Targeted Surveys for Eastern Sand Darter and Channel Darter in Beach Habitats of the Laurentian Great Lakes, 2009-2018

Anita LeBaron, Scott M. Reid, Mike Parna, Matt Sweeting, and Jason Barnucz

Ontario and Prairie Region
Fisheries and Oceans Canada
P.O. Box 5050, 867 Lakeshore Road
Burlington, ON
L7S 1A1

2020

Canadian Data Report of
Fisheries and Aquatic Sciences 1307

Fisheries and Oceans Canada | Pêches et Océans Canada

Canada

Canadian Data Report of Fisheries and Aquatic Sciences

Data reports provide a medium for filing and archiving data compilations where little or no analysis is included. Such compilations commonly will have been prepared in support of other journal publications or reports. The subject matter of the series reflects the broad interests and policies of Fisheries and Oceans Canada, namely, fisheries management, technology and development, ocean sciences, and aquatic environments relevant to Canada.

Data reports are not intended for general distribution and the contents must not be referred to in other publications without prior written clearance from the issuing establishment. The correct citation appears above the abstract of each report. Each report is abstracted in the data base *Aquatic Sciences and Fisheries Abstracts*.

Data reports are produced regionally but are numbered nationally. Requests for individual reports will be filled by the issuing establishment listed on the front cover and title page.

Numbers 1-25 in this series were issued as Fisheries and Marine Service Data Records. Numbers 26-160 were issued as Department of Fisheries and Environment, Fisheries and Marine Service Data Reports. The current series name was changed with report number 161.

Rapport statistique canadien des sciences halieutiques et aquatiques

Les rapports statistiques servent de base à la compilation des données de classement et d'archives pour lesquelles il y a peu ou point d'analyse. Cette compilation aura d'ordinaire été préparée pour appuyer d'autres publications ou rapports. Les sujets des rapports statistiques reflètent la vaste gamme des intérêts et politiques de Pêches et Océans Canada, notamment la gestion des pêches, la technologie et le développement, les sciences océaniques et l'environnement aquatique, au Canada.

Les rapports statistiques ne sont pas préparés pour une vaste distribution et leur contenu ne doit pas être mentionné dans une publication sans autorisation écrite préalable de l'établissement auteur. Le titre exact figure au haut du résumé de chaque rapport. Les rapports à l'industrie sont résumés dans la base de données *Résumés des sciences aquatiques et halieutiques*.

Les rapports statistiques sont produits à l'échelon régional, mais numérotés à l'échelon national. Les demandes de rapports seront satisfaites par l'établissement d'origine dont le nom figure sur la couverture et la page du titre.

Les numéros 1 à 25 de cette série ont été publiés à titre de Records statistiques, Service des pêches et de la mer. Les numéros 26-160 ont été publiés à titre de Rapports statistiques du Service des pêches et de la mer, ministère des Pêches et de l'Environnement. Le nom de la série a été modifié à partir du numéro 161.

Canadian Data Report of
Fisheries and Aquatic Sciences 1307

2020

Targeted Surveys for Eastern Sand Darter and Channel Darter in Beach Habitats of the Laurentian Great Lakes, 2009-2018

by

Anita LeBaron[1], Scott M. Reid[1], Mike Parna[1], Matt Sweeting[1], and Jason Barnucz

Ontario and Prairie Region
Fisheries and Oceans Canada
P.O. Box 5050, 867 Lakeshore Road
Burlington, ON
L7S 1A1

[1] Aquatic Research and Monitoring Section, Ontario Ministry of Natural Resources and Forestry. Trent University – DNA Building, 2140 East Bank Drive, Peterborough ON, K9L 1Z8

Cat. No. Fs97-13/1307E-PDF ISBN 978-0-660-35202-2 ISSN 1488-5395

Correct citation for this publication:

LeBaron, A., Reid, S.M., Parna, M., Sweeting, M., and Barnucz, J. 2020. Targeted Surveys for Eastern Sand Darter and Channel Darter in Beach Habitats of the Laurentian Great Lakes, 2009-2018. Can. Data Rep. Fish. Aquat. Sci.1307: vi + 54 p.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

ABSTRACT

LeBaron, A., Reid, S.M., Parna, M., Sweeting, M., and Barnucz, J. 2020. Targeted Surveys for Eastern Sand Darter and Channel Darter in Beach Habitats of the Laurentian Great Lakes, 2009-2018. Can. Data Rep. Fish. Aquat. Sci.1307: vi + 54 p.

Seine-based inventories of Laurentian Great Lakes (Erie, Huron and Ontario) beaches for Channel Darter (*Percina copelandi*) and Eastern Sand Darter (*Ammocrypta pellucida*) were undertaken between 2009 and 2018. Inventories were done to update distribution records, inform critical habitat descriptions, and document the occurrence of the invasive Round Goby (*Neogobius melanostomus*). One hundred ninety-five sandy and wadeable beach sites were sampled along the shorelines of southern Lake Huron (n = 9), eastern Lake Ontario (n = 168), and Rondeau Bay (Lake Erie, n = 18). Areas sampled were near historical and currently occupied sites or represented habitat considered suitable for the two species. Fishes were collected with a bag seine and/or a larger beach seine. Forty-one species were detected, including two species at risk, three invasive species, and six recreationally or commercially important species. Channel Darter (27 individuals) was only detected from a single Rondeau Bay site. Although, the collection record is the first from Rondeau Bay since 1953. Eastern Sand Darter (1288 individuals) was collected from Rondeau Bay (Lake Erie) and West Lake (Lake Ontario). Collections represent the first record of the species from Lake Ontario, and the first detection from Rondeau Provincial Park since 2005. Round Goby was widespread and common across all areas sampled, and often co-occurred with small, native benthic fishes. Timing of sampling (day or night) and gear type (bag or beach seine) influenced the number of individuals collected and number of species detected.

RÉSUMÉ

LeBaron, A., Reid, S.M., Parna, M., Sweeting, M., and Barnucz, J. 2020. Targeted Surveys for Eastern Sand Darter and Channel Darter in Beach Habitats of the Laurentian Great Lakes, 2009-2018. Can. Data Rep. Fish. Aquat. Sci.1307: vi + 54 p.

Des inventaires du fouille-roche gris (*Percina copelandi*) et du dard de sable (*Ammocrypta pellucida*) réalisés avec des sennes sur les rives des Grands Lacs laurentiens (lacs Érié, Huron et Ontario) ont été entrepris entre 2009 et 2018. Les inventaires ont été effectués pour mettre à jour les données sur la répartition, guider les descriptions des habitats essentiels et documenter la présence du gobie à taches noires envahissant (*Neogobius melanostomus*). Ce sont cent quatre-vingt-quinze rives sablonneuses et praticables à pied qui ont été échantillonnées le long du rivage de la partie sud du lac Huron (n = 9), de la partie est du lac Ontario (n = 168) et de la baie Rondeau (lac Érié, n = 18). Les aires échantillonnées étaient situées près de sites historiques et actuellement occupés ou représentaient un habitat considéré comme propice pour les deux espèces. Les poissons ont été prélevés avec une senne avec poche ou une senne de plage. Nous avons détecté quarante-et-une espèces, dont deux espèces en péril, trois espèces envahissantes et six espèces d'importance récréative ou commerciale. Le fouille-roche gris (27 individus) n'a été détecté que dans un seul site de la baie Rondeau, et il s'agit de la première fois qu'il est observé dans la baie Rondeau depuis 1953. Le dard de sable (1 288 individus) a été prélevé dans la baie Rondeau (lac Érié) et le lac West (lac Ontario). Ces prélèvements représentent le premier recensement de ces espèces dans le lac Ontario, et la première détection dans le parc provincial Rondeau, depuis 2005. Le gobie à taches noires était répandu et courant dans toutes les aires échantillonnées, et de petits poissons benthiques indigènes étaient souvent présents simultanément. La période d'échantillonnage (jour ou nuit) et le type d'équipement (senne avec poche ou senne de plage) ont influé sur le nombre d'individus prélevés et le nombre d'espèces détecté.

INTRODUCTION

Approximately 80% of Laurentian Great Lakes fishes use nearshore areas for at least part of the year (Chow-Fraser and Albert 1999). Although beaches account for approximately 20% of the Laurentian Great Lakes shoreline (Wei et al. 2004) and provide important reproductive and nursery habitats for fishes (Scott 1955; Heufelder et al.1982; Wei et al. 2004), these habitats have historically been perceived as ‘‘wet deserts’’. However, one-third of the fish species known from the Lake Erie basin have been collected from north shore beaches, including species at risk, and recreationally and commercially important species (Reid and Mandrak 2009). Two fish species at risk, Channel Darter (*Percina copelandi*) and Eastern Sand Darter (*Ammocrypta pellucida*), are strongly associated with sandy habitats and have been collected from Great Lakes beaches (Scott and Crossman 1973; Daniels 1993; O’Brien and Facey 2008; Holm et al. 2009). In the Great Lakes basin, both species are in decline, likely in response to habitat degradation and competition with the invasive Round Goby (*Neogobius melanostomus*) (Koonce et al. 1996; Meadows et al. 2005; COSEWIC 2009; Poesch et al. 2010).

Channel Darter is a small, elongate, benthic fish that prefers the sandy nearshore areas of lakes, and rivers with sand and gravel bottoms (Holm et al. 2009). In Ontario, populations have been assessed based on three designatable units (DU): Lake Erie populations (DU1), Lake Ontario populations (DU2), and St. Lawrence populations (DU3). Lake Erie populations were assessed by COSEWIC as Endangered in 2016 (COSEWIC 2016). Channel Darter was historically present along the north shore beaches, and other Lake Erie shoreline areas (Scott 1955; Phelps and Francis 2002). However, 2005 and 2006 surveys along the north shore of Lake Erie did not detect the species east of Point Pelee National Park (Reid and Mandrak 2008). Lake Ontario populations (also assessed as Endangered) are restricted to the Salmon, Moira, and Trent rivers in the Bay of Quinte area (COSEWIC 2016). The Channel Darter recovery strategy (DFO 2013) identifies research and monitoring as key recovery activities, including surveys of historical Channel Darter locations and targeted surveys of extant or suspected populations. Beaches along the southern shore of Lake Huron and eastern Lake Ontario represent potentially suitable habitats (but undocumented) for Channel Darter.

Eastern Sand Darter is a small, benthic fish with translucent flesh and an elongate body, almost round in cross-section (Scott 1955). The species is one of the most habitat-specific fishes in Ontario, found almost exclusively on sandy bottoms of large streams and nearshore areas of the Great Lakes (Scott and Crossman 1973; Holm et al. 2009). Eastern Sand Darter is in decline in Ontario, with 45% of known populations lost over the past 50 years (COSEWIC 2009). The species was assessed as Threatened by COSEWIC in 2009. In the spring of 2013, Eastern Sand Darter was collected from West Lake, Ontario (a small lake connected to eastern Lake Ontario) (Reid and Dextrase 2014). Prior to this record, the known range of this imperiled species consisted of two disjunct elements in eastern North America separated by about 500 km. The northeastern element includes St. Lawrence River and Lac Champlain drainages (Scott and Crossman 1973; Lee et al. 1980). The new occurrence is in the middle of these two distributional elements, suggesting there may be additional undiscovered populations in the drainages of Lake Ontario and Upper St. Lawrence River in Ontario and New York. Targeted surveys of areas with suitable Eastern Sand Darter habitat have been identified as a priority management action within this region (MNRF 2015).

The objective of this report is to present the methods and results from multiple seine-based inventories for Channel Darter and Eastern Sand Darter (undertaken between 2009 and 2018) at beach habitats in Lake Erie, Lake Huron and Lake Ontario. Inventories were undertaken to: (i) provide updated distribution records for COSEWIC status assessments and the delineation of

critical habitat; (ii) describe habitat conditions at sampling sites; and, (iii) document the occurrence of the invasive Round Goby.

METHODS

LAKE HURON AND LAKE ONTARIO

In August and September of 2009, nine sites along the southeast shore of Lake Huron (Table 1 and Figure 1) and eight sites along the north shore of Lake Ontario (Table 2 and Figure 2) were sampled with a beach seine (Reid and Mandrak 2008). Some of the beaches were located in the following provincial parks: Inverhuron Provincial Park (Lake Huron), MacGregor Point Provincial Park (Lake Huron), North Beach Provincial Park (Lake Ontario), Presquile Provincial Park (Lake Ontario) and Sandbanks Provincial Park (Lake Ontario). Sites were a mix of sand and gravel beaches with maximum water depths between 0.5 and 1.6 m. Water temperatures were similar in Lake Huron and Lake Ontario, ranging from 16.5 °C to 24.7 °C. Conductivity ranged from 206 to 229 µS/cm in Lake Huron and 240 to 302 µS/cm in Lake Ontario. Substrate composition of beaches was based on visual assessments, and water temperature and conductivity were measured with a hand-held water quality meter. Site specific habitat characteristics are presented in tables 3 and 4.

At most sites, 250 m of beach habitat were sampled with five consecutive 50 m long seine hauls pulled parallel along the shore's edge. The beach seine had the following dimensions: 15.2 m in length x 2.4 m high with a 2.4 m x 2.4 m x 2.4 m bag; and each wing measured 6.4 m in length. The mesh in the wings was 6.4 mm diameter and the mesh in the bag was 3.2 mm diameter. Day and night sampling were completed at each site; night sampling commenced after 2100 EDT. Sampling was done in late summer/early fall, as prior Lake Erie research found Channel Darter detection more likely during this time of year (Reid and Mandrak 2008).

WEST LAKE, NORTH BEACH, AND WELLER'S BAY

Between 2013 and 2015, inventories targeted suitable Eastern Sand Darter habitat in West Lake (Table 5 and Figure 3), North Beach (Table 6 and Figure 4), and Wellers Bay (Table 7 and Figure 5). All three sample areas are located along the western shore of Prince Edward County in eastern Lake Ontario. Most West Lake and North Beach sites were located within the boundaries of Sandbanks Provincial Park and North Beach Provincial Park, respectively. Sites sampled were sand beaches with water depths between 0.18 and 1.29 m. Water temperatures and conductivity ranged from 12.8 to 27.2 °C and 224.0 to 308 µS/cm respectively. Site specific habitat characteristics are presented in tables 8-10.

West Lake

In the summer and early fall of 2013 and 2014, a paired-gear approach was used to collect Eastern Sand Darter, and to compare the effectiveness of a bag seine and the larger beach seine to detect and monitor Eastern Sand Darter populations (see Reid and Dextrase 2017 for results). Each site was divided into two sampling units; a 20 m long unit and a 10 m long unit. Unit lengths were defined based on the minimum distance required to properly deploy each seine. The length of the unit sampled with the bag seine was based on past Eastern Sand Darter research in Ontario rivers (Drake et al. 2008; Finch et al. 2013; Dextrase et al. 2014). Sites were separated by a minimum of 20 m. The 20 m unit was sampled with five repeated hauls of a beach seine (see previous section for seine dimensions). The 10 m unit was sampled with five repeated hauls of a bag seine. The bag seine had the following dimensions: 9.1 m in

length x 1.8 m high with a 1.8 x 1.8 x 1.8 m bag; and each wing measured 3.65 m in length. The mesh in the wings was 4.8 mm in diameter and the mesh in the bag was 3.2 mm in diameter.

For each haul, the seine was pulled in a direction parallel to the shoreline and fishes were removed from the bag at the end of the sampling unit. Successive hauls were pulled in opposite directions over the same habitat area. At least 5 min elapsed between successive hauls. Over the course of each sampling day, the placement of 10 and 20 m long units in each site alternated.

In 2013 and 2014, sixty-nine sites were sampled using both seines. An additional 8 sites were sampled using only the beach seine. In 2015, 31 sites were sampled using the bag seine.

Eastern Sand Darter caught in each haul were counted and measured for total length (TL; mm). Numbers of other small benthic fishes were also recorded by haul.

North Beach

In July 2014, the beach and bag-seine sampling method described for West Lake was used to collect fishes at 12 sites distributed along 1 km of shallow (0.3-0.9m deep), sandy habitat at North Beach. Sites were in North Beach Provincial Park and separated from Lake Ontario by a barrier sand dune formation. All small benthic fishes were identified and counted separately by haul.

Weller's Bay

In the fall of 2014, thirteen sites in Wellers Bay were sampled with a beach seine. Habitats were shallow (0.2-0.9m deep) and sandy. Due to safety concerns related to encountering unexploded ordinance (UXO), potentially suitable habitats in the Wellers Bay National Wildlife Area were not sampled. Small benthic fishes were enumerated by haul, and all fishes were released after processing.

RONDEAU BAY

In September and October of 2018, seine-based inventories were done at 18 sites located along the public beach at Erieau, and in Rondeau Provincial Park (Table 11 and Figure 6). Sampling was focused on sand and sand/gravel habitats, with wadeable water depths (maximum depth of 1.5 m). Water temperatures and conductivity ranged from 15.2 to 24.1°C and 232 to 263 µS/cm respectively. Site specific habitat characteristics are presented in Table 12.

At each site, sampling consisted of successive seine hauls pulled parallel along the shore's edge. Six sites were sampled using a beach seine. Two sites were also sampled at night. At each site, 250 m of beach habitat was sampled with five consecutive 50 m long seine hauls. Due to limited amounts of suitable habitat, the other 12 sites were sampled using a bag seine. The number and length of hauls were variable, depending on the amount of suitable habitat.

Total length (mm) was measured for all Eastern Sand Darter, Channel Darter, and Logperch (*Percina caprodes*) collected. Other species in each haul were identified but individual counts were not recorded.

RESULTS

Common and Scientific names for all fishes captured in this study are provided in Table A1.

LAKE HURON AND LAKE ONTARIO

Lake Huron

A total of 15,462 individuals representing 24 species were seined from Lake Huron beaches (Table 13). The most abundant and widespread species were Alewife (*Alosa pseudoharengus*), Emerald Shiner (*Notropis atherinoides*), Round Goby, Spottail Shiner (*Notropis hudsonius*), and Yellow Perch (*Perca flavescens*) (Table 14). While no species at risk were captured, five recreationally and commercially important species (Largemouth Bass *Micropterus salmoides*, Smallmouth Bass *Micropterus dolomieu*, Rock Bass *Ambloplites rupestris*, Walleye *Sander vitreus*, and Yellow Perch) and three invasive species (Alewife, Rainbow Smelt *Osmerus mordax*, and Round Goby) were detected.

