PROPOSED

Species at Risk Act
Management Plan Series

Management Plan for the Bridle Shiner (*Notropis bifrenatus*) in Canada

Bridle Shiner

December 2010

Fisheries and Oceans Canada
Pêches et Océans Canada
Canada

About the *Species at Risk Act* Management Plan Series

What is the *Species at Risk Act* (SARA)?

SARA is the act developed by the federal government as a key contribution to the common national effort to protect and conserve species at risk in Canada. SARA came into force in 2003, and one of its purposes is "*to manage species of special concern to prevent them from becoming endangered or threatened*."

What is a species of special concern?

Under SARA, a species of special concern is a wildlife species that could become threatened or endangered because of a combination of biological characteristics and identified threats. Species of special concern are included in the SARA List of Wildlife Species at Risk.

What is a management plan?

Under SARA, a management plan is an action-oriented planning document that identifies the conservation activities and land use measures needed to ensure, at a minimum, that a species of special concern does not become threatened or endangered. For many species, the ultimate aim of the management plan will be to alleviate human threats and remove the species from the List of Wildlife Species at Risk. The plan sets goals and objectives, identifies threats, and indicates the main areas of activities to be undertaken to address those threats.

Management plan development is mandated under Sections 65–72 of SARA (http://www.sararegistry.gc.ca/approach/act/default_e.cfm).

A management plan has to be developed within three years after the species is added to the List of Wildlife Species at Risk. A period of five years is allowed for those species that were initially listed when SARA came into force.

What is next?

Directions set in the management plan will enable jurisdictions, communities, land users, and environmentalists to implement conservation activities that will have preventative or restorative benefits. Cost-effective measures to prevent the species from becoming further at risk should not be postponed for lack of full scientific certainty and may, in fact, result in significant cost savings in the future.

The series

This series presents the management plans prepared or adopted by the federal government under SARA. New documents will be added regularly as species get listed and as plans are updated.

To learn more

To learn more about the *Species at Risk Act* and conservation initiatives, please consult the SARA Public Registry (http://www.sararegistry.gc.ca/).

Management Plan for the Bridle Shiner (*Notropis bifrenatus*) in Canada [Proposed]

December 2010

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Additional copies:

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PREFACE

The Bridle Shiner is a freshwater fish and is under the responsibility of the federal government. The Minister of Fisheries and Oceans is a "competent minister" for aquatic species under the *Species at Risk Act* (SARA). Since the Bridle Shiner is located in the St. Lawrence Islands National Park and in the Rideau Canal National Historic Site of Canada administered by the Parks Canada Agency, the Minister of the Environment is also a "competent minister" under SARA for individuals of the species in or on those areas. The SARA (Section 65) requires the competent ministers to prepare management plans for species listed as special concern. The Bridle Shiner was listed as species of special concern under SARA in 2003. The development of this management plan was led by Fisheries and Oceans Canada – Quebec Region as well as Central and Arctic Region, in cooperation and consultation with many individuals, organizations and government agencies, including the Government of Ontario, the Government of Quebec, the Parks Canada Agency, and the members of the recovery teams. The plan meets SARA requirements in terms of content and process (SARA sections 65-67).

Success in the conservation of this species depends on the commitment and cooperation of many different constituencies that will be involved in implementing the directions set out in this plan and will not be achieved by Fisheries and Oceans Canada and Parks Canada Agency or any other party alone. This plan provides advice to jurisdictions and organizations that may be involved or wish to become involved in activities to conserve this species. In the spirit of the Accord for the Protection of Species at Risk, the Minister of Fisheries and Oceans and the Minister of the Environment invite all partner jurisdictions and Canadians to join Fisheries and Oceans Canada and Parks Canada Agency in supporting and implementing this plan for the benefit of the Bridle Shiner, and Canadian society as a whole. The competent ministers will report on progress within five years.

PARTNER JURISDICTIONS

Fisheries and Oceans Canada
Parks Canada Agency
Government of Quebec
Government of Ontario

AUTHORS

This document was prepared for Fisheries and Oceans Canada and Parks Canada Agency by a national recovery team with representatives from Quebec's Cyprinidae and Small Percidae Recovery Team and Ontario's Freshwater Fish Recovery Team.

ACKNOWLEDGEMENTS

The authors would like to thank Gilles Fortin (DFO) and Carolyn Bakelaar (DFO) for providing distribution maps for Quebec and Ontario, respectively.

STRATEGIC ENVIRONMENTAL ASSESSMENT

A strategic environmental assessment (SEA) is conducted on all SARA recovery planning documents, in accordance with the *Cabinet Directive on the Environmental Assessment of Policy, Plan and Program Proposals*. The purpose of a SEA is to incorporate environmental considerations into the development of public policies, plans, and program proposals to support environmentally-sound decision making.

Recovery planning is intended to benefit species at risk and biodiversity in general. However, it is recognized that plans may also inadvertently lead to environmental effects beyond the intended benefits. The planning process based on national guidelines directly incorporates consideration of all environmental effects, with a particular focus on possible impacts on non-target species or habitats. The results of the SEA are incorporated directly into the plan itself, but are also summarized below.

This management plan will clearly benefit the environment by promoting the conservation of the Bridle Shiner. The potential for the plan to inadvertently lead to adverse effects on other species was considered. The SEA concluded that this plan will clearly benefit the environment and will not entail any significant adverse effects. The reader should refer to the following sections of the document in particular: description of the species' habitat and biological needs, ecological role, and limiting factors; effects on other species; and, the management implementation actions.

EXECUTIVE SUMMARY

The Bridle Shiner (*Notropis bifrenatus* [Cope, 1867]) is a small Cyprinidae with a slender body. It is a globally rare species and its worldwide distribution is restricted to the Atlantic drainage basin in eastern North America. In Canada, the species occurs in eastern Ontario and southwest Quebec, from the Bay of Quinte (Lake Ontario) to Lake St. Paul, in Bécancour, and south to Lake Memphrémagog. In Quebec, the Bridle Shiner has been recorded in some areas of the St. Lawrence River and in tributaries of eight administrative regions: Montreal, Laval, Montérégie, Estrie, Laurentides, Lanaudière, Mauricie and Centre-du-Québec. In Ontario, the Bridle Shiner is believed to be present in the St. Lawrence River, Big Rideau Lake, Wood Creek, Jones Creek and the Napanee River. Based on available data, the range of the Bridle Shiner in Quebec is quite extensive, compared to Ontario, although a significant portion of the species' range remains under-sampled in both provinces.

The abundance of Bridle Shiner in Canada is unknown and population trends are difficult to determine due, in part, to difficulties in species identification. The Bridle Shiner can be easily confused with the Blacknose Shiner (*N. heterolepis*) and other blackline shiners with which it commonly co-occurs. It is possible that errors could occur in species identification, which could result in an underestimate of Bridle Shiner distribution and abundance. There is evidence of decline in many waterbodies where the species was formerly abundant, especially among populations in Quebec. The species' current status in many areas, such as Lake Memphrémagog, la Baie Missisquoi tributaries, Lake St. Paul and several sites in Ontario, is unknown as these areas have not been adequately sampled since the 1960s and 1970s. There are also many areas that have never been sampled, and it is possible that the species is more abundant and has a wider distribution than previously believed.

Known and suspected threats facing the Bridle Shiner in Canada include agricultural pollution, urban and industrial pollution, changes to natural flow regimes, loss of riparian cover, destruction of aquatic vegetation, large-scale fluctuations of water levels, climate change, exotic species and disease spread, and commercial baitfish harvesting.

The goal of this management plan is to maintain and enhance Bridle Shiner populations and their habitats, to ensure that viable populations are present throughout the species' current and historic range in Canada.

The following short-term objectives (over the next five years) have been established to assist in achieving the goal of the management plan:

i. To ensure the protection of known populations and habitats;

ii. To evaluate threat factors impacting the species and its habitat;

iii. To improve the quality of impacted habitats currently used by the Bridle Shiner;

iv. To determine the extent, abundance and demographics of Bridle Shiner populations;

v. To increase public awareness of the presence, threats and conservation of the Bridle Shiner and its habitat, and its status as a Canadian species at risk; and,

vi. To develop contacts and raise awareness among the various partners, recovery teams, stakeholders, organizations and landowners interested in supporting the conservation of the Bridle Shiner.

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1. SPECIES INFORMATION

1.1. Species Assessment Information from COSEWIC

Date of Assessment: November 2001
Common Name (population): Bridle Shiner (*Méné d'herbe*)
Scientific Name: *Notropis bifrenatus* (Cope, 1867)
COSEWIC Status: Special Concern
Reason for Designation: This species has a limited distribution in Canada and is susceptible to increased water turbidity from agricultural practices and urban development.
Canadian Occurrence: Quebec, Ontario
COSEWIC Status History: Designated Special Concern in April 1999. Status re-examined and confirmed in November 2001. Last assessment based on an existing status report with an addendum.

1.2. Description

The Bridle Shiner (*Notropis bifrenatus* [Cope, 1867]) (Figure 1) is a small minnow with a slender, somewhat laterally compressed body, whose total length seldom exceeds 60 mm (Bernatchez and Giroux 2000, Holm *et al.* 2001, Robitaille 2005). It has a small terminal mouth, and its upper jaw extends back to the lower edge of the eye (Scott and Crossman 1998, Robitaille 2005). The lower lip has little or no pigment (Holm *et al*. 2001). The Bridle Shiner has one of the largest eyes of Canadian cyprinids, with a diameter ranging from 31.2 to 38.8% of the head length (Scott and Crossman 1998). Mature individuals have a straw-coloured dorsal surface, and silvery sides with a green-blue iridescence, as well as a silvery-white ventral surface. A black lateral band extends from the snout to the tail (Bernatchez and Giroux 2000, Holm *et al.* 2001, Robitaille 2005). This lateral band is especially apparent on specimens preserved in alcohol or formaldehyde, but is much less obvious on live individuals. A caudal spot, confluent with the lateral band, is often present. There are usually seven principal rays on the anal fin, although Scott and Crossman (1998) recorded 32% of specimens with eight.

The Bridle Shiner lives for only two years and spawns only once, in its first or second year. It is sexually dimorphic during the breeding season which occurs in the spring and the summer. Then males turn a bright yellow or gold on the lower sides, and the first five or six pectoral rays become edged with brown. The back is darker than that of spawning females and non-breeding males. Males also develop small tubercles on the pectoral fins, head and nape. Both sexes develop yellow fins shortly before the spawning period (Harrington 1947, Scott and Crossman 1998, Holm *et al.* 2001, Robitaille 2005). The Bridle Shiner is difficult to identify and can be easily confused with other blackline shiners (*Notropis* species which are superficially very similar), particularly the Blacknose Shiner (*N. heterolepis*) (Holm *et al*. 2001). The lateral band of both the Bridle Shiner and the Blacknose Shiner extends onto the nose but not the chin. The Blacknose Shiner can be distinguished from the Bridle Shiner by its larger, overhanging, snout and subterminal mouth. The mouth of the Blacknose Shiner is angled at less than 45° while the Bridle Shiner's mouth is set at a 45° angle (Letendre 1960). The Bridle Shiner can be

distinguished from the Pugnose Shiner (*N. anogenus*) and Blackchin Shiner (*N. heterodon*) by the absence of black pigment on its chin (the lateral band of the Pugnose Shiner and Blackchin Shiner extends onto the nose and chin of both species). The incomplete lateral line and the insertion of the dorsal fin above or in front of the insertion of the pelvic fins also serve to distinguish adult Bridle Shiner from other similar species (Robitaille 2005).

Figure 1. Bridle Shiner (*Notropis bifrenatus*). Copyright Ellen Edmonson (Sportfishing and Aquatic Resources Education Program).

