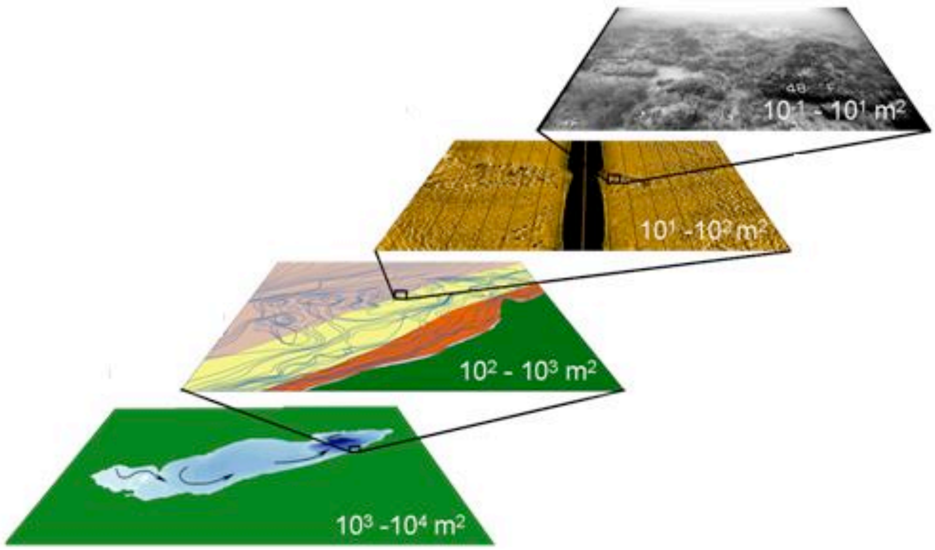
Report of the
Habitat Task Group
Lake Erie



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

March 2009

Prepared by members:

Tom MacDougall	*Ontario Ministry of Natural Resources (co-chair)*
Ann Marie Gorman	*Ohio Department of Natural Resources (co-chair)*
Jim Boase	*US Fish and Wildlife Service*
Jim Francis	*Michigan Department of Natural Resources*
Christine Geddes	*University of Michigan*
Carey Knight	*Ohio Department of Natural Resources*
Patrick Kocovsky	*US Geological Survey – L.E. Biological Station*
Ed Roseman	*US Geological Survey – Great Lakes Science Center*
Scudder Mackey	*University of Windsor*
Jim Markham	*New York Department of Environmental Conservation*
Ed Rutherford	*NOAA – Great Lakes Environmental Research Laboratory*
Eric Weimer	*Ohio Department of Natural Resources*

Presented to:

Standing Technical Committee
Lake Erie Committee
Great Lakes Fishery Commission

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Section 1. Charges to the Habitat Task Group 2008-2009

1. Document habitat related projects (e.g. critical information collection, habitat rehabilitation projects, habitat quantification, etc.) being conducted or proposed by LEC partners in the Lake Erie Basin

2. Develop strategy and support for Lake Erie GIS development and deployment. Provide assistance to Dr. Edward Rutherford during the development of the GIS and assist with training of Lake Erie Committee personnel in the use of the GIS database.

3. Assist the Coldwater Task Group in determining additional lake trout spawning habitat in Lake Erie.

4. Develop compilation of fish habitat metrics: *assist the Walleye Task Group with identifying metrics relating to walleye habitat for the purpose of re-examining the extent of suitable adult walleye habitat in Lake Erie*

5. Develop strategic research direction for Environmental Objectives.

In 2008, the HTG continued to focus most its efforts on charge number three. The only change to HTG charges from the previous year involved the addition of a specific focus on walleye for charge number four. Charges number one and two are addressed opportunistically as new projects arise or opportunities. The direction of focus for a white paper addressing charge number five was determined late in the year and will be drafted in 2009.

Section 2. Document Habitat Related Projects

The first charge to the HTG involves the documentation of habitat projects occurring throughout Lake Erie and Lake St. Clair basins, including their associated watersheds. Although originally designed as a simple spreadsheet table and included in the annual report, we now believe that the online, spatial inventory of this listing (created in 2007) is the most effective way of disseminating the project information.

As noted in our previous annual report (March 2008) the habitat listing, presented as a spatial inventory, and discoverable using a map interface, can be found online at: http://www.glfc.org/lakecom/lec/spatial_inventory/inventory_index.htm. By providing this kind of access to the listing, it is hoped that the information contained within will more readily be used to foster partnerships, avoid redundant or overlapping initiatives and expand awareness and use of products that result from completed projects.

Detailed descriptions of seven ongoing projects from the inventory are provided below:

2a. Ballville Dam Removal Project (City of Fremont)

S. D. Mackey

The Ballville Dam located in Fremont, Ohio is the first upstream, man-made barrier on the river located 17 miles upstream from Sandusky Bay. The 432-feet wide by 34-feet high concrete dam was constructed in 1911 to serve as a hydroelectric generating facility. In 1959, the dam was converted to a water supply facility by the City of Fremont. The water storage capacity of the impoundment has been reduced by 86% and seasonal water quality degradation and physical deterioration of the dam poses a potential public health and safety threat to the residents of Fremont, Ohio. The Ohio Division of Water has mandated the removal of the dam by 2012.

The primary project goal is to remove the Ballville Dam and reservoir to restore a degraded segment of the Sandusky River and significantly improve stream habitat within that segment. Critical walleye spawning habitat is located a short distance below the Ballville dam, and the dam forms a barrier to upstream fish migration (Figure 2a.1). Removal of the dam will restore 22 miles (35 km) of the Sandusky River to a free-flowing condition, thereby improving water quality and providing an additional 300 acres of suitable spawning habitat for walleye, white bass and other fish and benthic species (Figure 2a.2). Specific project goals include:

(1) Restoration of physical habitat and fish and macroinvertebrate aquatic communities within the affected stream segment.

(2) Restoration of biological connectivity between fish communities downstream and upstream from the Ballville Dam and reservoir.

(3) Establishment of self-sustaining (reproducing) populations of walleye, white bass, white sucker and other species of interest in stream segments upstream from the Ballville Dam and reservoir.

The City of Fremont has retained ARCADIS-U.S. Inc., as the prime contractor to design and construct an upground reservoir and pumping facility to serve as the new water supply for the City of Fremont. ARCADIS has also been retained to manage the removal of the Ballville Dam. A project team has been assembled that includes staff from ARCADIS U.S. Inc. the U.S. Army Corps of Engineers, Bowling Green State University, Granada Ecological Engineering LLC, and Habitat Solutions NA. The Ohio Division of Wildlife and the Aquatic Ecology Laboratory at the Ohio State University has agreed to provide technical support and expertise for fish habitat monitoring and fish community assessment prior to, during, and after dam removal.

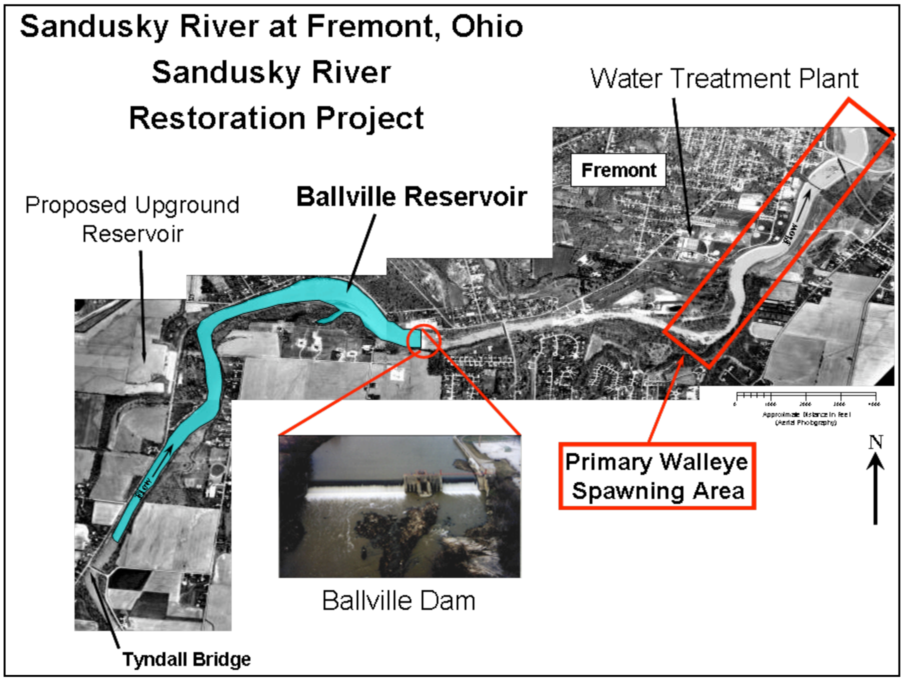

Figure 2a.1. Map showing Ballville dam and reservoir and location of walleye spawning area downstream from the dam

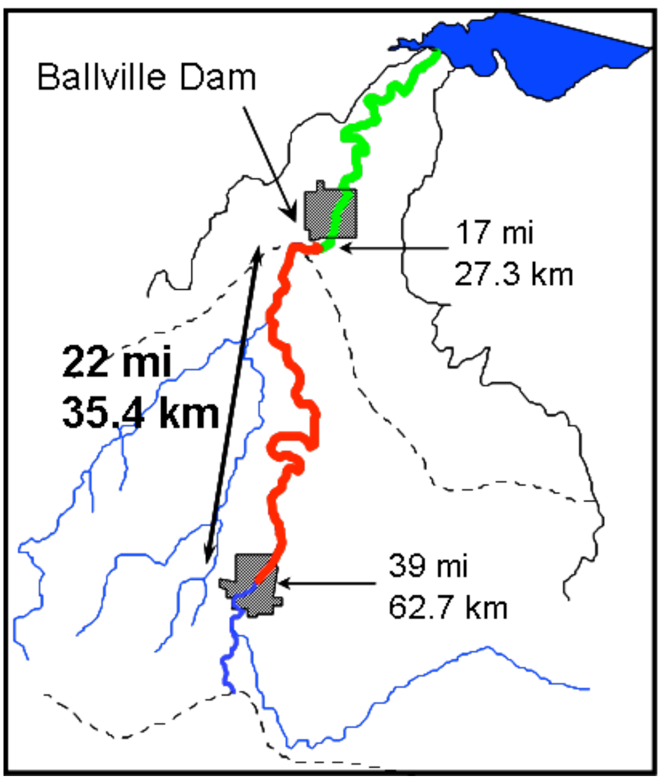

Figure 2a.2. Map showing additional areas of the Sandusky River made accessible by removal of the Ballville dam and reservoir.

