Volume 7, Number 1 *Fall 2003*

Great Lakes Research Review

great lakes program
GLR
GREAT LAKES RESEARCH CONSORTIUM
Sea Grant New York
Working together for Great Lakes research and education

Lake Ontario Interdisciplinary Science and Management Conference, March 13,2003

photo by Mark Bain, Cornell University

photo by Jack Manno, GLRC, SUNY-ESF

Great Lakes Research Review

great lakes program

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ABOUT THIS PUBLICATION:

This issue marks a major diversion from the normal content of the Great Lakes Research Review. Through this issue and the following we will provide a compilation of information presented during the Lake Ontario Interdisciplinary Science and Management Conference (LOISM) that was held in March 2003 at the SUNY College of Environmental Science and Forestry. Material from the conference includes presentations on larger projects; single-page abstracts describing ongoing work submitted by conference participants, and summaries of breakout sessions in which research and management issues for Lake Ontario were discussed. From comments received, the conference was a productive and worthwhile experience for participants. The speakers provided excellent overviews of the larger research and monitoring efforts on Lake Ontario. The breakout sessions were a great success, and many comments indicated that participants appreciated the chance to interact with colleagues involved with the lake system.

Previous issues have focused on special themes, from fisheries issues to toxic substances. More recent volumes have focused on the Lake Ontario and Lake Erie Ecosystems. The last issue focused on projects funded specifically through the New York State Great Lakes Protection Fund. This issue provides an overview of some of the presentations from the Lake Ontario conference, a random sampling of some of the research abstracts and summaries of the breakout sessions that were held during the afternoon portion of the conference.

THE UPCOMING ISSUE:

The second issue of Volume 7 will provide information on other presentations given during the conference and will contain the remainder of the abstracts on Lake Ontario research projects. If you did not attend the LOISM conference and are involved with research on Lake Ontario, we are interested in hearing about your work. Please contact Helen M. Domske (hmd4@cornell.edu) to submit a one-page abstract of your research efforts for possible inclusion in the next publication.

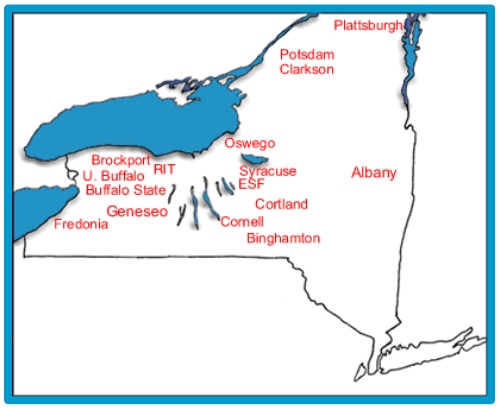
Great Lakes Research Review
Volume 7, No. 1, Fall 2003

NY Great Lakes Research Consortium

WELCOME TO THE LAKE ONTARIO INTERDISCIPLINARY SCIENCE CONFERENCE

Funded by
New York Great Lakes Protection Fund

What is the GLRC?
An organization of sixteen colleges and universities throughout New York cooperating to improve understanding of the largest freshwater system on earth
- 298 participating faculty



Canadian Affiliates
There are also
Nine Canadian Affiliate Colleges and Universities:
- 94 participating faculty

Purposes of the Lake Ontario Conference

1. Bring together people working on Lake Ontario science and management.
2. Discover opportunities for collaboration and synergy.
3. Identify research gaps and management information needs.
4. Prepare special Lake Ontario issue of GLRC and NY Sea Grant's Great Lakes Research Review.

Breakout Session Assignment

Leaders were asked to manage time and discussions to provide answers to the questions listed below. They were also asked to complete a form, and provide comments on the group's findings and conclusions.

NY Great Lakes Research Consortium

WELCOME TO THE LAKE ONTARIO INTERDISCIPLINARY SCIENCE CONFERENCE, CONT.

On Science Questions:
What are 3 to 5 top science questions of importance to understanding the Lake Ontario ecosystem? Which of these are being addressed now and by whom, and which have been neglected in recent years?

On Management Information Needs:
What are 3 to 5 top management information needs of importance to the sustainable use and conservation of Lake Ontario and associated habitats? Which of these are being addressed now and by whom, and which have been neglected in recent management programs?

Conference Overview

After a series of morning presentations reviewing the major new Lake Ontario research and management initiatives, participants broke into several discussion sessions to explore common interests and information sharing opportunities, and to identify priority research needs and management issues.

Beyond established agency monitoring efforts, university researchers have initiated several large research programs. The most prominent of the new projects are the International Joint Commission's 5-year study of water level regulation effects on Lake Ontario and the St. Lawrence River, an ecosystem scale study on Lake Ontario embayments sponsored by the National Science Foundation, and a NOAA-funded program on harmful algal blooms. These three efforts alone represent over $10 million of new science investment in understanding Lake Ontario. In addition, there are a number of more targeted study efforts and agency monitoring like the US EPA's Lake Ontario Atmospheric Deposition Study (LOADS), the Lake Ontario Lower Aquatic Foodweb study (LOLA), and the Great Lakes Environmental Indicators project (GLEI).

Lead researchers from each of these projects presented a synopsis of their research during the conference's morning session. Incredibly, some of the projects were collecting data in the same areas and were unaware of each other. In addition to the major new projects summarized during the morning plenary, nearly forty other research and management initiatives were described in abstracts received prior to the conference.

The afternoon sessions were designed to get people talking. One of the goals was to identify key priorities for research and management. Nearly twenty breakout sessions covered an array of topics facing Lake Ontario including hydrology and wetland plant communities, biological communities of bays, policy-making for the coastal zone, paleoecology of the coastal zone, nutrient dynamics in coastal waters, coastline stabilization, fish habitat and water level regulation and many others. According to Mark Bain**,** one of the organizers of the conference, one of the most common priorities identified by these sessions was the need for long term integrated monitoring and research programs. These kinds of data are invaluable for understanding trends and for adapting management to meet the changing nature of the Lakes.

Lake Ontario Lower Aquatic Foodweb Assessment (LOLA) 2003

UNDERSTANDING CHANGES IN A POST-ZEBRA MUSSEL FOODWEB

Project Organizers:

Lake Ontario Lakewide Management Plan

U.S. – Canada Great Lakes Water Quality Agreement

New York State Dept. of Environmental Conservation
Environment Canada
Ontario Ministry of the Environment
U.S. EPA Region 2

Lake Ontario Committee

Great Lakes Fishery Commission

New York State Dept. of Environmental Conservation
Ontario Ministry of Natural Resources

Department of Fisheries & Oceans Canada
National Oceanic & Atmospheric Administration
Cornell University
U.S. EPA Great Lakes National Program Office

Why the Emphasis on the Lower Foodweb in 2003?

- Lake Ontario's keystone benthic organism, *Diporeia*, disappearing from many nearshore waters.
- The impacts of exotic predatory zooplankton on native zooplankton are not well understood.
- Some evidence suggests that Mysids may also be declining.

***E**xotic species impacts also threaten –*

- Commercial & Recreational Fisheries
  - Commercial - $66 Million (Dockside)
  - Recreational - $2.4 Billion
- Efforts to restore naturally reproducing populations of trout, sculpin and bloater chub

Top Suspects – Zebra & Quagga Mussels

(*Dreissena polymorpha* and *D. bugensis*)

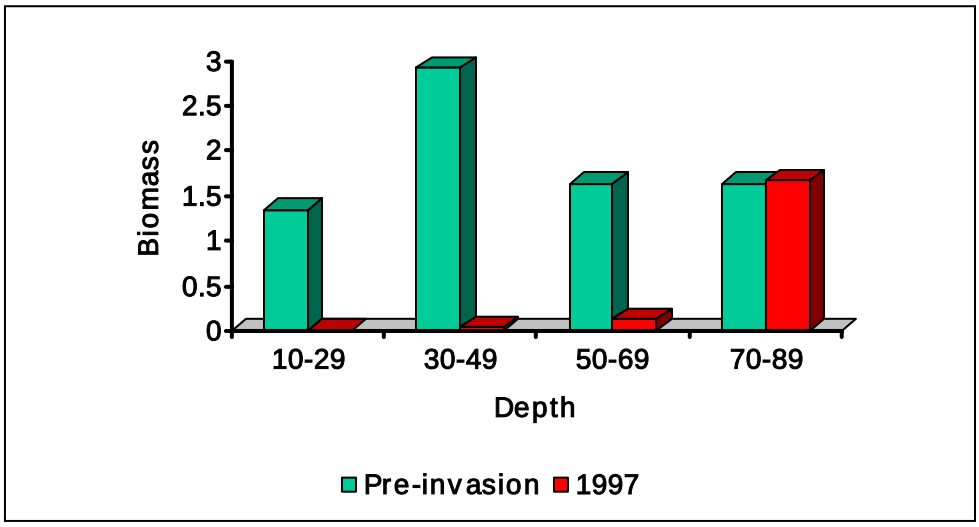
- First Reported on Lake Ontario in 1991
- Decline in native species followed its arrival

Lake Ontario Lower Aquatic Foodweb Assessment (LOLA) 2003, Cont.

Diporeia hoyi

- Deepwater benthic Amphipod native to the Great Lakes
- Historically comprised 80% of total benthic biomass
- High lipid content
- High energy food source for fish
- Dietary staple for many Great Lakes fish

Lake Ontario *Diporeia* Biomass
Before & After the Zebra Mussel Invasion

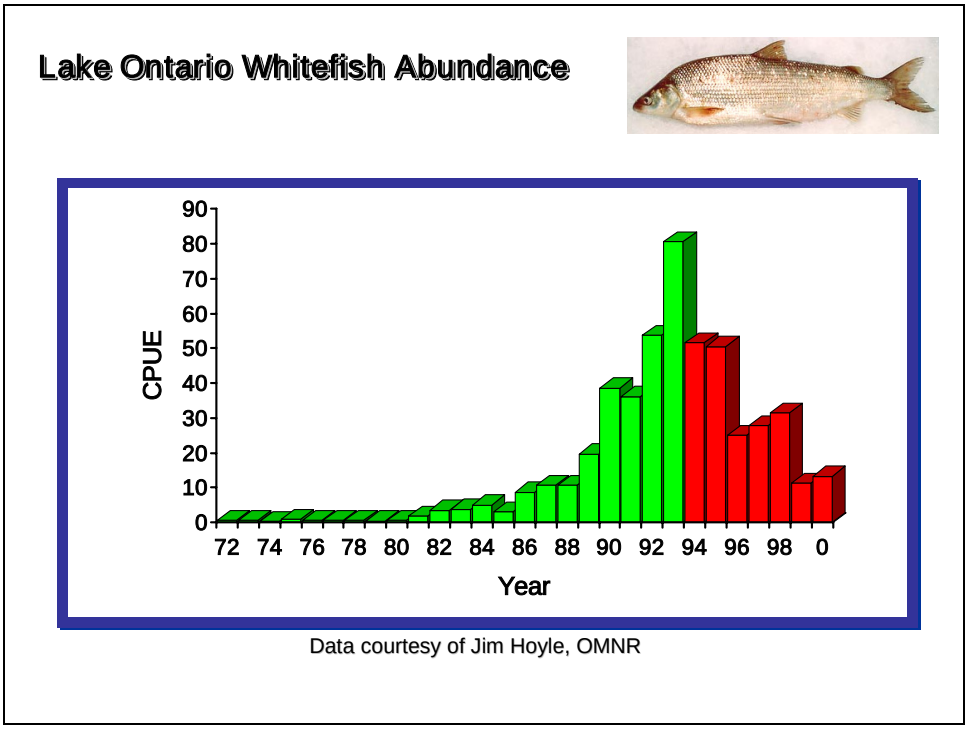


Data courtesy of Steve Lozano, GLERL

Lake Whitefish

- Benthic feeder
- Historical mainstay of Great Lakes commercial fisheries
- *Diporeia* important in diet
- Fisheries collapsed in 1950s
- Resurgence in 1980s

Lake Ontario Lower Aquatic Foodweb Assessment (LOLA) 2003, Cont.



