

**Report of the
Lake Erie
Habitat Task Group**



Big Creek Marsh, Long Point Wetlands Complex

March 2006

Prepared by members:

Jeff Tyson
Tom MacDougall
Bob Haas
Roger Kenyon
Scudder Mackey
Jim Markham
Patrick Kocovsky
Ed Rutherford
Elizabeth Wright

Ohio Department of Natural Resources (co-chair)
Ontario Ministry of Natural Resources (co-chair)
Michigan Department of Natural Resources
Pennsylvania Fish and Boat Commission
University of Windsor
New York State Department of Environmental Conservation
USGS-Lake Erie Biological Station
University of Michigan
Ontario Ministry of Natural Resources

Presented to:

**Standing Technical Committee
Lake Erie Committee
Great Lakes Fishery Commission**

Table of Contents

Section 1. Charges to the Habitat Task Group	3
Section 2. Document Habitat Related Projects	3
2a. Habitat Project Descriptions	3
2b. Bi-national Mapping Project	5
2c. Huron-Erie Corridor Habitat Assessment	6
Section 3. Complete Environmental Objectives.....	8
Section 4. Develop Strategies to Work With LaMP	9
Section 5. Lake Erie GIS Development	11
Section 6. Lake Trout Spawning Habitat	12
Section 7. Protocol for Use of HTG Data	13
Section 8. References	13
Section 9. Figures	15
Appendix 1. Habitat Related Projects in the Lake Erie Watershed	17

Section 1. Charges to the Habitat Task Group 2005-2006

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. Complete the final draft of the Environmental Objectives document.
3. Develop strategies to work with the Lake Erie LaMP as a vehicle to resolve environmental issues, beyond the mandates of fisheries agencies.
4. 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.
5. Assist the Coldwater Task Group in determining additional lake trout spawning habitat in Lake Erie.

Section 2. Document habitat related projects

(Tom MacDougall)

The HTG has continued to document and track progress on habitat related initiatives taking place throughout the Lake Erie basin. Included in the listing are efforts directed at i) assessment or monitoring of habitat, ii) creation of rehabilitation strategies, management plans or tools, and iii) implementation of habitat rehabilitation projects (Appendix 1). In several cases, continuity can be seen between the completion of an assessment project and the move to creation of rehabilitation strategies and ultimately implementation. In addition to new, proposed, and ongoing projects, the listing now provides information about completed projects along with references to related completion reports and/or summary documentation.

Section 2a. Habitat Project Descriptions

A total of 24 projects involving the monitoring or evaluation of habitat were identified in 2005. Several of these projects are ongoing long-term or annual programs which are tracking habitat conditions over multiple years. Examples of these projects include the ongoing sturgeon habitat surveys conducted by the Michigan Department of Natural Resources (MDNR) and plant community mapping in Lake St. Clair and the St. Clair River. Some of the shorter term projects listed in 2004 have been completed and are either at the reporting stage (e.g. the Army Corps of Engineers/Ohio Division of Wildlife's examination of the

Maumee River plume) or have produced documents which are now being utilized to focus more directed assessments or to direct implementation strategies. For example, previous wetland assessments in the Grand River and Rondeau Bay, Ontario, are complete and results are being used to focus new water quality, invasive species, and dissolved oxygen research in these areas in 2006. New listings include a multi-agency, led by NYSDEC, investigation of potential lake trout habitat (detailed in Section 7 of this report) and wetland assessments by Ontario's MNR in coastal areas, the Thames River watershed, and the Niagara River (Ont) AOC.

A total of 12 projects were identified under the heading of "Rehabilitation strategies: workshops, working groups and tools development". Several previous projects, including three Lake St. Clair initiatives (a Canadian watershed conditions report, fish community goals and objectives and a bi-national lake management plan) have been completed and details regarding related documents and reports are referenced on the last page of Appendix 1.

Significant progress has been made in two of the listed habitat mapping projects. The Lake Erie Bi-national Mapping project has been moving toward an ecological based classification of open water habitat within in the basin, and completion is expected before the end of 2006. A more extensive summary of the products resulting from this project is included below. The Great Lakes Aquatic Coastal Gap program has been running models aimed at predicting abundances of common fish species within parts of the basin and is continuing to expand and develop its functionality with regard to less common fish species and habitat analysis. New to this section is a working group, the Southern Grand River Work Group that is developing a habitat rehabilitation strategy for the Grand River (Ont). This represents the next step for several of the recently completed Grand River projects listed as complete in the assessment section.

