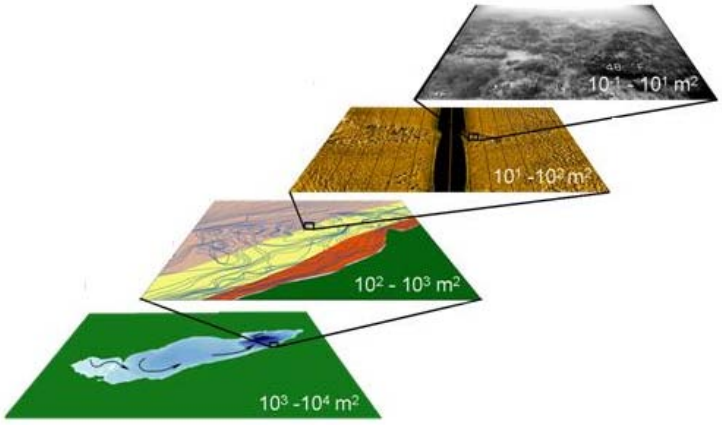
Report of the

Habitat Task Group

Lake Erie



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

March 2008

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Standing Technical Committee
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Section 1. Charges to the Habitat Task Group 2007-2008

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.

5. Develop strategic research direction for Environmental Objectives.

Section 2. Document Habitat Related Projects

A.M. Gorman and T. MacDougall

In 2007, the HTG continued to document and track habitat related initiatives taking place throughout the Lake Erie and Lake St. Clair basins. With the help of Christine Geddes (Great Lakes GIS project, UM, MDNR) and Hao Zhuang of the Great Lakes Fishery Commission, an online spatial inventory of these projects was generated last year and can be found 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. It is our intent that the online spatial inventory will be updated annually in late spring. With the assistance of Hao Zhuang, we are also in the process of developing a counter for the HTG web pages to determine the amount of online traffic visiting the spatial inventory as well as visitation to our main home page.

This year's table includes a field for 'Variables measured'. This field was added to help track metrics that are measured during each assessment. Environmental variables measured during the surveys include: water temperature, pH, and dissolved oxygen (bottom, surface/profiles), water clarity (secchi), depth (high resolution data), sediment (sidescan/Ponar grabs), water velocity, river flow regimes, nutrients, vegetative coverage and light penetration.

As in previous years, the current appendix table divides initiatives into the following categories: i) assessment or monitoring of habitat, ii) creation of rehabilitation strategies, management plans or tools and iii) implementation of habitat rehabilitation projects. 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 this year's table, twenty-six entries have been classified as 'Habitat monitoring and evaluation' projects. Several of these projects have been carried over from previous versions because they involve ongoing, long-term, or annual programs; which are tracking habitat conditions over multiple years. A new addition to this list is the Lake Erie Limnological Synthesis Project, lead by Dr. Timothy Johnson (OMNR). The objective of this project is to compile interagency datasets of temperature, dissolved oxygen and water clarity in order to conduct broad scale comparisons (in space and time) using a GIS interface. We believe the addition of the 'variables measured' field to our habitat-related projects table will provide an even more comprehensive list of potential sources for datasets that could eventually be incorporated into the Lake Erie Limnological Synthesis Project.

A total of 14 projects were identified as 'Rehabilitation Strategies' and may involve workshops, working groups or development of tools. Through the Ohio Balanced Growth Program, the Chagrin River Watershed Partners, Inc. (http://www.crwp.org) has made considerable progress towards prioritizing development and conservation areas in the Chagrin Watershed, Ohio. Land plats were geospatially delineated and prioritized based on a variety of metrics. Development areas are predicted to have negligible impact on the watershed and other conditions imply that further development would be acceptable (i.e. that there is existing urbanization in proximity to these locales). A change in landuse in a conservation area, on the other hand, is expected to have a high impact on the watershed with respect to flooding, erosion, and water quality, and, therefore needs protected. This project is an excellent example of regional-based planning that is increasingly significant for managing urban runoff, which brings excessive sediment loads to the nearshore areas of Lake Erie, as well as affecting the stability of hydrologic regimes in its tributaries.

A total of 25 listings representing 'Rehabilitation Projects', which involve implementation of research strategies, are identified in the current table. These projects all represent ongoing multi-year initiatives and have been listed previously. Changes have been made where warranted.

Detailed descriptions of several initiatives documented in the project list are provided below:

2a. Bi-national Mapping Project – An Integrated Habitat Classification Map of the Lake Erie Basin

S. Mackey

This project, funded by U.S. EPA – Great Lakes National Program Office, developed an integrated habitat classification and map for the Lake Erie basin. This project developed tools 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 Lake Erie 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: 1) developed and implemented a unified, consensus-based classification of six Lake Erie habitat zones from data available in existing habitat mapping projects; and 2) developed a geospatial database that integrates classification systems at relevant scales into map layers and eventually into a single, integrated GIS habitat map of the Lake Erie basin for the United States and Canada. This project addressed 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 project team collaborated with ongoing habitat assessment projects in the basin, including a Great Lakes Fishery Commission-supported GIS project through the University of Michigan's Institute for Fisheries Research 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 developing a strategy to apply the comprehensive classification scheme to the entire Lake Erie basin and will develop a binational habitat map data exchange website that will 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 basinwide habitat classification system and inventory for the entire Great Lakes basin. A final report, workshop summaries and presentations, maps and datasets, and additional materials can be accessed at http://www.glc.org/eriehabitat/.

Project Contacts: Dr. Lucinda Johnson (Natural Resources Research Institute, University of Minnesota Duluth). Project team: Dr. Jan Ciborowski and Dr. Scudder Mackey (University of Windsor); Mr. Matt Doss (Great Lakes Commission); Mr. Dan Button (U.S. Geological Survey); Mr. Tom Hollenhorst (Natural Resources Research Institute, University of Minnesota Duluth).

2b. Huron-Erie Corridor System Habitat Assessment – Changing Water Levels and Effects of Global Climate Change

S. 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 binational aquatic and fish habitat restoration opportunities in the Lake Huron to Lake Erie Corridor (Huron-Erie Corridor, HEC) within a 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 (Saxon, 2003) associated with anticipated changing water-level regimes in the HEC (Workshop 3.03).

A research strategy was developed that identifies the following critical research elements: 1) A comparison of historical reports of the location of high quality aquatic and fishery habitats with current distribution of those habitats in the HEC in order to asses the degree of habitat alteration and the stressors that cause those alterations; 2) The development of physical and ecological models that can simulate 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) develop 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, binational fishery and aquatic habitat research and monitoring effort within the HEC system. A summary report, workshop summaries, presentations, and additional materials can be accessed at http://www.lemn.org/ under *Workshop – Huron-Erie/Lake St. Clair Corridor Workshops*.

The climate change summaries from this project were presented at a symposium hosted by Michigan State University entitled *Climate Change in the Great Lakes Region: Decision-Making under Uncertainty* March 15 - 16, 2007. Symposium proceedings can be found at:

- http://environment.msu.edu/climatechange/abstracts.html

- http://environment.msu.edu/climatechange/presentations.html

Project Contacts: Dr. Jan Ciborowski and Dr. Scudder Mackey (University of Windsor)

2c. 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 NFWCO and the USGS Great Lakes Science Center are compiling and analyzing data to produce viewable maps of juvenile and adult sturgeon habitat in North Channel of the river with completion expected by spring 2008. 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.

