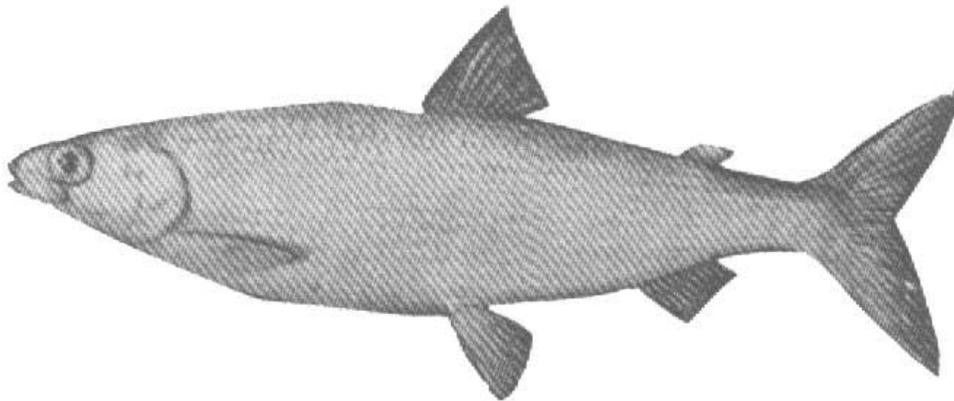


COSEWIC
Assessment and Update Status Report

on the

Shortnose Cisco
Coregonus reighardi

in Canada



ENDANGERED
2005

COSEWIC
COMMITTEE ON THE STATUS OF
ENDANGERED WILDLIFE
IN CANADA



COSEPAC
COMITÉ SUR LA SITUATION
DES ESPÈCES EN PÉRIL
AU CANADA

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

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Previous report:

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Production note:

COSEWIC would like to acknowledge Nicholas E. Mandrak for writing the update status report on the shortnose cisco *Coregonus reighardi* prepared under contract with Environment Canada, overseen and edited by Bob Campbell, the COSEWIC Freshwater Fish Species Specialist Subcommittee Co-chair.

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Également disponible en français sous le titre Évaluation et Rapport de situation du COSEPAC sur le cisco à museau court (*Coregonus reighardi*) au Canada – Mise à jour.

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Shortnose cisco — Illustration from Koelz (1929).

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COSEWIC Assessment Summary

Assessment Summary – May 2005

Common name

Shortnose Cisco

Scientific name

Coregonus reighardi

Status

Endangered

Reason for designation

Endemic to three of the Great Lakes, this species was last recorded in Lake Michigan in 1982, in Lake Huron in 1985, and in Lake Ontario in 1964. Although it has probably disappeared throughout its range, searches for this species have not been extensive enough to declare this species extinct. The species' apparent demise is suspected to be the result of commercial overfishing and possibly competition or predation from introduced species

Occurrence

Ontario

Status history

Designated Threatened in April 1987. Status re-examined and designated Endangered in May 2005. Last assessment based on an update status report.



COSEWIC
Executive Summary

Shortnose Cisco
Coregonus reighardi

Species Information

The shortnose cisco was one of 10 cisco species found in Canada, one of seven cisco species found in the Great Lakes, and one of six cisco species identified as endemic to the Great Lakes. The shortnose cisco can be distinguished from the other cisco species found in the Great Lakes by the distinctive dark pigmentation of the snout.

Distribution

The shortnose cisco was endemic to lakes Huron, Michigan and Ontario. It was last recorded in Lake Huron in 1985, Lake Michigan in 1982 and in Lake Ontario in 1964, so it may well be extinct.

Habitat

The shortnose cisco was reported at depths ranging from 22m to 146m.

