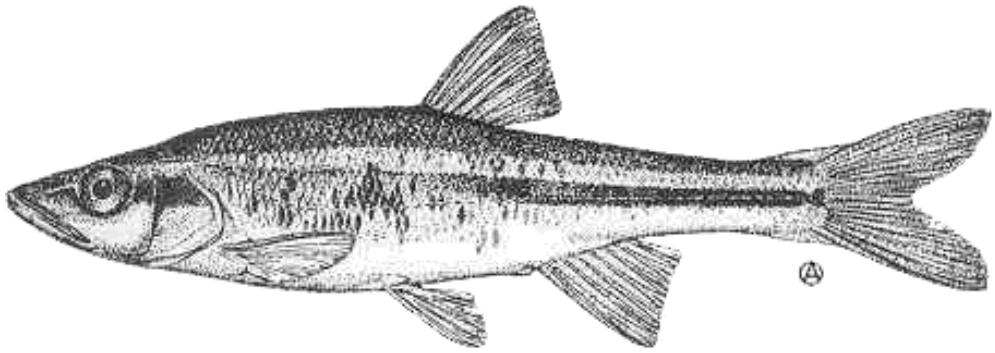
COSEWIC
Assessment and Update Status Report

on the

redside dace
Clinostomus elongatus

in Canada



ENDANGERED
2007

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:

Parker, B., Mckee, P. and Campbell, R.R. 1987. COSEWIC status report on the redside dace *Clinostomus elongatus* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. 1-20 pp.

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COSEWIC would like to acknowledge Erling Holm and Alan Dextrase for writing the update status report on the redside dace *Clinostomus elongates* in Canada, prepared under contract with Environment Canada, overseen and edited by Dr. Robert Campbell, Co-chair, COSEWIC Freshwater Fishes Species Specialist Subcommittee.

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Également disponible en français sous le titre Évaluation et Rapport de situation du COSEPAC sur le méné long (*Clinostomus elongatus*) au Canada – Mise à jour.

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Redside dace — Drawing by Anker Odum, from Scott and Crossman (1998) by permission.

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COSEWIC
Assessment Summary

Assessment Summary – April 2007

Common name
Redside dace

Scientific name
Clinostomus elongatus

Status
Endangered

Reason for designation
This species is especially sensitive to stream alterations that interfere with flow regimes and lead to increased siltation and water temperatures. It has been lost from 5 of its 24 historic locations, and may now be gone from an additional 5; continuing decline is evident in 8 of the 14 remaining locations. More than 80% of the Canadian distribution occurs in the 'Golden Horseshoe Region' of southwestern Ontario where urban development poses the most immediate threat to the continued existence of this species in Canada. The 6 stable populations are on the fringe of urban development in watersheds that are, as yet, relatively undisturbed, but more than 50% of these locations are in, or adjacent to, areas that are expected to be developed within the next 10 to 15 years.

Occurrence
Ontario

Status history
Designated Special Concern in April 1987. Status re-examined and designated Endangered in April 2007. Last assessment based on an update status report.

COSEWIC
Executive Summary

redside dace
Clinostomus elongatus

Species information

The redside dace is a colourful minnow that reaches a maximum length of 12 cm. In the spring it develops a bright red stripe along the front half of the body and a brilliant yellow stripe above. It is distinguished from other Canadian cyprinids by its very large mouth, protruding lower jaw, and large pectoral fins on the male. It is one of two species in the genus *Clinostomus* which is currently believed to be most closely related to *Richardsonius*, a genus of western dace.

Distribution

The redside dace has a discontinuous distribution ranging from southeastern Minnesota in the west; north to the Lake Superior drainage in upper Michigan, and the north end of Lake Huron in Ontario; east to New York in the Susquehanna drainage; and south to West Virginia and Kentucky.

In Canada, it is found only in Ontario in tributaries of western Lake Ontario from Oshawa to Hamilton, in tributaries of the Holland River (Lake Simcoe drainage), in a tributary of the Grand River (Lake Erie drainage), and three tributaries of Lake Huron.

Historically in Ontario, the species was found in small (< 10 m wide), isolated tributaries of 24 watersheds. It was most likely extirpated from seven of these tributaries between 1940 and 1980. Although one population (Humber River) appears to have undergone a range expansion between 1950 and 1980, most of the remaining populations have been restricted to, or become fragmented into, small isolated sections of an earlier, wider distribution in most watersheds. There is recent (2000-2004) sampling evidence that two populations (West Don and Morrison Creek) are close to extirpation, or have been extirpated.

Habitat

The redside dace is found in pools and slow-flowing sections of relatively small, clear headwater streams with both pool and riffle habitats and a moderate to high gradient. These streams typically flow through meadows, pasture or shrub overstory,

and have abundant overhanging riparian vegetation. Redside dace occupy pool habitats and spawn in riffles or the slow-flowing water at the bottom end of pools. Populations have been lost from several streams that have had major habitat changes associated with intensive urban development and the construction of reservoirs. Approximately one-half of the extant sites are in or near areas expected to be developed over the next 16 years. The beds of the streams inhabited by redside dace are either privately owned or, if navigable, are generally owned by the Crown. The majority of adjacent lands are privately owned, but those in urban subdivisions are usually returned to public ownership.

Biology

The redside dace is relatively short-lived, reaching a maximum age of 4 years, with most fish maturing at age 2. Redside dace spawn in gravel riffles in May when water temperatures reach 16-18ºC. The non-adhesive eggs are normally laid in the gravel nests of co-occurring minnow species such as creek chub (*Semotilus atromaculatus*) and common shiner (*Luxilus cornutus*) while these species are still on the nest. The fecundity of redside dace ranges from 409-1,971 eggs/female. The redside dace is a surface feeder and often leaps several centimetres out of the water to capture aerial insects. It feeds primarily on terrestrial insects, especially adult flies (Diptera). No long distance movements have been reported for redside dace populations. In Ontario, the redside dace usually co-occurs with tolerant, common coolwater fishes such as creek chub, common shiner and blacknose dace (*Rhinichthys atratulus* species complex). It occasionally co-occurs with various trout species that may compete with, and prey upon, redside dace.

Population sizes and trends

Absolute population sizes have not been estimated. Analysis of data on sampling at historical sites of occurrence indicates that redside dace have declined in most of the river systems in Canada with few exceptions. Large declines have occurred in 8 watersheds that were thought to have healthy or stable populations when the status was reviewed in 1985. This conclusion was based on the presence of healthy populations in the 1970s and 1980s. Redside dace populations are strongest in tributaries of the Humber River, the Rouge River and Sixteen Mile Creek. Search efforts have failed to find them, and they are likely extirpated, from the following streams: Pringle Creek, parts of Duffins Creek (main stem, Urfe Creek and Reesor Creek), Highland Creek, the lower Rouge River, middle sections of the Don River, German Mills Creek, Mimico Creek, Etobicoke Creek, a creek in Clarkson, and Mountsberg Creek, a tributary of Bronte Creek. Surveys also suggest declines in Lynde Creek, parts of the upper Rouge River, tributaries of the Credit River (Silver Creek and its tributaries, Huttonville Creek and Fletcher's Creek), Fourteen Mile Creek, the upper parts of all three branches of Sixteen Mile Creek, Spencer Creek, the Holland River tributaries Kettleby Creek and Sharon Creek, the Grand River tributary Irvine Creek, the Saugeen River and its tributary Meux Creek. The West Don and Morrison Creek populations are likely close to extirpation. There is no possibility of rescue from populations in the U.S.

Limiting factors and threats

The major threats to redside dace in Ontario are habitat alteration and degradation, resulting in changes in water quality and quantity and riparian vegetation, associated with urban development and agricultural activities and the introduction of non-indigenous species.

Special significance of the species

Redside dace feed primarily on terrestrial insects thereby importing terrestrial energy into stream ecosystems. Redside dace may be useful as an indicator of ecosystem health as they are more sensitive to environmental disturbance than most fish species in the Ontario streams where they occur.

Existing protection

The habitat of the redside dace receives general protection under the habitat provisions of the federal *Fisheries Act*. The harvest of redside dace is prohibited in Ontario as it is a specially protected fish under the *Ontario Fisheries Regulations*. The species is listed as Threatened in Ontario and as Endangered in Michigan and Indiana.

COSEWIC HISTORY

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

COSEWIC MANDATE

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

COSEWIC MEMBERSHIP

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

DEFINITIONS

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

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

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

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

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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

redside dace
Clinostomus elongatus

in Canada

2007

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SPECIES INFORMATION

Name and classification

Class:	Actinopterygii
Order:	Cypriniformes
Family:	Cyprinidae (carp and minnow family)
Scientific name:	*Clinostomus elongatus* (Kirtland, 1841)
English Common name:	redside dace
French Common name:	méné long

The genus *Clinostomus* is endemic to North America and consists of two described species (Nelson *et al*. 2004). A systematic study of the redside dace has not been completed and no subspecies have been described (Gilbert 1980). The other species in the genus, the rosyside dace, *Clinostomus funduloides*, consists of three described subspecies one of which may be close to species status (Gilbert and Lee 1980).

Coburn and Cavender (1992) include *Clinostomus* in the shiner group with such genera as *Notropis*, *Luxilus*, *Pimephales*, *Opsopoeodus* and *Cyprinella*. *Clinostomus* has specialized rows of comb-like scales on the breast of spawning males, a characteristic also found in genera such as *Phoxinus*, *Couesius*, *Margariscus* and *Richardsonius* (Cavender and Coburn 1992). Coburn and Cavender (1992) hypothesize that *Clinostomus* is the sister group to *Richardsonius* (e.g., redside shiner, *Richardsonius balteatus*) and these two are sister groups to the remaining members of the shiner group.

Morphological description

The redside dace (Fig. 1) is one of Canada's most brightly coloured minnows and reaches a maximum total length of 12 cm. It has a large mouth (the jaw extends to below the pupil of the eye), with a protruding lower jaw. It has relatively small scales (59-75 lateral scales). The adult has a wide, red, mid-lateral stripe that extends from the head to below the dorsal fin. Above the red stripe, there is a bright yellow stripe that extends from the head to near the tail fin. Colours intensify during spring and fade during late summer and fall, at which time there may be a purplish sheen on the sides. Males are more brightly coloured and have larger pectoral fins than females. Prior to spawning, the male develops small tubercles that are particularly prominent on top of the head and pectoral fins (Schwarz and Novell 1958, Scott and Crossman 1973, Page and Burr 1991).

The redside dace can be distinguished from other Canadian cyprinids by its very large mouth, protruding lower jaw, and large pectoral fins on the male. Other cyprinids that have red sides such as the northern redbelly dace (*Phoxinus eos*), the finescale dace (*P. neogaeus*), the blacknose dace (*Rhinichthys atratulus* species complex), and the pearl dace (*Margariscus margarita*) develop a red stripe that extends farther back

Figure 1. Redside dace from East Humber River. Photo by E. Holm, ROM.

(to the tail vs. to below the dorsal fin). The large mouth and protruding lower jaw is evident on juvenile redside dace. Very small juveniles (ca 20-25 mm) may also be distinguished from co-occurring shiners by having 5 (vs. 4) teeth in the throat (Fish 1932).

Genetic description

No genetic study of redside dace has been published, although allozyme and mitochondrial DNA analyses of several populations in Canada and the United States are underway (Wilson pers. comm. 2005). Preliminary findings based on allozyme electrophoresis have shown that populations in Ontario, Ohio and New York share a common postglacial ancestry from a presumably Mississippian refugium during the late Pleistocene. Populations in Ontario are genetically divergent from each other despite their geographic proximity, suggesting that these populations have been reciprocally isolated from each other since soon after their founding. Levels of genetic diversity in the sampled populations were higher than comparison populations in Ohio, indicating that inbreeding within the sampled populations is not an immediate concern. The high within-population diversity combined with the disappearance of previously known populations, however, may indicate that rates of population decline are occurring more rapidly than can be detected with genetic markers (Wilson pers. comm. 2005). These are preliminary findings based on comparisons between only a few populations, and we lack knowledge of the level of differences between all Ontario populations. Therefore, it is premature to treat populations as separate/genetically distinct units.

Designatable units

All Canadian populations are found within the Great Lakes-Western St. Lawrence Freshwater Ecological Area (COSEWIC 2003). There are no known distinctions between the populations within this area that warrant consideration of designatable units below the species level.

DISTRIBUTION

Global range

The global range of the redside dace is discontinuous (Fig. 2). It is found in streams of all five of the Great Lakes, the Susquehanna River, the Ohio River, and the upper Mississippi River drainages. It occurs in a wide band starting from northcentral New York continuing southwest through Maryland and West Virginia, west to Kentucky and north to Indiana, Ohio, Michigan and Ontario, where it was recently discovered in the Two Tree River, a northern Lake Huron tributary near the outlet of Lake Superior. In the west, this species is found primarily in Wisconsin, but populations also have been documented in the surrounding states of Minnesota, Illinois (Sabaj 2001) and Iowa. The most northerly population is in the upper peninsula of Michigan, where it was first discovered in 1998 in the Lake Superior drainage (Latta 1998). Bailey *et al.* (2004) suggest that this is an introduced population. Conservation Data Centres in range jurisdictions of the United States were contacted in 1997 regarding trends in the range and population abundance of redside dace. The species has been extirpated from two states (IA, MD), has experienced range reductions in at least two states (MI, OH) and was reported as having a stable range in three states (KY, IN, PA). Four jurisdictions did not have information with respect to changes in range (NY, WI, MN, WV).

Canadian range

The current Canadian distribution of redside dace is approximately 5% of the global range, and is limited to small, isolated populations in southern Ontario (Fig. 3 and 4). Most populations occur in tributaries to western Lake Ontario from Pringle Creek (west of Oshawa) in the east to Spencer Creek (northwest of Hamilton) in the west (Fig. 3). Populations are also known from the Lake Simcoe drainage (Holland River system), the Lake Erie drainage (Irvine Creek), and the Lake Huron drainage (Saugeen River system, Gully Creek and the Two Tree River) (Parker *et al.* 1988; Mandrak and Crossman 1992; ROM 2005). Details regarding trends in the Canadian range of redside dace are discussed in more detail under 'Fluctuations and Trends' in the **Population Sizes and Trends** section.

