warmer interior of the province where they typically occur at lower densities than populations in Washington and Oregon.

### Habitat

Chiselmouth are primarily a large river fish, although they can occur at high densities in lakes as well. In both habitats chiselmouth will only occur in productive systems with enough algal growth on rocks to support adult fishes. Consequently, their distribution in B.C. is largely restricted to interior lakes and rivers.

In rivers, adult chislelmouth usually occur in deeper (greater than a meter) faster water over a boulder-cobble substrate that will support algae for adults to feed on. Juvenile fish occur in slower weedy marginal or backwater areas, where they feed on aquatic and terrestrial insects and occur in mixed schools with juvenile northern pikeminnow (Ptychocheilus oregonensis), peamouth chub (Mylocheilus caurinus), and redside shiner (Richardsonius balteatus).

### Biology

Chiselmouth are unique in western Canada in that they are the only native freshwater fish species west of the Rockies specifically adapted to eating algae. Although chiselmouth will opportunistically feed on invertebrates like most other minnows, their lower lip is straight and hard and adapted to scraping algae off of boulders or other hard surfaces (Moodie and Lindsey 1972), and algae constitutes the

primary diet of adults (see Scott and Crossman (1973) and B.C. Fish facts - http://www.fisheries.gov.bc.ca/Publications/chiselmouth.pdf – for more general information on biology). Chiselmouth are a relatively large minnow, attaining a maximum size of up to 30 cm. Although they sometimes hybridize with northern pikeminnow and peamouth chub, chiselmouth are readily distinguished from both species by their distinctive lower lip.

Reproduction is in the spring over coarse substrate. Spawning habitat in rivers in Canada is undocumented, but is possibly coarser substrate in mainstem habitat. However, spawning in smaller tributaries is also a possibility, since Moodie (1966) observed spawning of the Wolfe Lake population in a small inlet stream.

**Population sizes and trends**

Populations of chiselmouth in British Columbia tend to be disjunct (non-continuous) and often occur at low densities. Population sizes are poorly documented, but range from being likely very large (Nicola river basin) to very small (Salmon river basin near Prince George). Population trends are unknown, but there is no reason to believe that they are declining, although most watersheds where chiselmouth are present have experienced some degree of habitat degradation associated with forestry or agriculture. There appear to be no recent major extirpations relative to past collections (although the B.C. Fisheries Branch has historically chemically treated some lakes to remove “coarsefish” for stocking with rainbow trout, resulting in several local extirpations from small lakes; Don McPhail pers. comm.), but there have been no reliable estimates of population size in the past, and none in the present beyond point resampling to verify current distribution (presence/absence).

**Limiting factors and threats**

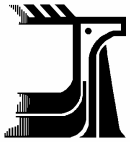
The large-scale distribution of chiselmouth in Canada is likely limited by temperature, i.e. colder rivers in B.C. provide inadequate thermal conditions for growth and development of eggs, juveniles and adults. Where temperatures are adequate, populations are probably limited by the availability of adequate deeper mainstem habitat with boulder/cobble substrate to support algae, and slower vegetated nearshore habitat for juvenile rearing. Threats primarily relate to habitat degradation from sedimentation of clean substrate used for adult foraging, loss of marginal and backwater habitats for juvenile rearing, and siltation of spawning habitat.

**Special significance of the species**

Chiselmouth are unique among Canadian fishes in both their body morphology and feeding mode. They are ecologically unique in that they are the sole primarily herbivorous freshwater fish native to western Canada. Canadian populations also encompass the northern range of the species global distribution.

## Existing protection or other status designations

Although chiselmouth are blue-listed in B.C. (identified as a species of concern), they have no protection. Chiselmouth are unlisted in the U.S.



## COSEWIC HISTORY

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

## COSEWIC MANDATE

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

## COSEWIC MEMBERSHIP

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

## DEFINITIONS
## (After May 2003)

| | |
|---|---|
| Species | Any indigenous species, subspecies, variety, or geographically or genetically distinct population of wild fauna and flora. |
| Extinct (X) | A species that no longer exists. |
| Extirpated (XT) | A species no longer existing in the wild in Canada, but occurring elsewhere. |
| Endangered (E) | A species facing imminent extirpation or extinction. |
| Threatened (T) | A species likely to become endangered if limiting factors are not reversed. |
| Special Concern (SC)* | A species of special concern because of characteristics that make it particularly sensitive to human activities or natural events. |
| Not at Risk (NAR)** | A species that has been evaluated and found to be not at risk. |
| Data Deficient (DD)*** | A species for which there is insufficient scientific information to support status designation. |

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

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

*** Formerly described as “Indeterminate” from 1994 to 1999 or “ISIBD” (insufficient scientific information on which to base a designation) prior to 1994.

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

# Update
# COSEWIC Status Report

on the

# Chiselmouth
*Acrocheilus aleutaceus*

**in Canada**

2003

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## SPECIES INFORMATION

### Name and Classification

*Acrocheilus alutaceus* (Agassiz and Pickering) is the only living member of it's genus. The cyprinid fauna west of the Rockies is relatively depauperate in Canada, and chiselmouth is a member of a small group of closely related four minnow species that are widespread throughout the Fraser and Columbia River basins, the other three species being northern pikeminnow (*Ptychocheilus oregonensis*), peamouth chub (*Mylocheilus caurinus*), and redside shiner (*Richardsonius balteatus*). Although these species are ecologically well differentiated – chiselmouth is an algivore, pikeminnow is a piscivore, and peamouth and redside shiners are planktivores – chiselmouth is known to hybridize with northern pikeminnow and peamouth chub (Patten 1960, Stewart 1966).

### Description

Chiselmouth (Fig. 1) are a relatively large cyprinid, reaching maximum sizes of up to 30 cm and a maximum recorded age of 6 years in Canada (Moodie 1966) and up to 22 years in Oregon (Lassuy 1990). Chiselmouth are uniquely adapted to herbivory, and have a chisel-like lower jaw that they use to scrape algae off of hard substrata (boulders, cobble, submerged wood). In addition to their distinctive lower jaw, chiselmouth have an unusually narrow caudal peduncle and large deeply forked caudal fin, suggesting adaptation to higher water velocities which is consistent with the habitat use observed for adult riverine fishes.

