Targeted sampling for Pugnose Shiner (*Notropis anogenus*) in the Trent River, Ontario, 2020

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2021

Canadian Data Report of Fisheries and Aquatic Sciences 1334

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Cat. No. Fs97-13/1334E-PDF ISBN 978-0-660-37364-5 ISSN 1488-5395

Correct citation for this publication:

LeBaron, A. and Reid, S.M. 2020. Targeted sampling for Pugnose Shiner (*Notropis anogenus*) in the Trent River, Ontario, 2020. Can. Data Rep. Fish. Aquat. Sci. 1334: vii + 46 p.

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In September and October of 2020, trawling surveys were completed in the Trent River to update distribution records for the Threatened Pugnose Shiner (*Notropis anogenus*) and describe habitat characteristics associated with the species. Sixty-six sites were sampled along five major reaches between Rice Lake and the Bay of Quinte (Lake Ontario). Sites were located in areas of vegetated habitat near the sites of previous (2011, 2012) Pugnose Shiner surveys. Fishes were collected using 3 consecutive passes of a Mamou (surface) trawl over a 50 m transect. Twenty-two species (11,093 individuals) were detected, including Pugnose Shiner, the invasive Round Goby (*Neogobius melanostomus*), and six recreationally-important species. Fewer species were detected than during a 2012 seine-based inventory of wetland habitats along the shoreline of the Trent River. Pugnose Shiner (66 individuals) were collected from 14 sites in the Glen Ross reach. At collection sites, water clarity was high, water depths were between 1.0 and 1.6 m, riverbed material was largely organics, silts and clay, and submerged vegetation cover was dense. Dominant submerged plant species were Wild Celery (*Vallisneria americana*) and Richardson's Pondweed (*Potamogeton richardsonii*). Although not sampled from Pugnose Shiner collection sites, the invasive Water Soldier (*Stratioles aloides*) was observed at several locations along the study area; including the Glen Ross reach.

RÉSUMÉ

LeBaron, A. and Reid, S.M. 2021. Target sampling for Pugnose Shiner (*Notropis anogenus*) in the Trent River, Ontario, 2020. Can. Data Rep. Fish. Aquat. Sci. 1334: vii + 46 p.

En septembre et en octobre 2020, on a mené des relevés au chalut dans la rivière Trent afin de mettre à jour les rapports sur la répartition du méné camus (*Notropis anogenus*), une espèce menacée, et de décrire les caractéristiques de l'habitat fréquenté par l'espèce. On a échantillonné 66 sites le long de cinq tronçons importants situés entre le lac Rice et la baie de Quinte (lac Ontario). Ces sites se trouvaient dans des milieux couverts de végétation, à proximité des sites utilisés lors des activités de relevé précédentes (2011 et 2012) ciblant le méné camus. Pour capturer des individus, on a effectué trois passes consécutives d'un chalut Mamou (chalut de surface) le long d'un transect de 50 m. On a détecté 22 espèces (11 093 individus), y compris le méné camus, le gobie à taches noires (*Neogobius melanostomus*), qui est une espèce envahissante, et six espèces importantes pour la pêche récréative. Toutefois, on a détecté moins d'espèces que lors du relevé à la senne de 2012 mené dans des milieux humides situés le long des rives de la rivière Trent. On a capturé des ménés camus (66 individus) dans 14 sites du tronçon Glen Ross. À ces sites, l'eau était très claire, la profondeur variait de 1 à 1,6 m, le lit de la rivière était composé en grande partie de matières organiques, de limon et d'argile, et le couvert de végétation submergée était dense. Les espèces de plantes submergées dominantes étaient la vallisnérie d'Amérique (*Vallisneria americana*) et le potamot de Richardson (*Potamogeton richardsonii*). Bien qu'il n'ait pas été échantillonné aux sites de capture de ménés camus, le stratiote faux-aloès (*Stratiotes aloides*), une espèce envahissante, a été observé à plusieurs endroits le long de la zone étudiée, y compris dans le tronçon Glen Ross.

INTRODUCTION

Fisheries and Oceans Canada (DFO) has the responsibility to provide for the protection and recovery of fishes listed under the Species at Risk Act (SARA) of 2002. To inform scientific aspects of the recovery process, DFO regularly conducts field sampling to satisfy various research objectives for SARA-listed fishes, such as evaluating the distribution and abundance of species, determining species-habitat relationships, and better understanding the influence of threats and recovery actions. DFO data reports are published to support the Species at Risk Program by providing a description of field activities and to provide a medium for archiving data associated with sampling SARA-listed fishes and their habitat.

This data report summarizes targeted field sampling by the Ontario Ministry of Natural Resources and Forestry (MNRF) in 2020 to better understand the distribution and population status of Pugnose Shiner (*Notropis anogenus*) along the Trent River (a tributary to the Bay of Quinte, Lake Ontario), Ontario. Pugnose Shiner, a species listed as Threatened under SARA, has a disjunct distribution in Canada; limited to six areas in the southern Lake Huron, Lake St. Clair, western and central Lake Erie drainages, eastern Lake Ontario basin, and in the upper St. Lawrence River (Bouvier et al. 2010). The species is strongly associated with submerged and emergent aquatic vegetation and locations with high water clarity (DFO 2012). Population declines have largely been attributed to habitat loss and degradation [Committee on the Status of Endangered Wildlife in Canada (COSEWIC) 2013].

The presence of Pugnose Shiner in the Trent River was first detected in 2011 during a transect-based boat electrofishing survey for translocated American Eel (*Anguilla rostrata*) (Reid and Hogg 2014). In 2012, MNRF conducted targeted seining for Pugnose Shiner at shoreline locations along the Trent River, between the town of Hastings and the City of Trenton. Sampling in 2011 and 2012 collected more than 50 Pugnose Shiner from a very small area of the Trent River between Glen Ross and Frankford, and one site upstream of Glen Miller[1]. The viability of such a small, fragmented population is unknown. Since 2012, targeted fish species at risk sampling along the Trent River has focused on other fishes at risk: Channel Darter (*Percina copelandi*) (Reid et al. 2016a, Reid 2019), and Lake Sturgeon[2]. Additionally, the invasive plant Water Soldier (*Stratiotes aloides*), which forms extensive floating mats and decreases native aquatic plant diversity, has been detected in the Trent River (2008). Water Soldier has recently spread downstream of Glen Ross where Pugnose Shiner were collected (EDDMapS Ontario 2020).

In this study, a repeat-sampling approach with a Mamou (surface) trawl was used to sample shoreline and wetland habitats at 66 sites along the Trent River. Dextrase et al. (2014) recommend electrofishing or seine netting as the optimal gear types for monitoring Pugnose Shiner. However, while seining is very effective at collecting Pugnose Shiner from shallow, vegetated habitats (e.g. Rook et al., 2016), the gear is impractical for deeper, mid-channel riverine sites. The Mamou trawl has been successfully applied to inventory fishes along southern Ontario watercourses, and investigate the spatial and temporal factors affecting species occurrence (Reid et al. 2016b, Lamothe and Drake 2019). Trent River reaches sampled in 2020 included areas with past collections of Pugnose Shiner, as well as other areas with preferred habitat features. Sampling objectives included: (i) update Pugnose Shiner distribution

[1] Reid, S.M. 2011-2012. Aquatic Research and Monitoring Section, Ontario Ministry of Natural Resources and Forestry. Unpublished data.

[2] LeBaron, A. and Haxton, T. 2015. Sturgeon assessment project – Trent River, September to October 2015. Aquatic Research and Monitoring Section, Ontario Ministry of Natural Resources and Forestry. Unpublished report.

data; (ii) describe the habitat characteristics at Pugnose Shiner collection sites; and (iii) provide distribution information for other wetland fishes at risk along the Trent River (e.g. Northern Sunfish (*Lepomis peltastes*). These objectives support the following research and monitoring actions in the Pugnose Shiner recovery strategy (DFO 2012):

1) conduct targeted surveys at new (where the species has only recently been discovered) and suspected locations
2) develop and implement standardized index population and habitat monitoring program with specific sampling and training protocol.

METHODS

STUDY SYSTEM AND SITE SELECTION

The Trent River (90 km) forms part of the Trent-Severn Waterway (National Historic Site of Canada) connecting Georgian Bay (Lake Huron) to Lake Ontario. It flows from Rice Lake through a series of locks, dams, and hydroelectric generating stations, and empties into the Bay of Quinte, Lake Ontario. Habitat conditions vary widely, ranging from soft, fine substrates and dense macrophytes in wetlands and slow-moving sections, to coarser substrates and bedrock along fast-flowing sections of the main channel, particularly below dams.

A total of 66 sites were sampled between September 3 and October 5, 2020 along five major reaches of the Trent River between Rice Lake and the Bay of Quinte: Seymour Lake (n = 14), Crowe Bay (n = 1), Percy Boom (n = 26), Glen Ross (n = 23), and Trenton (n = 2) as shown in Figure 1. Sites were selected based on previous detections of Pugnose Shiner as well as suitable habitat (wetland areas and shoreline with submerged vegetation; Holm et al. 2009) in other stretches of the river. Sampling was limited to locations free of obstructions (e.g. fallen trees or boulders) and with water depths greater than 1 m. Site location (latitude, longitude) was recorded using a Garmin® Montana 680 handheld GPS unit. Site locality information is provided in Appendix 1.

FISH ASSEMBLAGE SAMPLING

Fishes were collected with a Mamou Trawl™ manufactured by Innovative Net Systems (Reid et al. 2016b; Gáspárdy et. al 2020). The approximate length of the trawl was 6.5 m. The forward sections were constructed of 38 mm high-density, polyethylene stretched mesh, which runs from the head rope (float line) to 2 m back into the body of the trawl. The remainder exterior of the trawl consists of 6 mm polyester knotless mesh. The cod end of the trawl contains an inner bag comprised of 38 mm high-density stretched mesh. During operation, the net was opened by a pair of floating doors (0.6 m long x 0.3 m wide) which were towed on a pair of 23 m bridals tied to two cleats near the bow of the vessel. Sampling was done from a 5.5 m jon boat with a 40 hp motor. Each site was sampled with three consecutive passes along a 50 m transect running parallel to the shoreline. Floats were used to mark the upstream and downstream limits of the transect.

Prior to sampling, water depths and potential navigation hazards (e.g., large woody debris) were evaluated using a Garmin® Echomap™ Plus 95 SV Sonar Unit. Sampling was done in a downstream direction, with the boat travelling in reverse from the transect start (upstream) to the transect end (downstream). The boat travelled upstream approximately 30 m past the upstream float, then moved in reverse toward the transect start while the trawl was fed into the water off the bow. At the upstream float, the doors were dropped into the water to allow the net to open. Once the tow ropes were tight, a GPS stopwatch was started to track time/distance

travelled. A speed of approximately 2 km/h was maintained while trawling. Once a distance of 50 m was covered, the trawl was pulled in and fishes were removed from the cod end and placed in bins of fresh water (Figure 2).

Fishes were processed after each pass and released at least 30 m from the transect. For each pass, captured fishes were identified to species, enumerated, and the minimum and maximum total length (TL; mm) of each species was recorded. Individual TL was recorded for all Pugnose Shiner. Sampling-related mortalities were recorded for each pass. No physical vouchers were retained. Some digital (photograph) vouchers were taken.

HABITAT SAMPLING

Prior to trawling, a macrophyte sample was collected at the midpoint of the transect using the rake method (Figure 3) described by Wagner and Mikulyuk (2012). The method uses a rating scale to classify the density of macrophytes and filamentous algae as follows: 0 = no plants present; 1 = less than 25% of rake is full; 2 = 25% to 100% of rake is full, and; 3 = greater than 100% of rake is full. During sampling, macrophyte species pulled in by the trawl and visual observations within the transect were also recorded. Macrophytes were recorded to species where possible, and qualitatively classified as ‘dominant’ or ‘other’. Percent macrophyte cover was assessed visually within the sample area according to the following vegetation classes to a total of 100%: open water, emergent, submerged, and floating.

Wetted channel width (m) was measured perpendicular to the bank using a Leupold RX Full Draw 2 rangefinder. If unable to determine width in the field, Google Maps (satellite view) was later used to obtain an estimate. Water temperature (°C) and conductivity (µS/cm) were measured approximately 0.05 m beneath the water’s surface using a handheld meter. Channel depth (m) was measured in three representative locations within the boundaries of the trawling pass using the sonar unit. Water depth for each site is presented in this report as the mean of the three measurements.

River bed material (substrate) was sampled at the midpoint of the transect using a Wildco® Petite Ponar™ benthic grab (15 cm x 15 cm). Percent composition of each sample was assessed visually (based on size) and by texture (for clay and organics). Bed material size categories (Ontario Ministry of Natural Resources, 2015) were as follows: clay (<0.002 mm), silt (0.002 – 0.05 mm), sand (0.5 – 2.0 mm), gravel (0.2 – 80.0 mm), cobble (80 – 250 mm), rubble (250 – 600 mm), and boulder (>600 mm, excluding bedrock). Site photos are provided in Appendix 2 as visual examples of aquatic habitat.

SAMPLING PERMITS AND DATA ARCHIVING

Sampling for this project was conducted under Parks Canada Agency Research and Collection Permit TSW-2020-36777. Trawling was conducted under Animal Use Protocol ACC 161 approved by the MNRF Aquatic Research and Monitoring Section Animal Care Committee. Every effort has been made to ensure the accuracy of data contained in this report; however, results may be updated as part of ongoing data verification procedures. Data associated with this report may be obtained by contacting the Aquatic Research and Monitoring Section, Ontario Ministry of Natural Resources.

RESULTS

Common and Scientific names for all fishes and macrophytes identified in this study are provided in Appendix 3 (a,b) . *Pooled* refers to data that is combined from all three passes.

