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2015 Native Species Report

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CONSERVING AMERICA'S Fisheries

Great Lakes RESTORATION

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On the cover:

Staff from the Alpena Fish and Wildlife Conservation Office – Waterford Substation pose for a picture with two crappie captured during a fisheries assessment on Germania Pond located on Shiawassee National Wildlife Refuge property.

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EXECUTIVE SUMMARY

In 2015, the U.S. Fish and Wildlife Service Alpena FWCO-Waterford Substation conducted native species work throughout the St. Clair-Detroit River system (SCRDS) along with conducting a fisheries assessment of Germania Pond on Shiawassee National Wildlife Refuge property. Work conducted in the SCDRS targeted adult and juvenile lake sturgeon (*Acipenser fulvescens*), sites where artificial spawning reefs have been or are scheduled to be installed, and the benthic fish community. Adult lake sturgeon were targeted in the Detroit River, the St. Clair River, and southern Lake Huron using setlines during the spring. Seventy-two lake sturgeon were captured in the Detroit River with seven being recaptures. Eighty-five lake sturgeon were captured in southern Lake Huron with six of these being recaptures. Juvenile lake sturgeon were targeted with 25 – 51 mm monofilament and 75 – 150 mm multifilament mesh gill nets at the mouth of the Detroit River in September and October. One juvenile lake sturgeon was captured in a monofilament net and five were captured in multifilament nets during these assessments. Reef sampling in the Detroit and St. Clair rivers took place during the spring and fall using experimental multifilament gill nets. Four sites (Middle Channel reef, North Channel [control], Algonac reef, and Hart's Light reef) were sampled on the St. Clair River and four sites (Fort Wayne [control], Grassy Island, Fighting Island reef, and East Belle Isle) were sampled on the Detroit River with random locations also being sampled on each river. Twenty-four fish species were captured among all sites. Two species at the Middle Channel reef (channel catfish *Ictalurus punctatus* and logperch *Percina caprodes*), two species at the Algonac reef (burbot *Lota lota* and gizzard shad *Dorosoma cepedianum*), and three species at the Hart's Light reef (burbot, logperch, and round goby *Neogobius melanostomus*) were captured that had not documented in gill net catch prior to reef construction. The benthic fish community was monitored through the use of minnow traps, which were attached to setlines and gill nets on the Detroit River and in the St. Clair River. Eight species were captured in minnow traps in the Detroit River and five species were captured in the St. Clair River, including the endangered northern madtom (*Noturus stigmosus*). Germania Pond, within the Shiawassee National Wildlife Refuge was assessed using fyke nets, seins, and minnow traps. Nine total species were captured with seven species captured in fyke nets, six species in seine hauls, and one species in minnow traps. Crappie captured in Germania Pond exhibited slower growth than seen in other Michigan waters (growth index = -21). The Germania Pond fisheries and bathymetry assessment will also provide information for the Germania/Green Point Restoration Plan.

Lake Sturgeon Sampling

Adult/Subadult Lake Sturgeon

Introduction

Lake sturgeon (*Acipencer fulvescens*) were once an abundant species within the St. Clair-Detroit River System (SCDRS; Figure 1). However, habitat loss, channelization, dams, water pollution, and overfishing caused a decline in the sturgeon population. Their population stands at 1% of what they were in the early 1900s and are listed as a threatened species in the State of Michigan and Province of Ontario (Tody 1974). Recent funding through the Great Lakes Restoration Initiative (GLRI) has led to several habitat enhancement projects in the SCDRS aimed at restoring native fish species, including lake sturgeon. The mark-recapture assessments described below are intended to evaluate the lake sturgeon population in the SCDRS and the response by lake sturgeon to these habitat restoration efforts.

In an effort to evaluate the adult/subadult lake sturgeon population in the Detroit River and southern Lake Huron, the U.S. Fish and Wildlife Service (Service) annually conducts setline assessments as part of on-going mark-recapture assessments. From 2012 - 2014, these setline assessments also served as a way to capture adult lake sturgeon for implanting acoustic transmitters to evaluate movement in the SCDRS as part of a multi-agency telemetry project.

Methods

During the spring spawning season (April through June), adult lake sturgeon were targeted in the Detroit River and southern Lake Huron using setlines. These assessments have been conducted annually in the Detroit River since 2003 and periodically beginning in 2002 in southern Lake Huron. Setlines were fished on the bottom and typically consist of 25 small (1/0) and 25 large (9/0) hooks targeting subadult and adult lake sturgeon. Hooks were baited with dead round gobies (*Neogobius melanostomus*) and fished on a 150 m mother line (Thomas and Haas 1999). All setlines were set overnight and collected the following day (weather permitting). Upon retrieving the setline, the number of hooks that contained bait was noted and only these hooks were used in catch per unit effort (CPUE) calculations. CPUE is presented as number of fish captured per 1,000 hook hours and was calculated separately for 1/0 and 9/0 hooks.

Captured lake sturgeon were weighed (nearest 0.5 kg), measured (total length, fork length, commercial length, and girth), and examined for lamprey scars (classified as large [≥ 25 mm] or small [< 25mm]), deformities, and any abnormalities. If the fish was not previously captured, they were tagged with a Passive Integrated Transponder (PIT) tag under the first dorsal scute and an external Floy tag through the base of the dorsal fin. A tissue sample (partial fin clip) and the anterior ray of the left pectoral fin were taken for genetic analysis and aging, respectively.

Lake sturgeon greater than 1,000 mm total length were also examined for sex and maturity through the use of an ultrasound unit. Ultrasound images were taken of each fish and later analyzed in the lab to assign sex and maturity (Chiotti et al. 2016). This method provides a non-intrusive way to determine the sex of lake sturgeon during the spawning season. Lake sturgeon sex and maturity was determined in the field by applying hand pressure to the abdomen just posterior to the pectoral fins and moving towards the urogenital opening. If eggs or

milt were expressed, then ripe female or ripe male were assigned.

During June and July, lake sturgeon collected by commercial fishermen from Purdy Fisheries, Ltd. were tagged and released. Fish were caught between Point Edward and Blue Point in Ontario waters of southern Lake Huron. The same procedures were followed for working up lake sturgeon as above during setline assessments.

Results and Discussion

Detroit River

In 2015, 48 setlines (40,459 hooks hours) were deployed in the Detroit River between April 15th and May 12th (Figure 2A). Sets occurred at water temperatures of 5.7 to 13.0°C and depths of 5.2 to 11.9 m. A total of 362 lake sturgeon have been captured and tagged to date in the Detroit River using setlines with 65 newly tagged lake sturgeon in 2015 (72 total lake sturgeon caught). Since 2003, 30 lake sturgeon have been recaptured with seven lake sturgeon being recaptured during 2015 setline sampling.

CPUE of lake sturgeon in the Detroit River decreases drastically when water temperatures reach 14°C (Figure 3). Approximately 95% of the lake sturgeon captured on setlines (number of sets = 705) between 2003 - 2015 were captured at water temperatures < 14°C, therefore CPUE's were calculated only using sets at water temperatures below 15°C to reduce CPUE variability. In 2015, the mean CPUE for 9/0 hooks in the Detroit River was 4.54/1000 hook hours (SD ± 7.68), making 2015 CPUE the highest for the time series between 2003 and 2015 (Figure 4). The mean CPUE for 1/0 hooks was 1.65/1000 hook hours (SD ± 6.00), making 2015 1/0 CPUE the highest for the time series between 2010 and 2015 as well (no 1/0 hooks were used in 2014; Figure 5). Other species captured in 2015 included burbot (*Lota lota*), channel catfish (*Ictalurus punctatus*), rock bass (*Ambloplites rupestris*), white bass (*Morone chrysops*), and mudpuppies (*Necturus maculosus*).

Lake sturgeon captured with setlines in the Detroit River in 2015 were between 761 and 1810 mm (mean = 1426; SD ± 203) in total length; the most frequently captured lake sturgeon were between 1400 and 1500 mm on 9/0 hooks and between 1300 and 1400 mm on 1/0 hooks. Between 2003 and 2015, the average size of lake sturgeon captured was 1400 mm (SD ± 218) on 9/0 hooks and 1207 mm (SD ± 247) on 1/0 hooks. Lake sturgeon between 1300 and 1400 mm were most often captured on 9/0 hooks, while 900 – 1100 mm fish were most often captured on 1/0 hooks (Figure 6; Figure 7). The length-weight relationship calculated from all sturgeon captured between 2003 and 2015 in the Detroit River was $W = 6.0e^{-10}\ TL^{\wedge 3.3321}$ ($R^2 = 0.94$; Figure 8).

Of the 72 lake sturgeon captured in the Detroit River on setlines in 2015, no females and 18 males were expressing gametes upon collection. To date, 18 females and 92 males have been identified in the Detroit River (based on gamete expression and incisions); sex could not be determined on all other lake sturgeon.

In 2015 in the Detroit River, 24 lake sturgeon had 74 lamprey scars (39 small scars and 35 large scars). The proportion of sturgeon with small, large, and any size lamprey scars were all lower than 2014 (Table 1). Also, the amount of small, large, and any size scars per lake sturgeon were lower than 2014 (Table 1).

Southern Lake Huron

In 2015, 32 setlines (31,365 hook hours) were deployed in southern Lake Huron between May 27th and June 10th (Figure 2A). Water temperature during this time period

ranged from 9.5 to 12.8°C. From 2002 to the present, 345 lake sturgeon have been tagged during setline assessments in southern Lake Huron with 79 new lake sturgeon tagged in 2015 (85 total lake sturgeon caught). Since 2002, 32 lake sturgeon have been recaptured with six lake sturgeon being recaptured during 2015 setline sampling. Most lake sturgeon captured in southern Lake Huron since 2002 have been caught at water temperatures between 10 and 12°C, although the highest CPUE was at water temperatures between 18 and 20°C (Figure 9). However, only 4 sets have been at water temperatures between 18 and 20°C. Mean CPUE for 9/0 hooks (only 9/0 hooks were used in 2015) in southern Lake Huron was 2.72/1000 hook hours (SD ± 2.43), which is above average (Figure 10). No other species were captured on setlines in southern Lake Huron in 2015.

Lake sturgeon captured in southern Lake Huron in 2015 were between 861 and 1786 mm (mean = 1429; SD ± 171) in total length; the most frequently captured lake sturgeon were between 1501 and 1600 mm. Between 2002 – 2015, the average size of lake sturgeon captured on 9/0 hooks was 1364 mm (SD ± 201) with the most frequent size between 1401 and 1500 mm (Figure 7). The length-weight relationship calculated from all sturgeon captured between 2002 and 2015 in southern Lake Huron was $W = 2.0e^{-10}\ TL^{\wedge 3.4663}$ ($R^2 = 0.93$; Figure 8).

Of the 85 lake sturgeon captured in southern Lake Huron in 2015, no females and 32 males were expressing gametes upon collection. To date, 45 females and 146 males have been identified in southern Lake Huron (based on gamete expression and incisions); sex could not be determined on all other lake sturgeon.

In 2015, 156 lake sturgeon were captured by Purdy Fisheries, Ltd., four of which were recaptures. Lake sturgeon ranged from 547 to 1827 mm (mean = 1263; SD ± 239) in total length. Of the 156 lake sturgeon, 14 received acoustic transmitters to evaluate movement in the SCDRS. While inserting the tags, sex was noted by visually inspecting the incision. Six of the 14 were female while eight were male. The remainder of the lake sturgeon were sexed by checking for expression of gametes; only three could be identified (all male).

In 2015 in southern Lake Huron, 97 lake sturgeon had 591 lamprey scars (432 small scars and 159 large scars). The proportion of sturgeon with small, large, and any size lamprey scars were all higher than 2014 and the proportion with large scars was the highest for the time series (Table 1). Also, the amount of small, large, and any size scars per lake sturgeon were all the highest for the time series (Table 1).

Juvenile Lake Sturgeon

Introduction

Since 2010, juvenile lake sturgeon have been targeted in Lake Huron, SCDRS, and Lake Erie using setlines, gill nets, and bottom trawling. The goal of this work is to gain a better understanding of the abundance and distribution of juvenile lake sturgeon and also develop a long-term monitoring strategy for juvenile lake sturgeon in these waters.

Methods

In 2015 monofilament and multifilament gill nets were used to target juvenile lake sturgeon (<15 years old) at the mouth of the Detroit River. Monofilament gill nets were 91 m in length and 0.9 m in height and consisted of 3 mesh sizes (two 15 m panels of each, randomly placed): 25 mm, 38 mm, and 51 mm. Multifilament gill nets were 107 m in length and 1.8 m in height and consisted of mesh sizes ranging from 75 to 150 mm in 12.5 mm increments with each

net having 14 panels (two of each mesh size randomly placed). Sites were randomly chosen within three zones: 0-2 km (5 sites), 2-5 km (6 sites), and 5-10 km (5 sites) away from the river mouth (Schloesser et al. 2014). In addition to the random sites, eight targeted sites also were chosen. Nets were set at water depths greater than 2.5 m, outside commercial shipping lanes, and at least 500 m away from any other deployed gill net. A ponar grab was taken at the start and end of each net location and the dominant substrate sizes were visually determined. Substrate was classified according to the Wentworth Classification System, modified by Cummins (Wentworth 1922; Cummins 1962). Size categories were as follows: boulder (256 mm), cobble (64–256 mm), pebble (16–64 mm), gravel (2–16 mm), and sand/fine material (2 mm). Near substrate water chemistry and water flow (meters/sec) was collected during each monofilament gill net survey using a Quanta Hydrolab unit and OTT MF pro, respectively. Water chemistry data collected included water temperature, conductivity, dissolved oxygen, turbidity, and pH. Additionally, multifilament gill nets were used at targeted locations in the St. Clair and Detroit Rivers where juvenile lake sturgeon have previously been captured. Water quality measurements and ponar grabs were not conducted at these sites. All fish caught within the gill nets were identified to species, measured for total length, and mortalities were noted. The mesh size was recorded for all fish species captured in monofilament gill nets, but only for lake sturgeon when using multifilament nets. All lake sturgeon were measured, weighed (nearest g), and tagged. Lake sturgeon < 500 mm in total length did not receive a Floy tag due to their small size. For genetic and aging purposes, a tissue sample and the anterior ray of the left pectoral fin were collected from each lake sturgeon. After measurements were collected, all fish were released.

Results and Discussion

In 2015, juvenile lake sturgeon assessments began on September 1st and continued until October 23rd. Seventy-two monofilament gill nets (1,625 hours of effort) were deployed near the Detroit River mouth in western Lake Erie from September 1st to October 23rd at surface water temperatures between 10.8 and 24.7°C and depths ranging from 2.6 to 7.8 m (Figure 2B). One lake sturgeon (430 mm total length) was captured in 25 mm mesh. Twenty-four multifilament gill nets (552 hours of effort) were deployed near the Detroit River mouth in western Lake Erie from October 5th to October 9th at surface water temperatures between 13.7 and 16.1°C and depths ranging from 2.9 to 7.8 m. Five lake sturgeon were captured with total lengths ranging from 574 to 890 mm (mean = 710 ± 116 SD). Three of the lake sturgeon were captured in 127 mm mesh, one was captured in 152 mm mesh, and mesh size was not recorded for one (Table 2).

Twenty-six fish species were captured with monofilament gill nets and twenty were captured with multifilament gill nets (30 species total; Table 3). The most common species captured in monofilament gill nets were white perch (*Morone Americana*; 40%), yellow perch (*Perca flavescens*; 38%), and walleye (*Sander vitreus*; 10%). Fish captured in 25 mm mesh ranged from 82 to 430 mm (mean = 110 mm; SD = 41), fish in 38 mm mesh ranged from 106 to 800 mm (mean = 191 mm; SD = 89), and fish in 51 mm mesh ranged from 106 to 645 mm (mean = 240 mm; SD = 85). Most fish were captured in 51 mm mesh (53%), followed by 38 mm (32%), and 25 mm (14%). The most common species captured in multifilament gill nets were white perch (26%), gizzard shad (*Dorosoma cepedianum*; 18%), and walleye (15%). The mean total length of fish captured in multifilament nets was 408 mm (SD = 131).

Two sites in the St. Clair River were targeted for lake sturgeon between November 2nd and December 2nd. Temperatures and depths ranged from 7.1 to 11.6°C and 12.4 to 18.4 m, respectively. Six nets were set for a total effort of 163 hours. Seven lake sturgeon were captured (0.043/hour; 36.8%) and were the most common species followed by walleye (0.031/hour; 26.3%). Lake sturgeon total lengths ranged from 430 to 1025 mm (mean = 658; SD ± 185).