Biology

Maximum known age is 11 years for females and 9 years for males, and maximum known length and weight is 265mm in Total Length (tip of the snout to the tip of the tail) and 420g. The shortnose cisco was the only known spring-spawning cisco in lakes Huron, Michigan and Ontario and spawning occurred from April to June at depths of 52-146m. Age at maturity was reported as 2+ to 3+ years in Lake Michigan. Prey items in lakes Huron and Ontario were predominantly freshwater shrimps. Shortnose cisco was a prey item for burbot (*Lota lota*) and deep water forms of lake trout (*Salvelinus namaycush*).

Population Sizes and Trends

Although the deepwater cisco fishery (commonly known as the “chub fishery”) was very important in the Great Lakes, the catches were rarely identified to species. Too few collections of shortnose cisco (recorded to species) have been documented over time in a standardized manner to evaluate population sizes and trends. There are no known extant populations.

Limiting Factors and Threats

The decline of shortnose cisco in the Great Lakes was likely the result of commercial overfishing. It has been suggested that remnant shortnose cisco populations in these lakes may have competed with, or have been preyed upon by, introduced fish species.

Special Significance of the Species

The shortnose cisco was one of six cisco species identified as endemic to the Great Lakes.

Existing Protection or Other Status Designations

The shortnose cisco and its habitat are protected by the federal Fisheries Act. It was previously assessed as Threatened by COSEWIC in 1988. It is listed SX (extirpated) in Ontario by the Natural heritage Information Centre, and NH (historic) for Canada by NatureServe Canada. In the United States, it is listed as SX (extirpated) by 3 states and SH by 2 states.



COSEWIC HISTORY

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

COSEWIC MANDATE

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

COSEWIC MEMBERSHIP

COSEWIC comprises members from each provincial and territorial government wildlife agency, four federal agencies (Canadian Wildlife Service, Parks Canada Agency, Department of Fisheries and Oceans, and the Federal Biodiversity Information Partnership, chaired by the Canadian Museum of Nature), three non-government 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 (NOVEMBER 2004)

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

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

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

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



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de la faune

Canada

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

**Update
COSEWIC Status Report**

on the

Shortnose Cisco
Coregonus reighardi

in Canada

2005

TABLE OF CONTENTS

SPECIES INFORMATION.....	3
Name and classification.....	3
Description.....	4
Designatable units.....	4
DISTRIBUTION.....	4
Global range.....	4
Canadian range.....	5
HABITAT.....	5
Habitat requirements.....	5
Trends.....	6
Protection/ownership.....	6
BIOLOGY.....	6
General.....	6
Reproduction.....	6
Survival.....	6
Physiology.....	6
Movements/dispersal.....	6
Nutrition and Interspecific Interactions.....	7
POPULATION SIZES AND TRENDS.....	7
LIMITING FACTORS AND THREATS.....	8
SPECIAL SIGNIFICANCE OF THE SPECIES.....	8
EXISTING PROTECTION OR OTHER STATUS.....	9
TECHNICAL SUMMARY.....	10
ACKNOWLEDGEMENTS AND AUTHORITIES CONTACTED.....	12
LITERATURE CITED.....	12
BIOGRAPHICAL SUMMARY OF REPORT WRITER.....	14
COLLECTIONS EXAMINED.....	14

List of figures

Figure 1. Shortnose cisco, <i>Coregonus reighardi</i>	4
Figure 2. Global distribution of shortnose cisco.....	5

List of tables

Table 1. Global, National, and Subnational (State and Provincial) ranks and status for shortnose cisco (<i>Coregonus reighardi</i>).....	9
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SPECIES INFORMATION

Name and classification

Kingdom:	Animalia
Phylum:	Chordata
Class:	Actinopterygii
Order:	Salmoniformes
Family:	Salmonidae
Subfamily:	Coregoninae
Genus and Species:	<i>Coregonus reighardi</i> (Koelz)
Common English name:	shortnose cisco (Nelson <i>et al.</i> 2004)
Common French name:	cisco à museau court (Scott and Crossman 1998)

