RECOVERY POTENTIAL ASSESSMENT OF PUGNOSE SHINER (*NOTROPIS ANOGENUS*) IN CANADA

Pugnose Shiner (Notropis anogenus)
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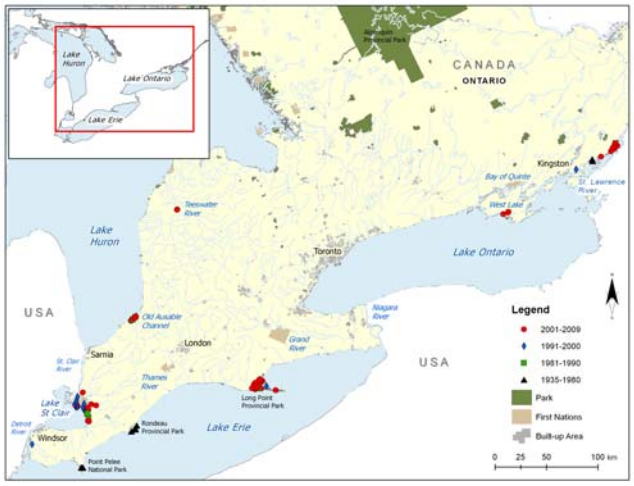

Figure 1. Distribution of Pugnose Shiner in Canada.

Context :

*The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) assessed the status of Pugnose Shiner (*Notropis anogenus*) in November 2002. The assessment resulted in the designation of Pugnose Shiner as Endangered. This designation was due to a limited, disjunct Canadian distribution. Subsequent to the COSEWIC designation, Pugnose Shiner was included on Schedule 1 of the* Species at Risk Act *(SARA) when the Act was proclaimed in June 2003.*

A species Recovery Potential Assessment (RPA) process has been developed by Fisheries and Oceans Canada (DFO) Science to provide the information and scientific advice required to meet the various requirements of the Species at Risk Act *(SARA), such as the authorization to carry out activities that would otherwise violate the SARA as well as the development of recovery strategies. The scientific information also serves as advice to the Minister of Fisheries and Oceans Canada regarding the listing of the species under SARA and is used when analyzing the socio-economic impacts of adding the species to the list as well as during subsequent consultations, where applicable. This assessment considers the scientific data available with which to assess the recovery potential of Pugnose Shiner in Canada.*

SUMMARY

- The current and historical distribution of the Pugnose Shiner is limited to four distinct areas of the Great Lakes basin: Lake Erie drainage; southern Lake Huron drainage; eastern Lake Ontario drainage; and, Lake Huron drainage (Figure 1). Three populations are thought to be extirpated.

- Pugnose Shiner is typically found in clear, heavily-vegetated lakes and embayments, and slow-moving streams. Although Pugnose Shiner has also been recorded from river systems,

it should be noted that its presence in these systems is restricted to areas with characteristics similar to coastal wetlands and lake systems.

- Based on an objective of long-term, self-sustaining population, recovery targets of at least 1 929 adult fish requiring up to 5 ha of habitat were required. In the absence of mitigative efforts or additional harm, a Pugnose Shiner population could reach this recovery target in 17 to 39 years. However, by affecting at least a 14% increase in survival rates, recovery strategies such as habitat rehabilitation or enhancement can reduce the recovery time of a heavily impacted population by half.

- The greatest threats to the survival and persistence of Pugnose Shiner are related to the degradation and loss of preferred habitat. These threats encompass the physical loss of habitat, including the removal and control of aquatic vegetation and habitat modifications, and habitat degradation through sediment and nutrient loading.

- The introduction of exotic species (fishes and aquatic macrophytes) may be negatively affecting Pugnose Shiner populations. The degree to which incidental harvest through the baitfish industry and trophic dynamic shifts are affecting Pugnose Shiner is currently unknown, but these threats may have a negative effect on the persistence and recovery of Pugnose Shiner populations.

- The dynamics of Pugnose Shiner populations are particularly sensitive to perturbations that affect survival in the first two years of life, and the fecundity of first-time spawners. Harm to these characteristics of Pugnose Shiner life history should be minimized to avoid jeopardizing the survival and future recovery of Canadian populations.

- There remain numerous sources of uncertainty related to Pugnose Shiner biology, ecology, life history, YOY and juvenile habitat requirements, population abundance estimates, population structure, and species distribution. A thorough understanding of the threats affecting the decline of Pugnose Shiner populations is also lacking. Numerous threats have been identified for Pugnose Shiner populations in Canada, although the severity of these threats is currently unknown.