1.3. Populations and Distribution

1.3.1. Distribution

Global Distribution – The global range of the Bridle Shiner (Figure 2) is restricted to the Atlantic drainage basin in eastern North America. It extends from eastern Lake Ontario, east to Maine and south to South Carolina (Holm *et al.* 2001, Robitaille 2005).

In the United States, the Bridle Shiner is found in Connecticut, Delaware, the District of Columbia, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, North Carolina, Pennsylvania, Rhode Island, South Carolina, Vermont and Virginia (NatureServe 2009).

Canadian Distribution – In Canada, the Bridle Shiner's distribution (Figure 2) extends west to the Bay of Quinte (Lake Ontario), east and north to Lake St. Paul (near Trois-Rivières), and south to Lake Memphrémagog (Holm *et al.* 2001, Robitaille 2005). There are no records of Bridle Shiner presence between the downstream end of the Thousand Islands region and the head of Lake St. Francis (i.e., Cornwall). However, it is possible that targeted surveys in areas of suitable habitat would detect the species in these areas.

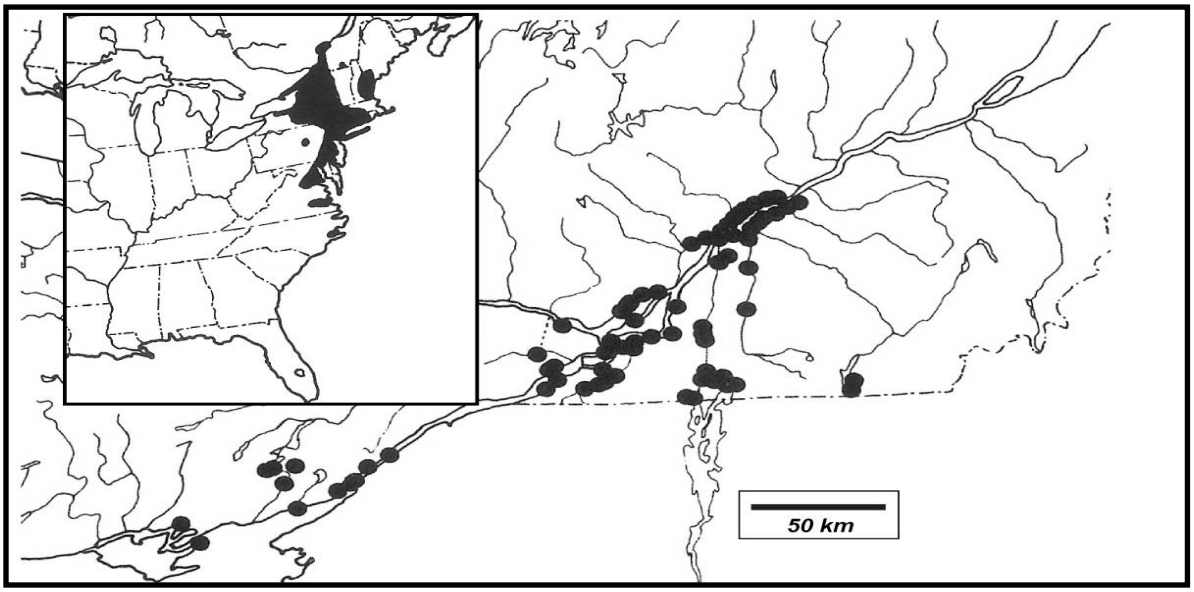

Figure 2. Bridle Shiner sites in Canada and the species' North American distribution (inset) (from Robitaille 2005 and modified from Holm *et al*. 2001).

***Quebec* –** In Quebec, the species was first recorded in the 1940s in the areas of Montréal and Lake St. Pierre. Since then, the species has been recorded in tributaries in eight different regions of the province: Montréal, Laval, Montérégie, Estrie, Laurentides, Lanaudière, Mauricie and Centre-du-Québec (Table 1 and Figure 3). The species is typically found in the aquatic environments of the lowlands of the St. Lawrence River and in the Richelieu River area. The Bridle Shiner was also captured in the St. Lawrence River upstream of Quebec City, during surveys conducted by the St. Lawrence River Fish Monitoring Network (FMN)[1] (N. La Violette, unpublished data). Details are presented below, in the Population Size, Status and Trends section.

[1]Two kinds of fishing gear were mainly used by the FMN: the beach seine for littoral lentic habitats and the experimental gillnet for lentic and lotic habitats, which are usually set back from the banks (La Violette *et al*. 2003).

Table 1. Historic and current Bridle Shiner sites in Quebec[(1)].

Administrative Area	Waterbody (reference number for Figure 3)	Location	Year of Last Observation
Laurentides	Lake Borcoman (*1*)	Ferme-Neuve	1988
	Lake des Journalistes (*2*)	Ferme-Neuve	1975
Lanaudière	Lake St. Pierre archipelago (*4*)	Berthierville	2002
	du Marais Noir creek (*5*)	La Visitation-de-l'Île-Dupas	2001
	L'Assomption River (*7*)	Joliette	1987
Mauricie and Centre-du-Quebec	Lake St. Pierre (*8*)	North and south shores	2003
	Lake St. Paul (*3*)	Bécancour	1964
Montérégie, Montréal and Laval	St. Lawrence River (*6*)	Montréal-Sorel	2001
	Lake St. Pierre archipelago (*4*)	Berthier-Sorel	2003
	Pot au Beurre River (*9*)	Berthier-Sorel	1997
	Little Pot au Beurre River (*10*)	Berthier-Sorel	1995
	des Ormes Creek (*9*)	Berthier-Sorel	1995
	St. Lawrence River (*11*)	Yamaska	1992
	St. Lawrence River (*12*)	Pointe-des-Cascades	1980
	St. Lawrence River (*13*)	St. Anne-de-Sorel	1971
	St. Lawrence River (*14*)	St. Ignace-de-Loyola	1971
	St. Lawrence River (*15*)	St. Barthélemy	1971
	St. Lawrence River (*16*)	Maskinongé	1971
	des Prairies River (*17*)	Pierrefonds	1990
	Richelieu River (*18*)	St. Jean sur Richelieu	1987
	Richelieu River (*19*)	Chambly	1970
	Richelieu River (*20*)	Mont-St. Hilaire	1970
	Richelieu River (*21*)	St. Roch de Richelieu	1970
	Richelieu River (*22*)	St. Paul-de-l'Île-aux-Noix	1969
	Richelieu River (*23*)	Henryville	1969
	Richelieu River (*24*)	Iberville	1969
	Châteauguay River (*25*)	St. Martine	1983
	Châteauguay River (*26*)	Ormstown	1983
	Châteauguay River (*27*)	Howick	1973
	Châteauguay River (*28*)	Châteauguay	1971
	Lake des Deux Montagnes (*29*)	Rigaud	1975
	Maskinongé River (*30*)	St. Barthélemy	1974
	St. Jean Creek (*not mapped*)	Châteauguay	1974
	Thousand Islands River (*31*)	St. Thérèse	1973
	Thousand Islands River (*32*)	St. Eustache	1973
	Thousand Islands River (*33*)	Rosemère	1973
	Thousand Islands River (*34*)	Fabreville	1973
	Norton Creek (27)	Howick	1973
	Chamberry Creek (*12*, *40*)	Pointe-des-Cascades	1971
	Lake St. Louis (*35*)	Lake Léry	1971
	Lake St. Louis (*36*)	Île Perrot	1968
	Lake St. Louis (*37*)	Îles de la Paix	1965
	St. Louis de Gonzague (*38*)	Rivière St. Louis	1941
	Yamaska River (*39*)	Yamaska	1967

Table 1 (Con't).

Administrative Area	Water body (*reference number for Figure 3*)	Location	Year of Last Observation
Montérégie, Montréal and Laval	Soulanges Channel (*40*)	Pointe des Cascades	1967
	Marigot Creek (*22*)	St. Paul-de-l'Île-aux-Noix	1966
	Bleury River (*22*)	St. Paul-de-l'Île-aux-Noix	1966
	La Guerre River (*41*)	St. Anicet	1965
	Patenaude Creek (*42*)	Cantic (place-name)	1965
	Beauvais-Davignon Creek (not mapped)	Iberville	1965
	du Sud River (43)	Henryville	1965
	Des Iroquois River (44)	Talon (hamlet)	1965
	À la Raquette River (45)	Rigaud	1965
	Beaudette River (46)	Rivière Beaudette (St. Claire-d'Assise)	1946
	Beaudette River (47)	Rivière Beaudette	1946
	De la Loutre Creek (48)	Abenakis Springs (place-name)	1945
	St. François River (49)	St. François du Lac	1944
	Brunson Creek (50)	Dundee Centre (hamlet)	1941
Estrie	Lake Memphrémagog (51)	The Narrow	1964
	Lake Memphrémagog (52)	Fitch Bay	1964
	Bunker Creek (52)	Fitch Bay	1999
	Tomkins Creek (53)	Cedarville	1965
	Tomkins Creek (53)	Marlington	1999
	Magog Lake (54)	Dauville	2007

(1) The information presented in Table 1 comes from the databases of the Quebec Ministère des Ressources naturelles et de la Faune and from Desroches *et al.* (2008).

Figure 3. Historic and current Bridle Shiner sites in Quebec. Numbers refer to waterbody locations in Table 1.

Ontario – In Ontario (Figures 4a and b), the Bridle Shiner was first captured in 1928 from the Bay of Quinte (Lake Ontario drainage) (Hubbs and Browne 1929). By 1938, after more extensive sampling, the species' known range was extended north-east into an un-named tributary of the Rideau Canal near Brewers Mills, and eastward into the Gananoque River, the St. Lawrence River near Gananoque, and a tributary of Lake St. Francis (Holm *et al*. 2001). Currently, the Bridle Shiner is believed to be present in the St. Lawrence River, Big Rideau Lake, Wood Creek, Jones Creek and the Napanee River. See Table 2 for historic and current Bridle Shiner sites in Ontario.

Table 2. Historic and current Bridle Shiner sites in Ontario.

Waterbody	Location	Year of Last Observation
Bay of Quinte (Lake Ontario)	Prinyer's Cove	1981
Gananoque River		1938
St. Lawrence River	Gananoque	1938
	Thousand Islands Region	2005
	Near Hill Island	1999
	Owen Island	1994
	Mulcaster Island	1994
	South Shore of Hill Island	1999
	Hill Island, across from Club Island	1994
	North Shore of Thompson's Bay	2005
	North side of Adelaide Island	1974
	Mallorytown Landing	1975
	Brown's Bay	1959
Big Rideau Lake		2005
Un-named tributary of the Rideau Canal	Brewers Mills	1937
Finney Creek	Raisin Region	1961
Wood Creek	Raisin Region	1994
Gunn Creek	Raisin Region	1987
Jones Creek	Cataraqui Region	1994
Napanee River	Strathcona	1998
Morton Creek	Cataraqui Region	1967
Outlet to Leo Lake	Cataraqui Region	1975
Kingsford Lake	Cataraqui Region	1975
Hart Lake	Cataraqui Region	1975
Fraser Creek	Cataraqui Region	1961

