Recovery Strategy

For Redside Dace in Ontario

2005 – 2009

Prepared by the

Redside Dace Recovery Team

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Disclaimer

This recovery strategy has been submitted by the Redside Dace Recovery Team to define recovery actions necessary to protect and recover redside dace in Canada. It does not necessarily represent the views of the individuals involved in the strategy's formulation or the official positions of the organizations with which the individual team members are associated. The goals, objectives, and recovery approaches identified in the strategy are based on the best existing knowledge and subject to modifications resulting from new findings and revised objectives. We recognize that implementation of the plan will be subjected to priorities and budgetary constraints imposed by participating jurisdictions and organizations.

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Executive Summary

The redside dace (*Clinostomus elongatus*) is a small colourful cyprinid (minnow family) that lives in small streams in the southern Great Lakes basin, the upper Mississippi drainage and the upper Susquehanna River drainage. In Canada, the redside dace is found only in southern Ontario where it most frequently occurs in streams flowing into western Lake Ontario. Although globally secure, the species has declined in many areas throughout its range. The species was listed as special concern in Canada by COSEWIC (Committee on the Status of Endangered Wildlife In Canada) in 1987. Ontario listed the redside dace as threatened in 2000 based on observed declines and threats to remaining populations.

The Recovery Strategy has been prepared by a recovery team consisting of representatives from the provincial and federal governments, conservation authorities, the Royal Ontario Museum, the Toronto Zoo, and Ontario Streams. The Recovery Strategy provides a framework for action for responsible jurisdictions and others to secure the persistence and sustainability of redside dace in Canada.

The long-term goal of this recovery strategy is to restore viable populations of redside dace in a significant portion of their historic range in Canada by:

i) protecting existing healthy, self-sustaining populations and their habitats;
ii) restoring degraded populations and habitats; and
iii) re-introducing redside dace to sites of former distribution where feasible.

The short-term recovery objectives to be addressed over the next 5 years are:

I. Determine distribution and abundance of extant populations.
II. Maintain the current geographical distribution and abundance of redside dace (no net loss of element occurrences) through habitat protection and other measures.
III. Establish a long-term monitoring program to assess the status of redside dace and its habitats, particularly all sites where restorative actions have occurred.
IV. Generate awareness regarding the significance of redside dace and protection of its habitats.
V. Rehabilitate degraded redside dace habitats and identify candidate areas for re-introductions.

The Recovery Strategy identifies approaches that will protect existing populations, rehabilitate degraded habitats, collect information on the status of redside dace and their habitats, and increase awareness regarding the significance of redside dace.

Significant progress has been made on several recovery actions during (and prior to) the development of the strategy. An action group has been established on Irvine Creek to promote stewardship initiatives and stream rehabilitation projects are ongoing on the Morningside tributary and Purpleville Creek. Monitoring projects have been conducted throughout the Ontario range of redside dace by the Royal Ontario Museum, the Ontario Ministry of Natural Resources (OMNR), Ontario Streams and several conservation authorities. Redside dace genetic research has been initiated by the OMNR and Fisheries and Oceans Canada. The Toronto Zoo has led the production and distribution of several awareness materials including a brochure, curriculum materials and displays.

An Action Group and Action Plan have already been established for Irvine Creek in association with the Grand River Recovery Plan. Additional Action Groups and the

development of Action Plans will be encouraged on a watershed basis (e.g., 14 Mile Creek, Rouge River, Humber River). Recovery Action Groups will be struck to prepare the awareness strategy and monitoring protocols for completion in 2005.

Evaluation of the approaches to recovery set out in this strategy will be largely accomplished through the extensive and site-specific monitoring programs. These programs will assess the number of extant occurrences, the extent of occupied range, as well as population and habitat trends at specific sites. Evaluation measures will also be incorporated into the awareness strategy to assess the effectiveness of awareness efforts. This Recovery Strategy will be reviewed in 5 years (after it is approved) to evaluate the progress on stated objectives and to identify additional approaches and changes that may be required.

Redside dace require cool, clear flowing water with riffle-pool sequences and overhanging streamside vegetation. Redside dace populations have been lost from several tributaries to western Lake Ontario and the length of stream occupied by several of the remaining populations has been reduced. Urban development is thought to be the most significant threat acting upon redside dace populations in Ontario. Most of Canada's redside dace populations are found in the Golden Horseshoe Region of Ontario which is an area that is rapidly being developed. Urban development can cause siltation, changes in stream channel structure and water clarity, increase stream temperatures, result in the removal of riparian vegetation and result in the input of pollutants to streams. All of these factors can have negative impacts on redside dace populations. Other contributing threats to redside dace populations include intensive agricultural activities and introductions of non-indigenous species.

Recovery habitat is considered to be all reaches currently occupied by redside dace as well as historically occupied reaches where there is a high likelihood of rehabilitation. Survival habitat is considered to be all reaches currently occupied by redside dace. Survival habitat includes wetted stream width and associated riparian habitat. The associated riparian habitat includes the area within 30 m of the meander belt width.

Several knowledge gaps are identified related to the distribution, biology and factors that limit redside dace populations. In order to direct recovery efforts efficiently, it is important to clearly identify the principal factors that limit the abundance and distribution of redside dace populations in Ontario.

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Introduction

The redside dace (*Clinostomus elongatus*) is a small colourful cyprinid that lives in small streams in the southern Great Lakes basin, the upper Mississippi drainage and the upper Susquehanna River drainage. Redside dace require cool, clear flowing water with riffle-pool sequences and overhanging streamside vegetation. Although globally secure, the species has declined in many areas throughout its range.

In Canada, the redside dace is found only in southern Ontario where it most frequently occurs in streams flowing into western Lake Ontario. The species was listed as vulnerable (now special concern) in Canada by COSEWIC (Committee on the Status of Endangered Wildlife In Canada) in 1987 (Parker et al. 1988). Ontario listed the redside dace as threatened in 2000, based on observed declines and threats to remaining populations.