The redside dace was once found in small (< 10 m wide), isolated tributaries of 24 watersheds in Ontario. The redside dace was most likely extirpated from seven watersheds between 1940 and 1980. Although one population (Humber River) appears to have undergone a range expansion between 1950 and 1980, most of the populations in the remaining 16 watersheds have been restricted to, or become fragmented into, small isolated sections of an earlier, wider distribution. There is recent (2000-2004) sampling evidence that two of these populations (West Don River and Morrison Creek) are close to extirpation, or have been extirpated, and some populations such as that in the Saugeen River, have undergone range reductions of greater than 90%. Populations have also been apparently extirpated from portions of the Humber River, Credit River and Duffins Creek watersheds. Although the overall extent of occurrence in Canada has declined slightly (estimated at 46,900 km^2 from Fig. 2), the area of occupancy

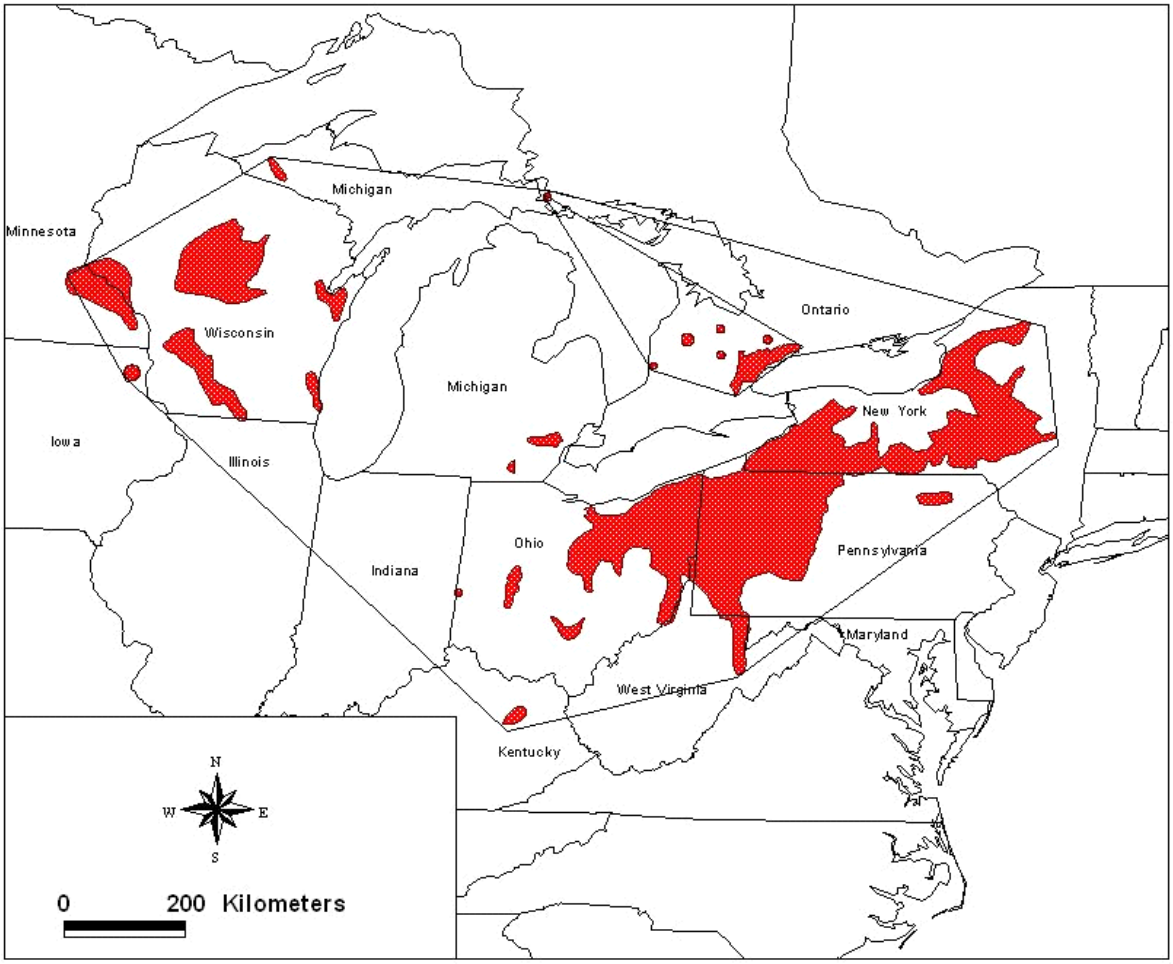

Figure 2. Global range of the redside dace. Map based on Gilbert 1980, updated with data from Lyons *et al*. 2000, MDNR 2004, Mandrak 2003, Cooper 1983, Meade *et al*. 1986, and NYDEC 2004. Global (930,000 km^2) and Canadian: (46,900 km^2). Extent of occurrences are outlined.

[estimated at less than 4 km^2 based on occupied stream length X steam width as determined from 1:50,000 (topographic maps), or as 441 km^2 (based on overlaid grids of cell size one km^2, total AO is the number of occupied squares that are intersected by streams)] has declined significantly (Table 1).

Unverified specimens that may represent misidentifications have been reported from Graham Creek, a Spencer Creek tributary (Fletcher Creek), and a tributary of Twenty Mile Creek (Lake Ontario drainage); upper Grand River near Belwood Lake (GRCA 1996), Nith River and Washington Creek (Grand River drainage) (Taylor 1988); Cobourg Creek (Lake Erie drainage); a creek near Sebringville (Thames River drainage); a Teeswater tributary, Greenock Creek (Saugeen River drainage); and Holmesville Creek (Maitland River drainage). Data are lacking to substantiate Coad's (1995) statement that the redside dace has dispersed outside its natural range in southern Ontario as a bait fish (Coad pers. comm. 2003).

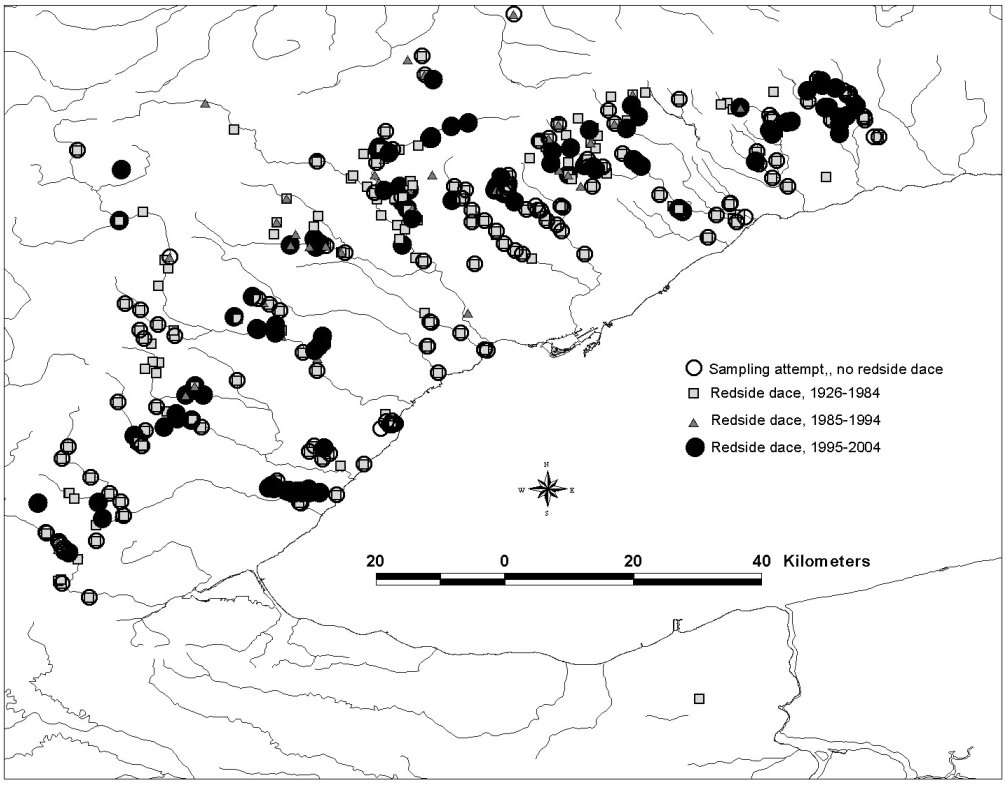

Figure 3. Distribution of redside dace in the "Golden Horseshoe" through time showing sampling attempts that did not capture redside dace. Based on Holm and Andersen (2005).

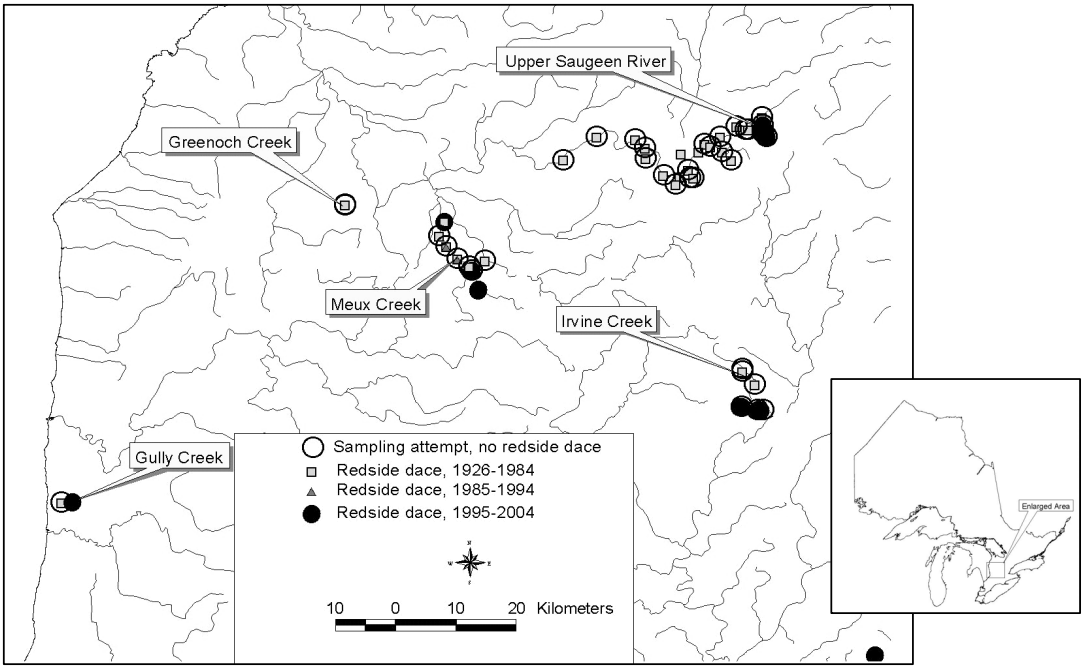

Figure 4. Distribution of redside dace in southwestern Ontario through time, showing sampling attempts that did not capture redside dace. Based on Holm and Andersen (2005).

Table 1. Trends in occupied range for Canadian redside dace populations.					
Drainage and stream	**Trend in range**				**Comments**
	Increase	**Stable**	**Decline**	**Extirpated**	
Lake Ontario					
Pringle Creek			X	X?	May be extirpated
Lynde Creek			X		Small range reduction
Carruthers Creek		X?			
Duffins Creek			X	X?	May be extirpated from two tributaries and main stem
Petticoat Creek			X	X?	Probably extirpated (not collected since 1954)
Highland Creek				X	Last seen in 1952
Rouge River			X		Remains widespread in watershed, small range reduction
Don River			X		Large range contraction
Humber River	X	X	X		Range expansion in West Humber, stable in east Humber, contraction in main stem
Mimico Creek				X	Last seen in 1949
Etobicoke Creek				X	Last seen in 1949
Clarkson Creek				X	Last seen in 1927
Credit River			X	X	Extirpated from Levi's creek, range reduction in Silver Creek.
Morrison Creek			X	X?	May be extirpated
Sixteen Mile Creek			X		Small range reduction
Fourteen Mile Creek			X		Small range reduction
Bronte Creek			X		Large range reduction
Spencer Creek			X		Large range reduction
Niagara area stream				X?	Probably extirpated – last seen in 1960
Lake Simcoe					
Holland River			X		Large range reduction
Lake Erie					
Irvine Creek			X		Large range reduction
Lake Huron					
Gully Creek		X?			Presumed stable
Saugeen River			X		94% range reduction
Two Tree River		X?			Presumed stable

The information on range and population trends comes from a database maintained by the Redside Dace Recovery Team (Holm and Andersen 2005) consisting of 644 records of redside dace captures and 364 attempts at former sites of occurrence.

HABITAT

Habitat requirements

The redside dace is found in pools and slow-flowing sections of relatively small headwater streams with both pool and riffle habitats and a moderate to high gradient (McKee and Parker 1982, Meade *et al.* 1986, Goforth 2000, Andersen 2002, Daniels pers. comm. 2005). Substrate varies from silt to boulders, but they are often associated with gravel (McKee and Parker 1982; Becker 1983; Holm and Crossman 1986, Daniels, pers. comm. 2005). Overhanging riparian vegetation in the form of grasses and shrubs as well as undercut banks and instream cover (boulders, large woody debris) are important components of redside dace habitat. Redside dace are typically found in stream segments that flow through open meadows, pasture or shrub overstory as opposed to closed canopy forest in Ontario (Andersen 2002, Parish 2004) and Wisconsin (Becker 1983). In Kentucky, redside dace are found in forested watersheds with canopy over the stream (Meade *et al.* 1986).

Redside dace typically occur in streams that are clear, and water clarity is often mentioned as being important to redside dace habitat (McKee and Parker 1982; Meade *et al.* 1986; Daniels and Wisniewski 1994; Goforth 2000). However, redside dace have been captured in Ontario in streams with moderate turbidity (Holm and Crossman 1986), and Coon (1993) suggested that redside dace may have a broader range of tolerances to temperature, turbidity and depth in areas where they are common. The redside dace is a visual feeder which probably explains its preference for clear water habitats (Daniels and Wisniewski 1994). Studies on the effect of turbidity on other fishes have shown that turbidity reduces foraging effectiveness in some species. For example, turbid water decreased growth in brook trout (*Salvelinus fontinalis*) because they became more active switching from drift feeding to active searching (Sweka and Hartman 2001). The volume and diversity of stomach contents in brown trout decreased progressively with increasing turbidity (Stuart-Smith *et al.* 2004). Bonner and Wild (2002) found that prey consumption by the Arkansas River shiner (*Notropis girardi*), the emerald shiner (*N. atherinoides*), red shiner (*Cyprinella lutrensis*), and sand shiner (*N. stramineus*) was reduced by elevated turbidity. Other species appear to be unaffected. Prey consumption by the peppered chub (*Macrhybopsis teranema*) and flathead chub (*Platygobio gracilis*) was unaffected by elevated turbidity (Bonner and Wild 2002).

Redside dace are considered to be a coolwater species (Coker *et al.* 2001). Becker (1983) stated that redside dace avoid warm water as well as very cold water. In Ontario, most streams where redside dace have been collected had summer temperatures less than 20^{o}C, although some streams were as warm as 23^{o}C (McKee and Parker 1982). In New York, redside dace have been collected at summer stream temperatures ranging from 13-30^{o}C, although most (80%) of the collections were at temperatures between 14 and 25^{o}C (Coon 1993). Coon (1993) suggested that the optimal summer temperature for redside dace was close to 20^{o}C.

Redside dace are normally found in smaller streams ranging from 1-10 m (mean= 5) in width (McKee and Parker 1982; Becker 1983), In New York, stream widths averaged 5-10 m (Daniels pers. comm. 2005). Occasional individuals have been captured in the larger main stems of Ontario rivers. It is not clear whether these individuals represent established populations, or strays from smaller tributary streams. With the exception of spawning time, redside dace reside in the deeper, slow-moving pool sections of streams. Reported stream depths for redside dace captures throughout their range vary from 0.1 – 2.0 m (McKee and Parker 1982; Becker 1983; Coon 1993, Daniels pers. comm. 2005). Coon (1993) suggested that suitable habitat for redside dace was provided by pools ranging from 11-100 cm in depth. Parish (2004) found that redside dace preferred streams with small width to depth ratios. Novinger and Coon (2000) observed that redside dace displayed a consistent preference for mid-water positions in the deepest part of pools. In New York, stream discharges at sites of redside dace capture ranged from 0.01-1.6 m^3/s, with most (80%) collections occurring at discharges between 0.01 and 0.43 m^3/s (Coon 1993).