FISH ASSEMBLAGE SAMPLING

Along the Trent River, 11,093 individuals were collected, and 22 species were detected. Sixty-six sites were sampled with a total of 198 trawls. Sixty-six Pugnose Shiner were collected from 14 sites between the village of Glen Ross and the town of Frankford. Other fish species at risk were not detected. Six recreationally-important species [Black Crappie (*Pomoxis nigromaculatus*), Bluegill (*Lepomis macrochirus*), Largemouth Bass (*Micropterus salmoides*), Northern Pike (*Esox Lucius*), Smallmouth Bass (*Micropterus dolomieu*), Yellow Perch (*Perca flavecens*)] and one invasive species [Round Goby (*Neogobius melanostomus*)] were collected in surface trawls. The most abundant and widespread species were Bluegill, Blackchin Shiner (*Notropis heterodon*), Mimic Shiner (*Notropis volucellus*), Bluntnose Minnow (*Pimephales notatus*), Golden Shiner (*Notemigonus crysoleucas*), Pumpkinseed (*Lepomis gibbosus*), and Rock Bass (*Ambloplites rupestris*) (Table 1, Figure 4).

One hundred eighty-four sampling-related mortalities were recorded, representing a 1.7% mortality rate (Appendix 4). Species most commonly affected were Blackchin Shiner (n = 65), Mimic Shiner (n = 32), Bluegill (n = 29), and Bluntnose Minnow (n = 25). No Pugnose Shiner mortalities were observed.

Fishes ranged in size from 18 to 600 mm (median 53 mm). Most individuals were either young-of-year and juvenile sunfishes, or small-bodied cyprinids. Catches of larger-bodied individuals (>200 mm) were limited to the following species: Brown Bullhead (*Ameiurus nebulosus*), Northern Pike, Rock Bass, and Yellow Perch.

The median number of individuals collected from each site was 141 (range: 5 to 768). The median number of species detected was 8 (range: 3 to 12). Numbers of individuals collected from each site declined with successive passes of the trawl (median number of individuals: first pass = 47; second pass = 41; and third pass = 27.5). Similarly, the number of species detected declined with successive passes of the trawl (median species number: first pass = 6; second pass = 5; and third pass = 4). In comparison with results from first pass of the trawl, the addition of two more passes at each site increased the overall rate of species detection (Figure 5) and increased the frequency of occurrence of each species (Table 2).

In 2012, a targeted Pugnose Shiner inventory of 41 suitable shoreline habitats along the Trent River was done with a bag-seine. Sites were located from the town of Hastings downstream to the City of Trenton, but did not include Glen Ross sites where Pugnose Shiner was detected in 2011. Habitats with aquatic vegetation were targeted. At each site, the number of seine hauls ranged from 1 to 3 (median: 2).

In comparison to 2020 trawling, four more species were detected by seining (Table 3) and the rate of species detection was more rapid than trawling deeper and more offshore habitats (Figure 6). Species detected only by seine included: Central Mudminnow (*Umbra limi*), Common Carp (*Cyprinus carpio*), Johnny Darter (*Etheostoma nigrum*), Logperch (*Percina caprodes*), Longnose Gar (*Lepisosteus osseus*), Muskellunge (*Esox masquinongy*), and White Sucker (*Catostomus commersonii*). Present in 2020 trawls, Emerald Shiner (*Notropis atherinoides*) was not collected during 2012 seining. In 2012, Pugnose Shiner (2 individuals) was detected from a small wetland site immediately upstream of Glen Miller. The site was not resampled in 2020 due to dam maintenance.

Details of 2020 fish assemblage sampling results for Seymour Lake, Percy Boom, and Glen Ross reaches are provided below. Species count data for each reach is presented in Appendix 5, including results for the one Crowe Bay site and two Trenton sites not summarized below. Photos of Pugnose Shiner and other notable species are provided in Appendix 6.

Seymour Lake

One thousand, four hundred and seventy fishes were captured (representing 17 species) from 14 sites distributed between Hastings and the Healey Falls (Lock 17) dam. The median number of fishes collected from each site was 62 (range: 5 to 400). The median number of species collected from each site was 7 (range: 3 to 11).

Pugnose Shiner was not detected along this reach. Six recreationally-important species (Black Crappie, Bluegill, Largemouth Bass, Northern Pike, Smallmouth Bass, Yellow Perch) and one invasive species (Round Goby) were collected by trawling. Based on pooled catch data the most abundant and widespread species were Bluegill, Blackchin Shiner, Bluntnose Minnow, Golden Shiner, Yellow Perch, and Rock Bass (Table 4). These species were detected at more than 70% of Seymour Lake sites. Most other species were detected at less than 25% of sites.

Percy Boom

A total of 5,438 fishes were trawled (representing 18 species) from 26 sites distributed downstream of Percy Reach (Lock 8) and upstream of the Glen Ross (Lock 7) dam. The median number of fishes collected from each site was 163 (range: 22 to 768). The median number of species collected from each site was 7.5 (range: 3 to 11).

Pugnose Shiner was not detected along this reach. Five recreationally-important species (Black Crappie, Bluegill, Largemouth Bass, Smallmouth Bass, Yellow Perch) and one invasive species (Round Goby) were collected by trawling. Based on pooled catch data the most abundant and widespread species were Bluegill, Blackchin Shiner, Bluntnose Minnow, Golden Shiner, and Pumpkinseed (Table 5). These species were detected at more than 70% of Percy Boom sites. Most other species were detected at less than 40% of sites.

Glen Ross

At Glen Ross, 3,919 fishes were trawled (representing 19 species) from 23 sites downstream of Glen Ross (Lock 7) and upstream of Frankford (Lock 6). The median number of fishes collected from each site was 161 (range: 8 to 383). The median number of species collected from each site was 9 (range: 4 to 12). Six recreationally-important species (Black Crappie, Bluegill, Largemouth Bass, Northern Pike, Smallmouth Bass, Yellow Perch) and 1 invasive species (Round Goby) were collected by trawling. Based on pooled catch data the most abundant and widespread species were Mimic Shiner, Bluegill, Blackchin Shiner, Bluntnose Minnow, Pumpkinseed, and Rock Bass (Table 6). These species were detected at more than 65% of Glen Ross sites. Most other species were detected at less than 40% of sites.

Pugnose Shiner was detected at 61% of the Glen Ross reach sites. Pugnose Shiner collection sites were in the vicinity of 2011 detections, and up to 2.5 km further upstream. Sixty-six individuals were collected; measuring between 21 and 54 mm. The distribution of length-classes indicates ongoing recruitment, and the presence of multiple age-classes (Figure 7).

HABITAT SAMPLING

Across all sites, the dominant substrate type was organic (median 90% composition), and dominant vegetation cover type was submerged (median 90% coverage). A total of 15 aquatic macrophyte species were identified. An additional five macrophyte taxa were only identified to genus-level. The number of macrophyte taxa per site ranged from 2 to 13 (median 8). The most abundant species across all sites were Wild Celery (*Vallisneria americana*), Richardson's Pondweed (*Potamogeton richardsonii*), and Eurasian Water Milfoil (*Myriophyllum spicatum*), listed as 'dominant' at 35, 21, and 20 sites, respectively. Other taxa that were widespread but not necessarily dominant include Coontail sp. (*Ceratophyllum sp*.; 56 sites), Milfoil sp.

(*Myriophyllum sp*.; 36 sites), Common Waterweed (*Elodea canadensis*; 34 sites), Flatstem Pondweed (*Potamogeton zosteriformis*; 33 sites), Slender Naiad (*Najas flexilis*; 29 sites), and Pondweed sp. (*Potamogeton sp.*; 28 sites).

Details of 2020 habitat sampling results for Seymour Lake, Percy Boom and Glen Ross reaches are provided below. Reach-based habitat data are provided in Appendices 7, 8, and 9, including results for the one Crowe Bay site and two Trenton sites not summarized below. Photos of dominant macrophyte species are provided in Appendix 10. A complete list of macrophyte taxa by site is provided in Appendix 11.

Seymour Lake

Channel width ranged from 280 m to 1,570 m (median 508 m). Water depth ranged from 0.83 to 2.17 m (median 1.28 m). Water temperatures ranged from 15.6 to 19.7°C (median 18.6°C). Conductivity ranged from 249 to 265 µS/cm (median 258 µS/cm). Secchi tube values ranged from 0.50 to 0.90 m (median 0.75 m). This reach was characterized by organic substrate, ranging from 50 to 100% (median 100%).

Density of submerged macrophytes as determined by the rake method ranged from 1 to 3 (median 2). Filamentous algae were not present at any site in this reach. Submerged vegetation was dominant, ranging from 70 to 100% (median 98%). Open water, emergent vegetation, and floating vegetation ranged from 0 to 20% (median 0%), 0 to 20% (median 0%), and 0 to 5% (median 0%) respectively. A total of 12 macrophyte species and four additional genera were identified in this reach. The number of macrophyte taxa per site ranged from 2 to 11 (median 6). The most abundant taxa were Wild Celery and *Chara sp*., listed as ‘dominant’ at 8 and 4 sites, respectively.

Percy Boom

Channel width ranged from 35 to 1,390 m (median 275 m). Water depth ranged from 0.77 to 2.43 m (median 1.15 m). Water temperatures ranged from 15.9 to 24.3 °C (median 19.4 °C). Conductivity ranged from 244 to 279 µS/cm (median 257 µS/cm). Secchi tube values ranged from 0.50 to 1.05 m (median 0.90 m). Organic substrate was dominant across all sites, ranging from 10 to 100% (median 100%). Silt ranged from 0 to 65% (median 0%). Sand ranged from 0 to 80% (median 0%). Clay ranged from 0 to 30% (median 0%). Gravel ranged from 0 to 5% (median 0%). Unknown substrate was recorded at one site (TR-37) where coarser substrates were ineffectively sampled by the Ponar.

Density of submerged macrophytes and filamentous algae ranged from 1 to 3 (median 2) and 0 to 3 (median 0), respectively. Submerged vegetation was dominant across sites, ranging from 55 to 100% (median 90%). Floating vegetation, emergent vegetation, and open water ranged from 0 to 35% (median 0%), 0 to 25% (median 0%), and 0 to 40% (median 0%), respectively. Fourteen macrophyte species and five additional genera were identified from Percy Reach. Number of taxa per site ranged from 2 to 11 (median 8). The most abundant species were Wild Celery and Eurasian Water Milfoil, listed as ‘dominant’ at 13 and 12 sites, respectively. Although not sampled from trawling sites, the invasive Water Soldier (*Stratioles aloides*) was observed at several locations along the Percy Boom reach.

Glen Ross

Channel width ranged from 28 to 693 m (median 412 m). Water depth ranged from 0.97 to 1.80 m (median 1.27 m). Water temperatures ranged from 17.0 to 19.7 °C (median 18.1 °C). Conductivity ranged from 251 to 264 µS/cm (median 258 µS/cm). Secchi tube values ranged from 0.88 to 1.06 m (median 0.96 m). Organic substrate was dominant across sites, ranging

from 10 to 100% (median 80%). Sand ranged from 0 to 90% (median 0%). Silt ranged from 0 to 45% (median 0%). Clay ranged from 0 to 50% (median 0%).

Density of submerged macrophytes and filamentous algae as determined by the rake method ranged from 1 to 3 (median 2) and 0 to 2 (median 0), respectively. Submerged vegetation was dominant across all sites, ranging from 65 to 100% (median 90%). Floating vegetation ranged from 0 to 30% (median 5%). Emergent vegetation ranged from 0 to 25% (median 0%). Open water was 0%. Thirteen macrophyte species and five additional genera were identified from this reach. Number of species per site ranged from 6 to 13 (mean 8). The most abundant species were Wild Celery and Richardson's Pondweed, listed as 'dominant' at 13 sites each.

Sites where Pugnose Shiner was detected were characterized by high water clarity (median Secchi tube depth 0.96 m; Table 7), organic substrate (median 55% composition; Table 8), and dense submerged vegetation (median 83% cover; Table 9). Dominant macrophyte species at these sites were Wild Celery and Richardson's Pondweed. Although not sampled from Pugnose Shiner collections sites, the invasive Water Soldier was observed at several locations along the Glen Ross reach.

ACKNOWLEDGEMENTS

Training and advice for the project was provided by Jason Barnucz, Robin Gaspardy, and Kurtis Smith. We thank Jason Barnucz and Doug Watkinson for helpful reviews. Funding for this project was provided by DFO's Species at Risk Program.

