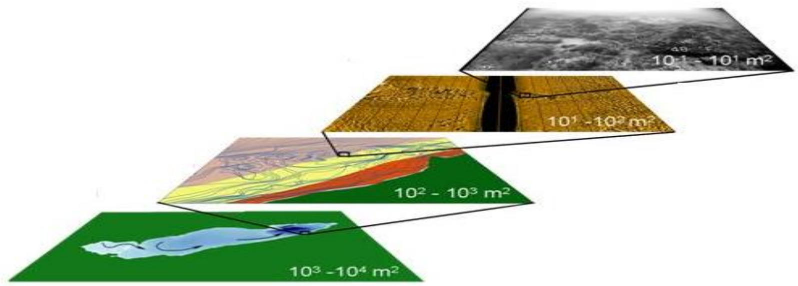
Report of the
Lake Erie Habitat Task Group
2015



Multiscalar habitat assessment of historical and potential lake trout spawning habitats in Lake Erie.

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Section 1. Charges to the Habitat Task Group 2014-2015

1. Document habitat improvement projects and research into fish use of habitat in Lake Erie. Identify and prioritize potential projects and research for future funding.

2. Assist member agencies with the use of technology (i.e., sidescan, GIS, remote sensing, etc.) to facilitate better understanding of habitat in Lake Erie, particularly in the Huron-Erie corridor, the nearshore, and other critical areas.
   a. Sidescan Workshop
   b. Continued support of LE GIS/GLAHF development and deployment
   c. Spawning habitat mapping
   d. Nearshore substrate mapping

3. Support other task groups by compiling metrics of habitat use by fish.

4. Develop a strategic research direction for the Environmental Objectives.

Section 2. Document Habitat Improvement Projects

E. Weimer, C. Castiglione

The first charge to the Habitat Task Group (HTG) involves the documentation of habitat projects occurring throughout the Lake Erie and Lake St. Clair basins, including their associated watersheds. Although originally designed as a simple spreadsheet table, by 2007 it had evolved into an online, spatial inventory which, it was believed, would be an effective way of disseminating project information.

The habitat listing, presented as a spatial inventory presented with a map interface can be found online at:
http://www.glfc.org/lakecom/lec/spatial_inventory/inventory_index.htm

In 2009, the LEC modified the charge to "Identify and prioritize relevant projects to take advantage of funding opportunities". Currently, we are re-evaluating the objectives of this charge and believe it is essential to provide a tool that promotes collaboration and prevents duplication of effort. We continue to address the initial charge by documenting current habitat improvement and research projects identified by task group members and need to expand the inventory beyond the task group member knowledge. The following tables identify the number of projects within each basin (Table 2-1), waterbody (Table 2-2), and watershed (Table 2-3).

Table 2-1. Summary of Habitat Projects by Basin.

Basin	# of Projects
Central basin	11
East-Central	7
East basin	15
Huron-Erie corridor	19
Lake Erie basin	11
West-central basin	3
West basin	11

Table 2-2. Summary of Habitat Projects by Waterbody.

Waterbody	# of Projects
Crooked Creek	1
Detroit River	4
East Branch of Conneaut Creek, PA	2
Elk Creek	2
Four Mile Creek, PA	1
Lake Erie	13
Lake St. Clair	2
Middle Harbor	1
NA	39
Niagara River	2
North Maumee Bay	1
Sandusky River and Bay	1
Spooner Creek	1
St. Clair River	1
St. Clair River, Lake St. Clair	1
St. Clair River, Lake St. Clair, Detroit River	3
Walnut Creek, PA	1
Western and Central Basin of Lake Erie	1

Table 2-3. Summary of Habitat Projects by Watershed.

Watershed	# of Projects
Ashtabula-Chagrin	1
Big Creek	1
Big Creek, Lower Grand	1
Black-Rocky	1
Buffalo-Eighteenmile	1
Cattaraugus	2
Cedar-Portage	1
Cedar Creek	1
Cedar Creek, Rondeau, Big Creek	1
Chautauqua	1
Chautauqua-Conneaut	8
Clinton	1
Cuyahoga	2
Detroit	1
Halfway Creek, Ottawa River	1
Huron	1
Lake Erie basin	9
Lake St. Clair, Clinton, Syndenham, Lower Thames, Cedar Creek	1
Lower Grand	3
Lower Thames	1
Maumee	3
Maumee to Cuyahoga	1
Maumee, Ashtabula-Chagrin	1
NA	16
Niagara	2
Raisin	1
Rondeau	3
Sandusky	2
Sandusky River	1
St. Clair, Lake St. Clair, Clinton	1
St. Clair, Upper Thames, Syndenham, Lower Thames, Lake St. Clair, Clinton, Detroit, Cedar Creek	1
Syndenham, Lower Thames, Cedar Creek, Upper Thames	1
Toussaint River	1
Upper Grand, Lower Grand	1
Upper Grand, Lower Grand, Big Creek, Niagara	1
Upper Thames, Lower Thames	2

Building on the development of the Environmental Objectives detailed in Section 5 (below), the second responsibility of this charge is focused on identifying potential projects and gaps in research/restoration for future funding opportunities. These recommendations would be developed from expert opinion within the task group and prioritized within the framework of the Environmental Objectives.

Regardless of the state of our method of relaying the information, habitat related projects continue throughout the basin and we present a summary of notable ones below.

2a. Fish Habitat Restoration and Monitoring in the St. Clair-Detroit River System

J. Fischer, E.F. Roseman, J. Craig, G. Kennedy, K. Keeler, S. Ireland, D. Mifsud, A. Briggs, and R. DeBruyne

Pre- and post-restoration biotic and physical habitat monitoring continues in the St. Clair-Detroit River System (SCDRS), to assess the biotic response to and maturation of artificial fish spawning reef restoration projects. Locations of artificial spawning reefs, larval fish sampling sites, and egg mat sample sites are shown in Figures 2a-1-3. Information gleaned from these assessments is being used to gauge and improve the effectiveness of artificial spawning reefs for providing spawning opportunities for native fishes, assess larval fish production at artificial spawning reefs and river wide, and adaptively develop reef restoration projects to ensure longevity of constructed spawning reefs.

Spawning Reef Construction

Artificial spawning reefs were constructed in the SCDRS to compensate for historic losses of critical fish spawning substrates. In the summer and fall of 2014 two reefs were constructed in the St. Clair River (SCR), the Pointe Aux Chenes (1.5 acres) and Hart’s Light (3.8 acres) reefs near Algonac and East China, MI, providing an additional 5.3 acres of gravel spawning substrate. Post construction monitoring of physical habitat and early life stages of fishes will begin spring 2015 at the new reefs and will continue at 3 existing reefs (Middle Channel in SCR; Belle Isle and Fighting Island in DR). Future reef restoration is focused on the Detroit River (DR), with site assessment underway at Belle Isle and Fort Wayne. Site assessment at a third location in the DR, Grassy Island, was completed in 2014 and this restoration project is currently in the permitting process.

Physical Habitat Assessment and Mapping

In the spring of 2014 the reef restoration team (USGS, USFWS, MI Sea Grant, MDNR, MI Wildlife Conservancy, Smith Group JJR) hosted a workshop with a panel of experts in fluvial geomorphology and sediment transport, to better understand sediment transport dynamics and how to avoid sedimentation of artificial spawning reefs. This workshop led to collaborations with hydrologists at U-M and USGS geomorphologists, which substantially improved the site selection and pre-assessment processes.

Water depths and velocities were measured with an acoustic Doppler current profiler (ADCP) to assess the availability of appropriate water depths (> 4.5 m), velocities (> 0.5 m/s), and identify zones of scour within candidate artificial fish spawning reef construction areas and assess flow patterns over existing artificial reefs in the SCDRS. Measurements were conducted at 3 existing artificial reef sites (Fighting Island, Belle Isle, and the Middle Channel Reefs) and 4 candidate reef sites (Grassy Island, East Belle Isle, Pointe Aux Chenes, and Harts Light). This information, in conjunction with side-scan sonar and underwater video documentation of substrate types, helped guide reef placement at the Pointe Aux Chenes, Hart's Light, and Grassy Island sites. Additionally, a manuscript validating a spatial model of water velocities with these ADCP measurements is currently in review at Journal of Great Lakes Research.

<u>2015 Plans</u>

Future plans include post-construction monitoring of the Pointe Aux Chenes, Harts Light, and Port Huron reefs and near shore structures associated with shoreline restoration projects in the SCR. Additionally, pre-assessments will be conducted at prospective reef sites within the DR. A collaborative project with researchers from the USGS Geomorphology and Sediment Transport Laboratory in Golden, Colorado, to model sediment transport within the Detroit River near reef sites is also scheduled for the spring of 2015.

Fish Egg Deposition in the SCDRS

Community composition, phenology, and spatial extent of egg deposition by lithophilic broadcast spawning fishes in the SCDRS continue to be assessed and measured. Intensive longitudinal studies of fish egg deposition using eggmats on natural habitat have been occurring in the DR since 2007 and in the SCR since 2010. Multiple habitat types were sampled in each river including main channels, channel fringes, shallow island margins, rivermouths, and open lake areas. In addition, spawning reefs were constructed in the DR at Belle Isle (2004) and Fighting Island (2008 and expanded in 2013) and in the SCR at Middle Channel (2012), Hart's Light (2014) and Pointe aux Chenes (2014). Studies of egg deposition occurred at the reefs sites, and at control sites upstream and downstream, during both pre- and post-construction years. Spring egg collection and rearing focused on walleye (*Sander vitreus*), suckers (Catostomidae), and lake sturgeon (*Acipenser fulvescens)* and fall collection and rearing has been specific to lake whitefish (*Coregonus clupeaformis*).

<u>Spring 2014</u>

This spring the full length of the DR was sampled. Eggmats were placed at reef and non-reef areas and the reef areas were for both pre- and post-assessment. Pre-assessment sites were at the heads of Belle Isle and Grassy Island; post-assessment sites were at Belle Isle (2004) and Fighting Island reefs. Non-reef sites included the head of Livingstone Channel, Hole-in-the-Wall, and Sugar Island. Walleye eggs were collected at all sites. The greatest densities of walleye eggs were collected at Hole-in-the-Wall and Grassy Island. Sucker eggs were collected in low densities throughout the river, with the exception of Fighting Island, where the average density nearly doubled that of walleye egg density. Lake sturgeon eggs were collected at Fighting Island. Overall egg density followed trends seen in previous years.

The sampling sites in the SCR followed the same pre/post-assessment and reef/non-reef design as in the DR. Pre-assessment sites were at Hart's Light and Pointe aux Chenes; post-assessment sites were at Middle Channel. Non-reef sites were located downstream of Port Huron, below St. Clair, and near Algonac. Walleye egg density was greatest at Point Aux Chenes and Hart's Light sites. These sites also had notable sucker egg densities, but the greatest sucker egg density was collected at a non-reef site just upstream of the Hart's Light site. Lake sturgeon eggs were collected from, Port Huron, Mazlinka's, and Hart's Light during 2014.

Fall 2014
Fall sampling for fish eggs in the SCDRS was at the same sites as in spring, except at Hart's Light reef area due to reef construction. All eggs collected were lake whitefish, most sites in the DR collected eggs and the greatest densities were at Grassy Island. In the SCR only one lake whitefish egg was collected from a site just upstream of Hart's Light.

