FISH COLLECTIONS IN THE VICINITY OF LAKE OKONOKA, BELLE ISLE, MICHIGAN

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Introduction

This study was conducted as a pre- and post-survey of the fish community prior to construction of a channel to connect Lake Okonoka to the Detroit River, as well as before and after construction of a series of breakwalls to reduce turbulence from wave action and ship wakes. The survey area was from the fishing pier west of the Coast Guard station, to the point near the Yacht Basin. Sampling for each assessment was conducted on two consecutive nights, using standard gear for nearshore fish assessment. The weather was clear at the time of both sampling efforts with westerly winds from 10-20 mph. Sampling proceeded with no major difficulties. Timing of the sampling coincided with the muskellunge spawning time, as well as peak inshore migrations for many forage fishes and small game fishes. Typically, the largest inshore catches are taken in spring.

Methods

Sampling for the pre-existing fish community in the vicinity of the construction project near Lake Okonoka was conducted in May 2015 and May 2019. Sampling extended over three days, with nets initially set on the first day then retrieved on subsequent days. The initial plan was to set pairs of hoop nets and minnow trap gangs, and to seine and electroshock at four distinct locations between the south fishing pier and the point immediately to the west. However, this was a fairly small area, and that much sampling could not be completed due to lack of space. As a result, hoop nets and minnow traps were set singly, starting at the fishing pier and then approximately every 100 yards between there and the point, for a total of 6 hoop nets and 6 minnow gangs in 2015 and 4 hoop nets and 4 minnow gangs in 2019. Electroshocking was conducted throughout the entire area, between the shore and five-foot depth, from the fishing pier to the point.

In physical characteristics, the area is very wave-swept, with predominant winds from the west causing waves along the shoreline on a regular basis, and the passage of freighters and other vessels causing wake to scour the shoreline, as well. As a result, nearly the entire shoreline has been armored with rip-rap, and the habitat appears to be open sand, gravel, and clay. In fact, in emptying one seine while sitting on shore at the time of a freighter passage, we witnessed the water dropping approximately one foot prior to the freighter passing, and then raising approximately two feet from that level during the passage. As a result, there was much surge in the area during that passage and most probably during any other significant freighter passage. This was also evidenced in the nets, in which their lead or pot anchors were often displaced by currents, probably causing reduced fishing effectiveness at times. However, no such surge problem occurred with minnow traps or electroshocking.

In 2019, the breakwalls had been constructed near the fishing pier, and these reduced turbulence considerably. However, water level was very high at that time, so waves still broke over the breakwalls and caused a reduced level of turbulence in that region.

Hoop nets were set over a period of two nights, and minnow trap gangs, with five baited minnow traps each, were set over the same two-night period. In 2015, we walked the entire shoreline to decide where to seine, and then seined at the two locations where the nets could be pulled to shore without dealing with significant problems from rocks and other rip-rap. In 2019, we could not seine due to high water levels and no shoreline available to pull up a seine. Finally, electrofishing was conducted throughout the entire study area, from near shore to a depth of approximately five feet (Table 1).

Results

2015

The region was poor fish habitat with relatively low abundances of fish estimated by any sampling method used. Our total fish collections (Table 2) resulted in 1,010 fish taken by all methods combined, with the dominant species being emerald shiners (86% of the total composition), and with rock bass, yellow perch, and spottail shiners being other common species, representing between 2-5% of the total collection. Most fish collected were either minnows or yearling game fish. Sampling in May prevented collection of young-of-year fish, which would not recruit to the gear for most species until fall. However, most of the fish collected were juveniles born the previous year.

Length information was collected on all species taken in hoop nets or minnow traps in order to evaluate the size distribution of each species (Table 2). Most species represented a narrow size range, identified as probably one-year class. A 610-mm Great Lakes musky was also collected, in addition to a 585-mm longnose gar, a 293-mm white bass, and a 308-mm northern pike. These game fish were adults, as were the

largest yellow perch taken in this study (264 mm). The fish represented 14 species overall.

Previous collections have been done in the Detroit River system at different sites, mostly downstream in the Trenton Channel. Percent composition of different fish species for these collections is shown in Figure 1, as is the composition of different species in the current collection. There were significant differences between the expectation based on fish collected throughout the Detroit River and the species composition of the study area (x^2, $P < 0.05$). There were fewer spottail shiner, rock bass, largemouth bass, blacknose shiner, pumpkinseed, bluegill, and round goby than expected for the river in general, with far more emerald shiner and yellow perch than expected. Of course, some of these differences are simply location or species bias differences.