I. RECOVERY

1. Recovery Goal

The long-term goal of this recovery strategy is to restore viable populations of redside dace in a significant portion of their historic range in Canada by:

i) protecting existing healthy, self-sustaining populations and their habitats;
ii) restoring degraded populations and habitats; and
iii) re-introducing redside dace to sites of former distribution where feasible.

2. Short-Term Recovery Objectives

I. Determine distribution and abundance of extant populations.

II. Maintain the current geographical distribution and abundance of redside dace (no net loss of element occurrences) through habitat protection and other measures.

III. Establish a long-term monitoring program to assess the status of redside dace and its habitats, particularly all sites where restorative actions have occurred.

IV. Generate awareness regarding the significance of redside dace and protection of its habitats.

V. Rehabilitate degraded redside dace habitats and identify candidate areas for re-introductions.

3. Strategies / Approaches for Recovery

The strategies/approaches to recovery have been organized into the four categories – Protection of Existing Populations and Habitats, Rehabilitation of Degraded Populations and Habitats, Research and Monitoring, and Community Awareness and Outreach. These categories are not exclusive in nature and successful implementation of some strategies will require coordinated efforts. A narrative is included at the end of each section when further explanation is warranted.

I. Management Approaches to Protect Existing Populations and Habitats

Priority	Objective No.	Broad Approach/ Strategy	Specific Steps	Anticipated Effect
high	I & II	Habitat Protection – habitat mapping	Maintain redside dace distribution database to identify redside dace survival and recovery habitat and transfer this information to appropriate planning authorities.	Will provide current information on the distribution of redside dace for the protection of habitat during the planning and review of proposals for development and works in and adjacent to redside dace streams.
high	II	Habitat Protection – Habitat Mapping Guidelines	Develop Provincial Habitat Mapping Guidelines to identify and protect redside dace habitat.	Redside dace habitat will be protected through application of the Provincial Policy Statement.
high	II & IV	Habitat Protection – guidelines/awareness	Hold a one-day workshop with MNR, CAs, municipal staff, and planning and review agencies to develop urban development guidelines for the protection of redside dace habitat.	Will lead to the development of habitat protection guidelines and will increase awareness of agencies regarding decisions that may impact redside dace habitat.
high	II	Habitat Protection – timing windows	Provide input to MNR on the development of in water timing windows for watersheds with redside dace.	Will provide protection to redside dace populations from in stream works during the sensitive spawning and incubation period.
medium	II & IV	Habitat Protection – municipal planning	Encourage municipal planning authorities to incorporate the goal of protecting redside dace habitat into their Official Plans.	Will provide additional protection for redside dace when development proposals are planned and reviewed.
medium	II & IV	Habitat Protection – Growth Management	Encourage the incorporation of redside dace protection goals in natural heritage plans and growth management plans in areas where redside dace occur.	Will provide additional protection for redside dace habitats.
medium	I & II	Habitat Protection –	Conduct field work to	Will improve ability to

Priority	Objective No.	Broad Approach/ Strategy	Specific Steps	Anticipated Effect
		habitat mapping	further refine and map redside dace distribution.	protect important habitat features.
medium	II	Habitat Protection – drainage	Work with drainage superintendents, drainage engineers and contractors, to limit the effects of drainage works on redside dace habitat (Irvine Creek).	Will protect redside dace habitat that may be impacted by drain maintenance activities.
medium	II	Harvest Management – baitfish	Work with baitfish harvesters and the Bait Association of Ontario to protect and monitor redside dace.	Will protect redside dace from incidental harvest and provide information dissemination.
medium	II	Introductions – intentional introductions	Ensure that potential impacts on redside dace populations are considered when introductions are proposed in redside dace waters.	Will protect redside dace populations from undesirable affects associated with planned introductions.
medium	II	Introductions – barriers	Ensure that the potential invasion of redside dace waters by exotic species is considered when removal of barriers is contemplated.	Will reduce the potential impact of exotic species invasions on redside dace.

Habitat Protection – Habitat Mapping Guidelines – Provincial Habitat Mapping Guidelines need to be developed for the identification of significant portions of the habitat of redside dace. These can then be used to protect redside dace habitat during municipal planning through application of the *Provincial Policy Statement* under the *Planning Act*. Survival habitat (as described in Section 14.2 of this strategy) should be considered when these guidelines are developed.

Habitat Protection – guidelines/awareness – The purpose of this workshop will be to develop guidelines for urban development that will maintain or enhance stream channel structure to protect or restore redside dace habitats. Key topics that should be addressed include (but should not be limited to) storm water treatment and threshold values for impervious cover in catchment areas where redside dace reside. The most effective means for dissemination of guidelines to planning authorities should also be investigated.

Introductions – Although interactions between redside dace and introduced fishes have

not been specifically studied, redside dace declines have been observed after the introduction of predatory fishes and minnow species in Ontario streams. A precautionary approach should be taken with respect to intentional introductions and the removal of barriers that might lead to introductions in redside dace streams. Salmonids, northern pike (*Esox lucius*), centrarchids (bass and sunfishes) and other cyprinids (minnows) are species of particular concern in this regard.

