STONY AND CELERON ISLANDS HABITAT RESTORATION DESIGN
BASELINE BIOLOGICAL MONITORING – FISH MONITORING, WATER QUALITY AND AQUATIC HABITAT ASSESSMENT

October 2, 2014

Introduction

The purpose of this document is to detail the fish monitoring as part of the baseline biological conditions at Stony and Celeron Islands. The monitoring was conducted to fulfill requirements outlined in the Quality Assurance Project Protocol (QAPP) for the proposed construction and restoration of habitat shoals previously located around the islands. This document will outline the methods used to complete the monitoring and provide a summary of the data collected. Locations of the electrofishing sampling transects and locations of the fyke nets are included in Appendix A. Selected photographs taken during biological monitoring for fish species are included in Appendix B.

Summary

Fish monitoring was conducted three times during April-July of 2014 around Stony and Celeron Islands, as well as two reference locations located in proximity to the two islands. The three monitoring dates were chosen to sample the islands during cool-water spawning months as well as the summer months. The assumption was that the fish community utilizes the islands differently during differing water temperature regimes. The fish communities were sampled using boat electroshocking and deploying fyke nets for one crepuscular cycle.

There was a general trend of species richness and individual abundances increasing as water temperatures increased. The species compositions also changed as water temperatures increased. In the cooler months, species such as white bass, sucker, and redhorse species were in higher abundances. During the warmer months, a larger percentage of young-of-year (YOY) fish were present, especially of the black basses (e.g., largemouth bass). Stony Island consistently had a higher species richness and individuals sampled than any other site, regardless of sampling season.

Water quality parameters were taken at Stony and Celeron Islands during the April fish sampling events. Aquatic habitat was qualitatively described in a general sense. Water levels were generally higher in the Detroit River and water visibility was lower during the observation period, preventing the observers from seeing to the bottom of the river from the boat.

FISH SAMPLING AND WATER QUALITY

Methods

Sampling sites concentrated in areas around both islands that are located inside the proposed habitat shoals. This was to determine the baseline utilization of the fish assemblages within the study sites to help guide restoration efforts. The sampling was conducted on April 23-26, May 20, and July 16-17 and 23-24, 2014. The purpose was to sample in the early spring through the mid-summer to determine the utilization of cool-water and warm-water species around the islands.

Two reference locations were chosen to compare sampling results around the project sites. The purpose of using reference sites is to compare compositional changes between sites and years. This is especially important during project implementation. The inclusion of a reference site allows us to determine if compositional changes at the projects sites are a direct result of the habitat improvements or are a result of natural variation in the environment.

Sampling was conducted using boat electroshocking and the deployment of fyke nets. The electroshocking consisted of using a boom-shocker mounted on a 17-foot aluminum boat powered by a 20-hp 4-cycle outboard motor. The boom shocker was powered by a Smith-Root GPP5.0 electrofisher supplying DC voltage to two boom-mounted electrode arrays manufactured by Smith-Root. The GPP5.0 was set for low-range voltage ad 30% power and 60 pulses per second, with a pulse width set between 6-8 amps. Boat electroshocking was conducted at near-shore and off-shore locations to sample a variety of habitats and depths to gain a comprehensive coverage of the fish assemblage structure. Three fyke nets were deployed near the shoreline with adequate water depths and suitable substrates. A large fyke net with a mouth opening 1.8 m long X 1.2 m in diameter with 19 mm stretch mesh and 23 m leads was set with the leads perpendicular to the shore. Mini fyke nets (2) with a mouth opening 0.75-m high by 1.25 m wide constructed with 4 mm delta mesh, with a 1 m by 7.5 m single lead were set so the lead was perpendicular from shore and the mouth sitting approximately 1 m of water. Fyke nets were set for one crepuscular cycle. Both electroshocking and fyke nets were used during the April and July sampling trips, while only electroshocking was used during the May sampling trip.