BACKGROUND

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) designated Pugnose Shiner (*Notropis anogenus)* in Canada as Endangered in November 2002, and it was subsequently included on Schedule 1 of the *Species at Risk Act* (SARA) when the Act was proclaimed in June 2003. When COSEWIC designates an aquatic species as Threatened or Endangered and Governor in Council decides to list it, the Minister of Fisheries and Oceans Canada (DFO) is required by the SARA to undertake a number of actions. Many of these actions require scientific information such as the current status of the population, the threats to its survival and recovery, and the feasibility of its recovery. This scientific advice is developed through a Recovery Potential Assessment (RPA). This allows for the consideration of peer-reviewed scientific analyses in subsequent SARA processes, including permitting on harm and recovery planning. This RPA focuses on Pugnose Shiner in Canada, and is a summary of a Canadian Science Advisory Secretariat peer-review meeting that occurred on 6 October 2009, in Burlington, Ontario. Two research documents, one providing background information on the species biology, habitat preferences, current status, threats and mitigations and alternatives (Bouvier *et al.* 2010), and a second on allowable harm, population-based recovery targets, and habitat targets (Venturelli *et al.* 2010) provide an in-depth account of the information

summarized below. Proceedings are also made available that document the activities and key discussions of the meeting (DFO 2010).

Species Description and Identification

The Pugnose Shiner (*Notropis anogenus* Forbes, 1885) is a small fish with a slender, elongate body. The overall colouration is silver, generally with pale yellow to olive tints on the back. It has a prominent dark lateral band that extends from a wedge-shaped blotch at the base of the caudal fin forward onto the snout including the chin, lower lip, and side of upper lip, and scales on the back are darkly outlined. The Pugnose Shiner has an extremely small, upturned mouth, which is positioned almost vertical to the body axis.

There is an overlap in Pugnose Shiner distribution with various similar blackline shiners that may lead to confusion when identifying this species including Blackchin Shiner (*Notropis heterodon*), Blacknose Shiner (*Notropis heterolepis*), and Bridle Shiner (*Notropis bifrenatus*). A few key characteristics exist to distinguish Pugnose Shiner from these species. Most notably, other blackline shiners have larger, less upturned mouths. In addition, Blacknose and Bridle shiners do not have any colouration on their chin. The Pugnose Shiner is also often confused with the Pugnose Minnow (*Opsopoeodus emiliae*), although these two species are distinguishable by the number of dorsal fin rays; the Pugnose Shiner generally has eight rays, while the Pugnose Minnow has nine.

ASSESSMENT

Current Species Status

Lake Erie Drainage

Long Point Bay

Long Point Bay represents one of the few historical locations where Pugnose Shiner is still extant. For the purposes of this report, Long Point Bay encompasses the entire Inner Long Point Bay, including Long Point National Wildlife Area – Thoroughfare Point Unit, and the area east of Turkey Point. Historically, Pugnose Shiner was caught in Long Point Bay in 1947 and 1996. In a 2004 fish community survey, Pugnose Shiner was detected in Long Point Bay (n=29), and in the Thoroughfare Point Unit of Long Point National Wildlife Area (n=1). Additionally, a 2007 survey conducted at eight sites at Turkey Point resulted in the capture of 38 individuals. Sampling completed in 2008 and 2009 yielded an additional 22 individuals.

Point Pelee National Park

Historical records for Pugnose Shiner were recorded from Point Pelee National Park in 1940 and 1941. Surveys at this site dating back to 1946, with more recent surveys between 1979 and 2004 have not detected any Pugnose Shiner. It is believed that Pugnose Shiner is likely extirpated from Point Pelee National Park.

Rondeau Bay

Historical records for Pugnose Shiner in Rondeau Bay date back to 1940 and 1963. Recent surveys of this area have failed to detect any additional Pugnose Shiner, and it is believed that the Rondeau Bay population may be extirpated.

Canard River

A total of four Pugnose Shiner vouchers were collected from the wetlands located at the mouth of the Canard River in 1994. Subsequent sampling in this area has not resulted in the capture of any additional Pugnose Shiner.

Lake Huron Drainage

Old Ausable Channel

Pugnose Shiner was first detected in the Old Ausable Channel (Ausable River watershed) in the early 1980s, and subsequently captured in 1997, 2002, 2004, 2005 and 2009. Although sampling in the Old Ausable Channel has been sporadic, it is believed that the Pugnose Shiner population may be stable.