The City of Fremont has successfully acquired $3.6 million from the WWRSP loan fund to assist with the removal of the Ballville Dam. These funds will become available mid-spring 2009. Additional funding will be requested as the project progresses.

In addition to standard engineering criteria, critical environmental components of the dam removal include an assessment of the type and volume of sediment impounded by the dam, whether or not those sediments are contaminated, the behavior and stability of those sediments as the reservoir is drawn down and the dam is removed, potential for flooding and/or ice damage, and the final configuration of the free-flowing river channel. The project team will evaluate the impact of various dam removal scenarios using hydrologic and hydraulic models to predict sediment erosion and transport rates and water levels under a range of anticipated flow conditions. The modeling work will be used to identify the most cost-effective way to remove the dam while minimizing harmful impacts to aquatic habitat and the environment. The Ballville dam will be removed after the upground reservoir is completed and operational, which is anticipated by May 2011.

2b. Sandusky River Habitat Assessment (Ohio Division of Wildlife, the Ohio State University)

S.D. Mackey

In the spring of 2008, an updated sidescan sonar survey of the lower Sandusky River was completed from Brady's Island to the mouth of the Sandusky River. These sidescan sonar data were used to characterize and map the sediment distribution and habitat structure in the lower Sandusky River. These new data will be compared with older sidescan sonar data collected by the Ohio Geological Survey in 1996 to assess long-term changes in sediment distribution and habitat structure within the Sandusky River. Moreover, these data will also provide baseline information that can be used to assess changes in the lower Sandusky River after the Ballville dam has been removed. Figure 2b.1 illustrates shows and example of the sidescan sonar data acquired from the lower Sandusky River.

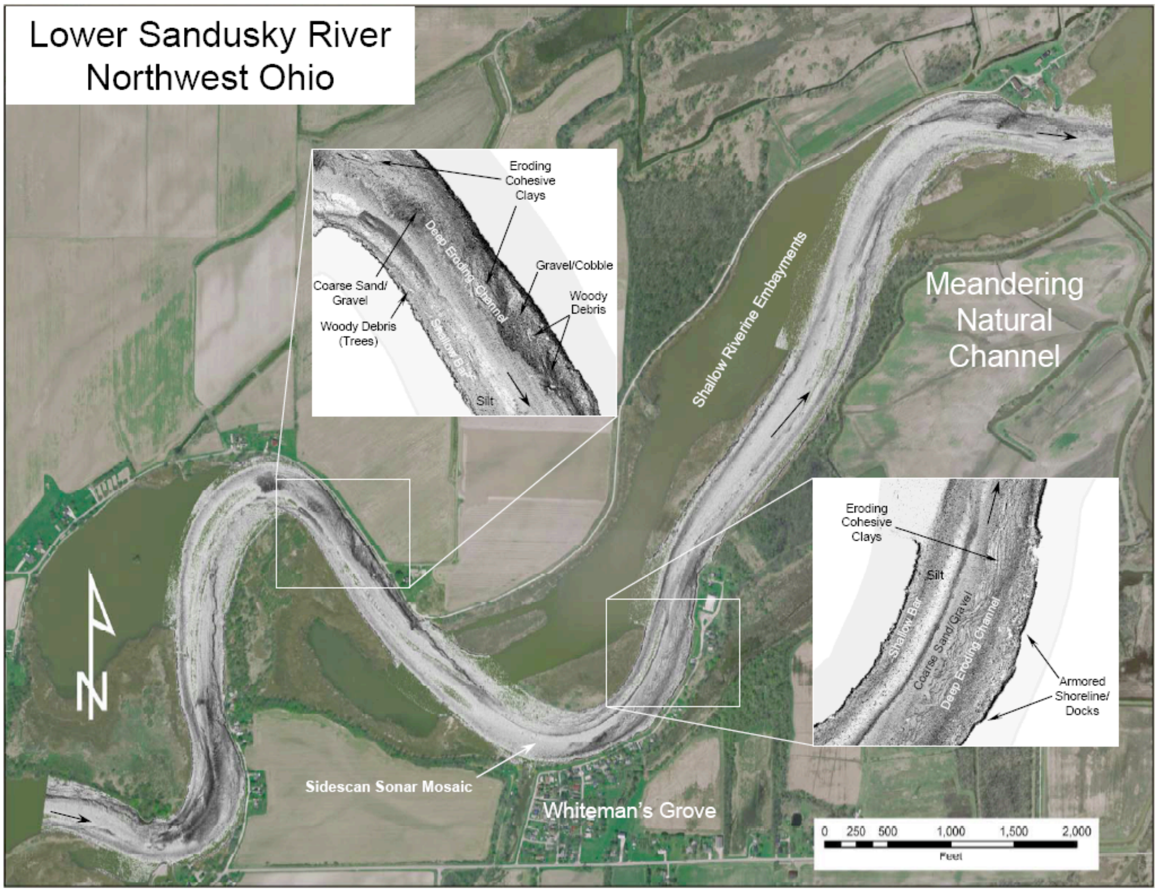

Figure 2b.1 Example sidescan sonar data acquired from the lower Sandusky River, Northwest Ohio. These data were used to characterize and map river bottom substrate and habitat structure in the lower Sandusky River.

2c. Middle Harbor Habitat Restoration- Ohio

E. Weimer

Middle Harbor is a 300 acre degraded coastal wetland located in East Harbor State Park, along the shore of Lake Erie near the city of Port Clinton, Ohio. Historically, this wetland was connected to Lake Erie through the neighboring East and Middle Harbors, and supported a diverse aquatic plant and animal community, including seasonally important habitat for northern pike and waterfowl. In 1945, causeway construction to provide access to the barrier beach isolated Middle Harbor; almost immediately, macrophyte loss due to wind and biological resuspension of sediments began to degrade the Middle Harbor ecosystem. In 1948, the park used rotenone to remove the large-bodied fish from the wetland, and the macrophytes returned, but the removal was not repeated. By 1950 Middle Harbor had become a shallow, highly turbid water body with little biological or recreational value.

Starting in 2004, the Ohio Department of Natural Resources Division of Parks and Recreation and Division of Wildlife began a collaborative project to develop a fish enhancement and coastal rehabilitation plan in Middle Harbor.

Rehabilitation activities in Middle Harbor would address three priority habitat restoration themes identified by the Lake Erie Committee (LEC) as important for restoration of the nearshore fish community. These priorities are: 1) re-establishment of submerged aquatic vegetation, 2) increased fish access to coastal wetlands for Lake Erie fish species, and 3) reduction of total suspended solids which will promote submerged aquatic vegetation restoration.

As part of the project, an island feature in Middle Harbor would be created to 1) beneficially reuse dredge material from East Harbor dredging, 2) maximize the reduction of sediment resuspension due to wind events through island location, and 3) maximize the amount of depth heterogeneity within the Middle Harbor complex to provide nearshore fishes with a diversity of summer and winter, vegetated and non-vegetated habitats (Figure 2c.1). In addition, efforts will be made to re-establish submerged aquatic vegetation in Middle Harbor by reconnecting Middle Harbor to East and West Harbors through culvert installation in the dikes that separate the units. This will allow water exchange and fish passage from Middle Harbor and is likely to reduce turbidity. This will also make Middle Harbor accessible to the Lake Erie nearshore fish community. As part of the process, the Division of Wildlife will provide pre- and post-restoration assessment data relative to fish and aquatic macrophyte changes within Middle Harbor and the reference East Harbor.

Preliminary pre-restoration sampling occurred in both Middle and East Harbors from 2004-2006 using both fall trap nets and spring electrofishing to adequately index the fish community. Fall trap netting incorporated standard Missouri-style trap nets during October surveys during all three years. All fish sampling conformed to Division of Wildlife-established sampling protocols (IMS sampling strategies). Spring electrofishing samples were collected in both East and Middle Harbors during May, 2005-2006. Nighttime electrofishing was used in East Harbor due to high water clarity, while excessive turbidity in Middle Harbor allowed for electrofishing during daylight. Trap net catches in Middle Harbor were dominated by turbidity tolerant fish species, while East Harbor catches consisted of intolerant species, particularly centrarchids. Electrofishing catches showed a similar pattern. Dominance within the fish community of Middle Harbor by large-bodied, intolerant species, such as carp and goldfish, can serve to increase turbidity through sediment re-suspension, and will continue to prevent the growth of submerged aquatic macrophytes.

Other indices were calculated to aid in meaningful comparisons between harbors. Proportional Stock Density (PSD) summarizes the length structure of a fish species within a population by examining the percentage of fish sampled over a pre-determined minimum length (stock length) that are over a standard ‘quality’ length (e.g., number of bluegill over 80-mm that are > 150-mm) (Gabelhouse 1984). An index of biotic integrity (IBI) adapted from Minns et al. (1994) was calculated to address fish community diversity and integrity. Both indices further portray the degradation of the Middle Harbor fish community.

On April 5th, 2007, the U. S. Army Corps of Engineers (USACE) denied the permit for the Middle Harbor Habitat Restoration project due to their perception that the proposed project represented a greater potential environmental harm to the Middle Harbor ecosystem than alternative dredge material disposal methods.

The ODNR appealed this decision based on the relative lack of science used by the USACE in rendering their decision in May, 2007. As of this writing, no final decision regarding the appeal has been made.

Currently, the Division of Parks and Recreation, with some assistance from the Division of Wildlife, is applying for a Coastal Management Assistance Grant for East Harbor State Park to begin construction on a culvert system to reconnect Middle Harbor with East and West Harbors. This construction will be a part of a larger project addressing access to the park beach and will provide benefits to the Middle Harbor ecosystem through fish passage and water exchange.