Fish assemblage data was assessed for species composition (richness), size structure, and abundance. Size structure for target species was assessed by plotting size-frequency histograms. Catch per unit effort (CPUE; an indirect measure of abundance) was calculated as:

$$\text{CPUE} = \frac{n}{t}$$

Where n = the number of individuals sampled, and t = the length of the sampling time (in minutes). Species diversity at each sampling location was assessed using two diversity indices, the Shannon-Weiner Index and the effective number of species. The Shannon-Wiener Index can show a significant difference between communities at each sampling site based on taxonomic diversity. However, the index cannot adequately describe the difference or the magnitude of the difference because it is highly non-linear. For example, a significant change in true diversity could represent a small change in the Shannon-Weiner Index. Therefore, the Shannon-Weiner Index is traditionally converted to the effective number of species, which is considered a true measure of diversity, e.g., a 2x change in the effective number of species can be considered a 2x change in species diversity. The Shannon-Weiner index is calculated as:

$$H' = -\Sigma p_i \log p_i$$

Where:

H’ Shannon-Wiener Index

p_i proportion of species i

The effective number of species is calculated as $e^{H'}$, or the base of the natural logarithm raised to the power of H’. Similarity between sampling times and between project sites and the reference sites were assessed using the Sørensen’s Similarity Index, calculated as:

$$S = \frac{2C}{A+B}$$

Where S is the similarity index, A and B are the number of species in assemblages A and B, respectively, and C is the number of species in common with the two assemblages.

Deviations from the QAPP

Due to a very low number of species, both in richness and abundances, collected during the April sampling trip, a supplemental trip was planned. The low numbers were thought to be a result of either a) utilization of the islands during the cool-water period (i.e., after ice-out) was low or, b) water temperatures were too low due to the extended winter weather and fish had not moved closer to shore yet. Therefore, the supplemental May sampling trip was scheduled on May 20, 2014, to determine which scenario was more likely.

Water quality parameters were taken using a YSI 556 multi-parameter handheld meter at Stony and Celeron Islands on April 24 and 25, 2014, respectively. Before each trip the instrument was calibrated according to the manufacturer's instructions. Quantification of turbidity was substituted for secchi depths. A secchi depth was taken at Celeron Island only, as it was overcast and conditions were not appropriate for a secchi depth reading at Stony Island. Water velocity was not quantified.

Due to high river (and Great Lakes) water levels, aquatic habitat mapping was described qualitatively and in a general sense due to low visibility of the river bottom during the July sampling event. Water quality parameters were taken only during the April sampling trip at a fixed point in close proximity to each island.

Results

The inside and outside transects were combined for electroshocking data and data from all three fyke nets are combined.

Celeron Island

Water quality parameters were within normal parameters during the April 24th sampling event. Temperature was 7.9°C, dissolved oxygen was 109.9% saturation (13.03 mg/L), pH was 7.45, conductivity was 264 µS/cm, and the secchi depth was 114 inches (9 ft. 6 in.).

In April, 4 species total were collected during electroshocking efforts, 83% of which were emerald shiner (*Notropis atherinoides*). Catch per unit effort (CPUE), which can be an indirect measure of abundance, was 0.57 fish/minute. The majority of fish caught were forage fish, with the exception of a single largemouth bass.

In May, a total of 11 different species were captured for a total of 142 individuals. The most abundant species captured was white bass (*Morone chrysops*), equaling 41% of the total catch, followed by emerald shiner (23%) and freshwater drum (10%; *Aplodinotus grunniens*). The CPUE for Celeron Island during May sampling was 4.41 fish/minute.

July electroshock sampling yielded slightly lower species richness than May (8 species) and significantly lower numbers (44). The lower numbers is likely due to the absence of white bass migration in the Detroit River for spawning. Quillback were also completely absent for similar reasons. The most abundant species were greater redhorse and longnose gar, which comprised of 32% and 27% of the total catch. The CPUE for Celeron Island in July was 1.2 fish/minute. A full list of the species and numbers captured during 2014 electroshocking are listed in Table 1.

In April, the fyke nets yielded slightly more species than electroshocking but the number of individuals captured was almost equal to electroshocking (22 for electroshocking, 21 for fyke nets). The most abundant fish captured in the fyke nets in April were rock bass (*Ambloplites rupestris*), equaling 43% of

the catch. In July, the most abundant species captured were YOY smallmouth bass, equaling 65% of the total fykne net catch. Rock bass were the second most abundant species captured, comprising 24% of the catch. A full list of the species and numbers captured during 2014 fyke net sampling are listed in Table 2.

There was a general trend of size-class utilization change from April to the July sampling periods. Typically, in April and May, the size classes of target species consisted of mainly adults and large juveniles. This would indicate that most of the species were in the 2+ age classes. However, in July, there were significantly more young-of-year (YOY) fish, especially largemouth bass (Figure 1). This would indicate that locations around Celeron Island are being utilized by some target species for spawning and nursery habitat.

