

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



Big Creek Marsh, Long Point Wetlands Complex

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Lake Erie Committee
Great Lakes Fishery Commission**

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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. 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.

Section 2. Document Habitat Related Projects

T. MacDougall and C. Geddes

In 2006, the HTG continued to document and track habitat related initiatives taking place throughout the Lake Erie and Lake St. Clair basins. The means by which this is accomplished has continued to evolve and expand. What began as a simple list of projects, available as an appendix to the task group's annual report, has been expanded to include direction to project contacts and reports where available. A spatial component has been added to aid in searching for initiatives within an area of interest.

To exploit this spatial component, a web-based interface is being developed to distribute the project inventory in a spatial context via the Internet. The web site will be available for public consumption on the Great Lakes Fishery Commission web site (likely nested under the Lake Erie Committee page). 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. Christine Geddes (Great Lakes GIS project, UM, MDNR) is developing the interface and Hao Zhuang is the Great Lakes Fishery Commission webmaster responsible for its installation. The interface is being developed under the guidance of T. MacDougall and A. M. Gorman.

Spatial Inventory of Habitat-Related Projects

The HTML-format interface is comprised of several web pages (example Appendix 1A). The main page consists of a clickable map of the Lake Erie basin and the Niagara River. Users can click on any of four clearly identified regions

on the map (i.e., Huron-Erie Corridor (HEC) and drainage; west basin and drainage; central basin and drainage; or east basin, east basin drainage, and the Niagara River) to launch a page of the respective region; alternatively, users can be directed to respective region pages via text links that exist below the map. Each region-specific page contains a clickable map of the region with visible watershed boundaries and labels. Users can then click on a watershed or water feature on the map (or the corresponding text link below the map) to see project inventories by watershed, waterbody, or other geography (i.e., for those projects that cross ecological boundaries). The current design is considered preliminary and is subject to change pending feedback. A set of criteria for future additions to the inventory and schedule for updating the site will be determined in the coming year. A copy of the table of projects will continue to be provided in the annual report (Appendix 1B)

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 (Appendix 1B). 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.

A total of 26 projects involving the monitoring or evaluation of habitat are currently documented. 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. Examples of these projects include the MDNR's ongoing sturgeon habitat surveys and plant community mapping in Lake St. Clair and the St. Clair River. Newly added is a planned 3-year ecological assessment of the nearshore and wetland habitats of Long Point. Some of the shorter term projects listed in 2005 have been completed and have produced documents which are now being utilized to focus more directed assessments or to direct implementation strategies. For example, results from previous wetland assessments in Rondeau Bay, Ontario, are being used to inform an Environment Canada rehabilitation strategy. The timeline of the investigation of lake trout spawning habitat (Cold Water Task Group/ HTG initiative, detailed below) has been shifted in anticipation of upcoming funding though preliminary field testing of methods.

A total of 14 projects were identified under the heading of "Rehabilitation strategies: workshops, working groups and tools development". The previously listed HEC habitat assessment is complete and a web-link to its project completion report is provided; a detailed description of the project outcome is found below. Significant progress has been made in two of the listed habitat mapping projects: The GL aquatic coastal GAP program and the LE Bi-national Mapping Project (detailed below). A newly listed item, Ohio's Lake Erie Balanced Growth Program, represents a watershed based planning initiative to develop urban growth plans within a conservation framework.

A total of 25 listings representing implementation projects and 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 four initiatives documented in the project list are detailed below:

2a. Bi-national Mapping Project

S. Mackey

An Integrated Habitat Classification and Map of the Lake Erie Basin

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 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 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.

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 of 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 and GIS tools to for each of the environmental zones. A summary report of workshops I and II are available at: <http://www.glc.org/eriehabitat/workshops.html>

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 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 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 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 basinwide habitat classification system and inventory for the entire Great Lakes basin.

Principal Investigator 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: 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 (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) examine how existing data and models could be applied to a range of "transitional habitat" issues, including refinement of conceptual models of habitat succession associated with anticipated changing water-level regimes within the HEC (Workshop 3.03).

The project team developed an approach that is based on the fundamental assumption that native fish and aquatic communities have co-evolved and adapted to the physical characteristics of the system, including the distribution, pattern, and function of aquatic habitats and the timing and seasonality of the dynamic processes that create and maintain those habitats. Thus, restorative actions that shift HEC physical characteristics and processes back toward a more "natural state" will be sustainable and will benefit native fish and aquatic communities. Three major environmental zones were identified based on physical and hydrogeomorphic characteristics: the connecting channels and adjacent riparian areas of the Detroit and St. Clair rivers; the St. Clair Delta and adjacent wetland complexes; and nearshore, coastal margin, and open-water areas of Lake St. Clair.

A summary list of existing datasets and publications was compiled and is available on the LEMN website at <http://www.lemn.org>. Workshop participants also identified critical data collection and research needs, including: 1) high-resolution bathymetry and substrate distribution data in nearshore/coastal margin areas of Lake St. Clair; 2) daily and seasonal flow, circulation, and temperature distribution patterns in the connecting channels and Lake St. Clair; 3) the location, distribution, and stability of contaminated sediments; 4) seasonal data on nutrient and contaminant loadings; and 5) the need to model hydrodynamic and ecological processes throughout the entire HEC. This information is critically needed to identify and map environmental characteristics that define and influence spawning and nursery habitats; the distribution of seasonal larval, YOY, and adult fish; the distribution of benthic invertebrate and aquatic macrophyte communities; and critical habitat for endangered or species-at-risk. Climate-change models predict up to a 1-m drop in Lake St. Clair water levels within the next 50 years. Reductions in connecting channel flows and a 1-m drop in lake level will directly influence critical shallow-water aquatic and fish spawning and nursery habitats. For example, a 1-m drop in lake level will shift the shoreline lakeward by up to 4 to 6 km in the St. Clair Delta area. The environmental effects of these flow and water-level regime changes will be significant, but suitable models do not currently exist to predict potential changes

in habitat distribution. To address this issue, workshop participants concluded that the most effective and economical approach is to develop an integrated 3-D hydrodynamic model that predicts flow and water levels in the HEC as a single hydrodynamic system rather than attempting to integrate existing models into a single modeling package. Participants also recognized the need to concurrently develop integrated ecological models for each of the three major environmental zones designed to predict changes in habitat distribution and response of vegetative and fish/benthic communities to altered flows and water-level regimes.

Based on the results of the three LEMN Research Needs Workshops, a long-term research strategy was developed that is designed to systematically 1) compare the historic distribution, pattern, and function of high-quality aquatic and fishery habitats with the current distribution of those habitats in order to assess habitat alteration and the stressors that cause those alterations; 2) develop 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) provide the tools and build the 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. As part of this strategy, six major research needs and/or actions were identified:

- 1) Develop an inventory of current and historical HEC datasets and publications. Identify critical data gaps and work to fill those data gaps.
- 2) Document the current and pre-disturbance distribution, pattern, and function of habitats within the three major HEC environmental zones using available contemporary and historical datasets.
- 3) Identify significant historical actions or stressors that have resulted in HEC habitat impairments.
- 4) Develop and apply integrated 1-D, 2-D, and 3-D hydrodynamic and ecological modeling tools to predict current, historical, and future distribution, pattern, and function of habitats for varying water-level regimes for the three major HEC environmental zones within the HEC system.
- 5) Establish restoration/rehabilitation targets and goals based on knowledge gained from historical comparison to current conditions.
- 6) Identify potential habitat restoration/rehabilitation opportunities based on qualitative and quantitative assessments of habitat distribution, pattern, and function. Establish a long-term habitat monitoring program tied to performance indicators.