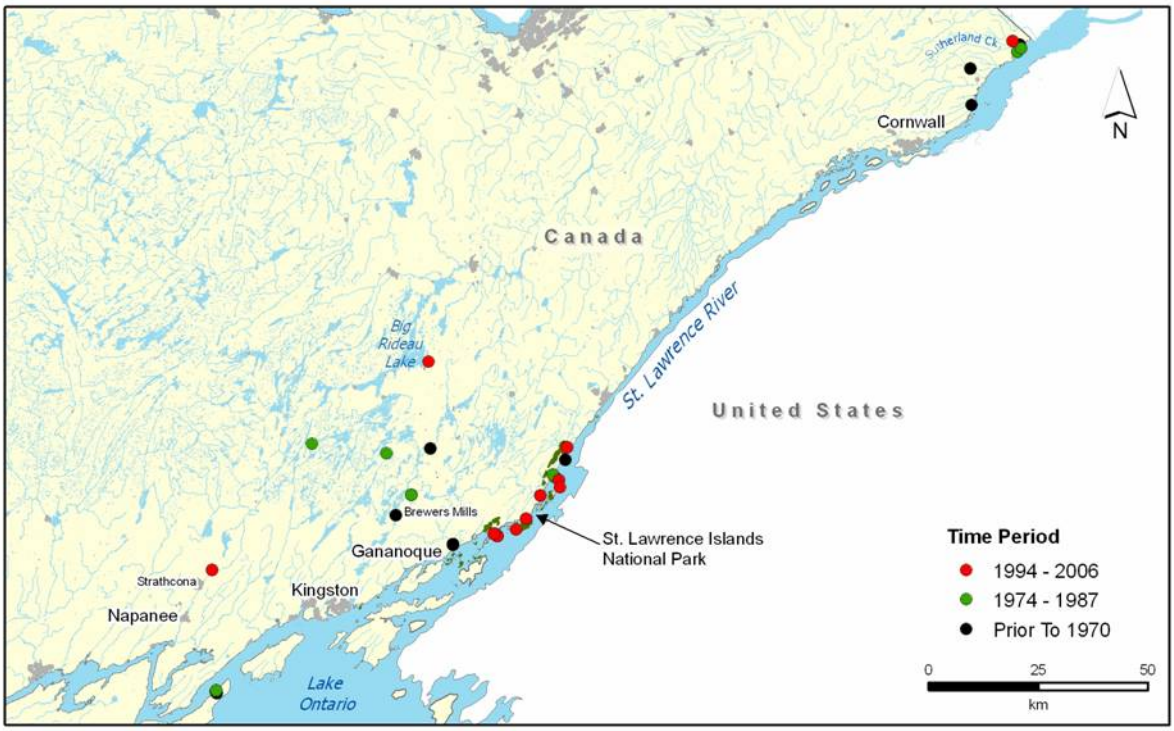

Figure 4a. Bridle Shiner distribution in Ontario.

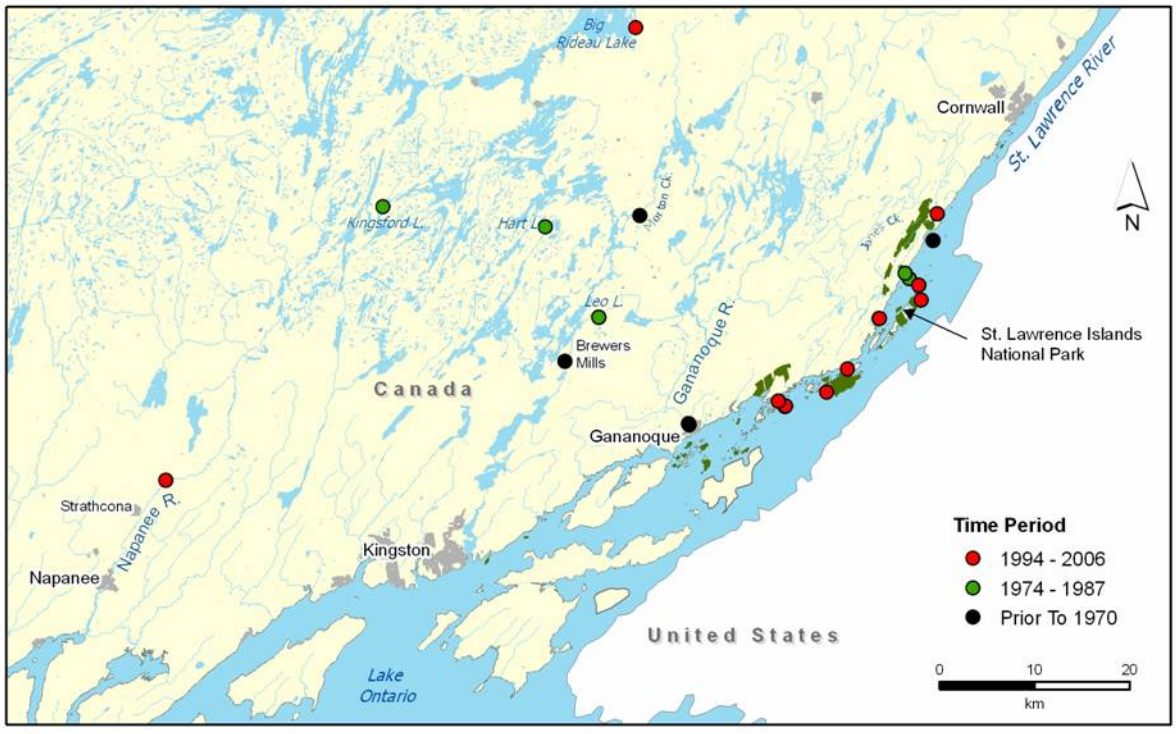

Figure 4b. Bridle Shiner distribution in Ontario - St. Lawrence National Islands Park sites.

Percentage of Global Distribution in Canada – Given the lack of recent sampling data, it is difficult to determine what percentage of the Bridle Shiner's global range is in Canada. However, it probably represents only a fraction of the species' global range (i.e., likely less than 5% of its global range is found in Canada [N.E. Mandrak, Fisheries and Oceans Canada, pers. comm. 2008]). In Canada, the Bridle Shiner is at the northern limit of its range.

Distribution Trends – The Bridle Shiner's area of occupancy has undergone a reduction across much of its North American range. For example, it has been found recently in only one of 31 historic locations in Pennsylvania and in a small percentage of several dozen historic locations in Massachusetts (NatureServe 2009). In Canada, particularly in Quebec, the Bridle Shiner is found in regions that are highly industrialized, heavily populated or used intensively for agriculture. Consequently, it is unlikely that the species will expand its present range (Scott and Crossman 1998). The lack of sampling in recent years in certain rivers with historic records has made it difficult to evaluate distribution trends. In Quebec, FMN data indicate that the species may be declining in some areas within its present range.

1.3.2. Population Size, Status and Trends

Global Population Size, Status and Trends – The species has experienced a range-wide decline in abundance and in the number of sub-populations. Without human intervention, the short-term decline rate (i.e., for the next 10 to 100 years) is estimated to be 10% to 30%, while over the long-term (i.e., the next 200 years) it is estimated to be 25% to 75% (NatureServe 2009).

Several North American locations with historic Bridle Shiner records have not been recently sampled, making it difficult to determine population trends. Species identification problems can also add to the difficulty, as specimens may have been identified incorrectly. Over its entire range, the Bridle Shiner is ranked as vulnerable (G3)[2] and it is considered rare (NatureServe 2009). In the United States, the Bridle Shiner is ranked as vulnerable (N3). It is considered possibly extirpated (SH) in the District of Columbia and Maryland; critically imperilled (S1) in North Carolina, Pennsylvania and Vermont; and, imperilled (S2) in Maine and Virginia. The species is undergoing status reviews in New Jersey, New York and Rhode Island (currently S4, S5 and S5 respectively) and it is believed that the S-ranks in all three states will be upgraded to either S2 or S3 (NatureServe 2009). Complete Bridle Shiner national and sub-national ranks appear in Table 3.

[2] Conservation status ranks are described in Appendix 1.

Table 3. Canadian and American national and sub-national conservation status ranks for the Bridle Shiner.

Location	Conservation Status	Ranking Organization
North America	Vulnerable (G3)	NatureServe
United States	Vulnerable (N3)	NatureServe
Connecticut	S3	NatureServe
Delaware	SU	NatureServe
District of Columbia	SH	NatureServe
Maine	S2	NatureServe
Maryland	SH	NatureServe
Massachusetts	S3	NatureServe
New Hampshire	S3	NatureServe
New Jersey	S4	NatureServe
New York	S5	NatureServe
North Carolina	S1	NatureServe
Pennsylvania	S1	NatureServe
Rhode Island	S5	NatureServe
South Carolina	SNR	NatureServe
Vermont	S1?	NatureServe
Virginia	S2	NatureServe
Canada	Special Concern	Committee on the Status of Endangered Wildlife in Canada (COSEWIC)
	Special Concern	*Species at Risk Act* (SARA)
	Vulnerable (N3)	NatureServe
Ontario	Special Concern	Species at Risk in Ontario (SARO) List
	Imperilled (S2)	NatureServe
Quebec	Vulnerable	*Threatened or Vulnerable Species Act*
	Vulnerable (S3)	NatureServe

Percentage of Global Abundance in Canada – An estimate of Bridle Shiner abundance in Canada is not available. However, given the decline in the number of sub-populations, in areas of occurrence, and in abundance of the species in the United States, it is possible that there may be a larger proportion in Canada than expected.

Significant Populations in Canada – None have been identified.

Canadian Population Size, Status and Trends – In Canada, available data indicate that the Bridle Shiner is declining in several locations. However, the species is still common in certain areas of the St. Lawrence River (e.g., Lake St. Pierre and its archipelago, Thousand Islands region) and there seems to be no indication of a reduction in abundance in these areas. The absence of recent sampling data makes it difficult to determine the population status in some Canadian locations, such as the lakes of the Rideau Canal system, Lake Memphrémagog, Lake

St. Paul (Holm *et al.* 2001) and Fraser, Gunn and Finney creeks (B. Jacobs, Raisin River Conservation Authority, pers. comm. 2008).

The rate of decline of Bridle Shiner populations in Canada is unknown (Holm *et al*. 2001). Currently the species is considered vulnerable nationally (N3), imperilled in Ontario (S2) and vulnerable in Quebec (S3) (NatureServe 2009). In Quebec, the Bridle Shiner is designated as a vulnerable wildlife species under the government of Quebec's *Act Respecting Threatened or Vulnerable Species*. It has also been listed as a species of special concern under Ontario's *Endangered Species Act, 2007* (Table 3).

Quebec – There are no population estimates for the Bridle Shiner in Quebec. However, abundance appears to be decreasing in certain locations, particularly in the basins of the Aux Brochets, Châteauguay, Richelieu, Yamaska and St. Francis rivers, as well as in the St. Lawrence River, in the areas of Lake St. Francis and Lake St. Louis. Although populations appear to be declining in some locations, the species remains common in some areas of the St. Lawrence River, including Lake St. Pierre and its archipelago (Robitaille 2005). Between 1995 and 2008, a large number of specimens were observed in the Montréal-Sorel reach of the St. Lawrence River as well as in Lake St. Pierre and its archipelago (Table 4).

Table 4. Bridle Shiner catch data from the St. Lawrence River in Quebec. Surveys conducted by the FMN (Data from N. La Violette and C. Côté, Quebec Ministère des Ressources naturelles et de la Faune).

Areas	Year of Last Observation	Number[1]
Lake St. Francis	1996	0
	2004	0
Lake St. Louis	1997	1
	1999	0
	2005	0
Montréal – Sorel reach	2001	102
Bécancour-Batiscan reach	1996	0
	2001	0
	2008	25
Lake St. Pierre archipelago	1995	61
	2003	221
Lake St. Pierre	1995	330
	1997	0
	2002	2512
	2007	3492
Grondines – Donnacona reach	1997	0
	2006	0

[1]A zero indicates that no Bridle Shiner were captured despite FMN sampling.

In Quebec, the species had not been the subject of targeted research until a rare fish species inventory was carried out in 2002 in the southern part of the L'Assomption River watershed (Lanaudière region). However, no Bridle Shiner were detected during this survey, which was conducted in the Ouareau, L'Assomption and Achigan rivers (CARA 2002). In 1987, the species was recorded in the L'Assomption River, between the Nadeau Rapids and the Gohier Dam, near Joliette (Robitaille 2005).