A total of 25 listings representing implementation projects and strategies were identified in 2005. Many of the projects found in this section are ongoing, multi-year initiatives. The Lake Erie LaMP Habitat Strategy 2004 has been completed and is now available as a web-based document. The Lake Erie LaMP 2006 document will be completed and available by May 2006. The Belle Isle/Detroit River Sturgeon Habitat Restoration project, headed by USGS, has been implemented and is currently being monitored for success. The Middle Harbor Fish Habitat Restoration project, (Ohio Department of Natural Resources (ODNR), Division of Wildlife and Division of State Parks), detailed in a previous report, will begin in the coming year to create islands by beneficially reusing dredge material. Other enhancements at Middle Harbor include breaching several dikes to allow for fish passage as well as to increase water circulation into this coastal marsh. Several of the western basin- AOC projects are ongoing and current updates are to be found by accessing web-sties referenced in the appendix table.

A newly proposed initiative, the Huron-Erie Corridor System Habitat Restoration Opportunities – Creating Sustainable Aquatic Habitat, will direct opportunities for protection and restoration by focusing on habitat process and function. This project is the natural follow up to much of the information gathered in the Huron-Erie Corridor Habitat Assessment project. A more extensive description of the objectives and products associated with the Huron-Erie Corridor Habitat Assessment project follows.

The complete project list, “Habitat Related Projects within the Lake Erie Watershed”, currently presented as an appendix table in the Habitat Task Group annual report, continues to grow and evolve. In order to make the information more accessible, preliminary steps were taken in 2005 to have the listing posted on the GLFC website. In the coming year (2006), the HTG will contribute to the design and content of a habitat web-page which, in addition to the habitat project table, will include position statements (LEC, GLFC, IJC, LaMP), white papers and other habitat related information. This initiative will make the habitat project list available to a wider audience and allow for updates, additions, and changes, to be made on a more regular basis.

Section 2b. Bi-national Mapping Project

(Scudder Mackey)

This project, funded by U.S. EPA – Great Lakes National Program Office, will develop an integrated habitat classification and map for the Lake Erie basin that can be used to assist the Lake Erie Lakewide Management Plan (LaMP) to develop a bi-national inventory of the status and trends in the quantity and quality of fish and wildlife habitats in the basin. The integrated habitat map will be used to track improvements in habitat quantity and quality resulting from preservation, conservation, and restoration efforts and to guard against further loss or degradation from land-use alterations.

Specifically, this project will: 1) develop and implement a unified, consensus-based classification of six Lake Erie habitat zones from data available in existing habitat mapping projects; and 2) develop a geospatial database that integrates classification systems at relevant scales into map layers and eventually into a single, integrated Geographic Information System (GIS) habitat map of the Lake Erie basin for the United States and Canada. This project addresses the need for a unified, consensus-based habitat classification system and inventory, which is a fundamental prerequisite to managing and conserving critical habitats and maintaining ecological integrity within the Lake Erie basin.

The Principal Investigator for the project is Dr. Lucinda Johnson from the Natural Resources Research Institute, University of Minnesota Duluth. Other members of the bi-national project team include: Dr. Jan Ciborowski and Dr. Scudder Mackey from the University of Windsor; Mr. Ric Lawson from the Great Lakes Commission; Dr. Nick Mandrak from Fisheries and Oceans Canada; Mr. Dan

Button from the U.S. Geological Survey; and Mr. Tom Hollenhorst from the Natural Resources Research Institute, University of Minnesota Duluth.

In early June 2005, an Experts Workshop was held at the Franz Theodore Stone Laboratory on Gibraltar Island to identify existing geospatial datasets within the Lake Erie basin and assess habitat classification schemes currently in use within the basin. Subgroups were established to further identify geospatial datasets and explore classification schemes within six natural and semi-natural habitat zones, including terrestrial, inland aquatic, coastal wetland, coastal margin, nearshore, and open water areas of the basin. These experts form the core of a Habitat Working Group that continues to provide guidance to the project team during the testing and validation phase of the project. A dynamic classification scheme will be tested in two pilot watersheds – the Maumee River watershed in northwestern Ohio and the Grand River watershed in southern Ontario.

