# Results of Fisheries and Oceans Canada's 2020 Asian Carp Early Detection Field Surveillance Program

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# RESULTS OF FISHERIES AND OCEANS CANADA'S 2020 ASIAN CARP EARLY DETECTION FIELD SURVEILLANCE PROGRAM

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In 2020, Fisheries and Oceans Canada's Asian Carp Program continued early detection surveillance for Asian carps in Canadian waters of the Laurentian Great Lakes. A total of 980 field sites were sampled at 30 locations using six gear types. A total of 61 247 fishes were caught representing 84 species. Buffalo (*Ictiobus* spp.) and Common Carp (*Cyprinus carpio*) were used as surrogate species to assess the effectiveness of gear types. A total of 434 buffalo and 995 Common Carp were caught. Trammel nets and boat electrofishing were the most effective at capturing these surrogate species. An additional 69 field sites were sampled at six locations for larval fishes and eggs using bongo nets. A total of 239 larval fishes were caught. One Grass Carp (*Ctenopharyngodon idella*) was caught during the 2020 early detection surveillance efforts; a diploid female captured in Jordan Harbour (Lake Ontario drainage). Surveillance for Asian carps will continue in 2021, with an emphasis on the lower Great Lakes where the threat of arrival remains highest.



## RÉSUMÉ

Aguiar, F., Colm, J.E., and Marson, D.M.. 2021. Results of Fisheries and Oceans Canada's 2020 Asian Carp Early Detection Field Surveillance Program. Can. Manuscr. Rep. Fish. Aquat. Sci. 3168-3: vii + 57 p.

En 2020, le Programme de lutte contre les carpes asiatiques de Pêches et Océans Canada a poursuivi ses activités de détection précoce des carpes asiatiques dans les eaux canadiennes des Grands Lacs laurentiens. Au total, 980 sites sur le terrain ont été échantillonnés à 30 emplacements à l'aide de 6 types d'engins. Au total, 61 247 poissons ont été capturés, représentant 84 espèces. Le buffalo (*Ictiobus* spp.) et la carpe commune (*Cyprinus carpio*) ont été utilisés comme espèces de remplacement pour évaluer l'efficacité des types d'engins. Au total, 434 buffalos et 995 carpes communes ont été capturés. Les trémails et la pêche à l'électricité en bateau ont été les plus efficaces pour capturer ces espèces de remplacement. En outre, 69 autres sites sur le terrain ont été échantillonnés à 6 emplacements pour les larves et les œufs de poissons à l'aide de filets Bongo. Au total, 239 larves de poissons ont été capturées. Une carpe de roseau (*Ctenopharyngodon idella*) a été capturée pendant les travaux de surveillance et de détection précoce de 2020; une femelle diploïde capturée dans le port de Jordan (bassin versant du lac Ontario). La surveillance des carpes asiatiques se poursuivra en 2021, l'accent étant mis sur les Grands Lacs inférieurs, où la menace d'introduction demeure la plus élevée.

## PREFACE

Fisheries and Oceans Canada's Asian Carp Program has conducted early detection surveillance for Asian carps throughout the Great Lakes basin since 2013. The program has improved sampling protocols and identified early detection locations considered suitable for Asian carps (for reproduction or feeding) that can be sampled effectively with a suite of gear types. The Asian Carp Program surveillance data has been summarized into annual reports, such as this since 2013. By 2017, the fifth year of sampling, standard protocols have been established, and the sampling methods and locations are not expected to change greatly from year to year. The Asian Carp Program will continue early detection surveillance in and around the Great Lakes basin for the foreseeable future. As such, data summaries will be produced each year as a sub-series contributing to the more detailed 2017 report (Colm et al. 2019). Any changes to methodology or sampling locations will be noted in the data summary reports, but readers will be referred back to the 2017 report for detailed descriptions of methods. An in-depth report is planned for every five years highlighting major changes and providing updates on the program, as well as present cumulative summaries from the previous five years of sampling as an appendix.

For full description of methods, please refer to:

Colm, J., Marson, D. and Cudmore, B. 2019. Results of Fisheries and Oceans Canada's 2017 Asian Carp Early Detection Field Surveillance Program. Can. Manuscr. Rep. Fish. Aquat. Sci. 3168: vi + 69 p

## INTRODUCTION

The focus of Fisheries and Oceans Canada's (DFO) Asian Carp Program is to prevent the entry and establishment of Asian carps in Canadian waters of the Great Lakes through outreach, early detection, response and management. The Asian Carp Program has conducted early detection surveillance in Canadian waters since 2013. Early detection and removal is essential to prevent the establishment of aquatic invasive species, as more response options are available and it is less costly than managing or controlling an established invasive species (Lodge et al. 2006; Vander Zanden et al. 2010).

For early detection surveillance, the Asian Carp Program uses a variety of gear types targeting all sizes and life stages of four species of Asian carps: Bighead Carp (*Hypophthalmichthys nobilis*), Black Carp (*Mylopharyngodon piceus*), Grass Carp (*Ctenopharyngodon idella*) and Silver Carp (*Hypophthalmichthys molitrix*). As Grass Carp reproduction has been detected in at least two Lake Erie tributaries in the Great Lakes (Embke et al. 2016; USGS 2019; Whitledge et al. 2021), more emphasis has been placed on targeting Grass Carp in recent years. Asian carps are not established in Canadian waters so in place of capture data on these target species, surrogate species are used to assess the effectiveness of gear types and sampling techniques, specifically buffalo species (*Ictiobus* spp., referred to hereafter as buffalo) and Common Carp (*Cyprinus carpio*). Both surrogate species are large-bodied and mobile, and relatively widespread in the basin. Although early detection of Asian carps is the primary objective of surveillance, the full fish community is sampled, providing a baseline of the fish community in areas that could be impacted by Asian carps.

Surveillance sampling in 2020 took place from June 29$^{th}$ to November 9$^{th}$ in 30 locations (wetlands, tributary rivers and interconnected channels) of the Great Lakes. A summary of the results from the 2020 early detection surveillance sampling effort is presented here.

## METHODS

Thirty-seven early detection locations were identified for surveillance in Canadian waters of the Great Lakes (Figure 1). These are large tributary rivers suitable to Asian carp spawning and large, productive wetlands with abundant submerged aquatic vegetation that would be attractive to Grass Carp for feeding (Cudmore et al. 2012, 2017). In these locations, sites were selected semi-randomly based on where gears could be deployed and fished effectively. A collection of sites in each waterbody have been selected to be standardized sites, and are sampled annually. If crews determine an area within the waterbody as a suitable sample site, targeted sampling is also completed. Thirty of the 37 early detection locations were sampled in 2020. Maps of 2020 sampling sites at each location are found in Appendix 2.

Sites were sampled using six gear types: boat electrofishing, hoop nets, mini fyke nets, seine nets, trammel nets, and trap nets (details and dimensions provided in Appendix 1). These gear types capture both large- and small-bodied fishes in a variety of habitats. Sampling the full extent of the fish community increases the likelihood of detecting all four species of Asian carps at both juvenile and adult life-stages. All fish captured are identified, counted (up to a maximum of 250 individuals per species) and total lengths of ten representative individuals are measured. A

habitat assessment is also completed at each site; the results of which are not presented here. Surveillance in some Lake Ontario locations (Duffins Creek, Frenchman's Bay, Toronto Islands, Humber and Rouge rivers) was completed by the Toronto and Region Conservation Authority (TRCA) following DFO Asian Carp Program protocols. Sampling for larval fishes and eggs was also conducted using bongo nets in select high-risk tributaries in lakes Erie and Huron (maps in Appendix 3).

## RESULTS

In 2020, the Asian Carp early detection field surveillance program sampled 980 sites in 30 waterbodies (i.e. wetlands, tributary rivers and interconnected channels) within Canadian waters of the Great Lakes basin. In total, 137 field sites were sampled in seven Lake Huron waterbodies, 333 sites in eight waterbodies in the Huron-Erie Corridor (HEC), 329 sites in eight Lake Erie waterbodies and 181 field sites in seven Lake Ontario waterbodies.

A total of 61 247 fishes were caught in 2020, representing 84 species (Table 1). The mean number of fishes caught per site was 62 and the mean number of species was five. Of the species caught, the most abundant were Gizzard Shad (*Dorosoma cepedianum*) totalling 20 379 fish (~33.3% of all fishes caught), Bluegill (*Lepomis macrochirus*) totalling 6 120 fish (~10.0%), Pumpkinseed (*Lepomis gibbosus*) totalling 3 577 fish (~5.8%), Emerald Shiner (*Notropis atherinoides*) totalling 3 323 fish (~5.4%), and Bluntnose Minnow (*Pimephales notatus*) totalling 2 214 fish (~3.6%; Table 3).

The species that were caught most frequently were Bluegill (caught at 40.4% of all sites sampled), Largemouth Bass (*Micropterus salmoides*; 39.9%), Pumpkinseed (39.1%), Common Carp (30.5%) and Gizzard Shad (27.6%).

An additional 69 field sites were sampled for larval fish and eggs using bongo nets. Approximately 239 larval fishes weighing a total of 0.72 g were collected.

## BOAT ELECTROFISHER

Boat electrofishing was conducted at 340 sites in all 30 of the waterbodies sampled. A total of 3 444.12 minutes of shocking were completed, with a mean of 10.22 minutes of shock time per site (Table 4). A total of 30 998 fishes were caught with this gear, representing 70 species. The mean catch per unit effort (CPUE) was 9.10 fishes per minute of shocking. There were three boat electrofishing sites where no fish were caught.

Boat electrofishing is often conducted in combination with either tied-down gill or trammel nets to prevent large fishes from fleeing the site; this method has been effective for DFO at capturing Grass Carp. Fish captures and effort were recorded separately for each gear. Of the 340 sites sampled with boat electrofishing, 203 were sampled with this gear alone, and had a mean CPUE of 9.03 fishes per minute of shocking. 137 sites were sampled in combination with trammel nets with a mean CPUE of 9.20 fishes per minute of shocking.

The most abundant species caught boat electrofishing were Gizzard Shad (63.1% of fishes caught), Emerald Shiner (9.0%) and Yellow Perch (*Perca flavescens*; 4.1%). The most frequently caught species were Largemouth Bass (caught at 67.4% of sites sampled), Gizzard

Shad (61.8%) and Pumpkinseed (52.6%). There were 123 buffalo and 437 Common Carp caught boat electrofishing. Of the total fishes captured by electrofishing, 1.81% were surrogate species.

In the Lake Huron drainage, 49 sites were sampled by boat electrofishing. A total of 2 252 fishes were caught, representing 51 species. The mean CPUE across these sites was 4.83 fishes per minute of shocking (Tables 2, 5).

In the HEC, 116 sites were sampled by boat electrofishing. A total of 16 330 fishes were caught, representing 49 species. The mean CPUE across these sites was 14.03 fishes per minute of shocking.

In the Lake Erie drainage, 118 sites were sampled by boat electrofishing. A total of 10 092 fishes we caught, representing 54 species. The mean CPUE across these sites was 8.56 fishes per minute of shocking.

In the Lake Ontario drainage, 57 sites were sampled by boat electrofishing. A total of 2 324 fishes we caught, representing 35 species. The mean CPUE across these sites was 3.93 fishes per minute of shocking.

## HOOP NET

Hoop nets were set at 35 sites in eight waterbodies. Nets were set for a total of 1 623.58 hours, with a mean of 46.39 hours of set time per site (Table 4). A total of 74 fishes were caught with this gear, representing 17 species. The mean CPUE was 0.05 fishes per hour of set time. There were 19 hoop net sites where no fish were caught.

The most abundant species caught in hoop nets were Freshwater Drum (*Aplodinotus grunniens*; 20.3% of fishes caught), Rock Bass (*Ambloplites rupestris*; 17.6%) and White Perch (*Morone americana*; 9.5%). The most frequently caught species in hoop nets were Rock Bass (caught at 20.0% of sites sampled) and Freshwater Drum (17.1%). There were no buffalo and one Common Carp caught in the hoop nets. Of the total fishes captured by hoop nets, 1.35% were surrogate species.

In Lake Erie, 11 sites were sampled with hoop nets. A total of 19 fishes were caught, representing nine species. The mean CPUE across these sites was 0.04 per hour of set time (Tables 2, 5).

In the HEC, 24 sites were sampled with hoop nets. A total of 55 fishes were caught, representing 13 species. The mean CPUE across these sites was 0.05 per hour of set time.

No hoop nets were set in Lake Huron or Lake Ontario waterbodies.

## MINI FYKE NET

Mini fyke nets were set at 259 sites in 30 waterbodies sampled. Nets were set for a total of 5 623.81 hours, with a mean of 21.71 hours of set time per site (Table 4). A total of 22 706 fishes were caught with this gear, representing 65 species. The mean CPUE was 4.11 fishes per hour of set time. There were six sites where no fish were caught in this gear.

The most abundant species caught in mini fyke nets were sunfish species (*Lepomis* sp; 33.1% of fishes caught), Bluegill (16.9%), and Pumpkinseed (8.1%). The most frequently caught species in mini fyke nets were Bluegill (caught at 51.0% of sites sampled), Pumpkinseed (49.8%), and Largemouth Bass (43.6%). There were 12 buffalo and 23 Common Carp caught in mini fyke nets. Of the total fishes captured by mini fyke nets, 0.15% were surrogate species.

In Lake Huron, 40 sites were sampled with mini fyke nets. A total of 2 280 fishes were caught, representing 37 species. The mean CPUE across these sites was 2.79 per hour of set time (Tables 2, 5).

In the HEC, 89 sites were sampled with mini fyke nets. A total of 8 416 fishes were caught, representing 36 species. The mean CPUE across these sites was 4.47 per hour of set time.

In Lake Erie, 82 sites were sampled with mini fyke nets. A total of 8 399 fishes were caught, representing 43 species. The mean CPUE across these sites was 4.83 per hour of set time.

In Lake Ontario, 48 sites were sampled with mini fyke nets. A total of 3 611 fishes were caught, representing 31 species. The mean CPUE across these sites was 3.32 per hour of set time.

## SEINE NET

Seine nets were used at 11 sites in eight waterbodies. A total of 27 hauls were completed, with a mean of 2.45 hauls per site (Table 4). A total of 1 983 fishes were caught with this gear, representing 25 species. The mean CPUE was 104.59 fishes per haul. There were no seine net sites where no fish were caught.

The most abundant species caught in seine nets were sunfish species (28.5% of fishes caught), Brook Silverside (*Labidesthes sicculus*; 15.7%), and Bluntnose Minnow (13.6%). The most frequently caught species in seine nets were Round Goby (*Neogobius melanostomus*; 25.93% of sites sampled), Bluntnose Minnow (25.93%), and Brook Silverside (25.93%). There were no buffalo and no Common Carp caught with seine nets.

In Lake Huron, six sites were sampled with seine nets. A total of 931 fishes were caught, representing 17 species. The mean CPUE across these sites was 119.19 per haul (Tables 2, 5).

In Lake Erie, five sites were sampled with seine nets. A total of 1 052 fishes were caught, representing 22 species. The mean CPUE across these sites was 87.07 per haul.

No seine nets were used in the HEC or Lake Ontario.

## TRAMMEL NETS

Trammel nets were set at 169 sites in 30 waterbodies with a total set time of 6 939 minutes, and a mean of 41.06 minutes of set time per site (Table 4). A total of 685 fishes were caught with this gear, representing 15 species. The mean CPUE was 0.08 fish per minute of set time. There were 92 sites where no fish we caught in this gear.

The most abundant species caught in trammel nets were Common Carp (53.1% of fishes caught), buffalo (38.2%), and Chinook Salmon (*Oncorhynchus tshawytscha*; 2.5%). The most frequently caught species in trammel nets were Common Carp (33.7% sites sampled), buffalo (21.3%), and

Channel Catfish (*Ictalurus punctatus*; 5.3%).There were 262 buffalo and 364 Common Carp caught with trammel nets. Of the total fishes captured by trammel nets, 91.39% were surrogate species.

In Lake Huron, 20 sites were sampled with trammel nets. A total of 15 fishes were caught, representing six species. The mean CPUE across these sites was 0.13 per minute of set time (Tables 2, 5).

In the HEC, 46 sites were sampled with trammel nets. A total of 330 fishes were caught, representing eight species. The mean CPUE across these sites was 0.14 per minute of set time.

In Lake Erie, 58 sites were sampled with trammel nets. A total of 78 fishes were caught, representing seven species. The mean CPUE across these sites was 0.03 per minute of set time.

In Lake Ontario, 45 sites were sampled with trammel nets. A total of 262 fishes were caught, representing seven species. The mean CPUE across these sites was 0.13 per minute of set time.

## TRAP NETS

Trap nets were set at 166 sites in 28 waterbodies. A total set time of 3 765.99 hours, with a mean of 22.69 hours of set time per site (Table 4). A total of 4 801 fishes were caught with this gear, representing 35 species. The mean CPUE was 1.34 fish per hour of set time. There were 18 sites where no fish were caught in this gear.

The most abundant species caught in trap nets were Brown Bullhead (*Ameiurus nebulosus*; 24.0% of fishes caught), Bluegill (22.1%), and Pumpkinseed (12.4%). The most frequently caught species in trap nets were Bluegill (54.8% of sites sampled), Black Crappie (*Pomoxis nigromaculatus*; 50.6%), and Pumpkinseed (42.2%). There were 37 buffalo and 170 Common Carp caught with trap nets. Of the total fishes captured by trap nets, 4.31% were surrogate species.

In Lake Huron, 22 sites were sampled with trap nets. A total of 288 fishes were caught, representing 19 species. The mean CPUE across these sites was 0.63 per hour of set time(Tables 2, 5).

In the HEC, 58 sites were sampled with trap nets. A total of 987 fishes were caught, representing 27 species. The mean CPUE across these sites was 0.82 per hour of set time.

In Lake Erie, 55 sites were sampled with trap nets. A total of 2 393 fishes were caught, representing 32 species. The mean CPUE across these sites was 2.03 per hour of set time.

In Lake Ontario, 31 sites were sampled with trap nets. A total of 1 133 fishes were caught, representing 21 species. The mean CPUE across these sites was 1.58 per hour of set time.

## SURROGATES

A total of 1 429 surrogate fishes were caught in 2020 consisting of 434 buffalo and 995 Common Carp. Buffalo ranged in size from 30 to 889 mm total length, with a mean and median total length of 555.7 mm and 611 mm, respectively. Buffalo was the 19$^{th}$ most abundant and the 15$^{th}$ most frequently caught species in 2020. It was caught in 14 of 30 waterbodies in all Great Lakes

sampled; however, in Lake Huron, it was only caught in the Ausable River, and in Lake Ontario, only in Jordan Harbour. The most buffalo were caught in the Thames River (137 individuals, approximately 2.1 per site).

Common Carp ranged in size from 32 to 971 mm total length, with a mean and median total length of 594.6 mm and 620 mm, respectively. Common Carp was the 11$^{th}$ most abundant and the fourth most frequently caught species in 2020. It was caught in all but one waterbody sampled (Rouge River). The most Common Carp caught and the greatest number caught per site was in Jordan Harbour (255 individuals, 5.1 per site).

The most buffalo were caught in trammel nets, a total of 262 (60.4% of all buffalo caught; approximately 1.6 buffalo per trammel net site; Table 4) were caught. Boat electrofishing and trap nets were also effective at capturing buffalo, with 123 (28.3%; 0.4 per site) and 37 (8.5%; 0.2 per site) caught in these gear types, respectively.

The most Common Carp were caught by boat electrofishing, a total of 437 (43.9% of all Common Carp caught; approximately 1.3 Common Carp per electrofishing site; Table 4) were caught; however, trammel nets caught the greatest number per site, a total of 364 individuals (36.6%; 2.2 individuals per site).

## ASIAN CARPS

On July 2, 2020, during early detection surveillance, field crews captured one Grass Carp in Jordan Harbour in a trammel net. Located in Lincoln, Ontario, Jordan Harbour is a large wetland habitat that drains into Lake Ontario.

The Grass Carp was 1 058 mm in total length, weighed 16.324 kg, and was a diploid female (capable of reproducing). This female had large and well hydrated eggs, was estimated to be at least nine years old, and its otolith microchemistry was consistent with that of a wild born individual.

The fish was captured at a depth of 1.2 m in an area dominated with emergent aquatic vegetation. The fish was captured in a 183 m (200 yard) trammel net with 10 cm (4”) bar mesh that was set for 64 minutes, and was captured within 32 m of shore. This trammel net was fished in combination with electrofishing with a shock time of 5 minutes.

Following the capture of the Grass Carp, response efforts were initiated on July 2, 2020. Three DFO crews from the Canadian Center of Inland Waters in Burlington, Ontario began sampling the area of capture within Jordan Harbour. and the crewsset 28 trammel net sets totalling 5 124 m of net and approximately 2 051 minutes of set time. Additionally, 27 000 seconds of boat electrofishing were conducted. The entire area of Jordan Harbour was intensively sampled for five days until July 7, 2020 and no additional Grass Carp were captured.

## OTHER NON-INDIGENOUS AQUATIC SPECIES

Other non-indigenous fish species (as listed in Sturtevant et al. 2019, updated from Mills et al. 1993) were caught during DFO’s early detection surveillance work targeting Asian carps. They included 66 Alewife (*Alosa pseudoharengus*), five Brown Trout (*Salmo trutta*), 53 Chinook Salmon (*Oncorhynchus tshawytscha*), 13 Flathead Catfish (*Pylodictis olivaris*), 116 Goldfish

(*Carassius auratus*), ten Goldfish x Common Carp hybrids (*Carassius auratus* x *Cyprinus carpio*), four Orangespotted Sunfish (*Lepomis humilis*), one Rainbow Trout (*Oncorhynchus mykiss*), 736 Round Goby, 177 Rudd (*Scardinius erythrophthalmus*), ten Tubenose Goby (*Proterorhinus semilunaris*) and 101 White Perch (*Morone americana*).

## LARVAL BONGO NETS

Bongo nets were deployed in six waterbodies at 69 sites in late-summer of 2020 (Table 6). Bongo nets were deployed for 12 300 seconds. A total of 239 larval fishes were caught, with a weight of 0.72 g. The greatest CPUE was in the Thames River with 5.7 fishes per minute of bongo tow. Genetic analysis (Colm et al. 2019) indicate 37 species present, all of which were detected as adults in traditional sampling during early detection surveillance. No Asian carps were detected in the genetic analysis.

## SUMMARY

In 2020, DFO's Asian Carp Program early detection surveillance crews sampled 30 waterbodies in the Great Lakes basin at high risk for the arrival of Asian carps. Six gear types were used to target large- and small-bodied fishes in a variety of wetland and riverine habitats where Asian carps are likely to arrive. A total of 980 field sites were sampled and 61 247 fishes representing 84 species were caught. Additionally, bongo nets were used to target Asian carp icthyoplankton (larval fish and eggs); another 69 field sites were sampled resulting in 239 larval fishes. One Grass Carp was detected during the 2020 surveillance in Jordan Harbour, Lake Ontario.