2015 Plans
Future plans for studying egg deposition as a measure of spawning habitat quality include pre-restoration assessment at prospective reef sites (head of Belle Isle and Grassy Island), post-assessment of constructed artificial spawning reefs (Fighting Island, 2004 Belle Isle reefs, Hart's Light, Pointe Aux Chenes, and Middle Channel reefs), and continued sampling at index stations throughout the river. Assessment of spatial and temporal trends in egg deposition are underway and will continue be evaluated through 2015.

Larval Fish Studies
Community composition, phenology, species abundances, spatial extent, movement, and production of larval fishes in and transported through the system continue to be assessed and measured. During 2014, 680 bongo net samples were collected from the DR and 920 from the SCR. To sample lake sturgeon larval drift, 227 D-frame sets and 360 depth-stratified conical sets were fished in the SCR in the vicinity of Middle Channel reef and 33 D-frame and 12 depth stratified conical sets fished in the DR at Fighting Island.

While many of the same species were found in both systems, the DR had about an order of magnitude more larval fish than the SCR and the phenology of life history events was delayed in the SCR compared to the DR, likely due to slower water warming rates in the SCR. In the DR, we found lake whitefish, walleye, yellow perch (*Perca flavescens*), Morone spp. (white bass/white perch), suckers, lake sturgeon, and several native forage fish species to be relatively abundant in the middle and lower river as well as at sites in Lake Erie near the river mouth. In the SCR, walleye, yellow perch, and suckers were found in lower abundances than in the DR. Transient coldwater fishes such as deepwater sculpin (*Myoxocephalus thompsoni*), rainbow smelt (*Osmerus* *mordax*), cisco (*Coregonus artedi*), and lake whitefish were found in both rivers in low abundances. Invasive species were found in both rivers and included rainbow smelt, round gobies (*Neogobius melanostomus*), tubenose gobies (*Proterorhinus marmoratus*), white perch (*Morone americana*), and common carp. Lake sturgeon were collected in the DR immediately below the Fighting Island reef and in the North and Middle Channels of the SCR. Collections of larval and juvenile native lampreys occurred in the North Channel of the SCR concurrent with collections of lake sturgeon.

2015-16 Plans

Sampling will continue in both rivers with an emphasis on pre- and post-construction assessments of constructed habitats such as Middle Channel reef, Hart's Light, Pointe Aux Chenes in the SCR and at Fort Wayne reef, Belle Isle, (reefs, connectivity and wetland restoration), Grassy Island in the DR, and assist with planning new restoration projects. In the lower DR and river mouth area, intensive collections will occur to satisfy data needs for collaborative bio-physical modeling efforts, genetics, and micro-elemental stock analyses. Sampling for larval lake sturgeon is scheduled to occur in the SCR at the Hart's Light and Pointe Aux Chenes reefs.

Zooplankton Surveys and Fish Diet Analysis

Zooplankton samples were collected bi-weekly from April through December. Thirteen sites in the throughout the SCDRS, SCR (4 sites), DR (3 sites), Lake St. Clair (3 sites), Lake Huron (1 site) and western Lake Erie (2 sites), were sampled to quantify zooplankton community dynamics in terms of species composition, abundance, and biomass. Species composition was fairly dichotomous between each river with Calanoid species dominating SCR samples and both Cyclopoid and Cladoceran species making up the majority of DR samples. Diet analyses of several species were completed from within SCDRS as well as outside in neighboring systems. Deepwater sculpin from the 2014 USGS fall bottom survey in Lake Huron were analyzed, ultimately finding both Mysis and Diporeia, as major prey items. Late summer near shore seining of the SCDRS yielded numerous species to be utilized for diet analysis. Yellow perch and tubenose gobies diets were analyzed yielding a variety of prey items (dragonfly larvae, mayfly larvae, and ostracods) found in both species. Collaboration continues with several higher learning institutions on various diet studies. Working with Michigan State University and graduate student Darrin McCullough, diets of larval burbot (*Lota lota*) from the SCR were analyzed. At the University of Toledo-Lake Erie Center, young of year walleye diets from western Lake Erie were analyzed while working with students from Dr. Chris Mayer's laboratory.

Use of Fisheries Gear for Collecting Multiple Life Stages of Mudpuppies in the SCDRS

Mudpuppy (*Necturus maculosus maculosus*) populations have been declining in the Great Lakes region. However, during fisheries assessments in the SCDRS, mudpuppy reproduction was documented when and all life stages from egg through adult were collected as by-catch in fisheries assessments. Eleven years of fisheries sampling resulted in three occurrences of mudpuppy egg collection and over 600 mudpuppies ranging in size from 37-392 mm, collected from water 3.5-15.1 m deep. Different types of fisheries gear collected specific life stages; cement structures were used by spawning females for egg deposition, larval mudpuppies were collected in eggmats (which were potentially used as refugia), and adults were caught with baited setlines and minnow traps, and in fyke nets set at the water surface. In addition to documenting the presence of all life stages of this sensitive species in the SCDRS, we were also able to show that standard fisheries research equipment can be used for mudpuppy research in areas not typically sampled in herpetological studies.

Relevant Publications from the SCDRS

DeBruyne, R.L. and E.F. Roseman. 2015. The Renaissance of Ecosystem Integrity in North American Large Rivers: Synthesis of the Special Section. Restoration Ecology. Accepted 8 Feb 2015.

Roseman, E.F., and R.L. DeBruyne. 2014. The Renaissance of Ecosystem Integrity in North American Large Rivers. Restoration Ecology 43:43-45.

McCullough, D., E.F. Roseman, K.M. Keeler, R.L. DeBruyne, J.J. Pritt, P.A. Thompson, S. Ireland, J. Ross, D. Bowser, R.D. Hunter, D. Castle, J. Fischer, and S. Provo. In press. Abundance, Distribution, and Diet of Transient Larval Burbot in the St. Clair-Detroit Rivers System. Invited to special issue on Burbot Biology and Management, Hydrobiologia. DOI: 10.1007/s10750-015-2179-3.

Pritt, J., E.F. Roseman, J.E. Ross, and R.L. DeBruyne. In press. Using larval fish community structure to guide long-term monitoring of fish spawning activity. North American Journal of Fisheries Management (UJFM-2014-0164). Revisions returned 25 November 2014.

Marranca, J.M., A. Welsh, and E.F. Roseman. In press. Genetic effects of habitat restoration in the Laurentian Great Lakes: an assessment of lake sturgeon origin and genetic diversity. Restoration Ecology.

McLean, M.W., E.F. Roseman, J. Pritt, B.A. Manny, G. Kennedy. 2014. Overview of artificial reefs in the Laurentian Great Lakes. Journal of Great Lakes Research doi:10.1016/j.jglr.2014.11.021.

Manny, B.A., E.F. Roseman, G. Kennedy, J.C. Boase, J.M. Craig, D.H. Bennion, J. Read, L. Vacarro, J. Chiotti, and R. Drouin. In press. A scientific basis for restoring fish spawning habitat in the St. Clair and Detroit rivers of the Laurentian Great Lakes. Restoration Ecology. Accepted October 10, 2014.

Bouckaert, E.K., N.A. Auer, E.F. Roseman, and J. Boase. 2014. Verifying success of artificial reefs in the Huron-Erie Corridor for lake sturgeon. Journal of Applied Ichthyology 30(6): 1393-1401.

Sutherland, J., Manny, B.A., Kennedy, G.W., Roseman, E.F., Allen, J.D., and Black, M.G. 2014. A portable freshwater closed-system fish egg incubation system. Submitted to North American Journal of Aquaculture. 76(4): 391-398.

Pritt, J.J., M.R. DuFour, C.M. Mayer, E.F. Roseman, and R.L. DeBruyne. 2014. Sampling little fish in big rivers: larval fish detection probabilities in two Lake Erie tributaries. Transactions of the American Fisheries Society 143(4): 1011-1027.

Pritt, J., E.F. Roseman, and T.P. O'Brien. 2014. Mechanisms Driving Recruitment Variability: Comparisons between Great Lakes and Marine Systems. ICES Journal of Marine Science, doi: 10.1093/icesjms/fsu080.

Roseman, E.F., P.A. Thompson, J.M. Farrell, N.E. Mandrak, and C.A. Stepien. 2014. Conservation and Management of Fisheries and Aquatic Communities in Great Lakes Connecting Channels. Journal of Great Lakes Research 40 (Suppl 2): 1-6.

Hondorp, D.W., E.F. Roseman, B.A. Manny, P.W. Seelbach, K.R. Newman, and R.M. Strach. 2014. An ecological basis for fish habitat restoration in the Huron-Erie Corridor. Journal of Great Lakes Research 40 (Suppl 2): 23-30.

Francis, J., J.A. Chiotti, J. Boase, M. Thomas, B. Manny, and E.F. Roseman. 2014. An Assessment of the Nearshore Fish Communities in the St. Clair-Detroit River System. Journal of Great Lakes Research 40 (Suppl 2): 52-61.

McDonald, E., S. McNaught, and E.F. Roseman. 2014. Use of main channel and two wetland habitats by larval fishes in the Detroit River. Journal of Great Lakes Research 40 (Suppl 2):69-80.

Roseman, E.F. 2014. Diet and habitat use by age-0 deepwater sculpins in northern Lake Huron, Michigan and the Detroit River. Journal of Great Lakes Research 40 (Suppl 2): 110-117.

Figure 2a-1. Artificial fish spawning reef and shoreline restoration sites in the St. Clair-Detroit River System.

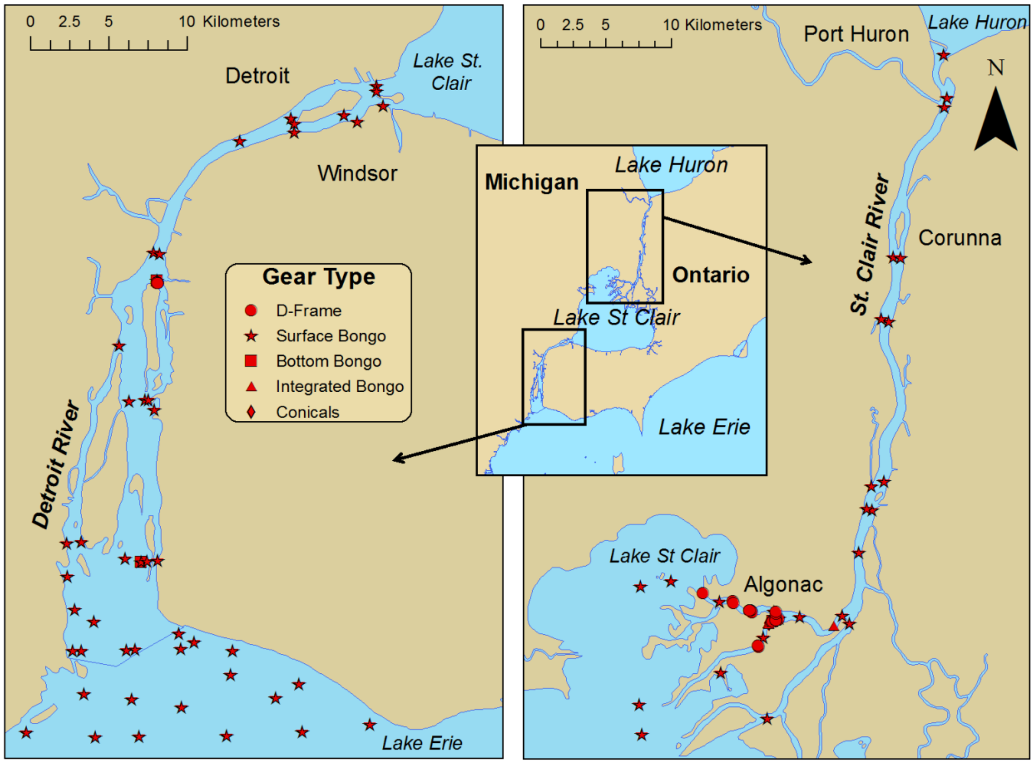

Figure 2a-2. Larval fish sampling locations and gear type used in the St. Clair-Detroit River System. Conical and D-frame nets were both used in close proximity to sample larval lake sturgeon near artificial fish spawning reefs and sites overlap at the scale depicted.