A second workshop, held in January 2006 reviewed and reached consensus on zone boundaries and an integrated hierarchical habitat classification scheme based on recommendations from each of the habitat zone subgroups. Geospatial coverages and linkages between those coverages were identified and compiled along with a list of critical attributes based on physical, chemical, and biological components for each of the six environmental zones. Ongoing subgroup discussions are guiding the development of processing algorithms to further develop the classification protocols for each of the environmental zones. Initial products should be available for review in late spring 2006.

The project team is collaborating with ongoing habitat assessment projects in the basin, including the University of Michigan's Institute for Fisheries Research Great Lakes GIS project, which is intended to provide fisheries resource managers with comprehensive geospatial datasets, and ongoing U.S. Geological Survey Aquatic GAP and U.S. EPA STAR projects designed to evaluate the biological diversity of aquatic species and their habitats. The project team is also developed a strategy to apply the comprehensive classification scheme to the entire Lake Erie basin, and will develop a bi-national habitat map data exchange website to include links to geospatial metadata and habitat coverages in the basin. The Lake Erie habitat classification and mapping project will serve as a model for developing a comprehensive basin-wide habitat classification system and inventory for the entire Great Lakes basin.

Section 2c. Huron-Erie Corridor Habitat Assessment (Scudder Mackey)

This project, funded by the Great Lakes Fishery Commission through the USFWS Restoration Act and sponsored by the Michigan Department of Natural Resources, established a framework and designed a process to systematically identify, coordinate, and implement bi-national aquatic and fish habitat restoration opportunities in the Lake Huron to Lake Erie Corridor (Huron-Erie Corridor, HEC) within the context of long-term water-level regime changes resulting from direct anthropogenic hydromodification and/or potential effects of global climate change.

In 2005, the University of Windsor and the Ohio State University hosted three Lake Erie Millennium Network (LEMN) research needs workshops to provide guidance on current and future research needs and to develop a long-term strategy to identify and assess high-quality aquatic and fish habitats within the HEC. These Experts' Workshops brought together fishery biologists, aquatic ecologists, physical scientists (geologists, hydrologists), and resource managers to: 1) assess the adequacy of existing physical and biological datasets within the HEC system, identify gaps and prioritize additional habitat research/data collection needs (Workshop 3.01); 2) explore issues associated with developing and validating robust physical and ecological models to predict current and future locations of critical aquatic and fishery habitats within the HEC system (Workshop 3.02); and 3) apply existing data and models to a range of "transitional habitat" issues, including refinement of conceptual models of habitat succession, i.e. "step-stone" or transitional habitats and refugia associated with anticipated changing water-level regimes in the HEC (Workshop 3.03).

Three major environmental zones were identified based on hydrogeomorphic characteristics and dominant physical processes. These zones include connecting channels and adjacent riparian areas, the St. Clair delta and adjacent wetland complexes, and nearshore, coastal margin, and open-water areas of Lake St. Clair. Critical data collection and research needs were identified, including the need for: 1) high-resolution bathymetry and substrate distribution data in nearshore/coastal areas of Lake St. Clair; 2) flow, circulation, and temperature distribution patterns - both daily and seasonal throughout the entire system; 3) the location and characteristics of active spawning and nursery habitats; 4) the distribution of seasonal larval, YOY, adult fish, benthic invertebrate, aquatic macrophytes, and species-at-risk; 5) the location, distribution, and stability of contaminated sediments; and 6) seasonal data on nutrient and contaminant loadings.

Workshop participants also identified a critical need to develop an integrated 3-dimensional hydrodynamic model that predicts flow and water levels in the connecting channels, the St. Clair delta, and circulation patterns and water levels in Lake St. Clair *as a single hydrodynamic system*. Also identified was the need

to develop integrated ecological models for each of the three major environmental zones that predict changes in habitat distribution and response of aquatic/coastal margin vegetative communities and fish/benthic communities to altered flow and water-level regimes.