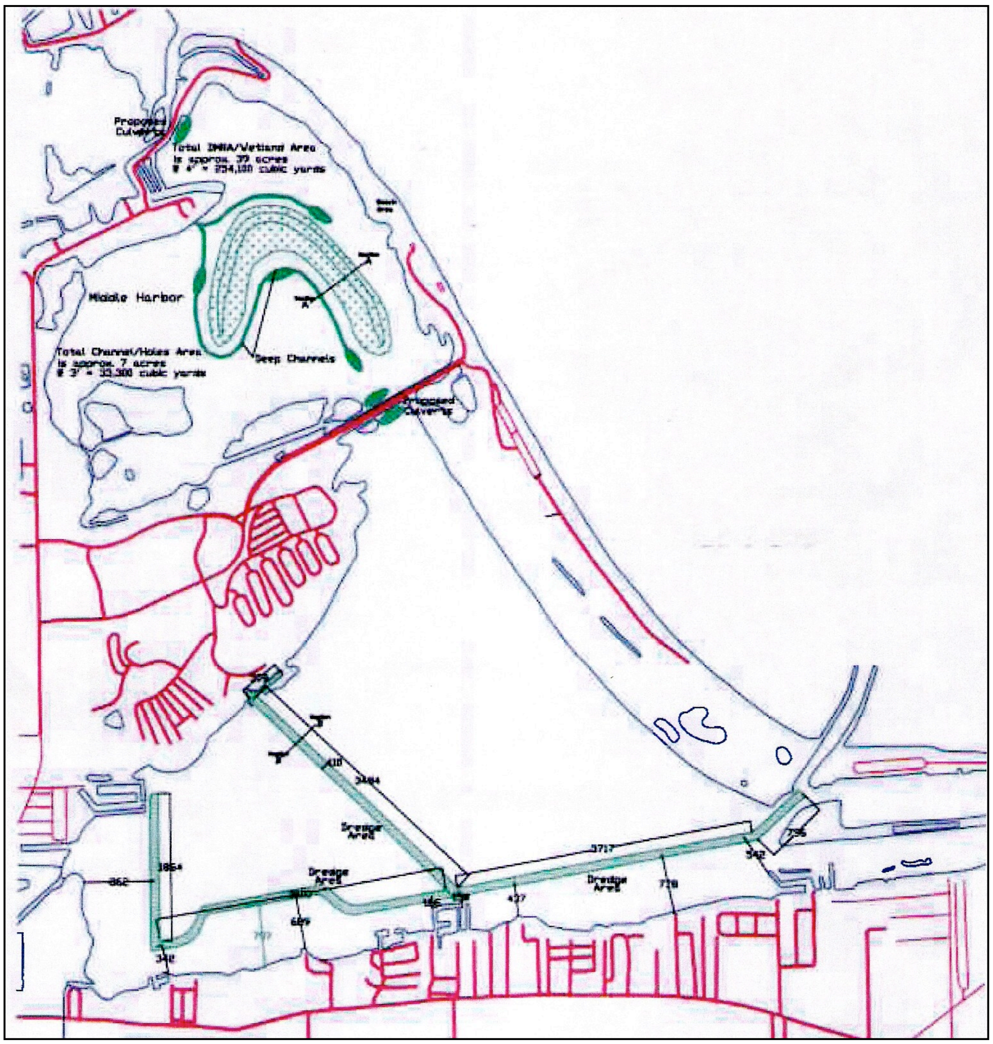

Figure 2c.1. Proposed habitat restoration project at Middle Harbor, Ohio. Dredge material from East Harbor will be used to construct an island feature in Middle Harbor to reduce fetch and restore aquatic macrophytes.

References:

Gabelhouse, D. W., Jr. 1984. A length-categorization system to assess fish stocks. North American Journal of Fisheries Management 4:273-285.

References cont'd:

Minns, C. K., V. W. Cairns, R. G. Randall, and J. E. Moore. 1994. An Index of Biotic Integrity (IBI) for fish assemblages in the littoral zone of Great Lakes' Areas of Concern. Canadian Journal of Fisheries and Aquatic Sciences 51:1804-1822.

2d. Nearshore Fish Community Assessment- Western Basin, Ohio

E. Weimer

Since 2007, the Ohio Department of Natural Resources Division of Wildlife has undertaken a preliminary trawling survey in the western basin to assess the composition and abundance of the fish community in the nearshore habitats of Lake Erie. Fourteen sites that represent a gradient of geomorphologic and anthropogenic influences to nearshore Lake Erie were sampled. Geomorphologic and shoreline protection variables from the Lake Erie GIS were used to select sites that varied by natural and anthropogenic influence.

Nearshore trawling was done aboard the 28' R/V Almar. A bottom trawl with a five meter head rope was towed parallel to shore for five minutes at approximately 3 knots; speeds varied due to changes in water depth. Trawls were towed in less than four meters of water; most trawls were at the three meter contour, and every attempt was made to stay on the same depth for the duration of the tow. Fish were sorted and enumerated by species and age classification, and total lengths (mm TL) were recorded for up to 30 individuals.

The first two years of sampling has generated mixed results. Nearshore fish species have been collected as some survey sites; however, bottom trawling in the nearshore is problematic, as the net frequently is hung or damaged on boulders or debris. In 2009, other sampling options, such as frame trawling or fyke netting, as well as the expansion of survey sites, will be evaluated for this project.

2e. Huron-Erie Corridor: Habitat Research

E. Roseman and J. Boase

St. Clair River Juvenile Sturgeon Habitat Mapping

Sidescan sonar data were collected in 2005. Scientists from the US Fish and Wildlife Service Alpena FRO and the USGS Great Lakes Science Center are compiling and analyzing data to produce viewable maps of juvenile sturgeon habitat in North Channel of the river. These maps will include substrate composition, size, and arrangement and will be overlain onto maps of juvenile sturgeon telemetry data to identify and characterize juvenile lake sturgeon habitat use.

Contact: Greg Kennedy, gkennedy@usgs.gov (734) 214-7215 or James Boase, James_Boase@fws.gov (248) 894-7594

Construction of Fish Spawning Habitat in the Detroit River
Fish habitat originally present in the Detroit River has been destroyed over the past 100 years by urbanization of the shoreline, filling of 97% of the river's coastal wetlands, creation of more than 96 km of deep-draft shipping channels in this 51-km river, and disposal of dredge spoils on more than 40 square km of river bottom (Manny 2003, Bennion and Manny 2008). In 1999, a survey of nine historic, reputed lake sturgeon spawning sites in the river revealed that seven of them no longer possessed any rock-rubble spawning substrates and the other two were no longer used by spawning sturgeon (McClain and Manny 2000). Subsequent assessment showed that lake sturgeon spawn in the Detroit River at only one site on man-made coal cinders (Manny and Kennedy 2002; Caswell et al. 2004). To restore spawning habitat for lake sturgeon and other desired fish species like lake whitefish and walleye, in 2004 we created 1,080 square meters of rock-rubble and coal cinders in Michigan waters near Belle Isle near the head of the river (Manny et al. 2005) and, in 2008, 3,300 square meters of rock-rubble on the river bottom in Ontario waters near Fighting Island, that is part of the Detroit River International Wildlife Refuge (U.S. Fish and Wildlife Service 2005; Hartig and Dushane 2007). Each of these habitat restoration projects was a collaborative venture funded by multiple sources at a cost of more than $200,000. Pre-construction assessment revealed only walleye spawned at Belle Isle (Manny et al. 2007) and only walleye and lake whitefish spawned on sub-optimal substrates at Fighting Island. Post-construction assessment showed 16 fish species quickly spawned at Belle Isle, including 14 native and two exotic species. Results of these two projects has shown that fish spawning habitat can be restored successfully in this degraded, urban river to enhance populations of migratory walleye and lake whitefish that support sport and commercial fisheries downstream in Lake Erie valued at more than $2 billion annually.

Additional sampling and monitoring of the reefs continued through spring 2008. Sampling for egg deposition was conducted in spring and fall 2007 and spring 2008 to assess continued use of the constructed reefs by spawning fishes. In addition, sampling for the presence of adult sturgeon in the vicinity of the reefs was conducted using baited set lines during the spring 2008. Finally, the physical condition of the reefs was assessed using underwater video and SCUBA. Eggs continued to be collected in increasing numbers through 2007 and 2008, with deposition rates equal to or greater than rates observed at other natural spawning sites. Reef preference continues to be observed, with walleye tending to prefer the limestone and rounded fieldstone, while the sucker species tend to prefer the cinders. Unfortunately, no adult sturgeon were caught on the set lines sampled during the spring 2008. Underwater video analysis of the reefs 4-years after construction indicate that the head and margins along each side of the limestone and fieldstone reefs are becoming filled in with softer sediment and zebra mussel shells, but that a core area within the center and rear of each reef still exhibits considerable interstitial void space. The cinder reef appears much the same as when it was first constructed. The loose material is readily filled in with soft sediment, but is easily cleared out when disturbed. Many peaks and valleys within the cinder material were observed indicating a lot of scour activity and reworking of the cinder material. Contact: Bruce Manny bmanny@usgs.gov 734-214-7255

References:

Bennion, D.H. and B.A. Manny. 2008. Construction of shipping channels in the Detroit River: History and Environmental Consequences. Can. J. of Fish. Aquat. Sci. (In review).

Caswell, N.M., D.L. Peterson, B.A. Manny and G.W. Kennedy. 2004. Spawning by lake sturgeon (Acipenser fulvescens) in the Detroit River. J. Appl. Ichthyol. 20 (2004):1-6.

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Manny, B.A., G.W. Kennedy, J.D. Allen, and J.R.P. French, III. 2007. First evidence of egg deposition by walleye (Sander vitreus) in the Detroit River. J. Great Lakes Res. 33(2):512-516.