The shortnose cisco (*Coregonus reighardi* Koelz) was originally described from lakes Huron, Michigan, Nipigon, Ontario and Superior (Koelz 1929). However, a form of this species, *C. reighardi dymondi*, described from lakes Nipigon and Superior by Koelz (1929) was more recently found to be a synonym of the shortjaw cisco (*C. zenithicus*) (Todd and Smith 1980). The shortnose cisco was one of 10 cisco species found in Canada (Scott and Crossman 1998), one of seven cisco species found in the Great Lakes (Cudmore-Vokey and Crossman 2000), and one of six cisco species identified as an incipient species flock 'endemic' to the Great Lakes by Koelz (1929). These counts exclude the longjaw cisco (*C. alpenae*), described by Koelz (1929) and included in Scott and Crossman (1998), as a synonym of the shortjaw cisco (*C. zenithicus*) by Todd *et al.* (1981). Two (*C. nigripinnis*, *C. zenithicus*) of the six valid species, originally identified as "endemic" to the Great Lakes by Koelz (1929), may occur outside of the Great Lakes basin (Lee *et al.* 1980, Mandrak and Crossman 1992).

Webb and Todd (1995) raised the possibility that the shortnose cisco populations in each of the Great Lakes may not share a recent, common ancestor, and that each population might be a separate evolutionary entity. However, they did not provide any evidence to support, or refute, this hypothesis.

Research on the shortjaw cisco (*C. zenithicus*), originally believed to be endemic to the Great Lakes, revealed that Great Lakes and inland populations of this species were genetically indistinguishable from the cisco (*C. artedii*); however, the shortjaw cisco is still considered to be a valid species (Todd *et al.* 1981, Turgeon *et al.* 1999, Turgeon and Bernatchez 2003). This may be an indication that some, or all, of the endemic cisco species may actually be ecomorphotypes of the cisco (*C. artedii*), rather than valid species. If, in future, this was shown to be true for the shortnose cisco, the shortnose cisco would still be considered an evolutionarily significant unit (ESU) or, at the very least, a unique morphotype. To date, a taxonomic revision of the endemic ciscoes has not been undertaken; therefore, the endemic species should be considered valid.

Description

The shortnose cisco was a member of the subfamily Coregoninae of the family Salmonidae (Nelson *et al.* 2004) (Figure 1). It is characterized by a short head (20-23% of total length), small eye (22.2-26.4% of head length), short snout (truncate in side view because of near vertical position of premaxillaries), small terminal mouth, lower jaw included in upper jaw, and gill raker count of 32-42 (Scott and Crossman 1998). Nuptial tubercles are present on mature males and, at least some, females (Scott and Crossman 1998). The shortnose cisco can be distinguished from the other cisco species found in the Great Lakes by the distinctive dark pigmentation of the snout (premaxillaries, maxillaries and lower jaw) (Scott and Crossman 1998).

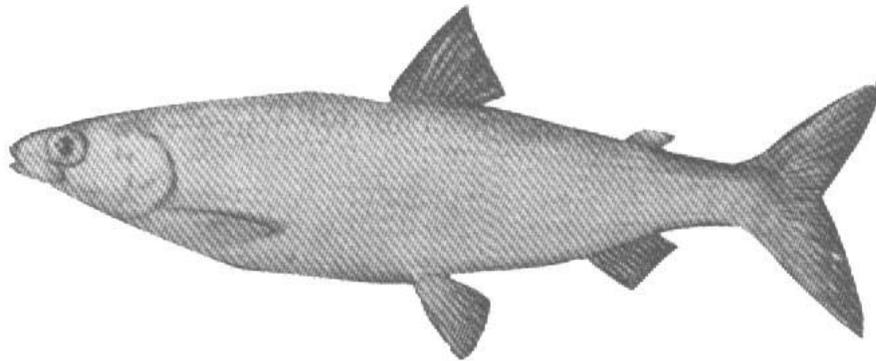


Figure 1. Shortnose cisco, *Coregonus reighardi*. From Koelz (1929).