A long-term research strategy was developed that identifies the following critical research elements: 1) A historical comparison with current HEC system aquatic and fishery habitats, including habitat distribution, pattern, and function in order to assess the degree of habitat alteration and the stressors that cause those alterations; 2) The development of scenarios based on physical and ecological models that explore habitat impacts resulting from potential long-term changes in water-level regime, assess the potential degree of habitat alteration, and identify potential long-term management, protection, and restoration opportunities based on historical habitat distribution, pattern, and function; and 3) development of tools and build capacity of key agencies, organizations, and institutions to identify and implement protection, restoration, and enhancement opportunities based on sound science as part of a long-term, bi-national fishery and aquatic habitat research and monitoring effort within the HEC system.

Section 3. Complete Environmental Objectives document (Jeff Tyson)

In accordance with the Joint Strategic Plan for Management of the Great Lakes Fisheries (1997) the Lake Erie Committee has established Fish Community Goals and Objectives (FCGOs) for Lake Erie (Ryan et al. 2003). The next step in the Joint Strategic Plan strategy was to identify the environmental conditions necessary to support achievement of the FCGOs and to define them as Environmental Objectives. To this end, a draft Environmental Objectives document (Davies et al. 2005) was developed by the Habitat Task Group and reviewed and endorsed by the Lake Erie Committee in 2005. Following Lake Erie Committee approval, the document was submitted to the Great Lakes Fishery Commission and subsequently published as a draft document on the Commissions website (www.qlfc.org). As of March, 2006 the document has been reviewed and finalized and will be submitted to the Great Lakes Fishery Commission as final, and posted on the Commission's website.

The Environmental Objectives document is intended to provide guidance to fishery and environmental management agencies in the form of descriptions of the various environmental conditions affecting the Lake Erie fisheries resources. Additionally, the Environmental Objectives document outlines issues or conditions necessary to achieving habitat conditions that are important to achieving the Lake Erie Committees stated FCGOs. The document provides examples of indicators of favorable conditions and provides policy, regulation, implementation, and strategic recommendations for achieving those conditions.

In the document habitat is defined in two ways – as an identifiable environmental feature (e.g. wetland, bay, rubble shoal etc.) or as a place where conditions were suitable for a fish species (e.g. oxygen, transparency) to survive and reproduce. Lake Erie is a mosaic of habitats whose distribution and characteristics depend upon the current dynamic equilibrium of physical structuring forces interacting with substrates and the water column, as well as biological structuring forces. Habitat units are lost or modified when the physical forces or processes are modified (e.g. shoreline structures interfere with coastal drift, modified hydrology of rivers affects seasonality of flows etc.). With this as the rationale for the development of the Environmental Objectives, the Habitat Task Group identified ten Environmental Objectives that were necessary to address the FCGOs. These ten objectives identify important environmental structures, processes or conditions that must be addressed at a number of spatial scales to effect achievement of the FCGOs.

Ultimately, the achievement of Environmental Objectives should lead to significant progress towards attainment of FCGOs for Lake Erie. Achievement of these objectives, however, cannot be completed by fisheries managers alone. Fisheries managers must identify the ecological and economic benefits of targeted rehabilitation work, develop strategic alliances, and influence priorities for funding with other agencies working in the environmental management realm.

Section 4. Develop strategy to work with Lake Erie LaMP (Beth Wright, Jeff Tyson)

In 2005, the task group continued to use the strategies developed in 2004 to work with the Lakewide Management Plan (LaMP) and environmental agencies to resolve environmental issues beyond the mandates of the fisheries agencies: 1) the development of Environmental Objectives, 2) the use of LEC position statements, and 3) active involvement with the LaMP. For a description of activities associated with the first strategy, (Environmental Objectives) see Section 3. The second strategy above is based on the LEC's capacity to issue position statements concerning issues that are beyond the scope of member management agencies. The LEC has released six significant statements (Table 1) and the Habitat Task Group participated in the drafting of the current Water Level Position Statement. These have been appended to the Environmental Objectives document.