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

Belle Isle Spawning Reef
In 2004, three fish spawning beds were constructed near the southeast corner of Belle Isle to provide spawning habitat for lake sturgeon and other native fishes in the Detroit River. The beds were composed of large broken limestone, coal cinders, and cobble. Post construction monitoring was conducted March to June in 2005, 2006 and 2007 to assess use of the beds by lake sturgeon and other fish. Adult fish were sampled using gillnets, set lines, and minnow traps; eggs were sampled with egg mats. Collection of viable eggs and spawning-ready adults from the reefs demonstrate that construction of the spawning beds enhanced reproduction by 12 species of native fishes (lake whitefish, emerald shiner, quillback, white sucker, northern hog sucker, silver redhorse, shorthead redhorse, trout-perch, white bass, rock bass, yellow perch and walleye) and two invasive fishes (round goby and white perch). In June 2006, minnow traps showed that the constructed beds were colonized by an existing population of the State-of-Michigan endangered northern madtom. Although no lake sturgeon spawned on the constructed beds yet, a spermiating and a sub-adult sturgeon were captured adjacent to the beds in May 2006. The design of these constructed beds also enhanced reproduction several fish species that are valued by licensed sport and commercial fishers. Our key findings were that the same spawning substrates were used in chronological sequence by a wide variety of spawning fishes, in response to changes in water temperature and that significantly more fish eggs were collected on the cinder bed than on the limestone or cobble beds. A final report is being prepared for the pre- and post-construction fish monitoring work. Additional sampling was done in spring 2007

and fall 2007 and will be done in spring 2008 to assess use of the constructed reefs by spawning fishes.

Project Contact: Bruce Manny bmanny@usgs.gov 734-214-7255.

Detroit River Larval Fish Survey

Sampling for larval fish was conducted during March through June 2006 and 2007 to assess species composition, timing of occurrence, density, growth, habitat use and transport of larvae in the river and into western Lake Erie. 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 and 514 samples were collected in 2007. Over 52,500 cubic meters of water were filtered and samples contained almost 14,000 larval fish in 2006; 40,000 cubic meters of water sampled in 2007 collecting over 9,000 larvae. Species found in larval fish samples include: burbot, deepwater sculpin, lake whitefish, walleye, yellow perch, rainbow smelt, *Catastomus* spp., *Moxostoma* spp., muskellunge, smallmouth bass, longnose gar, carp, emerald shiner, gizzard shad, alewife, white bass, white perch, darters and logperch, and troutperch. Samples collected in 2006 and 2007 are currently being processed to estimate abundance, daily age, and diet. Additional collections will be made in 2008.

Project Contact: Ed Roseman eroseman@usgs.gov 734-214-7237

Fish Spawning Habitat Assessment

Assessment of habitat use in the Detroit River by spawning fish began in fall 2005 and continued through fall 2007. Gillnets, egg mats, and egg pumping was conducted to assess the extent of spawning by fish during spring and fall 2006 and 2007. 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, 13 spawning ready or spent adult lake whitefish were collected at the mouth of the Detroit River east of the shipping lane and collected at Fighting Island in the Detroit River. 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 April and May 2007, 19 sites were sampled with egg mats to identify fish spawning locations and egg viability. 7,169 fish eggs 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, and lake sturgeon. No efforts will be made

to collect whitefish eggs near Fighting Island in the fall of 2008 because the construction of the artificial spawning reef is to begin at that time.

Project Contacts: 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/

2d. Grand River Ecosystem: Assessment, Monitoring and 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 it's 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.

A series of reports and papers have been produced (habitat and ecosystem status, wetland status, water quality, walleye rehabilitation status) which are currently being used to inform the development of habitat rehabilitation strategies. Preliminary steps toward a strategy have been taken by the Southern Grand River Ecosystem Rehabilitation Working Group, a multi-agency initiative with representation from OMNR, Environment Canada, GRCA, MOE, and Six Nations. COA continues to financially support this habitat initiative through these next steps toward rehabilitation. A workshop of technical experts will convene on March 4th and 5th, 2008 in order to review all current data, identify remediation actions, and prioritize next steps.

The HTG will continue to serve as a forum to facilitate information sharing between this and other initiatives which have interests in the Grand River and its

associate lake nearshore (e.g. Bi-national Mapping Project, L.E. LaMP habitat strategy, Lake Trout Habitat Initiative).

2e. Maumee Bay Habitat Mapping Project

S. Mackey

This project, funded by the Ohio Division of Wildlife, is intended to bridge a gap in substrate mapping and habitat coverage between deeper-water work done by Environment Canada in the western basin of Lake Erie and work done by the Ohio Division of Geological Survey in the Maumee River and in shallow-water nearshore areas near Little Cedar Point.

The reconnaissance survey consisted of acquisition of sidescan sonar data along survey lines oriented northwest-southeast at a 1 km spacing (Figure 2e.1). In May 2007, 65.6 nautical line miles (75.5 statute miles, 121.5 km) of sidescan sonar data were collected in Maumee Bay. Overall data quality was good (except over Tyson Reef where the sidescan impacted the bottom) with at least four major types of acoustic response noted on the records. The sidescan data were processed, georeferenced, and incorporated into a mosaic. The data were interpreted and a separate set of shapefiles were generated to illustrate the distribution of materials on the lakebed. The sidescan sonar data were validated by ground-truth samples at 23 sites. Additional ground-truth work is planned to further validate the interpretation. A copy of the draft substrate distribution map is presented below (Figure 2e.2).