Daytime seine hauls were dominated by Emerald Shiner (44.3% of total daytime catch) and Spottail Shiner (39.7%); nighttime catches were dominated by Spottail Shiner (36.9% of total nighttime catch). Round Goby was frequently captured in nighttime hauls (88.9% of hauls), but not in the day (<1.0%). Individually, most other species captured at a site represented <1.0% of the total catch. Daytime hauls captured greater numbers of fishes (daytime mean: 1,547 individuals; nighttime: 171), although species richness was similar for day and night sampling (daytime mean: 6.67 species; nighttime: 6.56). Banded Killifish (*Fundulus diaphanous*), Bluntnose Minnow (*Pimephales notatus*), Mimic Shiner (*Notropis volucellus*), and Smallmouth Bass were collected only in the day. Fathead Minnow (*Pimephales promelas*), Mottled Sculpin (*Cottus bairdii*), Rock Bass, Stonecat (*Noturus flavus*), and White Bass (*Morone chrysops*) were detected only at night. Round Goby co-occurred with small, native benthic fishes in 75 to 100% of nighttime seine hauls. Round Goby did not co-occur with small benthic fishes during the day.

Lake Ontario

A total of 7,207 individuals representing 16 species were seined from eastern Lake Ontario beaches (Table 15). The most abundant and widespread species were Emerald Shiner, Sand Shiner, and Spottail Shiner (Table 16). While no species at risk were captured from eastern Lake Ontario beaches, three recreationally and commercially important species (Largemouth Bass, Rock Bass, Yellow Perch) and two invasive species (Alewife and Round Goby) were detected.

While Mimic Shiner was collected from all daytime seine hauls and 42.9% of nighttime hauls, it represented <4.0% of the total catch. Daytime hauls were dominated by Spottail Shiner (40.7% of total daytime catch) and Emerald Shiner (21.0%); nighttime hauls were dominated by Sand Shiner (37.5% of total nighttime catch) and Emerald Shiner (32.8%). Individually, most other species captured at a site represented <1.0% of the total catch. Daytime hauls captured 78% of all individuals (mean: 699 individuals per site), representing 14 species (mean: 6.38 species per site); individuals captured in nighttime hauls (mean: 230 individuals per site) represented 15 species (mean: 6.71 species per site). Banded Killifish were only captured during the day, while Lake Chub and Rock Bass were captured only at night. Round Goby were found to co-occur with Logperch in day samples (1 of 1 haul), and with Logperch (75% of hauls) and Longnose Dace (13%) in the night.

WEST LAKE, NORTH BEACH, AND WELLER'S BAY

West Lake

A total of 13,657 individuals representing seven benthic fishes (Brown Bullhead *Ameiurus nebulosus*, Eastern Sand Darter, Iowa Darter *Etheostoma exile*, Johnny Darter *Etheostoma*

nigrum, Logperch, Round Goby, and Tadpole Madtom *Noturus gyrinus*) were seined from West Lake across three years (Table 17). One species at risk (Eastern Sand Darter: COSEWIC 2009), two recreationally and commercially important species (Largemouth Bass and Yellow Perch), and one invasive species (Round Goby) were captured from West Lake. More individuals were collected, and the rate of species detection was greater with the beach seine than the bag seine. The mean number of individuals captured with the beach seine was 130.4 (standard deviation, SD = 155.2) and 29.2 (SD = 41.8) with the bag seine. The mean number of small, benthic fishes detected was 3.3 (SD = 1.3) with the beach seine and 2.4 (SD = 1.3) with the bag seine.

One thousand two hundred and eighty-four Eastern Sand Darter were collected, with most collection sites within the borders of Sandbanks Provincial Park. At sites sampled by both seines, the mean number of Eastern Sand Darter collected with the bag seine was 3.1 individuals (SD = 7.4) and 14.0 (SD = 23.5) with the beach seine. The median total length of Eastern Sand Darter collected from West Lake was 46 mm (range: 20-69). Multiple age-classes and the presence of young-of-year Eastern Sand Darter are evident from the length-frequency distribution (Figure 7). Logperch and Round Goby were the most widespread and abundant species, followed by Johnny Darter and Eastern Sand Darter (Table 18). Logperch and Round Goby dominated catches with both seine types (bag: 24.3% and 21.8% respectively; beach: 30% and 51.8%). Round Goby was often caught from the same sampling unit as each darter species (in 59% of all hauls).

North Beach and Weller's Bay

A total of 2,774 individuals representing three species were seined from North Beach (Table 19), and 1,997 individuals representing three species were seined from Wellers Bay respectively (Table 20). No species at risk were collected from North Beach or Wellers Bay.

At North Beach, the beach seine was more effective at detecting small, benthic species than the bag seine. The mean number of individuals per site collected by beach seine was 213.1 (SD = 318.2) and by bag seine was 18.1 (SD = 33.1). The mean number of species per site detected by beach seine was 1.3 (SD = 1.0) and by bag seine was 0.6 (SD = 0.5). Johnny Darter, Logperch and Round Goby were all collected with the beach seine. The bag seine captured only Johnny Darter. Johnny Darter was the most widespread (collected from 7 of 12 sites) and abundant species (98.7% of total catch). The mean number of individuals per site collected by beach seine was 210.3 (SD = 314.8) and by bag seine was 18.1 (SD = 33.1). Small, native benthic fishes occurred with Round Goby only in beach seine hauls.

At Wellers Bay, Round Goby was the most widespread (collected at all 13 sites) and abundant species (81% of total catch). Therefore, Round Goby was found at all sites with native, benthic fishes (Johnny Darter and Logperch).

RONDEAU BAY

Twenty-nine species were captured from Rondeau Bay (Table 21). Fishes captured included two species at risk (Channel Darter and Eastern Sand Darter, Figure 8), four recreationally and commercially important species (Largemouth Bass, Northern Pike, Walleye, and Yellow Perch), and one invasive species (Round Goby). Across all sites, Round Goby and Yellow Perch were most frequently captured (47% of all hauls) (Table 22).

Twenty-seven species were collected from Rondeau Provincial Park sites sampled with the bag seine. Twenty-seven Channel Darter (median TL: 48 mm; range: 45 – 53) were seined from one site (RB11). Collection sites were sandy (90% sand) with a small amount of gravel (10%). Mean number of species detected per haul was 4.9. Yellow Perch was the most frequently

captured species, followed by Banded Killifish and Bluntnose Minnow. Four Eastern Sand Darter (TL range: 53 – 67 mm) were captured from across three sites (RB07, RB08, and RB11). Round Goby was detected at ten of the twelve sites sampled (found in 44% of all hauls) and co-occurred with Channel Darter and Eastern Sand Darter.

Eighteen species were detected using the beach seine, but not Channel Darter and Eastern Sand Darter. Mean number of species detected in daytime hauls was 5.6, compared to 4.8 in nighttime hauls. Among daytime hauls, Mimic Shiner was captured most frequently, followed by Brook Silverside, Spottail Shiner, and White Bass. Among nighttime beach seine hauls, White Perch and Walleye were captured most frequently, followed by Round Goby and White Bass. Most species collected at night were also detected during the day (except for Gizzard Shad, Pumpkinseed, and Walleye). Round Goby was seined from all beach seine sites and collected in 54% of hauls.

DISCUSSION

LAKE HURON AND LAKE ONTARIO

Channel Darter historically occurred in wave-swept nearshore areas of Lake Huron (Michigan) and Lake Erie in coarse sand, fine gravel beach and sandbar habitats (Scott 1955; Trautman 1981). However, targeted sampling of suitable habitats along the Canadian shores of Lake Huron, and near areas of known occurrence in Lake Ontario (Bay of Quinte tributaries) had not been completed prior to this study. Channel Darter was not collected from any of the Lake Huron and Lake Ontario beaches sampled. Most Lake Ontario sites were shallow and comprised of fine and hard-packed sand; not consistent with descriptions of Lake Erie Channel Darter habitat (Scott 1955; Trautman 1981; Reid and Mandrak 2008). A greater representation of gravel-sized material was found at Lake Huron beaches.

At Lake Erie beaches, the timing (diel and seasonal) of sampling was found to have a large influence on the number and composition of species detected; including the likelihood of detecting Channel Darter and Round Goby (Reid and Mandrak 2008; 2009). At Lake Huron and Lake Ontario beaches, daytime sampling captured more individuals, but species detection was similar for both day and night sampling. Small, benthic species, including Round Goby, were detected during both day and night sampling, but were more common at night.

WEST LAKE, NORTH BEACH, AND WELLER'S BAY

The discovery of Eastern Sand Darter in West Lake in 2013 prompted targeted surveys for other undiscovered populations in the Lake Ontario drainage. In this study, Eastern Sand Darter was widespread along the southwestern shoreline of West Lake, but not detected at North Beach or Wellers Bay despite geographic proximity and similar habitat to West Lake. The greatest amount of potentially suitable Eastern Sand Darter habitat is along Wellers Bay National Wildlife Area. However, safety concerns related to encountering unexploded ordinance (UXO) will require different sampling methods (i.e. environmental DNA) to detect Eastern Sand Darter.

Despite requiring more time for sampling, the beach seine was more effective than the bag seine at capturing fishes and detecting species, including Eastern Sand Darter. There was also greater representation of young-of-year in beach seine hauls. As increasing the amount of habitat sampled at a site has been found to have a positive effect on occupancy estimates for other aquatic taxa (Rodtka et al. 2015; Reid 2016), this result is likely largely driven by the differences in the sizes of the sites sampled by the beach (site length: 20 m) and bag seines (site length: 10 m) (Reid and Dextrase 2017).

In southwestern Ontario rivers, the abundance of Eastern Sand Darter has been negatively correlated to Round Goby abundance (Raab et al. 2018). Small, benthic species, including the invasive Round Goby, were widespread in all three waterbodies. Data collected during this study provides a robust baseline for future monitoring of the impacts of Round Goby on Eastern Sand Darter populations.

RONDEAU BAY

Channel Darter was last reported from Erieau in 1953 (Scott 1955); 2005 and 2006 surveys along the north shore of Lake Erie did not detect the species east of Point Pelee National Park. Eastern Sand Darter was last collected from Rondeau Provincial Park in 2005. During this study, Channel Darter and Eastern Sand Darter were collected from Rondeau Bay during daytime hauls with the bag seine. Collection sites were consistent with habitat descriptions for these species (Scott 1955; Trautman 1981; Daniels 1993; Holm et al. 2009). In contrast to 2005 and 2006 beach seining sites, Eastern Sand Darter and Channel Darter were collected from sites inside Rondeau Bay and protected from Lake Erie.

In Lake Erie, declines in the distribution of small, native benthic fishes have coincided with the Round Goby invasion (Reid and Mandrak 2008). In this study, Round Goby was widespread throughout Rondeau Bay, and occurred at all Channel Darter and Eastern Sand Darter sites.

More species were detected with the bag seine than with the beach seine; however, it is not possible to make a direct comparison between seine types as total area sampled was not consistent.

ACKNOWLEDGEMENTS

Field sampling was supported was supported by the Canada-Ontario Agreement with Respect to the Great Lakes Basin Ecosystem, and Fisheries and Oceans Canada and Ontario Ministry of Natural Resources and Forestry species-at-risk program funds. We acknowledge the many Fisheries and Oceans Canada and Ontario Ministry of Natural Resources and Forestry staff that help with seining. Earlier versions of the report were improved by comments from Sarah Parna, and Dave Marson and Doug Watkinson.

REFERENCES

Chow-Fraser, P. and Albert, D. 1999. Biodiversity investment areas for coastal wetland systems. In State of the Great Lakes Ecosystem Conference 1998. US Environmental Protection Agency and Environment Canada, Buffalo.

Committee on the Status of Endangered Wildlife in Canada (COSEWIC). 2009. COSEWIC Assessment and Status Report on the Eastern Sand Darter *Ammocrypta pellucida* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa, ON.

Daniels, R.A. 1993. Habitat of the Eastern Sand Darter, *Ammocrypta pellucida*. Journal of Freshwater Ecology, 8:287–295.

Dextrase A.J., Mandrak N.E., and Schaefer, J.A. 2014. Modelling occupancy of an imperilled stream fish at multiple scales while accounting for imperfect detection: implications for conservation. Freshwater Biology, 59:1799–1815.

Drake, D.A.R., Power, M., Koops, M.A., Doka, S.E., and Mandrak, N.E. 2008. Environmental factors affecting growth of Eastern Sand Darter. Canadian Journal of Zoology, 86:714–722.

Finch M., Faber, J.E., Koops, M.A., Doka, S., and Power, M. 2013. Biological traits of Eastern Sand Darter (*Ammocrypta pellucida*) in the lower Thames River, Canada, with comparisons to a more southern population. Ecology of Freshwater Fish, 22:234–245.

Fisheries and Oceans Canada (DFO). 2013. Recovery Strategy for the Channel Darter (*Percina copelandi*) in Canada. Species at Risk Act Recovery Strategy Series. Fisheries and Oceans Canada, Ottawa. viii + 82 pp.

Fisheries and Oceans Canada (DFO). 2012. Recovery strategy for the Eastern Sand Darter (*Ammocrypta pellucida*) in Canada: Ontario populations. Species at Risk Act Recovery Strategy Series, Fisheries and Oceans Canada, Ottawa. vii + 58 pp.

Heufelder, G.H., Jude, D.J., and Tesar, F.J. 1982. Coldwater upwelling effects on abundance and distribution of larval alewives (*Alosa pseudoharengus*) in eastern Lake Michigan. Canadian Journal of Fisheries and Aquatic Sciences, 39:1531–1537.

Holm, E., Mandrak, N.E., and Burridge, M.E. 2009. Freshwater fishes of Ontario. Royal Ontario Museum, Toronto. 462 p.

Koonce, J.F., Busch, W.D.N., and Czapla, T. 1996. Restoration of Lake Erie: contribution of water quality and natural resource management. Canadian Journal of Fisheries and Aquatic Sciences, 53 (Suppl. 1):105–112.

Meadows, G.A., MacKey, S.D., Goforth, R.R., Mickelson, D.M., Edil, T.B., Fuller, J., Guy Jr, D.E., Meadows, L.A., Brown, E., Carman, S.M., and Liebenthal, D.L. 2005. Cumulative habitat impacts of nearshore engineering. Journal of Great Lakes Research, 31(Supplement 1):90–112.

Ministry of Natural Resources and Forestry (MNRF). 2015. Government response statement to the recovery strategy for Eastern Sand Darter. Toronto, Ontario: Queen's Printer for Ontario.

O'Brien, S.M., and Facey D.E. 2008. Habitat use by the Eastern Sand Darter, *Ammocrypta pellucida*, in two Lake Champlain tributaries. Canadian Field-Naturalist, 122:239–246.

Phelps, A. and Francis, A. 2002. Update COSEWIC status report on the Channel Darter *Percina copelandi* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa, ON.

Raab, D., Mandrak, N.E., Ricciardi. A. 2018. Low-head dams facilitate Round Goby *Neogobius melanostomus* invasion. Biological Invasions, 20: 757-776.

Reid, S.M., and Mandrak, N.E. 2008. Historical Changes in the distribution of threatened Channel Darter (*Percina copelandi*) in Lake Erie with general observations on the beach fish assemblage. Journal of Great Lakes Research, 34: 324-333.

Reid, S.M., and Mandrak, N.E. 2009. Lake Erie beaches: diel variation in fish assemblage structure and implications for monitoring. Hydrobiologia, 618:139–148.

Reid, S.M., and Dextrase, A. 2017. Monitoring lake populations of Eastern Sand Darter (*Ammocrypta pellucida*): a comparison of two seines. Journal of Freshwater Ecology, 32:499–511.

Scott, D.M. 1955. Additional records of two fishes*, Erimyzon sucetta kennerlyi* and *Hadropterus copelandi*,from southern Ontario, Canada. Copeia, 1955(2):151.

Scott, W.B. and Crossman, E.J. 1973. Freshwater fishes of Canada. Bulletin 184. Fisheries Research Board of Canada, Ottawa.

Trautman, M.B. 1981. Fishes of Ohio, Revised Edition. Columbus, Ohio: Ohio State University Press.

Wei, A., Chow-Fraser, P., and Albert, D. 2004. Influence of shoreline features on fish distribution in the Laurentian Great Lakes. Canadian Journal of Fisheries and Aquatic Sciences, 61:1113–1123.

Table 1. Summary of 2009 Lake Huron fish sampling site details and sampling effort.

Site	Description	Coordinates		Start Time	Seine Type	Hauls	Total Distance Sampled (m)
		Latitude	Longitude				
LH01D	Canatara Beach at Point Edward	43.00515	-82.40689	12:00	Bag	5	-
LH01N	Canatara Beach at Point Edward	43.00517	-82.40663	-	Bag	5	250
LH02D	Beach at Mike Weir Park (West of Brights Grove)	43.03040	-82.27459	15:15	Bag	4	230
LH02N	Beach at Mike Weir Park (West of Brights Grove)	43.03027	-82.27486	23:30	Bag	4	1880
LH03D	Wild Wood Park - Beside rocky point, below wooden staircase	43.03302	-82.25556	17:22	Bag	3	250
LH03N	Wild Wood Park - Beside rocky point, below wooden staircase	43.03302	-82.25556	22:35	Bag	1	270
LH04D	Pinery Beach 4	43.27932	-81.81523	-	Bag	5	250
LH04N	Pinery Beach 4	43.27932	-81.81523	22:12	Bag	5	250
LH05D	Pinery Beach 9	43.26759	-81.83546	16:20	Bag	5	250
LH05N	Pinery Beach 9	43.26759	-81.83541	23:10	Bag	5	250
LH06D	Ipperwash Beach at Duffus Drain Mouth	43.21598	-81.95910	18:15	Bag	5	250
LH06N	Ipperwash Beach at Duffus Drain Mouth	43.21598	-81.95910	0:27	Bag	5	250
LH07D	MacGregor Point Provincial Park	44.42002	-81.45413	11:25	Bag	1	50
LH07N	MacGregor Point Provincial Park	44.42002	-81.45413	21:05	Bag	1	50
LH08D	Inverhuron Provincial Park	44.29399	-81.59332	12:35	Bag	5	250
LH08N	Inverhuron Provincial Park	44.29412	-81.59345	22:10	Bag	5	250
LH09D	Kincardine Beach	44.18445	-81.63896	14:08	Bag	5	250
LH09N	Kincardine Beach	44.18445	-81.63896	23:47	Bag	5	250

Table 2. Summary of 2009 Lake Ontario fish sampling site details and sampling effort.