Three sites in the Detroit River were targeted for lake sturgeon between October 26th and December 8th. Water temperatures and depths ranged from 4.2 to 11.8°C and 6.9 to 11.3 m, respectively. Twelve nets were set for a total effort of 282 hours. One lake sturgeon was captured (0.004/hour; 10.0%) while the most common species was white sucker (*Catostomus commersonii*; 0.011/hour; 30.0%). Total length of the lake sturgeon was 1349 mm.

Reef Restoration Sampling

Introduction

A large scale habitat restoration effort is currently underway in the SCDRS in an attempt to delist the St. Clair and Detroit River Areas of Concern. Two of the beneficial use impairments being addressed are the loss of fish and wildlife habitat and the loss of fish and wildlife populations. Dredging within the system to facilitate commercial ship traffic has led to a drastic loss of rocky habitat (Bennion and Manny 2011). This rocky habitat is vital to many native fish species within the Great Lakes, particularly for spawning (Marsden et al. 1995; Caswell et al. 2004; Roseman et al. 2007).

Artificial spawning reefs are being constructed in the SCDRS to increase the amount of suitable spawning habitat available to native fish species. Reefs have already been constructed near Belle Isle (2004), Fighting Island (2008), and Grassy Island (2015) in the Detroit River and Middle Channel (2012), Algonac (2014), and Hart's Light (2014) in the St. Clair River (Figure 1). More reefs are scheduled for construction near east Belle Isle and near Fort Wayne on the Detroit River (Figure 1). These reefs are constructed of loosely piled rock about two feet thick and range between 0.28 and 4.0 acres in size. The species of particular concern include lake sturgeon, northern madtom (*Noturus stigmosus*), walleye, and lake whitefish (*Coregonus clupeaformis*), which are threatened and/or economically important fish species that utilize rocky substrate for spawning (French and Jude 2001; Caswell et al. 2004; Roseman et al. 2007; Manny et al. 2010).

The objective of this work was to evaluate the success of the artificial reefs by monitoring the adult and benthic fish community near the reefs using gill nets and minnow traps. The work presented here has been ongoing since 2010.

Methods

Gill net surveys have been conducted to monitor the adult fish community pre- and post-reef construction within the SCDRS. Experimental gill nets were fished once per week in the spring and early summer (April through June) and fall (October through December) at several locations in the St. Clair and Detroit Rivers from 2010 to 2015. From 2014 to 2015, two minnow traps were attached to each gill net (see **Benthic Fish Community Section** for methods). Locations in the St. Clair River included the Middle Channel reef, North Channel control site, Hart's Light reef, Algonac reef, and other randomly selected sites (Figure 2B). Locations on the Detroit River included Grassy Island reef, Fighting Island reef, East Belle Isle reef, Fort Wayne (control site),

and other randomly selected sites. Random sites within the SCDRS were selected by numbering 500 x 500 m grids throughout the system and using a random number generator to select sites within the St. Clair and Detroit rivers. The Grassy Island site was not sampled during the fall due to reef construction. One gill net was set at each location parallel with the stream current. Gill nets consisted of mesh sizes ranging from 75 to 150 mm in 12.5 mm increments with each net having 14 panels (2 of each mesh size randomly placed). Net panel dimensions were 2 m tall x 7.6 m long for a total net length of 106 m. Nets fished the bottom of the water column, were held in place by anchors at each end, and were fished overnight for roughly 24 hours. Total length (mm) and weight (g) were collected from each fish species along with genetic samples (caudal fin clip) and aging structures (scales or fin ray) from select sport fish. Lake sturgeon captured in gill nets also received PIT and Floy tags for population monitoring purposes and had the left pectoral spine removed for aging. Lake sturgeon smaller than 500 mm have not received Floy tags since 2012.

At the St. Clair River sites gill nets were set every other week during the spring between April 13th and June 16th (5 weeks of sampling) and during the fall between November 2nd and December 2nd (3 weeks of sampling). During the spring on the Detroit River gill nets were set April 14th and 20th and every other week from May 4th to June 4th (5 weeks of sampling). During the fall on the Detroit River nets were set during four weeks between October 26th and December 8th.

Results and Discussion

St. Clair River - Middle Channel Reef

During the spring of 2015, water temperatures and depths sampled at the Middle Channel reef site ranged from 2.8 to 13.6°C and 10.1 to 12.6 m, respectively. Five gill nets were set for a total effort of 118.5 hours (Table 4). Thirty-six fish representing seven species were captured with the most common being walleye (0.110/hour; 36.1%) and white sucker (0.076/hour; 25.0%; Table 5). Ten minnow traps were set for a total effort of 237 hours. Three round goby (0.013/hour) and one creek chub (*Semotilus atromaculatus*; 0.004/hour) were captured.

During the fall of 2015, water temperatures and depths sampled at the Middle Channel reef site ranged from 7.0 to 11.5°C and 11.2 to 12.8 m, respectively. Three nets were set for a total effort of 80.25 hours (Table 4). Ten fish representing five species were captured with walleye (0.050/hour; 40%), rock bass (0.025/hour; 20%), and smallmouth bass (*Micropterus dolomieu*; 0.025/hour; 20%) being the most common (Table 5). Six minnow traps were set for a total effort of 160.5 hours. Twenty-five round goby (0.156/hour) and one logperch (*Percina caprodes*; 0.006/hour) were captured in the minnow traps.

Prior to construction of the Middle Channel reef, 20 fish species were documented at the site. Since construction, 15 fish species have been documented with three new fish species being captured: black redhorse (*Moxostoma duquesnei*), channel catfish, and logperch. Since spring of 2013 (first spring post-construction), white sucker spring CPUE has been higher than during the springs of 2010 and 2011 (pre-construction; Table 5). Walleye spring CPUE increased in 2013 before decreasing in 2014 (lowest for the time series) and increasing in 2015 (highest for the time series). However, once data is standardized for depth of sets and temperatures sampled the CPUE values are relatively consistent until 2015 when catch rates of walleye and redhorse sucker species increase to their

highest levels for the time series (Figure 11a).

St. Clair River – Algonac Reef

During the spring of 2015, water temperatures and depths sampled at the Algonac reef site ranged from 2.9 to 13.9°C and 14.6 to 16.1 m, respectively. Five nets were set for a total effort of 111 hours (Table 4). Sixty-one fish representing nine species (highest spring species richness among sites in 2015) were captured with the most common being walleye (0.261/hour; 47.5%) and white sucker (0.171/hour; 31.1%; Table 6). Ten minnow traps were set for a total effort of 246 hours. Two round goby (0.008/hour) were captured.

During the fall of 2015, water temperatures and depths sampled at the Algonac reef site ranged from 7.2 to 11.7°C and 10.2 to 15.8 m, respectively. Three nets were set for a total effort of 72 hours (Table 4). One rock bass (0.014/hour; 20%), one shorthead redhorse (*Moxostoma macrolepidotum*; 0.014/hour; 20%), one smallmouth bass (0.014/hour; 20%) one walleye (0.014/hour; 20%), and one white sucker (0.014/hour; 20%; Table 6) were captured. Six minnow traps were set for a total effort of 145.5 hours with 11 round goby (0.076/hour) being captured.

Prior to construction of the Algonac reef, 17 fish species were documented at the site (two years of sampling). After the first year of monitoring since reef construction, 10 fish species have been documented with two new fish species being captured: burbot and gizzard shad. After standardizing for depth of sets and temperatures sampled, the CPUE of walleye in 2015 was the highest it has been for the time series while CPUE of white sucker and redhorse sucker species remained relatively consistent (Figure 11b).

St. Clair River - Hart's Light Reef

During the spring of 2015, water temperatures and depths sampled at the Hart's Light reef site ranged from 2.6 to 13.6°C and 9.4 to 12.0 m, respectively. Five nets were set for a total effort of 101 hours (Table 4). Thirty-nine fish representing eight species were captured with the most common being white sucker (0.237/hour; 61.5%), shorthead redhorse (0.069/hour; 17.9%) and walleye (0.030/hour; 7.7%; Table 7). Ten minnow traps were set for a total effort of 202.5 hours. One northern madtom (0.005/hour) and one round goby (0.005/hour) were captured.

During the fall of 2015, water temperatures and depths sampled at the Hart's Light reef site ranged from 6.9 to 11.3°C and 9.1 to 11.6 m, respectively. Three nets were set for a total effort of 63.5 hours (Table 4). Five walleye (0.079/hour; 71.4%) and two shorthead redhorse (0.031/hour; 28.6%; Table 7) were captured. Six minnow traps were set for a total effort of 127 hours with one logperch (0.008/hour) being captured.

Prior to construction of the Hart's Light reef, 14 fish species were documented at the site (two years of spring sampling, one year of fall sampling). After the first year of monitoring since reef construction, eight fish species have been documented with three new fish species being captured: burbot, logperch, and round goby (had been captured in minnow traps previously, however). After standardizing for depth of sets and temperatures sampled, the CPUE of walleye in 2015 was the lowest it has been during the time series while CPUE of white sucker and redhorse sucker species were the highest in the time series (Figure 11c).

St. Clair River - North Channel (Control)

During the spring of 2015, water temperatures and depths sampled at the

North Channel control site ranged from 2.5 to 13.5°C and 13.3 to 15.7 m, respectively. Five nets were set for a total effort of 114.5 hours (Table 4). Seventeen fish representing four species were captured with the most common being white sucker (0.105/hour; 70.6%) and walleye (0.026/hour; 17.6%; Table 8). Ten minnow traps were set for a total effort of 229 hours. One round goby (0.004/hour) was captured.

During the fall of 2015, water temperatures and depths sampled at the North Channel control site ranged from 6.8 to 11.4°C and 13.3 to 15.2 m, respectively. Three nets were set for a total effort of 75 hours (Table 4). Two shorthead redhorse (0.027/hour; 66.7%) and one silver redhorse (*Moxostoma anisurum*; 0.013/hour; 33.3%; Table 8) were captured. Six minnow traps were set for a total effort of 147.5 hours. Eleven round goby (0.075/hour) and 13 spottail shiner (*Notropis hudsonius*; 0.237/hour) were captured.

Since monitoring began in 2011, catch rates of walleye have remained relatively consistent (Figure 11d). White sucker CPUE has shown some fluctuations with peaks in 2012 and 2015 and redhorse sucker species CPUE has been consistent since 2013 (Figure 11d).

St. Clair River – Random Sites

During the spring of 2015, water temperatures and depths sampled at the random St. Clair River sites ranged from 2.3 to 14.0°C and 5.9 to 9.7 m, respectively. Ten nets were set for a total effort of 199.5 hours. Thirty-three fish representing eight species were captured with the most common being walleye (0.055/hour; 33.3%), white sucker (0.055/hour; 33.3%), and silver redhorse (0.020/hour; 12.1%; Table 9). Twenty minnow traps were set for a total effort of 423 hours. Seven round goby (0.017/hour) and one logperch (0.002/hour) were captured.

During the fall of 2015, water temperatures and depths sampled at the random St. Clair River sites ranged from 6.6 to 11.2°C and 7.3 to 12.8 m, respectively. Six nets were set for a total effort of 134.5 hours (Table 9). One northern hogsucker (*Hypentelium nigricans*; 0.007/hour; 25%), one silver redhorse (0.007/hour; 25%), one smallmouth bass (0.007/hour; 25%), and one walleye (0.007/hour; 25%; Table 9) were captured. Twelve minnow traps were set for a total effort of 269 hours. Forty-four round goby (0.164/hour) and one logperch (0.009/hour) were captured.

Detroit River - Fort Wayne

During the spring of 2015, water temperatures and depths sampled at the Fort Wayne site ranged from 6.2 to 14.5°C and 9.7 to 12.4 m, respectively. Five nets were set for a total effort of 129.5 hours (Table 4). Eighty-three fish representing seven species were captured with the most common being walleye (0.224/hour; 34.9%), white bass (0.185/hour; 28.9%), and white perch (0.178/hour; 27.7%; Table 10). Three crayfish and one mudpuppy were also caught in the gill nets. Ten minnow traps were set for a total effort of 259 hours. Four round goby (0.015/hour) were collected along with three crayfish (0.012/hour).

During the fall of 2015 at the Fort Wayne site, water temperatures and depths sampled at the Fort Wayne site ranged from 4.6 to 12.1°C and 9.6 to 12.1 m, respectively. Four nets were set for a total effort of 88 hours (Table 4). Eight walleye (0.091/hour; 61.5%), three shorthead redhorse (0.034/hour; 23.1%), and two smallmouth bass (0.023/hour; 15.4%) were captured (Table 10). Eight minnow traps were set for a total effort of 176.5 hours with no fish being captured.

Detroit River - Grassy Island

During the spring of 2015, water temperatures and depths sampled at the Grassy Island site ranged from 5.8 to 14.5°C and 6.6 to 10.1 m, respectively. Five nets were set for a total effort of 140 hours (Table 4). One hundred twenty-eight fish representing eight species were captured with the most common being walleye (0.414/hour; 45.3%), white perch (0.293/hour; 32.0%), and white bass (0.114/hour; 12.5%; Table 11). One crayfish was also captured in a gill net. Twelve minnow traps were set for a total effort of 330 hours. Four round goby (0.012/hour) and one rock bass (0.003/hour) were captured. Two crayfish (0.006/hour) and one mudpuppy (0.003/hour) also were collected in minnow traps.

Detroit River - Fighting Island Reef

During the spring of 2015, water temperatures and depths sampled at the Fighting Island reef site ranged from 6.0 to 15.4°C and 7.6 to 9.0 m, respectively. Five nets were set for a total effort of 120 hours (Table 4). One hundred thirty-one fish representing 13 species were captured with the most common being quillback (*Carpiodes cyprinus*; 0.449/hour; 41.2%), silver redhorse (0.183/hour; 16.8%), and white bass (0.125/hour; 11.5%; Table 12). Ten minnow traps were set for a total effort of 216.5 hours with two round goby (0.009/hour), one yellow perch (0.005/hour), and one crayfish (0.005/hour) being captured.

During the fall of 2015, water temperatures and depths sampled at the Fighting Island reef site ranged from 4.4 to 11.7°C and 7.9 to 8.5 m, respectively. Four nets were set for a total effort of 91.5 hours (Table 4). Five fish representing four species were captured with white sucker (0.022/hour; 40%) being the most common (Table 12). Eight minnow traps were set for a total effort of 185 hours with no fish being captured.

Detroit River – East Belle Isle Reef

During the spring of 2015, water temperatures and depths sampled at the East Belle Isle reef site ranged from 6.0 to 13.9°C and 5.9 to 10.2 m, respectively. Five nets were set for a total effort of 98.5 hours (Table 4). One hundred sixty fish representing nine species were captured with the most common being walleye (0.863/hour; 53.1%) and white perch (0.548/hour; 33.8%; Table 13). Ten minnow traps were set for a total effort of 197 hours with two round goby (0.010/hour) and one crayfish (0.005/hour) being captured.

During the fall of 2015, water temperatures and depths sampled at the East Belle Isle reef site ranged from 5.1 to 12.3°C and 5.8 to 10.2 m, respectively. Four nets were set for a total effort of 84 hours (Table 4). Nine fish representing four species were captured with walleye (0.060/hour; 55.6%) and shorthead redhorse (0.024/hour; 22.2%) being the most common (Table 13). Eight minnow traps were set for a total effort of 167.5 hours with two round goby (0.012/hour) captured.

Detroit River – Random Sites

During the fall of 2015, water temperatures and depths sampled at the random Detroit River sites ranged from 5.1 to 12.3°C and 3.8 to 10.1 m, respectively. Four nets were set for a total effort of 100 hours. Seven walleye (0.070/hour; 77.8%), one smallmouth bass (0.010/hour; 11.1%), and one silver redhorse (0.010/hour; 11.1%) were captured (Table 14). Eight minnow traps were set for a total effort of 199.5 hours. Six round goby (0.030/hour) were captured.

Benthic Fish Community

Introduction

As mentioned above, a large scale habitat restoration effort is currently underway in the SCDRS in an effort to delist the St. Clair and Detroit River Areas of Concern. Loss of habitat and reduced water quality has led to the decline of many native fish species within the SCDRS (Bennion and Manny 2011). One such species is the northern madtom, which is an endangered species in the state of Michigan (Manny et al. 2014). Monitoring the benthic fish community allows the Service to monitor the northern madtom population along with changes in the fish community as a result of habitat restoration projects. The objective of this work was to monitor the benthic fish community through the use of minnow traps while conducting setline and gill net assessments. The information presented below is a summary of the benthic fish community data collected at the reef restoration sites in the St. Clair and Detroit Rivers, in addition to minnow traps set independently of reef restoration sampling in each river.

