

# **Application of a fish IBI to coastal wetlands in the St. Clair and Detroit River Areas of Concern**

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## ABSTRACT

Midwood, J.D., Budgell, E, and Reddick, D. 2020. Application of a fish IBI to coastal wetlands in the St. Clair and Detroit River Areas of Concern. Can. Tech. Rep. Fish. Aquat. Sci. 3400: vi + 23 p.

Fish community data collected using boat electrofishing and fyke netting were used to calculate fish index of biotic integrity (IBI) scores for coastal areas and wetlands in the St. Clair River (SCR) and Detroit River (DR) Areas of Concern (AOC). For each system and gear type, IBI scores were compared with values derived at sites in the Walpole Island Delta (a regional reference area with comparatively low anthropogenic disturbance) to determine whether there was evidence of impairment within the AOC. Based on fyke net data, there were no significant differences in IBI score among wetlands in the SCR that had been restored ( $75.8 \pm 5.7$  [mean  $\pm$  standard deviation]) or not restored ( $69.5 \pm 7.4$ ) relative to wetlands in the Walpole Island Delta ( $73.3 \pm 7.9$ ). An important caveat to this comparison is that the application of the IBI to fyke net data has not been fully validated, therefore comparisons should only be made within gear-types and values should not be used outside of this study without validation. A lack of difference between sites within the SCR AOC and Walpole Island Delta suggests that, from a fish IBI perspective, wetland conditions in the SCR AOC do not indicate impairment under Beneficial Use Impairment (BUI) #14 (*Loss of Fish and Wildlife Habitat*). Confirmation of this status from surveys of other biotic communities (e.g., submerged aquatic vegetation, marsh birds, and invertebrates) is recommended prior to delisting. Sampling at sites in the DR was primarily intended to establish baseline conditions pre-restoration; however, based on boat electrofishing data, no differences were found between IBI scores at DR sites ( $68.3 \pm 14.8$ ) and comparable sites in the Walpole Island Delta ( $66.5 \pm 11.5$ ). In addition to IBI scores, fish community data are also presented herein with generally high species richness in both DR (49 species) and SCR (up to 37 species) and multiple species at risk in both systems. A more thorough investigation of these community data may contribute to the assesment to BUI#3 (*Degradation of Fish and Wildlife Populations*) in the DR AOC and could also be used to validate fish habitat suitability models for both systems.

## RÉSUMÉ

Midwood, J.D., Budgell, E, and Reddick, D. 2020. Application of a fish IBI to coastal wetlands in the St. Clair and Detroit River Areas of Concern. Can. Tech. Rep. Fish. Aquat. Sci. 3400: vi + 23 p.

Les données sur la communauté de poissons recueillies grâce à la pêche à l'électricité par bateau et la pêche au verveux ont été utilisées pour calculer les cotes de l'indice d'intégrité biotique (IIB) pour les zones côtières et humides dans les secteurs préoccupants (SP) de la rivière St. Clair (RSC) et de la rivière Détroit (RD). Pour chaque type de système et d'engin, les cotes d'IIB ont été comparées à des valeurs obtenues sur des sites du delta de Walpole Island (une zone de référence régionale où les perturbations anthropiques sont relativement faibles) afin de déterminer s'il y avait des signes d'altération dans les SP. Selon les données recueillies grâce à la pêche au verveux, aucune différence significative n'a été constatée dans les cotes d'IIB des zones humides de la RSC qui ont été restaurées ( $75,8 \pm 5,7$  [moyenne  $\pm$  écart-type]) ou qui n'ont pas été restaurées ( $69,5 \pm 7,4$ ) en comparaison avec les zones humides du delta de Walpole Island ( $73,3 \pm 7,9$ ). Une mise en garde importante s'impose pour cette comparaison : l'application de l'IIB aux données recueillies grâce à la pêche au verveux n'a pas été pleinement validée; les comparaisons ne doivent donc être faites que pour les types d'engins et les valeurs ne doivent pas être utilisées à l'extérieur de la présente étude sans avoir été préalablement validées. L'absence de différence entre les sites des SP de la RSC et du delta de Walpole Island suggère que du point de vue de l'indice d'intégrité biotique du poisson, les conditions dans les zones humides dans les SP de la RSC ne présentent pas de signe d'altération aux termes de l'altération d'utilisation bénéfique (AUB) n° 14 (disparition d'habitats de poissons et de la faune). Une confirmation de cet état par des enquêtes des autres communautés biotiques (p. ex. végétation aquatique submergée, oiseaux des marais et invertébrés) est recommandée avant le retrait de la liste. L'échantillonnage aux sites de la RD visait principalement à établir les conditions de référence préalables à la restauration; cependant, selon les données recueillies grâce à la pêche à l'électricité par bateau, aucune différence n'a été observée entre les cotes d'IIB sur les sites de la RD ( $68,3 \pm 14,8$ ) et les sites comparables dans le delta de Walpole Island ( $66,5 \pm 11,5$ ). En plus des cotes d'IIB, les données sur les communautés de poisson sont aussi présentées ici, et celles-ci révèlent une grande richesse en espèces pour la RD (49 espèces) et la RSC (jusqu'à 37 espèces) ainsi que plusieurs espèces en péril dans les deux systèmes. Une analyse plus approfondie de ces données sur les communautés pourrait contribuer à l'évaluation de l'AUB n° 3 (dégradation des populations de poissons et d'espèces sauvages) dans les SP de la RD et pourrait aussi servir en vue de valider les modèles d'habitat propice du poisson pour les deux systèmes.

## INTRODUCTION

Under the terms of the Great Lakes Water Quality Agreement, in 1987 the St. Clair River (SCR) and the Detroit River (DR) were identified as two of 43 Great Lakes Areas of Concern (AOC). Historical industrialization, urbanization, and intensified land use practices both along the margins of the rivers and within their watersheds were identified as the primary causes of their impairment, with nine beneficial use impairments (BUI) being identified in SCR and 12 in DR. In both systems, BUI #14 – *Loss of Fish and Wildlife Habitat* was identified as impaired, whereas in DR, the status of BUI #3 – *Degradation of Fish and Wildlife Populations* was originally designated as unimpaired but later changed to impaired (Briggs et al. 2012; DRCC 2013); BUI #3 in SCR was never listed as impaired. Fish habitat objectives in these systems have sought to protect remaining habitat and encourage the creation or remediation of aquatic habitat where possible. Relevant for this report, SCR delisting criteria for BUI #14 seek to have wetland quality either be ranked as “Good” based on a variety of indices of biotic integrity (IBI) or have wetland quality that is comparable to wetlands outside of the AOC. The criteria relating to habitat in DR is less specific, but still seeks to protect habitat and restore ecosystem function to priority areas through the remediation or improvement of these habitats.

For both AOCs, IBI are a key tool for the assessment of fish and wildlife communities and habitats. These indices integrate complex ecological or community data into a single metric or score that can more easily be tracked and understood. The Canadian Wildlife Service (CWS) is using IBI for macroinvertebrates, submerged aquatic vegetation (SAV), and marsh birds to assess the condition of wetlands in this AOC and inform on the SCR habitat BUI. Particular focus has been placed on the condition of remediated sites relative to other sites within SCR, as well as, sites outside of the AOC including locations within the DR (Croft-White 2018). While the macroinvertebrate IBI found no difference among wetlands, the SAV IBI suggested remediated sites were more degraded than reference areas (remediated sites were general categorized as being in “poor” condition based on the SAV IBI), primarily due to high levels of filamentous algae. Continued monitoring at these sites using these IBI is planned to determine whether the patterns observed in 2017 are consistent through time. These same IBI have also been used by CWS in DR wetlands, with SAV IBI scores being comparable to wetlands in the SCR AOC. The macroinvertebrate IBI scores showed slightly lower values in the DR and considerably lower values were detected for the marsh bird IBI assessment (Croft-White 2018). Collectively these results demonstrate the utility of IBI for assessing ecosystem condition in the DR and SCR AOCs.

A fish-based IBI (Minns et al. 1994) has been used to monitor conditions in other Great Lakes AOCs including Hamilton Harbour, Severn Sound, Toronto and Region, and the Bay of Quinte (Randall and Minns 2002; Boston et al. 2016; Hoyle et al. 2018). This IBI was designed to monitor ecosystem condition in littoral areas of the Great Lakes based on fish community data collected using standardized electrofishing surveys (Brousseau

et al. 2005). Spatially comprehensive field surveys of wetland fish communities were undertaken by Fisheries and Oceans Canada and Walpole Island First Nation within the Walpole Island Delta during the summer of 2015 using both electrofishing and fyke net sampling protocols. Similar surveys were undertaken in the SCR and DR AOCs in the summer of 2017 and again in the SCR AOC in 2018 and 2019. By applying the fish IBI to these data the relative condition of wetland and nearshore areas within the AOCs and the Delta can be determined. The objective of this report is to assess the habitat condition of selected wetland and nearshore areas in the SCR and DR AOCs using the fish IBI. Sites within the Walpole Island Delta will serve as reference locations for the surveys completed in both DR and SCR. This area was selected as a reference location based on its proximity to DR and SCR, relatively high scoring habitat metrics (e.g., SAV IBI), and the availability of fish community data that were collected using the same methods (i.e. fyke net and boat electrofishing; Gardner-Costa et al. in prep.). It is important to note that the fish IBI was not developed and has yet to be tested for fyke net data, therefore comparisons among sites are undertaken separately for electrofishing and fyke netting. Collectively these works will determine if wetlands within the SCR and DR AOCs are in comparable condition to reference wetlands (i.e., those within Walpole Island Delta) as assessed through the use of a fish-based IBI. These results should be integrated with efforts underway by CWS to ensure multiple IBI yield similar conclusions regarding aquatic habitat conditions.