II. Management Approaches to Rehabilitate Degraded Populations and Habitats

Priority	Objective No.	Broad Approach/ Strategy	Specific Steps	Anticipated Effect
high	III & V	Habitat Improvement – rehabilitation	Evaluate health of all redside dace populations and habitats to identify degraded redside dace populations/ habitats and investigate the feasibility of their restoration.	Will allow for the identification of recovery habitats and best bets for rehabilitation projects.
high	V	Habitat Improvement - rehabilitation	Continue riparian and in stream works on existing rehabilitation projects (Irvine Creek and Morningside Creek) and initiate rehabilitation projects on top priority streams.	Will improve redside dace habitat in streams where its abundance/range has been reduced, allowing for re-colonization/re-introduction.
high	II & V	Habitat Improvement – Best Management Practices	Encourage the use of best management practices in rural streams to restore a healthy riparian zone, reduce livestock access, establish manure storage and runoff collection systems, encourage conservation tillage and reduce the impact of tile drains. Financial incentives should be offered as part of a stewardship program. Riparian rehabilitation should focus on the re-establishment of grasses and shrubs.	Will improve redside dace habitat by reducing bank erosion, thereby limiting the input of sediments and nutrients from agricultural lands.
medium	V	Re-introductions –	Investigate the	This will provide a

Priority	Objective No.	Broad Approach/ Strategy	Specific Steps	Anticipated Effect
		artificial rearing	feasibility of artificial propagation versus wild fish transfers for redside dace re-introductions.	source for redside dace re-introductions and potentially a refuge for threatened native populations.
medium	V	Re-introductions	Identify candidate streams for redside dace re-introduction. Re-introductions should be restricted to areas of former occurrence where suitable habitat occurs or has been restored and where no obvious impediments to re-establishment exist. Strain considerations will be contingent on genetics work.	Will increase the number and range of redside dace occurrences.
low	II, IV & V	Habitat Improvement – farm planning	Encourage development of Environmental Farm Plans and Nutrient Management Plans.	Provides for additional habitat protection and improvement in relation to farming practices.

Habitat Improvement – rehabilitation – The current status of all Ontario populations and their habitats needs to be assessed to identify priority sites for restoration. Redside dace populations have declined in the Saugeen River drainage, Irvine Creek, Spencer Creek, Bronte Creek, Morrison Creek, Don River, some Rouge River tributaries, and Lynde Creek. Redside dace are also probably extirpated from an unnamed creek in Clarkson, Highland Creek, Pringle Creek, Petticoat Creek, Etobicoke Creek, Mimico Creek and a watershed on the Niagara peninsula. Although apparently healthy populations are found in a few streams (14-Mile Creek, East Humber River, some Rouge River tributaries) where protective measures may be adequate, the status of several populations is unknown. The feasibility of rehabilitating or restoring degraded and extirpated populations has not been assessed. It is likely that restoration is not feasible in some watersheds due to the extent and nature of changes in the watershed.

III. Research and Monitoring Approaches

Priority	Objective No.	Broad Approach/ Strategy	Specific Steps	Anticipated Effect
high	I & III	Monitoring - element occurrences	Establish a standard broad-scale monitoring program to assess presence/absence through time in streams throughout the Ontario range of redside dace.	Will provide an ongoing assessment of occupied range in Ontario.
high	I & III	Monitoring – population and habitat assessment	Establish an index, site-specific monitoring program to assess temporal changes in population abundance and habitat conditions resulting from restorative actions and to compare disturbed vs. undisturbed sites).	Will allow an assessment of the effects of restorative actions and the condition of redside dace populations and habitats at specific sites.
high	III	Monitoring – fluvial geomorphology	Conduct rapid fluvial geomorphological assessments of select redside dace habitats (good sites vs. poor sites).	Will describe redside dace habitat with regard to channel form and flow necessary from an engineering perspective to develop urban development guidelines.
high	II & III	Research – habitat and life history requirements	Identify critical habitats required for spawning, incubation and larval development. Investigate seasonal use of habitat, particularly over-wintering areas. Investigate movements and physiological tolerances.	Will improve ability to identify and protect redside dace habitat.
medium	III	Monitoring – riparian health assessment	Conduct an inventory of riparian buffer areas and their health on all streams.	Will identify areas in most need of attention and will allow for the assessment of best riparian conditions (i.e., forested vs. grass and shrub).
medium	II & V	Research – genetics	Examine global and local variation in genetic diversity of	Will provide information and allow for decision making regarding the

Priority	Objective No.	Broad Approach/ Strategy	Specific Steps	Anticipated Effect
			redside dace populations through DNA and allozyme analysis.	importance of source strains for re-introductions and how the conservation of redside dace can be assessed using a metapopulation approach.
medium	II	Research – urban and agricultural impacts	Identify key factors associated with urban development and agricultural practices that may contribute to declines in redside dace populations. Determine, experimentally, the effects of these factors on redside dace population dynamics.	Will improve ability to both protect and enhance redside dace habitat through urban planning and the use of best management practices.
Low	II	Research - Introductions	Investigate the impacts of the introduced species most often introduced into redside dace streams (salmonids, centrarchids, northern pike, other cyprinids).	Will allow for the protection of populations from harmful impacts of introductions.

Establishment of a Monitoring Program – Most of the monitoring of redside dace populations in Ontario has been *ad hoc* or has been incidental to other sampling programs. Given the number of redside dace streams, it is important to conduct regular extensive monitoring to assess presence/absence on an ongoing basis. It is also important to conduct more intensive monitoring to assess habitat and population abundance at select index sites. This will allow for a more detailed assessment of temporal trends at representative sites in the province. A standard protocol that has been developed and adopted for both monitoring programs needs to be evaluated and refined.

Research – Only the highest priority research needs are identified in the Approaches table above. Additional research requirements are identified in Section 19 of this Strategy. Wherever possible, the Recovery Team will encourage the involvement of graduate students and fourth-year undergraduates to address redside dace research questions. The Recovery Team will also collaborate with other groups that are addressing similar issues at a watershed scale (e.g., conservation authorities, university researchers).

IV. Community Awareness and Outreach

Priority	Objective No.	Broad Approach/ Strategy	Specific Steps	Anticipated Effect
high	II & IV	Awareness - strategy	Develop a redside dace awareness action plan to guide awareness efforts.	The action plan will identify audiences, develop conservation messages and encourage media support to deliver the awareness program.
high	II & IV	Awareness - outreach	Foster public support and awareness by developing appropriate materials and programs identified in the strategy.	This will improve understanding within the general public, landowners, developers, municipalities and other stakeholders to stimulate community support for recovery efforts.
medium	II & IV	Habitat Protection - incentives	Make landowners aware of existing incentive programs for conservation lands (Ecological Gifts Program, easements, Conservation Land Tax Incentive Program).	Will increase the number of landowners participating in incentive programs that protect habitat

Awareness Action Plan – The development of an awareness action plan is necessary to provide for a coordinated approach to the production and distribution of awareness materials. The goal of the action plan will be to generate awareness regarding the significance of redside dace and the protection of their habitats to promote private land stewardship and help engender public support for implementation of recovery actions. The action plan will address several different target audiences including government agencies, municipalities, developers, environmental groups, stewardship councils, the farming community, school groups and other stakeholders. The action plan will identify potential funding sources/partners that will assist in delivering the awareness program.