Although chiselmouth are readily distinguished from adults of other cyprinids, juveniles are difficult to distinguish from young redside shiners, peamouth, and pikeminnow with which they typically school. Scott and Crossman (1973) provides a more detailed description of chiselmouth morphology and a key for identifying adults; McPhail and Carveth (1993) and Rosenfeld et al. (2001) provide a key for separating juvenile chiselmouth, redside shiners, peamouth, and northern pikeminnow.

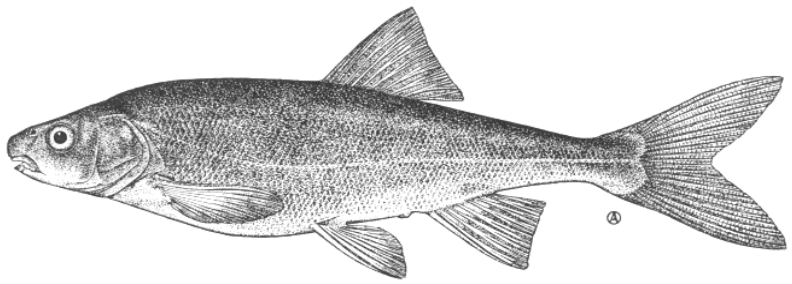

Figure 1. Chiselmouth, *Acrocheilus alutaceus*, -Male, 663 mm, British Columbia, Missizoula Lake, July 24-25, 1959; B.C. 60-221. [Drawing by Anker Odum, from Scott and Crossman (1973) by permission of the authors.]

## DISTRIBUTION

### Global Range

Chiselmouth are endemic to the west coast of North America, where they are restricted to the Fraser and Columbia river basins and Malheur Lake in Oregon (Scott and Crossman 1973, Wydowski and Whitney 1979). Chiselmouth are abundant and widespread throughout Oregon streams and rivers (Lassuy 1990) as well as Washington State, where Patten et al. (1970) reported chiselmouth to be the most abundant fish in the Yakima River in Washington (a major tributary of the Columbia). Chiselmouth are also present in Idaho and the northeast corner of Nevada (Columbia River tributaries). The combined area of the drainages occupied by chiselmouth in the United States is large, well over 20,000 $km^2$, and the linear distance of stream and river channels occupied is in the order of hundreds or thousands of kilometers.

Canadian populations of chiselmouth are more disjunct and appear to occur at much lower densities than in the central and southern part of the species range, and consequently may be ecologically and genetically distinct from populations in the U.S.

### Canadian Range

Chiselmouth are restricted to the warmer interior rivers and lakes in British Columbia. The total area of drainage basins occupied in Canada is well in excess of 5,000 $km^2$. However, this statistic is somewhat misleading, because only a fraction of the habitat available in each basin is suitable for chiselmouth. Nevertheless, the linear distance of streams and rivers occupied is approximately four hundred kilometers (based on very rough visual estimates of channel length from topographic maps), and close to a dozen lake populations occur in the same drainages. Extremely rough back-of-the-envelope calculations give an approximate wetted area of 40 $km^2$ for river habitat and 90 $km^2$ of wetted lake habitat area (excluding the very large Okanagan Lake; total lake area increases to 440 $km^2$ when Okanagan Lake is included).

Fraser basin populations of chiselmouth occur in the Blackwater River drainage west of Quesnel (including the tributary Euchiniko and Nazko rivers), in the Nicola river (Vadas 1998) as well as Nicola Lake, Vidette Lake, and Mara Lake, the upper Chilcotin, the Muskeg river (tributary to the Salmon river near Prince George, and the northernmost recorded occurrence of chiselmouth), and the Shuswap River (Fig. 2). Chiselmouth have also been reported from the mainstem Fraser between Quesnel and Prince George (McPhail unpublished). Columbia basin populations occur in the Okanagan river (including Skaha, Osoyoos and Okanagan Lakes), the Kettle river, and Wolfe and Missezula lake in the Similkameen drainage. This information is summarized in Table 1 (from Rosenfeld et al. 2001). The earlier record of chiselmouth from Lake Windermere in the Kootenay-Columbia drainage basin has not been confirmed. Although the specimen is correctly identified as a chiselmouth (Peter Troffe, Royal B.C. Museum, personal communication 1999), it is possible that the fish samples may have been mislabeled or confused during the original sampling survey (Don McPhail, UBC

Zoology, personal communication 1999). Chiselmouth were not collected during a 1998 inventory in Lake Windermere specifically targeted at them (Radridge 1998), however the most effective gear for collecting adults (2 – 2 ½ inch gill nets) was not used.

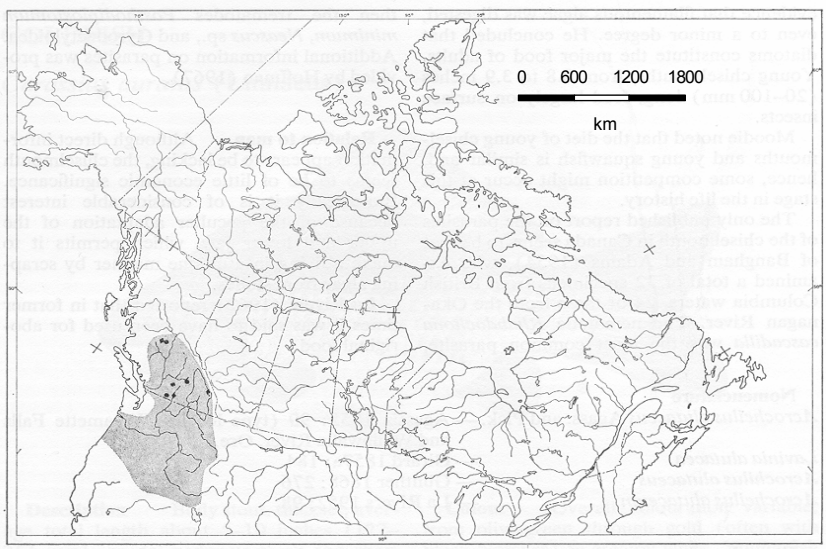


Figure 2. North American Distribution of chiselmouth [adapted from Scott and Crossman (1973)].