Manny, B.A., J. Read, D. Denison, R. Reider, G. Kennedy, N. Caswell, J. Boase, and J. McClain. 2005. Creation of lake sturgeon spawning habitat in the Detroit River. In State of the Strait: Monitoring for Sound Management. eds. R. Eedy, J. Hartig, C. Bristol, M. Coulter, T. Mabee, and J. Ciborowski. pp. 98-100, Great Lakes Institute for Environmental Research, Occasional Publication No., 4, University of Windsor, Windsor, Ontario.

McClain, J. and B.A. Manny. 2000. Evaluation of lake sturgeon habitat in the Detroit River. Research Completion Report on Project #GL98105 submitted to USEPA-GLNPO, Chicago, IL.

U.S. Fish and Wildlife Service 2005. Detroit River International Wildlife Refuge Comprehensive Conservation Plan and Environmental Assessment. pp. 1-65.

Detroit River Larval Fish Survey

The Detroit River is a viable spawning and nursery area for Great Lakes fishes and also serves as a corridor for larval fish movements from upper Great Lakes to Lake Erie. Complementing recent fish population and habitat restoration efforts in the river, we assessed the dynamics of the larval fish community to document spawning success of river residents as well as movement of fishes from upstream sources. Sampling was conducted from March - June in 2006 and 2007 and March - May in 2008 to assess species composition, timing of occurrence, density, growth, and transport of larvae in the river and into western Lake Erie. Weekly active sampling was conducted using bongo nets in main channel and nearshore areas. About 700 samples were collected from the Detroit River, lower Lake St. Clair, and northwest Lake Erie near the mouth of the Detroit River between March 20 and June 15, 2006, 514 samples were collected in 2007, and 180 samples collected in 2008. Additional collections will be made in 2009 to assess production from the new spawning reefs at Fighting Island and connectivity between main river channels and riparian nursery habitats. Species found during 2006-2008 include burbot *Lota lota*, deepwater sculpin *Myoxocephalus thompsoni*, lake whitefish *Coregonus clupeaformis* (Roseman et al. 2008), walleye *Sander vitreus*, yellow perch *Perca flavescens*, rainbow smelt *Osmerus mordax*, suckers *Catastomus* and *Moxostoma* spp, muskellunge Esox masquigongy, smallmouth bass Micropterus dolomieu, longnose gar *Lepisosteus osseus*, common carp *Cyprunis carpio*, emerald shiner *Notropis atherinoides*, gizzard shad *Dorosoma cepedianum*, alewife *Alosa pseudoharengus*, white bass *Morone chrysops*, white perch *Morone americana*, tessellated darter *Etheostoma olmstedi*, logperch *Percina caprodes*, and troutperch *Percopsis omyscomaycus*. Our data showing the species composition, timing, and magnitude of abundance for select species during 2006-2008 differ markedly from a similar survey conducted during the late 1970s (Hatcher and Nester 1983; Hatcher et al. 1991). Our results show a vastly different larval fish community than that observed during the 1970s survey likely due to increased spawning of native fishes in the river. Contact: Ed Roseman eroseman@usgs.gov 734-214-7237

Hatcher, R.O., R.T. Nester. 1983. Distribution and abundance of fish larvae in the St. Clair and Detroit Rivers. U.S. Fish and Wildlife Service, Great Lakes Fishery Laboratory, Ann Arbor, MI.

Hatcher, C.O., R.T. Nester, and K.M. Muth. 1991. Using larval fish abundance in the St. Clair and Detroit rivers to predict year-class strength of forage fish in lakes Huron and Erie. Journal of Great Lakes Research 17:74-84.

Roseman, E.F., G.W. Kennedy, J. Boase, B.A. Manny, T.N. Todd, and W. Stott. 2007. Evidence of lake whitefish spawning in the Detroit River: implications for habitat and population recovery. Journal of Great Lakes Research 33:397-406.

Fish Spawning Habitat Assessment

Assessment of habitat use in the Detroit River by spawning fish began in fall, 2005. Gillnets, egg mats, and egg pumping was conducted to assess the extent of spawning by fish during spring and fall 2006 and 2007, and concluded in spring 2008. A spermiating lake whitefish and several dozen whitefish eggs were collected in the lower Detroit River in fall 2005. No adult lake whitefish were collected in gillnets in 2006 but adults and juveniles of twelve fish species were collected including four juvenile lake sturgeon, and spawning-ready walleye, yellow perch, smallmouth bass, and northern pike. In fall 2007, thirteen spawning ready or spent adult lake whitefish were collected. Viable lake whitefish eggs were found on egg mats and in egg pump samples fished on the river bottom throughout the river in both years. Highest lake whitefish egg densities were recorded at Fighting Island. In spring 2007, ninteteen sites were sampled with egg mats to identify fish spawning locations and egg viability. Fish eggs (N= 7,169) were collected as well as numerous spawning-ready adults of 12 native and two exotic fishes in gillnets and setlines. Evidence of spawning was documented for lake whitefish, emerald shiner, quillback, white sucker, northern hog sucker, silver redhorse, shorthead redhorse, trout-perch, white bass, rock bass, yellow perch and walleye. Sampling will continue in spring of 2008 to assess the extent of fish spawning in the Detroit River with efforts directed toward walleye, yellow perch, lake sturgeon, and lake whitefish.

In spring 2008, twenty nine sites were sampled with egg mats to identify fish spawning locations and egg viability. In addition, detailed sampling was conducted at the NE Fighting Island site. Nine gangs of egg mats were deployed to sample for egg distribution among several different habitat and depths in the area of the proposed International fish spawning restoration reef site, which was constructed during the fall 2008. Similar to the results observed during the 2007 sampling, egg deposition was observed throughout most of the Detroit River, and was dominated by walleye eggs. Walleye eggs were collected at 27 of the 29 sites and averaged 832 eggs/m² system-wide. The highest egg density collected was observed at the fieldstone artificial reef located at the Belle Isle sturgeon spawning restoration site, and collected an average of over 15,000 eggs/m². Sucker eggs of several species were the next common eggs collected during the spring 2008. Eggs were collected at 9 of the 29 sample sites, and averaged 116 eggs/m². Egg mats at the NE fighting Island site collected the greatest density of eggs at 741 eggs/m².

Contact: Greg Kennedy, gkennedy@usgs.gov (734) 214-7215; James Boase, James_Boase@fws.gov (248) 894-7594
Additional information about these projects can be found on the following web sites:

- http://www.glsc.usgs.gov/main.php?content=research_initiatives_huroncorridor&title=Initiatives0&menu=research_initiatives_huroncorridor
- http://huron-erie.org/

2f. Grand River Ecosystem: Assessment, Monitoring and Habitat Rehabilitation

T. MacDougall

Seven years of assessment activities on the lower reaches of the Grand River and associated Lake Erie nearshore were completed in 2006. Funding from the Canada-Ontario Agreement (COA) had allowed for the expansion of a cursory survey into a detailed examination of walleye and fish habitat in these waters. A thorough review of the data collected over 5 years in the Southern Grand River revealed a system impacted by both water quality problems and restricted access for migratory fish moving upstream from the lake.

A dam on the lower stretch of river has emerged as a major contributor to habitat impairment. This in not only due to the impediment that it presents for migratory fish but also through its documented ability to change the nature of the ecosystem from a lentic to a lotic environment. It therefore is able to exacerbate the effects of the eutrophic nutrient concentrations in the watershed as well as sever the important river/lake interface connection.

In 2008, work toward the rehabilitation of the lower reach of the Grand River proceeded on three different levels, 1- Information dissemination and public awareness, 2- Modeling to explore restoration scenarios and 3- On the ground habitat restoration as follows:

1. A technical workshop was convened which synthesized all available habitat data and sought to create a simple ecosystem model that could be used to describe “best bet” actions and guide restoration actions. Workshop proceedings and a “State of the Southern Grand” document were created and distributed at public open houses and agency meetings throughout the year.
2. Major hydrological changes will be necessary to address issues of fish movement, spawning ground access, and the magnification of the consequences of high nutrient loads. First steps toward the construction of a three dimensional, physical, scale model of the lower 35 km of the river were undertaken in 2008. This model will allow for the exploration of flow scenarios that include the partial or whole removal of the Dunnville dam, alterations to the current fishway, and /or the creation of a by-pass channel. It will be used to predict sediment movement under each scenario. Sediment sampling of the reservoir area behind the dam, to determine sediment type and to screen for contaminants was also conducted.
3. First steps were taken toward re-connecting Pike Creek, a tributary to the southern river, to the main channel near the town of Cayuga. This watershed had been disconnected from the main channel due to agricultural modifications to the tributary mouth which include tile-drainage. Natural channel design will be used to daylight the tile drain. Initial surveys and engineering designs toward this have been completed.

The HTG continues to serve as a forum to facilitate information sharing between this and other initiatives which have interests in the Grand River and its associated lake nearshore (e.g. Bi-national Mapping Project, L.E. LaMP habitat strategy, Lake Trout Habitat Initiative).

2g. Habitat Assessment of Long Point Bay

T. MacDougall

A three year ecological assessment of Long Point Bay, conducted by the Ontario Ministry of Natural Resources in collaboration with Bird Studies Canada, was initiated in 2007. Primary funding comes from the Canada Ontario Agreement. Partners include: Canadian Wildlife service (Environment Canada), University of Waterloo, McMaster University, Western University, Long Point Wetland and Waterfowl Research Fund, Long Point Waterfowlers association, Long Point Anglers, Long Point World Biosphere Foundation, Norfolk Naturalists.

In order to focus research priorities for this study, an examination of existing literature derived from Long Point-area research activities was performed to identify areas of research that are well-represented, under-represented, or completely lacking in scientific study in recent decades. This GAP analysis was used to inform the study design.

The study incorporates assessments of fish communities, nutrient loading, sediment quality, marsh birds, waterfowl, invasive species and amphibians, among other aspects of Long Point Bay biotic and abiotic features. Habitat in Long Point Bay will be considered as: i) Long Point spit and Turkey Point wetland complexes, ii) nearshore embayment areas, and iii) offshore areas.