Teeswater River

A total of four Pugnose Shiner have been caught from the Teeswater River (Saugeen River tributary). Three vouchers were captured in 2005, while the fourth was captured in 2009. The first two were captured from below a dam within the main branch of the river, the third from the tailrace, and the fourth from Cargill Mill Pond, a reservoir of the Teeswater River.

Lake St. Clair Drainage

Lake St. Clair

In Lake St. Clair, Pugnose Shiner is known to occur in Mitchell's Bay, St. Luke's Bay, and the coastal marshes surrounding Walpole Island. Pugnose Shiner was captured in Mitchell's Bay in 1983, 1996, 1999 and 2006, and in St. Luke's Bay in 1983 and 2006. A targeted survey in the Lake St. Clair watershed in 2003 detected the presence of Pugnose Shiner in Little Bear Creek and Whitebread Drain/Grape Run, two tributaries of Lake St. Clair. Subsequent sampling conducted in 2006, detected nine additional individuals in MacLeod Creek. A total of 31 additional sites in Lake St. Clair were sampling in 2007; however, no Pugnose Shiner were detected. In 1999, 281 Pugnose Shiner were caught in the coastal marshes of Walpole Island, and this species was sampled in this area once again in 2002. Within the Walpole Island complex, there are three partially diked areas: Pottowatamie Island; Walpole Island; and, St. Anne Island. Since these cells are often breached and there is a continuous exchange of water between the cells and Lake St. Clair proper through the use of pumps, the Pugnose Shiner captured in the cells may have originated from Lake St. Clair. For the remainder of this report, all Pugnose Shiner captured in Mitchell's Bay, St. Luke's Bay, the coastal marshes surrounding Walpole Island and all associated tributaries of Lake St. Clair will be referred to as the Lake St. Clair population.

St. Clair National Wildlife Area

Pugnose Shiner was detected for the first time in the St. Clair National Wildlife Area (NWA) in 2003, and once more in 2004, during a graduate student project; each detection consisted of a single specimen.

Lake Ontario Drainage

Gananoque River/St. Lawrence River

Pugnose Shiner was originally collected in 1935 from the Gananoque River, and the mouth of the Gananoque River in the St. Lawrence River. Since this original record, Pugnose Shiner has not been collected in the Gananoque River, and was last recorded at the mouth of the Gananoque River in the St. Lawrence River in 1937. However, Pugnose Shiner has been captured both east and west of this original location at Mallorytown Landing and Eastview,

respectively. Sampling completed in 2005 at three sites in the St. Lawrence Islands National Park yielded 256 individuals. Sampling completed throughout the Thousand Islands area by Parks Canada Agency detected 18 additional sites from east of Mallorytown Landing to west of Gananoque in the Bateau Channel inhabited by Pugnose Shiner. Targeted sampling from 2009 yielded the capture of 344 individuals.

West Lake

Two Pugnose Shiner were collected from West Lake (Prince Edward County, eastern Lake Ontario) during a fish assemblage electrofishing study conducted in June 2009. This was the first time Pugnose Shiner had been collected in this area. In September 2009, additional sampling was completed in this area targeting Pugnose Shiner preferred habitat and an additional 32 vouchers were collected.

Population Status

There are currently no studies that have specifically focused on the abundance of Pugnose Shiner throughout its Canadian distribution; therefore, it is not possible to discuss quantitative population estimates. However, repeated sampling at select Pugnose Shiner sites does allow a comparison of population trends. To assess the population status of Pugnose Shiner populations in Canada, each population was ranked in terms of its abundance (Relative Abundance Index) and trajectory (Population Trajectory). The level of certainty was also associated with each assignment was also recorded (1=quantitative analysis; 2=CPUE or standardized sampling; 3=best guess). The Relative Abundance Index and Population Trajectory values were then combined in the Population Status matrix to determine the Population Status for each population. Each Population Status was subsequently ranked as Poor, Fair, Good, Unknown or Extirpated (Table 1). The Certainty assigned to each Population Status is reflective of the lowest level of certainty associated with either initial parameter. Refer to Bouvier *et al.* (2010) for the complete methodology on Population Status assessment.

Table 1. Population Status for all Pugnose Shiner populations in Canada, resulting from an analysis of both the Relative Abundance Index and Population Trajectory. Certainty assigned to each Population Status is reflective of the lowest level of certainty associated with either initial parameter (Relative Abundance Index, or Population Trajectory).