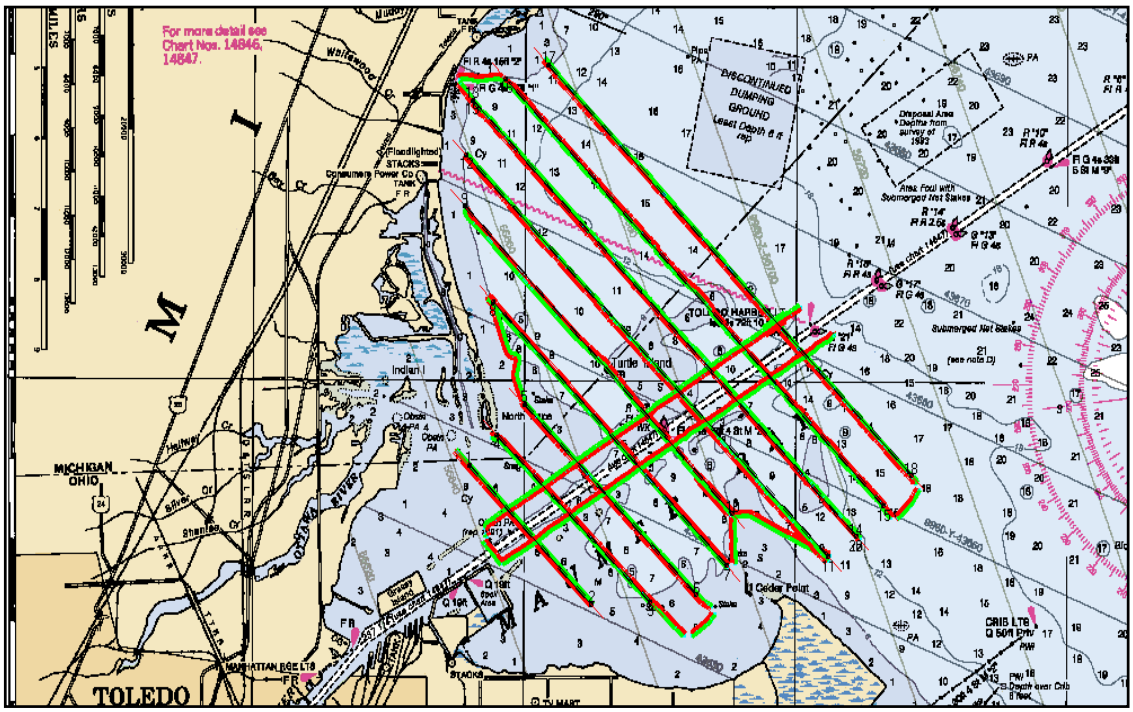

Figure 2e.1. Map showing coverage area of Maumee Bay sidescan sonar survey.

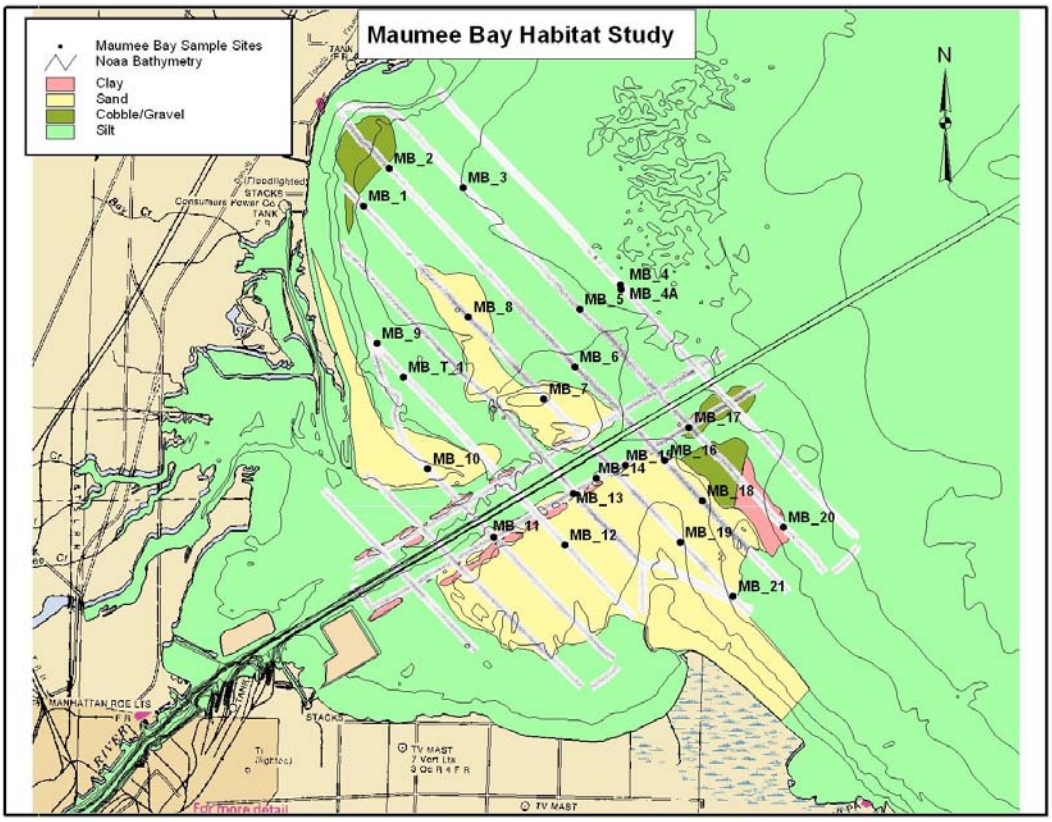

Figure 2e.2. Preliminary map of substrate distributions in Maumee Bay.

2f. Ballville Dam Removal, Sandusky River Habitat Assessment

S. 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. Moreover, critical walleye spawning habitat is located a short distance below the Ballville dam, and the dam forms a barrier to upstream fish migration (Figure 2f.1). Removal of this dam would provide an additional 22 miles of connected river and access to potential spawning habitat. If the Ballville dam were to be removed, there would then be a total of 39 miles of connected river from its mouth to the next upstream barrier at Bacon's dam in Tiffin, Ohio.

Two projects, funded by the Ohio Division of Wildlife, are intended to facilitate the removal of the dam by the City of Fremont and assess riverine habitat characteristics below the dam prior to dam removal. Earlier work done by ODNR has 1) characterized the volume and type of sediments impounded by the dam, and 2) mapped the distribution of shallow-water habitats both downstream and upstream from the dam. These data are being summarized into a GIS which will guide the Department and the City of Fremont as to the most efficient and environmentally acceptable way to remove the dam. A second project will consist of acquisition of sidescan sonar data within the navigable portion of the Sandusky River (and portions of Sandusky Bay) to characterize and map sediment distribution and habitat structure prior to removal of the Ballville dam. These new data will be compared with older sidescan sonar data collected in 1996 to assess changes in sediment distribution and habitat structure within the Sandusky River. The sidescan sonar survey is scheduled for spring 2008.