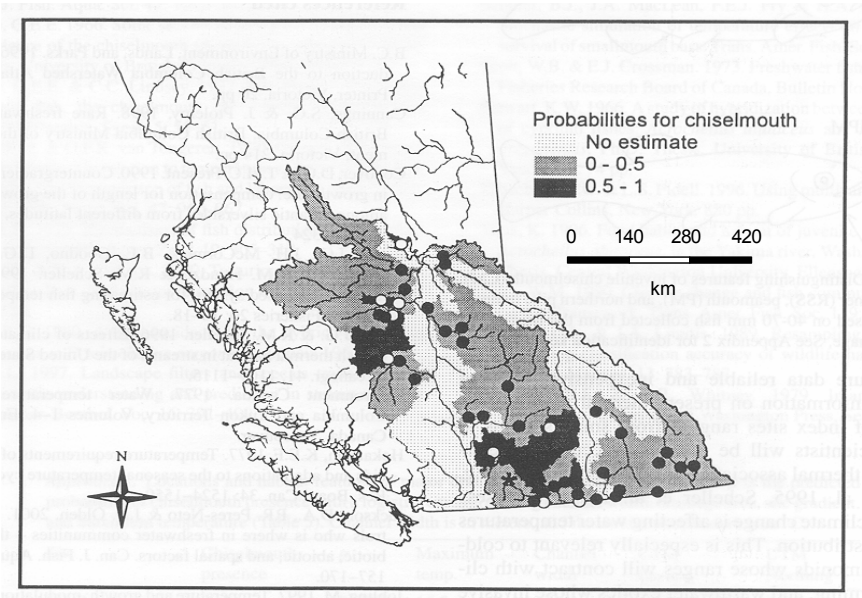


Figure 3. Canadian distribution of chiselmouth (from Rosenfeld et. al. 2001). White dots represent collection sites on major drainages where chiselmouth are present, and black areas represent drainage basins where chiselmouth are present within the Fraser and Columbia Rivers basins with a probability of greater than 0.5 based on habitat-based logistic regression models (from Rosenfeld et. al. 2001). Black dots represent sites where chiselmouth were absent, and grey areas represent major drainages with an estimated probability of chiselmouth occurrence less than 0.5.

**Table 1. Sites and corresponding drainage basins where chiselmouth have been collected in British Columbia (Rosenfeld et. al. 2001).**

| Site | Maximum temp. ¯C | Channel width m | UTM Easting | UTM Northing |
|---|---|---|---|---|
| Blackwater R. | 20.1 | 60 | 10U 0470550 | 5900450 |
| Euchiniko R. | 21.0 | 90 | 10U 0441200 | 5911500 |
| Nazko R. | 21.5 | 21 | 10U 0458500 | 5873400 |
| Muskeg R. | 22.0 | 20 | 10U 0490374 | 6034860 |
| Shuswap | 23.4 | 85 | 11U 0357426 | 5601119 |
| Upper Chilcotin | 24.4 | 32 | 10U 0453184 | 5775573 |
| Kettle R. | 24.5 | 193 | 11U 0400642 | 5429442 |
| Okanagan R. | 24.5 | 45 | 11U 0313650 | 5442000 |
| Nicola R. | 25.6 | 17 | 10U 0658418 | 5553912 |

Although there have been no formal or quantitative estimates of chiselmouth populations in Canada, fish catches during sampling indicate that chiselmouth are likely most abundant in the Nicola and Okanagan river populations. Chiselmouth appear to be less abundant (i.e. fewer were caught for a given sampling effort) in the more northerly and likely colder drainages – particularly the upper Chilcotin and Muskeg rivers.

Recent sampling throughout the known Canadian range of chiselmouth indicates that the range does not appear to have changed relative to earlier occurrences, i.e. there are no apparent trends in chiselmouth area of occupancy at the scale of major drainages. Although the absence of chiselmouth from Lake Windemere could be interpreted as a range contraction, it could equally be an original labeling error; similarly, the new record of chiselmouth in the Muskeg River near Prince George is likely the result of more intensive sampling rather than a range expansion. There have unquestionably been a number of deliberate local extirpations of chiselmouth from lakes which were chemically treated (up until the 1960s) by the provincial fisheries branch to remove “coarsefish” to facilitate stocking of monoculture rainbow trout for recreational angling. While these extirpations likely permanently eliminated isolated populations that could not be naturally recolonized, the total number of lakes that were treated is unknown. Identification of these lakes as potential sites for reintroduction may be useful, particularly if chiselmouth undergo declines in the future (although there is at present no reason to expect this).

In terms of long-term trends, in the absence of long-term habitat degradation (a questionable assumption), future range expansions and contractions will likely be related to climate change. Since the major limitation on chiselmouth distribution appears to be an adequate thermal regime (discussed below under habitat requirements and limiting factors and threats), chiselmouth distribution may be positively affected by global warming.

# HABITAT

## Habitat Requirements

Detailed habitat requirements of chiselmouth are poorly understood, but more is known about general habitat associations from which inferences on habitat requirements can be made. The factor that appears to limit chiselmouth distribution is stream temperature (Rosenfeld et al. 2001). Chiselmouth are absent from sites that have maximum temperatures below 20 °C or 2100 annual degree days. This is likely due to insufficient thermal conditions for growth and development of eggs, juveniles, adults, or their gonads at lower temperatures. In addition to an appropriate thermal regime, chiselmouth adults appear to require an abundance of deeper (greater than 1 m) faster flowing (water column velocities in the range of 40-80 cm $s^{-1}$; Rosenfeld et. al. 1998) habitat with boulder-cobble substrate that can be colonized by periphyton (as a food source). Thus adults will be restricted to streams with adequate suitable substrate as well as enough nutrients to support algal production. Based on location of captures, juveniles appear to require marginal, backwater, or side-channel habitat with slow current velocities for rearing. Juveniles are almost invariably collected in association with aquatic macrophytes, which are likely both a source of food (aquatic invertebrates – juveniles are insectivorous) and cover from predators. Juvenile chiselmouth are invariably collected in mixed schools with redside shiner, northern pikeminnow, and peamouth chub, likely reflecting similar juvenile habitat requirements and the advantage of schooling to avoid predation by larger fish.

