STONY ISLAND HABITAT RESTORATION PROJECT
PRE- AND POST- CONSTRUCTION FISH MONITORING SUMMARY

The purpose of this summary is to present the fisheries collection data for pre- and post- construction monitoring of the Stony Island Restoration project. This document will outline the methods used to complete the monitoring, provide a summary of the data collected, and assess those data based on the project performance metrics outlined in the NOAA Performance Measures. The data were then analyzed for differences between pre- and post- project construction.

Methods

Sampling sites were located in areas around Stony Island shoreline and between the habitat shoals and the island (Figure 1) to determine the species present and their utilization of habitats within the project area prior to and following project construction. Three sampling methods were utilized: ichthyoplankton net tows (i.e., larval fish and eggs), fyke net sets, and boat electrofishing. Multiple sampling methods were chosen to capture all fish life stages.

Ichthyoplankton

Larval fish sampling was conducted on July 21, 2016 for pre-construction monitoring and once a month from April to July, 2018, for post-construction monitoring. It was originally planned for ichthyoplankton sampling to be conducted from April to July, 2016 for pre-construction monitoring; however, QAPP approval and the timing of construction did not allow for the extended sampling, as the QAPP was finalized in late July of 2016.

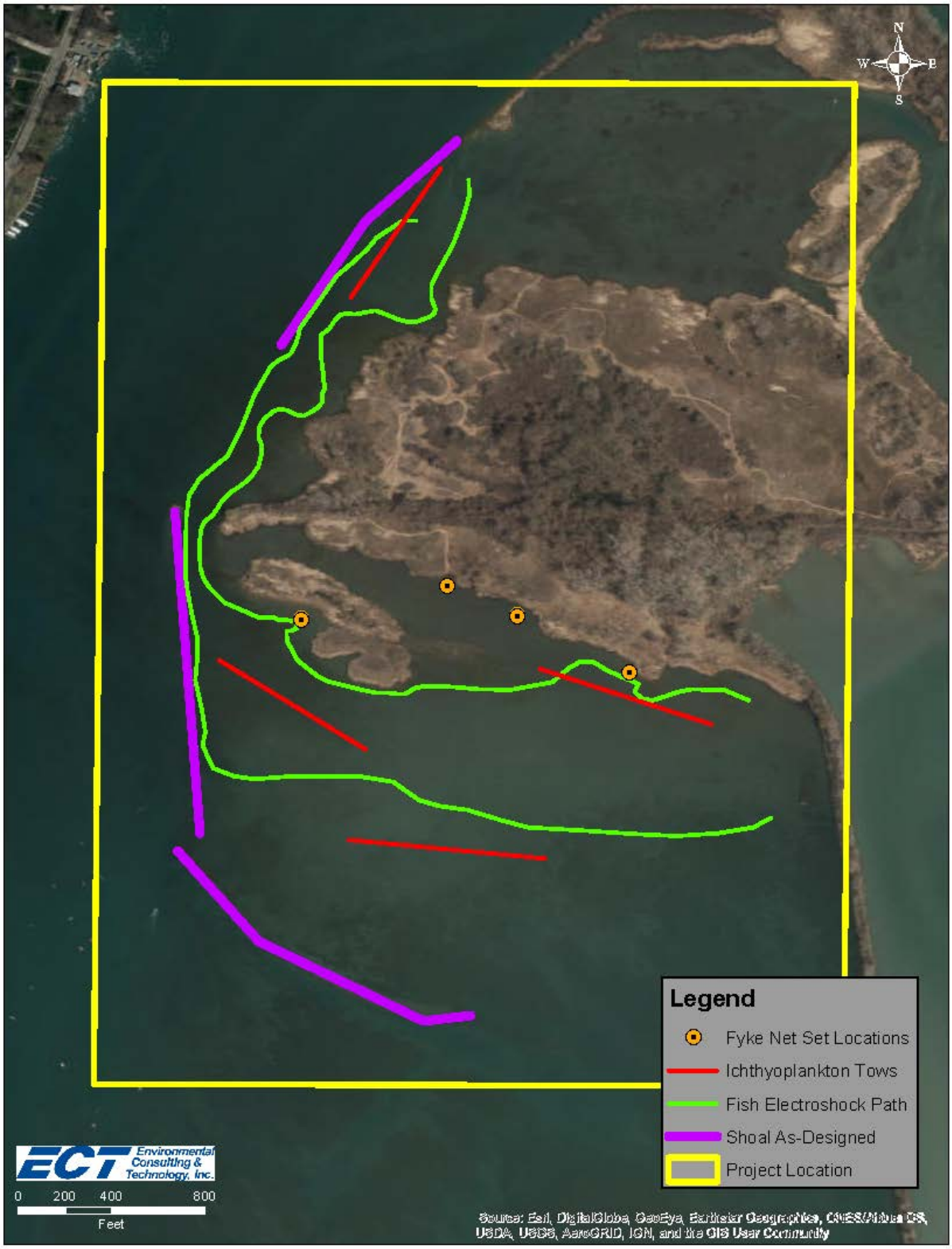

Figure 1. Site Map of Stony Island Fish Sampling Locations.

Ichthyoplankton for pre-construction monitoring were collected using a net deployed off the bow of the boat. The conical net was equipped with a 0.5 meter diameter mouth and 3.0 meter body consisting of 500 micron mesh terminating in a 9 cm diameter by 30.4 cm long 500 micron mesh filtering cod end bucket. The volume of water sampled was approximated by calculating the area of the net opening multiplied by the length of the transect. The net was lowered by a boom attached to the bow of the boat, with the top of the net sitting at the water line (Figure 2). All sampling transect speeds were conducted at approximately 2 m/s (5 mph).

Post-construction monitoring of ichthyoplankton involved deploying the same net approximately 10 m behind the boat and the same speeds and following the same transects as the pre-construction monitoring. GPS was used for position tracking. A different tow method was used post-construction because a different boat was used. While the deployment method used for post-construction was different than the method used for pre-construction, it was not assumed there would a difference in the capture efficiencies between the two methods.