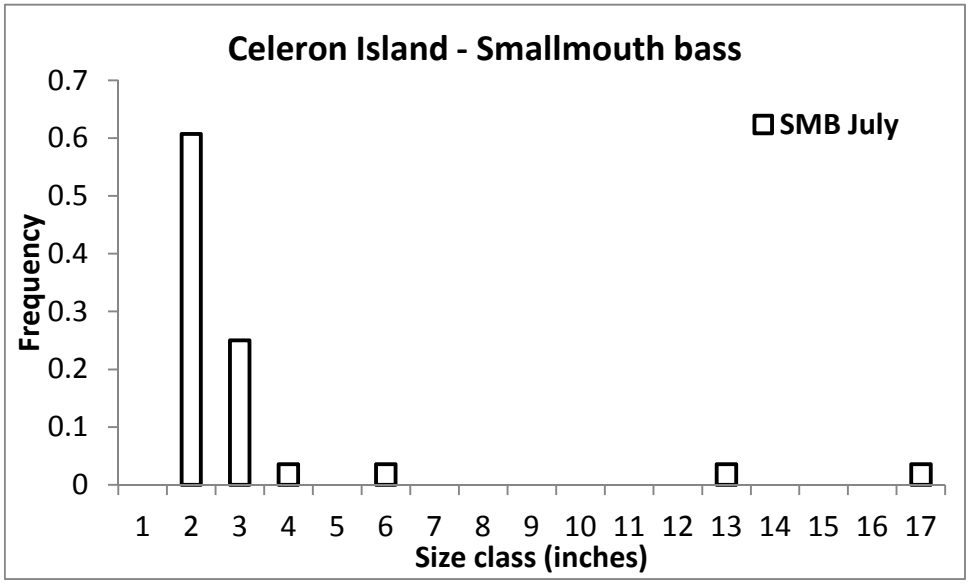

Figure 1 Size class of smallmouth bass captured during fish monitoring sampling at Celeron Island. No smallmouth bass were collected during the April or May sampling events, but were present during July sampling.

Table 1 Species richness and abundance of fish sampled using electroshocking around Celeron Island on the Detroit River. Electroshocking occurred on April 23, May 20, and July 16, 2014.

Common name	Scientific name	April	May	July	Total
White bass	*Morone chrysops*		58		58
Emerald shiner	*Notropis atherinoides*	19	32		51
Longnose gar	*Lepisosteus osseus*		5	12	17
Freshwater drum	*Aplodinotus grunniens*		14	2	16
Greater redhorse	*Moxostoma erythrurum*			14	14
Black bullhead	*Ameiurus melas*		11		11
Quillback	*Carpiodes cyprinus*		9		9
Silver redhorse	*Moxostoma anisurum*		4	5	9
Round goby	*Neogobius melanostomus*			5	5
Smallmouth bass	*Micropterus dolomieu*		1	4	5
Common carp	*Cyprinus carpio*	1	2		3

Goldfish	*Carassius auratus*		3		3
Yellow perch	*Perca flavescens*		3		3
Largemouth bass	*Micropterus salmoides*	1			1
Rock bass	*Ambloplites rupestris*			1	1
Spottail shiner	*Notropis hudsonius*	1			1
Walleye	*Sander vitreus*			1	1
	Total	22	142	44	208
	Species richness	4	11	8	17

Table 2 Species richness and abundance of fish sampled using fyke nets around Celeron Island on the Detroit River. Fyke nets have been combined by sampling period. Sampling occurred on April 23-24, 2014 and July 16-17, 2014.

Common name	Scientific name	April	July	Total
Bluegill	*Lepomis macrochirus*	2		2
Bluntnose minnow	*Pimephales notatus*	2		2
Emerald shiner	*Notropis atherinoides*	5		5
Goldfish	*Carassius auratus*	1	1	2
Rock bass	*Ambloplites rupestris*	9	9	18
Round goby	*Neogobius melanostomus*		3	3
Smallmouth bass	*Micropterus dolomieu*		24	24
Spottail shiner	*Notropis hudsonius*	1		1
White perch	*Morone americana*	1		1
	Total	**21**	**37**	**58**
	Species richness	**7**	**4**	**9**

There was a substantial increase in diversity from April to July at Celeron Island. Shannon-Weiner diversity (H') increased from 0.55 in April to 1.78 in May. July sampling had a similar H' to May (1.74). Species evenness increased as well, with the community becoming more even (i.e., less dominance by a low number of species) throughout the sampling period. A full list of diversity indices are reported in Table 3. Overall, each of the sampling periods at Celeron Island were very dissimilar to each other. The S index for between-month comparisons were all below 0.5, indicating the communities were compositionally dissimilar each sampling period (Table 4).