## METHODS

The methods used to sample fish communities using either electrofishing or fyke netting were consistently applied across sites and sampling years. As such, data collected by the Walpole Island First Nation and Fisheries and Oceans Canada during the summer of 2015 in the Walpole Island Delta should be comparable to data collected during summer 2017, 2018, and 2019. In 2017, eight sites in DR were surveyed with electrofishing and two sites, Canard River Marsh and Turkey Creek, were sampled using fyke nets due to depth limitations (Table 1; Figure 1). Fyke nets were used in all sites sampled in SCR in 2017 (N = 9), 2018 (N = 8), and 2019 (N = 7; Table 1; Figure 2). Running Creek was not sampled after 2017 since it was not part of the CWS wetland monitoring program and Stag Island could not be accessed in 2019 due to high water levels. For the 2015 surveys, 15 sites were surveyed using electrofishing and nine sites were surveyed with fyke nets in the Walpole Island Delta (Table 1; Figure 2). Details on these 2015 surveys, including information on substrate, water chemistry, plant communities, and SAV distributions can be found in Gardner-Costa et al. (in prep.).

Fyke nets (dimensions: 3.6 m long with 1.2 m x 0.9 m frames, lead is 7.6 m x 0.9 m with two wings 3.6 m x 0.9 m set at 45° angle from the net mouth, mesh size 4.8 mm) were set perpendicular to stands of emergent vegetation with the lead starting at the edge of the vegetation. An air gap (~10 cm) was maintained at the cod end to prevent turtles and other air breathing vertebrates from drowning. Nets were set for approximately 24-hrs to capture diel movements of fishes into and out of the emergent vegetation. There was variability in the number of nets set per site and this was largely dependent on the size of the site and, to a lesser extent, the number of nets that were available during the survey.

For electrofishing surveys, a Smith-Root SR20E electrofishing boat (length = 6.1 m, beam = 1.9 m) with an output of approximately 8 amperes was used. Surveys followed the protocol outlined in Brousseau et al. (2005) with 100-m transects run at approximately 1.5-m depth at a speed such that effort was approximately 300 shock seconds. All transects were surveyed at night (between sunset and sunrise). Similar to the fyke net surveys, there was variability in the number of transects completed at each site based on its size.

Fish were processed in the same manner regardless of whether they were captured using fyke nets or boat electrofishing. Captured fish were held in aerated tanks and then identified to species and their lengths (fork length  $\pm$  1 mm) and wet mass (g) were measured. For each fyke net or electrofishing transect, the first 20 individuals of each species were fully processed. Any additional individuals were counted and a batch mass was taken. Captured fish were released following processing, unless they could not be identified in the field or were required to be collected under the Species At Risk permitting requirements. In these instances, they were measured, weighed, sacrificed, and vouchered for later identification in the laboratory.

## **ANALYSIS**

For each sampling event, the total catch and total species richness were determined and effort was reported as either “total shock-seconds” (electrofishing) or “total soak time” (hours; fyke netting). A fish-based IBI, which integrates 12 fish community-based sub-metrics (e.g., number of native fish species, percent piscivore biomass, number of turbidity intolerant species, etc.; Minns et al. 1994) into a single overall score to help ease reporting and dissemination to the public and stakeholders, was calculated for each sampling event (i.e., transect for electrofishing and net for fyke nets). The mean IBI score for each year (with standard deviation) was then determined for each sampling site as well as for each sampling site type (e.g., DR AOC, SCR AOC, SCR Restored, or Walpole Island Delta [further divided by gear type]). These sampling site types were assigned, where possible, based on previous surveys completed by CWS (Croft-White 2018). It is important to stress again that the fish IBI was developed using electrofishing data and has not previously been applied to fish community data derived from fyke netting. These two distinct gear and sampling approaches (active vs. passive) are known to target different components of the fish community with small schooling fishes often found in fyke nets (Hubert 1989) and more sedentary large predators captured with electrofishing (Bohlin et al. 1989; Reynolds 1989). Despite differences in the fish assemblage that is captured, previous applications of a fish-based index (Wetland Fish Index, Seilheimer et al. 2006) to electrofishing and fyke net data have yielded comparable index scores for the same site (Cvetkovic et al. 2012). That study, however, did not use the fish IBI used for the present assessment, therefore IBI scores derived from the fyke net surveys should be interpreted with caution and should not be compared to scores derived using electrofishing until a more complete evaluation of its efficacy for fyke net data is undertaken.

In order to test for differences between DR AOC sites and Walpole Island Delta sites (electrofishing) and among restored SCR AOC, un-restored SCR AOC, and Walpole Island Delta sites (fyke nets) a non-parametric Kruskal-Wallis rank sum test was used. This test was selected since the data did not meet the assumptions of normality and equal variance necessary for parametric statistical tests. When significant effects were found ( $\alpha = 0.05$ ), post-hoc pairwise comparisons were conducted using a Wilcoxon rank sum test.

## RESULTS

Detailed results relating to species richness and total catch for the Walpole Island Delta surveys are not presented here, but can be found in Gardner-Costa et al. (in prep.).

### DETROIT RIVER

During the 2017 DR surveys, over 4000 fish representing 49 different species were captured (Table 2). This included several federally (F) and provincially (P) listed species at risk (Grass Pickerel [*Esox americanus*; F and P; special concern], Pugnose Minnow [*Opsopoeodus emiliae*; F special concern and P threatened], Spotted Sucker [*Minytrema melanops*; F and P; special concern]; and Northern Sunfish [*Lepomis peltastes*; P; special concern]). Commonly occurring species included Rock Bass (*Ambloplites rupestris*) and Yellow Perch (*Perca flavescens*), which were found at all sites; however, the most abundant species were Bluegill (*Lepomis macrochirus*), Largemouth Bass (*Micropterus salmoides*), and Gizzard Shad (*Dorosoma cepedianum*) with greater than 250 of each encountered throughout the survey (Table 2). In some instances, large catches of a single species drove overall abundance estimates (e.g., *Lepomis* spp. at Lower Canard or all Northern Sunfish being captured at Turkey Creek), therefore, species that had high overall abundance were not necessarily common (i.e., found across all sites). Total catch was also higher at DR sites surveyed using fyke nets compared to those surveyed using electrofishing (Table 2).

There was some variability in mean IBI scores among sites surveyed with electrofishing in the DR AOC and Walpole Island Delta, with the lowest scores at sites DFE\_17 (30.8), WHB\_15 (42.8), and WSA\_15 (49.1) and highest value at DBI\_17 (84.9; Figure 3). In contrast most other sites had IBI scores between 60 to 80 (Table 1). When the data were pooled, there was no significant difference in mean IBI score at sites in the DR AOC ( $68.3 \pm 14.8$ ; Kruskal-Wallis,  $\chi^2(1) = 0.22$ ,  $p = 0.64$ ) compared to those in the Walpole Island Delta ( $66.5 \pm 11.5$ ; Figure 3). The two sites in DR surveyed using fyke nets, CRB\_17 and TKC\_17, also had mean IBI scores comparable to those observed at sites surveyed using fyke nets in the Walpole Island Delta (Figure 4).

### ST. CLAIR RIVER

Total catch in the St. Clair River was considerably higher in 2018 (8761) and 2019 (7281) compared to 2017 (3011), however, species richness was slightly lower (33 [2018] and 32 [2019] vs 37 [2017]). Higher total catches in 2018 and 2019 was largely driven by increased catch of centrarchids (e.g., Pumpkinseeds [*Lepomis gibbosus*],

Bluegill, and *Lepomis* spp.[likely young of the year of these species]; Table 3-5), although these species were abundant compared to the rest of the community in all years. Several federally and provincially listed species at risk were encountered during the study (Grass Pickerel, Pugnose Shiner [*Notropis anogenus*; F endangered and P threatened], Spotted Sucker; and Northern Sunfish), but Blackstripe Topminnow (*Fundulus notatus*; F and P; special concern) were only observed in 2017 and Lake Chubsucker (*Erimyzon sucetta*; F endangered and P threatened) in 2019 (Tables 3-5). Commonly occurring (i.e., detected at all sites) species included: Bluegill, Largemouth Bass, Pumpkinseed, Rock Bass and Yellow Perch (Tables 3-5).