2003 Lower Foodweb Sampling Approach

- Building on DFO's Lake Ontario Trophic Transfer (LOTT) Studies 1990s Approach (Spatially intensive - Spring, Summer, Fall)
- Use sampling methods that will allow comparison with LOTT lower foodweb surveys.
- Coordinate timing, methods and reporting with other vessels & efforts to develop more complete picture.
- Build on existing GLNPO, EC, DFO SOPs.
- Maximize coordination of sample collection among vessels to minimize required boat time.
- Develop Binational process to interpret data and develop reports/recommendations.

LOLA Cruise Plans 2003

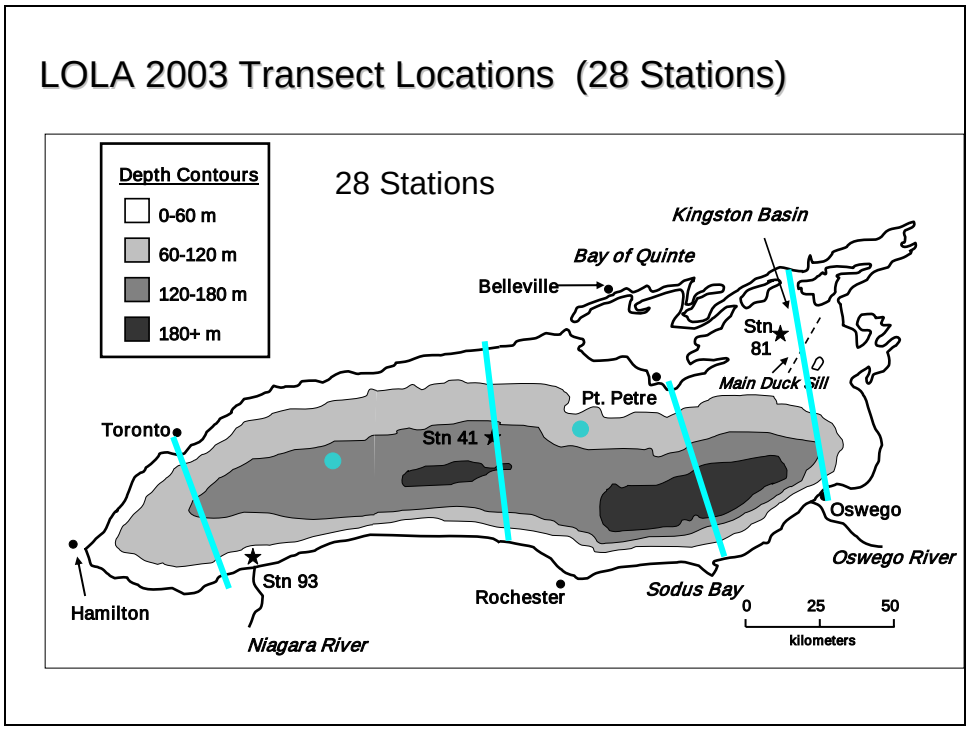
Four 5-day cruises:

April – R/V Limnos
August – R/Vs Limnos & Lake Guardian
September – R/V Lake Guardian
October – (to be determined)

Sampling for:

TP, SRP, Chl-a, Silica
Phytoplankton
Benthos
Zooplankton
Mysids

Lake Ontario Lower Aquatic Foodweb Assessment (LOLA) 2003, Cont.



Water Quality Parameters

US Lead: Ed Mills, Cornell University
Canadian Lead: Scott Millard, DFO

- TP, SRP, Chl-a, Silica
- TP and Chl-a to be analyzed using both U.S. & Canadian.
- Analytical methods to allow comparability with long term programs.
- Final report may include an analysis of how well U.S. and Canadian methods compare.
- Phytoplankton samples will be collected and archived.

Benthos Sampling Approach

U.S. Lead: Steve Lozano, NOAA
Canadian Lead: Ron Dermot, DFO

- Determine spatial changes in zebra/quagga mussel and Diporeia since 1999 lakewide survey.
- Ensure adequate coverage of nearshore zones (10-50m).
- Collect 3 ponar samples/location.
- Benthos samples would be analyzed for Diporeia & Zebra/Quagga mussels at ~50 locations.
- Complete benthic community assessment performed at ~20 locations.

Lake Ontario Lower Aquatic Foodweb Assessment (LOLA) 2003, Cont.

Zooplankton Sampling Approach

U.S. Lead: Ed Mills, Cornell University
Canadian Lead: Ora Johannsson, DFO

- Define current zooplankton community structure.
- Ensure adequate coverage of nearshore zones (10-50m) where mussel impacts are greatest.
- Shallow and deep tows during stratified conditions.
- Taxonomic and Productivity measures.
- August cruise critical to capture peak production.

Mysid Sampling Approach

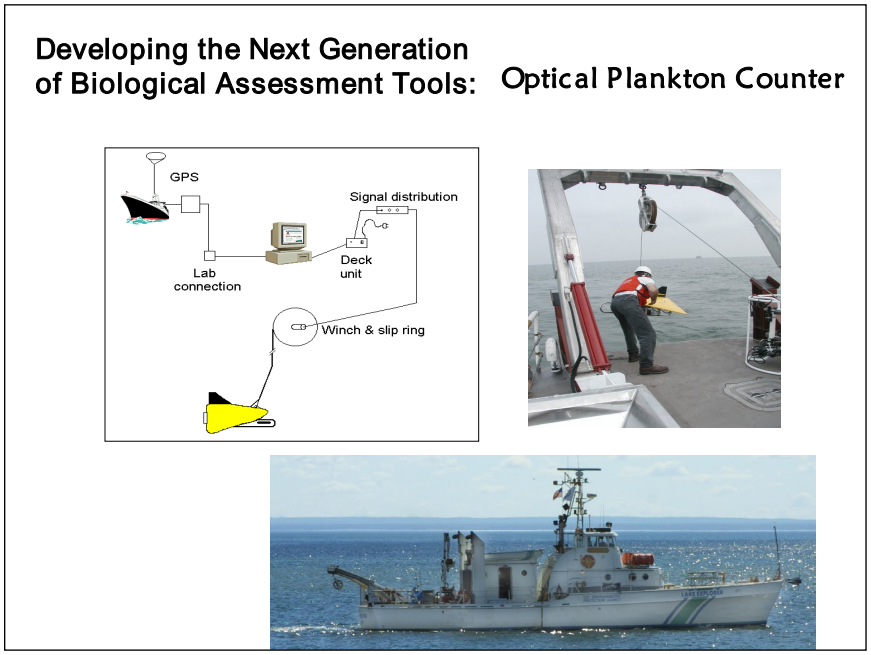
U.S. Lead: Ed Mills, Cornell University
Canadian Lead: Ora Johannsson, DFO

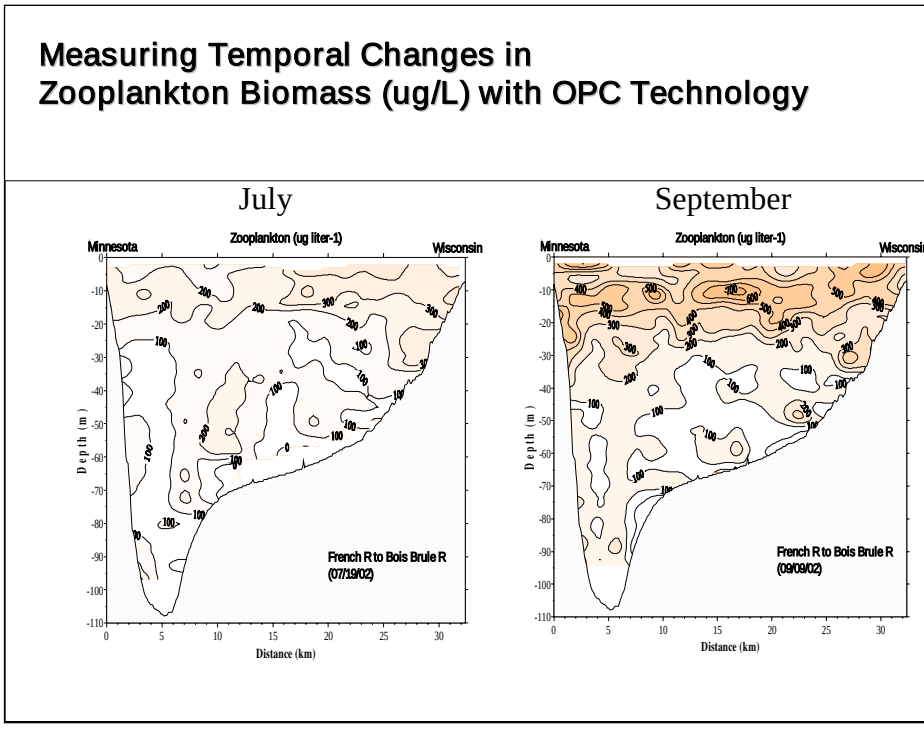
- Determine current status of mysid abundance.
- Samples collected at night under red light conditions.
- Analyses to include egg counts to allow productivity estimates.
- October cruise critical for production estimates.

Improving Ecosystem Indicators

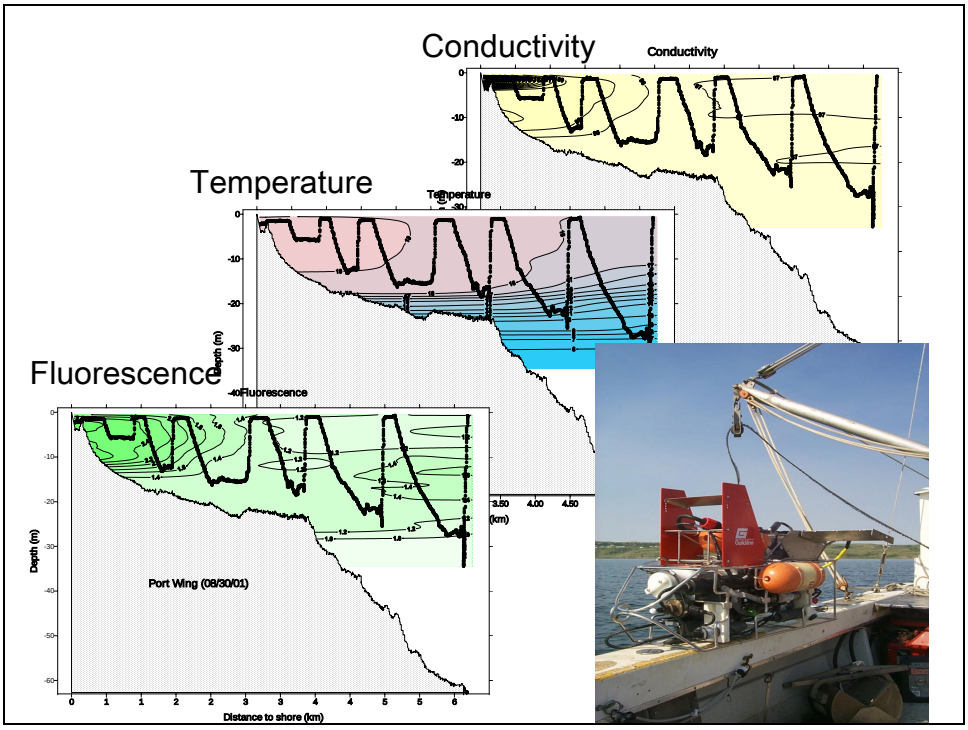
- Expand Lake Ontario LaMP's zooplankton indicator beyond mean length to include:
  - size spectra
  - community structure
- Explore the use of Optical Plankton Counter (OPC) to perform broad scale zooplankton assessments. Coordinating with:
  - EPA ORD /Duluth's R/V Lake Explorer's 2003 OPC work
  - Gary Sprules, Toronto University OPC work?
- Coordinate with U.S. & Canadian Nearshore Monitoring Programs

Lake Ontario Lower Aquatic Foodweb Assessment (LOLA) 2003, Cont.





Lake Ontario Lower Aquatic Foodweb Assessment (LOLA) 2003, Cont.