4. Actions Already Completed or Underway

Irvine Creek Action Group – An Action Group has been formed to implement specific actions identified in the Grand River Recovery Strategy (Portt et al. 2004). Initial actions have included monitoring, working with local bait fishermen, increasing awareness and promoting stewardship initiatives.

Morningside Tributary Rehabilitation – Initiated in 1997 by Ontario Streams and the Toronto Zoo, this community-based project is rehabilitating a 3 km reach of the Morningside Creek tributary of the Rouge River in Toronto, where a remnant population of redside dace occurs. The project includes removal of concrete-lined reaches of the stream and development of a natural channel, creation of in-stream cover, barrier mitigation and riparian buffer rehabilitation.

Conservation Halton - Conservation Halton has confirmed locations of extant populations within its watershed including Sixteen Mile and Morrison Creek (east branch).

Purpleville Creek – In 1996, the Ontario Ministry of Natural Resources, with the assistance of the Region of York, City of Vaughan, Ontario Streams and local schools, undertook an extensive fencing project to restrict cattle access from approximately 1.6 km of redside dace habitat. Work has continued, both upstream and downstream of the initial site, focusing on reducing in-stream erosion and improving the health of the stream corridor.

Lynde Creek – The Central Lake Ontario Conservation Authority has identified potential redside dace habitats in the watershed and confirmed locations of extant populations.

Extensive Monitoring – The Royal Ontario Museum has coordinated substantial targeted monitoring throughout the Ontario range of redside dace. Sampling has focused on determining presence/absence of redside dace and comparing abundance with historical records.

Intensive Monitoring – Several streams with redside dace populations have been sampled using the Ontario Stream Assessment Protocol through the work of Conservation Authorities, Ontario Streams and a University of Toronto research project.

Genetic Research – Allozyme samples have been obtained from three Ontario populations and one Ohio population (samples are still required from Kentucky and Wisconsin). DNA samples have been collected from several Ontario populations. Analysis is being conducted by OMNR's Aquatic Biodiversity and Conservation Lab at Trent University. The lab is also developing microsatellite DNA markers for redside dace.

Awareness/outreach – The Recovery Strategy has been promoted at the public redside dace display at the Toronto Zoo. The Zoo has also developed a brochure, a curriculum package and a display focusing on redside dace with support from Canada's Habitat Stewardship Program for Species at Risk.

5. Statement of When One or More Action Plans In Relation To the Recovery Strategy Will Be Completed

An Action Group and Action Plan have already been established for Irvine Creek in association with the Grand River Recovery Plan. Additional Action Groups and the development of Action Plans will be encouraged on a watershed basis (e.g., 14 Mile Creek, Rouge River, Humber River). Recovery Action Groups will be struck to prepare the awareness strategy and monitoring protocols for completion in 2005.

6. Potential Management Impacts for Other Species/Ecological Processes

The protection and recovery of redside dace populations will achieve ecosystem objectives as it can be considered a sensitive indicator species, particularly for streams in the rapidly urbanizing Golden Horseshoe Region. Co-occurring species that are generally less sensitive to disturbance than redside dace (see Section 18) will also benefit from habitat improvements. Some common, widespread species, whose abundance is strongly associated with degraded conditions (e.g., fathead minnow [*Pimephales promelas*]) may experience local declines in abundance as a consequence of ameliorative actions. Improving riparian health in urban areas will also benefit wildlife species that depend on riparian corridors.

7. Evaluation

Evaluation of the approaches to recovery set out in this strategy will be largely accomplished through the extensive and site-specific monitoring programs. These programs will assess the number of extant occurrences, the extent of occupied range, as well as population and habitat trends at specific sites. Evaluation measures will also be incorporated into the awareness strategy to assess the effectiveness of awareness efforts. This recovery strategy will be reviewed in 5 years (after it is approved) to evaluate the progress on stated objectives and to identify additional approaches and changes that may be required. Improved information on range and abundance may permit the development of quantitative population targets at that time.

II. BACKGROUND

8. Species Information

Scientific Name: *Clinostomus elongatus*
Common Name: Redside Dace
Current COSEWIC Status & Year of Designation: Special Concern (1987 – status update in preparation), Ontario – Threatened (2000)
Range in Canada: Restricted to southern Ontario.
Rationale for Status: This species is restricted in Canada to a few Great Lakes streams where the populations are in decline because of habitat destruction and degradation from urban development and agricultural practices.

9. Distribution

9.1 – Global Range The global range of the redside dace is discontinuous (Figure 1). In the west, this species is found in the upper Mississippi basin in Minnesota, and the upper Mississippi and Lake Michigan watersheds of Wisconsin. In the east it occurs in a wide band south of Lake Erie and Lake Ontario, as well as in parts of Michigan and Ontario. Page and Burr (1991) described the redside dace as locally common in the eastern part of its range although it is declining in many areas. In the western portion of its range, the redside dace is localised and rare.

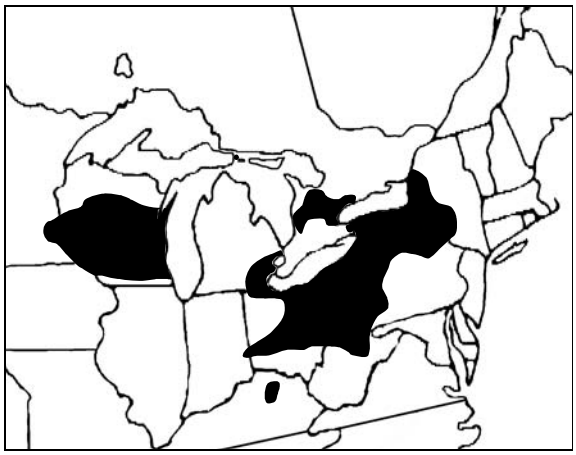

Fig. 1. Global distribution of redside dace (*Clinostomus elongatus*) [modified from Page and Burr (1991)].