Population	Population Status	Certainty
Lake Erie drainage		
Long Point Bay	Poor	2
Canard River/Detroit River	Unknown	3
Point Pelee	Extirpated	3
Rondeau Bay	Extirpated	3
Lake Huron drainage		
Old Ausable Channel	Fair	2
Teeswater River	Unknown	3
Lake St. Clair drainage		
Lake St. Clair	Fair	2
St. Clair National Wildlife Area	Unknown	3
Lake Ontario drainage		
St. Lawrence River	Good	2
Gananoque River	Extirpated	3
West Lake	Unknown	2

Habitat Requirements

Spawning

Pugnose Shiner is known to spawn in densely-vegetated, shallow water (2 m maximum depth), where the substrate is composed of sand/silt and, to a lesser degree, gravel. Pugnose Shiner generally spawn when the water temperature is between 21 and 29°C, which occurs in June in Ontario waters. The presence of submergent aquatic vegetation appears to play an important role in the spawning process.

Young-of-the-Year (YOY) and Juvenile

Pugnose Shiner YOY are associated with heavily-vegetated, shallow (2 m maximum depth) habitats. Pugnose Shiner has been associated with stonewort (*Chara vularis*), Eurasian watermilfoil, wild celery (*Vallisneria americana*), pondweeds (*Potamogeton* spp.) and naiad (*Najas flexilis*). Although there are limited data on juvenile Pugnose Shiner habitat requirements, these may be inferred from other life stages since Pugnose Shiner habitat requirements seem to be similar across all known life stages.

Adult

Similar to all other life stages, adult Pugnose Shiner are typically found in clear, heavily-vegetated lakes and embayments. Although Pugnose Shiner has also been recorded from river systems (i.e., St. Lawrence, Teeswater and Canard rivers), it should be noted that their presence in these systems is restricted to areas with characteristics similar to coastal wetlands and lake systems. Substrates generally associated with the presence of adult Pugnose Shiner include sand, silt, organic, clay, and marl. Pugnose Shiner is also generally collected at shallow water depth (less than 2 to 3 m); although, it is thought that they may move into deeper water during the cooler months, making capture difficult. Although it is generally believed that Pugnose Shiner prefers waters with low turbidity, this species has been captured on occasion in turbid areas.

Pugnose Shiner is always very closely associated with dense macrophytes, which may include both emergent and submergent species. Specifically, Pugnose Shiner is noted to be associated with filamentous algae, submergent macrophytes, such as wild celery and pondweeds (*Potamogeton* spp.), and emergent macrophytes, such as cattail (*Typha* spp.), bulrush (*Scriptus* spp.), and sedge (*Carex* spp.). Pugnose Shiner is also highly associated with the presence of an introduced macrophyte species, Eurasian watermilfoil; however, it has been noted that the presence of Eurasian watermilfoil may have led to the extirpation of Pugnose Shiner and several other minnow species from a Wisconsin lake.

Feeding habits of the Pugnose Shiner have been described as both detritivore (feeding on decomposing organic matter) and omnivore (feeding on stonewort, filamentous green algae, cladocerans, small leeches and caddisfly larvae).

Residence

Residence is defined in SARA as a, “dwelling-place, such as a den, nest or other similar area or place, that is occupied or habitually occupied by one or more individuals during all or part of their life cycles, including breeding, rearing, staging, wintering, feeding or hibernating”. Residence is interpreted by DFO as being constructed by the organism. In the context of the

above narrative description of habitat requirements during YOY, juvenile and adult life stages, Pugnose Shiner does not construct residences during their life cycle.

Recovery Targets

Recovery Targets and Times

Consistent with preconditions of SARA section 73(3), demographic sustainability was used to set recovery targets for the Pugnose Shiner. Demographic sustainability is related to the concept of minimum viable population (MVP), and was defined as the minimum adult population size that results in a 95% probability of persistence over 250 years. Simulations indicated that MVP was 1 929 adults when the probability of a catastrophic (50%) decline was 0.05, and 14 325 adults when this probability was 0.10. Under current conditions, and in the absence of recovery efforts, a Pugnose Shiner population that was at 10% of either of these MVP values was predicted to take 24 years to reach a 95% probability of recovery (Figure 2). The recovery times associated with each strategy varied with initial percentage of MVP: 15-29 years if starting from 2%, and 7 to 13 years if starting from 20%. Regardless of the starting percentage of the population, an increase in the first and second years of life had a consistently greater effect on recovery time than an equivalent increase in the fertility of first-time spawners. Thus, depending on the initial percentage, the outcome of a strong and proactive recovery strategy would have a 95% probability of reaching the recovery target in 7 to 21 generations.