Methods

In 2015, galvanized gee minnow traps with 30 mm openings (Figure 12) were used to survey the benthic fish community in the Detroit and St. Clair Rivers. Three minnow traps were attached to each lake sturgeon setline, two were attached to each gill net, and all were baited with cheese. Traps were attached to the middle, upstream, and downstream end of the setlines and at the upstream and downstream ends of gill nets. Similar methods have been used to survey the benthic fish community since 2003 (not sampled in 2004); although minnow traps have only been attached to gill nets since 2014.

Results and Discussion

On the St. Clair River in 2015, minnow trapping began on April 13th and continued until June 16th during spring and from November 2nd to December 2nd during the fall. Water temperature ranged from 2.3 to 14.0°C and the water depth ranged from 5.9 to 18.4 m at set locations. One hundred eight minnow traps were set at 21 different locations (Figure 2C) for a total sampling effort of 2,513 hours. Five fish species were captured with round goby (0.046/hour; 85.2%) and spottail shiner (0.0004/hour; 9.6%) being the most common (Table 15). In addition, one mudpuppy was captured.

On the Detroit River in 2015, minnow trapping began on April 14th and continued until June 4th during spring and took place October 26th through December 8th during the fall. Water temperature ranged from 4.2 to 15.4°C and water depths at set locations ranged from 3.8 to 12.4 m. Two hundred thirty-nine minnow traps were set at 15 different locations (Figure 2C) for a total sampling effort of 5,496 hours. Eight fish species were captured with the most common being round goby (0.023/hour; 81.6%) and spottail shiner (0.002/hour; 7.9%; Table 16). Twenty-three mudpuppies and 32 crayfish were also collected.

Catch rates of northern madtom in the Detroit River in 2015 were the lowest on record since 2007 (Figure 13). One possible explanation for the sudden decline in northern madtom catch rates in 2007 is a shift in sampling locations. From 2003 to 2006, minnow traps were fished near Belle Isle of the Detroit River (Figure 2C). However, starting in 2007 sampling effort shifted towards the lower Detroit River due to adult lake sturgeon sampling. This was the second full year of minnow trapping in the St. Clair River and one northern madtom (0.040/100 hours) was captured in a minnow trap (one captured in 2014 as well).

Northern madtoms have also been captured in small mesh (25.4, 38.1, and 50.8 mm mesh) and experimental (see **Reef Restoration Section** for gill net description) gill nets between 2011 and 2015. Of the 112 northern madtoms captured in the SCDRS from 2003 to 2015, six were captured in small mesh gill nets, six were captured in experimental gill nets, one was captured in a fyke net, and 99 were captured in minnow traps. Figure 14 shows northern madtom capture locations and Table 17 shows the total lengths of northern madtoms captured in 2015 using all gear types.

Shiawassee NWR Germania Pond Fish Community and Bathymetry Assessment

Introduction

Germania Pond is located within the city of Saginaw and is part of the Shiawassee National Wildlife Refuge. The pond is found in an area of the refuge known as the Germania Tract, which contains 135 acres of land. The Germania Tract was formerly a golf course and was transferred to the Service by The Nature Conservancy in May 2014. The management and outreach goals of this land include providing easy access areas for nature and wildlife viewing in an urban area of Saginaw as well as shoreline recreational fishing opportunities for the local community. In the summer of 2015, a fish community and bathymetry assessment was conducted on Germania Pond in an effort to provide information for the Germania/Green Point Restoration Plan and Environmental Assessment.

Methods

Fyke nets, seines, and minnow traps were the three different gear types used to assess the fish community in Germania Pond. Fyke nets were used to sample larger panfish and juvenile fish, seines were used to sample forage fish, and minnow traps targeted small benthic fish species. Seines were 15.2 m in length with 4.7 mm mesh. Galvanized Gee-style minnow traps with 30 mm openings and 6.4 mm mesh were baited with cheese and attached to an anchored 23 m rope. Fyke nets had 1.1 m × 1.8 m net openings, 3 mm mesh, and 12.2 m leads were anchored to shore. Three fyke nets and 25 minnow traps were set overnight on August 25, 2015 and collected approximately 25 hours later. Three seine hauls were performed on August 26, 2015 near the locations of the fyke nets. The three sites chosen for fyke nets and seine hauls were near the pump house, at the northern point, and the northwest point of the pond (Figure 15). These sites offered ideal water depths for the nets. Minnow traps were set in the center of the pond. Boat electroshocking was considered in the study design but was not feasible due to the steepness of the pond banks and shallow water depth.

Water chemistry and bathymetry data were collected in order to determine water quality conditions and water depth of the pond. Water temperature, specific conductivity (SpC), dissolved oxygen (DO), pH, and turbidity were recorded using a Hydrolab (Quanta Multi-Probe Meter). Bathymetric measurements were recorded using a Humminbird 1197c side imaging system. A transducer was mounted to a jon boat and water depths were recorded as the boat slowly motored around the pond. Bathymetry maps were created using Dr. Depth Software (DrDepthPC Version 5.1.8). Secchi depth and the presence/absence of vegetation were also noted.

All fish collected were enumerated and identified to species. Lengths and weights were recorded from a subsample of fish captured, along with dorsal spines and rays for age determination.

For fyke nets, the CPUE was calculated as the number of fish per net night. Seine

haul CPUE was calculated as the number of fish per haul. Minnow trap CPUE was calculated as the number of fish captured per 24 hours per 25 minnow traps.

Dorsal fin spines and rays were sectioned using a table-mounted dremel tool and cut as close to the proximal end of the spine or ray as possible. Final ages were determined using the modal age of three readers. Mean length at age was calculated and compared with state average growth rates (Schneider et al. 2000). Growth indices were calculated for each age group using the difference between mean length at age and the statewide seasonal average length. Generally, growth indices between -12.7 mm and +12.7 mm are satisfactory for panfish, while growth indices outside this range may be indicative of stunted (< 12.7 mm) or "faster growing" (>12.7 mm) populations. It is recommended to use age groups that contain at least five samples; however, due to low sample sizes growth indices for age groups containing four or more samples were calculated.

Results and Discussion

Fyke Nets

Water temperature during net retrieval was 20.4°C and the range of depths where nets were set was from 1 – 1.3 m. Vegetation was low at all deployment sites and Secchi depth was 0.25 m.

A total of 140 fish representing seven fish species were captured in fyke nets (Table 18). White crappie (*Pomoxis annularis*) were the predominant fish species caught (n = 82; 59% of catch), followed by black crappie (*Pomoxis nigromaculatus*) (n = 33, 24% of catch), and yellow bullhead (*Ameiurus natalis*; n = 20; 14% of catch; Table 18). Length measurements of white crappie ranged from 126 – 365 mm (mean = 224 mm) and weights ranged from 20 – 449 g (mean = 137 g). The length-weight relationship was calculated from 59 white crappie and the determination coefficient was 0.94 (Figure 16). Black crappie ranged in length from 150 – 400 mm (mean = 187 mm) and weights ranged from 44 – 734 g (mean = 112 g; n = 26). The length-weight relationship was calculated from 26 black crappie and had a determination coefficient of 0.95 (Figure 17). A common snapping turtle (*Chelydra serpentina*) was also captured. Based on the presence of bigmouth buffalo (*Ictiobus cyprinellus*) and northern pike (*Esox lucius*), it is suggested that gill nets or electrofishing be used in the future to characterize the fish community of Germania Pond. The gear types used in the current study are not effective at capturing bigmouth buffalo and northern pike due to the size of hoop openings (101 mm), therefore the composition of these species and other fish of this size may be underestimated.

White crappie had the greatest mean CPUE at 27.33 while bluegill (*Lepomis macrochirus*), bigmouth buffalo, and northern pike had the lowest mean CPUE at 0.33 (Table 18; Figure 18). Overall, fyke nets captured the largest fish based on total length (Figure 19).

Seine Hauls

Water temperature during seining was 20.4°C. Water depth ranged from 0.0 – 1.3 m and Secchi depth was 0.25 m. A total of 333 fish representing six fish species were captured (Table 19). Crappie were the predominant species captured (n = 176; 53% of catch). This number included black and white crappie since dorsal spines were not counted to distinguish between the two species. Bluegill (n = 108; 32% of catch), green sunfish (*Lepomis cyanellus*; n = 35; 11% of catch), yellow bullhead (n = 10; 3% of catch), smallmouth bass (n = 3; 1% of catch), and largemouth bass (*Micropterus salmoides*; n = 1; 0.3% of catch) were also

captured. Crappie lengths ranged from 40 – 224 mm (mean = 61 mm; n = 34) and weights ranged from 49 – 135 (mean = 78 g; n = 3). Lengths of bluegill ranged from 19 – 86 mm (mean = 33 mm; n = 34) and weights had a mean of 10 g (n = 2). Length measurements for green sunfish ranged from 27 – 125 mm (mean = 47 mm). Weight measurements ranged from 7 – 36 g with a mean of 16 g (n = 5). Yellow bullhead lengths ranged from 37-297 mm (mean = 103 mm). Weights ranged from 91-380 g (mean = 223 g; n = 3). Smallmouth bass lengths ranged from 52 – 59 mm (mean = 55 mm). The largemouth bass length was 56 mm. Two rusty crayfish (*Orconectes rusticus*) were also captured. Crappie had the greatest mean CPUE at 62.67. Largemouth bass had the least mean CPUE at 0.33 (Table 19; Figure 18). Overall, seines captured smaller fish than fyke nets based on total length (Figure 19).

Minnow Traps

Water temperature when the minnow traps were retrieved was 20.4°C. Crappie were the only species captured and could have included both black and white species of crappie since dorsal spines were not counted to determine species. A total of nine crappie were captured (length and weight measurements were not recorded) for a CPUE of 9.84 (Figure 18).

Water Chemistry

Water chemistry values were recorded on August 25, 2015. Secchi depth at all sites was 0.25 m and bottom depth ranged from 1.0 – 1.3 m. Vegetation was low at all sites and surface water temperature was consistent at 20.4°C. Specific conductivity was 0.390 mS/cm at the surface and 0.396 mS/cm at the bottom. DO was 7.69 mg/L at the surface and 6.45 mg/L at the bottom. At the surface, pH was 9.06 and 9.04 at the bottom. Turbidity was 169 NTU at the surface and 204 NTU at the bottom (Table 20).

Bathymetry

A total of 2,955 data points were collected using the Humminbird side scan sonar unit to determine the bathymetry of Germania Pond. Based on the data collected, the water depth ranged from 0.0 – 1.5 m in depth, with an average depth of 0.9 m (Figure 20 & Figure 21).

Age and Growth

Twenty-three fish captured in fyke nets were aged by three readers using dorsal spines and rays. Of these 23 fish, a modal age was reached on 17. This included one northern pike, 15 white crappie, and one black crappie. The northern pike sampled was estimated at four years old, while the crappie were estimated between two to nine years of age (Table 21).

Comparing the mean lengths at age of crappie from Germania Pond with the statewide seasonal average length of black crappie, the mean growth index was -21. This corresponds to slowed growth of crappie within Germania Pond as compared to crappie in other Michigan waters. Only Germania Pond crappie that were aged at three and five years old were used for the growth index, due to low samples sizes (< 4 individuals) of other ages (Table 21). Statewide seasonal average lengths for white crappie were not available; therefore black crappie lengths were used for comparison.

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Table 1. The proportion of lake sturgeon with small (< 25 mm), large (≥ 25 mm), and any size lamprey scars observed and the amount of small, large, and any size lamprey scars per lake sturgeon in the Detroit River and southern Lake Huron from 2011 – 2015.

	Detroit River					Southern Lake Huron			
	2011	2012	2013	2014	2015	2012	2013	2014	2015
Proportion of Lake Sturgeon With Small Scars	0.42	0.09	0.24	0.35	0.25	0.36	0.29	0.19	0.26
Proportion of Lake Sturgeon With Large Scars	0.29	0.18	0.29	0.27	0.22	0.19	0.22	0.22	0.24
Proportion of Lake Sturgeon With Any Size Scars	0.53	0.23	0.41	0.43	0.33	0.43	0.40	0.36	0.40
Small Scars Per Lake Sturgeon	1.89	0.14	0.56	1.08	0.53	1.21	0.67	0.38	1.79
Large Scars Per Lake Sturgeon	0.49	0.23	0.63	0.55	0.48	0.40	0.56	0.51	0.66
Any Size Scars Per Lake Sturgeon	2.38	0.36	1.20	1.63	1.01	1.62	1.24	0.88	2.45

Table 2. Mesh type and size that each juvenile lake sturgeon was captured in in western Lake Erie along with the mean substrate composition at the corresponding netting location.

	430 mm LAS	669 mm LAS	694 mm LAS	890 mm LAS	724 mm LAS	574 mm LAS
Mesh Type	Monofilament	Multifilament	Multifilament	Multifilament	Multifilament	Multifilament
Mesh Size (mm)	25 mm	127 mm	152 mm	127 mm	127	UNKNOWN
Mean Clay %	-	52.5	52.5	52.5	67.5	20.0
Mean Gravel %	18.8	-	-	-	2.5	12.5
Mean Pebble %	5.0	-	-	-	-	5.0
Mean Sand %	76.3	-	-	-	1.3	42.5
Mean Silt %	-	47.5	47.5	47.5	28.8	20.0

Table 3. Gill net catch per unit effort (CPUE; fish per hour), total number of fish captured, total number of nets sets, total effort (hours), sampling dates, and water temperature range (°C) for sets targeting lake sturgeon in 2015. See text for net dimensions.

	Lake Erie			
	Monofilament	Multifilament	Detroit River	St. Clair River
Black bullhead	0.001	-	-	-
Black redhorse	0.001	0.002	-	0.012
Brown bullhead	0.001	-	-	-
Burbot	-	-	-	0.006
Carp	0.001	0.011	-	-
Channel catfish	0.004	0.072	-	-
Freshwater drum	0.002	0.024	-	-
Gizzard shad	0.016	0.118	-	-
Golden redhorse	-	0.004	-	-
Greater redhorse	-	0.002	-	-
Lake Sturgeon	0.001	0.009	0.004	0.043
Largemouth bass	0.001	-	-	-
Longnose gar	0.007	-	-	-
Logperch	0.001	-	-	-
Northern hog sucker	-	-	0.004	-
Northern pike	0.001	0.004	-	-
Pumpkinseed	-	-	0.004	-
Quillback	-	0.004	-	-
Rock bass	0.034	0.007	-	0.006
Round Goby	0.005	-	0.004	-
Shorthead redhorse	0.004	0.025	-	0.006
Silver chub	0.004	-	-	-
Silver redhorse	-	0.007	0.007	0.006
Smallmouth bass	0.018	0.045	-	0.006
Stonecat	0.001	-	-	-
Spottail shiner	0.013	-	-	-
Trout-perch	0.001	-	-	-
Walleye	0.093	0.094	-	0.031
White bass	0.007	0.020	-	-
White perch	0.383	0.163	-	-
White sucker	0.001	0.009	0.011	-
Yellow bullhead	0.001	0.004	-	-
Yellow perch	0.362	0.014	0.004	-
Total Fish Captured	1566	352	10	19
Total Nets Set	72	24	12	6
Total Effort (Hours)	1625	552	282	163
Dates Sampled	9/1 - 10/23	10/5 - 10/9	10/26 - 12/8	11/2 - 12/2
Water Temperature (°C)	10.8 - 24.7	13.7 - 16.1	4.2 - 11.8	7.1 - 11.6

Table 4. Gill net assessment effort associated with the reef construction projects. Effort is reported in hours, number of weeks assessments occurred in parentheses.

Year	Season	Algonac Reef	Hart's Light Reef	Middle Channel Reef	North Channel Control Site	Fort Wayne Control	Grassy Island Reef	East Belle Isle Reef
2010	Spring	-	-	184 (6 weeks)	-	-	-	-
	Fall	-	-	-	-	-	-	-
2011	Spring	-	-	445 (7 weeks)	266 (5 weeks)	-	-	-
	Fall	-	-	135 (2 weeks)	91 (2 weeks)	-	-	-
2012	Spring	-	-	113 (2 weeks)	143 (2 weeks)	-	-	-
	Fall	-	-	219 (4 weeks)	194 (4 weeks)	191 (4 weeks)	-	-
2013	Spring	370 (8 weeks)	298 (7 weeks)	403 (8 weeks)	383 (8 weeks)	304 (10 weeks)	-	-
	Fall	237 (5 weeks)	222 (5 weeks)	263 (5 weeks)	249 (5 weeks)	-	-	-
2014	Spring	345 (7 weeks)	269 (7 weeks)	371 (7 weeks)	362 (7 weeks)	58 (3 weeks)	-	-
	Fall	53 (2 weeks)	-	43 (2 weeks)	53 (2 weeks)	24 (1 week)	26 (1 week)	21 (1 week)
2015	Spring	111 (5 weeks)	101 (5 weeks)	119 (5 weeks)	115 (5 weeks)	130 (5 weeks)	140 (5 weeks)	99 (5 weeks)
	Fall	72 (3 weeks)	64 (3 weeks)	80 (3 weeks)	75 (3 weeks)	88 (4 weeks)	-	84 (4 weeks)

Table 5. Gill net catch per unit effort (CPUE; fish per hour), total number of fish captured, sampling dates, and water temperature at the Middle Channel reef.