Within a river system, chiselmouth appear to use primarily larger mainstem habitat; Rosenfeld et. al. (2001) did not find chiselmouth at sites with a bankful channel width of less than 17 m. This suggests that there may be little direct dependence of riverine chiselmouth on small stream habitat, although clearly habitat change that degrades small stream habitat leading to cumulative impacts on mainstem habitat will negatively affect chiselmouth. However, small streams may be very important for some lake populations, since Moodie (1966) observed spawning in the small inlet stream to Wolfe Lake.

Spawning habitat and substrate for riverine populations is largely unknown, but is likely over coarse gravel-cobble-boulder substrate, as documented for closely related species (e.g. redside shiner, northern pikeminnow, peamouth chub) and lake populations of chiselmouth (Moodie 1966). Presence of juveniles in marginal habitat of larger rivers suggests that spawning takes place in riffles of mainstem river habitat rather than in smaller tributary streams, although this remains largely speculative.

Overwintering habitat of chiselmouth is poorly defined, but observations in the Blackwater drainage (Rosenfeld et. al. 1998) suggest that fish appear to shift their distribution out of mainstem habitats in the fall (September-October, water temperatures below 6°C) towards lakes tributary to rivers or deeper (8 m) backwater habitat on the mainstem. Adult peamouth chub, northern pikeminnow, largescale sucker (*Catostomus macrocheilus*), longnose sucker (*Catostomus catostomus*), rainbow trout (*Oncorhynchus mykiss*), and bull trout (*Salvelinus confluentus*) were also caught in

deeper habitat, suggesting that many species of fish may overwinter in either lakes or larger deeper backwaters connected to mainstem habitat. Overwintering of chiselmouth in deeper water is supported by the observations of Moodie (1966) in Wolfe Lake, who found that by mid-October chiselmouth could no longer be found near the lake margins, and were only captured in deep-water habitat where they were previously absent.

Habitat requirements of chiselmouth in terms of water quality are undocumented. However, chiselmouth remain widespread in Oregon and Washington, indicating that they are likely not excessively sensitive to water quality impairment.

It is difficult to say what the minimum viable population size is for chiselmouth, since there are no reliable estimates of population size in any habitats. However, chiselmouth occur at relatively low densities in northern populations, and can typically be the least abundant fish collected; for instance, chiselmouth constituted approximately 2% of the total fish collected at 32 sites in the Blackwater drainage (Rosenfeld et. al. 1998), and were generally less than 10% of the total fish catch at any of the subset of sites where they occurred. That being said, chiselmouth populations in the Blackwater drainage probably have adult populations numbering in the thousands, and there is no reason to expect that these populations are under any particular threat. Nevertheless, small populations are more subject to extinction from stochastic events than larger ones, and northern populations are likely more vulnerable to extinction than southern ones, although the degree of vulnerability is unclear and likely not large.

Although chiselmouth distribution in Canada is discontinuous, no populations stand out as being essential for the survival of other populations. In terms of uniqueness, Fraser basin populations are potentially more unique than Columbia basin populations, since they are likely smaller, more disjunct, and potentially isolated longer from source populations, although velocity barriers and dams downstream of Canadian populations in the Okanagan and Kettle Rivers would likely limit exchange with populations in the United States. Recolonization of extirpated Fraser drainage populations might also be slow because densities are low and it is unclear whether populations are consistently present in the mainstem. Than being said, nothing is know concerning movements of chiselmouth, colonization ability, and what constitutes a barrier to an adult fish, so that classification of Fraser basin populations as more unique or more vulnerable is purely speculative.

**Trends**

There is insufficient data to evaluate trends in habitat for individual populations as there are no reliable past or present estimates of habitat availability or quality for any Canadian population. Trends based on range contraction or expansion indicate that there has been no change in species distribution between recent sampling (last 5 years) and historically recorded distribution (last 40 years), suggesting that there have been no major changes in habitat quality; however, distributional data does not take into account changes in abundance within a range, and habitat quality has clearly degraded in certain river basins (e.g. Nicola river and Okanagan river), as a consequence of

resources extraction activities and general development (e.g. agriculture, livestock grazing, logging, channelization, water extraction).

In terms of long-term trends, assuming that there is no long-term habitat degradation (a questionable assumption for populations experiencing agricultural or forestry impacts), future range expansions and contractions will likely be related to climate change. Since the major limitation on chiselmouth distribution appears to be an adequate thermal regime (discussed below under habitat requirements and limiting factors and threats), if anything chiselmouth distribution is likely to be positively affected by global warming, although the outcome of global warming is always difficult to predict because of complex effects on flow regimes, prey species, disease, and competitors (Davis et al. 1998).

Habitat trends in the United States are unknown, but likely similar to those in Canada, or worse (i.e. more habitat degradation associated with ongoing development in watersheds). However, American populations are apparently neither in decline or protected.

### Protection/Ownership

Although chiselmouth occur throughout British Columbia, most of the river frontage where they occur is on crown land. Much of this land is subject to active resource extraction (e.g. logging in the Blackwater, upper Chilcotin, and Salmon rivers, extensive livestock grazing and agriculture in the Nicola and Okanagan rivers). None of this habitat is legally protected (e.g. in protected areas), and it is unclear how much of it will be secure in the future. Although land-use legislation exists to regulate resource extraction on this land base (e.g. B.C. Forest Practices Code), logging, agriculture, and livestock grazing may have cumulative impacts that will degrade habitats used by chiselmouth, but it is unclear whether these effects have resulted in population declines. While local impacts are likely, particularly in streams subjected to intensive agriculture (e.g. Nicola and Okanagan rivers), it seems unlikely that land-use impacts will seriously decrease chiselmouth populations throughout their range. It also seems likely that other species (e.g. salmonids) are more likely to experience negative impacts of habitat change before chiselmouth. However, it should be made clear that this remains speculative, given that details of the tolerance of chiselmouth to habitat change are poorly documented.