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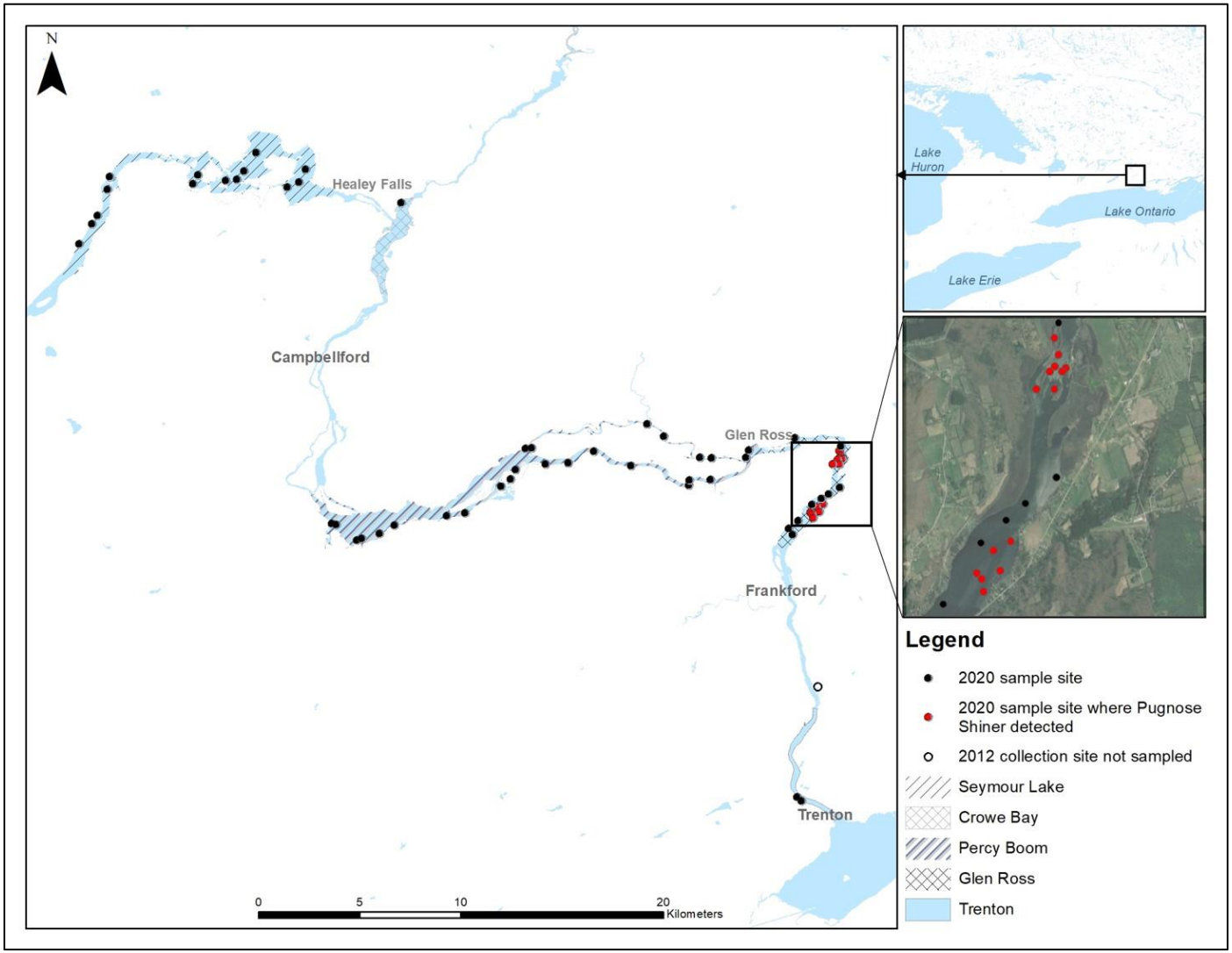


*Figure 1. Map of 66 sites sampled for Pugnose Shiner (*Notropis anogenus*) using a repeat Mamou (surface) trawl method along five reaches of the Trent River in 2020, and one site sampled by bag seine in 2012. Black circle = 2020 sample site where Pugnose Shiner was not detected; red circle = 2020 sample site where Pugnose Shiner was detected; open circle = 2012 sample site where Pugnose Shiner was detected, not accessible in 2020 due to dam maintenance.*

Figure 2. Photographs showing the Mamou trawl during operation: a) lifting the floating doors that open the net, b) towing the trawl, c) retrieving the trawl, and d) emptying the cod.

Figure 3. Macrophyte sample collected following methods described by Wagner and Mikulyuk (2012). This sample was classified as 2 on the scale of 0-3 representing density of plants on the rake.

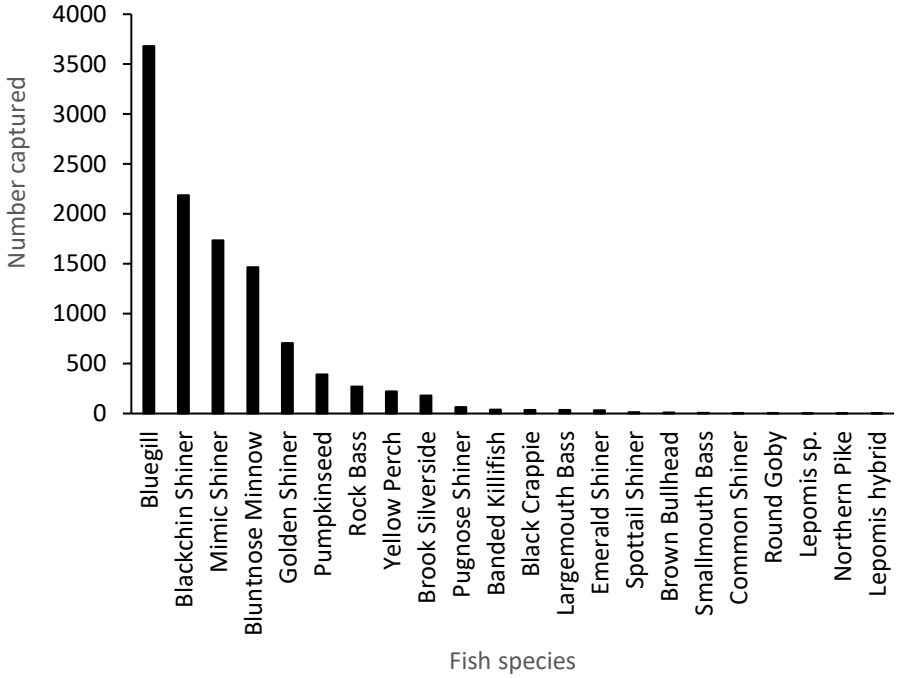


Figure 4. Rank-abundance of fish species captured from the Trent River in 2020, calculated from pooled (three passes combined) catch data.

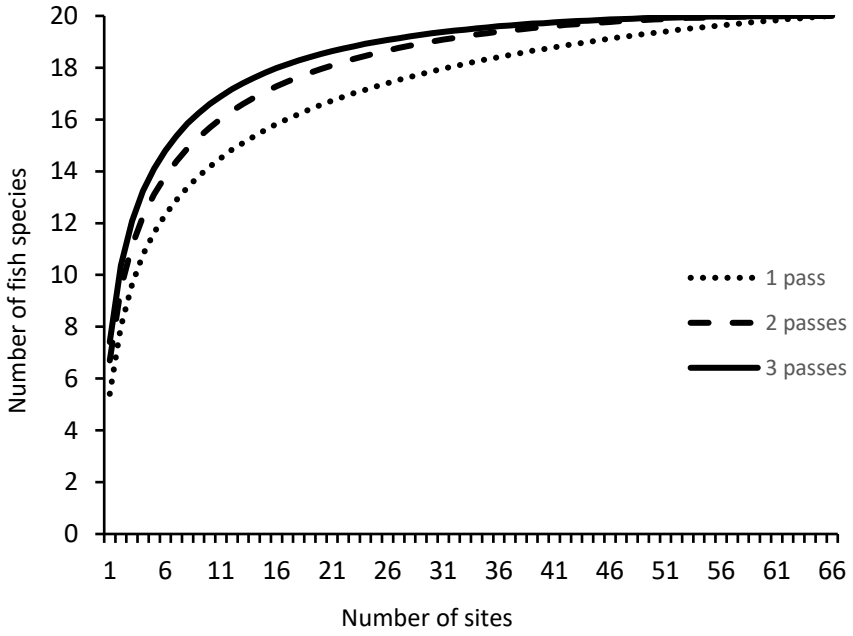


Figure 5. Comparison of species accumulation rates from pass one (dotted line), passes one and two combined (dashed line), and all three passes combined (solid line) from sampling along the Trent River in 2020. Species accumulation curves were generated using EstimateS software (Colwell 2013).

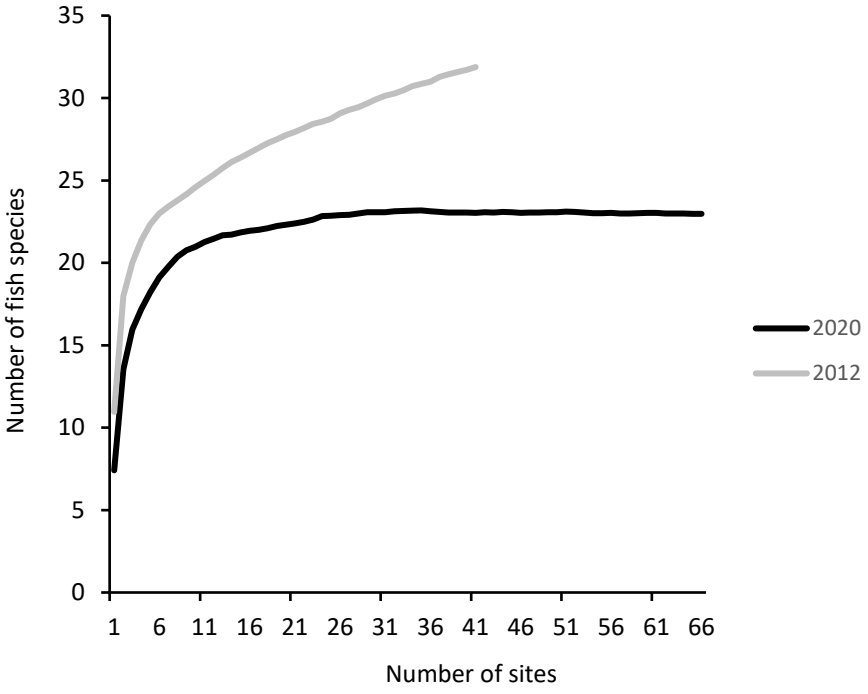


Figure 6. Comparison of fish species accumulation rates from 2020 (black line) surface trawling (66 sites) and 2012 (grey line) seining (41 sites) along the Trent River. Species accumulation curves were generated using EstimateS software (Colwell 2013) and species presence-absence data.

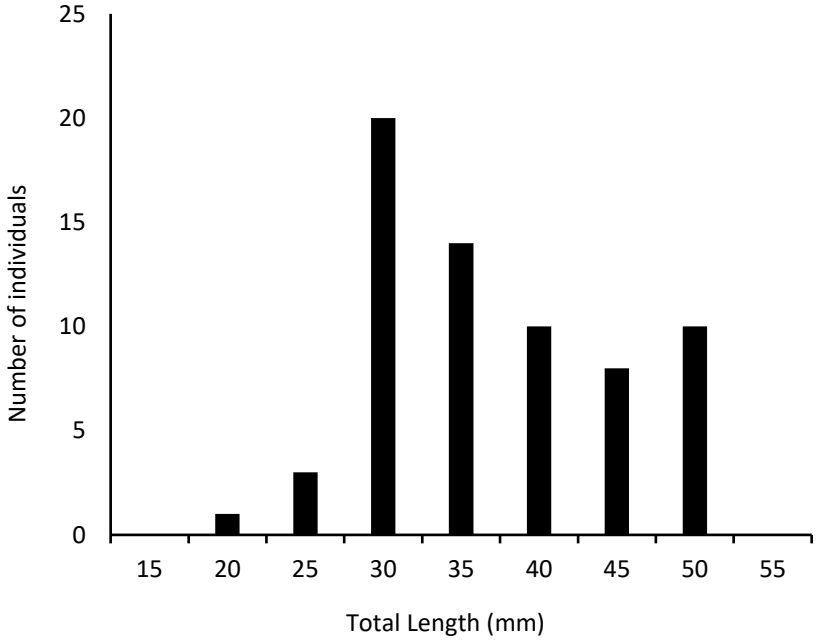


*Figure 7. Length frequencies for 66 Pugnose Shiner (*Notropis anogenus*) collected from 14 sites along the Glen Ross reach of the Trent River in 2020.*

Table 1. Relative abundance (%) and frequency of occurrence (%) of fishes captured from the Trent River in 2020, calculated from pooled (three passes combined) catch data. Species are listed in order from most to least abundant.

Common name	Relative abundance (%)	Frequency of occurrence (%)
Bluegill	33.18	100.00
Blackchin Shiner	19.72	78.79
Mimic Shiner	15.65	36.36
Bluntnose Minnow	13.22	75.76
Golden Shiner	6.36	66.67
Pumpkinseed	3.52	72.73
Rock Bass	2.42	66.67
Yellow Perch	1.99	56.06
Brook Silverside	1.63	36.36
Pugnose Shiner	0.59	21.21
Banded Killifish	0.34	15.15
Black Crappie	0.32	21.21
Largemouth Bass	0.32	34.85
Emerald Shiner	0.29	16.67
Spottail Shiner	0.13	4.55
Brown Bullhead	0.10	13.64
Smallmouth Bass	0.05	9.09
Common Shiner	0.05	4.55
Round Goby	0.05	7.58
Sunfish sp.	0.05	7.58
Northern Pike	0.02	3.03
Pumpkinseed x Bluegill	0.01	1.52

Table 2. Comparison of fish species frequency of occurrence (%) from one pass and three passes (pooled) at sites along the Trent River in 2020.