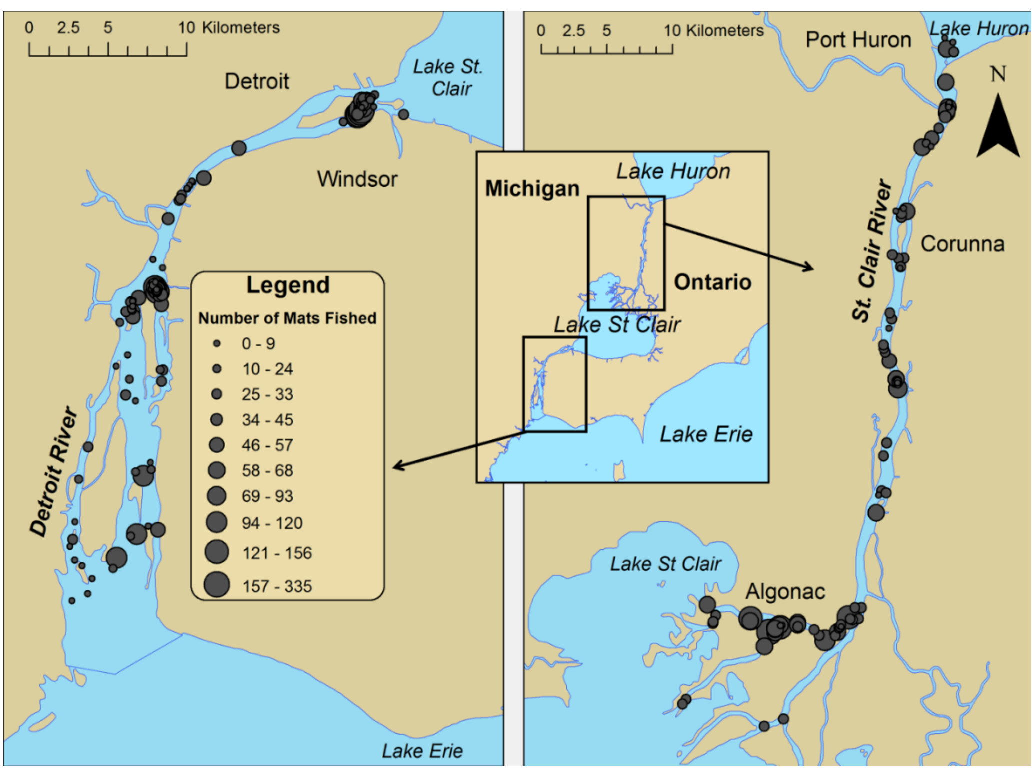

Figure 2a-3. Eggmat sampling locations and cumulative effort (number of mats fished at a site) since 2005 in the St. Clair-Detroit River System.

Adult Fish Community Assessments Associated with the Reef Projects in the St. Clair-Detroit River System

J. Boase, J. Chiotti

The U.S. Fish and Wildlife Service (Service) has been deploying gill nets to monitor the adult fish community before and after the construction of reefs within the St. Clair-Detroit River System since 2005. Experimental gill nets are fished once per week in the spring and early summer (April - June) and fall (October - December) at several locations in the St. Clair and Detroit Rivers. Gill nets consist 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). Nets dimensions are 2 m tall x 7.6 m panels x 14 panels (with randomly placed mesh sizes) for a total length of 106 m. Common biological metrics are collected from each fish species along with genetic samples and aging structures from select sport fish. In 2014, two galvanized minnow traps with 30 mm openings were attached to each gill net to monitor the small benthic fish community throughout the river.

<u>2014 Detroit River Results:</u> In the spring of 2014, gill nets were deployed between April 16th – May 14th at Fort Wayne and the future site of the NE Grassy Island Reef. Water temperature ranged from 6.8 – 12.7°C. In total, six nets were deployed and 168 fish were captured consisting of seven different fish species. CPUE reported as number/hour: rock bass = 0.03, smallmouth bass = 0.02, smallmouth buffalo = 0.01, walleye = 1.19, white bass = 0.15, white perch = 0.01, white sucker = 0.04.

In the fall of 2014, gill nets were deployed on November 4th. Water ranged between 7.8 – 9.7°C at the eight sites sampled. Nets were deployed at Fort Wayne, Fighting Island Reef, future East Belle Isle Reef, Belle Isle Reef, future NE Grassy Island Reef, and three random locations in the river. In total, eight nets were deployed and 14 fish were captured consisting of five different fish species. CPUE reported as number/hour: channel catfish = 0.01, muskellunge = 0.01, shorthead redhorse = 0.02, smallmouth bass = 0.03, walleye 0.02.

CPUE for all species at each reef site, dates sampled, total number of fish captured, and water temperatures for all years sampled can be seen in the Appendix.

<u>2014 St. Clair River Results:</u> In the spring of 2014, gill nets were deployed between April 22nd – June 3rd at the Middle Channel Reef, PAC Reef, North Channel Control, and Hart's Light Reef sites. Water temperature during this time period ranged from 4.0 – 13.3°C. In total, 54 nets were set and 188 fish were captured consisting of nineteen different species. CPUE reported as number/hour: black redhorse < 0.01 , common carp < 0.01 , emerald shiner < 0.01 , golden redhorse < 0.01 , lake sturgeon < 0.01 , northern hogsucker < 0.01 , northern madtom < 0.01 , northern pike < 0.01 , rainbow trout < 0.01 , rock bass < 0.01 , shorthead redhorse = 0.01 , silver redhorse = 0.01, smallmouth bass <

0.01 , stonecat < 0.01 , walleye = 0.04, white bass < 0.01, white crappie < 0.01 , white perch < 0.01 , and white sucker = 0.07.

In the fall of 2014, gill nets were deployed at Middle Channel Reef, PAC Reef, North Channel Control, and random locations in the river on November 14th and November 26th. Water temperature ranged between 5.3 – 8.4°C. In total, fifteen nets were set and 22 fish were captured consisting of eight different fish species. CPUE reported as number/hour: northern hogsucker < 0.01, northern pike = 0.01, rock bass = 0.01, shorthead redhorse = 0.02, silver redhorse = 0.01, smallmouth bass < 0.01, walleye = 0.01, white sucker = 0.01.

CPUE for all species at each reef site, dates sampled, total number of fish captured, and water temperatures for all years sampled can be seen in the Appendix.

<u>Pre/Post Reef Gill Net Comparisons:</u> Comparisons pre and post reef construction can only be made at the Middle Channel Reef site. Prior to reef construction, 20 fish species were documented at the reef construction site. Since construction two additional fish species have been detected at this site, channel catfish and logperch. Target species, walleye, white sucker, and redhorse sucker (golden redhorse, shorthead redhorse, and silver redhorse) CPUE has remained similar to the pre-construction time period (Figure 2a-4). CPUE values comparing other fish species pre and post-construction remained fairly stable.

<u>2015 Field Work:</u> The Service plans to continue deploying gill nets in the St. Clair and Detroit Rivers in the spring and fall of 2015. Minnow traps will be attached to all gill nets.

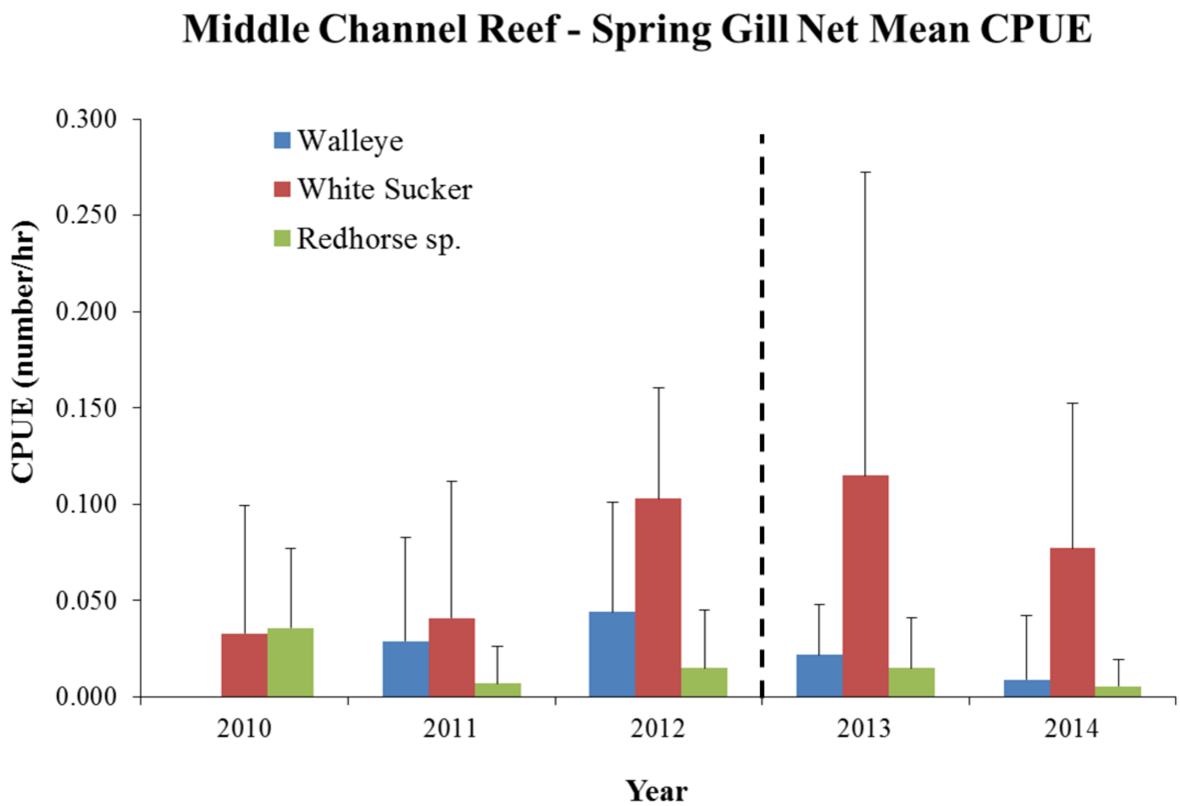

Figure 2a-4. Walleye, white sucker, and redhorse sucker spring gill net CPUE at the Middle Channel Reef site. Vertical dashed line represents pre and post reef construction periods. Data was standardized (4.1 – 14.8 C) to include water temperature ranges sampled during all years.