At the end of each sampling transect, samples were carefully rinsed from the cod end bucket into a pre-labeled Nalgene container using 95% ethanol. Samples were then preserved in 95% ethanol. Container labels (both exterior and interior) contained the following information: date, sampling times (start and end) for each tow, location, collectors, project site, and sample number. Sample containers were shipped to a taxonomy laboratory for processing and identification to the lowest possible taxonomic level. Ichthyoplankton life stages were also determined in the lab. Terminology for the developmental phases included eggs, yolk-sac larvae, post yolk-sac larvae, and juveniles. The criteria for the three latter developmental phases are as follows:

- Yolk-sac larvae – Phase of development from the time of hatch to complete absorption of yolk
- Post yolk-sac larvae – Phase of development from complete absorption of yolk to development of full compliment of adult fin rays and absorption of finfold.
- Juvenile – Phase of development from complete fin ray development and finfold absorption to sexual maturity (includes young-of-year fish).

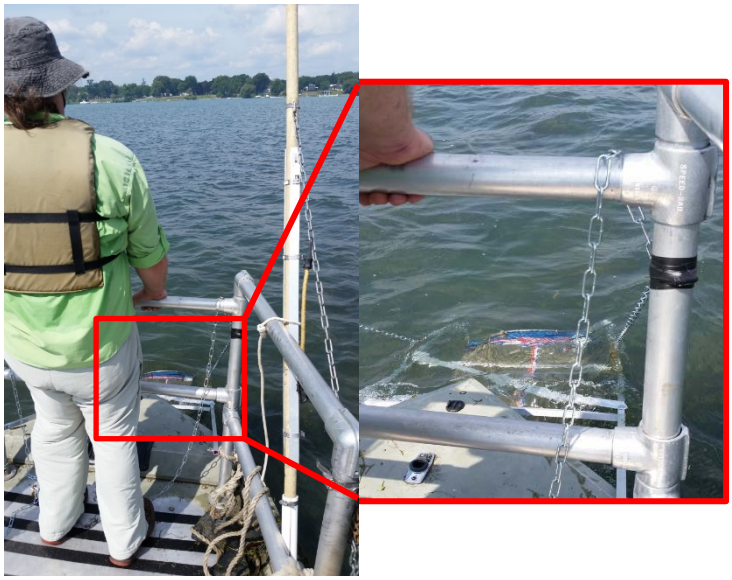

Figure 2. Larval Fish Sampling Along a Transect Located Within the Stony Island Restoration Project Prior to Construction Activities.

Boat Electrofishing

Boat electrofishing on August 2, 2016 for pre-construction and July 25, 2018 for post-construction consisted of using a boom-shocker mounted to a 17-foot aluminum boat powered by a 20-hp 4-cycle outboard motor (Figure 3a and b) for pre-construction and a 22-foot aluminum welded boat powered by a 75-hp two-stroke outboard motor for post-construction. The boom shocking equipment on both boats was powered by a Smith-Root GPP5.0 electrofisher supplying DC voltage to two boom-mounted electrode arrays manufactured by Smith-Root, Inc. on the 17-foot boat and by Oquawka Boats and Fabrication, Inc. on the 22-foot boat. The difference in boom array manufacturers should not affect capture efficiencies. The GPP5.0 was set for high-range voltage, between 40% and 50% power and 60 pulses per second, with a pulse width set between 6-8 amps. Boat electrofishing was conducted at near-shore and offshore locations to sample a variety of habitats and depths to gain a comprehensive coverage of the fish habitats and species present. At the end of each sampling transect, fish were identified to the species level and measured to the inch class (Figure 4). Fish were then released live back into the water.

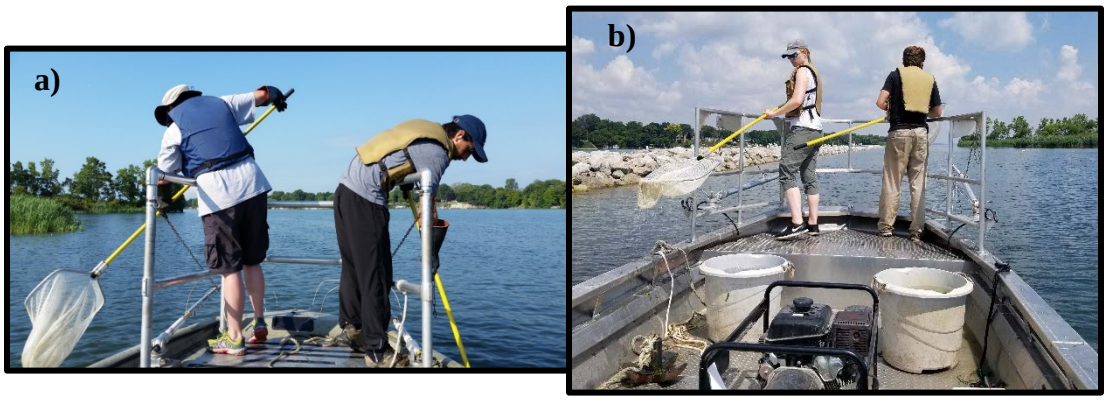

Figure 3a (left) and 3b (right). Fish Collections Using Boat Electrofishing at the Stony Island Restoration Project.

Fyke Nets

Four fyke nets were deployed on July 21, 2016 for pre-construction monitoring and July 26, 2018 for post-construction monitoring near the shoreline with adequate water depths and suitable substrates. Four mini fyke nets with a mouth opening 0.75-m high × 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 to the shore and the mouth sitting in approximately 1 m of water. Fyke nets were set in the same places during pre and post monitoring activities based on GPS coordinates. The nets were set for one crepuscular (overnight) cycle. After the recovery of each net, fish were identified to the species level and measured to the nearest millimeter or inch class. Fish were then released back into the water.

Data analysis

Three project performance measures were assessed (increase or decrease) based on the abundance and densities of young-of-year (YOY) and juvenile fish present within the project area. These project performance measures were:

- # Larvae/m^3 of water volume
- # YOY and Juveniles per net night
- # YOY and Juveniles per minute of effort

Fish assemblage data were assessed for species composition (richness), abundance, and size structure. Size structure for target species was assessed by plotting size-frequency distributions. 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.

To show project-wide utilization of the fish assemblage present within the Stony Island restoration area, sampling units were combined for each of the three sampling gear types. For example, the inside and outside electrofishing transects were combined into one dataset, the four fyke nets were combined into one dataset, and the four larval fish tows were combined into one dataset. For size class distributions, all electrofishing and fyke net data were combined.

Fish species were also grouped based on their ecological or social importance into three categories: game, rough, and forage. Game fish are typically of recreational and commercial importance and are species commonly targeted by anglers. Examples would include Largemouth Bass *Micropterus salmoides* and Walleye *Sander vitreus*. Rough fish are typically species not commonly targeted by anglers or commonly eaten within a regional context. Examples would include catfish, suckers, and redhorse species. Forage fish are species that are commonly eaten as a prey source for aquatic and/or terrestrial animal species. Examples would include minnows and shiners.