	Frequency of occurrence (% of sites)	
Common Name	**One pass**	**Three passes**
Bluegill	98.48	100.00
Pumpkinseed	60.61	72.73
Blackchin Shiner	59.09	78.79
Bluntnose Minnow	59.09	75.76
Rock Bass	50.00	66.67
Golden Shiner	42.42	66.67
Yellow Perch	40.91	56.06
Mimic Shiner	28.79	36.36
Brook Silverside	22.73	36.36
Black Crappie	16.67	21.21
Pugnose Shiner	15.15	21.21
Largemouth Bass	13.64	34.85
Banded Killifish	7.58	15.15
Emerald Shiner	7.58	16.67
Brown Bullhead	6.06	13.64
Sunfish sp.	4.55	7.58
Round Goby	3.03	7.58
Smallmouth Bass	3.03	9.09
Spottail Shiner	3.03	4.55
Common Shiner	1.52	4.55
Northern Pike	1.52	3.03
Pumpkinseed x Bluegill	0.00	1.52

*Table 3. Comparison of fish species frequency of occurrence (%) from 2012 and 2020 Trent River targeted surveys for Pugnose Shiner (*Notropis anogenus*).*

	Frequency of Occurrence			
	2020 Surface Trawl		2012 Seine	
Species	First Pass (n = 66)	Pooled Data (n = 66)	Haul-based (n = 68)	Site-based (n = 41)
Banded Killifish	7.6	15.2	41.2	52.4
Black Crappie	16.7	21.2	22.1	31.0
Blackchin Shiner	59.1	78.8	27.9	35.7
Bluegill	98.5	100.0	70.6	76.2
Bluntnose Minnow	59.1	75.8	82.4	85.7
Brook Silverside	22.7	36.4	47.1	59.5
Brown Bullhead	6.1	13.6	25.0	31.0
Central Mudminnow	0.0	0.0	1.5	2.4
Common Carp	0.0	0.0	1.5	2.4
Emerald Shiner	7.6	16.7	0.0	0.0
Fathead Minnow	0.0	0.0	1.5	2.4
Golden Shiner	42.4	66.7	27.9	33.3
Johnny Darter	0.0	0.0	10.3	16.7
Largemouth Bass	13.6	34.8	97.1	95.2
Logperch	0.0	0.0	73.5	83.3
Longnose Gar	0.0	0.0	2.9	4.8
Mimic Shiner	28.8	36.4	1.5	2.4
Muskellunge	0.0	0.0	5.9	9.5
Northern Pike	1.5	3.0	2.9	4.8
Pugnose Shiner	15.2	21.2	1.5	2.4
Pumpkinseed	60.6	72.7	70.6	73.8
Rock Bass	50.0	66.7	77.9	81.0
Round Goby	3.0	7.6	83.8	83.3
Smallmouth Bass	3.0	9.1	29.4	38.1
Spottail Shiner	3.0	4.5	8.8	9.5
White Sucker	0.0	0.0	10.3	11.9
Yellow Perch	40.9	56.1	88.2	92.9

Table 4. Relative abundance (%) and frequency of occurrence (%) of fishes captured from the Seymour Lake reach of the Trent River in 2020, calculated from pooled (three passes combined) catch data. Species are listed in order from most to least abundant.

Common name	Relative abundance (%)	Frequency of occurrence (%)
Bluegill	41.80	100.00
Blackchin Shiner	22.36	71.43
Bluntnose Minnow	15.12	71.43
Golden Shiner	10.79	71.43
Pumpkinseed	3.90	50.00
Yellow Perch	1.77	71.43
Brook Silverside	1.64	14.29
Rock Bass	1.05	78.57
Black Crappie	0.57	21.43
Banded Killifish	0.42	21.43
Largemouth Bass	0.20	42.86
Brown Bullhead	0.13	7.14
Common Shiner	0.07	0.00
Mimic Shiner	0.06	0.00
Smallmouth Bass	0.04	7.14
Sunfish sp.	0.04	14.29
Emerald Shiner	0.02	7.14
Round Goby	0.02	21.43
Spottail Shiner	0.02	14.29
Northern Pike	0.00	7.14
Pugnose Shiner	0.00	0.00
Pumpkinseed x Bluegill	0.00	0.00

Table 5. Relative abundance (%) and frequency of occurrence (%) of fishes captured from the Percy Boom reach of the Trent River in 2020, calculated from pooled (three passes combined) catch data. Species are listed in order from most to least abundant.

Common name	Relative abundance (%)	Frequency of occurrence (%)
Bluegill	41.80	100.00
Blackchin Shiner	22.36	88.46
Bluntnose Minnow	15.12	84.62
Golden Shiner	10.79	76.92
Pumpkinseed	3.90	76.92
Yellow Perch	1.77	65.38
Brook Silverside	1.64	50.00
Rock Bass	1.05	50.00
Black Crappie	0.57	38.46
Banded Killifish	0.42	11.54
Largemouth Bass	0.20	30.77
Brown Bullhead	0.13	19.23
Common Shiner	0.07	7.69
Mimic Shiner	0.06	11.54
Smallmouth Bass	0.04	7.69
Sunfish sp.	0.04	7.69
Emerald Shiner	0.02	3.85
Round Goby	0.02	3.85
Spottail Shiner	0.02	3.85
Northern Pike	0.00	0.00
Pugnose Shiner	0.00	0.00
Pumpkinseed x Bluegill	0.00	0.00

Table 6. Relative abundance (%) and frequency of occurrence (%) of fishes captured from the Glen Ross reach of the Trent River in 2020, calculated from pooled (three passes combined) catch data. Species are listed in order from most to least abundant.

Common name	Relative abundance (%)	Frequency of occurrence (%)
Mimic Shiner	44.19	86.96
Bluegill	16.39	100.00
Blackchin Shiner	14.53	78.26
Bluntnose Minnow	12.84	69.57
Pumpkinseed	3.80	86.96
Rock Bass	2.83	78.26
Pugnose Shiner	1.68	60.87
Brook Silverside	1.02	34.78
Golden Shiner	0.94	47.83
Emerald Shiner	0.46	34.78
Largemouth Bass	0.43	39.13
Yellow Perch	0.31	34.78
Banded Killifish	0.28	17.39
Smallmouth Bass	0.08	13.04
Brown Bullhead	0.05	8.70
Black Crappie	0.03	4.35
Common Shiner	0.03	4.35
Northern Pike	0.03	4.35
Pumpkinseed x Bluegill	0.03	4.35
Round Goby	0.03	4.35
Sunfish sp.	0.03	4.35
Spottail Shiner	0.00	0.00

Table 7. Summary of channel and water quality characteristics from 14 sites where Pugnose Shiner (Notropis anogenus) was detected along the Glen Ross reach of the Trent River in 2020.

	Channel width (m)	Mean depth (m)	Water temperature (°C)	Conductivity (µS/cm)	Secchi tube (m)
Minimum	28.0	0.97	17.0	255	0.88
Maximum	688.0	1.63	19.7	264	1.01
Mean	397.1	1.20	18.1	259	0.95

Table 8. Summary of substrate composition (%) from 14 sites where Pugnose Shiner (Notropis anogenus) was detected along the Glen Ross reach of the Trent River in 2020.

	Substrate (% Composition)							
	Organic	**Clay**	**Silt**	**Sand**	**Gravel**	**Cobble**	**Rubble**	**Unknown**
Minimum	10	0	0	0	0	0	0	0
Maximum	100	50	45	90	0	0	0	0
Mean	60.4	4.3	6.1	29.3	0.0	0.0	0.0	0.0

Table 9. Summary of aquatic vegetation data from 14 sites where Pugnose Shiner (Notropis anogenus) was detected along the Glen Ross reach of the Trent River in 2020.

	Vegetation rake		% Aquatic vegetation cover					
	Submerged macrophytes	**Filamentous algae**	**Open water**	**Emergent**	**Submerged**	**Floating**	**Unknown**	**Dominant macrophyte species**
Minimum	1	0	0	0	65	0	0	Wild Celery, Richardson's Pondweed
Maximum	3	2	0	25	100	30	0	
Mean	2.1	0.1	0.0	5.4	83.9	10.7	0.0	

APPENDICES

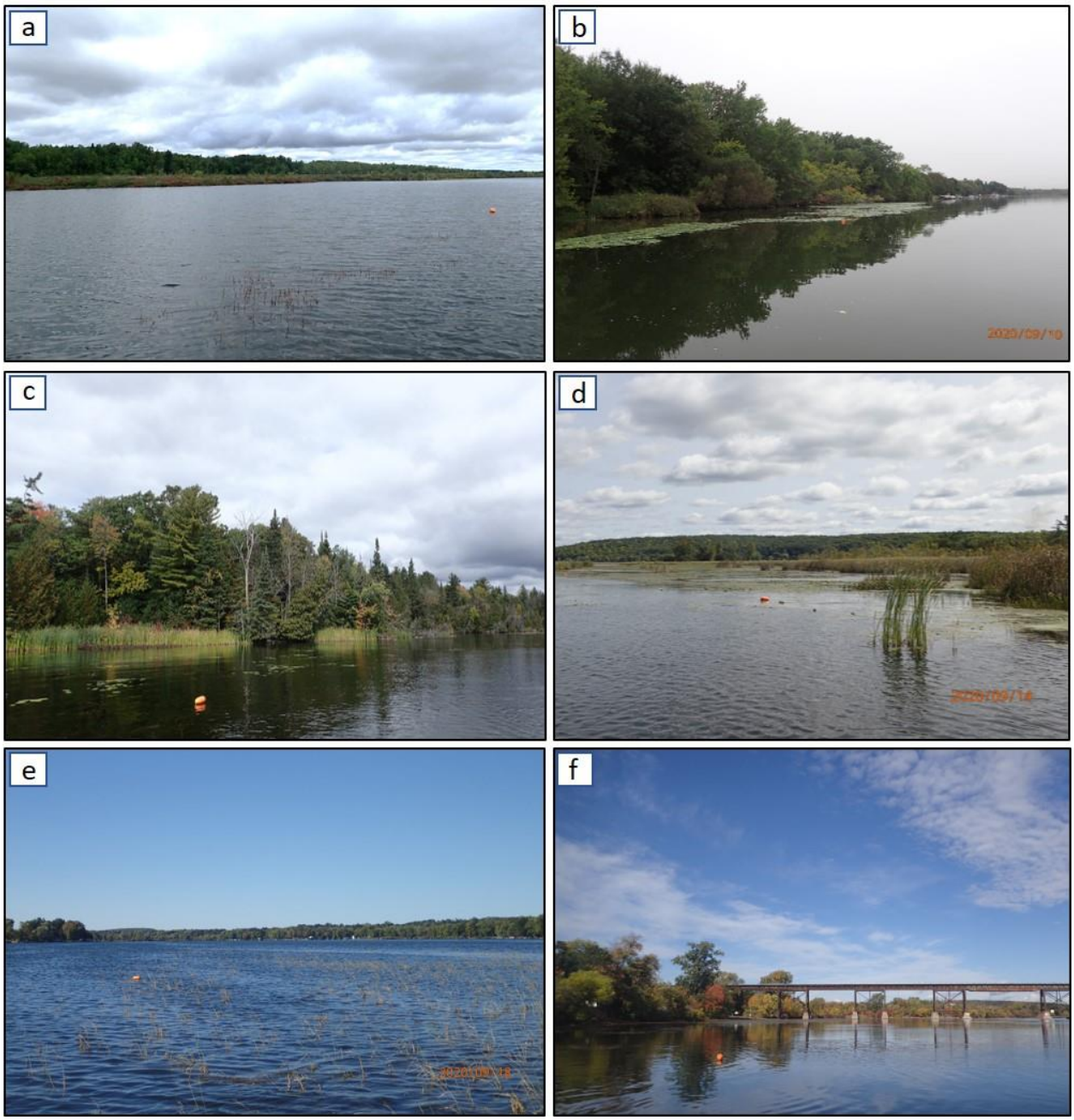
*Appendix 1. Site locality information for 66 sites sampled for Pugnose Shiner (*Notropis anogenus*) using a repeat Mamou (surface) trawl method along five reaches of the Trent River in 2020.*

Site code	River reach	Sample date	Latitude	Longitude
TR-01	Seymour Lake	10-Sep-20	44.35505	-77.90870
TR-02	Seymour Lake	10-Sep-20	44.36393	-77.90297
TR-03	Seymour Lake	10-Sep-20	44.36774	-77.90045
TR-04	Seymour Lake	10-Sep-20	44.37930	-77.89608
TR-05	Seymour Lake	10-Sep-20	44.38486	-77.89520
TR-06	Seymour Lake	8-Sep-20	44.38568	-77.85583
TR-07	Seymour Lake	8-Sep-20	44.38169	-77.85812
TR-08	Seymour Lake	8-Sep-20	44.38327	-77.84357
TR-09	Seymour Lake	8-Sep-20	44.38361	-77.83873
TR-10	Seymour Lake	8-Sep-20	44.38736	-77.83538
TR-11	Seymour Lake	22-Sep-20	44.39550	-77.83006
TR-12	Seymour Lake	22-Sep-20	44.38803	-77.80800
TR-13	Seymour Lake	22-Sep-20	44.38253	-77.81110
TR-14	Seymour Lake	22-Sep-20	44.38028	-77.81628
TR-15	Crowe Bay	5-Oct-20	44.37323	-77.76574
TR-16	Percy Reach	3-Sep-20	44.23103	-77.79650
TR-17	Percy Reach	3-Sep-20	44.23051	-77.79443
TR-18	Percy Reach	3-Sep-20	44.22371	-77.78545
TR-19	Percy Reach	3-Sep-20	44.22448	-77.78319
TR-20	Percy Reach	3-Sep-20	44.22654	-77.77528
TR-21	Percy Reach	21-Sep-20	44.23038	-77.76850
TR-22	Percy Reach	21-Sep-20	44.23449	-77.74555
TR-23	Percy Reach	21-Sep-20	44.23577	-77.73726
TR-24	Percy Reach	21-Sep-20	44.24754	-77.72138
TR-25	Percy Reach	21-Sep-20	44.25072	-77.71716
TR-26	Percy Reach	28-Sep-20	44.25496	-77.71474
TR-27	Percy Reach	17-Sep-20	44.26442	-77.71046
TR-28	Percy Reach	17-Sep-20	44.26458	-77.70778
TR-29	Percy Reach	28-Sep-20	44.25739	-77.70164
TR-30	Percy Reach	15-Sep-20	44.26318	-77.68018
TR-31	Percy Reach	28-Sep-20	44.25785	-77.69145
TR-32	Percy Reach	15-Sep-20	44.25663	-77.66368
TR-33	Percy Reach	17-Sep-20	44.27523	-77.65649
TR-34	Percy Reach	17-Sep-20	44.26973	-77.64899

Appendix 1 continued.