2b. Habitat in the Maumee River

C. Mayer, B. Schmidt, J. Sherman, J. Bossenbroek

Assessing Walleye spawning habitat in the Maumee River

Habitat loss and degradation are the largest contributors to species decline and extinction. The Maumee River has undergone a long history of anthropogenic degradation, yet still provides critical spawning and nursery habitat for many potadromous fish including one of four major substocks of walleye in Lake Erie. The goal of our project is to determine if spawning habitat availability and quality could limit production of Maumee River walleye by assessing egg deposition and mapping of spawning substrates using side scan sonar.

Objectives:

1. Identify and quantify the extent of walleye spawning habitat through the use of site-occupancy modeling and biotic habitat mapping of physical habitat features including substrate, depth, and flow rates

2. Determine if habitat is limiting walleye production in the Maumee River

    a. Compare to possible historical habitat

b. Determine if longitudinal range restricted
c. Compare number of spawning adult females to available space

We sampled eggs with a benthic pump from April 1st- May 7th 2014 at ten sites longitudinally distributed in the Maumee River to assess spatial and temporal trends in relative egg abundances. Sites for the initial 2014 sampling season were selected primarily on proximity to public access points. Further we prioritized sites expected to have favorable walleye spawning substrate (gravel/cobble) and depth based on data from ARCGIS substrate maps provided by the U.S. Fish and Wildlife Service (Boase 2008). Focusing on sites with preferred spawning habitat allowed us to assess the longitudinal extent of the spawning locations.

In the summer and fall of 2014, we began mapping substrate using sidescan sonar imaging (Humminbird 998C). Thus far we have data from the section of river between Interstate 80/90 (~25 river km), and the Independence and Grand Rapids dams (31 river km). Currently, we are processing data using 'SonarWiz', software to delineate substrate classes. The end goal is to quantify the amount of preferred walleye spawning substrate available in the lower reach of the Maumee River in ArcGIS to determine if spawning habitat may be a limiting factor of walleye production from the Maumee River.

Peak walleye spawning occurred between April 10th and April 24th in the Maumee River. Egg abundance was higher in the five downstream spawning sites, indicating a longitudinal restriction where fish have difficulty passing. Downstream egg counts per two minute sample = 164.3 ± 203.2 SD whereas the upstream = 3.3 ± 6.4 SD. Eggs were most abundant after temperatures rose above 8°C and discharge began dropping after large flow events.

Future Goals:

1. Continue to assess the longitudinal distribution and relative abundance of egg deposition in 2015 with increased sampling effort
2. Use Side Scan Sonar (SSS) to map the upper 31 km of river to quantify the amount of suitable spawning habitat available compared to currently-utilized spawning habitat.

Constructing a Habitat Suitability Model to Support a Lake Sturgeon (Acipenser fulvescens) Restoration Plan in the Maumee River

Lake Sturgeon were once common throughout the Great Lakes basin but currently are threatened; their population has been reduced by over-exploitation and habitat degradation and destruction. Lake sturgeon numbers are estimated at approximately 1% of their historical abundance. While they were once abundant in the Maumee River, a seventh-order stream that empties into the Western Basin of Lake Erie, published accounts suggest lake sturgeon may have been absent from the system as early as 1885 with no documentation of spawning in the last century.

Restoration efforts have been initiated throughout the Great Lakes basin to improve habitat conditions and rebuild lake sturgeon populations. An initial step in this process is to determine the quality and quantity of lake sturgeon habitat in target systems. Habitat suitability models are valuable tools to assist ecological and species rehabilitation. The goal of this project is to develop a lake sturgeon restoration plan for the Maumee River using spatially explicit habitat suitability models to delineate optimal habitat for multiple (e.g., adult & juvenile) lake sturgeon life stages.

We will model the Maumee River from the mouth of the river at Lake Erie to the first geographic constraint: the Grand Rapids and Providence dams approximately 56-rkm upstream. Substrate composition, measured with side-scan sonar, velocity, water depth, and water quality will be used to characterize spatial cells as high and low suitability for lake sturgeon. Areas that are less suitable will be assessed for their potential to become optimal habitat through restoration efforts. We began conducting side-scan sonar surveys during the summer and fall of 2014 and plan to complete this task along with measuring other water quality variables by the fall of 2015. This model will aid the development of a restoration plan for potential reintroduction of the species into the Maumee River. While lake sturgeon will be the target species for this model, the outcomes will have implications for monitoring other lithophilic spawning fish. Further research will be conducted to determine if the model can be successfully applied to other riverine systems in the Great Lakes basin.

2c. Other Notable Habitat Projects in Brief

- *Coastal Wetland Re-connection Projects, OH:* Multiple projects along Ohio's shoreline of Lake Erie have focused on reestablishing connectivity between wetlands and the Lake proper.
    - Work began in late-2011 to reestablish connectivity between Middle Harbor and Lake Erie to foster aquatic macrophyte recovery and allow natural water exchange and fish passage. In 2014, this coastal wetland was partially dewatered to expose sediments for vegetation growth. Japanese millet was seeded to reduce the colonization of exotic plants and to provide food for waterfowl; however, native vegetation colonized the area instead. Dewatering and seeding will continue in future years. Once plant community goals have been achieved, restoration will focus on water level management and fish community restoration. Post-reconnection fish, invertebrate, and plant community monitoring will follow. (Ducks Unlimited, The Nature Conservancy, ODNR).

- Preparation for restoring nearly 600 acres of coastal marsh at Howard Farms Metropark, Toledo, continued in 2014. This includes designing a water transfer/fish passage structure on Ward's Canal. (Toledo Metroparks, D.U., T.N.C., ODNR, etc.)
- Research is being planned for 2015 to evaluate whether fish use various structures constructed for the intent of allowing seasonal passage between coastal wetlands and Lake Erie and tributaries. Wetlands selected for evaluation include Toussaint Marsh, The Blausey Unit, Great Egret Marsh, and Winous Point. (Ohio SeaGrant, T.N.C., ODNR).

- *Frog Island Habitat Project, Niagara River (Timothy DePriest):* Frog Island habitat improvement project (HIP), designed to improve wetland and aquatic habitat in the Niagara River, reached a significant milestone with the completion of the construction phase of the project (Figure 2c-1). A large U-shaped rock berm has been created to enclose about two acres of river bed and protect the area inside from wave and ice forces so that plant communities can flourish in the protected area. Inside the berm, the river bed was transformed from a shallow, uniform depth to an undulating topography with a range of depths to encourage a diverse plant community to become established and provide the essential habitat requirements for Niagara's abundant fish and wildlife populations. This HIP is collaboration between the NY Power Authority and NYS DEC resulting from the 2007 re-licensing of the Niagara Power Project. Completion of the HIP will involve planting of the wetland and aquatic plant species next spring.

- *Buffalo River Aquatic Habitat Work:* As part of the Buffalo River Restoration project that involved the extensive remedial dredging of contaminated legacy sediments, aquatic habitat impacted by project operations was restored at five different locations. Dredging impacted submerged aquatic vegetation and some emergent wetland habitat, so the first priority involved restoring these important features of the aquatic habitat. Clean sediment consisting of sandy gravel was placed in the areas that were dredged so that these areas can support the re-growth of the vegetation that will be planted in the spring of 2015. In addition, habitat was enhanced by the installation of underwater structures such as rock vanes, anchored logs, gravel spawning beds and unique structures called a "porcupine cribs", which provide cover for juvenile fish.

Figure 2c-1. Aerial View of Frog Island near completion. Photo: Paul Leuchner

- *Status of Chautauqua Creek Fish Passage Project (New York):* A long awaited fish passage project on Chautauqua Creek (Chautauqua County, New York) was completed by the Army Corp of Engineers (ACOE) during July, 2012. This project was initially started in 2006 through the Great Lake Fisheries and Ecosystem Restoration (GLFER) program and was a collaboration between the ACOE, the NYSDEC (non-federal sponsor), and the Village of Westfield. The goal of the project was to provide fish access to approximately 10 miles of high quality spawning areas in the upper portion of Chautauqua Creek. The design involved two separate dams and included creating a notch in the lowermost dam and a rock ramp at the uppermost dam to promote fish passage of all species. Measures were also added to prevent the upstream migration of invasive Sea Lamprey.

  Unfortunately the project didn't have a long wait to find out if the fish passage design would hold up to a serious flooding event. A combination cold front and the remnants of Superstorm Sandy dumped approximately seven inches of rain over a 24 hour period, and ten inches over a week, in Western New York during late October 2012, causing a major flooding event on all the streams including Chautauqua Creek. The most extensive damage at the fish passage project was to the rock ramp at the uppermost dam where a major portion of the rocks were displaced (Figure 2c-2). Some of the rocks measuring feet in diameter were actually moved several hundred feet downstream below the lowermost dam, an indication of the severity of the flooding event, while others traveled over three miles to the mouth of the stream in Lake Erie. While there was not any physical damage to the notch at the lowermost dam, there were several trees and a large boulder that were stuck in the notch which hindered any upstream fish passage (Figure 2c-3).

In Spring 2013, the ACOE, the NYSDEC, and the Village of Westfield reviewed the status of the project and discussed the possibility of restoring the project back to its original state, and if possible incorporate modifications for withstanding future flooding events. The preferred improvements included repositioning of the stones in the rock ramp and pinning them in place, and adding additional rocks below the lower dam to raise the pool height to promote better passage of non-jumping species.

In 2014, the Chautauqua County Soil and Water District applied for and received funding through the Great Lake Basin Fish Habitat Partnership to repair the upper dam and raise the pool height at the lower dam in order to restore functionality back to the project. In addition, another fish passage impediment downstream will be improved through raising the pool height to allow access to additional prime spawning habitat for non-jumping lake run species such as smallmouth bass and white suckers. Several other agencies are providing funds and services for this project including NYSDEC, Village of Westfield, USFWS, and local TU chapters. This project is scheduled for construction during summer 2015.

Figure 2c-2.   Rock ramp on the uppermost dam post-construction and pre-flood, and after the Superstorm Sandy flood.

Figure 2c-3. Notching in the lower dam post-construction and pre-flood, and logs and rocks in notch after the Superstorm Sandy flood.

- *<u>Estuary restoration in the Grand River, ON:</u>* The lake-effect zone of the Grand River has been identified within Lake Erie's Environmental Objectives as a Priority management area for issues pertaining to: *Coastal and Shoreline Processes; Rivers and Estuaries; Dissolved Oxygen; Coastal Wetlands and Submerged Macrophytes; Fish Habitat Protection; and Fish Access*. Restoration of this habitat is generally recognized to be a long-term goal, given the complexity of the issues, number and variety of stakeholders and regulatory agencies involved, and political and sociological sensitivities. In 2014 progress was made in the form of:

    - Endorsement by all associated parties of a Water Management Plan that incorporates the lake EOs and recognizes the need to modify the first upstream dam; identified as a key impediment to the majority of objectives.
    - Technical data collection (reservoir bathymetry), synthesis (LiDAR-derived DEM and fused bathymetry) and modelling (wetlands in relation to changing water elevations) were used to inform predictions of outcomes expected from a variety of dam modification alternatives.
    - Progress through a Strategic Decision Making exercise that will advise on the best approach to modifying the dam
    - Ongoing stop-gap assistance continued to be provided to walleye, in the form of physical movement past the barrier during the spring 2014 spawning run.