Trammel nets, boat electrofishing and trap nets continue to be the most effective gear types for capturing surrogate species; trammel nets especially so for buffalo, and boat electrofishing for Common Carp. This is generally consistent with effectiveness of gear types at capturing Asian carps in the Missouri River, USA (Wanner and Klumb 2009).

Buffalo and Common Carp were the 19th and 11th most abundant of the 84 species caught, and the 15th and fourth most frequently caught species, respectively, suggesting our methods are targeting large-bodied fishes effectively.

There were minimal changes in the gear types used for early detection surveillance in 2020. The program continued to deploy two custom Henley boats fitted with Halltech (Guelph, Ontario) and Midwest Lake electrofishing equipment (Polo, Missouri) to improve consistency in sampling efforts. Due provincial travel restrictions imposed as a result of the COVID-19 pandemic, fewer sites were sampled overall, but particularly for larval fishes, and only bongo nets were deployed during larval sampling. Due to reduced sampling events, tie-down gill nets were also not used during early detection sampling. No changes in gear are anticipated for the 2021 sampling season.

The Asian Carp Program conducted early detection surveillance in 30 of 37 early detection locations identified as highly suitable for Asian carps. The early detection locations in Lake Superior and northern Lake Huron (Georgian Bay) were not visited in 2020 as these remain lower risk. Whereas, there are sites in the lower Great Lakes where Grass Carp have been detected and/or are reproducing (i.e. two Lake Erie tributaries in US waters). These northern early detection sites will be visited when opportunity allows or if the threat increases.

In 2021, the Asian Carp Program will continue to conduct early detection surveillance for Asian carps and to concentrate efforts in the western basin of Lake Erie, and the southern HEC where the threat of Grass Carp arrival is most imminent. Other sites in the Great Lakes basin may be visited fewer times or may be sampled with non-traditional techniques (e.g. environmental DNA surveillance). This change in strategy is intended to further improve early detection and prevent the spread of Grass Carp beyond western Lake Erie and into Canadian waters.

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## TABLES

Table 1 Summary of the 2020 catch data for the Asian Carp Program's early detection surveillance.

| | |
|---|---|
| Number of Sites | 980 |
| Number of Waterbodies | 30 |
| Number of Fish Caught | 61 247 |
| Mean Number of Fish per Site | 62.50 |
| Maximum Number of Fish per Site | 553 |
| Total Number of Species | 84 |
| Mean Number of Species per Site | 5.27 |
| Maximum Number of Species per Site | 40 |
| Total Number of Asian carp | 1 |
| Total Number of Buffalo | 434 |
| Total Number of Common Carp | 995 |

Table 2 Catch data by waterbody for the 2020 Asian Carp Program's early detection surveillance.

| Great Lake | Waterbody Name | Number of Sites | Total Number of Fish Captured | Mean Number of Fish Captured per Site | Number of Species | Mean Number of Species per Site | Number of Sites with No Fish | Number of Buffalo | Number of Common Carp |
|---|---|---|---|---|---|---|---|---|---|
| Huron | Ausable River | 37 | 2127 | 57.49 | 36 | 7.03 | 4 | 2 | 25 |
| | Bayfield River | 18 | 753 | 41.83 | 31 | 5.17 | 2 | 0 | 16 |
| | Coldwater River | 25 | 614 | 24.56 | 17 | 5.36 | 2 | 0 | 14 |
| | Maitland River | 17 | 819 | 48.18 | 22 | 4.06 | 4 | 0 | 8 |
| | Pine River | 12 | 927 | 77.25 | 22 | 4.17 | 0 | 0 | 6 |
| | Sauble River | 15 | 213 | 14.20 | 21 | 4.33 | 3 | 0 | 2 |
| | Sturgeon River | 13 | 313 | 24.08 | 21 | 4.92 | 2 | 0 | 2 |
| HEC | Big Creek | 22 | 1660 | 75.45 | 21 | 4.50 | 0 | 15 | 110 |
| | Canard River | 53 | 5091 | 96.06 | 31 | 5.38 | 6 | 30 | 39 |
| | Detroit River | 31 | 600 | 19.35 | 31 | 5.45 | 3 | 39 | 42 |
| | Jeanette's Creek | 45 | 3537 | 78.60 | 34 | 6.78 | 3 | 40 | 36 |
| | Ruscom River | 30 | 4880 | 162.67 | 34 | 6.73 | 2 | 5 | 56 |
| | St. Clair River | 25 | 258 | 10.32 | 29 | 3.08 | 8 | 0 | 5 |
| | Sydenham River | 61 | 2936 | 48.13 | 32 | 4.59 | 11 | 24 | 23 |
| | Thames River | 66 | 7156 | 108.42 | 40 | 6.97 | 3 | 137 | 98 |
| Erie | Big Otter Creek | 33 | 1856 | 56.24 | 31 | 3.42 | 8 | 0 | 2 |
| | Cedar Creek | 55 | 8171 | 148.56 | 29 | 6.42 | 3 | 38 | 50 |
| | Grand River | 64 | 3332 | 52.06 | 35 | 5.20 | 17 | 2 | 15 |
| | Kettle Creek | 26 | 880 | 33.85 | 24 | 2.50 | 5 | 1 | 12 |
| | Long Point Bay | 39 | 2085 | 53.46 | 30 | 7.49 | 3 | 0 | 15 |
| | Nanticoke Creek | 30 | 1454 | 48.47 | 31 | 5.83 | 4 | 0 | 26 |
| | Rondeau Bay | 46 | 3239 | 70.41 | 27 | 5.83 | 12 | 2 | 13 |
| | Welland River | 36 | 1016 | 28.22 | 35 | 6.69 | 0 | 43 | 35 |
| Ontario | Credit River | 19 | 1306 | 68.74 | 22 | 4.37 | 0 | 0 | 44 |
| | Duffins Creek | 18 | 540 | 30.00 | 17 | 4.50 | 2 | 0 | 5 |
| | Frenchman's Bay | 12 | 217 | 18.08 | 10 | 3.83 | 3 | 0 | 25 |
| | Humber River | 29 | 830 | 28.62 | 25 | 3.69 | 10 | 0 | 7 |
| | Jordan Harbour | 50 | 3692 | 73.84 | 32 | 5.94 | 1 | 56 | 255 |
| | Toronto Islands (Lake Ontario) | 32 | 445 | 13.91 | 22 | 2.72 | 13 | 0 | 9 |
| | Rouge River | 21 | 300 | 14.29 | 15 | 3.38 | 4 | 0 | 0 |

Table 3 Summary of the species caught during the 2020 Asian Carp Program's early detection surveillance.

Common and scientific names according to Page et al. (2013). Status in capital letters refers to Species at Risk Act listing; lower case status refers to Committee on the Status of Endangered Wildlife in Canada (COSEWIC) assessment.

| Common Name | Scientific Name | Number Captured | Status |
|---|---|---|---|
| Alewife | *Alosa pseudoharengus* | 66 | |
| American eel | *Anguilla rostrata* | 1 | thr |
| Banded Killifish | *Fundulus diaphanus* | 44 | |
| Black Bullhead | *Ameiurus melas* | 4 | |
| Black Crappie | *Pomoxis nigromaculatus* | 676 | |
| Blackchin Shiner | *Notropis heterodon* | 58 | |
| Blacknose Shiner | *Notropis heterolepis* | 2 | |
| Blackside Darter | *Percina maculata* | 1 | |
| Bluegill | *Lepomis macrochirus* | 6120 | |
| Bluntnose Minnow | *Pimephales notatus* | 2214 | |
| Bowfin | *Amia calva* | 433 | |
| Brook Silverside | *Labidesthes sicculus* | 791 | |
| Brook Stickleback | *Culaea inconstans* | 6 | |
| Brown Bullhead | *Ameiurus nebulosus* | 1621 | |
| Brown Trout | *Salmo trutta* | 5 | |
| buffalo | *Ictiobus sp* | 434 | |
| Burbot | *Lota lota* | 1 | |
| Central Mudminnow | *Umbra limi* | 67 | |
| Central Stoneroller | *Campostoma anomalum* | 2 | |
| Channel Catfish | *Ictalurus punctatus* | 420 | |
| Chinook Salmon | *Oncorhynchus tshawytscha* | 53 | |
| Common Carp | *Cyprinus carpio* | 995 | |
| Common Shiner | *Luxilus cornutus* | 82 | |
| Creek Chub | *Semotilus atromaculatus* | 3 | |
| Emerald Shiner | *Notropis atherinoides* | 3323 | |
| Fathead Minnow | *Pimephales promelas* | 6 | |
| Flathead Catfish | *Pylodictis olivaris* | 13 | |
| Freshwater Drum | *Aplodinotus grunniens* | 172 | |
| Ghost Shiner | *Notropis buchanani* | 514 | |
| Gizzard Shad | *Dorosoma cepedianum* | 20379 | |
| Golden Redhorse | *Moxostoma erythrurum* | 53 | |
| Golden Shiner | *Notemigonus crysoleucas* | 728 | |
| Goldfish | *Carassius auratus* | 116 | |
| Grass Carp | *Ctenopharyngodon idella* | 1 | |
| Grass Pickerel | *Esox americanus vermiculatus* | 8 | SC |
| Greater Redhorse | *Moxostoma valenciennesi* | 14 | |
| Green Sunfish | *Lepomis cyanellus* | 74 | |
| Greenside Darter | *Etheostoma blennioides* | 3 | |

| | | | |
|---|---|---|---|
| Hornyhead Chub | *Nocomis biguttatus* | 20 | |
| Johnny Darter | *Etheostoma nigrum* | 1 | |
| Lake Chubsucker | *Erimyzon sucetta* | 6 | END |
| Largemouth Bass | *Micropterus salmoides* | 1979 | |
| Least Darter | *Etheostoma microperca* | 1 | |
| Logperch | *Percina caprodes* | 102 | |
| Longnose Dace | *Rhinichthys cataractae* | 1 | |
| Longnose Gar | *Lepisosteus osseus* | 121 | |
| Mimic Shiner | *Notropis volucellus* | 181 | |
| Mooneye | *Hiodon tergisus* | 1 | |
| Muskellunge | *Esox masquinongy* | 8 | |
| Northern Hog Sucker | *Hypentelium nigricans* | 2 | |
| Northern Pike | *Esox lucius* | 179 | |
| Northern Sunfish | *Lepomis peltastes* | 230 | |
| Orangespotted Sunfish | *Lepomis humilis* | 4 | |
| Pugnose Minnow | *Opsopoeodus emiliae* | 1 | THR |
| Pugnose Shiner | *Notropis anogenus* | 40 | THR |
| Pumpkinseed | *Lepomis gibbosus* | 3577 | |
| Quillback | *Carpiodes cyprinus* | 18 | |
| Rainbow Darter | *Etheostoma caeruleum* | 2 | |
| Rainbow Trout | *Oncorhynchus mykiss* | 1 | |
| Rock Bass | *Ambloplites rupestris* | 558 | |
| Rosyface Shiner | *Notropis rubellus* | 28 | |
| Round Goby | *Neogobius melanostomus* | 736 | |
| Rudd | *Scardinius erythrophthalmus* | 177 | |
| Shorthead Redhorse | *Moxostoma macrolepidotum* | 68 | |
| Silver Lamprey | *Ichthyomyzon unicuspis* | 4 | |
| Silver Redhorse | *Moxostoma anisurum* | 32 | |
| Smallmouth Bass | *Micropterus dolomieu* | 75 | |
| Spotfin Shiner | *Cyprinella spiloptera* | 125 | |
| Spottail Shiner | *Notropis hudsonius* | 129 | |
| Spotted Gar | *Lepisosteus oculatus* | 6 | END |
| Spotted Sucker | *Minytrema melanops* | 120 | SC |
| Stonecat | *Noturus flavus* | 1 | |
| Striped Shiner | *Luxilus chrysocephalus* | 86 | |
| Tadpole Madtom | *Noturus gyrinus* | 8 | |
| Trout-perch | *Percopsis omiscomaycus* | 1 | |
| Tubenose Goby | *Proterorhinus semilunaris* | 10 | |
| Walleye | *Sander vitreus* | 47 | |
| Warmouth | *Lepomis gulosus* | 12 | end/SC |
| White Bass | *Morone chrysops* | 189 | |
| White Crappie | *Pomoxis annularis* | 181 | |
| White Perch | *Morone americana* | 101 | |
| White Sucker | *Catostomus commersonii* | 368 | |

| | | |
|---|---|---|
| Yellow Bullhead | *Ameiurus natalis* | 64 |
| Yellow Perch | *Perca flavescens* | 1409 |

| | | |
|---|---|---|
| bullhead | *Ameiurus sp.* | 442 |
| Goldfish X Common Carp hybrid | *Carassius auratus X Cyprinus carpio* | 10 |
| sucker | *Catostomus sp.* | 29 |
| Sunfishes and basses family | *Centrarchidae* | 16 |
| true Minnow family | *Leuciscidae* | 47 |
| darter | *Etheostoma sp.* | 2 |
| Goby family | *Gobiidae* | 1 |
| lamprey | *Ichthyomyzon sp.* | 2 |
| sunfish hybrid | *Lepomis hybrid* | 18 |
| sunfish | *Lepomis sp.* | 8431 |
| shiner | *Luxilus sp.* | 377 |
| Temperate basses | *Morone sp.* | 27 |
| redhorse | *Moxostoma sp.* | 41 |
| shiner | *Notropis sp.* | 1267 |
| crappie | *Pomoxis sp.* | 21 |
| Unknown | Unknown | 3 |

*END=Endangered; SC=Special Concern; THR=Threatened

Table 4 Summary of the catch data by gear type used in the 2020 Asian Carp Program's early detection surveillance.

| Gear Type | Acronym | Number of Sites | Number of Waterbodies | Total Effort | Mean Effort per Site | Effort Units | Number of Fishes | Mean Number of Fishes Caught per Site | Mean Catch per Unit Effort | Number of Species | Mean Number of Species per Site | Number of Sites with No Fish Caught | Number of Buffalo sp. | Number of Common Carp | Surrogates Captured (%) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Boat Electrofishing | BEF | 340 | 30 | 3444.12 | 10.22 | minutes | 30998 | 91.17 | 9.10 | 70 | 7.46 | 3 | 123 | 437 | 1.81 |
| Hoop Net | HN | 35 | 8 | 1623.58 | 46.39 | hours | 74 | 2.11 | 0.05 | 17 | 1.89 | 19 | 0 | 1 | 1.35 |
| Mini Fyke Net | MFN | 259 | 30 | 5623.81 | 21.71 | hours | 22706 | 87.67 | 4.11 | 65 | 5.59 | 6 | 12 | 23 | 0.15 |
| Seine Net | SN | 11 | 8 | 27.00 | 2.45 | hauls | 1983 | 180.27 | 104.59 | 25 | 8.36 | 0 | 0 | 0 | 0.00 |
| Trammel Net | TRM | 169 | 30 | 6939.00 | 41.06 | minutes | 685 | 4.05 | 0.08 | 15 | 1.34 | 92 | 262 | 364 | 91.39 |
| Trap Net | TN | 166 | 28 | 3765.99 | 22.69 | hours | 4801 | 28.92 | 1.34 | 35 | 5.15 | 18 | 37 | 170 | 4.31 |

Table 5 Summary of sampling effort by waterbody for boat electrofishing (BEF), hoop nets (HN), mini fyke nets (MFN), seine nets (SN), trammel nets (TRM) and trap nets (TN) during the 2020 Asian Carp Program's early detection surveillance.

| | | Boat Electrofishing | | | Hoop Net | | | Mini Fyke Net | | | Seine Net | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Great Lake | Waterbody Name | Number of Sites | Total Effort (minutes) | Mean CPUE (catch per minute) | Number of Sites | Total Effort (hours) | Mean CPUE (catch per hour) | Number of Sites | Total Effort (hours) | Mean CPUE (catch per hour) | Number of Sites | Total Effort (hauls) | Mean CPUE (catch per haul) |
| Huron | Ausable River | 10 | 95.17 | 6.36 | 0 | | | 11 | 225.52 | 5.90 | 2 | 4 | 50.25 |
| | Bayfield River | 6 | 60.00 | 2.50 | 0 | | | 5 | 93.6 | 4.64 | 2 | 5 | 30.67 |
| | Coldwater River | 10 | 110.00 | 3.73 | 0 | | | 8 | 165.06 | 0.48 | 0 | | |
| | Maitland River | 5 | 50.00 | 0.94 | 0 | | | 5 | 101.64 | 2.32 | 1 | 1 | 537.00 |
| | Pine River | 6 | 60.00 | 13.95 | 0 | | | 4 | 92.6 | 0.93 | 0 | | |
| | Sauble River | 8 | 80.00 | 1.79 | 0 | | | 4 | 99.96 | 0.70 | 0 | | |
| | Sturgeon River | 4 | 40.00 | 4.50 | 0 | | | 3 | 62.6 | 0.56 | 1 | 3 | 16.33 |
| HEC | Big Creek | 7 | 60.00 | 23.40 | 0 | | | 7 | 147.37 | 0.90 | 0 | | |
| | Canard River | 17 | 172.00 | 13.76 | 0 | | | 20 | 428.24 | 5.79 | 0 | | |
| | Detroit River | 11 | 110.00 | 3.10 | 4 | 173.5 | 0.05 | 6 | 131.81 | 0.69 | 0 | | |
| | Jeanette's Creek | 14 | 140.00 | 15.35 | 2 | 92 | 0.00 | 16 | 331.7 | 3.67 | 0 | | |
| | Ruscom River | 13 | 131.00 | 30.82 | 0 | | | 8 | 165.52 | 4.67 | 0 | | |
| | St. Clair River | 15 | 148.00 | 1.70 | 2 | 39.26 | 0.10 | 2 | 39.95 | 0.10 | 0 | | |
| | Sydenham River | 15 | 161.05 | 11.20 | 11 | 578.7 | 0.04 | 16 | 360.82 | 2.96 | 0 | | |
| | Thames River | 24 | 255.17 | 16.50 | 5 | 219.13 | 0.09 | 14 | 297.53 | 9.16 | 0 | | |
| | Big Otter Creek | 14 | 140.00 | 8.04 | 4 | 181.11 | 0.04 | 7 | 147.57 | 4.93 | 0 | | |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Erie | Cedar Creek | 16 | 162.83 | 32.28 | 3 | 155.65 | 0.02 | 16 | 338.64 | 6.83 | 0 | | |
| | Grand River | 23 | 230.00 | 2.29 | 4 | 184.23 | 0.04 | 11 | 245.12 | 7.87 | 1 | 2 | 254.00 |
| | Kettle Creek | 10 | 100.00 | 8.05 | 0 | | | 6 | 126.22 | 0.52 | 0 | | |
| | Long Point Bay | 15 | 152.00 | 7.00 | 0 | | | 11 | 228.34 | 1.35 | 2 | 6 | 69.50 |
| | Nanticoke Creek | 11 | 110.50 | 2.99 | 0 | | | 8 | 172.97 | 2.54 | 1 | 3 | 35.33 |
| | Rondeau Bay | 16 | 160.00 | 2.97 | 0 | | | 11 | 233.77 | 10.64 | 0 | | |
| | Welland River | 13 | 110.60 | 4.10 | 0 | | | 12 | 282.9 | 0.90 | 1 | 3 | 7.00 |
| Ontario | Credit River | 7 | 90.00 | 0.84 | 0 | | | 7 | 152.61 | 7.52 | 0 | | |
| | Duffins Creek | 4 | 40.00 | 1.70 | 0 | | | 6 | 139.1 | 1.79 | 0 | | |
| | Frenchman's Bay | 4 | 40.00 | 2.25 | 0 | | | 3 | 70.5 | 0.21 | 0 | | |
| | Humber River | 10 | 100.00 | 1.36 | 0 | | | 6 | 140.57 | 4.74 | 0 | | |
| | Jordan Harbour | 16 | 173.80 | 10.31 | 0 | | | 13 | 301.46 | 3.90 | 0 | | |
| | Toronto Islands (Lake Ontario) | 9 | 92.00 | 1.54 | 0 | | | 8 | 184.86 | 1.54 | 0 | | |
| | Rouge River | 7 | 70.00 | 1.43 | 0 | | | 5 | 115.26 | 0.77 | 0 | | |

| | | Trap Net | | | Trammel Net | | |
|---|---|---|---|---|---|---|---|
| Great Lake | Waterbody Name | Number of Sites | Total Effort (hours) | Mean CPUE (catch per hour) | Number of Sites | Total Effort (minutes) | Mean CPUE (catch per minutes) |
| Huron | Ausable River | 9 | 367.28 | 0.59 | 5 | 214.00 | 0.01 |
| | Bayfield River | 2 | 39.81 | 0.08 | 3 | 95.00 | 0.05 |
| | Coldwater River | 6 | 123.29 | 1.01 | 1 | 10.00 | 0.00 |
| | Maitland River | 2 | 43.15 | 0.02 | 4 | 192.00 | 0.02 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Pine River | 0 | | | 2 | 76.00 | 0.04 |
| | Sauble River | 0 | | | 3 | 141.00 | 0.00 |
| | Sturgeon River | 3 | 62.26 | 0.79 | 2 | 92.00 | 0.00 |
| HEC | Big Creek | 3 | 62.91 | 0.58 | 5 | 251.00 | 0.25 |
| | Canard River | 9 | 188.63 | 1.65 | 7 | 348.00 | 0.03 |
| | Detroit River | 6 | 126.77 | 0.93 | 4 | 133.00 | 0.23 |
| | Jeanette's Creek | 9 | 182.41 | 0.81 | 4 | 189.00 | 0.10 |
| | Ruscom River | 5 | 101.66 | 0.72 | 4 | 225.00 | 0.06 |
| | St. Clair River | 2 | 38.58 | 0.00 | 4 | 123.00 | 0.05 |
| | Sydenham River | 13 | 282.24 | 0.26 | 6 | 301.00 | 0.07 |
| | Thames River | 11 | 224.86 | 1.01 | 12 | 833.00 | 0.22 |
| Erie | Big Otter Creek | 2 | 43.04 | 0.05 | 6 | 206.00 | 0.00 |
| | Cedar Creek | 14 | 309.77 | 2.42 | 6 | 353.00 | 0.05 |
| | Grand River | 8 | 173.07 | 2.10 | 17 | 595.00 | 0.01 |
| | Kettle Creek | 5 | 104.95 | 0.08 | 5 | 172.00 | 0.03 |
| | Long Point Bay | 8 | 167.22 | 1.75 | 3 | 131.00 | 0.00 |
| | Nanticoke Creek | 5 | 108.09 | 4.94 | 5 | 205.00 | 0.08 |
| | Rondeau Bay | 7 | 148.78 | 2.01 | 12 | 484.00 | 0.00 |
| | Welland River | 6 | 140.69 | 1.27 | 4 | 226.00 | 0.18 |
| Ontario | Credit River | 2 | 45.78 | 0.89 | 3 | 95.00 | 0.22 |
| | Duffins Creek | 4 | 94.53 | 2.36 | 4 | 80.00 | 0.05 |
| | Frenchman's Bay | 3 | 70.91 | 1.62 | 2 | 40.00 | 0.00 |
| | Humber River | 4 | 91.34 | 0.26 | 9 | 180.00 | 0.00 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Jordan Harbour | 7 | 158.94 | 3.79 | 14 | 689.00 | 0.34 |
| Toronto Islands (Lake Ontario) | 7 | 162.83 | 0.09 | 8 | 160.00 | 0.00 |
| Rouge River | 4 | 102.2 | 1.20 | 5 | 100.00 | 0.01 |

Table 6 Summary of larval fish and egg sampling with bongo nets during the 2020 Asian Carp Program's early detection surveillance.

| Waterbody Name | Gear Type | Number of Sites | Effort (minutes) | Number of Fish | Fish per Minute | Total Weight (g) |
|---|---|---|---|---|---|---|
| Ausable River | Bongo Net | 21 | 63 | 2 | 0.03 | 0.01 |
| Grand River | Bongo Net | 15 | 45 | 0 | | |
| Jeannette's Creek | Bongo Net | 1 | 3 | 0 | | |
| Sydenham River | Bongo Net | 10 | 30 | 2 | 0.07 | 0.10 |
| Thames River | Bongo Net | 14 | 40 | 235 | 5.74 | 0.61 |
| Welland River | Bongo Net | 8 | 24 | 0 | | |

## FIGURES


Figure 1 DFO's Asian Carp Program's Early detection surveillance sites in Canadian waters of the Great Lakes.