LOLA Preliminary Goals 2003 - 2004

- Develop better understanding of the status of Lake Ontario's lower aquatic foodweb.
- Promote increased communication and information sharing among lower foodweb researchers.
- Develop improved monitoring approaches and ecosystem indicators.
- Develop recommendations for the development of a long term U.S. - Canadian monitoring approach.

Management Priorities and Science Needs on Lake Ontario

Don Zelazny
Great Lakes Programs Coordinator
NYS DEC

Multi-level Management

- International
- Binational - National
- State Government/Departments
- Local/Regional Government & NGOs

NYS DEC Program Areas

- Environmental Quality - Air Resources
  - Regional & Urban Modeling of Ozone, SOx/NOx, and particulates
  - Ambient Air Quality Trends
  - Long-range Contaminant Transport, Fate & Effects
  - Air Pollutant Microscopy Identification
  - Acid Deposition

- Environmental Quality - Water Resources
  - Watershed Assessment & Restoration Program (WRAP) - 305(b) and 303(d) stream listing
  - Water quality, Sediments and Macroinvertebrates Assessment
  - Environmental Indicators
  - Non-Point Source Controls
  - Groundwater Quality Monitoring
  - Toxicity Testing

- Environmental Quality - Remediation
  - Site Investigation & Characterization Methods
  - Human Health & Environmental Risk Assessment at Inactive Waste Sites & Brownfields
  - Voluntary Cleanup Partnerships & Cost Share Strategies
  - Spill Prevention, Investigation and Cleanup
  - Remedial Technology R&D

- Environmental Quality - Solid & Hazardous Waste Management
  - Household and Industrial Waste Reduction
  - Fate & Effects of Pesticide Use
  - Naturally Occurring Radioactive Materials (NORM) and Rad Disposal Site Assessment/Remediation Methods
  - Recycling - especially Waste Tires & Mercury
  - Beneficial Uses of Low-Contaminated Materials

- Environmental Quality - Pollution Prevention
  - Comparative Risk Analysis
  - Environmental Performance Improvement Tools
  - Toxics Release Inventory
  - Alternative Materials, Processes and Design

- Natural Resource Stewardship - Fish & Wildlife
  - Fish Hatchery - Stocking Methods and Strain Compatibility/Resistance
  - Habitat - Fragmentation, Restoration, Toxicology & Pathology, Resource Damage Assessment
  - Native, Rare and Endangered Species
  - Aquatic Nuisance Species
  - Species Diversity & Richness
  - Diseases

- Natural Resource Stewardship - Lands, Forests and Minerals
  - Sustainable Use Policies & Practices
  - Safe Harvest & Extraction Technologies
  - Economic Valuation

New York State

- Coastal Zone Management
  - Open & Green Space Preservation
  - Inland & Coastal Wetlands Protection & Restoration
  - Shoreline & Riparian Erosion Control
  - Ecologically-compatible Waterfront Development
  - Beach Monitoring & Public Health

- Decision-Support Information Tools
  - GPS/GIS Databases
  - Conceptual & Analytical Models
  - Integrated Networks & Technology
  - Bioinfomatics

Summary of Emerging Issues

- Priorities for Lake Ontario:
  - Adverse Impacts of Water Withdrawals & Flow Controls
  - Lower Food Web Degradation
  - Emerging Chemicals of Concern
  - Economic Justification for Environmental Resources
  - Decision-Support Information Tools & Networks
  - Better-Cheaper-Faster Monitoring & Surveillance
  - Type – E Botulism
  - Climate Change
  - Security from Biochemical and Eco-Terrorism

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Biodiversity Monitoring in Oswego County Monitoring of Bog Turtle Populations and Habitat

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SUNY Oswego

Abstract

We are cooperating with the Oswego County Environmental Management Council, the NYS Natural Heritage Program, the NYS DEC Endangered Species Unit, and the U. S. Fish and Wildlife Service to develop a Biodiversity Inventory of Oswego County and to inventory Oswego County wetlands specifically for the purpose of identifying and characterizing habitats occupied or suitable for the federally threatened, state endangered Bog Turtle (*Clemmys muhlenbergii*). Much of Oswego County occupies the Lake Ontario coastal plain and many of the wetlands with which we are concerned are associated with current or prehistoric Lake Ontario – Lake Iroquois coastlines. In addition to evaluating the current status of Bog Turtles on the Lake Ontario lowlands, we are interested in the history of this area as it may relate to the past and current distribution of Bog Turtles and their habitat.

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Sponsors:

Oswego County Environmental Management Council
NYS DEC Endangered Species Unit
U. S. Fish and Wildlife Service

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Durham Region Coastal Wetland Monitoring Project - *A Cooperative Program to Monitor Wetland Health*

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Coastal wetlands located within the Regional Municipality of Durham, just east of Toronto on the north shore of Lake Ontario, have experienced a range of degradation and are under continued pressure due to population growth associated with the Greater Toronto Area. Maintaining key wetland functions and values in the face of rapidly urbanizing watersheds make management of Durham Region coastal wetlands a formidable challenge. A critical first step in conserving and restoring wetland functions is understanding the current capacity of a wetland to support various biological communities in relation to what would be expected of healthy wetlands in this region. The Durham Region Coastal Wetland Monitoring Project is a multi-partner monitoring program designed to provide this information for the 15 coastal wetlands within the Region. Through the use of standardized biological monitoring protocols, wetland health will be determined based on measurements of plant, bird, amphibian, fish and other wetland community indicators. With this understanding, appropriate biological goals can be set and management resources focused on addressing issues that will improve or maintain coastal wetland health in the Durham Region. The regional approach will improve understanding of lake effects, regional trends and local site specific changes. The investment by partners and stakeholders will be realized locally and throughout the Great Lakes basin and sharing resources and information through the partnership will improve the effectiveness and efficiency of the monitoring project. To ensure comparability at a Great Lakes level, progress and recommendations resulting from the Great Lakes Coastal Wetland Consortium are also being monitored. In addition, long term monitoring will enable implementation of an adaptive management approach, where by management actions can be assessed and adapted as necessary to meet wetland objectives.

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Investigation of the Ecological Interactions of Dreissenid Mussels and the Amphipod, *Diporeia hoyi*, Implications for the Profundal Food Web of Lake Ontario / Influence of Physical Factors and Exotics on *Diporeia*

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Abstract

The impact of invaders on established native communities can be swift and dramatic. After the invasion of the Great Lakes region by exotic mussels, density of the deep water amphipod *Diporeia hoyi* has fallen precipitously, but it is still present in some profundal areas. This amphipod has been a key food web link between primary production and fish production in deep cold lakes. The two major objectives of this study are 1: to quantify the current spatial and temporal composition of the benthic macroinvertebrate community in the profundal benthos of Lake Ontario, with emphasis on the distribution and population structure of the amphipod, *D. hoyi*, and Dreissenid mussels, 2: to quantify/identify the ecological interactions of the exotic invasive Dreissenid mussels with the native benthic burrowing amphipod through laboratory microcosm experiments. From 1999 to 2002, there has been a trend toward decline in the densities of major native macroinvertebrate groups: amphipods, oligochaete worms, and small native clams. Quagga mussels are now the dominant Dreissenid and dominant invertebrate in the profundal zone and are found at all depths. The amphipod *Diporeia spp.*, once the most abundant deepwater macroinvertebrate, is absent in depths less than 95m. The temporal and spatial community data and laboratory data will assist in understanding the mechanisms of the continuing Lake Ontario benthic community change, predicting potential trajectories of those changes, and provide data critical for managing Great Lakes ecosystem health.

Abstract

For a focused assessment of areas with and without deepwater amphipods to characterize physical and biological factors, high-resolution seismic profiles, side scan sonar, and surface sediment samples (analyzed for grain size, total organic carbon content, and carbonate content) were collected in 2001, along two shore-perpendicular transects from 50 to 150 m of water offshore of Olcott, and Rochester, New York in Lake Ontario. Results show thinner and coarser postglacial muds (implying sediment resuspension and erosion) recovered from the deepest water north of Olcott NewYork. This area appears to be a refuge for *Diporeia spp.* from the invading *Dreissena spp.,* at least up to August of 2001. The sediment sampling survey was extended during May 2002, 20 to 30 km northwest of each 2001 transect and to depths of 180m to assess the extent of the thinner postglacial muds and the apparent refuge for amphipods. The 2002 results confirm the continued presence of the amphipod, minimal quagga mussels, and primarily coarse sand and glacial clay substrate in both of the targeted Lake Ontario profundal areas. Evaluation of the universality of this combination of physical and biotic factors in the Great Lakes is ongoing.

This second project is partially funded by the EPA-GLNPO and is a collaboration with John D. Halfman of Department of Geoscience, Hobart and William Smith Colleges and Randall W. Owens, Lake Ontario Biological Station, USGS Oswego NY.

Education/Outreach Activities of Cornell Cooperative Extension of Onondaga County in the Lake Ontario Basin

Finger Lakes Landscapes: Landscaping for Water Quality Series –

CCE of Onondaga County has put together a booklet series and Powerpoint presentation targeted at lakeshore and streamside homeowners for the Finger Lakes region on how to landscape for water quality protection. The books list native plant species and steps to take to prevent erosion and runoff from lakeshore and streamside properties. Included in the books are bioengineering techniques that homeowners can implement.

The books have been distributed to over 15,000 homeowners in the region. The presentation has been adapted and used by other organizations including CCE. The presentation includes information about a demonstration erosion control project conducted on Skaneateles Lake with two homeowners. The web site for this project is found at: http://www.cce.cornell.edu/onondaga/fingerlakeslan/

Contact: Sheila Myers 424-9485 ext. 230
smm24@cornell.edu

Aquatic Plant Management: What Makes a Plant a Weed?

This educational program includes a series of brochures on specific problem aquatic plants targeted at specific lakeshore communities. The brochures cover issues such as the benefits of aquatic plants, what makes a plant a nuisance species to lakeshore homeowners, and methods for controlling aquatic plants including permit information. So far, the brochure series has covered: Eurasian Watermilfoil in Skaneateles and Otisco Lakes, Chara in Tully Lake, and Water Chestnut in Oneida Lake. CCE has also developed a Powerpoint presentation in collaboration with CCE of Cayuga County and the Cayuga Lake Network that outlines issues associated with management of Water Chestnut.

CCE is a facilitator of the Water Chestnut Task Force – a group of agencies that meet quarterly to discuss water chestnut control options for the Oswego River Basin. CCE also began a volunteer hand-pulling program for water chestnut on Oneida Lake and plans to expand this program into the three rivers system if funding allows. In addition, CCE is working with a collaboration of other Finger Lakes educational and grass roots organizations to develop an aquatic plant education program and weed watch program that will recruit volunteers to monitor for invasive aquatic plants in the Oswego River Basin (pending funding).

Contact: Amy Samuels 424-9485 ext. 233 ams71@cornell.edu Visit web site: www.cce.cornell.edu/onondaga

Lakeshore Homeowners Education on Non-Point Source Water Pollution

CCE of Onondaga has provided educational seminars and publications on a number of non-point source issues in the Finger Lakes region. The Home*A*Syst program offers educational presentations and materials on controlling pollution from septic systems, stormwater runoff around the home, and protecting private drinking water supplies. This program has reached over 1000 people in the Owasco, Skaneateles, Otisco, and Oneida Lake region.

In addition, CCE has collaborated with other organizations to produce three lake books that outline steps homeowners can take to protect their lakes. The Skaneateles, Otisco, and Oneida Lake books are part of a series first developed by CCE of Yates County. These books have been distributed to over 5,000 people in the region.