Table 1. Position statements issued by the Lake Erie Committee and date of issuance

	Statement	Date of Issue
1	Water Level Position Statement	2005
2	LaMP Rehabilitation of Near shore Habitat and Lower Tributaries	2002
3	Position Statement on Ballast Water Management	2000
4	Position Statement Regarding Structuring of Native Fish Communities in the 21 st Century	1999
5	Position Statement Concerning Lower Trophic Level Changes and Their Implications to Fish Community Composition and Productivity in Lake Erie	1998
6	Lake Erie Interim Position on Phosphorus Management in Lake Erie	1995

All of the LEC position statements will be posted on the GLFC's Habitat webpage in 2006.

The third strategy above was achieved using the Lake Erie Environmental Objectives (Davies et al. 2005) for guidance in LaMP participation by Habitat Task Group members. Task Group members represented the Lake Erie Committee in several LaMP tasks in 2005/06 including LaMP workgroup participation, participation in a LaMP Indicators workgroup, and reviewed the draft 2006 LaMP Update document. The 2006 LaMP update is currently being reviewed by the LaMP Management Committee and is slated for release in April 2006. The LaMP Workgroup focus will be changing over the next two years from assessment to implementation and should further make use of the Habitat Strategy, developed with HTG input, during the implementation phase.

Task Group members have been actively involved in as members of the LaMP Indicators workgroup. The Indicators workgroup has been charged with developing a suite of indicators that will be used to: assess overall ecosystem management integrity; evaluate components contributing to change; evaluate important components for reporting and long-term trends; and have a predictive capacity (i.e., they allow us to anticipate problems and adopt a proactive approach). Currently the LaMP indicators workgroup has developed a list of >80 potential indicators across five habitat types (terrestrial, stream, coastal wetlands, nearshore, and offshore) and three indicator categories (pressure, process, and state). The workgroup is currently in the process of refining the list of indicators based upon a set of pre-established criteria for indicator selection. The result will be a suite of indicators that meet the needs of the Lake Erie LaMP. Task group members have used a number of LEC products, including the draft

Environmental Objectives and the Fish Community Goals and Objectives to inform the process. For example, hydrologic alteration, total chlorophyll, water transparency, production and yield and fish community targets have all been established in the EOs and FCGOs and these have been incorporated into the indicator suite to date. For further details on the Indicators workgroup progress, see the LaMP 2006 Update.

Section 5. Lake Erie GIS Development

(Chris Geddes, Bob Haas)

In December 2005, a prototype Lake Erie GIS was distributed to contacts at several agencies and institutions interested in Lake Erie basin resources as well as all members of the Habitat Task Group. Agencies and institutions that received the prototype GIS include: Ontario Ministry of Natural Resources (OMNR), Ohio Department of Natural Resources (ODNR), Michigan Department of Natural Resources, New York Department of Environmental Conservation (NYSDEC), the Pennsylvania Fish and Boat Commission, the University of Windsor, and the University of Minnesota Duluth. Development of the GIS has continued; since the distribution of the prototype GIS, several datasets have been added to the GIS (e.g., LIO data), as well as a complete and more extensive User Guide. Moreover, feedback will be solicited from those that received the prototype GIS, and any feedback received will be incorporated in the Lake Erie GIS v. 1.0.

A major objective of the Lake Erie GIS Project is to derive an ecological classification of fish habitats in Lake Erie. The Institute for Fisheries Research has partnered with ODNR and the Bi-national Map Project to classify fish habitats, with a focus on the open-water region of Lake Erie (i.e., beyond 15-m bathymetric contour). Preliminary results were presented at the Lake Erie Millennium Network conference in February 2006. Development of the ecoregional classification has continued and newly available data are being incorporated. Refined results will be presented at the International Association for Great Lakes Research (IAGLR) conference in May 2006.

The original deadline for the Lake Erie GIS v. 1.0 was December 31, 2005. A no-cost extension was granted by the Great Lakes Fishery Commission mainly due to the deficiency of several critical datasets, including Land Information Ontario (LIO) data (i.e., Ontario's base data) and Ontario tributary classification data. The extended deadline is July 31, 2006.

Section 6. Lake Trout Spawning Habitat **(Patrick Kocovsky, Ann Marie Gorman, Jim Markham, Scudder Mackey)**

In 2005, the Habitat Task Group was given the task of identifying potential lake trout spawning habitat in Lake Erie. This task was added to assist the Coldwater Task Group with their charge of restoring a viable population of lake trout in Lake Erie. The goal of this exercise is to identify areas with suitable physical habitat for lake trout spawning within Lake Erie so that future stocking efforts may be directed at those sites. Our examination of potential spawning areas will be comprehensive in that we will seek to identify a wide range of potential habitats suitable to different lake trout morphs (e.g., deepwater spawners) to potentially broaden the strains and origins of lake trout that might be used in future stocking operations.