Designatable units

All Canadian populations were found within the Great Lakes-Western St. Lawrence ecozone of the freshwater ecozone classification adopted by COSEWIC (COSEWIC 2003). As a result of its absence from Lake Erie, the Lake Ontario population was likely distinct from the population(s) in the upper Great Lakes. The population structure of shortnose cisco within lakes Huron and Michigan is unknown.

DISTRIBUTION

Global range

The shortnose cisco was endemic to lakes Huron, Michigan and Ontario (Koelz 1929, Todd 1980, Scott and Crossman 1998) (Figure 2). As it was last recorded in Lake Huron in 1985, Lake Michigan in 1982 and in Lake Ontario in 1964, it is currently believed to be extinct (Webb and Todd 1995).

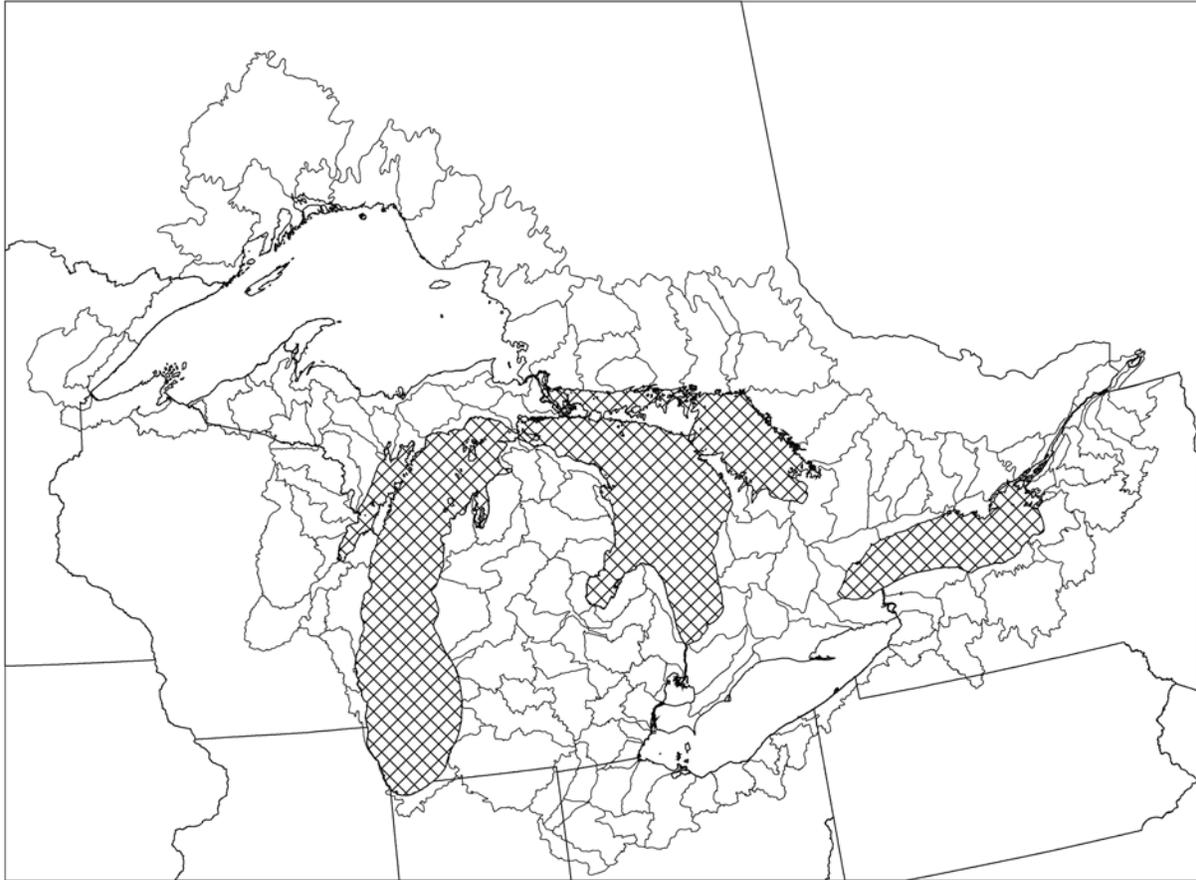


Figure 2. Global distribution of shortnose cisco, *Coregonus reighardi* is identified by cross-hatch.