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Web site: www.cce.cornell.edu/onondaga/skaneateles
http://www.cce.cornell.edu/onondaga/homeasyst/

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Effects of a Flow-Control Structure on Functions of a Cattail Marsh at the Mouth of Irondequoit Creek Near Rochester, New York

Project Chief: **William F. Coon**
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Abstract

Since 1990, the U.S. Geological Survey, in cooperation with Monroe County Department of Health, has been conducting a study of the Ellison Park wetland, a 423-acre, predominantly cattail (T*ypha glauca*) marsh at the mouth of Irondequoit Creek in Monroe County near Rochester, New York. The study is designed to document the effects that a flow-control structure (FCS) has on the wetland's ability to decrease surface-water chemical loads that are brought into the wetland by Irondequoit Creek and would otherwise be carried into Irondequoit Bay on Lake Ontario. Wetland functions under non-controlled conditions were studied from 1990-96. The FCS was installed at a natural constriction midway through the wetland during 1997 to increase dispersal and detention time of storm runoff, and post-control conditions have been monitored since that time. A comprehensive ecological-monitoring program was established to assess the hydrologic effects of the FCS and to monitor changes in the wetland's biology, chemistry, and sedimentology that might be attributable to the FCS. Periodic surveys of the flora, fish, benthic macro invertebrate, and bird communities were conducted. Sedimentation rates were measured and sediment quality was analyzed. Calculations of chemical loads carried into and out of the wetland were used to evaluate the effects that the FCS had on water-quality.

Based on data collected and analyzed through 2001, no adverse effects that could be attributed to the FCS were identified in regards to flooding problems, the wetland flora and fauna, and sediment chemistry. Sedimentation rates upstream from the FCS increased during the post-control period, but were limited in extent, and a concurrent increase in sediment accumulation was noted in a backwater area downstream of the FCS. Statistical analyses of monthly inflow and outflow loads and flow-weighted concentrations indicated that the FCS contributed significantly to the decrease in total-phosphorus and suspended-solids loads. The FCS had little or no significant effect on loads of other measured constituents (orthophosphate, ammonia, nitrate-plus-nitrite nitrogen, ammonia-plus-organic nitrogen, chloride, and sulfate).

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Evaluating Groundwater Hydrologic and Biogeochemical Processes in a Large Cattail Wetland Draining Into Irondequoit Bay

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Abstract

Our study is examining the groundwater hydrology and biogeochemical functions of a 200 ha cattail wetland that intercepts Irondequoit Creek flow and runoff from Rochester, New York. A network of 7 stations, consisting of stage gauges, piezometers, and water table wells, was established within a 10 ha subset of the marsh in 1999. The first phase of the project documented four different phases in the interactions between surface water and groundwater as climate / seasonal conditions shifted from full flooding to severe drought (M.S. thesis: M. Traynor, 2001). Relationships between wetland water levels and Lake Ontario water fluctuations were modeled and compared between pre- and post- regulation periods (Ph.D. L. Luz, 2002). This past year our research efforts focused on an in-depth examination of evapotranspiration by the extensive cattail system as it influences groundwater processes. Replicated in-situ lysimeters were used to measure actual cattail ET rates throughout the growing season and continuous water level recorders in several wells documented the impact on adjacent groundwater. The results indicate that ET, interacting with sediment type, influences groundwater hydrology at three different spatial scales throughout the wetland. We also have initiated the second phase of the project that is examining the linkages between groundwater – surface water hydrology and biogeochemical filtering. Oliver Pierson is conducting his M.S. thesis project examining spatial and temporal influences on phosphorus retention by the wetland (see separate project summary).

Current Status: This year's research is being summarized for publication. Funding is being sought to build on the existing infrastructure and information to examine further biogeochemical – hydrologic linkages. Of particular interest are how climatic changes and Lake Ontario water level regulation will impact wetland filtering and other ecological services.

Sponsors: U.S. Geological Survey, Water Resources Institute

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Fueling the Base of Lake Foodwebs: Internal Nutrient Loading in the Littoral Zone of Lakes

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The sediments that cover the bottom of lakes are a very large reservoir of phosphorus. Several mechanisms of phosphorus exchange between the sediments and lake water have been proposed, including the classical theory of redox-dependent desorption of phosphate from iron hydroxides under reduced conditions. Several studies have since clearly shown that phosphorus can also be released from sediments under apparently oxic conditions. In this project, we test the role of resuspended sediments in the internal loading of phosphorus to shallow littoral areas. The release of phosphorus into warm, well-lit and biologically diverse shallow areas can directly enhance lake productivity during the summer months, and may be more important from an ecological perspective, than the well-known summer nutrient release in deep anoxic waters.

The exchange of phosphorus between resuspended sediment particles and the surrounding water is well-described by sorption equilibrium models. This means that the phosphorus (P) exchange can go in both directions: resuspended sediments can either release P to water with low P concentrations (.e.g. during the growing season), or strip P from water with high P concentrations (.e.g. lake turnover, from point sources). Several studies have shown good relationships between sediment characteristics (e.g. mean particle size, Fe, Al or Ca content, Fe:P ratio) and their affinity or their maximum sorption capacity for phosphorus. This suggests that internal loading of phosphorus from resuspended sediments should be unevenly distributed around lake basins (depending on sediment types and on the probability of sediment resuspension), and should vary with the timing and duration of these resuspension events. We are comparing sediment-water P exchanges across very different types of littoral sediments, ranging from fine muds to coarse sands, and across a wide range of sites with respect to their degree of eutrophication.

Governance and Policy Making for the Great Lakes: *4 Year Project 2001-2005*

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Abstract

The research addresses basin wide governance and policy issues for the Great Lakes, placing emphasis on institutional design and analysis. It builds on previous research at a micro scale (Hamilton Harbour) and meso scale (43 Areas of Concern for Remedial Action Plans & their implementation). The macro scale issues include:

- Sustainability & Lake Levels: a focus on the regulatory effectiveness of the Great Lakes arrangements, including the International Joint Commission with the more comprehensive management of the Murray-Darling Basin in S.E. Australia.
- Regulation of Toxic Contaminants. A comparative analysis of voluntary regulation of 10 basin wide contaminants with compulsory permit regulation of 200+ industries discharging into the basin in both Canada and the United States.
- Sustainability and Water Exports: A comparison of the institutional arrangements for basin exports in the forms of diversions, withdrawals, tankers, bottles, and slurries from lakes, rivers and groundwaters in the basin, with a comparison across nine state/regional and two nation state legal systems.
- Management of Non-Point Sources: A comparison of alternative methods of regulating non-point source regulations across three Canadian and three U.S. watersheds in the Great Lakes.
- Basin Wide Planning: An Analysis of Lake Wide Plans, Remedial Action Plans and Coastal Zone Plans across all jurisdictions with a view to assessing their potential combined effectiveness in addressing basin-wide problems.

The theory that is extended and applied is that of Common Property Resources which has focussed until now largely on small scale single water resource issues; it is being extended to a large scale multiple use situation in the Great Lakes.

Of the above five projects, their current status is as follows:

- Lake levels: Data collected and analyzed. Writing under way.
- Voluntary Regulation: Data collected, cleaned and analysis is under way.
- Water Exports: Background information only collected to date.
- Non-Point Pollution: Project essentially completed with journal articles to come.
- Planning: still to begin.

SPONSORS:

Networks of Centres of Excellence, Industry Canada, Program on "Clean Water":	$200,000.
Social Science and Humanities Research Council of Canada:	$109,000.
City of Hamilton, Ontario.	$100,000.

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Importance of Groundwater as a Linkage Between Oneida Lake and It's Watershed

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Abstract:

Oneida Lake is New York's fourth most heavily fished waterway. It is a key contributor to the local economic vitality, accounting for angler expenditures last year of approximately 8.8 million dollars. Water quality is a critical factor contributing to the lake's sustainability however only recently have researchers begun to examine how the lake is influenced by activities and land uses in the surrounding 3,600 km^2 watershed. Working with students from 1997 through 2001, we have been documenting the significant contribution of groundwater flowing from upland habitats into the Oneida Lake shoreline, a linkage that has been previously overlooked. Using seepage meters and associated controls, we have documented the timing, magnitude and direction of groundwater flow at Shackleton Point on the south shore, and, in 1999, around the entire lake edge. Results of this work indicate that such groundwater linkages are vulnerable to the increasing development of year-round shoreline homes and impacts from agriculture and suburban sprawl.

Current Status:

Funding is being sought to examine the chemistry of lakeshore groundwater, its interactions with shoreline wetlands, and the sources and age of the groundwater as they are affected by land use activities.

Sponsors:
Cornell University; U.S. Dept. Agriculture

Preliminary Assessment of the Role of Lake Effect Precipitation in the Deposition of Organic Contaminants

J. Chiarenzelli (chiarejr@potsdam.edu), J. Pagano, M. Milligan, and T. Holsen

Recent studies conducted along the southeast shore of Lake Ontario and on the Tug Hill Plateau suggest that contaminant levels in air and sediment are elevated above those expected in rural and remote areas. In particular, PCB concentrations are significantly elevated over those in other areas throughout the Great Lakes Basin. In addition, PCB chlorination levels measured in air near the lake are also significantly higher than measured at IADN sites. Sediment cores from two localities east of Lake Ontario suggest that this is a long-term, regional phenomenon and the congener-specific composition of the sediment is similar to that of the air samples. PCBs in air and sediment cores samples from east of Lake Ontario are comprised of many of the same highly chlorinated congeners and in similar ratio, while clear differences exist compared to other Great Lakes air sampling sites such as Stockton and Point Petre. Prevailing winds from the west result in significant amounts of lake-effect precipitation east of Lake Ontario and it has been suggested that the scavenging of contaminants, including PCBs, by precipitation may enhance the deposition and accumulation of organic contaminants. However, recent air sampling at Stockton and Sturgeon Point within Lake Erie's 'snow-belt' do not show anomalous airborne PCB concentrations. Therefore, lake-effect precipitation alone cannot account for these differences.

One factor that may account for the differences found between air samples collected east of Lake Ontario and those collect east of Lake Erie could be their location with respect to contaminant sources. Prevailing winds put the southeastern shore of Lake Ontario downwind of the highly contaminated Toronto-Hamilton Harbor, Niagara Falls-Buffalo, and Rochester urban and industrial centers while Stockton and Sturgeon Point are rarely downwind of these areas. ***We propose that the enhanced contaminant levels recorded in air and sediment downwind of Lake Ontario are related to scavenging of contaminants derived from upwind urban and industrial sources by lake-effect precipitation. Further we also suggest that this enhanced deposition and accumulation of contaminants has occurred over historic time spans and continues to influence contaminant levels in air via volatilization processes, particularly during warmer weather.***

These hypotheses can be direct tested by determining the amount and composition of select organic and inorganic contaminants in soils from Lake Ontario's 'snow-belt' and comparing them with similar samples from areas effected by lake-effect precipitation along Lake Erie. A greater understanding of the role of lake-effect precipitation in the deposition of contaminants is clearly needed for any realistic contaminant mass balance efforts in Lake Ontario. The proposed enhancement mechanism may also be an important factor in the nearly complete acidification in western Adirondack watersheds, also impacted by lake-effect precipitation. The work may also result in the reassessment of the impact of major industrial and urban areas on distant areas throughout the Great Lakes region and elsewhere.

Sponsor: *Great Lakes Research Consortium*

Lake Ontario Basin Research

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The primary focus of my Lake Ontario basin research is studing the habitat, ecology & genetics (demographics & molecular aspect) of the federally threatened bog turtle (*Clemmys muhlenbergii*) and its sympatric congener the spotted turtle (*Clemmys gutatta*). I also work as a member of the GLRC Task Force on Reptiles & Amphibians of the Lake Ontario/ St. Lawrence Basin on various issues associated with reptiles & amphibians in the basin.

Another area of research interest and activity include working with Oswego County and the NYS Natural Heritage Program to conduct biodiversity inventories within Oswego County.

I also have worked with Jim Pagano of the SUNY-Oswego Environmental Research Center & other collaborators on using snapping turtles and their eggs as monitors of pollution, especially persistent toxic such as PCBs, DDT, etc.