Whereas work in 2007 focussed on nearshore embayment areas, work in 2008 focussed on inner wetland complexes, primarily those associated with the Crown marsh, a provincially owned and locally managed wetland. Fish community data was compiled along with concurrently collected substrate, plant (submerged and emergent) and water quality data. Of particular interest was the observed presence of a lake chubsucker (*Erimyzon sucetta*) and pugnose minnow (*Opsopoeodus emiliae*), both federally listed species at risk. Water quality parameters (including nutrients and suspended solids), plant indices, temperature, dissolved oxygen, and substrate, will be used to help define habitat use by these and other fish species. Zooplankton sampling was used to make the connection between fish species and lower trophic levels. Additional to the crown marsh work, a reference site was established near the tip of Long Point in an area considered relatively pristine.

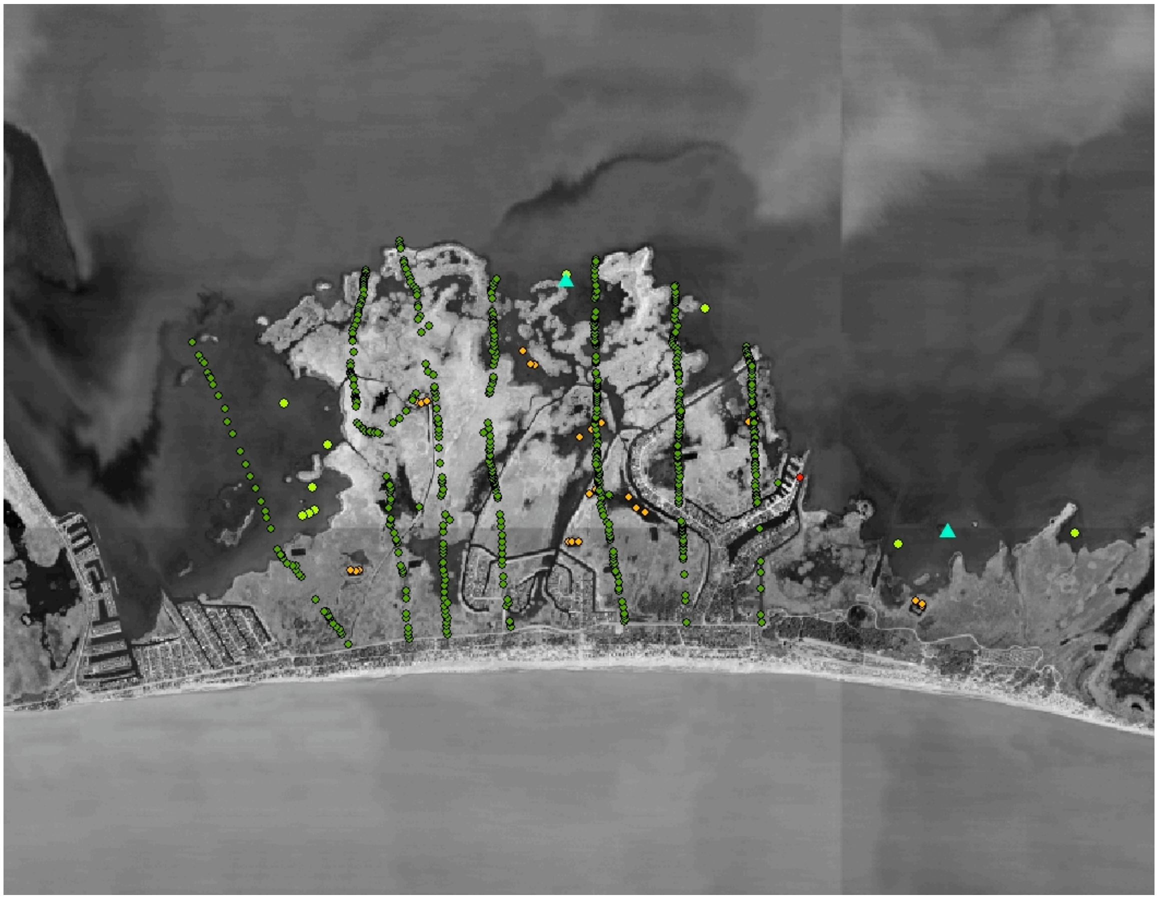

Figure 2g.1. Image of the Crown Marsh, Long Point, Ontario, showing sites sampled during 2008 habitat assessment. Parameters measured include plant, elevation and wildlife transects (linear series of green dots), fish community (larger, light green dots), water quality, nutrients and zooplankton (orange dots) and hourly temperature (blue triangles)

During 2009, attention will turn to additional wetland complexes (particularly those associated with outer Long Point) and their connections to Long Point Bay proper. Long term, continuous (hourly) temperature logging at 15+ stations, over the three year period will help to thermally characterize the entire area. An examination of fish diets from both wetland proper and embayment habitats will be undertaken.

Section 3. Lake Erie GIS Status

C. Geddes and E. Rutherford

The Great Lakes GIS, including the Lake Erie GIS, was created in order to facilitate the sharing of data and holistic management of the Great Lakes basin as described in the Joint Strategic Plan for Management of Great Lakes Fisheries. The project includes map-delineated spatial units and associated habitat and biological attribute data for terrestrial, tributary rivers, nearshore, and offshore ecosystems. Funding for development was provided by the Michigan Department of Natural Resources, the U.S. Environmental Projection Agency, the U.S. Fish and Wildlife Service, and the Great Lakes Fishery Commission. As reported last year, funding for the development of the Great Lakes GIS concluded on December 31, 2007.

The project is currently being partially supported by grants from the Michigan's Department of Natural Resources (MDNR) and Department of Environmental Quality (MDEQ) that extend through September 2009 and March 2010, respectively. For MDNR, project objectives include acquiring and mapping data on habitat and habitat suitability of non-game species within Michigan's waters of the Great Lakes. For MDEQ, the project objective is to develop a decision support project to aid in visualizing the impacts of lakebed alteration on fish habitat in Michigan waters of the Great Lakes. We are actively seeking funding for long-term management of the Great Lakes GIS project that will support data updates, education, and Internet distribution.

Charge two to the HTG involves continuing to support the Lake Erie GIS initiative. While there is currently no funding designated for maintenance, upkeep or data updates, several side initiatives are progressing with the expectation that they will eventually be incorporated into the LEGIS. In particular, this includes substrate and habitat mapping being conducted as part of HTG charge number three (lake trout spawning habitat identification). Additionally, cooperative ecosystem and food web modeling work initiated by scientists at University of Michigan, NOAA GLERL, and several other regional resource agencies and universities are being conducted with the recognition that generated information can be incorporated into the LEGIS product. Efforts are underway to incorporate the Lake Erie Limnological Synthesis database into the LEGIS.

HTG members continue to promote and encourage use of, and data contributions to, this very worthwhile initiative.

Information about LEGIS, and the overall Great Lakes GIS initiative, can be found at: http://www.glfc.org/glgis/GLGIS_User_Guide.htm

Section 4. Identification of potential lake trout spawning habitat in Lake Erie

A. Gorman, P. Kocovsky, S.D. Mackey, T. MacDougall, and J. Markham

In 2005, at the request of the Coldwater Task Group (CWTG), the HTG was assigned the task of identifying potential lake trout spawning habitat in Lake Erie. This would assist the CWTG with their charge of restoring a viable population of lake trout in Lake Erie as outlined in the recently finalized "Strategic Plan for the Rehabilitation of Lake Trout in Lake Erie, 2008-2020" (http://glfc.org/pubs/SpecialPubs/2008-02.pdf). A project overview, background rationale and methodology for the HTG component of this initiative are detailed in the 2008 annual report of the HTG (http://glfc.org/lakecom/lec/HTG.htm).

Briefly, the project uses a multi-tiered approach that includes: 1) identification of key environmental characteristics of lake trout habitat based on published records from other Great Lakes including bathymetry, substrate, slope, water depth, and proximity to deeper water nursery areas; 2) substrate mapping using side-scan sonar and underwater video; and 3) an assessment of linkages and connectivity between potential spawning and juvenile rearing areas.

Previous work has included the creation of a GIS model as a first cut at identifying potential sites based on the most current data sources, primarily the LEGIS database (2005-2006). Sidescan sonar and underwater video were then used to validate the results of the GIS model and examine potential spawning areas in greater detail (2006). In 2007, using a modified GIS model, a series of eastern basin, north shore shoals were targeted for Sidescan sonar mapping. Additionally, reconnaissance surveys were conducted at Brocton Shoal, in New York waters; a historically recognized lake trout spawning site.

Initial interpretation of the 2007 surveys, described in last year's report, indicated that suitably sized cobble substrate existed at several areas along the north shore as well as at the historic site, Brocton Shoal. These areas tended to be found in relatively small piles (tens of meters up to 5000 m^2) and as long linear narrow ridges (esp. Brocton Shoal).

One area of particular interest was Nanticoke Shoal which, in addition to having quantities of appropriate substrate, is situated in close proximity to deeper-water areas that may serve as lake trout nursery habitat. Substrate interpretation of Nanticoke shoal was used to direct lake trout stocking efforts in 2008. On May 15th, 50,000 yearling lake trout were stocked at locations identified as having cobble substrate on the down-slope (south) flank of Nanticoke Shoal. Video imaging of the stocking event revealed that the stocked fish proceeded immediately to the lakebed and did not drift or travel horizontally to any significant degree. Subsequently two yearling lake trout, presumed to have originated with this stocking event, were captured by trawl on August 21, at 30 m depth and at a location mid-way between the stocking site and the deepest part of the basin.

Similarly, interpretation of cobble substrate at Brocton Shoal from the 2007 Sidescan surveys was used to direct the placement of lake trout egg traps (Figure 4.1) and gill nets in the fall of 2008 to determine if lake trout were using this historical spawning site. Results of the survey can be found in Charge 1 of the Coldwater Task Group Report (2008).