- *<u>Rondeau Bay: Watershed Restoration & Wetland Monitoring:</u>* Rondeau Bay is identified in the Lake Erie Environmental Objectives as a Priority Management Area for issues pertaining to: *Coastal and Shoreline Processes, and Coastal Wetlands and Submerged Macrophytes*. Previous comprehensive assessment work has attributed much of the current impairment to nutrient inputs from the small but heavily agricultural watershed. A broad collective of agencies and groups including OMNRF, Lower Thames Valley Conservation Authority, Municipality of Chatham Kent, and Ducks Unlimited. Much of the work includes working with private landowners to implement best management practices. Results for 2014/15 include:

    - The restoration of 130 acres of "green" infrastructure upstream of Rondeau Bay;
    - Wetland, Riparian Buffer, Grassland, Forest Cover and Pollinator Habitat restoration on four agricultural properties;
    - 30 + wetland/riparian buffer restoration projects to date and numerous grass waterway and sediment trap projects.

  In order to assess progress, a Great Lakes wide coastal wetland monitoring program, conducted by the Canadian Wildlife Service, was directed to Rondeau Bay in 2014. Monitoring in 2014 included wetland water quality, submerged aquatic vegetation and benthic invertebrate surveys. Results will inform a GL standardized IBI assessment of current state and progress.

- *Long Point Causeway Improvement Project:* Long Point, ON and its associated Big Creek Marsh are recognized as a Priority Management Area within Lake Erie's Environmental Objective of *Coastal Wetlands and Submerged Macrophytes.* A key habitat impediment involves the isolation of the marsh from Inner Long Point Bay and the lake proper, by a causeway built across series of barrier islands, resulting in the reduction of both biotic and hydraulic connectivity

  For the past several years, A local community group administered by the LP Biosphere Foundation and consisting of citizens and local agencies, has raised $$ through the Habitat Stewardship Fund, Species at Risk Fund, Great Lakes Restoration Fund to plan, design, approve and install passages & maintain fencing. The primary approach to restoration is to re-connect isolated habitats, through connections under the roadway. Recent and ongoing work includes:

  - 7 Terrestrial passages complete (by April 2015)
  - 1 aquatic passage in place (2 more in progress; 2015-16))
  - Ongoing monitoring and documentation of use by variety of fish, amphibian and terrestrial species
  - Regular water exchange; bi-directional flows

Section 3. Assist Member Agencies with Technology Use

Members of the HTG are involved in a variety of projects, often using specialized equipment and techniques to identify, survey, and modify aquatic habitat in Lake Erie and its surrounding watersheds. The HTG desires to assist interested agencies and researchers with the selection, use, and analysis of data collected with these technologies in a standardized fashion. What follows is a brief synopsis of how the HTG is working toward this charge.

3a. Sidescan Sonar Comparison

E. Weimer, S. Mackey

Sidescan sonar technology is an increasingly popular and important tool for evaluating habitat in aquatic systems. Sidescan has been used on Lake Erie to map substrate distributions, target potential Lake Trout spawning habitat, and evaluate habitat in the nearshore. Historically, this work has required the use of specialized, stand-alone sidescan systems that have been cost prohibitive for many agencies to purchase. In recent years, manufacturers have begun to integrate sidescan technology into sonar/chart plotter systems that mount on vessel hulls. These integrated sidescan systems are relatively inexpensive, and many agencies around Lake Erie have begun using these systems to collect data. The HTG encourages these activities, but understands that integrated sidescan systems may perform differently at various depths, ranges, and frequencies compared to traditional, stand-alone systems. Recognizing this, the HTG has begun a series of exercises that will establish recommendations for collecting, processing, and analyzing sidescan data in Lake Erie.

Members of the HTG gathered in Sandusky, OH, on August 26, 2014, to collect data using a stand-alone Klein sidescan unit and an integrated Lowrance system with the intent of identifying relative strengths, weaknesses, and recommendations for using each type of system. Three unique locations were surveyed using both systems; the Cedar Point breakwall, the Marblehead Lighthouse, and an area off of Sheldon’s Marsh (Figure 3a-1). These sites represent varying depths and substrates that represent habitats typically sampled in the western basin. Settings for both systems were similar; 25m or 100ft ranges, and boat speed around 5 mph. Frequencies varied: the Klein unit collected data at 500 kHz at all transects, while the Lowrance unit collected data at 455 kHz at all sites. In addition, data was collected at 800 kHz at the Cedar Point breakwall using the Lowrance system to enable some comparisons between data collected from the same system at different frequencies. Data processing has not been completed, but initial comparisons of raw imagery suggest that at shallow depths/short ranges, the two systems collect comparable data (Figure 3a-2). At longer ranges, the stand-alone Klein system is superior. Also, for general survey work, the 455 kHz setting on the Lowrance system provides a wider swath of useable data than the 800 kHz setting; the 800 kHz setting may be superior for vegetation mapping at very shallow depths (this is something we intend on investigating in the future).

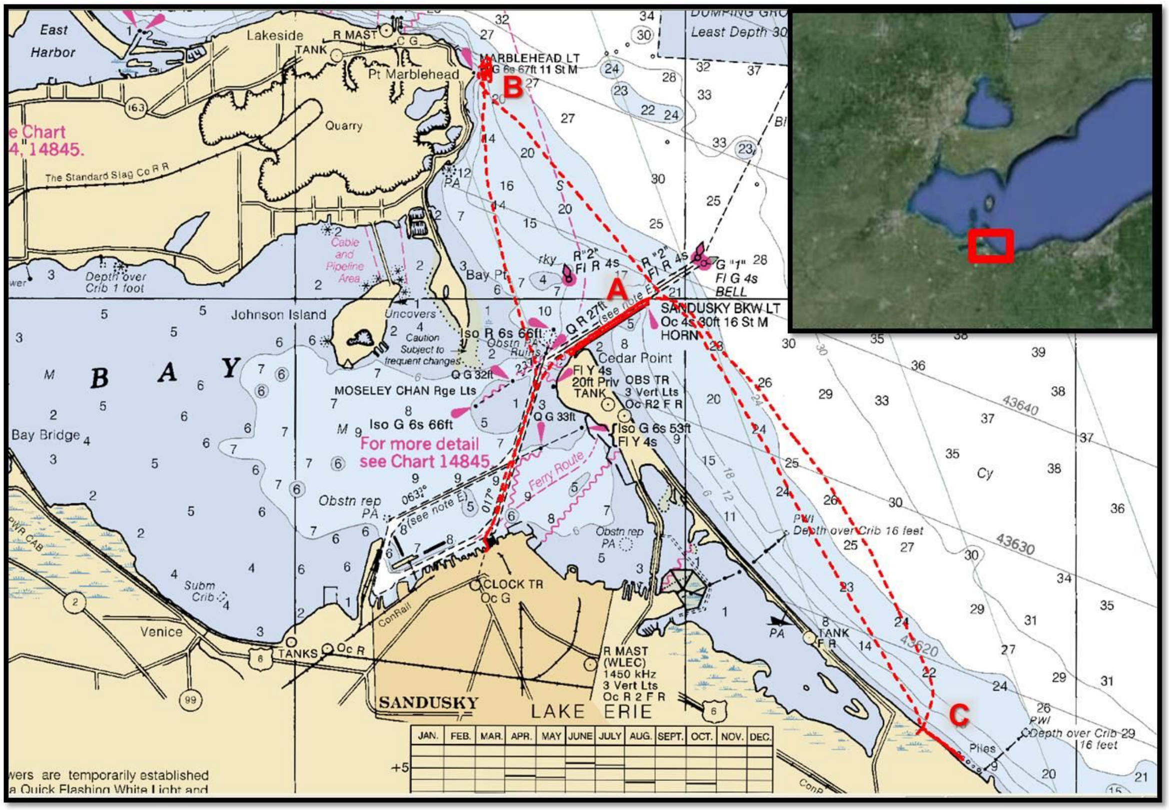

Figure 3a-1. Map of sidescan sonar comparison sites from August 26th, 2014. Site A is the Cedar Point breakwall, site B is the Marblehead lighthouse, and site C is off Sheldon's Marsh.

In the upcoming year, the HTG intends to further process the data collected in 2014 for comparative purposes. In addition, we plan on conducting further comparative collections using other stand-alone and integrated systems available to the HTG whenever possible. We also intend on examining different data processing software and techniques. It is hoped that a guidance document identifying recommended sidescan systems and settings for a particular data collection need can be developed, and that options for data processing can be evaluated. Once this process is completed, the HTG hopes to develop a workshop for those interested in collecting sidescan data throughout the Great Lakes.

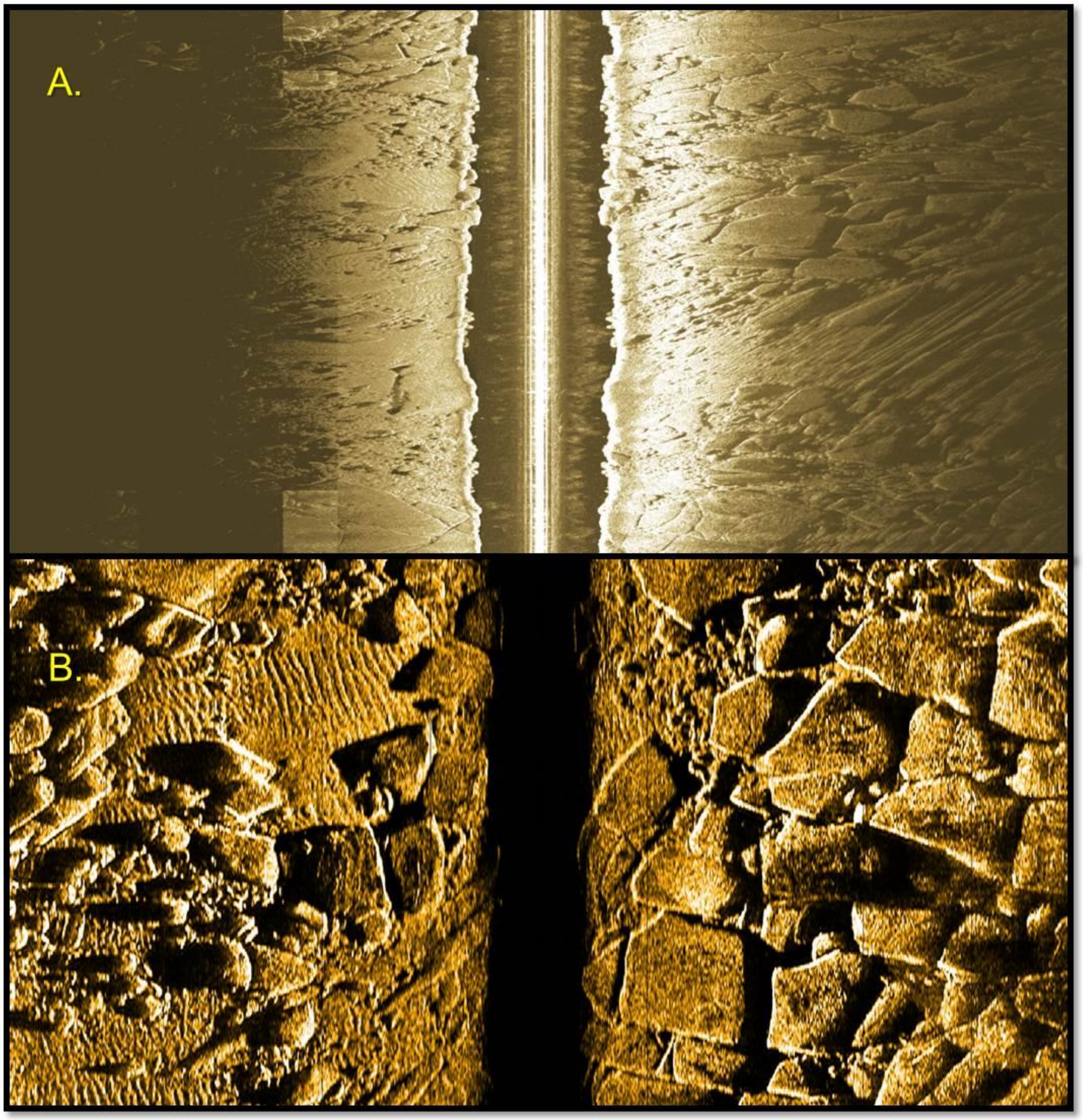

Figure 3a-2. Comparison of raw sidescan sonar images collected off the Marblehead Lighthouse, Marblehead, OH, on August 26th, 2014. Images were collected in similar locations using a Lowrance LSS-1 integrated sidescan/chart plotter at 455 kHz (A.) and a Klein stand-alone system at 500 kHz (B.); both systems were set to collect a 25m swath on both sides.