Lake Ontario Lower Aquatic Foodweb Assessment: Understanding Changes in a Post-Zebra Mussel Foodweb

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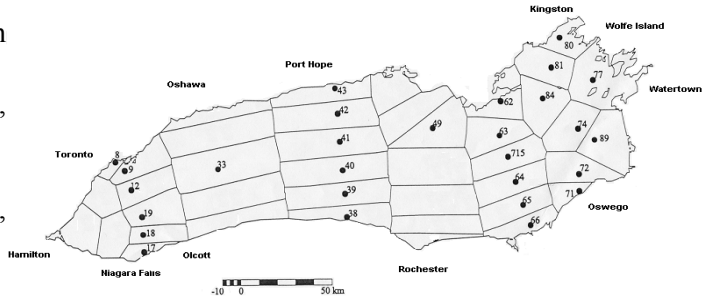
Major Areas of Investigation
Benthos & zooplankton communities, mysid production, traditional water quality parameters

Background
This assessment was initiated at the request of the LaMP & LOC to develop a better understanding of exotic species impacts on Lake Ontario's lower aquatic foodweb. Zebra mussels have changed the way nutrients are cycling through the foodweb impacting the productivity of fisheries and threatening efforts to restore naturally reproducing populations of native fish. The amphipod *Diporeia*, once the keystone benthic species, has disappeared from some nearshore waters. The cause of this decline is not known, although there it appears to be linked to the arrival of zebra and quagga mussels. The impact of exotic mussels and other exotic species, such as recently introduced predatory zooplankton, on native zooplankton communities is not well understood.

Approach
Coordinated Spring, Summer and Fall sample collection efforts will be conducted with the assistance of U.S. EPA's vessel *Lake Guardian* and the Canadian Coast Guard's vessel *Limnos*. Approximately 30 stations per cruise will be sampled along four north-south transects for benthos, zooplankton, mysids, TP, Chl-a, SRP and silica. Mysids will be collected at night under red light conditions. Phytoplankton and microbial samples may be added if resources and time allow. Data interpretation and report writing will be coordinated among U.S. & Canadian partners. DFO surveys conducted in the 1990s served as the model for this effort and will provide a historical point of comparison for these results.

Organized by
U.S.-Canada Lake Ontario Lakewide Management Plan (LaMP), (EC, OME, NYSDEC & EC)
U.S.-Canada Lake Ontario Committee (LOC), (NYSDEC & OMNR), Great Lakes Fishery Com.
Department of Fisheries & Oceans Canada (DFO)
National Oceanographic & Atmospheric Administration,
Cornell University

2003 Planned Sample Locations & Transects



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Lake Ontario's Dynamic Coast: Exploring History for Sustaining Environmental Health

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SUMMARY

This proposal will develop an integrated alert system to monitor and detect toxic cyanobacteria blooms in the lower Great Lakes: Lake Erie, Lake Ontario and Lake Champlain. The proposal is organized around six different working groups, each with their own tasks. The Lake Erie working group will investigate the spatial distribution of toxic *Microcystis* in Lake Erie, evaluate the chemical diversity of microcystin(s) produced in the lake, evaluate the use of molecular markers for the microcystin biosynthesis genes *mcy*B and *mcy*D as monitoring tools for toxigenic species, and examine nutritional probes for iron, nitrogen and phosphorus as predictors for toxic cyanobacterial blooms. The Champlain working group will investigate the occurrence of anatoxin-a and microcystins in Lake Champlain, including the identification of the phytoplankton species responsible for toxin formation in this system, examine the correlation between blue-green algal density and toxin production, validate a newly developed dipstick assay for anatoxin-a, evaluate cyanotoxin screening protocols for potential use by water treatment operators, and develop training programs for those water quality managers. The Lake Ontario group will examine the occurrence of toxic cyanobacteria in the Lake Ontario's southern shore embayments and determine if these embayments are a source of cyanobacteria and toxins to the open lake water and to the St Lawrence River. It will also examine the potential of using zebra mussels as a surrogate monitoring system (mussel watch). A centralized toxin support group will analyze for the cyanobacteria toxins including microcystins, anatoxin-a, anatoxin-a(s), PSP toxins and cylindrospermopsin. They will also develop extraction methodology and form an HAB event response team. A remote sensing and modeling working group will provide information on the occurrence/movement of phytoplankton blooms in the region and apply new remote sensing platforms to the occurrence of toxic cyanobacteria blooms. Finally, an education working group will disseminate this material to concern parties by developing a public awareness program for cyanobacteria toxins, informing and educate local environmental, health, and monitoring agencies integrating the groups field studies into information on management strategies, detection techniques, health risks, and what is likely to be an appropriate public response.

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Meteorological Station at Sterling Nature Center in Support of Great Lakes Research and Environmental Education

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Abstract

A WLS-8000 Weather Logging Station with digital display from Scientific Sales, Inc, Lawrenceville, NJ (www.scientificsales.com) was installed at Sterling Nature Center, Sterling, New York, on the south shore of Lake Ontario. The WLS-8000 comes equipped with sensors to measure wind speed, wind direction, temperature, humidity, rainfall, solar radiation, and barometric pressure. Each collaborator will use the proposed weather instrumentation in the following ways:

Lake Ontario Air Deposition Study (LOADS): provide site-specific weather data for instrument calibration/operation, and contaminant and source receptor modeling. We envision that the acquisition of the proposed weather station will build the required equipment infrastructure for the development of a permanent air deposition station in support of the goals of the Lake Ontario LaMP along the south shore of Lake Ontario at Sterling Nature Center (SNC). We also believe that the acquisition of this equipment infrastructure will facilitate additional grant activity in the areas of particulate studies, acid deposition, and additional contaminant studies (pesticides/PAHs).

Sterling Nature Center: provide current and future field-based research projects (amphibians/reptiles, plant/animal/stream/wetland surveys) with local meteorological data; provide local weather-data archive for future research uses; and provide real time weather for interpretive use at the SNC visitor center, GLOBE environmental education program (www.globe.gov), and SNC web page (www.cayuganet.org/sterlingpark).

SUNY Oswego: provide additional lakeshore based weather site for refinement of lake effect snow and lake breeze models, provide meteorology students with the field experience performing calibrations and maintaining weather instrumentation at SNC, provide students with experience manipulating weather data logging for use by LOADS and lake effect snow and lake breeze modeling.
Sponsor: **NYS Great Lakes Protection Fund – Small Grants Program**

The Nature Conservancy

The Nature Conservancy is engaged in a number of projects tied together under the general theme of developing science-based information to support conservation action. Specific projects include:

Experts Workshop to Select Environmental Regulation Criteria: a project of the Environment Working Group of Lake Ontario St. Lawrence River Water Level regulation Study. PI: David Klein, *with Sandy Bonanno, Brian Richter, Kevin Godwin.* ***Contact: David Klein,*** *The Nature Conservancy, 339 East Ave, Suite 300, Rochester, NY 14604; (585) 546-8030 x24; dklein@tnc.org*

ABSTRACT

The Nature Conservancy (TNC) conducted an analysis potentially boiologically significant components of the water level fluctuation regime for Lake Ontario and the upper St. Lawrence River, using a tool called Indicators of Hydrologic Alteration (IHA). The analysis statistically characterized changes in the hydrologic regime since regulation. An Experts Workshop considered the analysis and began to link these changes to conditions needed to maintain habitat quality, essential ecosystem processes, and viability of key fauna. Continuing analysis has begun to clarify acceptable ranges in key hydrologic variables for consideration as regulation criteria to support biodiversity.

Eastern Lake Ontario Sand Transport Study (ELOSTS): Final Report on Sediment Transport Patterns and Management Implications for Eastern Lake Ontario. PI: Donald L. Woodrow*, Hobart and William Smith Colleges, Emeritus (****woodrow@hws.edu*** *), with Charles McClennen/Colgate University, William Ahrnsbrak/Hobart and William Smith Colleges, and several others.* ***Contact: Sandy Bonanno,*** *The Nature Conservancy, 31 South Jefferson St., Pulaski, NY 13142; (315) 298-2040 x22;* ***sbonanno@tnc.org****; website (report available):* ***www.nature.org/CWNY***

ABSTRACT

To provide a basis for decisions concerning management of the Eastern Shore of Lake Ontario, studies were conducted to address lake currents, sediment type, distribution, internal structure and thickness in the lake and on the sand barriers; size variation of sand on the lake floor and on the beaches; water level in North Sandy Pond as a guide to short-term lake-level variations; shoreline evolution as seen in charts, maps and aerial photographs; and carbon dating of sediments to provide a chronology for the changes observed. ***Major findings include the following:*** The Eastern Lake Ontario barrier beach/dune complex was established at least 1290 years ago. Most of the sand, is inherited from earlier, higher stands of lakes in the Ontario Basin. The sand sheet offshore is a few meters thick. Its boundary on the south is off the Salmon River, on the north off Black Pond and lakeward at a depth of approximately 100 ft (30 m). Sand deposited on the pondside of the barrier is lost to the system for decades or centuries. Sand is not accumulating on the lake floor off Black Pond, nor is it being transported to the deep lake. Changes in sand grain size both offshore and on the beaches and the geometry of most of the shoreline indicate sand movement to the north. The geometry of some inlet-mouth bars suggest northerly transport, some southerly. The position of the barrier beach/dune complex at North Pond and Lakeview Marsh WMA has changed little over the past 150 years, while the inlet has moved several times. The internal structure of the barrier system suggests that inlet-movements were normal over its entire existence. Currents over the study period showed net water movement toward the north with few southerly excursions. Currents over the winter are unknown but southerly currents and water movement can be expected.

The Nature Conservancy, Cont.

Eastern Lake Ontario Bog Buck Moth Population Monitoring Program *: 2002 Field Season, Temporal Trends, and Management Implications. PI: Edward Stanton (stantoned11@mchsi.com); Contact**: Sandy Bonanno,** The Nature Conservancy, 31 South Jefferson St., Pulaski, NY 13142; (315) 298-2040 x22*; sbonanno@tnc.org

ABSTRACT

A population monitoring program was initiated in 1996 on all known occurrences of the bog buck moth (*Hemileuca* sp. 1) in Oswego County, New York. The monitoring protocol was modified in 1998 from the original method developed by Greg Pryor. Since 1996, there has been a region-wide decline in abundance. The population at Mud Pond Fen appears to have increased between 2001 and 2002, but numbers continued to drop at South Pond Fen. Data from other sites are not sufficient to interpret trends, although data collected from the Rainbow Shores Fen population do imply continued low numbers since a dramatic decline following Greg Pryor's observations in 1996. Data collected in 2002 from Mud Pond Fen were the most complete of all data sets collected to date, which allowed newly recognized trends to become apparent. Previous assumptions held that the peak daily flight at any one locality was consistent, but the flight at Mud Pond in 2002 was seen to shift to earlier in the day as the season progressed. This shift may be due to the mean age and number of males (mating competition) within a population. Although the start of the flight season appears to be consistent, the date of the seasonal peak fluctuates. The cause of seasonal variation in peak flight most likely has a climatic cause, but the relationship is not yet understood. I recommend continuation of the monitoring program, but the focus should be placed on only two localities (Mud Pond Fen and South Pond Fen) to maximize the quality of data.

Eastern Lake Ontario Dune Photomonitoring*. PI: Sandy Bonanno, with Kathleen Conrad (TNC) and Molly Thompson (NY Sea Grant Extension).* ***Contact: Sandy Bonanno,*** *The Nature Conservancy, 31 South Jefferson St., Pulaski, NY 13142; (315) 298-2040 x22; sbonanno@tnc.org*

ABSTRACT

A wide variety of partners have engaged in a partnership for dune conservation over the past two decades, with intensive efforts toward visitor management and restoration since 1995. The Conservancy has developed a photomonitoring program with each expansion of restoration and recovery activity. The current project uses web-based GPS Photolink and Dreamweaver software to organize and display the photo record. The product will allow land managers, conservation partners, landowners, and other stakeholders to easily access documentation of dune recovery and restoration. The site will be updated with new pictures annually. Anticipated uses will include adaptive management decision making, education of users and stakeholders, demonstration of conservation success for any number of additional purposes. The project is currently under development, with first products being tested. Once completed, a website address will be available.

Remote Sensing of Lake Ontario

The Digital Imaging and Remote Sensing Laboratory
Chester F. Carlson Center for Imaging Science
Rochester Institute of Technology

The Digital Imaging and Remote Sensing Laboratory (DIRS) has been conducting research on Lake Ontario and surrounding bays, ponds, and lakes since its inception in 1985. Remote sensing science and its use in long-term environmental monitoring has been one of the cornerstone of the laboratory's research. Its initial studies monitored the thermal bar process of Lake Ontario using LANDSAT satellite and RIT's airborne thermal line scanner. Thermal imagery collected from these instruments were used to develop techniques to improve the accuracy of temperature measurements, providing maps of the progression of this spring phenomenon.