## APPENDIX 1: GEAR DESCRIPTIONS

Table A1.1 Descriptions of gear used in Asian Carp Program's 2020 Early detection surveillance.

| Gear Type | Dimensions | Habitat | Standardized Effort | Notes |
|---|---|---|---|---|
| Boat Electrofishing | 6.4-7.3 m (21-24') boat; dual boom; Midwest Lake Infinity control box | Nearshore to offshore areas in 3.5 m of water or less. Low to moderate flow. Little to heavy vegetation coverage. All substrate types. | 600 seconds | |

| | | | | |
|---|---|---|---|---|
| Hoop Net | 1.5 m (5') diameter; 6.1 m (20') length; 2.5 cm (1") square mesh; treated; 2 funnels<br><br>0.91 m (3') diameter; 4.57 m (15') length; 2.5 cm (1") square mesh; 2 funnels | Deep (>3.5 m), fast flowing areas in mid-channel/ thalweg. Clay, silt and sand substrates.<br><br>Depth range: 1.5-3.5 m | 48 hours | |
| Mini Fyke Net | 3 mm (1/8") ace mesh; 0.61 m x 4.6 m (2'x15') lead; 0.61 m (2') seines; 0.61 m x 1.22 m (2'x4') box | Nearshore, shallow areas (<2 m of water). Low or no flow; back-bays and still shorelines. Little to heavy vegetation coverage. Clay, silt, sand and cobble substrates. | 24 hours | Turtle exclusion netting added |
| Seine Net (bag) | 6.3 mm (1/4") bag mesh; 6.3 mm (1/4") wing mesh; 9.1 m (30') length | Nearshore, wadeable areas up to 1.5 m in depth. Low to moderate flow. Little to moderate vegetation. Clay, silt, sand, cobble and bedrock substrates. | 3 hauls | |
| Trammel Net | **Trammel Net**<br>10.1 cm (4") mesh; 4.3 m (14') height; 183 m (200 yd) long; 10.1 cm (4") square inner wall panels; 45.7 cm (18") outer wall panels | Nearshore areas up to 5 m in depth. Low or no flow. Little to moderate vegetation. All substrate types. Set near coarse woody debris recommended. | 20 minutes | Site is disturbed by pounding the water, revving the engine, or with electrofishing to drive fish to net |

| | | | | |
|---|---|---|---|---|
| Trap Net | 2.9 cm (1-1/8") square mesh, 5.7 cm (2-1/4") stretch mesh; 1.2 m wide x 2.4 m long x 1.2 m deep (4’ x 8’ x 4’) crib; 3 m wings; 25 m lead. | Nearshore areas up to 2.5 m in depth. Low or no flow. Little to heavy vegetation coverage. All substrate types. | 24 hours | |
| Bongo Net | 50 cm diameter ring openings; 2 m long conical nets; 500 micron mesh; 11 cm cod-ends | Slightly offshore to mid-channel, >1 m in depth. Low to moderate flow. Little vegetation coverage. All substrate types. | 180 seconds | Flow is recorded to calculate discharge; 0.4-0.6 m/s target velocity during tow |

# APPENDIX 2: MAPS OF ASIAN CARP SURVEILLANCE LOCATIONS

Table A2.1 Overview of site map label abbreviations.

| Gear type | Abbreviation |
|---|---|
| Boat Electrofishing | BEF |
| Mini Fkye Net | MFN |
| Trammel Net | TRM |
| Hoop Net | HN |
| Trap Net | TN |
| Seine Net | SN |

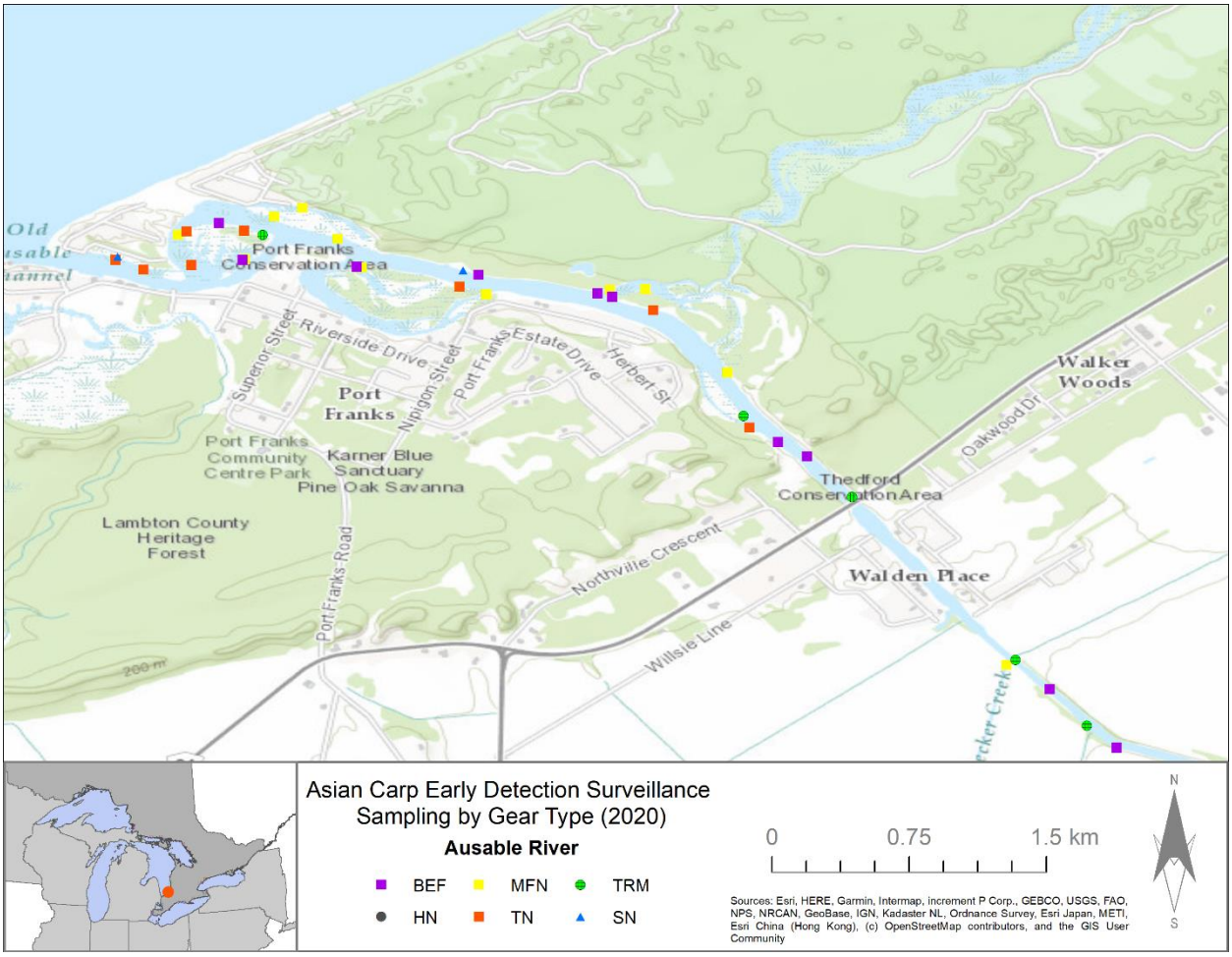


Figure A2.1 2020 Asian Carp Program Early detection surveillance field sites in the Ausable River.

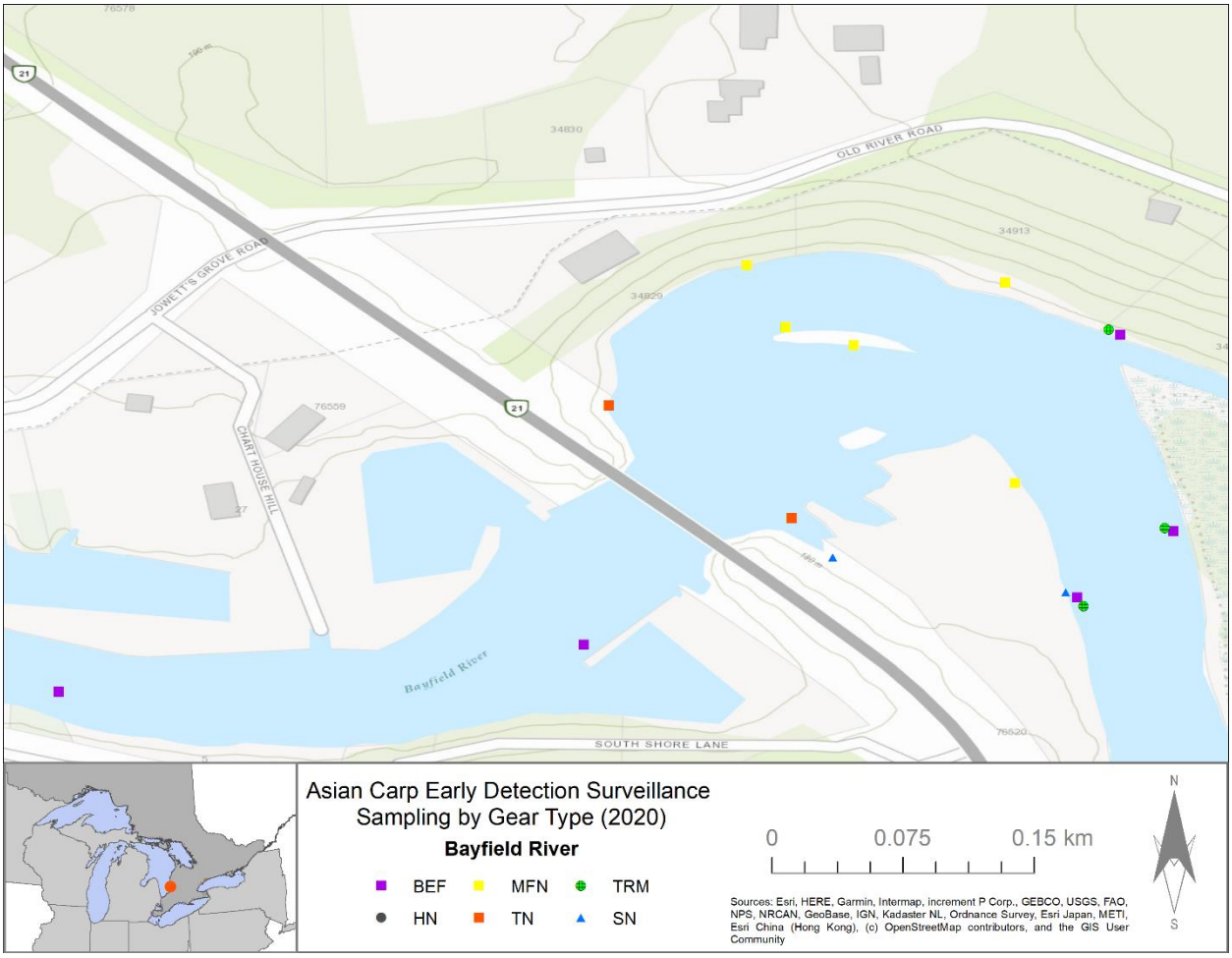


Figure A2.2 2020 Asian Carp Program Early detection surveillance field sites in the Bayfield River.

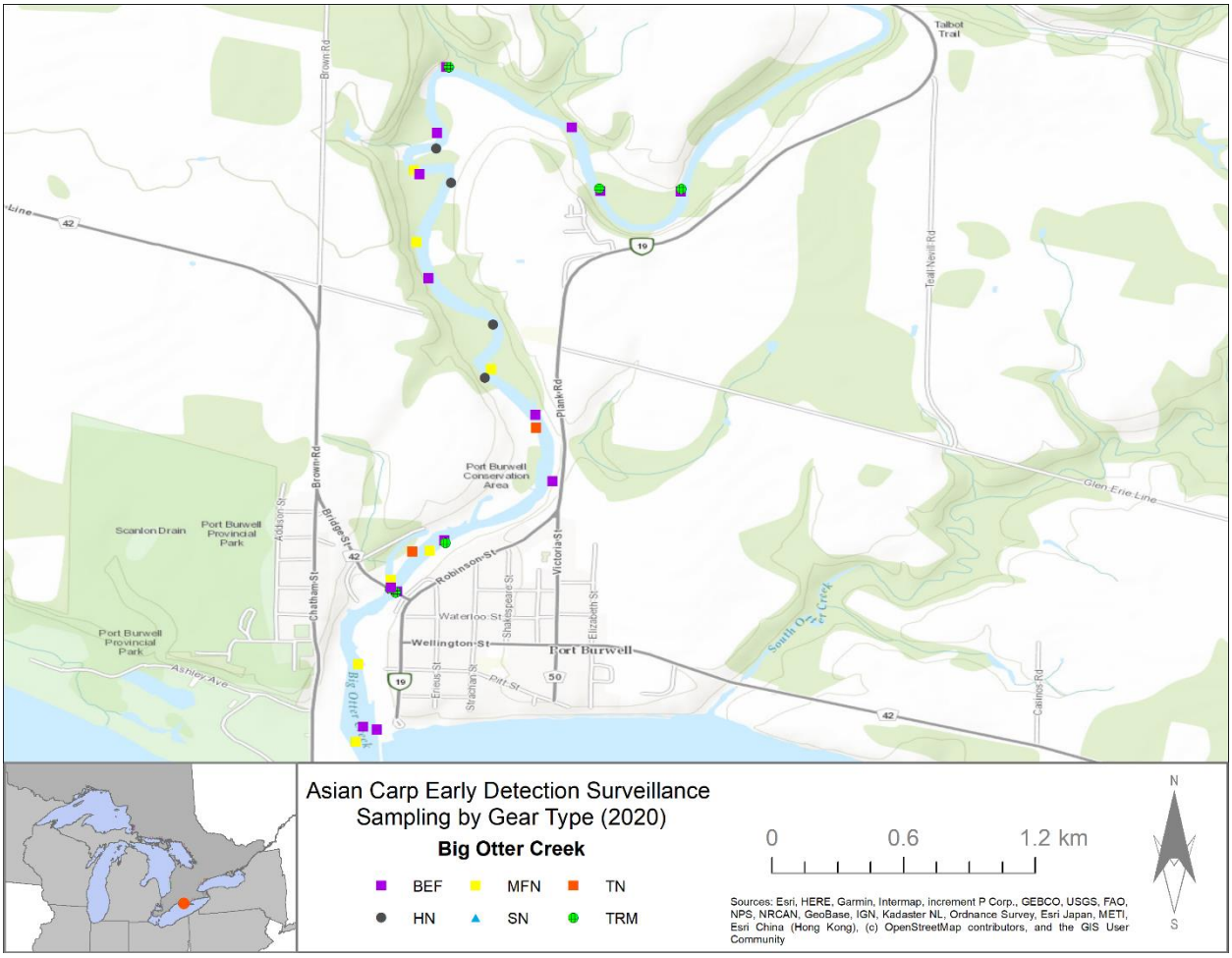


Figure A2.3 2020 Asian Carp Program Early detection surveillance field sites in Big Otter Creek.

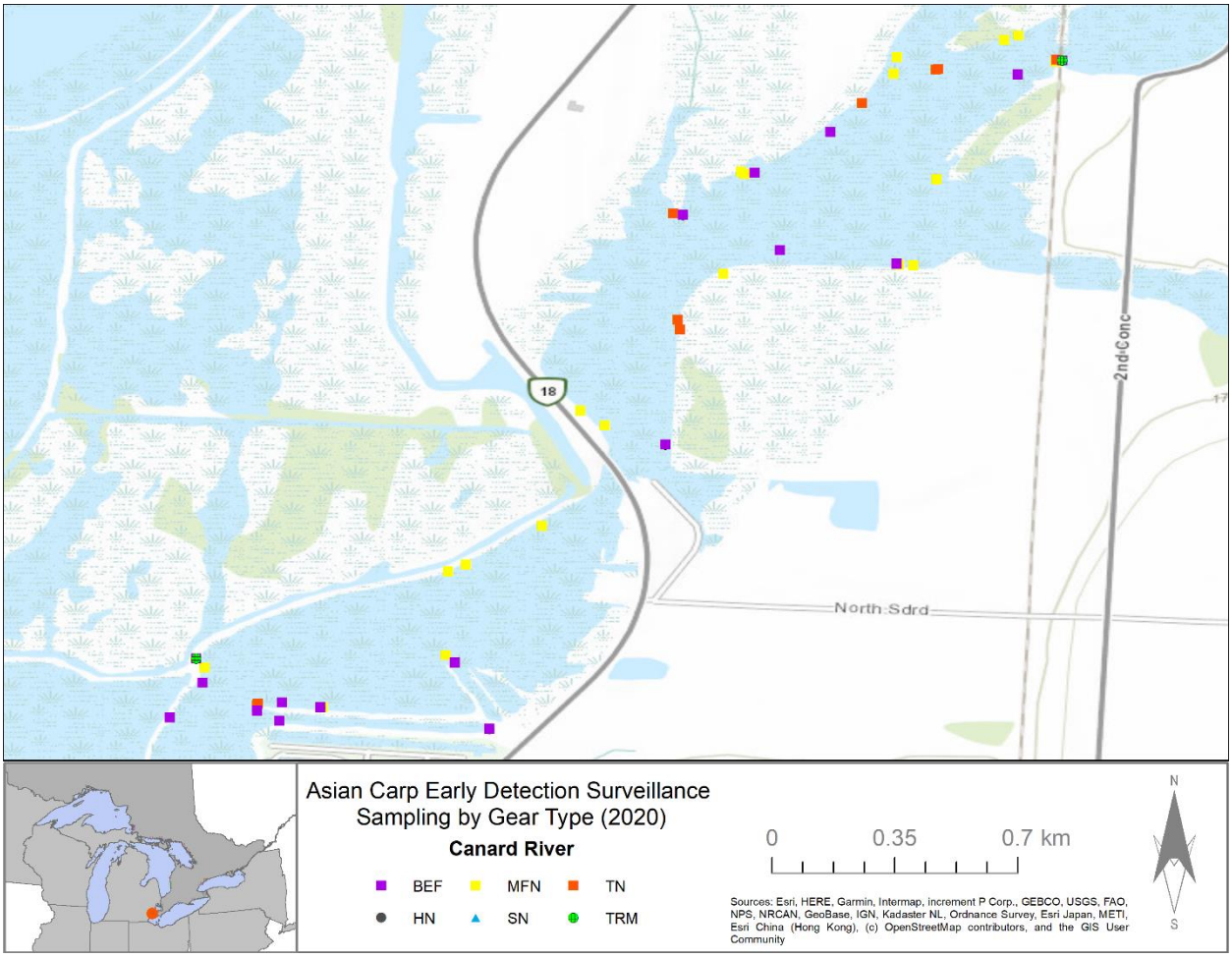


Figure A2.4 2020 Asian Carp Program Early detection surveillance field sites in the Canard River.

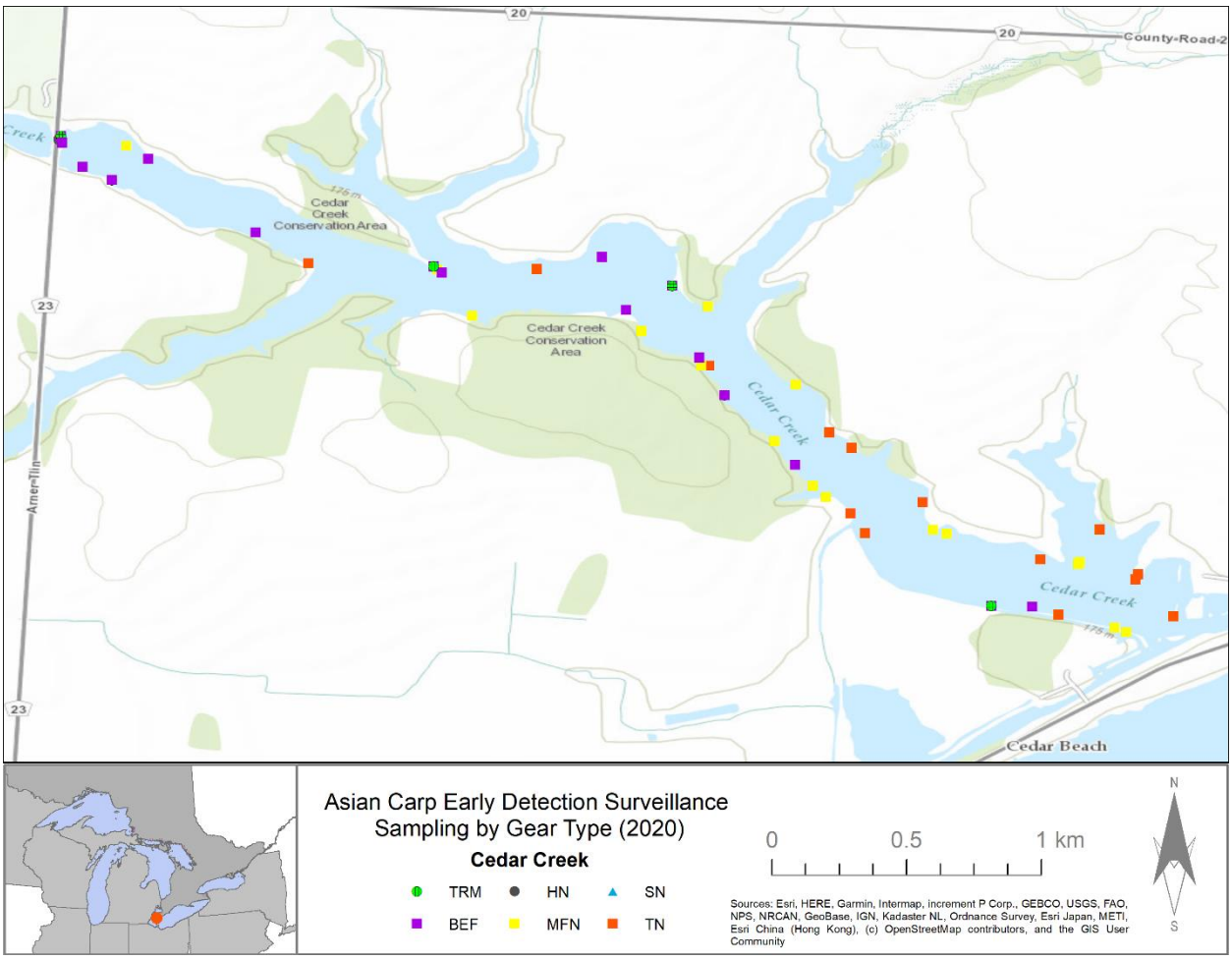


Figure A2.5 2020 Asian Carp Program Early detection surveillance field sites in Cedar Creek.