Site code	River reach	Sample date	Latitude	Longitude
TR-35	Percy Reach	15-Sep-20	44.24815	-77.63794
TR-36	Percy Reach	14-Sep-20	44.25036	-77.63770
TR-37	Percy Reach	14-Sep-20	44.26035	-77.63301
TR-38	Percy Reach	14-Sep-20	44.25045	-77.62822
TR-39	Percy Reach	14-Sep-20	44.26012	-77.62777
TR-40	Percy Reach	28-Sep-20	44.26035	-77.61242
TR-41	Percy Reach	15-Sep-20	44.26368	-77.61122
TR-42	Glen Ross	18-Sep-20	44.26889	-77.59071
TR-43	Glen Ross	11-Sep-20	44.26527	-77.57037
TR-44	Glen Ross	18-Sep-20	44.26342	-77.57111
TR-45	Glen Ross	11-Sep-20	44.26163	-77.57030
TR-46	Glen Ross	1-Oct-20	44.26014	-77.57098
TR-47	Glen Ross	24-Sep-20	44.25989	-77.56910
TR-48	Glen Ross	1-Oct-20	44.25960	-77.56976
TR-49	Glen Ross	1-Oct-20	44.25949	-77.57188
TR-50	Glen Ross	11-Sep-20	44.25751	-77.57110
TR-51	Glen Ross	1-Oct-20	44.25751	-77.57408
TR-52	Glen Ross	24-Sep-20	44.24710	-77.57078
TR-53	Glen Ross	25-Sep-20	44.24405	-77.57587
TR-54	Glen Ross	18-Sep-20	44.24210	-77.57904
TR-55	Glen Ross	25-Sep-20	44.23962	-77.57823
TR-56	Glen Ross	24-Sep-20	44.23847	-77.58111
TR-57	Glen Ross	23-Sep-20	44.23941	-77.58320
TR-58	Glen Ross	24-Sep-20	44.23613	-77.57995
TR-59	Glen Ross	11-Sep-20	44.23584	-77.58383
TR-60	Glen Ross	18-Sep-20	44.23509	-77.58311
TR-61	Glen Ross	23-Sep-20	44.23360	-77.58264
TR-62	Glen Ross	23-Sep-20	44.23222	-77.58942
TR-63	Glen Ross	25-Sep-20	44.22874	-77.59347
TR-64	Glen Ross	25-Sep-20	44.22606	-77.59186
TR-65	Trenton	30-Sep-20	44.10964	-77.58978
TR-66	Trenton	30-Sep-20	44.10796	-77.58778

Appendix 2. Site photos representing examples of aquatic habitat sampled during 2020 targeted sampling for Pugnose Shiner (Notropis anogenus) along the Trent River: a) TR-02 (Seymour Lake), b) TR-05 (Seymour Lake), c) TR-15 (Crowe Bay), d) TR-39 (Percy Boom), e) TR-60 (Glen Ross), and f) TR-66 (Trenton).



Appendix 3a. Common and Scientific names of fishes captured from the Trent River during 2012 and 2020 targeted sampling for Pugnose Shiner (Notropis anogenus).

Common Name	Scientific Name
Banded Killifish	*Fundulus diaphanus*
Black Crappie	*Pomoxis nigromaculatus*
Blackchin Shiner	*Notropis heterodon*
Bluegill	*Lepomis macrochirus*
Bluntnose Minnow	*Pimephales notatus*
Brook Silverside	*Labidesthes sicculus*
Brown Bullhead	*Ameiurus nebulosus*
Central Mudminnow	*Umbra limi*
Common Carp	*Cyprinus carpio*
Common Shiner	*Luxilus cornutus*
Emerald Shiner	*Notropis atherinoides*
Golden Shiner	*Notemigonus crysoleucas*
Johnny Darter	*Etheostoma nigrum*
Largemouth Bass	*Micropterus salmoides*
Logperch	*Percina caprodes*
Longnose Gar	*Lepisosteus osseus*
Mimic Shiner	*Notropis volucellus*
Muskellunge	*Esox masquinongy*
Northern Pike	*Esox lucius*
Pugnose Shiner	*Notropis anogenus*
Pumpkinseed	*Lepomis gibbosus*
Pumpkinseed x Bluegill	*Lepomis gibbosus x Lepomis macrochirus*
Rock Bass	*Ambloplites rupestris*
Round Goby	*Neogobius melanostomus*
Smallmouth Bass	*Micropterus dolomieu*
Spottail Shiner	*Notropis hudsonius*
Sunfish sp.	*Lepomis sp.*
Yellow Perch	*Perca flavescens*
White Sucker	*Catostomus commersonii*

*Appendix 3b. Common and Scientific names of aquatic macrophytes collected from the Trent River during 2020 targeted sampling for Pugnose Shiner (*Notropis anogenus*).*

Common Name	Scientific Name
Chara sp.	*Chara sp.*
Common Bladderwort	*Utricularia vulgaris*
Common Waterweed	*Elodea canadensis*
Coontail sp.	*Ceratophyllum sp.*
Curly-leaf Pondweed	*Potamogeton crispus*
Crowfoot sp.	*Ranunculus sp.*
Eurasian Water Milfoil	*Myriophyllum spicatum*
Fern Pondweed	*Potamogeton robbinsii*
Flatstem Pondweed	*Potamogeton zosteriformis*
Large-leaved Pondweed	*Potamogeton amplifolius*
Milfoil sp.	*Myriophyllum sp.*
Pondweed sp.	*Potamogeton sp.*
Richardson's Pondweed	*Potamogeton richardsonii*
Sago Pondweed	*Stuckenia pectinata*
Slender Naiad	*Najas flexilis*
Slender Pondweed	*Potamogeton pusillus*
Water Marigold	*Caltha palustris*
White Pond Lily	*Nymphaea alba*
Wild Celery	*Vallisneria americana*
Wild Rice	*Zizania palustris*

Appendix 4. Species-specific sampling-related mortalities associated with surface trawling at 66 sites along the Trent River in 2020.

Site Code	Pass #	Blackchin Shiner	Bluegill	Bluntnose Minnow	Brook Silverside	Emerald Shiner	Golden Shiner	Mimic Shiner	Rock Bass	Spottail Shiner	Sunfish sp.	Yellow Perch
TR-01	1	0	0	2	0	0	2	0	0	0	0	0
TR-02	1	0	0	0	0	0	0	0	0	1	0	0
TR-02	2	1	0	0	0	0	0	0	0	0	0	0
TR-04	1	0	2	0	0	0	0	0	0	0	0	0
TR-04	2	1	0	0	0	0	2	0	0	0	0	0
TR-04	3	0	1	0	0	0	0	0	1	0	0	0
TR-06	3	2	0	0	0	0	0	0	0	0	0	0
TR-07	2	0	0	1	0	0	0	0	0	0	0	0
TR-08	3	0	1	1	0	0	0	0	0	0	0	0
TR-09	3	1	0	0	0	0	0	0	0	0	0	0
TR-14	1	4	0	1	0	0	0	0	0	0	0	0
TR-14	2	1	0	0	0	0	0	0	0	0	0	0
TR-16	2	0	2	0	0	0	0	0	0	0	0	0
TR-16	3	0	5	0	0	0	0	0	0	0	0	0
TR-19	3	0	0	0	0	0	0	0	0	1	0	0
TR-20	1	0	0	2	0	0	0	0	0	0	0	0
TR-20	3	0	0	1	0	0	0	0	0	0	0	0
TR-23	1	1	0	0	0	0	1	0	0	0	0	0
TR-25	3	0	0	0	1	0	0	0	0	0	0	0
TR-27	2	2	0	0	0	0	0	0	0	0	0	0
TR-27	3	0	0	1	0	0	0	0	0	0	0	0
TR-28	1	2	0	0	0	0	0	0	0	0	1	0
TR-28	2	0	5	0	0	0	0	0	0	0	0	0
TR-28	3	7	2	0	0	0	0	0	0	0	0	0
TR-30	1	0	2	0	0	0	0	0	0	0	0	0
TR-30	3	0	1	0	0	0	0	0	0	0	0	0
TR-32	2	1	2	0	0	0	1	0	0	0	0	1
TR-33	2	0	1	0	1	0	1	0	0	0	0	0
TR-33	3	0	1	0	0	0	0	0	0	0	0	0
TR-35	1	2	0	0	0	0	0	0	0	0	0	0
TR-35	2	0	0	1	0	0	5	0	0	0	0	0
TR-35	3	0	0	0	0	0	3	0	0	0	0	0
TR-37	1	0	0	0	1	0	0	0	0	0	0	0
TR-37	3	1	0	0	0	0	0	0	0	0	0	0
TR-38	2	10	0	0	0	0	0	0	0	0	0	0
TR-38	3	1	0	0	1	0	1	0	0	0	0	0
TR-39	2	2	0	0	0	0	0	0	0	0	0	0
TR-39	3	10	2	0	0	0	0	0	0	0	0	0
TR-41	1	5	0	0	0	0	0	0	0	0	0	0
TR-44	1	3	0	11	0	0	0	10	0	0	0	0

Appendix 4 continued.

Site Code	Pass #	Blackchin Shiner	Bluegill	Bluntnose Minnow	Brook Silverside	Emerald Shiner	Golden Shiner	Mimic Shiner	Rock Bass	Spottail Shiner	Sunfish sp.	Yellow Perch
TR-46	2	1	0	0	0	0	0	0	0	0	0	0
TR-49	2	1	0	0	0	0	0	0	0	0	0	0
TR-49	3	0	0	2	0	0	0	0	0	0	0	0
TR-50	1	3	0	0	3	2	0	16	0	0	0	0
TR-51	1	1	0	0	0	0	0	0	0	0	0	0
TR-51	2	0	0	1	0	0	0	0	0	0	0	0
TR-56	1	0	0	0	0	0	0	1	0	0	0	0
TR-57	3	0	0	0	0	0	1	0	0	0	0	0
TR-58	1	0	0	1	0	0	0	2	0	0	0	0
TR-59	2	1	0	0	0	0	0	2	0	0	0	0
TR-59	3	1	0	0	0	0	0	0	0	0	0	0
TR-60	3	0	0	0	0	0	0	0	1	0	0	0
TR-64	1	0	0	0	0	0	0	1	0	0	0	0
TR-65	1	0	0	0	0	0	1	0	0	0	0	0
TR-66	1	0	1	0	0	0	0	0	0	0	0	0
TR-66	3	0	1	0	0	0	0	0	0	0	0	0
Total		65	29	25	7	2	18	32	2	2	1	1

Appendix 5a. Species count data for fishes captured at 14 sites in the Seymour Lake reach (TR-01 to TR-14) and one site in the Crowe Bay reach (TR-15) of the Trent River in 2020, listed in order from most to least abundant.

Common Name	TR-01	TR-02	TR-03	TR-04	TR-05	TR-06	TR-07	TR-08	TR-09	TR-10	TR-11	TR-12	TR-13	TR-14	TR-15
Bluegill	23	30	2	215	18	98	24	30	24	13	40	16	4	72	13
Blackchin Shiner	6	4	0	2	0	70	22	0	21	0	27	6	1	241	3
Mimic Shiner	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bluntnose Minnow	15	1	0	0	2	28	4	8	18	0	3	0	2	57	1
Golden Shiner	21	0	2	6	2	0	10	0	2	2	1	0	5	13	2
Pumpkinseed	0	3	0	1	0	9	6	2	0	0	6	0	0	1	0
Rock Bass	7	8	0	12	0	30	14	11	1	1	4	2	0	3	0
Yellow Perch	5	4	0	21	0	24	6	2	2	0	9	3	0	10	0
Brook Silverside	0	0	0	0	1	0	12	0	0	0	0	0	0	0	0
Pugnose Shiner	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Banded Killifish	0	0	0	0	0	1	2	0	0	0	0	0	0	1	0
Black Crappie	1	0	0	2	0	0	1	0	0	0	0	0	0	0	0
Largemouth Bass	0	0	0	0	2	1	0	1	1	0	1	0	0	1	0
Emerald Shiner	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Spottail Shiner	0	1	0	12	0	0	0	0	0	0	0	0	0	0	0
Brown Bullhead	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Smallmouth Bass	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Common Shiner	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Round Goby	1	0	0	1	0	1	0	0	0	0	0	0	0	0	0
Sunfish sp.	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0
Northern Pike	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Pumpkinseed x Bluegill	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	80	51	5	272	25	263	102	55	69	16	91	27	12	400	19

Appendix 5b. Species count data for fishes captured at 26 sites in the Percy Boom reach of the Trent River in 2020, listed in order from most to least abundant.

Common Name	TR-16	TR-17	TR-18	TR-19	TR-20	TR-21	TR-22	TR-23	TR-24	TR-25	TR-26	TR-27
Bluegill	107	16	29	1	116	187	1	4	58	3	82	85
Blackchin Shiner	0	0	7	2	14	21	139	26	1	41	34	104
Mimic Shiner	0	0	1	1	0	0	0	0	0	0	0	0
Bluntnose Minnow	0	2	14	19	18	79	102	17	0	79	21	76
Golden Shiner	0	0	0	2	0	7	59	3	7	21	0	0
Pumpkinseed	6	0	4	1	9	12	0	0	2	0	11	4
Rock Bass	0	0	0	0	0	7	0	0	0	0	0	2
Yellow Perch	3	0	0	0	1	1	0	0	1	1	11	4
Brook Silverside	0	0	8	0	0	20	10	0	0	4	2	0
Pugnose Shiner	0	0	0	0	0	0	0	0	0	0	0	0
Banded Killifish	0	0	0	0	0	0	0	0	0	0	2	0
Black Crappie	2	0	5	0	4	0	0	0	0	0	0	1
Largemouth Bass	0	1	0	0	0	1	0	0	1	0	1	0
Emerald Shiner	0	0	0	0	0	0	0	0	0	0	0	0
Spottail Shiner	0	0	0	1	0	0	0	0	0	0	0	0
Brown Bullhead	0	0	1	0	0	1	0	0	0	0	0	0
Smallmouth Bass	0	1	1	0	0	0	0	0	0	0	0	0
Common Shiner	0	2	0	2	0	0	0	0	0	0	0	0
Round Goby	0	0	0	0	0	1	0	0	0	0	0	0
Sunfish sp.	0	0	0	0	0	0	0	0	0	0	0	0
Northern Pike	0	0	0	0	0	0	0	0	0	0	0	0
Pumpkinseed x Bluegill	0	0	0	0	0	0	0	0	0	0	0	0
Total	118	22	70	29	162	337	311	50	70	149	164	276

Appendix 5b continued.