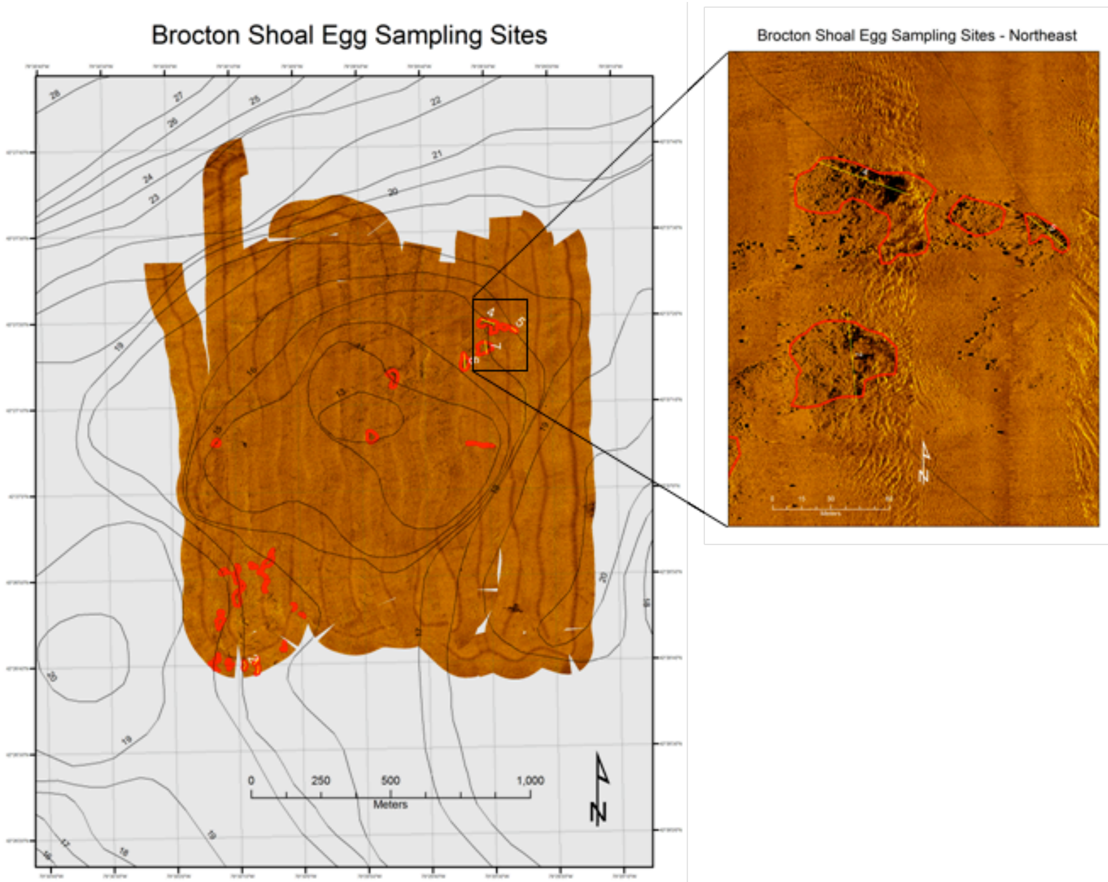

Figure 4.1. Sidescan sonar mosaic showing location of potential Lake Trout spawning locations for egg trap placement.

Fieldwork in 2008 was hindered by uncooperative weather and unforeseen logistical constraints. Plans to focus on Brocton Shoal and areas associated with the Pennsylvania Ridge were not realized. During a period of unusually calm weather (rare during 2008), additional sidescan sonar data were acquired over the north shore shoals (Canada) in the eastern basin of Lake Erie and served to infill some areas missed during 2007 and new areas identified during the winter of 2007/08. This included a steep slope area (identified using the NOAA bathymetry data) south of Hoover Point, portions of Tecumseh Reef, and additional areas over Hoover Point south (Figure 4.2). This work was funded by the Canada Ontario Agreement (COA). To date, more than 741 line km (400 nautical line miles) of sidescan sonar data have been acquired and more than 7600 ha of lakebed has been ensonified, mapped, and interpreted along the Canadian north shore in the eastern basin of Lake Erie.

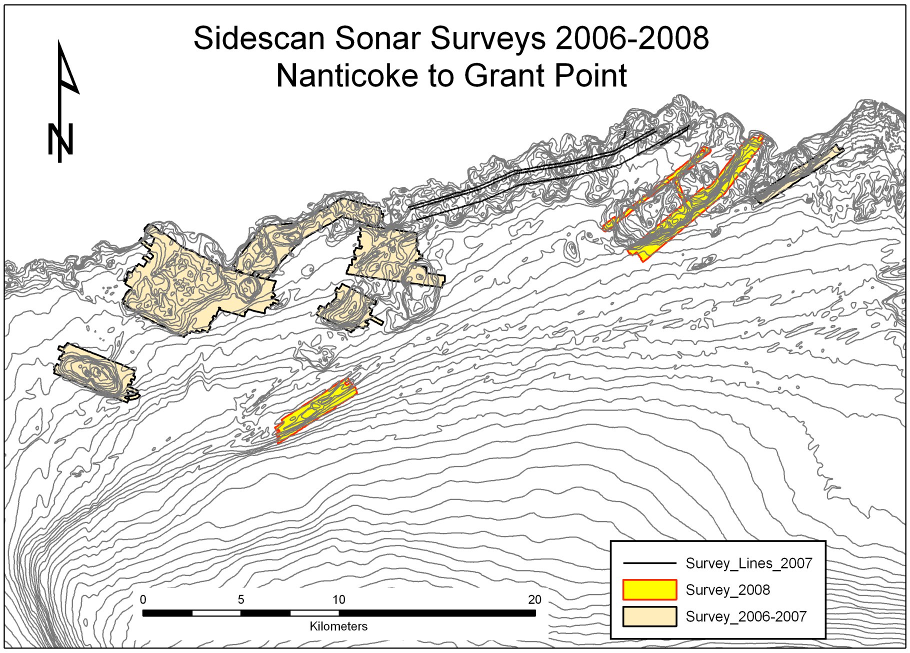

Figure 4.2. 2008 sidescan sonar data acquisition areas (red outline, yellow fill) and priority data acquisition areas for spring 2009. Survey coverage from previous year appear as tan boxes with black outline Poor weather severely limited sidescan sonar field data collection in 2008.

Habitat classification and interpretation techniques continued to evolve over the course of 2008. Two separate geodatabases are created from the sidescan sonar data: 1) traditional substrate maps that classify bottom texture and composition (e.g. bedrock, boulder, cobble, gravel, sand, silt, clay, and cohesive clay), and 2) habitat structure that includes bedrock scarps, ledges, scarp debris, rock piles or linear ridges, woody debris). It is the integration of substrate type with habitat structure that provides the most useful assessment of fish habitat potential. Figure 4.3 illustrates several different types of habitat structure associated with a bedrock substrate.

Moreover, many substrates are heterogeneous, i.e. a complex mosaic of different types of geologic materials and habitat structure. In many cases, it is not possible to classify an area as a single substrate type. To address this issue, currently, there are 9 substrate classes being utilized to describe the range of bottom types found within the eastern basin of the lake. These include *Bedrock, Bedrock-fractured slabs, Cobble_Lag_Bedrock, Cobble_Lag_Cohesive Clay, Boulder_Cobble, Cobble_Patches_Sand, Course_Sand_Cobble, Fine_Med_Sand, Cohesive_Clay, Silt_Clay, and Rock_Cobble_Pil*e. These classes may be modified as a function of the materials observed on the lakebed.

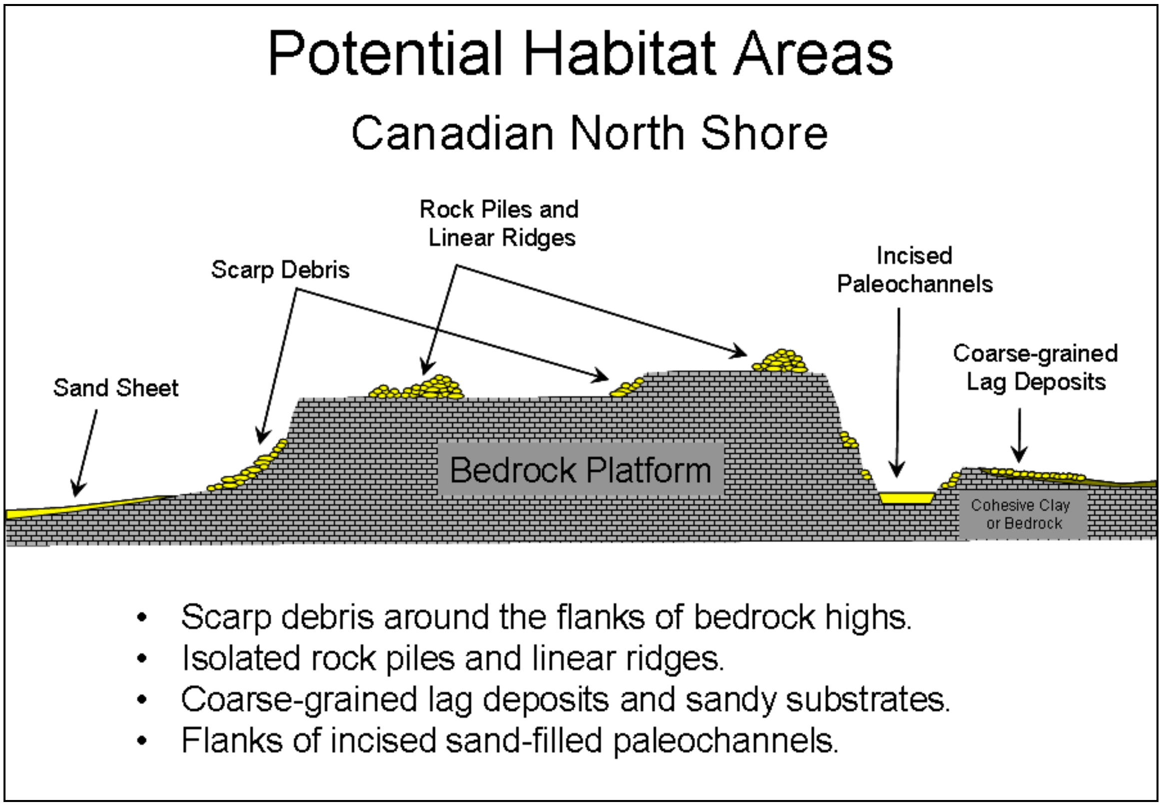

Figure 4.3 Illustrates different types of potential habitat structure observed on bedrock substrates along the Canadian north shore of Lake Erie.