Deviations from the QAPP

Sampling for larval fish as well as boat electrofishing and fyke net sets was to occur in the spring and summer of 2016. However, approval of the QAPP addendum and larval fish sampling Standard Operating Procedures (SOP) was not approved by NOAA until mid-July of 2016. Therefore, fish sampling could not take place in the spring of 2016 for pre-construction monitoring.

Results

Pre-Construction

Ichthyoplankton

Only one of the four transects that were sampled for ichthyoplankton contained samples. Eight different species and 28 individuals were captured. Two different life stages were present: young-of-year (YOY) and post yolk sac larvae. The dominant species were Tubenose Goby *Proterorhinus semilunaris* and Round Goby *Neogobius melanostomus*, two non-native invasive species. Of the eight species captured, only one was a sport fish (Rock Bass *Ambloplites rupestris*). The remaining seven

species were either forage fish or rough fish. This is to be expected for the timing of the survey, since these types of species typically spawn for longer periods and can spawn multiple times throughout the summer months.

Table 1. Catch Data from the Larval Fish Sampling Conducted on July 21, 2016. Only One Transect Contained Larval Fish Samples.

Common name	Scientific name	Number	Life stage	Density (#/m^3)
Banded Killifish	*Fundulus diaphanus*	2	YOY	0.012
Bluntnose Minnow	*Pimephales notatus*	2	YOY	0.012
Common Carp	*Cyprinus carpio*	1	PYSL	0.006
Emerald Shiner	*Notropis atherinoides*	1	PYSL	0.006
Golden Shiner	*Notemigonus crysoleucas*	1	PYSL	0.006
Rock Bass	*Ambloplites rupestris*	2	YOY	0.012
Round Goby	*Neogobius melanostomus*	3	YOY	0.019
Tubenose Goby	*Proterorhinus semilunaris*	16	YOY	0.099

YOY=young-of-year
PYSL=post-yolk sac larvae

Fyke Nets

Thirteen species and 372 individuals were captured in fyke nets recovered on July 22, 2016. The majority of species captured were in the Centrarchidae (sunfish) family. Fifty-nine percent of the species captured in fyke nets were Largemouth Bass, followed by Rock Bass, and Pumpkinseed *Lepomis gibbosus* (Table 2). Sport fish consisted of 5 of the 13 species captured, and rough and forage fish each consisted of 4 of the 13. With the exception of Bowfin *Amia calva*, the size ranges of all species captured in the fyke nets indicated that the individuals ranged between zero and year-one age classes.

Table 2. Fish Assemblage Data from Fyke Net and Electrofishing Surveys, Conducted at Stony Island on July 21 and August 2, 2016, Respectively.

Common name	Scientific name	Electrofishing			Fyke nets		
		Number	%	CPUE (fish/hr)	Number	%	CPUE (fish/net night)
Black Bullhead	*Ameiurus melas*				10	2.7	10
Blackchin Shiner	*Notropis heterodon*				1	0.3	1
Blacknose Shiner	*Notropis heterolepis*	2	0.6	1.9			
Bluegill	*Lepomis macrochirus*	2	0.6	1.9			
Bluntnose Minnow	*Pimephales notatus*	13	3.9	12.3			
Bowfin	*Amia calva*	2	0.6	1.9	2	0.5	2
Brook Silverside	*Labidesthes sicculus*	1	0.3	0.9			
Common Carp	*Cyprinus carpio*	18	5.4	17.0	19	5.1	19
Emerald Shiner	*Notropis atherinoides*	2	0.6	1.9			
Freshwater Drum	*Aplodinotus grunniens*	21	6.3	19.8			
Gizzard Shad	*Dorosoma cepedianum*				1	0.3	1
Golden Redhorse	*Moxostoma erythrurum*	3	0.9	2.8			
Greenside Darter	*Etheostoma blennioides*	1	0.3	0.9			
Johnny Darter	*Etheostoma nigrum*	1	0.3	0.9	4	1.1	4
Largemouth Bass	*Micropterus salmoides*	13	3.9	12.3	219	58.9	219
Logperch	*Perca caprodes*	121	36.1	114.1			
Northern Hogsucker	*Hypentelium nigricans*	4	1.2	3.8			
Northern Pike	*Esox lucius*	2	0.6	1.9			
Pumpkinseed	*Lepomis gibbosus*	2	0.6	1.9	31	8.3	31
Rainbow Darter	*Etheostoma caeruleum*	1	0.3	0.9			
River Chub	*Nocomis micropogon*	7	2.1	6.6			
Rock Bass	*Ambloplites rupestris*	11	3.3	10.4	62	16.7	62
Round Goby	*Neogobius melanostomus*	9	2.7	8.5	2	0.5	2
Shorthead Redhorse	*Moxostoma macrolepidotum*	5	1.5	4.7			
Smallmouth Bass	*Micropterus dolomieu*	16	4.8	15.1	14	3.8	14
Striped Shiner	*Luxilus chrysocephalus*	3	0.9	2.8			
Tubenose Goby	*Proterorhinus semilunaris*	4	1.2	3.8			
Unidentified Minnow	*Notropis spp.*	4	1.2	3.8			
White Bass	*Catostomus commersonii*	1	0.3	0.9			
White Sucker	*Catostomus commersonii*	2	0.6	1.9			
Yellow Bullhead	*Ameiurus natalis*	3	0.9	2.8	1	0.3	1
Yellow Perch	*Perca flavescens*	61	18.2	57.5	6	1.6	6
	Total:	**335**	**100**	**316.0**	**372**	100	**372**

Electrofishing

Electrofishing surveys yielded a total of 29 species and 335 individuals. The dominant species captured were Logperch *Perca caprodes*, Yellow Perch *Perca flavescens*, and Freshwater Drum *Aplodinotus grunniens* (Table 2). Four species of darter were captured (37% of total individuals) and two Northern Pike *Esox lucius*, one of which was an age one fish. Sport and rough fish both consisted of 8 of the 29 species captured, and forage fish consisted of the remaining 13 species captured.