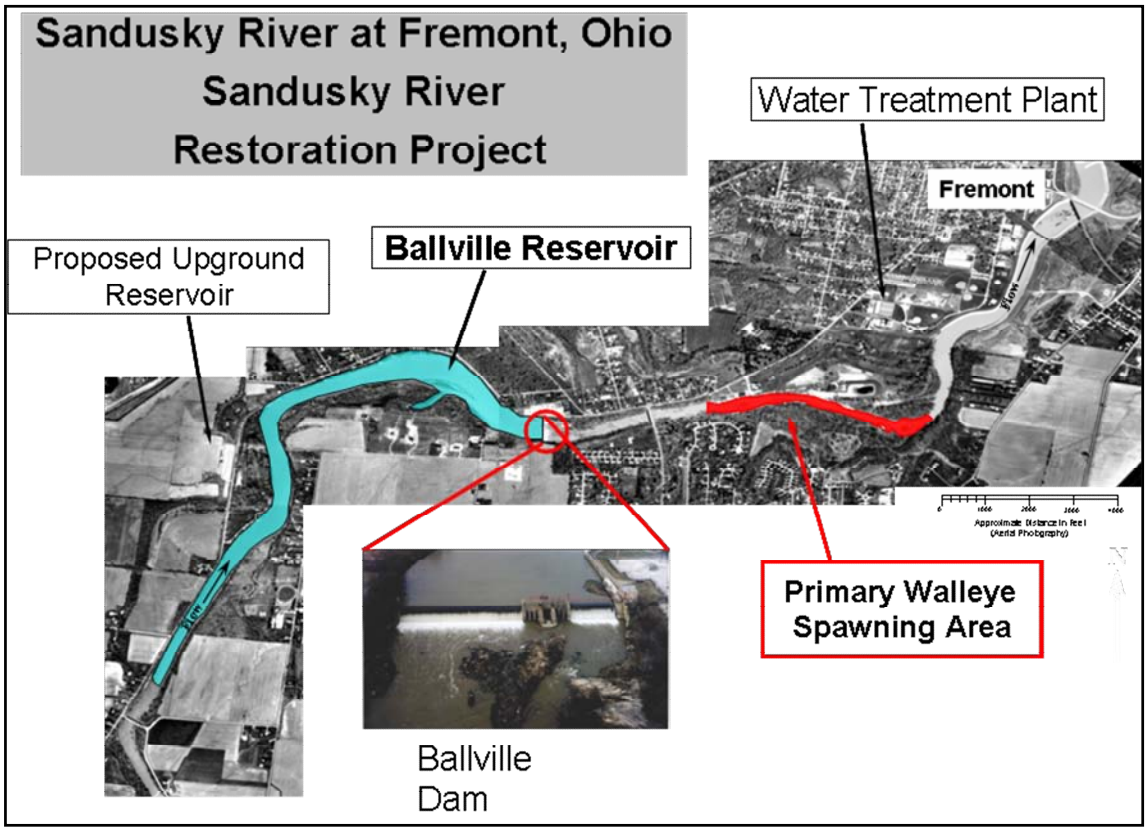

Figure 2f.1. Map showing Ballville dam and reservoir and location of walleye spawning area downstream from the dam

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.

During summer 2007, seining in nearshore embayment areas and some wetland complexes was conducted at 27 sites on a rotational basis. This was supplemented with comparative boat electroshock fishing. 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.

During 2008 and 2009, attention will turn to the extensive wetland complexes (particularly those associated with 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 define a thermal characterization of the entire area.

Section 3. Lake Erie GIS Status

C. Geddes

The Great Lakes GIS, including the Lake Erie GIS, has been funded 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. 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 and March of

2009, 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.

A day and a half workshop was designed to acquaint end-users with GIS and the Great Lakes GIS project. The exercises allowed users to learn basic GIS concepts, become acquainted with the ArcGIS interface, and interact with a spatially explicit, fisheries data. Four workshops were offered in August 2007, two in Ann Arbor, Michigan, and two in Guelph, Ontario. Originally, our intention was to offer one workshop per Great Lake basin. However, due to travel restrictions at several agencies, we determined we would better accommodate all interested parties by offering two workshops targeting United States residents and two workshops targeting Canadian residents. Collectively, 52 individuals participated in the workshops.

The HTG recognizes both the amount of work that has gone into the development of this project and its value as a management tool. Several ongoing projects detailed in this document involve the creation of geo-referenced data layers which will ultimately need to find a common home. The LE GIS is the logical place to house this data. For more information on the Lake Erie GIS project, and the Great Lakes GIS project, visit the project web page at www.glfc.org/glgis or contact the Project Coordinator, Christine Geddes, at cgeddes@umich.edu.

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

T. MacDougall, P. Kocovsky, S. Mackey

In 2005, the Habitat Task Group (HTG) was given the task of identifying potential lake trout spawning habitat in Lake Erie at the request of the Coldwater Task Group (CWTG). This task was added to assist the CWTG with their charge of restoring a viable population of lake trout in Lake Erie.

Two key impediments to lake trout rehabilitation identified in the Lake Trout Management Plan (Markham, 2008) are, i) insufficient biomass of spawning fish and ii) insufficient spatial coverage of current stocking. In order to address these impediments (through increased stocking over a greater geographic scale), locations of potential spawning habitat need to be identified. Our examination of potential spawning areas is designed to 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).

This research uses a multi-tiered approach that includes: 1) identification of key environmental characteristics 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.

The first stage of this research was to create a GIS model to identify areas with suitable physical habitat for lake trout spawning within Lake Erie using existing maps of substrate and bathymetry. That step was completed in 2005 and reported in the HTG report (HTG 2006). Briefly, a review of the literature on lake trout spawning habitat (e.g., Edsall 1990; Edsall and Kennedy 1995; Fitzsimons 1995; Gunn 1995; Marsden et al. 1995; Fitzsimons and Williston 2000) identified physical characteristics where lake trout are known to spawn. Criteria included: bathymetric slope, substrate, and prevailing winds in autumn.

The second stage included examining some of the areas identified by the GIS model using Sidescan sonar and underwater video in order to validate the results of the GIS model and examine the potential spawning areas in greater detail. This validation stage was undertaken in the summer of 2006 and is detailed in the 2006 HTG report (HTG 2007). Briefly, the collection of over 40 line km of sidescan data and 12 accompanying video transects, were used to i) validate the methodology, test the equipment and determine appropriate scales of mapping resolution. We were able to differentiate between 2 areas identified by the GIS model (Grant Point and east Port Maitland) and further were able to interpret that the Grant Point survey site met many of the requirements for potential lake trout spawning habitat while the shallow-water Port Maitland site did not.

At Grant Point, exposed bedrock is present on the broad shallow platform adjacent to Grant Point. As slope and water depth increases, bedrock grades into coarse boulder-cobble substrates and eventually into sand, silt, and clay. Incised areas (shallow valleys) on the bedrock surface were observed and are believed to channelize and direct current flows and sediments moving across the bedrock platform into deeper water areas. Large sand dunes (sand waves) were observed at the base of these incised valleys. Results from Grand Point provided encouraging evidence that potential lake trout spawning areas were not confined to the south shore of the eastern basin and supported plans to conduct additional survey work along this shoreline.

The GIS model was modified in 2007 in order to address concerns that previous runs had not identified Brocton shoal (New York) as a potential target. This bedrock outcropping along the southern shore, WSW of Van Buren Point is recognized as a historic lake trout spawning area (Goodyear et al. 1982) and is the almost exclusive focus of current Lake Erie lake trout stocking efforts. Limitations to the model imposed by the coarse scale of available substrate data

was identified as one reason that the model failed to identify Brocton Shoal. In addition to the slope parameter (>5%) used in previous model runs, variables associated with bathymetric heterogeneity (shoals and valleys) were used to target eastern and east-central basin locations. In addition to Brocton Shoal, seven additional eastern and east-central basin areas were identified during this exercise (Figure 4.1). These include Nanticoke Shoal, shoals associated with Peacock Point and Hoover Point, the Tecumseh Reef complex, the Pennsylvania Ridge and shoal areas offshore of the Pennsylvania / New York border.