Table 3 Diversity indices for the four sampling site, including the two project sites (Stony and Celeron Islands) and the two reference sites (Sugar Island and the Celeron Reference site). H' is the Shannon-Weiner diversity index, $e^{H'}$ is the effective number of species, and E is species evenness.

	Month	CPUE (fish/min)	Species richness	Total individuals (n)	H'	$e^{H'}$	E
Celeron	April	0.569	4	22	0.55	1.73	0.40
	May	4.408	11	142	1.78	5.93	0.74

	July	1.231	8	44	1.74	5.72	0.84
Stony	April	1.405	11	84	1.61	4.99	0.67
	May	3.065	20	230	2.31	10.08	0.77
	July	1.907	29	160	2.89	18.07	0.86
Sugar	April	0	0	0	-	-	-
	May	5.293	8	122	0.88	2.41	0.42
	July	0.796	6	19	1.59	4.90	0.89
Celeron Reference	April	0.073	1	1	-	-	-
	May	0.664	4	21	1.20	3.31	0.86
	July	3.148	16	102	2.43	11.40	0.88

Table 4 Sørensen's similarity index comparing the species composition at Celeron Island between the three sampling periods. The index is on a scale from 0 to 1, with similarity increasing as the index approaches 1.

Month comparison	Celeron
April vs May	0.27
May vs July	0.42
April vs July	0.00

Compositional similarity between Celeron Island and the two reference locations was low for most sampling periods (i.e., below 0.5). In July, the species composition between Celeron Island and Sugar Island were most similar; however, the Sørensen's index was still below 0.75 (Table 5). This would indicate that, while some species are found at both the project site and reference sites, utilization of the different islands are not similar based on the species present.

Table 5 Sørensen's similarity index comparing the species composition at Celeron Island between the three sampling periods and the two reference locations over the same sampling period. The index is on a scale from 0 to 1, with similarity increasing as the index approaches 1.

	Sugar	Celeron Reference
May	0.42	0.40

July	0.57	0.50

Stony Island

Water quality parameters at Stony Island during the April sampling event were within normal ranges for the time of year. Water temperature was 7.66°C, dissolved oxygen was 104.3% saturation (12.46 mg/L), pH was 7.74, and conductivity was 232 µS/cm.

On April 4, 11 species were collected during electroshocking efforts, with a total of 84 individuals. The most abundant species were bluntnose minnow (*Pimphales notatus*), comprising of 54% of the total catch. There were more sucker species (Catostomidae) caught at Stony Island during the April sampling event than any other site. The majority were northern hogsucker (*Hypentelium nigricans*), with low abundances of spotted sucker (*Minytrema melanops*) and white sucker (*Catostomus commersonii*). The CPUE for electroshocking in April was 1.40.

In May, 230 individuals were sampled during electroshocking efforts, comprised of 20 species. The most abundant species were white bass (30%), quillback (*Carpiodes cyprinus*; 17%), and bluntnose minnow (11%). There were also a larger abundance of suckers and redhorse species caught at Stony Island than any other site. The sucker species caught at Stony Island during the May sampling include northern hogsucker, shorthead redhorse (*Moxostoma macrolepidotum*), silver redhorse (*Moxostoma anisurum*), quillback, and white sucker. The CPUE for Stony Island in May was 3.07 fish/minute.

In July, fewer numbers of fish were sampled (160), but resulted in higher species richness than the previous sampling periods (29). The dominant species was the round goby (*Neogobius melanostomus*) which was 18% of the total catch, followed by yellow perch (14%), and rock bass (10%). The CPUE for electroshocking in July was 2.4 fish/minute. A full list of the species and numbers captured during 2014 electroshock sampling are listed in Table 6.

There was a general trend of size-class utilization change from April to the July sampling periods. Typically, in April and May, the size classes of target species consisted of mainly adults and large juveniles. This would indicate that most of the species were in the 2+ age classes. However, in July, there were significantly more young-of-year (YOY) fish, especially largemouth and smallmouth bass (Figure 2, 3). This would indicate that locations around Stony Island are being utilized by some target species for spawning and nursery habitat.