3b. Continued support of LE GIS/GLAHF development and deployment

C. Riseng, L. Mason, E. Rutherford

The Lake Erie GIS has been incorporated into a larger initiative, the Great Lakes Aquatic Habitat Framework (GLAHF). The GLAHF is a GIS database of geo-referenced data for Great Lakes coastal, large rivermouth, and open water habitats being developed by the University of Michigan, along with multiple partner researchers, universities, and agencies. The goal of the GLAHF is to develop and provide access to a Great Lakes aquatic habitat database and classification framework to provide a consistent geographic framework to integrate and track data from habitat monitoring, assessment, indicator development, ecological forecasting, and restoration activities across the Great Lakes. The project is funded for three years by the Great Lakes Fishery Trust and recently received additional funding from the UM Water Center to develop a web-accessible Decision Support Tool. Using coastal and offshore spatial processing zones and a gridded network of cells, the framework was developed and has been attributed with existing available georeferenced data including GL GIS data.

The GLAHF project has been identifying, acquiring, and geo-processing biological data, especially fish community data, and data collected in recent surveys of nearshore areas (Environment Canada, U.S. EPA, state DNRs, USGS). The GLAHF has received and incorporated several datasets from the LEHTG, including data on total phosphorus and chlorophyll a (2001-2011) updated substrate (Habitat Solutions, Mackey), and benthic invertebrate densities (1999-2011). Data important for fisheries management and restoration has been included in GLAHF including substrate and habitat mapping, and walleye and yellow perch harvest by grid data. The other effort has focused on developing an ecological habitat classification. To date, aquatic and coastal habitat zones have been defined and fine-scale ecological habitat units have been identified through multivariate analysis and clustering procedures (Figure 3b-1).

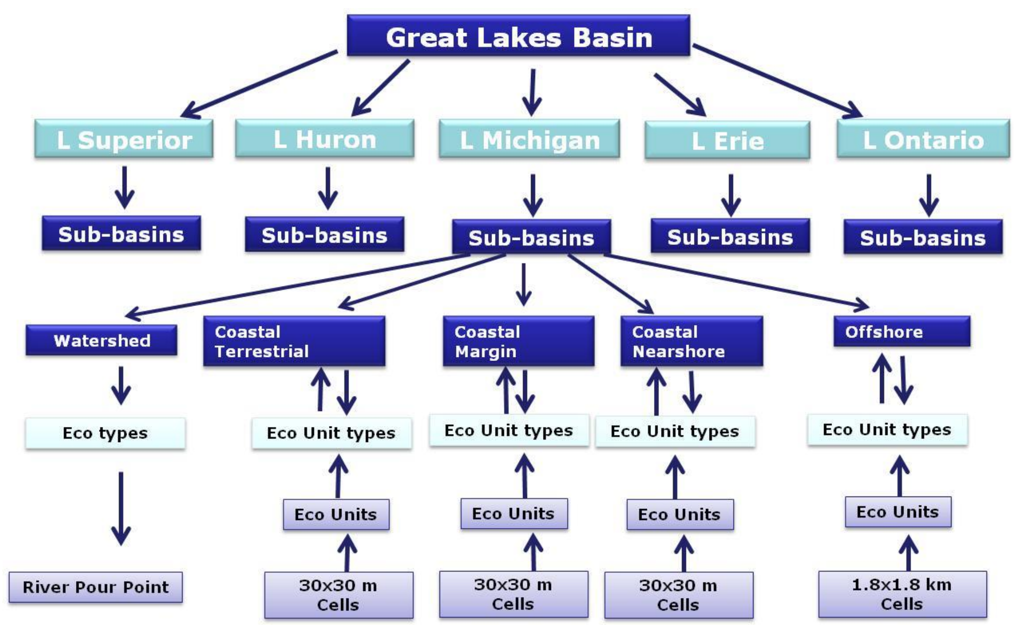

Figure 3b-1. GLAHF ecological classification framework

Additional work to develop a web-based Decision Support Tool was undertaken in 2014. In July and October, GLAHF staff with help from the HTG hosted workshops with biologists in the U.S. and Canada to identify what kinds of DSTs would help managers in their work and provide information at appropriate scales useful for decision making. A conceptual manuscript for the GLAHF has been accepted with the Journal of Great Lakes Research, and should be available by mid-2015. The GLAHF is scheduled to release the Spatial Framework and Database, Aquatic Habitat Classification, and DSS-viewer by the end of summer, 2015. The GLAHF team, with others, has received a grant to conduct a Coastal Condition Assessment of coastal and nearshore fish habitats of the Great Lakes from the Great Lakes Basin Fish Habitat Partnership and the Great Lakes Fishery Trust. This assessment is scheduled to be completed by the summer of 2016. This team will work with the HTG and may use the Lake Erie fish and habitat data as a focal area of more detailed assessment.

Information about GLAHF, and the overall Great Lakes GIS initiative, can be found at: http://ifrgis.snre.umich.edu/projects/GLAHF/glahf.shtml.

Section 4. Support Other Task Grouped by Compiling Metrics of Habitat

Habitat influences the distribution of fish species. Evaluating how fish relate to habitat can play an important role in assessing and modeling key fish species in Lake Erie, particularly walleye and yellow perch. The HTG has been tasked with assisting other task groups in understanding the role of habitat in assessing these key species where appropriate. What follows is a review of HTG activities towards this charge.

4a. Central Basin Hypoxia and Yellow Perch

R. Kraus, A. M. Gorman, and C. Knight

Seasonal hypoxia in the hypolimnion of the central basin of Lake Erie has been increasing in extent and severity over the past decade. This situation represents a problem not only for the bi-national water quality agreement, but also for fishery independent population assessments. In particular, avoidance of low oxygen appears to concentrate Yellow Perch at the edge of hypoxia, and may bias recruitment predictions. Further, evidence suggests that catchability of Yellow Perch in the trap net fishery may be increased through strategic gear placement at the edge of the hypoxic zone. A manuscript, entitled “Dynamic Hypoxic Zones in Lake Erie Compress Fish Habitat, Altering Vulnerability to Fishing Gears”, documents these effects and has recently been accepted for publication in an upcoming issue of Canadian Journal of Fisheries and Aquatic Sciences. We will continue to provide and develop information on hypoxia relevant to the Yellow Perch Task Group for reducing uncertainty in stock assessments. Efforts this year will include developing more intensive data on dissolved oxygen from commercial trap nets.

4b. Identify Metrics Related to Walleye Habitat

A.M. Gorman, R. Kraus, Y. Zhao, and C. Knight,

The HTG was charged with assisting the Walleye Task Group (WTG) with identifying metrics related to walleye habitat for the purpose of re-examining the extent of suitable adult walleye habitat in Lake Erie. This information may ultimately be used to quantify the amount of preferred adult walleye habitat by jurisdiction, thereby providing the Lake Erie Committee (LEC) with an alternate way to allocate fishery quota for walleye. Presently, quotas are allocated proportionally based on surface area of waters less than or equal to 13 m deep by jurisdiction (Figure 4b-1; STC 2007). This strategy, adopted in 2008, reflects an effort to utilize advances in spatial analysis (GIS) and newly compiled data (LEGIS) and to recognize expanding populations and changing distributions relative to the original strategy established in 1988. The LEC assigned the HTG this charge in an attempt to further improve estimates of suitable walleye habitat through an expanded definition of habitat based on recent literature, geospatial analyses, and historic datasets. To date, a habitat suitability model developed from gill net catch data has been published (Pandit et al. 2013).

Since 2010, an extensive acoustic telemetry tagging program has developed in Lake Erie as a part of the Great Lakes Acoustic Telemetry Observation System (GLATOS, Figure 4b-2). In Lake Erie, annual curtain arrays have been established on the boundaries between quota management units and at the east and west ends of the Lake to determine inter-jurisdictional movement of walleye. Seasonal deployments have occurred at predicted river and reef spawning locations for walleye for the past 2 years, and the geographic coverage continues to expand each year as new projects are funded. Additional coverage throughout the central basin began with the Cooperative Science and Monitoring Initiative in 2014 and will continue in 2015. The HTG intends to collaborate with the WTG and the GLATOS initiative to address objectives that are related to better understanding seasonal and geographic habitat preferences of walleye using acoustic telemetry. The use of telemetry will provide a comparison for the existing habitat suitability model using data that are not biased by gill net survey gear.

References

Pandit, S.N., Y. Zhao, J.J.H. Ciborowski, A.M. Gorman, and C. Knight. 2013. Suitable habitat model for walleye (Sander vitreus) in Lake Erie: Implications for inter-jurisdictional harvest quota allocations. Journal of Great Lakes Research 39 (4):591–601.

STC. 2007. Quota Allocation Strategies. Report of the Standing Technical Committee to the Lake Erie Committee. 8pp.

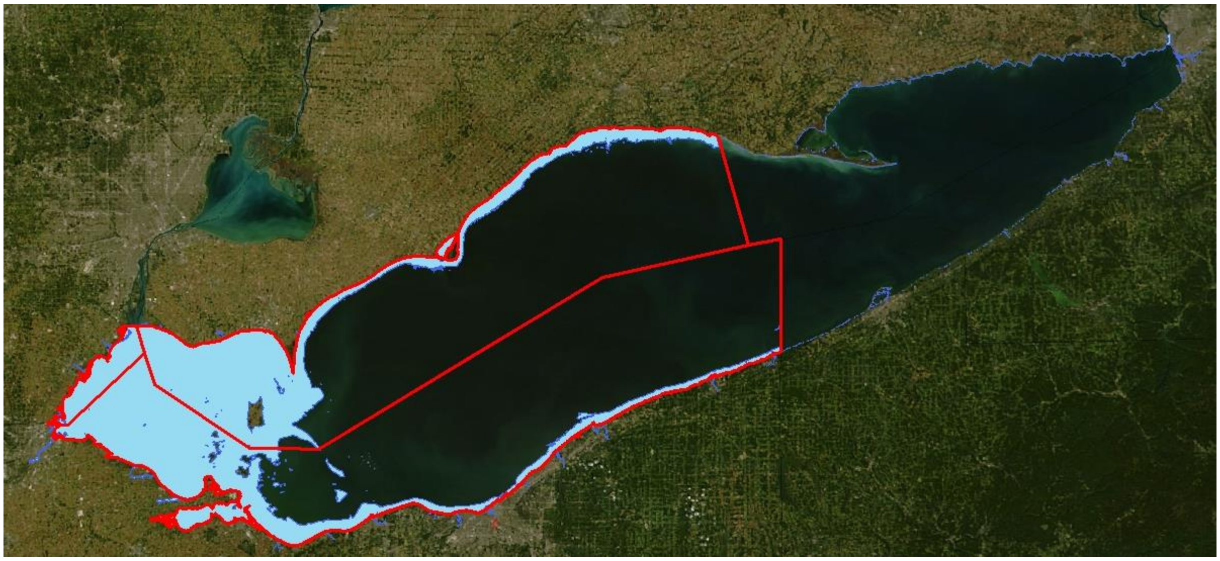

Figure 4b-1. This map represents the present quota sharing allocation, which is proportionally based on surface area of waters less than or equal to 13 m deep (area in light blue) by jurisdiction for Ohio, Ontario and Michigan (outlined in red).