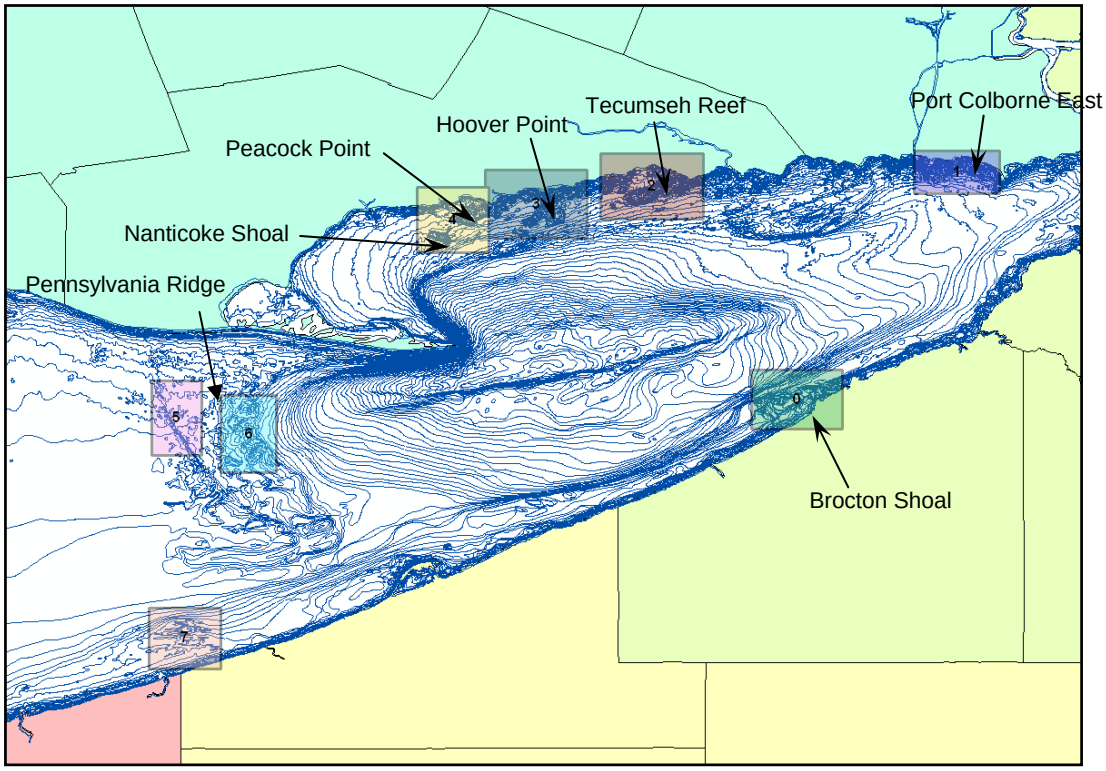

Figure 4.1 Potential lake trout spawning habitat as identified by GIS analysis of slope, substrate and bathymetric heterogeneity.

Funding from the Canada-Ontario-Agreement: Respecting the Great Lakes Basin (COA) supported Sidescan sonar and video imaging surveys directed at four of these areas in 2007 (Figure 4.2). Reconnaissance level surveys occurred at Brocton Shoal in late July.

More detailed coverage was achieved at north shore locations in August and early September (Figure 4.2). Of the north shore locations, Nanticoke Shoal (44 line kilometres), Peacock Point Shoals (164 line km), and Hoover's Point Shoals (87 line km) received complete coverage while logistical problems associated with poor weather prevented all but the most cursory survey of Tecumseh Reef (25 line km). In addition to sidescan sonar data, underwater video data was collected from 30 transects located at Hoover Point Shoals, Sandusk Creek nearshore, Peacock Point Shoals, and Nanticoke Shoal survey sites. Mosaicked sidescan images and creation of geospatial substrate datasets will allow for the

identification, location, quantification of potentially available spawning substrate along the Canadian north shore.

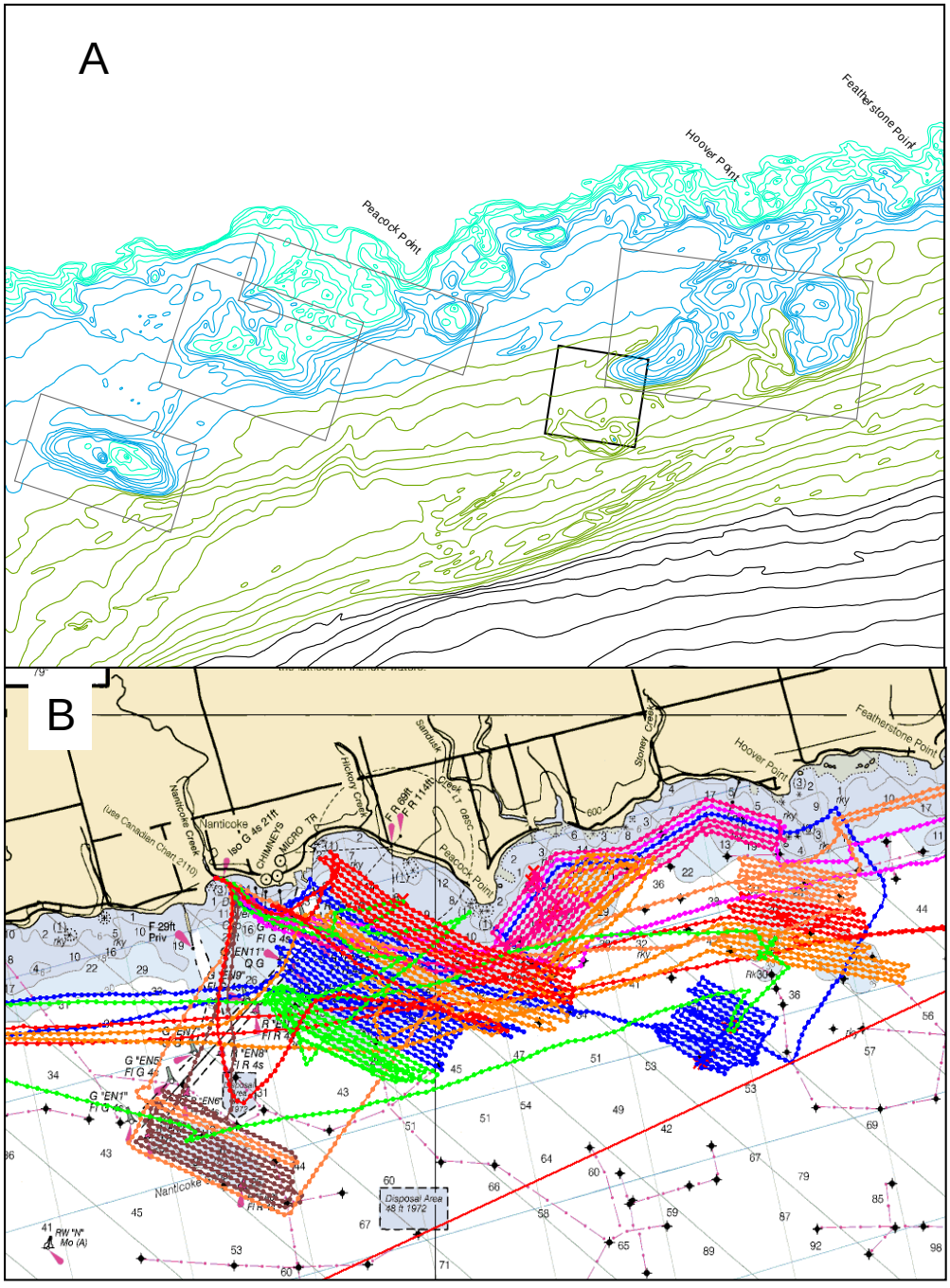

Figure 4.2 Targeted areas (A) and Navigation track-line coverage of Sidescan sonar survey lines and underwater video transects (B) between Nanticoke Harbour and Featherstone Point through 30 September 2007. Note nearshore coverage in non-target areas. Reconnaissance survey lines for Tecumseh Reed and Evans Point nearshore not shown.