Site	Description	Coordinates		Start Time	Seine Type	Hauls	Total Distance Sampled (m)
		Latitude	Longitude				
ON01D	Presquile Provincial Park at Owen's Point	43.99003	-77.72959	13:20	Bag	5	250
ON01N	Presquile Provincial Park at Owen's Point	43.99003	-77.72959	19:10	Bag	5	250
ON02D	Presquile Provincial Park at Beach #1	44.00354	-77.73920	10:45	Bag	5	250
ON02N	Presquile Provincial Park at Beach #1	44.00354	-77.73920	20:45	Bag	5	250
ON03D	North Beach Provincial Park	43.95291	-77.52384	16:05	Bag	5	250
ON03N	North Beach Provincial Park	43.95291	-77.52384	22:20	Bag	5	250
ON04D	Sandbanks Provincial Park at Sandbanks day use area	43.90353	-77.28392	13:45	Bag	5	250
ON04N	Sandbanks Provincial Park at Sandbanks day use area	43.90353	-77.28392	20:30	Bag	5	250
ON05D	Sandbanks Provincial Park at Lakeside Lodge day use area	43.89839	-77.27959	11:45	Bag	5	250
ON05N	Sandbanks Provincial Park at Lakeside Lodge day use area	43.89839	-77.27959	21:30	Bag	5	250
ON06D	Sandbanks Provincial Park at outlet of parking lot #2	43.89963	-77.22985	11:15	Bag	5	250
ON06N	Sandbanks Provincial Park at outlet of parking lot #2	43.89963	-77.22985	22:45	Bag	5	250
ON07D	Wellington Public Beach	43.94975	-77.34063	9:30	Bag	5	250
ON07N	Wellington Public Beach	43.94975	-77.34063	19:30	Bag	5	250
ON08D	Sandbanks Provincial Park at outlet of parking lot 8-12	43.89342	-77.22230	12:30	Bag	5	250

Table 3. Summary of habitat characteristics at nine sites sampled for fishes along the southeast shore of Lake Huron in 2009.

Site	Sample Date	Water Temperature (°C)	Conductivity (us/ms)	Max Depth (m)	Substrate Composition (%)						Aquatic Vegetation (%)		
					Fines	Sand	Pebble	Gravel	Cobble	Boulder	Open Water	Submerged	Algae
LH01D	24-Aug-09	22.4	209	1.6	0	80	20	0	0	0	100	0	0
LH01N	24-Aug-09	20	217	1.6	0	80	0	20	0	0	100	0	0
LH02D	24-Aug-09	24.2	206	1.5	0	90	10	0	0	0	100	0	0
LH02N	24-Aug-09	19	215	1.5	0	90	10	0	0	0	100	0	0
LH03D	24-Aug-09	24.7	210	1.5	0	60	0	30	10	0	100	0	0
LH03N	24-Aug-09	20.4	209	1.5	0	90	10	0	0	0	100	0	0
LH04D	25-Aug-09	25.5	216	1.5	0	80	0	20	0	0	100	0	0
LH04N	25-Aug-09	22.3	222	1	0	80	0	20	0	0	100	0	0
LH05D	25-Aug-09	24.6	216	1	0	80	0	20	0	0	100	0	0
LH05N	25-Aug-09	21.9	227	1	0	80	0	20	0	0	100	0	0
LH06D	25-Aug-09	24.7	225	1	0	75	25	0	0	0	95	5	0
LH06N	25-Aug-09	21.4	216	1	0	75	0	25	0	0	95	5	0
LH07D	26-Aug-09	17.5	223	0.6	0	20	0	0	50	30	100	0	0
LH07N	26-Aug-09	19.9	213	0.6	0	20	0	0	50	30	100	0	0
LH08D	26-Aug-09	21.9	213	0.6	0	90	0	10	0	0	100	0	0
LH08N	26-Aug-09	18.4	217	0.6	0	100	0	0	0	0	60	0	40
LH09D	26-Aug-09	21.2	221	0.6	0	70	0	25	5	0	100	0	0
LH09N	26-Aug-09	17.5	229	0.6	0	20	0	0	70	10	100	0	0

Table 4. Summary of habitat characteristics at eight sites sampled for freshwater fishes along the north shore of Lake Ontario in 2009.

Site	Sample Date	Water Temperature (°C)	Conductivity (us/ms)	Max Depth (m)	Substrate Composition (%)						Aquatic Vegetation (%)		
					Fines	Sand	Pebble	Gravel	Cobble	Boulder	Open Water	Submerged	Algae
ON01D	15-Sep-09	22.1	297	1	0	84	0	0	16	0		-	
ON01N	15-Sep-09	-	-	1	0	84	0	0	16	0		-	
ON02D	15-Sep-09	20.2	300	0.5	0	100	0	0	0	0		-	
ON02N	15-Sep-09	-	-	0.5	0	100	0	0	0	0		-	
ON03D	15-Sep-09	23.1	300	0.75	0	100	0	0	0	0	100	0	0
ON03N	15-Sep-09	-	-	0.75	0	100	0	0	0	0		-	
ON04D	16-Sep-09	19.5	300	0.5	0	100	0	0	0	0		-	
ON04N	16-Sep-09	-	-	0.5	0	100	0	0	0	0		-	
ON05D	16-Sep-09	20.6	240	0.75	0	97	0	3	0	0		-	
ON05N	16-Sep-09	-	-	0.75	0	97	0	3	0	0		-	
ON06D	17-Sep-09	17.3	304	0.5	0	100	0	0	0	0		-	
ON06N	17-Sep-09	-	-	0.5	0	100	0	0	0	0		-	
ON07D	16-Sep-09	16.5	300	1.25	0	82	0	6	12	0		-	
ON07N	16-Sep-09	-	-	1.25	0	82	0	6	12	0		-	
ON08D	17-Sep-09	19.1	302	0.75	0	100	0	0	0	0		-	

Table 5. Summary of 2013-2015 West Lake sampling sites and details.

Site	Coordinates		Start Time	Seine Type	Hauls
	Latitude	Longitude			
WL13-01a	43.91056	-77.27322	10:13	Bag	5
WL13-01b	43.91056	-77.27322	10:07	Beach	5
WL13-02a	43.91039	-77.27364	10:55	Bag	5
WL13-02b	43.91039	-77.27364	10:50	Beach	5
WL13-03a	43.91047	-77.27518	11:27	Bag	5
WL13-03b	43.91047	-77.27518	11:24	Beach	5
WL13-04a	43.91080	-77.27549	12:00	Bag	5
WL13-04b	43.91080	-77.27549	12:06	Beach	5
WL13-05a	43.91113	-77.27616	13:30	Bag	5
WL13-05b	43.91113	-77.27616	13:24	Beach	5
WL13-06a	43.91124	-77.27641	13:29	Bag	5
WL13-06b	43.91139	-77.27673	13:45	Beach	5
WL13-07a	43.91152	-77.27703	14:08	Bag	5
WL13-07b	43.91152	-77.27703	14:15	Beach	5
WL13-08a	43.91180	-77.27738	14:17	Bag	5
WL13-08b	43.91188	-77.27742	14:42	Beach	5
WL13-09a	43.91240	-77.27743	14:48	Bag	5
WL13-09b	43.91240	-77.27743	15:00	Beach	5
WL13-10a	43.91276	-77.27805	16:05	Bag	5
WL13-10b	43.91270	-77.27790	15:18	Beach	5
WL13-11a	43.91284	-77.27834	15:30	Bag	5
WL13-11b	43.91284	-77.27834	16:05	Beach	5
WL13-12a	43.92468	-77.29944	8:41	Bag	5
WL13-12b	43.92466	-77.29958	8:42	Beach	5
WL13-13a	43.92510	-77.29995	9:28	Bag	5
WL13-13b	43.92503	-77.29970	9:17	Beach	5
WL13-14a	43.92518	-77.30029	10:18	Bag	5
WL13-14b	43.92522	-77.30039	10:18	Beach	5
WL13-15a	43.92527	-77.30116	11:22	Bag	5
WL13-15b	43.92525	-77.30096	11:20	Beach	5
WL13-16a	43.93016	-77.30731	12:19	Bag	5
WL13-16b	43.93000	-77.30717	12:19	Beach	5
WL13-17a	43.93037	-77.30746	13:29	Bag	5
WL13-17b	43.93048	-77.30754	13:24	Beach	5
WL13-18a	43.93095	-77.30793	14:09	Bag	5
WL13-18b	43.93080	-77.30779	14:09	Beach	5
WL13-19a	43.93113	-77.30820	14:56	Bag	5
WL13-19b	43.93119	-77.30831	14:56	Beach	5

Table 5. continued

Site	Coordinates		Start Time	Seine Type	Hauls
	Latitude	Longitude			
WL13-20a	43.93140	-77.30898	15:27	Bag	5
WL13-20b	43.93132	-77.30881	15:28	Beach	5
WL13-21a	43.91711	-77.28489	8:33	Bag	5
WL13-21b	43.91704	-77.28465	8:31	Beach	5
WL13-22a	43.91723	-77.28545	9:04	Bag	5
WL13-22b	43.91721	-77.28518	9:04	Beach	5
WL13-23a	43.91725	-77.28585	9:37	Bag	5
WL13-23b	43.91725	-77.28592	9:35	Beach	5
WL13-24a	43.92128	-77.29153	10:35	Bag	5
WL13-24b	43.92138	-77.29144	10:36	Beach	5
WL13-25a	43.92181	-77.29144	11:13	Bag	5
WL13-25b	43.92191	-77.29149	11:14	Beach	5
WL13-26a	43.92247	-77.29191	12:19	Bag	5
WL13-26b	43.92230	-77.29182	12:18	Beach	5
WL13-27a	43.92270	-77.29216	12:59	Bag	5
WL13-27b	43.92275	-77.29224	13:00	Beach	5
WL13-28a	43.92313	-77.29283	13:39	Bag	5
WL13-28b	43.92301	-77.29263	13:38	Beach	5
WL13-29a	43.92319	-77.29321	14:29	Bag	5
WL13-29b	43.92319	-77.29331	14:29	Beach	5
WL13-30a	43.92337	-77.29385	15:11	Bag	5
WL13-30b	43.92340	-77.29398	15:10	Beach	5
WL13-31a	43.92350	-77.29432	7:43	Bag	5
WL13-31b	43.92339	-77.29414	7:43	Beach	5
WL13-32a	43.92357	-77.29472	8:31	Bag	5
WL13-32b	43.92361	-77.29480	8:30	Beach	5
WL13-33a	43.92396	-77.29542	9:16	Bag	5
WL13-33b	43.92380	-77.29520	9:14	Beach	5
WL13-34a	43.92413	-77.29572	10:06	Bag	5
WL13-34b	43.92418	-77.29584	10:06	Beach	5
WL13-35a	43.92440	-77.29639	10:53	Bag	5
WL13-35b	43.92435	-77.29628	10:50	Beach	5
WL13-36a	43.92466	-77.29674	11:45	Bag	5
WL13-36b	43.92469	-77.29686	11:44	Beach	5
WL13-37a	43.92464	-77.29759	12:41	Bag	5
WL13-37b	43.92461	-77.29733	12:37	Beach	5
WL14-01a	43.94720	-77.33013	10:05	Bag	5
WL14-01b	43.94720	-77.33013	10:31	Beach	5
WL14-02a	43.94674	-77.32858	12:17	Bag	5
WL14-02b	43.94674	-77.32858	11:33	Beach	5

Table 5. continued

Site	Coordinates		Start Time	Seine Type	Hauls
	Latitude	Longitude			
WL14-03a	43.94619	-77.32822	13:00	Bag	5
WL14-03b	43.94619	-77.32822	13:32	Beach	5
WL14-04a	43.94522	-77.32714	15:12	Bag	5
WL14-04b	43.94522	-77.32714	14:30	Beach	5
WL14-05a	43.94408	-77.32332	9:08	Bag	5
WL14-05b	43.94408	-77.32332	9:41	Beach	5
WL14-06a	43.94363	-77.32273	11:13	Bag	5
WL14-06b	43.94363	-77.32273	10:41	Beach	5
WL14-07a	43.94374	-77.32167	11:58	Bag	5
WL14-07b	43.94374	-77.32167	12:32	Beach	5
WL14-08a	43.94223	-77.31926	13:56	Bag	5
WL14-08b	43.94223	-77.31926	13:18	Beach	5
WL14-09a	43.92138	-77.29142	11:14	Bag	5
WL14-09b	43.92146	-77.29137	11:13	Beach	5
WL14-10a	43.92199	-77.29150	12:10	Bag	5
WL14-10b	43.92181	-77.29140	12:08	Beach	5
WL14-11a	43.92223	-77.29165	12:57	Bag	5
WL14-11b	43.92231	-77.29170	12:58	Beach	5
WL14-12a	43.92270	-77.29209	13:48	Bag	5
WL14-12b	43.92263	-77.29197	13:48	Beach	5
WL14-13a	43.92292	-77.29253	14:28	Bag	5
WL14-13b	43.92292	-77.29253	14:28	Beach	5
WL14-14a	43.91124	-77.27328	9:00	Bag	5
WL14-14b	43.91113	-77.27335	8:59	Beach	5
WL14-15a	43.91150	-77.27312	9:42	Bag	5
WL14-15b	43.91164	-77.27303	9:42	Beach	5
WL14-16a	43.91205	-77.27280	10:19	Bag	5
WL14-16b	43.91196	-77.27286	10:21	Beach	5
WL14-17a	43.91079	-77.27380	11:20	Bag	5
WL14-17b	43.91065	-77.27395	11:21	Beach	5
WL14-18a	43.91059	-77.27461	12:05	Bag	5
WL14-18b	43.91061	-77.27432	12:06	Beach	5
WL14-19a	43.91066	-77.27499	13:04	Bag	5
WL14-19b	43.91069	-77.27510	13:02	Beach	5
WL14-20a	43.91113	-77.27569	13:40	Bag	5
WL14-20b	43.91109	-77.27560	13:40	Beach	5
WL14-21a	43.91130	-77.27600	14:15	Bag	5
WL14-21b	43.91132	-77.27600	14:15	Beach	5
WL14-22a	43.91150	-77.27656	14:54	Bag	5
WL14-22b	43.91156	-77.27677	14:55	Beach	5

Table 5. continued

Site	Coordinates		Start Time	Seine Type	Hauls
	Latitude	Longitude			
WL14-23a	43.91182	-77.27731	15:40	Bag	5
WL14-23b	43.91182	-77.27731	15:38	Beach	5
WL14-24a	43.91224	-77.27721	16:12	Bag	5
WL14-24b	43.91224	-77.27721	16:14	Beach	5
WL14-25a	43.93350	-77.26325	8:51	Bag	5
WL14-25b	43.93343	-77.26316	8:51	Beach	5
WL14-26a	43.91304	-77.27815	9:59	Bag	5
WL14-26b	43.91293	-77.27789	9:59	Beach	5
WL14-27a	43.91305	-77.27879	10:41	Bag	5
WL14-27b	43.91305	-77.27879	10:42	Beach	5
WL14-28a	43.91318	-77.27941	11:32	Bag	5
WL14-28b	43.91318	-77.27941	11:32	Beach	5
WL14-29a	43.91328	-77.27965	12:18	Bag	5
WL14-29b	43.91325	-77.27988	12:18	Beach	5
WL14-30a	43.92321	-77.29379	13:29	Bag	5
WL14-30b	43.92316	-77.29355	13:29	Beach	5
WL14-31a	43.92335	-77.29459	14:14	Bag	5
WL14-31b	43.92335	-77.29459	14:15	Beach	5
WL14-32a	43.92359	-77.29495	15:24	Bag	5
WL14-32b	43.92350	-77.29474	15:25	Beach	5
WL14-33b	43.93261	-77.26272	8:31	Beach	5
WL14-34b	43.93225	-77.26251	9:11	Beach	5
WL14-35b	43.93191	-77.26242	9:48	Beach	5
WL14-36b	43.93153	-77.26231	10:35	Beach	5
WL14-37b	43.93116	-77.26215	11:10	Beach	5
WL14-38b	43.93083	-77.26212	11:46	Beach	5
WL14-39b	43.93044	-77.26212	12:41	Beach	5
WL14-40b	43.93000	-77.26205	13:12	Beach	5
WL15-01	43.94387	-77.32265	9:43	Bag	5
WL15-02	43.94397	-77.32195	10:18	Bag	5
WL15-03	43.94370	-77.32159	10:49	Bag	5
WL15-04	43.94124	-77.31379	11:26	Bag	5
WL15-05	43.92852	-77.30528	12:07	Bag	5
WL15-06	43.92326	-77.29409	12:55	Bag	5
WL15-07	GPS Error		14:06	Bag	5
WL15-08	43.91650	-77.28214	10:12	Bag	5
WL15-09	43.92872	-77.30537	12:10	Bag	5
WL15-10	43.92339	-77.29385	13:00	Bag	5
WL15-11	43.91693	-77.28264	14:02	Bag	5
WL15-12	GPS Error		10:55	Bag	5

Table 5. continued

Site	Coordinates		Start Time	Seine Type	Hauls
	Latitude	Longitude			
WL15-13	43.91397	-77.28120	11:59	Bag	5
WL15-14	GPS Error		12:34	Bag	5
WL15-15	43.92270	-77.29216	13:20	Bag	5
WL15-16	GPS Error		14:05	Bag	5
WL15-17	GPS Error		9:38	Bag	5
WL15-18	43.91654	-77.28204	10:08	Bag	5
WL15-19	GPS Error		10:49	Bag	5
WL15-20	GPS Error		12:32	Bag	5
WL15-21	43.92273	-77.29205	13:23	Bag	5
WL15-22	GPS Error		14:09	Bag	5
WL15-23	43.91701	-77.28295	9:53	Bag	5
WL15-24	43.91694	-77.28301	10:24	Bag	5
WL15-25	43.91689	-77.28263	11:00	Bag	5
WL15-26	43.91646	-77.28209	11:26	Bag	5
WL15-27	43.91549	-77.28130	11:56	Bag	5
WL15-28	43.91691	-77.28265	12:41	Bag	5
WL15-29	43.91690	-77.28312	13:16	Bag	5
WL15-30	43.91702	-77.28346	13:45	Bag	5
WL15-31	43.91703	-77.28372	14:10	Bag	5

Table 6. Summary of 2013 North Beach sampling site details and sampling effort.