Most of the fish were taken by one seine haul in the middle of the study region. That haul produced over 800 of the 1,010 fish individuals collected. The haul was dominated by emerald shiner with a few other species, as well. In comparison to that haul, all other sampling attempts had very low productivity.

Catch-per-unit effort was considerably lower than other sampling conducted in the Detroit River. A typical catch-per-unit effort for the same combination of nets in nearshore habitats with abundant wetland vegetation for the river was approximately 60 fish/hour. Our catch-per-unit effort was approximately 1 fish/hour. This low catch rate was consistent across all gear types, as relatively few fish were taken in any sampling technique, except the one seine haul. This area appears to have a depauperate fish fauna, with relatively few species compared to other locations and relatively low abundance of individuals.

2019

This sampling period was targeted to determine if the breakwalls had any effect on the fish populations. We did two sets of nets in the area behind the breakwalls and two in the area outside that protection. We also shocked the entire shoreline again.

Sampling by fyke net and minnow trap was much more effective this year than in 2015. Fourteen species were again collected, and only 172 individuals, but many of the fish were adult sizes of game fishes. Compared to 2015, we did not collect white bass, bluegill, longnose gar, spotfin shiner, or bluntnose minnow, although none of these species represented more than 1% of the collections in 2015. In 2019, we collected hornyhead chub, white sucker, golden shiner, largemouth bass, and smallmouth bass that were not collected in 2015, and hornyhead chub were common, comprising 8% of the fish collected. Rock bass were the dominant species collected at 50% of the total catch (Table 3), much higher than in 2015 (Figure 2). Round goby also increased in relative abundance (from 0.8 to 10.5%). Another change from 2015 was collection of more adult game fish, with rock bass averaging 134 mm in size, as well as adult

largemouth bass, pike, and muskellunge being collected. The two collections were significantly different in species relative abundances (chi-square, p<0/001).

Of more interest to this analysis is the difference between samples within and beyond the breakwalls. Electroshock surveys were similar in the two regions, with most fish taken near shore. This is not surprising, given that shocking tends to move fish into hiding locations, where they are taken, and the only real hiding locations were in the nearshore area. Similarly, minnow trap collections were similar in the two areas, indicative of the traps collecting mainly small fish near shore where they are set. Conversely, hoop nets took far more rock bass in the breakwall area (64 compared to only 4 taken in the open region), and the only ones taken outside that area were young fish. It was clear in our sampling that the breakwalls had an effect on fishes found there, and that rock bass had quickly started to colonize this area as adults over the short time period the walls had been in place.

While the fish population appeared to increase in 2019, it was still limited compared to vegetated areas of the Detroit River. Our overall catch in 2019 was 2.2 fish per net hour, still considerably below the 60 fish per net hour for samples in vegetated areas, although it was twice the value for collections in 2019.

Discussion

The overall sampling of the region near the fishing pier on Belle Isle in 2015 indicated very low abundance of mainly juvenile fish, and of those, predominantly minnows. The catch-per-unit effort was exceptionally lower than other sites throughout the Detroit River, and the species composition was devoid of many common species, especially juvenile game fishes. The area has limited habitat that could serve as a nursery for juvenile fishes and, as a result, has a very limited juvenile fish population. Adult fishes are also relatively uncommon, with only a few muskellunge, yellow perch, and white bass as representatives taken as adult sized game fishes. This is a marginal fish habitat that could be improved considerably by restoration.

In 2019, shortly after completion of the breakwalls, fish abundance had increased to roughly double that of 2015 and included a decent population of adult rock bass in the breakwall area. Species relative abundances had also changed, with far more rock bass, less emerald shiner, and more round goby and hornyhead chub. Abundance was still low compared to vegetated areas in the river. As the only change had been a short period of protection by the breakwalls, and no real change in vegetation abundance or sediments had occurred in the area, it might be expected that more fish will take up residence in the area after time has allowed for physical habitat changes. This may even be altered significantly by the opening of Lake Okonoka to the river, which could bring in occupation of other lake fish such as bluegill and other sunfishes, as well as nutrients and sediments from the inland lake to enrich the area behind the breakwalls.

Table 1. Sampling methods and durations for fish sampling, May 17-19, 2015 near Lake Okonoka, Belle Isle.