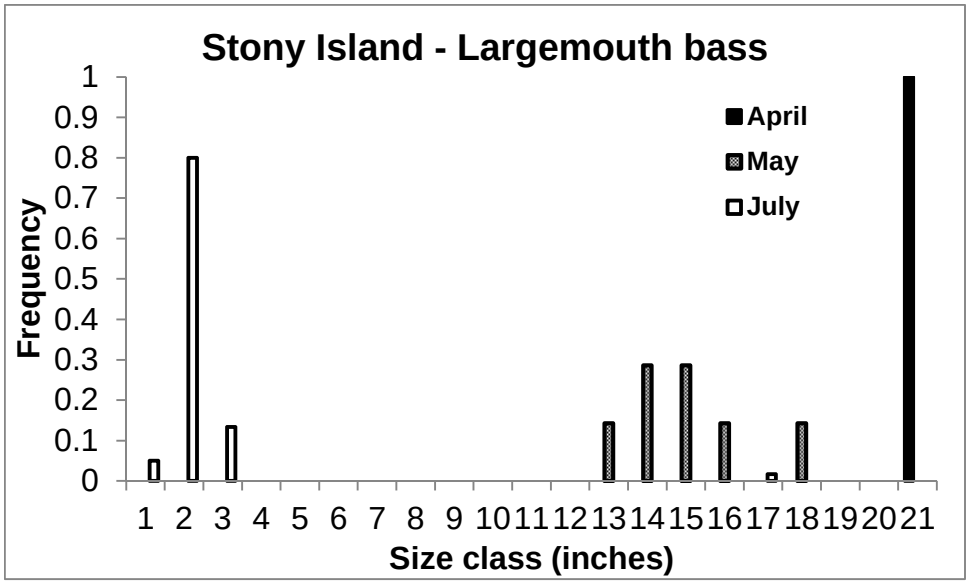

Figure 2 Largemouth bass size classes during the 2014 fish monitoring sampling at Stony Island.

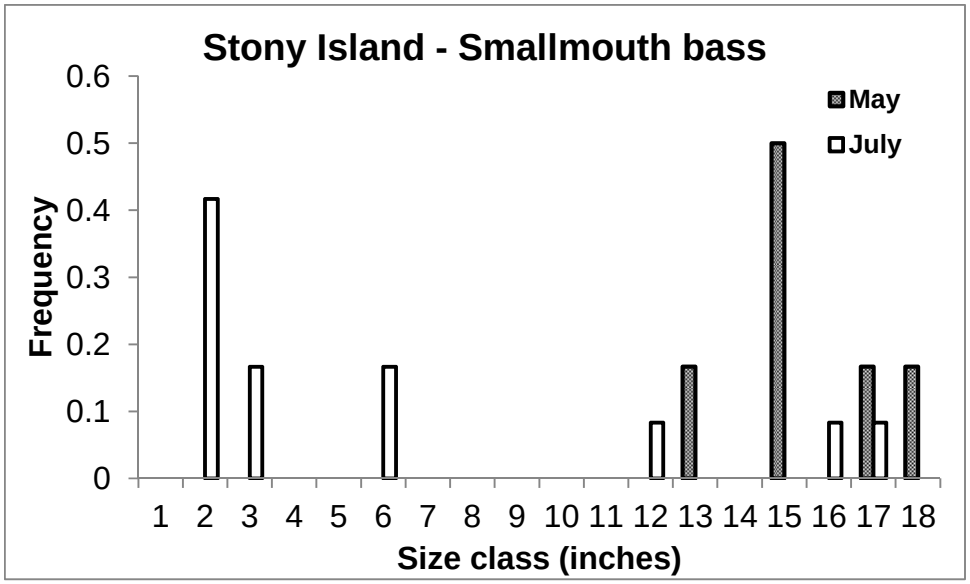

Figure 3 Smallmouth bass size classes during the 2014 fish monitoring sampling at Stony Island. No smallmouth bass were collected during the April fish sampling survey.

Three fish comprised of two species were caught in the fyke nets during the April sampling: rock bass (2) and bluntnose minnow (1). In July, species richness was 11 and the total number of individuals captured was 93. The most abundant species captured were YOY largemouth bass and rock bass, equaling 56% and 24% of the total, respectively. However, two of the fyke nets had rolled over as a result of strong currents so fyke net catch effectiveness was likely reduced. A full list of the species and numbers captured during 2014 fyke net sampling are listed in Table 7.

Table 6 Species richness and abundance of fish sampled using electroshocking around Stony Island on the Detroit River. Electroshocking occurred on April 23, May 20, and July 16, 2014.