Based on fyke net data, IBI scores were generally high (low of 59.6 [SRM\_17] and a high of 88.6 [BAY\_19]; Table 1; Figure 4) with no evidence for significant differences among restored ( $75.8 \pm 5.7$ ) or un-restored ( $69.5 \pm 7.4$ ) sites in the SCR AOC and those within the Walpole Island Delta ( $73.3 \pm 7.9$ ; Kruskal-Wallis,  $\chi^2(2) = 4.41$ ,  $p = 0.11$ ; Figure 4).

## DISCUSSION

We found no evidence for differences in fish IBI scores for wetlands within the DR AOC or SCR AOC (either restored or un-restored) relative to reference wetlands in the Walpole Island Delta. For most sites sampled using either electrofishing or fyke nets, fish IBI scores generally fell between 60 to 80, which is higher than some Great Lakes Areas of Concern (e.g., Hamilton Harbour and Toronto and Region) and comparable to past surveys in the Bay of Quinte AOC (Hoyle et al. 2018) where fish communities targets have been achieved (Brousseau et al. 2011). For the few SCR and DR AOC sites that fell outside of this range, there were sites within the Walpole Island Delta that had comparable scores suggesting the observed variation in IBI score within the AOCs was also present in the Walpole Island Delta reference area. The sole exception was at the Fighting Island End electrofishing site, in the Detroit River (DFE\_17) where the lowest electrofishing-based IBI score was observed. This lower value may be related to the open nature of this site since the fish IBI was originally derived for embayments (Minns et al. 1994). Other work with this protocol on open coast sites in Lake Ontario has similarly found naturally lower IBI scores (e.g., Bronte Shore and Port Dalhousie, Hoyle et al. 2018). Scores were generally consistent within sites that were surveyed over multiple years (e.g., SCR 2017-2019 fyke netting). Collectively these results suggest that, based on a fish IBI, wetlands within the DR and SCR AOCs are in comparable condition as wetlands in the Walpole Island Delta reference area.

To further validate these results, there are some additional steps that should be undertaken. Results derived from the fish IBI should be integrated with efforts by CWS to ensure multiple IBI yield similar conclusions regarding the condition of aquatic habitat. Multiple lines of evidence are critical since IBI based on other components of the biotic community that are also reliant on coastal wetlands (e.g., marsh birds, invertebrates) may indicate there is still an impairment under BUI #14, as is the case for the SAV IBI at some sites within the DR AOC (Croft-White 2018). The decision on delisting BUI #14 rests with the RAP committee, but in the opinion of the authors, as

many of the available IBI scores as possible should indicate healthy biotic communities in monitored coastal wetlands in the DR and SCR AOCs.

IBI scores represent an aggregation of fish community information that can mask differences in fish community composition (i.e., difference in species dominance, richness, or abundance). While these differences may be of less interest for BUI#14, they can reflect important community-based differences that are relevant for the assessment of BUI#3. Therefore, an evaluation of differences in fish community composition among DR AOC, SCR AOC, and Walpole Island Delta sites is warranted to ensure the higher-level summaries provided by an interpretation of IBI scores do not mask important species-specific variation that is driven by conditions within the AOC. This specific assessment seems only relevant to the DR AOC, since BUI#3 is not listed as impaired for the SCR AOC.

Since an assignment of a categorical quality to observed fish IBI scores has not been developed, it is not possible to evaluate whether SCR sites have met the target of having wetlands in “Good” condition from a fish community perspective. Such categorical evaluations have been applied to a SAV IBI (Grabas et al. 2012; Croft-White 2018) with scores from 0 to 20 indicating “Poor” conditions; 21 to 40 indicating “Fair” conditions; 41 to 60 indicating “Good” conditions; 61 to 80 indicating “Very Good” conditions; and 81 to 100 indicating “Excellent” conditions. It is important to further stress, however, that the appropriateness of this type of categorization has not been explored for the fish IBI applied in this report. In the short term, therefore, it is likely best to approach the assessment of this BUI by evaluating whether wetland quality within the AOC is comparable to reference wetlands outside of the AOC (e.g., in the Walpole Island Delta), as has been done in the present report.

While efforts within the SCR AOC were primarily driven by the desire to compare conditions within the AOC to those outside the AOC, in the DR AOC the primary objective of the 2017 survey was to collect baseline data on fish communities at proposed restoration sites. The methods outlined in the present report and baseline information on the fish community should be used in the future to evaluate the efficacy of restoration actions at these sites in DR. At this time additional sampling at select sites in the DR AOC is currently not expected, but may be beneficial to provide multi-year baseline data prior to undertaking any restoration action. Such a decision, however, will need be determined in consultation with DR RAP coordinators. Finally, if sites within the Walpole Island Delta will be used as reference areas in the future, it would be prudent to re-sample a subset of sites with both gear types used in the present report. This would not only provide greater temporal coverage on conditions in this reference area, but also facilitate a direct comparison in IBI scores derived using electrofishing and fyke netting, which could increase overall confidence in the as yet un-validated IBI scores derived using fyke nets.

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**Table 1.** Basic information on where and when each sampling event occurred and the type of gear used and effort (fyke = number of nets, electrofishing = number of transects). Sites area grouped based on their general location: Detroit River Area of Concern = DR AOC, Walpole Island Delta = Walpole, St. Clair River Area of Concern = SCR AOC, and restored in the SCR AOC = SCR RES. The mean ( $\pm$  standard deviation), minimum, and maximum, IBI scores for each sampling event are also shown.