These research needs/actions can be implemented by supporting ongoing efforts to assess historical and current habitat patterns and functions within the HEC by the USGS Great Lakes Science Center, Michigan DNR, Ontario MNR, and Fisheries and Oceans Canada. Ongoing efforts by the Great Lakes Regional Collaboration, NOAA, USGS, USACE, Environment Canada, and the Great Lakes Commission to develop a fully integrated 3-D hydrodynamic model for the HEC should also be supported. Given the size and complexity of the HEC, an international effort is required to implement comprehensive monitoring programs and to provide technical support and guidance to key agencies, organizations, and institutions to identify and implement aquatic habitat restoration opportunities at multiple scales within the HEC.

This project was completed in March of 2006. The project completion report (Mackey et al. 2006) is available on the LEMN website at: <http://www.lemn.org>.

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

2c. Huron-Erie Corridor: Habitat Research

E. Roseman

St. Clair River Habitat Mapping

Sidescan sonar data acquisition was completed 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 benthic habitat in the river. These maps will include substrate composition and size and will be overlain onto maps of juvenile sturgeon telemetry data to help identify and characterize lake sturgeon habitat use.

Project Contacts: Gregg Kennedy (USGS Great Lakes Science Center); James Boase (USFWS Alpena FRO)

Belle Isle Spawning Reef

An artificial reef was constructed near the northeast corner of Belle Isle in 2004 to provide increased spawning habitat for lake sturgeon and other native fishes in the Detroit River. The reef was composed of three separate mounds using limestone, coal cinders, and rock cobble. Post construction monitoring was conducted in 2005 and 2006 to assess the extent of lake sturgeon and other fish using the reef to spawn. Adult fish were sampled using gillnets, set lines, and minnow traps, while embryos 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). Additionally, effort with minnow traps in June 2006 demonstrated that the constructed spawning 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, the design of these constructed beds was adequate to attract a spawning-ready lake sturgeon at spawning time and enhance reproduction by a large number of 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, in 2005 and 2006, 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 monitoring work. Additional sampling will be conducted in the spring of 2007 to assess use of the constructed reefs by spawning fishes.

Project Contact: Bruce Manny USGS Great Lakes Science Center

Detroit River Larval Fish Survey

Sampling for larval fish was conducted during March through June 2006 to assess species composition, timing of occurrence, density, growth, habitat use and transport of larvae in the river and into western Lake Erie. In summary, 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. Over 52,500 m³ of water were filtered and samples contained almost 14,000 larval fish. Samples collected in 2006 are currently being processed and additional collections will be made in 2007.

Project contact: Ed Roseman USGS Great Lakes Science Center

Fish Spawning Habitat Assessment

Assessment of habitat use in the Detroit River by spawning fish began in fall, 2006. Gillnets, egg mats, and egg pumping was conducted to assess the extent of spawning by lake whitefish during fall 2006. No adult lake whitefish were collected in gillnets but adults and juveniles of twelve species were collected including four juvenile lake sturgeon, several walleye, yellow perch, smallmouth bass, and northern pike. Viable lake whitefish eggs were found in egg mats and egg pump samples fished on the river bottom throughout the river. Highest egg densities were recorded at Fighting Island. Sampling will continue in the spring and fall of 2007 to assess the extent of fish spawning in the Detroit River with efforts directed toward walleye, yellow perch, lake sturgeon, and lake whitefish.

*Project contacts: Gregg Kennedy (USGS Great Lakes Science Center);
James Boase (USFWS Alpena FRO)*

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 had allowed for the expansion of a cursory survey into a detailed examination of walleye and fish habitat in these waters. A

preliminary review of the data collected over the past 5 years in the Southern Grand River reveals a system impacted by both water quality problems and restricted access for migratory fish moving upstream from the lake. Detailed reporting on individual components of the initiative will be completed through the spring of 2007. This will include an overall assessment of the Dunnville fishway, a detailed description of habitat use by various life stages of Grand River walleye, and a report on water quality with a focus on temperature, oxygen and flow. This data, along with contributions from other groups working in this section of the watershed and lake nearshore, is being used to inform a "State of the Southern Grand River" report. This report is currently being compiled by the Southern Grand River Ecosystem Rehabilitation Working Group, a multi-agency initiative with representation from OMNR, Environment Canada, GRCA, MOE, and Six Nations. The "state of" report will act as a stepping stone to the development of remediation strategies and future habitat rehabilitation initiatives. The HTG will serve as a forum to facilitate information sharing between this and other initiatives which have interests in the Grand River and its nearshore (e.g. Bi-national Mapping Project, L.E. LaMP habitat strategy, Lake Trout Habitat Initiative).

Section 3. Lake Erie GIS Status

C. Geddes

The Lake Erie GIS version 1.0 was completed and ready for distribution on December 31, 2006. The database totals nearly 40 GB in size and contains data from several Canadian and U.S. agencies in the Lake Erie basin.

Documentation was created for each file and can be accessed in the database using ArcGIS or a standard Internet browser. Data sets include: base and political data; biological, chemical, and physical data; and ecological classifications from both the United States and Canada. A targeted data set to acquire in the future includes data from the collaborative effort called the International Field Year on Lake Erie (IFYLE).

Fisheries-specific data include commercial and recreational (charter and non-charter) catch rates, spawning locations of various species, walleye tag and recapture data, and mid- and bottom-trawl surveys for yellow perch as well as other forage fish species. We also created useful base maps of fisheries statistical districts in each of the Great Lakes, as defined in 'Fishery Statistics Districts of the Great Lakes' (Great Lakes Fishery Commission Technical Report No. 2, September 1961).

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 in Lake Erie. Preliminary results were presented at the Lake Erie

Millennium Network conference in February of 2006 and refined results were presented at the International Association for Great Lakes Research (IAGLR) conference in May of 2006.

Using physical habitat variables (i.e., substrate, surface temperature, bathymetry, slope, and circulation) summarized at a 3-km resolution, ecoregions were defined using a two-step cluster algorithm in SPSS. Cluster differentiation was evaluated by cluster analysis measures as well as by discriminant analysis. The Lake Erie classification also was compared with an existing habitat classification developed by Jeff Tyson (ODNR) and tested with walleye fisheries catch rates.

Six clusters of unique fish habitat were derived for Lake Erie, two for nearshore waters (<15m) and four for offshore waters (>15m). Discriminant analysis showed 91% to 100% classification accuracy, suggesting very good discrimination among classes. ANOVA tests showed that cluster membership was able to explain some variation in fisheries catch rates. More testing will be done as data become available.

An array of support documents and educational materials has also been developed. A Lake Erie fact sheet was created to serve as an overview of the project. Also, the Great Lakes GIS web site was redesigned and made available for public access (<http://www.glfcr.org/glgis>). The new site is more informative and better organized. Our partnerships are more prominently displayed on the new site, and other important GIS projects in the region are highlighted. Additionally, a GIS Help page has been added to the site that has FAQs about the project and support documents. Currently, the following pdf-format support documents are accessible via the web site: Geographic Data Primer, Getting Started with the Great Lakes GIS, Great Lakes GIS Naming Conventions, and An Introduction to Projections. In the future, a recently developed self-paced tutorial will be accessible online as well.

A full-day, hands-on workshop was designed to acquaint end-users with GIS and the Great Lakes GIS project. In August 2006, the workshop was offered to the Lake Superior Technical Committee in Marquette, Michigan. The exercises allowed users to learn basic GIS concepts, become acquainted with the ArcGIS interface, and interact with a spatially explicit, lakewide survey of lake trout. Workshop materials were designed to double as a self-paced tutorial. Interested parties can request a CD that contains all exercises and workshop data to review at their own pace. We plan to offer four workshops throughout the Great Lakes basin during 2007, including one in the Lake Erie basin.

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

P. Kocovsky and 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. 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 origins of lake trout that might be used in future stocking operations.