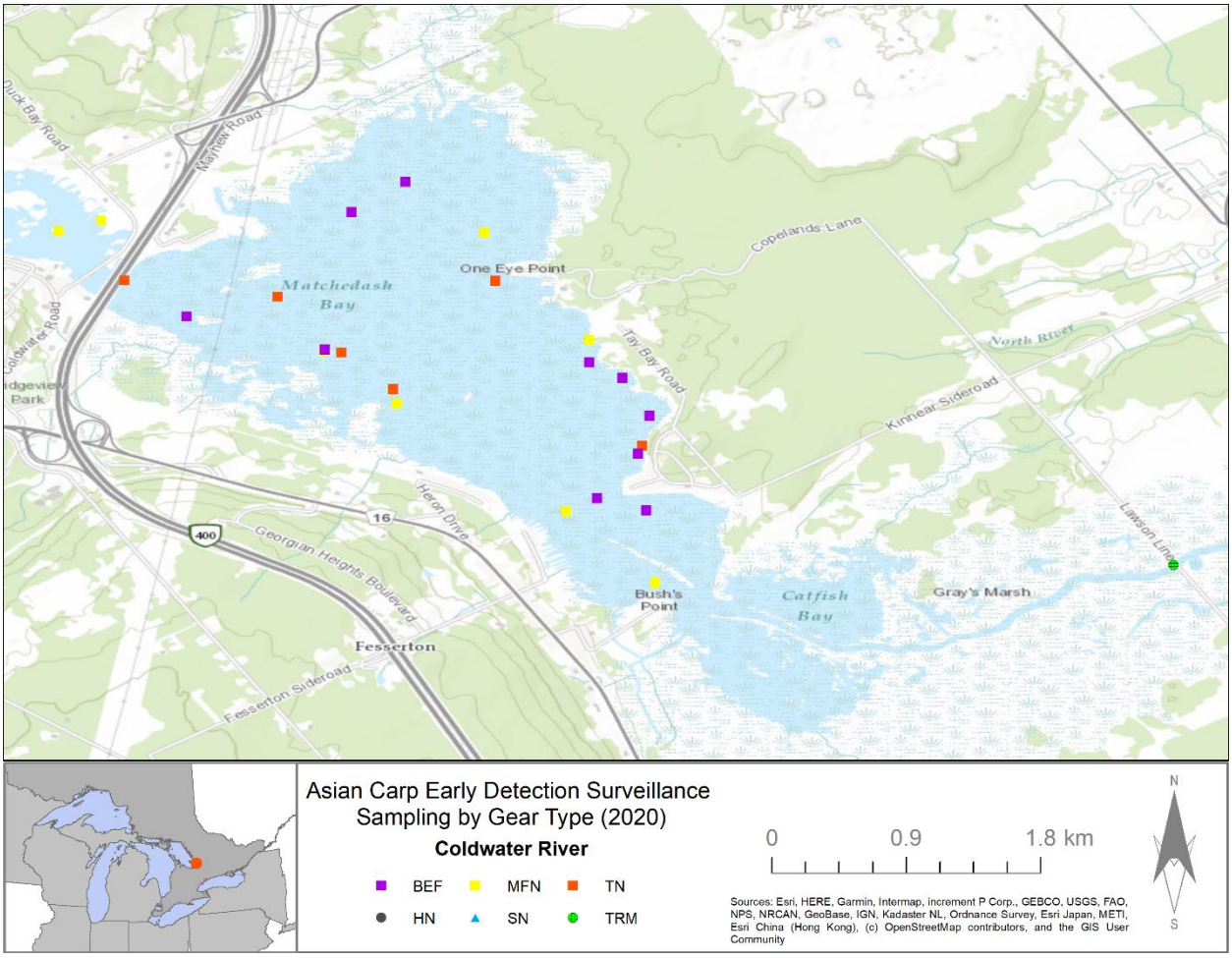


Figure A2.6 2020 Asian Carp Program Early detection surveillance field sites in the Coldwater River.

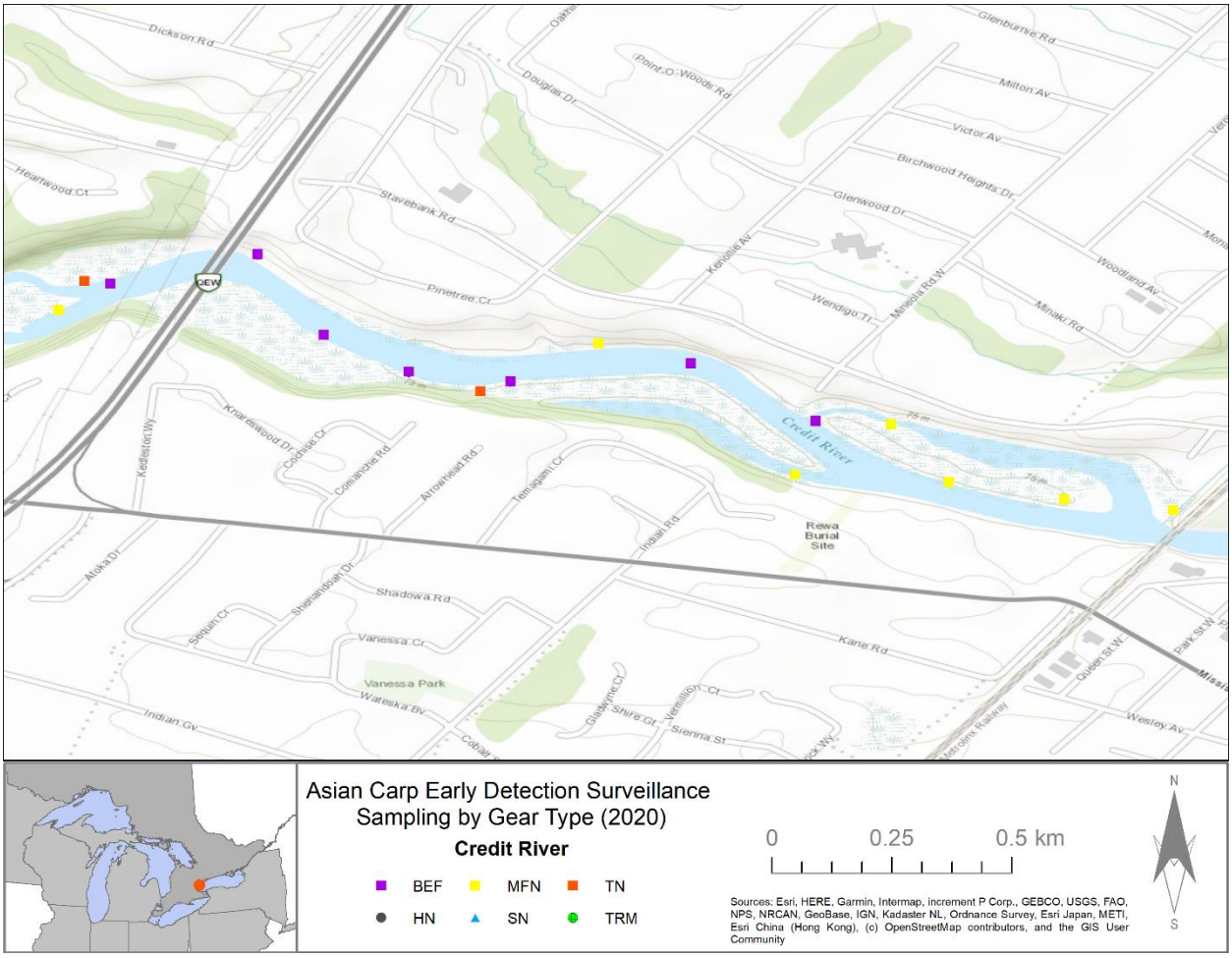


Figure A2.7 2020 Asian Carp Program Early detection surveillance field sites in the Credit River.

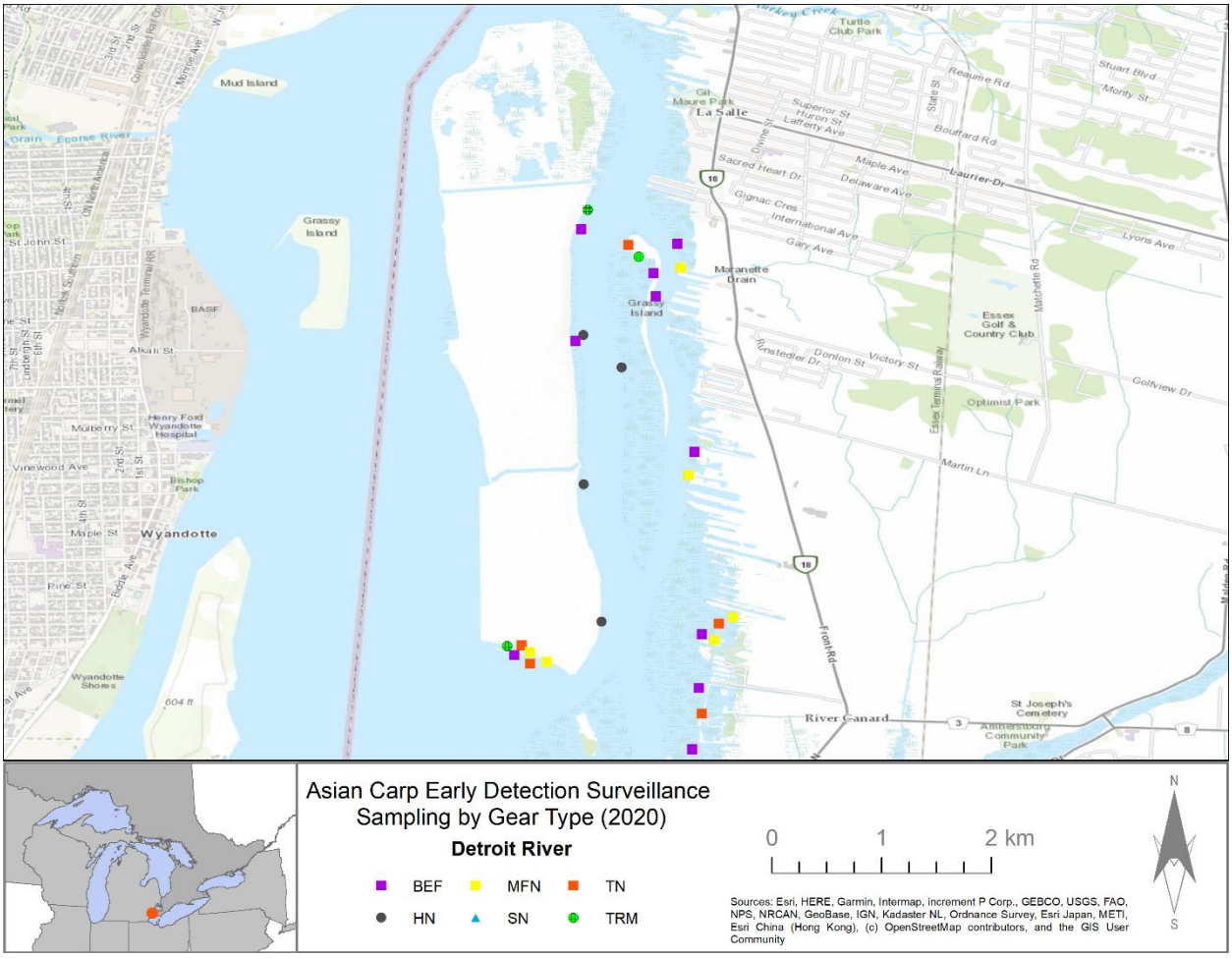


Figure A2.8 2020 Asian Carp Program Early detection surveillance field sites in the Detroit River.

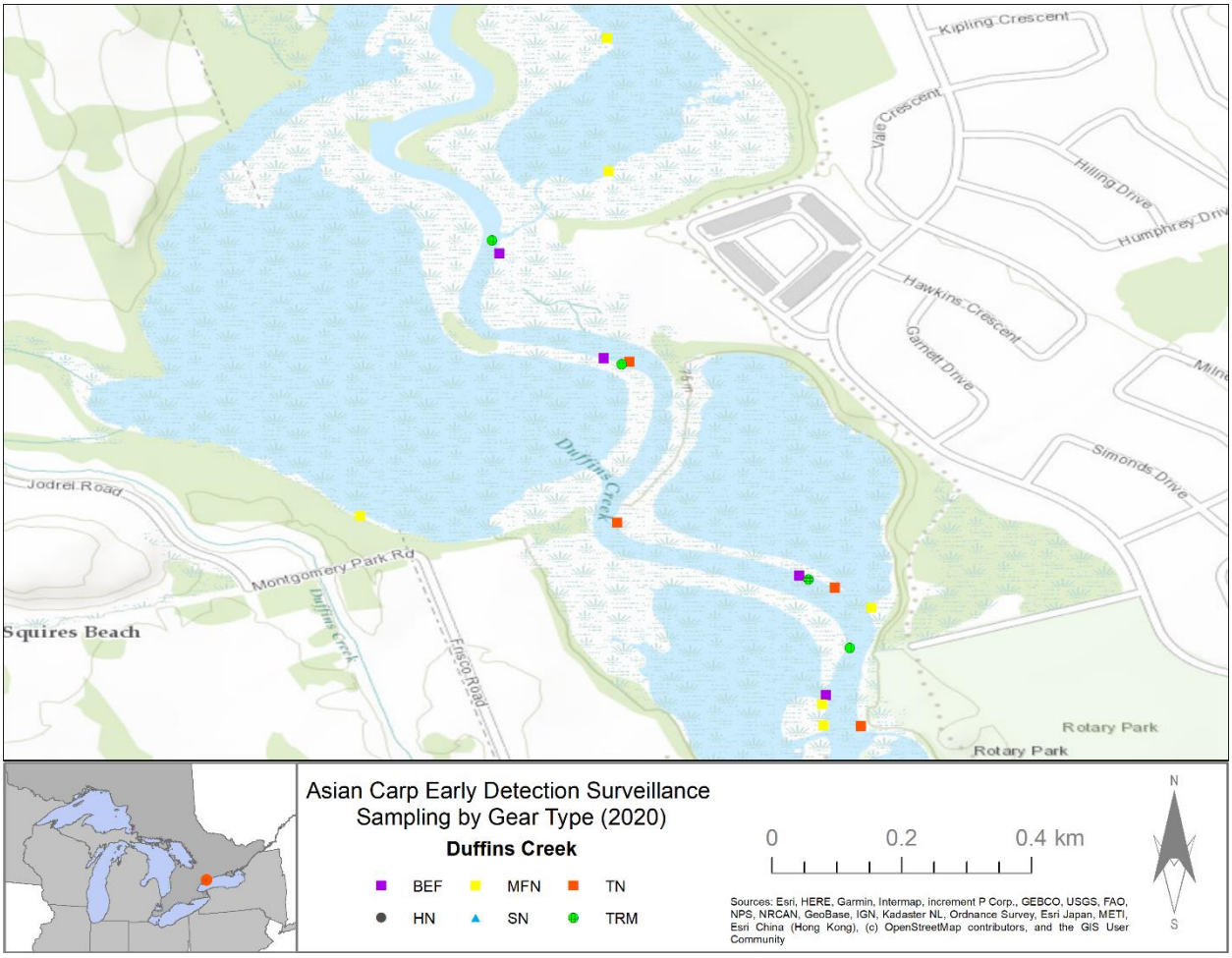


Figure A2.9 2020 Asian Carp Program Early detection surveillance field sites in Duffins Creek.

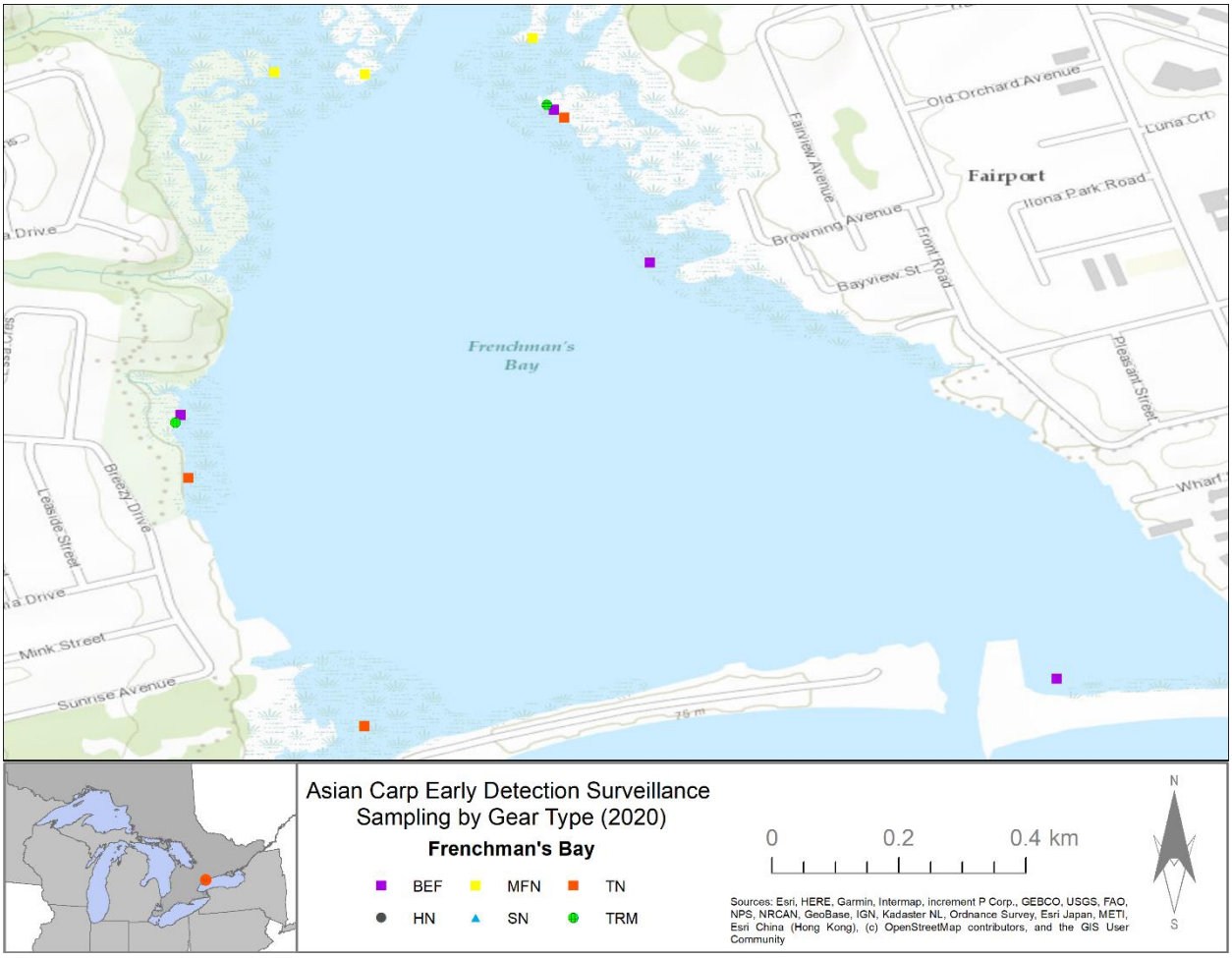


Figure A2.10 2020 Asian Carp Program Early detection surveillance field sites in Frenchman's Bay.