In Lake St. Francis, the species was confirmed in 1941 and 1945, at the mouth of the La Guerre River and in the northeast area of the lake in the late 1960s (Holm *et al.* 2001, Robitaille 2005). There were no Bridle Shiner captured during sampling conducted by the FMN in Lake St. Francis in 1996 and 2004 (N. La Violette, unpublished data).

Similar observations were made during surveys by the FMN in Lake St. Louis where only one specimen was caught in 1997 and no specimens were caught in 1999 and 2005, although the species was formerly abundant at this area (Holm *et al.* 2001, Robitaille 2005, N. La Violette, unpublished data).

Between 1995 and 2007, numerous Bridle Shiner were observed in the Montréal-Sorel reach of the St. Lawrence River as well as in Lake St. Pierre and its archipelago. More than 6692 specimens were collected during surveys conducted by the FMN in these locations (Holm *et al.* 2001, Robitaille 2005, N. La Violette, unpublished data). During the first year of the FMN surveys in 1995, only Lake St. Pierre and its archipelago were sampled. In 1997, sampling was concentrated in lotic habitats. Between 1970 and 1971, 5387 specimens were also collected in the Lake St. Pierre archipelago, in the channels of Sorel and Berthier islands. During this same period, 727 specimens were collected in Lake St. Pierre (Massé and Mongeau 1974).

In the Yamaska River watershed, inventories carried out between 1963 and 1971 confirmed the presence of the Bridle Shiner in the lower reaches of the river. In 1989, 16 specimens were collected in this river; however, an electro-fishing survey carried out in 1995 did not yield any specimens (Holm *et al.* 2001).

The Bridle Shiner was recorded in the lower part of the Châteauguay River watershed in 1968, 1975 and 1976 (Holm *et al.* 2001). However, in 1993 and 2006, electro-fishing surveys did not yield any specimens at this location.

The Bridle Shiner was caught in the St. François River in the 1940s; however, no specimens were reported during surveys carried out at this location between 1960 and 1970, and in 1991. The species was also found in the Aux Brochets River in 1941, but no specimens were observed during a systematic survey carried out in the 1970s. However, six Bridle Shiner were collected in the spring of 1990 in Bay Missisquoi (Lake Champlain), near the mouth of the Aux Brochets River (Holm *et al.* 2001).

The species was frequently observed in the Richelieu River in the late 1960s and thereafter, 27 specimens were collected in 1970 and six in 1989. In 1993, none were captured, and only one specimen was collected at the mouth of the river in 1995. To date, information appears to

indicate that the species is still present in this river, but that numbers have been declining since the1970s (Holm *et al.* 2001).

The presence of the Bridle Shiner in Lake St. Paul, in the Centre-du-Québec area, and in Lake Memphrémagog, in Estrie, has not been recently confirmed. Therefore, the current status of these populations remains unknown (Holm *et al.* 2001, Robitaille 2005).

Ontario – It is difficult to estimate Bridle Shiner population sizes or trends in Ontario, as there are few records of the species and it has never been commonly encountered. The species appears to be stable in some areas but insufficient recent sampling makes it impossible to determine its status in other areas (Holm *et al*. 2001). Population trends are also obscured by the difficulty in identifying the species (Holm *et al*. 2001).

In 1975, the Bridle Shiner was detected in Kingsford Lake (used as a water reservoir by the Gananoque Power Company) (Ontario Ministry of Natural Resources [OMNR], unpubl. data). However, it is not clear if a population remains at this location as the area has not been sampled recently. Sampling by the Royal Ontario Museum (ROM), in 1994, failed to catch any Bridle Shiner in Sutherland Creek (a new location), Finney Creek and an unnamed creek near Brewers Mills (historic locations). However, the species was detected in Wood Creek, the St. Lawrence River in the Thousand Islands region and in a new location, Jones Creek (Holm *et al*. 2001). In 1998, the species was detected in the Napanee River, near Strathcona, confirming the species' continued presence in this drainage (Holm *et al*. 2001).

In 1999, the Bridle Shiner was collected from a new location on the St. Lawrence River, on the southwest side of Hill Island (Holm *et al*. 2001). Also in 1999, several locations with historic records but lacking recent capture records were re-sampled by the OMNR, including Morton Creek and Leo Lake, where historic records dated from 1967 and 1975, respectively. The Bridle Shiner was not detected at either location during the 1999 survey and effective sampling using a bag seine was limited by the soft substrates and by water depth (Dextrase 1999). It is reasonable to assume that the species is still present in Morton Creek and Leo Lake, based on habitat conditions. Further sampling using different sampling techniques, such as electro-fishing and overnight traps, should be conducted to confirm the species' presence at these locations (Dextrase 1999). The unnamed creek near Brewers Mills where the Bridle Shiner was originally caught in 1937 is now extremely turbid and has been converted into agricultural drains along much of its reach. It is probable that the species has been extirpated from this location (Dextrase 1999). New sites with apparently suitable habitat were also sampled by the OMNR in 1999, to determine the species' presence (Dextrase 1999). A private access beach on the east side of Gananoque Lake was sampled as it appeared to have suitable habitat and was close to other sites with recorded occurrences. Although no Bridle Shiner were caught, further sampling should be conducted using a boat to access quiet, weed-filled bays (Dextrase 1999).

Surveys conducted in 2004 at 28 sites on the St. Lawrence River and Lake St. Francis (Edwards *et al.* 2008) did not detect any Bridle Shiner, while surveys of the St. Lawrence Islands National Park and Big Rideau Lake in 2005 yielded ten specimens from four sites (one site in Big Rideau Lake and three sites in the St. Lawrence Islands area) (Mandrak *et al*. 2006). In 2007, 30 sites along the Rideau Canal between Smiths Falls, Ottawa and Lake Opinicon, were sampled in an

attempt to determine the status of four species at risk, including the Bridle Shiner. However, no Bridle Shiner was detected during this survey (Mapleston *et al.* 2007).

1.4. Needs of the Bridle Shiner

1.4.1. Habitat and biological needs

Habitat Description – The Bridle Shiner is a warmwater fish that is typically found in clear, quiet areas of streams, lagoons and lakes that have an abundance of submerged aquatic vegetation (Scott and Crossman 1998). This type of environment provides food as well as shelter from predators (Holm *et al.* 2001, Robitaille 2005). In Canada, the Bridle Shiner has been captured in still waters of creeks and of the St. Lawrence River as well as in small lakes. The species is associated with various types of substrates, such as silt, organic debris, clay or gravel, but according to Scott and Crossman (1998), mud and sand bottoms are more typical of its habitat. The Bridle Shiner prefers clear or moderately clear waters, and is believed to avoid areas with high turbidity as it is a sight feeder, although, in Canada, it has been captured at sites where transparency was low (Secchi depths between 0.5 and 0.7 m) (Holm *et al*. 2001). The species is tolerant of brackish water but is not acid tolerant and this will likely limit its distribution in the Canadian Shield, which is subjected to acidification (Holm *et al*. 2001). Physical habitat at capture sites has been described as having slow-moving current, dense aquatic vegetation and substrates of organic detritus, clay, silt, gravel, rubble and rocks.

Bridle Shiner spawning habitat has been characterized as having an abundance of submerged aquatic vegetation, above which is a 15 to 50 cm layer of vegetation-free water (Harrington 1947). Spawning occurs in the water column above the vegetation. Aquatic macrophytes are essential for juvenile Bridle Shiner, which remain in amongst the vegetation in the spawning area. Larvae have cement glands enabling them to adhere to plants (Jenkins and Burkhead 1994). According to Harrington (1947), native water-milfoil (*Myriophyllum* sp.) stands seem to be optimal for the species during spawning.

A recent literature review (Giguère *et al*. 2005) to model spawning habitats of the Bridle Shiner (from early June to mid-July, for populations between Lake St. Louis and Lake St. Pierre, excluding the La Prairie basin), suggests the following spawning habitat characteristics:

- water depth ranging from 45 cm to 120 cm (excluding sites where the water depth is less than 30 cm for the period considered);
- fine substrate of clay, silt or sand;
- water velocity ranging between 0 cm/sec and 15 cm/sec; and,
- medium or high density of submerged vegetation.

The Bridle Shiner feeds on microcrustaceans, aquatic insects, detritus and living plant material. The majority of its food items are found on or above submerged aquatic plants and the species only feeds on the bottom when and where the vegetation is sparse or lacking (Harrington 1948b).

Habitat Trends in Quebec - In Quebec, the intensification of agricultural activities over the last fifty years has resulted in increased stress on aquatic environments, particularly in the St. Lawrence lowlands, which encompass the majority of the Bridle Shiner's range. The Bridle Shiner has been observed in the watersheds of the L'Assomption, Richelieu, Yamaska and St. François rivers, which are some of the most polluted rivers in Quebec. Water quality in these rivers is very poor, with high concentrations of nutrients (nitrogen, phosphorus), pesticides, suspended matter and organic matter (MDDEP 2007). These four rivers discharge into Lake St. Pierre, an area where the Bridle Shiner is abundant. It is estimated that nearly 800 000 tons of suspended matter from agricultural lands enter this lake annually. Lake St. Pierre is also influenced by the pollutant loads from agricultural lands and the highly industrialized areas found in its periphery. For example, in 2004, Hudon and Carignan (2008) estimated that the phosphorus levels in approximately 40% of Lake St. Pierre exceeded the provincial water quality criterion to protect aquatic life in rivers (phosphorus > 30 µg $P \bullet L^{-1}$). Water quality was poorest under high discharge conditions and in shallow riparian areas under the influence of small tributaries that drained farmlands.

Habitat Trends in Ontario – In Ontario, the Lake St. Francis watershed has been impacted by agricultural development, including feedlots and dairy farms, as well as corn and mixed pasture crops. Streams in this watershed, such as Wood, Gunn, Fraser and Finney creeks, have been channelized for field drainage and contain high loads of pesticides, sediments and nutrients (Holm *et al*. 2001). In the Ontario portion of the St. Lawrence River, there has been an increase in water clarity due to the presence of Zebra Mussels (*Dreissena polymorpha*), which were first discovered in the river in 1989 (Holm *et al*. 2001). An increase in clarity would be expected to enhance aquatic macrophyte growth, which in turn may benefit Bridle Shiner. However, reports on the abundance of aquatic macrophytes have been conflicting (Holm *et al.* 2001) and it is not clear what effect increased water clarity is having on vegetation densities. Although there are no data to support it, there are many anecdotal accounts of increased abundance of Eurasian water-milfoil (*Myriophyllum spicatum*) in sections of the Rideau Canal over the past few years (H. Knack, Parks Canada Agency, pers. comm. 2008), which could have a potentially negative impact on the Bridle Shiner (see Section 1.5.2). In Ontario, phosphorous levels in the St. Lawrence River have declined over the last 30 years, as the result of improvements to sewage treatment, decreased levels of industrial pollution and reductions in agricultural run-off (Holm *et al*. 2001).

1.4.2. Ecological role

The small size of the Bridle Shiner and its weak swimming ability make it an ideal forage fish (Harrington 1948a, Scott and Crossman 1998, Robitaille 2005). In the United States, it is considered to be one of the primary food sources of the Chain Pickerel (*Esox niger*) (Scott and Crossman 1998). Where the Bridle Shiner is abundant, it could constitute a significant food source for several fish species of interest to sport fishermen, including the Largemouth Bass (*Micropterus salmoides*), Redfin Pickerel (*Esox americanus*) and Yellow Perch (*Perca flavescens*) (Holm *et al.* 2001). In eastern Lake Ontario, the Bridle Shiner likely is, or used to be, an important food item for Black Crappie (*Pomoxis nigromaculatus*), Smallmouth Bass (*Micropterus dolomieu*), White Perch (*Morone americana*) and Yellow Perch (Scott and Crossman 1998).