This research has a multi-tiered approach that includes: identification of potentially suitable habitat based on published records from other Great Lakes; assessment of bathymetry and substrate using side-scan sonar; assessment of juxtaposition of habitat components (e.g., spawning and juvenile rearing); and reconnaissance of potential spawning areas for use by lake trout using video imaging equipment. 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 (Tyson et al. 2006). The second stage included examining some of the areas identified by the GIS model using side-scan sonar and underwater video to validate the results of the GIS model and examine the potential spawning areas in greater detail. The second stage was undertaken in the summer of 2006. Below, we briefly revisit methods and results of the GIS modeling work and present primary findings of the 2006 field season.

Our effort to develop a predictive GIS model began with a review of the literature on lake trout spawning habitat (e.g., Edsall 1990; Edsall and Kenndy 1995; Fitzsimons 1995; Gunn 1995; Marsden et al. 1995; Fitzsimons and Williston 2000) to identify physical characteristics where lake trout are known to spawn. We also reviewed Goodyear et al. (1982) to identify purported historic spawning sites for lake trout. Criteria included: bathymetric slope, substrate, and prevailing winds in autumn. Details on criteria that were used in developing the GIS model are in the 2006 HTG report (Tyson et al. 2006).

Our GIS model identified dozens of potentially suitable sites in all 3 basins of Lake Erie. The largest number of sites was in US waters of the western basin around several islands (Tyson et al. 2006). Two sites were identified near the mouth of the Grand River (Ontario). These sites were used as validation sites for detailed examination in 2006. One site that was not clearly identified using the GIS model but that was a purported lake trout spawning site in Goodyear et

al. (1982) was Brocton shoal, a bedrock outcropping along the southern shore WSW of Van Buren Point.

Two potential Lake Trout spawning sites identified by the GIS analysis in the eastern basin were in the Port Maitland area near the mouth of the Grand River (Ontario). One site was located immediately east of the Grand River in relatively shallow water. The second site was located offshore from Grant Point west of Port Maitland. On June 1 and 2, 2006, sidescan sonar and underwater video data were acquired over these sites in order to: 1) validate GIS model predictions and identify potential Lake Trout spawning habitat; 2) evaluate the feasibility of using sidescan sonar and underwater video to identify, characterize, and map the distribution of potential Lake Trout spawning habitat in nearshore areas of Lake Erie; 3) test equipment suitability, evaluate appropriate mapping scales and resolution, and estimate time required to acquire and process the field data; and 4) produce a set of preliminary examples and products to demonstrate the utility of these tools for habitat identification, characterization, and mapping.

Working cooperatively with Ontario Ministry of Natural Resources (OMNR) Fishery Biologists, we acquired 23.3 line km of sidescan data and 1 underwater video transect in the Grant Point area (west of Port Maitland) and 18.1 line km of sidescan data and 11 underwater video transects from the Port Maitland area adjacent to the mouth of the Grand River. We also acquired a 1.7 km reconnaissance line out of the mouth of the Grand River and a 6 km reconnaissance line that extends from Grant Point back to Port Maitland. Data quality was excellent and the sidescan data for both Grant Point and Port Maitland were processed, mosaicked, and converted into geographically-referenced (GIS) coverages for further analyses.

Initial interpretation of the data shows that the Grant Point survey site meets many of the requirements for potential Lake Trout spawning habitat while the shallow-water Port Maitland site does 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.

Offshore and slightly east of the mouth of the Grand River, a large shore-normal feature was observed on the sidescan data that is interpreted to be the ancestral paleo-channel of the Grand River that was incised when Lake Erie water levels were tens of meters lower than they are today (~3,000 to 4,000 years B.P.). The 150 m-wide ancestral channel is filled with rippled fine to medium grain sand. Examination of National Oceanic and Atmospheric Administration bathymetric data indicates a corresponding change in water depth (slightly deeper) over the

feature and further offshore than what may have been the remnants of a delta at the mouth of the ancestral river (15 to 20 m water depth).

Results of this pilot field study suggest that these tools can be used to identify, characterize, and map potential spawning and nursery habitat areas in Lake Erie. The equipment worked flawlessly and the data quality was excellent. The combination of geospatial (GIS) models and remote sensing tools (sidescan sonar and underwater video) is an efficient and powerful way to identify potential spawning and nursery habitats in the Great Lakes.

The HTG has submitted proposals for funding through the Canada-Ontario Agreement, the US Fish and Wildlife Service (USFWS), and the Great Lakes Fishery Commission to complete a comprehensive review of remaining sites in all three basins. We have also submitted a proposal to the USFWS to perform a detailed examination of Brocton Shoal, which is a known spawning site for several species and is a suspected former spawning site for lake trout (Goodyear et al. 1982). 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. Lake Erie LaMP Update

J. Tyson

In 2006-07, 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 change from assessment and planning to implementation.

Lake Erie Committee representatives participated/contributed to several LaMP tasks in 2006-07 including LaMP workgroup participation, participation in the LaMP Indicators workgroup, and review of the 2006 LaMP Update document. The 2006 Lake Erie LaMP Update was released last spring with another update scheduled for the spring of 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 initially 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) which were refined based upon a set of pre-established criteria for indicator selection. Currently, the Task Group has identified approximately 40 indicators across the above habitat types and categories that are useful for tracking ecosystem health, are bounded, have targets, and currently have monitoring programs in place. In conjunction with the Bi-national Mapping and the Great Lakes Environmental Indicators projects, the Indicators Task Group will 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. 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. Additionally, many of the targeted environmental conditions established by the LEC have been inserted into the LaMP process as desired ecosystem states (i.e. mesotrophic conditions). Lastly, much of the data from current monitoring programs supported by LEC agencies will be used for indicator developing and ecosystem health tracking (e.g. total phosphorus and chlorophyll from the Interagency Lower Trophic Level program).

Section 6. US National Fish Habitat Initiative Update

P. Kocovsky, E. Weimer

The US National Fish Habitat Initiative (NFHI) began in 2004 to address challenges to fish habitat inventory, conservation and restoration 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 important habitat-related programs. The NAWMP has been very successful. Critical habitats for waterfowl have been identified, conserved and restored, 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 to date have been neglected and for many species have not even been properly identified (e.g., lake trout in the Great Lakes).

The NFHI has set a goal to establish a minimum of 12 Joint Ventures by 2010. Officially recognized joint ventures will be able to compete for funding for their various habitat-related projects. There are currently 5 such ventures, four of which are directed toward salmonids (<http://www.fishhabitat.org/action.htm>). 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 regional scale for Joint Ventures is 129,500 – 1,295,000 km² (50,000 to 500,000 mi²).

Members of the HTG participated in a conference call in February 2007 with several Great Lakes-region state and federal agency scientists to discuss plans for developing a Great-Lakes wide Joint Venture for funding through the NFHI. Several ideas for focal areas were discussed, including work by the HTG on lake trout spawning habitat. Because the HTG already possesses all of the functional characteristics required by the NFHI, we envision the HTG playing an important role in development and eventual participation in a Great Lakes Joint Venture.