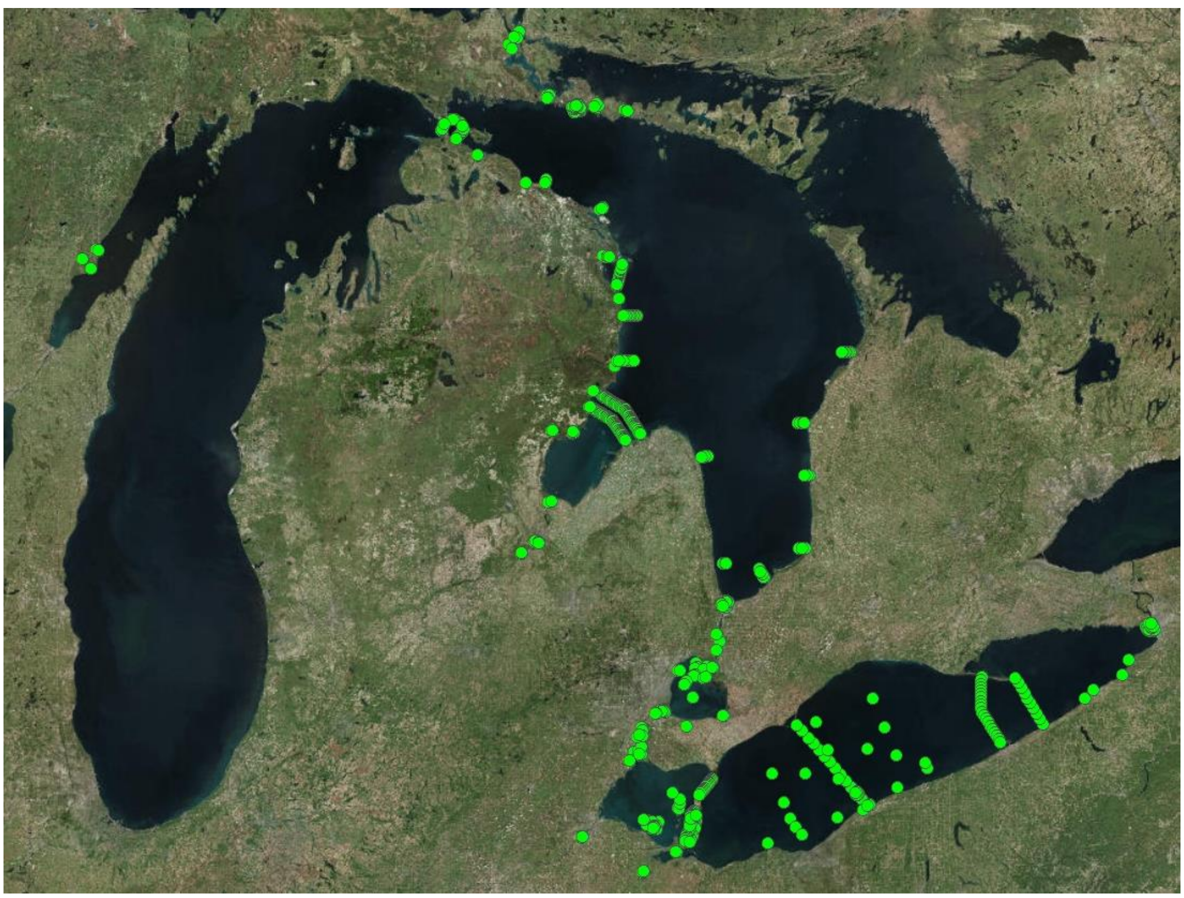

Figure 4b-2. This map represents the acoustic telemetry receivers deployed in 2014 that are involved in the GLATOS project.

Section 5. Strategic Research Direction for the Environmental Objectives

S.D. Mackey

The Lake Erie Environmental Objectives provide guidance to fishery and environmental management agencies in the form of descriptions of the various environmental conditions affecting Lake Erie fisheries resources and conditions needed to ensure that Lake Erie's FCGOs will be achieved. For Lake Erie, the Environmental Objectives sub-committee (now the HTG) identified ten Environmental Objectives in support of the thirteen Fish Community Goals and Objectives. The rationale behind each of the Environmental Objectives was described in a white paper released in July 2005.

<u>Protect and Restore Physical Processes</u>

1. Restore natural coastal systems and nearshore hydrological processes;
2. Restore natural hydrological functions in Lake Erie rivers and estuaries; and
3. Recognize and anticipate natural water level changes and long-term effects of global climate change and incorporate these into management decisions.

<u>Recover and Restore Fish Communities</u>

4. Re-establish open water transparency consistent with mesotrophic conditions that are favorable to walleye in the central basin and areas of the eastern basin;
5. Maintain dissolved oxygen conditions necessary to complete all life history stages of fishes and aquatic invertebrates;
6. Restore submerged aquatic macrophyte communities in estuaries, embayments, and protected nearshore areas; and
7. Minimize the presence of contaminants in the aquatic environment such that the uptake of contaminants by fishes is significantly reduced.

<u>Halt Habitat Degradation</u>

8. Halt cumulative incremental loss and degradation of fish habitat and reverse, where possible, loss and degradation of fish habitat;
9. Improve access to spawning and nursery habitat in rivers and coastal wetlands for native and naturalized fish species; and
10. Prevent the unauthorized introduction and establishment of additional non-native biota into the Lake Erie basin, which have the capability to modify habitats in Lake Erie.

Process

The HTG continues to employ a process designed to systematically identify and address data gaps, knowledge gaps, and lack of understanding by evaluating past, current, and potential future threats and trends for the Environmental Objectives, and how those threats and trends may impact the ability of Lake Erie Committee to achieve stated Lake Erie FCGOs.

Discussion

Review of ongoing Great Lakes habitat restoration projects and literature reveals a paucity of techniques for in-water restoration or enhancement of rivermouth, nearshore, and coastal habitats. Thus, even if fishery management agencies had the authority to manipulate nearshore and coastal habitats, limited information is available to provide guidance as to how best to enhance or restore those habitats. Science-based information and guidance is a key outreach strategy of the HTG to promote sound restoration projects and practices in riverine, coastal, and nearshore environments.

The HTG is implementing the following research strategies to address these needs:

1. There is a continuing need to identify habitat knowledge gaps and research needs.
    a. Development of techniques and methods to restore fish habitat in riverine, coastal, and nearshore environments through implementation of small pilot projects and associated monitoring work to validate project results.
    b. Encourage continued regional mapping and assessment of nearshore and coastal habitat areas (promote the use of new technologies such as sidescan sonar, multibeam, and underwater video technologies).
    c. Encourage continued sampling of fish communities in shallow-water coastal and nearshore habitats.
    d. Build linkages between coastal processes, hydrology, and habitat structure to promote sustainable habitat enhancement/restoration projects.
2. There is a need to identify opportunities and develop guidance materials to promote and implement nearshore habitat enhancement and restoration projects:
    a. Identify potential opportunities to influence the design and function of proposed shoreline projects through early collaboration with the USACE, U.S. EPA, Port Authorities, County Planning agencies, Municipalities, Townships, Engineering firms, Contractors, NGOs, and Coastal Property Owners.

b. Develop guidance materials to support and implement nearshore and coastal habitat restoration through *existing State and Local regulatory processes* in collaboration with Federal, State, and Local agencies.
c. Develop an outreach and education program to *actively distribute* guidance materials and information about the Lake Erie Environmental Objectives to other agencies/programs for inclusion in ongoing and proposed projects
d. Support increased monitoring of nearshore areas adjacent to restoration/enhancement sites to document how improvements in nearshore habitats have benefited nearshore fish communities, including the development of performance indicators that can be used to quantify fisheries benefits.

Implementation

The Ohio Department of Natural Resources Office of Coastal Management, working collaboratively with the Ohio Division of Wildlife and the University of Toledo, is currently funding initiatives designed to address several of the research and implementation needs described above. The objective is to develop criteria that can be used to identify and manage Priority Management Areas along the Ohio Lake Erie shoreline. These areas will be incorporated into the regulatory review process when evaluating proposed shoreline modification projects.

Section 6. Protocol for Use of Habitat Task Group Data and Reports

- The Habitat Task Group (HTG) has used standardized methods, equipment, and protocol in generating and analyzing data; however, the data are based on surveys that have limitations due to gear, depth, time and weather constraints that vary from year to year. Any results or conclusions must be treated with respect to these limitations. Caution should be exercised by outside researchers not familiar with each agency's collection and analysis methods to avoid misinterpretation.

- The HTG strongly encourages outside researchers to contact and involve the HTG in the use of any specific data contained in this report. Coordination with the HTG can only enhance the final output or publication and benefit all parties involved.

- Any data intended for publication should be reviewed by the HTG and written permission received from the agency responsible for the data collection.

Section 7. Acknowledgements

The HTG would like to acknowledge and thank the many contributors to the work presented in this report. As this report is mostly an overview of projects underway in the Lake Erie basin, it is impossible to identify every project and every individual involved. If you are involved in a habitat-related project in the Lake Erie basin and would like your work to be represented in the project table, please contact a member of the Habitat Task Group.

APPENDIX.