Redside dace spawn in shallow gravel riffles, usually as a nest associate of other cyprinid species (Koster 1939; Page and Johnston 1992; E. Holm, unpublished data). Parish (2004) found that Ontario streams with redside dace populations tended to have riffles with larger particle sizes than streams without redside dace, even though eggs are laid on gravel substrates.

There is no information available regarding winter habitat use, although presumably they overwinter in deep pool areas with little current. There is no information available regarding the habitat of redside dace larvae. Habitat use by juveniles has not been specifically studied, although juveniles are often collected in Ontario from the same pools as adult fish.

Habitat trends

Loss of suitable habitat (or habitat modification) is likely the major factor contributing to redside dace declines in Ontario. Populations have been lost from several streams that have had major habitat changes associated with intensive urban development and the construction of reservoirs. Population declines associated with habitat loss have probably occurred in about one-half of Ontario's redside dace streams, and only a few are considered to be relatively undisturbed. The species is now restricted to the relatively undisturbed headwaters of many streams where it was once widespread (McKee and Parker 1982).

As urbanization has proceeded over the last 50 years in the Greater Toronto Area, most redside dace populations have disappeared from developed areas or populations have become increasingly restricted to headwater areas (Fig. 5). Approximately one-half of the redside dace sites that have been shown to be extant over the last 15 years are within, or immediately adjacent to, areas that are scheduled to be developed over the next 16 years. The nature of stream habitat changes associated with urbanization is summarized below under **Limiting Factors**.

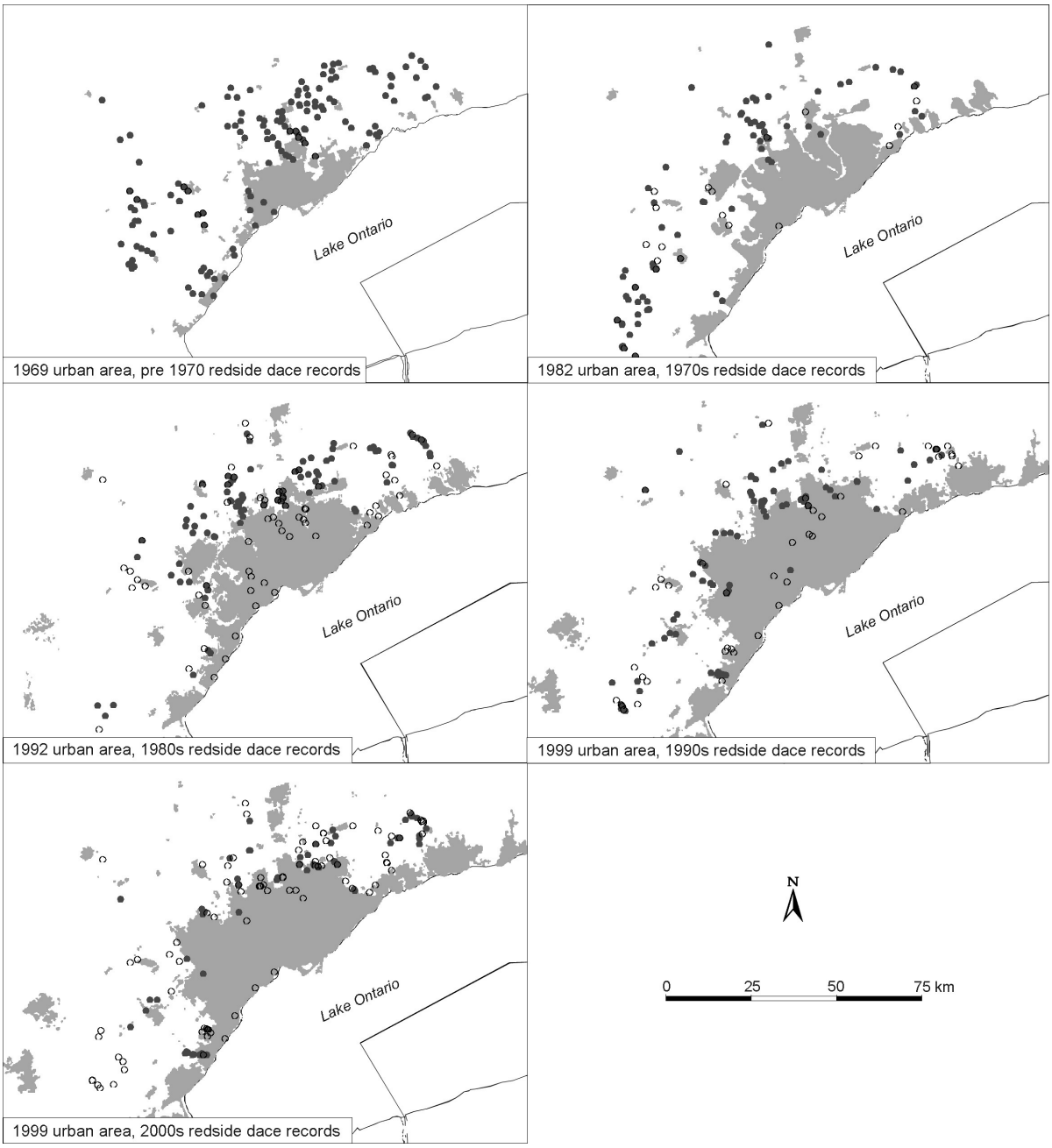

Figure 5. Distribution of redside dace (*Clinostomus elongatus*) in the Greater Toronto Area over time. Closed circles represent sites where redside dace were captured; open circles represent sites of former redside dace occurrence where sampling occurred, but no redside dace were captured; grey shading represents extent of urban area.

A draft recovery strategy has been prepared for redside dace in Ontario that is attempting to protect and restore redside dace habitats (Redside Dace Recovery Strategy 2005).

Habitat protection/ownership

The habitat of the redside dace receives general protection under the habitat provisions of the federal *Fisheries Act*. Adjacent lands receive policy level protection through the fish habitat and species at risk provisions of the Provincial Policy Statement (PPS) under the provincial *Planning Act*. The PPS prohibits development or site alteration on adjacent lands (within 30 m of fish habitat) unless it can be shown through an Environmental Impact Study that the fish habitat in question will not be negatively impacted. Development and site alteration is not permitted in the significant habitat of Ontario Threatened and Endangered species. Recent amendments to the *Planning Act* now require municipal planning decisions to be consistent with the PPS. The provincial *Lakes and Rivers Improvement Act* may also indirectly protect redside dace habitat when applications for the construction or maintenance of dams and dredging activities are reviewed. Alteration in or near floodplain, wetland, and/or watercourses is regulated by Conservation Authorities through the Development, Interference with Wetlands and Alterations to Shorelines and Watercourses Regulation. Aspects of the provincial *Nutrient Management Act, Environmental Protection Act, Water Resources Act, Source Water Protection Act* may also provide indirect protection for the habitat of redside dace.

The beds of the streams inhabited by redside dace are either privately owned or, if navigable, are generally owned by the Crown. The majority of adjacent land is privately owned and in agricultural production or in urbanizing landscapes. Lands immediately adjacent to streams in urban subdivisions are usually returned to public ownership.

BIOLOGY

Aspects of the biology of redside dace have been studied throughout much of its range (Kentucky, Michigan, New York, Ontario, Pennsylvania), but there have been few comprehensive studies. There are still several aspects of its life history that are not well understood.

Life cycle and reproduction

The redside dace is relatively short-lived, reaching a maximum age of 4 years (Koster 1939, Schwartz and Norvell 1958). The oldest reported Ontario specimens were 3 year olds (McKee and Parker 1982). Schwartz and Norvell (1958) captured a very low ratio of males to females (1:3.5) in Pennsylvania. The highest number of males (15-50%) occurred in March-June, after which they virtually disappeared. Most were 1-2 year olds. Of 227 individuals there were 118 Age I, 72 Age II, 31 Age III and 6 Age IV.

Redside dace grow quickly and achieve about 50% of their total growth during their first year (McKee and Parker 1982). Growth of fish from pooled Ontario streams analyzed by Parker and McKee (1982) was comparable to growth in populations studied from New York, Pennsylvania and Wisconsin (Koster 1939; Schwartz and Norvell 1958; Becker 1983). Females grow faster, and reach a larger size than males (Koster 1939;

McKee and Parker 1982). In a pooled sample of redside dace from Ontario, all 1 year old fish were immature, while most 2 year olds and all 3 year olds were mature (McKee and Parker 1982). Koster (1939) found that redside dace in a New York stream mature at age 2 and that fish apparently spawned every year after reaching maturity. Given that most fish mature at age 2 and live until age 4, generation time is estimated at 3 years.

Redside dace spawn in late May in New York when water temperatures reach 18°C (Koster 1939). Parker and McKee (1982) captured redside dace in prespawning condition in early May in the East Humber River, Ontario, at water temperatures of 16-19°C and suggested that spawning times and temperatures in Ontario are likely similar to those observed in New York. The authors have observed redside dace spawning activity in a western Lake Ontario tributary (Fourteen Mile Creek) from 10-29 May at temperatures ranging from 16-18.3°C.

Eggs are normally laid in riffles in the gravel nests of other minnows (Cyprinidae). Koster (1939) described spawning by redside dace in the nests of creek chub (*Semotilus atromaculatus*) and common shiners (*Luxilus cornutus*) in New York. Redside dace spawning activity has also been observed in Ontario streams while these two common species were still active on the nest. Observations indicated that spawning in Fourteen Mile Creek usually occurred at the bottom end of pools, or in the upper part of riffles, where the current was 5-30 cm/sec (E. Holm, unpublished data). Johnston and Page (1992) also included minnows of the genus *Nocomis* as nest associates. Although the range of redside dace overlaps with two Ontario species in this genus (hornyhead chub [*Nocomis biguttatus*] and river chub [*Nocomis micropogon*]), redside dace spawning activity has not been observed in *Nocomis* nests in Ontario. By spawning in the nests of larger minnow species, which are better at excavating nests, the eggs of the redside dace presumably have a greater chance of survival because they receive better aeration and increased protection from predation (Johnston and Page 1992). Although the practice can result in the frequent production of hybrids (Koster 1939), hybridization does not appear to be a serious problem (Becker 1983). Most nest associates are capable of spawning independently (Johnston, pers. comm. 2001), but this has not been observed in redside dace. Although creek chub and common shiners are ubiquitous in southern Ontario streams, they initiate spawning at slightly cooler temperatures (12-17°C) than the preferred spawning temperature for redside dace (18°C) (Becker 1983), although redside dace spawning activity has been observed as low as 16°C. The temperature differential and the shorter spawning period of redside dace may limit opportunities for communal nesting in some years.

Koster (1939) described the spawning behaviour observed in a New York stream in great detail and most of his observations are consistent with observations from Ontario streams (E. Holm, unpublished data). During the spawning period, males leave their resident pools, and travel short distances to spawning sites, especially in the middle of the day. Prior to spawning, males defend small territories (a few centimetres in each direction) immediately behind creek chub (or common shiner) nests. When ready to spawn, redside dace congregate in dense schools behind the nest. Females

then individually move forward into the nest and are followed by groups of up to 4-6 males and spawning takes place. Eggs are broadcast and fertilized in the depression of the nest. Each individual spawns several times with a number of partners. The fecundity of redside dace reported in the literature ranges from 409-1,971 eggs/female (Koster 1939; Becker 1983; McKee and Parker 1982). Eggs are non-adhesive and measure 1.2-2.4 mm in diameter (Koster 1939). Koster (1939) found that males remained in spawning condition for a period of 17 days in a New York stream.

There is no direct parental care of eggs, but indirect protection may be afforded by the nest and the presence of the male nest associate. The guarding male keeps the nest free of silt and deters egg predators. Koster (1939) found that male creek chub displayed tolerance to redside dace that had moved into their nest to spawn. Development of eggs and the larval stages of redside dace have not been described. Fish (1932) described a small (23 mm) juvenile, which can be distinguished from *Notropis* and *Luxilus* in having 5 (vs. 4) pharyngeal teeth.

Feeding/nutrition

The redside dace is primarily a surface feeder (Schwartz and Norvell 1958). The large upturned mouth of the redside dace makes it ideally adapted to capturing prey from below. Redside dace often leap several centimetres out of the water to capture aerial insects (Koster 1939; Schwartz and Norvell 1958; Daniels and Wisniewski 1994). This type of feeding behaviour relies on vision and would obviously be facilitated in habitats with clear water. The mid-water position maintained by redside dace also helps to facilitate surface feeding.

The redside dace feeds primarily on terrestrial insects, especially adult flies (Diptera) (Schwartz and Norvell 1958; McKee and Parker 1982; Daniels and Wisniewski 1994). Schwartz and Norvell (1958) found that terrestrial insects made up 77% of the diet by volume in a Pennsylvania stream from March to October. Parker and McKee (1982) found that adult flies made up 85% of the food volume consumed by redside dace from Ontario streams in August and September. Adult flies also comprised 85% of the food consumed between April and November in two New York streams (Daniels and Wisniewski 1994). Dance flies (Empididae) of the genus *Hilara* were the most important prey. Dance flies were not found in drift samples suggesting that redside dace were importing terrestrial energy produced in riparian vegetation into the stream (Daniels and Wisniewski 1994). Although redside dace do consume benthic insects and other invertebrate prey, these organisms are of minor importance in the diet and are more commonly eaten when winged forms are absent (Schwartz and Norvell 1958; McKee and Parker 1982; Daniels and Wisniewski 1994). Terrestrial insects are important to all age classes, although the size of food items consumed increases with age (Schwartz and Norvell 1958).

Predation on redside dace has not been reported in the literature although it undoubtedly occurs. McKee and Parker (1982) identified several piscivorous fishes that were captured infrequently at or near redside dace capture sites – brook trout, rainbow

trout (*Oncorhynchus mykiss*), black crappie (*Pomoxis nigromaculatus*) and rock bass (*Ambloplites rupestris*). Piscivorous birds and mammals may also prey upon redside dace. Novinger and Coon (2000) suggest that the close association with cover (overhanging vegetation) and selection for deep water may guard redside dace against aerial attacks.

Physiology

Only one study has examined the physiological tolerances of redside dace. Novinger and Coon (2000) examined the critical thermal maxima and metabolic rates at various acclimation temperatures. The critical thermal maximum for redside dace from New York acclimated at 20°C was 32.6°C. This value is slightly higher than some common minnow species that overlap in range with redside dace, but the data may not be strictly comparable due to differences in determining the end points when estimating critical thermal maxima (Novinger and Coon 2000). Predicted final preferred and optimum temperatures for growth were 24.5 and 24.7°C, respectively. Tolerance to low oxygen levels have not been examined in the laboratory, but McKee and Parker (1982) reported capturing redside dace from Ontario streams in August and September at dissolved oxygen levels between 4-11.5 mg/l. Dissolved oxygen levels were usually greater than 7 mg/l.

Dispersal/migration

No long distance movements have been reported for redside dace populations. Koster (1939) only noted local movements between adjacent pools and riffles at spawning time in a New York stream. McKee and Parker (1982) noted that pools inhabited in the summer in the East Humber River, Ontario were unoccupied in the spring, suggesting the fish had congregated in spawning areas.

Interspecific interactions

The fish communities that are normally associated with redside dace populations in Ontario typically consist of common, tolerant coolwater species such as creek chub, common shiner and blacknose dace. The relationship with creek chub and common shiner as nest associates appears particularly important to redside dace. Redside dace do not regularly co-occur with other species at risk.