Net Type	Number	Set Time	Pull time	Number of Fish	Number of Species
Hoop	1	5/17 14:58	5/18 11:13	4	1
Hoop	2	5/17 15:05	5/18 11:20	13	3
Hoop	3	5/17 15:11	5/18 11:38	1	1
Hoop	4	5/17 15:16	5/18 11:43	3	1
Hoop	5	5/17 15:19	5/18 11:49	4	2
Hoop	6	5/17 15:27	5/18 11:55	0	0
Minnow	1	5/17 16:50	5/18 12:36	2	12
Minnow	2	5/17 16:41	5/18 12:29	0	0
Minnow	3	5/17 16:34	5/18 12:23	0	0
Minnow	4	5/17 16:28	5/18 12:15	3	1
Minnow	5	5/17 16:22	5/18 12:10	2	1
Minnow	6	5/17 16:16	5/18 12:04	0	0
Hoop	1	5/18 11:13	5/19 12:47	3	3
Hoop	2	5/18 11:20	5/19 12:42	17	3
Hoop	3	5/18 11:38	5/19 12:36	4	3
Hoop	4	5/18 11:43	5/19 12:28	0	0
Hoop	5	5/18 11:49	5/19 12:15	3	1
Hoop	6	5/18 11:55	5/19 12:10	0	0
Minnow	1	5/18 12:36	5/19 14:01	3	1
Minnow	2	5/18 12:29	5/19 13:51	1	1
Minnow	3	5/18 12:23	5/19 13:44	0	0
Minnow	4	5/18 12:15	5/19 13:37	4	1
Minnow	5	5/18 12:10	5/19 13:31	4	2
Minnow	6	5/18 12:04	5/19 13:26	0	0
Seine	1	5/18 14:50		23	3
Seine	2	5/18 15:10		882	8
Electrofish	1	5/19 10:50	5/19 11:40	39	7

Table 2. Fish collection data from sampling, May 17-19, 2015, at Belle Isle.

Species	Common Name	Total Collected	Length Range	Mean Length
Notropis atherinoides	Emerald shiner	871	63-82	73.8
Ambloplites rupestris	Rock bass	46	63-194	91.2
Perca flavescens	Yellow perch	38	63-264	141.9
Notropis hudsonius	Spottail shiner	23		
Labidesthes sicculus	Brook silverside	15	68-74	73.8
Neogobius melanostomus	Round goby	8	67-80	71
Lepomis macrochirus	Bluegill	2	71-93	82
Esox masquinongy	Muskellunge	1	610	610
Lepisosteus osseus	Longnose gar	1	585	585
Morone chrysops	White bass	1	293	293
Esox lucius	Northern pike	1	308	308
Cyprinella spiloptera	Spotfin shiner	1		
Moxostoma macrolepidotum	Shorthead redhorse	1		
Pimephales notatus	Bluntnose minnow	1		
TOTAL	**14**	**1010**		

Figure 1. Species composition of fish collected in the Detroit River in previous studies, compared to the composition of fish sampled in this analysis.