Common name	Scientific name	April	May	July	Total
Black bullhead	*Ameiurus melas*		1	1	2
Blacknose shiner	*Notropis heterolepis*			1	1
Bluegill	*Lepomis macrochirus*			1	1
Bluntnose minnow	*Pimephales notatus*	45	26	11	82
Bowfin	*Amia calva*		1	3	4
Common carp	*Cyprinus carpio*	12		6	18
Common shiner	*Luxilus cornutus*		3		3
Emerald shiner	*Notropis atherinoides*	3	3		6
Freshwater drum	*Aplodinotus grunniens*		8	15	23
Goldfish	*Carassius auratus*			5	5
Grass pickerel	*Esox americanus*			1	1
Greater redhorse	*Moxostoma valenciennesi*			15	15
Johnny darter	*Etheostoma nigrum*		3	2	5
Largemouth bass	*Micropterus salmoides*	2	7	8	17
Logperch	*Perca caprodes*			2	2
Longnose gar	*Lepisosteus osseus*		9	2	11
Mudpuppy	*Necturus maculosus*			1	1
Northern hogsucker	*Hypentelium nigricans*	7	2	1	10
Northern pike	*Esox lucius*	4	2	3	9
Pumpkinseed	*Lepomis gibbosus*			5	5
Quillback	*Carpiodes cyprinus*		38		38
Rainbow darter	*Etheostoma caeruleum*			1	1
Rock bass	*Ambloplites rupestris*			13	13
Round goby	*Neogobius melanostomus*		2	23	25
Shorthead redhorse	*Moxostoma macrolepidotum*		17		17
Silver lamprey	*Ichthyomyzon unicuspis*	1			1
Silver redhorse	*Moxostoma anisurum*		16	2	18
Smallmouth bass	*Micropterus dolomieu*		6	8	14
Spottail shiner	*Notropis hudsonius*	6		4	10
Spotted sucker	*Minytrema melanops*	1		1	2
Striped shiner	*Luxilus chrysocephalus*		1		1
Tubenose goby	*Proterorhinus marmoratus*			3	3
Walleye	*Sander vitreus*	1			1
White perch	*Morone americana*		68		68
White sucker	*Catostomus commersonii*	2	15	2	19
Yellow bullhead	*Ameiurus natalis*			2	2
Yellow perch	*Perca flavescens*		2	18	20
	Total	84	230	160	474
	Species richness	11	20	29	37

Table 7 Species richness and abundance of fish sampled using fyke nets around Stony Island on the Detroit River. Fyke nets have been combined by sampling period. Sampling occurred on April 24-25, 2014 and July 22-23, 2014.

Common name	Scientific name	April	July	Total

Bluegill	*Lepomis macrochirus*		6	6
Bluntnose minnow	*Pimephales notatus*	1		1
Bowfin	*Amia calva*		1	1
Common carp	*Cyprinus carpio*		1	1
Largemouth bass	*Micropterus salmoides*		52	52
Longnose gar	*Lepisosteus osseus*		1	1
Pumpkinseed	*Lepomis gibbosus*		2	2
Rock bass	*Ambloplites rupestris*	2	22	24
Round goby	*Neogobius melanostomus*		2	2
Smallmouth bass	*Micropterus dolomieu*		4	4
Spotted sucker	*Minytrema melanops*		1	1
Yellow bullhead	*Ameiurus natalis*		1	1
	Total	**3**	**93**	**96**
	Species richness	**2**	**11**	**12**

In general, the fish assemblage around Stony Island became more diverse as the season progressed. April had the lowest species diversity (H' = 1.61) while July had the highest (H' = 2.89). Species evenness also increased from April to July, indicating there was less dominance by a low number of species as the months progressed. Catch per unit effort was highest in May (3 fish/minute); however, species richness was highest in July, with 29 species sampled. A full list of diversity indices are reported in Table 3. Comparatively, the assemblages in May and July were the most similar to each other (S = 0.57), but when comparing the other sampling periods, compositional similarity was mostly dissimilar (Table 8).

Table 8 Sørensen's similarity index comparing the species composition at Stony Island between the three sampling periods. The index is on a scale from 0 to 1, with similarity increasing as the index approaches 1.

	Stony
April vs May	0.39
May vs July	0.57
April vs July	0.40

Compositional similarity between Stony Island and the two reference locations was low for most sampling periods (i.e., below 0.5). In July, the species composition between Stony Island and Celeron Island Reference site were most similar; however, the Sørensen's index was still below 0.75 (Table 9). This would indicate that, while some species are found at both the project site and reference sites, utilization of the different islands are not similar based on the species present.