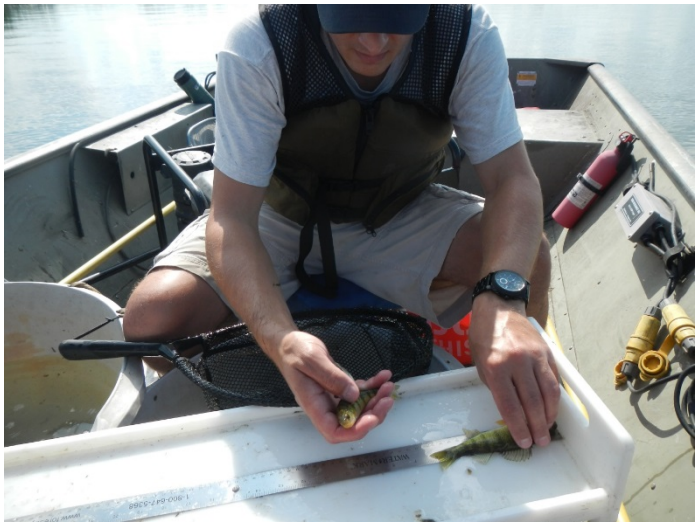

Figure 4. Measuring Length of Yellow Perch Captured During Electrofishing Surveys at Stony Island on August 2, 2016.

Size Trends

Small size classes were abundant for fish captured around Stony Island during the electrofishing and fyke net surveys (Figure 5a-g). While larger adults were captured for many species, the majority of sport fish captured during the two surveys were in the zero to two-inch size classes, which correspond to age 0 and 1 fishes. This is largely evident with Largemouth Bass, where over 200 of the fish captured were young-of year (0 to 1-inch size classes) (Figure 5d). Yellow Perch age classes (based on sizes captured) typically ranged from age 0 fish to age 4 fish (2 to 8-inch size classes; Figure 5f). Because of the large number of fishes captured that were young-of-year or juveniles, the data indicate that littoral habitats around Stony Island are seasonally being utilized by numerous species for spawning and nursery habitat.

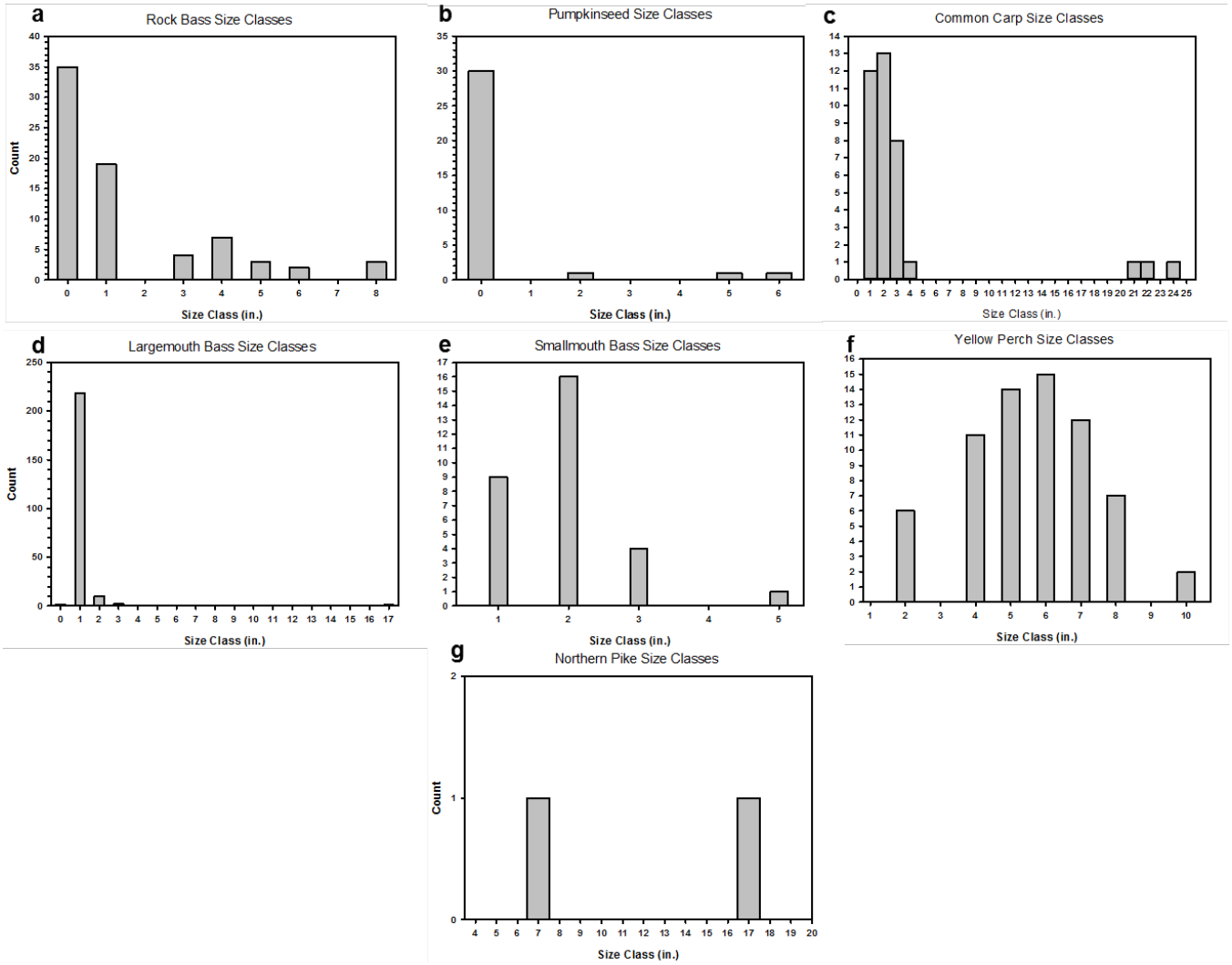

Figure 5. Size Class Distributions for Fish Captured During Electrofishing and Fyke Net Sampling Around Stony Island During the Pre-Construction Collections.

Post-Construction

Ichthyoplankton

Ichthyoplankton were present in one or more samples for each month (Table 3). May had the largest density of ichthyoplankton (2.9 fish/m^3) with eight species present and 409 individuals. The majority (62%) of the samples were yolk-sac White Perch *Morone americana*, a non-native invasive species that is abundant in Lake Erie. While Gizzard Shad *Dorosoma cepedianum* ichthyoplankton were present in April through June, they were most abundant in May (Table 3). Two species were only present in the July sampling, Johnny Darter *Etheostoma nigrum* and Tubenose Goby, both juvenile life stages. Yolk-

sac larvae dominated the samples in May and June but were absent in July samples. Fish eggs were present in April, May, and June, but absent in July samples (Figure 6).