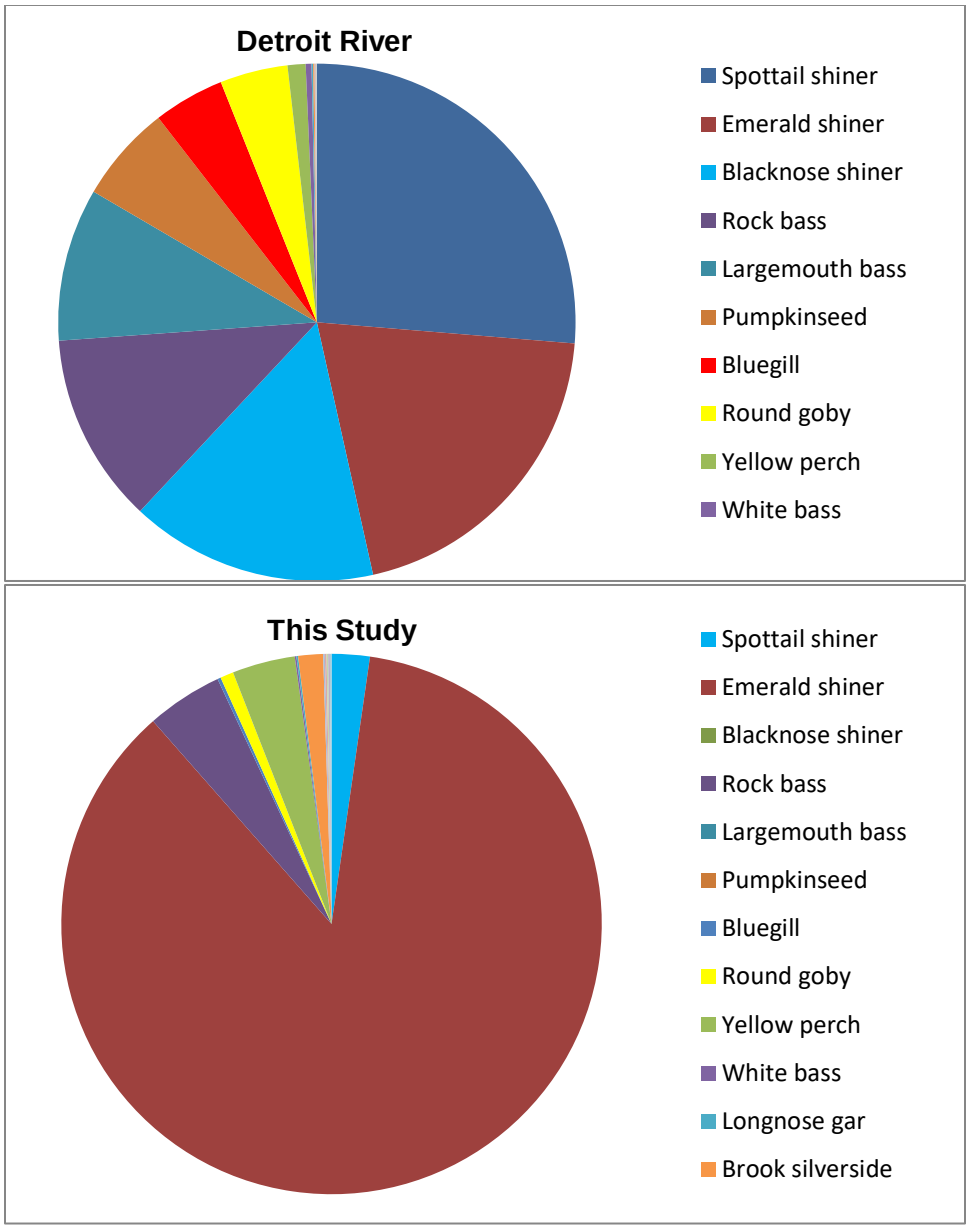

Table 3. Sampling methods and durations for fish sampling, May 15-17, 2019, near Lake Okonoka, Belle Isle.

Net Type	Number	Set Time	Pull time	Number of Fish	Number of Species
Hoop	1	5/15 13:13	5/16 10:00	27	1
Hoop	2	5/15 13:16	5/16 10:12	17	1
Hoop	3	5/15 13:22	5/16 10:19	0	0
Hoop	4	5/15 13:31	5/16 10:28	0	0
Minnow	1	5/15 13:56	5/16 10:34	0	0
Minnow	2	5/15 14:05	5/16 10:40	4	2
Minnow	3	5/15 14:11	5/16 10:47	5	2
Minnow	4	5/15 14:18	5/16 10:56	9	3
Hoop	1	5/16 10:00	5/17 12:47	3	3
Hoop	2	5/16 10:12	5/17 12:42	17	3
Hoop	3	5/16 10:19	5/17 12:36	4	3
Hoop	4	5/16 10:28	5/17 12:28	0	0
Minnow	1	5/16 10:34	5/17 9:25	3	1
Minnow	2	5/16 10:40	5/17 9:35	7	3
Minnow	3	5/16 10:47	5/17 9:40	1	1
Minnow	4	5/16 10:56	5/17 9:50	10	3
Electrofish	1	5/16 11:20	5/16 12:23	76	13

Table 4. Fish collection data from sampling, May 15-17, 2019, at Belle Isle.

Species	Common Name	Total Collected	Length Range	Mean Length
Ambloplites rupestris	Rock bass	86	44-241	133.9
Notropis atherinoides	Emerald shiner	22	63-82	73.8
Neogobius melanostomus	Round goby	18	67-80	71
Perca flavescens	Yellow perch	10	102-133	114
Nocomis biguttatus	Hornyhead chub	14		
Notropis hudsonius	Spottail shiner	6		
Labidesthes sicculus	Brook silverside	4	68-74	73.8
Esox lucius	Northern pike	4	362-724	516
Micropterus salmoides	Largemouth bass	2	333	333
Catostomus commersoni	White sucker	2		
Notemigonus crysoleucas	Golden shiner	1		
Rhinichthys atratulus	Blacknose dace	1		
Micropterus dolomeiu	Smallmouth bass	1	95	95
Esox masquinongy	Muskellunge	1	1041	1041
TOTAL	**14**	**172**		

Figure 2. Species composition of fish collected during sampling in 2019 compared to 2015.