The Bridle Shiner is one of several blackline shiners or *Notropis* species that are superficially similar, each having a prominent black lateral band that extends from the snout to the tail (e.g., Blackchin Shiner, Blacknose Shiner and Pugnose Shiner) (Holm *et al*. 2001). These species are sensitive to environmental changes such as aquatic vegetation removal, turbidity, and excessive nutrient and chemical loads (Holm *et al*. 2001). Therefore, the presence of these species in streams is a good indicator of good water quality (Scott and Crossman 1998).

1.4.3. Limiting factors

The short lifespan of this species, its disjunct distribution and its limited dispersal ability, increase its sensitivity to habitat disturbance. Isolated populations are more likely to be negatively impacted by localized stress factors, which could ultimately lead to the loss of the population (Robitaille 2005). The Bridle Shiner's specific habitat requirements, which include clear water, submersed macrophytes, adequate water depth, and slow currents, likely represents another limiting factor for the species (Holm *et al.* 2001).

1.5. Threats

The COSEWIC status report (Holm *et al*. in press) states that the Bridle Shiner has a limited distribution in Canada and is susceptible to increased water turbidity from agricultural practices and urban development.

Currently, known and suspected threats to the Bridle Shiner include agricultural pollution, urban and industrial pollution, local modification of natural flow regimes (e.g., channelization, artificial drainage and wetland filling), removal/destruction of riparian vegetation, removal/destruction of aquatic vegetation, large-scale fluctuation of water levels, climate change, exotic species and disease spread and commercial baitfish harvesting.

1.5.1. Threat classification

Table 5 summarizes known and suspected threats to the Bridle Shiner in Canada. In general, threats have been listed in order of perceived impact. The severity of the threats and the overall level of concern may vary depending on the individual populations.

The threat classification parameters are defined as follows:

Extent – the spatial extent of the threat (widespread/localized);
Occurrence – indicates if the threat is present or expected (current/imminent)
Frequency – the frequency with which the threat occurs (seasonal/continuous);
Causal Certainty – the level of certainty that it is a threat to the species (high, medium, low);
Severity – the severity of the threat (high, medium, low); and,

Overall Level of Concern – the composite level of concern regarding the threat to the species (high, medium, low).

Table 5. Threats to Bridle Shiner populations in Canada, listed in order of their overall level of concern, from highest to lowest (some variability may occur in the severity and level of concern at specific locations).

Specific Threat	**Extent** (widespread/localized)	**Occurrence** (current/imminent)	**Frequency** (seasonal/continuous)	**Causal Certainty** (high, medium, low)	**Severity** (high, medium, low)	**Overall Level of Concern** (high, medium, low)	**Stress**
Agricultural Pollution	Widespread	Current	Continuous	High	High	High	▪ Increased mortality ▪ Decreased production ▪ Reduction in available resources ▪ Modification or loss of habitat quality
Urban and Industrial Pollution	Widespread	Current	Continuous	Medium	High	High	▪ Increased mortality ▪ Decreased production ▪ Low reproductive success ▪ Physiological changes ▪ Behavioural changes
Removal/Destruction of Riparian Vegetation	Widespread	Current	Continuous	High	High	High	▪ Reduction in population abundance ▪ Reduction in available resources ▪ Increased sedimentation and turbidity
Large-Scale Fluctuation of Water Levels	Widespread	Current/ Imminent	Continuous	Medium	High	High	▪ Reduction in available resources ▪ Modification or loss of habitats
Climate Change	Widespread	Imminent	Continuous	Medium	High	High	▪ Decrease in abundance ▪ Modification or loss of habitat
Local Modification of Natural Flow Regimes	Widespread	Current	Continuous	Medium	Medium	Medium	▪ Reduction in available resources ▪ Modification or loss of habitats
Removal/Destruction of Aquatic Vegetation	Localized	Current	Continuous	High	High	Medium	▪ Low reproductive success ▪ Reduction in available resources
Exotic Species and Disease Spread	Widespread	Current	Continuous	Low	Medium/Not known	Medium	▪ Decrease in abundance ▪ Modification or loss of habitat
Baitfish Harvesting	Localized	Current	Seasonal	Medium	Medium/Low	Low	▪ Decrease in abundance

1.5.2. Description of threats

1. Agricultural Pollution: The Bridle Shiner is sensitive to the habitat degradation and poor water quality conditions that can occur in waterbodies located within intensive agricultural areas (Holm *et al.* 2001). Therefore, the species' presence can be a good indicator of environmental conditions, particularly in agricultural environments. Backfilling of marshes, channelization, eutrophication, sediment input, as well as increased turbidity, are believed to be responsible for the decline of the species across its North American range. These negative impacts are commonly associated with agricultural practices related to crop and livestock production, and particularly corn production. In Quebec, corn crops have experienced a significant expansion since 1970 throughout the range of the Bridle Shiner. Excess fertilizer (i.e., nitrogen and phosphorus), which is the principal impact of corn farming, results in the eutrophication of waterbodies, thereby negatively impacting fishes (FAPAQ 2002, Vachon 2003). With the exception of the St. Lawrence River, the majority of locations where the Bridle Shiner has been observed are seriously impacted by eutrophication (Holm *et al.* 2001, Robitaille 2005). Agricultural practices also include various contaminant inputs to which the Bridle Shiner could be exposed.

Increases in turbidity, due predominantly to agricultural practices, may prevent the Bridle Shiner from locating food and impedes the growth of submerged aquatic plants, on which the species depends (Holm *et al*. 2001). Poor land use practices contribute to turbidity through increased input of fine particulate matter that does not settle out of the water column. Grazing and trampling of riparian vegetation by livestock decreases its capacity to act as a buffer zone and increases bank erosion, sediment re-suspension, and siltation of water bodies (FAPAQ 2002, Vachon 2003).

2. Urban and Industrial Pollution: The development and exploitation of resources, as well as urbanization, are the cause of several sources of pollution throughout the Canadian range of the Bridle Shiner. The presence of urban and industrial pollutants in aquatic environments results in a decline in water quality and can have a negative impact on various stages of the life cycle of fish.

Wastewater from cities, textile mills, pulp and paper mills and mines, contains several chemicals, such as heavy metals (e.g., lead and mercury), chlorinated hydrocarbons (e.g., dichlorodiphenyltrichloroethane [DDT] and polychlorinated biphenyls [PCBs]) and polycyclic aromatic hydrocarbons (e.g., benzopyrene). Some of these chemicals disturb the endocrine system of organisms exposed to these wastewaters and cause malformations as well as reproductive and developmental problems for many fish species that co-habit with the Bridle Shiner (e.g., White Sucker [*Catostomus commersonii*], Spottail Shiner [*Notropis hudsonius*] and Copper Redhorse [*Moxostoma hubbsi*]) (de Lafontaine *et al.* 2002, Jobling and Tyler 2003, Aravindakshan *et al.* 2004). In addition, increases in turbidity or water temperature that may negatively impact the Bridle Shiner can be associated with effluent releases.

3. Local Modification of Natural Flow Regimes (e.g., Channelization, Artificial Drainage and Wetland Filling): In Quebec, more than 25 000 km of streams and rivers were straightened between 1944 and 1986 (Roy 2002) to permit or increase agricultural production.

This has resulted in the loss of many habitat features (e.g., instream cover, undercut banks), making the streams uniform in nature and creating changes in their hydrological regimes. Rain and snowmelt saturate soils with water and increase flow rates; this is intensified in streams that have been straightened, resulting in higher turbidity, the collapse of riverbanks and shoreline erosion (FAPAQ 2002, Robitaille 2005). This would likely have a negative impact on Bridle Shiner populations. In Ontario, the tributaries of Lake St. Francis, which have been historically inhabited by the Bridle Shiner (i.e., Wood, Finney, Gunn and Fraser creeks), are located within agricultural areas. Stretches of these tributaries are now maintained (i.e., dredged) as agricultural drains; this has negatively impacted the Bridle Shiner (B. Jacobs, Raisin Region Conservation Authority, pers. comm. 2008).

During low flow periods in summer and winter, reduced water infiltration due to runoff and drainage practices as well as increased urbanization and the related increase in impermeable surfaces (i.e., more paved areas), result in lower aquifers and interrupted base flows. In some cases this can cause stream desiccation, which could negatively impact Bridle Shiner populations (FAPAQ 2002, Robitaille 2005).

4. Removal/Destruction of Riparian Vegetation: The removal or destruction of riparian vegetation is believed to be of greater concern for Bridle Shiner populations within Quebec and the extreme eastern portion of the species' Ontario distribution, in the Cornwall area. Any human intervention likely to result in increased turbidity can be harmful to the Bridle Shiner (Holm *et al.* 2001). Riparian zones play a significant role in protecting water quality. They slow down and capture particles that are washed onto the soil surface and retain the soil while protecting the banks from lateral erosion. Deforestation and the removal of riparian zones to increase cultivable areas can result in an increase in runoff, water temperature, as well as sediment and nutrient loading in waterbodies (FAPAQ 2002, Vachon 2003). Excessive siltation can suffocate deposited eggs, reduce oxygen availability in the substrate and reduce the abundance of food resources (Holm and Mandrak 1996).

5. Removal/Destruction of Aquatic Vegetation: As with the removal or destruction of riparian vegetation, this threat is believed to be of greater concern for Bridle Shiner populations within Quebec and the extreme eastern portion of the species' Ontario distribution, around Cornwall. Whether it is for spawning or feeding, sites occupied by the Bridle Shiner are typically characterized by an abundance of submerged vegetation. The physical or chemical removal of aquatic macrophytes (e.g., for drain cleanouts, recreational purposes or aesthetic reasons) would be expected to negatively impact the Bridle Shiner (Holm *et al*. 2001). Additional factors that are likely to destroy or reduce aquatic vegetation density include changes in water levels (e.g., as a result of dams), wave action of passing boats, channelization, agricultural drainage, runoffs, pollutants, and exotic plants such as Eurasian water-milfoil (Holm *et al.* 2001, Robitaille 2005).

6. Large-Scale Fluctuation of Water Levels: Fluctuating water levels in the St. Lawrence River are a result, in part, of anthropogenic factors such as hydroelectric dams, agricultural drains and water-taking activities. The river level is controlled to limit spring flooding, facilitate commercial shipping and generate hydroelectric power. The construction of the St. Lawrence Seaway also brought about considerable changes in flow and has an ongoing effect

on water levels. Dredging of the shoals and shipping lanes concentrates the flow in the main channel, reduces current velocity in shallow areas and increases sediment deposition. This leads to habitat dessication and loss of submerged aquatic vegetation.

7. Climate Change: Global climate change is expected to have significant effects on the aquatic communities of the Great Lakes and St. Lawrence basin because of major changes in hydrological cycles and in the type and availability of aquatic ecosystems (Environment Canada 2001, Lemmen and Warren 2004). Climate prediction models are becoming more powerful and accurate and they point towards major global and local climate change by the year 2020 (Bourque and Simonet 2008).

In the Great Lakes and St. Lawrence basin, forecasted drying will be associated with a reduction in annual stream flow and lake levels and by the disappearance of ponds and wetlands (Environment Canada 2001, Bourque and Simonet 2007). Models predict reduced flows in tributaries of the St. Lawrence (Croley 2003, Fagherazzi *et al.* 2005). Lefaivre (2005) concludes that water levels in the St. Lawrence, around Montreal, will be reduced by 0.2 m to 1.2 m and predicts a reduction in open water surfaces, particularly in the relatively shallow Lake St. Pierre area.