Redside dace are most abundant in the state of Pennsylvania (upper Susquehana River drainage) where they are ranked as S4 (Table 1). The species has a restricted distribution in Indiana, Michigan and West Virginia and has been extirpated from Iowa and Maryland (where only a few populations formerly occurred). Redside dace were recently discovered at one location in the Raccoon Creek drainage of Illinois adjacent to the Wisconsin border (Sabaj 2000). The redside dace is listed as endangered in Indiana, as threatened in Michigan and as special concern in Wisconsin.

Table 1. Sub-national conservation status ranks[1] for redside dace (*Clinostomus elongatus*) (NatureServe 2004)

United States	Indiana (S1), Iowa (SX), Kentucky (S3S4), Maryland (SX), Michigan (S1S2), Minnesota (SNR), New York (S3), Ohio (SNR), Pennsylvania (S4), West Virginia (S1S2), Wisconsin (S3)
Canada	Ontario (S3)

[1] **S1** **Extremely rare** - usually 5 or fewer occurrences in the province/state or very few remaining individuals; often especially vulnerable to extirpation.
S2 **Very rare** - usually between 5 and 20 occurrences in the province/state or with many individuals in fewer occurrences; often susceptible to extirpation.
S3 **Rare to uncommon** - usually between 20 and 100 occurrences in the province/state; may have fewer occurrences, but with a large number of individuals in some populations; may be susceptible to large-scale disturbances.
S4 **Common** and apparently secure - usually with more than 100 occurrences in the province/state.
S5 **Very common** and demonstrably secure in the province/state.
SX Apparently **extirpated** from the province/state, with little likelihood of rediscovery.
SNR - not ranked/under review.

Staff from Conservation Data Centres in U.S. range jurisdictions 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). Only one state reported that extant populations were declining (MI),

while two reported that existing populations were stable (IN, KY). The rest of the states did not have sufficient information re population trends.

9.2 - Canadian Range The current Canadian distribution of redside dace is limited to southern Ontario and the Two Tree River on St. Joseph's Island (Figure 2). Most populations occur in tributaries to western Lake Ontario from Spencer Creek in the west, to Pringle creek in the east. Populations are also known from the Holland River system (Lake Simcoe drainage), the Two Tree River, the Saugeen River system, Gully Creek, (Lake Huron drainage) and Irvine Creek (Lake Erie drainage) (Parker et al. 1988; Mandrak and Crossman 1992; E. Holm, ROM, unpublished data). Canadian populations have experienced a continuing decline over the last 50 years, and only a few populations could currently be considered to be healthy. Redside dace populations have been lost from several tributaries to western Lake Ontario and the length of stream occupied by several populations has been reduced (Parker et al. 1988; E. Holm, ROM unpublished data). Despite observed declines, the boundaries of the overall range (extent of occurrence) of redside dace in Canada have not retracted significantly.

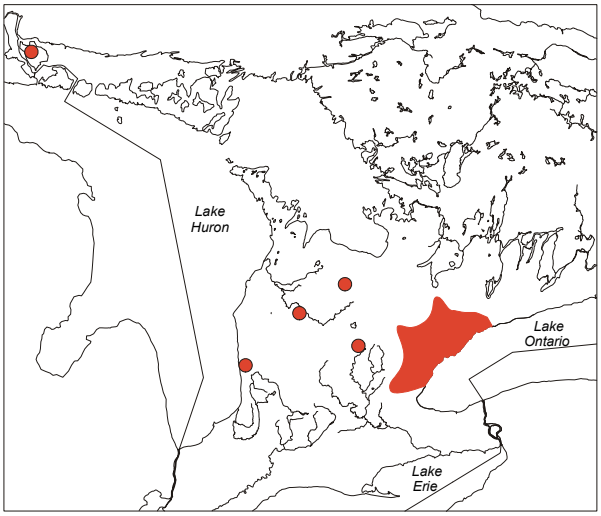

Fig. 2. Distribution of redside dace (*Clinostomus elongatus*) in Canada.

9.3 - **Percent of Global Distribution in Canada** In Canada, the redside dace is found only in Ontario. The Ontario distribution represents just under 10% of the global distribution of redside dace. The number of element occurrences for redside dace is estimated as a little over 100, although these are decreasing and disjunct (NatureServe 2004). Given the ranks of S4 in Pennsylvania and S3S4 in Kentucky combined with ranks of S3 in three other jurisdictions, it seems likely that there are several hundred populations globally. The G-rank for redside dace is G4.

10. Nationally Significant Populations

None have been identified.

11. Population Sizes and Trends

Redside dace have been captured from a total of 62 streams or sections of rivers in 23 watersheds in Canada. Our knowledge of its decline is inadequate because many streams have been insufficiently surveyed through time and all known collecting efforts have not been summarized in a database. However, a summary of available data indicates that the species was still extant in 34 streams in 16 watersheds from 1980-2002. It has likely been extirpated from the following seven watersheds: a creek in Clarkson, Highland Creek, Pringle Creek, Petticoat Creek, Etobicoke Creek, Mimico Creek and a watershed on the Niagara peninsula. Sampling that targeted historical sites

of redside dace indicate that the abundance and range of many of the extant populations have been reduced, in some cases dramatically. For example, in the upper Saugeen River, redside dace were recorded in a stream stretch of approximately 40 km at 25 sites in 1951. Sampling in 1985 and 2000 at most of these sites found it at only 3 sites in a 3 km stretch. In Spencer Creek, it was found in scattered locations in a stream stretch of approximately 18 km in the early 1970s. Intensive sampling in 1997-2001 at historical sites produced only a single specimen. Reductions in range and abundance have also occurred in other watersheds such as Lynde Creek, the Don River, Duffins Creek, Kettleby Creek, Bronte Creek and Morrison Creek.