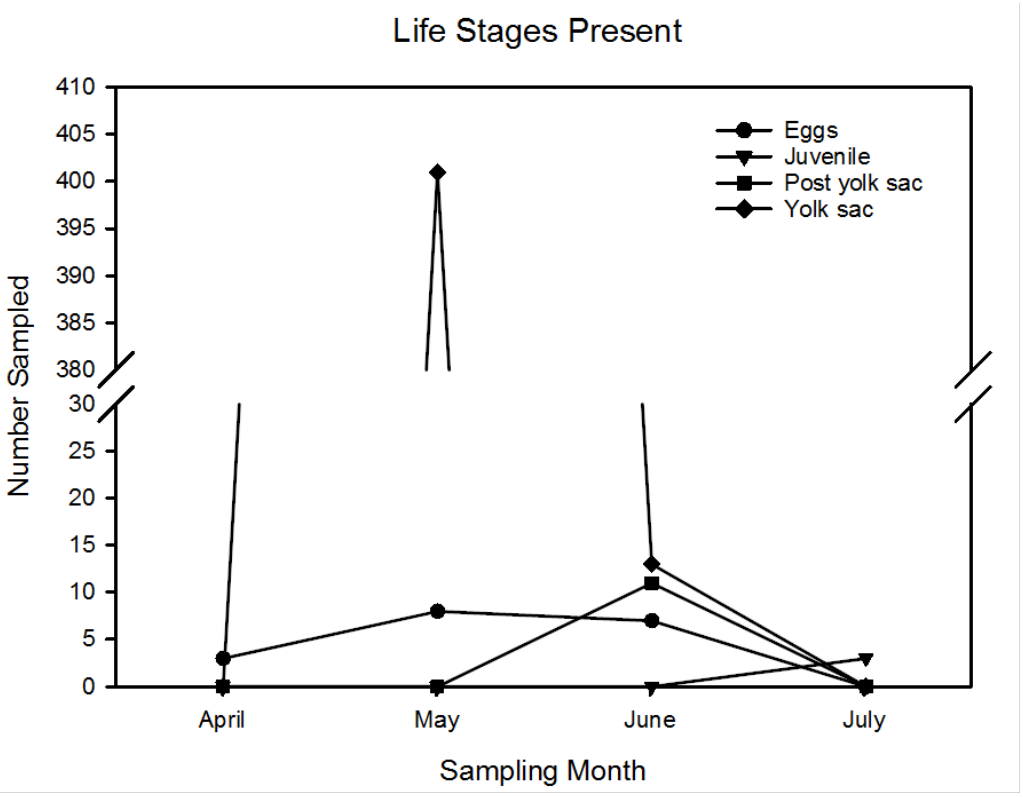

Figure 6. Life Stages of Ichthyoplankton that were Sampled at Stony Island During the Post Construction Monitoring.

Table 3. Sampling Data from the Ichthyoplankton Collections Conducted from April through July, 2018.

Common Name	Scientific name	Life Stage	April		May		June		July		All	
			Number	Density (#/m³)	Number	Density (#/m³)	Number	Density (#/m³)	Number	Density (#/m³)	Number	Density (#/m³)
Bluegill	*Lepomis macrochirus*	YSL			8	0.057					8	0.014
Brook Silverside	*Labidesthes sicculus*	PYSL					1	0.007			1	0.002
Brook Silverside		YSL			2	0.014	5	0.036			7	0.012
Common Carp	*Cyprinus carpio*	YSL					2	0.014			2	0.004
Emerald Shiner	*Notropis atherinoides*	PYSL					2	0.014			2	0.004
Emerald Shiner		YSL			35	0.249	4	0.029			39	0.069
Gizzard Shad	*Dorosoma cepedianum*	EGG	3	0.021	3	0.021	7	0.050			13	0.023
Gizzard Shad		YSL			56	0.399					56	0.100
Golden Shiner	*Notemigonus crysoleucas*	PYSL					1	0.007			1	0.002
Green Sunfish	*Lepomis cyanellus*	YSL			13	0.093					13	0.023
Johnny Darter	*Etheostoma nigrum*	JUV							2	0.014	2	0.004
Tubenose Goby	*Proterorhinus semilunaris*	JUV							1	0.007	1	0.002
Walleye	*Sander vitreus*	PYSL					3	0.021			3	0.005
White Bass	*Morone chrysops*	EGG			2	0.014					2	0.004
White Bass		YSL			27	0.192					27	0.048
White Perch		EGG			3	0.021					3	0.005
White Perch	*Morone americana*	PYSL					4	0.029			4	0.007
White Perch		YSL			254	1.810	2	0.014			256	0.456
Yellow Perch	*Perca flavescens*	YSL			6	0.043					6	0.011
		Total	**3**	**0.021**	**409**	**2.914**	**31**	**0.221**	**3**	**0.021**	**446**	**0.794**

PSYL: Post yolk-sac larvae
YSL: Yolk-sac larvae
JUV: Juvenile

Fyke Nets

A total of 10 species and 163 individuals were captured in fyke nets recovered on July 26, 2018. One net had flipped between deployment and retrieval, reducing the ability of the net to fish effectively. The majority of species captured were in the Centrarchidae (sunfish) family. Fifty-six percent of the species captured in fyke nets were Bluegill *Lepomis macrochirus*, the most abundant species, followed by Rock Bass at 28% (Table 4). Sport fish consisted of 7 of the 10 species captured, and rough fish consisted of 3 of the 13 species captured. No forage fish were captured in the nets. The majority of fish captured in the fyke nets were YOY or juveniles.

Table 4. Fish Assemblage Data from Electrofishing and Fyke Net Surveys, Conducted at Stony Island on July 25 and July 26, 2018, Respectively.