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 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. Acknowledgements

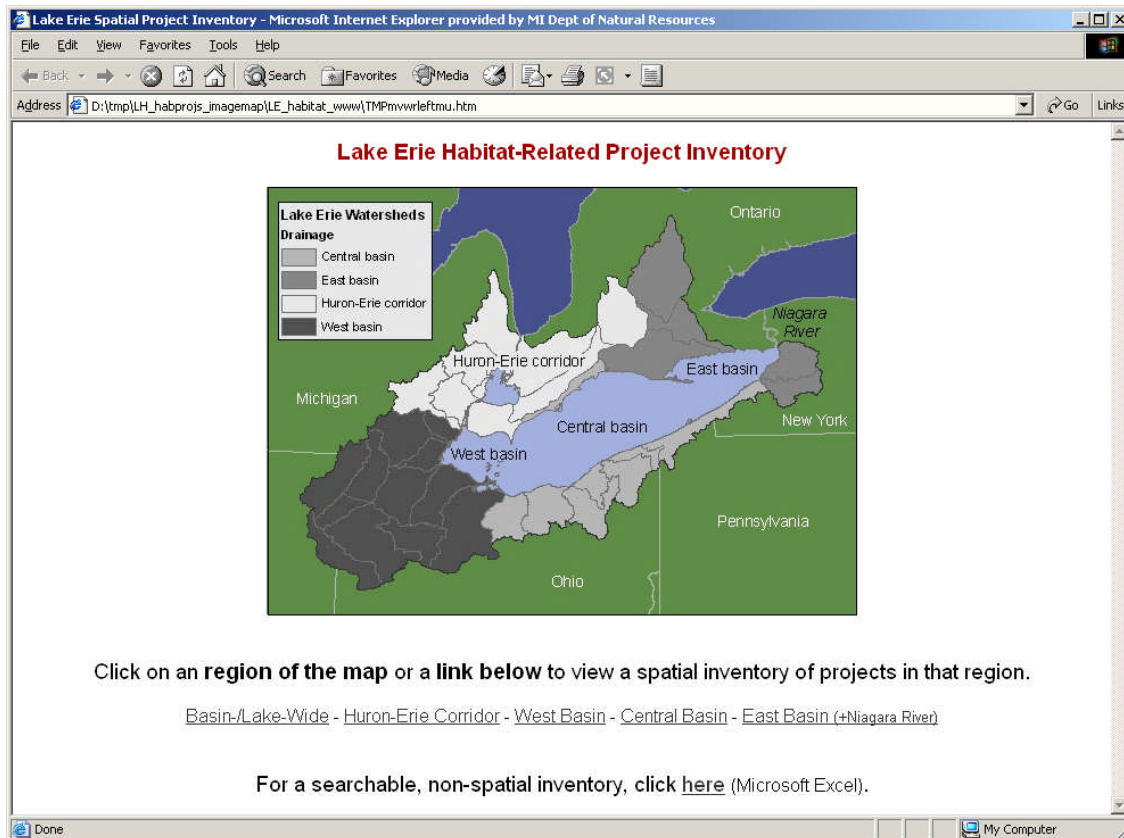
The habitat task group would like to acknowledge Jeff Tyson for continued input, advice and for helping maintain necessary connections between the HTG and Lake Erie LaMP.

Section 9. References

- 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.
- Mackey, S.D., J.M. Reutter, J.J.H.Ciborowski, R.C. Haas, M.N. Charlton, and R.J. Kreis. 2006. Huron-Erie Corridor System Habitat Assessment – Changing Water Levels and Effects Of Global Climate Change. Project Completion Report, USFWS Restoration Act Sponsored Research, Agreement # 30181-4-J259. 47p.
- 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.
- 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.

Appendix 1A: Example of Web Interface for Habitat Project Summary

Cover Page



Example of Associated Table

Title	Location	Status	Agency	Partners	Contact	Links
Monitoring and Evaluation of Habitat						
Plant Community Mapping – Lake St. Clair	Lake St. Clair	Ongoing: annual survey 3-4 weeks mid-summer	MDNR, USGS	Oakland University	Bob Haas, MDNR-Fisheries	NA
	Description. Hydroacoustic surveys of rooted plant communities within Lake St. Clair. Identification of mapping and habitat based on both conventional and side-scan sonar transects.					
Sturgeon Habitat Surveys – Lake St. Clair	Lake St. Clair and St. Clair River	Ongoing: annual surveys 2-3 weeks mid-summer	MDNR	USGS, USFWS	Mike Thomas, MDNR-Fisheries	NA