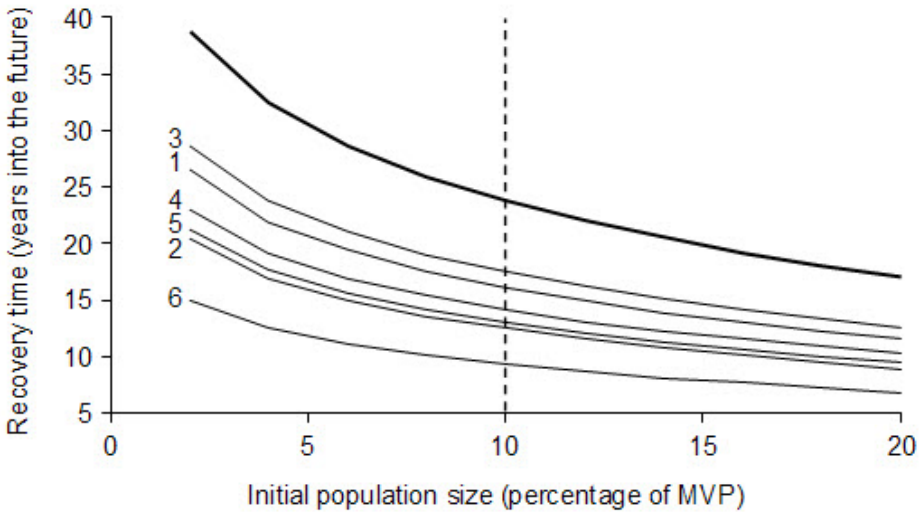

Figure 2. Stochastic projections of mean Pugnose Shiner recovery times over a range of initial population sizes (percentage of a recovery target) for six hypothetical recovery strategies. The thick line shows recovery times in the absence of mitigation or additional harm, and numbered lines correspond to various recovery scenarios: 1 – added a 10% increase in the survival rate in the first two years of life; 2 – added a 20% increase in the survival rate in the first two years of life; 3 – added a 10% increase in the fertility of first-time spawners, 4 – added a 20% increase in the fertility of first-time spawners; 5 – added a 10% increase in the survival rate in the first two years of life and a 10% increase in the fertility of first-time spawners; 6 - added a 20% increase in the survival rate in the first two years of life and a 20% increase in the fertility of first-time spawners.

Minimum Area for Population Viability

Minimum area for population viability (MAPV) is a quantification of the amount of habitat required to support a viable population. Variables included in the MAPV assessment include previously calculated MVP values, and area required per adult individual (API values). API values were estimated from an allometry for lake and river environments. With a target MVP of 1 929 adults under a 0.05 probability of catastrophe per generation, the MAPV in lakes is 0.7 ha and 0.2 ha in rivers. With a target MVP of 14 325 under a 0.10 probability of catastrophe per generation, the MAPV in lakes is 5 ha and 1.5 ha in rivers.

Threats to Survival and Recovery

The greatest threats to the survival and persistence of Pugnose Shiner are related to the degradation and loss of preferred habitat. These threats encompass the physical loss of habitat, including the removal and control of aquatic vegetation and habitat modifications, and habitat degradation through sediment and nutrient loading. Although habitat loss and degradation is thought to be one of the largest threats to Pugnose Shiner, population declines in highly protected areas, such as Point Pelee National Park, suggest that other threats are also having significant effects on the survivorship of Pugnose Shiner. Changes in trophic dynamics may be negatively affecting Pugnose Shiner populations. The presence of introduced species, including exotic fishes, and aquatic plants may also negatively impact Pugnose Shiner. The degree to which incidental harvest through the baitfish industry affects Pugnose Shiner is currently unknown, but this industry may pose a threat to the persistence of Pugnose Shiner populations. Due to the specific habitat vulnerabilities of the Pugnose Shiner, it is thought that climate change may have both direct and indirect effects on Pugnose Shiner populations, although these effects are difficult to quantify. It is important to note that these threats may not always act independently on Pugnose Shiner populations; rather, one threat may directly affect another, or the interaction between two threats may introduce an interaction effect on the Pugnose Shiner populations. It is quite difficult to quantify these interactions and therefore, each threat is discussed independently.

Threat Status

To assess the Threat Status of Pugnose Shiner populations in Canada, each threat was ranked in terms of the Threat Likelihood and Threat Impact on a population by-population basis (see Bouvier *et al*. 2010 for details). The Threat Likelihood and Threat Impact for each population were combined in the Threat Status Matrix resulting in the final Threat Status for each population (Table 2). Certainty has been classified for both Threat Likelihood and Threat Impact and is based on: 1= causative studies; 2=correlative studies; and 3=expert opinion. Certainty associated with the Threat Status is reflective of the lowest level of certainty associated with either initial parameter.