From the reconnaissance surveys at Brocton Shoal, it appears as if appropriately sized cobble does not cover extensive areas but is found in discrete, linear rock ridges. These ridges vary from a few tens of meters up to 1000 m^2 in size (Figure 4.3). Large portions of the surveyed portion of this historic spawning site appear to be a relatively smooth bedrock surface overlain by thin deposits of rock debris and coarse sand. The video imaging showed that where rubble/cobble does exist, coverage by dreissenid mussels is extensive. Interstitial spaces may be occluded with mussels, or mussel shell debris. Large numbers of round goby were observed throughout.

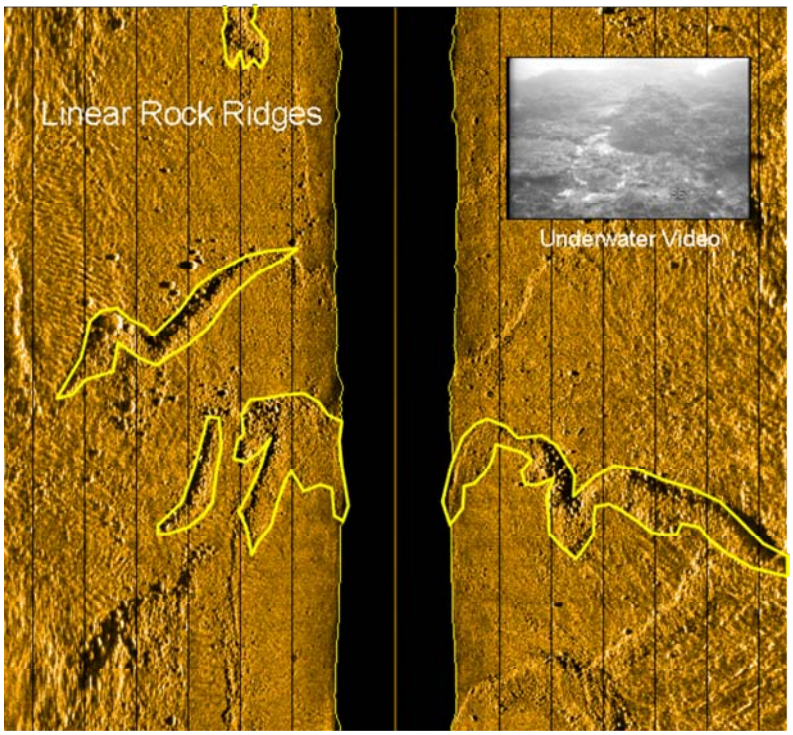

Figure 4.3. Sidescan sonar image from Brocton Shoal showing discrete linear rock ridges made up of cobble-sized material thought to be potential Lake Trout Spawning habitat. Thin vertical lines are spaced 10 m apart. Underwater video shows hard surfaces covered by dressenids and some *Cladophora*.

Preliminary examination of Sidescan sonar results from the north shore showed that areas of appropriate sized cobble were similarly located in relatively small discrete piles, a tens of meters up to 5000 m^2. Often these deposits were associated with the edge of fractured bedrock shelves and drop-offs. 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. Additional coverage completed in nearshore corridors which bridge the main shoal sites (129 line kilometres), may give some insight into water movement in the areas. Similar to the incised channels observed at Grant Point; submerged incised channels s were observed in nearshore areas which may channelize and direct current flows and sediments

moving across the bedrock platform into deeper water areas. In addition to extensive coverage of the area by dreissenid mussels (and associated shell debris) and use by round gobies, dense mats of *Cladophora* sp. algae were observed covering hard substrates in all of the underwater video transects.

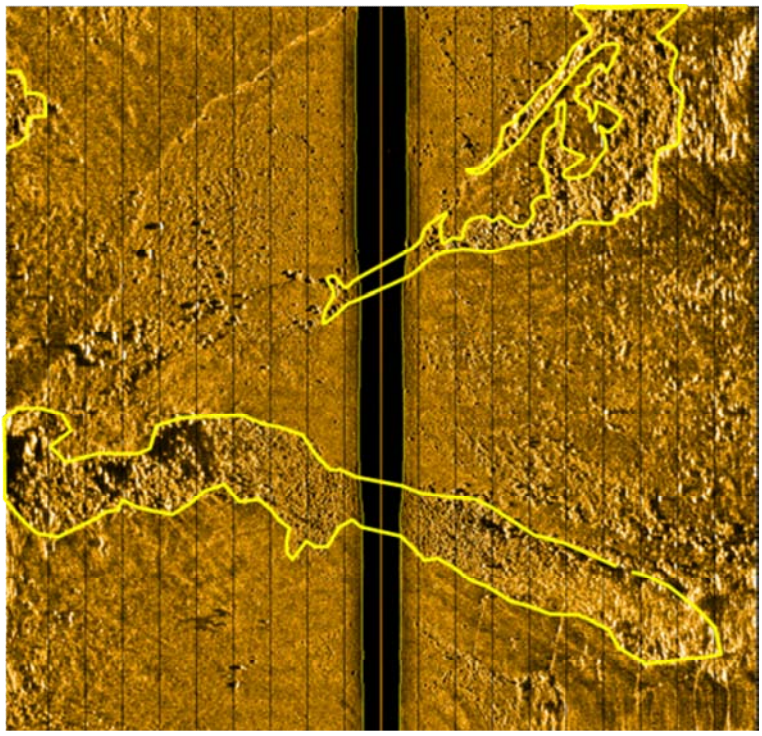

Figure 4.4. Sidescan sonar image from Nanticoke Shoal showing discrete linear rock ridges bedrock ledge material made up of cobble-sized material thought to be potential Lake Trout Spawning habitat. Thin vertical lines are spaced 10 m apart. Underwater video shows hard surfaces covered by dreissenids and *Cladophora*.

Aside from appropriate substrate, questions remain regarding the quality of these potential areas in light of recent environmental changes (invasive species, nearshore algal growth) as well as their proximity to (and connection with) suitable nursery habitat. Additional detailed survey work is needed to assess these potential habitat areas. This would include acquisition of high-resolution sidescan sonar and more detailed underwater video data. Ultimately, we would like to identify potential spawning sites in all three Lake Erie basins.

Ongoing work in 2008 and 2009 will mainly focus on Brocton Shoal and areas associated with the Pennsylvania Ridge. 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. Limited COA funding in 2008 will help to further the

characterization of some North Shore areas; those missed or incompletely surveyed during 2007.

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.