**Appendix 1B: Habitat Related Projects, L. Erie and L. St.
Clair watersheds**

Project Title	Location	Description	Status	Lead Agency	Partners	Documents	Contact	Links
Projects involving monitoring and evaluation of habitat								
1. East Basin Rehabilitation Plan: Habitat component	North Shore of Eastern Basin	A component of a 5-yr fisheries management plan that involves fisheries and habitat surveys in the nearshore waters and lower section of tributaries in the Ontario waters of the eastern basin from Long Point to the Niagara River. The intent of this component is to link key species (yellow perch and walleye) and the fish community with habitat types in order to identify sites with potential for	April 2000 - Dec 2004. Reporting completed in 2005	OMNR (LEMU)	EC, OCFA, OFAH	Reference 1.	Kurt Oldenburg, OMNR Lake Erie Management Unit, P.O. Box 429 Port Dover, ON, N0A 1N0	n/a
2. Rondeau Bay Nearshore Fish Community Monitoring	Lake Erie Central Basin North shore	Electrofishing to determine status of fish communities/ biodiversity/fish, reptilian, and amphibian SAR/habitat availability/water quality/ contaminants related to aquatic biota in Rondeau Bay and sites in the west-central basin of Lake Erie.	Completed 2004, Reporting completed in 2005	OMNR- LEMU / DFO research and assessment Branch	Rondeau Provincial Park, LTVCA, OMNR-Aylmer District.	Reference #2	B. Locke, OMNR Lake Erie Fisheries Station, R. R. #2, 320 Milo Rd., Wheatley, ON N0P 2P0	n/a
3. Presque Isle Bay AOC	Presque Isle Bay, PA	Monitoring program involving benthos and sediment. Focussing on Brown Bullhead (skin lesions and lip papillomas) as indicator species for evidence of recovery.	Ongoing: target of 2010	PAFBC, PADEP, Erie County Dept. of Health	Coastal Zone Mgt., PFBC, DEP, Erie Co. Health			http://www.epa.gov/glnpo/aoc/presque.html
4. Plant community mapping - Lake St. Clair	Lake St. Clair	Hydroacoustic surveys of rooted plant communities within L. St. Clair. Identification and mapping of habitat based on both conventional and side-scan sonar transects.	Ongoing: annual surveys 3-4 weeks mid summer	MDNR, USGS	Oakland University		B. Haas, Lake St. Clair Fisheries Research Station, 33135 South River Road, Harrison Twp., Michigan 48045	n/a
5. Sturgeon Habitat surveys - Lake St. Clair	Lake St. Clair and St. Clair River	Habitat analysis: Availability of habitat required for spawning and surveys for juvenile sturgeon; Identification of habitat used by juvenile (<3yr) sturgeon.	Ongoing: annual surveys 2-3 weeks mid summer	MDNR	USGS, USFWS		M. Thomas, Lake St. Clair Fisheries Research Station, 33135 South River Road, Harrison Twp., Michigan 48046	n/a
6. Grand River Ecosystem Multi-Partner Initiative for Assessment, Monitoring and Rehabilitation	Grand River, Ontario (eastern basin)	Field work and reporting of fisheries and aquatic habitat concerns in the Grand River, towards the development of a strategy for ecosystem rehabilitation. Including: 1) Water quality 2) Fish migration & habitat use and refuges 3) Fish community IBI and SAR reporting and 4) evaluation of fishway performance to restore natural reproduction of walleye stock. Contributing to "State of" Reporting and the refining of rehabilitation targets and recommendations for reaching them (stream rehab, WPCP operation and reservoir discharge management).	Fieldwork complete. Review of 2000-2005 assessment underway. 2007: Agency and stakeholder workshops and development of habitat rehabilitation strategy	OMNR-LEMU (Assessment) and EC (LE LAMP Strategy)	GRCA, MOE, EC, DFO, OFAH	i) "State of the Southern Grand River"; Summer 2007. ii) Completion Reports (water quality, fish community); spring 2007; iii) walleye habitat; Reference #3	T. MacDougall, OMNR Lake Erie Management Unit, P.O. Box 429 Port Dover, ON, N0A 1N0	n/a
7. Clinton River Watershed Assessment	Tributary to Lake St. Clair	Assessment of landscapes, fisheries, and aquatic habitats in the river's watershed providing a comprehensive reference for all resource management applications.	Completed	MDNR			J. Francis, Livonia DNR Office, 38980 Seven Mile Rd., Livonia, MI 48152	http://www.crcw.org/programs/programs.html
8. Raisin River Watershed Assessment	Tributary to western Lake Erie	Assessment of landscapes, fisheries, and aquatic habitats in the river's watershed providing a comprehensive reference for all resource management applications.	Completed	MDNR			Jeff Braunscheidel; MDNR-Fisheries; 248-359-9048	http://www.epa.gov/glnpo/aoc/rvra/sin.html
9. Rouge River Watershed Assessment	Tributary to the Detroit River	Assessment of landscapes, fisheries, and aquatic habitats in the river's watershed providing a comprehensive reference for all resource management applications.	Completed	MDNR			Jeff Braunscheidel; MDNR-Fisheries; 248-359-9049	www.michigandnr.com/publications/pdfs/rlr/rlr/special/reports/sr22/sr22.pdf
10. Huron River Watershed Assessment	Tributary to western Lake Erie	Assessment of landscapes, fisheries, and aquatic habitats in the river's watershed providing a comprehensive reference for all resource management applications.	Completed	MDNR			Jeff Braunscheidel; MDNR-Fisheries; 248-359-9050	n/a
11. Niagara River AOC (Ont) Fisheries Assessment	Niagara River (CAN)	Assessment of fisheries and fish habitat including wetlands in selected areas throughout the AOC. Selection of sites, development of methodology, electrofishing (both boat and backpack).	Fieldwork Complete (2003-2005). Reporting spring 2006	OMNR (Niagara office)	Land Care Niagara, Eco Program		A. Yagi, OMNR, 4890 Victoria Avenue North, Vineland Station, Ont. L0R 2E0	http://www.epa.gov/glnpo/aoc/niagara.html
12. Larval fish transport in the Detroit River	Detroit River, MI and ON	This project measures the abundance, periodicity, and habitat use of larval fishes occurring in the Detroit River.	sampling completed in 2006, continues in 2007 and 2008	USGS GLSC	USFWS, OMNR, Central MI Univ. MIDNR		E. Roseman, USGS Great Lakes Science Center, 1451 Green Road, Ann Arbor, Michigan 48105-2807	proposal on file at GLSC link Roseman1.doc
13. Fish spawning habitat survey in the Detroit River	Detroit River, MI and ON	This project investigates spawning habitat use by major species in the Detroit River. Work is also underway to assess feasibility of proposed habitat restoration for spawning reefs.	new, 2007-2008	USGS GLSC	USFWS, OMNR, Central MI Univ. MIDNR		G. Kennedy, USGS Great Lakes Science Center, 1451 Green Road, Ann Arbor, Michigan 48105-2807	proposal on file at GLSC link Kennedy1.doc
14. Nearshore reefs for walleye spawning in the Central Basin	Nearshore areas (<3 m) from Fairport Harbor to Ashtabula, OH	Identification of potential nearshore spawning reefs and examination of the use of these areas by spawning walleye.	Spring 2007	ODNR, Div. of Wildlife			C. Knight, Fairport Fish Research Unit, ODNR, 1190 High St., Fairport Harbor, OH 44077	n/a
15. Characterization of yellow perch spawning movement in association with substrate in the Central Basin	Nearshore areas (<20 m) at Cleveland and Chagrin, OH	Spatial distribution of yellow perch by gender and age during the inshore spring spawning migration.	Spring 2006 and 2007	ODNR, Div. of Wildlife			C. Knight, Fairport Fish Research Unit, ODNR, 1190 High St., Fairport Harbor, OH 44077	n/a
16. Niagara River (Ont) AOC Wetland Assessment	Niagara River	Wetland assessments and ranking with a focus on the Welland R. watershed.	Summer 2006	OMNR (Niagara office)			A. Yagi, OMNR, 4890 Victoria Avenue North, Vineland Station, Ont. L0R 2E0	http://www.epa.gov/glnpo/aoc/niagara.html

17	Lyons Creek Watershed Study	Welland River watershed	Watershed habitat study on Lyons's Creek (tributary of the Welland River, Niagara AOC) in order to evaluate existing natural areas and determine hydrology regime.	Fieldwork Complete (2003-2005); Reporting 2006	OMNR (Niagara)/NPCA			A. Yagi, OMNR, 4890 Victoria Avenue North, Vineland Station, Ont. L0R 2E0	
18	Thames River Habitat Assessment and Monitoring	Thames River	This project will build on and augment several current monitoring initiatives and historical data focused on water flow, habitat availability, benthos, and municipal drains. This project will: assess thermal and flow regime, habitat, benthos, sediment and macrophytes at traditional MNR sites; extend Municipal Drain data collection to natural watercourses and link all to GIS; expand benthic monitoring network to include Lower...	Ongoing: April 2003-2007	OMNR (LEMU)/UTRCA	LTVCA, LEMU, MNR SIRD.		B. Locke, OMNR Lake Erie Fisheries Station, R. R. #2, 320 Milo Rd., Wheatley, ON N0P 2P0	
19	Dredge Sediment Plume Characterization Study	Maumee Bay, Ohio	Characterization of spatial extent of suspended sediment plumes as they relate to dredging operations in and around Maumee Bay using Acoustic Doppler Current Profiler and turbidity meters.	Summer 2004, results/completion report summer 2006	US Army Corps of Engineers, Ohio Division of Wildlife				
20	Sandusky River/Bay walleye movement and spawning habitat study	Sandusky River/Bay	Sandusky River/Bay spawning stock movement will be monitored during spawning to determine, among other things, location and use of available spawning habitat within the bay and river.	Ongoing 2006-2008	ODNR, Div. of Wildlife	Ohio State University		E. Weimer, Sandusky Fish Research Unit, ODNR, 305 E. Shoreline Dr. Sandusky, Ohio 44	
21	Coupling Ecological, Economic and Engineering Studies to Formulate Guidelines for Dam Removal and River Restoration in the Great Lakes.	Sandusky River, Ohio	Development of general guidelines and modeling tools to assess the ecological, hydraulic, and economic impacts of dam removals and management options within the Great Lakes. This work has also entailed additions of spawning substrate below the Balville Dam (Sandusky River) to monitor response of walleye spawning.	Spring 2003-2006; Completed (Reference #3)	Ohio State University	ODNR		T. Granata, 417C Hitchcock, 2070 Neil Avenue, Columbus, Oh 43210	
22	Evaluation of Southern Grand River wetlands between Cayuga and Dunnville	Bottom 42km of Grand River, Ontario	Ten wetlands were evaluated in the summer of 2004 for water and sediment quality along with vegetation and aquatic invertebrate and fish diversity and richness. Surveys were also conducted to determine wetland and river basin bathymetry elevations tied to geodetic benchmarks to assess potential impacts due to a Dunnville Dam removal scenario.	2004, Final Reporting Complete 2005	LEMU- OMNR	EC	Reference #4	Janice Gilbert or Kurt Oldenburg; OMNR Lake Erie Management Unit, P.O. Box 429 Port Dover, ON, N0A 1N0	
23	Rondeau Bay Wetland Complex Assessment	Lake Erie Central Basin North shore	To assess the status of the coastal wetland complex located within Rondeau Bay. Analysis parameters will include: water and sediment quality, vegetation diversity and richness, aquatic invertebrate diversity and IBI scores, fish, marsh bird and amphibian diversity, water fowl production and predation pressures, tributary water quality and landuse impacts. The results of this study will be used to guide stewardship initiatives within the watershed.	May-Dec 2005; Reporting Spring 2006; continued assessment focussing on invasive species and water quality, Summer 2006.	LEMU- OMNR	BSC, Rondeau Provincial Park, OMNY-Aylmer District, EC	Reference # 5 and #6	Janice Gilbert or Brian Locke; Lake Erie Fisheries Station, R. R. #2, 320 Milo Rd., Wheatley, ON N0P 2P0	
24	Lake Erie Coastal- and Thames River- Wetland assessments and evaluation	L.E. north shore and Thames river watershed	Evaluation, ranking and mapping of coastal wetlands in Aylmer District as well as select wetlands in the Thames River watershed.	summer 2006	OMNR (Aylmer)	UTRCA		Dave Richards, Ontario Ministry of Natural Resources, Aylmer, Ontario	
25	Identifying potential lake trout spawning habitat in Lake Erie	Lake Erie: specific locations to be determined by GIS analyses.	This project will identify potential lake trout spawning habitat within Lake Erie to assist with ongoing restoration efforts. The project team will evaluate the hypotheses that potential lake trout spawning habitat in Lake Erie can be identified using GIS, RoxAnn and side-scan sonar, hydroacoustic and video imaging equipment. Once identified, these sites can be targeted for potential protection/rehabilitation efforts.	Preliminary work conducted on north shore in vicinity of Grand River Ontario in June 2006, Continuing pending funding. Tentative: GIS work beginning 1/2007. Field data collected Summer 2007. Final analyses completed Spring 2008.	Habitat Solutions	USGS, NYSDEC, OMNR, ODNR, OSU		S. Mackey, Habitat Solutions, Beach Park, IL 60087	link Mackey1.doc
26	Long Point Wetland Complex Assessment	Lake Erie Eastern Basin North shore	To assess the status of the coastal wetland complex located within Long Point. Analysis parameters will include: water and sediment quality, vegetation diversity and richness, aquatic invertebrate diversity and IBI scores, fish, marsh bird and amphibian diversity, tributary water quality and landuse impacts. The results of this study will be used to guide stewardship within the immediate area.	Pending Funding; Spring and Summer 2007- 2009	LEMU- OMNR			Janice Gilbert or Kurt Oldenburg; OMNR Lake Erie Management Unit, P.O. Box 429 Port Dover, ON, N0A 1N0	