Table 2. Threat Status for all Pugnose Shiner populations in Canada, resulting from an analysis of both the Threat Likelihood and Threat Impact. The number in brackets refers to the level of certainty assigned to each Threat Status, which is reflective of the lowest level of certainty associated with either initial parameter (Threat Likelihood, or Threat Impact). Clear cells do not necessarily represent a lack of a relationship between a population and a threat; rather, they indicate that either the Threat Likelihood or Threat Impact was Unknown.

	Lake Erie Drainage				Lake Huron Drainage	
Threats	**Long Point Bay**	**Canard River**	**Point Pelee**	**Rondeau Bay**	**Old Ausable Channel**	**Teeswater River**
Habitat modifications	High (3)	High (3)	Medium (3)	High (3)	High (3)	Unknown (3)
Aquatic vegetation removal	Medium (3)	Medium (3)	Medium (3)	High (3)	Medium (3)	Unknown (3)
Sediment loading	High (3)	High (3)	Medium (3)	High (3)	High (3)	Unknown (3)
Nutrient loading	High (3)	High (3)	Medium (3)	High (3)	High (3)	Unknown (3)
Exotic species	Medium (3)	Medium (3)	Medium (3)	Medium (3)	Medium (3)	Unknown (3)
Baitfish industry	Low (3)	Low (3)	Low (3)	Low (3)	Low (3)	Low (3)
Changes in trophic dynamics	Unknown (3)	Unknown (3)	Low (3)	Low (3)	Low (3)	Unknown (3)

	Lake St. Clair Drainage		Lake Ontario Drainage		
Threats	**Lake St. Clair**	**St. Clair NWA**	**St. Lawrence River**	**Gananoque River**	**West Lake**
Habitat modifications	High (3)	High (3)	Medium (3)	Unknown (3)	Medium (3)
Aquatic vegetation removal	Medium (3)	Medium (3)	Medium (3)	Unknown (3)	Medium (3)
Sediment loading	High (3)	Medium (3)	High (3)	Unknown (3)	High (3)
Nutrient loading	High (3)	Medium (3)	High (3)	Unknown (3)	High (3)
Exotic species	Medium (3)	Medium (3)	Medium (3)	Unknown (3)	Medium (3)
Baitfish industry	Low (3)	Low (3)	Low (3)	Low (3)	Low (3)
Changes in trophic dynamics	Unknown (3)	Unknown (3)	Unknown (3)	Unknown (3)	Unknown (3)

Allowable Harm

Allowable harm was assessed in a demographic framework following Vélez-Espino and Koops (2007, 2009). This assessment uses perturbation analysis that depends on the construction of projection matrices from which population growth rate can be calculated and the relative importance of each vital rate can be used to project the effects of recovery efforts. See Venturelli *et al*. (2010) for complete details on the model and results. Modelling indicated that Pugnose Shiner population growth rate was most sensitive to perturbations of annual survival in the first and second years of life, and the fertility of first-time spawners (Figure 3). From a precautionary perspective (i.e., assuming an upper 95% CL), our results suggest a maximum allowable reduction of 14% for the survival rate of 1 or 2 year-olds, or 15% for the fertility rate of first-time spawners in individual populations of Pugnose Shiner. Similarly, simultaneous impacts on all rates of either survival or fertility should not exceed 6% or 12%, respectively. If human

activities are such that harm exceeds just one of these thresholds, the future survival and recovery of individual populations is likely to be compromised.