Methods and Preliminary Results

Our effort began with a review of the literature on lake trout spawning (Edsall 1990; Edsall and Kennedy 1995; Fitzsimons 1995; Gunn 1995; Marsden et al. 1995; Fitzsimons and Williston 2000) to identify physical characteristics where lake trout are known to spawn. Sites were identified as most suitable for lake trout spawning if they: 1) consist of steeply sloping (>8%), hard surfaces with deep interstices within bedrock or coarse, loose substrates (e.g. boulders) and 2) receive moderate wave action or subsurface currents to carry away fine sediments. In lakes with very deep water, deep areas adjacent to suitable spawning areas were identified as important rearing areas (Schram et al. 1995). We also reviewed Goodyear et al. (1982) to identify purported historic spawning sites for lake trout. Brocton shoal, a bedrock outcropping which is a purported spawning site along the southern shore WSW of Van Buren Point, was also examined for maximum slope. We then used GIS (ArcView v. 3.3) and existing data on bathymetry and substrate to locate all areas within Lake Erie where slopes were at least 8% and substrate was bedrock or boulder/cobble.

Very few sites met the 8% slope criterion identified from the literature. The maximum slope identified near Brocton Shoal was only about 5%, so we used a minimum slope of 5% for our final determination of potential spawning sites. We identified several sites primarily in the eastern and western basins of Lake Erie where there is a 5% slope over hard substrate. To verify substrate, we overlaid potential lake trout spawning sites in the western basin with side-scan sonar data provided by the Ohio Geological Survey. All of the identified sites were indeed over hard substrate, primarily bedrock and boulder/cobble.

Potentially suitable sites based on substrate and slope in the western basin were located around Sugar Island, Rattlesnake Island, Green Island, South and Middle Bass Islands, and Kelley Island in US waters. No steep areas with hard substrate were identified in Canadian waters, but Goodyear et al. (1982) reported that waters off of Pelee Point were historical spawning grounds based on capture of mature females. High slope areas were also identified throughout the central

basin near man-made breakwaters and ports in US waters. In the eastern basin, 4 areas between 55 and 60 m in depth near the center of the eastern basin were identified. We also identified areas near Long Point that are suitably steep (Figures 1-4). Several smaller areas were located in nearshore areas along both the Canadian and US borders. Figures 1-4 demonstrate that these areas are relatively small, generally less than 2.5 km².

Several members of the Habitat Task Group submitted a proposal to the GLFC for funding to further examine the sites identified in the first phase of this exercise. We proposed to use side-scan sonar (in those sites not already examined) RoxAnn sonar, underwater video imaging, and diving to fully examine substrate type (i.e., bedrock, boulder, cobble) and interstice depth. The type and extent of future work is contingent upon funding.