Redside dace occasionally co-occur with native brook trout but the two are generally not found together. The influence of introduced rainbow trout and brown trout (*Salmo trutta*) on redside dace has not been investigated experimentally. In one study in the Susquehanna River in New York, however, redside dace, as well as other minnows, were extirpated after the introduction of 12-inch brown trout in 1998 (Stewart pers. comm. 2006).Their influence on redside dace may be conditional on the presence of other predators in the same habitat. Bryan *et al.* (2002) found that the joint presence of two introduced predators (virile crayfish (*Orconectes virilis*) and rainbow trout) negatively affected the Little Colorado spinedace (*Lepidomeda vittata*), a trout-like

minnow. Treatments with only rainbow trout did not result in predation of spinedace, but there was a significant reduction of activity level. Treatments with both crayfish and rainbow trout resulted in a decrease in activity rates and a decrease in rates of movements into and out of refuges. An experimental examination of the interactions between rainbow trout and the closely related rosyside dace suggested that interactions between the two species were minimal (Rincon and Grossman 1998). Some authors have identified the redside dace as a problem in that it competes with trout for food and may limit trout production (Greeley 1938; Becker 1983).

The introduction of predatory northern pike (*Esox lucius*), basses and sunfishes (Centrarchidae) has coincided with the disappearance of the redside dace in at least two creeks (Spencer and Mountsberg). Habitat change from urbanization and agriculture in these two systems has been minimal.

Adaptability

The redside dace does not appear to be able to adapt to habitat alteration as many populations have been extirpated or have declined in the face of habitat change. Artificial propagation and re-introductions have not been attempted with redside dace to date.

POPULATION SIZES AND TRENDS

Population sizes have never been determined, but are probably much greater in parts of the United States than in Canada. For example, Greeley (1938) analyzed 701 collections in New York and found the redside dace at 27.1% of the sites in the Allegheny watershed and 13.8% of the sites in the Chemung (Susquehanna) watershed. About 50 years later, there had been little change in the distribution of redside dace in New York. Surveys in the Allegheny River found the redside dace at 47 (27%) of 174 sites. A small decline had occurred in only one creek (Daniels, pers. comm. 2005).

Search effort

No targeted surveys were conducted for redside dace in Canada prior to 1979, whereas several recent surveys have targeted areas where redside dace are known from historical records or where suitable habitats existed. Many historical records of redside dace result from the extensive surveys by the Ontario Department of Planning and Development (ODPD) from 1946 to 1959 in several watersheds of southern Ontario. These and other surveys prior to 1970 were conducted with seine nets and traps. In the 1970s, the Ontario Ministry of Natural Resources (OMNR) conducted stream surveys which included systematic fish sampling using a variety of gear types (including backpack electrofishing) throughout most streams, rivers and their major tributaries in southern Ontario. In 1979, specific survey efforts were directed to sampling redside dace and 12 other species thought to be at risk for inclusion in a

COSEWIC list of rare, threatened, endangered and extinct fishes of Canada (McKee and Parker 1982). The Royal Ontario Museum (ROM) sampled 69 sites in 1985 (38 sites with historical redside dace records) specifically searching for redside dace. For the last 8 years, numerous surveys have been conducted by the ROM, Conservation Authorities, Fisheries and Oceans Canada (DFO), OMNR and Ontario Streams throughout the range of redside dace in Ontario to confirm its distribution and investigate abundance at some sites. In addition to these specific search efforts, records of redside dace have been contributed by consultants, management agencies and students conducting work for other purposes. These have been documented in a database (Holm and Andersen 2005) and are summarized in Tables 1-22 of the Appendix. It is important to note that most of the recent records for redside dace are related to specific search efforts for this species, while most of the early records come from general survey work.

A repeat sampling event may suffer from a number of problems including unintentional sampling at the wrong location or in unsuitable habitat, differences in methods or effort, changed environmental conditions (e.g., water levels, current speed, temperature, timing, turbidity), misidentification of the species, and a shift in habitat location as the stream course moves naturally over time or has been intentionally altered. Therefore, some differences in results between the original sampling event and the repeat sampling event may result from factors other than a change in the status of the redside dace in the stream.

Abundance

The total Canadian population size is unknown and would be very difficult to estimate accurately. Based on the number of successful collecting events and the total number of individuals collected, the healthiest populations occur or occurred in the Humber, Rouge, Don, Credit and Saugeen watersheds. Despite such healthy populations, the redside dace is still described as a rare species in these watersheds (Parker *et al.* 1988).

Fluctuations and trends

Sampling has been adequate in most watersheds to qualitatively identify trends in abundance. This sampling indicates that declines or extirpations have occurred in 21 of 24 Canadian watersheds (see Table 1, Appendix: Tables 1-22). Abundance has probably remained relatively stable in three streams (Carruthers Creek, Gully Creek, and Two Tree River), and within the East Humber River of the Humber River watershed. There is evidence that a range expansion may have occurred in the West Humber River portion of this watershed. While range reduction and, presumably, declines in abundance have occurred in Sixteen Mile Creek, the main stem of the Humber River, the Rouge River and Fourteen Mile Creek, there are still fairly abundant populations remaining in large parts of these streams. The species has probably been extirpated from five streams (Highland, Mimico, Etobicoke and Clarkson creeks and a Niagara area stream). Redside dace may also be extirpated from all or parts of five additional streams (Petticoat, Pringle and Morrison creeks and parts of Duffins Creek and the

Credit River). Large declines, or extirpations, have occurred in six creeks (Morrison, Bronte, Spencer, Irvine, Meux and Kettleby) that were presumed to have healthy or stable populations in 1985 (Holm and Crossman 1986 and Parker *et al.* 1988).

Lake Ontario Drainage

Pringle Creek: The redside dace has not been seen since 1959, despite efforts in 1985 (Holm and Crossman 1986) and 1999 (Andersen 2002) (Appendix: Table 1). Andersen (2002) concluded that the species is severely limited or extirpated from Pringle Creek.

Lynde Creek: The redside dace was first captured at 5 sites in the upper half of both branches of Lynde Creek in 1959 (Appendix Table 2a). In 1983 it was reported from 10 new sites in the east branch but visits to two ODPD sites in 1985 failed to catch the species. Sampling conducted between 1999 and 2001 (Andersen 2002, Andersen unpublished data) found them at only 1 of the 5 ODPD sites (Appendix Table 2a) but captured them at another 10 new sites in both branches (Appendix Table 2b). Results of these surveys suggest range contraction in the east branch, and the maintenance of range in the west branch. Two 1959 records in lower Lynde Creek (2.4 km NW of Whitby, listed by Crossman and Holm (1986), appear to be erroneous (see ROM Accession 525). One of them was sampled in 2000 and failed to yield redside dace (Anderson pers. comm. 2001).

Carruthers Creek: This is a local name for a small tributary of Lake Ontario just west of Ajax. The redside dace was first recorded from the lower reaches of this creek in 1978 (Natural Heritage Information Centre, Element Occurrence). Sampling in 2001 at two sites, located about 10 km farther upstream, resulted in the capture of 90 redside dace (Ruthven, pers. comm. 2000). Its presence at the 1978 site has not been confirmed since, although sampling effort is unknown.

Petticoat Creek: The redside dace has not been captured in Petticoat Creek since 1954, when it was recorded at two sites by the ODPD. Attempts in 1975, 2003, and 2005 at one of the sites and several attempts at other sites yielded no redside dace. Recently, many summer survey efforts have failed to find water, except in the lower reaches of Petticoat Creek (Lawrie, pers comm. 2005). The lack of redside dace in this sampling, and the lack of reports of redside dace in a 50-year period, suggests that the species may be extirpated in Petticoat Creek.

Duffins Creek: Known from five tributaries and the main branch, the redside dace has only recently been found in three (Michell Creek in 2003, a Brougham Creek tributary in 1999, and Ganatsekiagon Creek in 1996). Despite continuing to be found at new sites, sampling conducted from 1979-2003 indicates a decline in frequency of occurrence at historical sites, as well as overall numbers of individuals captured (Appendix Table 3a, b). Significant decline or extirpation has occurred in Reesor Creek, Urfe Creek and the main channel of Duffins Creek.

Highland Creek: The redside dace was last seen in the lower reaches of Highland Creek in 1952 (ROM 15637). The species has not been captured since, despite at least 4 attempts (Appendix: Table 4), and it is likely extirpated from Highland Creek.

Rouge River: The redside dace is still widespread and has been recently captured in high numbers in the tributaries of the upper Rouge River. Results of sampling at 30 historical sites, however, have seen a steady decline in the number of sites with redside dace. Although numbers captured have been relatively high, there has also been considerable effort spent to get them (Appendix: Table 5a). The species continues to be found at new sites in the Rouge in fairly high numbers but search effort is unknown (Appendix: Table 5b). Although the redside dace was still present in 2003 in Morningside Creek, sampling in 1997 and 2003 yielded 4 times fewer individuals of redside dace, and a dramatic decline in relative abundance (4.5% in 1984 and 1985 vs. 0.1% in 1997 and 2003).

Don River: The redside dace has demonstrated a dramatic range contraction in both branches of the Don River, and may be near extirpation in the Don River West Branch. It was first captured in the lower East Branch in 1926 and again in 1935. In 1949, it was still widespread in the upper half of both sections, when the ODPD found them at 23 sites (Fig. 6). Although it appears to be maintaining itself in the upper East Don, considerable effort has yielded fewer individuals (Appendix: Table 6a) and they have been reported from very few new sites (Appendix: Table 6b). A larger decline in both number of sites and individuals captured has occurred in the West Don (Appendix: Table 7a,b). This population was still extant in 1998, but survey efforts in 2002-2003 suggest that the species may have disappeared.

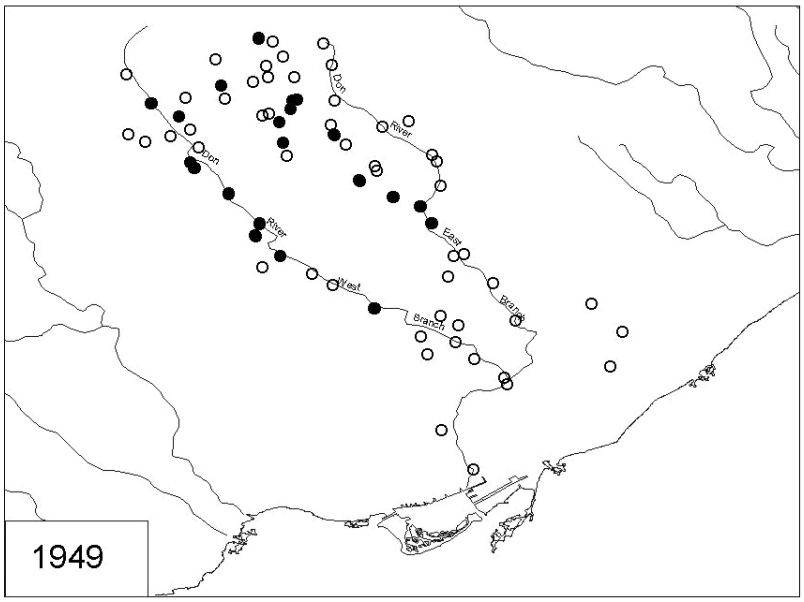

Figure 6. Sampling in the Don River in 1949 showing presence of redside dace (solid circles). Open circles indicate its absence (area ~ 33 km X 37 km).

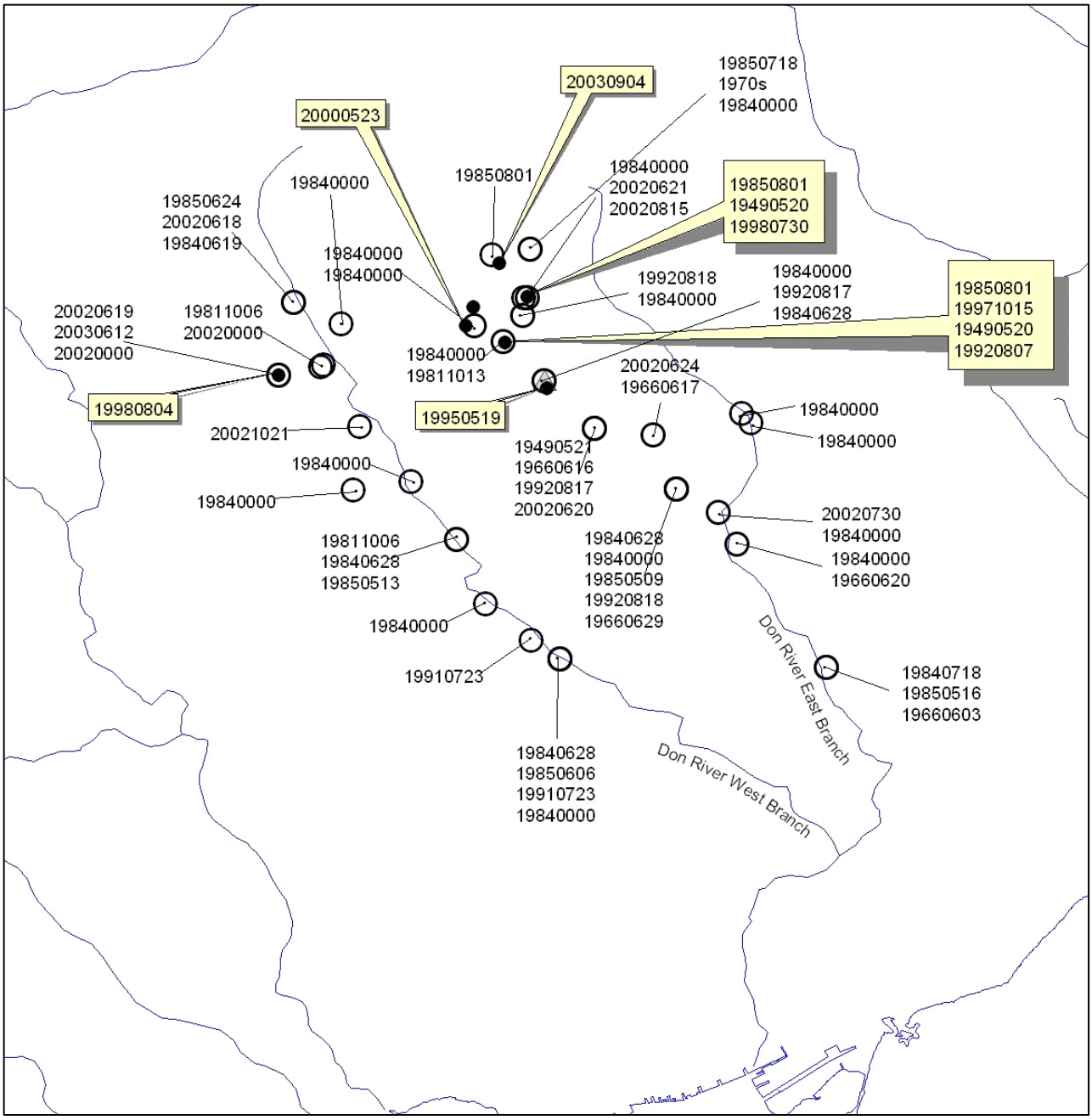

Figure 7. Summary of results of sampling effort in the Don River (both branches). Solid circles represent presence of redside dace in 1995-2004 (Dates of capture (format YYYYMMDD) in boxed labels). Open circles represent sites of past redside dace occurrence where more recent sampling for redside dace was unsuccessful (Dates of sampling in unboxed labels). Note that 3 unsuccessful sampling events in the West Branch occurred in 2002-2003 at the site that is marked with a solid circle (area ~ 32 km^2).