Monitoring of the thermal bar process pointed to obvious impacts on water quality of near the shores of Lake Ontario. This was apparent in the visible as well as the thermal bands of the LANDSAT satellite. In order to better study and quantify environmental effects such as these, DIRS took the opportunity to improve its technological capabilities by building a new airborne scanner with improved thermal channels and hyperspectral capabilities. This sensor, MISI (Modular Imaging Spectrometer Instrument) has been undergoing flight tests and improvements for the past 5 years and has been involved in the following investigations:

1. Collected images of the thermal bar in Lake Ontario in support of NASA's thermal calibration of LANDSAT 7.
2. Underflight of JPL's AVIRIS sensor in the Rochester Embayment to study algorithms for quantifying water quality parameters.
3. Mapping of benthic algae along the south shore of Lake Ontario for the Monroe County Health Department.
4. Collected images in Lake Superior to support the Keweenaw Interdisciplinary Transport Experiment in Superior (KITES).

An archive of various forms of remote sensing imagery, both satellite and airborne, has been collected in support of the many projects conducted in the Lake Ontario region (See URL below). The weak link in the analysis of remote sensing data is often the lack of observations and measurements in the water. However, recently acquired equipment for in-water and above water radiometric measurements now provides a means for improving the optical characterization of these waters. However, the DIRS group cannot itself undertake the full suite of physical, chemical, and biological measurements needed to fully understand the formation of the remotely sensed signal. To improve our in-water observations we are seeking collaborations with other research teams that are interested in understanding how remote sensing might provide a better perspective of the environmental processes they are monitoring. We are particularly interested in collaborating with investigators who have study sites that are being monitored (or plan to be monitored) with deployed instruments in waters in Lake Ontario and surrounding areas. We would like to understand the measurements being acquired in the hopes of suggesting new protocols that would make the in-water data more salient with remote sensing data. Since we conduct several test flights as well as contract-sponsored flights during the upcoming collection season, there may be a an opportunity to acquire imagery of your study site (within the flying area and given sufficient notification).

For more information, please contact Rolando Raqueno (rolando@cis.rit.edu) or Anthony Vodacek (vodacek@cis.rit.edu)

For additional technical information, please visit the following URL's
DIRS lab's overall activities. http://www.cis.rit.edu/research/dirs/
Our water related activity. http://www.cis.rit.edu/research/dirs/research/hywater/ Overview of our archive of hyperspectral imagery from MISI and other platforms. http://www.cis.rit.edu/research/dirs/pages/images.html
Our annual reports. http://www.cis.rit.edu/research/dirs/pages/annual.html

Restoration of Coastal Wetlands in the St. Lawrence River, through Restablishment of Natural Hydrologic Regimes

Principal Investigators: John M. Farrell, Donald J. Leopold , Alison Halpern, Jason Toner, Molly Beland, Brent Murry, and Emily Cloyd, SUNY College of Environmental Science and Forestry, Thousand Islands Biological Station, Syracuse New York 13210.

Our project goal is to increase biodiversity and improve functioning of coastal wetlands of the upper St. Lawrence River. Information generated by this study applicable to the restoration and enhancement of coastal wetlands throughout the Great Lakes Basin.

Source of Support: Great Lakes Protection Fund

Websites: www.glpf.org/GLPFflow.html http://www.esf.edu/efb/leopold/default.htm
http://www.esf.edu/efb/faculty/farrell.htm

Project Title: Use of Spawning Marshes in Rehabilitation of St. Lawrence River Northern Pike and Muskellunge Populations

Principal Investigators: John M. Farrell, and Aaron Bosworth, SUNY College of Environmental Science and Forestry, Thousand Islands Biological Station, Syracuse New York 13210

A spawning marsh project was completed as a joint effort between NYSDEC, NYSDOT and SUNY-ESF in 1998 to increase esocid reproductive habitat. Our research will demonstrate the effects of this hydrologic management project on reproductive success for northern pike and muskellunge.

Source of support: New York State Great Lakes Protection Fund

Project Title: Fish Recruitment – Evaluation of Hydrologic Management of Northern Pike and Muskellunge Performance in Lake Ontario and the Upper St. Lawrence River

Principal Investigators: John M. Farrell, Jason Toner, and Emily Cloyd, SUNY College of Environmental Science and Forestry, Thousand Islands Biological Station, Syracuse New York 13210.

The International Joint Commission through its Lake Ontario-St. Lawrence River Water Levels Study is re-evaluating the USACE Plan 1958 for all interests including the environment. We are developing methods to evaluate the response of northern pike (Esox lucius) and muskellunge (Esox masquinongy) to new regulation plan scenarios.

Source of Support: International Joint Commission

Website: http://www.ijc.org/ijcweb-e.html

Project Title: Coupling Ecological, Economic, and Engineering Studies to Formulate Guidelines For Dam Removal and River Restoration in Great Lakes Watersheds

Restoration of Coastal Wetlands in the St. Lawrence River, through Restablishment of Natural Hydrologic Regimes, Cont...

Principal Investigators: John M. Farrell, Jason Toner, and John E. Cooper, SUNY College of Environmental Science and Forestry, Thousand Islands Biological Station, Syracuse New York 13210.

This is a joint project with Ohio State University, SUNY-ESF and New York Rivers United designed to guide the process of dam removals in the Great Lakes. In New York we are completing an ecological evaluation of a dam removal on the Salmon River in Fort Covington, New York.

Source of Support: Great Lakes Protection Fund

Website: http://www.glpf.org/02awards.htm

Project Title: St. Lawrence River Fisheries Ecology and Management

Principal Investigators: John M. Farrell, Molly Connerton, Susan Hardin, Brent Murry, and Molly Beland, SUNY College of Environmental Science and Forestry, Thousand Islands Biological Station, Syracuse New York 13210.

Source of Support: Federal Aid in Sportfish Restoration through New York State Department of Environmental Conservation

This project is guided to address a variety of research and management issues regarding St. Lawrence River fisheries and critical habitats.

Website: http://federalaid.fws.gov/sfr/fasfr.html

Sandy Pond Beach & Sandy Island Beach; Unique Areas

Both Sandy Pond Beach and Sandy Island Beach are a integral component of a larger coastal barrier environment that consists of beaches, sand dunes, embayments and wetlands extending some 17 miles along the eastern shore of Lake Ontario. These beaches are composed of several geographically distinct but physically and ecologically interacting sub systems. These include: 1) the coastal ecosystem which encompasses near shore lake waters and beaches; 2) the sand dune and upland ecosystem found on the spit itself; 3) the protected aquatic habitat, including North Pond and several wetlands, located on the landward side of the spit; and 4) the upland ecosystem of the protected mainland.

The main resource management objectives are 1) To protect and restore the dunes and dune formation process. 2) To protect feeding, resting, and nesting habitats for a wide variety of migrating and breeding birds. 3) To provide pubic access.

Some main projects and accomplishments are 1) The development of a walk over and walk thru to allow access from the pond side to the beach while protecting the dunes. 2) the delineation of a bird sanctuary to provide resting and nesting habitat for threatened bird species. 3) providing education to beach users through signs and seasonal "Dune Stewards" which are on the beaches most of the summer. 4) the restoration of dune blow out by mechanically moving the dune back and then stabilizing them with snow fence and extensive planting's of native beach grass.

Contact Information:
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315-298-7467

Major Partners:
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Great Lakes Research Review
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Spatial, Temporal and Hydrological Influences on Phosphorus Dynamics in a Large Cattail Wetland

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Abstract

Wetlands are now heavily regulated and recognized as key landscape features because of their roles in improving water quality through the removal of dissolved and sediment bound contaminants. However, wetland filtration processes, particularly those involving groundwater flow, are still the subject of considerable research. Limited evidence suggests that wetland filtration varies considerably as water levels follow natural rise and fall cycles. As precipitation patterns become variable due to global warming, improved knowledge about phosphorus retention mechanisms in natural wetlands will be useful for water quality improvement. From April until November 2002, research was conducted in the Ellison Park Wetland, a 171-hectare cattail-dominated marsh near Rochester, NY, to determine how a varying hydrological regime affects phosphorus dynamics. A mass balance approach was used to determine whether phosphorus retention processes vary seasonally or spatially. Groundwater-surface water hydrology of the study site was carefully monitored to determine potential influences it has on the wetland's biogeochemistry. Replicated samples of sediment, plant tissues, litter, surface water and groundwater have been collected at 18 stations seven times since May 2002. Surface and groundwater have been monitored using stage gages and seven nests of piezometers distributed throughout the study site. Preliminary findings show distinct differences in phosphorus dynamics spatially, in near-stream vs. interior plots. The combined effects of cattail phenology and two distinct hydrologic phases during the study period (wet spring and dry summer) on phosphorus processes show that a wetland's ability to filter phosphorus is more dynamic over space and time than often assumed.

Sponsors: U.S. Geological Survey, Water Resources Division, Ithaca Office
Cornell University Program in Biogeochemistry & Environmental Change
Society of Wetland Scientists
Andrew W. Mellon Student Research Grant, Cornell University

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Current Status: Study is ongoing. Field work was performed from April – November 2002 and will continue throughout the spring of 2003. Lab analysis of environmental samples is proceeding, and final presentation of results will occur in the fall of 2003**.**

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Tunison Laboratory of Aquatic Science Nearshore Research

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I have been studying nearshore areas of eastern Lake Ontario since 1995 and have two active studies focused on the nearshore aquatic systems of that region. My initial work in the coastal zone examined community structure of fish and aquatic invertebrate assemblages found in the lower reaches of two major tributaries (the Oswego and Salmon Rivers) and at their interfaces with Lake Ontario. The primary objective was identification of statistically significant spatial and temporal differences in the structure of the species assemblages in these two important systems and at their Lake Ontario interfaces, and quantitative descriptions of these distinct assemblages. Analysis of the fish assemblages sampled for that study is complete and findings are reported in a paper entitled, Biological Structure and Dynamics of Fish Assemblages in Tributaries of Eastern Lake Ontario, which will be published in an Ecovision World Monograph Series book on the State of Lake Ontario. This study was the first step in a research plan to construct a conceptual model of the role of the nearshore and major tributaries in the Great Lakes ecosystem and their influence on the fish communities of the Lakes.

My present 'Nearshore' study began in 1999 and is designed to explain fish community structure in nearshore habitats of Lake Ontario by examining the relationships between nearshore fish assemblages and their biotic and abiotic environments. This work builds on that of the earlier tributaries study and expands habitat coverage along the coastline to include embayments. Field sampling consists of collections of fish with nocturnal trawl and seine hauls (and benthic invertebrate assemblages via cores) from habitat 10 m deep to the shoreline in four study areas, Little Sodus Bay, Oswego River, Salmon River, and North Pond. Collections are made both inside each river or embayment and outside in Lake Ontario proper. Field sampling will be completed in 2003. This study will also generate measures of ecosystem health (e.g., Index of Biotic Integrity) and help track recovery of native fish populations. Preliminary analysis of data collected thus far has captured inshore movements of alewife and three-spine stickleback, and migration of chinook salmon smolts out of the Salmon River. Both of the above studies feed directly into my most recent project, Great Lakes Regional Aquatic Gap Analysis. The Aquatic Gap Program was developed to better understand the biological diversity of aquatic species and to identify gaps in the distribution of aquatic species and their habitats with relation to present-day conservation areas. Several states have begun similar projects, but this is the first regional Aquatic Gap Analysis and I lead a specific component intended to conduct the first Coastal Aquatic Gap Analysis for the Great Lakes. The primary goal of this project is to provide information on basinwide, lakewide, and statewide patterns in aquatic biodiversity and gaps in the distribution and conservation of aquatic species. The resulting information and analysis tools are meant to assist natural resource managers with development of conservation priorities and planning. The Coastal Gap Analysis component will classify each spatial unit of nearshore habitat within specific pilot areas (including eastern Lake Ontario), develop models of the relationships between species occurrence and various habitat conditions, and project species and assemblage distributions and biodiversity throughout each area. Data collection and formatting, and development of the nearshore habitat classification framework are well under way. In the long-term, this project will be expanded to include the entire Great Lakes coastline.