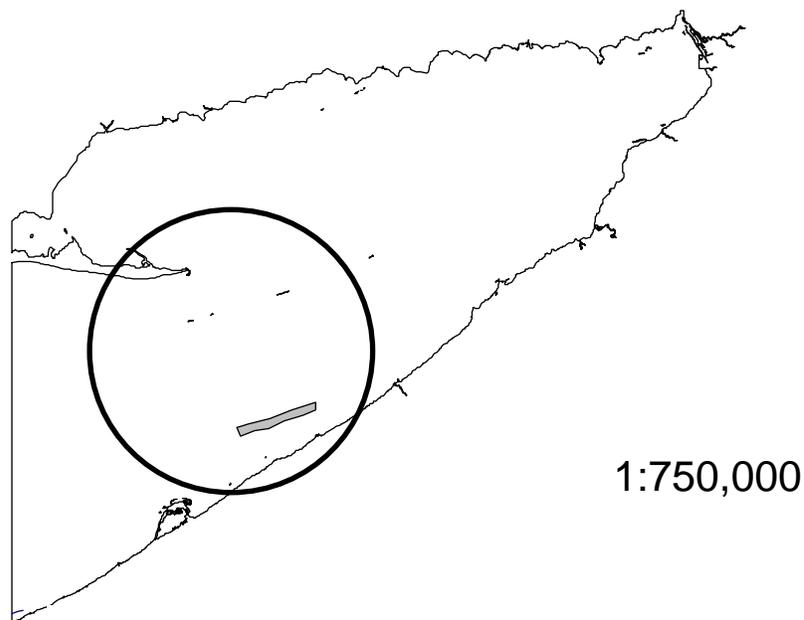


Figure 1. Approximate areas of Lake trout spawning habitat (gray areas) in the eastern basin of Lake Erie based upon slope (>5%) from bathymetry charts as well as coarse substrate distribution maps (1:750,000 scale). Area of interest in circle.

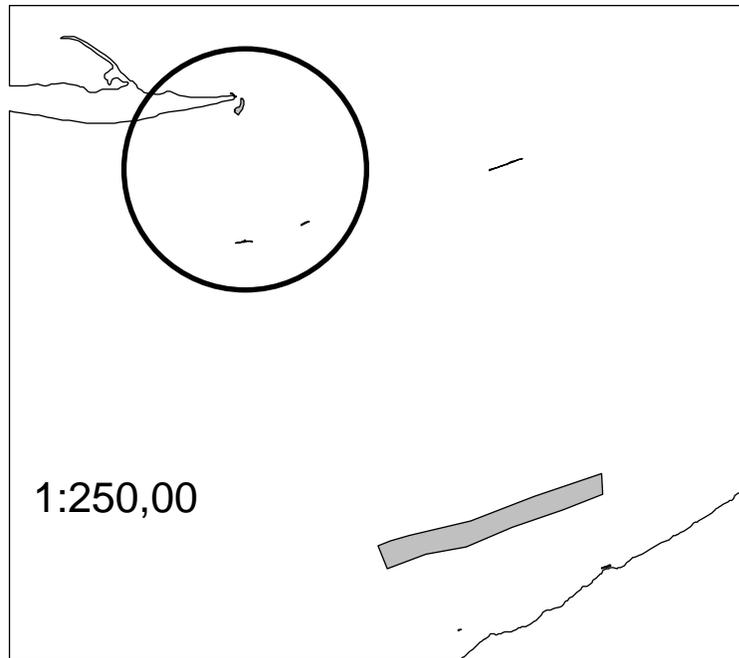


Figure 2. Approximate areas of Lake trout spawning habitat (gray areas) in the eastern basin of Lake Erie based upon slope (>5%) from bathymetry charts as well as coarse substrate distribution maps (1:250,000 scale). Area of interest in circle.

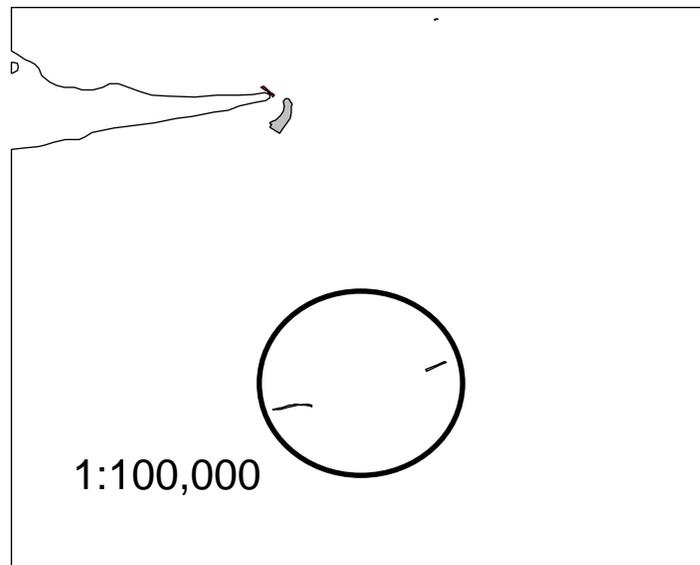


Figure 3. Approximate areas of Lake trout spawning habitat (gray areas) off Long Point in the eastern basin of Lake Erie based upon slope (>5%) from bathymetry charts as well as coarse substrate distribution maps (1:100,000 scale). Area of interest in circle.