Site	Coordinates		Start Time	Seine Type	Hauls
	Latitude	Longitude			
NB01a	43.96168	-77.52772	8:56	Bag	5
NB01b	43.96168	-77.52772	9:26	Beach	5
NB02a	43.96199	-77.52813	10:08	Bag	5
NB02b	43.96199	-77.52813	10:44	Beach	5
NB03a	43.96262	-77.52845	12:40	Bag	5
NB03b	43.96262	-77.52845	13:08	Beach	5
NB04a	43.95950	-77.52522	14:45	Bag	5
NB04b	43.95950	-77.52522	15:15	Beach	5
NB05a	43.95865	-77.52442	8:30	Bag	5
NB05b	43.95865	-77.52442	8:58	Beach	5
NB06a	43.95830	-77.52412	9:50	Bag	5
NB06b	43.95830	-77.52412	10:20	Beach	5
NB07a	43.96005	-77.52604	11:55	Bag	5
NB07b	43.96005	-77.52604	12:20	Beach	5
NB08a	43.95996	-77.52558	12:58	Bag	5
NB08b	43.95996	-77.52558	13:26	Beach	5
NB09a	43.95790	-77.52357	14:20	Bag	5
NB09b	43.95790	-77.52357	14:50	Beach	5
NB10a	43.96121	-77.52759	8:09	Bag	5
NB10b	43.96121	-77.52759	8:38	Beach	5
NB11a	43.96098	-77.52741	9:10	Bag	5
NB11b	43.96098	-77.52741	9:38	Beach	5
NB12a	43.96044	-77.52668	10:13	Bag	5
NB12b	43.96044	-77.52668	10:41	Beach	5

Table 7. Summary of 2013 Wellers Bay fish sampling site details and sampling effort.

Site	Coordinates		Start Time	Seine Type	Hauls
	Latitude	Longitude			
WB01	43.98939	-77.57201	9:25	Beach	5
WB02	43.98994	-77.53813	11:03	Beach	5
WB03	43.98954	-77.57130	9:28	Beach	5
WB04	43.98981	-77.57072	10:06	Beach	5
WB05	43.99057	-77.56989	10:47	Beach	5
WB06	44.00887	-77.53911	12:23	Beach	5
WB07	44.00859	-77.53572	13:08	Beach	5
WB08	44.00822	-77.53542	13:52	Beach	5
WB09	44.00593	-77.53296	10:27	Beach	5
WB10	44.00316	-77.52528	11:53	Beach	5
WB11	44.00225	-77.52504	12:34	Beach	5
WB12	44.00064	-77.52436	13:24	Beach	5
WB13	44.00652	-77.53589	9:32	Beach	5

Table 8. Summary of habitat characteristics at sites sampled for freshwater fishes in West Lake between 2013 and 2015.

Site	Sample Date	Water Temperature (°C)	Conductivity (us/ms)	Max Depth	Substrate Composition (%)					
					Fines	Sand	Pebble	Gravel	Cobble	Boulder
WL13-01a	16-Sep-13	13.5	297	0.23	0	100	0	0	0	0
WL13-01b	16-Sep-13	13.5	297	0.23	0	100	0	0	0	0
WL13-02a	16-Sep-13	13.5	297	0.18	0	100	0	0	0	0
WL13-02b	16-Sep-13	13.5	297	0.18	0	100	0	0	0	0
WL13-03a	16-Sep-13	15.2	276	0.36	0	100	0	0	0	0
WL13-03b	16-Sep-13	15.2	276	0.36	0	100	0	0	0	0
WL13-04a	16-Sep-13	15.7	276	0.45	0	100	0	0	0	0
WL13-04b	16-Sep-13	15.7	276	0.45	0	100	0	0	0	0
WL13-05a	16-Sep-13	16.6	277	0.61	0	100	0	0	0	0
WL13-05b	16-Sep-13	16.6	277	0.61	0	100	0	0	0	0
WL13-06a	16-Sep-13	17.7	278	0.46	0	100	0	0	0	0
WL13-06b	16-Sep-13	17.2	278	0.63	0	100	0	0	0	0
WL13-07a	16-Sep-13	16.4	277	0.72	0	100	0	0	0	0
WL13-07b	16-Sep-13	16.4	277	0.72	0	100	0	0	0	0
WL13-08a	16-Sep-13	17.0	277	1.00	0	100	0	0	0	0
WL13-08b	16-Sep-13	17.0	277	1.10	0	100	0	0	0	0
WL13-09a	16-Sep-13	18.6	279	0.62	0	100	0	0	0	0
WL13-09b	16-Sep-13	18.6	279	0.62	0	100	0	0	0	0
WL13-10a	16-Sep-13	19.6	283	0.26	0	100	0	0	0	0
WL13-10b	16-Sep-13	19.6	283	0.91	0	100	0	0	0	0
WL13-11a	16-Sep-13	18.7	283	0.28	0	100	0	0	0	0
WL13-11b	16-Sep-13	18.7	283	0.28	0	100	0	0	0	0
WL13-12a	17-Sep-13	-	-	0.45	0	100	0	0	0	0
WL13-12b	17-Sep-13	12.8	270	0.34	0	100	0	0	0	0
WL13-13a	17-Sep-13	13.9	275	0.85	0	100	0	0	0	0
WL13-13b	17-Sep-13	13.9	275	0.84	0	100	0	0	0	0
WL13-14a	17-Sep-13	14.6	277	0.70	0	100	0	0	0	0
WL13-14b	17-Sep-13	14.6	277	0.69	0	100	0	0	0	0
WL13-15a	17-Sep-13	15.8	273	0.56	0	100	0	0	0	0
WL13-15b	17-Sep-13	15.8	273	0.56	0	100	0	0	0	0
WL13-16a	17-Sep-13	17.5	281	0.44	0	100	0	0	0	0
WL13-16b	17-Sep-13	17.5	281	0.56	0	100	0	0	0	0
WL13-17a	17-Sep-13	19.6	270	0.54	0	100	0	0	0	0
WL13-17b	17-Sep-13	19.6	270	0.49	0	100	0	0	0	0
WL13-18a	17-Sep-13	19.5	270	1.12	0	100	0	0	0	0
WL13-18b	17-Sep-13	19.5	270	-	0	100	0	0	0	0
WL13-19a	17-Sep-13	19.8	262	0.90	0	100	0	0	0	0
WL13-19b	17-Sep-13	19.5	270	0.89	0	100	0	0	0	0

Table 8. continued

Site	Sample Date	Water Temperature (°C)	Conductivity (us/ms)	Max Depth	Substrate Composition (%)					
					Fines	Sand	Pebble	Gravel	Cobble	Boulder
WL13-20a	17-Sep-13	19.5	280	0.47	0	100	0	0	0	0
WL13-20b	17-Sep-13	19.5	280	0.75	0	100	0	0	0	0
WL13-21a	18-Sep-13	14.7	277	0.37	0	100	0	0	0	0
WL13-21b	18-Sep-13	14.7	277	0.31	0	100	0	0	0	0
WL13-22a	18-Sep-13	15.5	273	0.69	0	100	0	0	0	0
WL13-22b	18-Sep-13	15.5	273	0.58	0	100	0	0	0	0
WL13-23a	18-Sep-13	15.5	276	0.77	0	100	0	0	0	0
WL13-23b	18-Sep-13	15.5	276	0.62	20	80	0	0	0	0
WL13-24a	18-Sep-13	18.6	269	0.79	0	100	0	0	0	0
WL13-24b	18-Sep-13	18.6	269	0.73	0	100	0	0	0	0
WL13-25a	18-Sep-13	16.8	272	0.54	0	100	0	0	0	0
WL13-25b	18-Sep-13	16.8	272	0.75	0	100	0	0	0	0
WL13-26a	18-Sep-13	19.6	266	0.34	0	100	0	0	0	0
WL13-26b	18-Sep-13	19.6	266	0.41	0	100	0	0	0	0
WL13-27a	18-Sep-13	18.9	266	0.76	0	100	0	0	0	0
WL13-27b	18-Sep-13	18.9	266	1.01	0	100	0	0	0	0
WL13-28a	18-Sep-13	19.4	270	0.67	0	100	0	0	0	0
WL13-28b	18-Sep-13	19.4	270	0.78	0	100	0	0	0	0
WL13-29a	18-Sep-13	19.7	271	0.67	0	100	0	0	0	0
WL13-29b	18-Sep-13	19.7	271	1.29	0	100	0	0	0	0
WL13-30a	18-Sep-13	19.7	276	0.84	0	100	0	0	0	0
WL13-30b	18-Sep-13	19.7	276	1.15	0	100	0	0	0	0
WL13-31a	19-Sep-13	14.1	280	0.70	0	100	0	0	0	0
WL13-31b	19-Sep-13	14.1	280	0.86	0	100	0	0	0	0
WL13-32a	19-Sep-13	17.8	260	0.58	20	80	0	0	0	0
WL13-32b	19-Sep-13	17.8	260	0.64	30	70	0	0	0	0
WL13-33a	19-Sep-13	19.6	260	0.80	20	80	0	0	0	0
WL13-33b	19-Sep-13	19.6	260	1.00	20	80	0	0	0	0
WL13-34a	19-Sep-13	18.0	276	0.65	10	90	0	0	0	0
WL13-34b	19-Sep-13	18.0	276	0.63	10	90	0	0	0	0
WL13-35a	19-Sep-13	19.2	269	0.56	0	100	0	0	0	0
WL13-35b	19-Sep-13	19.2	269	0.59	0	100	0	0	0	0
WL13-36a	19-Sep-13	21.0	257	0.58	0	100	0	0	0	0
WL13-36b	19-Sep-13	20.8	264	0.76	0	100	0	0	0	0
WL13-37a	19-Sep-13	21.8	263	0.44	0	100	0	0	0	0
WL13-37b	19-Sep-13	21.8	263	0.45	0	100	0	0	0	0
WL14-01a	27-Aug-14	24.4	262	0.63	0	100	0	0	0	0
WL14-01b	27-Aug-14	24.4	262	0.65	0	100	0	0	0	0
WL14-02a	27-Aug-14	25.4	263	0.98	5	95	0	0	0	0
WL14-02b	27-Aug-14	25.4	263	0.94	5	95	0	0	0	0

Table 8. continued

Site	Sample Date	Water Temperature (°C)	Conductivity (us/ms)	Max Depth	Substrate Composition (%)					
					Fines	Sand	Pebble	Gravel	Cobble	Boulder
WL14-03a	27-Aug-14	25.8	257	0.9	5	95	0	0	0	0
WL14-03b	27-Aug-14	25.8	257	0.86	5	95	0	0	0	0
WL14-04a	27-Aug-14	26.2	255	0.48	10	90	0	0	0	0
WL14-04b	27-Aug-14	26.2	255	0.56	10	90	0	0	0	0
WL14-05a	28-Aug-14	21.7	247	0.65	10	90	0	0	0	0
WL14-05b	28-Aug-14	21.7	247	0.65	10	90	0	0	0	0
WL14-06a	28-Aug-14	22.0	246	0.63	5	95	0	0	0	0
WL14-06b	28-Aug-14	22.0	246	0.61	5	95	0	0	0	0
WL14-07a	28-Aug-14	22.6	264	0.86	0	100	0	0	0	0
WL14-07b	28-Aug-14	22.6	264	0.90	0	100	0	0	0	0
WL14-08a	28-Aug-14	21.9	255	0.80	10	90	0	0	0	0
WL14-08b	28-Aug-14	22.0	254	0.88	10	90	0	0	0	0
WL14-09a	15-Sep-14	17.7	290	0.63	0	100	0	0	0	0
WL14-09b	15-Sep-14	17.1	290	0.79	20	80	0	0	0	0
WL14-10a	15-Sep-14	18.1	291	0.82	5	95	0	0	0	0
WL14-10b	15-Sep-14	18.1	291	0.91	10	90	0	0	0	0
WL14-11a	15-Sep-14	18.3	287	0.81	5	95	0	0	0	0
WL14-11b	15-Sep-14	18.3	287	0.83	5	95	0	0	0	0
WL14-12a	15-Sep-14	18.7	283	0.71	0	100	0	0	0	0
WL14-12b	15-Sep-14	18.7	283	0.83	10	90	0	0	0	0
WL14-13a	15-Sep-14	19.5	286	0.85	0	100	0	0	0	0
WL14-13b	15-Sep-14	19.5	286	0.72	5	95	0	0	0	0
WL14-14a	16-Sep-14	15.2	303	0.69	0	100	0	0	0	0
WL14-14b	16-Sep-14	15.2	303	0.93	0	100	0	0	0	0
WL14-15a	16-Sep-14	16.0	288	0.71	0	100	0	0	0	0
WL14-15b	16-Sep-14	16.0	288	0.71	0	100	0	0	0	0
WL14-16a	16-Sep-14	16.0	290	0.73	0	100	0	0	0	0
WL14-16b	16-Sep-14	16.0	290	0.75	0	100	0	0	0	0
WL14-17a	16-Sep-14	18.0	288	0.73	0	100	0	0	0	0
WL14-17b	16-Sep-14	18.0	288	0.81	0	100	0	0	0	0
WL14-18a	16-Sep-14	18.2	290	0.68	0	100	0	0	0	0
WL14-18b	16-Sep-14	18.2	290	0.95	0	100	0	0	0	0
WL14-19a	16-Sep-14	18.6	282	0.61	0	100	0	0	0	0
WL14-19b	16-Sep-14	18.6	282	0.66	0	100	0	0	0	0
WL14-20a	16-Sep-14	18.8	285	0.79	0	100	0	0	0	0
WL14-20b	16-Sep-14	18.8	285	0.80	0	100	0	0	0	0
WL14-21a	16-Sep-14	18.4	289	0.92	0	100	0	0	0	0
WL14-21b	16-Sep-14	18.4	289	0.94	0	100	0	0	0	0
WL14-22a	16-Sep-14	18.2	287	0.81	0	100	0	0	0	0
WL14-22b	16-Sep-14	18.2	287	0.75	10	90	0	0	0	0

Table 8. continued

Site	Sample Date	Water Temperature (°C)	Conductivity (us/ms)	Max Depth	Substrate Composition (%)					
					Fines	Sand	Pebble	Gravel	Cobble	Boulder
WL14-23a	16-Sep-14	18.3	290	1.05	0	100	0	0	0	0
WL14-23b	16-Sep-14	18.3	290	0.73	0	100	0	0	0	0
WL14-24a	16-Sep-14	18.3	282	0.62	0	100	0	0	0	0
WL14-24b	16-Sep-14	18.3	282	0.54	0	100	0	0	0	0
WL14-25a	17-Sep-14	16.7	292	0.70	0	100	0	0	0	0
WL14-25b	17-Sep-14	16.7	297	0.76	0	100	0	0	0	0
WL14-26a	17-Sep-14	16.7	277	0.44	0	100	0	0	0	0
WL14-26b	17-Sep-14	16.7	277	0.39	0	100	0	0	0	0
WL14-27a	17-Sep-14	18.3	275	0.43	0	100	0	0	0	0
WL14-27b	17-Sep-14	18.3	275	0.45	0	100	0	0	0	0
WL14-28a	17-Sep-14	18.2	279	0.31	0	100	0	0	0	0
WL14-28b	17-Sep-14	18.2	279	0.32	0	100	0	0	0	0
WL14-29a	17-Sep-14	19.0	277	0.29	0	100	0	0	0	0
WL14-29b	17-Sep-14	19.0	277	0.27	0	100	0	0	0	0
WL14-30a	17-Sep-14	20.1	287	0.38	0	100	0	0	0	0
WL14-30b	17-Sep-14	20.1	287	0.36	0	100	0	0	0	0
WL14-31a	17-Sep-14	21.4	284	0.41	0	100	0	0	0	0
WL14-31b	17-Sep-14	21.4	284	0.40	0	100	0	0	0	0
WL14-32a	17-Sep-14	21.9	308	0.43	0	100	0	0	0	0
WL14-32b	17-Sep-14	21.9	308	0.41	0	100	0	0	0	0
WL14-33b	18-Sep-14	16.6	296	0.70	0	100	0	0	0	0
WL14-34b	18-Sep-14	16.7	292	0.69	0	100	0	0	0	0
WL14-35b	18-Sep-14	16.6	293	0.75	0	100	0	0	0	0
WL14-36b	18-Sep-14	16.9	292	0.63	0	100	0	0	0	0
WL14-37b	18-Sep-14	16.7	289	0.73	0	100	0	0	0	0
WL14-38b	18-Sep-14	16.9	290	0.79	0	100	0	0	0	0
WL14-39b	18-Sep-14	17.8	289	0.71	0	100	0	0	0	0
WL14-40b	18-Sep-14	17.3	293	0.77	0	100	0	0	0	0
WL15-01	1-Sep-15	23.0	279	0.75	0	100	0	0	0	0
WL15-02	1-Sep-15	22.7	283	0.93	0	100	0	0	0	0
WL15-03	1-Sep-15	23.0	282	0.97	0	100	0	0	0	0
WL15-04	1-Sep-15	23.9	274	0.80	0	65	0	15	20	0
WL15-05	1-Sep-15	23.7	301	0.71	0	100	0	0	0	0
WL15-06	1-Sep-15	23.9	299	0.61	0	100	0	0	0	0
WL15-07	1-Sep-15	24.8	284	0.53	0	100	0	0	0	0
WL15-08	1-Sep-15	24.4	275	0.41	0	100	0	0	0	0
WL15-09	1-Sep-15	23.7	301	1.01	0	100	0	0	0	0
WL15-10	1-Sep-15	23.9	299	0.92	0	100	0	0	0	0
WL15-11	1-Sep-15	24.8	284	0.71	0	100	0	0	0	0
WL15-12	2-Sep-15	26.0	293	0.53	0	100	0	0	0	0

Table 8. continued

Site	Sample Date	Water Temperature (°C)	Conductivity (us/ms)	Max Depth	Substrate Composition (%)					
					Fines	Sand	Pebble	Gravel	Cobble	Boulder
WL15-13	2-Sep-15	25.2	276	0.95	0	100	0	0	0	0
WL15-14	2-Sep-15	25.4	289	0.58	0	100	0	0	0	0
WL15-15	2-Sep-15	25.7	290	0.48	0	100	0	0	0	0
WL15-16	2-Sep-15	25.6	299	0.62	0	100	0	0	0	0
WL15-17	2-Sep-15	23.6	289	0.68	0	100	0	0	0	0
WL15-18	2-Sep-15	24.4	275	0.86	0	100	0	0	0	0
WL15-19	2-Sep-15	26.0	293	0.96	0	100	0	0	0	0
WL15-20	2-Sep-15	25.4	289	0.85	0	100	0	0	0	0
WL15-21	2-Sep-15	25.7	290	0.88	0	100	0	0	0	0
WL15-22	2-Sep-15	25.6	299	1.10	0	100	0	0	0	0
WL15-23	3-Sep-15	24.7	278	0.83	0	100	0	0	0	0
WL15-24	3-Sep-15	26.1	278	0.95	0	100	0	0	0	0
WL15-25	3-Sep-15	26.9	275	0.93	0	100	0	0	0	0
WL15-26	3-Sep-15	26.0	277	0.87	0	100	0	0	0	0
WL15-27	3-Sep-15	26.1	273	0.91	0	100	0	0	0	0
WL15-28	3-Sep-15	26.2	275	0.88	0	100	0	0	0	0
WL15-29	3-Sep-15	26.3	275	0.81	0	100	0	0	0	0
WL15-30	3-Sep-15	26.2	274	0.92	0	100	0	0	0	0
WL15-31	3-Sep-15	27.2	268	0.95	0	100	0	0	0	0

Table 9. Summary of habitat characteristics at 12 sites sampled for freshwater fishes at North Beach, Prince Edward County in 2013.