12. Biologically Limiting Factors

Foraging Strategy/Predator Avoidance Behavior*:* The redside dace is a small insectivorous fish (average length 7.5 cm, maximum 11 cm) that relies on visual search of prey at the water's surface. It spends most of its time in mixed-species schools in pools, at or near a mid-depth position in the water column. It is a specialized feeder, its primary food consisting of terrestrial insects such as danceflies (*Hilara*) that occur in large swarms over the surface of the water. The redside dace leaps out of the water to obtain such prey. On occasion, it may also feed on aquatic insects and invertebrates. In a study of two streams in New York, most of its insect prey was found to oviposit on riparian vegetation (Daniels and Wisniewski 1994). The redside dace seeks cover under overhanging grasses, forbs and small shrubs. This streamside vegetation is important both as a source of cover and as a source of food.

Reproductive Attributes: Typically, the redside dace is sexually mature at 2 to 3 years, but spawning may not occur until its third year. Maximum age is 3 years, with occasional individuals surviving to age 4. Fecundity ranges from 409-1526 eggs, based on 15 individuals from northern New York (Scott and Crossman 1973). Redside dace spawning is somewhat specialized and may limit their ability to rebound from low population levels. Spawning occurs when water temperature reaches 18°C, typically in May on gravely riffles (Koster 1939, E.Holm, personal observations). It uses nests of creek chub (*Semotilus atromaculatus*) and/or common shiner (*Luxilus cornutus*), synchronizing its spawning with that of these two species. This strategy contributes to increased egg survivorship of redside dace through the protection afforded by the guarding behaviour of the parental creek chub or common shiner. The guarding fish keep the nest free of silt and protect the eggs from predation. Although creek chub and common shiners are ubiquitous in southern Ontario streams they initiate spawning at slighter cooler temperatures (12-17°C) than the preferred spawning temperature for redside dace (18°C) (Becker 1983). The temperature differential and the shorter spawning period of redside dace may limit opportunities for communal nesting in some years. The eggs of redside dace are non-adhesive (Scott and Crossman 1973), possibly making them more susceptible to being washed away from nests by high water velocities (e.g. spring floods).

Other Attributes: The bright yellow and red colour pattern of the redside dace may make it more visible to predators as well as more desirable for aquarists and pond keepers and thus more susceptible to both predation and exploitation (no evidence of exploitation exists). Its preference for small cool water headwater streams limits widespread dispersal. Although known for their leaping ability, redside dace are probably intolerant of vertical in stream barriers over 50 cm high.

13. Threats

Redside dace populations in Ontario 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. At least nine threats or potential threats to redside dace populations in Canada have been identified (Table 2) and these are characterized and described below. None of these threats have been empirically demonstrated, but there is sufficient evidence to identify probable cause and effect in some instances. The mechanisms by which these stressors affect redside dace populations are poorly understood. Direct or indirect effects are likely involved depending on the severity of the threat in question.

Table 2. Threats to redside dace populations in Canada.

Threats	Relative Impact	Spatial Temporal	Certainty
Urban Development	Predominant	Widespread/Chronic	Probable
Agricultural Activities	Contributing	Local/Chronic	Probable
Introductions	Contributing	Local/Chronic	Probable
Scientific Monitoring	Contributing	Ephemeral	Speculative
Succession	Contributing	Widespread/Chronic	Speculative
Extraction Activities (water, aggregates)	Contributing	Local/Chronic	Speculative
Climate Change	Contributing	Widespread/Chronic	Speculative
Bait Harvest	????	Widespread/Chronic	Speculative
Genetic Diversity	????	????	????

Urban Development: 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. Many of the remaining populations are found in areas currently scheduled for development, or that will likely be developed in the near future. 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 surrounded by 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 over-riding 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. These changes also contribute to siltation that

may affect redside dace feeding success through reductions in water clarity. 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 (see Environment Canada 2004). Environment Canada (2004) recommends maintaining urbanizing watersheds at less than 10% imperviousness to maintain stream-water quality and quantity, and to preserve aquatic species density and biodiversity. This guideline would be appropriate for the drainage basins of redside dace streams in Ontario. Parish (2004) found that redside dace preferred stream channels that are not heavily influenced by urban drainage (0-27% urban drainage area).

Direct changes to channel structure, through channelization that often occurs in urban areas, would have similar affects. Removal of riparian vegetation would directly affect the production of terrestrial insects required by redside dace during a large portion of the year. Riparian vegetation is also an important source of cover in the small streams inhabited by redside dace. 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. A rise in stream temperature is often associated with clearing of forests and urban development within a watershed and may pose a particular problem for redside dace is some streams owing to their preference for cool water habitats. Other developments may contribute to reductions in ground water inputs, that are important in regulating summer temperatures and base flows in streams. 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.

Agricultural Activities*:* Despite the fact that urban development is the 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 and changes in channel structure. 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 and pollutants. 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 fish along several km of stream (D. Coulson, OMNR Pembroke, pers. comm.). Specific mechanisms affecting redside dace in agricultural settings have not been empirically tested.

Introductions: 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 and predatory northern pike (Holm 1999). Declines in redside dace populations in the Bronte Creek watershed occurred after introductions of centrarchids and northern pike in the upper portions of the watershed (David Featherstone, Nottawasaga Valley Conservation Authority, pers. comm.). Although Greeley (1938) reported that redside dace compete with trout for food, the interactions between redside dace and salmonids have not been

specifically studied. Resident brown trout (*Salmo trutta*) and migratory rainbow trout (*Oncorhynchus mykiss*) have been introduced into several Toronto area streams with redside dace populations and redside dace occasionally naturally co-occur with brook trout (*Salvelinus fontinalis*). An experimental examination of the interactions between rainbow trout and the closely related rosyside dace (*Clinostomus funduloides*) suggested that interactions between the two species were minimal (Rincon and Grossman 1998). Redside dace may be more susceptible to the impacts of introduced species when stream systems are affected by multiple stresses.