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Water Resources of Monroe County, New York, with Emphasis on Water Quality in the Irondequoit Creek Basin

Includes: ***Atmospheric Deposition, Ground Water, Streamflow, Trends in Water Quality, and Chemical Loads to Irondequoit Bay***

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ABSTRACT

The U.S. Geological Survey (USGS), in cooperation with the Monroe County Health Department and the Monroe County Environmental Health Laboratory (MCEHL), has had an ongoing program since 1980, to collect and analyze water-resources information from Monroe County and in particular the Irondequoit Creek basin in an effort to identify sources of contamination and to quantify the annual loads and trends in concentration of selected chemical constituents in the streams and rivers of Monroe County. A particular focus of concern was Irondequoit Bay, which has been eutrophic for several decades, as a result of sewage, sediment, and nutrients that are transported to the Bay by Irondequoit Creek. In 1979, the discharge of sewage to Irondequoit Creek was eliminated when the Monroe County wastewater treatment plant along the shore of Lake Ontario began operation. Data collection has continued over the years in an effort to further improve the chemical quality of Irond-equoit Creek and its tributaries and to assess the effectiveness of management practices already in place.

During 1980-81, the USGS National Urban Runoff Program (NURP) study of the Irondequoit Creek basin investigated nonpoint-source contamination from selected areas representing specific land uses. The results of that study provided a basis from which changes in the nutrient and chemical loads of Irondequoit Creek could be identified. In 1993, the USGS, in cooperation with the Monroe County Health Department, began a program to publish and analyze water-resources data collected in Monroe County to detect any significant temporal trends in the concentrations of selected chemical constituents in streamflow and ground water. Data collection has continued since then for comparison with previous results to detect improvements or deterioration in water quality since 1993 and to identify the causes.

Many years of systematic collection and analysis of hydrologic data by Monroe County personnel have provided a foundation for a comprehensive assessment of the county's water resources. Long-term records of precipitation and unregulated streamflow provide the basis for determining the normality of much shorter periods of record. Long-term trends in concentration of constituents at sites in the Irondequoit Creek basin and elsewhere in Monroe County differ from site to site and in magnitude and direction. Statistically significant downward trends in the concentration of ammonia + organic nitrogen, were noted at some Irondequoit Creek basin sites. Orthophosphate showed an upward trend at one site. There were two significant trends in suspended solids concentration, one upward and one. Water quality management practices and improved treatment, or diversion, of sewage-treatment plant effluent continue to decrease the median concentration of some constituents (particularly nutrients) in surface water throughout Monroe County.

Cooperator: Monroe County Department of Health
Project Status: Ongoing

Lake Ontario Interdisciplinary Science and Management Conference, March 13, 2003

SUNY College of Environmental Science and Forestry Syracuse, New York

Time	Place	Agenda
8:50	140 Baker	Introduction Jack Manno, Great Lakes Research Consortium
9:00		Lake Ontario and St.Lawrence River Water Management Study. Joe Atkinson, IJC Environmental Technical Group
9:20		EPA Lower Food Web sampling plans, Fred Luckey, USEPA
9:40		Lake Ontario Biocomplexity Project, Mark Bain, Cornell U.
10:00		Monitoring and Event Response for Harmful Algai Blooms, Greg Boyer, SUNY ESF
10:20	Baker Foyer	Break
10:40	140 Baker	The Great Lakes Environmental Indiacators Project, Jan Cibrorowski, U. of Windsor
11:00		New York State Science and Management Activities on Lake Ontario Don Zelazny, NYDEC
11:20		LOADS project, Tom Holsen, Clarkson U.
11:40		Great Lakes Coastal Wetlands Consortium, Joel Ingram, Environmental Canada
12:00 to 1:15 Lunch		
		Breakout Topics: Research Topics and LOADS meeting (324 Bray Hill)
	127 Illick	1. Hydrology and Wetland Plant Communities
	135 Baker	2. Biological communities of Bays and Lagoons: Trophic Interactions
	327 Marshall	3. Coastal Community Composition and Structure; plants, birds, fich and more
	8 Illick	4. Water and Materials Movement Through Embayments
	105 Marshall	5. GIS and remote Sensing Applications
	241 Illick	6. Watershed Hydrology
	167 Baker	7. Paleoecology of the Coastal Zone
	334 Illick	8. Nutrient Dynamics of Coastal Waters
	122 Jahn	9. Groundwater and Lake Interactions
	213 Marshall	10. Contaminant Dynamics

Lake Ontario Interdisciplinary Science and Management Conference, March 13, 2003, Cont

Time	Place	Agenda
2:45 Break		Organize Round 1 results
		Breakout Sessions: Management Issues and LOADS meeting (324 Bray)
	105 Marshal	11. Aquatic Plant Managemnt
	167 Baker	12. Water Pollution in Coastal Waters
	8 Illick	13. Policy Making for the Coastal Zone and Remedial Action Planning
	135 Baker	14. Water Leven Regulation
	127 Illick	15. Fish Habitat Management
	241 Illick	16. Bay Barrier Breaching and Coastline Stabilization
	334 Illick	17. Protection of Wetland Coastal Flora
	122 Jahn	18. Invasive Species
	213 Marshall	19. Containment Management
	140 Baker	20. Avian Management
4:00 Break		Organize Round 2 results
4:15	140 Baker	Synthesis and Discussion

Breakout Sessions - Results

Hydrology & Wetland Plant Communities

- What is the relative contribution of changes in Lake Ontario wetlands due to controlled water levels?
- What are highly predictable and measurable (ideally in dollars) metrics to assess environmental responses?
- Can we use wetland valuation techniques (to access wetland loss & loss of function) to wetland response to controlled water levels?
- To what extent are wetlands of concern? groundwater – dominated (re: to major hydrologic inputs)? and recharge to groundwater?
- What are keystone species, their determinants, and their implications? What are compounding factors that also affect wetland response (e.g., nutrient inputs)
- What compositional and structural attributes of submerged aquatic vegetation and wetland vegetation are critical for animal species of concern?
- What ecological and environmental services are denied?
- How has watershed land use affected embayment wetland functions?
- What is the response of floating cattail mats regarding wetland change?
- How does geomorphology influence community response?
- To what extent is climate change a compounding factor?
- To what extent can citizens become involved with (e.g. breeding bird surveys) monitoring significant changes on wetlands of Lake Ontario?
- What is the importance of monitoring significant components of this system - especially long term?

Nutrient Dynamics in Coastal Waters (embayments, creeks & lake nearshore waters)

On Science Questions:

- What are nutrient concentration in coastal zones; spatial and temporal?
- What are the factors affecting spatial and temporal variations? seiches? resuspention? upwellings? lake level fluctuation? wet/dry cycles on geochemistry? thermal bars?
- How does the biota transform and respond to nutrient and suspended loads in coastal zone?

Which are being addressed?

- All are neglected – a literature review would confirm this.

On Management Information Needs:

- Determining total daily maximum loads (TDML); eutrophication of nearshore?
- What are regulatory criteria?
- What effects do TDML have on nuisance algal species in nearshore areas?
- What is the relative importance of internal vs. eternal phosphorus sources in embayments?

Which are being addressed?

- TDML – NYS Department of Environmental Conservation will not consider TDML, USEPA is approaching issue.

Coastal Communities

On Science Questions:

1. There is a need to measure human impacts to the ecological community – What are those impacts? Socio-economic components?
2. Impacts of water level/controls?
3. Effects of fragmentation?
4. Need to know bioproductivity of the lake.
5. Need to place value (environmental economics) on the resource.

Which are being addressed?

1. Not enough background information available. Loss of human dimension researchers.
2. Long-term monitoring – need management for data-collect/share data sets.

NOTE: As a group, there was genuine concern about the loss of critical agency staff due to current and future budget cuts. This loss will impact research and monitoring programs that are essential.

Management Information Needs:

Need long-term monitoring. Develop data sets that cover data gaps. Need to have central databases.

Water & Materials Movement Through Embayments

On Science Questions:

1. Effect of macrophytes on water movement.
2. Importance of wetlands on nutrient transformation/cycling uplands to bays.
3. Importance of groundwater in coastal bays?
4. What are critical times of year of biological interchange, is it episodic? Timing and (a) synchrony of lake and embayment dynamics.
   - Are all embayments different, or can they be characterized by a few types?
   - What are the impacts of bays on lakes – what is the degree of interchange?
   - Are impacts direct or indirect?
   - What are impacts of major runoff events?
5. Role of wetlands and embayments in metals and other contaminant cycling/loading?

Which are being addressed?

1. Vodacek and others on Conesus Lake.
2. Lake Ontario biocomplexing - Joe Makarewicz (Brockport) monitoring near Rochester.
3. Has been done for great marsh area of Lake Michigan.

On Management Information Needs:

1. What is phosphorus loading from embayments to Lake Ontario (also related to wetlands)?
2. What is sediment load from embayments to Lake Ontario? How much is organic?
3. Any change in functioning of bays as key habitats, effects of policies, etc.?
4. Role of embayments in nuisance alga blooms – or is this just an open lake phenomenon?
5. What are key management issues besides regulating lake level?

Which are being addressed?

Numbers 1,2, and possibly 3 above – GLC and GLEI indicators, for key habitats, Lake Ontario for effects of policies.

Optional comments:

- There seems to be a lack of general, continuous/routine data on open Lake Ontario that would be useful for researchers and managers working on embayments.
- More basic streamflow data would be useful.

GIS and Remote Sensing Applications

On Science Questions:

- Lack of large scale and small scale data.
- "Lack" of information both small and large scale. We, as a group, believe that the data/information exists, but access to the data/information is not easily accessible.
- A communication method (e.g. bulletin board system) to ask people for information or inform people of available data and information. Experiment coordination (e.g. we will be collecting data on …)
- Development of historical data for land use, land cover, and groundwater, soils
- Need to work with other GLRC Members to understand their study sites.
- Suggest additional measurements that will make ground measurements more useful with overhead imagery
- Make data available for study sites if flights are convenient over instrumented sites

Which are being addressed?

- Communication and distribution data.
- "Online" GIS or catalog and point of contact. (Is GLRC the organization to facilitate this?) Could GLRC facilitate with NYGIS clearinghouse?
- Development of historical data for land use, land, soils, etc.

On Management Needs:

1. Establish management tools (models) to predict temporal response to change, e.g. land-use, contaminant source alternatives.
2. Produce a high quality data-set. There is a need to establish long-term monitoring programs.
3. Effective communication for translation and distillation of primary scientific information to ensure broader impacts, i.e. information transfer to public and managers.

Issues Facing Great Lakes Remote Sensing/GIS Community:

- Access to Imagery by Ground Truth PI's
- Access to Ground Truth by Imagery PI's
- Quality Control of Ground Truth and documentation
- Announcement and Coordination of Collections (air, ship, ground)
- Maintenance of distributed sensors
- Should there be a centralized location of this information?

Collaboration Examples:

- Remote sensing validation of census data through synthetic image modeling
- Fusing remote sensing data with census information
  - Taking small scale spectral information and correlating it with census data
  - Correlate socioeconomic data with spectral information to fill in gaps between 10-year census sampling
- Collaboration with Remote Sensing and Biocomplexity project

Miscellaneous Notes:

- Biocomplexity is at many different scales
- Lack of Data, e.g., sediment type, detailed soils maps, more information on parcel ownership, land use change – with parcel ownership, changes in crop cover over time
- Needs assessment of Data
- DOQ, Satellite Data, Interpretation of data

Watershed Hydrology

On Science Questions:

1. Water Budget – A water budget, with understanding of surface and groundwater storages and their variability associated with climate and regulation is needed.
2. Water Quality – Need for further characterization and assessment of water quality: (e.g. from nutrients to endocrine disruptors). Our baseline data from existing monitoring is not well developed; need baseline information, and monitoring designed to assess trends. Also, need to understand residence times of groundwater and turnover times of lakes.
3. Climatic Variability – effects on hydrology and biogeochemistry are needed.

Management Information Needed.