Site	Sample Date	Water Temperature (°C)	Conductivity (us/ms)	Max Depth (m)	Substrate Composition (%)*					
					Fines	Sand	Pebble	Gravel	Cobble	Boulder
NB01a	10-Jul-14	22.2	293	0.64	0	100	0	0	0	0
NB01b	10-Jul-14	22.2	293	0.71	0	100	0	0	0	0
NB02a	10-Jul-14	22.3	290	0.84	20	80	0	0	0	0
NB02b	10-Jul-14	22.3	290	0.94	20	80	0	0	0	0
NB03a	10-Jul-14	24.5	291	0.84	10	90	0	0	0	0
NB03b	10-Jul-14	24.5	291	0.84	15	85	0	0	0	0
NB04a	10-Jul-14	25.1	291	0.5	0	100	0	0	0	0
NB04b	10-Jul-14	25.1	291	0.46	0	100	0	0	0	0
NB05a	16-Jul-14	22.2	231	0.47	0	100	0	0	0	0
NB05b	16-Jul-14	22.2	231	0.73	0	100	0	0	0	0
NB06a	16-Jul-14	23.1	283	0.64	5	95	0	0	0	0
NB06b	16-Jul-14	23.1	283	0.7	0	100	0	0	0	0
NB07a	16-Jul-14	23.7	282	0.62	0	100	0	0	0	0
NB07b	16-Jul-14	23.7	282	0.67	0	100	0	0	0	0
NB08a	16-Jul-14	23.4	285	0.77	0	100	0	0	0	0
NB08b	16-Jul-14	23.4	285	0.77	0	100	0	0	0	0
NB09a	16-Jul-14	24.2	277	0.46	5	95	0	0	0	0
NB09b	16-Jul-14	24.2	277	0.47	5	95	0	0	0	0
NB10a	28-Jul-14	22.0	264	0.3	0	100	0	0	0	0
NB10b	28-Jul-14	22.1	264	0.34	0	100	0	0	0	0
NB11a	28-Jul-14	22.6	253	0.56	0	100	0	0	0	0
NB11b	28-Jul-14	22.6	253	0.56	0	100	0	0	0	0
NB12a	28-Jul-14	22.1	252	0.76	0	100	0	0	0	0
NB12b	28-Jul-14	22.1	252	0.76	0	100	0	0	0	0

Table 10. Summary of habitat characteristics at 13 sites sampled for freshwater fishes in Wellers Bay, Prince Edward County in 2013.

Site	Sample Date	Water Temperature (°C)	Conductivity (us/ms)	Max Depth (m)	Substrate Composition (%)					
					Fines	Sand	Pebble	Gravel	Cobble	Boulder
WB01	10-Sep-14	22.0	225	0.96	0	100	0	0	0	0
WB02	10-Sep-14	22.5	224	0.98	3	95	0	2	0	0
WB03	30-Sep-14	18.1	241	0.91	0	100	0	0	0	0
WB04	30-Sep-14	18.1	242	0.45	0	100	0	0	0	0
WB05	30-Sep-14	18.0	242	0.24	0	90	0	10	0	0
WB06	30-Sep-14	20.1	240	0.82	0	80	0	10	10	0
WB07	30-Sep-14	20.6	241	0.41	5	95	0	0	0	0
WB08	30-Sep-14	21.5	238	0.58	0	100	0	0	0	0
WB09	1-Oct-14	17.8	248	0.52	0	100	0	0	0	0
WB10	1-Oct-14	18.1	246	0.78	0	95	0	0	5	0
WB11	1-Oct-14	18.3	244	0.77	0	100	0	0	0	0
WB12	1-Oct-14	18.3	245	0.76	0	100	0	0	0	0
WB13	1-Oct-14	17.8	245	1.06	0	100	0	0	0	0

Table 11. Summary of Rondeau Bay sampling sites and details.

Site	Description	Coordinates		Start Time	Seine Type	Hauls	Distance Sampled (m)
		Latitude	Longitude				
RB01	Erieau Beach	42.25767	-81.91670	9:00	Beach	5	250
RB02	Erieau Beach	42.25530	-81.90909	10:15	Beach	5	250
RB03	Barrier Beach, South side	42.25913	-81.89271	12:00	Beach	5	250
RB04	Barrier Beach, North side	42.25963	-81.88952	13:05	Beach	3	150
RB05	Erieau Beach	42.25764	-81.91676	20:20	Beach	5	250
RB06	Erieau Beach	42.25555	-81.90958	21:45	Beach	5	250
RB07	Barrier Beach, North side	42.26040	-81.89233	8:40	Bag	10	-
RB08	Barrier Beach, North Side	42.26061	-81.89603	13:22	Bag	4	80
RB09	Barrier Beach, North Side	42.26065	-81.90057	13:50	Bag	2	-
RB10	East Shore, South of old pier	42.31789	-81.85056	15:50	Bag	3	-
RB11	Barrier Beach, North side	42.25929	-81.88880	8:05	Bag	10	-
RB12	Island off South-east shore	42.27366	-81.88470	-	Bag	3	60
RB13	East Shore midpoint	42.29034	-81.86535	-	Bag	3	60
RB14	East Shore, North of boat launch	42.32425	-81.84763	-	Bag	2	40
RB15	East Shore, 400m south of boat launch	42.31425	-81.85210	-	Bag	5	100
RB16	Lake Erie side, opposite boat launch	42.32506	-81.84063	-	Bag	10	100-200
RB17	East Shore, 1.75km south of boat launch	42.30800	-81.85527	-	Bag	2	40
RB18	East Shore, 200m south of boardwalk lookout	42.30137	-81.85827	-	Bag	7	160

Table 12. Summary of habitat characteristics at 18 sites sampled for freshwater fishes in Rondeau Bay, Lake Erie in 2018.

Site	Sample Date	Water Temperature (°C)	Conductivity (us/ms)	Max Depth	Substrate Composition (%)					
					Fines	Sand	Pebble	Gravel	Cobble	Boulder
RB01	19-Sep-18	22.6	262	1.5	0	60		30	0	0
RB02	19-Sep-18	23.3	259	1.5	0	85		15	0	0
RB03	19-Sep-18	23.4	261	1.5	0	95		5	0	0
RB04	19-Sep-18	24.1	255	0.5	0	90		10	0	0
RB05	19-Sep-18	23.5	262	1.5	0	90		10	0	0
RB06	19-Sep-18	22.8	260	1.5	0	85		15	0	0
RB07	20-Sep-18	22.2	260	1.0				Not recorded		
RB08	20-Sep-18	22.1	256	1.0	0	90		10	0	0
RB09	20-Sep-18	21.9	259	1.0	0	95		5	0	0
RB10	20-Sep-18	22.5	232	0.8	0	95		5	0	0
RB11	21-Sep-18	22.4	263	1.0	0	90		10	0	0
RB12	3-Oct-18	18.0	253	0.8	0	100		0	0	0
RB13	3-Oct-18	18.3	249	1.2	0	100		0	0	0
RB14	3-Oct-18	19.2	257	0.8	0	90		10	0	0
RB15	3-Oct-18	19.0	249	1.2	0	100		0	0	0
RB16	3-Oct-18	19.9	263	0.8	0	100		0	0	0
RB17	5-Oct-18	15.2	256	1.0	0	80		20	0	0
RB18	5-Oct-18	15.5	253	-	0	100		0	0	0

Table 13. Summary of individuals caught from diel sampling at nine sites along the southeast shore of Lake Huron in 2009.

Site Code	Sample Period	Alewife	Banded Killifish	Bluntnose Minnow	Brook Stickleback	Emerald Shiner	Fathead Minnow	Gizzard Shad	Largemouth Bass	Logperch	Longnose Dace	Mimic Shiner	Mottled Sculpin	Moxostoma Sp.	Rainbow Smelt	Rock Bass	Round Goby	Smallmouth Bass	Spotfin Shiner	Spottail Shiner	Stonecat	Walleye	White Bass	White Perch	White Sucker	Yellow Perch
LH01D	Day	1	0	1	0	686	0	0	17	0	0	1	0	0	4	0	3	4	6	53	0	0	0	0	0	5
LH01N	Night	0	0	0	0	328	0	0	1	0	0	0	1	0	0	2	46	0	0	68	0	0	0	0	0	11
LH02D	Day	13	0	0	0	889	0	0	0	0	0	64	0	0	0	0	4	0	48	414	0	0	0	0	0	26
LH02N	Night	0	0	0	0	1	0	0	0	1	0	0	0	0	1	0	124	0	3	35	0	0	0	0	0	3
LH03D	Day	1	0	0	0	350	0	0	0	1	0	0	0	0	0	0	0	0	9	149	0	1	0	0	0	701
LH03N	Night	1	0	0	0	16	0	0	0	0	0	0	0	0	0	0	28	0	1	68	1	3	0	0	0	1
LH04D	Day	4	0	0	0	810	0	2	0	0	0	17	0	0	0	0	0	0	0	962	0	0	0	0	3	0
LH04N	Night	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	6	0	0	29	0	0	0	0	0	0
LH05D	Day	0	0	0	0	1295	0	1	0	0	0	0	0	1	0	0	5	0	0	732	0	0	0	0	0	2
LH05N	Night	1	0	0	0	3	0	0	0	0	0	0	0	0	0	0	1	0	0	36	0	0	0	0	0	0
LH06D	Day	10	0	0	1	2129	0	515	0	0	0	0	0	1	0	0	71	0	5	675	0	0	0	6	0	495
LH06N	Night	3	0	0	2	2	1	40	0	0	0	0	0	0	0	0	9	0	111	8	0	1	1	5	0	2
LH07D	Day	0	0	8	0	0	0	0	0	0	0	43	0	0	0	0	0	0	73	5	0	0	0	0	0	0
LH07N	Night	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	29	1	0	0	0	0	1
LH08D	Day	4	1	0	0	6	0	0	0	0	4	1	0	0	0	0	2	0	0	2525	0	0	0	0	0	8
LH08N	Night	0	0	0	1	1	0	0	0	0	48	0	0	1	1	0	10	0	0	290	0	0	0	0	1	0
LH09D	Day	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	40	0	0	8	0	0	0	0	0	0
LH09N	Night	0	0	0	0	13	0	0	0	0	10	0	0	0	2	0	106	0	1	4	5	0	0	0	1	0

Table 14. Frequency of occurrence and relative abundance for fish species captured from Lake Huron in 2009.

	Frequency of Occurrence (%)		Relative Abundance (%)	
Species	Day	Night	Day	Night
Alewife	66.67	33.33	0.24	0.33
Banded Killifish	11.11	0.00	0.01	0.00
Bluntnose Minnow	22.22	0.00	0.06	0.00
Brook Stickleback	11.11	22.22	0.01	0.20
Emerald Shiner	88.89	88.89	44.31	24.02
Fathead Minnow	0.00	11.11	0.00	0.07
Gizzard Shad	33.33	11.11	3.72	2.60
Largemouth Bass	11.11	11.11	0.12	0.07
Logperch	11.11	11.11	0.01	0.07
Longnose Dace	11.11	22.22	0.03	3.78
Mimic Shiner	55.56	0.00	0.90	0.00
Mottled Sculpin	0.00	11.11	0.00	0.07
Moxostoma Sp.	22.22	11.11	0.01	0.07
Rainbow Smelt	11.11	33.33	0.03	0.26
Rock Bass	0.00	11.11	0.00	0.13
Round Goby	66.67	88.89	0.90	21.48
Smallmouth Bass	11.11	0.00	0.03	0.00
Spotfin Shiner	55.56	44.44	1.01	7.55
Spottail Shiner	100.00	100.00	39.66	36.91
Stonecat	0.00	33.33	0.00	0.46
Walleye	11.11	22.22	0.01	0.26
White Bass	0.00	11.11	0.00	0.07
White Perch	11.11	11.11	0.04	0.33
White Sucker	11.11	22.22	0.02	0.13
Yellow Perch	66.67	55.56	8.88	1.17

Table 15. Summary of individuals caught from diel sampling at eight sites along the north shore of Lake Ontario in 2009.

Site Code	Sample Period	Alewife	Banded Killifish	Brook Silverside	Cyprinid Sp	Emerald Shiner	Fathead Minnow	Lake Chub	Largemouth Bass	Logperch	Longnose Dace	Mimic Shiner	Notropis Sp	Rock Bass	Round Goby	Sand Shiner	Spottail Shiner	Unknown Fish	White Perch	Yellow Perch	YOY Lepomis
ON01D	Day	3	1	0	0	296	1	0	0	0	0	22	0	0	4	39	1477	0	0	0	0
ON01N	Night	1	0	0	1	22	3	0	1	0	59	3	0	0	83	5	13	3	0	1	0
ON02D	Day	3	0	1	1	36	0	0	0	0	52	7	0	0	0	2	150	0	1	0	1
ON02N	Night	2	0	0	0	1	0	1	0	0	47	8	0	0	0	9	0	0	0	0	0
ON03D	Day	1	0	0	65	290	0	0	0	0	0	3	0	0	0	0	159	0	0	280	0
ON03N	Night	0	0	0	0	3	0	0	0	0	45	43	0	0	0	54	3	0	0	1	0
ON04D	Day	2	0	0	0	135	0	0	0	0	0	59	806	0	0	4	112	0	0	0	0
ON04N	Night	2	0	7	0	1	0	0	0	0	0	0	0	0	0	52	1	0	0	0	0
ON05D	Day	2	0	1	0	407	0	0	1	0	0	58	0	0	0	56	369	0	21	327	0
ON05N	Night	1	0	5	0	499	0	0	0	0	2	0	0	1	3	59	1	0	1	0	0
ON06D	Day	1	0	1	0	10	0	0	0	0	0	26	0	0	0	6	2	0	0	0	0
ON06N	Night	4	0	0	0	2	0	0	0	0	0	0	0	0	0	287	0	0	0	3	0
ON07D	Day	0	0	34	0	0	0	0	0	1	0	5	0	0	32	0	0	0	0	195	0
ON07N	Night	0	0	9	0	0	0	0	4	7	0	0	0	0	92	139	5	0	0	12	0
ON08D	Day	0	0	7	0	3	0	0	0	0	0	7	0	0	0	2	9	0	0	0	0

Table 16. Frequency of occurrence and relative abundance for fish species captured from Lake Ontario in 2009.

	Frequency of Occurrence (%)		Relative Abundance (%)	
Species	Day	Night	Day	Night
Alewife	75.00	71.43	0.21	0.62
Banded Killifish	12.50	0.00	0.02	0.00
Brook Silverside	62.50	42.86	0.79	1.30
Cyprinid Sp.	25.00	14.29	1.18	0.06
Emerald Shiner	87.50	85.71	21.03	32.77
Fathead Minnow	12.50	14.29	0.02	0.19
Lake Chub	0.00	14.29	0.00	0.06
Largemouth Bass	12.50	28.57	0.02	0.31
Logperch	12.50	14.29	0.02	0.43
Longnose Dace	12.50	57.14	0.93	9.50
Mimic Shiner	100.00	42.86	3.34	3.35
Notropis Sp	12.50	0.00	14.40	0.00
Rock Bass	0.00	14.29	0.00	0.06
Round Goby	25.00	42.86	0.64	11.05
Sand Shiner	75.00	100.00	1.95	37.55
Spottail Shiner	87.50	71.43	40.71	1.43
Unknown Fish	0.00	14.29	0.00	0.19
White Perch	25.00	14.29	0.39	0.06
Yellow Perch	37.50	57.14	14.33	1.06
YOY Lepomis	12.50	0.00	0.02	0.00

Table 17. Summary of individuals caught from sites sampled by each bag seine and beach seine at West Lake, Prince Edward County between 2013 and 2015.