Scientific Monitoring: 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. Direct impacts can occur when specimens are collected. 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 indirect impacts of non-lethal sampling (electrofishing, seining) have not been studied.

Succession: In Ontario, redside dace appear to achieve 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 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

Extraction Activities: Activities associated with the extraction of aggregates may result in reduced base flows and increased stream temperatures (OMNR 2001). Similarly, withdrawals of surface water and ground water 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.

Climate Change: Global climate change effects are unpredictable. It 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.

Bait Harvest: 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.

Genetic Diversity: Genetic diversity may be an important conservation issue for redside dace in Ontario (and elsewhere) as most populations are small and isolated. Many potential pathways of genetic interchange have been lost through the loss of intervening

populations and habitat or the construction of barriers. Research into the genetic diversity of this species in Ontario is required to determine how important these losses may be to the conservation of redside dace in Ontario.

14. Habitat Requirements

In Ontario, redside dace inhabit slow moving sections of small headwater streams having a mixture of overhanging stream side vegetation and pool and riffle habitat (Parker et al. 1988; Holm and Crossman 1986). Pools are used as a resident habitat while riffles are used for spawning. Commonly, redside dace have been observed spawning in or near the nests of creek chub and common shiners (Scott and Crossman 1973). Stream sections with overhanging vegetation, undercut banks and submerged branches and logs are most suitable. Bottom substrates include boulders, rocks, gravel or sand, often with a shallow surface covering of detritus or silt (McKee and Parker 1982). Streams are clear or colourless in conjunction with hard substrates and clear to brown tinged in streams with organic substrates. Redside dace prefer clear water and are sensitive to turbidity, however, they have been found in some streams of moderate turbidity (Holm and Crossman, 1986). Temperatures are usually less than 24 ^{o}C and dissolved oxygen concentrations are at least 7 mg/L (McKee and Parker 1982).

Destruction and degradation of habitat are believed to be the major factors in the reduction of redside dace distribution. Siltation, removal of riparian forest, baseflow alterations, channelization and agricultural, domestic and industrial pollution of streams in urban areas reduces suitable habitat and food sources. The species is now restricted to the headwaters of many streams where it was once widespread.

14.1 – Recovery Habitat Recovery habitat is considered to be all reaches (aquatic resource areas as defined by OMNR) currently occupied by redside dace as well as historically occupied reaches where there is a high likelihood of rehabilitation.

14.2 – **Survival Habitat** Survival Habitat is considered to be all reaches (aquatic resource areas[1] as defined by OMNR) currently occupied by redside dace. Survival habitat consists of two elements. The first element includes bankfull stream width[2] and the meander belt[3] width of the stream. The second element of survival habitat includes associated riparian habitat that is a minimum of 30 m from the meander belt (measured horizontally). This is consistent with science-based guidelines recently developed for guiding habitat rehabilitation in Great Lakes Areas of Concern (Environment Canada 2004). The inclusion of associated riparian habitat recognizes the naturally dynamic nature of riverine systems in perpetuity and the importance of riparian areas to highly sensitive stream ecosystems. Protection of riparian areas helps to maintain channel morphology characteristics over time, filters surface runoff containing sediment and

[1] Aquatic Resource Areas are aggregations of stream segments with similar physical and biological characteristics.

[2] Bankfull stream width is the width of the stream or river at bankfull discharge which is the flow at which water begins to leave the channel and move into the floodplain.

[3] The meander belt is the land area on either side of a watercourse representing the furthest potential limit of channel migration. Areas within the meander belt may some day be occupied by the watercourse; areas outside of the meander belt will not.

nutrients, and provides shade, cover and terrestrial insect food. All of these elements are necessary for the long-term survival of redside dace. Existing structures constructed by humans (e.g., buildings, roads) that are within the associated riparian habitat should not be considered as survival habitat. This definition of survival habitat should be considered when Habitat Mapping Guidelines for the identification of significant portions of redside dace habitat are being developed in relation to the *Provincial Policy Statement* (Section 3.I).

It is recognized that activities on the landscape beyond the associated shoreline habitat can have a profound impact on redside dace habitat, particularly in urban areas. Therefore, recovery actions will be necessary from a broader watershed perspective to protect and rehabilitate habitat. Factors such as the percent impervious cover at a subwatershed scale and stormwater management practices can have hydrologic impacts on highly sensitive stream channels that in turn is important to the conservation of redside dace habitat. Urban Development Guidelines will need to be developed to help address these concerns (see Section 3.I), but the definition of survival habitat is not intended to extend beyond the associated riparian zone as defined above.

14.3 – 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 four 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.

14.4 – Habitat Protection/Ownership The habitat of the redside dace receives general protection under the habitat provisions of the federal *Fisheries Act*. Floodplain regulations enforced by local Conservation Authorities and the Provincial Policy statement under the provincial *Planning Act* provide some control over stream-side development. The beds of navigable streams inhabited by redside dace are owned by the Crown, but in many areas, the adjacent lands are in private ownership. Lands immediately adjacent to streams in urban subdivisions are normally given back to the local municipality as green space.

15. Ecological Role

The redside dace is an insectivore that feeds primarily on terrestrial insects (Scott and Crossman 1973; Daniels and Wisniewski 1994). It therefore provides a conduit for energy cycling between terrestrial and lotic 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.

16. Importance to People

In Ontario, the redside dace may occasionally be harvested incidentally as a bait fish, but is likely not abundant enough in any stream to support a sustained fishery. Redside dace are harvested and sold as a high value specialty bait fish in the state of Wisconsin.