## BIOLOGY

### General

Key life stages are eggs, which are deposited over clean coarse substrate (Moodie 1966), juvenile life stage (requires slow weedy marginal habitat), adult (coarse substrate in deeper mainstem habitat), and overwintering (deeper lake habitat tributary to mainstem habitat). Chiselmouth do not seem more vulnerable at any of these life stages than other cyprinids.

## Reproduction

Chiselmouth are relatively large for a cyprinid, and can live for up to 22 years (Lassuy 1990), although the maximum age recorded for a Canadian population is 6 years (Moodie 1966) and average adult age in the Wolfe Lake population studied by Moodie was 4-6 years. Moodie reported that males were sexually mature at age 3, and females usually at age 4. Later age of reproduction is a factor that contributes to the vulnerability of a species, however because chiselmouth are not subject to sport or commercial harvest this is of lesser concern.

Spawning habitat and substrate for riverine populations is largely unknown, but is likely over coarse gravel-cobble-boulder substrate, as documented for closely related species (e.g. redside shiner, northern pikeminnow, peamouth chub) and lake populations (Moodie 1966, summarized in Scott and Crossman 1973). Observation of hybrids (based on intermediate morphology; Patten 1960, Stewart 1966) indicates that spawning may take place in similar habitats for these species. Presence of juveniles in marginal habitat of larger rivers suggests that spawning takes place in riffles of mainstem river habitat, rather than in smaller tributary streams, although this is largely speculative. Lake populations will use small tributary streams for spawning (Moodie 1966). Moodie (1966) also observed spawning only at temperatures of 17 °C or higher, and 6 females had average egg counts of 6200. Further details of reproductive behaviour and requirements are lacking, particularly for riverine populations.

## Survival

There is little information on population age structure, stability, or survival rate of different life stages and what influences mortality. What information exists is for the lake population studied by Moodie (1966, summarized in Scott and Crossman 1973). Although Moodie (1966) observed higher growth rates of chiselmouth in the Okanagan River, it is unclear whether this difference reflects intrinsic differences in habitat quality or density dependent effects.

Growth potential of the more northern populations is likely low, since temperatures and shorter growing seasons likely limit growth and development of individuals. Periodic recruitment failure for northern populations is possible, since this has been documented for other cool-water fish species near the northern limits of their range (Shuter et al. 1980, Shuter and Post 1990), but there are no data to support this for chiselmouth.

## Physiology

Chiselmouth are a coolwater cyprinid, and it is likely that minimal thermal thresholds for development and growth at different life stages (eggs, juvenile, adult growth and gonad development) limit the distribution of the species in B.C., although it is unclear which particular life stage may be limiting. Absence of populations in water bodies with maximum temperatures below 20 °C or 2100 annual degree days (Rosenfeld et. al. 2001) supports the supposition of temperature limitation.

## Movements/Dispersal

Nothing is know concerning movements of chiselmouth, colonization ability, and what constitutes a barrier to an adult fish. It is unknown to what degree the Fraser River is a partial or complete barrier to adults from populations in tributaries; adults have been collected from the mainstem Fraser (Don McPhail, UBC Zoology, personal communication 1999), suggesting that some exchange of adults between tributary populations is possible.

Natural immigration from southern populations in the U.S. (Columbia basin) into Canadian populations is unlikely. There is a natural velocity barrier in the Kettle River at Cascade, B.C., that would prevent natural upstream dispersal, and there is also a barrier on the Okanagan River at Okanagan Falls. Fraser drainage populations are more fragmented with apparently relatively disjunct distributions. Populations in the Blackwater/Nazko/ Euchiniko, Salmon/Muskeg, Upper Chilcotin, Nicola, and Shuswap rivers are relatively isolated from one another and cannot be naturally colonized from outside of Canada.

## Nutrition and Interspecific Interactions

System productivity (availability of nutrients influencing algal production) may likely be a limiting factor for chiselmouth populations, insofar as growth rates would be slower in less productive streams. This could be one reason why populations are restricted to the more productive interior streams and lakes of B.C., unlike other cyprinid species (e.g. redside shiner). However, system productivity is highly correlated with water temperature (interior streams are both warmer and more productive), so that it is difficult to separate trophic and temperature effects.

Competition with other species may be a limiting factor in certain populations or habitats, although this is entirely speculative. Competition may be less likely to be important for adults, since their feeding mode and resource consumption is relatively unique in the B.C. fish fauna (although it is likely that sucker – largescale and bridgelip – also feed on periphyton on hard substrata). Juvenile chiselmouth occur in mixed schools with redside shiner, peamouth chub, and northern pikeminnow, and presumably consume similar resources, so that there is likely more scope for competition at the juvenile life stage, but this is speculative as well.

## Behaviour/Adaptability

Chiselmouth are relatively highly specialized trophically and morphologically. Specialization of their mouthparts as adults requires the presence of periphyton on hard substrates in sufficient quantities to support adult fish. However, chiselmouth remain omnivorous, and consume invertebrates as well as algae as adults – in fact they can be caught fly fishing or with live bait (e.g. worms). Similarly, chiselmouth are flexible in their habitat requirements insofar as they may occur in either lakes or streams, providing that suitable hard substrata is present for adults to feed on, and spawning and rearing habitat are also present.

Chiselmouth do not appear to be unusually susceptible to disturbance or stochastic perturbations, although this is based on limited information and is largely speculative. Because northern chiselmouth populations occur at low densities and populations are somewhat disjunct, they may be more subject to stochastic disturbance and have a lower probability of recovery or recolonization than populations or species that occur at higher densities or have more continuous distributions.

Moodie and Lindsey (1972) reported aggressive behaviour of chiselmouth held in aquaria, but it is unclear whether the species is territorial in the wild (seems unlikely but would be interesting to verify).

## POPULATION SIZES AND TRENDS

Chiselmouth are extremely abundant in many streams and rivers in their U.S. distribution. Chiselmouth were the most abundant species caught in the Yakima river (Patten et al. 1997) and are equally abundant in Oregon (Lassuy 1990). Densities of juveniles can be extremely high, and population size in larger rivers are unknown but probably on the order of tens of thousands of adults.