Site Code	Seine Type	Banded Killifish	Blackchin Shiner	Bluegill	Bluntnose Minnow	Brook Silverside	Brown Bullhead	Eastern Sand Darter	Iowa Darter	Johnny Darter	Largemouth Bass	Lepomis sp.	Logperch	Mimic Shiner	Pumpkinseed	Round Goby	Sand Shiner	Spotfin Shiner	Spottail Shiner	Tadpole Madtom	Yellow Perch
WL13-01a	Bag	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
WL13-01b	Beach	0	0	0	0	0	0	0	0	0	0	0	0	0	0	65	0	0	0	0	0
WL13-02a	Bag	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WL13-02b	Beach	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
WL13-03a	Bag	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WL13-03b	Beach	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WL13-04a	Bag	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
WL13-04b	Beach	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	1	0
WL13-05a	Bag	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WL13-05b	Beach	0	0	0	0	0	0	2	0	0	0	0	4	0	0	0	0	0	0	0	0
WL13-06a	Bag	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WL13-06b	Beach	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0
WL13-07a	Bag	0	0	0	0	0	0	1	0	0	0	0	3	0	0	0	0	0	0	0	0
WL13-07b	Beach	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0
WL13-08a	Bag	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WL13-08b	Beach	0	0	0	0	0	0	1	0	2	0	0	7	0	0	1	0	0	0	0	0
WL13-09a	Bag	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
WL13-09b	Beach	0	0	0	0	0	0	1	0	2	0	0	8	0	0	0	0	0	0	0	0
WL13-10a	Bag	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WL13-10b	Beach	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0
WL13-11a	Bag	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WL13-11b	Beach	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WL13-12a	Bag	0	0	0	0	0	0	7	0	1	0	0	5	0	0	33	0	0	0	0	0
WL13-12b	Beach	0	0	0	0	0	0	2	0	0	0	0	0	0	0	58	0	0	0	0	0
WL13-13a	Bag	0	0	0	0	0	0	3	0	3	0	0	19	0	0	20	0	0	0	0	0
WL13-13b	Beach	0	0	0	0	0	0	12	0	15	0	0	125	0	0	252	0	0	0	0	0
WL13-14a	Bag	0	0	0	0	0	0	1	0	11	0	0	28	0	0	14	0	0	0	0	0
WL13-14b	Beach	0	0	0	0	0	0	7	0	11	0	0	73	0	0	180	0	0	0	0	0

Table 17. continued

Site Code	Seine Type	Banded Killifish	Blackchin Shiner	Bluegill	Bluntnose Minnow	Brook Silverside	Brown Bullhead	Eastern Sand Darter	Iowa Darter	Johnny Darter	Largemouth Bass	Lepomis sp.	Logperch	Mimic Shiner	Pumpkinseed	Round Goby	Sand Shiner	Spotfin Shiner	Spottail Shiner	Tadpole Madtom	Yellow Perch
WL13-15a	Bag	0	0	0	0	0	0	0	0	2	0	0	65	0	0	24	0	0	0	0	0
WL13-15b	Beach	0	0	0	0	0	0	0	0	10	0	0	185	0	0	296	0	0	0	0	0
WL13-16a	Bag	0	0	0	0	0	0	29	0	4	0	0	6	0	0	0	0	0	0	0	0
WL13-16b	Beach	0	0	0	0	0	0	60	0	0	0	0	15	0	0	1	0	0	0	0	0
WL13-17a	Bag	0	0	0	0	0	0	8	0	3	0	0	4	0	0	2	0	0	0	0	0
WL13-17b	Beach	0	0	0	0	0	0	27	1	25	0	0	85	0	0	5	0	0	0	0	0
WL13-18a	Bag	0	0	0	0	0	0	2	0	8	0	0	29	0	0	3	0	0	0	0	0
WL13-18b	Beach	0	0	0	0	0	0	10	0	19	0	0	114	0	0	6	0	0	0	0	0
WL13-19a	Bag	0	0	0	0	0	0	1	0	2	0	0	15	0	0	1	0	0	0	0	0
WL13-19b	Beach	0	0	0	0	0	0	4	0	9	0	0	64	0	0	20	0	0	0	0	0
WL13-20a	Bag	0	0	0	0	0	0	0	0	9	0	0	48	0	0	18	0	0	0	0	0
WL13-20b	Beach	0	0	0	0	0	0	1	0	13	0	0	36	0	0	21	0	0	0	0	0
WL13-21a	Bag	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0
WL13-21b	Beach	0	0	0	0	0	0	0	0	6	0	0	0	0	0	0	0	0	0	0	0
WL13-22a	Bag	0	0	0	0	0	0	0	0	6	0	0	6	0	0	22	0	0	0	0	0
WL13-22b	Beach	0	0	0	0	0	0	1	1	16	0	0	17	0	0	58	0	0	0	0	0
WL13-23a	Bag	0	0	0	0	0	0	2	1	5	0	0	12	0	0	38	0	0	0	0	0
WL13-23b	Beach	0	0	0	0	0	0	1	0	18	0	0	19	0	0	48	0	0	0	0	0
WL13-24a	Bag	0	0	0	0	0	0	0	0	3	0	0	15	0	0	10	0	0	0	0	0
WL13-24b	Beach	0	0	0	0	0	0	17	0	1	0	0	21	0	0	14	0	0	0	0	0
WL13-25a	Bag	0	0	0	0	0	0	5	0	0	0	0	1	0	0	0	0	0	0	0	0
WL13-25b	Beach	0	0	0	0	0	0	4	0	0	0	0	14	0	0	17	0	0	0	1	0
WL13-26a	Bag	0	0	0	0	0	0	8	0	0	0	0	3	0	0	6	0	0	0	0	0
WL13-26b	Beach	0	0	0	0	0	0	40	0	1	0	0	9	0	0	14	0	0	0	0	0
WL13-27a	Bag	0	0	0	0	0	0	8	0	0	0	0	1	0	0	0	0	0	0	0	0
WL13-27b	Beach	0	0	0	0	0	0	41	0	4	0	0	20	0	0	74	0	0	0	0	0
WL13-28a	Bag	0	0	0	0	0	0	8	0	0	0	0	0	0	0	0	0	0	0	0	0
WL13-28b	Beach	0	0	0	0	0	0	65	0	8	0	0	22	0	0	130	0	0	0	0	0

Table 17. continued

Site Code	Seine Type	Banded Killifish	Blackchin Shiner	Bluegill	Bluntnose Minnow	Brook Silverside	Brown Bullhead	Eastern Sand Darter	Iowa Darter	Johnny Darter	Largemouth Bass	Lepomis sp.	Logperch	Mimic Shiner	Pumpkinseed	Round Goby	Sand Shiner	Spotfin Shiner	Spottail Shiner	Tadpole Madtom	Yellow Perch
WL13-29a	Bag	0	0	0	0	0	0	6	0	0	0	0	2	0	0	1	0	0	0	0	0
WL13-29b	Beach	0	0	0	0	0	0	21	0	2	0	0	33	0	0	42	0	0	0	0	0
WL13-30a	Bag	0	0	0	0	0	0	25	0	4	0	0	17	0	0	13	0	0	0	0	0
WL13-30b	Beach	0	0	0	0	0	0	97	1	18	0	0	46	0	0	76	0	0	0	0	0
WL13-31a	Bag	0	0	0	0	0	0	5	0	11	0	0	53	0	0	38	0	0	0	0	0
WL13-31b	Beach	0	0	0	0	0	0	34	1	19	0	0	45	0	0	121	0	0	0	0	0
WL13-32a	Bag	0	0	0	0	0	0	1	0	16	0	0	69	0	0	77	0	0	0	0	0
WL13-32b	Beach	0	0	0	0	0	0	1	0	13	0	0	169	0	0	395	0	0	0	0	0
WL13-33a	Bag	0	0	0	0	0	0	1	0	17	0	0	72	0	0	134	0	0	0	0	0
WL13-33b	Beach	0	0	0	0	0	0	0	0	16	0	0	291	0	0	387	0	0	0	0	0
WL13-34a	Bag	0	0	0	0	0	0	0	0	7	0	0	40	0	0	98	0	0	0	0	0
WL13-34b	Beach	0	0	0	0	0	0	5	0	26	0	0	159	0	0	253	0	0	0	0	0
WL13-35a	Bag	0	0	0	0	0	0	12	0	1	0	0	15	0	0	7	0	0	0	0	0
WL13-35b	Beach	0	0	0	0	0	0	71	0	23	0	0	54	0	0	83	0	0	0	0	0
WL13-36a	Bag	0	0	0	0	0	0	48	0	9	0	0	13	0	0	60	0	0	0	0	0
WL13-36b	Beach	0	0	0	0	0	0	113	1	29	0	0	166	0	0	412	0	0	0	0	0
WL13-37a	Bag	0	0	0	0	0	0	7	0	0	0	0	3	0	0	10	0	0	0	0	0
WL13-37b	Beach	0	0	0	0	0	0	39	0	0	0	0	57	0	0	20	0	0	0	0	0
WL14-01a	Bag	0	0	0	0	0	0	0	0	13	0	0	9	0	0	4	0	0	0	0	0
WL14-01b	Beach	0	0	0	0	0	0	0	1	52	0	0	66	0	0	57	0	0	0	0	0
WL14-02a	Bag	0	0	0	0	0	0	0	0	1	0	0	2	0	0	9	0	0	0	0	0
WL14-02b	Beach	0	0	0	0	0	0	0	2	24	0	0	12	0	0	74	0	0	0	0	0
WL14-03a	Bag	0	0	0	0	0	0	0	0	2	0	0	1	0	0	0	0	0	0	0	0
WL14-03b	Beach	0	0	0	0	0	0	0	0	12	0	0	12	0	0	2	0	0	0	0	0
WL14-04a	Bag	0	0	0	0	0	0	0	0	5	0	0	19	0	0	1	0	0	0	0	0
WL14-04b	Beach	0	0	0	0	0	0	0	0	46	0	0	90	0	0	1	0	0	0	0	0
WL14-05a	Bag	0	0	0	0	0	0	0	0	2	0	0	46	0	0	2	0	0	0	0	0
WL14-05b	Beach	0	0	0	0	0	0	0	1	3	0	0	24	0	0	3	0	0	0	0	0

Table 17. continued

Site Code	Seine Type	Banded Killifish	Blackchin Shiner	Bluegill	Bluntnose Minnow	Brook Silverside	Brown Bullhead	Eastern Sand Darter	Iowa Darter	Johnny Darter	Largemouth Bass	Lepomis sp.	Logperch	Mimic Shiner	Pumpkinseed	Round Goby	Sand Shiner	Spotfin Shiner	Spottail Shiner	Tadpole Madtom	Yellow Perch
WL14-06a	Bag	0	0	0	0	0	0	0	0	0	0	0	14	0	0	1	0	0	0	0	0
WL14-06b	Beach	0	0	0	0	0	0	0	0	2	0	0	64	0	0	17	0	0	0	0	0
WL14-07a	Bag	0	0	0	0	0	0	0	0	0	0	0	2	0	0	33	0	0	0	0	0
WL14-07b	Beach	0	0	0	0	0	0	0	0	24	0	0	6	0	0	28	0	0	0	0	0
WL14-08a	Bag	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0	0	0	0
WL14-08b	Beach	0	0	0	0	0	0	0	0	32	0	0	7	0	0	14	0	0	0	0	0
WL14-09a	Bag	0	0	0	0	0	0	0	0	1	0	0	33	0	0	4	0	0	0	0	0
WL14-09b	Beach	0	0	0	0	0	0	0	2	2	0	0	20	0	0	16	0	0	0	0	0
WL14-10a	Bag	0	0	0	0	0	0	0	1	0	0	0	3	0	0	0	0	0	0	0	0
WL14-10b	Beach	0	0	0	0	0	0	2	2	1	0	0	20	0	0	24	0	0	0	0	0
WL14-11a	Bag	0	0	0	0	0	0	1	0	0	0	0	10	0	0	0	0	0	0	0	0
WL14-11b	Beach	0	0	0	0	0	0	27	1	2	0	0	31	0	0	9	0	0	0	0	0
WL14-12a	Bag	0	0	0	0	0	0	0	1	0	0	0	7	0	0	5	0	0	0	0	0
WL14-12b	Beach	0	0	0	0	0	1	8	0	7	0	0	24	0	0	52	0	0	0	0	0
WL14-13a	Bag	0	0	0	0	0	0	1	0	0	0	0	13	0	0	8	0	0	0	0	0
WL14-13b	Beach	0	0	0	0	0	0	26	0	1	0	0	81	0	0	96	0	0	0	0	0
WL14-14a	Bag	0	0	0	0	0	0	0	0	0	0	0	21	0	0	57	0	0	0	0	0
WL14-14b	Beach	0	0	0	0	0	0	0	0	8	0	0	46	0	0	118	0	0	0	0	0
WL14-15a	Bag	0	0	0	0	0	0	0	0	0	0	0	33	0	0	6	0	0	0	0	0
WL14-15b	Beach	0	0	0	0	0	0	0	0	1	0	0	70	0	0	214	0	0	0	0	0
WL14-16a	Bag	0	0	0	0	0	0	0	0	0	0	0	3	0	0	5	0	0	0	0	0
WL14-16b	Beach	0	0	0	0	0	0	0	0	0	0	0	27	0	0	108	0	0	0	0	0
WL14-17a	Bag	0	0	0	0	0	0	4	0	1	0	0	0	0	0	0	0	0	0	0	0
WL14-17b	Beach	0	0	0	0	0	0	62	0	0	0	0	2	0	0	1	0	0	0	0	0
WL14-18a	Bag	0	0	0	0	0	0	2	0	1	0	0	3	0	0	4	0	0	0	0	0
WL14-18b	Beach	0	0	0	0	0	0	31	0	3	0	0	4	0	0	2	0	0	0	0	0
WL14-19a	Bag	0	0	0	0	0	0	4	0	0	0	0	2	0	0	0	0	0	0	0	0
WL14-19b	Beach	0	0	0	0	0	0	15	0	0	0	0	1	0	0	0	0	0	0	0	0

Table 17. continued

Site Code	Seine Type	Banded Killifish	Blackchin Shiner	Bluegill	Bluntnose Minnow	Brook Silverside	Brown Bullhead	Eastern Sand Darter	Iowa Darter	Johnny Darter	Largemouth Bass	Lepomis sp.	Logperch	Mimic Shiner	Pumpkinseed	Round Goby	Sand Shiner	Spotfin Shiner	Spottail Shiner	Tadpole Madtom	Yellow Perch
WL14-20a	Bag	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0
WL14-20b	Beach	0	0	0	0	0	0	20	0	0	0	0	0	0	0	0	0	0	0	0	0
WL14-21a	Bag	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0
WL14-21b	Beach	0	0	0	0	0	0	26	0	0	0	0	4	0	0	1	0	0	0	0	0
WL14-22a	Bag	0	0	0	0	0	0	8	0	0	0	0	2	0	0	0	0	0	0	0	0
WL14-22b	Beach	0	0	0	0	0	0	20	0	7	0	0	5	0	0	1	0	0	0	0	0
WL14-23a	Bag	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
WL14-23b	Beach	0	0	0	0	0	0	9	0	0	0	0	5	0	0	1	0	0	0	0	0
WL14-24a	Bag	0	0	0	0	0	0	0	0	8	0	0	10	0	0	8	0	0	0	0	0
WL14-24b	Beach	0	0	0	0	0	0	3	0	12	0	0	19	0	0	20	0	0	0	0	0
WL14-25a	Bag	0	0	0	0	0	0	0	0	0	0	0	3	0	0	15	0	0	0	0	0
WL14-25b	Beach	0	0	0	0	0	0	0	0	0	0	0	2	0	0	87	0	0	0	0	0
WL14-26a	Bag	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WL14-26b	Beach	0	0	0	0	0	0	12	0	1	0	0	5	0	0	3	0	0	0	0	0
WL14-27a	Bag	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
WL14-27b	Beach	0	0	0	0	0	0	0	0	6	0	0	44	0	0	88	0	0	0	0	0
WL14-28a	Bag	0	0	0	0	0	0	0	0	7	0	0	0	0	0	5	0	0	0	0	0
WL14-28b	Beach	0	0	0	0	0	0	0	1	28	0	0	7	0	0	215	0	0	0	0	0
WL14-29a	Bag	0	0	0	0	0	0	0	0	8	0	0	0	0	0	11	0	0	0	0	0
WL14-29b	Beach	0	0	0	0	0	0	0	0	34	0	0	4	0	0	117	0	0	0	0	0
WL14-30a	Bag	0	0	0	0	0	0	3	0	0	0	0	3	0	0	0	0	0	0	0	0
WL14-30b	Beach	0	0	0	0	0	0	22	0	0	0	0	5	0	0	0	0	0	0	0	0
WL14-31a	Bag	0	0	0	0	0	0	1	0	7	0	0	7	0	0	1	0	0	0	0	0
WL14-31b	Beach	0	0	0	0	0	0	4	3	16	0	0	125	0	0	16	0	0	0	0	0
WL14-32a	Bag	0	0	0	0	0	0	0	0	3	0	0	2	0	0	3	0	0	0	0	0
WL14-32b	Beach	0	0	0	0	0	0	2	0	10	0	0	51	0	0	183	0	0	0	0	0
WL14-33b	Beach	0	0	0	0	0	0	10	0	0	0	0	7	0	0	49	0	0	0	0	0
WL14-34b	Beach	0	0	0	0	0	0	11	0	0	0	0	1	0	0	18	0	0	0	0	0