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Section 5. Development of a compilation of fish habitat metrics

T. MacDougall and A.M. Gorman

In 2007, the HTG was charged with the task of identifying and compiling habitat metrics, particularly those that might prove useful to the other LEC task groups. This charge originated from the idea that habitat variables might help explain variation in stock success and concepts such as the 'Traffic Light Approach', proposed in the Yellow Perch Management Plan (YPTG, in prep.) and currently under development by the STC. This approach would allow for the incorporation of variables external to the stock/recruitment models (e.g. environmental variables) into fisheries management decisions. The set of "traffic" rules developed will dictate the habitat variables relevant to yellow perch. The, Walleye Management (Locke et al., 2005) and Lake Trout Management Plan (Markham et al., 2008) also report that gaps in understanding fish production and survival could be best explained through a more comprehensive knowledge of relationships between population dynamics and environmental factors or habitat.

We received valuable feedback from members of the Forage Task Group, which maintains the lakewide lower trophic database. There were several datasets that they explicitly mentioned as not being readily-available, including: higher resolution maps of substrate and bathymetry, especially in specific areas (tributaries, embayments, wetlands, etc.), temporal and spatial temperature, dissolved oxygen, and water clarity data (including summaries like winter severity), maps of shoreline features (substrate type, gradient, vegetation, etc.) and shoreline disturbance levels (development, natural/altered, residential/commercial/recreational/protected, etc.). In discussions about defining the task, it was decided that the job of locating and compiling a comprehensive dataset was not feasible, particularly given some agency and research program data-sharing limitations.

Concurrently, Dr. Timothy Johnson (OMNR) received Canada-Ontario-Agreement funding to generate a spatial database of historic interagency temperature, oxygen, and water clarity data. The Lake Erie Limnological Synthesis Project presently consists of over 29,000 observations from 1960-present, and completion of the visualization component is expected by April 2008. This product is a perfect example of the type of research that the HTG would like to promote as part of this charge. Although the database is easily updated, Johnson is funded only for the development of the database. For this reason, we hope to facilitate the transfer of its management from Johnson to the LE GIS. We will also lend support to this project by including a new field in our spatial inventory of habitat-related projects (Section 2) for investigators to include information about the environmental variables that they measure during their assessments, with the intention of providing a list of potential additional sources environmental data.

Again, the objective of this charge is to improve interactivity between the HTG and other task groups, in hopes of quantifying the impact of environmental effects on fish production. In 2008, we plan to conduct a structured survey of the Task Groups to obtain information about the types of fish-habitat projects or analyses that they may be interested in the HTG conducting for or with them.

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

T. MacDougall and A.M. Gorman

The second of the two new charges tasked to the HTG in 2007 involves the development of strategic research directions that are 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.

There are two research areas that concur with the EO's and that deserve further research allocated to them: 1). the impact of climate variability on fish populations, and 2). human activity in the coastal margin and its impact on nearshore fish dynamics. First, Climate change becomes an increasingly important topic each year. Knowledge about how fisheries populations will be affected because of increased temperatures and decreased water levels would be a proactive. Secondly, most of the work that is funded is solely lake or inland-

based (i.e. independent of each other). Understanding of the physical processes concerning the connectivity between the watershed and the Lake is becoming well-understood but knowledge of how biological processes and fish population dynamics are affected is still limited.

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, fine scale information about how fish relate to their environments.

One fundamental concern is that fish habitat preferences (including optimal ranges of environmental factors) are often well-documented, but little work quantifies viability/predation/production with respect to these variables. Quantifying the impact of or change in these variables on fish populations is essential to integrating them into the management process. We suggest further study into these relationships is necessary. Secondly, there is a need to synthesize existing work that does examine the linkages between habitat/environmental variables and spawning success, egg viability, year class strength, overwinter morality for various species, thereby making these models useful management tools across species (i.e. ecosystem-based management) or life stages. In particular, the two variables that emerged as essential and having little high resolution information are water circulation and bottom substrate. Understanding advection processes is crucial to delineating nursery habitats for many species. The present state of circulation data that is readily-available is much too coarse (often summarized by season across years) to improve advection investigations. Also, the some species require very specific spawning substrates, and changes in the quantity or distribution of these habitats could have severe impacts on spawning potential. The existing lakewide substrate map does not provide the detail necessary to make estimates of these areas (especially in the central and east basins), nor does it allow us to quantify how the distribution of these substrates changes in time.

As part of addressing this charge in 2008, we plan to include questions pertaining to habitat research priorities in the surveys that we distribute to the other task groups (Section 5). This will help us determine common research interests across the groups, resulting in a more comprehensive list of research priorities.

Section 7. Lake Erie LaMP Update

J. Tyson

In 2007-08, 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. The Lake Erie LaMP focuses on measuring ecosystem health, teasing out the stressors responsible for impairments, implementing programs to address impairments, and evaluating the effectiveness of existing programs in resolving

the stress by continuing to monitor the system. The role of the LaMP, as a management plan, is to define the management intervention needed to bring Lake Erie back to chemical, physical, and biological integrity, as outlined in the Great Lakes Water Quality Agreement. In addition, the Lake Erie LaMP is a vehicle to further define federal, state, provincial, and local agency commitments to actions needed to achieve ecosystem management objectives. Over the next several years, the Lake Erie LaMP focus will continue to change from assessment and planning to an implementation phase.

Lake Erie Committee representatives participated/contributed to several LaMP tasks in 2007-08 including LaMP workgroup participation, participation in the LaMP Indicators workgroup, and review of the 2008 LaMP update document. The 2008 Lake Erie LaMP update is scheduled for release in April, 2008. Task Group members have been actively involved as members of the Lake Erie LaMP Indicators workgroup. Prior to moving to the implementation phase, the Lake Erie LaMP must finalize measurable indicators that identify the current state of the ecosystem relative to the desired state of the ecosystem, as described by the Lake Erie Vision and ecosystem management objectives. The Indicators Task Group has initially developed a list of approximately 40 indicators across five habitat types (terrestrial, stream, coastal wetlands, nearshore, and offshore) and categories that could be useful for tracking ecosystem health, are bounded, and currently have monitoring programs in place.

The Indicators workgroup has proposed one method of developing targets for a phosphorus indicator and presented this to the LaMP Workgroup and Management Committee in September. Watershed specific targets for total phosphorus were developed using USEPA ecoregion targets and the area of each watershed within each of these ecoregions (Figure 7.1). Lake Erie total phosphorus targets were derived from those established in the Fish Community Goals and Objectives (Ryan et al. 2003). These targets were then compared to data collected during the 2004 sample year in Ontario tributary mouths as well as the open waters of Lake Erie (Provincial Water Quality Monitoring Network, unpublished data; FTG 2004) (Figure 7.2). In conjunction with the Bi-national Mapping and the Great Lakes Environmental Indicators projects, the Indicators Task Group will continue to demonstrate the application of a subset of these indicators in targeted watersheds to track ecosystem health relative to the desired state of the ecosystem this spring. Task group members have used a number of LEC products, including the Environmental Objectives and the Fish Community Goals and Objectives, to inform the process.