Table 9 Sørensen's similarity index comparing the species composition at Stony Island between the three sampling periods and the two reference locations over the same sampling period. The index is on a scale from 0 to 1, with similarity increasing as the index approaches 1.

	Sugar	Celeron Reference
May	0.50	0.33
July	0.29	0.64

Sugar Island

Sugar Island was one of the two potential reference sites chosen. No fish were caught during electroshocking or fyke net deployment in April.

In May, 122 individuals were sampled comprising 8 different species. Emerald shiner were 78% of the total catch, with white bass and white perch (*Morone americana*) being the next most abundant species captured (8% and 7% respectively). The CPUE for this site was 5.29 fish/minute.

In July, fewer species were sampled as well as total individuals than during May sampling. Six different species were sampled comprised of 19 individuals. The community was dominated by round goby (37%) and smallmouth bass (21%). A full list of species composition and abundances can be found in Tables 10.

Species compositions and diversity were relatively low at Sugar Island. No species were captured in April of 2014, indicating little to no use of the island during the cooler water period. While diversity increased from May to July, CPUE was highest in April (5.3 fish/second) as well as species richness. However, evenness was lowest in May, which was driven by the high number of emerald shiner sampled. Evenness and diversity were highest in July. A full list of diversity indices are reported in Table 3.

Table 10 Species richness and abundance of fish sampled using electroshocking around Sugar Island on the Detroit River. Electroshocking occurred on April 23, May 20, and July 16, 2014.

Common name	Scientific name	April	May	June	Total
Emerald shiner	*Notropis atherinoides*		95		**95**
White bass	*Morone chrysops*		10		**10**
Round goby	*Neogobius melanostomus*		1	7	**8**
White perch	*Morone americana*		8		**8**
Smallmouth bass	*Micropterus dolomieu*			4	**4**
Common shiner	*Luxilus cornutus*		3		**3**
Greater redhorse	*Moxostoma valenciennesi*			3	**3**
Logperch	*Perca caprodes*			3	**3**
Quillback	*Carpiodes cyprinus*		3		**3**
Freshwater drum	*Aplodinotus grunniens*		1	1	**2**
Striped shiner	*Luxilus chrysocephalus*			1	**1**
White sucker	*Catostomus commersonii*		1		**1**
	Total	0	122	19	141
	Species richness	0	8	6	12

NE Celeron Reference

Because of the lack of sampling data during the April sampling trip at Sugar Island, the northeast section of Celeron Island was chosen as a supplemental reference site.

In April, only two largemouth bass were collected through boat electroshocking. One of the fyke nets contained emerald shiner that numbered in the multiple thousands, so a subsample of 500 were

counted and the rest were approximated and released. However, all of the emerald shiners were still visually processed before releasing back into the water to ensure no different species were missed. The second most abundant species captured in the fyke nets at this site were rock bass.

In May, low numbers of fish and species were caught at the Celeron reference site. Four species were caught comprised of 21 individuals. The two most abundant species were white bass and yellow perch (*Perca flavescens*), each of which were 38% of the total catch. Interestingly, all but one of the yellow perch were between the 8" and 12" size classes.

July sampling yielded a species richness of 16 with a total of 102 individuals sampled. The dominant species were yellow perch (23%), goldfish and common carp (22%), and greater redhorse (11%). The CPUE for July electroshocking was 3.1 fish/minute. %). A full list of species composition and abundances can be found in Tables 11.

Recovered fyke nets in April yielded over 500 individuals, a large majority of which were emerald shiners. Due to the large number that were captured, only 500 were subsampled and the rest were released. The second most dominant species was rock bass. In July, catch numbers were lower but had a higher species richness. The dominant species were rock bass, bluegill, and largemouth bass. In July, one of the fyke nets had rolled over in the strong currents upon recovery so fyke net catch efficiency was likely reduced. Table 12 lists the species composition and abundance for the two fyke net sampling periods.

Species richness and individuals sampled increased from April to July at the Celeron Reference site. Diversity was comparatively low in May compared to July, with a 244% increase in true diversity ($e^{H'}$) between the two sampling periods. Despite this large increase in diversity, species evenness was very similar (0.86 in May and 0.88 in July), indicating the assemblages during the two months did not have a high dominance of a low number of species. Catch per unit effort was also highest in July with a value of 3 fish/second. A full list of diversity indices are reported in Table 3.

Table 11 Species richness and abundance of fish sampled using electroshocking around the reference site on Celeron Island on the Detroit River. Electroshocking occurred on April 23, May 20, and July 16, 2014.