Rehabilitation Strategies (workshops, working groups, tools development)

1	Lake Erie Millennium Network Habitat Workshops	Lake Erie and Lake St. Clair	An ongoing series of workshops designed to focus management needs and coordinate research toward a better understanding of the Great Lakes ecosystem. To date: Habitat Classification (Dec 2002), Habitat Restoration and Protection (Feb 2003), 2005 meetings to tackle i) predicting the effects of changing water levels, modelling the Huron/Erie Corridor/Lake St.Clair system and ii) research protection and restoration planning for HEC, LSC aquatic habitats.	Ongoing	SL Millennium Network	multiple, bi-national partner list		J. Ciborowski, 36 Biology Building, U. of Windsor, Windsor, ON N9B 3P4	http://www.lemn.org
2	Fish Community Goal and Objectives for Lake St. Clair, the St. Clair River and Detroit River (St. Clair System)	Lake St. Clair, St. Clair and Detroit Rivers	Fish community objectives identified will provide a framework for managing fisheries resources in the St. Clair system	Complete	Lake Erie Committee, Great Lakes Fishery Commission	OMNR (LEMU), MDNR, ODNR, PFBC, NYSDEC	Reference #7	Rich Drouin; rich.drouin@ontario.ca	
3	A Geographic Information System for Great Lakes Aquatic Habitat	Lakewide and Basinwide	The Lake Erie Geographic Information System (LEGIS) is part of the Great Lakes GIS, a basin-wide GIS that serves as a tool for science inquiry and a comprehensive resource for Great Lakes basin resource managers.	Complete 12/31/06	JSFWS, USEPA, MDNR, GLFC				http://www.gllc.org/gllc/support_docs/html/lake_GIS/LEGIS_index.htm

4	Ohio's Lake Erie Balanced Growth Program	Pilot projects: Chagrin, Rocky and Swan Creek watersheds	Pilot watersheds are developing Watershed Balanced Growth Plans which are a regional framework for coordinated, local decision making about how growth and conservation should be promoted by local and state policies and investments.	2005-2008	Ohio Lake Erie Commission				http://www.epa.state.oh.us/oleo/bg1/chagrinriver.html http://www.epa.state.oh.us/oleo/bg1/swancreek.html http://www.epa.state.oh.us/oleo/bg1/rockyriver.html
5	Lake St. Clair Canadian Watershed Technical Report: An Examination of Current Conditions	Lake St. Clair watershed	Provides basis from which future management recommendations and actions can be developed	Complete	Environment Canada	OMNR, OMOE, UTRCA, ERCA, STRCA, OMAF, LTVCA, DFO, CWS, CCG, Walpole Island First Nation	Reference #8	R. Drouin, Lake Erie Management Unit, OMNR, 659 Exeter Road, London, ON N6E 1L3	http://www.scrca.on.ca/lakestclair.asp
6	St. Clair River - Lake St. Clair Comprehensive Management Plan	primarily US portion of the Lake St. Clair basin	Development of a comprehensive management plan to identify causes and sources of environmental degradation, address biological and chemical contamination, disseminate information, provide recommendations for future restoration measures	Complete	Great Lakes Commission		Reference #9		http://www.lre.usace.army.mil
7	St. Clair River AOC - Shoreline habitat inventory	CAN portion of the St. Clair River	Inventory of habitat and shoreline features to be used to direct rehabilitation targets.	Ongoing				R. Drouin, Lake Erie Management Unit, OMNR, 659 Exeter Road, London, ON N6E 1L3	
8	Lake St. Clair Coastal Habitat Restoration and Conservation	Lake St. Clair	The Great Lakes Commission, in cooperation with the U.S. National Oceanic and Atmospheric Administration (NOAA) is undertaking a project to characterize Lake St. Clair's coastal habitat and develop a restoration and conservation plan based on that characterization. The Great Lakes Commission is the principal cooperator with NOAA and will work cooperatively with various other project partners to gather data and information about Lake St. Clair coastal habitat and incorporate that information into a digital information resource.	Complete	Michigan Dept. Natural Resources	GLC, NOAA, Michigan Natural Features Inventory, MDNR			
9	Great Lakes Aquatic and Coastal GAP Programs	Great Lakes Basin	The goal of the Great Lakes Aquatic and Coastal GAP Programs is to evaluate the biological diversity of aquatic species and their habitats in the Great Lakes. Using a Geographic Information System (GIS), maps of aquatic and coastal habitats along with fish distribution can be used to identify gaps in the distribution and protection of aquatic species and their habitats within the Great Lakes basin. These programs will develop maps of ecoregional drainage units in a GIS framework, provide hierarchical habitat classification schemes, and allow for modeling of aquatic species-habitat affinities and interactions.	Ongoing	USGS	Ohio DNR, Michigan DNR			http://www.glsc.usgs.gov/main.php?content=research_GAP&title=Aquatic%20GAP&menu=research_NCE_GAP
10	Great Lakes Aquatic Biodiversity Conservation Blueprint Project	Great Lakes Basin	Mapping project designed to identify and prioritize sites for aquatic conservation in Canadian Great Lakes watersheds; similar to GAP projects and TNC initiative in the US	Ongoing	Nature Conservancy of Canada, OMNR	The Nature Conservancy (US)			www.mnr.gov.on.ca/MNR/inhr/projects/conservation_blueprint/Aqua1_exec_summary.pdf
11	Detroit River (AOC) Restoration Priorities development	Detroit River	Creation of "best bets" for direction rehabilitation dollars.	Ongoing	Detroit River Habitat Working Group	see #25 under "Strategies, engineering studies, implementation", below			
12	Lake Erie Binational Habitat Mapping Project	Lake Erie	Development of a comprehensive habitat classification system for the entire Lake Erie basin that includes terrestrial, inland lakes and tributaries, wetlands, and coastal margin, nearshore, and open-water offshore areas. Dynamic classification scheme is based fundamental integrity components (physical, chemical, and biological) and uses existing geospatial datasets and coverages. Aquatic classification scheme will be three-dimensional and integrate geospatial data from coastal margin, nearshore, and offshore areas of Lake Erie.	Ongoing, Completion Date December 2006	NRRI - University of Minnesota	G.L. Millennium Network - bi-national project team, Univ. Windsor, USGS, DFO, GLC - multiple binational partners		S. Mackey, Habitat Solutions, Beach Park, IL 60087	
13	Huron-Erie Corridor Habitat Assessment	St. Clair River, St. Clair Delta, Lake St. Clair, Detroit River, Western Basin Lake Erie	This project will create a framework and design a process to systematically identify, coordinate, and implement aquatic and fish habitat restoration opportunities in the Lake Huron to Lake Erie Corridor (Huron-Erie Corridor, HEC) within a context of water level change resulting from direct anthropogenic hydromodification and/or long-term effects of global climate change.	Complete	The Ohio State University, University of Windsor	G.L. Millennium Network - bi-national project team, MDNR, DFO, U.S. EPA, NWRI - multiple binational partners	Reference #10	S. Mackey, Habitat Solutions, Beach Park, IL 60087	
14	National Fish Habitat Initiative, Lower Lakes	Basinwide	The National Fish Habitat Action Plan is "a nationwide effort that harnesses the energies, expertise and existing partnerships of state and federal agencies and conservation organizations." This is an effort to develop partnerships in the lower lakes with an emphasis on restoration, protections and enhancement of fish habitat in Lake Erie tributaries and their associated watersheds.	Proposed	National Fish Habitat Initiative	Various local, state, federal, academic and non-traditional organizations		Kofi Fynn-Aikins Lower Great Lakes Fishery Resources Office, Amherst, NY	http://www.fish.org