Common Name	TR-28	TR-29	TR-30	TR-31	TR-32	TR-33	TR-34	TR-35	TR-36	TR-37	TR-38	TR-39	TR-40	TR-41
Bluegill	276	50	116	5	419	59	21	78	20	22	60	282	81	95
Blackchin Shiner	115	5	17	40	194	6	15	116	0	27	119	94	29	50
Mimic Shiner	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Bluntnose Minnow	23	10	11	25	107	59	38	33	0	61	21	1	0	6
Golden Shiner	1	7	24	11	36	26	36	244	1	49	39	6	7	1
Pumpkinseed	28	1	13	0	1	25	3	9	0	3	11	40	11	18
Rock Bass	8	0	2	0	1	2	0	4	1	1	13	9	4	3
Yellow Perch	29	0	5	0	2	3	1	0	0	1	3	14	9	7
Brook Silverside	0	0	0	0	5	3	6	12	0	13	1	1	0	4
Pugnose Shiner	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Banded Killifish	20	0	0	0	0	0	0	1	0	0	0	0	0	0
Black Crappie	0	6	2	0	1	6	0	3	0	0	1	0	0	0
Largemouth Bass	3	0	0	0	2	0	0	1	0	0	0	1	0	0
Emerald Shiner	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Spottail Shiner	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Brown Bullhead	1	0	0	0	0	0	0	0	0	0	2	0	0	2
Smallmouth Bass	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Common Shiner	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Round Goby	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sunfish sp.	1	0	0	0	0	0	0	0	0	0	1	0	0	0
Northern Pike	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pumpkinseed x Bluegill	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	506	79	190	81	768	189	120	501	22	177	271	448	142	186

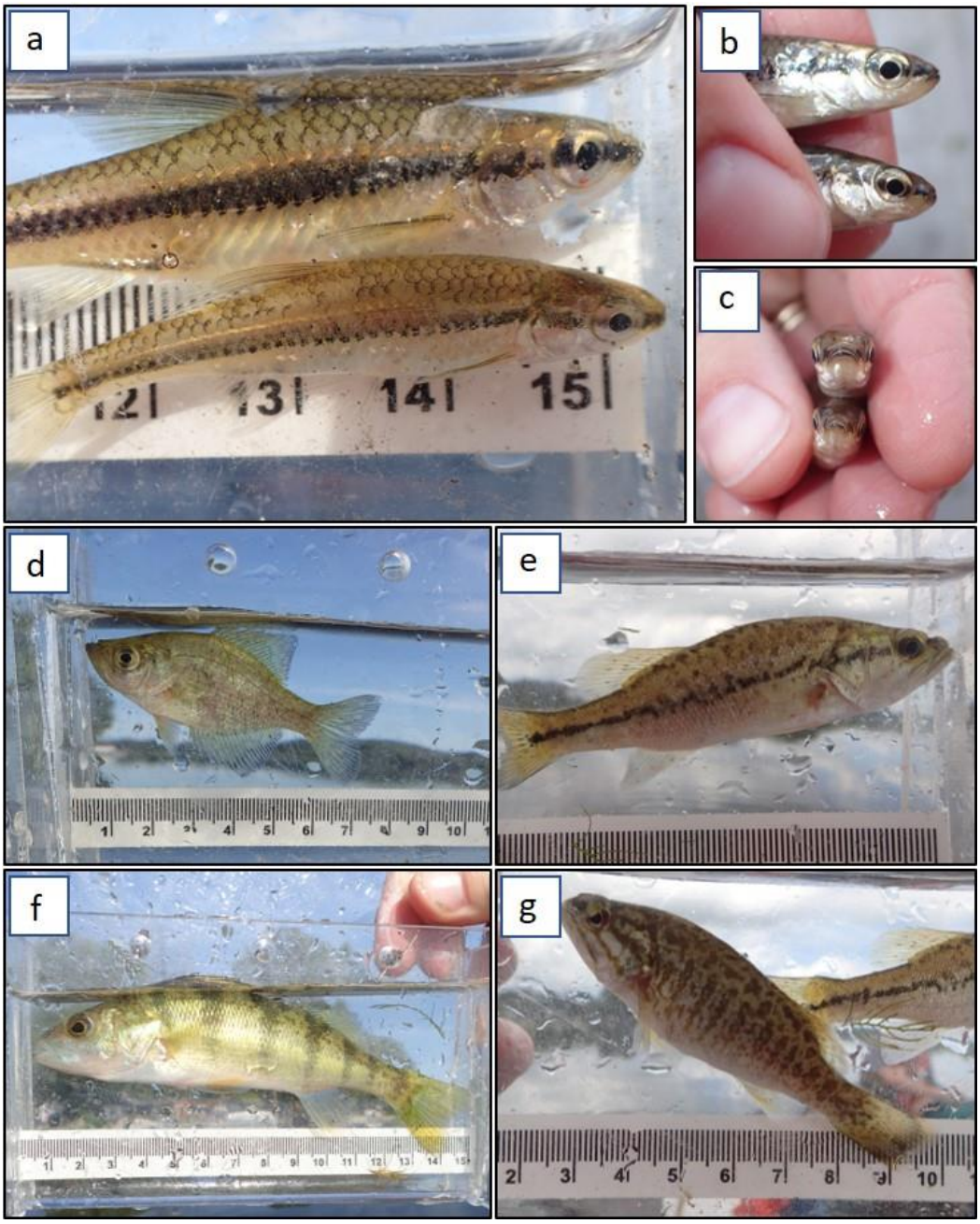
Appendix 5c. Species count data for fishes captured at 23 sites in the Glen Ross reach (TR-42 to TR-64) and two sites in the Trenton reach (TR-65 and TR-66) of the Trent River in 2020, listed in order from most to least abundant.

Common Name	TR-42	TR-43	TR-44	TR-45	TR-46	TR-47	TR-48	TR-49	TR-50	TR-51	TR-52	TR-53
Bluegill	61	20	26	30	15	6	26	30	2	54	30	4
Blackchin Shiner	36	5	33	53	47	4	17	108	7	51	5	0
Mimic Shiner	3	110	91	58	57	95	267	25	40	22	3	0
Bluntnose Minnow	0	12	56	8	68	21	58	38	2	68	0	0
Golden Shiner	0	0	2	3	5	0	1	7	0	13	1	0
Pumpkinseed	0	2	9	4	1	1	0	7	3	16	10	2
Rock Bass	0	2	5	9	2	3	0	2	6	12	2	1
Yellow Perch	0	1	0	0	0	2	0	0	0	1	1	0
Brook Silverside	5	0	1	2	0	0	1	2	25	0	0	0
Pugnose Shiner	0	0	1	5	13	1	6	11	2	2	0	0
Banded Killifish	0	0	0	0	1	0	3	0	1	0	0	0
Black Crappie	0	0	0	0	0	0	1	0	0	0	0	0
Largemouth Bass	0	0	1	0	1	2	2	0	0	2	0	0
Emerald Shiner	0	2	0	0	0	4	1	0	6	0	0	0
Spottail Shiner	0	0	0	0	0	0	0	0	0	0	0	0
Brown Bullhead	0	0	0	0	0	0	0	0	0	1	0	0
Smallmouth Bass	0	0	0	0	0	0	0	0	0	0	0	1
Common Shiner	0	1	0	0	0	0	0	0	0	0	0	0
Round Goby	0	0	0	0	0	0	0	0	0	0	0	0
Sunfish sp.	0	0	0	0	0	1	0	0	0	0	0	0
Northern Pike	0	0	0	0	0	0	0	0	0	0	1	0
Pumpkinseed x Bluegill	0	0	1	0	0	0	0	0	0	0	0	0
Total	105	155	226	172	210	140	383	230	94	242	53	8

Appendix 5c continued.

Common Name	TR-54	TR-55	TR-56	TR-57	TR-58	TR-59	TR-60	TR-61	TR-62	TR-63	TR-64	TR-65	TR-66
Bluegill	38	55	18	24	4	18	23	76	5	70	7	40	104
Blackchin Shiner	0	73	0	6	23	53	17	20	0	11	0	0	0
Mimic Shiner	0	129	107	0	203	193	76	104	60	78	10	2	0
Bluntnose Minnow	0	47	5	0	29	3	4	74	0	10	0	2	0
Golden Shiner	0	2	0	1	0	1	0	0	1	0	0	14	1
Pumpkinseed	18	4	7	6	0	10	24	12	2	5	6	1	0
Rock Bass	5	4	7	0	0	4	10	26	0	10	1	1	7
Yellow Perch	1	0	0	0	0	2	1	0	0	3	0	13	14
Brook Silverside	0	1	0	0	0	0	3	0	0	0	0	39	0
Pugnose Shiner	0	1	1	0	3	15	2	3	0	0	0	0	0
Banded Killifish	0	0	0	0	0	0	0	6	0	0	0	0	0
Black Crappie	0	0	0	0	0	0	0	0	0	0	0	0	0
Largemouth Bass	0	0	1	0	2	0	0	2	0	4	0	0	0
Emerald Shiner	0	1	2	0	1	0	1	0	0	0	0	12	0
Spottail Shiner	0	0	0	0	0	0	0	0	0	0	0	0	0
Brown Bullhead	0	0	0	0	0	0	0	1	0	0	0	1	0
Smallmouth Bass	0	1	0	0	0	0	0	0	0	0	1	0	0
Common Shiner	0	0	0	0	0	0	0	0	0	0	0	0	0
Round Goby	0	1	0	0	0	0	0	0	0	0	0	0	0
Sunfish sp.	0	0	0	0	0	0	0	0	0	0	0	0	0
Northern Pike	0	0	0	0	0	0	0	0	0	0	0	0	0
Pumpkinseed x Bluegill	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	62	319	148	37	265	299	161	324	68	191	25	125	126

*Appendix 6. Photos of notable species captured from the Trent River in 2020: a) Blackchin Shiner (*Notropis heterodon*; top) and Pugnose Shiner (*Notropis anogenus*; bottom) full body comparison, b) Blackchin Shiner (top) and Pugnose Shiner (bottom) side view mouth comparison, c) Blackchin Shiner (top) and Pugnose Shiner (bottom) front view mouth comparison, d) Black Crappie (*Pomoxis nigromaculatus*), e) Largemouth Bass (*Micropterus salmoides*), f) Yellow Perch (*Perca flavescens*), and g) Smallmouth Bass (*Micropterus dolomieu*).*



Appendix 7a. Channel and water quality characteristics at 14 sites sampled along the Seymour Lake reach of the Trent River in 2020.

Site code	Stream width (m)	Mean depth (m)	Water temperature (°C)	Conductivity (µS/cm)	Secchi tube (m)
TR-01	402	1.00	19.7	254	0.65
TR-02	476	2.17	19.1	255	-
TR-03	369	1.33	18.7	256	0.82
TR-04	489	2.00	18.5	258	0.80
TR-05	280	1.47	18.3	258	0.74
TR-06	483	0.83	19.7	256	0.75
TR-07	526	1.53	19.5	259	0.70
TR-08	295	1.07	18.3	265	0.70
TR-09	1570	1.13	19.3	261	0.50
TR-10	912	1.53	19.2	260	0.75
TR-11	795	0.97	18.1	255	0.90
TR-12	705	1.23	15.6	262	0.70
TR-13	882	1.43	16.2	260	0.80
TR-14	1060	0.87	16.9	249	0.90
Minimum	280	0.83	15.6	249	0.50
Maximum	1570	2.17	19.7	265	0.90
Median*	508	1.28	18.6	258	0.75

Appendix 7b. Channel and water quality characteristics at one site sampled in the Crowe Bay reach of the Trent River in 2020.

Site code	Channel width (m)	Mean water depth (m)	Water temperature (°C)	Conductivity (µS/cm)	Secchi tube (m)
TR-15	375	1.07	15.3	192	1.21

Appendix 7c. Channel and water quality characteristics at 26 sites sampled along the Percy Boom reach of the Trent River in 2020.

Site code	Stream width (m)	Mean depth (m)	Water temperature (°C)	Conductivity (µS/cm)	Secchi tube (m)
TR-16	540	2.43	22.6	263	0.50
TR-17	780	0.87	22.8	254	0.65
TR-18	1350	1.03	23.7	273	0.70
TR-19	1390	1.50	23.6	270	0.65
TR-20	1110	0.77	24.3	277	0.50
TR-21	694	1.33	17.5	279	0.94
TR-22	607	1.40	15.9	265	0.96
TR-23	223	1.17	16.4	263	1.00
TR-24	122	1.67	17.6	257	0.90
TR-25	35	1.30	18.4	255	0.95
TR-26	1170	0.93	19.9	256	0.92
TR-27	262	0.93	18.0	244	0.91
TR-28	190	0.83	17.7	253	0.88
TR-29	362	1.07	20.0	256	1.04
TR-30	220	1.10	19.5	253	0.90
TR-31	336	1.33	19.3	257	1.05
TR-32	288	0.90	19.4	255	0.90
TR-33	35	1.50	19.0	255	0.89
TR-34	47	1.53	19.4	258	0.89
TR-35	149	1.03	18.5	259	0.87
TR-36	195	2.03	18.5	257	0.95
TR-37	77	1.23	19.9	255	-
TR-38	165	1.60	19.2	257	0.85
TR-39	121	0.90	19.5	257	0.96
TR-40	295	1.13	20.2	255	1.00
TR-41	438	0.83	17.3	262	0.95
Minimum	35	0.77	15.9	244	0.50
Maximum	1390	2.43	24.3	279	1.05
Median	275	1.15	19.4	257	0.90

Appendix 7d. Channel and water quality characteristics at 23 sites sampled along the Glen Ross reach of the Trent River in 2020.