Canadian range

In Canada, the shortnose cisco was known from lakes Huron and Ontario (Figure 2). It is believed to be extirpated in these lakes (Webb and Todd 1995).

HABITAT

Habitat requirements

The shortnose cisco was collected in depths ranging from 37m to 92m in Lake Huron (Webb and Todd 1995), from 37m to 110m in Lake Michigan (Jobes 1943), and from 22m to 92m in Lake Ontario (Pritchard 1931). As a result, it lived in a clear, cold water environment year round. Nothing else is known about its habitat preferences.

Trends

The preferred deepwater habitat of the shortnose cisco has likely changed little over time (Allen *et al.* 1969, Berst and Spangler 1973).

Protection/ownership

The Great Lakes are publicly owned, and all fish habitat within the lakes are protected by the federal Fisheries Act.

BIOLOGY

General

Maximum known age is 11 years for females and 9 years for males (Webb and Todd 1995). Maximum known length and weight is 265mm TL and 420g (Scott and Crossman 1998).

Reproduction

The shortnose cisco was the only known spring-spawning cisco in lakes Huron, Michigan and Ontario (Webb and Todd 1995). Spawning occurred from May to June in lakes Huron and Michigan (Koelz 1929, Jobes 1943, Scott and Crossman 1998), and April to May in Lake Ontario (Pritchard 1931). Spawning occurred at depths of 52-146m in Lake Michigan (Jobes 1943), and predominantly at 73m in Lake Ontario (Pritchard 1931). Spawning depths in Lake Huron are unknown (Scott and Crossman 1998). Age at maturity was reported as 2+ to 3+ years in Lake Michigan (Hile and Deason 1947).

Survival

Maximum known age is 11 years for females and 9 years for males (Webb and Todd 1995). Since sexual maturity is reached at 2 to 3 years (Hile and Deason 1947) and information on reproductive senescence is not known, the average age of reproducing individuals may be in the order of 5 years.

Physiology

Unknown.

Movements/dispersal

Based on skewed sex ratios, and the different depths at which the species was found, outside of spawning season, the shortnose cisco likely underwent a spawning migration to deeper waters (Webb and Todd 1995).

Nutrition and Interspecific Interactions

Prey items in lakes Huron and Ontario were predominantly the freshwater crustaceans *Mysis relicta* and *Diporeia hoyi* (Koelz 1929, Pritchard 1931). As the result of their preferred deepwater habitat, the shortnose cisco likely had limited interactions with other fish species, except in the shallowest part of their range. It was likely a prey item for burbot (*Lota lota*) and deep water forms of lake trout (*Salvelinus namaycush*). Periodic increases in lake trout numbers in the Great Lakes likely increased the predation pressure on the deepwater ciscoes (Christie 1973, Selgeby *et al.* 1994). Shortnose cisco may have competed with lake whitefish (*Coregonus clupeaformis*), deepwater sculpin (*Myoxocephalus thompsoni*) and other deepwater ciscoes for benthic prey. Remnant shortnose cisco populations may have competed with, or have been preyed upon by, introduced fish species in lakes Huron, Michigan and Ontario (Smith 1964, Christie 1973, Todd and Stedman 1989, Todd and Smith 1992). As the shortnose cisco did occur in relatively shallow depths (< 40m at times), it is possible that it may have interacted with introduced pelagic fishes such as the sea lamprey (*Petromyzon marinus*), alewife (*Alosa pseudoharengus*), and rainbow smelt (*Osmerus mordax*). The decline of lake trout in lakes Huron and Ontario may have shifted sea lamprey predation to deepwater ciscoes and other species (Christie 1973). Smith (1995) noted that the decline in deepwater ciscoes in Lake Ontario coincided with the increasing abundance of alewife. He postulated that this may have been the result of competition for plankton, or predation on, larval ciscoes. However, the decline of deepwater ciscoes in Lake Superior prior to colonization by the sea lamprey, alewife and rainbow smelt (Lawrie and Rahrer 1973) suggests that these introduced species may not have had a significant impact on deepwater ciscoes, including shortnose cisco, in the Great Lakes.