Humber River: In 1946, a basin-wide survey was conducted by the ODPD. The redside dace was captured only in the East Humber River at 8 sites and at one site in Black Creek (TRCA 2000). After 1946, surveys suggest that the redside dace expanded its range into the main and west Humber branches. It was first found in the main branch near Bolton in 1959. Surveys in the 1970s reported the species from several more sites in the main Humber, and at two sites in the West Humber. In the 1980s, it was more widespread in the West Humber (Fig. 8). In the 1990s, it was found at a new site in the headwaters of the main Humber, but attempts in the rest of the main branch failed to catch any. Search efforts in the East Humber River at the 8 ODPD sites continue to yield redside dace, although at reduced numbers after 1994 (Appendix: Table 8a). In 1991, a juvenile was captured in Black Creek, near its mouth (ROM 62630). This juvenile indicates that between 1946 and 1991, the redside dace in Black Creek may have been present in low numbers, or it may have drifted downstream from the more healthy population in the East Humber. It continues to be found in high numbers at new sites in the Humber River as recently as 2003 (Appendix: Table 8b).

Mimico Creek: In 1935-1949, the redside dace occurred in the lower half of Mimico Creek where it was recorded at 4 sites. Several survey attempts since 1985 at these sites and others have failed to capture it (Appendix: Table 9a), and it is presumed extirpated.

Etobicoke Creek: In the 1940s, the redside dace occurred in the lower and middle half of Etobicoke Creek and its tributaries (Appendix: Table 10a). No sampling is known from three sites in the middle reaches, which have become highly modified as a result of the expansion of Pearson Airport and adjacent development. Surveys at the two sites in lower Etobicoke Creek have failed to find it since the late 1940s despite considerable effort (Appendix: Table 10a,b), and it is presumed extirpated.

"Clarkson Creek": No redside dace have been captured in the creeks in Clarkson since 1927. In 1985, two creeks in Clarkson were sampled at 9 sites, 7 in Sheridan Creek and 2 in Turtle Creek (Holm and Crossman 1986). Other attempts in these creeks in 1986 (ROM Accession 5021), 1994 (ROM Accession 6186), 1996 (ROM Accession 6420) and 2004 (Coker pers. comm. 2004) failed to capture redside dace.

Credit River: In the Credit River system, the redside dace is widely distributed, but rare. It has been documented from the main branch and several tributaries: Roger's Creek, Silver Creek and three of its tributaries (Black Creek, Nichols Creek and Snows Creek), Huttonville Creek, Fletcher's Creek and Levi's Creek. Recent sampling attempts have discovered them in a tributary of Caledon Creek and Springbrook Creek. The most comprehensive survey occurred in 1954 when the ODPD documented the redside dace at 12 sites. Sampling attempts from 1965 to 2003 at these sites indicate a decline in both frequency and number of individuals (Appendix: Table 11a). Repeated sampling in Levi's Creek has yielded no redside dace, and repeated sampling in Silver Creek and its tributaries has yielded only a single specimen in 2005. Decline also appears to be occurring in most of the other creeks of the Credit River. Although a single redside dace was captured in 2003 in Fletcher's Creek, many attempts, particularly those in the more

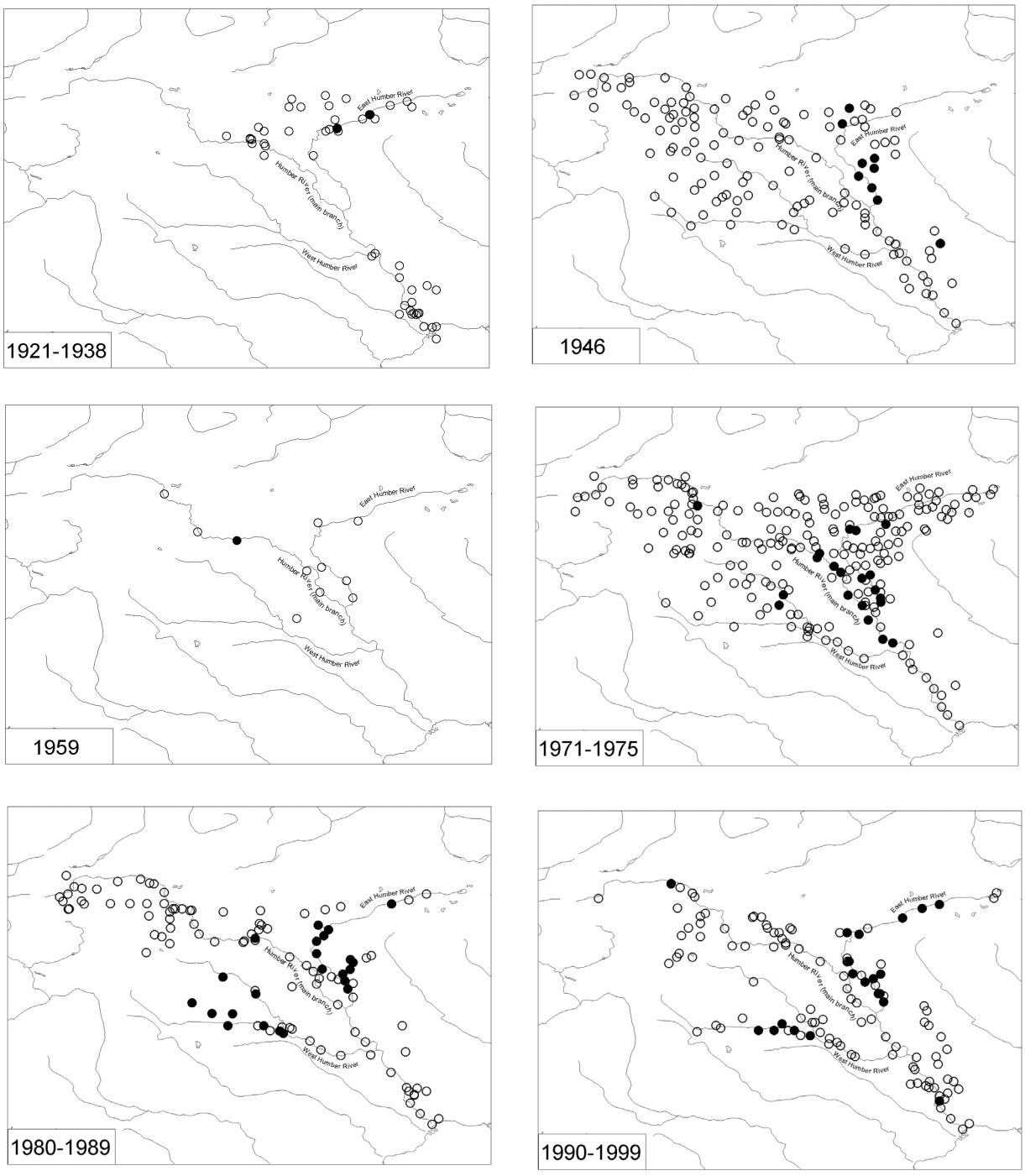

Figure 8. Distribution of redside dace in the Humber River through time. Open circles are sampling sites for time period indicated at lower left. Closed circles indicate presence of redside dace. 1921-1938: Royal Ontario Museum; 1946: ODPD (summarized in Wainio and Hester (1972) and by Toronto Region Conservation Authority (2000); 1959: Wainio and Hester (1972); 1970-1999 Toronto Region Conservation Authority (2000) [area~ 45 km X 53 km].

heavily urbanized middle reaches, have yielded none. There is evidence that some of the decline has occurred very recently. Sampling since 1999 (8 attempts) conducted by Credit Valley Conservation has failed to capture redside dace in Huttonville Creek at a site where every sampling attempt before 2000 had yielded redside dace. Status of the population in the Caledon Creek tributary is unknown but the creek was dry when visited in 1999 (Grewal pers. comm. 1999).

Morrison Creek: In 1954, the redside dace was widespread in both branches of Morrison Creek where it was found at 6 of 7 sites sampled by the ODPD. Sampling attempts in 2000-2003 at 5 of these sites resulted in no redside dace (Appendix: Table 12a). Although two specimens were found at a new site in 2000 (Appendix: Table 12b), these were captured after electrofishing 1.7 km of stream. Two subsequent attempts in 2003, near or at that site, failed to capture any redside dace. The species is, therefore, either extirpated or near extirpation.

Sixteen Mile Creek: In 1957, the redside dace was widespread in the upper half of all three branches of Middle Sixteen Mile Creek. It was found at 9 sites in the west, 4 in the middle and 1 in the east branch (ODPD 1957). Sampling in 1995-2003 has failed to find the redside dace at the most upstream sites of all three branches, but they were found in the middle and lower reach of the west and in tributaries of the lower reach of the middle branch. Three sites in the upper reaches of Middle Sixteen Mile Creek where the redside dace was captured in 1957 and 1975 were sampled in 2001 and no redside dace were captured (Watson-Leung, pers. comm. 2001). Despite this apparent range contraction, the redside dace is still thriving in many tributaries of Sixteen Mile Creek. Sampling of historical sites has had a high rate of success recently (Appendix: Table 13a) and the species continues to be found at new sites (Appendix: Table 13b).

Fourteen Mile Creek: In 1957, redside dace were captured at 3 of 8 sites sampled by the ODPD. It occurred from near the mouth to near the headwaters. Surveys in 1985, however, found the redside dace at only 1 of 3 of these sites, and it is likely that it is no longer found near the mouth and in a small tributary entering Fourteen Mile Creek from the east. In 1998-2003 15 sampling events at 12 sites captured 288 individuals of redside dace (Appendix: Table 14a,b) indicating that a healthy population of redside dace still occurred throughout the remaining historical range of Fourteen Mile Creek.

Bronte (Twelve Mile) Creek: The redside dace was first captured in 1958 in surveys by the ODPD, but locality data of these sites are missing. Surveys conducted in the 1970s found them at five sites throughout most of Mountsberg (Badenoch) Creek and at six sites in the main branch in a 20 km stretch. At least five of the sites yielded over 10 specimens and two sites yielded 20 and 23 specimens each (Appendix: Table 15a). In 1995-2000, surveys at 7 of these sites resulted in the capture of only a single individual (Appendix: Table 15a) in the main branch. Most of these recent surveys have been in Mountsberg Creek, where the redside dace has virtually disappeared. Since 1979, the species has been captured at only one new site (Appendix: Table 15b) in the main branch.

Spencer Creek: Parker *et al*. (1988) suggested that the redside dace population in Spencer Creek was stable in 1985. This was based on 1970s surveys that found the species widespread in the upper half of Spencer Creek and a tributary, Flamborough Creek. Redside dace, however, appear to be now present only in very low numbers in a small stretch of the main branch of Spencer Creek. Sampling in 1993 at 11 sites within the historic range captured redside dace at four sites in a 1 km stretch of the main branch. It was not captured from three sites upstream or four sites downstream, or from a site in lower Flamborough Creek (Staton *et al*. 1993). Sampling in 1995 (Thompson *et al*. 1995) reported the redside dace from two sites in the main branch, and at a new site in Fletcher Creek, a cold-water tributary that flows into upper Spencer Creek. There is no voucher and this latter record may have been misidentified (Duncan pers. comm. 1998). Surveys in 1998, 2001 and 2004 found no redside dace at 3 sites of former occurrence (Appendix: Table 16a). Only a single individual was captured at a site close to the ones captured in 1993 after considerable fishing effort (Holm 1999).

Niagara Peninsula: The species was last observed in 1960 from a stream in the Niagara Peninsula (near the 7th Lock of the Welland Canal). This may have been Ten Mile Creek or a tributary of Twelve Mile Creek. These streams now run through St. Catharines, and it is unlikely that this population is still extant, although there has been no known sampling at the site.

Lake Simcoe Drainage

Holland River: In 1976-1980 the redside dace was recorded from three sites in a small Holland River tributary, Kettleby Creek. In 1994 it was found in another tributary, Sharon Creek at one site, and it was recorded from a third unnamed tributary of the South Holland Canal just west of Kettleby Creek at one site (Gamsby & Mannerow Limited, 1995). Extensive sampling between 1988 and 2003 in Kettleby Creek and Sharon Creek (Appendix: Tables 17 and 18) resulted in the capture of only a single redside dace at one site in Kettleby Creek. This sampling indicates that, in 2003, the range of the redside dace in the Holland River system appears to be greatly reduced from previous levels. No known attempts have been made in the unnamed tributary of the Holland Canal west of Kettleby Creek since the 1995 report.

Lake Erie drainage

Irvine Creek: In the 1970s, the redside dace was widely distributed in Irvine Creek (ROM Accession 2701, Parker and McKee 1980). Extensive sampling at the 5 historical redside dace sites and many new sites in Irvine Creek in 1997-2005 (Holm 2003, Mandrak, pers. comm. 2005) suggests that it has disappeared from three of the sites (Appendix: Table 19a), although relatively high numbers were captured at three new sites in 2001-2003 (Appendix: Table 19b). There is recent evidence, however, that the abundance at a site where 25 individuals were captured in 2001 (Holm 2003) has now been significantly reduced. Three sampling events at that site in 2003-2005 yielded only two specimens (Barnucz, pers. comm. 2005).

Lake St. Clair drainage

Thames River: A record exists for the Thames River from “a creek near Sebringville”, but a voucher specimen could not be found (Kott, pers. comm. 2000). Extensive sampling in streams tributary to the Thames River in the Sebringville area in 1997 by the ROM and the Upper Thames Region Conservation Authority found no redside dace. If the original record was valid, it appears unlikely that the species exists there now.

Lake Huron drainage

Saugeen River: In 1953 and 1954, surveys by the ODPD recorded redside dace from five sites in a 13 km stretch in Meux Creek, at one site in the headwaters of the South Saugeen River, and at 20 sites in a stretch of approximately 40 km in the upper Saugeen River and its tributaries. In 1972, it was found at one additional site in the upper Saugeen River (Appendix: Table 20b) and in 2001, it was found at three additional sites in the headwaters of Meux Creek (Appendix: Table 21b). Surveys in 1985-2004 in the upper Saugeen River captured redside dace at only 3 sites in 2000 in a 2.4 km section in the headwaters of the Saugeen River (Appendix: Table 20a). Abundance of the redside dace in Meux Creek was still relatively high in 1985, when over 100 individuals were captured at 4 sites (Appendix: Table 21a). Extensive sampling in 2004, however, at all 5 ODPD sites resulted in the capture of only a single individual (Appendix: Table 21a). A 1992-1993 study by Cam Portt and Associates (Coker, pers. comm. 2001) found 15 individuals of redside dace prior to construction of a road crossing in Meux Creek, but none were captured after construction in 1993. A 1977 record of redside dace in Greenock Creek reported by Parker and McKee (1980) was considered invalid by Holm and Crossman (1986). This record is based on an observation of 2 specimens by the collector (D. Krewtzweiser) and documented on a Canadian Museum of Nature (CMN) catalog sheet (CMN1979-1205A); however, no voucher specimens exist. Sites near or at the described locality sampled in 1985 and 2004 did not yield any redside dace (Holm and Crossman 1986; Forder 2005). The failed attempts to capture redside dace in the South Saugeen, most of the upper Saugeen River and in Meux Creek indicate that its range has declined dramatically in the Saugeen River in the last 46 years. Of 26 sites, it has been recaptured at only 7 (27%) since 1954. Based on estimated occupied stream length, the range of the redside dace in the Saugeen River has declined from approximately 54 km to 3 km (6.5% of its estimated range in the early 1950s).