	Spring						Fall				
Year	2010	2011	2012	2013	2014	2015	2011	2012	2013	2014	2015
Black redhorse	-	-	-	-	-	-	-	-	-	-	0.012
Burbot	-	-	-	-	-	-	-	-	-	-	-
Common carp	-	-	-	-	-	-	-	-	-	-	-
Channel catfish	-	-	-	-	-	-	-	0.002	-	-	-
Chinook salmon	-	0.007	-	-	-	-	-	-	-	-	-
Emerald shiner	-	-	-	-	-	-	-	-	-	-	-
Freshwater drum	0.005	-	-	-	-	-	-	-	-	-	-
Gizzard shad	-	-	0.009	-	-	-	0.006	0.009	-	-	-
Golden redhorse	-	-	0.009	0.012	0.003	0.025	0.006	-	0.004	-	-
Lake sturgeon	-	0.002	-	-	-	-	-	-	0.004	-	-
Lake whitefish	-	-	-	-	-	-	-	-	-	-	-
Largemouth bass	-	-	-	-	-	-	-	-	-	-	-
Logperch	-	-	-	-	-	-	-	0.002	-	-	-
Longnose gar	-	-	-	-	-	-	-	-	-	-	-
Muskellunge	-	-	-	-	-	-	-	-	-	-	-
Northern hogsucker	0.016	-	0.009	-	-	-	0.006	-	-	-	-
Northern madtom	-	0.002	-	-	-	-	-	0.004	-	-	-
Northern pike	0.021	0.010	0.009	-	-	-	0.039	0.007	-	-	-
Quillback	-	-	-	-	-	-	-	-	-	-	-
Rainbow trout	-	0.002	-	-	-	-	-	-	-	-	-
Rock bass	0.026	0.020	-	0.027	-	0.017	0.006	0.024	0.011	-	0.025
Round goby	-	0.002	-	-	-	-	-	0.002	-	-	-
Shorthead redhorse	0.016	0.005	-	0.016	0.003	-	0.006	-	0.023	0.023	0.012
Silver lamprey	-	-	-	-	-	-	-	-	-	-	-
Silver redhorse	0.037	0.022	-	0.008	-	0.051	0.013	-	-	0.023	-
Smallmouth bass	-	0.002	-	-	-	0.008	0.013	-	-	-	0.025
Smallmouth buffalo	-	-	-	-	-	-	-	-	-	-	-
Spottail shiner	-	-	-	-	-	-	-	-	-	-	-
Spotted sucker	-	-	-	-	-	-	-	-	-	-	-
Stonecat	-	0.018	-	0.016	0.003	0.017	-	0.004	-	-	-
Walleye	0.037	0.030	0.044	0.070	0.008	0.110	0.026	0.046	0.011	-	0.050
White bass	0.032	0.065	-	0.019	-	-	-	-	-	-	-
White perch	0.005	0.002	-	-	-	-	-	0.004	-	-	-
White sucker	0.042	0.023	0.096	0.132	0.073	0.076	0.013	0.004	0.011	-	-
Yellow perch	-	0.007	-	-	-	-	-	-	-	-	-
Total Fish Captured	45	151	20	77	33	36	21	52	15	2	11
Dates Sampled	4/19 - 6/8	4/13 - 6/21	4/13 - 4/26	4/1 - 6/18	4/22 - 6/3	4/13 - 6/16	11/14 - 11/30	10/17 - 12/6	10/22 - 11/19	11/14 & 11/26	11/2 - 12/2
Water Temperature	8.1 - 18.7	4.9 - 17.4	5.8 - 8.3	1.7 - 14.8	4.1 - 13.2	2.8 - 13.6	6.0 - 10.0	3.7 - 13.7	7.4 - 13.6	5.5 - 8.3	7.0 - 11.5

Table 6. Gill net catch per unit effort (CPUE; fish per hour), total number of fish captured, sampling dates, and water temperature at the Algonac reef.

	Spring			Fall		
Year	2013	2014	2015	2013	2014	2015
Black redhorse	-	0.003	-	-	-	-
Burbot	-	-	0.009	-	-	-
Common carp	-	-	-	-	-	-
Channel catfish	0.003	-	-	-	-	-
Chinook salmon	-	-	-	-	-	-
Emerald shiner	-	-	-	-	-	-
Freshwater drum	-	-	-	-	-	-
Gizzard shad	-	-	0.009	-	-	-
Golden redhorse	0.014	-	0.009	0.008	-	-
Lake sturgeon	0.005	0.006	-	-	-	-
Lake whitefish	-	-	-	-	-	-
Largemouth bass	-	-	-	-	-	-
Logperch	-	-	-	-	-	-
Longnose gar	-	-	-	-	-	-
Muskellunge	-	-	-	-	-	-
Northern hogsucker	0.014	0.003	0.018	0.013	0.019	-
Northern madtom	0.003	-	-	-	-	-
Northern pike	-	0.003	-	-	-	-
Quillback	-	-	-	-	-	-
Rainbow trout	-	-	-	-	-	-
Rock bass	0.024	0.003	0.027	0.013	0.019	0.014
Round goby	-	-	-	0.004	-	-
Shorthead redhorse	0.005	0.012	0.027	0.008	0.019	0.014
Silver lamprey	-	-	-	-	-	-
Silver redhorse	0.014	0.017	0.018	-	-	-
Smallmouth bass	-	0.003	-	0.017	-	0.014
Smallmouth buffalo	-	-	-	-	-	-
Spottail shiner	-	-	-	-	-	-
Spotted sucker	-	-	-	-	-	-
Stonecat	0.030	0.006	-	-	-	-
Walleye	0.043	0.046	0.261	0.038	-	0.014
White bass	0.011	0.003	-	-	-	-
White perch	0.003	0.003	-	-	-	-
White sucker	0.165	0.052	0.171	0.008	-	0.014
Yellow perch	-	-	-	-	-	-
Total Fish Captured	123	55	61	26	3	5
Dates Sampled	4/1 - 6/17	4/22 - 6/3	4/13 - 6/16	10/22 - 11/19	11/14 & 11/26	11/2 - 12/2
Water Temperature	2.0 - 15.1	4.4 - 13.3	2.9 - 13.9	7.4 - 13.5	6.0 - 8.4	7.2 - 11.7

Table 7. Gill net catch per unit effort (CPUE; fish per hour), total number of fish captured, sampling dates, and water temperature at the Hart's Light reef.

	Spring			Fall		
Year	2013	2014	2015	2013	2014	2015
Black redhorse	-	-	-	-	*NA*	-
Burbot	-	-	0.010	-	*NA*	-
Common carp	-	0.004	0.010	-	*NA*	-
Channel catfish	0.003	-	-	-	*NA*	-
Chinook salmon	-	-	-	-	*NA*	-
Emerald shiner	-	0.007	-	-	*NA*	-
Freshwater drum	-	-	-	-	*NA*	-
Gizzard shad	-	-	-	-	*NA*	-
Golden redhorse	0.010	-	-	0.010	*NA*	-
Lake sturgeon	-	-	-	-	*NA*	-
Lake whitefish	-	-	-	-	*NA*	-
Largemouth bass	-	-	-	-	*NA*	-
Logperch	-	-	0.010	-	*NA*	-
Longnose gar	-	-	-	-	*NA*	-
Muskellunge	-	-	-	-	*NA*	-
Northern hogsucker	0.007	-	-	-	*NA*	-
Northern madtom	-	0.004	-	-	*NA*	-
Northern pike	-	-	-	-	*NA*	-
Quillback	-	-	-	-	*NA*	-
Rainbow trout	-	-	-	-	*NA*	-
Rock bass	0.003	-	-	-	*NA*	-
Round goby	-	-	0.010	-	*NA*	-
Shorthead redhorse	0.034	0.011	0.069	0.041	*NA*	0.031
Silver lamprey	-	-	-	-	*NA*	-
Silver redhorse	0.003	-	-	0.005	*NA*	-
Smallmouth bass	-	-	-	-	*NA*	-
Smallmouth buffalo	-	-	-	-	*NA*	-
Spottail shiner	-	-	-	-	*NA*	-
Spotted sucker	-	-	-	-	*NA*	-
Stonecat	0.003	-	0.010	-	*NA*	-
Walleye	0.141	0.100	0.030	0.045	*NA*	0.079
White bass	0.007	-	-	-	*NA*	-
White perch	0.010	-	-	-	*NA*	-
White sucker	0.148	0.115	0.237	0.005	*NA*	-
Yellow perch	-	-	-	-	*NA*	-
Total Fish Captured	110	65	39	23	*NA*	7
Dates Sampled	4/8 - 6/17	4/22 - 6/3	4/13 - 6/16	10/22 - 11/19	*NA*	11/2 - 12/2
Water Temperature	2.0 - 14.8	4.0 -12.9	2.6 - 13.6	6.7 - 13.5	*NA*	6.9 - 11.3

Table 8. Gill net catch per unit effort (CPUE; fish per hour), total number of fish captured, sampling dates, and water temperature at the North Channel control site.

	Spring					Fall				
Year	2011	2012	2013	2014	2015	2011	2012	2013	2014	2015
Black redhorse	-	-	-	-	-	-	-	-	-	-
Burbot	-	-	-	-	-	-	-	-	-	-
Common carp	0.004	-	-	-	-	-	-	0.004	-	-
Channel catfish	-	-	-	-	-	-	-	-	-	-
Chinook salmon	-	-	-	-	-	-	-	-	-	-
Emerald shiner	-	-	-	-	-	-	-	-	-	-
Freshwater drum	-	-	-	-	-	-	-	-	-	-
Gizzard shad	-	-	0.004	-	-	-	0.010	0.016	-	-
Golden redhorse	0.004	-	0.004	-	-	0.011	0.004	0.004	-	-
Lake sturgeon	0.008	0.021	0.016	0.003	-	0.011	0.010	0.024	-	-
Lake whitefish	-	-	-	-	-	-	-	-	-	-
Largemouth bass	0.004	-	-	-	-	-	-	-	-	-
Logperch	-	-	-	-	-	-	0.002	-	-	-
Longnose gar	-	-	-	-	-	-	-	-	-	-
Muskellunge	-	-	-	-	-	-	-	-	-	-
Northern hogsucker	0.015	-	-	0.003	0.009	0.011	0.002	-	-	-
Northern madtom	0.004	-	-	-	-	-	0.006	-	-	-
Northern pike	-	0.007	-	-	-	0.011	0.006	-	-	-
Quillback	-	-	-	-	-	-	-	-	-	-
Rainbow trout	-	-	-	0.003	-	-	0.002	-	-	-
Rock bass	0.030	-	0.013	0.003	-	-	0.014	0.004	-	-
Round goby	-	-	-	-	-	-	0.002	-	-	-
Shorthead redhorse	0.004	-	0.004	-	0.009	0.011	0.016	0.040	0.038	0.027
Silver lamprey	-	-	-	-	-	-	0.002	-	-	-
Silver redhorse	0.019	-	0.004	0.003	-	0.011	0.008	0.004	0.019	0.013
Smallmouth bass	-	-	-	-	-	-	-	-	-	-
Smallmouth buffalo	-	-	-	-	-	-	-	-	-	-
Spottail shiner	-	-	-	-	-	-	0.002	-	-	-
Spotted sucker	-	-	0.004	-	-	-	-	-	-	-
Stonecat	0.015	-	0.013	-	-	-	0.006	-	-	-
Walleye	0.034	0.028	0.029	0.017	0.026	0.022	0.008	0.012	-	-
White bass	0.038	-	0.038	-	-	-	-	0.004	-	-
White perch	-	-	-	-	-	-	0.027	-	-	-
White sucker	0.083	0.153	0.113	0.061	0.105	-	0.002	0.004	0.019	-
Yellow perch	-	0.007	-	-	-	-	0.002	-	-	-
Total Fish Captured	69	31	60	35	17	8	65	29	4	3
Dates Sampled	5/11 - 6/21	4/13 - 4/26	4/1 - 6/18	4/22 - 6/3	4/13 - 6/16	11/14 - 11/30	10/11 - 12/6	10/22 - 11/19	11/14 & 11/26	11/2 - 12/2
Water Temperature	9.5 - 16.9	5.8 - 8.3	2.0 - 14.8	4.2 - 12.9	2.5 - 13.5	6.0 - 10.0	5.8 - 14.2	7.3 - 13.5	5.7 - 8.1	6.8 - 11.4

Table 9. Gill net catch per unit effort (CPUE; fish per hour), total number of fish captured, sampling dates, and water temperature at randomly selected sites within the St. Clair River.

	Spring	Fall	
Year	2015	2014	2015
Black redhorse	-	-	-
Burbot	-	-	-
Common carp	-	-	-
Channel catfish	-	-	-
Chinook salmon	-	-	-
Emerald shiner	-	-	-
Freshwater drum	-	-	-
Gizzard shad	-	-	-
Golden redhorse	-	-	-
Lake sturgeon	-	-	-
Lake whitefish	-	-	-
Largemouth bass	-	-	-
Logperch	-	-	-
Longnose gar	-	-	-
Muskellunge	-	-	-
Northern hogsucker	0.010	-	0.007
Northern madtom	-	-	-
Northern pike	-	0.009	-
Quillback	-	-	-
Rainbow trout	-	-	-
Rock bass	0.005	0.005	-
Round goby	-	-	-
Shorthead redhorse	0.010	0.014	-
Silver lamprey	-	-	0.007
Silver redhorse	0.020	0.005	-
Smallmouth bass	-	0.005	0.007
Smallmouth buffalo	-	-	-
Spottail shiner	-	-	-
Spotted sucker	0.005	-	-
Stonecat	0.005	-	-
Walleye	0.055	0.019	0.007
White bass	-	-	-
White perch	-	-	-
White sucker	0.055	0.005	-
Yellow perch	-	-	-
Total Fish Captured	33	13	4
Dates Sampled	4/13 - 6/16	11/14 & 11/26	11/2 - 12/2
Water Temperature	2.3 - 14.0	5.3 - 8.3	6.6 - 11.2

Table 10. Gill net catch per unit effort (CPUE; fish per hour), total number of fish captured, sampling dates, and water temperature at the Fort Wayne site.

	Spring			Fall			
Year	2013	2014	2015	2012	2013	2014	2015
Black redhorse	-	-	-	-	*NA*	-	-
Burbot	-	-	-	-	*NA*	-	-
Common carp	-	-	-	-	*NA*	-	-
Channel catfish	0.003	-	-	-	*NA*	-	-
Chinook salmon	-	-	-	-	*NA*	-	-
Emerald shiner	-	-	-	-	*NA*	-	-
Freshwater drum	-	-	-	-	*NA*	-	-
Gizzard shad	0.007	-	-	0.073	*NA*	-	-
Golden redhorse	0.003	-	-	-	*NA*	-	-
Lake sturgeon	-	-	-	-	*NA*	-	-
Lake whitefish	-	-	-	0.005	*NA*	-	-
Largemouth bass	-	-	-	-	*NA*	-	-
Logperch	-	-	-	-	*NA*	-	-
Longnose gar	-	-	0.008	-	*NA*	-	-
Muskellunge	-	-	-	-	*NA*	-	-
Northern hogsucker	-	-	-	0.005	*NA*	-	-
Northern madtom	-	-	-	0.005	*NA*	-	-
Northern pike	-	-	-	-	*NA*	-	-
Quillback	-	-	-	-	*NA*	-	-
Rainbow trout	-	-	-	-	*NA*	-	-
Rock bass	0.020	0.017	0.031	-	*NA*	-	-
Round goby	-	-	-	-	*NA*	-	-
Shorthead redhorse	0.026	-	-	0.020	*NA*	0.042	0.034
Silver lamprey	-	-	-	-	*NA*	-	-
Silver redhorse	0.026	-	-	-	*NA*	-	-
Smallmouth bass	0.026	-	-	0.037	*NA*	0.125	0.023
Smallmouth buffalo	-	-	-	-	*NA*	-	-
Spottail shiner	-	-	-	-	*NA*	-	-
Spotted sucker	-	-	-	-	*NA*	-	-
Stonecat	-	-	-	-	*NA*	-	-
Walleye	0.658	1.078	0.224	0.105	*NA*	0.042	0.091
White bass	0.322	0.209	0.185	-	*NA*	-	-
White perch	0.115	-	0.178	-	*NA*	-	-
White sucker	0.023	0.052	0.008	0.010	*NA*	-	-
Yellow perch	-	-	0.008	-	*NA*	-	-
Total Fish Captured	374	78	83	50	*NA*	5	13
Dates Sampled	4/2 - 7/1	4/16 - 5/14	4/14 - 6/4	11/6 - 12/6	*NA*	11/4	10/26 - 12/8
Water Temperature	3.6 - 21.1	7.6 - 12.7	6.2 - 14.5	5.1 - 6.4	*NA*	7.8	4.6 - 12.1

Table 11. Gill net catch per unit effort (CPUE; fish per hour), total number of fish captured, sampling dates, and water temperature at the Grassy Island reef.