| Site Name            | Grouping | Site Code | Sampling Date | Gear           | Effort | Latitude | Longitude | Mean $\pm$ SD   | Min  | Max  |
|----------------------|----------|-----------|---------------|----------------|--------|----------|-----------|-----------------|------|------|
| Canard River         | DR AOC   | CRB_17    | 16/08/2017    | Fyke Net       | 4      | 42.17242 | -83.09368 | 75.9 $\pm$ 7.1  | 65.8 | 82.2 |
| Turkey Creek         | DR AOC   | TKC_17    | 14/08/2017    | Fyke Net       | 4      | 42.24586 | -83.10525 | 80.4 $\pm$ 2.3  | 77.0 | 82.2 |
| Boblo Dock           | DR AOC   | DBD_17    | 14/07/2017    | Electrofishing | 4      | 42.08635 | -83.11283 | 69.3 $\pm$ 23.7 | 34.1 | 84.3 |
| Boblo Island         | DR AOC   | DBI_17    | 13/07/2017    | Electrofishing | 4      | 42.09125 | -83.11808 | 84.9 $\pm$ 6.0  | 78.8 | 93.0 |
| Crystal Bay          | DR AOC   | DCB_17    | 14/07/2017    | Electrofishing | 4      | 42.11600 | -83.11850 | 69.5 $\pm$ 7.0  | 61.4 | 76.5 |
| Fighting Island End  | DR AOC   | DFE_17    | 13/07/2017    | Electrofishing | 4      | 42.19155 | -83.11800 | 30.8 $\pm$ 8.6  | 23.5 | 43.2 |
| Fight Island Side    | DR AOC   | DFS_17    | 12/07/2017    | Electrofishing | 4      | 42.21060 | -83.12287 | 61.7 $\pm$ 9.0  | 50.3 | 70.5 |
| Peché Island Channel | DR AOC   | DPC_17    | 11/07/2017    | Electrofishing | 4      | 42.34790 | -82.92820 | 70.9 $\pm$ 2.3  | 68.6 | 73.8 |
| Peché Island Head    | DR AOC   | DPH_17    | 11/07/2017    | Electrofishing | 4      | 42.34720 | -82.92217 | 73.6 $\pm$ 12.4 | 55.7 | 83.5 |
| Peché Island Inner   | DR AOC   | DPI_17    | 10/07/2017    | Electrofishing | 4      | 42.34520 | -82.92495 | 65.7 $\pm$ 26.0 | 28.8 | 89.9 |
| Basset Channel       | Walpole  | WBC_15    | 30/07/2015    | Electrofishing | 20     | 42.52009 | -82.57786 | 60.1 $\pm$ 22.5 | 0.0  | 85.4 |
| Chematogan Bay       | Walpole  | WCB_15    | 06/08/2015    | Electrofishing | 5      | 42.49246 | -82.52738 | 62.6 $\pm$ 9.8  | 50.5 | 76.6 |
| Chematogan Channel   | Walpole  | WCC_15    | 04/08/2015    | Electrofishing | 21     | 42.54919 | -82.53911 | 76.5 $\pm$ 11.4 | 51.1 | 93.2 |
| Clubhouse Bay        | Walpole  | WCL_15    | 28/07/2015    | Electrofishing | 9      | 42.48244 | -82.45837 | 69.9 $\pm$ 10.6 | 45.1 | 78.8 |
| Grassy Island        | Walpole  | WGI_15    | 05/08/2015    | Electrofishing | 4      | 42.46122 | -82.49137 | 58.6 $\pm$ 7.0  | 49.4 | 64.4 |
| Goose Lake           | Walpole  | WGL_15    | 06/08/2015    | Electrofishing | 5      | 42.52120 | -82.51934 | 78.3 $\pm$ 5.0  | 73.5 | 85.5 |
| Horseshoe Bay        | Walpole  | WHB_15    | 27/07/2015    | Electrofishing | 6      | 42.51181 | -82.59890 | 42.8 $\pm$ 21.4 | 0.0  | 58.6 |
| Johnston Bay         | Walpole  | WJB_15    | 06/08/2015    | Electrofishing | 4      | 42.50268 | -82.50467 | 66.4 $\pm$ 14.8 | 51.2 | 81.1 |
| Johnston Channel     | Walpole  | WJC_15    | 07/08/2015    | Electrofishing | 11     | 42.48970 | -82.50520 | 77.0 $\pm$ 11.4 | 48.4 | 86.8 |
| Johnston Mouth       | Walpole  | WJM_15    | 06/08/2015    | Electrofishing | 5      | 42.47708 | -82.52709 | 76.4 $\pm$ 18.2 | 48.3 | 91.2 |
| Mud Bay              | Walpole  | WMB_15    | 28/07/2015    | Electrofishing | 5      | 42.48015 | -82.46717 | 79.5 $\pm$ 4.6  | 75.0 | 85.6 |
| Pocket Bay           | Walpole  | WPO_15    | 27/07/2015    | Electrofishing | 4      | 42.53180 | -82.61764 | 74.2 $\pm$ 4.8  | 68.4 | 80.1 |
| St. Anne's Bay       | Walpole  | WSA_15    | 28/07/2015    | Electrofishing | 1      | 42.48639 | -82.47246 | 49.1 $\pm$      | 49.1 | 49.1 |
| Whitney Islands      | Walpole  | WWI_15    | 05/08/2015    | Electrofishing | 5      | 42.47178 | -82.46600 | 59.7 $\pm$ 6.9  | 51.5 | 69.8 |
| Bay Lodge            | SCR RES  | BAY_17    | 15/08/2017    | Fyke Net       | 4      | 42.45975 | -82.41113 | 72.2 $\pm$ 9.9  | 61.1 | 83.5 |
| Bay Lodge            | SCR RES  | BAY_18    | 30/08/2018    | Fyke Net       | 4      | 42.46161 | -82.41074 | 82.3 $\pm$ 9.4  | 71.5 | 93.1 |
| Bay Lodge            | SCR RES  | BAY_19    | 20/09/2019    | Fyke Net       | 4      | 42.45953 | -82.41061 | 88.6 $\pm$ 4.4  | 84.2 | 94.1 |
| Casilco North        | SCR RES  | CSN_17    | 31/07/2017    | Fyke Net       | 4      | 42.48899 | -82.41789 | 65.4 $\pm$ 7.3  | 58.4 | 72.2 |
| Casilco North        | SCR RES  | CSN_18    | 27/08/2018    | Fyke Net       | 4      | 42.48859 | -82.41832 | 75.8 $\pm$ 8.7  | 64.2 | 85.2 |

| Site Name            | Grouping | Site Code | Sampling Date | Gear     | Effort | Latitude | Longitude | Mean $\pm$ SD   | Min  | Max  |
|----------------------|----------|-----------|---------------|----------|--------|----------|-----------|-----------------|------|------|
| Casilco North        | SCR RES  | CSN_19    | 17/09/2019    | Fyke Net | 4      | 42.48853 | -82.41835 | 76.9 $\pm$ 12.6 | 63.7 | 92.5 |
| Casilco South        | SCR RES  | CSS_17    | 02/08/2017    | Fyke Net | 4      | 42.48089 | -82.41514 | 73.0 $\pm$ 16.4 | 56.0 | 93.9 |
| Casilco South        | SCR RES  | CSS_18    | 29/08/2018    | Fyke Net | 4      | 42.47993 | -82.41499 | 78.4 $\pm$ 10.8 | 64.6 | 88.5 |
| Casilco South        | SCR RES  | CSS_19    | 18/09/2019    | Fyke Net | 4      | 42.48042 | -82.41432 | 78.2 $\pm$ 15.9 | 55.7 | 90.8 |
| Griffore Marsh       | SCR RES  | GFM_17    | 28/06/2017    | Fyke Net | 4      | 42.52053 | -82.41242 | 74.5 $\pm$ 16.5 | 51.2 | 87.3 |
| Griffore Marsh       | SCR RES  | GFM_18    | 27/08/2018    | Fyke Net | 4      | 42.52405 | -82.41171 | 67.6 $\pm$ 5.6  | 62.6 | 73.9 |
| Griffore Marsh       | SCR RES  | GFM_19    | 24/09/2019    | Fyke Net | 4      | 42.51995 | -82.41233 | 77.1 $\pm$ 7.9  | 66.3 | 85.3 |
| Rex Club             | SCR RES  | REX_17    | 01/08/2017    | Fyke Net | 4      | 42.48472 | -82.41654 | 74.9 $\pm$ 26.3 | 36.8 | 95.9 |
| Rex Club             | SCR RES  | REX_18    | 28/08/2018    | Fyke Net | 4      | 42.48394 | -82.41556 | 80.5 $\pm$ 12.4 | 64.8 | 93.9 |
| Rex Club             | SCR RES  | REX_19    | 18/09/2019    | Fyke Net | 4      | 42.48539 | -82.41717 | 72.0 $\pm$ 10.3 | 60.0 | 84.7 |
| Moon Cove/Tic Tac    | SCR AOC  | MCT_17    | 14/08/2017    | Fyke Net | 4      | 42.44958 | -82.41710 | 70.4 $\pm$ 11.3 | 55.4 | 81.9 |
| Moon Cove/Tic Tac    | SCR AOC  | MCT_18    | 30/08/2018    | Fyke Net | 4      | 42.44928 | -82.41756 | 74.6 $\pm$ 19.2 | 52.6 | 97.4 |
| Moon Cove/Tic Tac    | SCR AOC  | MCT_19    | 19/09/2019    | Fyke Net | 4      | 42.44906 | -82.41763 | 85.0 $\pm$ 2.6  | 83.0 | 88.8 |
| Running Creek        | SCR AOC  | SRC_17    | 26/06/2017    | Fyke Net | 2      | 42.60493 | -82.47028 | 63.2 $\pm$ 11.1 | 55.4 | 71.1 |
| Snye River           | SCR AOC  | SRM_17    | 26/06/2017    | Fyke Net | 4      | 42.59959 | -82.47772 | 59.6 $\pm$ 11.3 | 43.0 | 68.1 |
| Bass Bay             | Walpole  | WBB_15    | 21/07/2015    | Fyke Net | 7      | 42.50399 | -82.55982 | 80.0 $\pm$ 9.3  | 64.6 | 94.6 |
| Chematogan Channel   | Walpole  | WCC_15    | 17/07/2015    | Fyke Net | 8      | 42.52880 | -82.54850 | 77.3 $\pm$ 11.9 | 65.7 | 95.4 |
| Little Bass Bay      | Walpole  | WLB_15    | 19/07/2015    | Fyke Net | 7      | 42.50168 | -82.54885 | 78.4 $\pm$ 5.4  | 67.0 | 84.3 |
| Little Strahns Bay   | Walpole  | WLS_15    | 10/08/2015    | Fyke Net | 4      | 42.53716 | -82.57576 | 59.8 $\pm$ 8.4  | 51.1 | 70.1 |
| Pocket Bay           | Walpole  | WPB_15    | 22/07/2015    | Fyke Net | 6      | 42.53345 | -82.61348 | 77.3 $\pm$ 8.0  | 68.4 | 89.4 |
| Snooks Lake          | Walpole  | WSL_15    | 11/08/2015    | Fyke Net | 6      | 42.52943 | -82.56522 | 81.3 $\pm$ 7.0  | 72.4 | 89.5 |
| Upper Johnston Marsh | Walpole  | WUJ_15    | 12/08/2015    | Fyke Net | 6      | 42.55527 | -82.44417 | 69.5 $\pm$ 15.2 | 51.5 | 94.4 |
| Volkswagon Bay       | Walpole  | WVB_15    | 09/08/2015    | Fyke Net | 6      | 42.51069 | -82.55563 | 74.4 $\pm$ 8.2  | 63.7 | 84.5 |
| West Basset Braid    | Walpole  | WWB_15    | 10/08/2015    | Fyke Net | 2      | 42.52866 | -82.57436 | 61.9 $\pm$ 6.3  | 57.4 | 66.4 |