Interpretive work in the eastern basin of Lake Erie clearly demonstrates the inadequacy of current substrate maps and bathymetric data. Figure 4.4 illustrates the Hoover Point South survey site which was originally mapped as glacial till (gray area on map). The 1-m NOAA bathymetric shows considerable structural relief. However, most of the major habitat features identified at this site are not captured by the NOAA bathymetry or existing substrate maps. The scale of many of these habitat features is small, and may be missed by a more traditional substrate mapping and/or bathymetric surveys. Note the presence of multiple bedrock scarps with steeply sloping coarse-grained scarp debris that may be considered to be potential lake trout spawning habitat. Moreover, there are several rock piles and linear ridges resting on the bedrock platform that do not show up on the NOAA bathymetry. Any of these areas could potentially serve as lake trout spawning habitat. Preliminary calculations show that less than 1% of the lakebed has been mapped at a resolution suitable to identify, characterize, and map potential fish habitat in Lake Erie.

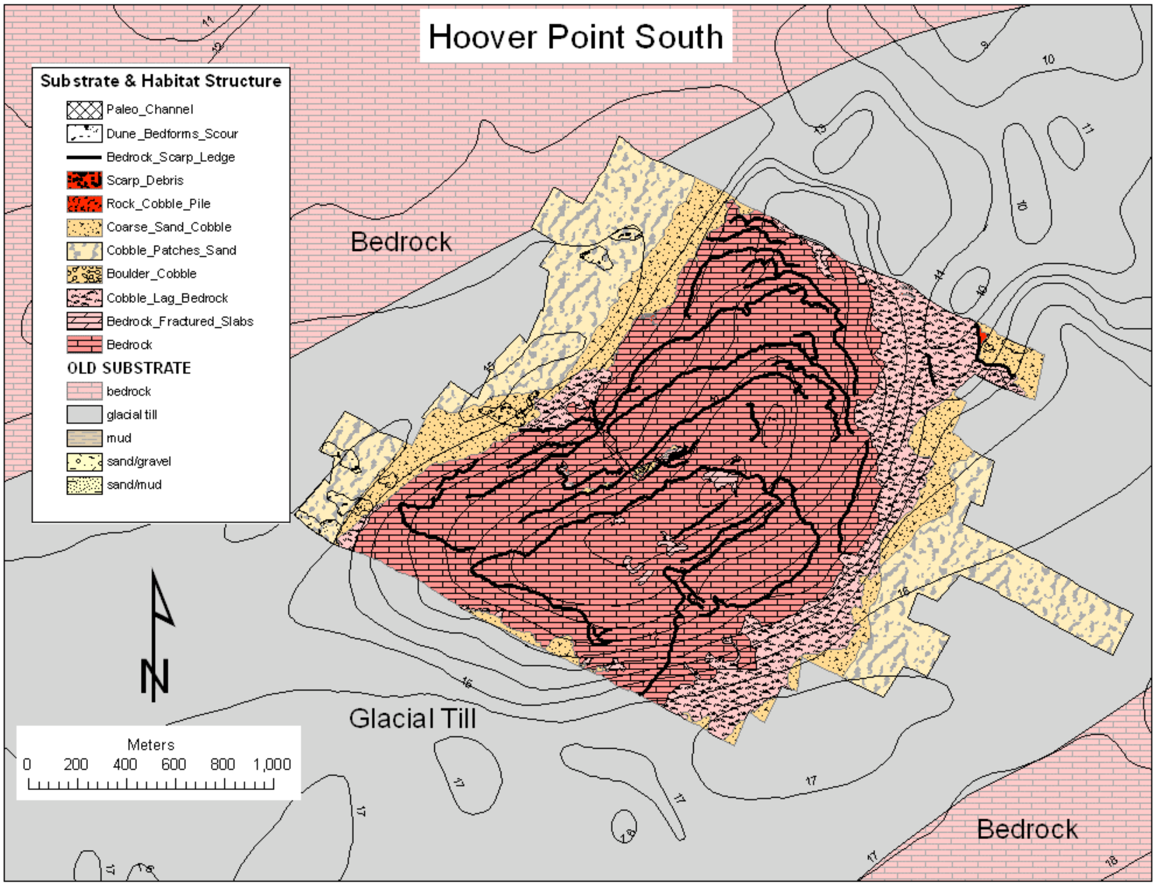

Figure 4.4 Comparison of existing substrate mapping (old substrate) with new substrate and habitat structure mapping at the Hoover Point South survey site. Many of the habitat features are not detected by existing substrate or bathymetric maps (1-m NOAA bathymetry).

Planned modifications to the GIS model include incorporating wind fetch and newly acquired substrate data. Wind fetch, distance of wind over open water, is a driving force in the distribution of particles along the lakebed. Factors to consider when incorporating wind fetch include determining prevailing direction during the spawning season and how depth of water may influence the effects of wind. Influences of wind also vary with location within the lake. To date only a fraction of the potentially suitable areas for lake trout spawning identified by the original GIS model have been examined in detail for substrate. Once data are available for a majority of predicted locations, we will reassess the parameters that were included in the original model, determine if there are better techniques for quantifying these parameters, and add parameters that emerge as important through more detailed examinations of the substrate data.

In the upcoming year, fieldwork will focus on areas originally planned for 2008. Much of this will focus on Brocton Shoal and the Pennsylvania Ridge south of Long Point. Funding from the US Fish and Wildlife Service Restoration Act will allow for a comprehensive survey utilizing a RoxAnn seabed classification system in addition to sidescan sonar and video imaging techniques. Questions pertaining to hydrologic connectivity and use of substrate by lake trout will be addressed using *in situ* current meters and bottom-moored, long term video.

It is worth repeating that, while this work is targeted at lake trout in particular, we anticipate learning more about spawning habitat and habits of several other Great Lakes species. Future work with sidescan sonar and underwater video will also generate new, detailed, and geographically-referenced data on substrate type and rugosity that will be added to the Lake Erie GIS. The type and extent of future work is contingent upon funding.

Principal Investigators: P. Kocovsky (USGS–L.E. Biological Station), S. Mackey (U of Windsor), A. Gorman (ODNR), T. MacDougall (OMNR), J. Markham (NYSDEC).

Section 5. Development of a compilation of fish habitat metrics

5.1 Defining adult walleye habitat

A.M. Gorman and T. MacDougall

This year the HTG was given a detailed sub-charge to assist the Walleye Task Group (WTG) with identifying metrics relating to walleye habitat for the purpose of re-examining the extent of suitable adult walleye habitat in Lake Erie. The purpose of this charge is to quantify the amount of preferred adult walleye habitat by jurisdiction by management unit (MU). This would assist the LEC in assessing the current quota allocation strategy for walleye. Presently, quotas are allocated proportionally based on surface area of waters less than 13 m deep by jurisdiction and MU. This most recent iteration of the strategy (STC 2007) 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 previous iteration (1988). The LEC feels that HTG may be able to further improve estimates of preferred habitat through an expanded definition of habitat based recent literature, geospatial analyses and historic datasets.

To date, the HTG has derived a plan to approach this charge. We intend to develop a temperature and light driven model similar to the Thermal-Optical Habitat Area Model developed by Lester et al. (2004). With the help of Dr. Timothy Johnson (OMNR), we will use the Lake Erie Limnological Synthesis (LELS) database to determine the spatial coverage of secchi and temperature data for recent years across each jurisdiction. If there are gaps in coverage, we plan to approach agencies within each jurisdiction to determine if there are additional datasets available and will incorporate additional data into the existing database.

As an example, preliminary examination of data currently available within the LELS suggests that, while spatial coverage of secchi data is relatively good for recent years (Figure 5.1), surface temperature data is spotty. We expect that a closer examination of temperature/depth profiles data will prove to be more robust than the currently available surface temperature data.

We will develop a spatial model of preferred habitat based on locations of preferred secchi and temperature ranges as defined after a thorough literature review and input from the Walleye Task Group (WTG). Because secchi readings do not always correlate well with water transparency values, relationships between LANDSAT satellite imagery and secchi (S. Shaw/J. Tyson; Binding et al. 2007) will be investigated. We will also determine if measures of light attenuation and total dissolved solids are available in order to improve quantification of water clarity and productivity.

Water transparency and temperature are extremely dynamic (e.g. secchi readings can change significantly within a day from a high precipitation event). We will likely generate several types of maps resulting from methods that build on different themes and techniques, thereby allowing us to understand how proportional areas of habitat by jurisdiction may change under different environmental conditions. We intend to explore the effects of seasonal changes by generating models in times of low, moderate, and high temperatures and precipitation levels. Not only will we develop these models based on mean seasonal values, but we will also examine high and low thresholds. We plan to run comparisons between a volume-based model and an area-based model, however, the literature indicates that the area-based model relates better with the harvest data (e.g. Christie and Regier 1988, Lester et al. 2004). Ultimately, this will allow us to compare proportional areas of preferred habitat under a variety of conditions. It would be ideal if these areas are similar independent of which method we use, thereby eliminating room for conflict. If they differ, it will help us understand the variability across these estimates.

