

Memo

To: Kathy Evans
Environmental Program Manager
West Michigan Shoreline Regional Development Commission

From: Kelly Rice, Ryan Holem

Date: February 8, 2017

Re: **Summary of Fish and Wildlife Relocation Associated with the Bear Creek Pond Drawdown and Hydrologic Reconnection**

In 2015 and 2016, GEI Consultants of Michigan, P.C. (GEI) conducted fish and wildlife relocation efforts in the ponds (former celery fields) adjacent to Bear Creek and Bear Lake in Muskegon County, Michigan. These efforts were associated with the drawdown of the aforementioned ponds in advance of ongoing hydrologic reconnection and habitat restoration work at this location. It was initially thought that drawdown might occur in 2015, so efforts to characterize the fish community and optimize relocation protocol began in May 2015. However, the drawdown subsequently took place in 2016, thus, the bulk of the relocation efforts occurred in 2016. A Michigan Department of Natural Resources (MDNR) scientific collector's permit was obtained and issued to GEI staff who participated in the field survey work. This memo summarizes the relocation efforts. A summary of fish collected was transmitted to the MDNR in January 2017 to fulfill MDNR scientific reporting requirements.

Methods

In 2015, fish collection efforts included the use of baited minnow traps deployed around the perimeter of both ponds, neither of which had yet to begin the drawdown process. Minnow traps were checked approximately every 12 hours during time frames shown in Table 1. Captured fish were transferred to buckets containing site water, then were identified and counted before being released into Bear Creek, which contains a similar fish community. In mid-summer, it was communicated that the drawdown would take place in 2016, rather than 2015, so another round of trapping was conducted in the fall of 2015 to confirm general fish abundance and diversity in the ponds, which would help to calibrate 2016 relocation efforts.

In the spring of 2016, GEI staff monitored water levels in the ponds and conducted initial fish relocation efforts in May. The bulk of the relocation efforts took place in early June when water levels in the ponds were low enough to effectively deploy multiple types of sampling equipment.

Fish were captured using baited minnow traps, seines, and fyke nets. As the ponds were drawn down, fish began concentrating in deeper (2-3 feet in depth) areas, presumably due to predation pressure from predatory birds and turtles and because the deeper areas likely contained greater concentrations of dissolved oxygen (DO). All techniques utilized were



effective in collecting fish. However, the most productive capture technique involved setting up a fyke net in these deeper areas and then pulling a seine towards the fyke net. The seine encouraged fish to swim towards the fyke net, where they were captured by the thousands. GEI ecologists then removed fish from the fyke net and transferred them to large Rubbermaid® tubs containing slightly cooler water (with greater DO levels) from Bear Creek. Battery-powered aerators were also used to supplement oxygen levels in the tubs. Fish were then identified, counted, and released into Bear Creek. Fish species and counts were recorded on waterproof notebook pages and representative photos of fish and collection techniques were taken throughout the effort (see Attachment A).

Results

In total, over 46,000 fish were captured from the two ponds and relocated into Bear Creek (Table 1). The vast majority of these fish were relocated in 2016, when the drawdown concentrated the fish and made trapping efforts more effective. Approximately 20 species of fish were documented with golden shiners (*Notemigonus crysoleucas*), sunfishes (*Lepomis spp.*), and killifish (*Fundulus diaphanus*) being the most common. Large, predatory fish species were uncommon and the fish community was generally similar in composition across both ponds. More than 90% of the captured fish came from the larger west pond (22 acres) as compared to the east pond (12 acres). The west pond contained more fish given its greater surface area and more prolific aquatic vegetation beds, the latter of which likely provided cover for fish. The east pond was also more challenging to sample as substrates were soft and deep, often exceeding one foot of depth, which limited the use of seines to areas with more firm substrate. Nevertheless, several thousand fish were relocated from the east pond. Multiple painted (*Chrysemys picta*) and snapping turtles (*Chelydra serpentina*) were observed during this effort. Several of the snapping turtles were captured in fyke nets. When this occurred, the turtles were carefully removed from the net and moved to Bear Creek outside of the active construction area.

Discussion

GEI's fish collection efforts resulted in the characterization of the fish community of the Bear Creek ponds and the relocation of approximately 46,000 fish to Bear Creek. The vast majority of relocated fish were observed swimming away from their release location and likely quickly acclimated to Bear Creek where they would become part of the Bear Creek/Bear Lake food web. It is possible that additional fish species were captured and relocated, but GEI staff did not physically examine every single fish during large capture events (several thousand fish in the fyke net) in the interest of minimizing fish handling and the amount of time fish were held in tubs. Larger predatory fish such as bowfin (*Amia calva*) or mature largemouth bass (*Micropterus salmoides*) may have been present in low numbers, but generally low DO levels and high water temperatures (particularly in late summer) likely result in substantial annual mortality of fish, minimizing the amount of fish that are able to reach maturity in these ponds. Dozens of wading birds (e.g., great blue heron [*Ardea herodias*] and egrets [*Ardea spp.*]) were also observed foraging on the ponds during draw-down.



Another positive aspect of the effort was the unique educational opportunity recognized when students from North Muskegon High School visited the site in May of 2016 and assisted GEI staff with fish collection efforts. Students were shown the basics of fisheries sampling with seines and minnow traps and received a “short course” on fish identification from GEI biologists.