**Table 2.** Total catch for each species at each site from summer 2017 Detroit River fish community surveys. The gear type used at each site (EF = electrofishing, FN = fyke net), total catch, and species richness (excluding hybrids and unidentified species) are also presented.

|                        | Boblo Dock | Boblo Island | Crystal Bay | Fight. Island End | Fight. Island Side | Lower Canard | Pecche Channel | Pecche Head | Pecche Inner | Turkey Creek |
|------------------------|------------|--------------|-------------|-------------------|--------------------|--------------|----------------|-------------|--------------|--------------|
| Gear                   | EF         | EF           | EF          | EF                | EF                 | FN           | EF             | EF          | EF           | FN           |
| Bigmouth Buffalo       |            |              |             |                   | 1                  |              |                |             |              |              |
| Black Buffalo          | 7          |              |             | 1                 |                    |              |                |             | 12           |              |
| Black Crappie          | 1          |              |             |                   |                    | 22           |                |             |              | 1            |
| Blacknose Shiner       |            |              |             |                   |                    |              | 1              |             | 1            |              |
| Bluegill               | 5          |              | 106         |                   |                    | 256          |                | 1           | 15           | 437          |
| Bluntnose Minnow       |            |              | 2           |                   |                    |              |                |             | 1            | 4            |
| Bowfin                 | 3          | 2            | 1           |                   |                    | 2            |                |             | 8            | 8            |
| Brook Silverside       | 2          | 3            |             |                   |                    |              |                |             |              |              |
| Brown Bullhead         |            |              |             |                   |                    | 4            |                |             |              | 6            |
| Channel Catfish        |            | 1            |             | 1                 |                    |              |                |             |              |              |
| Common Carp            | 4          | 1            | 1           | 7                 | 4                  | 3            |                | 1           | 5            | 4            |
| Common Carp x Goldfish | 5          | 2            | 1           |                   | 3                  |              |                |             |              |              |
| Common Shiner          |            | 2            | 1           |                   |                    |              |                |             |              |              |
| Emerald Shiner         |            | 3            |             |                   | 1                  |              | 18             | 4           |              |              |
| Fathead Minnow         |            |              |             |                   |                    |              |                |             | 2            |              |
| Freshwater Drum        | 4          | 2            |             | 2                 | 9                  | 1            | 1              | 3           |              |              |
| Gizzard Shad           |            | 1            | 1           | 2                 | 1                  | 2            |                |             |              | 288          |
| Golden Shiner          |            |              |             |                   |                    |              |                |             | 23           |              |
| Goldfish               | 2          | 1            |             | 1                 |                    |              |                |             | 1            |              |
| Grass Pickerel         |            |              |             |                   |                    |              |                |             | 2            |              |
| Greater Redhorse       |            | 1            |             |                   |                    |              |                |             |              |              |
| Green Sunfish          |            |              |             |                   |                    | 12           |                |             |              | 57           |
| Hornyhead Chub         | 2          | 1            |             |                   |                    |              |                |             |              |              |
| Largemouth Bass        | 16         |              | 14          | 2                 | 2                  | 41           |                | 1           | 19           | 256          |
| Lepomis spp.           |            | 1            |             |                   |                    | 919          |                |             |              | 237          |
| Logperch               |            |              | 5           |                   | 6                  |              |                | 25          |              |              |
| Longnose Gar           | 2          |              |             | 1                 | 5                  | 7            |                |             |              |              |
| Mimic Shiner           | 10         | 71           | 2           |                   | 124                |              | 2              | 14          |              |              |
| Mottled Sculpin        |            |              |             |                   |                    |              |                | 1           |              |              |
| Northern Hog-Sucker    |            |              |             |                   |                    |              |                | 2           |              |              |

|                                       | Boblo Dock | Boblo Island | Crystal Bay | Fight. Island End | Fight. Island Side | Lower Canard | Peché Channel | Peché Head | Peché Inner | Turkey Creek |
|---------------------------------------|------------|--------------|-------------|-------------------|--------------------|--------------|---------------|------------|-------------|--------------|
| Gear                                  | EF         | EF           | EF          | EF                | EF                 | FN           | EF            | EF         | EF          | FN           |
| Northern Pike                         |            | 1            |             |                   |                    | 2            |               |            | 1           | 4            |
| Northern Sunfish                      |            |              |             |                   |                    |              |               |            |             | 118          |
| Pugnose Minnow                        |            |              |             |                   |                    | 1            |               |            |             |              |
| Pumpkinseed                           | 19         |              | 3           |                   |                    | 24           |               |            | 31          | 83           |
| Rainbow Darter                        |            |              |             |                   |                    |              |               | 1          |             |              |
| River Chub                            |            | 9            |             |                   |                    |              | 1             |            |             |              |
| Rock Bass                             | 11         | 22           | 35          | 1                 | 3                  | 1            | 9             | 5          | 13          | 63           |
| Round Goby                            |            |              | 1           |                   |                    | 1            |               |            |             | 5            |
| Shorthead Redhorse                    | 3          | 2            | 1           |                   | 2                  |              | 1             | 3          |             |              |
| Silver Redhorse                       | 1          | 3            |             |                   | 1                  |              |               |            |             |              |
| Smallmouth Bass                       | 3          | 35           | 2           |                   | 3                  |              | 7             | 16         |             |              |
| Smallmouth Buffalo                    |            |              |             | 2                 |                    |              |               |            |             |              |
| Smallmouth Buffalo x<br>Black Buffalo |            |              | 1           | 1                 | 2                  |              |               |            |             |              |
| Spottail Shiner                       | 1          |              |             |                   |                    |              | 5             | 2          | 9           |              |
| Spotted Sucker                        |            |              | 4           |                   |                    | 3            |               |            |             | 9            |
| Tubenose Goby                         |            |              |             |                   |                    |              |               |            |             | 86           |
| Walleye                               | 1          | 11           |             |                   |                    |              |               | 1          |             |              |
| White Crappie                         |            |              |             |                   |                    | 3            |               |            |             |              |
| White Sucker                          | 7          | 3            |             |                   |                    |              | 1             |            | 4           |              |
| Yellow Bullhead                       |            |              |             |                   |                    | 5            |               |            |             | 17           |
| Yellow Perch                          | 32         | 12           | 9           | 7                 | 43                 | 1            | 27            | 2          | 52          | 43           |
| <b>Total Catch</b>                    | 141        | 190          | 190         | 28                | 210                | 1310         | 73            | 82         | 199         | 1726         |
| <b>Species Richness</b>               | 21         | 21           | 16          | 11                | 14                 | 19           | 11            | 16         | 17          | 18           |

**Table 3.** Total catch for each species at each site from summer 2017 St. Clair River fish community surveys. All fish were collected using fyke nets. For each site, total catch and species richness (excluding hybrids and unidentified species) are also presented.

|                        | Bay Lodge | Casilco Marsh | Casilco South | Griffore Marsh | Rex Club | Running Creek | Snye River | Stag Island | Tictac Point |
|------------------------|-----------|---------------|---------------|----------------|----------|---------------|------------|-------------|--------------|
| Banded Killifish       |           |               | 1             |                |          |               |            |             |              |
| Black Buffalo          |           |               |               |                |          | 2             | 2          |             |              |
| Black Crappie          | 1         |               |               | 1              | 1        |               |            |             | 4            |
| Blackchin Shiner       | 2         |               |               |                | 2        |               |            |             | 1            |
| Blacknose Shiner       | 4         |               |               | 4              |          | 3             | 1          | 10          |              |
| Blackstripe Topminnow  |           |               |               |                |          | 1             |            |             |              |
| Bluegill               | 64        | 212           | 19            | 195            | 87       | 11            | 2          | 52          | 128          |
| Bluntnose Minnow       | 8         |               |               |                |          |               |            |             |              |
| Bowfin                 | 2         |               | 4             | 7              | 12       |               | 1          |             | 1            |
| Brown Bullhead         | 1         | 1             | 2             |                | 6        |               |            |             | 2            |
| Central Mudminnow      |           |               |               |                |          |               | 3          | 2           |              |
| Channel Catfish        | 1         |               |               |                |          |               |            |             |              |
| Common Carp            |           | 2             |               | 2              | 3        |               |            |             |              |
| Darter spp.            |           |               |               |                |          | 1             |            |             |              |
| Emerald Shiner         |           |               |               |                |          |               | 4          |             |              |
| Freshwater Drum        |           |               |               | 1              |          |               |            |             |              |
| Gizzard Shad           |           | 22            | 2             |                | 14       |               |            |             |              |
| Golden Shiner          |           |               | 1             |                |          |               |            | 1           |              |
| Grass Pickerel         |           |               |               |                |          | 1             | 1          |             |              |
| Green Sunfish          | 1         |               |               | 11             |          | 1             | 1          | 24          | 24           |
| Largemouth Bass        | 32        | 175           | 18            | 5              | 92       | 2             | 5          | 2           | 48           |
| Lepomis spp.           | 15        | 291           | 304           |                | 195      |               |            |             |              |
| Logperch               | 3         |               |               |                |          |               |            |             |              |
| Longnose Gar           | 2         |               |               |                | 1        |               | 1          |             |              |
| Northern Pike          |           |               |               | 1              |          |               | 1          | 2           | 1            |
| Northern Sunfish       |           |               |               |                | 1        |               |            |             |              |
| Pugnose Shiner         | 1         |               |               | 31             | 1        |               |            |             |              |
| Pumpkinseed            | 15        | 254           | 22            | 30             | 19       | 3             | 6          | 139         | 50           |
| Pumpkinseed x Bluegill |           |               |               |                |          |               |            | 1           |              |
| Rock Bass              | 32        | 3             | 8             | 4              | 4        | 3             | 7          | 9           | 2            |
| Round Goby             |           |               | 3             |                |          |               |            |             |              |
| Spottail Shiner        | 4         |               | 5             |                |          |               |            |             |              |
| Spotted Sucker         |           |               |               | 2              |          | 1             | 2          |             |              |