Table 17. continued

Site Code	Seine Type	Banded Killifish	Blackchin Shiner	Bluegill	Bluntnose Minnow	Brook Silverside	Brown Bullhead	Eastern Sand Darter	Iowa Darter	Johnny Darter	Largemouth Bass	Lepomis sp.	Logperch	Mimic Shiner	Pumpkinseed	Round Goby	Sand Shiner	Spotfin Shiner	Spottail Shiner	Tadpole Madtom	Yellow Perch
WL14-35b	Beach	0	0	0	0	0	0	3	0	0	0	0	5	0	0	32	0	0	0	0	0
WL14-36b	Beach	0	0	0	0	0	0	11	0	0	0	0	1	0	0	23	0	0	0	0	0
WL14-37b	Beach	0	0	0	0	0	0	8	0	0	0	0	1	0	0	19	0	0	0	0	0
WL14-38b	Beach	0	0	0	0	0	0	5	0	0	0	0	0	0	0	7	0	0	0	0	0
WL14-39b	Beach	0	0	0	0	0	0	3	0	0	0	0	1	0	0	5	0	0	0	0	0
WL14-40b	Beach	0	0	0	0	0	0	4	0	0	0	0	0	0	0	3	0	0	0	0	0
WL15-01	Bag	0	0	0	0	35	0	0	0	1	0	0	3	11	0	0	1	0	3	0	4
WL15-02	Bag	0	0	0	1	67	0	0	0	4	0	0	1	13	0	1	0	0	0	0	1
WL15-03	Bag	0	0	0	0	32	0	0	0	0	0	0	1	2	0	2	0	0	0	0	0
WL15-04	Bag	4	0	0	28	21	0	0	0	0	0	3	3	0	0	25	0	0	0	0	37
WL15-05	Bag	0	0	0	0	39	0	1	0	0	0	0	6	1	0	3	2	2	0	0	2
WL15-06	Bag	2	0	0	3	32	0	0	0	0	0	0	11	13	0	0	24	4	0	0	2
WL15-07	Bag	16	0	0	0	27	0	3	0	0	0	0	2	20	0	0	73	4	0	0	2
WL15-08	Bag	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	51	4	0	0	0
WL15-09	Bag	0	0	0	32	13	0	0	0	3	0	0	11	13	0	12	8	0	0	0	1
WL15-10	Bag	0	0	0	19	169	0	1	0	1	1	0	13	5	0	0	12	3	0	0	11
WL15-11	Bag	0	0	0	12	21	0	15	0	7	0	0	4	0	0	2	33	2	0	0	4
WL15-12	Bag	31	0	0	4	1	0	3	0	1	0	0	51	1	0	0	9	10	0	0	82
WL15-13	Bag	0	1	6	35	0	0	0	0	0	0	30	1	0	0	2	31	0	0	0	9
WL15-14	Bag	12	0	0	0	8	0	0	0	0	0	0	14	0	0	0	18	0	0	0	5
WL15-15	Bag	1	0	0	5	2	0	0	0	0	0	0	6	0	0	0	91	0	0	0	1
WL15-16	Bag	1	0	0	0	42	0	0	0	1	1	0	16	0	0	0	12	0	0	0	1
WL15-17	Bag	0	0	0	29	0	0	0	0	3	0	6	4	1	0	9	12	1	0	0	0
WL15-18	Bag	0	1	0	31	0	0	2	1	8	0	2	5	0	0	3	0	0	0	0	1
WL15-19	Bag	0	0	0	15	0	0	0	0	9	0	40	10	0	0	5	0	1	0	0	0
WL15-20	Bag	0	0	0	16	3	0	0	0	0	0	2	9	0	0	15	0	0	0	0	2
WL15-21	Bag	0	0	0	54	0	0	0	0	0	0	1	3	0	0	0	4	0	0	0	1
WL15-22	Bag	1	0	0	12	10	0	0	1	0	0	0	31	0	0	30	6	0	0	1	21

Table 17. continued

Site Code	Seine Type	Banded Killifish	Blackchin Shiner	Bluegill	Bluntnose Minnow	Brook Silverside	Brown Bullhead	Eastern Sand Darter	Iowa Darter	Johnny Darter	Largemouth Bass	Lepomis sp.	Logperch	Mimic Shiner	Pumpkinseed	Round Goby	Sand Shiner	Spotfin Shiner	Spottail Shiner	Tadpole Madtom	Yellow Perch
WL15-23	Bag	0	0	0	0	1	0	0	0	1	0	0	16	0	0	2	3	0	0	0	2
WL15-24	Bag	0	0	0	5	3	0	15	0	2	0	0	2	0	0	0	2	0	0	0	8
WL15-25	Bag	0	0	0	8	1	0	0	0	1	0	1	10	0	0	2	0	0	0	0	0
WL15-26	Bag	0	0	0	3	1	0	0	0	1	0	8	3	0	0	5	0	1	0	0	0
WL15-27	Bag	1	3	5	21	1	0	0	0	1	0	20	12	0	1	11	0	0	0	0	20
WL15-28	Bag	0	0	3	0	8	0	5	0	2	0	3	2	0	0	1	0	0	0	0	0
WL15-29	Bag	0	0	0	20	7	0	0	0	0	1	8	10	0	1	8	0	0	0	0	1
WL15-30	Bag	0	0	7	9	0	0	0	0	0	0	3	9	0	0	4	0	0	0	0	2
WL15-31	Bag	0	1	2	10	5	0	0	0	2	1	4	13	0	0	8	0	0	0	0	3

Table 18. Frequency of occurrence and relative abundance for fish species captured from West Lake between 2013 and 2015.

	Frequency of Occurrence (%)		Relative Abundance (%)	
Species	Bag	Beach	Bag	Beach
Banded Killifish	10.00	N/A	1.58	N/A
Blackchin Shiner	4.00	N/A	0.14	N/A
Bluegill	5.00	N/A	0.52	N/A
Bluntnose Minnow	22.00	N/A	8.39	N/A
Brook Silverside	24.00	N/A	12.38	N/A
Brown Bullhead	0.00	1.30	0.00	0.01
Eastern Sand Darter	40.00	66.23	5.91	11.08
Iowa Darter	5.00	16.88	0.11	0.20
Johnny Darter	51.00	62.34	5.23	6.94
Largemouth Bass	4.00	N/A	0.09	N/A
Lepomis sp.	14.00	N/A	2.96	N/A
Logperch	82.00	88.31	24.32	30.00
Mimic Shiner	10.00	N/A	1.80	N/A
Pumpkinseed	2.00	N/A	0.05	N/A
Round Goby	61.00	84.42	21.81	51.76
Sand Shiner	18.00	N/A	8.84	N/A
Spotfin Shiner	10.00	N/A	0.72	N/A
Spottail Shiner	1.00	N/A	0.07	N/A
Tadpole Madtom	1.00	2.60	0.02	0.02
Yellow Perch	25.00	0.00	5.05	0.00

*N/A: these species captured in 2015, when sampling was done with a bag seine only

Table 19. Summary of individuals caught from 12 sites sampled by each bag seine and beach seine at North Beach, Prince Edward County in 2013. Only small benthic species were recorded.

Site Code	Seine Type	Johnny Darter	Logperch	Round Goby	Unknown Minnow
NB01a	Bag	0	0	0	0
NB01b	Beach	84	0	0	0
NB02a	Bag	73	0	0	0
NB02b	Beach	860	0	3	0
NB03a	Bag	17	0	0	0
NB03b	Beach	894	1	14	0
NB04a	Bag	4	0	0	0
NB04b	Beach	140	4	0	0
NB05a	Bag	4	0	0	0
NB05b	Beach	19	0	0	0
NB06a	Bag	12	0	0	0
NB06b	Beach	175	0	0	0
NB07a	Bag	0	0	0	0
NB07b	Beach	0	0	0	1
NB08a	Bag	1	0	0	0
NB08b	Beach	0	1	0	0
NB09a	Bag	106	0	0	0
NB09b	Beach	352	8	1	0
NB10a	Bag	0	0	0	0
NB10b	Beach	0	0	0	0
NB11a	Bag	0	0	0	0
NB11b	Beach	0	0	0	0
NB12a	Bag	0	0	0	0
NB12b	Beach	0	0	0	0

Table 20. Summary of individuals caught from 13 sites sampled at Wellers Bay, Prince Edward County in 2013. Only small benthic species were recorded.

Site Code	Seine Type	Johnny Darter	Logperch	Round Goby
WB01	Beach	1	1	68
WB02	Beach	9	0	201
WB03	Beach	5	9	16
WB04	Beach	3	9	64
WB05	Beach	8	47	106
WB06	Beach	0	2	173
WB07	Beach	1	3	142
WB08	Beach	5	6	56
WB09	Beach	10	3	131
WB10	Beach	54	153	71
WB11	Beach	10	3	203
WB12	Beach	13	16	337
WB13	Beach	2	6	50

Table 21. Summary of species detections (1 = present, 0 = absent) from 18 sites sampled at Rondeau Bay, Lake Erie in 2018.

Site	Seine Type	Banded Killifish	Blackchin Shiner	Bluegill	Bluntnose Minnow	Brook Silverside	Channel Darter	Common Shiner	Eastern Sand Darter	Emerald Shiner	Gizzard Shad	Golden Shiner	Iowa Darter	Johnny Darter	Largemouth Bass	Logperch	Mimic Shiner	Northern Pike	Pumpkinseed	Pumpkinseed X Bluegill	Quillback	Rock Bass	Rosyface Shiner	Round Goby	Sand Shiner	Spottail Shiner	Tadpole Madtom	Walleye	White Bass	White Perch	Yellow Perch
RB1	Beach	0	0	0	0	1	0	0	0	1	1	0	0	0	1	1	1	0	0	0	0	0	0	1	0	1	0	0	1	1	1
RB2	Beach	0	0	1	0	1	0	0	0	1	0	0	0	0	0	1	1	0	0	0	0	0	0	1	1	1	0	0	1	1	1
RB3	Beach	1	0	0	1	1	0	0	0	1	0	0	0	0	0	1	1	0	0	0	1	0	0	1	1	1	0	0	1	1	1
RB4	Beach	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	1	0	0	0	0	1	0	0
RB5	Beach	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	1	0	1	0	1	1	1	0
RB6	Beach	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	1	0	1	0	1	1	1	0
RB7	Bag	1	0	0	1	1	0	0	1	1	0	0	1	1	1	1	1	0	1	0	0	0	1	1	1	1	0	0	0	0	1
RB8	Bag	0	0	0	1	1	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	1	0	1	0	0	0	0	1
RB9	Bag	1	0	0	0	1	0	0	0	1	0	0	0	0	1	1	1	0	0	0	0	0	0	1	1	1	0	0	0	0	1
RB10	Bag	1	1	1	1	1	0	0	1	0	0	0	0	1	1	1	1	0	0	0	0	0	0	1	0	0	0	0	0	0	1
RB11	Bag	1	1	1	1	1	1	0	1	0	0	0	1	1	1	1	1	1	0	0	0	1	0	1	0	0	1	0	0	0	1
RB12	Bag	1	1	0	1	1	0	1	0	0	0	1	0	1	1	0	1	0	0	0	0	0	0	1	0	1	0	0	0	0	1
RB13	Bag	1	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1
RB14	Bag	1	0	0	1	1	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	1
RB15	Bag	1	0	1	1	0	0	0	0	0	0	0	0	1	0	0	1	0	1	0	0	1	0	1	0	0	0	0	0	0	1
RB16	Bag	0	0	0	0	1	0	0	0	1	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0
RB17	Bag	1	0	1	1	0	0	0	0	0	0	1	1	1	1	1	0	0	1	0	0	1	0	1	0	0	0	0	0	0	1
RB18	Bag	1	0	1	1	0	0	0	0	0	0	0	0	1	1	0	1	0	1	1	0	0	0	1	0	0	0	0	0	0	1

Table 22. Frequency of occurrence for fish species captured from Rondeau Bay in 2018.

	Frequency of Occurrence (% of Hauls)		
Species	Beach Day	Beach Night	Bag Day
Banded Killifish	6	0	46
Blackchin Shiner	0	0	8
Bluegill	6	0	26
Bluntnose Minnow	11	0	46
Brook Silverside	67	30	26
Channel Darter	0	0	5
Common Shiner	0	0	3
Eastern Sand Darter	0	0	5
Emerald Shiner	61	0	23
Gizzard Shad	11	60	5
Golden Shiner	0	0	5
Iowa Darter	0	0	8
Johnny Darter	0	0	28
Largemouth Bass	6	0	30
Logperch	33	10	28
Mimic Shiner	72	0	25
Northern Pike	0	0	2
Pumpkinseed	0	10	16
Pumpkinseed X Bluegill	0	0	2
Quillback	6	0	0
Rock Bass	0	0	5
Rosyface Shiner	0	0	2
Round Goby	44	70	44
Sand Shiner	17	0	3
Spottail Shiner	67	50	8
Tadpole Madtom	0	0	3
Walleye	0	90	0
White Bass	67	70	11
White Perch	44	90	0
Yellow Perch	39	0	57

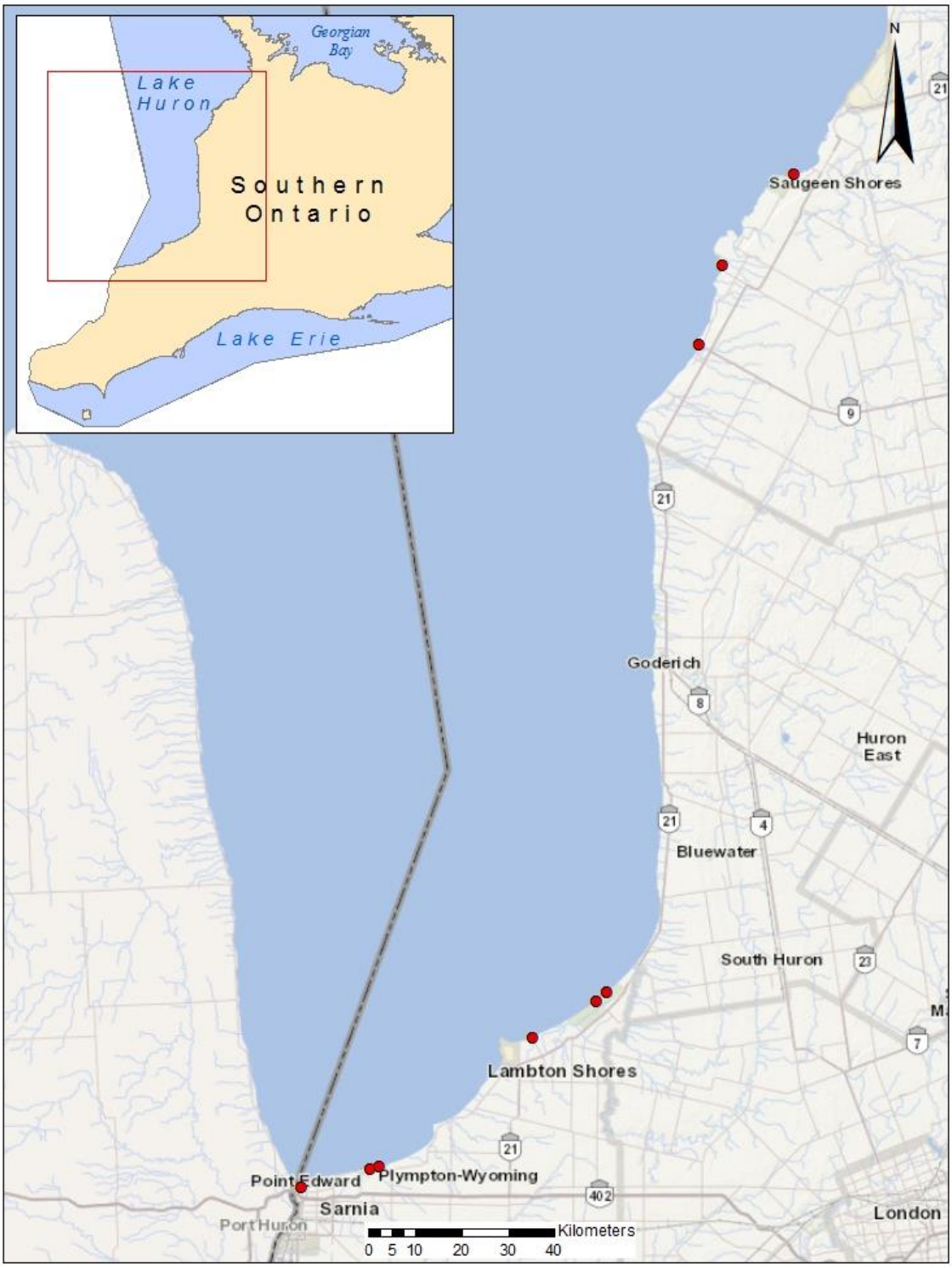

Figure 1. Locations of nine seine-based diel fish sampling sites along the southeast shore of Lake Huron.