Chiselmouth occur at much lower densities and population sizes in British Columbia than in the southern (U.S.) part of their range. This is presumably because climatic conditions are harsher towards the northern end of the species distribution. In the more northern populations in B.C. chiselmouth are often one of the rarest species in the fish community, typically accounting for 2% or less of the fish caught within a drainage. The individuals recently collected in the Salmon(Muskeg) River north of Prince George represented only 3-4 individuals (including juveniles) of well over one thousand fish collected during fisheries inventory throughout the entire drainage basin. Low densities in the cooler northern rivers contrast with populations in the Nicola River, where chiselmouth are reported to be a dominant part of the fish community (R. L. Vadas, personal communication 1998). Populations may also be somewhat larger in the Kettle and Okanagan rivers of B.C. as well.

Population structure of chiselmouth is unclear. It remains unclear whether the Fraser River is a barrier to movement of adults between tributaries; although Haas (1998) suggests that populations are largely isolated, adults have been collected from the mainstem Fraser (Don McPhail, UBC Zoology, personal communication 1999), suggesting that some exchange of adults between tributary populations is possible. Similarly, it is unclear whether lake populations (e.g. in the Euchiniko drainage) are really distinct from river populations in the same drainage. Regardless, chiselmouth occur in at least eight large drainage basins that can probably be considered to represent separate populations or population complexes by conservative criteria – the Blackwater/Nazko/Euchiniko, the Salmon/Muskeg, the Similkameen, Okanagan, Kettle, Upper Chilcotin, Nicola, and Shuswap. However, distribution and population size within some of these drainages may in some instances be small, and fish may occur at very low densities.

There is no real data on population trends of chiselmouth in British Columbia. Chiselmouth appear to occur in the same drainage basins now as they did in previous surveys of several decades ago, suggesting that there has been no obvious range contraction, although this gives no insight into populations trends. Don McPhail (pers. com.) indicates that a number of chiselmouth lake populations have been extirpated by provincial fisheries to reduce competition with stocked rainbow trout, and suggests that re-introduction might be appropriate[1]. To my knowledge no trends are documented for chiselmouth populations in Washington and Oregon where the species is more abundant and widespread.

As with long-term trends in species distribution, long-term trends in population size may be influenced strongly by climate change. Global warming may have positive effects on chiselmouth development and growth rate at various life stages, leading to higher densities and larger populations. However, this assumes no trends in habitat quality (i.e. no habitat degradation), and climate change effects may also be further complicated by changes in rainfall patterns and associated changes in rivers flows as well as complex interactions with predators, competitors, and disease that make net outcomes difficult to predict.

Given the absence of any reliable (or even unreliable) estimates of population size for Canadian populations, it is extremely difficult to speculate on the number of mature individuals in Canada. A population such as that in the Blackwater River (including the Nazko and Euchiniko Rivers and associated lakes) might contain at least 2,000-5,000 individuals. If there are eight drainage basins that can probably be considered to represent separate populations or population complexes by conservative criteria – the Blackwater/Nazko/Euchiniko, the Salmon/Muskeg, the Similkameen, Okanagan, Kettle, Upper Chilcotin, Nicola, and Shuswap – and at least 4 of these (the Blackwater, Okanagan, Kettle, and Nicola) are likely to have similar populations, then this yields a coarsely quesstimated cumulative population of 8,000-20,000 for the 4 populations, rounded up to 10,000 – 30,000 if the four likely smaller populations are included. Confidence in such a quesstimate is extremely low.

Although there are no reliable estimates of population sizes or trends, and consequently huge gaps in our knowledge of chiselmouth status and populations size, chiselmouth appear to be maintaining their range in British Columbia (and elsewhere), and there is no obvious reason to expect that populations have been declining in recent years. That being said, regular sampling of chiselmouth abundance at several index sites would be a good idea to create a baseline of information to assess population trends through time.

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[1]Following WW II into the 1970s the Province undertook a “lake rehabilitation” program that involved chemical treatment of lakes to remove unwanted species prior to introduction of “more desirable species” Alex Peden (a member of the Freshwater Fishes SSC) has initiated a compendium of the lakes involved, species removed, introductions and current status of populations *vis à vis* prior to treatment. Of the more than 50 lakes he has been able to identify to-date, two contained chiselmouth prior to treatment and do not now. This information is summarized in Appendix 1. R. Campbell, Co-chair ,COSEWIC Freshwater Fishes SSC.

Chiselmouth remain apparently widespread in Washington and Oregon. The degree of local differentiation/adaptation of the Canadian populations of chiselmouth in the Columbia drainage is unclear, but in any case dams and natural barriers to movement would prevent dispersal into Canada. Fraser drainage populations are more fragmented than the Columbia river populations and have relatively disjunct distributions. Populations in the Blackwater/Nazko/Euchiniko, Salmon/Muskeg, Upper Chilcotin, Nicola, and Shuswap rivers are relatively isolated from one another and cannot be naturally colonized from outside of Canada. It is also more likely that these populations are divergent from those in the U.S.

## LIMITING FACTORS AND THREATS

Temperature appears to be the major factors limiting chiselmouth distribution in British Columbia. Chiselmouth do not appear to occur in streams with maximum temperatures of less than 20°C or 2100 annual degree days (Rosenfeld et al. 2001), suggesting temperature-related constraints on juvenile or adult growth or egg development. Riverine populations also occur primarily in larger rivers rather than small streams, suggesting that the availability of the larger substrate and flows associated with larger streams also limit chiselmouth distribution. This does not appear to be an artifact of a positive correlation between stream size and temperature, since limited data suggests that small warm streams do not harbor chiselmouth. Smaller streams may not provide the appropriate combination of larger substrate with periphytic growth to support adults, and slow weedy marginal habitat for juvenile rearing, whereas both of these habitats may be present in larger intermediate-gradient rivers with marginal and off-channel habitat. Lack of suitable river habitat in Canada (relative to the U.S.) is probably due to both colder average temperatures and steeper river gradients that preclude the development of suitable off-channel or marginal habitat.