		Electrofishing			Fyke nets		
Common name	**Scientific name**	**Count**	**%**	**CPUE (fish/hr)**	**Count**	**%**	**CPUE (fish/net night)**
Black Bullhead	*Ameiurus melas*	1	0.4	1.2	1	0.6	1
Blackchin Shiner	*Notropis heterodon*	4	1.5	4.7			
Bluegill	*Lepomis macrochirus*	1	0.4	1.2	92	56.4	92
Bluntnose Minnow	*Pimephales notatus*	2	0.7	2.4			
Bowfin	*Amia calva*	7	2.6	8.3			
Brown Bullhead	*Ameiurus nebulosus*	3	1.1	3.5			
Common Carp	*Cyprinus carpio*	3	1.1	3.5			
Common Shiner	*Luxilus cornutus*	5	1.8	5.9			
Emerald Shiner	*Notropis atherinoides*	139	51.3	164.1			
Fathead Minnow	*Pimephales promelas*	3	1.1	3.5			
Freshwater Drum	*Aplodinotus grunniens*	8	3.0	9.4			
Goldfish	*Carassius auratus*				2	1.2	2
Greater Redhorse	*Moxostoma valenciennesi*	2	0.7	2.4			
Hornyhead Chub	*Nocomis biguttatus*	2	0.7	2.4			
Largemouth Bass	*Micropterus salmoides*	8	3.0	9.4	6	3.7	6
Logperch	*Perca caprodes*	4	1.5	4.7			
Northern Hogsucker	*Hypentelium nigricans*	2	0.7	2.4			
Northern Pike	*Esox lucius*	1	0.4	1.2	1	0.6	1
Pumpkinseed	*Lepomis gibbosus*	1	0.4	1.2	2	1.2	2
Rainbow Darter	*Etheostoma caeruleum*	1	0.4	1.2			
Rock Bass	*Ambloplites rupestris*	17	6.3	20.1	45	27.6	45
Round Goby	*Neogobius melanostomus*	4	1.5	4.7			
Shorthead Redhorse	*Moxostoma macrolepidotum*	7	2.6	8.3			
Smallmouth Bass	*Micropterus dolomieu*	4	1.5	4.7	4	2.5	4
Spottail Shiner	*Notropis hudsonius*	3	1.1	3.5			
Spotted Sucker	*Minytrema melanops*	4	1.5	4.7			
Striped Shiner	*Luxilus chrysocephalus*	5	1.8	5.9			
Yellow Bullhead	*Ameiurus natalis*	2	0.7	2.4	7	4.3	7
Yellow Perch	*Perca flavescens*	28	10.3	33.1	3	1.8	3
	Species Richness	**28**			**10**		
	Species Total:	**271**			**163**		

Electrofishing

Electrofishing surveys yielded a total of 28 species and 271 individuals. The dominant species captured were Emerald Shiner *Notropis atherinoides*, Yellow Perch *Perca flavescens*, and Rock Bass *Ambloplites rupestris* (Table 4). Two species of darter and two Northern Pike were captured. One of Northern Pike captured was in the year-one age class. Sport and rough fish consisted of 7 and 10 of the 28 species captured, respectively, and forage fish consisted of the remaining 11 species captured.

Figure 7. Measuring Length of Freshwater Drum Captured During Electrofishing Surveys at Stony Island on July 25, 2018.

Size Trends

Small size classes predominated the sport fish (e.g., Largemouth and Smallmouth bass, sunfish, Yellow Perch, etc.) captured around Stony Island during the electrofishing and fyke net surveys. While larger adults (Figure 7) were captured for many species (e.g., Bowfin, Freshwater Drum, suckers, etc.), the majority of sport fish captured during the two surveys were in the zero to two-inch size classes, which correspond to age 0 and 1 fishes. For example, nearly all Bluegill captured in the fyke nets (n=92) were young-of year (0 to 1-inch size classes; Figure 8). Yellow perch age classes (based on sizes captured) typically ranged from age 0 fish to age 4 fish (1 to 9-inch size classes (Figure 9). Because of the large

amount of fish captured that were young-of-year or juveniles, the data indicate that littoral habitats around Stony Island were seasonally being utilized by many species for spawning and nursery habitat.

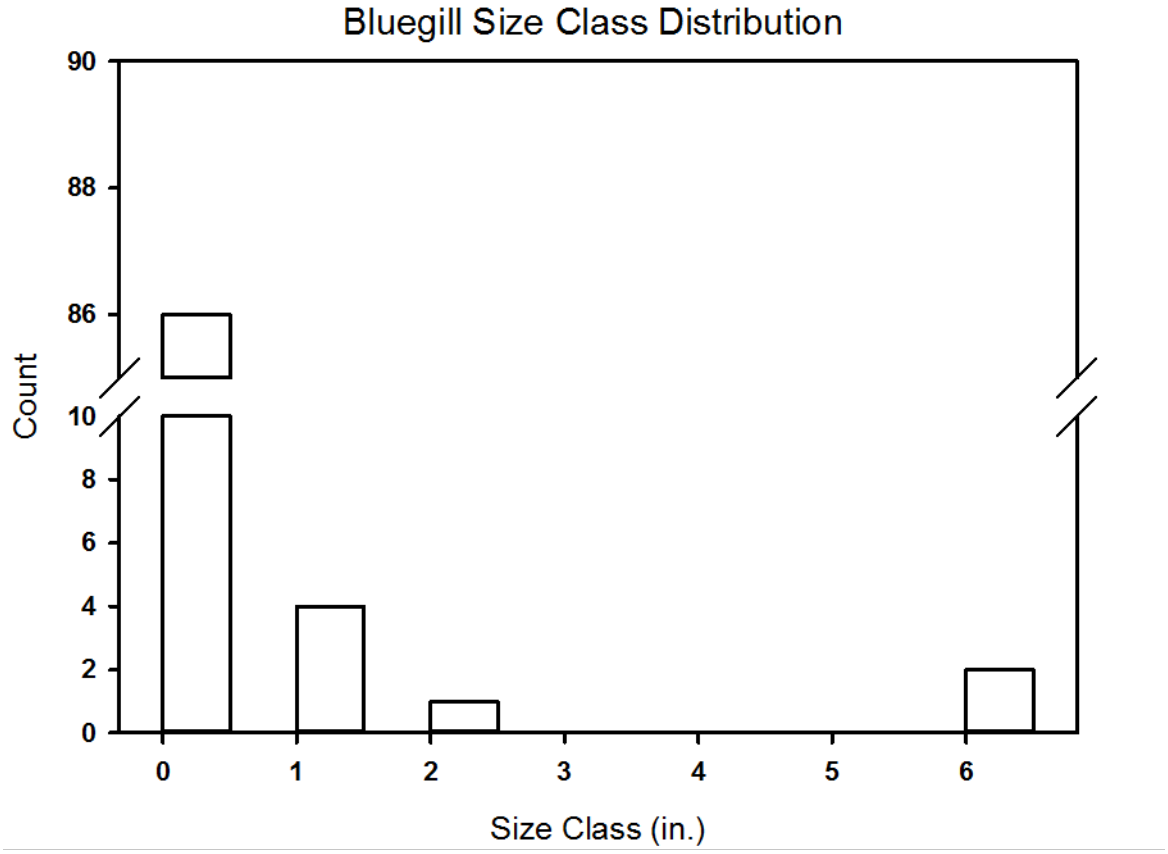

Figure 8. Bluegill Size Classes During the Post-Monitoring Survey.