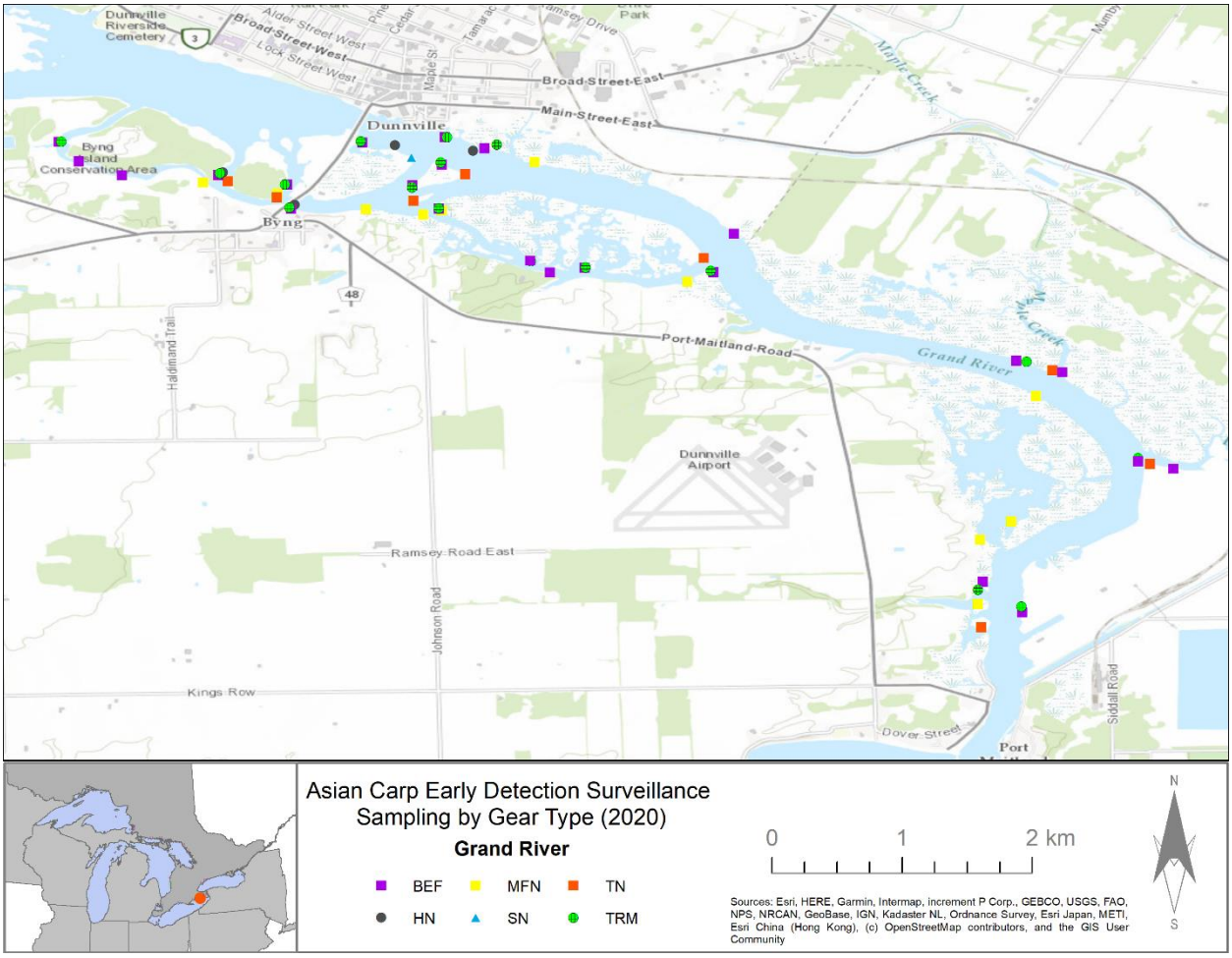


Figure A2.11 2020 Asian Carp Program Early detection surveillance field sites in the Grand River.

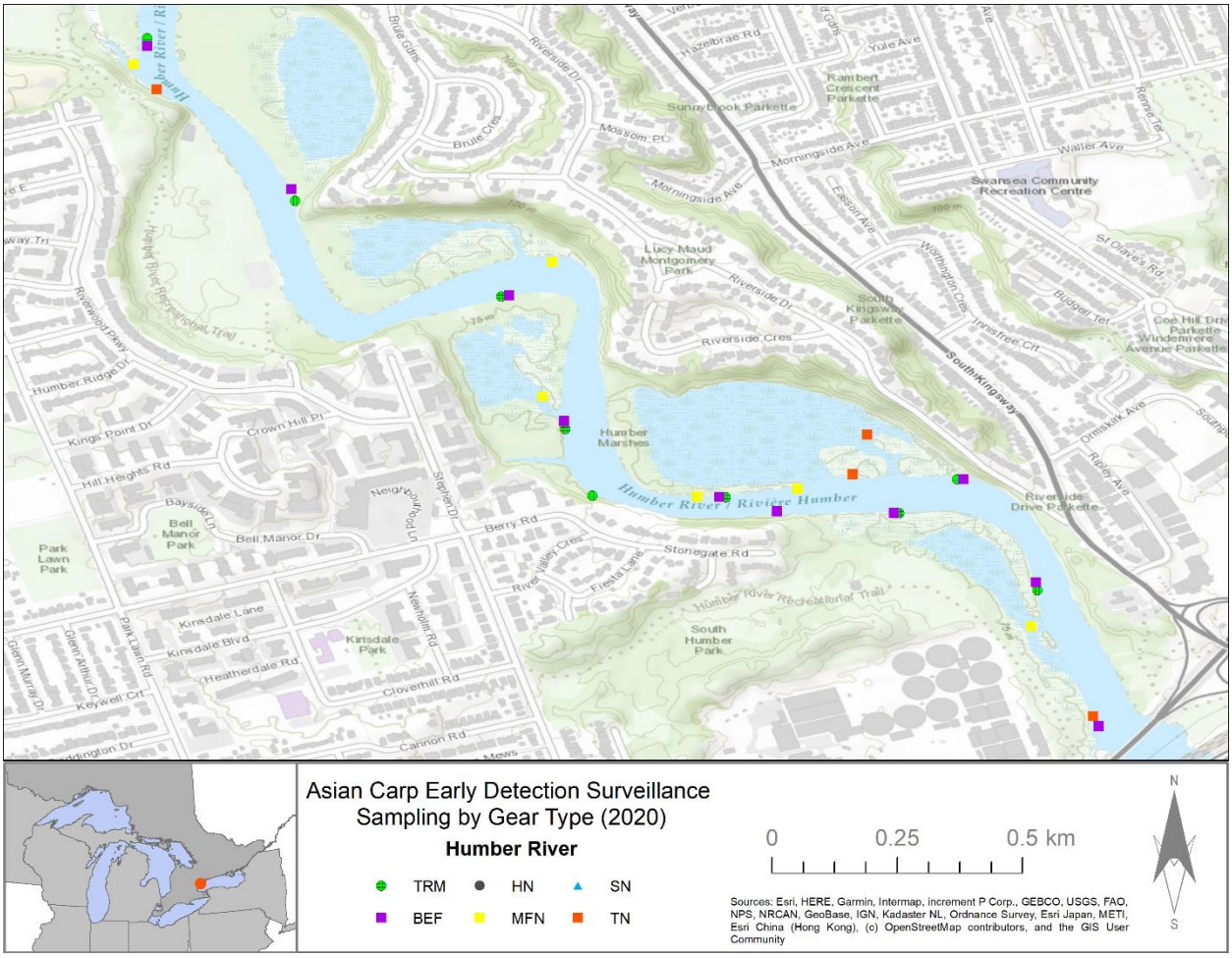


Figure A2.12 2020 Asian Carp Program Early detection surveillance field sites in the Humber River.

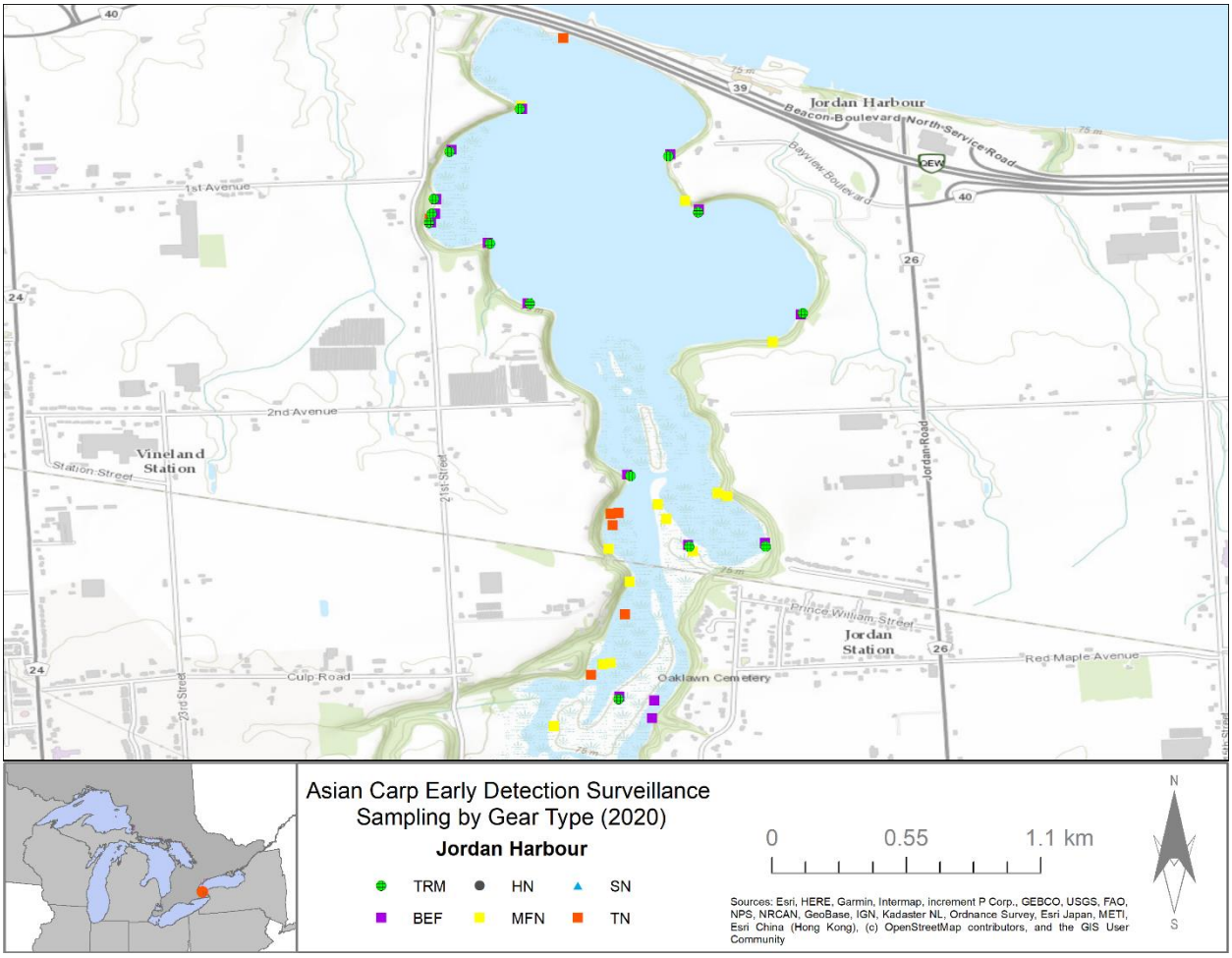


Figure A2.13 2020 Asian Carp Program Early detection surveillance field sites in Jordan Harbour.

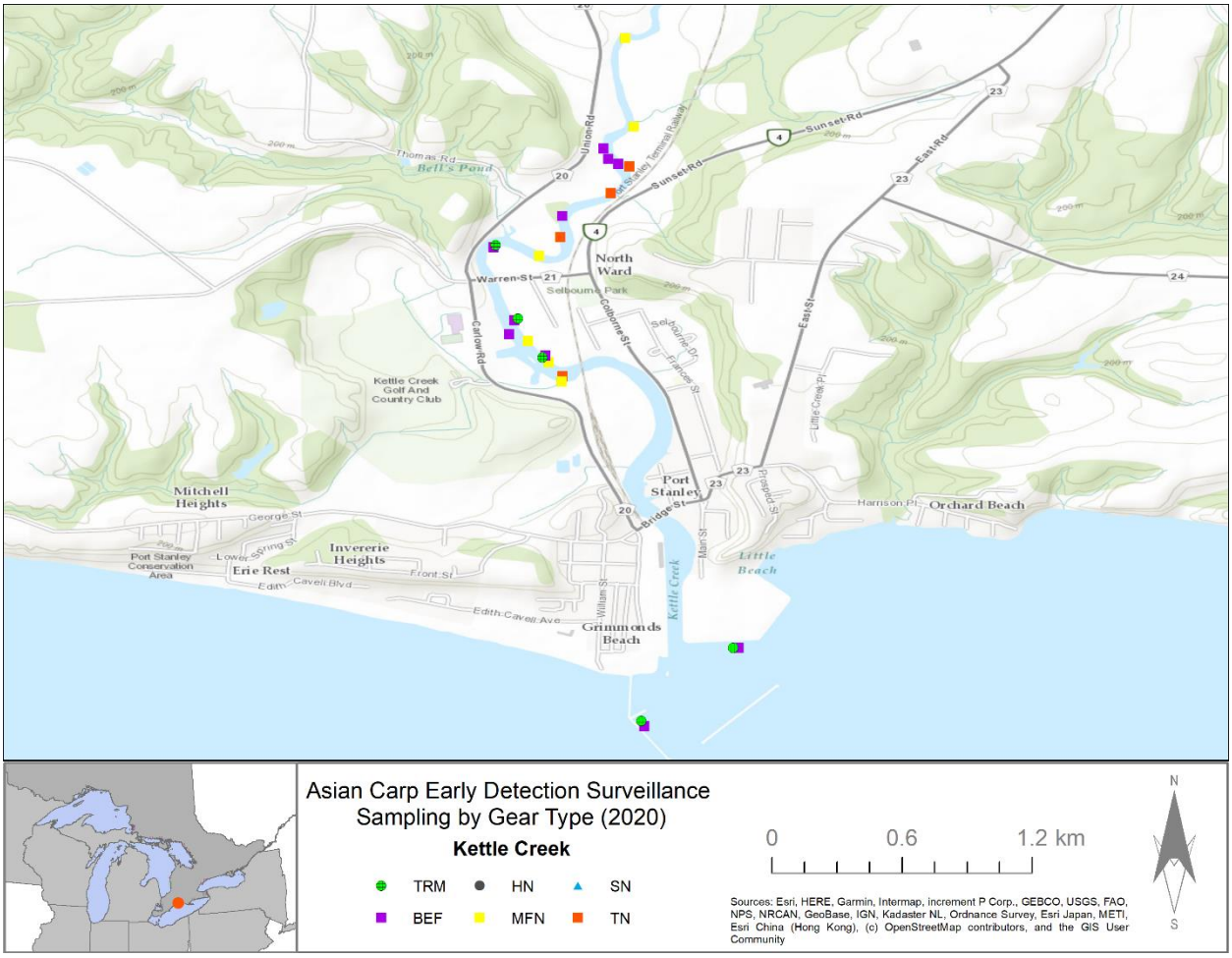


Figure A2.14 2020 Asian Carp Program Early detection surveillance field sites in Kettle Creek.

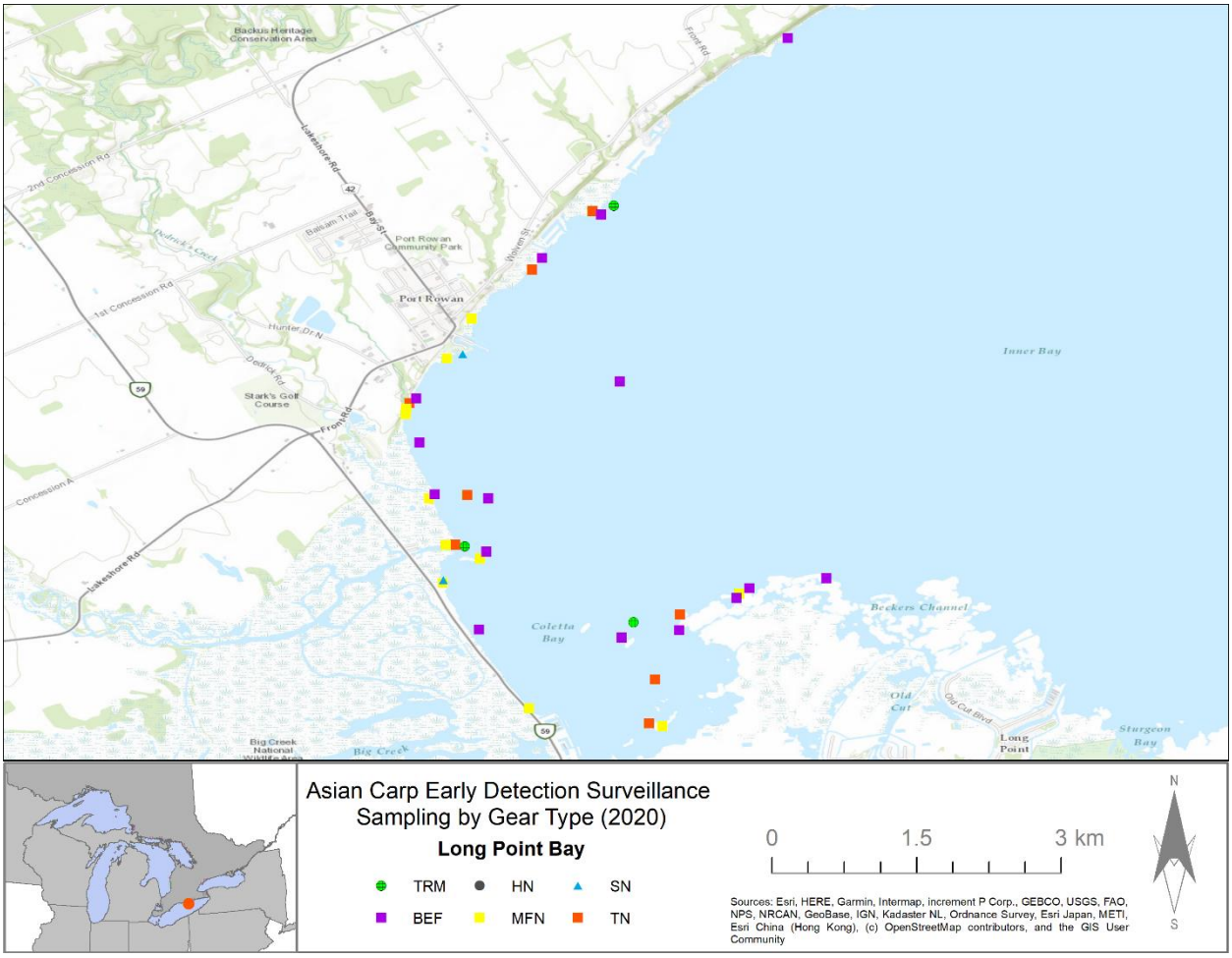


Figure A2.15 2020 Asian Carp Program Early detection surveillance field sites in Long Point Bay.

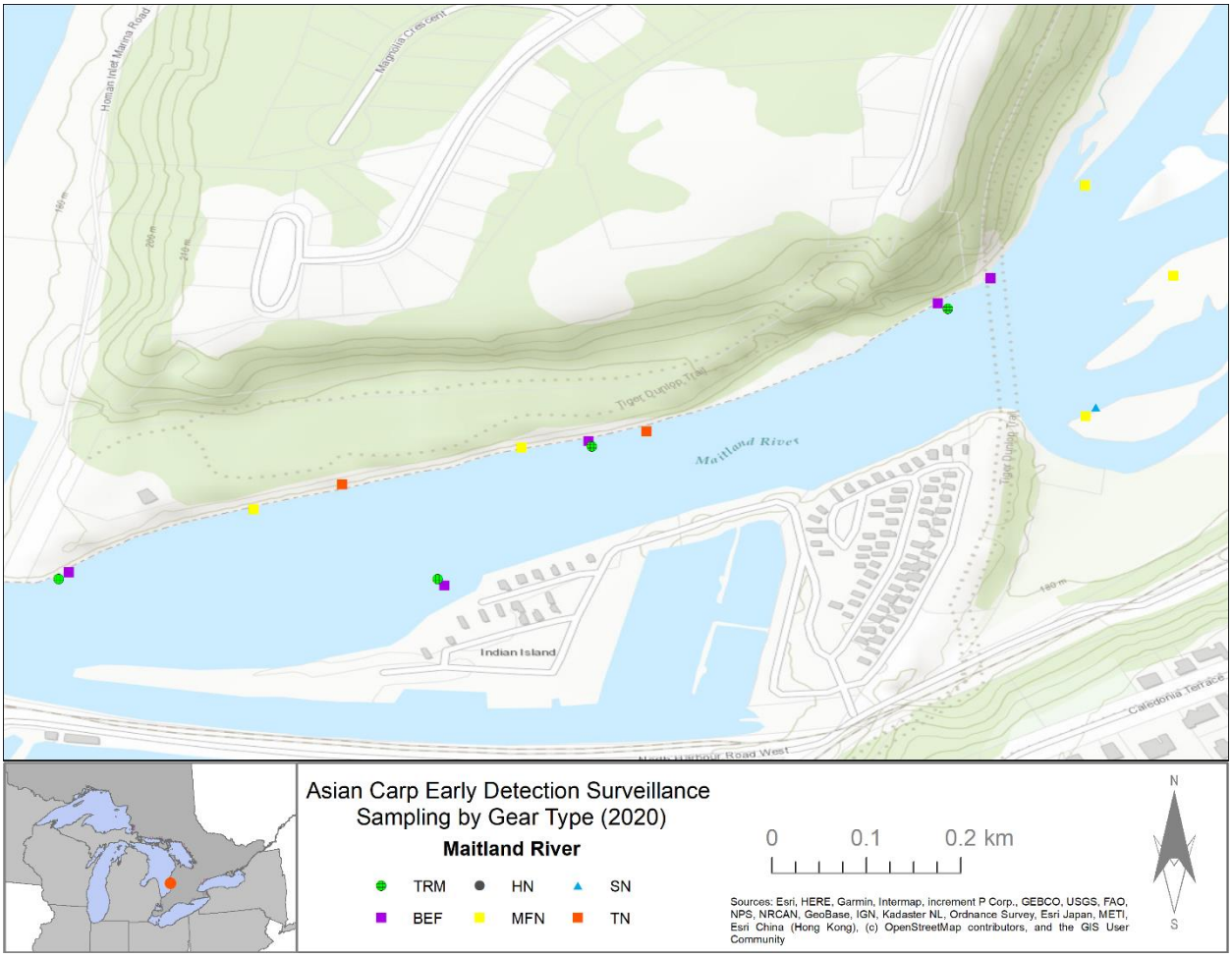


Figure A2.16 2020 Asian Carp Program Early detection surveillance field sites in the Maitland River.