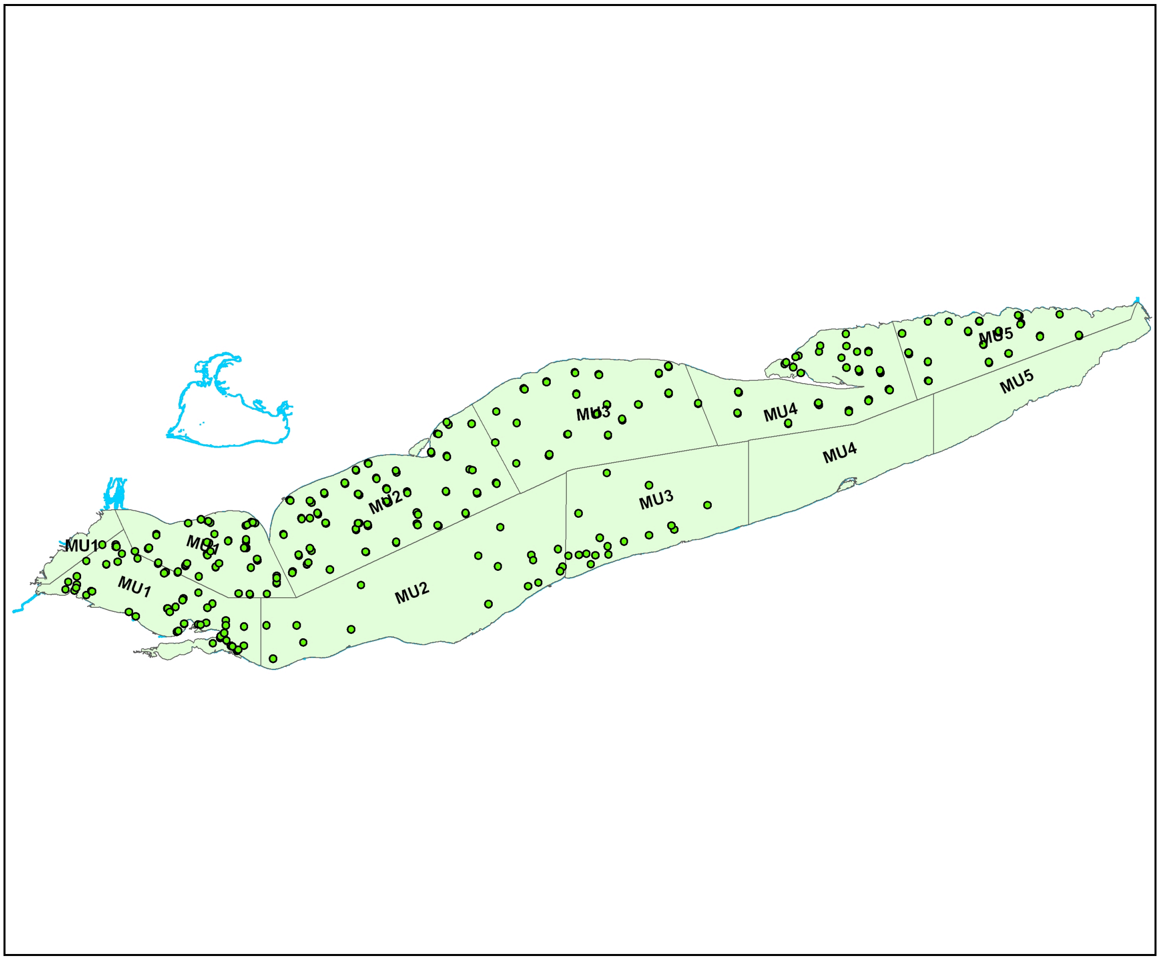

Figure 5.1. Locations of available secchi data from the Lake Erie Limnological Synthesis for 1990, relative to current management unit boundaries.

Once the models are developed, we will validate their accuracy with walleye catches as provided by the WTG. We were made aware of a gill net dataset from the early 1990's that has lakewide coverage within a season (WTG meeting, 2009). Recognizing that habitat has changed significantly in many ways since the 1990s, this validation exercise may be replicated for more recent years using Ontario's partnership gillnet index which, although constrained to Canadian waters, encompasses all three basins at one point in time. Confounding factors to this approach involve the significant movement patterns (even within seasons) that some Lake Erie walleye exhibit. Ultimately, we plan to overlay catch rates on different versions of the abiotic map model of preferred habitats. This will allow us to determine which techniques for quantifying the amount of preferred adult habitat (i.e. season averages, seasonal thresholds, volume vs. area, etc.) relate best to the catch data. At this point, we can decide if the best models are suitable or whether parameters need to be added.

We acknowledge that methods developed to justify the sharing of a resource such as fish, usually involve factors external to the biology/environment of the species in question. Even within a biological estimation of habitat, arguments around proportional entitlement could be made based on metrics such as production (which jurisdiction has more (or more productive) spawning or nursery habitat?). Keeping this in mind we hope to develop a number of options by which managers can use "walleye habitat" to justify a proportional allocation of the walleye harvest.

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Binding, C.E., J.H. Jerome, R.P. Bukata, and W.G. Booty. 2007. Trends in Water Clarity of the Lower Great Lakes from Remotely Sensed Aquatic Color. J. Great Lakes Res. 33(4):828-841.

Christie, G.C., and H.A. Regier. 1988. Measures of optimal thermal habitat and their relationship to yields for four commercial fish species. Can. J. Fish. Aquat. Sci. 45:301-314.

Lester, N.P., A.J. Dextrase, R.S. Kushneriuk, M.R. Rawson, and P.A. Ryan. 2004. Light and temperature: key factors affecting walleye abundance and production. Trans. Amer. Fish. Soc. 133:588-605.

STC. 2007. Quota Allocation Strategies. Report of the Standing Technical Committee to the Lake Erie Committee. 8pp. http://www.glfc.org/lakecom/lec/STC_docs/other_reports_and_docs/Quota%20allocation%20strategies%20-%20LEC.pdf

5.2 Other Fish Habitat Metrics

C.T. Knight and A.M. Gorman

Historic datasets of abiotic parameters that cover broad geographic areas have become more readily-available in recent years (e.g. National Buoy Data Center, National Climatic Data Center). Additionally, most agencies have now accumulated long-term annual recruitment indices from field surveys. Researchers are examining the relationship between these measures of environmental condition and year-class strength. One example of such work is a project initiated at the Fairport Fisheries Research Station, ODNR. In this study, researchers used water temperature to predict shoreward spawning migrations of adult yellow perch. They found that the extent and duration of the nearshore aggregations, in more optimal spawning habitats, were related to bottom temperatures. In addition to spawning temperature, they found that the start of the spawn (i.e. Julian date) and winter severity were related to trawl indices and predicted year-class strength. Below is a list of some references for similar projects in Lake Erie.

Presentations and Publications:

Crane, V. 2007. Lower trophic level and climate influences on western Lake Erie fish recruitment, 1988 through 2005. Master's Thesis. Ohio State University, Columbus, OH, pp. 105.

Einhouse, D. W., W. J. Culligan, and J. Prey. 2002. Changes in the smallmouth bass fishery of New York's portion of Lake Erie with Initiation of a spring black bass season. American Fisheries Society Symposium 31:603-614, 2002.

Hahn, C., T. Strakosh, and D. Einhouse. Influence of biotic and abiotic factors on walleye (sander vitreus) year class strength in Lake Erie. Great Lakes Research Consortium Annual Conference, Syracuse, NY, 2009.

Knight, C., and A.M. Gorman. Spawning dates and winter severity predict year class strength of Lake Erie yellow perch. 138th Annual Meeting of the American Fisheries Society, Ottawa, ON. 2008.

Zhao, Y., M. Jones, B. Shuter, E. Roseman. 2009. A biophysical model of Lake Erie walleye (Sander vitreus) explains interannual variations in recruitment. Can. J. Fish. Aquat. Sci. 66(1) 114-125.

Ongoing research:

Ludsin, S. 2006-2010. River discharge as a predictor of Lake Erie yellow perch recruitment. Ohio State University.

Section 6. Development of strategic research direction for the Environmental Objectives

A.M. Gorman and T. MacDougall

This charge, new to the HTG in 2007 involves the development of strategic research direction that is in accordance with the Lake Erie Environmental Objectives (Environmental Objectives Sub-Committee 2005). The Environmental Objectives (EO's) outline issues and the conditions required to attain environmental conditions addressed in the Fish Community Goals and Objectives (FCGO's, Ryan et al. 2003). The primary concerns of the FCGO's are: minimizing contaminant loading, maintaining adequate dissolved oxygen levels, and restoring water clarity and coverage of submerged aquatic vegetation. In addition to the FCGO's, the EO's address the importance of improving fish access to habitat, assessing water levels and climate change and the habitat impacts of invasive species, as well as restoring coastal and shoreline processes, hydrologic function of rivers, and fish habitat, if possible.

Direction on this charge as described last year involved an exploration general research needs around two broad topics: 1) The impact of climate variability on fish populations, and 2). human activity in the coastal margin and its impact on nearshore fish dynamics including development of an understanding of the physical processes involved in the connectivity between watersheds and the lake proper. Acknowledged limitations included information gaps around detailed information about how fish relate to their environments across a range of spatial scales. As we wrote last year: The EO's pertain to projects that encompass very broad spatial scales. Before confidently directing actions across these broad scales, we feel attention needs to be focused on obtaining more detailed information about how fish relate to their environments on a variety of smaller scales.

Little progress has been made on addressing this charge in a tangible way over the previous year. Recent discussions have led us to the conclusion that any strategic direction developed needs to address fish habitat in a much more specific way than the general statements of objectives as laid out in the EO document. In the upcoming year, a survey of the other, species specific task groups (originally planned for 2008) will ensure that we address common research interests across the groups. It has been decided that the development of a "white paper" on desired research direction and priorities (including locations and data gaps) should be developed as a concrete product that can be distributed for use by not only by the LEC but by universities, agencies, and NGOs seeking to develop habitat-related programs pertaining to fisheries management. This document will be developed in the coming year and will ultimately be available on the HTG website.

References

Environmental Objectives Sub-Committee. 2005. Report of the Environmental Objectives Sub-Committee of the Lake Erie Committee, Great Lakes Fishery Commission, July 2005. Presented to the Standing Technical Committee, Lake Erie Committee of the Great Lakes Fishery Commission. Ann Arbor, Michigan, USA. Available at www.glfc.org.

Ryan, P.A., R. Knight, R. MacGregor, G. Towns, R. Hoopes, and W. Culligan. 2003. Fish-Community Goals and Objectives for Lake Erie. Great Lakes Fishery Commission Special Publication 03-02. Available at www.glfc.org.

Section 9. 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 10. Acknowledgements

The habitat task group would like to acknowledge Jeff Tyson (ODNR) for continued input and advice. We also appreciate the efforts of Dr. Timothy Johnson (OMNR) including his input regarding the compilation of fish habitat metrics.