	Spring		Fall	
Year	2014	2015	2014	2015
Black redhorse	-	-	-	*NA*
Burbot	-	-	-	*NA*
Common carp	-	-	-	*NA*
Channel catfish	-	-	-	*NA*
Chinook salmon	-	-	-	*NA*
Emerald shiner	-	-	-	*NA*
Freshwater drum	-	-	-	*NA*
Gizzard shad	-	-	-	*NA*
Golden redhorse	-	-	-	*NA*
Lake sturgeon	-	-	-	*NA*
Lake whitefish	-	-	-	*NA*
Largemouth bass	-	-	-	*NA*
Logperch	-	-	-	*NA*
Longnose gar	-	-	-	*NA*
Muskellunge	-	-	-	*NA*
Northern hogsucker	-	-	-	*NA*
Northern madtom	-	0.007	-	*NA*
Northern pike	-	-	-	*NA*
Quillback	-		-	*NA*
Rainbow trout	-	-	-	*NA*
Rock bass	0.034	0.014	-	*NA*
Round goby	-	-	-	*NA*
Shorthead redhorse	-	-	0.038	*NA*
Silver lamprey	-	-	-	*NA*
Silver redhorse	-	0.050	-	*NA*
Smallmouth bass	0.034	0.014	-	*NA*
Smallmouth buffalo	0.017	-	-	*NA*
Spottail shiner	-	-	-	*NA*
Spotted sucker	-	-	-	*NA*
Stonecat	-	-	-	*NA*
Walleye	1.301	0.414	0.038	*NA*
White bass	0.085	0.114	-	*NA*
White perch	0.017	0.293	-	*NA*
White sucker	0.034	0.007	-	*NA*
Yellow perch	-	-	-	*NA*
Total Fish Captured	90	128	2	*NA*
Dates Sampled	4/16 - 5/14	4/14 - 6/4	11/4	*NA*
Water Temperature	6.8 - 11.8	5.8-14.5	8.0	*NA*

Table 12. Gill net catch per unit effort (CPUE; fish per hour), total number of fish captured, sampling dates, and water temperature at the Fighting Island reef.

	Spring	Fall	
Year	2015	2014	2015
Black redhorse	-	-	-
Burbot	-	-	0.011
Common carp	-	-	-
Channel catfish	-	-	-
Chinook salmon	-	-	-
Emerald shiner	-	-	-
Freshwater drum	-	-	-
Gizzard shad	0.008	-	-
Golden redhorse	0.008	-	-
Lake sturgeon	-	-	-
Lake whitefish	-	-	-
Largemouth bass	-	-	-
Logperch	-	-	-
Longnose gar	-	-	-
Muskellunge	-	-	-
Northern hogsucker	-	-	-
Northern madtom	-	-	-
Northern pike	-	-	0.011
Quillback	0.449	-	-
Rainbow trout	-	-	-
Rock bass	0.017	-	-
Round goby	-	-	-
Shorthead redhorse	0.008	-	-
Silver lamprey	0.008	-	-
Silver redhorse	0.183	-	0.011
Smallmouth bass	0.017	-	-
Smallmouth buffalo	-	-	-
Spottail shiner	-	-	-
Spotted sucker	-	-	-
Stonecat	-	-	-
Walleye	0.108	-	-
White bass	0.125	-	-
White perch	0.050	-	-
White sucker	0.100	-	0.022
Yellow perch	0.008	-	-
Total Fish Captured	131	0	5
Dates Sampled	4/14 - 6/4	11/4	10/26 - 12/8
Water Temperature	6.0 - 15.4	7.9	4.4 - 11.7

Table 13. Gill net catch per unit effort (CPUE; fish per hour), total number of fish captured, sampling dates, and water temperature at the East Belle Isle reef.

	Spring	Fall	
Year	2015	2014	2015
Black redhorse	-	-	-
Burbot	-	-	-
Common carp	-	-	-
Channel catfish	-	0.047	-
Chinook salmon	-	-	-
Emerald shiner	-	-	-
Freshwater drum	-	-	-
Gizzard shad	-	-	-
Golden redhorse	-	-	-
Lake sturgeon	-	-	-
Lake whitefish	-	-	-
Largemouth bass	-	-	-
Logperch	-	-	-
Longnose gar	0.010	-	-
Muskellunge	-	-	-
Northern hogsucker	-	-	-
Northern madtom	-	-	-
Northern pike	0.030	-	0.012
Quillback	-	-	-
Rainbow trout	-	-	-
Rock bass	-	-	-
Round goby	-	-	-
Shorthead redhorse	0.010	-	0.024
Silver lamprey	-	-	-
Silver redhorse	0.051	-	-
Smallmouth bass	0.020	-	0.012
Smallmouth buffalo	-	-	-
Spottail shiner	-	-	-
Spotted sucker	-	-	-
Stonecat	-	-	-
Walleye	0.863	-	0.060
White bass	0.041	-	-
White perch	0.548	-	-
White sucker	0.051	-	-
Yellow perch	-	-	-
Total Fish Captured	160	1	9
Dates Sampled	4/14 - 6/4	11/4	10/26 - 12/8
Water Temperature	6.0 - 13.9	7.8	5.1 - 12.3

Table 14. Gill net catch per unit effort (CPUE; fish per hour), total number of fish captured, sampling dates, and water temperature at randomly selected Detroit River sites.

	Fall	
Year	2014	2015
Black redhorse	-	-
Burbot	-	-
Common carp	-	-
Channel catfish	-	-
Chinook salmon	-	-
Emerald shiner	-	-
Freshwater drum	-	-
Gizzard shad	-	-
Golden redhorse	-	-
Lake sturgeon	-	-
Lake whitefish	-	-
Largemouth bass	-	-
Logperch	-	-
Longnose gar	-	-
Muskellunge	0.014	-
Northern hogsucker	-	-
Northern madtom	-	-
Northern pike	-	-
Quillback	-	-
Rainbow trout	-	-
Rock bass	-	-
Round goby	-	-
Shorthead redhorse	-	-
Silver lamprey	-	-
Silver redhorse	-	0.010
Smallmouth bass	0.014	0.010
Smallmouth buffalo	-	-
Spottail shiner	-	-
Spotted sucker	-	-
Stonecat	-	-
Walleye	0.014	0.070
White bass	-	-
White perch	-	-
White sucker	-	-
Yellow perch	-	-
Total Fish Captured	3	9
Dates Sampled	11/4	10/26 - 12/8
Water Temperature	7.5 - 8.1	5.1 - 12.3

Table 15. The number and catch per unit effort (CPUE; number per 100 hours) of fish species captured in minnow traps in the St. Clair River in 2015.

Species	Number Captured	CPUE (number/100 hours)
Creek chub	1	0.038
Logperch	4	0.159
Northern madtom	1	0.038
Round goby	115	4.576
Spottail shiner	13	0.517

Table 16. The number and catch per unit effort (CPUE; number per 100 hours) of fish species captured in minnow traps in the Detroit River in 2015.

Species	Number Captured	CPUE (number/100 hours)
Bluntnose minnow	1	0.018
Logperch	7	0.127
Northern madtom	1	0.018
Rock bass	3	0.055
Round goby	124	2.256
Spottail shiner	12	0.218
Tubenose goby	1	0.018
Unknown species	1	0.018
Yellow perch	1	0.018

Table 17. Total lengths of northern madtom captured in the St. Clair-Detroit River system in 2015 using multiple gear types.

Total Length (mm)	Gear Type
99	Gill net
117	Minnow trap
118	Minnow trap

Table 18. Total number of each fish species collected, mean lengths, and mean weights from fyke nets deployed on Germania Pond on August 26, 2015.

Species	Total Fish Captured	Mean CPUE (fish/net night)	Mean Length (mm ± SD)	Mean Weight (g ± SD)
Bigmouth buffalo	1	0.33	679 ± 0	-
Black crappie	33	11.00	187 ± 54	112 ± 141
Bluegill	1	0.33	162 ± 0	-
Northern pike	1	0.33	690 ± 0	1713 ± 0
White crappie	82	27.33	224 ± 45	137 ± 80
White sucker	2	0.67	332 ± 18	353 ± 35
Yellow bullhead	20	6.67	224 ± 26	-

Table 19. Total number of each fish species collected, mean lengths, and mean weights from seine hauls conducted on Germania Pond on August 26, 2015.

Species	Total Fish Captured	Mean CPUE (fish/haul)	Mean Length (mm ± SD)	Mean Weight (g ± SD)
Bluegill	108	36.00	33 ± 16	10 ± 2
Crappie	176	62.67	61 ± 41	78 ± 49
Green sunfish	35	12.00	47 ±23	16 ± 12
Largemouth bass	1	0.33	56 ± 0	-
Smallmouth bass	3	1.00	55 ± 4	2 ± 0
Yellow bullhead	10	3.33	103 ± 101	223 ± 146

Table 20. Water chemistry measurements from Germania Pond collected on August 25, 2015.

Measurements	Surface	Bottom
Temperature (°C)	20.37	20.37
SpC (mS/cm)	0.39	0.40
DO (mg/L)	7.69	6.45
pH	9.06	9.04
Turbidity (NTU)	169	204

Table 21. Mean total length at age of fish collected from Germania Pond compared to fish from other Michigan waters. The numbers in parenthesis are the number of fish aged from each age class.

Species	Age	State Mean Length (mm)	Germania Pond Mean Length (mm)	Deviation (mm)	Growth Index
Northern pike	4 (1)	635	690	+55	NA
White crappie	2 (2)	183	194	+11	NA
White crappie	3 (4)	213	183	-30	-30
White crappie	4 (3)	234	256	+22	NA
White crappie	5 (5)	254	242	-12	-12
White crappie	6 (1)	272	289	17	NA
Black crappie	9 (1)	NA	400	NA	NA

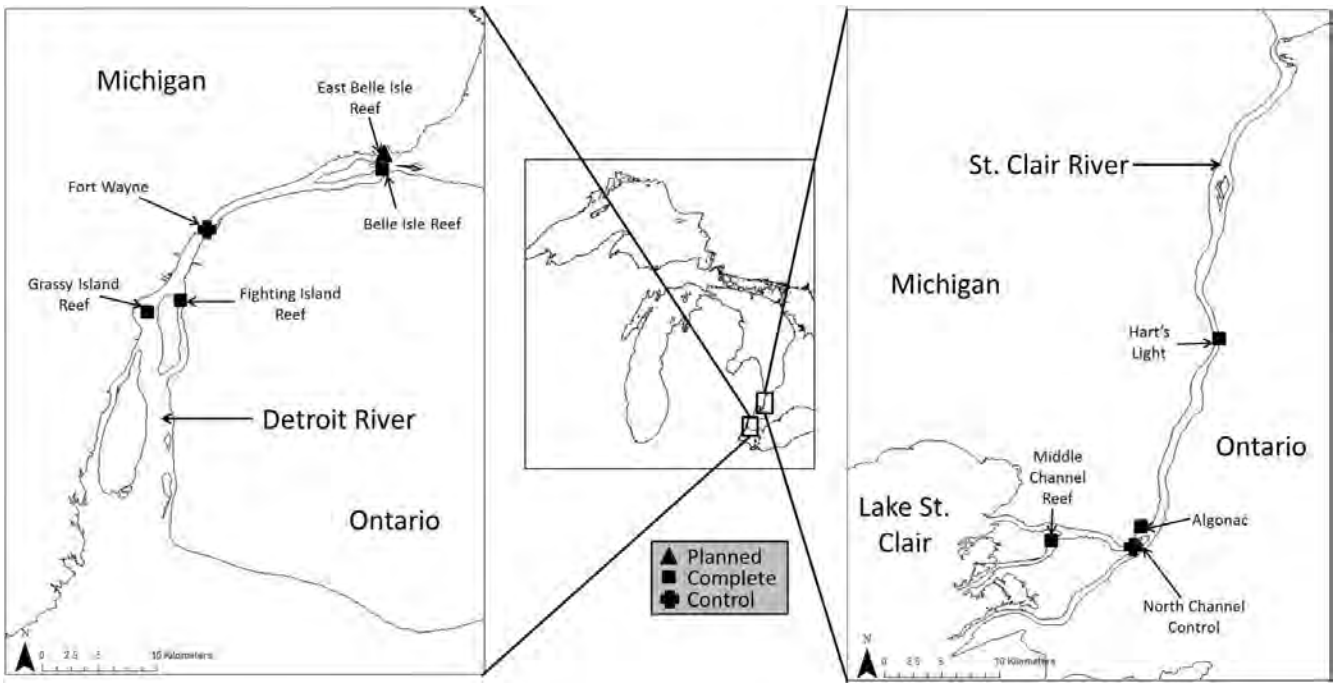

Figure 1. Map of where artificial reefs have been completed or planned and the associated control sites in the St. Clair – Detroit River System (SCDRS).

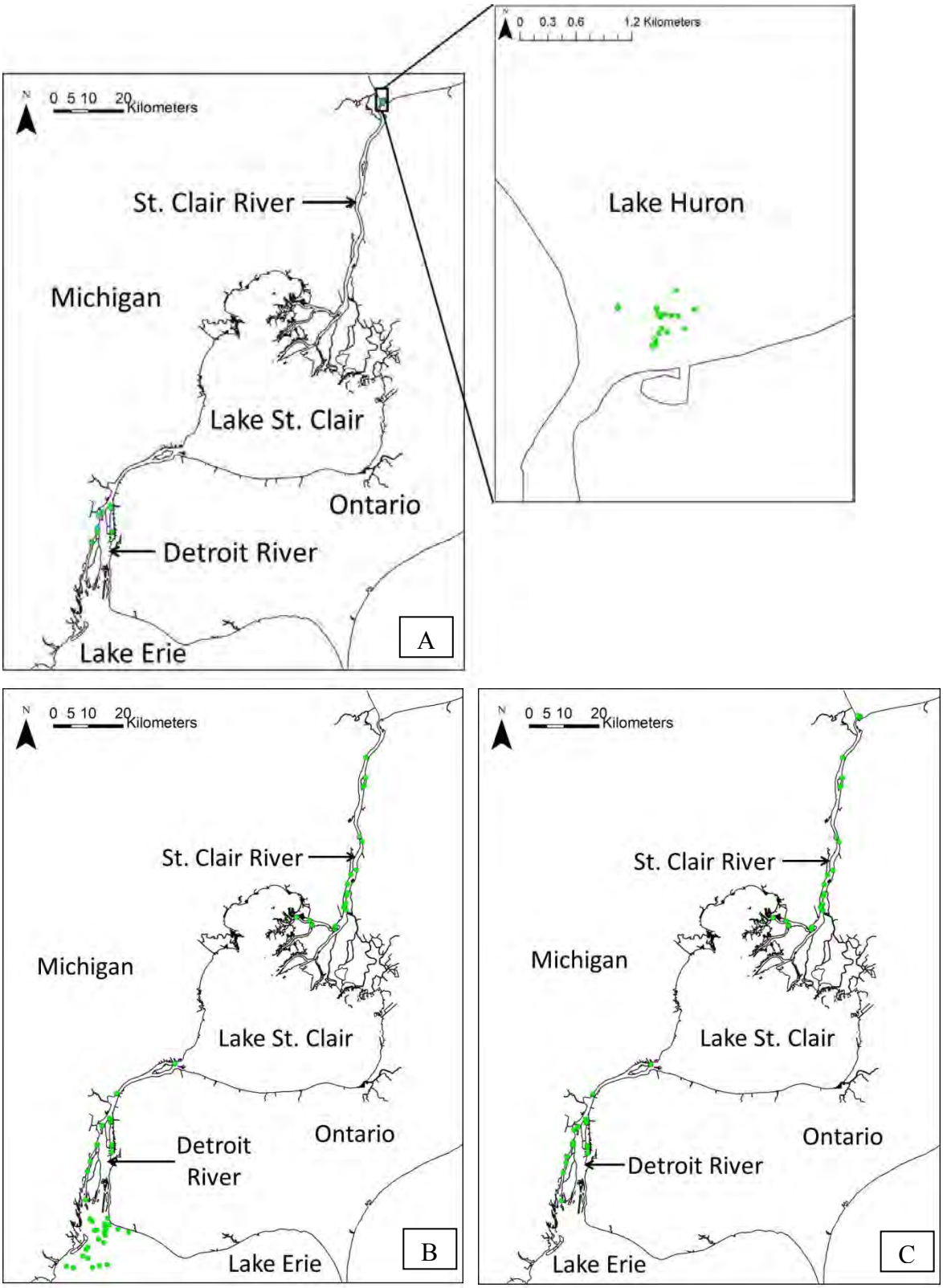

Figure 2. Map of setline (A), gill net (B), and minnow trap (C) locations in 2015.