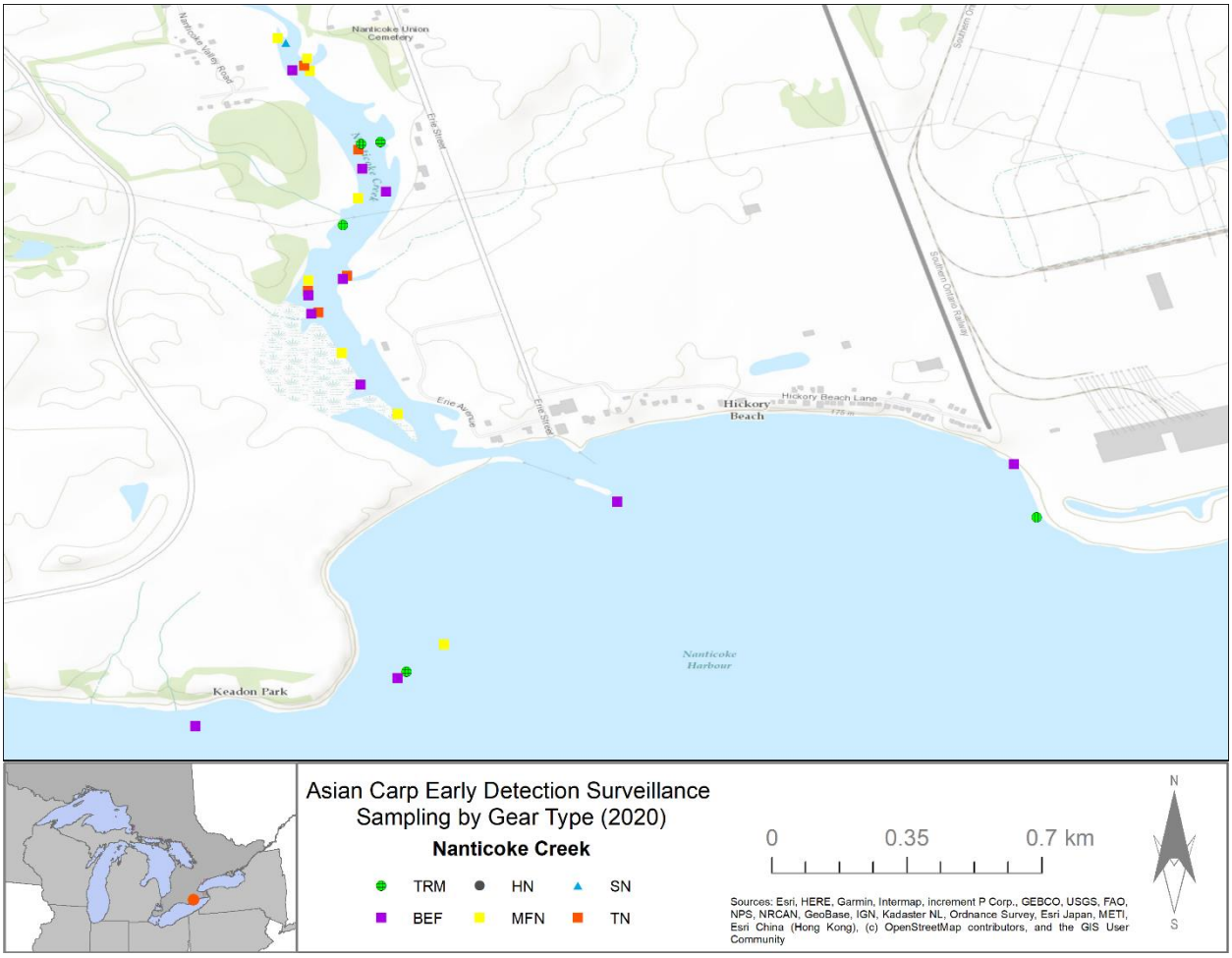


Figure A2.17 2020 Asian Carp Program Early detection surveillance field sites in Nanticoke Creek.

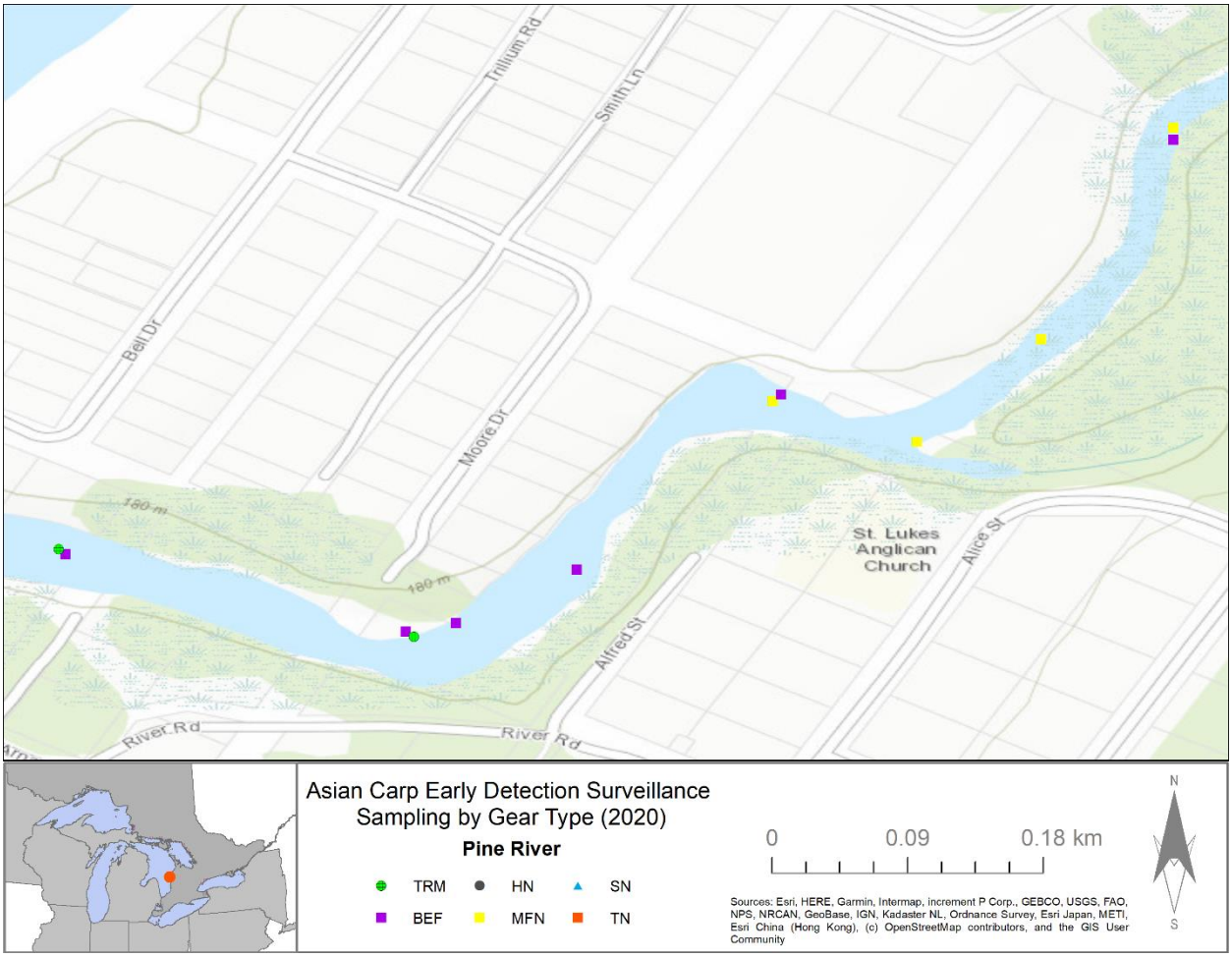


Figure A2.18 2020 Asian Carp Program Early detection surveillance field sites in the Pine River.

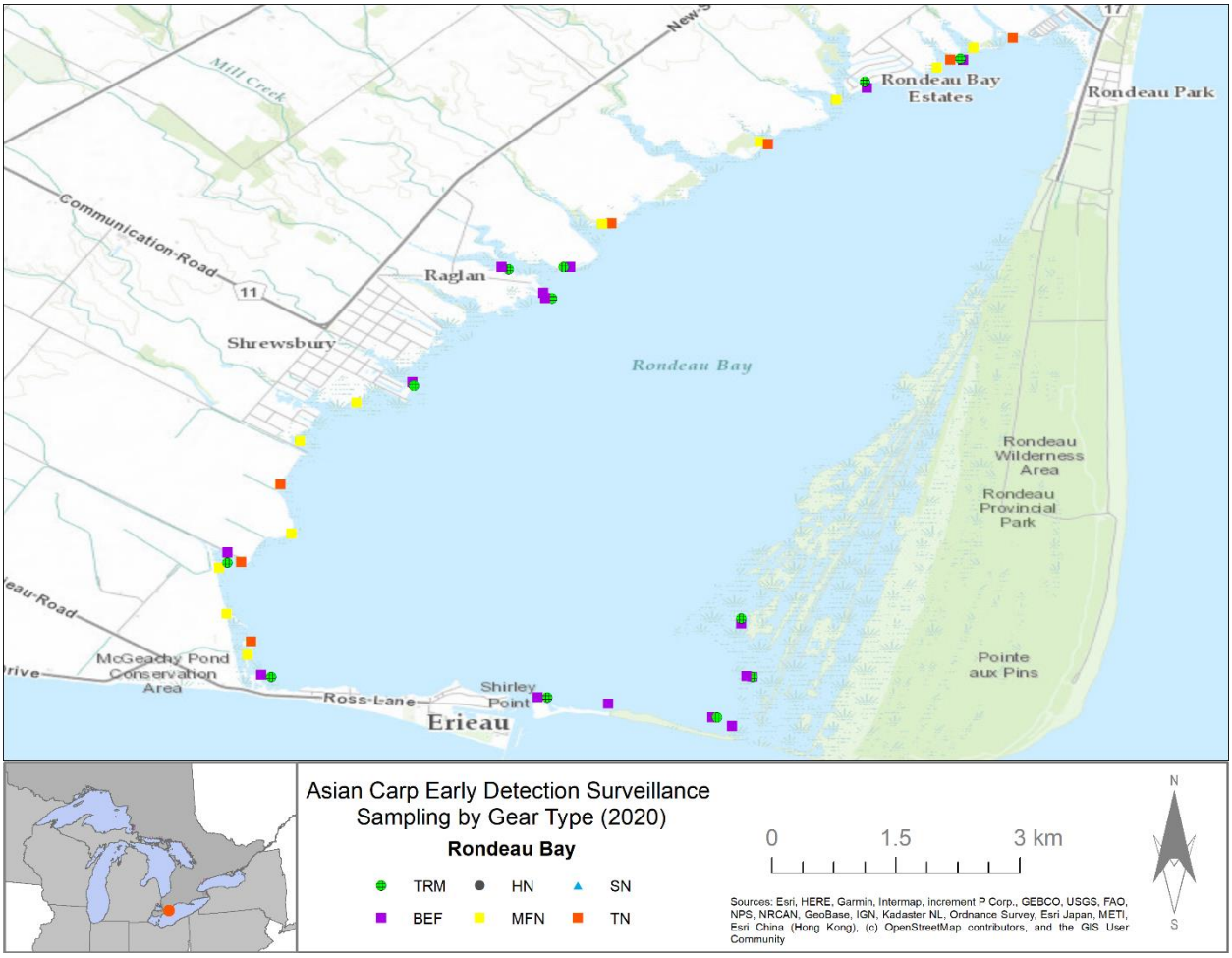


Figure A2.19 2020 Asian Carp Program Early detection surveillance field sites in Rondeau Bay.

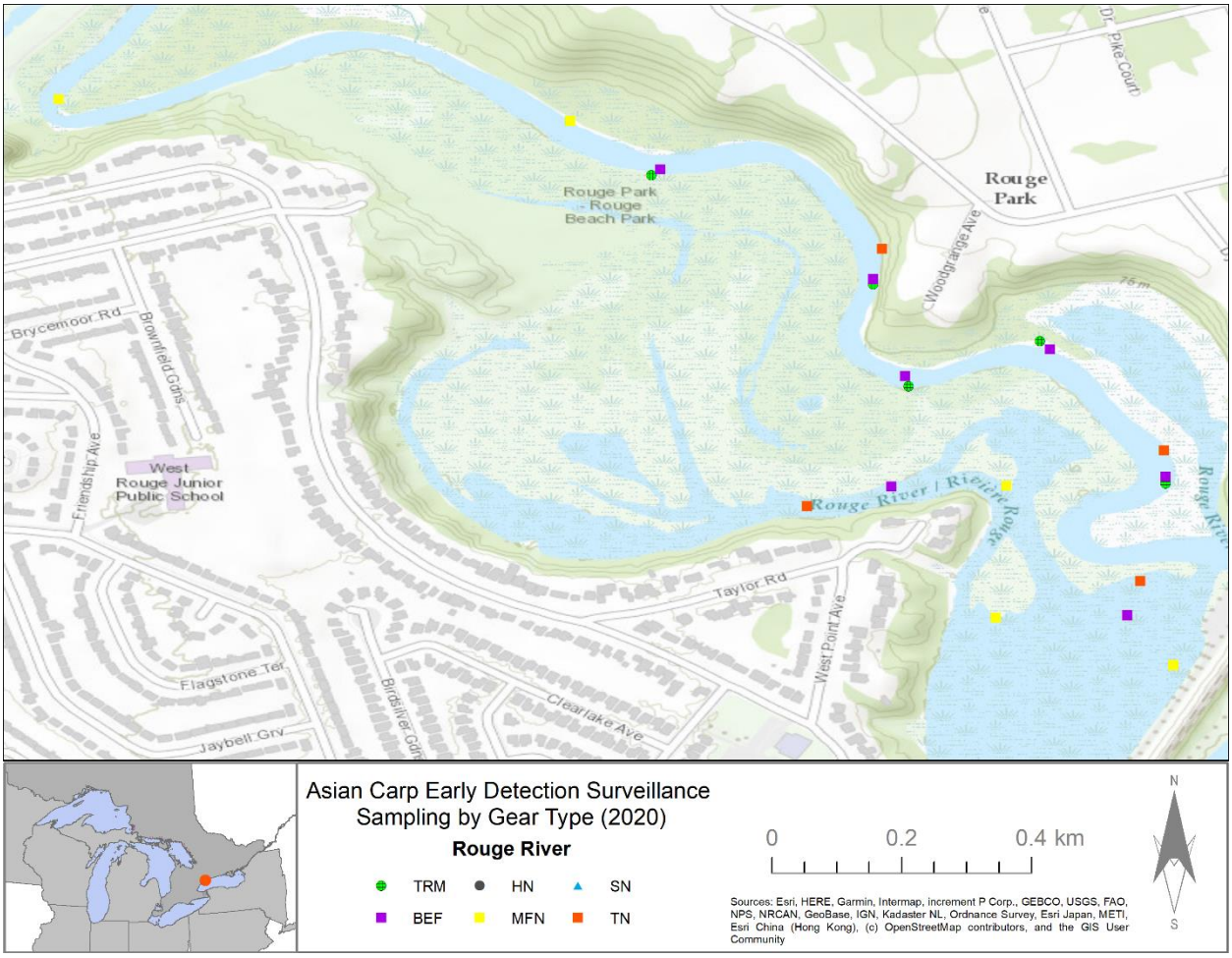


Figure A2.20 2020 Asian Carp Program Early detection surveillance field sites in the Rouge River.

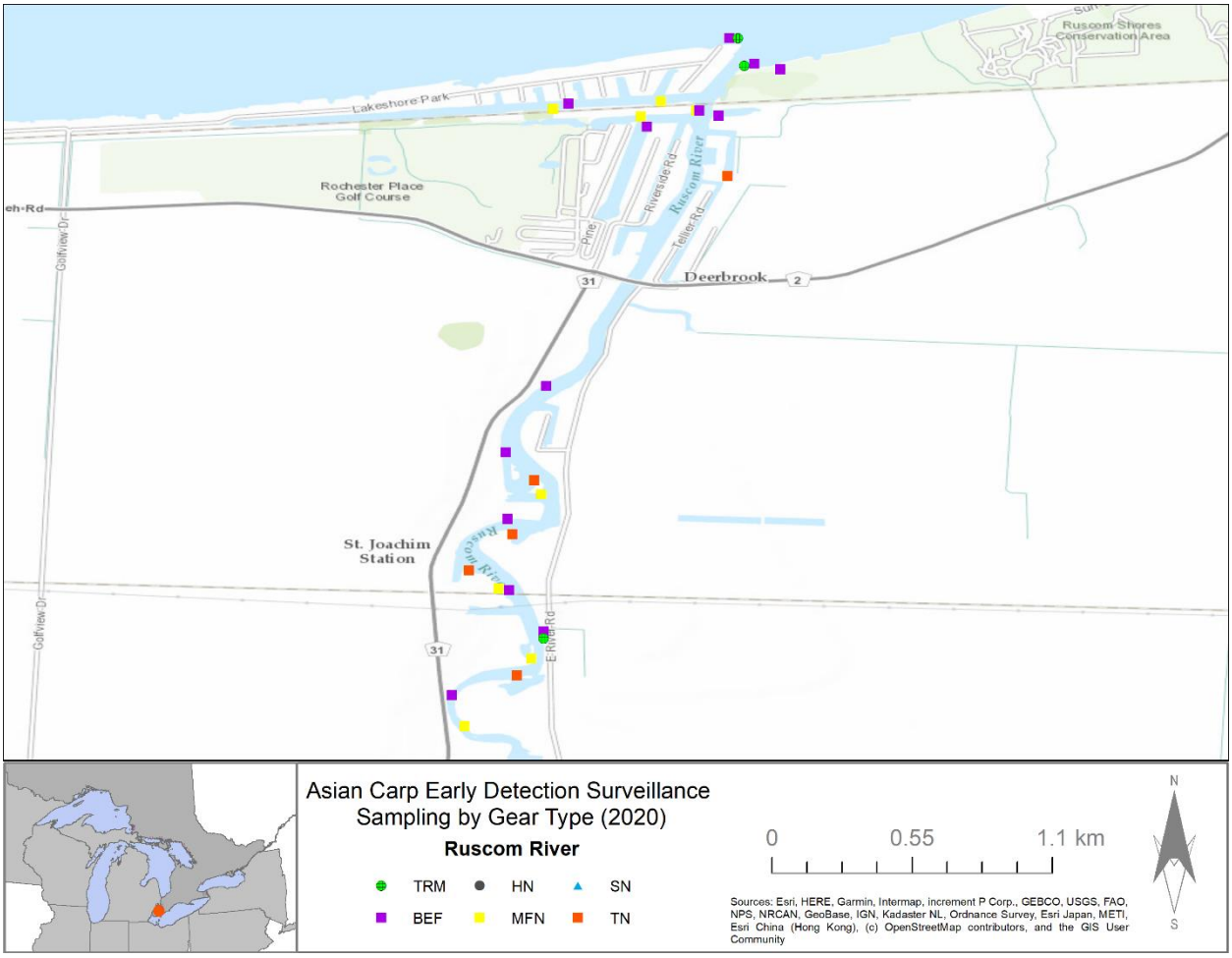


Figure A2.21 2020 Asian Carp Program Early detection surveillance field sites in the Ruscom River.

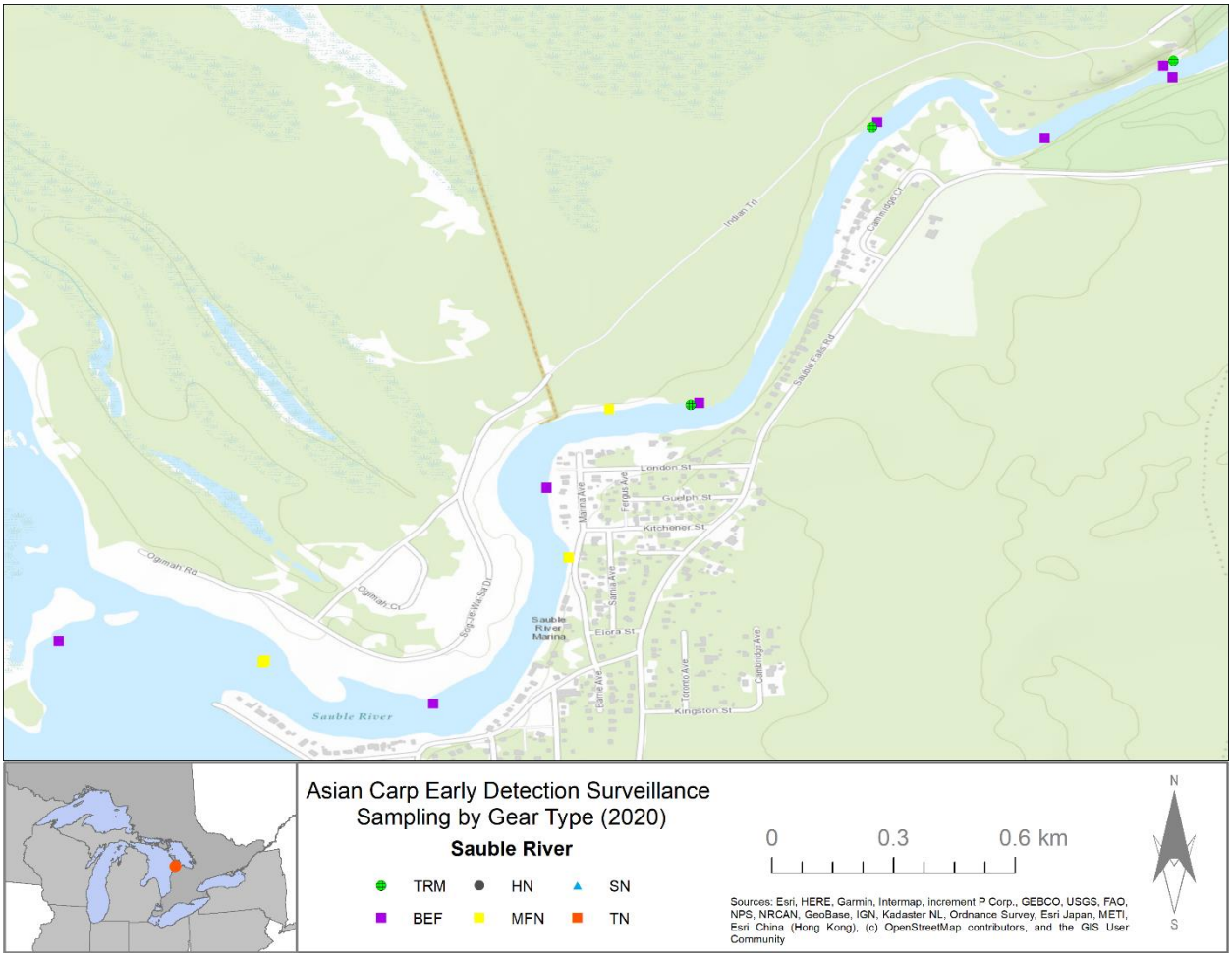


Figure A2.22 2020 Asian Carp Program Early detection surveillance field sites in the Sauble River.