Site code	Stream width (m)	Mean depth (m)	Water temperature (°C)	Conductivity (µS/cm)	Secchi tube (m)
TR-42	118	1.50	18.2	258	0.95
TR-43	55	1.23	19.3	258	0.90
TR-44	28	1.63	18.1	259	0.93
TR-45	226	1.27	19.7	257	0.88
TR-46	392	1.10	18.1	260	1.00
TR-47	370	1.03	18.6	259	0.95
TR-48	426	1.40	17.8	262	1.01
TR-49	45	1.23	18.2	258	0.98
TR-50	180	1.37	18.4	264	0.90
TR-51	117	1.00	18.2	260	0.99
TR-52	412	1.20	18.8	251	1.05
TR-53	292	1.57	18.9	254	0.98
TR-54	361	1.57	17.3	263	0.92
TR-55	615	0.97	17.5	259	0.96
TR-56	688	1.13	17.8	256	0.96
TR-57	693	1.80	18.5	254	-
TR-58	660	1.33	17.0	260	0.97
TR-59	590	1.30	18.0	261	0.92
TR-60	627	1.03	17.8	261	0.92
TR-61	596	1.00	18.1	255	0.96
TR-62	505	1.60	17.0	257	0.96
TR-63	478	1.10	17.7	257	0.97
TR-64	511	1.57	19.6	256	1.06
Minimum	28	0.97	17.0	251	0.88
Maximum	693	1.80	19.7	264	1.06
Median	412	1.27	18.1	258	0.96

Appendix 7e. Channel and water quality characteristics at 2 sites sampled along the Trenton reach of the Trent River in 2020.

Site code	Stream width (m)	Mean depth (m)	Water temperature (°C)	Conductivity (µS/cm)	Secchi tube (m)
TR-65	290	1.20	18.5	300	1.00
TR-66	263	1.30	18.6	275	0.96
Median	277	1.25	18.6	288	0.98

Appendix 8a. Percent substrate composition at 14 sites sampled along the Seymour Lake reach of the Trent River in 2020.

	Substrate (% composition)							
Site code	**Organic**	**Clay**	**Silt**	**Sand**	**Gravel**	**Cobble**	**Rubble**	**Unknown**
TR-01	100	0	0	0	0	0	0	0
TR-02	100	0	0	0	0	0	0	0
TR-03	100	0	0	0	0	0	0	0
TR-04	80	0	20	0	0	0	0	0
TR-05	60	0	40	0	0	0	0	0
TR-06	60	0	40	0	0	0	0	0
TR-07	80	0	20	0	0	0	0	0
TR-08	50	0	50	0	0	0	0	0
TR-09	80	0	20	0	0	0	0	0
TR-10	100	0	0	0	0	0	0	0
TR-11	100	0	0	0	0	0	0	0
TR-12	100	0	0	0	0	0	0	0
TR-13	100	0	0	0	0	0	0	0
TR-14	100	0	0	0	0	0	0	0
Minimum	50	0	0	0	0	0	0	0
Maximum	100	0	50	0	0	0	0	0
Median	100	0	0	0	0	0	0	0

Appendix 8b. Percent substrate composition at one site sampled in the Crowe Bay reach of the Trent River in 2020.

	Substrate (% composition)							
Site code	**Organic**	**Clay**	**Silt**	**Sand**	**Gravel**	**Cobble**	**Rubble**	**Unknown**
TR-15	100	0	0	0	0	0	0	0

Appendix 8c. Percent substrate composition at 26 sites sampled along the Percy Boom reach of the Trent River in 2020.

	Substrate (% composition)							
Site code	**Organic**	**Clay**	**Silt**	**Sand**	**Gravel**	**Cobble**	**Rubble**	**Unknown**
TR-16	100	0	0	0	0	0	0	0
TR-17	80	0	10	10	0	0	0	0
TR-18	50	0	40	10	0	0	0	0
TR-19	50	0	50	0	0	0	0	0
TR-20	30	0	65	5	0	0	0	0
TR-21	20	0	0	80	0	0	0	0
TR-22	95	0	0	5	0	0	0	0
TR-23	100	0	0	0	0	0	0	0
TR-24	100	0	0	0	0	0	0	0
TR-25	100	0	0	0	0	0	0	0
TR-26	100	0	0	0	0	0	0	0
TR-27	100	0	0	0	0	0	0	0
TR-28	70	30	0	0	0	0	0	0
TR-29	100	0	0	0	0	0	0	0
TR-30	100	0	0	0	0	0	0	0
TR-31	100	0	0	0	0	0	0	0
TR-32	70	30	0	0	0	0	0	0
TR-33	80	0	0	20	0	0	0	0
TR-34	80	0	20	0	0	0	0	0
TR-35	75	20	0	0	5	0	0	0
TR-36	100	0	0	0	0	0	0	0
TR-37	10	0	0	0	0	0	0	90
TR-38	100	0	0	0	0	0	0	0
TR-39	100	0	0	0	0	0	0	0
TR-40	100	0	0	0	0	0	0	0
TR-41	100	0	0	0	0	0	0	0
Minimum	10	0	0	0	0	0	0	0
Maximum	100	30	65	80	5	0	0	90
Median	100	0	0	0	0	0	0	0

Appendix 8d. Percent substrate composition at 23 sites sampled along the Glen Ross reach of the Trent River in 2020.

	Substrate (% composition)							
Site code	**Organic**	**Clay**	**Silt**	**Sand**	**Gravel**	**Cobble**	**Rubble**	**Unknown**
TR-42	100	0	0	0	0	0	0	0
TR-43	60	0	20	20	0	0	0	0
TR-44	50	50	0	0	0	0	0	0
TR-45	80	0	20	0	0	0	0	0
TR-46	30	0	0	70	0	0	0	0
TR-47	20	0	0	80	0	0	0	0
TR-48	10	0	0	90	0	0	0	0
TR-49	60	0	0	40	0	0	0	0
TR-50	20	0	20	60	0	0	0	0
TR-51	90	0	0	10	0	0	0	0
TR-52	100	0	0	0	0	0	0	0
TR-53	10	0	0	90	0	0	0	0
TR-54	100	0	0	0	0	0	0	0
TR-55	90	10	0	0	0	0	0	0
TR-56	50	0	0	50	0	0	0	0
TR-57	100	0	0	0	0	0	0	0
TR-58	100	0	0	0	0	0	0	0
TR-59	45	0	45	10	0	0	0	0
TR-60	100	0	0	0	0	0	0	0
TR-61	100	0	0	0	0	0	0	0
TR-62	100	0	0	0	0	0	0	0
TR-63	90	10	0	0	0	0	0	0
TR-64	50	0	0	0	50	0	0	0
Minimum	10	0	0	0	0	0	0	0
Maximum	100	50	45	90	50	0	0	0
Median	80	0	0	0	0	0	0	0

Appendix 8e. Percent substrate composition at 2 sites sampled along the Trenton reach of the Trent River in 2020.

	Substrate (% composition)							
Site code	**Organic**	**Clay**	**Silt**	**Sand**	**Gravel**	**Cobble**	**Rubble**	**Unknown**
TR-65	50	30	20	0	0	0	0	0
TR-66	0	0	0	20	0	20	60	0
Median	25	15	10	10	0	10	30	0

Appendix 9a. Aquatic vegetation data from 14 sites sampled along the Glen Ross reach of the Trent River in 2020.

	Vegetation rake			% Aquatic vegetation cover			
Site code	Submerged macrophytes	Filamentous algae	Open water	Emergent	Submerged	Floating	Dominant macrophytes
TR-01	1	0	0	0	100	0	Wild Celery, Slender Naiad
TR-02	2	0	0	0	100	0	Eurasian Water Milfoil
TR-03	1	0	20	0	80	0	Wild Celery
TR-04	2	0	0	0	100	0	Eurasian Water Milfoil
TR-05	2	0	10	0	90	0	Common Waterweed
TR-06	2	0	0	0	100	0	*Chara sp*., Richardson's Pondweed
TR-07	2	0	0	0	100	0	*Chara sp.*
TR-08	1	0	10	0	90	0	*Chara sp*., Wild Celery
TR-09	3	0	0	5	95	0	*Chara sp*.
TR-10	1	0	0	0	100	0	Wild Celery
TR-11	1	0	0	0	100	0	Wild Celery, Large-leaved Pondweed
TR-12	1	0	10	20	70	0	Wild Celery, Wild Rice
TR-13	2	0	0	5	95	0	Wild Celery
TR-14	2	0	0	0	95	5	Wild Celery
Minimum	1	0	0	0	70	0	Overall dominant:
Maximum	3	0	20	20	100	5	Wild Celery, *Chara sp*.
Median	2	0	0	0	98	0	

Appendix 9b. Aquatic vegetation data from one site sampled in the Crowe Bay reach of the Trent River in 2020.

	Vegetation rake			% Aquatic vegetation cover			
Site code	Submerged macrophytes	Filamentous algae	Open water	Emergent	Submerged	Floating	Dominant macrophytes
TR-15	2	1	0	0	100	0	Eurasian Water Milfoil, Slender Pondweed

Appendix 9c. Aquatic vegetation data from 26 sites sampled along the Percy Boom reach of the Trent River in 2020.

	Vegetation rake		% Aquatic vegetation cover				
Site code	Submerged macrophytes	Filamentous algae	Open water	Emergent	Submerged	Floating	Dominant macrophytes
TR-16	2	0	0	0	100	0	Milfoil sp.
TR-17	1	0	0	5	95	0	Flatstem Pondweed
TR-18	2	1	40	0	55	5	Wild Celery
TR-19	2	1	10	0	90	0	Wild Celery
TR-20	2	2	0	0	100	0	Wild Celery, Coontail sp.
TR-21	1	1	0	5	75	20	Eurasian Water Milfoil, Pondweed sp., Wild Celery
TR-22	2	0	0	0	85	15	Wild Celery, Eurasian Water Milfoil
TR-23	2	0	0	5	95	0	Richardson's Pondweed, Eurasian Water Milfoil
TR-24	3	1	0	0	100	0	Eurasian Water Milfoil, Richardson's Pondweed
TR-25	2	1	0	0	90	10	Wild Celery
TR-26	2	1	0	5	95	0	Wild Celery, Crowfoot sp.
TR-27	2	0	0	5	60	35	Pondweed sp.
TR-28	2	0	0	0	70	30	Wild Celery, Pondweed sp., Slender Naiad
TR-29	2	1	0	0	100	0	Eurasian Water Milfoil, Large-leaved Pondweed
TR-30	2	0	0	0	100	0	Eurasian Water Milfoil, Richardson's Pondweed
TR-31	1	0	5	25	65	5	Wild Celery, Eurasian Water Milfoil, Wild Rice
TR-32	2	0	5	5	80	10	Wild Celery, Eurasian Water Milfoil, Coontail sp.
TR-33	2	0	0	20	80	0	Large-leaved Pondweed, Coontail sp., Wild Rice
TR-34	2	0	0	0	100	0	Eurasian Water Milfoil, Flatstem Pondweed, Richardson's Pondweed
TR-35	2	0	0	0	80	20	Wild Celery, Pondweed sp., Richardson's Pondweed
TR-36	1	1	0	0	100	0	Eurasian Water Milfoil, Milfoil sp.
TR-37	1	0	0	20	65	15	Wild Rice, White Pond Lily, Milfoil sp.
TR-38	1	0	0	0	85	15	Wild Celery, Common Waterweed
TR-39	2	0	0	0	70	30	Milfoil sp., Richardson's Pondweed, Pondweed sp.
TR-40	2	3	0	0	100	0	Eurasian Water Milfoil
TR-41	2	2	0	0	100	0	Richardson's Pondweed, Eurasian Water Milfoil
Minimum	1	0	0	0	55	0	Overall dominant:
Maximum	3	3	40	25	100	35	Wild Celery, Eurasian Water Milfoil
Median	2	0	0	0	90	0	

Appendix 9d. Aquatic vegetation data from 23 sites sampled along the Glen Ross reach of the Trent River in 2020.

	Vegetation rake			% Aquatic vegetation cover			
Site code	Submerged macrophytes	Filamentous algae	Open water	Emergent	Submerged	Floating	Dominant macrophytes
TR-42	2	0	0	0	85	15	Eurasian Water Milfoil
TR-43	1	1	0	0	100	0	Wild Celery
TR-44	2	0	0	0	90	10	Wild Celery, Richardson's Pondweed
TR-45	2	0	0	5	80	15	Wild Celery, Richardson's Pondweed, Pondweed sp.
TR-46	2	0	0	0	70	30	Pondweed sp., Wild Celery, Flatstem Pondweed
TR-47	2	0	0	0	100	0	Wild Celery
TR-48	2	0	0	5	75	20	Large-leaved Pondweed
TR-49	1	0	0	0	85	15	Eurasian Water Milfoil, Richardson's Pondweed
TR-50	2	0	0	5	80	15	Slender Pondweed, Pondweed sp., Richardson's Pondweed
TR-51	2	0	0	0	80	20	Wild Celery, Eurasian Water Milfoil, White Pond Lily
TR-52	3	2	0	0	100	0	Wild Celery, Richardson's Pondweed
TR-53	2	0	0	0	90	10	Large-leaved Pondweed
TR-54	2	0	0	5	85	10	Richardson's Pondweed
TR-55	3	0	0	0	95	5	Wild Celery, Richardson's Pondweed
TR-56	2	2	0	20	65	15	Richardson's Pondweed, Wild Rice
TR-57	2	0	0	0	100	0	Richardson's Pondweed
TR-58	3	0	0	0	100	0	Wild Celery, Coontail sp.
TR-59	2	0	0	15	85	0	Eurasian Water Milfoil, Richardson's Pondweed
TR-60	3	0	0	25	75	0	Wild Celery, Wild Rice
TR-61	2	0	0	0	95	5	Wild Celery, Richardson's Pondweed
TR-62	2	0	0	0	100	0	Wild Celery, Richardson's Pondweed
TR-63	2	0	0	5	90	5	Wild Celery, Richardson's Pondweed
TR-64	2	0	0	0	95	5	Large-leaved Pondweed
Minimum	1	0	0	0	65	0	Overall dominant:
Maximum	3	2	0	25	100	30	Wild Celery, Richardson's Pondweed
Median	2	0	0	0	90	5	

Appendix 9e. Aquatic vegetation data from 2 sites sampled along the Trenton reach of the Trent River in 2020.