POPULATION SIZES AND TRENDS

Although the deepwater cisco fishery (commonly known as the “chub fishery”) was very important in the Great Lakes, the catches were rarely identified to species (Lawrie and Rahrer 1973). Too few collections of shortnose cisco (recorded to species) have been documented over time in a standardized manner to evaluate population sizes and trends.

Webb and Todd (1995) documented the capture of a total of 324 individuals in Lake Huron in only 11 different years between 1919 and 1985. After the first record of shortnose cisco in 1919, based on a single specimen, it was not recorded in Lake Huron again until 1956 (n=106 individuals). It was subsequently recorded in 1966 (2), 1967 (3), 1973 (9), 1974 (2), 1975 (197), 1977 (1), 1980 (1), 1982 (1), 1985 (1). Despite extensive sampling of commercial catches and assessment surveys in Georgian Bay in 1992 and 1993 (Webb and Todd 1995), and targeted sampling of all Canadian sites in 2002 and 2003 (N.E. Mandrak, unpubl. data), no shortnose cisco were captured. Another deepwater cisco, the shortjaw cisco (*C. zenthicus*), was recently (2002 and 2003) caught in Lake Huron after not being found since 1985 (N.E. Mandrak, unpubl. data).

Therefore, it is possible, but unlikely due to recent unsuccessful sampling, that the shortnose cisco might still be present in Lake Huron.

The National Biological Service (NBS) (currently part of the United States Geological Survey) conducted a Lake Michigan fisheries assessment program intermittently from 1951 to 1955, and continuously from 1960 to the present (Webb and Todd 1995). In the 1950s, 2,446 shortnose cisco individuals were captured. In 1960 and 1961, 1,107 individuals were captured. Between 1962 and 1967, no more than 10 individuals were captured per year, and only a single individual per year (none in 1971 and 1973) were caught between 1968 and 1982, the last year that shortnose cisco was recorded in Lake Michigan.

Limited survey data exist for the shortnose cisco in Lake Ontario (Webb and Todd 1995). Shortnose cisco (2 individuals) was last collected in Lake Ontario in 1964. Subsequent surveys by the Canadian Department of Fisheries and Oceans (2002, western basin only; N.E. Mandrak, unpubl. data) and NBS (Webb and Todd 1995) failed to collect any specimens.

LIMITING FACTORS AND THREATS

The declines of shortnose cisco in lakes Huron, Michigan and Ontario were the result of commercial overfishing (Moffett 1957, Smith 1964, Berst and Spangler 1973, Christie 1973). Commercial fishing of deepwater ciscoes, including shortnose cisco, no longer occurs in the American waters of the Great Lakes, except for a small portion of northwestern Lake Huron, but still takes place, to a limited degree, in the Canadian waters of lakes Huron and Superior.

Shortnose cisco was likely preyed upon by native lake trout and burbot. Although it has been suggested that remnant shortnose cisco populations may have competed with, or have been preyed upon by, introduced fish species in lakes Huron, Michigan and Ontario, evidence from Lake Superior for other deepwater cisco species suggests that these species were probably not a major threat to larger species of deepwater ciscoes.