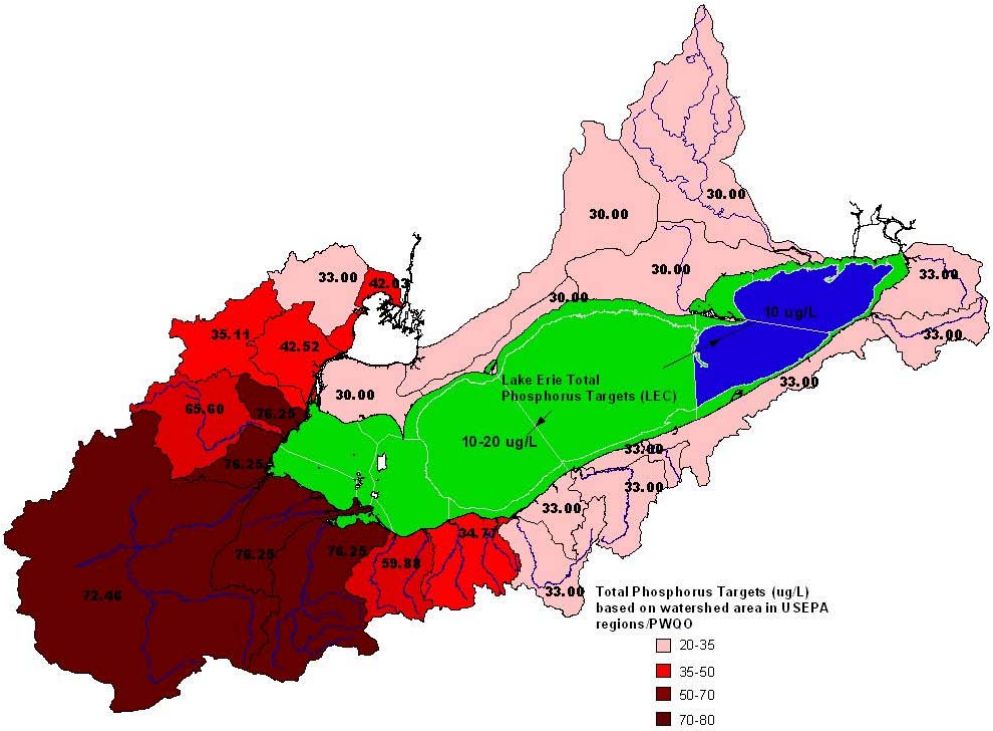

Figure 7.1. Proposed total phosphorus targeted concentrations for Lake Erie watersheds.

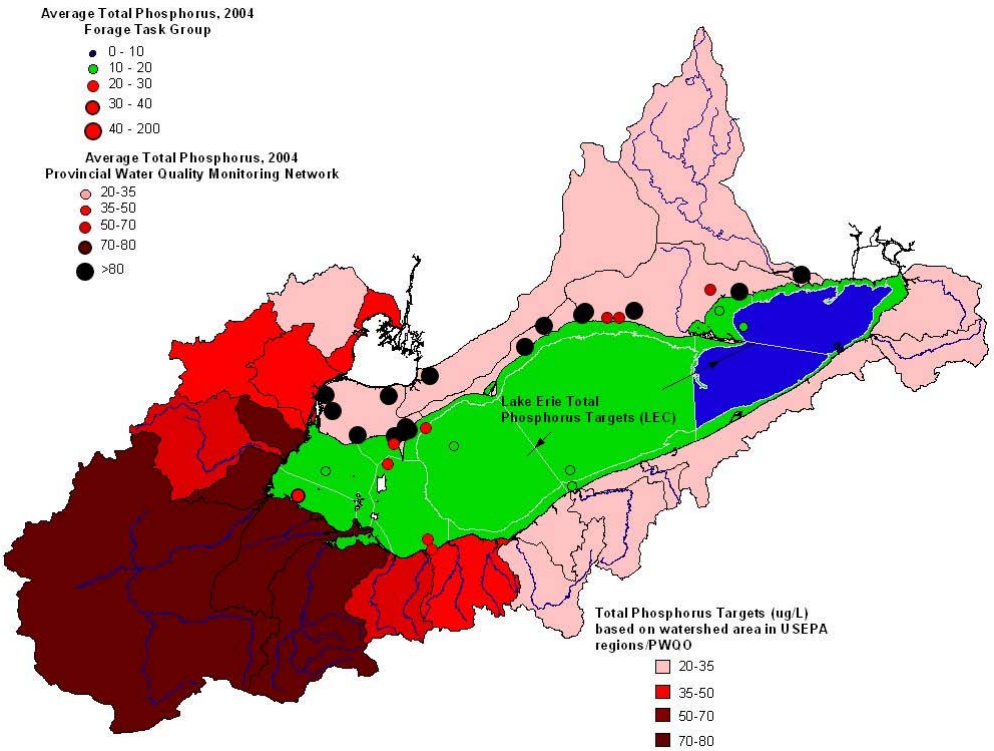

Figure 7.2. Mean annual total phosphorus values (*u*g/L) for selected Lake Erie tributary sample locations and the open waters of Lake Erie, 2004.

Section 8. US National Fish Habitat Initiative Update

P. Kocovsky

The US National Fish Habitat Initiative (NFHI) was implemented in 2004 to address assessment, conservation, and restoration of fish habitat in the United States. The NFHI is modeled after the highly successful North American Waterfowl Management Plan (NAWMP), which uses regional partnerships of private conservation groups and public agencies to generate interest in and leverage funding for habitat inventory and restoration programs. The NAWMP has been very successful in identifying, conserving and restoring critical habitats for waterfowl, and populations of most waterfowl species have recovered from their minima in the middle of the 20th century. The goal of the NFHI is to accomplish much the same for fishes whose habitat needs are unknown or whose habitat has been damaged, altered or outright destroyed (e.g., whitefish spawning habitat in the Detroit River; lake trout habitat in the Great Lakes).

The NFHI has set a goal to establish a minimum of 12 Joint Ventures by 2010. As of February 2008 there were 5 officially-recognized joint ventures that will be able to compete for federal funding for their various habitat-related projects (http://www.fishhabitat.org/action.htm). This number is unchanged over last year. Four of these ventures are directed toward salmonids while the fifth is more generally directed.

The primary criteria for eligibility as a Joint Venture include: strong and diverse partnerships; geographic focus; strategic planning; and capability of scientific assessment. The preferred scale for Joint Ventures is 129,500 – 1,295,000 square kilometers (50,000 to 500,000 square miles). That scale exceeds the scale of each individual Great Lake (watersheds included), but the Great Lakes system as a whole is well within the parameters of the preferred scale.
In 2007 the USGS Great Lakes Science Center took a leadership role in developing a Great-Lakes-wide initiative. It will be modeled after the regionally-successful Huron-Erie Corridor Initiative (HEC), which seeks to identify and rehabilitate spawning habitat for fishes native to the HEC. The Great-Lakes wide initiative will include Federal, State, and Tribal representatives. Although the NFHI is focused primarily on US fish habitat, the Great-Lakes wide initiative will likely also include Canadian partners because the Great Lakes are an international resource.

> *Partners: New York State Department of Environmental Conservation, Pennsylvania Fish and Boat Commission, Ohio Department of Natural Resources, Michigan Department of Natural Resources, Ontario Ministry of Natural Resources, United States Geological Survey, United States Fish and Wildlife Service, Department of Fisheries and Oceans Canada, Habitat Solutions.*

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, advice and for helping maintain necessary connections between the HTG and Lake Erie LaMP. We also appreciate the efforts of Dr. Timothy Johnson (OMNR) including his input regarding the compilation of fish habitat metrics.

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