Common name	Scientific name	April	May	June	Total
Yellow perch	*Perca flavescens*		8	23	**31**
Goldfish	*Carassius auratus*			12	**12**
Common carp	*Cyprinus carpio*			11	**11**
Greater redhorse	*Moxostoma valenciennesi*			11	**11**
Rock bass	*Ambloplites rupestris*			9	**9**
White bass	*Morone chrysops*		8		**8**
Largemouth bass	*Micropterus salmoides*	2	1	4	**7**
Round goby	*Neogobius melanostomus*			7	**7**
White sucker	*Catostomus commersonii*			7	**7**
Longnose gar	*Lepisosteus osseus*		4	2	**6**
Bluegill	*Lepomis macrochirus*			4	**4**
Carp x goldfish				3	**3**

Pumpkinseed	*Lepomis gibbosus*			3	**3**
Freshwater drum	*Aplodinotus grunniens*			2	**2**
Spottail shiner	*Notropis hudsonius*			2	**2**
Brown bullhead	*Ameiurus nebulosus*			1	**1**
Silver redhorse	*Moxostoma anisurum*			1	**1**
	Total	2	21	102	125
	Species richness	1	4	16	17

Table 12 Species richness and abundance of fish sampled using fyke nets around the northeast Celeron Island reference site on the Detroit River. Fyke nets have been combined by sampling period. Sampling occurred on April 25-26, 2014 and July 23-24, 2014.

Common name	Scientific name	April	July	Total
Black bullhead	*Ameiurus melas*		2	2
Bluegill	*Lepomis macrochirus*		9	9
Bluntnose minnow	*Pimephales notatus*	2	1	3
Brook silverside	*Labidesthes sicculus*	2		2
Common carp	*Cyprinus carpio*		2	2
Emerald shiner	*Notropis atherinoides*	500		500
Green sunfish	*Lepomis cyanellus*	1		1
Johnny darter	*Etheostoma nigrum*		2	2
Largemouth bass	*Micropterus salmoides*	1	7	8
Northern pike	*Esox lucius*		1	1
Pumpkinseed	*Lepomis gibbosus*		1	1
Rock bass	*Ambloplites rupestris*	39	14	53
Round goby	*Neogobius melanostomus*	1	1	2
Smallmouth bass	*Micropterus dolomieu*		2	2
Spotfin shiner	*Cyprinella spiloptera*		1	1
White sucker	*Catostomus commersonii*	1	1	2
Yellow bullhead	*Ameiurus natalis*		1	1
Yellow perch	*Perca flavescens*	2		2
	Total	**549**	**45**	**594**
	Species richness	**9**	**14**	**18**

AQUATIC HABITAT MAPPING

Celeron Island

The aquatic habitat around Celeron Island where the proposed shoals will be constructed was a combination of sand and gravel substrate or dense vegetation. The dominant vegetation was wild celery (*Vallisneria Americana*). Closer to the island, vegetation was sparse and the bottom was primarily sand and gravel. Further offshore, the vegetation became more dense and shifted to the dominant habitat type. Along the south west section to the north west section of the shoal, the composition and hard substrate (e.g., bedrock) and vegetation was approximately half. North of the western side of the proposed shoal, the substrate was dominated more by sand, gravel, and bedrock with patches of vegetation.

Stony Island

The majority of the southern end of Stony Island was dominated by wild celery. There were little to no areas in this section where substrate was observed due to dense growth of aquatic macrophytes. Along the west side of Stony Island, the substrate shifted to less vegetation and was dominated by sand and cobbles, due to the faster current. The north western section of Stony Island was also dominated by sand substrates with gravel and cobbles. Vegetation was present closer to the shore within this section in the stiller waters.

APPENDIX A


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Celeron Island
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ECT Environmental Consulting & Technology, Inc.
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Feet
Copyright© 2014 Esri, DeLorme, HERE, TomTom, Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community


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Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community


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ECT Environmental Consulting & Technology, Inc.
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Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

APPENDIX B

Figure 1 Fish electroshocking at the south section near Stony Island

Figure 2 Fish electroshocking at the south end near Stony Island

Figure 3 Fyke net retrieval along the south western section of Celeron Island

Figure 4 Fyke net retrieval along the south western section of Celeron Island

Figure 5 Fyke net retrieval along the south western section of Celeron Island

Figure 6 Measuring fish sampled at the Celeron Reference site

Figure 7 Measuring fish sampled at the Celeron Reference site

Figure 8 Freshwater drum (*Aplodinotus grunniens*) sampled along the southern section of Stony Island