Within the Canadian range of the Bridle Shiner, Bourque and Simonet (2008) expect warmer winters, summer "tropicalization", and an increase in frequency, intensity, and duration of extreme climatic events. This anticipated increase in the frequency and magnitude of extreme weather events such as higher precipitation rates, accelerated runoff and snowmelt, will produce higher leaching of sediment and soil erosion and the increased transport of pollutants and nutrients into waterbodies (Environment Canada 2001). Additionally, warming trends may favour the establishment of potentially harmful exotic species that may currently be limited by cooler water temperatures (Environment Canada 2001, Drew *et al*. 2002). Water-taking as a result of increased demand could further alter habitats (Environment Canada 2001).

Bourque and Simonet (2008) suggest that climate change presents a greater challenge for species at risk with fragmented habitats and low migratory capacity, already coping with several stress factors.

Doka *et al*. (2006) achieved an assessment of the projected impacts of climate change on coastal wetland fish assemblages in the lower Great Lakes (Bridle Shiner did not occur in the area of study). They found that Pugnose Shiner was highly vulnerable to climate-induced changes in coastal wetlands and nearshore habitats. Pugnose Shiner was ranked sixth most vulnerable out of 99 species assessed. Given the similarities in the two species with respect to habitat requirements, it is reasonable to believe that Bridle Shiner would be as sensitive as the Pugnose Shiner to the impacts of climate change. Furthermore, the only remaining area where the Bridle Shiner is found in abundance is Lake St. Pierre, where the species is likely to be affected by forecasted lower water levels and a reduction in surface area covered by shallow aquatic vegetation (Robitaille 2005).

8. Exotic Species and Disease Spread: Exotic species may affect the Bridle Shiner through several different pathways, including the restructuring of aquatic food webs and competition for space, habitat and food. There are at least 185 exotic species established in the Great Lakes and 88 in the fluvial St. Lawrence (Y. De Lafontaine, Environment Canada – Centre Saint-Laurent, comm. pers. 2009, NCRAIS 2009), some of which impact native species, including species at risk. Dextrase and Mandrak (2006) indicate that while habitat loss and degradation constitute the principal threat affecting aquatic species at risk, exotic species are the second most prevalent threat, affecting 26 of 41 federally-listed freshwater fishes across Canada.

The Common Carp (*Cyprinus carpio*), Round Goby (*Neogobius melanostomus*) and Zebra Mussel are exotic species that have had a dramatic impact on many aquatic species and will continue to alter ecosystems and ecosystem processes. The effects of exotic species such as Common Carp and Round Goby on the Bridle Shiner are unknown. Common Carp could have a negative impact on the species through their habit of uprooting aquatic macrophytes essential to the survival of the Bridle Shiner. This would result in a loss of aquatic vegetation and an increase in turbidity levels. In areas where Round Goby has become abundant, the abundance of native benthic fishes (e.g., darters [*Percina* spp., *Etheostoma* spp.]) has declined (e.g., Baker 2005); however, it is unclear how the Round Goby may impact the Bridle Shiner. The Zebra Mussel may actually have a positive impact on the Bridle Shiner as its presence results in increased water clarity which would allow more light to penetrate the water, thereby encouraging aquatic macrophyte growth.

Exotic plant species are also a concern in coastal wetland areas as they can significantly change vegetation communities. For example, the introduction in the 1940s of Eurasian water-milfoil, an invasive exotic species, could have a negative impact on the Bridle Shiner. Unlike native species of milfoil, Eurasian water-milfoil forms a dense canopy over the water surface, effectively eliminating the preferred spawning habitat of the Bridle Shiner. This species is of particular concern to the Bridle Shiner as it has been associated with the decline of Blackchin Shiner, Blacknose Shiner, Pugnose Shiner, three species closely related to the Bridle Shiner, as well as the Common Shiner (*Luxilus cornutus*) (Lyons 1989, Holm *et al*. 2001). The impact of the Eurasian water-milfoil on Canadian populations is consequently expected to be negative (Holm *et al.* 2001, Auger 2006). The potential impacts of other exotic plant species, such as the water chestnut (*Trapa natans*) on the Bridle Shiner have not been investigated.

Diseases such as Viral Hemorrhagic Septicemia (VHS) are a concern. There are currently no known cases of VHS affecting the Bridle Shiner, and the impact of VHS on this species has not been studied. However, VHS was confirmed from a fish die-off in Hamilton Harbour (western Lake Ontario) in May 2007 (CFIA 2010) and the virus is known to be present in the Lake Ontario watershed. The Canadian Food Inspection Agency (CFIA) considers that the freshwater portion of the St. Lawrence River, east of the Moses-Saunders Dam and directly linked to Lake Ontario, constitutes a watershed which is at high risk of infection (CFIA 2010). In 2007, CFIA implemented a monitoring program to track the virus in wild fishes in Canada, with contributions by its Aquatic Animal Health Division, Fisheries and Oceans Canada (DFO), the Animal and Plant Health Inspection Service of the U.S. Department of

Agriculture, the U.S. Fish and Wildlife Service, and the Great Lakes Fish Health Committee (CFIA 2010).

9. Commercial Baitfish Harvesting: In Quebec, a study assessing the impacts of the commercial baitfish industry on five fishes at risk was conducted in the fall of 2005. Over 60 Bridle Shiner were found among the more than 41 500 fish that were sampled in tanks of commercial baitfish harvesters and retailers. The majority of the Bridle Shiner was harvested by the commercial baitfish harvesters in Lake St. Pierre, confirming that the species is common in this location (Boucher *et al*. 2006). However, the low fishing pressure in this area and the few specimens collected by bait fishermen during the survey indicate that Bridle Shiner populations are not significantly affected. Furthermore, in a similar summer survey in 2007, no Bridle Shiner were identified in the live-wells of commercial baitfish harvesters or retailers. Results from this study also suggest that the impacts of commercial baitfish harvesting on the Bridle Shiner are very low (Garceau *et al.* in press). In addition, mitigation measures are included in the baitfish harvesting permit and could be adapted to Bridle Shiner management. These measures include commercial harvesting exclusion periods and zones.

In Ontario, the extent to which the Bridle Shiner is affected by baitfish harvesting remains unknown. Baitfish harvesting is regulated in Ontario and the Bridle Shiner is not a legal baitfish (Cudmore and Mandrak 2005, OMNR 2008). However, it may be subject to incidental catch should the baitfish harvest occur in areas occupied by the species.

1.6. Actions Already Completed or Underway

Quebec –

Surveys: In 2006, an inventory of fish species at risk was conducted in the Montérégie and Outaouais regions to establish the distribution of Eastern Sand Darter (*Ammocrypta pellucida*), Channel Darter (*Percina copelandi*) and Bridle Shiner. Specifically, this inventory targeted the watersheds of the Châteauguay River, in Montérégie (Garceau *et al.* 2007), and the Ottawa River, in Outaouais (Pariseau *et al.* 2007). This study was conducted by the Ministère des Ressources naturelles et de la Faune (MRNF), with the collaboration of DFO and the Société Provancher d'histoire naturelle du Canada.

In 2002, an ichthyological inventory of rare fish species (Eastern Sand Darter, Channel Darter and Bridle Shiner) was carried out in the southern part of the Assomption River watershed, in the Lanaudière region. Sampling was specifically conducted in L'Assomption, Ouareau and L'Achigan rivers. This project was carried out by CARA, in collaboration with the MRNF and the Des Seigneuries ZIP (Zone d'intervention prioritaire/Area of Prime Concern) Committee (CARA 2002).

The FMN has been conducting systematic sampling of the fish communities in six areas of the St. Lawrence River upstream from Quebec City since 1995: Lake St. Francis, Lake St. Louis, the Montréal-Sorel reach (beginning in 2001), Lake St. Pierre and its archipelago, the Bécancour-Batiscan reach and the Grondines–St. Nicolas reach (La Violette *et al.* 2003). The locations

were first sampled in 1995-1997. A second round of sampling was conducted in 2001-2006, and a third round was begun in 2007.

Baitfish Studies: In 2005, a study was conducted in collaboration with baitfish harvesters to assess the impact of the fall commercial baitfish industry on five SARA-listed fish species: Copper Redhorse, Grass Pickerel (*Esox americanus vermiculatus*), Bridle Shiner, Eastern Sand Darter and Channel Darter. A report was submitted to DFO by the Quebec MRNF with the collaboration of the Société Provancher d'histoire naturelle du Canada (Boucher *et al.* 2006). In the summer of 2007, another survey continued the project launched in 2005 (Garceau *et al.* in press). This study was carried out by the Quebec MRNF in collaboration with the Comité de concertation et de valorisation du bassin de la rivière Richelieu (COVABAR) and with the help of DFO (financial support).

Restoration work: In Quebec, restoration work in agricultural watercourses is planned or has been successfully undertaken by local non-profit organizations. Funds from the federal government's Habitat Stewardship Program for Species at Risk are used to finance these actions.

Ontario –

Baitfish Study: A graduate student from the University of Toronto is conducting a study (initiated in 2007) to examine the impacts of baitfish harvesting on species at risk and the distribution and spread of exotic species. The study is being conducted in cooperation with DFO.

Recent Surveys: Table 6 summarizes recent (since 2000) fish surveys conducted by various organizations throughout the Ontario range of the Bridle Shiner. These surveys did not specifically target the Bridle Shiner, with the exception of the Rideau Canal survey, which targeted four species at risk, including the Bridle Shiner.

Table 6: Summary of recent fish surveys (since 2000) throughout the Ontario range of the Bridle Shiner.

Water body/General Area	Survey Description (years of survey effort)
St. Lawrence River – St. Lawrence Islands National Park	• DFO/St. Lawrence Islands National Park, 2005 [a,b,c,d]
St. Lawrence River	• DFO, fish assemblage survey, 2004[a]
Lake St. Francis	• DFO, fish assemblage survey, 2004[a]
Rideau Canal	• Targeted species at risk survey, Parks Canada Agency, 2007, 2008 [b, e, f, g]

a – electro-fishing from a boat; b – seine net; c – fyke net; d – minnow trap; e – hoop net; f – trap net; g –backpack electro-fishing.

1.7. Knowledge Gaps

Additional knowledge of the distribution, abundance and population trends of Bridle Shiner populations in Canada is required. The species has never been thoroughly studied and available information on the species is limited. It is particularly important to measure population demographics in the portions of the St. Lawrence River where the species is still abundant. Moreover, as the Bridle Shiner can be easily confused with the Blacknose Shiner and other species of blackline shiners, re-examination of preserved specimens in government and museum collections would aid in clarifying historical distribution patterns.

Current knowledge on the species' biology comes primarily from studies carried out in New England in the 1940s by Harrington (1947, 1948a, b). Additional basic data concerning habitat and life-history requirements and threats facing Canadian Bridle Shiner populations are necessary to prioritize habitat restoration activities for the species. The expanding range of Eurasian water-milfoil, an invasive exotic plant, and its impact on Bridle Shiner populations requires further study. Habitat fragmentation by dams, water-crossings or culverts should also be regarded as a threat to the Bridle Shiner and their impacts should be studied further.

Research on Bridle Shiner genetics could help distinguish between populations or estimate population sizes. Currently, there is no information available on the genetics of the species.