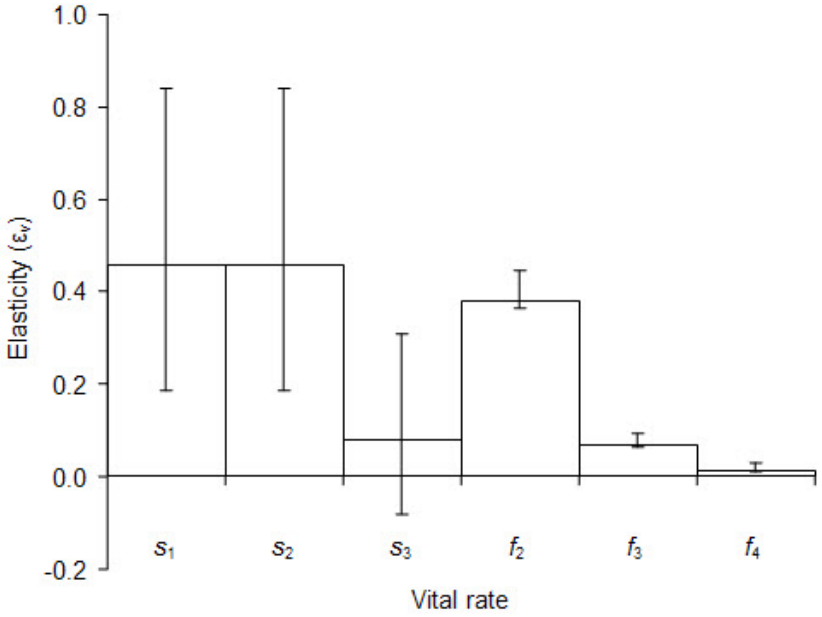

Figure 3. Results of the stochastic perturbation analysis showing elasticities (ε_v) of the vital rates annual survival probability at age i (s_i) and fertility at age i (f_i), with associated 95% CL.

Mitigations and Alternatives

Numerous threats affecting Pugnose Shiner populations are related to habitat loss or degradation. Habitat-related threats to Pugnose Shiner have been linked to the Pathways of Effects developed by DFO Fish Habitat Management (FHM) (Table 3). DFO FHM has developed guidance on generic mitigation measures for 19 Pathways of Effects for the protection of aquatic species at risk in the Ontario Great Lakes Area (Coker *et al*. 2010). This guidance should be consulted when considering mitigation and alternative strategies. Additional mitigation and alternative measures, specific to exotic species and incidental harvest through the baitfish industry, are listed below.

Table 3. Threats to Pugnose Shiner populations and the Pathways of Effect associated with each threat. 1-Vegetation clearing; 2–Grading; 3–Excavation; 4–Use of explosives; 5–Use of industrial equipment; 6–Cleaning or maintenance of bridges or other structures; 7–Riparian planting; 8–Streamside livestock grazing; 9–Marine seismic surveys; 10–Placement of material or structures in water; 11–Dredging; 12–Water extraction; 13–Organic debris management; 14–Wastewater management; 15–Addition or removal of aquatic vegetation; 16–Change in timing, duration and frequency of flow; 17–Fish passage issues; 18–Structure removal; 19–Placement of marine finfish aquaculture site.

Threats	Pathway(s)
Habitat modifications	1, 2, 3, 4, 5, 7, 8, 10, 11, 13, 14, 15, 16, 18
Aquatic vegetation removal	10, 11, 15
Sediment loading	1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 12, 13, 15, 16, 18
Nutrient loading	1, 4, 7, 8, 11, 12, 13, 14, 15, 16
Exotic species	
Baitfish industry	
Changes in trophic dynamics	

Exotic Species

Common Carp (*Cyprinus carpio*) and Eurasian watermilfoil introduction and establishment could have negative effects on Pugnose Shiner populations.

Mitigation

- Physically remove non-native species from areas known to be inhabited by Pugnose Shiner.
- Monitor watersheds for exotic species that may negatively affect Pugnose Shiner populations directly, or negatively affect preferred habitat of the Pugnose Shiner.
- Develop a plan to address potential risks, impacts, and proposed actions if monitoring detects the arrival or establishment of an exotic species.
- Prohibit the use of live baitfish in areas known to be inhabited by Pugnose Shiner.
- Introduce a public awareness campaign.

Alternatives

- Unauthorized
  - None.
- Authorized
  - Use only native species.
  - Follow the National Code on Introductions and Transfers of Aquatic Organisms for all aquatic organism introductions (DFO 2003).

Incidental Harvest

Incidental harvest of Pugnose Shiner through the baitfish industry was recognized as a potentially low risk threat.

Mitigation

- Provide information and education to bait harvesters on Pugnose Shiner, and request the voluntary avoidance of occupied Pugnose Shiner areas.
- Immediate release of all blackline shiners (Pugnose Shiner, Blacknose Shiner, Blackchin Shiner, and Bridle Shiner) if incidentally caught. The release of all blackline shiners is necessary due to difficulties in properly identifying species within this group of fishes.

Alternatives

- Prohibit the harvest of baitfish in areas where Pugnose Shiner are known to exist.

Sources of uncertainty

There are many sources of uncertainty surrounding the biology and ecology of Pugnose Shiner. Its small size, elusive nature and preference for areas with dense macrophyte coverage makes Pugnose Shiner difficult to sample and, therefore, populations may be under-represented by the few individuals caught. Information regarding population size and the number of mature individuals, as well as recruitment and mortality rates, is not available for this species. The life history of this species is also poorly understood.