To summarize, the Bear Creek pond fish relocation efforts were highly successful despite challenging conditions that included dense aquatic vegetation and substantial amounts of unconsolidated soft substrate. The relocation efforts not only transferred fish to Bear Creek, but also served to introduce/reinforce environmental studies to high school students.

Attachments

Attachment A: Relocation Photographs

Attachment B: 2015 - 2016 Bear Creek Ponds Fish Relocation Summary Table



Attachment A: Relocation Photographs



Photo 1. GEI staff using a bag seine to collect fish from the east pond



Photo 2. Representative photo of a pumpkinseed (*Lepomis gibbosus*) captured during the fish relocation effort



Photo 3. Representative photo of fish holding tanks with aerators



Photo 4. North Muskegon High School students helping GEI staff deploy a seine in the east pond



Geotechnical
Environmental
Water Resources
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**Bear Creek Fish and Wildlife Relocation
Muskegon County, Michigan**

Date: May/June, 2016
GEI Project #: 1504550



Photo 5. Students from North Muskegon High School learning fish identification and documentation techniques



Photo 6. A student from North Muskegon High School releasing fish into Bear Creek



Photo 7. GEI staff setting up a fyke net in the west pond



Photo 8. Representative photo of a golden shiner (*Notemigonus crysoleucas*) captured during the fish relocation effort



**Attachment B: 2015 - 2016 Bear Creek Ponds Fish
Relocation Summary Table**

Table 1. 2015 - 2016 Bear Creek Ponds Fish Relocation Summary

Scientific Name:			<i>Notemigonus crysoleucas</i>	<i>Lepomis</i> spp. ¹	<i>Fundulus diaphanus</i>	<i>Lepomis gibbosus</i>	<i>Pimephales promelas</i>	<i>Ameiurus melas</i>	<i>Pimephales notatus</i>	<i>Luxilus cornutus</i>	<i>Micropterus salmoides</i>	<i>Umbra limi</i>	<i>Lepomis gulosus</i>			
Date	Gear	Location	Golden shiner		Western banded killifish	Pumpkinseed	Fathead minnow	Black bullhead	Bluntnose minnow	Common shiner	Largemouth bass ²	Central mudminnow	Warmouth	Other ³	TOTAL	
5/13/2015-5/15/2015	Minnow traps	All fish collected from Bear Creek ponds located on either side of Witham Drive, North Muskegon then released into Bear Creek.	23	3	0	0	63	5	0	0	0	1	0	2	97	
10/6/2015-10/8/2015	Minnow traps		1	0	50	794	3	13	11	2	0	4	0	2	880	
5/9/2016	Seine		100	385	0	20	475	3	0	100	2	0	0	3	3	1,091
5/9/2016	Seine		2	573	3	6	53	2	0	12	0	3	3	1	658	
5/16/2016	Minnow trap		49	293	1	0	1	1	0	0	0	4	1	1	351	
5/16/2016	Minnow trap		46	155	0	0	1	0	0	0	0	1	0		203	
5/16/2016	Seine		148	1,180	13	0	125	0	0	0	0	0	0	1	1,467	
5/25/2016	Minnow trap		0	41	0	0	1	0	0	0	0	0	1	0	43	
5/26/2016	Minnow trap		9	112	0	0	2	1	0	0	0	0	0	0	124	
5/27/2016	Seine, fyke net		843	826	2	48	64	2	9	0	0	0	0	0	1,794	
6/2/2016	Fyke net	GPS coordinates of approximate mid-point: N 43.266653° W 86.261784°	2,063	1,427	2,388	26	454	171	160	0	4	0	0		6,693	
6/2/2016	Fyke net		5,129	2,369	2,598	229	317	298	155	0	71	0	0		11,166	
6/2/2016	Fyke net		2,005	1,465	284	192	83	129	0	0	13	1	0		4,172	
6/3/2016	Fyke net		0	0	0	12	12	0	0	0	0	0	1		25	
6/3/2016	Fyke net		4,121	1,865	704	961	143	91	0	0	0	0	0		7,885	
6/3/2016	Fyke net		4,898	2,584	547	186	182	413	0	0	1	1	0		8,812	
6/9/2016	Fyke net		182	10	0	0	0	74	0	0	0	0	0		266	
6/9/2016	Fyke net		392	22	0	0	0	38	0	0	0	0	0		452	
6/9/2016	Fyke net		5	6	1	0	0	0	0	0	0	1	0		13	
Totals:			20,016	13,316	6,591	2,474	1,979	1,241	335	114	91	17	8	10	46,192	

¹ The majority of *Lepomis* spp. observed were 25 mm or less and were not identified to species to decrease handling time and holding time in tanks. It is likely that 3-4 *Lepomis* species were represented.

² All largemouth bass were immature individuals.

³ Three or fewer of the following were also relocated: green sunfish (*Lepomis cyanellus*), common carp (*Cyprinus carpio*), emerald shiner (*Notropis atherinoides*), spottail shiner (*Notropis hudsonius*), brook stickleback (*Culaea inconstans*), and white sucker (*Catostomus commersonii*).