1. Required for successful implementation of Annex 2001: e.g., managing for water withdrawals.
2. Need a better understanding of land use change (and associated management) and how stormwater management affects water quality. Need to understand how ecoterrorism and/or human/natural disasters affect water quality.
3. How climatic variability interacts with lake level management decisions. How to manage for droughts and floods?

To Address All:

- More monitoring and modeling
- Index station concept by Ed Bugliosi

Paleoecology of the Coastal Zone

On Science Questions:

1. How do past vegetational changes effect water level changes and past climate variability?
2. How did European impact affect wetland vegetative change, water quality and associated changes?
3. What do sedimentation rate changes indicate about human impact, vegetation change, and the carbon cycle?
4. What is the fire history of the region and how does it relate to past climate change?

Which are being addressed?

None addressed now

On Management Information Needs:

1. What is natural variability? (over last 10,000 years?) of climate and vegetative change as benchmark?
2. Preservation of wetlands is dependent on understanding reasons for communities today and their distribution.
3. Given the historical record, what is in best interest of preserving biodiversity, water quality, etc., or restoration?

Which are being addressed?

None

Contaminant Dynamics

On Science Questions:

1. What is the comprehensive mass balance for contaminants in the lake – including contaminant sources and rates of transfer between sources and sinks?
2. What are the human health effects of contaminants on humans in the lake watershed? What are the magnitudes and pathways of exposure routes for human exposures and importantly, what are the chronic effects?
3. What are the chronic effects of contaminants on ecosystem – health?

Exotic Species

On Science Questions:

1. Need to focus on pathogens. What are the threats and human health impacts?
2. What are the cumulative impacts – ecosystem impacts of exotics?
3. What are population levels for exotics? This was done for zebra mussels several years ago, but population dynamics are not being studied. Other biological parameters need to be researched.
4. Federal programs like USFWS should also look at other species (than fish) – invertebrates and plants.
5. Need unified terminology – exotics/invasive.
6. What are the invasion corridors?

Which of these are being addressed?

1. Pathogens are not being monitored for in ballast – pathogens should not be ignored.
2. Lower taxonomic groups (other than zebra mussels) are overlooked.
3. Pathogens need to be looked at and monitored for in ballast water.
4. Need to develop predictive models for exotics, some have been developed for fish, but other are needed.
5. Need genetic work to determine the source for exotics. Do we know if an exotic is from the same stock/source?

On Management Information Needs:

1. NOBOBS (No ballast on board) – Ballast sludge needs to be examined.
2. Ballast water treatment technologies need to be researched.
3. Long-term monitoring programs are lacking.
4. Bait industry, aquaculture, aquarium trade should be controlled.
5. Bait bucket transfer, bait industry, aquarium industry, aquaculture, ornamental horticulture industry – all need to be looked at as sources. Should work with these industries.
6. Look at "e-commerce" (Internet sales). Legislative action might be warranted for controlling mail shipments.
7. Need to make the public aware of the ecological and economics impacts of exotics – Need to see the "big-picture" – Systemic impacts.

Which of these are being addressed?

Monitoring programs (long-term) should be maintained. They serve as sentinels for new exotics.
Pathogens should be monitored for.

Optional comments:

The group is concerned about budget cuts and the impacts on exotic species monitoring and management programs.

Hydrology and Wetland Communities

On Science Questions:
1. Effect of flow regimes on trophic interactions, connection between lagoons and lake.
2. Climate effects on trophic interactions.
3. Exotic species disrupting lower food webs and trophic interaction.
4. Sediment food web, importance of micro/macrobertions, benthic-pelagic coupling.
5. Variable temporal and spatial scales affect food web structure.

Which are being addressed?
1. Biocomplexity, Farrell group, Atkinson IJC group.
2. Casselman for fish, sedineal core – Farnell, biocomplexity, Mullini
3. Mills, DFO Canada, OMNR, NYSDEC, Mager, Schulz, Makarewicz
4. Meyer, DFO Canada (Dermott) Quinta group, Cyr
5. Biocomplexity.

On Management Needs:
1. Conservation target – how does a lagoon ecosystem look like, what is worth protecting.
2. Social, human response to ecosystem change and feedback to ecosystem, trophirler.
3. Monitory data series to evaluate. Ways of collecting them efficiently and for less money.
4. Predictive models of food web interaction.

Which are being addressed?
1. Biocomplexity program
2. Biocomplexity program, Sea Grant Diane Kuehn, Jeff Dawson
3. Luckey EPA, Cornell BFS, DFO Canada, OMND, NYSDEC
4. Millard/Mills, biocomplexity.

Optional comments:
- Hard to focus on specifics – feeling that food webs not well enough known in general leads to general "unknowns."

Aquatic Plant Management

On Science Questions:
1. What factors – (e.g. water clarity) lead to benthic algae blooms?
2. Are embayments a good place to investigate alternate stable states (phytoplankton – plant)?
3. Are benthic algae affected differently than angiosperms by light and nutrients?
4. How do macrophytes get into the food web? Detritus?
5. Role as fish habitat?

Which are being addressed?
1. Waterloo – Hecky lab – Cladophora
2. Todd Howell – OMNR – Cladophora
3. Murray Charlton – Environment Canada – Cladophora
4. John Farrell – SUNY ESF
5. Bob Johnson – Cornell
6. Mayer/Zhu and Rudstam

On Management Information Needs:
1. Are blooms occurring?
2. Do we want green water or plants? People complain about both.
3. How does harvest effect long-term productivity?
4. Effects of exotics (milfoil)

Bay Barrier Breaching and Coastline Stabilization

On Science Questions:

1. What are impacts of armoring and channelization on transpodal sediments?
2. How does stabilization and wetland segregation impact bird habitat, especially critical habitat for piping plover?
3. What happens when we prevent natural overwash?
4. How do changes in patterns and water levels affect littoral drift?
5. Variability between south, east and north shores?

Which are being addressed?

1. Woodrowet
2. LGLES, (Eberhardt et.al)
3. LOSL (coastal and environment groups)

Neglected:

1. Ice studies/Lake Ontario
2. Preventing natural overwash
3. Piping plovers

On Management Information Needs:

1. What are historic patterns of breader and head formation?
2. Who monitors????
3. What are immediate and cumulative effects of stabilization and adjacent shoreline?
4. How does natural vegetation stabilize compared to rock arrowing?

Which are being addressed?

1. The Nature Conservancy - McClemmer
2. Bongnao, 1998 Torrey Boat Club

Neglect:

1. Monitoring
2. Cumulative

Optional comments:

- This group cold move us toward figuring out how to get monitoring going.

Water Pollution in Coastal Waters

On Science Questions:

1. What is the relative importance of internal sources vs. externally supplied materials (e.g., tributaries, point source) on the structure and function of coastal ecosystems?
2. Can we develop models that link watershed and lake processes at the coastal ecosystem scale?
3. What are the contaminants that are currently of concern in coastal ecosystems with respect to human and ecosystem health?

Management Information Needs:

1. What are the impacts of climatic and/or land-use change on the water quality of coastal zones?
2. Need to know how pollution of coastal waters impacts fisheries and the trophic transfer of contaminants.
3. What are the effects of lake level regulation and water withdrawal on the water quality of coastal waters?
4. A clearinghouse of data and information and information on the water quality of coastal waters.
5. What are the timescales over which managers need information to address water quality problems of the coastal zones?
6. Are there specific challenges of coastal water that requires that they be examined separately from the whole lake?

Water Level Regulation

Three top issues:

1. The water level study needs an external evaluation process, and needs it soon. An evaluation of the process with suggested mid-course connections.
2. The environmental interest needs to articulate a vision. What do we wish the environmental outcome of a new regulation plan to be?
3. There is a big need to communicate this vision to the public, and also to communicate the work of the larger study to the public. There is a lack of understanding of what regulation can accomplish, and how the various interests are impacted by regulations.

Lake Ontario Communities

- Where do human impacts fit in?
- Nearshore areas – basic issues need to be resolved (not enough background information to look at).
- Academic setting – loss/lack of increase in human dimension – social research to do the work.
- Water level issues – impacts of lake levels.
- Effects of fragmentation of environmental areas – do not have a sense.
- Indirect concerns of urbanization/development.
- Need a way to value biodiversity.
- Put an economic value on the resource.
- Develop partnerships with land owners.
- "Demystify" management/decision making.
- Subjective aspects (beauty, enjoyment, etc.) (values) calculations are dynamic.
- Have economic and social indicators – both are important. Numbers are important, but people are as well.
- Cumulative impact that needs to be considered.
- Models do not take that into account.
- Cause/effect are important, but you must look at time lags. Humans always blame the most recent happening.
- Long-term monitoring and data sets. How often do you need to monitor?
- Single mater plant for monitoring. "Census Bureau" for coastal communities. Information management is important. Central Databases.
- Cap analysis
- Monitoring – could involve the community – citizen monitoring – helps build "buy-in."

Protection of Wetland Coastal Flora

Prior to generating a list of top management information needs and which are being addressed or ignored, the group discussed the many issues impacting protection efforts for wetland coastal flora, summarized as follows:

1. What are we interested in protecting? Structure? Function? Species composition?
2. What are we protecting these systems from? Nutrient loading? Development? Invasive species?
3. Do current regulatory approaches work? Are current regulations appropriate and enforced?
4. What are current functions and values of coastal wetlands?
5. What are the nature of the connections between plants and faunal habitat?
6. The impact of federal and state regulations on connected (e.g. coastal wetlands) vs. isolated (e.g. some wetlands within coastal watersheds) and the effect of regulations on what size wetlands are currently regulated?
7. The need for land use planning and zoning in coastal communities to control for land use change impacts on coastal wetlands.
8. The need for greater educational dissemination of information about the functions/values of coastal wetland communities given the large concentration of populations along the Lake Ontario coast (e.g. 2% of Oswego County's wetlands along the L.O. coast, but 41% of the population in coastal towns).
9. What are the relative contributions of non-point sources of pollution to the bays/wetlands (agricultural runoff, septic systems)?
10. What are the effects of shoreline structures, e.g. docks, jetties, rip-rap?
11. What are the effects of invasive species, e.g. *Lythrum salicaria*, *Phragmites*, European frog's-bit?
12. What impact do local marsh management activities, e.g. diking/water level control, cattail cutting, dynamite, carp control, have on these systems? (management often for waterfowl hunting)
13. What is the effect of broader scale management activities such as IJC's basin-wide control of water levels?
14. The lack of mechanisms to protect diversity, since current regulations only control dredge and fill activities.
15. Public land ownership is a mechanism for wetland protection (state parks, DEC, TNC), but how are these properties managed? Often for recreational access?
16. The inaccessibility of sites promotes protection, but impedes public education, although nature trails increase access and possibly education (via interpretive signs).
17. What is the impact of management techniques?

Management Information Needs:

1. A comprehensive inventory of current resources in these coastal wetlands including the species present (of many different taxa), system hydrology, and system functions, such as water quality effects.
2. An understanding of the interaction of water quality/nutrient levels and vegetation within coastal wetlands.
3. Protection of institutional memories relative to these coastal wetland systems, i.e. many DEC employees leaving the agency and their detailed system knowledge is being lost.
4. Providing for long-term knowledge development and preservation, direction/guidance, planning, management, and information sharing.
5. Developing an understanding of what we are trying to protect – some past site condition, conditions prior to water level control, maximization of particular functions? (which requires understanding what the past conditions of a site were).

Which are being addressed?

The degree to which these issues are being addressed or ignored and who is addressing them is as follows:

1. Inventory – some work is being done to this end by EPA, DEC, TNC, NYNHP, and USFWS
2. Nutrient/vegetation interactions – being investigated by graduate students at SUNY-ESF
3. Institutional memory – not being addressed, being lost as state employees are cut due to budget shortfalls
4. Long-term knowledge/planning/information sharing – some databases are available for vegetation information (NY Flora Association, NYNHP, Integrated Taxonomic Information System and Plants databases from the USDA), but funding for long-term studies, and the development of long-range planning/management is generally lacking.
5. Understanding what we want to protect – many studies of these systems have been and are being conducted but there is a need to connect the results of these studies with management decisions.

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