17. Recovery Potential and Rationale

17.1 - Ecological and Technical Feasibility of Species Recovery Recovery of redside dace populations in Ontario is technically and ecologically feasible, but its success is dependent on substantial investment in research and restoration. Recovery success will depend primarily on the cooperation and stewardship efforts of developers, municipalities and farmers. Protection of the existing highest quality habitats will be easiest to achieve, while restoring degraded habitats and populations will require considerable effort and investment of capital. The use of captive reared stock to augment existing populations or to re-introduce redside dace into areas of former occurrence should not be attempted until habitat has been restored (efforts should be made to develop rearing techniques and facilities in the interim). A few streams where redside dace have been extirpated have extremely low potential for recovery due to the extent and nature of the urbanization of their watersheds (e.g., Mimico Creek).

17.2 - Anticipated Conflicts or Challenges The large expansion of the human population that is anticipated for the Golden Horseshoe Region over the next few decades poses a large threat to many of the remaining redside dace populations and their habitats. The design of subdivisions and other urban developments needs to incorporate channel-friendly imperviousness and stormwater management features. Achieving a balance between development pressure and the needs of redside dace will indeed be a challenge. The restoration of degraded habitats in heavily urbanized areas will be difficult, if not impossible, in some cases due to the degree of imperviousness already present in the watershed.

18. Recommended Approach / Scale of Recovery

The redside dace is ideally suited to an individual species recovery planning effort for the following reasons:

- The fish communities that are normally associated with redside dace populations in Ontario are very unremarkable. Associated species usually include common generalists such as creek chub, common shiner, and blacknose dace (*Rhinichthys atratulus*). Redside dace do not regularly co-occur with other species at risk.
- Redside dace are distributed as isolated populations across a broad range in southern Ontario. Although they appear to prefer certain habitats, these habitats are not particularly rare in Ontario (although the habitat quality is often degraded). It is not a habitat type that is targeted for other recovery actions.

19. Knowledge Gaps

Is Knowledge of Species Adequate for Objectives and/or Approaches to be Defined Accurately? There are several gaps in knowledge related to the distribution, abundance, biology, and factors that limit redside dace populations in Ontario. Despite the extensive information requirements, there is little doubt that populations in Ontario have declined drastically over the last 50 years, primarily related to human-caused factors, most notably urban development. However, significant declines have also

occurred in non-urban streams. Specific knowledge gaps and the priorities to fill them are defined below.

19.1 - Survey Requirements As with most freshwater fishes at risk in Canada, specific knowledge regarding the distribution and abundance of redside dace is limited. However, knowledge of redside dace is better than for many other species. Early records for redside dace were based on incidental captures associated with other survey work. In 1985 the Royal Ontario Museum conducted specific field surveys to assess redside dace populations (Holm and Crossman 1986), and in the last 5 years there have been considerable efforts to examine redside dace populations in Ontario (Holm and Boehm 1998, Holm 1999, Holm 2003, Holm unpublished data). Many of the streams are also sampled intensively on a regular basis by Conservation Authorities. Despite recent sampling efforts, there is an immediate need to assess the following streams to identify if populations are extant, their area of occupancy and relative abundance:

Two Tree River, Meux Creek, 16 Mile Creek, South Saugeen River, Turtle Creek, Credit River (Rogers Creek, Silver Creek, upper watershed), Morrison Creek (west branch), Etobicoke Creek, Duffin's Creek, and Holland River tributaries.

In addition to these survey requirements, there is a need to establish a long-term monitoring program that can provide reliable trend-through-time information on the status of redside dace populations in Canada.

19.2 - Biological/Ecological Research Requirements Little is known regarding the life history and ecology of redside dace in Ontario. A few studies have examined the feeding ecology, physiology and behavior of this species in the United States, but, like many cyprinids, it is not a well-studied species. Table 3 identifies priority research needs related to the biology/ecology of redside dace in Ontario.

Table 3. Research needs related to the biology/ecology of redside dace in Ontario.

Research Need	Details
Habitat Use	Identification of most important habitats for adults and juveniles, seasonal changes, aquatic and terrestrial components.
Spawning Habitat	Identification of spawning areas and spawning behavior – are nests of other species (i.e., creek chub, common shiner) always required for successful spawning?
Physiological Tolerances	What are the physiological tolerances of redside dace to the key physical and chemical water quality parameters?
Feeding Behavior	What are the primary foods of redside dace in Ontario? How do they vary seasonally? Are there specific terrestrial features that are important to prey organisms?
Migration/Movements	Are there redside dace spawning migrations? What is the degree of movement between areas of suitable habitat?
Genetic Diversity	What is the variation across the global range? Is there divergence among/within Ontario populations? Are metapopulation dynamics important?

Community Interactions	Do different fish communities affect the abundance and distribution of redside dace? Which species are important competitors/predators?
Disease/Parasites	Are there diseases or parasites that limit Ontario populations?

19.3 - Threat Clarification Research Requirements No studies have been undertaken to determine the factors that contribute to redside dace decline in Ontario. In order to direct recovery efforts efficiently, it is important to clearly identify the principal factors that limit the abundance and distribution of redside dace populations in Ontario. Research questions related to threats and potential threats to redside dace populations are identified in Table 4.

Table 4. Research needs related to factors threatening redside dace in Ontario.

Threat	**Research Needs**
Urban Development	What are the key factors associated with urban development that cause declines in redside dace populations?
Agriculture Development	What are the key factors associated with agricultural activities that cause declines in redside dace populations?
Extraction Activities	How do aggregate operations and water withdrawals affect the supply of redside dace habitat?
Introduced Species	What are the interactions/impacts of the introduced species most often introduced into redside dace streams (salmonids, centrarchids, northern pike, other cyprinids)?
Succession	Are forested riparian areas with canopy closure unsuitable for redside dace? Implications for rehab projects.
Genetic Diversity	What is the variation across the global range? Is there divergence among/within Ontario populations? Are metapopulation dynamics important?
Bait Harvest	Empirical Investigation of the impact of bait harvest on redside dace populations.
Sampling Mortality	What are the effects of timing, gear type and water temperature on mortality associated with scientific sampling.
Climate Change	Model impacts on future supply of redside dace habitat.

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