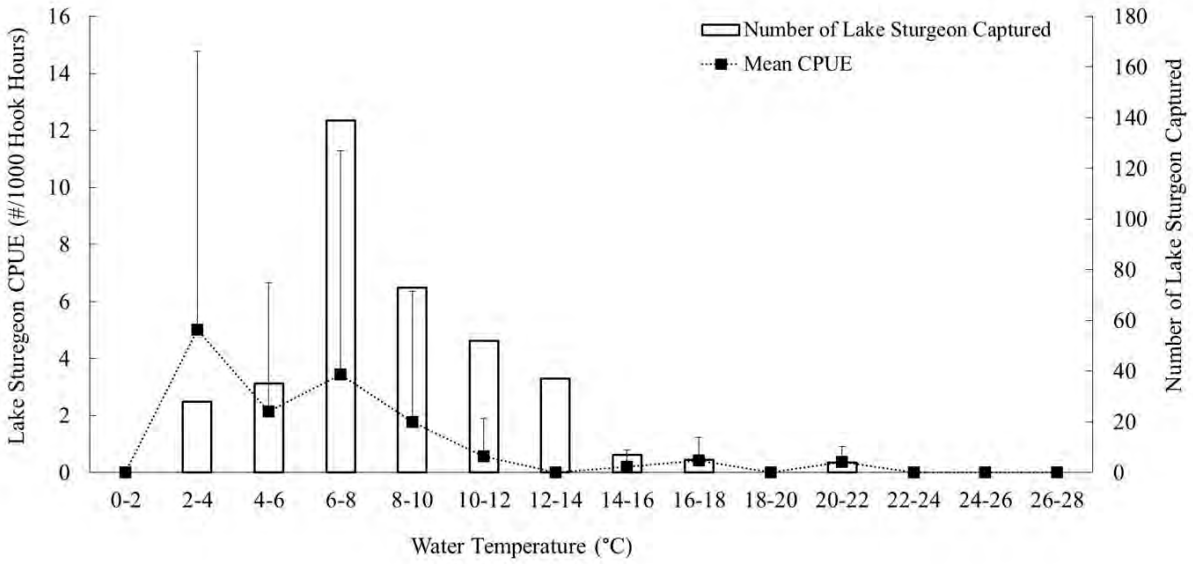

Figure 3. Mean catch per unit effort (#/1000 hook hours; + SD) and number of lake sturgeon captured on setlines in the Detroit River in relation to water temperature (°C).

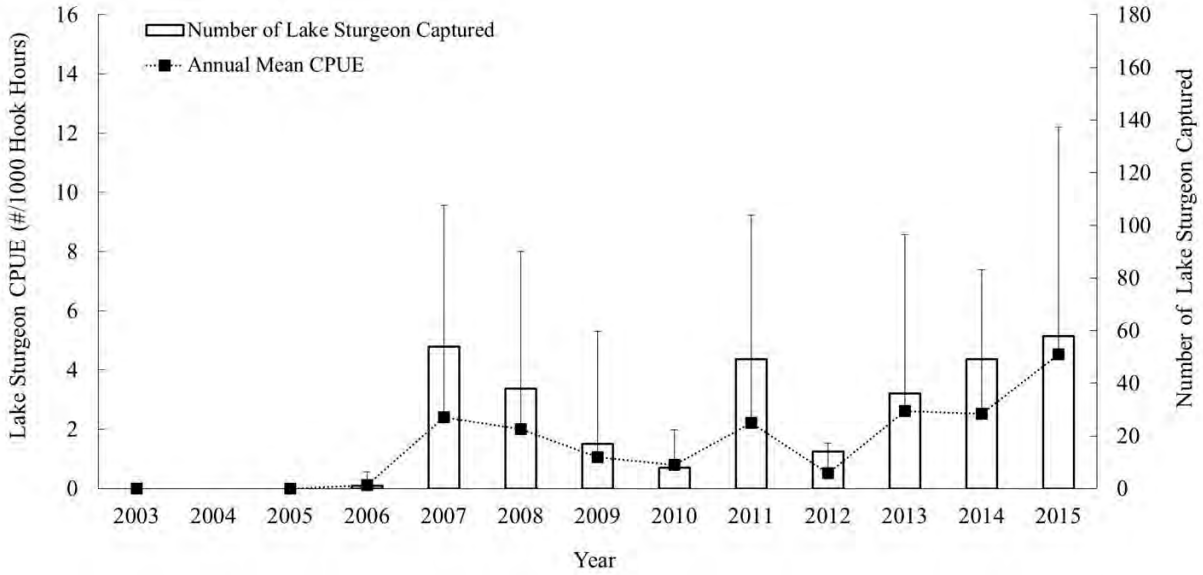

Figure 4. Annual mean catch per unit effort (#/1,000 hook hours; +SD) using large (9/0) hooks and number of lake sturgeon captured in the Detroit River, 2003-2015.

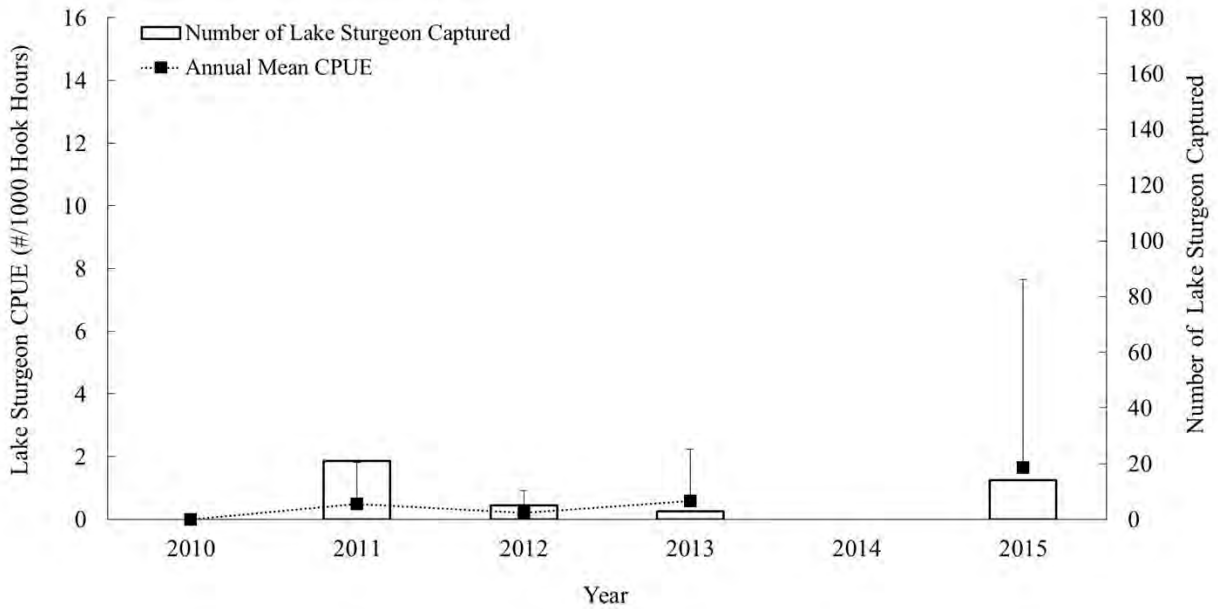

Figure 5. Catch per unit effort (#/1,000 hook hours) using small (1/0) hooks and number of lake sturgeon captured in the Detroit River, 2010-2015 (small hooks were not fished in the Detroit River in 2014).

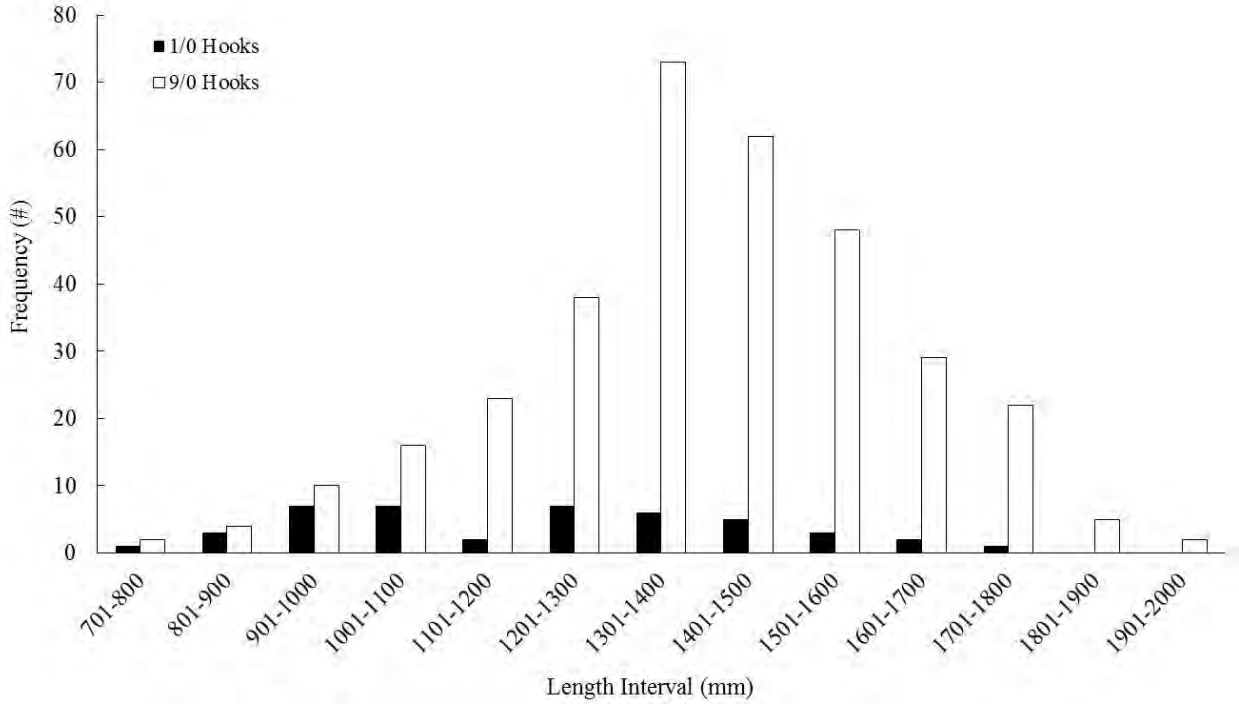

Figure 6. Length frequency histogram of lake sturgeon captured on large (9/0) hooks and small (1/0) hooks in the Detroit River from 2003-2015.

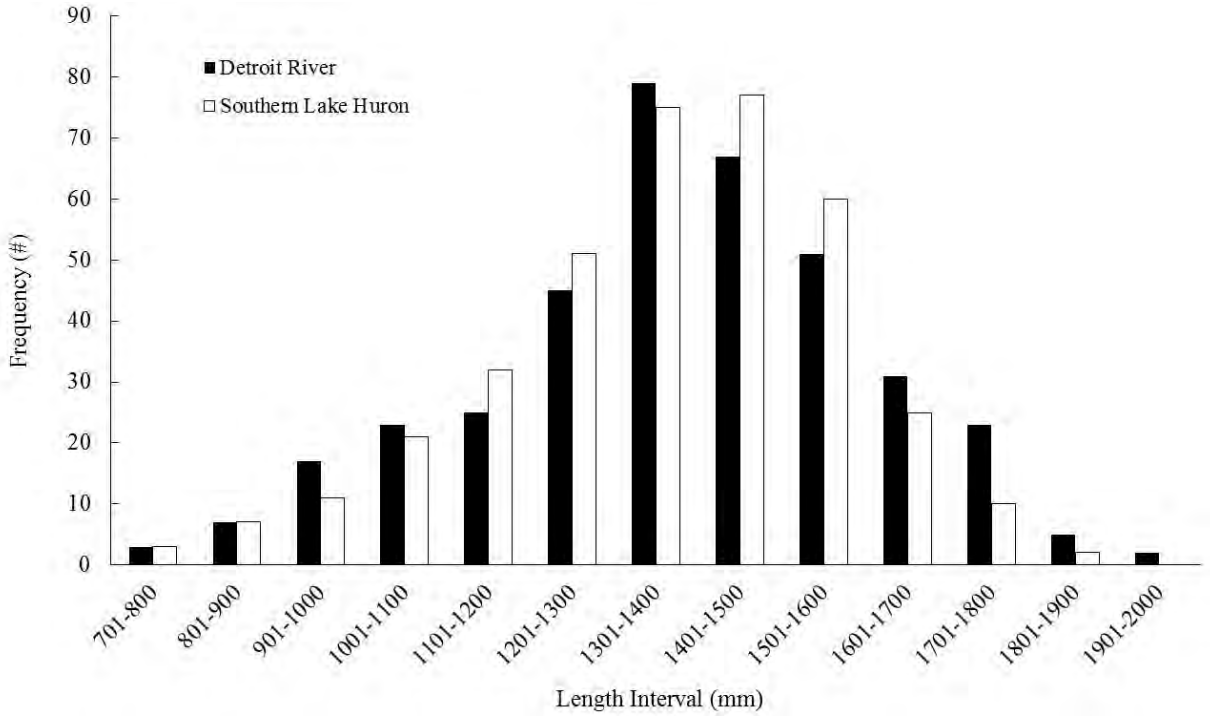

Figure 7. Length frequency histogram of all lake sturgeon captured on setlines in the Detroit River (2003 – 2015) and southern Lake Huron (2002 – 2015).

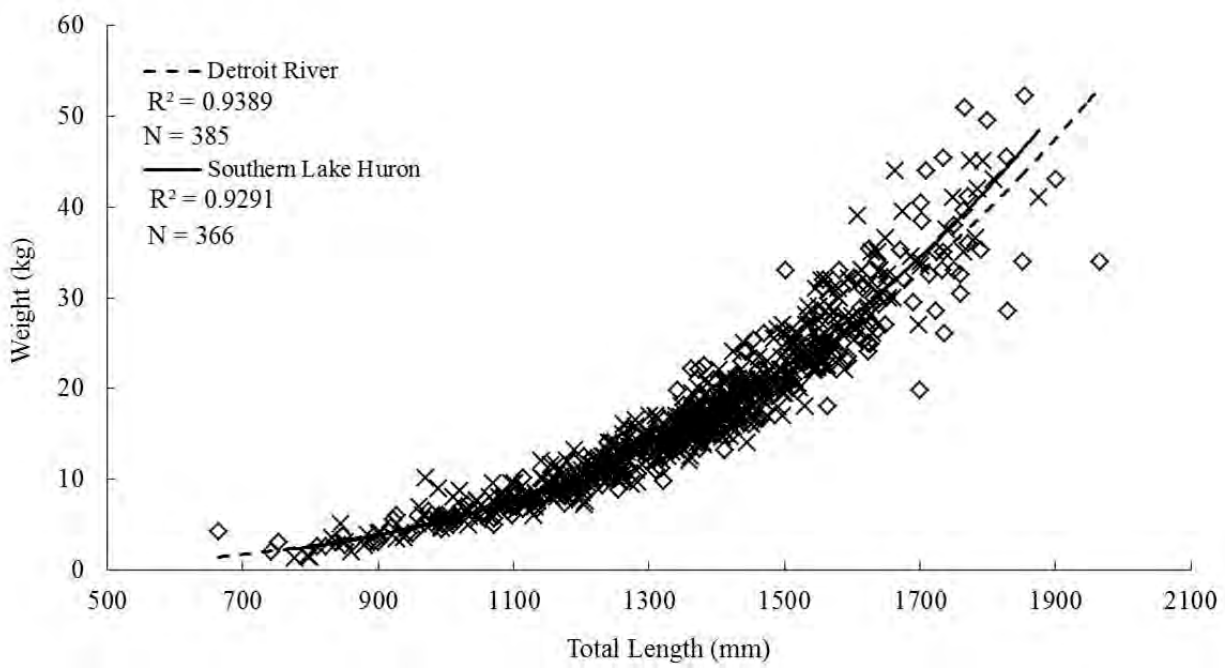

Figure 8. The length-weight relationship for lake sturgeon captured in the Detroit River (2003 - 2015) and southern Lake Huron (2002 – 2015).