Lake populations probably also require an abundance of hard substrate in the littoral zone to support periphyton for adult grazing. Presence of suitable small streams for spawning may also limit abundance of lake populations (Moodie 1966), since chiselmouth are probably incapable of spawning successfully in lakes. Limitation of riverine populations by suitable spawning habitat is also possible, although this is difficult to evaluate because of lack of information on spawning habitats used by chiselmouth in larger rivers.

System productivity also likely limits both distribution and abundance of chiselmouth. Adults likely require substantial periphytic growth on rocks, which is absent from low productivity systems characteristic of coastal streams as well as cold-water glacier fed interior streams. The same is also likely true for lakes, where temperature and productivity also likely co-limit the presence and abundance of chiselmouth.

Although chiselmouth do not appear to be directly threatened by any specific anthropogenic or environmental impacts, like most lotic fishes they are likely to be

sensitive to sedimentation that covers periphyton or fills interstices of spawning substrate. They are also probably sensitive to loss of marginal, backwater, or off-channel rearing habitat that is likely critical for juvenile survival. Lake populations that spawn in small inlet streams may be especially vulnerable to sedimentation of spawning habitats, since small spawning streams may be adversely affected by habitat degradation associated with forestry, livestock grazing, or urbanization.

There appear to be no specific threats to habitat used by chiselmouth, beyond the cumulative effects of habitat degradation in a watershed associated with logging, agriculture, or livestock grazing. In some instances these effects can be substantial (e.g. Vadas 1998), but it is unclear how they affect chiselmouth, since their sensitivity to habitat degradation is unclear, as is their tolerance to impaired water quality. However, persistence of chiselmouth in the U.S. portion of their range suggests that the species is not excessively sensitive to perturbation, and is likely less sensitive to changes in water quality than salmonids, although this is largely speculative and not based on hard data.

Since chiselmouth distribution and density appear to be temperature-limited, climate warming may have indirect positive effects on chiselmouth distribution, although this remains speculative. One clearly negative impact of global warming is that warmer water temperatures will also permit colonization and survival of a broader range of exotic species in B.C. freshwaters. Even in the absence of any warming trend, it is likely that exotic species will begin to have negative impacts on native fauna in the near future as development progresses and pathways of introduction (e.g. international trade) expand. For example, an exotic tapeworm has been found in Oregon infecting chiselmouth as well as other species (Bend Bulletin, Sept. 30 2001). That being said, all native fauna are likely susceptible to negative impacts of exotics, and specific impacts are difficult to predict.

At present the specific identifiable threats to chiselmouth in British Columbia are those associated with habitat degradation, either from local impacts of development, range, and agriculture, or from more diffuse effects at a landscape scale (e.g. in the Okanagan valley; Scudder and Smith 1998). However, the degree of impact of these effects remains speculative in the absence of reliable data on chiselmouth population trends and corresponding changes in habitat for any Canadian populations.

## SPECIAL SIGNIFICANCE OF THE SPECIES

Chiselmouth are endemic to western Canada and the Pacific Northwest United States, and are the only extant species in their genus. The species is not at risk globally. Chiselmouth are morphologically and ecologically unique in Canada because they are the only western species exclusively adapted to herbivory as adults. They are ecologically unique from eastern herbivorous cyprinids (e.g. *Campostoma*) because of their much larger size and unique chisel-like lower lip and foraging mode. Chiselmouth play a unique ecological role in the streams where they occur (i.e. benthic herbivore), although there are other fishes (e.g. largescale sucker, bridgelip sucker) that may

perform similar roles, although this is somewhat speculative as well. It is unclear whether chiselmouth have a keystone effect on nutrient cycling or trophic interactions where they are present (e.g. reduction in benthic algal and invertebrate biomass).

Canadian populations of chiselmouth near the periphery of the species range (e.g. Fraser drainage) are likely to be somewhat ecologically and genetically distinct from populations in the southern (U.S.) part of their distribution. The disjunct distribution of chiselmouth (particularly the more isolated northern Fraser drainage populations) suggests that the smaller lower-density northern populations are likely to be both genetically and ecologically unique and more vulnerable to human impacts or stochastic natural disturbances.

The public are on the whole not familiar with chiselmouth, since it is not a game species subject to harvest, so that there is no strong support or opposition to protecting this species.

The closest species to chiselmouth in appearance are northern pikeminnow and peamouth chub. Since all three species are considered coarsefish and often disparaged or killed by unappreciative anglers, public education to appraise anglers of the unique and fascinating biology of this species would be useful.

## EXISTING PROTECTION OR OTHER STATUS

The 1997 COSEWIC status of chiselmouth in Canada is Data Deficient (Coffie 1998). Chiselmouth is blue-listed by the CDC in British Columbia. CDC global rank is G5 (globally secure – common to very common, not susceptible to extirpation or extinction), provincial rank is S3 (provincially vulnerable – provincially rare and local, making it susceptible to extirpation or extinction). It has no protection in Canada, and has no protection in the United States unless it becomes listed under U.S. endangered species legislation, which is extremely unlikely given the robust populations in the Pacific Northwest. Very little of the range of chiselmouth falls within any protected area.

## SUMMARY OF STATUS REPORT

The primary limiting factors for chiselmouth in Canada appear to be i) the availability of rivers or lakes with suitably warm temperatures to permit growth and development of different life stages ii) aquatic systems with sufficient productivity (nutrients) to support sufficient algal growth for adult fish to feed on iii) the availability of aquatic systems (large rivers or lakes) with hard substrates (e.g. boulders or cobbles) for periphyton to grow on, and iv) the availability of adequate clean spawning substrate, slow-water juvenile rearing habitat, and deep-water overwintering habitat. The largest potential threat to chiselmouth appears to be the cumulative impacts of habitat change within a watershed (e.g. from agriculture, forestry, livestock grazing, etc.). Although these threats are present they do not yet appear to be pervasive for most populations

(based on very limited data), but tolerance of chiselmouth to habitat change is poorly understood.

There have been no apparent changes in chiselmouth distribution at the provincial scale since the original collections of chiselmouth in B.C. This indicates that the range of chiselmouth in B.C. has been largely stable, or at least presents no evidence to anticipate that there has been a range contraction. However, it is impossible to evaluate trends because there is no historic or current information on population size for any populations in B.C.. Although northern populations appear to occur at lower densities than populations in warmer rivers and may therefore be at higher risk from stochastic events, there is no reason to anticipate that local populations have been declining, although habitat for some populations has been subject to degradation from local impacts such as livestock grazing or agriculture, or extensive watershed development (e.g. Nicola and Okanagan basins).