Another larger source of uncertainty is related to the Pugnose Shiner distribution and population estimates and population structure. Limited records, represented by a few individuals, have been noted for Canard River, St. Clair National Wildlife Area, Teeswater River, and West Lake. Repeated standardized sampling in these locations is necessary to determine if reproducing populations are present. In addition, standardized sampling is needed at all locations where

Pugnose Shiner is known to exist to determine population size, distribution, stability, and number of reproducing individuals. Repeated standardized sampling in all areas is also necessary to determine Pugnose Shiner abundance over time to determine the trajectory of these populations. Repeated standardized sampling would result in increased certainty when assigning Population Status to Pugnose Shiner populations. Furthermore, baseline data required to monitor Pugnose Shiner population trends could also be used to measure the success of any recovery measures. There is also a need to assess genetic variation across all Pugnose Shiner populations in Canada to determine population structure.

The current distribution and extent of suitable Pugnose Shiner habitat should be investigated and mapped. These areas should be the focus of future targeted sampling efforts for this species. There is also a need to identify habitat requirements for each life stage. There is very little information available for both YOY and juvenile Pugnose Shiner habitat requirements, necessitating the inference of these requirements from the adult life stage. Novel sampling techniques should be applied to investigate whether or not Pugnose Shiner are utilizing deeper habitats.

A thorough understanding of the threats affecting the decline of Pugnose Shiner populations is also lacking. Numerous threats have been identified for Pugnose Shiner populations in Canada, although the severity of these threats is currently unknown. There is a need for more causative studies to evaluate the impact of each threat on each Pugnose Shiner population with greater certainty. A greater knowledge of the effects of habitat modifications and aquatic vegetation removal on Pugnose Shiner populations and spawning areas is required. The Pugnose Shiner is considered to be a turbidity-intolerant species, although there is a lack of evidence on the direct or indirect effects of siltation on Pugnose Shiner populations. Incidental harvest through the baitfish industry, as well as shifts in trophic dynamics, may also play a role in the decline of Pugnose Shiner, although the degree to which these threats are affecting Pugnose Shiner populations is still unknown.

SOURCES OF INFORMATION

Bouvier, L.D., A.L. Boyko, and N.E. Mandrak. 2010. Information in support of a Recovery Potential Assessment of Pugnose Shiner (*Notropis anogenus*) in Canada. DFO Can. Sci. Advis. Sec. Res. Doc. 2010/009. vi + 23 p.

Coker, G.A., D.L. Ming, and N.E. Mandrak. 2010. Mitigation guide for the protection of fishes and fish habitat to accompany the species at risk recovery potential assessments conducted by Fisheries and Oceans Canada (DFO) in Central and Arctic Region. Version 1.0. Can. Manuscr. Rep. Fish. Aquat. Sci. 2904: vi + 40 p.

DFO. 2003. National code on introductions and transfers of aquatic organisms. http://www.dfo-mpo.gc.ca/Science/enviro/ais-eae/code-eng.htm. 53 p.

DFO. 2010. Proceedings of the Recovery Potential Assessment Meeting for Pugnose Shiner in Canada. 6 October 2009. DFO Can. Sci. Advis. Sec. Proceed. Ser. 2010/012.

Velez-Espino, L.A. and M.A. Koops. 2009. Quantifying allowable harm in species at risk: Application to the Laurentian Black Redhorse (*Moxostoma duquensnei)*. Aquatic Conservation: Marine and Freshwater Ecosystems 19: 676-688.

Vélez-Espino, L. A. and M. A. Koops. 2007. Recovery potential assessment of an extirpated population: Lake Ontario Atlantic Salmon (*Salmo salar*). DFO Can. Sci. Advis. Sec. Sci. Res. Doc. 2007/083. 27 p.

Venturelli, P.A., L.A. Velez-Espino and M.A. Koops. 2010. Recovery potential modelling of Pugnose Shiner (*Notropis anogenus*) in Canada. DFO Can. Sci. Advis. Sec. Res. Doc. 2010/007. iv + 22 p.

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ISSN 1919-5079 (Print)
ISSN 1919-5087 (Online)

La version française est disponible à l'adresse ci-dessus.

CORRECT CITATION FOR THIS PUBLICATION

DFO. 2010. Recovery Potential Assessment of Pugnose Shiner (*Notropis anogenus*) in Canada. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2010/025.