Rehabilitation Projects: Implementing strategies, engineering studies

1	Lake Erie LaMP Habitat Strategy	Lakewide	Creation of a strategy to address habitat issues within the Lake Erie Basin. Includes 1) Guiding principals, goals and objectives 2) Listing of relevant management strategies already in place 3) Listing of priority watersheds on which to focus attention and 4) Criteria and tools for choosing additional priority watersheds.	Complete	EC	USEPA, DFO, USFWS, USGS, USACE, OMNR, ODNR, OEPA, UofWindsor, UTRCA, ERCA	Reference #11	J. Tyson, Sandusky Fish Research Unit, ODNR, 305 E. Shoreline Dr. Sandusky, Ohio 44 / OR / Jennifer Vincent, 867 Lakeshore Road Burlington, ON L7R 4A6	http://www.epa.gov/glnpo/lakeene
2	Grand River (Fairchild Creek) Stewardship Initiative	Grand River, Ontario (eastern basin)	Stewardship initiatives in Brant and Haldimand Counties to implement "Best Management Practices for agricultural land. Includes the monitoring of baseline and anticipated temporal improvements in water quality (esp. P, N, and TSS) as land use practices change in the watershed. Initial focus will be on the subwatershed of Fairchild Creek, other areas getting attention as impacts are better understood.	Ongoing	OMNR (Brant Stewardship Council)	Environment Canada, DFO, GRCA, MOE		D. Depuydt, OMNR, 353 Talbot St., W. Aylmer, Ont. N5H 2S8	
3	Grand River Wetlands: Process Wetland Feasibility Study	Grand River, Ontario (eastern basin)	A study is currently taking place to assess the feasibility of using treatment wetlands to polish WPCP effluent from the Brantford, Caledonia, Cayuga and Dunnville plants. This study will address the current loading rates of nutrients to the river from these plants, the potential reduction loads treatment wetlands could provide if located at these four sites, and the cost/benefits of these systems for habitat and other functions compared to conventional systems.	Assessment Complete; Working group established 2006; Ongoing	OMNR (LEMU)	6-Nations Ecocentre, MOE, Haldimand-Norfolk Stewardship council, Environment Canada	Reference #12	Janice Gilbert or Kurt Oldenburg; OMNR Lake Erie Management Unit, P.O. Box 429 Port Dover, ON, N0A 1N0	
4	Thames River Habitat Stewardship Program	Thames River	Initiate a Thames River Habitat Stewardship Program to provide incentives to landowners throughout the Thames River Basin to implement riparian BMPs. Focus will be on buffer strips, bank stabilization, livestock fencing, retiring fragile land. Related to Lake Erie via walleye stock contributions.	Ongoing	OMNR (Aylmer)	UTRCA, LEMU, Aylmer District, LTVCA; other potential partners include Perth, Middlesex, Oxford, & Elgin counties.			
5	Thames River Watershed Barriers Assessment	Thames River	Over 180 barriers have been identified in the Thames River basin. These impact water quality and fish movement & migration (incl walleye which utilize Lake Erie). This project will assess impacts and prioritize barriers for removal. 20 key impoundments will be assessed and prioritized for mitigation or removal and a detailed plan outlining action in 2004 will be developed for 3 priority impoundments.	Ongoing	OMNR (LEMU)/UTRCA	LTRCA, Aylmer District, Stewardship Ontario, LEMU, Municipalities		B. Locke, OMNR Lake Erie Fisheries Station, R. R. #2, 320 Milo Rd., Wheatley, ON N0P 2P0	
6	Rondeau Bay Watershed Habitat Stewardship Program	Lake Erie Central Basin North shore	Lever marginal rural properties for the restoration and protection of 375 acres of habitat over years 1-3. Education of landowners, community groups on benefits of BMPs through natural resource projects. Lever local groups to continue education efforts.	Ongoing	OMNR (Aylmer)	LTVCA, LEMU, Aylmer District, Rondeau Bay Watershed Coalition, Rondeau Provincial Park staff and the Lake Erie Corridor Stewardship Initiative		Don Hector, OMNR, 353 Talbot St., W. Aylmer, Ont. N5H 2S8	
7	Spooner Ck. Rehabilitation Project	Spooner Creek, Tributary of Cattaraugus Creek, NY	Bank stabilization project to minimize erosion, stabilize the creekbed, and improve instream habitat and cover. The project mainly involves tree plantings, but may also include the construction of cribs on high erosion areas.	Spring 2003 - Ongoing	NYSDEC	Western NY Chapter of TU		J. Markham, Lake Erie Fisheries Unit - NYSDEC, Dunkirk, NY 14048-1031	
8	Belle Isle/ Detroit River Sturgeon Habitat Restoration, Monitoring, and Education Project	Upper Detroit River (Belle Isle)	Three kinds of rocky substrate of representing a gradient of void space were placed on featureless, hardpan clay bottom in the upper Detroit River; monitored for spawning by lake sturgeon and other fish; and monitored for relative predation by round goby on deposited lake sturgeon eggs.	Preliminary surveys spring 2003 & 2004, Construction June 2004; Post-construction monitoring spring 2005 & 2006	Michigan Sea Grant; USGS is the science leader.	Smith Group JJR, Great Lakes Fishery Trust, Michigan DEQ, DTE Energy, City of Detroit, US Fish & Wildlife Service, US Coast Guard, Faust Marine Corp., Michigan DNR.			
9	Ashtabula River AOC	Ashtabula River, OH	Ongoing rehab via implementation of RAP: details [http://www.epa.gov/glnpo/aoc/ashtabula.html]	Ongoing	OHEPA: RAP coordinator	Extensive list of government, industry and NGO, see website			http://www.epa.gov/glnpo/aoc/ashtabula.html
10	Black River AOC	Black River, OH	Ongoing rehab via implementation of RAP: details [http://www.epa.gov/glnpo/aoc/blackriver.html]	Ongoing	OHEPA: RAP coordinator	Extensive list of government, industry and NGO, see website			http://www.epa.gov/glnpo/aoc/blackriver.html
11	Cuyahoga River AOC	Cuyahoga River, OH	Ongoing rehab via implementation of RAP: details [http://www.epa.gov/glnpo/aoc/cuyahoga.html]	Ongoing	OHEPA: RAP coordinator	Cuyahoga Valley National Recreation Area, USDA, OHEPA, OH DNR, USACE, USDHHS, USEPA and numerous industrial and community groups			http://www.epa.gov/glnpo/aoc/cuyahoga.html
12	Maumee River AOC	Maumee River, OH	Ongoing rehab via implementation of RAP (stage 2): details [http://www.epa.gov/glnpo/aoc/maumee.html]	Ongoing	OHEPA: RAP coordinator	Extensive list of government, industry and NGO, see website			http://www.epa.gov/glnpo/aoc/maumee.html
13	Maumee Bay Habitat Restoration Unit	Maumee Bay and nearby nearshore areas and or south shore marshes of the western basin, Ohio	Examining the beneficial reuse of dredge materials for physical habitat restoration. Potential for restoration of degraded sites - such as dredge disposal sites, or use to soften wave energy in nearshore areas.	Ongoing - information from Middle Harbor experiment will be further developed for this project	Ohio Division of Wildlife	Army Corps of Engineers, ODNR, USFWS, Toledo Port Authority, Lake Erie Charter Boat Association		J. Tyson, Sandusky Fish Research Unit, ODNR, 305 E. Shoreline Dr. Sandusky, Ohio 44	
14	Drapers Creek Barrier Removal	Welland River watershed	Barrier removal project in the lower portion of 12:12 creek (tributary to the Welland River, part of Niagara AOC above N. Falls). Barrier by erosion of the creek bed resulting in a perched culvert. Impacting known sports fish migration.	Initially April 2003-2006	OMNR (Niagara) /NPCA			J. Durst; OMNR Vineland Area Office, Vineland, Ontario	