	Vegetation rake		% Aquatic vegetation cover				
Site code	Submerged macrophytes	Filamentous algae	Open water	Emergent	Submerged	Floating	Dominant macrophytes
TR-65	2	0	0	0	90	10	Wild Celery, Sago Pondweed
TR-66	2	0	0	0	85	15	Slender Pondweed, Eurasian Water Milfoil
Median	2	0	0	0	88	13	

*Appendix 10. Photos of dominant macrophyte species identified from the Trent River during 2020 targeted sampling for Pugnose Shiner (*Notropis anogenus*): a) Wild Celery (*Vallisneria americana*), b) Richardson's Pondweed (*Potamogeton richardsonii*), and c) Eurasian Water Milfoil (*Myriophyllum spicatum*).*

Appendix 11. Complete list of macrophytes identified from 66 sites sampled along the Trent River in 2020.

Site	Dominant species	Other species
TR-01	Slender Naiad; Wild Celery	Flatstem Pondweed; Eurasian Water Milfoil
TR-02	Eurasian Water Milfoil	Flatstem Pondweed
TR-03	Wild Celery	Coontail sp.; Slender Naiad, Flatstem Pondweed; Eurasian Water Milfoil
TR-04	Eurasian Water Milfoil	Coontail sp.; Milfoil sp.; Wild Celery
TR-05	Common Waterweed	Richardson's Pondweed; Crowfoot sp.; Wild Celery; Eurasian Water Milfoil
TR-06	Chara sp.; Richardson's Pondweed	Coontail sp.; Common Waterweed; Milfoil sp.; Slender Naiad; Large-leaved Pondweed, Wild Celery; Eurasian Water Milfoil
TR-07	Chara sp.	Coontail sp.; Common Waterweed; Wild Celery; Eurasian Water Milfoil
TR-08	Chara sp.; Wild Celery	Water Marigold; Common Waterweed, Milfoil sp.; Slender Naiad; Large-leaved Pondweed; Flatstem Pondweed, Eurasian Water Milfoil
TR-09	Chara sp.	Coontail sp.; Slender Naiad; Richardson's Pondweed; Flatstem Pondweed; Common Bladderwort; Wild Celery; Wild Rice; Eurasian Water Milfoil
TR-10	Wild Celery	Chara sp.; Richardson's Pondweed; Eurasian Water Milfoil
TR-11	Large-leaved Pondweed; Wild Celery	Water Marigold; Coontail sp.; Chara sp.; Milfoil sp.; Slender Naiad; Richardson's Pondweed; Flatstem Pondweed; Fern Pondweed; Eurasian Water Milfoil
TR-12	Wild Celery; Wild Rice	Water Marigold; Common Waterweed; Milfoil sp.; Slender Naiad; Flatstem Pondweed; Eurasian Water Milfoil
TR-13	Wild Celery	Water Marigold; Common Waterweed; Milfoil sp.; Richardson's Pondweed; Flatstem Pondweed; Wild Rice; Eurasian Water Milfoil
TR-14	Wild Celery	Chara sp.; Slender Naiad; White Pond Lily; Richardson's Pondweed; Flatstem Pondweed; Eurasian Water Milfoil
TR-15	Slender Pondweed; Eurasian Water Milfoil	Coontail sp.; Common Waterweed; Milfoil sp.; Large-leaved Pondweed; Richardson's Pondweed; Flatstem Pondweed; Wild Celery
TR-16	Milfoil sp.	Wild Celery
TR-17	Flatstem Pondweed	Coontail sp.; Common Waterweed; Pondweed sp.; Sago Pondweed; Wild Celery; Wild Rice; Eurasian Water Milfoil
TR-18	Wild Celery	Coontail sp.; White Pond Lily; Eurasian Water Milfoil
TR-19	Wild Celery	Coontail sp.; Eurasian Water Milfoil
TR-20	Coontail sp.; Wild Celery	Common Waterweed; Slender Naiad; Eurasian Water Milfoil
TR-21	Pondweed sp.; Wild Celery; Eurasian Water Milfoil	Coontail sp.; Common Waterweed; Richardson's Pondweed; Flatstem Pondweed; Wild Rice
TR-22	Wild Celery; Eurasian Water Milfoil	Coontail sp.; Common Waterweed; Milfoil sp.; Richardson's Pondweed; Pondweed sp.
TR-23	Richardson's Pondweed; Eurasian Water Milfoil	Coontail sp.; Chara sp.; Common Waterweed; Milfoil sp.; Slender Naiad; Large-leaved Pondweed; Flatstem Pondweed; Sago Pondweed; Wild Celery
TR-24	Richardson's Pondweed; Eurasian Water Milfoil	Coontail sp.; Milfoil sp.; Slender Pondweed; Wild Celery
TR-25	Wild Celery	Coontail sp.; Milfoil sp.; Slender Naiad; White Pond Lily; Slender Pondweed; Richardson's Pondweed; Flatstem Pondweed; Common Bladderwort; Eurasian Water Milfoil

Appendix 11 continued.

Site	Dominant species	Other species
TR-26	Crowfoot sp.; Wild Celery	Coontail sp.; Chara sp.; Common Waterweed; Milfoil sp.; Slender Naiad; Sago Pondweed; Wild Rice; Eurasian Water Milfoil
TR-27	Pondweed sp.; Wild Celery	Coontail sp.; Chara sp.; Slender Naiad; Large-leaved Pondweed; Richardson's Pondweed; Common Bladderwort; Eurasian Water Milfoil
TR-28	Slender Naiad; Pondweed sp.; Wild Celery	Water Marigold; Coontail sp.; Chara sp.; Common Waterweed; Large-leaved Pondweed; Richardson's Pondweed; Common Bladderwort; Eurasian Water Milfoil
TR-29	Large-leaved Pondweed; Eurasian Water Milfoil	Water Marigold; Coontail sp.; Slender Naiad; Slender Pondweed; Richardson's Pondweed; Wild Celery
TR-30	Richardson's Pondweed; Eurasian Water Milfoil	Coontail sp.; Common Waterweed; Milfoil sp.; Large-leaved Pondweed; Flatstem Pondweed; Wild Celery
TR-31	Wild Celery; Wild Rice; Eurasian Milfoil	Coontail sp.; Milfoil sp.; Slender Naiad; Large-leaved Pondweed; Richardson's Pondweed; Pondweed sp.; Flatstem Pondweed; Sago Pondweed
TR-32	Coontail sp.; Wild Celery; Eurasian Water Milfoil	Milfoil sp.; Richardson's Pondweed; Pondweed sp.
TR-33	Coontail sp.; Large-leaved Pondweed; Wild Rice	Richardson's Pondweed; Flatstem Pondweed; Sago Pondweed; Common Bladderwort
TR-34	Richardson's Pondweed; Flatstem Pondweed; Eurasian Water Milfoil	Coontail sp.; Common Waterweed; Milfoil sp.; Slender Pondweed; Sago Pondweed; Common Bladderwort; Wild Celery
TR-35	Richardson's Pondweed; Pondweed sp.; Wild Celery	Coontail sp.; Milfoil sp.; Sago Pondweed; Eurasian Water Milfoil
TR-36	Milfoil sp.; Eurasian Water Milfoil	Coontail sp.; Crowfoot sp.; Wild Celery
TR-37	Milfoil sp.; White Pond Lily; Wild Rice	Coontail sp.; Common Waterweed; Slender Naiad; Richardson's Pondweed; Pondweed sp.; Common Bladderwort; Wild Celery; Eurasian Water Milfoil
TR-38	Common Waterweed; Wild Celery	Coontail sp.; Milfoil sp.; White Pond Lily; Richardson's Pondweed; Sago Pondweed; Eurasian Water Milfoil
TR-39	Milfoil sp.; Richardson's Pondweed; Pondweed sp.	Coontail sp.; Common Waterweed; White Pond Lily; Flatstem Pondweed; Common Bladderwort
TR-40	Eurasian Water Milfoil	Coontail sp.; Common Waterweed; Milfoil sp.; Slender Naiad; Slender Pondweed; Richardson's Pondweed; Flatstem Pondweed; Wild Celery
TR-41	Richardson's Pondweed; Eurasian Water Milfoil	Coontail sp.; Common Waterweed; Milfoil sp.; Large-leaved Pondweed; Curly-leaf Pondweed; Common Bladderwort
TR-42	Eurasian Water Milfoil	Coontail sp.; Richardson's Pondweed; Pondweed sp.; Flatstem Pondweed; Wild Celery
TR-43	Wild Celery	Coontail sp.; Milfoil sp.; Slender Naiad; Richardson's Pondweed; Pondweed sp.; Common Bladderwort; Eurasian Water Milfoil
TR-44	Richardson's Pondweed; Wild Celery	Coontail sp.; Chara sp.; Milfoil sp.; Slender Naiad; Pondweed sp.; Common Bladderwort; Eurasian Water Milfoil
TR-45	Richardson's Pondweed; Pondweed sp.; Wild Celery	Coontail sp.; Common Waterweed; Milfoil sp.; Slender Pondweed; Wild Rice
TR-46	Pondweed sp.; Flatstem Pondweed; Wild Celery	Coontail sp.; Chara sp.; Slender Naiad; White Pond Lily; Large-leaved Pondweed; Slender Pondweed; Richardson's Pondweed; Crowfoot sp.; Sago Pondweed; Eurasian Water Milfoil

Appendix 11 continued.

Site	Dominant species	Other species
TR-47	Wild Celery	Coontail sp.; Slender Pondweed; Richardson's Pondweed; Pondweed sp.; Eurasian Water Milfoil
TR-48	Large-leaved Pondweed	Water Marigold; Coontail sp.; Chara sp.; Common Waterweed; Milfoil sp.; Wild Celery; Wild Rice; Eurasian Water Milfoil
TR-49	Richardson's Pondweed; Eurasian Water Milfoil	Chara sp.; Common Waterweed; Milfoil sp.; White Pond Lily; Large-leaved Pondweed; Pondweed sp.; Crowfoot sp.; Wild Celery
TR-50	Slender Pondweed; Richardson's Pondweed; Pondweed sp.	Coontail sp.; Common Waterweed; Milfoil sp.; Slender Naiad; Wild Celery; Wild Rice; Eurasian Water Milfoil
TR-51	White Pond Lily; Wild Celery; Eurasian Water Milfoil	Coontail sp.; Chara sp.; Common Waterweed; Milfoil sp.; Slender Naiad; Richardson's Pondweed; Pondweed sp.
TR-52	Richardson's Pondweed; Wild Celery	Coontail sp.; Common Waterweed; Large-leaved Pondweed; Eurasian Water Milfoil
TR-53	Large-leaved Pondweed	Coontail sp.; Milfoil sp.; Slender Pondweed; Richardson's Pondweed; Pondweed sp.; Sago Pondweed; Wild Celery
TR-54	Richardson's Pondweed	Coontail sp.; Pondweed sp.; Sago Pondweed; Wild Celery; Wild Rice; Eurasian Water Milfoil
TR-55	Richardson's Pondweed; Wild Celery	Coontail sp.; Common Waterweed; Slender Naiad; Large-leaved Pondweed; Pondweed sp.; Flatstem Pondweed; Common Bladderwort; Eurasian Water Milfoil
TR-56	Richardson's Pondweed; Wild Rice	Coontail sp.; Common Waterweed; Large-leaved Pondweed; Slender Pondweed; Pondweed sp.; Flatstem Pondweed; Wild Celery; Eurasian Water Milfoil
TR-57	Richardson's Pondweed	Coontail sp.; Chara sp.; Common Waterweed; Slender Naiad; Flatstem Pondweed; Common Bladderwort; Eurasian Water Milfoil
TR-58	Coontail sp.; Wild Celery	Common Waterweed; Milfoil sp.; Slender Naiad; Richardson's Pondweed; Flatstem Pondweed; Eurasian Water Milfoil
TR-59	Richardson's Pondweed; Eurasian Water Milfoil	Coontail sp.; Common Waterweed; Slender Naiad; Flatstem Pondweed; Wild Celery; Wild Rice
TR-60	Wild Celery; Wild Rice	Coontail sp.; Chara sp.; Common Waterweed; Slender Naiad; Richardson's Pondweed; Flatstem Pondweed; Sago Pondweed; Eurasian Water Milfoil
TR-61	Richardson's Pondweed; Wild Celery	Coontail sp.; Chara sp.; Milfoil sp.; Slender Pondweed; Pondweed sp.; Flatstem Pondweed; Eurasian Water Milfoil
TR-62	Richardson's Pondweed; Wild Celery	Coontail sp.; Common Waterweed; Milfoil sp.; Slender Naiad; Flatstem Pondweed; Eurasian Water Milfoil
TR-63	Richardson's Pondweed; Wild Celery	Coontail sp.; Pondweed sp.; Flatstem Pondweed; Eurasian Water Milfoil
TR-64	Large-leaved Pondweed	Coontail sp.; Slender Pondweed; Pondweed sp.; Flatstem Pondweed; Wild Celery; Eurasian Water Milfoil
TR-65	Sago Pondweed; Wild Celery	Coontail sp.; White Pond Lily; Pondweed sp.; Eurasian Water Milfoil
TR-66	Slender Pondweed; Eurasian Water Milfoil	Coontail sp.; Chara sp.; Milfoil sp.; White Pond Lily; Richardson's Pondweed; Pondweed sp.; Flatstem Pondweed; Sago Pondweed; Wild Celery