Gully Creek: A total of 8 redside dace were captured at two of three sites in 1980 in this small Lake Huron tributary (Appendix: Table 22). Attempts at both sites in 2001 captured six specimens at only one site. Additional sampling for rainbow trout in 1988 failed to catch any redside dace (Malhiot pers. comm. 2001).

Two Tree River: A total of 4 specimens have been captured in 2 of 4 sampling attempts indicating that the abundance of redside dace in the Two Tree River is low.

Rescue effect

The redside dace is confined to small streams (often in headwater areas) and there is no confirmed record from the Great Lakes proper. Therefore, it is unlikely that any dispersal from even adjacent populations in Canada, much less the more healthy U.S. populations, is possible. The healthiest populations are in Ohio (SNR), Pennsylvania (S4) and New York (S3). Rescue from any of these states is improbable because it would require migration across the open expanses of the Great Lakes. While the Michigan populations are adjacent to the Detroit River, the redside dace is a declining species in the state where it is listed as endangered (Goforth 2000).

LIMITING FACTORS AND THREATS

Redside dace populations have declined in many areas of their North American range (Page and Burr 1991). A variety of factors including deforestation, agriculture, urban development, coal mining, golf course development, pollution and introduced species have been implicated in these declines (Trautman 1981; McKee and Parker 1982; Becker 1983; Meade *et al.* 1986; Goforth 2000; Lyons *et al.* 2000). In Ontario, redside dace are subject to numerous threats that vary across its range. Parker *et al.* (1988) suggested that siltation and removal of bank cover in urban areas were important limiting factors. None of these threats has been empirically demonstrated, but there is sufficient evidence to identify probable cause and effect in some instances.

Given that more than 80% of Canada's redside dace populations are found in the 'Golden Horseshoe Region' of Ontario, urban development represents the most immediate threat to the species in Canada. Several populations have been lost or remain only in headwater areas as urban development proceeds. About one-half of the extant redside dace locations are in, or adjacent to, areas expected to be developed over the next 15 years. The human population of the Greater Toronto Area is expected to increase by 1.3 million over the next 15 years (Federation of Ontario Naturalists 2001). In the Golden Horseshoe Region, the population is expected to increase by almost 4 million people by 2031 (MPIR 2004). The healthiest remaining populations are near the current extent of urban development, but are found in watersheds that are relatively undisturbed.

The underlying mechanisms associated with urban development that negatively impact redside dace are poorly understood, but likely relate to numerous factors. An important overriding factor may be changes to in-stream channel structure that result in widening of the channel and reductions in pool depth. Such changes are often associated with hydrological changes and increases in peak discharges that occur when the landscape is cleared of vegetation and hardened (OMNR 2001). These changes also contribute to siltation that may affect redside dace feeding success through reductions in water clarity, particularly during the construction phase.

Several studies have shown that the quality of streams and their biota can be negatively affected when impervious cover (e.g., roads, houses, parking lots) exceeds

10% of a stream's catchment area (Booth and Jackson 1997, Wang *et al.* 2001, Environment Canada 2004, Stanfield *et al.* 2004). A study of streams in the Lake Ontario basin demonstrated that salmonid species only occurred in streams with a catchment that was less than 10% impervious cover (Stanfield *et al.* 2004). Wang *et al.* (2001) concluded that levels of connected imperviousness above 12% are associated with sharp declines in fish species richness, bank erosion and base flow. While such detailed landscape-based analysis has not yet been conducted for redside dace habitats in Ontario, a preliminary analysis by Parish (2004) also found that redside dace preferred stream channels that are not heavily influenced by urban drainage.

Direct changes to channel structure, through channelization that often occurs in urban areas, may also widen channels, reduce pool depth, increase peak discharges, and increase siltation. Removal of riparian vegetation, an important source of cover, would directly affect the production of terrestrial insects required by redside dace during a large portion of the year. Daniels and Wisniewski (1994) suggested that extensive alteration of riparian vegetation may be more important than instream habitat alterations in causing declines of redside dace populations. In-stream barriers and weirs may affect redside dace access to spawning areas and could be detrimental if metapopulation dynamics are important to redside dace populations. A rise in stream temperature is often associated with clearing of forests (Johnson and Jones 2000) and urban development (Leopold 1968), and may be detrimental to redside dace, particularly if the increase is sudden. Other developments may contribute to reductions in groundwater inputs that are important in regulating summer temperatures and base flows in streams. Groundwater is probably also important to maintain winter habitat. Although the tolerance of redside dace to pollutants is unknown, urban developments pose the risk of exposing local populations to household chemicals and storm water run-off. Nutrients, metals, chlorides and bacteria counts were elevated in two Credit River tributaries (Fletcher's and Silver creeks) where redside dace have disappeared or declined due primarily to loadings from urban runoff (CVC 2002).

Despite the fact that urban development is a primary factor affecting redside dace populations in Canada, declines in redside dace distribution and abundance have also been observed in agricultural settings (e.g., Saugeen River and Irvine Creek). While low intensity operations (e.g., hayfields) may not pose a problem, intensive agriculture (e.g., row cropping and intensive grazing) presents several threats to redside dace populations. Some of the factors that may affect redside dace are similar to those found in urban settings; however, specific mechanisms are poorly understood. Removal of riparian vegetation to increase crop production or allowing livestock access to streams can contribute to siltation, changes in channel structure and deplete supplies of terrestrial insect food. Some streams formerly occupied by redside dace and tributaries to streams currently occupied, have been channelized and converted to municipal drains. The extensive use of tile drains also increases flows after storm events and can serve as a conduit for sediment (Culley *et al.* 1983). Agricultural landscapes also provide the opportunity for episodic or chronic pollution events associated with the use of pesticides and fertilizers. A recent manure spill in Irvine Creek killed all fishes along several kilometres of stream, but no redside dace were identified (Coulson pers. comm. 1999).

The decline of redside dace in Mountsberg Creek and Spencer Creek followed the construction of reservoirs near the headwaters. These have altered the thermal regime and may have made temperatures unsuitable for redside dace (Featherstone pers. comm. 2000). Potential predators such as northern pike, largemouth bass (*Micropterus salmoides*) and black crappie were also newly captured in the creeks and may have had a deleterious effect on the redside dace.

The impacts of introduced species on redside dace have not been specifically studied, but declines in redside dace populations have been observed in Spencer Creek concomitant with the introduction of potential cyprinid competitors, such as rosyface shiners (*Notropis rubellus*), and predatory northern pike (Holm 1999). Resident brown trout and migratory rainbow trout have been introduced into several Toronto area streams with redside dace populations and redside dace occasionally naturally co-occur with brook trout. There is evidence that redside dace have co-existed with introduced salmonids in several Toronto area streams, but specific studies on the interactions between these species are required. Lyons *et al.* (2000) noted that redside dace disappeared in two Wisconsin streams after the introduction of brown trout, but no cause and effect relationship was established. Redside dace may be more susceptible to the impacts of introduced species when stream systems are affected by multiple stresses.

Activities associated with the extraction of aggregates may result in reduced base flows and increased stream temperatures (OMNR 2001). Redside dace disappeared in a Kentucky stream that was impacted by gravel extraction, septic seepage and agricultural activities (Meade *et al.* 1986). Similarly, withdrawals of surface water and groundwater (e.g., golf ourses; agricultural irrigation) in watersheds with redside dace populations may reduce flows to unacceptable levels and result in increased stream temperatures. The impacts of such extraction and withdrawal activities on redside dace populations have not been investigated but are expected to be negative.

The impact of bait harvest on populations of redside dace has not been studied. Populations restricted to a small length of stream may be particularly vulnerable to exploitation through bait harvesting. Redside dace are very vulnerable to seine nets, the most common gear used by baitfish harvesters in southern Ontario streams. However, due to restricted access, most streams are only harvested at road crossings. Redside dace are not a legal baitfish in Ontario (they are protected under the *Ontario Fisheries Regulations*), but there is potential for incidental harvest.

In Ontario, redside dace appear to achieve their highest abundance in open streams with riparian zones consisting of grasses, forbs and low shrubs. These habitats may be maintained by the presence of wetlands, land clearing, spring flooding, ice scour and beaver activity. Treed areas with complete canopy closure do not appear to provide optimal habitat. Succession to tree species and canopy closure in riparian areas may similarly reduce the quality of redside dace habitat. Andersen (2002) found that areas that supported redside dace in the 1950s when they were under agricultural use, did not support redside dace when they had reverted to forest. Current streamside restoration efforts on redside dace streams in Ontario are using native grasses and shrubs to revegetate riparian areas.

The impacts of climate change effects are difficult to predict. Climate change is expected to 1) have no effect, 2) reduce stream flows and increase stream temperatures or 3) increase the frequency of flooding events in southern Ontario within the range of redside dace (IPCC 2001). The last two changes are expected to be detrimental to populations of redside dace, although, if properly managed, higher rates of precipitation could increase available habitat. Although climate change may make conditions more suitable for redside dace in more northern portions of the province, the potential for colonizing new areas is low.

While it is unlikely that scientific collections have had a major impact on redside dace populations in Canada (few have been collected), collecting should be viewed as a potential threat. This is particularly true for populations that currently occupy a reduced length of stream and may be restricted to a small number of pools. Although redside dace are normally released when they are captured during monitoring projects, there are examples of studies where relatively large numbers of specimens have been collected. The OMNR generally prohibits lethal sampling when Scientific Collector's Permits are issued.

SPECIAL SIGNIFICANCE OF THE SPECIES

The redside dace is an insectivore that feeds primarily on terrestrial insects (Scott and Crossman 1973; Daniels and Wisniewski 1994); therefore it provides a conduit for energy cycling between terrestrial and stream environments. Where redside dace are abundant, they may serve as prey for piscivorous fishes and fish-eating birds. Redside dace may be useful as an indicator of ecosystem health as they are more sensitive to environmental disturbance than most fish species in the Ontario streams where they occur. Becker (1983) suggested that the colour and active nature of redside dace would make it desirable as an aquarium fish.

EXISTING PROTECTION OR OTHER STATUS DESIGNATIONS

The harvest of redside dace is prohibited in Ontario as it is a specially protected fish under the Ontario Fisheries Regulations (made under the federal *Fisheries Act*). The redside dace was assessed by COSEWIC in 1987 as Special Concern (COSEWIC 2004) and a species of Special Concern under Schedule 3 of the federal *Species at Risk Act*. It is listed as Threatened on the Species at Risk in Ontario List. It has been ranked as "at risk" at the provincial level and "may be at risk" at the national level by the General Status of Wild Species in Canada. The redside dace is considered apparently secure globally (G4) and is ranked as rare (S1 to S3) in most U.S. states where it occurs (Table 2). The sub-national rank for this species in Ontario is S3. The redside dace is listed as Endangered in the states of Indiana (IDNR 2002) and Michigan (Goforth 2000), and is a species of Special Concern in Wisconsin (Lyons *et al*. 2000).

Table 2. Global, national and subnational heritage ranks for the redside dace (*Clinostomus elongatus*) (NatureServe 2006).		
Rank level	**Rank**	**Jurisdictions**
Global	G4	
National	N4	United States
	N3	Canada
Subnational	S4	Pennsylvania
	S3S4	Kentucky
	S3	New York, Ontario, Wisconsin
	S1S2	Michigan, West Virginia
	S1	Indiana
	SX	Iowa, Maryland
	SNR	Minnesota, Ohio

TECHNICAL SUMMARY

Clinostomus elongatus
redside dace méné long

Range of Occurrence in Canada: southern Ontario

Extent and Area Information	
• *Extent of occurrence (EO)(km²)* Calculated using polygons in ArcView 3.2 that encompass the global and Canadian distributions as defined by COSEWIC (see Fig. 2)	Global: 930,000 Canada: 46,900
• *Specify trend in EO*	decline
• *Are there extreme fluctuations in EO?*	no
• *Area of occupancy (AO) (km²)* – based on occupied stream length X steam width as determined from 1:50,000 topographic maps – based on overlaid grid of cell size one km^2, total AO is the number of occupied squares that are intersected by streams	 ≈ 4 km² 441 km²
• *Specify trend in AO*	decline
• *Are there extreme fluctuations in AO?*	no
• *Number of known or inferred current locations* (watersheds see Table 1)	14 -19
• *Specify trend in # of locations* - extirpated from 6 and possibly extirpated from another 4	decline
• *Are there extreme fluctuations in number of locations?*	no
• *Specify trend in area, extent or quality of habitat*	decline
Population Information	
• *Generation time (average age of parents in the population)*	3 years
• *Number of mature individuals*	unknown
• *Total population trend:*	decline
• *% decline over the last/next 10 years or 3 generations.*	unknown
• *Are there extreme fluctuations in number of mature individuals?*	unlikely
• *Is the total population severely fragmented?*	yes
• *Specify trend in number of populations*	decline
• *Are there extreme fluctuations in number of populations?*	no
• List populations with number of mature individuals in each: see Table 1- number of individuals unknown in all populaltions	
Threats (actual or imminent threats to populations or habitats)	
• Urban development and its associated impacts (instream channel structure changes through peak flow increases and channelization, increases in siltation, removal of riparian vegetation, increases in water temperatures, reductions in groundwater inputs, increases in contaminants) • Introduced species (competitors and predators such as trout, bass, and pike) • Intensive agriculture and its associated impacts (removal of riparian vegetation, increases in siltation, channelization, pesticides, manure spills) • Water extraction (reduced flows, increased stream temperatures) • Stream barriers • Succession from field to dense forest (reductions in suitable riparian vegetation) • Climate change (potential for reducing stream flows or increasing flooding events) • Bait harvesting • Scientific collecting	

Rescue Effect (immigration from an outside source)	
• *Status of outside population(s)?* **USA: Secure (N4)** [other jurisdictions or agencies]	
• *Is immigration known or possible?*	No
• *Would immigrants be adapted to survive in Canada?*	Yes
• *Is there sufficient habitat for immigrants in Canada?*	Unknown
• *Is rescue from outside populations likely?*	No
Quantitative Analysis	Not Applicable

Current Status

National and Sub-national Heritage Ranks – see Table 2
Wild Species 2005 – National - 1, ON –1 (At risk) [Canadian Endangered Species Council 2006]
*Ontario (***COSSARO: Threatened)**

COSEWIC: Special Concern 1987
Endangered 2007

Status and Reasons for Designation

Status: Endangered	**Alpha-numeric code**: B2ab(I,ii,iii,iv,v)

Reasons for Designation:

This species is especially sensitive to stream alterations that interfere with flow regimes and lead to increased siltation and water temperatures. It has been lost from 5 of its 24 historic locations, and may now be gone from an additional 5; continuing decline is evident in 8 of the 14 remaining locations. More than 80% of the Canadian distribution occurs in the 'Golden Horseshoe Region' of southwestern Ontario where urban development poses the most immediate threat to the continued existence of this species in Canada. The 6 stable populations are on the fringe of urban development in watersheds that are, as yet, relatively undisturbed, but more than 50% of these locations are in, or adjacent to, areas that are expected to be developed within the next 10 to 15 years.