SPRING - ST. CLAIR RIVER GILL NET ASSESSMENTS

	North Channel (Control)				Middle Channel					Hart's Light		Algonac	
Year	2011	2012	2013	2014	2010	2011	2012	2013	2014	2013	2014	2013	2014
Black redhorse	-	-	-	-	-	-	-	-	-	-	-	-	0.003
Common carp	0.004	-	-	-	-	-	-	-	-	-	0.004	-	-
Channel catfish	-	-	-	-	-	-	-	-	-	0.003	-	0.003	-
Chinook salmon	-	-	-	-	-	0.007	-	-	-	-	-	-	-
Emerald shiner	-	-	-	-	-	-	-	-	-	-	0.007	-	-
Freshwater drum	-	-	-	-	0.005	-	-	-	-	-	-	-	-
Gizzard shad	-	-	0.004	-	-	-	0.009	-	-	-	-	-	-
Golden redhorse	0.004	-	0.004	-	-	-	0.009	0.012	0.003	0.010	-	0.014	-
Lake sturgeon	0.008	0.021	0.016	0.003	-	0.002	-	-	-	-	-	0.005	0.006
Lake whitefish	-	-	-	-	-	-	-	-	-	-	-	-	-
Largemouth bass	0.004	-	-	-	-	-	-	-	-	-	-	-	-
Logperch	-	-	-	-	-	-	-	-	-	-	-	-	-
Muskellunge				-					-		-	-	-
Nothern hogsucker	0.015	-	-	0.003	0.016	-	0.009	-	-	0.007	-	0.014	0.003
Northern madtom	0.004	-	-	-	-	0.002	-	-	-	-	0.004	0.003	-
Northern pike	-	0.007	-	-	0.021	0.010	0.009	-	-	-	-	-	0.003
Rainbow trout	-	-	-	0.003	-	0.002	-	-	-	-	-	-	-
Rock bass	0.030	-	0.013	0.003	0.026	0.020	-	0.027	-	0.003	-	0.024	0.003
Round goby	-	-	-	-	-	0.002	-	-	-	-	-	-	-
Shorthead redhorse	0.004	-	0.004	-	0.016	0.005	-	0.016	0.003	0.034	0.011	0.005	0.012
Silver lamprey	-	-	-	-	-	-	-	-	-	-	-	-	-
Silver redhorse	0.019	-	0.004	0.003	0.037	0.022	-	0.008	-	0.003	-	0.014	0.017
Smallmouth bass	-	-	-	-	-	0.002	-	-	-	-	-	-	0.003
Smallmouth buffalo	-	-	-	-	-	-	-	-	-	-	-	-	-
Spottail shiner	-	-	-	-	-	-	-	-	-	-	-	-	-
Spotted sucker	-	-	0.004	-	-	-	-	-	-	-	-	-	-
Stonecat	0.015	-	0.013	-	-	0.018	-	0.016	0.003	0.003	-	0.030	0.006
Walleye	0.034	0.028	0.029	0.017	0.037	0.030	0.044	0.070	0.008	0.141	0.100	0.043	0.046
White bass	0.038	-	0.038	-	0.032	0.065	-	0.019	-	0.007	-	0.011	0.003
White perch	-	-	-	-	0.005	0.002	-	-	-	0.010	-	0.003	0.003
White sucker	0.083	0.153	0.113	0.061	0.042	0.023	0.096	0.132	0.073	0.148	0.115	0.165	0.052
Yellow perch	-	0.007	-	-	-	0.007	-	-	-	-	-	-	-
Total Fish Captured	69	31	60	35	45	151	20	77	33	110	65	123	55
Dates Sampled	5/11 - 6/21	4/13 - 4/26	4/1 - 6/18	4/22 - 6/3	4/19 - 6/8	4/13 - 6/21	4/13 - 4/26	4/1 - 6/18	4/22 - 6/3	4/8 - 6/17	4/22 - 6/3	4/1 - 6/17	4/22 - 6/3
Water Temperature	9.5 - 16.9	5.8 - 8.3	2.0 - 14.8	4.2 - 12.9	8.1 - 18.7	4.9 - 17.4	5.8 - 8.3	1.7 - 14.8	4.1 - 13.2	2.0 - 14.8	4.0 -12.9	2.0 - 15.1	4.4 - 13.3

SPRING - DETROIT RIVER GILLNET ASSESSMENTS			
	Fort Wayne		NE Grassy Island
Year	2013	2014	2014
Black redhorse	-	-	-
Common carp	-	-	-
Channel catfish	0.003	-	-
Chinook salmon	-	-	-
Emerald shiner	-	-	-
Freshwater drum	-	-	-
Gizzard shad	0.007	-	-
Golden redhorse	0.003	-	-
Lake sturgeon	-	-	-
Lake whitefish	-	-	-
Largemouth bass	-	-	-
Logperch	-	-	-
Muskellunge			
Nothern hogsucker	-	-	-
Northern madtom	-	-	-
Northern pike	-	-	-
Rainbow trout	-	-	-
Rock bass	0.020	0.017	0.034
Round goby	-	-	-
Shorthead redhorse	0.026	-	-
Silver lamprey	-	-	-
Silver redhorse	0.026	-	-
Smallmouth bass	0.026	-	0.034
Smallmouth buffalo	-	-	0.017
Spottail shiner	-	-	-
Spotted sucker	-	-	-
Stonecat	-	-	-
Walleye	0.658	1.078	1.301
White bass	0.322	0.209	0.085
White perch	0.115	-	0.017
White sucker	0.023	0.052	0.034
Yellow perch	-	-	-
Total Fish Captured	374	78	90
Dates Sampled	4/2 - 7/1	4/16 - 5/14	4/16 - 5/14
Water Temperature	3.6 - 21.1	7.6 - 12.7	6.8 - 11.8

FALL - ST. CLAIR RIVER GILL NET ASSESSMENTS

Year	North Channel (Control) 2011	2012	2013	2014	Middle Channel Reef 2011	2012	2013	2014	Hart's Light Reef 2013	2014	Algonac Reef 2013	2014	Random Sites 2014
Black redhorse	-	-	-	-	-	-	-	-	-	-	-	-	-
Common carp	-	-	0.004	-	-	-	-	-	-	*NA*	-	-	-
Channel catfish	-	-	-	-	-	0.002	-	-	-	*NA*	-	-	-
Chinook salmon	-	-	-	-	-	-	-	-	-	*NA*	-	-	-
Emerald shiner	-	-	-	-	-	-	-	-	-	*NA*	-	-	-
Freshwater drum	-	-	-	-	-	-	-	-	-	*NA*	-	-	-
Gizzard shad	-	0.010	0.016	-	0.006	0.009	-	-	-	*NA*	-	-	-
Golden redhorse	0.011	0.004	0.004	-	0.006	-	0.004	-	0.010	*NA*	0.008	-	-
Lake sturgeon	0.011	0.010	0.024	-	-	-	0.004	-	-	*NA*	-	-	-
Lake whitefish	-	-	-	-	-	-	-	-	-	*NA*	-	-	-
Largemouth bass	-	-	-	-	-	-	-	-	-	*NA*	-	-	-
Logperch	-	0.002	-	-	-	0.002	-	-	-	*NA*	-	-	-
Muskellunge	-	-	-	-	-	-	-	-	-	*NA*	-	-	-
Nothern hogsucker	0.011	0.002	-	-	0.006	-	-	-	-	*NA*	0.013	0.019	-
Northern madtom	-	0.006	-	-	-	0.004	-	-	-	*NA*	-	-	-
Northern pike	0.011	0.006	-	-	0.039	0.007	-	-	-	*NA*	-	-	0.009
Rainbow trout	-	0.002	-	-	-	-	-	-	-	*NA*	-	-	-
Rock bass	-	0.014	0.004	-	0.006	0.024	0.011	-	-	*NA*	0.013	0.019	0.005
Round goby	-	0.002	-	-	-	0.002	-	-	-	*NA*	0.004	-	-
Shorthead redhorse	0.011	0.016	0.040	0.038	0.006	-	0.023	0.023	0.041	*NA*	0.008	0.019	0.014
Silver lamprey	-	0.002	-	-	-	-	-	-	-	*NA*	-	-	-
Silver redhorse	0.011	0.008	0.004	0.019	0.013	-	-	0.023	0.005	*NA*	-	-	0.005
Smallmouth bass	-	-	-	-	0.013	-	-	-	-	*NA*	0.017	-	0.005
Smallmouth buffalo	-	-	-	-	-	-	-	-	-	*NA*	-	-	-
Spottail shiner	-	0.002	-	-	-	-	-	-	-	*NA*	-	-	-
Spotted sucker	-	-	-	-	-	-	-	-	-	*NA*	-	-	-
Stonecat	-	0.006	-	-	-	0.004	-	-	-	*NA*	-	-	-
Walleye	0.022	0.008	0.012	-	0.026	0.046	0.011	-	0.045	*NA*	0.038	-	0.019
White bass	-	-	0.004	-	-	-	-	-	-	*NA*	-	-	-
White perch	-	0.027	-	-	-	0.004	-	-	-	*NA*	-	-	-
White sucker	-	0.002	0.004	0.019	0.013	0.004	0.011	-	0.005	*NA*	0.008	-	0.005
Yellow perch	-	0.002	-	-	-	-	-	-	-	*NA*	-	-	-
Total Fish Captured	8	65	29	4	21	52	15	2	23	*NA*	26	3	13
Dates Sampled	11/14 - 11/30	10/11 - 12/6	10/22 - 11/19	11/14 & 11/26	11/14 - 11/30	10/17 - 12/6	10/22 - 11/19	11/14 & 11/26	10/22 - 11/19	*NA*	10/22 - 11/19	11/14 & 11/26	11/14 & 11/26
Water Temperature	6.0 - 10.0	5.8 - 14.2	7.3 - 13.5	5.7 - 8.1	6.0 - 10.0	3.7 - 13.7	7.4 - 13.6	5.5 - 8.3	6.7 - 13.5	*NA*	7.4 - 13.5	6.0 - 8.4	5.3 - 8.3

FALL - DETROIT RIVER GILL NET ASSESSMENTS

	Fort Wayne			NE Grassy Island Reef	Fighting Island Reef	East Belle Isle Reef	Belle Isle Reef	Random Sites
Year	2012	2013	2014	2014	2014	2014	2014	2014
Black redhorse	-	*NA*	-	-	-	-	-	
Common carp	-	*NA*	-	-	-	-	-	-
Channel catfish	-	*NA*	-	-	-	0.047	-	-
Chinook salmon	-	*NA*	-	-	-	-	-	-
Emerald shiner	-	*NA*	-	-	-	-	-	-
Freshwater drum	-	*NA*	-	-	-	-	-	-
Gizzard shad	0.073	*NA*	-	-	-	-	-	-
Golden redhorse	-	*NA*	-	-	-	-	-	-
Lake sturgeon	-	*NA*	-	-	-	-	-	-
Lake whitefish	0.005	*NA*	-	-	-	-	-	-
Largemouth bass	-	*NA*	-	-	-	-	-	-
Logperch	-	*NA*	-	-	-	-	-	-
Muskellunge	-	*NA*	-	-	-	-	-	0.014
Nothern hogsucker	0.005	*NA*	-	-	-	-	-	-
Northern madtom	0.005	*NA*	-	-	-	-	-	-
Northern pike	-	*NA*	-	-	-	-	-	-
Rainbow trout	-	*NA*	-	-	-	-	-	-
Rock bass	-	*NA*	-	-	-	-	-	-
Round goby	-	*NA*	-	-	-	-	-	-
Shorthead redhorse	0.020	*NA*	0.042	0.038	-	-	0.049	-
Silver lamprey	-	*NA*	-	-	-	-	-	-
Silver redhorse	-	*NA*	-	-	-	-	-	-
Smallmouth bass	0.037	*NA*	0.125	-	-	-	0.049	0.014
Smallmouth buffalo	-	*NA*	-	-	-	-	-	-
Spottail shiner	-	*NA*	-	-	-	-	-	-
Spotted sucker	-	*NA*	-	-	-	-	-	-
Stonecat	-	*NA*	-	-	-	-	-	-
Walleye	0.105	*NA*	0.042	0.038	-	-	0.049	0.014
White bass	-	*NA*	-	-	-	-	-	-
White perch	-	*NA*	-	-	-	-	-	-
White sucker	0.010	*NA*	-	-	-	-	-	-
Yellow perch	-	*NA*	-	-	-	-	-	-
Total Fish Captured	50	*NA*	5	2	0	1	3	3
Dates Sampled	11/6 - 12/6	*NA*	11/4	11/4	11/4	11/4	11/4	11/4
Water Temperature	5.1 - 6.4	*NA*	7.8	8.0	7.9	7.8	9.7	7.5 - 8.1