1.8 Federal and Provincial Legal Protection

Canada – In addition to SARA, the *Fisheries Act* and its supporting regulations have direct or indirect applications to the management of the Bridle Shiner and its habitat. The *Fisheries Act* has provisions that (a) make fish passage mandatory and require the construction of fish-ways (when deemed appropriate by the Minister) (section 20); (b) prohibit the destruction of fish by means other than fishing, unless authorized (section 32); (c) prohibit the harmful alteration, disruption or destruction of fish habitat, unless authorized (section 35); and, (d) prohibit, subject to regulations, the deposit of deleterious substances into waters frequented by fish (section 36). The provisions of the *Fisheries Act* and supporting regulations are mostly administered by DFO. Environment Canada administers section 36 of this Act which pertains to the release of deleterious substances into watercourses. The *Canadian Environmental Assessment Act* (CEAA) requires the assessment of the environmental effects of a proposed project. Environmental effects are, among other things, "any change that the project may cause in the environment, including any change it may cause to a listed wildlife species, its critical habitat or the residences of individuals of that species, as those terms are defined in subsection 2(1) of the *Species at Risk Act*." In addition, section 79 of SARA requires that, during the CEAA review of a project, all effects of the project on a listed species must be identified. If the project is carried out, measures must be taken that are consistent with applicable recovery strategies or action plans to avoid or lessen those effects (mitigation measures) and to monitor those effects.. Finally, Bridle Shiner habitat located within the St. Lawrence Islands National Park is afforded protection through the *Canada National Parks Act* and related regulations, which are administered by the Parks Canada Agency. In the Rideau Canal, habitat is protected through enforcement of the *Historic Canal Regulation* under the *Department of Transport Act*.

Quebec – Bridle Shiner habitat is protected by two pieces of Quebec's legislation. The Wildlife Habitats Chapter IV.1 of *An Act respecting the conservation and development of wildlife* protects fish habitat on public lands. All activities that are likely to modify a biological, physical or chemical component of fish habitat are prohibited, aside from the exceptions mentioned in the regulations.

Additionally, the *Environment Quality Act* (EQA) protects fish habitat by prohibiting the release or emission into the environment of any contaminant likely to be prejudicial to wildlife, beyond the quantity or concentration established by the regulations, whether on private or public lands. The EQA also regulates the development and implementation of the Politique de protection des rives, du littoral et des plaines inondables (Protection policy for lakeshores, riverbanks, littoral zones and floodplains) that aims to protect lakes and streams. This policy establishes minimum standards that must, under *An Act respecting land use planning and development*, be adapted in development plans of regional municipalities. Additionnaly, under the terms of the *Agricultural Operations Regulation* of the EQA, with the exception of fords, it is prohibited as of April 1st, 2005, to allow livestock free access to water bodies and shorelines.

Ontario – In Ontario, subsection 3(5) of the *Planning Act* requires that decisions taken by various bodies "be consistent with" provincial policy statement issued under subsection 3(1) of that Act. Paragraph 2.1.3(a) of the *Provincial Policy Statement, 2005* prohibits development and site alteration in the "significant habitat of endangered species and threatened species". This will indirectly benefit species of special concern that co-habit with endangered or threatened species. Subsection 2.1.5 of the *Provincial Policy Statement, 2005* prohibits development and site alteration in fish habitat except in accordance with provincial and federal requirements which provides some protection to Bridle Shiner habitat. Stream-side development in Ontario is managed through floodplain regulations enforced by local conservation authorities. A majority of the land adjacent to the rivers inhabited by the Bridle Shiner is privately owned; however, the river-bottom is generally owned by the Crown. Subject to permission being granted by the Raisin Region Conservation Authority, aquatic habitats in the Ontario tributaries of Lake St. Francis below Highway 2, which contain Bridle Shiner populations, are protected against wetland fill-in by the *Raisin Region Conservation Authority: Regulation of Development, Interference with Wetlands and Alterations to Shorelines and Watercourses* (O.Reg. 175/06), which is administered by the Raisin Region Conservation Authority (Holm *et al*. 2001). Bridle Shiner habitat may also be indirectly protected under the *Environmental Assessment Act*, *Environmental Protection Act* and the *Water Resources Act*.

2. MANAGEMENT

2.1. Goal

The goal of this management plan is to maintain and enhance Bridle Shiner populations and their habitats, to ensure that viable populations are present throughout the species' current and historic range in Canada.

2.2. Objectives

Short-term objectives (over a five year period)

i. To ensure the protection of known populations and habitats;

ii. To evaluate threat factors impacting the species and its habitat;

iii. To improve the quality of impacted habitats currently used by the Bridle Shiner;

iv. To determine the extent, abundance and demographics of Bridle Shiner populations;

v. To increase public awareness regarding the presence, threats and conservation of the Bridle Shiner and its habitat, and its status as a Canadian species at risk; and,

vi. To develop contacts and raise awareness among the various partners, recovery teams, interest groups, organizations and landowners interested in supporting the conservation of the Bridle Shiner.

2.3. Actions

2.3.1. Research

Habitat requirements

Research is required to determine the age-specific and seasonal habitat needs of the Bridle Shiner, including spawning and nursery habitat, home range and species movement. This information is required to achieve the management objective to protect and restore Bridle Shiner habitats and will help to define current and potentially suitable habitats for the species.

Population dynamics

Bridle Shiner population dynamics have never been studied in Canada. Information regarding population structure, mortality rates, productivity, recruitment and migratory behaviour is lacking for this species. Such information is necessary to ensure accurate monitoring of population trends, to determine limiting life-stages (eggs, juveniles or mature individuals) and to prevent disturbance of the species during critical phases in the life cycle.

Threat evaluation

It is important to investigate and evaluate the significance of threats facing Canadian Bridle Shiner populations, both locally and throughout the species' Canadian distribution. To be effective, research should focus on perceived high priority threats. Known threats currently impacting closely related species should also be investigated to assist in evaluating threats to the Bridle Shiner.

2.3.2. Population Inventory and Monitoring

Consolidate existing Bridle Shiner data and create a centralized database in Quebec

The protection and management of a species requires knowledge of its habitat needs. Miscellaneous information on the Bridle Shiner is available in the regional offices of the MRNF and in other institutions. Available Bridle Shiner information, including habitat characteristics, will be entered into a data management system to facilitate the protection of areas where Bridle Shiner is known to occur. A clearer and more complete picture of this species' situation can be drawn from the integration of available information on the Bridle Shiner, which will also outline future research priorities. Data dissemination would be ensured by the Centre de données sur le patrimoine naturel du Québec (CDPNQ), an organization already established and accessed by various stakeholders in wildlife management. This action is ongoing.

Establish standardized sampling and identification methods

Given the apparent decline of some Bridle Shiner populations in Canada, non-lethal methods for capturing and identifying the species are recommended. The protocol for detecting species at risk in the Ontario side of the Great Lakes (Portt *et al.* 2008) includes methods for sampling the Bridle Shiner, which should be used when targeting the species. Methods should be standardized to allow long-term monitoring and comparisons of Bridle Shiner populations. Field personnel conducting surveys should have appropriate fish identification training, including the identification of species at risk, such as provided by the ROM. A field fact sheet describing key features of the blackline shiner group (e.g., Blackchin Shiner, Bridle Shiner and Pugnose Shiner) should be developed.

Habitat mapping – potential habitat locations

A survey of Bridle Shiner habitat across the species' Canadian range is required. A habitat mapping tool to identify potential Bridle Shiner locations across the species' Canadian range will be necessary to aid in survey efforts, considering the extent of the area to be covered and the paucity of available resources.

Targeted habitat surveys will help to identify Bridle Shiner habitats, including significant locations such as spawning grounds, rearing areas and congregation sites. This would also facilitate recommendations for habitat protection under SARA, should the species be re-classified at a higher level (e.g., endangered, threatened).

Surveys – current, historic and potential locations

The extent of the species' distribution in Canada will be more thoroughly defined by conducting targeted surveys in areas where Bridle Shiner is known to exist, areas where the species was found historically and in areas containing suitable habitat but lacking Bridle Shiner records.

2.3.3. Habitat protection and restoration

Habitat protection

Actions to protect and restore habitats include:
- ensuring that stakeholders and proponents have access to or are aware of the habitat needs of the Bridle Shiner;
- considering additional mechanisms for protecting fish habitat (e.g., land acquisition, land trusts);
- encouraging the rehabilitation and conservation of riparian zones; and,
- ensuring that land use planning and re-zoning take into account the requirements of the Bridle Shiner (e.g., by specifying locations in development plans where the species is known to exist and by implementing appropriate actions when defined.)

Habitat stewardship

Efforts must be made to encourage stewardship initiatives to improve habitat quality (e.g., planting of riparian vegetation, restricting livestock access to streams) and to increase the awareness of landowners, private companies, volunteer organizations, aboriginal communities and citizens. Stewardship programs provide assistance in sound decision-making and facilitate the conservation of species at risk and their habitats. They also help increase awareness among the general public and interest groups regarding the threats facing the Bridle Shiner. Management practices beneficial to fish and fish habitat (e.g., in Ontario, Best Management Practices Series http://www.omafra.gov.on.ca/english/environment/bmp/series.htm) will also be encouraged and facilitated.

Sampling guidelines and methods

Proponents requesting to conduct work that may impact Bridle Shiner habitat, in areas where species presence is highly probable but unsupported by current data, will be required to carry out targeted surveys using standardized sampling techniques proven effective at detecting the species. Low impact sampling techniques will be used to avoid jeopardizing the survival of the population.

Habitat restoration

A list should be drawn up of the sites that should be given priority for habitat restoration activities, including sites where the species has been extirpated, and potential new sites. This list should be included in the Atlas of Bank Restoration Sites of the St. Lawrence River (http://www.qc.ec.gc.ca/faune/AtlasDeRestaurationDesRivesDuSaint-Laurent/). Restoration work should be facilitated at high priority locations. In Ontario, restoration activities should target the eastern portion of the species' range (Cornwall area).

2.3.4. Outreach and Communication

Outreach and communication plan

A plan to raise awareness and facilitate communication should be developed and implemented to inform the public about the Bridle Shiner, where it occurs and its status as a Canadian species at risk and to raise public interest and involvement in conservation activities. The plan should outline objectives, identify target audiences, and select the most efficient means of communication. To ensure a coordinated approach, the communication plan will be developed in cooperation with existing management or recovery plans (single-species, multi-species and ecosystem-based plans) covering the range of the Bridle Shiner.

2.3.5. Partnerships and Coordination

Identify prospective partners and funding programs

Prospective partners and funding programs must be engaged to ensure the wide-scale implementation of actions. For example, research partners and university grants could facilitate further research and add to our knowledge of the species. Funding programs for agri-environmental activities should take into consideration the requirements of healthy aquatic ecosystems.

Coordination with recovery teams and other complementary groups

A coordinated approach is recommended between the National Bridle Shiner Recovery Team and other single-species, multi-species or ecosystem-based recovery teams (see Section 4.0 Associated Plans). This will maximize opportunities to share resources and information, and combine efforts during the implementation of management actions for the Bridle Shiner. Opportunities also exist to achieve management objectives through integration with ongoing watershed planning or source water protection planning.

2.4. Effects on Other Species

Proposed management actions will benefit the environment in general. It is likely that implementation of the suggested actions will benefit a wide variety of native species, including other co-occurring species at risk. No negative impacts on other species resulting from implementation of Bridle Shiner management actions are expected.

3. PROPOSED IMPLEMENTATION SCHEDULE

Fisheries and Oceans Canada and Parks Canada Agency encourage other agencies and organizations to participate in the conservation of the Bridle Shiner through the implementation of this management plan. Table 7 summarizes those actions that are recommended to support the management goals and objectives. The activities implemented by DFO and Parks Canada Agency will be subject to the availability of funding and other required resources. Where appropriate, DFO and Parks Canada Agency will request specific organizations and sectors to provide the necessary expertise and capacity to carry out the listed actions. However, the identification of specific organizations is intended to be advice to the other agencies, and carrying out these actions will be subject to each agency's priorities and budgetary constraints.