Applicability of Criteria

Criterion A: (Declining Total Population): Not Applicable – decline rate unknown.

Criterion B: (Small Distribution, and Decline or Fluctuation): Meets criterion B2 as the area of occupancy is well below the threshold value. Criteria B2a, and B2b(i,ii,iii,iv,v) are also met as populations are fragmented, and continuing decline is observed in the extent of occurrence and occupancy, as well as the extent and quality of habitat, number of locations and number of mature individuals.

Criterion C: (Small Total Population Size and Decline): Not applicable – the number of mature individuals is unknown.

Criterion D: (Very Small Population or Restricted Distribution): Not Applicable – distribution and number of locations exceed threshold values.

Criterion E: (Quantitative Analysis): Not Applicable – no data available for quantitative analysis.

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BIOGRAPHICAL SUMMARY OF REPORT WRITERS

E. Holm

Erling Holm is Assistant Curator (Ichthyology), Department of Natural History, ROM. He has co-authored 12 status reports, conducted fieldwork in Ontario, principally related to species at risk, and coordinates the ROM's annual fish identification workshops. He is a member of the Sydenham River, Redside Dace and Eastern Sand Darter Recovery Teams.

A. Dextrase

Alan Dextrase has a B.Sc. in Fisheries Biology from the University of Guelph and an M.Sc. in Biology from Lakehead University. After graduating, Alan worked for the Ontario Ministry of Natural Resources as a fisheries biologist in northwestern Ontario for 10 years on the management of recreational and commercial fisheries and fish and wildlife habitat management. Since 1993, he has worked as a biologist for OMNR in Peterborough, Ontario, where he has worked on the management of invasive species and species at risk. He is currently the Senior Species at Risk Biologist in the Fish and Wildlife Branch. Alan has been a member of COSEWIC and the COSEWIC Freshwater Fishes Specialist Subcommittee since 1994 and is a member of several recovery teams for freshwater species at risk in Ontario.

COLLECTIONS EXAMINED

No museum collections were examined.

Appendix. Results of early and recent sampling in Canadian watersheds (Tables 1 - 22).

The information presented in the following 22 tables is summarized from data in the Redside Dace database (Holm and Andersen 2005), It consists of a table for each watershed in Canada where there is information on success of capture of redside dace at both historical and more recent sampling sites. Where known, the effort is summarized: gear (S-seine, E=electrofisher), number of sampling attempts, electrofisher seconds (Total e-secs), length of stream sampled (Total Run Length), and number of seine hauls (Total # hauls). In many cases, there is no information on the number of redside dace captured in a sampling event. In these cases, the number of individuals given is preceded by ≥. For example, if 29 sites were sampled, but there is no information on the number captured at any of the sites, the number of individuals is given as ≥ 29. In many cases, an historical site was visited more than once at different times, often by different individuals. Thus, if the number of sites sampled is 13 and the number of sampling events is 22, some of the sites were visited more than once.

List of Appendix Tables

Table 1. Results of Sampling in Pringle Creek at 1959 Ontario Department of Planning and Development sites.											
Results					Effort						
Time Period	No. of Sites Sampled	No. of Sites with Redside Dace	% of Sites with Redside Dace	Number of Specimens	Gear*	No. of Sampling Events	Total E-secs	Total Run Length	Total # Hauls	Total Area Seined	Comments
1959	1	1	100	≥ 1	S?	1	n/a				
1985	1	0	0	0	S/E	4	100		3	44	
1999	1	0	0	0	E	1	n/a				SAPO† protocol

*Gear S=seine, E=electrofisher
n/a not available
†SAPO Stream Assessment Protocol of Ontario

The redside dace was not found at any additional sites in Pringle Creek since the 1959 survey.

Table 2a. Results of Sampling in Lynde Creek at 1959 Ontario Department of Planning and Development sites.											
Results					Effort						
Time Period	No. of Sites Sampled	No. of Sites with Redside Dace	% of Sites with Redside Dace	Number of Specimens	Gear*	No. of Sampling Events	Total E-secs	Total Run Length	Total # Hauls	Total Area Seined	Comments
1959	5	5	100	≥5	S ?	5	n/a				
1985	2	0	0	0	S/E	2	189		4	>17	
2000	5	1	20	1	E	5					SAPO† protocol

*Gear S=seine, E=electrofisher
†SAPO Stream Assessment Protocol of Ontario

Table 2b. Number of additional sites where redside dace were found in Lynde Creek since 1959 surveys.			
Time Period	Number of New Sites	Number of Specimens	Sources
1983	10	≥10	Tumey 1984, ROM 44166
1997-2001	10	73	Central Lake Ontario Conservation Authority (2001), Ecotec (1999), Andersen 2002, ROM 71031, 72455

Sources for Table 1a and 2a
1959 Ontario Department of Planning and Development surveys
1985 ROM Accession 4910
2000 Andersen 2002

Table 3a. Results of Sampling in Duffins Creek watershed at 1954 Ontario Department of Planning and Development sites.								
Results					Effort			
Time Period	No. of Sites Sampled	No. of Sites with Redside Dace	% of Sites with Redside dace	Number of Specimens	Gear*	No. of Sampling Events	Total E-secs	Total # Hauls
1954	8	8	100	≥8	S ?	8	n/a	
1978-1979	4	2	50	28	n/a	5	n/a	
1985	8	4	50	99	S/E	9	1528	≥18
1999-2003	3	1	33	≥1	E	3	>4210	0

*Gear S=seine, E=electrofisher
n/a not available

Sources for Table 3a
1954 Ontario Department of Planning and Development surveys
1978 ROM Accession 3752 (Ministry of Natural Resources stream surveys)
1979 CMN79-1077, 79-1079 (Parker and McKee 1980)
1985 ROM Accession 4910 (Holm and Crossman 1986), ROM Accesion 5267 (R. Steedman)
1999 ROM Accession 6771 (Ecotec)
2003 Forder 2003, Toronto Region Conservation Authority database (2003)

Table 3b. Number of additional sites where redside dace were found in Duffins Creek since 1954 surveys.			
Time Period	Number of New Sites	Number of Specimens	Sources
1973-1979	5	≥51	ROM Accession 2314 and 3751, 3752; CMN 79-1080, CMN 79-1194, CMN 79-1196
1984-1985	2	≥18	ROM Accession 5267 (R. Steedman)
1996-2004	3	≥10	ROM Accessions 6750, 7100, 7217; Ministry of Natural Resources, Salmonid Unit

Table 4. Results of Sampling in Highland Creek at site where redside dace were captured prior to 1953.								
Results					Effort			
Time Period	No. of Sites Sampled	No. of Sites with Redside Dace	% of Sites with Redside Dace	Number of Specimens	Gear	No. of Sampling Events	Total E-secs	Total # Hauls
1928-1952	1	1	100	2	S	2	n/a	≥2
1976-1985	1	0	0	0	E/S?	4	>1004	?

Sources for Table 4

1928 UMMZ 85643
1952 ROM 15637
1976 ROM Accession 3074 (Ministry of Natural Resources)
1981 ROM Accession 4415 (Metro Toronto Region Conservation Authority)
1984-1985 ROM Accession 5267 (R. Steedman)
There are no additional sites where redside dace were found since the 1952 survey.

Table 5a. Results of Sampling in Rouge River watershed at 1954 Ontario Department of Planning and Development sites.								
Results					Effort			
Time Period	No. of Sites Sampled	No. of Sites with Redside Dace	% of Sites with Redside Dace	Number of Specimens	No. of Sampling Events	Total E-secs	Total Run Length	Total # Hauls
1954	30	29	97	≥ 29	29	n/a		
1982-1987	11	9	82	≥ 120	15	n/a		
1992-1994	5	3	60	38	5	>1567	n/a	≥4 ?
1999-2003	13	4	31	≥ 138	22	>3687	>443.6	≥1
2005	1	0	0	0	1		50	

Sources for Table 5a

1954 Ontario Department of Planning and Development surveys
1982 ROM Accession 4556
1984-1985 ROM Accession 5267 (R. Steedman), ROM Accession 4830, ROM Accession 4749
1987 Ministry of Natural Resources, Aurora, files (Rouge .171)
1992 ROM Accession 6386 (G. Wichert)
1994 Ministry of Natural Resources, Aurora files (Rouge .80)
1999 ROM Accession 6750 (Sir Sanford Fleming Student)
2000 ROM Accession 6797, 6807 (Holm *et al*.), Toronto Region Conservation Authority database (2003)
2001 J. Andersen (pers. comm.). W. King (pers. comm)
2002 Andersen *et al*. 2002 (Aurora MNR files), M. Cece and R. Roth (Marshall Macklin Monaghan), OMNR Aurora files
2003 Toronto Region Conservation Authority database (2003), W. King (pers. comm)
2005 Comments from a reviewer (Andersen?) of the redside dace status update 2006

Table 5b. Number of additional sites in Rouge River watershed where redside dace were found since 1954 surveys.			
Time Period	**Number of New Sites**	**Number of Specimens**	**Sources**
1972-1987	13	≥ 123	ROM Accessions 2163 (Ministry of Natural Resources), 4830, 4685, 5267 (R. Steedman), CMN79-1199, Ministry of Natural Resources, Aurora files
1991-1998	2	54	ROM 58162; ROM Accessions 6386, and 6767; Ecotec, Muinistru of Natural Resources Stream Assessment Protocol of Ontario database
2000-2004	7	73	Toronto Region Conservation Authority database (2003), W. King (pers. comm.); J. Andersen (pers. comm.); Forder (2003)

Table 6a. Results of Sampling in East Branch Don River at 1949 Ontario Department of Planning and Development sites.									
	Results				**Effort**				
Time period	**No. of Sites Sampled**	**No. of Sites with Redside Dace**	**% of Sites with Redside Dace**	**Number of Specimens**	**Gear***	**No. of Sampling Events**	**Total E-secs**	**Total Run Length**	**Total # Hauls**
1949	14	13	93	≥13	S ?	14	-	n/a	≥14
1970s	2	1	50	≥1	n/a	2	n/a		
1984-1985	12	6	50	48	E/S	26	>6425	>430	≥5
1992	6	2	33	32	E/S	6	3350	n/a	≥6
1995-2003	8	5	63	13	E	10	>15141	>333.5	0

*Gear S=seine, E=electrofisher, n/a=not available

Sources for Table 6a

1949 Ontario Department of Planning and Development surveys
1970s ROM Accession 2094, Martin (1986)
1995-2003 TRCA database (2003); Ministry of Natural Resources, Aurora, files (Dillon Consulting); ROM Accessions 6542, 6768, 6783, 6876, 7268,
1981-1985 Martin 1986, ROM Accessions 4497 (Martin/Whillans) and 5267 (R. Steedman)
1991-1992 ROM Accession 6386 (G. Wichert), 6768

Table 6b. Number of additional sites in East Don where redside dace were found since 1949 surveys.			
Time Period	**Number of New Sites**	**Number of Specimens**	**Sources**
1966	1	1	ROM Accession 1222 (Ontario Water Resources Commission)
1991	1	4	ROM Accession 5864, 6876 (J. Lane)

Table 7a. Results of Sampling in West Branch Don River at 1949 Ontario Department of Planning and Development sites.									
Results					Effort				
Time period	No. of Sites Sampled	No. of Sites with Redside Dace	% of Sites with Redside Dace	Number of Specimens	Gear*	No. of Sampling Events	Total E-secs	Total Run Length	Total # Hauls
1949	10	10	100	≥10	S ?	10	-	n/a	≥10
1970s	1	1	100	≥1	n/a	1	n/a		
1981-1985	8	1	13	3	E/S	14	>3940	n/a	≥1
1991	3	1	33	6	E/S	3	3163	n/a	≥2
2002	3	0	0	0	E	3	>1279	>42.5	n/a

Sources for Table 7a

1949 Ontario Department of Planning and Development surveys
1970s ROM Accession 2094, Martin (1986)
1995-2003 TRCA database (2003); Ministry of Natural Resources, Aurora, files (Dillon Consulting); ROM Accessions 6542, 6768, 6783, 6876, 7268,
1981-1985 Martin 1986, ROM Accessions 4497 (Martin/Whillans) and 5267 (R. Steedman)
1991-1992 ROM Accession 6386 (G. Wichert), 6768

Table 7b. Number of additional sites where redside dace were found since 1949 surveys.			
Time Period	Number of New Sites	Number of Specimens	Sources
1991-1998	1	3	ROM Accessions 5864 and 6768

Table 8a. Results of Sampling in East Humber River watershed at 1946 Ontario Department of Planning and Development sites.								
Time Period	No. of Sites Sampled	No. of Sites with Redside Dace	% of Sites with Redside Dace	Number of Specimens	Effort			
					No. of Sampling Events	Total E-secs	Total # Hauls	Total Area Seined
1946	8	8	100	≥77	8	n/a		
1972-1994	8	7	87.5	≥116	20	>3571	≥8	n/a
1996-1999	3	3	100	3	4	5711	-	-

Sources for Table 8a

1946	Ontario Department of Planning and Development surveys
1972	Toronto Region Conservation Authority database
1979	CMN79-1015, 79-1016, 79-1020, 79-1021
1981	ROM Accession 4415
1984-1985	ROM Accession 5267 (R. Steedman)
1987	Toronto Region Conservation Authority database
1992	ROM Accession 6386 (G. Wichert)
1996	ROM Accession 6767 (OMNR), ROM Accession 6709 (TRCA)

Table 8b. Number of additional sites in East Humber watershed where redside dace were found since 1946 surveys.			
Time Period	Number of New Sites	Number of Specimens	Sources
1952-1959	3	6	ROM 15972, 17316; Wainio and Hester 1973
1972-1983	28	≥112	ROM records, Toronto Region Conservation Authority records. Canadian Museum of Nature records, Wilfrid Laurier University records
1984-1994	20	≥181	ROM records (mostly R. Steedman), Toronto Region Conservation Authority records.
1995-2003	10	189	ROM Accessions 6709, 6767, 6774, 6959, records, Toronto Region Conservation Authority records; Forder (2003); Holm (pers. observations)

Table 9. Results of Sampling in Mimico Creek at sites where redside dace were captured prior to 1950.								
Results					Effort			
Time Period	No. of Sites Sampled	No. of Sites with Redside Dace	% of Sites with Redside Dace	Number of Specimens	Gear*	No. of Sampling Events	Total E-secs	Total # Hauls
1935-1949	4	4	100	≥4	S	4	n/a	
1984-1985	4	0	0	0	S/E	7	≥2556	≥21
1992-2002	3	0	0	0	S/E	3	7986	≥1

Sources for Table 9

*S=seine, E=backpack electrofisher

1935 ROM 11712 (1 site)

1949 Ontario Department of Planning and Development surveys (3 sites)

1984-1985 ROM Accessions 49?? (4 sites), 5267 (R. Steedman 3 sites)

1992-2002 Toronto Region Conservation Authority database (2 sites), ROM Accession 6386 (G. Wichert, 1 site)

There are no additional sites in Mimico Creek where redside dace were found since the 1949 survey.