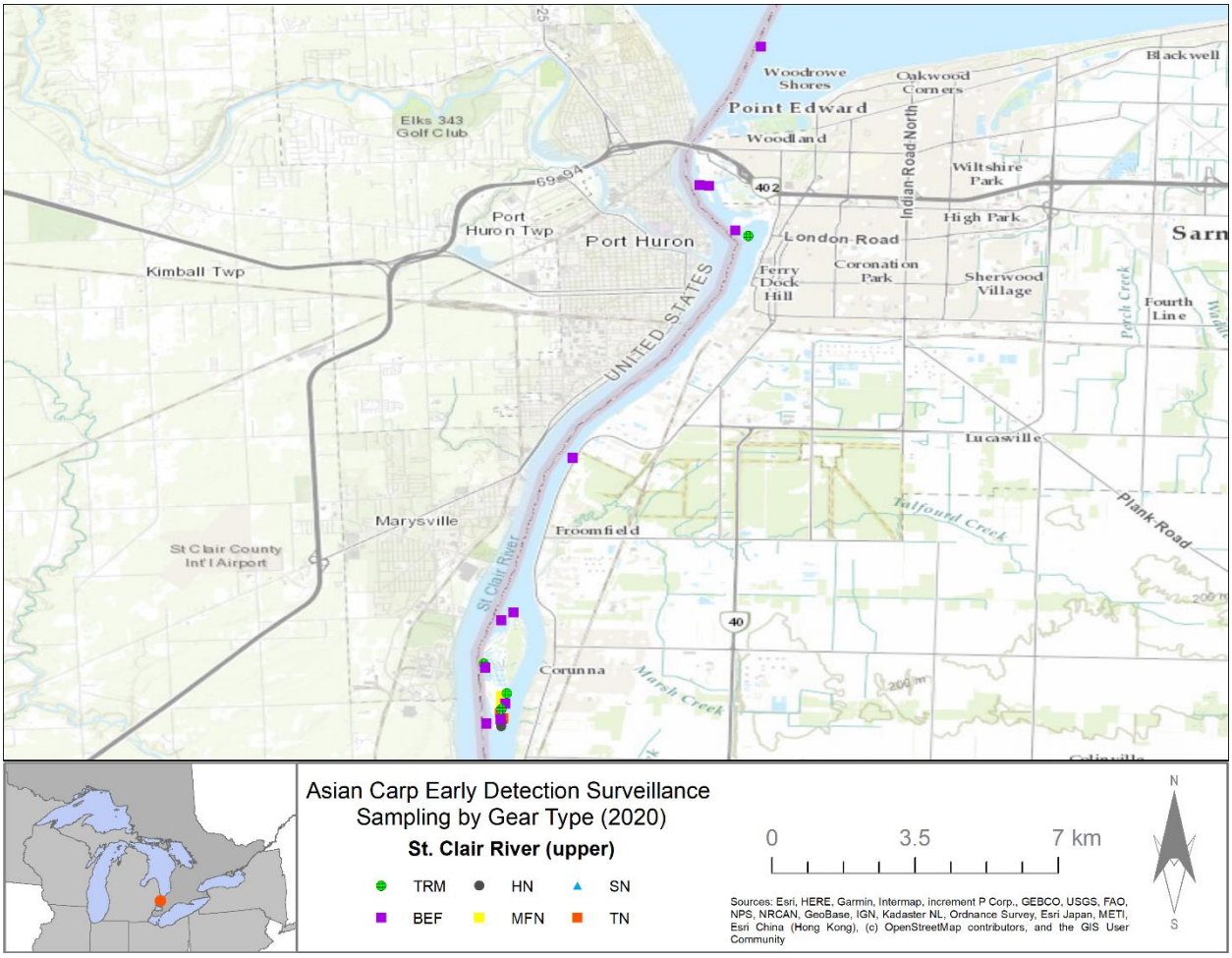


Figure A2.23 2020 Asian Carp Program Early detection surveillance field sites in the upper St. Clair River.

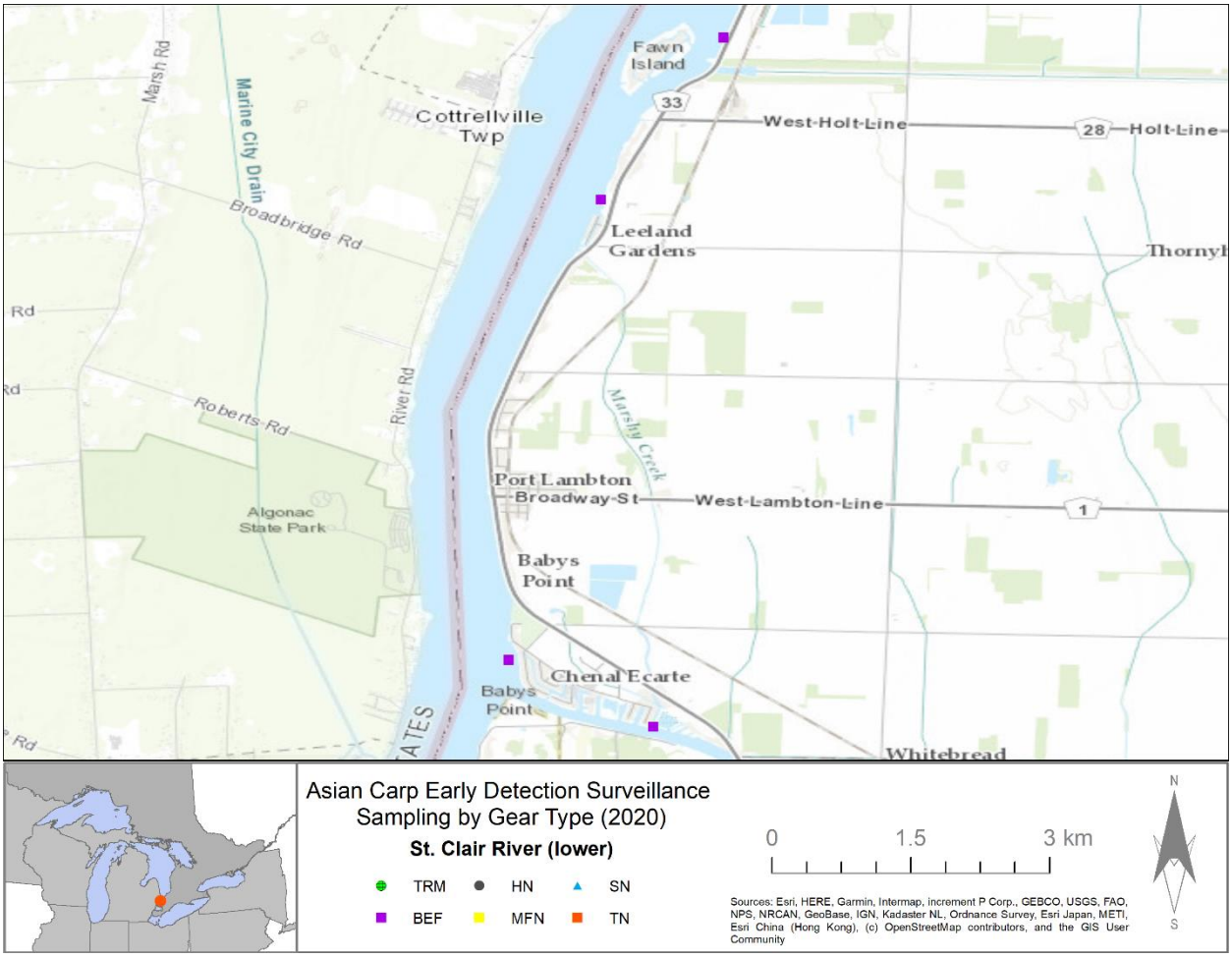


Figure A2.24 2020 Asian Carp Program Early detection surveillance field sites in the lower St. Clair River.

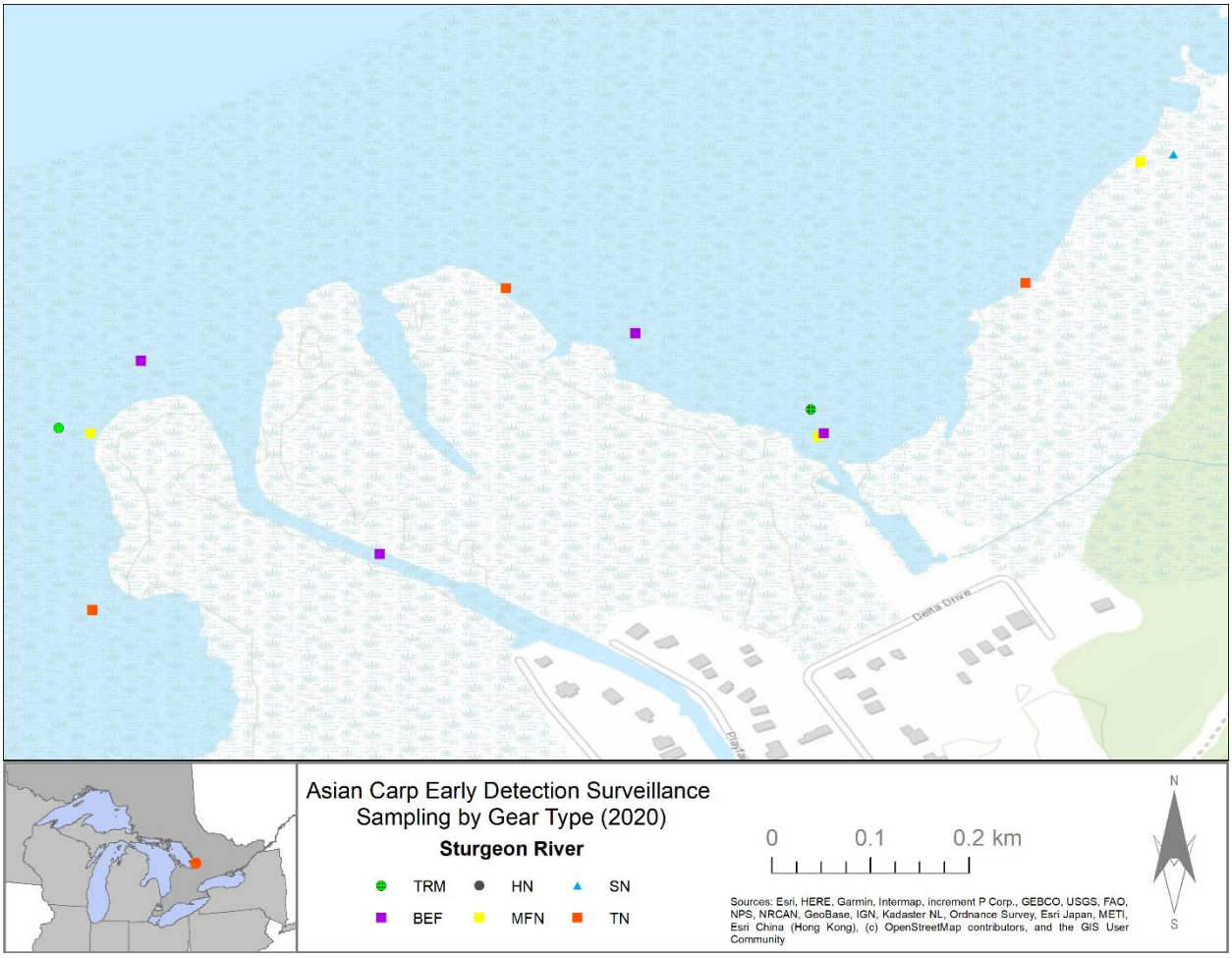


Figure A2.25 2020 Asian Carp Program Early detection surveillance field sites in the Sturgeon River.

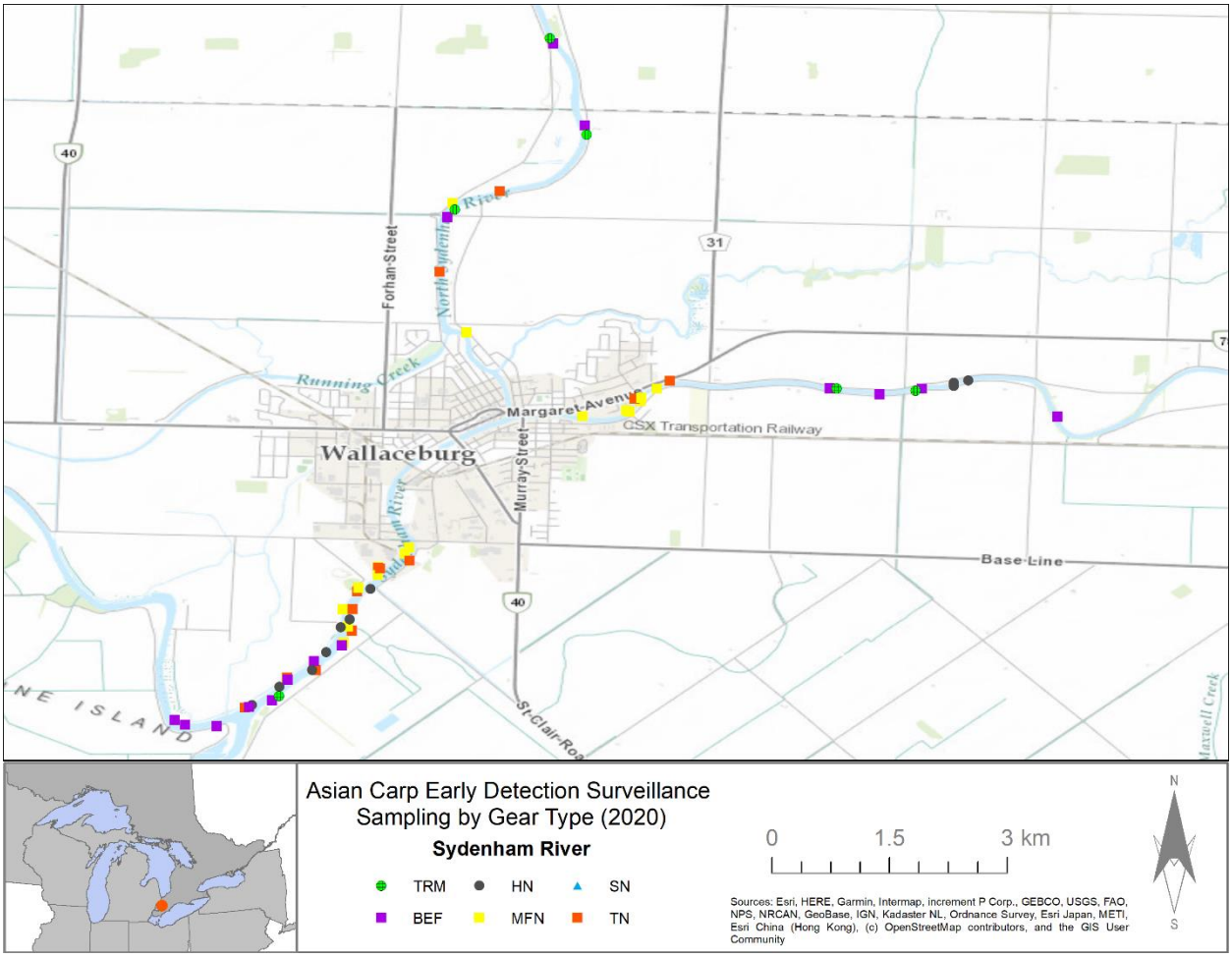


Figure A2.26 2020 Asian Carp Program Early detection surveillance field sites in the Sydenham River.

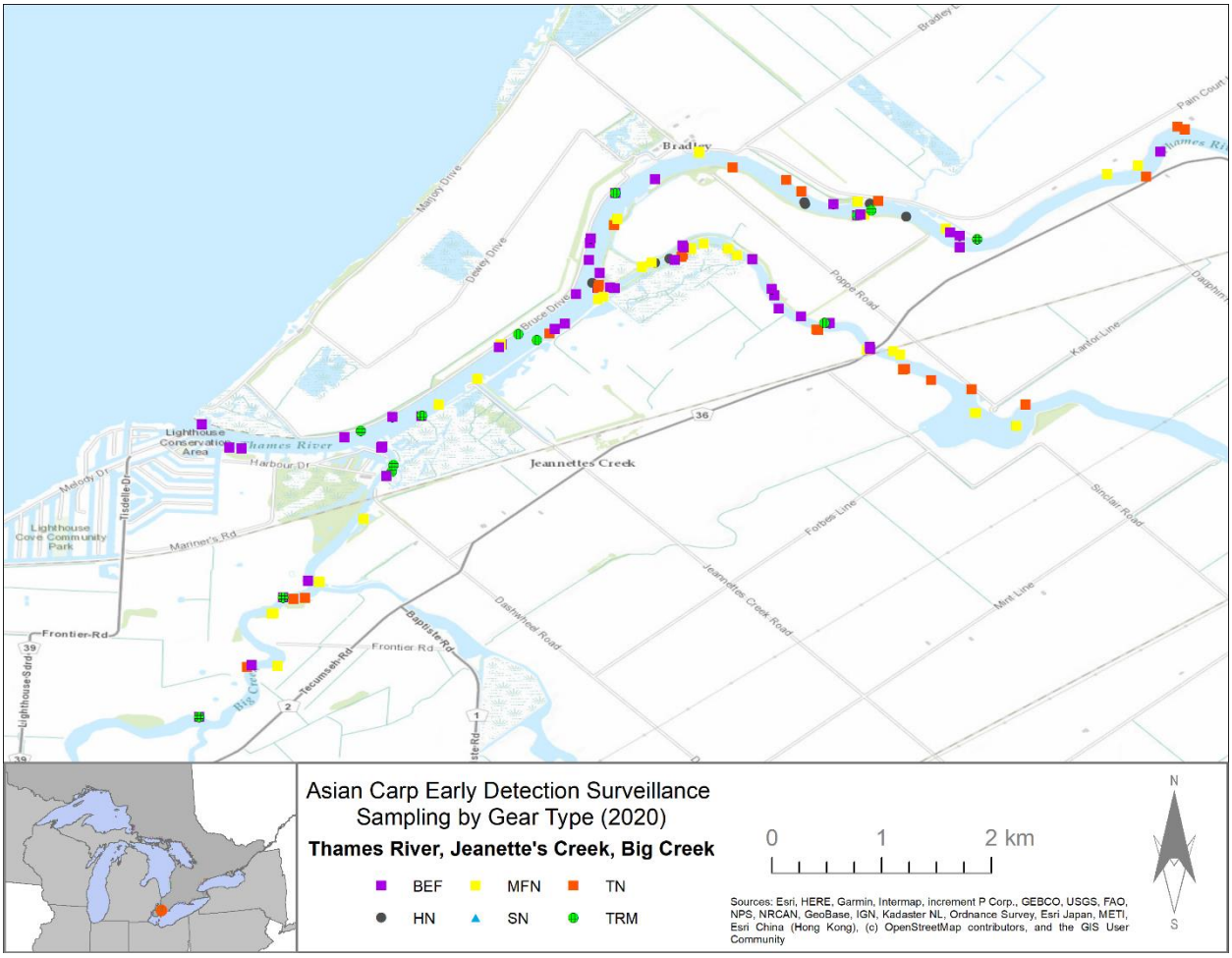


Figure A2.27 2020 Asian Carp Program Early detection surveillance field sites in the Thames River, Jeanette's Creek, and Big Creek.

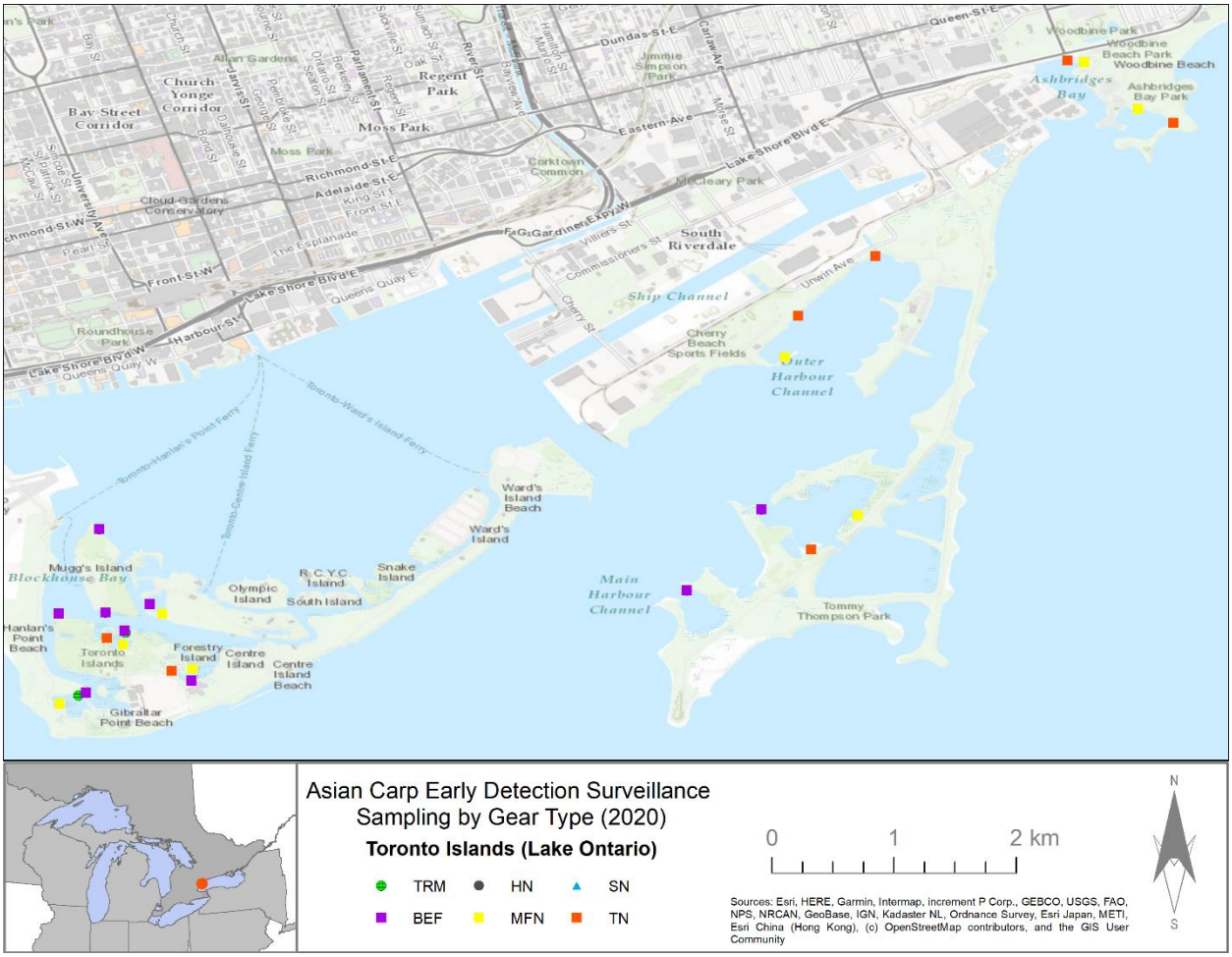


Figure A2.28 2020 Asian Carp Program Early detection surveillance field site around the Toronto Islands.