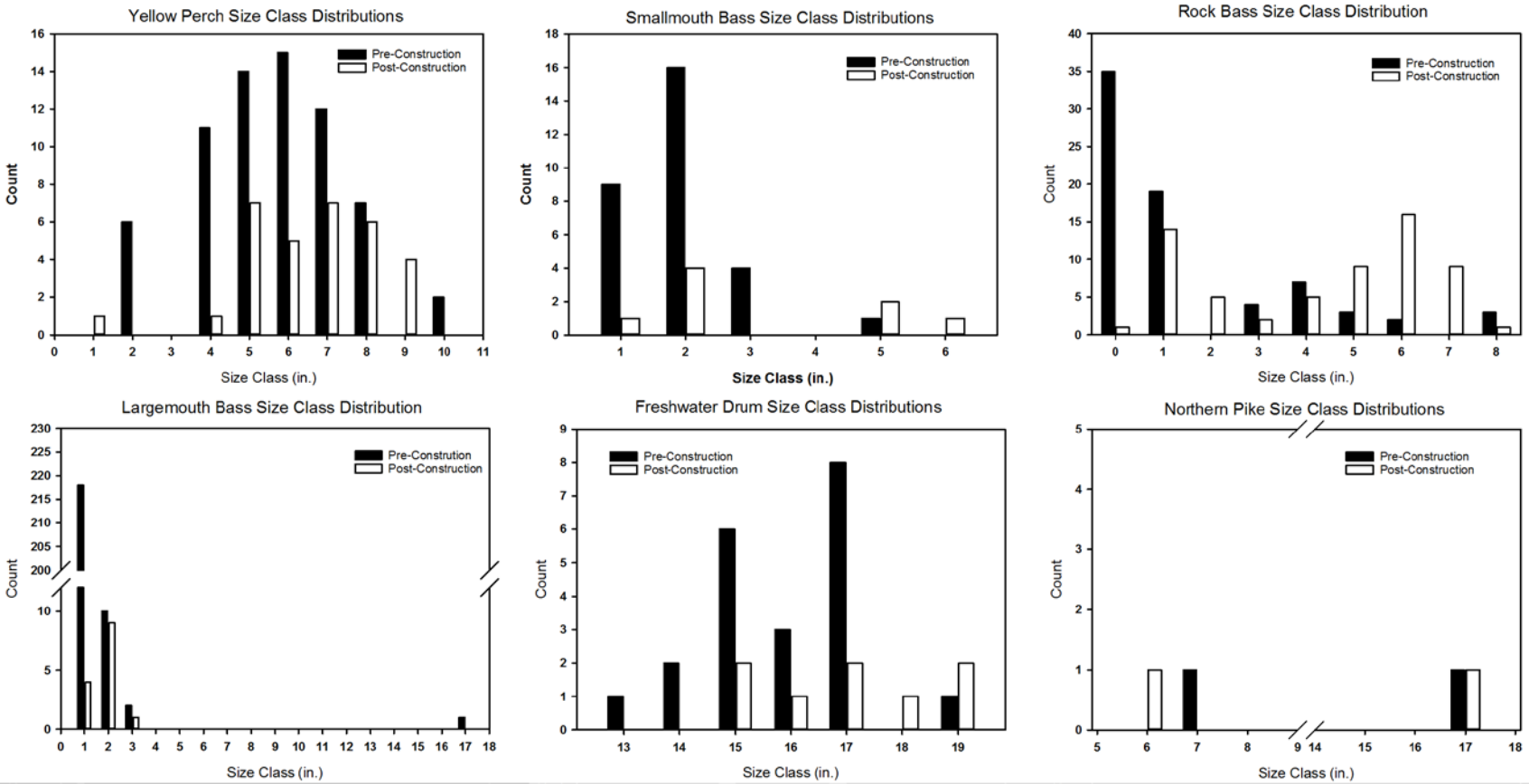

Figure 9. Size Classes Comparisons for Both the Pre- and Post-Construction Monitoring Surveys. Species Included are Only Those Collected During Both Sampling Periods.

Pre and Post Construction Performance Comparisons

Three project performance measures were assessed (increase or decrease) based on the abundance of YOY and juvenile fish present within the project area. These project performance measures were:

- # Larvae/m^3 of water volume
- # YOY and Juveniles per net night
- # YOY and Juveniles per minute of effort

The data did not allow a complete comparison of # larvae/m^3 between spring of 2016 and spring of 2018 because ichthyoplankton sampling could only be conducted for one month of 2016. Ichthyoplankton density in July of 2016 was 0.174 larvae/m^3 while density was 0.021 larvae/m^3 in July of 2018. These data suggest the number of ichthyoplankton decreased between 2016 and 2018, but multiple months of sampling would have been required in 2016 to support that conclusion. It is unclear why July densities between the two years were different. The difference may be due to variability in fish spawning locations, timing, habits (e.g., broadcast spawners vs. nest building), egg buoyancy, flow conditions, and the behavior of the larvae themselves (diel vertical migrations, mobile of free floating, etc.). These sources of variability could have been reduced had multiple monthly samples been taken in 2016.

Monthly ichthyoplankton sampling in 2018 showed clear utilization of littoral habitats by ichthyoplankton between April and June of 2018, some of which contained densities higher than what was seen in July of 2016. For example, May and June of 2018 densities were 2.9 and 0.221 larvae/m^3, respectively.

The second metric also showed a decrease in the number of YOY and juveniles per net night. There were 350 individuals identified as YOY or juveniles during pre-construction and only 126 during post-construction.

The third metric also decreased between the two construction periods. The CPUE during pre-construction of YOY and juveniles was 2.7 fish/minute while CPUE of YOY and juveniles was 0.34 fish/minute during post-construction monitoring.