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|                         | Bay Lodge | Casilco Marsh | Casilco South | Griffore Marsh | Rex Club | Running Creek | Snye River | Stag Island | Tictac Point |
|-------------------------|-----------|---------------|---------------|----------------|----------|---------------|------------|-------------|--------------|
| Tadpole Madtom          |           |               |               | 2              |          | 1             |            | 1           |              |
| Tube-nose Goby          | 1         |               |               | 2              |          |               | 1          |             |              |
| White Perch             | 65        |               |               |                |          |               |            |             |              |
| Yellow Bullhead         | 2         | 4             | 7             | 1              | 19       |               | 2          |             | 6            |
| Yellow Perch            | 12        | 3             | 2             | 3              | 4        | 1             | 25         | 4           | 6            |
| <b>Total Catch</b>      | 268       | 967           | 398           | 302            | 461      | 31            | 65         | 247         | 273          |
| <b>Species Richness</b> | 20        | 9             | 13            | 17             | 15       | 12            | 17         | 11          | 12           |

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**Table 4.** Total catch for each species at each site from summer 2018 St. Clair River fish community surveys. All fish were collected using fyke nets. For each site, total catch and species richness (excluding hybrids and unidentified species) are also presented.

|                     | Bay Lodge | Casilco Marsh | Casilco South | Griffore Marsh | Rex Club | Snye River | Stag Island | Tictac Point |
|---------------------|-----------|---------------|---------------|----------------|----------|------------|-------------|--------------|
| Gear                | FN        | FN            | FN            | FN             | FN       | FN         | FN          | FN           |
| Banded Killifish    | 2         | 1             | 4             |                |          |            |             | 4            |
| Black Bullhead      |           |               |               |                |          |            |             | 4            |
| Black Crappie       | 1         | 5             |               |                | 2        | 1          |             | 10           |
| Blackchin Shiner    | 1         |               | 1             | 1              |          |            | 17          | 3            |
| Blacknose Shiner    | 15        |               | 35            |                |          |            |             |              |
| Bluegill            | 683       | 244           | 493           | 82             | 638      | 10         | 33          | 2439         |
| Bluntnose Minnow    | 100       |               | 9             |                | 1        | 7          |             |              |
| Bowfin              | 4         | 4             | 10            |                | 7        | 1          | 1           | 3            |
| Brook Silverside    | 2         | 3             | 9             | 4              | 3        | 23         |             | 1            |
| Brown Bullhead      | 1         |               | 1             | 4              | 3        |            |             | 1            |
| Central Mudminnow   |           |               |               |                |          | 1          | 1           |              |
| Common Carp         |           |               | 1             | 1              | 2        |            |             |              |
| Gizzard Shad        |           | 1             |               |                |          |            |             | 2            |
| Golden Shiner       | 62        | 1             | 3             | 3              | 9        | 4          | 4           | 352          |
| Grass Pickerel      |           |               |               | 1              |          |            |             |              |
| Green Sunfish       |           | 2             |               |                |          |            |             | 1            |
| Hybrid Lepomis      |           |               |               |                |          | 1          | 41          |              |
| Largemouth Bass     | 24        | 219           | 15            | 48             | 60       | 5          | 4           | 281          |
| <i>Lepomis</i> spp. |           |               | 1             | 2              |          | 6          | 230         |              |
| Logperch            | 1         |               |               |                |          |            |             |              |
| Longnose Gar        | 5         | 1             |               |                |          | 1          |             | 1            |
| Northern Pike       |           |               |               | 2              |          | 2          | 8           | 1            |
| Pugnose Shiner      |           |               |               |                |          | 1          |             | 3            |
| Pumpkinseed         | 85        | 310           | 84            | 81             | 312      | 3          | 137         | 1069         |
| Rock Bass           | 112       | 6             | 33            | 3              | 16       | 10         |             | 2            |
| Round Goby          |           | 4             | 1             |                | 1        |            |             |              |
| Spottail Shiner     | 51        |               |               |                |          | 6          |             |              |
| Spotted Sucker      | 1         |               |               | 1              |          | 1          | 1           |              |
| Tadpole Madtom      |           | 1             |               |                |          | 1          | 1           |              |
| Tubenose Goby       | 2         |               |               |                |          | 1          |             |              |
| White Crappie       |           |               |               | 1              |          |            |             |              |
| Yellow Bullhead     | 8         |               |               | 2              | 3        | 2          |             | 9            |

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|                         | Bay Lodge | Casilco Marsh | Casilco South | Griffore Marsh | Rex Club | Snye River | Stag Island | Tictac Point |
|-------------------------|-----------|---------------|---------------|----------------|----------|------------|-------------|--------------|
| Gear                    | FN        | FN            | FN            | FN             | FN       | FN         | FN          | FN           |
| Yellow Perch            | 7         | 1             | 2             | 3              | 4        | 10         | 7           | 21           |
| <b>Total Catch</b>      | 1167      | 803           | 702           | 239            | 1061     | 97         | 485         | 4207         |
| <b>Species Richness</b> | 20        | 15            | 15            | 15             | 14       | 19         | 11          | 19           |

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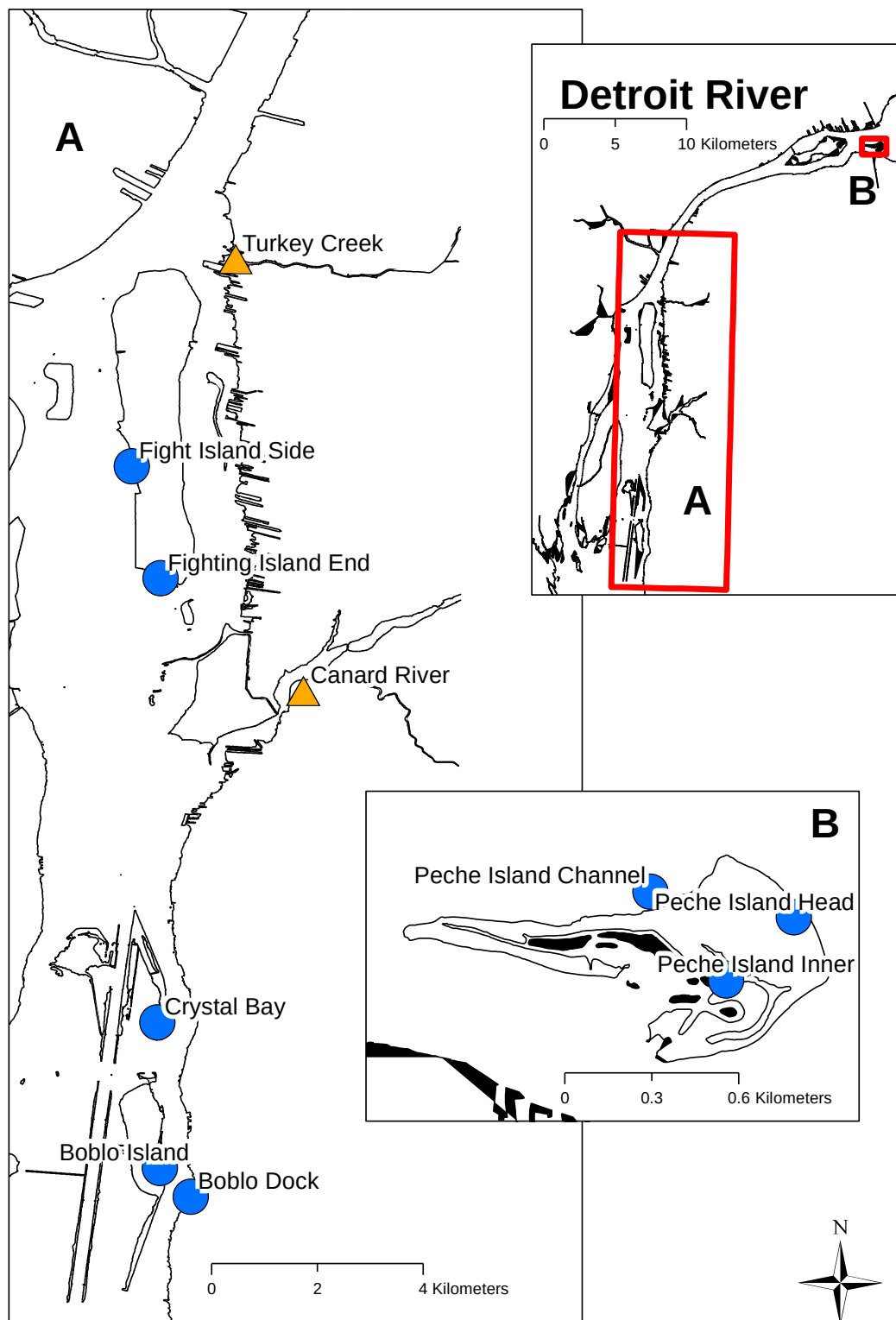
**Table 5.** Total catch for each species at each site from summer 2019 St. Clair River fish community surveys. All fish were collected using fyke nets. For each site, total catch and species richness (excluding hybrids and unidentified species) are also presented. Stag Island was not sampled in 2019 as the site could not be safely accessed.