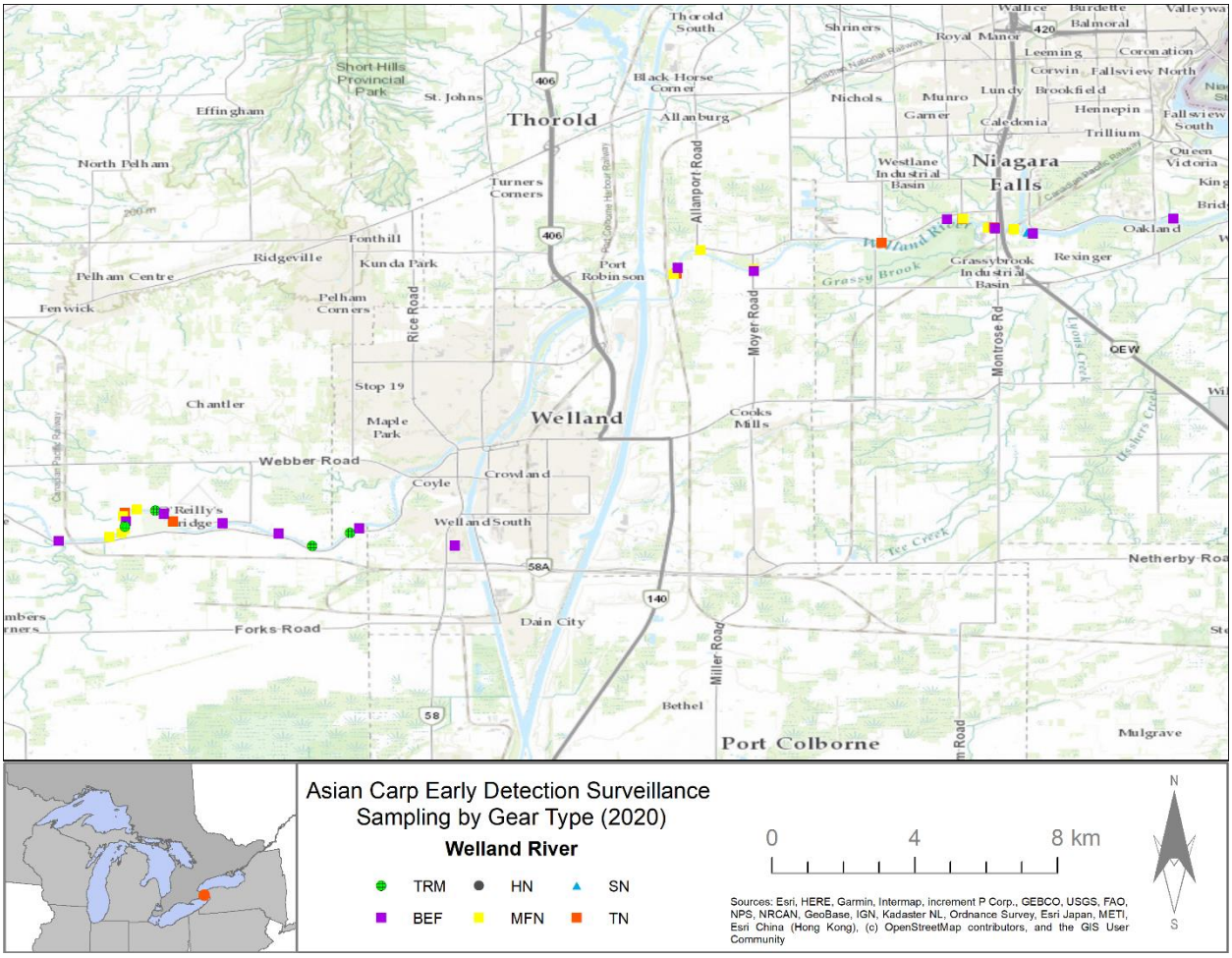


Figure A2.29 2020 Asian Carp Program Early detection surveillance field sites in the Welland River.

# APPENDIX 3: MAPS OF ASIAN CARP LARVAL SAMPLING LOCATIONS

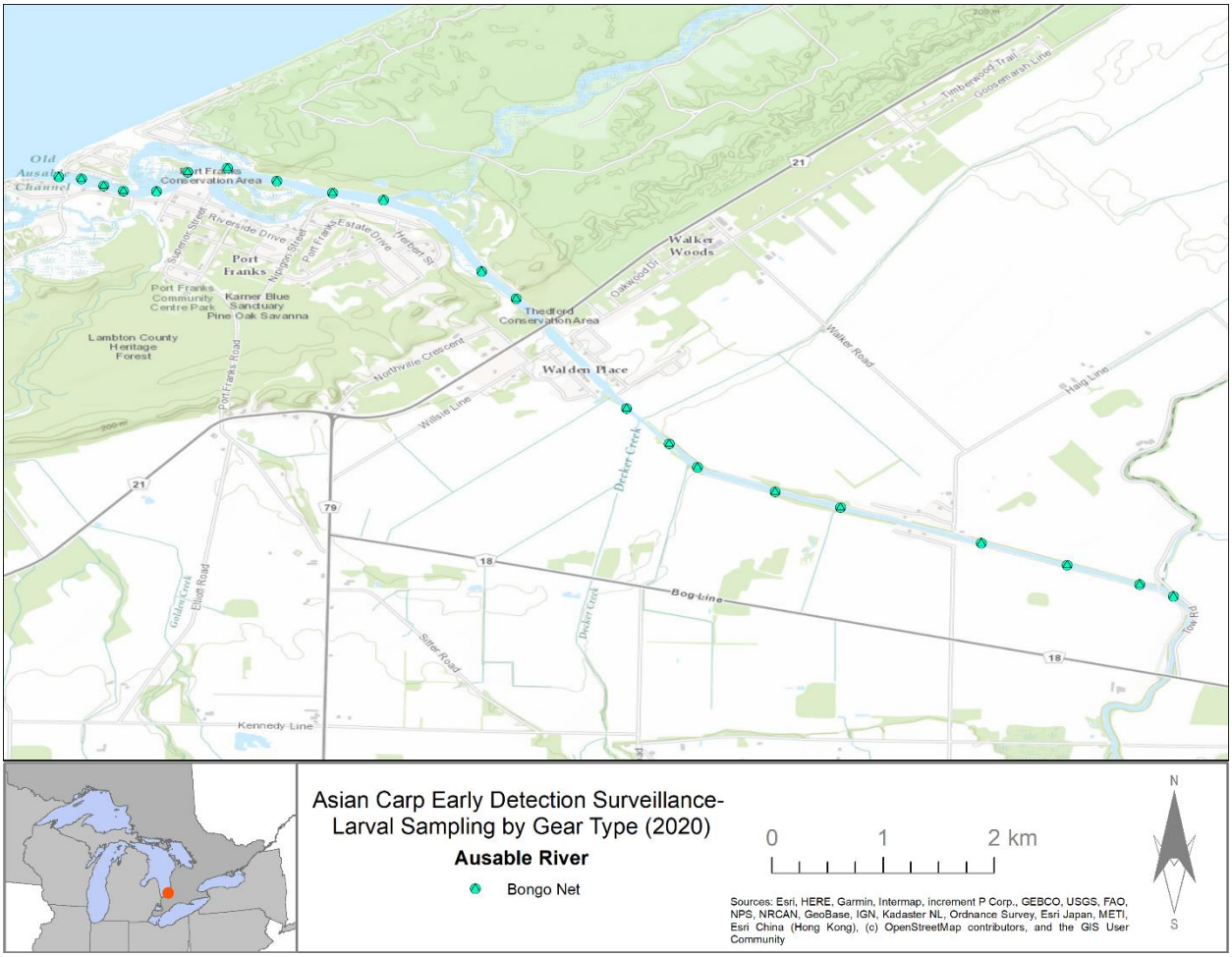


Figure A3.1 2020 Asian Carp Program larval Early detection surveillance field sites in the Ausable River.

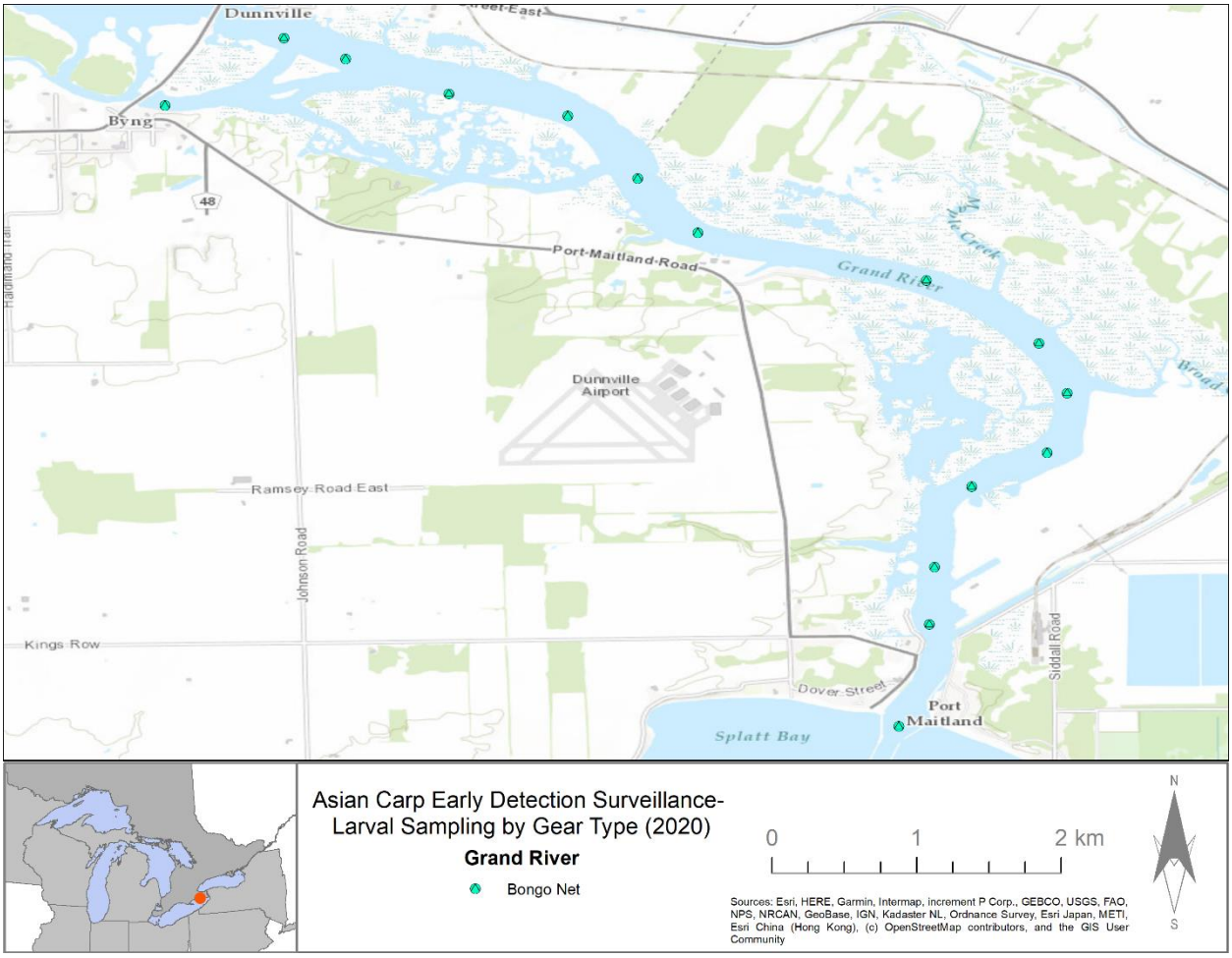


Figure A3.2 2020 Asian Carp Program larval Early detection surveillance field sites in the Grand River.

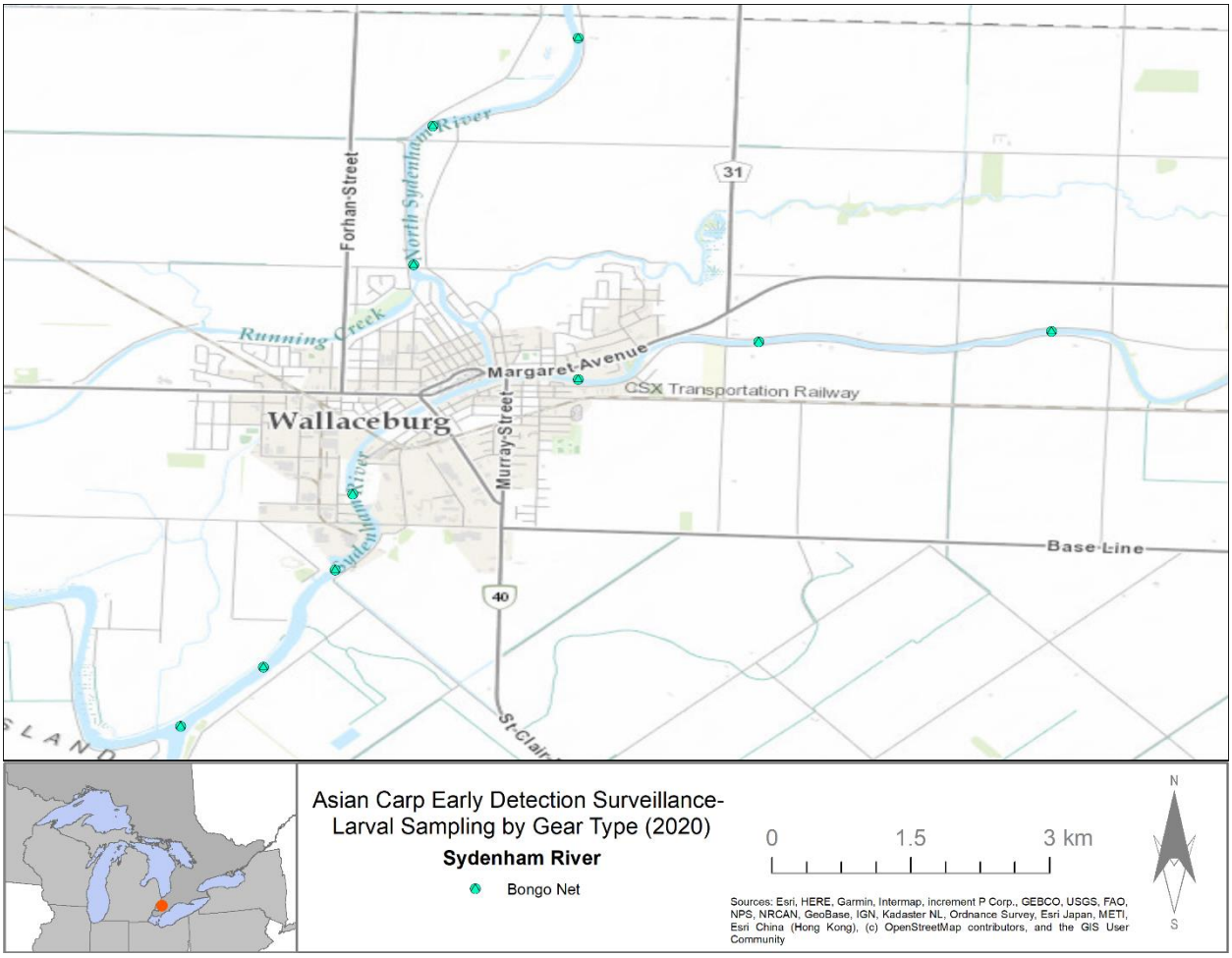


Figure A3.3 2020 Asian Carp Program larval Early detection surveillance field sites in the Sydenham River.

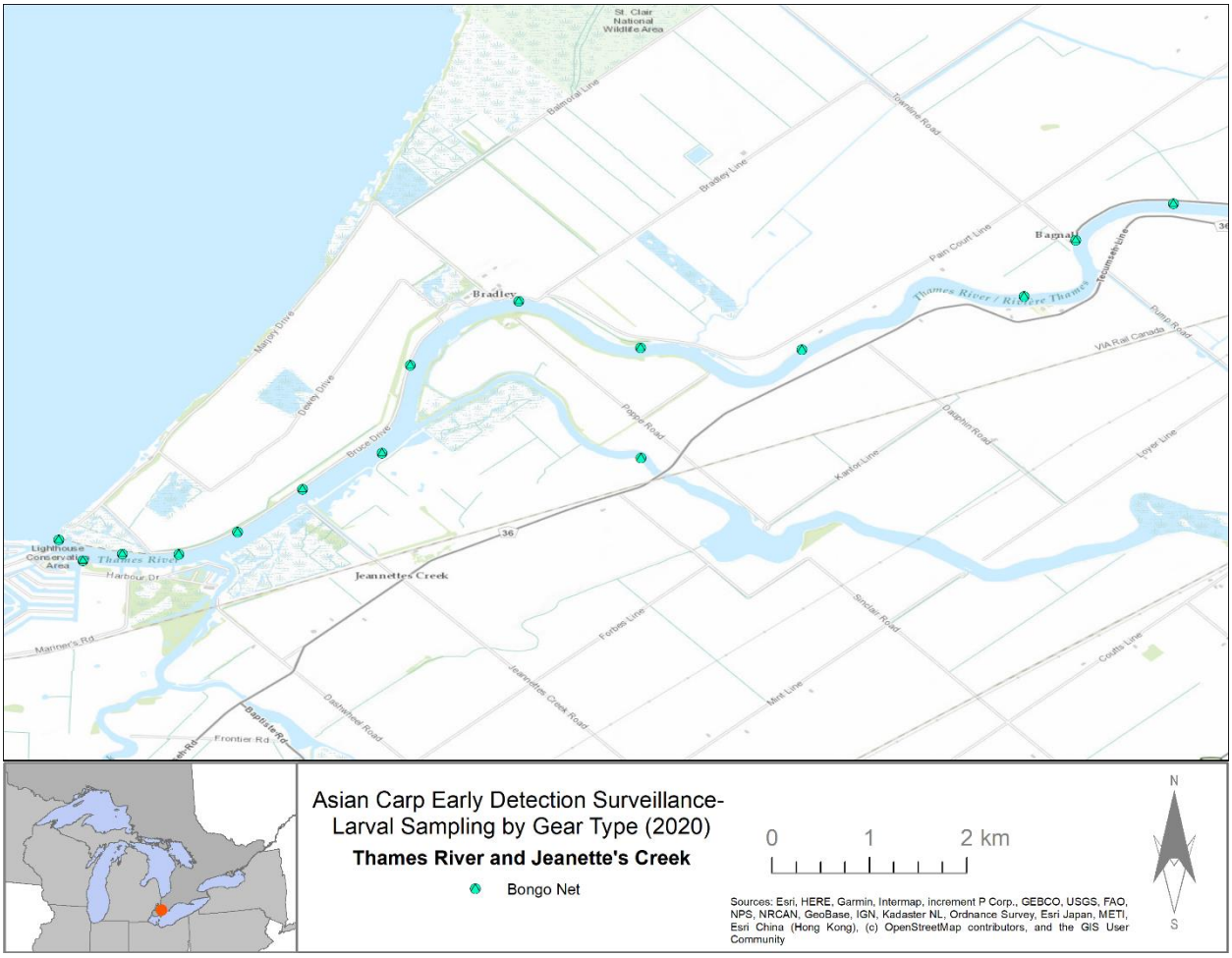


Figure A3.4 2020 Asian Carp Program larval Early detection surveillance field sites in the Thames River and Jeanette's Creek.

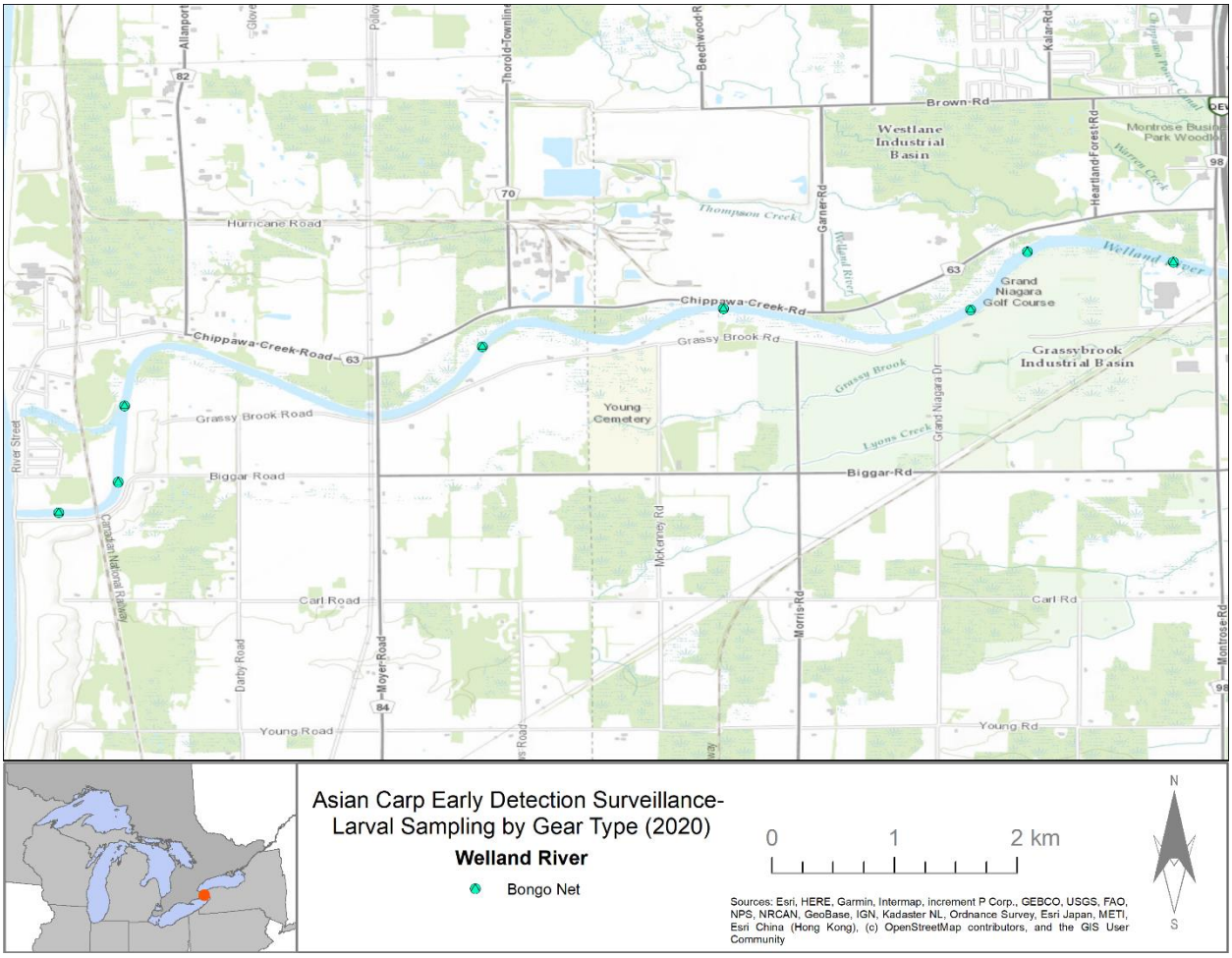


Figure A3.5 2020 Asian Carp Program larval Early detection surveillance field sites in the Welland River.