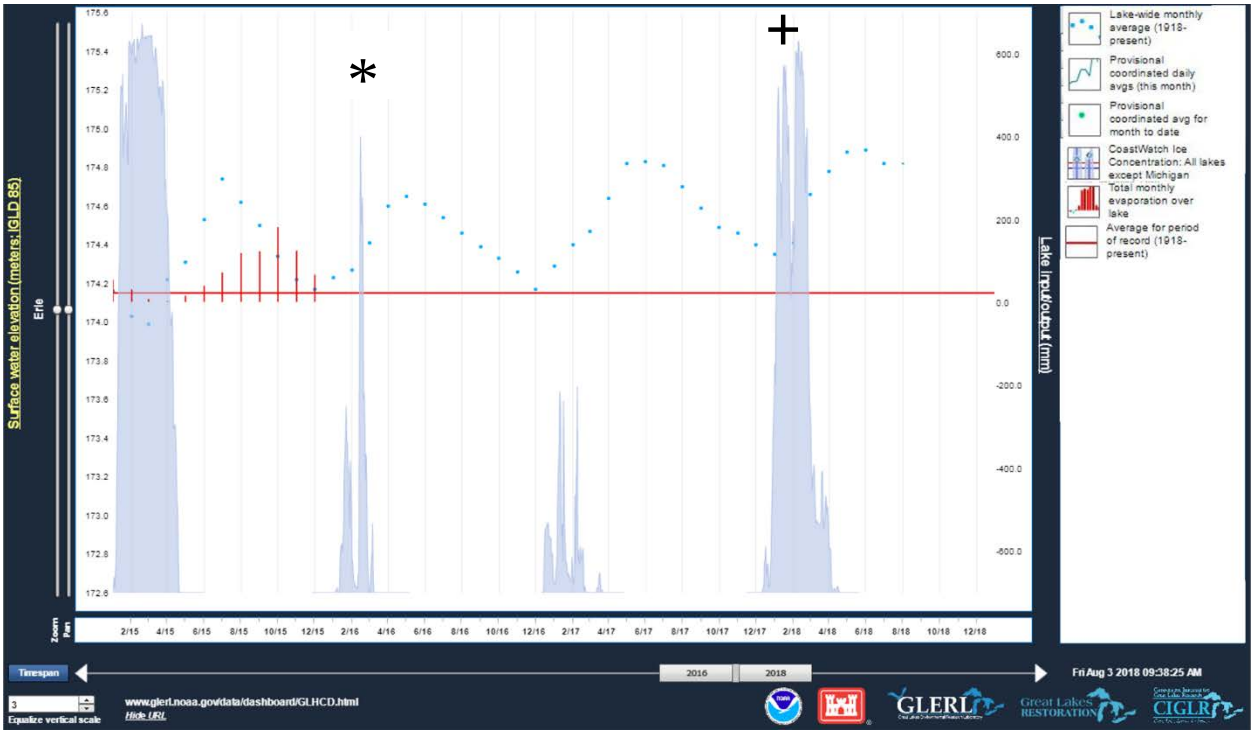

Figure 10. Ice Cover on Lake Erie During the Construction Monitoring Periods. The Asterisk (*) Indicates Ice Cover the Winter Before Pre-Construction Monitoring and the Plus Sign (+) Indicates Ice Cover the Winter Before Post-Construction Monitoring. Source: GLHCD 2018[1].

[1] https://www.glerl.noaa.gov/data/dashboard/GLHCD.html

While there were decreases seen in the performance metrics, it is important to note that fish populations are inherently unsteady over time. It is rare to show steady year-to-year states for any fish assemblage, especially when multiple factors can affect abundances and densities. It is natural for species to increase, decrease, or to remain consistent year-to-year. Water temperatures and over-winter ice cover are two of numerous influencing factors to consider in the Great Lakes when observing trends in fish assemblages. For example, ice cover in Lake Erie was much greater in the winter before the post-construction monitoring than the winter before the pre-construction monitoring (Figure 10). This led to much warmer temperatures earlier in the spring of 2016 than 2018 (Figure 11), which can affect spawning behaviors and success. Warmer or cooler springs can cause many species to begin spawning earlier or later in the year. This can extend the spawning season further into the year, allowing for abundances of YOY and juvenile life stages to increase, or reduce the spawning season to periods potentially lasting a few days, decreasing YOY and juvenile abundances. Therefore, despite apparent decreases in the metrics pre- and post-construction, external factors may be driving the differences in metrics between the two sampling years rather than the project.

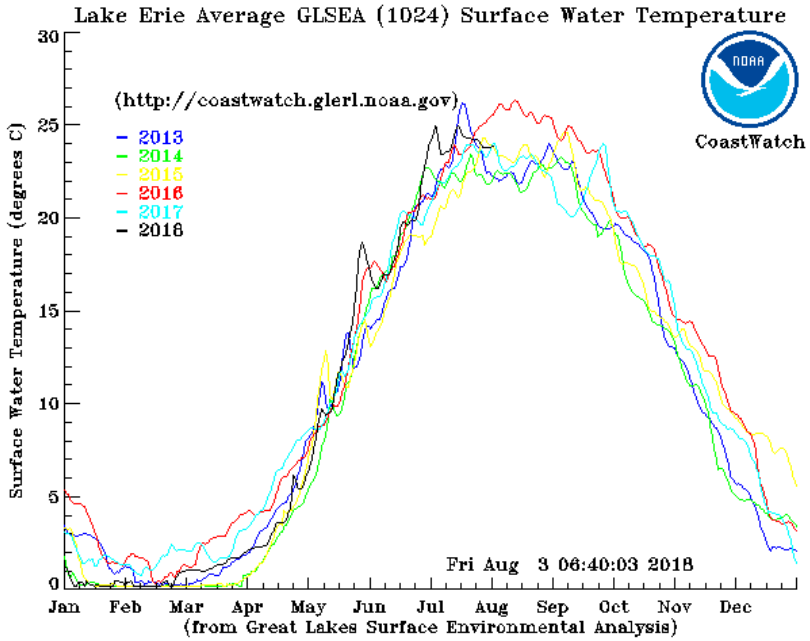

Figure 11. Mean Water Temperatures for Lake Erie. The Red Line Indicates 2016 (Pre-Construction Monitoring) and the Black Line Indicates 2018 (Post-Construction Monitoring). Source NOAA Coast Watch 2018[2]

[2] https://coastwatch.glerl.noaa.gov/statistic/

Lastly, habitat development is a process that takes multiple years to show marked signs of improvement. The Detroit River system will continue responding and changing to the shoals as wetland and littoral habitats develop on the leeward side of the shoals. Fish behaviors may also take time to adapt to those habitat changes. It is likely that a single post-construction monitoring period cannot show a difference caused by the project. Habitat requires time to develop, and the response of fish to those habitat changes will follow.