15	Buffalo River Walleye introductions	Buffalo R., NY	Stocking of walleye fingerlings in the Buffalo River in an attempt to establish a breeding walleye population - Project will also monitor water quality and thermal profiles, and evaluate the overall habitat for possible future improvements.	Spring 2004	NYSDEC	Southtowns Walleye Association, Erie County Fish Advisory Board		J. Markham, Lake Erie Fisheries Unit – NYSDEC, Dunkirk, NY 14048-1031	
16	Ohio Barrier/Access Project: Balville Dam	Sandusky Co., Ohio; Freemont	Balville Dam on Sandusky River blocks upstream walleye migration and starves existing spawning habitat of gravel/cobble renourishment.	Ongoing; dam removal feasibility study being considered	Ohio Div. of Wildlife, USFWS, ODNR, USACE, Ohio Div. of Water			E. Weimer, Sandusky Fish Research Unit, ODNR, 305 E. Shoreline Dr. Sandusky, Ohio 44	
17	Guidance for Proposals Linked to Environmental Objectives under the F&W Restoration Act	Great Lakes Basin	The goal was to develop a prioritized list of draft environmental objectives across the Great Lakes basin that have the most significance as related to achievement of the Fish Community Goals and Objectives that would be used by the CLC for setting funding priorities for the Great Lakes Fish and Wildlife Restoration Act Grant cycle.	Completed - priorities list incorporated into GLFC F&W Restoration Act RFP for 2006	GLFC, OMNR, ODNR	GLFC and all Lake Committees	Reference #13	J. Tyson, Sandusky Fish Research Unit, ODNR, 305 E. Shoreline Dr. Sandusky, Ohio 44	
18	Middle Harbor Fish Habitat Restoration	Ottawa Co., Ohio; Catawba Island	Project to restore nearshore coastal fish community to Middle Harbor, Ohio. Project will demonstrate beneficial reuse of dredge material for island construction to reduce fetch/sediment resuspension, create depth heterogeneity, and reconnect Middle Harbor to East and West Harbor. Fish and aquatic plant community will be monitored.	Begin in 2007	ODNR, Div. of Wildlife, Div. of State Parks	ODNR, Friends of East Harbor State Park		Eric Weimer, Sandusky Fish Research Unit, ODNR, 305 E. Shoreline Dr. Sandusky, Ohio 44	
19	Cattaraugus Creek Migratory Access Improvement	Cattaraugus Creek, NY	This is the initial phase of an investigations into feasibility, costs, and benefits associated with fish passage and sea lamprey attraction traps at a dam in Springville, NY on Cattaraugus Ck. Results of this initial study will determine future direction of this project.	2005 to completion	US Army Corp of Engineers, Erie County	NYSDEC		J. Markham, Lake Erie Fisheries Unit – NYSDEC, Dunkirk, NY 14048-1031	
20	Chautauqua Creek Fish Passage Project	Chautauqua Creek, NY	This is the initial phase of an investigations into feasibility, costs, and benefits associated with fish passage at a pair of dams near Westfield, NY on Chautauqua Ck. Results of this initial study will determine future direction of this project.	2006 to completion	US Army Corp of Engineers, Erie County, Village of Westfield, USFWS, and NY Rivers United	NYSDEC, Red House Chapter of Trout Unlimited		J. Markham, Lake Erie Fisheries Unit – NYSDEC, Dunkirk, NY 14048-1031	
21	Ontario Stewardship Initiatives	Watersheds draining into L. Erie (Grand River, Welland River, Long Point Complex,	Implementation of Best management practices, Environmental Farm practices and riparian recovery on watersheds draining into Lake Erie	Ongoing	OMNR/ Stewardship Ontario (Haldimand-Norfolk, Brant, Waterloo-Wellington Counties)				OMNR; Guelph District office
22	Windsor Soft Shoreline Project	Shoreline and	Bulkhead removal and activities associated with reversing hardening of shoreline. In association with Lake St. Clair nearshore and small embayment recovery projects	Beginning Summer 2006 to completion; Ongoing	OMNR / City of Windsor	EC-GLLFAS			Rich Drouin; rich.drouin@ontario.ca
23	Wheatley Harbour AOC RAP	Wheatley Harbour, western basin L. Erie		Ongoing	EC	multi-partner initiative including OMNR, MOE, Stewardship Ontario		B. Locke, OMNR Lake Erie Fisheries Station, R. R. #2, 320 Milo Rd., Wheatley, ON N0P 2P0	http://www.on.ec.gc.ca/water/raps/wheatley/intro_e.html
24	Wetland Drain Project	Southern Ontario Watersheds draining into L.Erie	Designing, financially supporting and assisting the conversion of marginal farmland to wetland via the breaking of drainage tile and introducing small structure to facilitate the holding of water.	Ongoing	OMNR (Aylmer District)			Dave Richards, Ontario Ministry of Natural Resources, Aylmer, Ontario	
25	Huron-Erie Corridor System Habitat Restoration Opportunities – Creating Sustainable Aquatic Habitat	St. Clair River, St. Clair Delta, Lake St. Clair, and Detroit River AOC's	This project will use historical and current aquatic habitat data and modeling tools developed in an ongoing GLFC/USFWS Restoration Act-supported project to systematically identify and delineate aquatic and fish habitat restoration opportunities that protect and restore the processes responsible for creating and maintaining the pattern and function of <i>instream, riparian nearshore, and open-water aquatic habitats</i> within the St. Clair River and Detroit River AOC's and Lake St. Clair.	2006 Pending - NFWF/U.S. EPA	Univ. of Windsor	G.L. Millennium Network - binational project team - MDNR, USGS, DFO, DRCC - Multiple binational partners			