|                  | Bay Lodge | Casilco Marsh | Casilco South | Griffore | Rex Club | Snye River | Tictac Point |
|------------------|-----------|---------------|---------------|----------|----------|------------|--------------|
| Gear             | FN        | FN            | FN            | FN       | FN       | FN         | FN           |
| Banded Killifish | 1         | 1             |               |          | 2        |            | 1            |
| Black Crappie    | 13        | 10            | 3             | 2        | 3        | 1          | 7            |
| Blackchin Shiner | 10        |               | 8             |          |          |            | 13           |
| Blacknose Shiner | 11        |               | 36            |          |          |            |              |
| Bluegill         | 901       | 1253          | 295           | 98       | 185      | 10         | 2488         |
| Bluntnose Minnow | 119       |               | 29            | 2        | 6        |            | 2            |
| Bowfin           | 5         | 1             | 4             | 5        | 4        | 4          | 2            |
| Brook Silverside | 77        | 314           | 15            | 57       | 7        |            | 6            |
| Channel Catfish  |           |               |               | 1        |          |            |              |
| Common Carp      | 3         | 1             |               |          | 1        |            |              |
| Emerald Shiner   |           |               |               | 4        |          |            |              |
| Gizzard Shad     | 4         | 42            | 9             | 2        | 5        |            | 4            |
| Golden Shiner    | 9         | 38            |               | 1        | 2        | 1          | 75           |
| Goldfish         |           |               |               |          | 1        |            |              |
| Green Sunfish    |           |               | 1             |          |          | 1          |              |
| Lake Chubsucker  |           |               |               |          |          | 49         |              |
| Largemouth Bass  | 16        | 111           | 29            | 9        | 39       | 23         | 17           |
| Logperch         | 7         | 25            | 1             |          | 2        |            | 1            |
| Longnose Gar     |           |               | 1             |          |          |            |              |
| Northern Pike    |           | 2             |               | 1        |          | 1          |              |
| Pugnose Shiner   | 4         |               |               | 1        |          |            | 10           |
| Pumpkinseed      | 84        | 168           | 53            | 13       | 32       | 5          | 117          |
| Rock Bass        | 86        | 8             | 25            |          | 12       | 5          | 31           |
| Round Goby       |           | 2             | 3             |          | 6        |            | 1            |
| Spotfin Shiner   |           |               |               |          | 1        |            |              |
| Spottail Shiner  | 3         |               |               | 18       |          |            |              |
| Spotted Sucker   |           | 1             | 1             | 9        |          | 1          |              |
| Tadpole Madtom   | 1         |               | 1             | 1        | 1        |            | 1            |
| Tubenose Goby    | 1         |               | 1             | 1        |          | 1          | 2            |
| White Perch      |           |               | 1             | 1        | 5        |            |              |
| Yellow Bullhead  | 1         |               | 2             | 4        | 1        | 1          | 4            |
| Yellow Perch     | 62        | 226           | 37            | 5        | 24       | 7          | 26           |

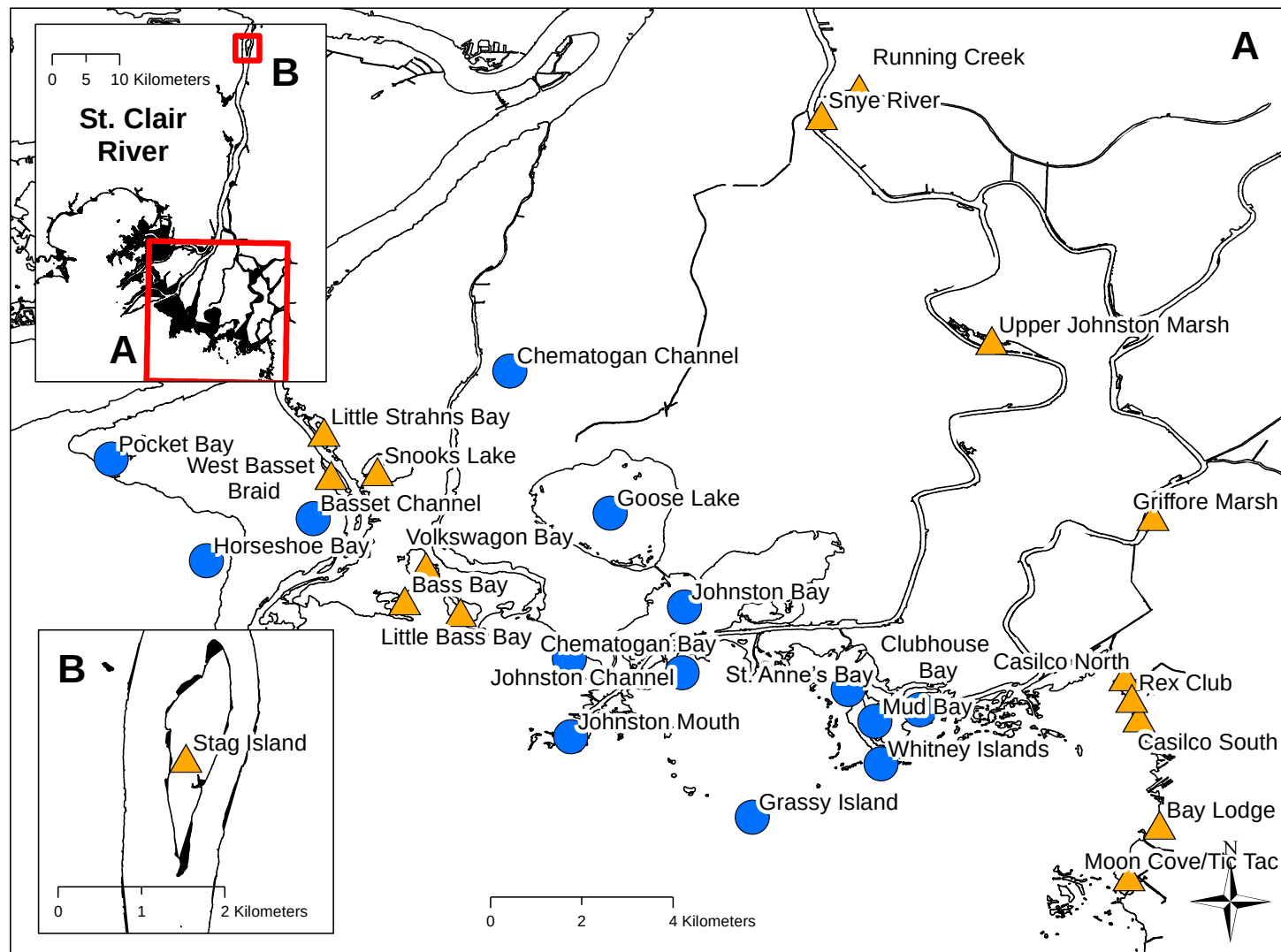
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|                         | <b>Bay Lodge</b> | <b>Casilco Marsh</b> | <b>Casilco South</b> | <b>Griffore</b> | <b>Rex Club</b> | <b>Snye River</b> | <b>Tictac Point</b> |
|-------------------------|------------------|----------------------|----------------------|-----------------|-----------------|-------------------|---------------------|
| <b>Gear</b>             | <b>FN</b>        | <b>FN</b>            | <b>FN</b>            | <b>FN</b>       | <b>FN</b>       | <b>FN</b>         | <b>FN</b>           |
| <b>Total Catch</b>      | 1356             | 1977                 | 518                  | 230             | 315             | 103               | 2782                |
| <b>Species Richness</b> | 21               | 16                   | 21                   | 20              | 20              | 14                | 19                  |