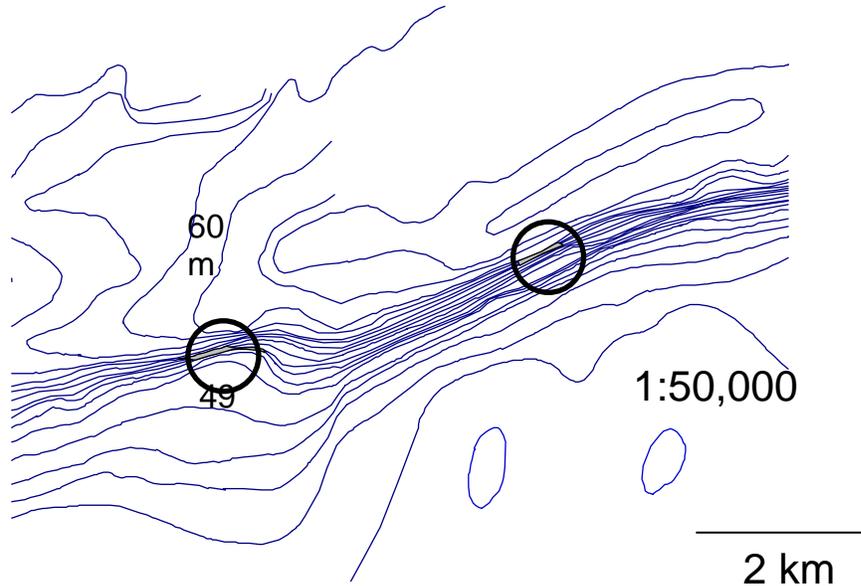


Figure 4. Approximate areas of Lake trout spawning habitat (gray areas) off Long Point in the eastern basin of Lake Erie based upon slope (>5%) from bathymetry charts as well as coarse substrate distribution maps (1:50,000 scale). Area of interest in circle.

Section 7. 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 8. References

- Davies, D., B. Haas, L. Halyk, R. Kenyon, S. Mackey, J. Markham, E. Roseman, P. Ryan, J. Tyson, and E. Wright. 2005. Lake Erie Environmental Objectives. Report of the Environmental Objectives Sub-Committee of the Lake Erie Committee. Great Lakes Fishery Commission, Ann Arbor, MI.
- Edsall, T. A. 1990. Surficial substrates and bathymetry of five historical lake trout spawning reefs in nearshore waters of the Great Lakes. Great Lakes Research Completion Report, Ann Arbor, 29 pp.
- Edsall, T. A., and G. W. Kennedy. 1995. Availability of lake trout reproductive habitat in the Great Lakes. *Journal of Great Lakes Research* 21(Supplement 1):290-301.
- Fitzsimons, J. D. 1995. Assessment of lake trout spawning habitat and egg deposition and survival in Lake Ontario. *Journal of Great Lakes Research* 21(Supplement 1):337-347.
- Fitzsimons J. D., and B Williston. 2000. Evidence of lake trout spawning in Lake Erie. *Journal of Great Lakes Research* 26:489-494.
- Goodyear, C. S., T. A. Edsall, D. M. Ormsby, G. C. Ross, and P. E. Polanski. 1982. Atlas of the spawning and nursery areas of Great Lakes fishes. Volume 9: Lake Erie. Wildlife Services, Washington D.C., FWS/OBS-82/52. 193 pp.
- Gunn, J. M. 1995. Spawning behavior of lake trout: effects on colonization ability. *Journal of Great Lakes Research* 21(Supplement 1):323-329.
- Marsden, J. E., J. M. Casselman, T. A. Edsall, R. F. Elliott, J. D. Fitzsimons, W. H. Horns, B. A. Manny, S. C. McAughey, P. G. Sly, and B. L. Swanson. 1995. Lake trout spawning habitat in the Great Lakes: a review of current knowledge. *Journal of Great Lakes Research* 21(Supplement 1):487-497.
- 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. 56 p.
- Schram, S. T., J. H. Selgeby, C. R. Bronte, and B. L. Swanson. 1995. Population recovery and natural recruitment of lake trout at Gull Island Shoal, Lake Superior, 1964-1992. *Journal of Great Lakes Research* 21(Supplement 1):225-232.