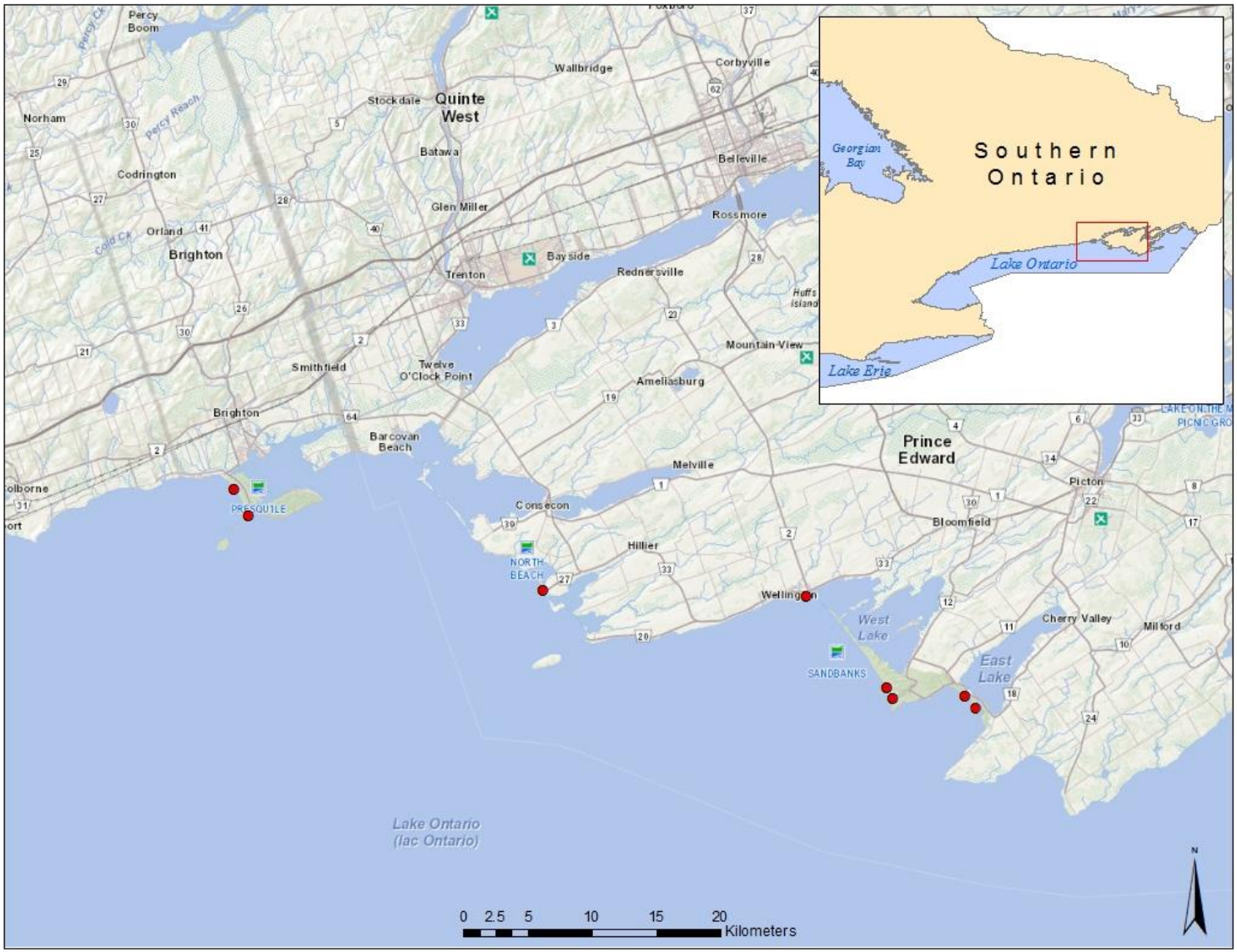

Figure 2. Locations of eight seine-based diel fish sampling sites along the north shore of Lake Ontario.

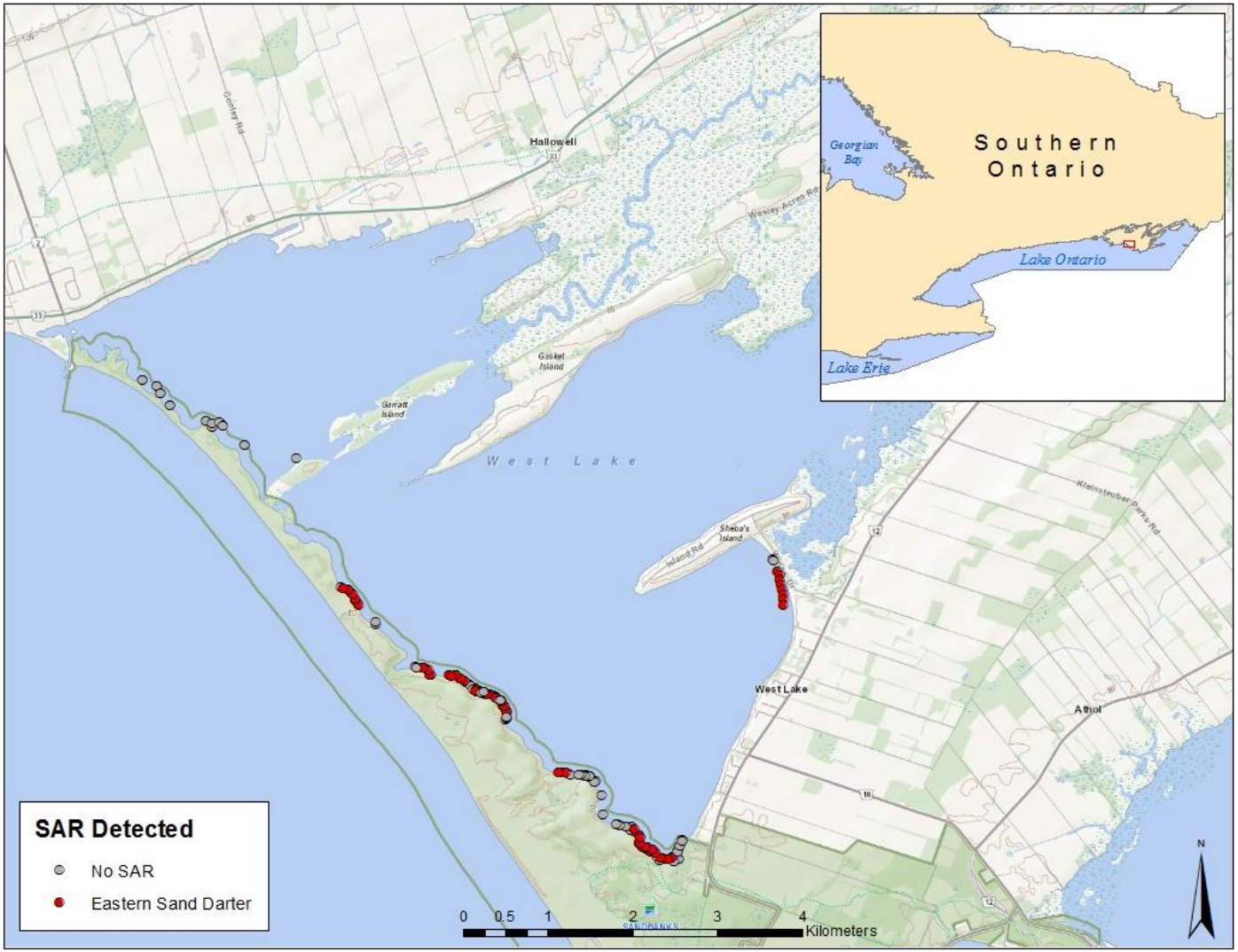

Figure 3. Locations of seine-based fish sampling sites at West Lake, Prince Edward County between 2013 and 2015. Red points indicate sites where Eastern Sand Darter were captured.

Figure 4. Locations of 12 seine-based fish sampling sites at North Beach, Prince Edward County.

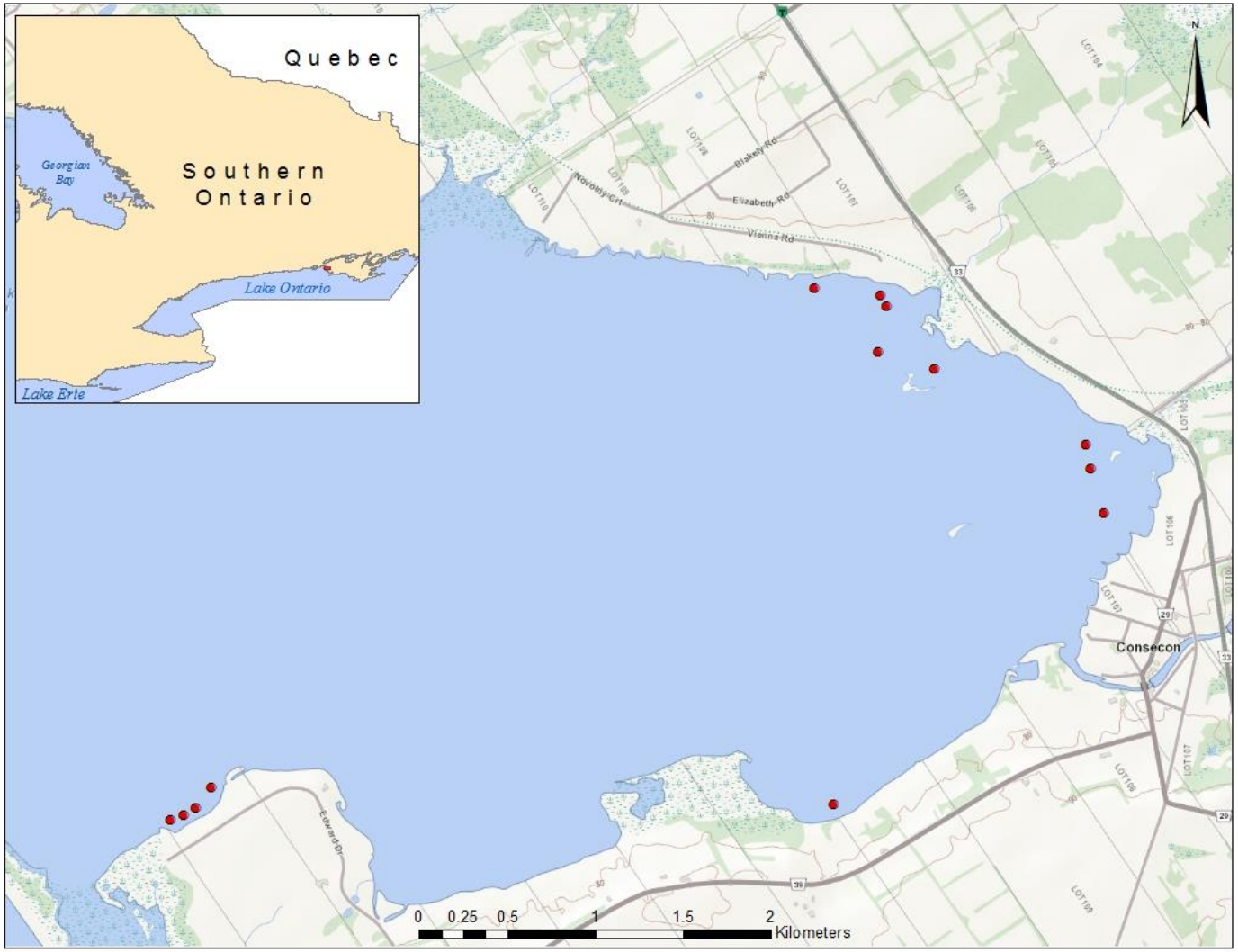

Figure 5. Locations of 13 seine-based fish sampling sites at Wellers Bay, Prince Edward County.

Figure 6. Locations of seine-based fish sampling sites at Rondeau Bay, Lake Erie. Red points indicate sites where Eastern Sand Darter were captured; points with an X represent sites where Channel Darter were captured.

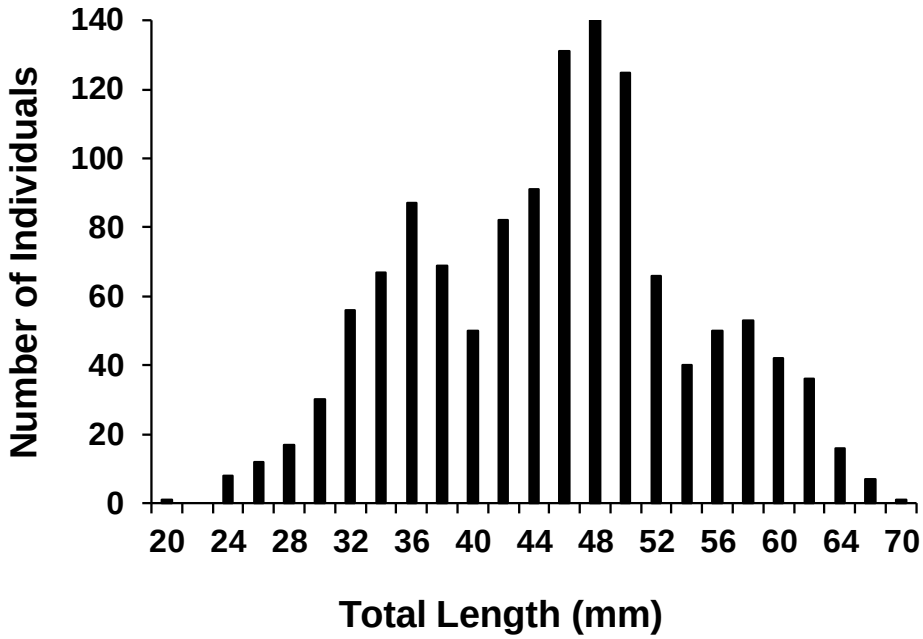

Figure 7. Length frequency distribution of Eastern Sand Darter (n = 1277) seined from West Lake (2013-2015).

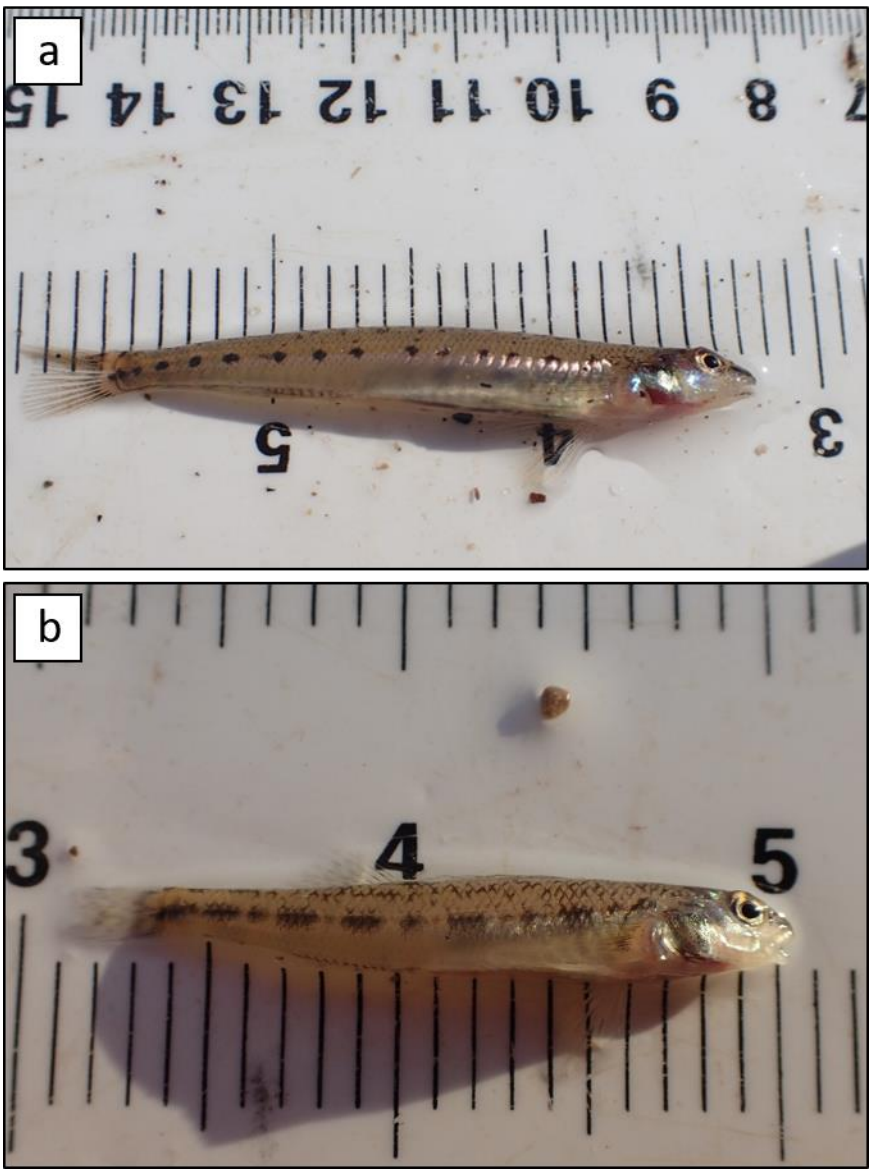

Figure 8. Photos of Eastern Sand Darter (a) and Channel Darter (b) collected from Rondeau Bay, Lake Erie.

APPENDIX

Table A1. Common and scientific fish names.

Common Name	Scientific Name
Alewife	*Alosa pseudoharengus*
Banded Killifish	*Fundulus diaphanus*
Blackchin Shiner	*Notropis heterodon*
Bluegill	*Lepomis macrochirus*
Bluntnose Minnow	*Pimephales notatus*
Brook Silverside	*Labidesthes sicculus*
Brook Stickleback	*Culaea inconstans*
Brown Bullhead	*Ameiurus nebulosus*
Channel Darter	*Percina copelandi*
Common Shiner	*Luxilus cornutus*
Cyprinid Sp	*Cyprinid sp.*
Eastern Sand Darter	*Ammocrypta pellucida*
Emerald Shiner	*Notropis atherinoides*
Fathead Minnow	*Pimephales promelas*
Gizzard Shad	*Dorosoma cepedianum*
Golden Shiner	*Notemigonus crysoleucas*
Iowa Darter	*Etheostoma exile*
Johnny Darter	*Etheostoma nigrum*
Lake Chub	*Couesius plumbeus*
Largemouth Bass	*Micropterus salmoides*
Lepomis sp.	*Lepomis sp.*
Logperch	*Percina caprodes*
Longnose Dace	*Rhinichthys cataractae*
Mimic Shiner	*Notropis volucellus*
Mottled Sculpin	*Cottus bairdii*
Moxostoma Sp.	*Moxostoma sp.*
Northern Pike	*Esox lucius*
Notropis Sp	*Notropis sp.*
Pumpkinseed	*Lepomis gibbosus*
Quillback	*Carpiodes cyprinus*
Rainbow Smelt	*Osmerus mordax*
Rock Bass	*Ambloplites rupestris*
Rosyface Shiner	*Notropis rubellus*
Round Goby	*Neogobius melanostomus*
Sand Shiner	*Notropis stramineus*
Smallmouth Bass	*Micropterus dolomieu*
Spotfin Shiner	*Cyprinella spiloptera*
Spottail Shiner	*Notropis hudsonius*
Stonecat	*Noturus flavus*
Tadpole Madtom	*Noturus gyrinus*
Walleye	*Sander vitreus*
White Bass	*Morone chrysops*
White Perch	*Morone americana*
White Sucker	*Catostomus commersonii*
Yellow Perch	*Perca flavescens*