SPECIAL SIGNIFICANCE OF THE SPECIES

The deepwater ciscoes of the Laurentian Great Lakes are the most notable of the few species endemic to the relatively young waterbodies of northern North America, and are believed to be one of a few examples of the incipient species flock concept in North America (Smith and Todd 1984). As endemic species, these ciscoes represent unique evolutionary and ecological processes. The Laurentian Great Lakes are no more than 18,000 years old (Dyke and Prest 1987); therefore, the endemic ciscoes have likely evolved in the Great Lakes within the last 18,000 years (Smith and Todd 1984). Changes in gill raker morphology (e.g. number, length) over time leading to different

diets, have minimized competition between the endemic ciscoes (Smith and Todd 1984). The deepwater ciscoes, including shortnose cisco, were once a commercially important species in the Great Lakes.

EXISTING PROTECTION OR OTHER STATUS

The shortnose cisco and its habitat are protected by the federal *Fisheries Act*. It was previously assessed as Threatened by COSEWIC based on a report by Parker (1988). It is listed as SX (extirpated) by the Natural Heritage Information Centre, and NH (historic) for Canada by NatureServe Canada. In the United States, it is listed as SX by three states and SH by two states (Table 1). The Global, National (US and Canada), State and Provincial ranks for the shortnose cisco are provided in Table 1. Commercial fishing quotas for all cisco species combined (including shortnose cisco) in the Canadian Great Lakes are regulate and enforced by OMNR.

**Table 1. Global, National, and Subnational (State and Provincial) ranks and status for shortnose cisco (*Coregonus reighardi*) (NatureServe 2004).
G/N/S ranks: 1=critically imperiled; 2=imperiled; 3=vulnerable to extirpation or extinction; 4=apparently secure; 5=demonstrably widespread, abundant and secure; X – extinct; H – historic; ?=unknown.**

Global	US National	Canadian National	Subnational	
			US States	Ontario
GH	NH	Threatened; NH	SX – IL, IN, NY SH – MI, WI	SX

TECHNICAL SUMMARY

Coregonus reighardi

shortnose cisco

Lake Huron, Lake Ontario.

cisco à museau court

Extent and Area Information							
<ul style="list-style-type: none"> extent of occurrence (EO)(km²) Measured as combined areas of lakes Huron and Ontario. 	<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 100px;">Huron</td> <td style="text-align: right;">60,166</td> </tr> <tr> <td>Ontario</td> <td style="text-align: right;">24,157</td> </tr> <tr> <td>Total</td> <td style="text-align: right;">84,323</td> </tr> </table>	Huron	60,166	Ontario	24,157	Total	84,323
Huron	60,166						
Ontario	24,157						
Total	84,323						
<ul style="list-style-type: none"> specify trend 	Decline						
<ul style="list-style-type: none"> are there extreme fluctuations in EO (> 1 order of magnitude)? 	No						
<ul style="list-style-type: none"> area of occupancy (AO) (km²) Measured as combined areas of depths 35m-100m for lakes Huron and Ontario. 	<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 100px;">Huron</td> <td style="text-align: right;">28,450</td> </tr> <tr> <td>Ontario</td> <td style="text-align: right;">6,229</td> </tr> <tr> <td>Total</td> <td style="text-align: right;">34,679</td> </tr> </table>	Huron	28,450	Ontario	6,229	Total	34,679
Huron	28,450						
Ontario	6,229						
Total	34,679						
<ul style="list-style-type: none"> specify trend 	Decline						
<ul style="list-style-type: none"> are there extreme fluctuations in AO (>1 order magnitude)? 	No						
<ul style="list-style-type: none"> number of extant locations 	0						
<ul style="list-style-type: none"> specify trend in # locations 	100% Decline						
<ul style="list-style-type: none"> are there extreme fluctuations in # locations (>1 order of magnitude)? 	No						
<ul style="list-style-type: none"> habitat trend: specify declining, stable, increasing or unknown trend in area, extent or quality of habitat 	Stable						
Population Information							
<ul style="list-style-type: none"> generation time (average age of parents in the population) (indicate years, months, days, etc.) 	5 years?						
<ul style="list-style-type: none"> number of mature individuals (capable of reproduction) in the Canadian population (or, specify a range of plausible values) 	Unknown, presumed none						
<ul style="list-style-type: none"> total population trend 	Decline						
<ul style="list-style-type: none"> if decline, % decline over the last/next 10 years or 3 generations, whichever is greater (or specify if for shorter time period) 	100%						
<ul style="list-style-type: none"> are there extreme fluctuations in number of mature individuals (>1 order of magnitude)? 	Unknown						
<ul style="list-style-type: none"> is the total population severely fragmented (most individuals found within small and relatively isolated (geographically or otherwise) populations between which there is little exchange, i.e., ≤ 1 successful migrant / year)? 	Yes, if consider lakes Huron and Ontario as two populations.						
<ul style="list-style-type: none"> list each population and the number of mature individuals in each 	Presumed 0						
<ul style="list-style-type: none"> specify trend in number of populations (decline, stable, increasing, unknown) 	Decline						
<ul style="list-style-type: none"> are there extreme fluctuations in number of populations (>1 order of magnitude)? 	No						
Threats							
- commercial overexploitation, introduced species?							
Rescue Effect (immigration from an outside source)							
<ul style="list-style-type: none"> does species exist elsewhere (in Canada or outside)? 	No						
<ul style="list-style-type: none"> status of the outside population(s)? 	SX or SH						
<ul style="list-style-type: none"> is immigration known or possible? 	No						
<ul style="list-style-type: none"> would immigrants be adapted to survive here? 	Yes						
<ul style="list-style-type: none"> is there sufficient habitat for immigrants here? 	Yes?						
Quantitative Analysis: No data							