1 **Table 7.** Implementation schedule.
2

Actions	Objectives	Priority	Threats Addressed†	Recommended Participating Agencies ††		Approximate Timeframe[1]
				Quebec	Ontario	
Research						
Habitat requirements	i, iii, and iv	High	All threats (1 to 9)	MRNF, DFO, CWS, MDDEP, Universities	DFO, OMNR, PCA, CA, Universities	1 to 5 years
Population dynamics	iv	High	All threats (1 to 9)	MRNF, Universities	DFO, OMNR, PCA, Universities	1 to 5 years
Threat evaluation	ii	High	All threats (1-9)	MRNF, DFO	DFO, OMNR, PCA, CA, Universities	
Population Inventory and Monitoring						
Information consolidation and data management	iv	High	All threats (1 to 9)	MRNF	DFO, ROM, OMNR, CMN, CA	1 year
Establish standardized sampling and identification methods	i	High	All threats (1 to 9)	MRNF	DFO, OMNR, ROM, CMN	1 year
Habitat mapping – potential habitat locations	iv	High	All threats (1 to 9)	MRNF	DFO, OMNR, PCA, CA, Universities	1 to 3 years
Surveys – current, historic and potential locations	iv	High	All threats (1 to 9)	MRNF	DFO, OMNR, PCA, CA, Universities	1 to 5 years
Habitat Protection and Restoration						
Habitat protection	i, ii	High	All threats (1 to 9)	MRNF, MDDEP, DFO, EC, MRC, municipalities	DFO, OMNR, PCA, CA, EC	1 to 5 years
Habitat stewardship	i, ii, v, vi	High	1 to 6 and 8, 9	MRNF, DFO, Landowners, private companies, non-profit organizations, aboriginal communities, MRC, municipalities	DFO, OMNR, PCA, CA	1 to 5
Sampling guidelines and methods	ii, iv, vi	High	1 to 6 and 8, 9	MRNF, MDDEP, DFO	DFO, OMNR, CA	1 to 5
Habitat restoration	ii, iii	Medium	All threats (1 to 9)	MRNF, DFO, EC, Non-profit organizations	DFO, OMNR, PCA, CA, EC	1 to 5

Table 7 (Con't). Implementation schedule.

Action	Objectives	Priority	Threats Addressed	Participating Agencies††		Approximate Timeframe[1]
				Quebec	Ontario	
Communication and Awareness						
Outreach and communication plan	v and vi	Medium	All threats (1 to 9)	MRNF, DFO, Non-profit organizations	DFO, OMNR, PCA, CA	1 to 5 years
Partnerships and Coordination						
Prospective partners and funding programs	All	High	N.A.	MRNF	DFO, OMNR, PCA, Universities, CA	1 to 5 years
Coordination with recovery teams and other complementary groups	All	High	N.A.	MRNF, DFO, Non-profit organizations	DFO, OMNR, PCA, CA	Ongoing

[1] Timeframes are subject to change in response to demands on resources.

† See section: *1.5.2. Threat description*

†† Acronyms: **CA:** Conservation Authorities (Ontario)
CMN: Canadian Museum of Nature
CWS: Canadian Wildlife Service
DFO: Fisheries and Oceans Canada
EC: Environment Canada
MDDEP: Quebec Ministère du Développement durable, de l'Environnement et des Parcs
MRC: Municipalités régionales de comté
MRNF: Quebec Ministère des Ressources naturelles et de la Faune
OMNR: Ontario Ministry of Natural Resources
PCA: Parks Canada Agency
ROM: Royal Ontario Museum

4. ASSOCIATED PLANS

There are no associated plans that deal specifically with the Bridle Shiner. However, management plans and recovery strategies are in development for the Grass Pickerel, Pugnose Shiner and Copper Redhorse, three species at risk with distributions that overlap that of the Bridle Shiner. These plans are all relevant to the management of the Bridle Shiner.

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Jacobs, Brendan. Raisin Region Conservation Authority, Ontario.

Knack, Hillary. Parks Canada Agency. Rideau Canal National Historic Site of Canada.

La Violette, Nathalie. Ministère des Ressources naturelles et de la Faune, Secteur Faune Québec, Direction de la recherche sur la faune.

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6. CONTACTS

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The following members of the Ontario Freshwater Fish Recovery Team were involved in the development of the management plan for the Bridle Shiner:

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APPENDIX 1. DEFINITION OF STATUS RANKING

National Designations:

COSEWIC Status – Status assigned to species by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). COSEWIC was established in 1977 and has been included in the *Species at Risk Act* as an independent body of experts, for the purpose of evaluating and assigning national conservation status to species at risk. This committee is an apolitical committee that includes representatives of federal, provincial and territorial governments, as well as university and museum academics and independent biologists with expertise in relevant fields. Each species receives a status designation from COSEWIC following the completion and review of a species status report. Status reports contain information on the biology, range, abundance and possible threats to the species (for more information on national status definitions see http://www.cosewic.gc.ca/index.htm).

EXT (Extinct) – A species that no longer exists.

EXP (**Extirpated) –** A species no longer existing in the wild in Canada, but exists elsewhere.

END (**Endangered)** – A wildlife species facing imminent extirpation or extinction.

THR (**Threatened)** – A wildlife species that is likely to become endangered if nothing is done to reverse the factors leading to its extirpation or extinction.

SC (Special Concern) – A wildlife species that may become threatened or endangered because of a combination of biological characteristics and identified threats.

DD (Data Deficient) – A category that applies when the available information is insufficient (a) to resolve a wildlife species' eligibility for assessment or (b) to permit an assessment of the wildlife species' risk of extinction.

NAR (Not At Risk) – A wildlife species that has been evaluated (by COSEWIC) and found to be not at risk of extinction given the current circumstances.

Provincial Designations:

Quebec species at risk legislation: *An Act respecting threatened or vulnerable species*

Vulnerable Species – Any species whose survival is at risk even if its disappearance is not foreseen.

Threatened Species – Any species whose disappearance is foreseen.

For more information see: http://www.mrnf.gouv.qc.ca/lois/lois-faune.jsp.

Ontario:

Species at Risk in Ontario List Status – Ontario's new *Endangered Species Act, 2007* (ESA 2007) came into effect June 2007. Species thought to be at risk are assessed by The Committee on the Status of Species at Risk in Ontario (COSSARO). COSSARO is an independent body that reviews species based on the best available science, including community knowledge, and Aboriginal Traditional Knowledge. Species listed "at risk" are automatically placed on the official Species at Risk in Ontario (SARO) List. (For more information see: http://www.mnr.gov.on.ca/en/Business/Species/2ColumnSubPage/276722.html).

For the purposes of this Act, COSSARO shall classify species in accordance with the following rules:

Extirpated (EXP) - A species is classified as an extirpated species if it lives somewhere in the world, lived at one time in the wild in Ontario, but no longer lives in the wild in Ontario.

Endangered (END) - A species is classified as an endangered species if it lives in the wild in Ontario but is facing imminent extinction or extirpation.

Threatened (THR) - A species is classified as a threatened species if it lives in the wild in Ontario, is not endangered, but is likely to become endangered if steps are not taken to address factors threatening to lead to its extinction or extirpation.

Special Concern (SC) - A species is classified as a special concern species if it lives in the wild in Ontario, is not endangered or threatened, but may become threatened or endangered because of a combination of biological characteristics and identified threats.

COSSARO may also identify species as Extinct, Data Deficient or Not at Risk. These species do not receive protection under the ESA 2007 and are not included on the SARO list.

NatureServe Global Ranks and Subnational/Provincial Ranks:

Global Rank (GRank) – Global ranks are assigned by a consensus of the network of natural heritage programs (Conservation Data Centres), scientific experts and The Nature Conservancy (http://www.tnc.org) to designate a rarity rank based on the range-wide status of a species, subspecies or variety. The most important factors considered in assigning global ranks are the total number of known, extant sites worldwide, and the degree to which they are potentially or actively threatened with destruction. Other criteria include the number of known populations considered to be securely protected, the size of the various populations and the ability of the taxon to persist at its known sites. The taxonomic distinctness of each taxon has also been considered. Hybrids, introduced species and taxonomically dubious species and varieties, have not been included (for more information on global ranks see http://www.natureserve.org/explorer/granks.htm.

GX (Presumed Extinct [species]) — Not located despite intensive searches and virtually no likelihood of rediscovery. Eliminated (ecological communities)—Eliminated throughout its range, with no restoration potential due to extinction of dominant or characteristic species.

GH (Possibly Extinct [species]) — Missing; known from only historical occurrences but still some hope of rediscovery. Presumed Eliminated - (historic, ecological communities) - Presumed eliminated throughout its range, with no or virtually no likelihood that it will be rediscovered, but with the potential for restoration, for example, American Chestnut (Forest).

G1 (Critically Imperilled) – At very high risk of extinction due to extreme rarity (often 5 or fewer populations), very steep declines, or other factors.

G2 (Imperilled) – At high risk of extinction due to very restricted range, very few populations (often 20 or fewer), steep declines, or other factors.

G3 (Vulnerable) — At moderate risk of extinction due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors.

G4 (Apparently Secure) — Uncommon but not rare; some cause for long-term concern due to declines or other factors.

G5 (**Secure) —** Common; widespread and abundant.

GU (Unrankable) — Currently unrankable due to lack of information or due to substantially conflicting information about status or trends. Whenever possible, the most likely rank is assigned and the question mark qualifier is added (e.g., G2?) to express uncertainty, or a range rank (e.g., G2G3) is used to delineate the limits (range) of uncertainty.

National (NRank) and Subnational/Provincial Rank (SRank) – The term "national" refers to the assignment of a rank at a country-scale. The term "subnational" refers to state or province-level jurisdictions (e.g., California, Ontario). Assigning national and subnational conservation status ranks for species and ecological communities follows the same general principles as used in assigning global status ranks. However, a subnational rank cannot imply that the species or community is more secure at the state/province level than it is nationally or globally (i.e., a rank of G1S3 cannot occur), and similarly, a national rank cannot exceed the global rank. Subnational ranks are assigned and maintained by state or provincial natural heritage programs and conservation data centers.

NX, SX (Presumed Extirpated) — Species or community is believed to be extirpated from the nation or state/province. Not located despite intensive searches of historical sites and other appropriate habitat, and virtually no likelihood that it will be rediscovered.

NH, SH (Possibly Extirpated [Historical]) — Species or community occurred historically in the nation or state/province, and there is some possibility that it may be rediscovered. Its presence may not have been verified in the past 20-40 years. A species or community could become NH or SH without such a 20-40 year delay if the only known occurrences in a nation or state/province were destroyed or if it had been extensively and unsuccessfully looked for. The NH or SH rank is reserved for species or communities for which some effort has been made to relocate occurrences, rather than simply using this status for all elements not known from verified extant occurrences.

N1, S1 (Critically Imperilled) — Critically imperilled in the nation or state/province because of extreme rarity (often 5 or fewer occurrences) or because of some factor(s) such as very steep declines making it especially vulnerable to extirpation from the state/province.

N2, S2 (Imperilled) — Imperilled in the nation or state/province because of rarity due to very restricted range, very few populations (often 20 or fewer), steep declines, or other factors making it very vulnerable to extirpation from the nation or state/province.

N3, S3 (Vulnerable) — Vulnerable in the nation or state/province due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors making it vulnerable to extirpation.

N4, S4 (Apparently Secure) — Uncommon but not rare; some cause for long-term concern due to declines or other factors.

N5, S5 (Secure) — Common, widespread, and abundant in the nation or state/province.

NNR, SNR (Unranked) — Nation or state/province conservation status not yet assessed.

NU, SU (Unrankable) — Currently unrankable due to lack of information or due to substantially conflicting information about status or trends.

NNA, SNA (Not Applicable) — A conservation status rank is not applicable because the species is not a suitable target for conservation activities.

N#N#, S#S# (Range Rank) — A numeric range rank (e.g., S2S3) is used to indicate any range of uncertainty about the status of the species or community. Ranges cannot skip more than one rank (e.g., SU is used rather than S1S4).

Not Provided – Species is known to occur in this nation or state/province. Contact the relevant natural heritage program for assigned conservation status.