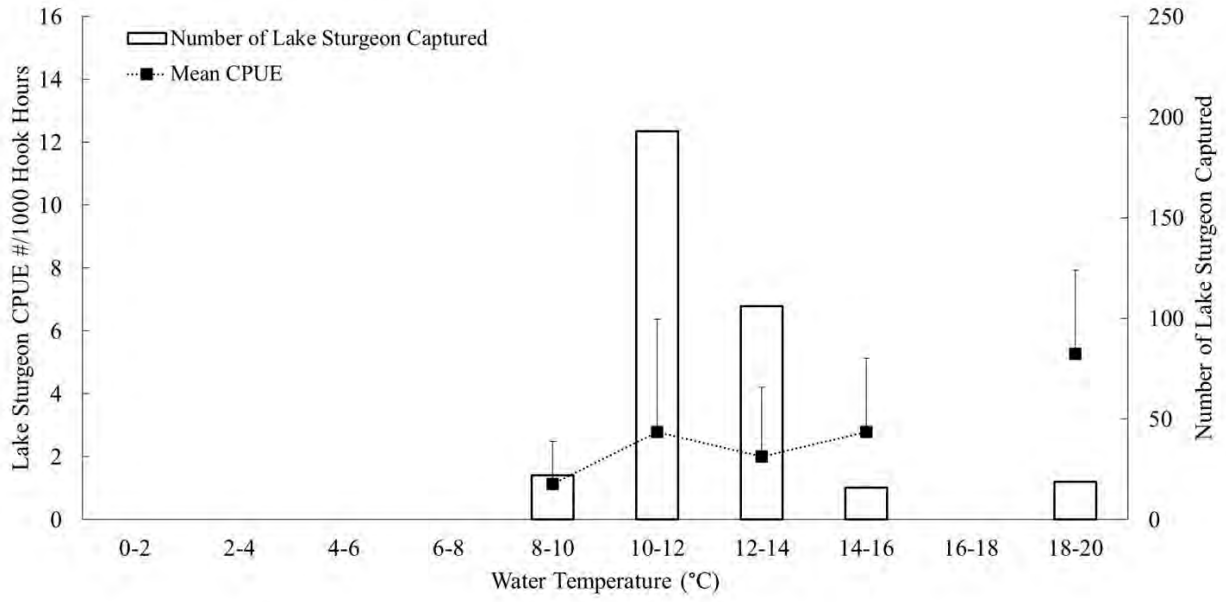

Figure 9. Mean catch per unit effort (#/1000 hook hours; + SD) and number of lake sturgeon captured on setlines in the southern Lake Huron in relation to water temperature (°C).

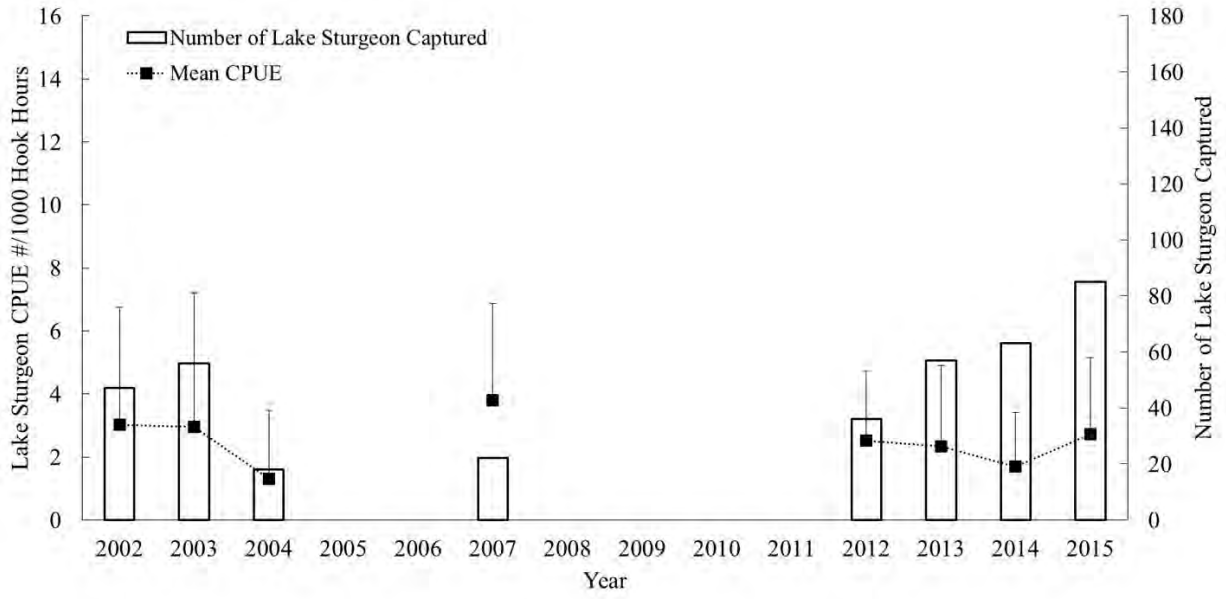

Figure 10. Annual mean catch per unit effort (#/1,000 hook hours; +SD) and number of lake sturgeon captured in southern Lake Huron, 2002-2015. Only size 9/0 hooks were used in southern Lake Huron (except in 2012 when 11 out of 36 sets were mixed 1/0 and 9/0).

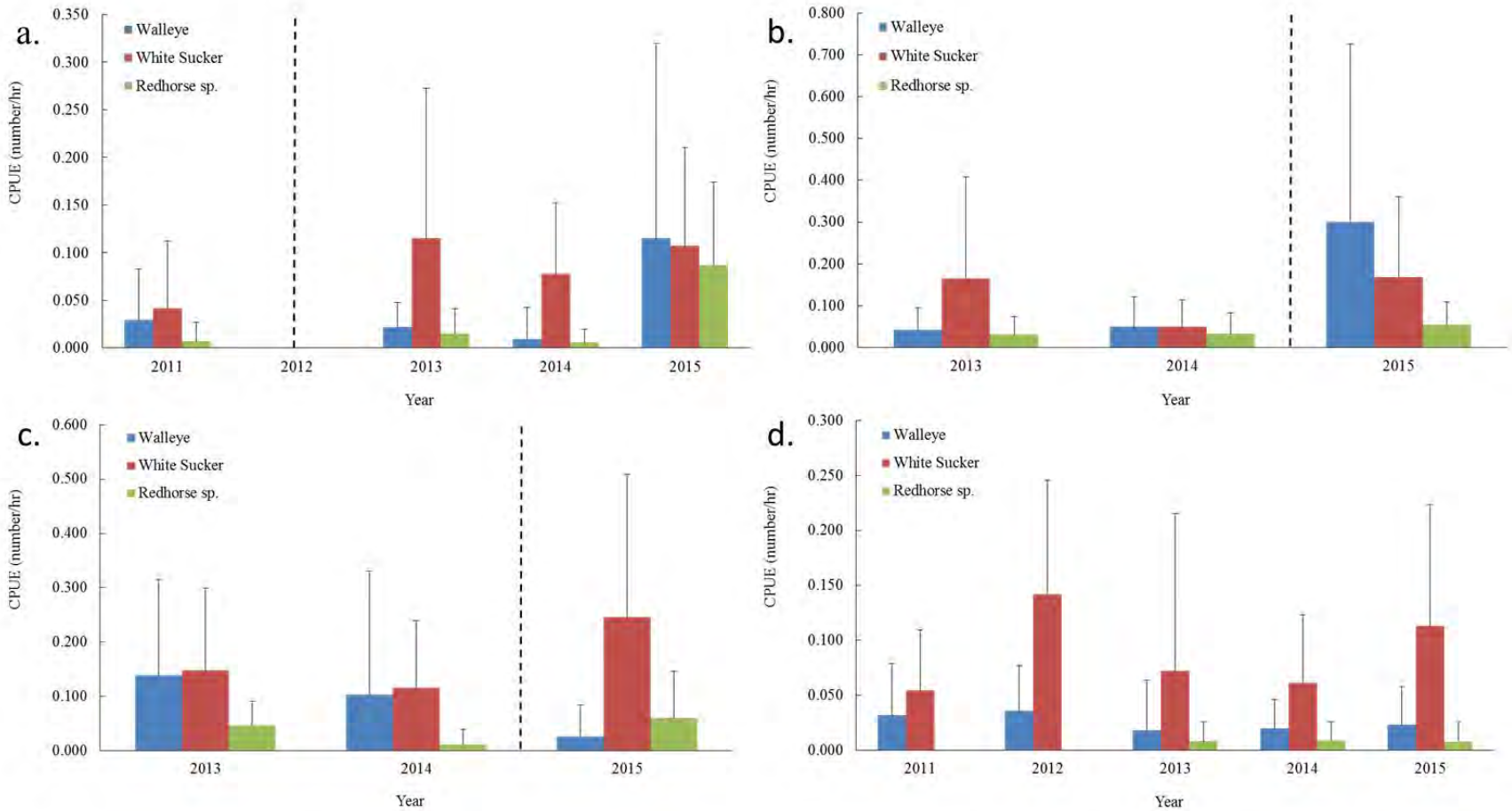

Figure 11. Walleye, white sucker, and redhorse (all redhorse species combined) spring gill net mean catch per unit effort (CPUE; ± SD) at the Middle Channel reef (a.), Algonac reef (b.), Hart's Light reef (c.), and North Channel control site (d.). Vertical dashed line separates pre and post reef construction periods. Spring 2012 CPUE values are not shown for the Middle Channel reef since sampling was only conducted for two weeks, just prior to reef construction. Mean CPUE values were standardized so only deep sets (start and end depth >5 m) and sets with water temperatures < 15°C were used in the analysis.

Figure 12. Gee minnow traps baited with cheese to capture small benthic fish.

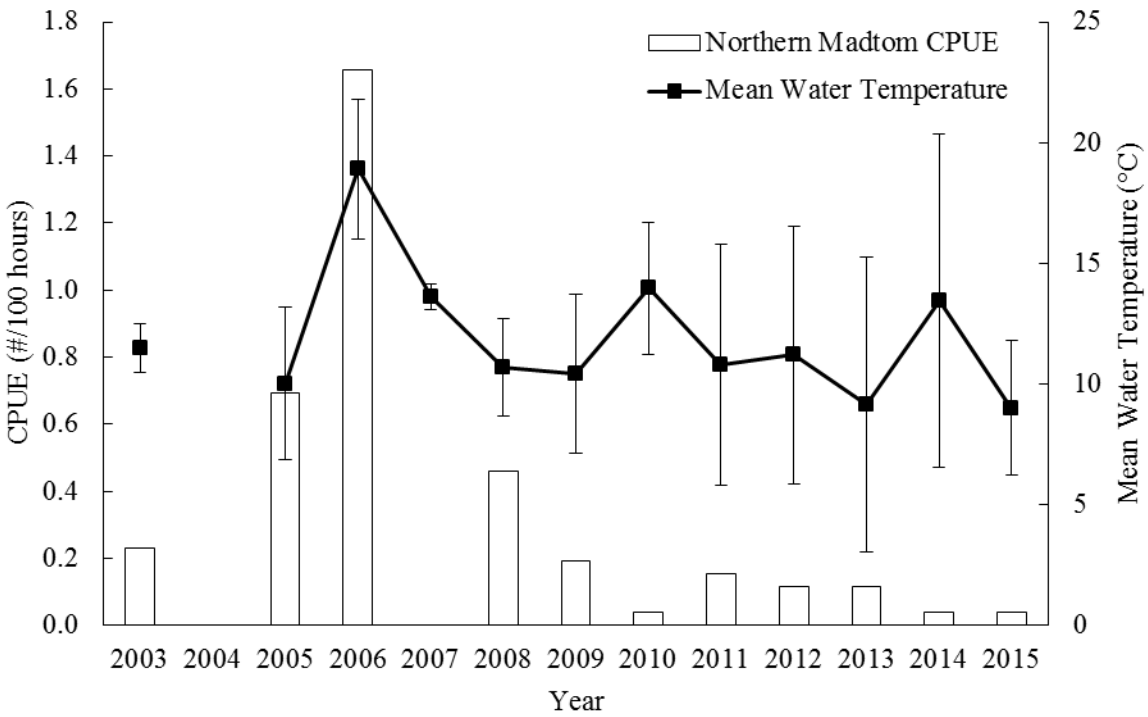

Figure 13. Northern madtom catch per unit effort (CPUE; number per 100 hours) in the Detroit River from 2003 to 2015 using gee minnow traps and mean water temperature during minnow trapping. Minnow traps were not fished in the Detroit River during 2004.

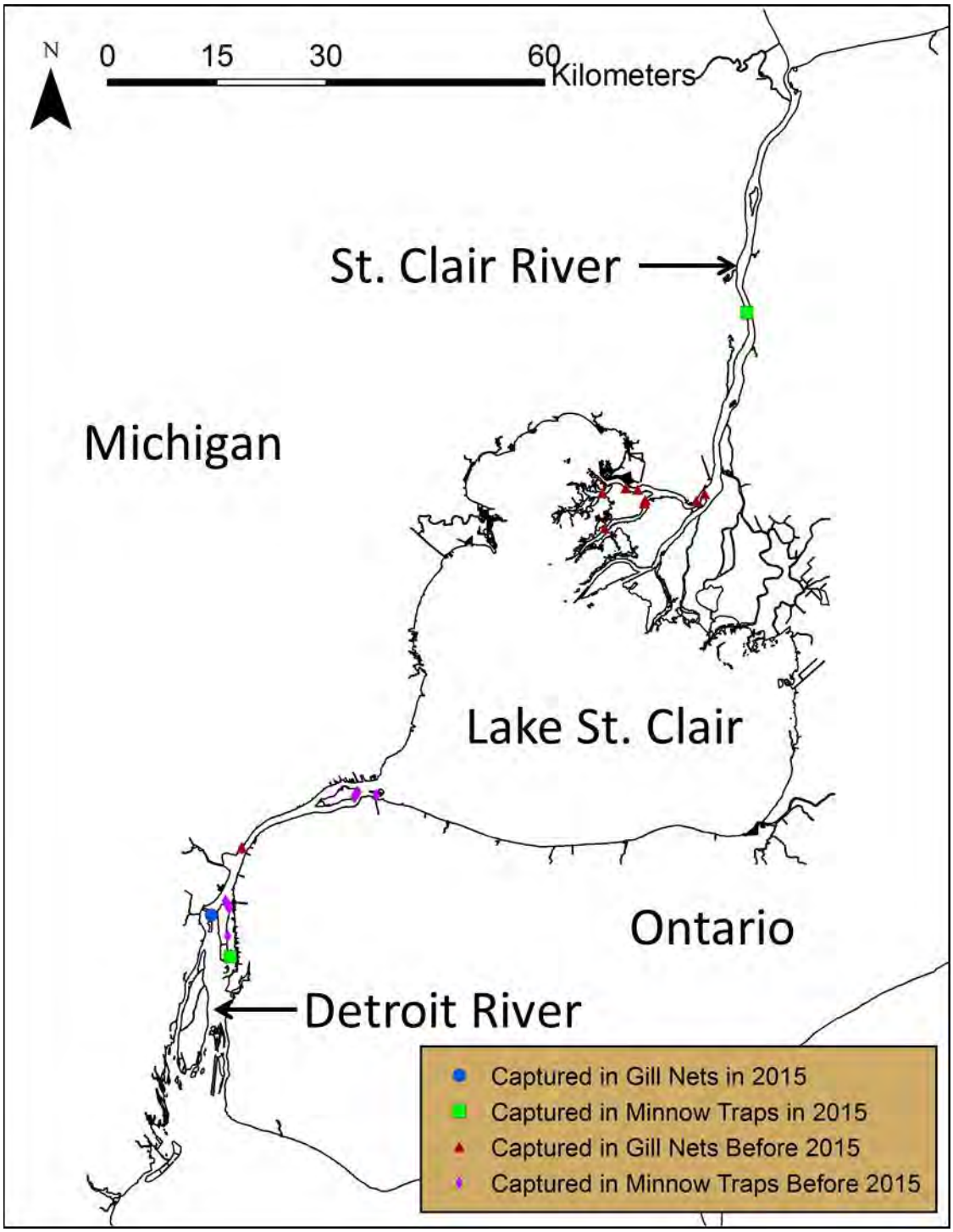

Figure 14. Locations of northern madtom captured in gill nets and minnow traps from 2003 to 2015 in the Detroit and St. Clair Rivers.

Figure 15. Map of Germania Pond, Saginaw, Michigan with locations of fyke nets (green), seine hauls (yellow), and minnow traps (blue line).