Existing Status

Nature Conservancy Ranks (NatureServe 2004)

Global – GH

National

US – NH

Canada NH

Regional

US –IL – SX, IA – SX, MI – SH, NY – SX, WI – SH

Canada – ON – SX

Other

IUCN - CR

AFS – E

Wild Species 2000 (Canadian Endangered Species Council 2001)

Canada – 0

Ontario – 0

COSEWIC

Endangered (May 2005)

Status and Reasons for Designation

Status: Endangered	Alpha-numeric Code: D1
Reasons for Designation: Endemic to three of the Great Lakes, this species was last recorded in Lake Michigan in 1982, in Lake Huron in 1985, and in Lake Ontario in 1964. Although it has presumably disappeared throughout its range, searches for this species have not been extensive enough to declare this species extinct. The species' apparent demise is suspected to be the result of commercial overfishing and possibly competition or predation from introduced species.	
Applicability of Criteria Criterion A (Declining Total Population): Not applicable - The species has disappeared from Lakes Michigan, Huron, and Ontario (last recorded occurrences were 1982, 1985, and 1964 respectively). However the declines did not occur over the last 3 generations or 10 –15 years. Criterion B (Small Distribution, and Decline or Fluctuation): Not Applicable - The current extent of occurrence and area of occupancy are presumed to be 0, as is the number of locations. However, continuing decline and extreme fluctuations do not apply for this species. Criterion C (Small Total Population Size and Decline): Not Applicable - The number of mature individuals is already presumably 0, thus the criterion does not apply. Criterion D (Very Small Population or Restricted Distribution): The number of mature individuals is presumably 0, so the criterion for Endangered D1 is met. Criterion E (Quantitative Analysis): Not applicable.	

ACKNOWLEDGEMENTS AND AUTHORITIES CONTACTED

Acknowledgements

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Authorities contacted

Dr. John Casselman, Ontario Ministry of Natural Resources, Glenora, ON.
Adam Cottrill, Ontario Ministry of Natural Resources, Owen Sound, ON.
Erling Holm, Royal Ontario Museum, Toronto, ON.

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COLLECTIONS EXAMINED

None.