Table 10a. Results of Sampling in Etobicoke Creek at two sites.							
Results					Effort		
Time Period	No. of Sites Sampled	No. of Sites with Redside Dace	% of Sites with Redside Dace	Number of Specimens	No. of Sampling Events	Total E-secs	Total # Seine Hauls
1928-1935	2	2	100	15	3	-	≥3
1984-1985	2	0	0	0	3	-	≥7
1995-2004	1	0	0	0	3	21301	-

Sources for Table 10a

1928-1935 ROM and UMMZ records

1984-1985 ROM Accession 4923

1995-2004 ROM Accession 6645 and TRCA Watershed Monitoring database, 2003 and 2005

Table 10b. Number of additional sites in Etobicoke Creek where redside dace were found since 1928-1935 surveys.			
Time Period	**Number of New Sites**	**Number of Specimens**	**Sources**
1940s	3	≥3	Ontario Department of Planning and Development surveys

Table 11a. Results of Sampling in Credit River watershed at 1954 Ontario Department of Planning and Development sites.									
Results					**Effort**				
Time Period	**No. of Sites Sampled**	**No. of Sites with Redside Dace**	**% of Sites with Redside Dace**	**Number of Specimens**	**Gear***	**No. of Sampling Events**	**Total E-secs**	**Total Run Length**	**Total # Hauls**
1954	13	12	92	≥ 12	S ?	12			≥ 13 ?
1965	13	6	46	≥ 6	?	13	n/a		
1982-1985	11	3	27	≥ 20	E	22	> 4270	> 340	
1992-1999	7	3	43	7	E/?	9	> 3592		
2000-2003	5	1	20	1	E	5	> 4765	> 140	

*Gear S=seine; E=electrofisher

Sources for Table11a

1954 Ontario Department of Planning and Development surveys
1965 Reed 1968 in Martin 1984
1982-1985 Martin 1984, ROM Accession 5267 (Steedman surveys), M Ruthven (pers. comm.)
1992-1999 Credit Valley Conservation records; ROM Accessions 6386 (G. Wichert), 6567, 6765, and 6769
2000-2003 Credit Valley Conservation; Ministry of Natural Resources, Aurora files; Forder 2003

Table 11b. Number of additional sites in Credit River watershed where redside dace were found since 1954 surveys.			
Time Period	**Number of New Sites**	**Number of Specimens**	**Sources**
1966-1975	3	≥ 3	Ministry of Natural Resources surveys, ROM 58236
1976-1995	11	≥ 50	CMN 79-1094, 79-1096, 80-0876; Martin (198?), ROM Accessions 5267 (R. Steedman), 6765 (Credit Valley Conservation records)
1996-2005	4	≥ 5	ROM Accession 6428 (D. Featherstone), Ministry of Natural Resources, Aurora, (LGL Consulting), S. Copeland (pers. comm. 2002)

Table 12a. Results of sampling in Morrison Creek at 1957 Ontario Department of Planning and Devleopment Sites.									
	Results				Effort				
Time Period	No. of Sites Sampled	No. of Sites with Redside Dace	% of Sites with Redside Dace	Number of Specimens	No. of Sampling Events	Total E-secs	Total Run Length	Total # Hauls	Total Area Seined
1957	6	6	100	≥6	6	n/a	n/a	n/a	n/a
1985	3	1	33	22	3	100	10	0	
2000-2003	5	0	0	0	11	>2682	>305		

Sources for Table 12a

1957 Ontario Department of Planning and Development surveys
1985 ROM Accession 4964 (Holm and Crossman 1986)
1991 A.Timmerman
1993, 1995 Ministry of Natural Resources, Aurora, files
2000 ROM Accession 6822 (Holm *et al*.)
2001 Conservation Halton
2002 Ministry of Natural Resources, Aurora, files
2003 Ministry of Natural Resources, Aurora, files (M. Heaton)

Table 12b. Number of additional sites in Morrison Creek where redside dace were found since 1957 surveys.			
Time Period	Number of New Sites	Number of Specimens	Sources
1984	1	≥1	Proctor and Redfern
2000	1	2	ROM 72282

Table 13a. Results of Sampling in Sixteen Mile Creek watershed at 1957 Ontario Department of Planning and Development sites.									
Results					Effort				
Time Period	No. of Sites Sampled	No. of Sites with Redside Dace	% of Sites with Redside Dace	Number of Specimens	Gear*	No. of Sampling Events	Total E-secs	Total Run Length	Total # Hauls
1957	14	14	100	≥ 14	S ?	14	0	-	≥ 14
1972-1979	5	2	40	≥ 2	?	7	n/a		
1994-2003	4	3	75	≥ 43	E	6	≥ 4334	> 325	0

*Gear E=electrofisher, S=seine
n/a not available

Sources for Table 13a
1957 Ontario Department of Planning and Development surveys
1972-1979 Halton Conservation, Ministry of Natural Resources, Parker & McKee 1980
1994-2003 Halton Conservation; Ministry of Natural Resources, Aurora; ROM Accessions 6621, 6960; Forder 2003

Table 13b. Number of additional sites in Sixteen Mile Creek watershed where redside dace were found since 1957 surveys.			
Time Period	Number of New Sites	Number of Specimens	Sources
1972-1975	5	≥ 17	McIlwrick 1996; Ministry of Natural Resources stream surveys; ROM 29999
1995-2003	4	≥ 9	ROM Accessions 6621 and 6960 (Halton Conservation surveys), 7143 (LGL Ltd)

Table 14a. Results of Sampling in Fourteen Mile Creek at 1957 Ontario Department of Planning and Development sites.									
Results					Effort				
Time Period	No. of Sites Sampled	No. of Sites with Redside Dace	% of Sites with Redside Dace	Number of Specimens	Gear*	No. of Sampling Events	Total E-secs	Total # Hauls	Total Area Seined
1957	3	3	100	≥ 3	S ?		n/a		
1985	3	1	33	8	S/E	3	351	4	>50
1990	1	1	100	≥6	?	2	n/a		
1998-2003	1	1	100	65	S/E	4	?	≥1	≥150

*Gear E=electrofisher, S=seine
n/a not available

Sources for Table 14a
1957 Ontario Department of Planning and Development surveys
1985 ROM Accession 4964 (Holm and Crossman 1986.)
1990 ROM 60209
1998 ROM 71696
2000 ROM Accession 6825
2001 ROM Accession 6956
2003 Ministry of Natural Resources (M. Heaton)

Table 14b. Number of additional sites in Fourteen Mile Creek where redside dace were found since 1957 surveys.			
Time Period	Number of New Sites	Number of Specimens	Sources
1960	1	2	CMN60-0533A
1990	1	≥ 1	Ministry of Natural Resources, Aurora, files
1998-2003	11	223	Ministry of Natural Resources, Aurora, files; G. Coker, pers. comm.; ROM Accessions 6825, 6832, 6853, 6956; R. Bilz (pers. comm.); P. Anderson (pers. comm.); M. Heaton, pers. comm.); Cam Portt & Associates (pers. comm.)

Table 15a. Results Sampling in Bronte Creek watershed at sites where redside dace were captured in 1972-1979.									
Results					Effort				
Time Period	No. of Sites Sampled	No. of Sites with Redside Dace	% of Sites with Redside Dace	Number of Specimens	Gear	No. of Sampling Events	Total E-secs	Total Run Length	Total # Hauls
1972-1979	11	11	100	>100	S/E	22	n/a		
1995-2000	7	1	14	1	S/E	10	>3922	>420	≥2

Sources for Table 15a

1972, 1978 McIlwrick 1996, Halton Conservation watershed reports, B. Edmondson and A. Sorenson
1974 Ministry of Natural Resources Stream surveys
1979 Canadian Museum of Nature records, Paton and Sharp 1979
1995 ROM Accession 6770 (A Timmerman, Ministry of Natural Resources); Conservation Halton
1998 ROM Accession 6771 (Ecotec); Conservation Halton
2000 ROM Accession 6797 (ROM and Halton Conservation); Conservation Halton

Table 15b. Number of additional sites in Bronte Creek watershed where redside dace were found since 1979 surveys.			
Time Period	Number of New Sites	Number of Specimens	Sources
1998	1	1	ROM Accession 6771 (Ecotec)

Table 16a. Results of Sampling in Spencer Creek watershed at 1970s sites.									
Results					Effort				
Time Period	No. of Sites Sampled	No. of Sites with Redside Dace	% of Sites with Redside Dace	Number of Specimens	Gear*	No. of Sampling Events	Total E-secs	Total # Hauls	Total Area Seined
1970-1979	9	9	100	≥ 129		15			
1984	4	3	75	16		4			
1993	1	1	100	1					
1998-2004	3	0	0	0		12	> 1946	> 13	> 630

Sources for Table 16a

1970 Ministry of Natural Resources stream surveys, ROM records
1972 ROM 28384, 28387, 28388
1973 Ministry of Natural Resources stream surveys, ROM Accession 2448
1979 CMN 79-1085, 79-1087
1984 Holmes 1986 (Fig 6, Table 17)
1993 Staton *et al*. 1993
1998 ROM Accession 6597, 6622
2004 Hamilton Region Conservation Authority (S. Wiseman, email and attachment 25 April 2005)

Table 16b. Number of additional sites in Spencer Creek watershed where redside dace were found since 1970s surveys.			
Time Period	**Number of New Sites**	**Number of Specimens**	**Sources**
1993-1998	6	≥ 34	Staton *et al.* 1993, Thompson *et al*. 1995, ROM Accession 6622

Table 17. Results of sampling in Kettleby Creek at sites where redside dace were captured in 1976-1980.									
Results					**Effort**				
Time Period	**No. of Sites Sampled**	**No. of Sites with Redside Dace**	**% of Sites with Redside Dace**	**Number of Specimens**	**No. of Sampling Events**	**Total E-secs**	**Total Run Length**	**Total # Hauls**	**Total Area Seined**
1976-1980	3	3	100	≥4	4	n/a			
1987-1991	2	1	50	12	4	n/a			
2000-2003	3	1	33	1	7	> 8000	> 526	≥ 1	≥ 60

Sources for Table 17
1976 Ministry of Natural Resources Stream survey
1980 ROM 41411, ROM Accessions 4413, 4402
1987-1988 ROM Accession 6988
1991 Gamsby & Mannerow Limited, 1995
2000 ROM Accession 6797 (Holm *et al.*)
2002-2003 ROM Accession 7280 (J. Andersen)
There are no additional sites where redside dace were found since 1976-1980 surveys

Table 18. Results of Sampling in Sharon Creek at one site where redside dace was captured in 1994.									
Results					Effort				
Time Period	No. of Sites Sampled	No. of Sites with Redside Dace	% of Sites with Redside Dace	Number of Specimens	No. of Sampling Events	Total E-secs	Total Run Length	Total # Hauls	Total Area Seined
1994	1	1	100	4	4	n/a			
2003	1	0	0	0	1	2018	200		

Sources for Table 18
1994 Ministry of Natural Resources, Aurora, files (Holland River 155)
2003 ROM Accession 7280 (J. Andersen)
There are no additional sites where redside dace were found since 1994 survey.

Table 19a. Results of Sampling in Irvine Creek at five 1970s sites.										
Results					Effort					
Time Period	No. of Sites Sampled	No. of Sites with Redside Dace	% of Sites with Redside Dace	Number of Specimens	No. of Sampling Events	Gear*	Total E-secs	Total Run Length	Total # Hauls	Total Area Seined
1974-1979	5	5	100	48	6	E/S	n/a			
1997-2003	5	2	40	8	15	E/S	>2832	n/a	8	n/a

*Gear: E=electrofisher, S=seine
n/a not available

Sources for Table 19a
1974 ROM Accession 2701 (Grand River Conservation Authority surveys)
1979 CMN79-1064
1997 ROM Accession 6534 (Holm & Boehm 1998)
1998 ROM Accession 6601 (Holm *et al*.)
2000 ROM Accession 6797 (Holm *et al*.)
2001 ROM Accession 6924 (Holm *et al*.)
2003 N. Mandrak, pers. comm.

Table 19b. Number of additional sites in Irvine Creek where redside dace were found since 1970s surveys.			
Time Period	Number of New Sites	Number of Specimens	Sources
2001-2003	3	31	ROM Accession 6797; N. Mandrak, pers. comm.

Table 20a. Results of Sampling in upper Saugeen River at 1951 Ontario Department of Planning and Development sites.									
Results					Effort				
Time Period	No. of Sites Sampled	No. of Sites with Redside Dace	% of Sites with Redside Dace	Number of Specimens	No. of Sampling Events	Total E-secs	Total Run Length	Total # Hauls	Total Area Seined
1951	24	24	100	n/a	24	n/a			
1985	10	0	0	0	10	3388		40	≥4033
2000	9	3	33	6	9	≥483		15	1603
2001	2	0	0	0	2	1850		-	-
2004	10	0	0	0	10	11362	800	≥2	n/a

Sources for Table 20a

1951 Ontario Department of Planning and Development surveys
1985 Holm and Crossman 1986
2000 ROM records
2001 Gibson 2001
2004 Forder 2005

Table 20b. Number of additional sites in upper Saugeen River where redside dace were found since 1951 surveys.			
Time Period	Number of New Sites	Number of Specimens	Sources
1972	1	3	Ministry of Natural Resources stream surveys

Table 21a. Results of Sampling in Meux Creek, Saugeen River, at 1953 Ontario Department of Planning and Development sites.											
Results					**Effort**						
Time Period	**No. of Sites Sampled**	**No. of Sites with Redside Dace**	**% of Sites with Redside Dace**	**Number of Redside Dace**	**No. of Sampling Events**	**Gear***	**Total E-secs**	**Total Run Length**	**Total # Hauls**	**Total Area Seined**	**Comments**
1953	5	5	100	≥5	5	S?	n/a				
1985	4	4	100	≥100	4	E/S	1519	n/a	24	318	
1990	4	2	50	>41	4	S		120	≥2		50 m bag seine
1992	1	1	100	15	1	n/a					
1993	1	0	0	0	1	n/a					
2001	1	0	0	0	1	E	n/a	153	-	-	OSAP† Protocol
2004	5	1	20	1	5	E/S	6588	400	4	n/a	Redside Dace Protocol

*Gear S= seine, E=backpack electrofisher
†OSAP Ontario Stream Assessment Protocol
n/a not available

Sources for Table 21a
1953 Ontario Department of Planning and Development surveys
1985 ROM Accession 4901
1990 C. Portt & Associates (ROM Accession 6873)
1992-1993 ROM Accession 7131 (BAR Environmental and Ministry of Natural Resources)
2001 S. Gibson, MSc thesis, University of Toronto
2004 ROM Accession 7236 (Forder 2005)

Table 21b. Number of additional sites in Meux Creek where redside dace were found since 1953 surveys.			
Time Period	**Number of New Sites**	**Number of Specimens**	**Sources**
2001-2004	3	≥10	Saugeen Valley Conservation Authority Municipal Drain Classification Project (2001), Forder 2005

Table 22. Results of Sampling in Gully Creek at two 1980 sites.									
Results									
					Effort				
Time Period	No. of Sites Sampled	No. of Sites with Redside Dace	% of Sites with Redside Dace	Number of Specimens	Gear	No. of Sampling Events	Total E-secs	Total Run Length	Total # Hauls
1980	2	2	100	8	?	2			
1999-2001	2	1	50	7	S/E	3	>635		≥1

Sources for Table 22

1980 Ministry of Natural Resources stream surveys
1999 ROM Accession 6750 (Sir Sanford Fleming Student)
2001 S. Gibson

There are no additional sites where redside dace were found since the 1980 surveys.