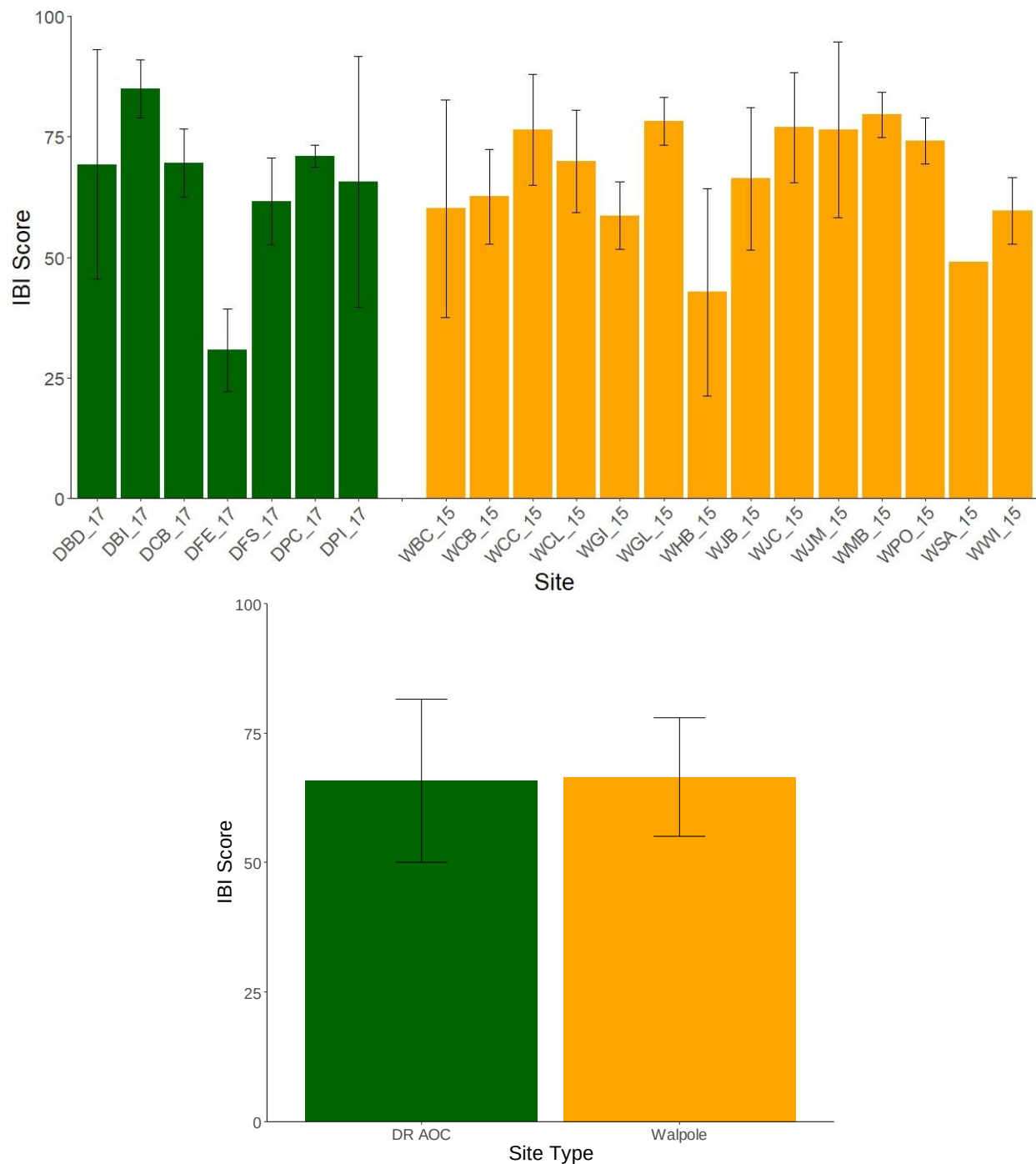
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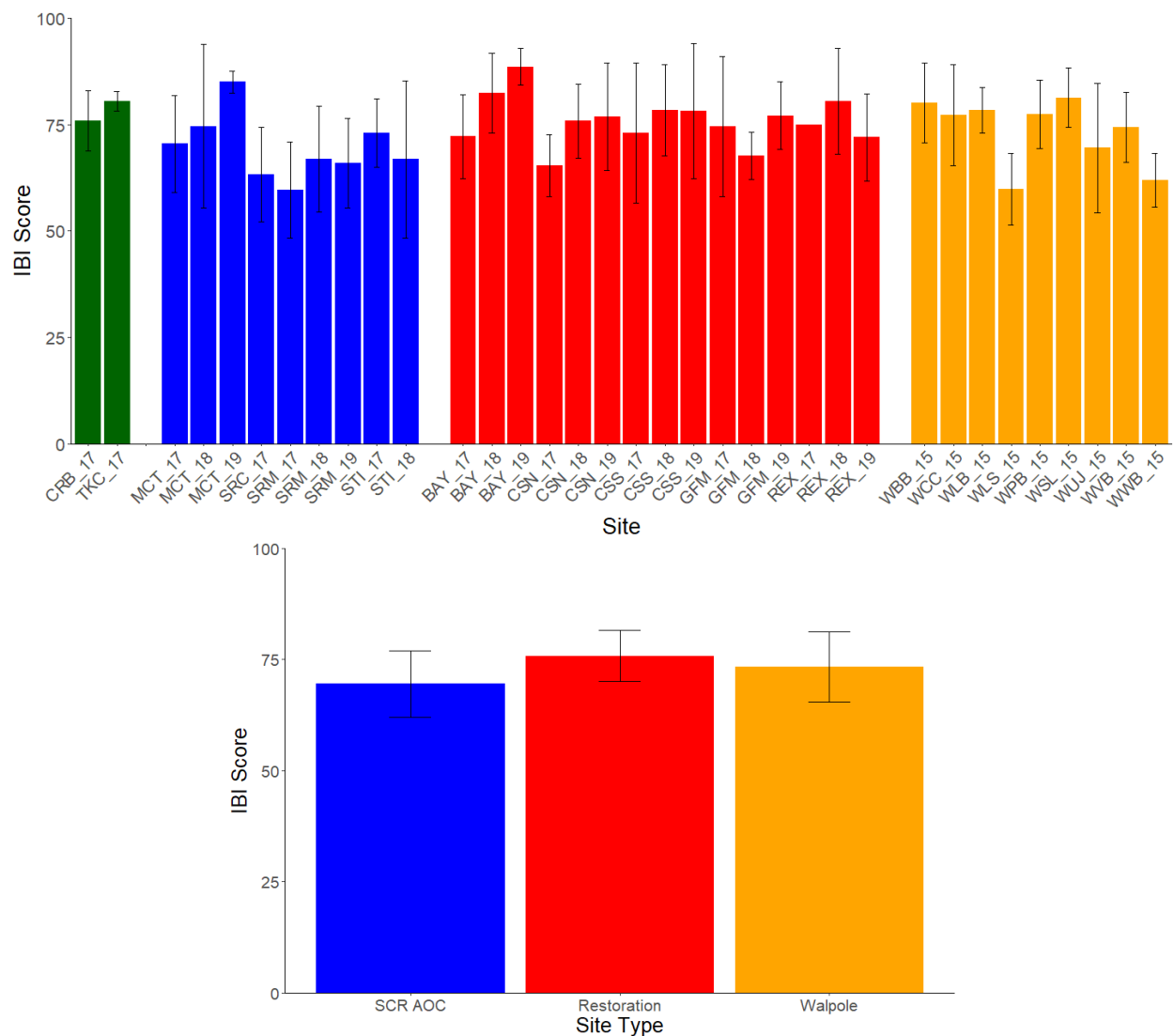
**Figure 1.** Location of sampling sites in the Detroit River Area of Concern. Sites are coded based on the gear used during the survey (electrofishing = blue circle, fyke netting = orange triangle).



**Figure 2.** Location of sampling sites in the St. Clair River Area of Concern and Walpole Island Delta. Sites are coded based on the gear used during the survey (electrofishing = blue circle, fyke netting = orange triangle).



**Figure 3.** Mean Index of Biotic Integrity (IBI) score (with standard deviation[SD]) for each site surveyed using electrofishing in the Detroit River Area of Concern (green) and Walpole Island Delta (yellow; top panel). Overall mean IBI score (with SD) for each group surveyed using electrofishing in the Detroit River Area of Concern (green) and Walpole Island Delta (yellow; bottom panel).



**Figure 4.** Mean IBI score (with standard deviation[SD]) for each site surveyed using fyke nets in the Detroit River Area of Concern (green), St. Clair River Area of Concern (blue), restored sites in the St. Clair River Area of Concern (red), and Walpole Island Delta (yellow; top panel). Overall mean IBI score (with SD) for each group surveyed using fyke nets (bottom panel, colour patterns are the same as the top panel).