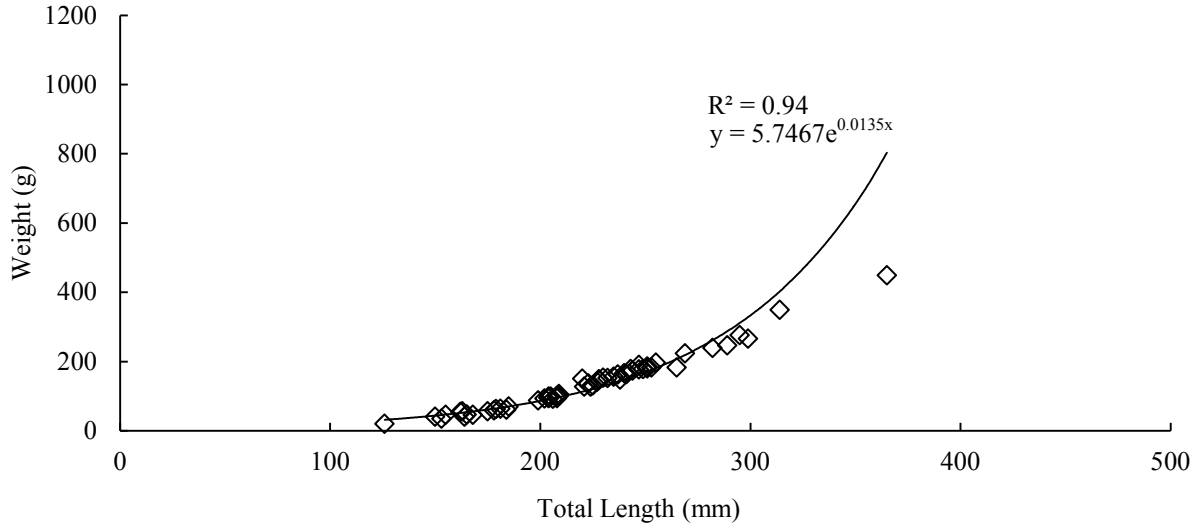

Figure 16. Length-weight relationship for white crappie captured in fyke nets (n=59).

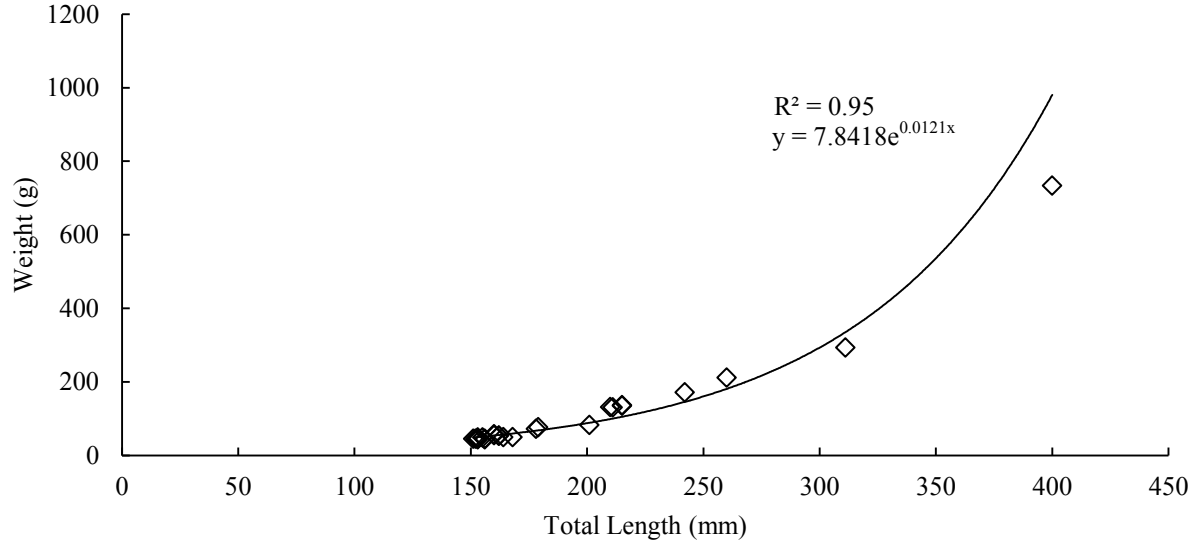

Figure 17. Length-weight relationship for black crappie captured in fyke nets (n=26).

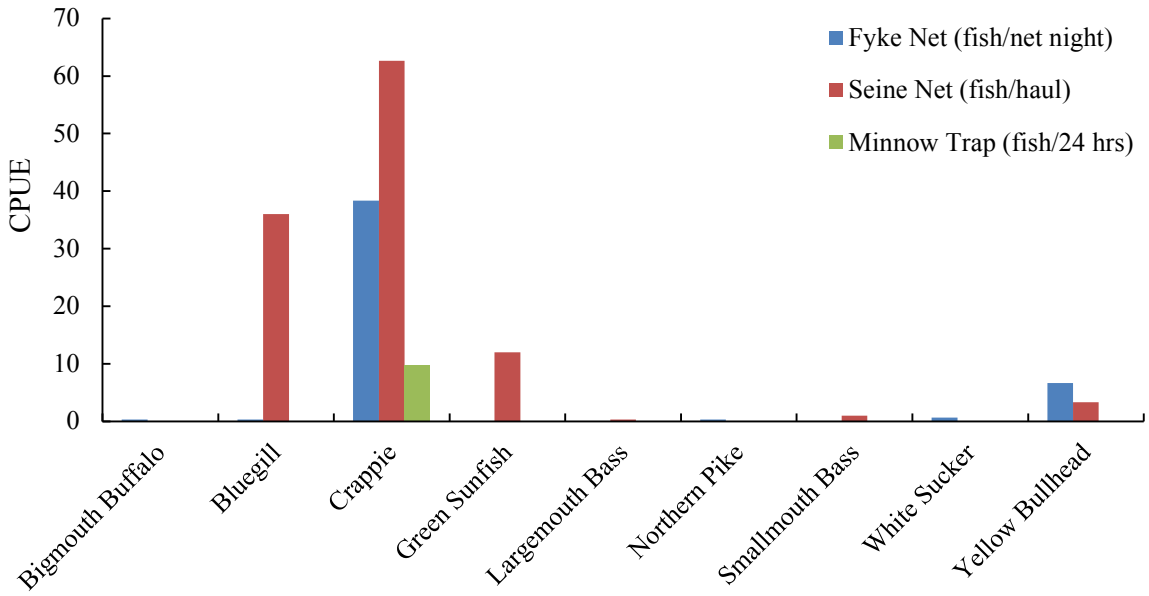

Figure 18. CPUE (catch per unit effort) for all fish species and all gear types captured in Germania Pond.

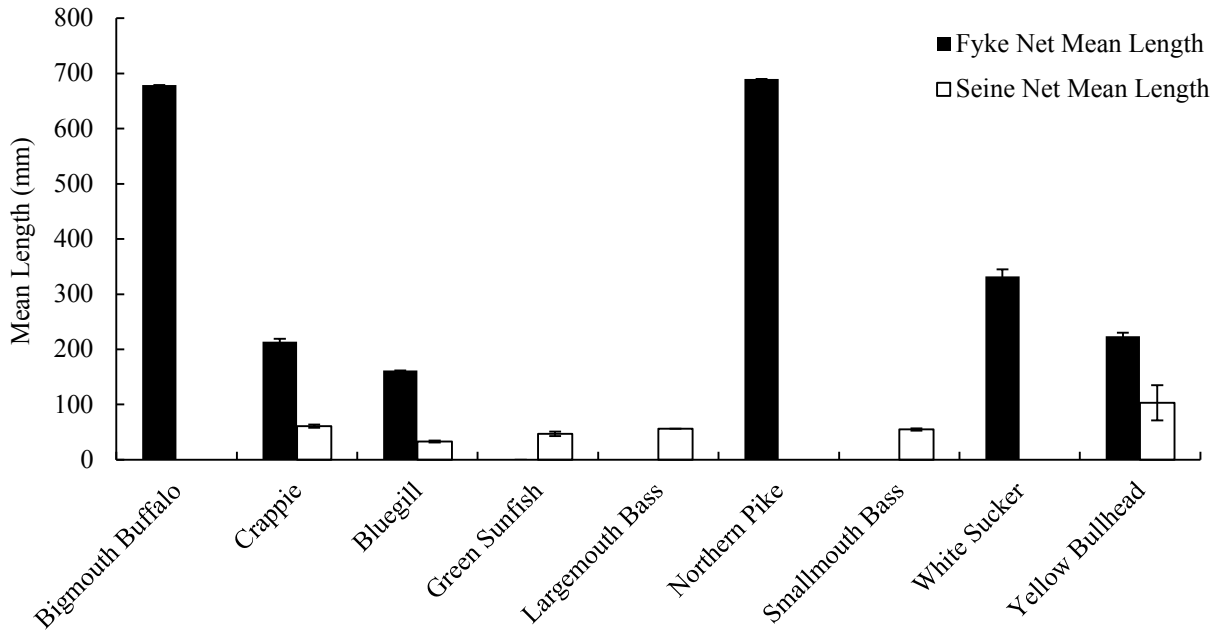

Figure 19. Comparison of fish species mean lengths captured in fyke and seine nets in Germania Pond.

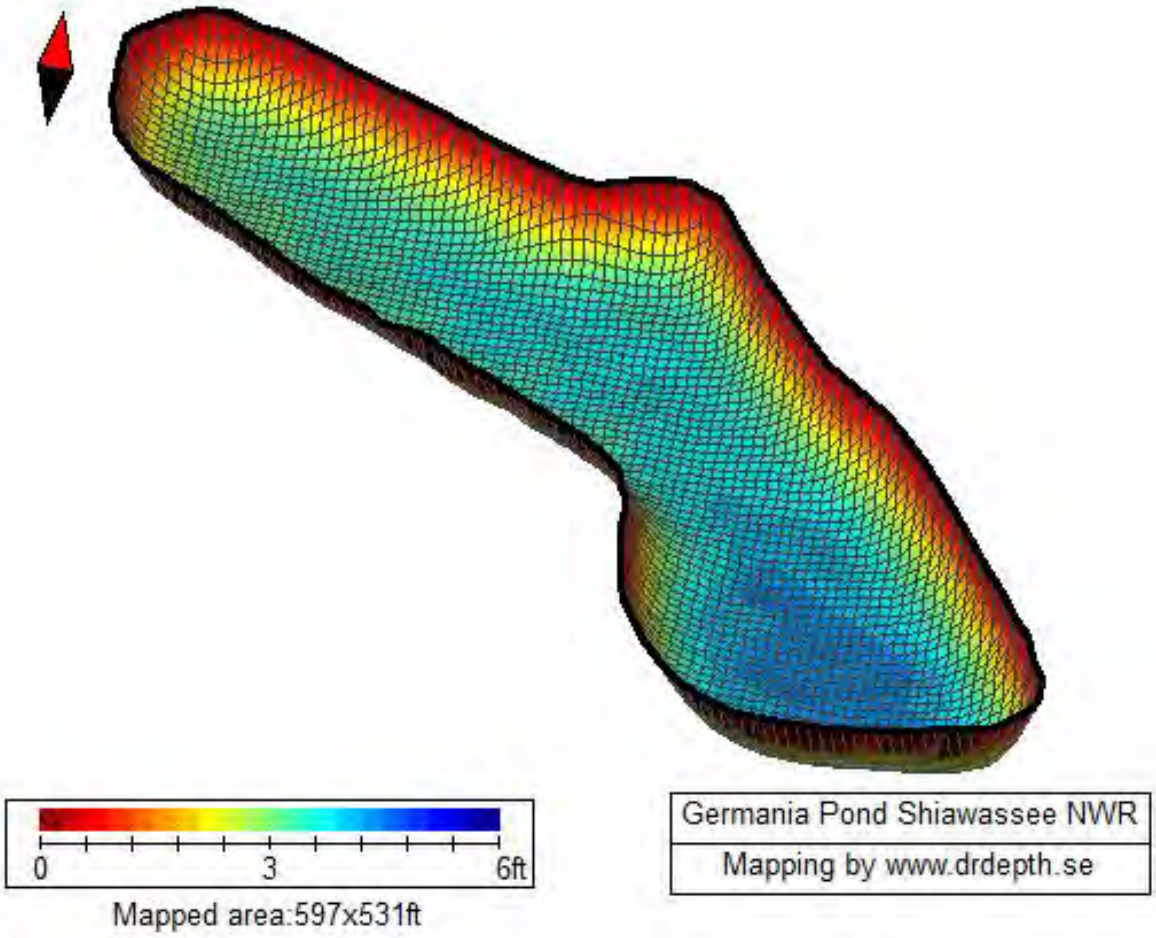

Figure 20. Bathymetric mapping of Germania Pond, Saginaw, Michigan.

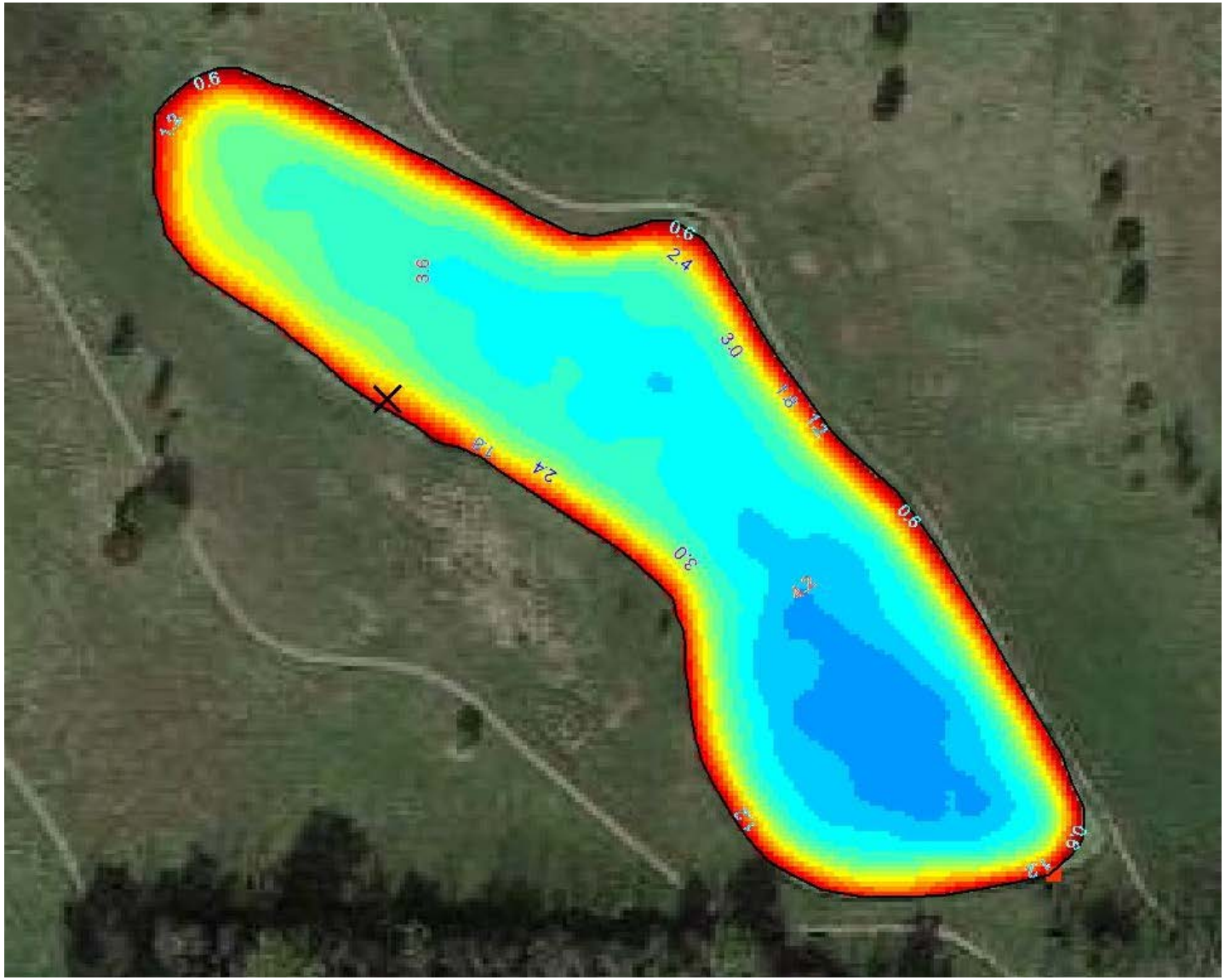

Figure 21. Bathymetric mapping of Germania Pond, Saginaw, Michigan.