Despite the fact that there does not appear to be any discernable trend in chiselmouth populations, or any specific reason to anticipate one, in the absence of reliable information on population sizes or trends a conservative assessment of chiselmouth status must conclude that the species remains data deficient. Any inferences about population trends are speculative in the complete absence of baseline data, and some level of monitoring of representative populations is essential to assess present and future status. Provincial or federal fisheries agencies responsible for stewarding fish biodiversity should establish index sites and a long-term monitoring program to assess and monitor the status of chiselmouth and other species at risk or of concern in British Columbia.

# TECHNICAL SUMMARY

*Acrocheilus alutaceus*
Chiselmouth — Bouche coupante
British Columbia

| | |
|---|---|
| Extent and Area information | |
| • ***Extent of Occurrence*** | <5000 km$^2$ |
| • *Trend* | Likely stable, although several small lake populations deliberately extirpated |
| • *Fluctuations in extent of occurrence* | No |
| • ***Area of Occupancy*** | <500 km$^2$ several hundred linear km of stream length; half a dozen lakes |
| • *Trend* | Likely stable |
| • *Fluctuations in area of accupancy* | Unknown, but unlikely |
| • ***Number of extant locations*** | Present in at least 8 major drainages |
| • *Trend in # locations* | Stable |
| • *Fluctuations in # locations* | No |
| • *No. locations from which populations have been extirpated* | Several (deliberate, but exact number unknown) |
| • *Habitat trend* | Unknown |
| Population Information | |
| • *Generation time* | 4-6 years |
| • *Number of mature individuals in the Canadian population* | 10,000 – 30,000 (estimate) |
| • *Population trend* | Unknown |
| • *Fluctuations in number of mature individuals* | Unknown |
| • *Are populations fragmented?* | Populations are relatively isolated from one another, but the exchange rate of individuals between pops. Is unknown |
| • *Populations and the number of mature individuals in each*<br>L = 2000-5000 M = 1000-2000 S = < 1000 | 1)Blackwater/Nazko/Euchi niko L<br>2)Salmon/Muskeg S<br>3)Similkameen M<br>4)Okanagan L<br>5)Kettle L<br>6)Upper Chilcotin S<br>7)Nicola L<br>8)Shuswap M |
| • *Trend in number of populations* | Likely stable |
| • *Fluctuations in number of populations* | Probably not |

**Threats:**
- Cumulative impacts of agriculture, forestry, and livestock grazing may be impacting chiselmouth in some rivers (e.g. Okanagan, Nicola), and these impacts will likely get worse in the near future.
- Populations in some lakes may be subject to extermination as competitors of game fish species.

| | |
|---|---|
| Rescue Effect | Low for most pops. |
| • *Does species exist elsewhere in Canada?*<br>• *In the U.S.?* | No<br>Yes – ID, NV, OR and WA |
| • *Status of the outside populations?* | ID-S5, NV-S?, OR-S4, WA-S4 |
| • *Is immigration known or possible?* | Dams and natural barriers prevent most natural migration |
| • *Would immigrants be adapted to survive here?* | For Columbia R. pops, likely; possibly not for Fraser basin pops. |
| • *Is there sufficient habitat for immigrants here?* | yes |
| **Quantitative Analysis** | None |

**Existing Status**
**CDC Ranks**
**Global** – N5
**National** U.S. N5
Canada – N3
**Regional** U.S. ID - S5, NV – S?, OR – S4, WA – S4
Canada BC – S3, Provincial Listing Blue (Special Concern)

**COSEWIC** – DD 1997
**Status Designated May 2003**
Not At Risk

**Reasons for Status Designation**
The Canadian distribution of this species is restricted to a few disjunct populations in south-central British columbia where they are found in low densities, but appear to be stable and are not subject to any known factors that could put them at risk.

## ACKNOWLEDGEMENTS

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## BIOGRAPHICAL SUMMARY OF THE AUTHOR

Jordan Rosenfeld completed a M.Sc. in stream ecology at the University of Guelph in 1989 and a Ph.D. in stream ecology at UBC in 1998. He has been employed as fisheries research biologist with the Province of British Columbia since 1996. Research interests include energy flow in streams ecosystems, assessing the habitat requirements of fish, and the effects of changes in stream habitat structure on ecological processes in streams.

## AUTHORITIES CONSULTED

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## Appendix 1. Freshwater Fishes SSC Information on Chiselmouth Eradications from B.C. Lakes.

**Table 1 Lakes where Chizelmouths were killed in lake poisoning programs: Data from computer data base of Data Management Unit, Fisheries Planning and Informations Branch, British Columbia Ministry of Fishes. Other lakes may have been poisoned and eradicated chizelmouths, with field crew focussed on economic species, thus chizelmouths could have been missed amongst other poisoned cyprinid minnow species.**

| New Watershed code | Waterbody identifier | Alias 1 | NAD83 UTM Zone | NAD83 UTM Easting | NAD83 UTM Northing | Primary Map | Gasetted Name | Date Treated | Current Status | Area of Lake | Area of Marsh | Area of Stream | Barrier Constructed |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 160-024400 | 00001QUES | * | 10 | 536234 | 5880378 | 093G01 | Ten mile lake | 9-Sep-58 | * | 397.4 | * | * | **Yes** |
| 310 | 01597OKAN | * | 11 | 316584 | 5457141 | 8.20E+05 | Gallacher Lake | 2-Aug-56 | * | 6.2 | * | * | **No** |

| | | | Comments | Complete Kill Acchieved | Domestic Supply | Domestic Water | **NAME** | **Active Ingredient** |
|---|---|---|---|---|---|---|---|---|
| | | | * | * | * | * | **Chiselmouth Chub** | Toxaphene |
| | | | * | * | * | * | **Chiselmouth Chub** | Toxaphene |

*List with associated data facilitated by Stan Orchard, edited by Alex E. Peden.

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