LAKE ONTARIO LAKEWIDE ACTION AND MANAGEMENT PLAN Annual Report 2015

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What Is the Lake Ontario LAMP?

Under the Great Lakes Water Quality Agreement, the governments of Canada and the United States have committed to restore and maintain the physical, biological and chemical integrity of the waters of the Great Lakes.

The Lake Ontario Lakewide Action and Management Plan (LAMP) is a binational action plan for restoring and protecting the Lake Ontario ecosystem. The LAMP is developed and implemented by the Lake Ontario Partnership, which is led by the U.S. Environmental Protection Agency and Environment Canada and which facilitates information sharing, sets priorities, and assists in coordinating binational environmental protection and restoration activities. The next Lake Ontario LAMP will be issued in 2017; in the interim, the Lake Ontario Partnership will be assessing the state of the lake, measuring progress against existing LAMP goals and objectives, and promoting management actions to address identified problems.

This 2015 annual report highlights accomplishments and progress in achieving LAMP goals during the past year and identifies LAMP-related activities including outreach, monitoring, and protection and restoration actions.

Overview

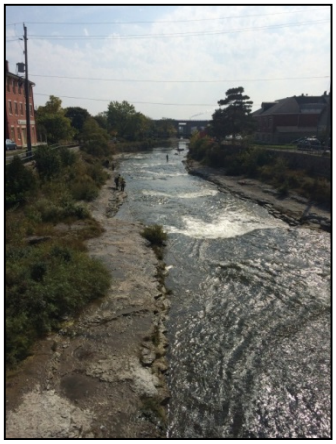
In 2015, the Lake Ontario Partnership continued its efforts to address important lakewide stressors and worked cooperatively to protect and restore water quality and ecosystem health. This was accomplished through a series of priority actions and programs, including the Binational Biodiversity Conservation Strategy (BBCS), the Cooperative Science and Monitoring Initiative (CSMI), reducing critical pollutants, restoring fish species and a productive food web, improving environmental quality of nearshore ecosystems and coastal wetlands, and undertaking outreach and communication activities.

Ontario Ministry of Natural Resources and Forestry (OMNRF) staff member interviewing tributary angler for the Lake Ontario Tributary Survey.
Credit: OMNRF.

Accomplishments

Fisheries Research and Monitoring in Lake Ontario

Lake Ontario is home to an exceptional and diverse salmon and trout fishery. Chinook Salmon, Rainbow Trout, Brown Trout and Coho Salmon are important species in both the open waters of Lake Ontario and its tributaries (as fish migrate up the tributaries to spawn). The Ontario Ministry of Natural Resources and Forestry (OMNRF) and New York State Department of Environmental Conservation (NYSDEC) have regularly surveyed the amount of fishing activity on the open waters of Lake Ontario for over 30 years. The NYSDEC surveyed the amount of fishing activity in New York's Lake Ontario tributaries from 2005–2007 and in 2011–2012. OMNRF just completed the first-ever comprehensive survey of the amount of fishing activity on Canadian tributaries to Lake Ontario. These surveys show that fishing activity on Lake Ontario's tributaries has increased, while fishing activity on Lake Ontario itself has decreased. In fact, the most recent NYSDEC survey showed that the amount of annual fishing activity on tributaries is two times greater than the amount of fishing activity on the lake itself. The Salmon River (Oswego County, N.Y.) is by far the largest fishery on the U.S. side of the lake, accounting for approximately 50% of the total fishing activity in New York tributary waters.




**Left: Anglers fishing the Ganaraska River, Port Hope, Ont.
Right: OMNRF staff member collecting biological information on harvested Chinook Salmon.
Credit: OMNRF.**

This past year, University of Windsor and OMNRF received a grant from the Great Lakes Fisheries Commission to tag Chinook Salmon, Rainbow Trout, Lake Trout and Atlantic Salmon with pop-off data storage tags (pDST). These tags store data on date, time, depth and water temperature of the fish every 5 seconds for 1 year, before detaching and floating to the surface. The aim of the project is to improve understanding of how these species are distributed in the offshore ecosystem. Preliminary results have shown that one Rainbow Trout travelled 270 kilometres in just 3 weeks! You can help: any tags found or retrieved from fish should be returned to Dr. Aaron Fisk (afisk@uwindsor.ca, 519-253-3000 ext 4740).

**Brown Trout released back to Lake Ontario after successful pDST surgery.
Credit: OMNRF.**

2013 Cooperative Science and Monitoring Initiative Results

Autonomous Underwater Glider Explores the Deep Chlorophyll Layer

During the 2013 CSMI effort, the Cooperative Institute for Limnology and Ecosystems Research at the University of Michigan, U.S. Geological Survey (USGS), and Cornell University scientists used a new technology to explore Lake Ontario. An autonomous underwater glider was released near Oswego, N.Y. and travelled to Olcott, N.Y. more than 100 miles away. During its 30-day journey, the glider changed buoyancy to move up and down in the water column, and fins guided it in a zig-zag path while its sensors gathered data to map the deep chlorophyll layer (DCL).

The DCL is important because the concentrations of algae growing in the deep waters of the lake may be an important energy source for the offshore food web, from zooplankton all the way to big sport fish. The information collected by the glider, in combination with that gathered by other techniques, found that a strong DCL developed in the lake during the summer of 2013 at the thermocline (the depth where warm surface waters change to cold deep waters), and that dissolved oxygen and particulate concentrations strongly suggest the importance of the DCL as a productivity and biomass feature in the lake.

Better understanding the dynamics of the DCL will build upon recent work on nearshore-offshore gradients by USGS, Environment Canada (EC), OMNRF and University of Windsor. Since the invasion of zebra and quagga mussels, aquatic food webs in Lake Ontario are becoming more dependent on ecological processes in offshore deep waters and in the nearshore zone rather than in the offshore surface waters.

**Launching the CILER glider in Lake Ontario, July 31, 2013, near Oswego, N.Y.
Credit: Brian Weidel, USGS Great Lakes Science Center, Lake Ontario Biological Station.**

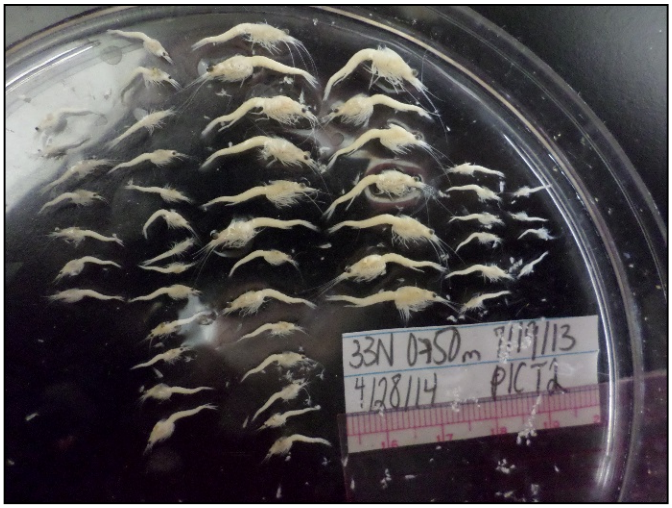
Meet the Mysis

You probably have heard of the breathtaking mass migrations of monarch butterflies across North America, and the legendary hunting dives of the sperm whale to the dark depths of the ocean. Yet you may not know the tale of a local creature that possesses elements of both mass migration and watery deeps.

Each day, trillions of tiny opossum shrimp (*Mysis diluviana*) hide from predators in the darkness of Lake Ontario's depths. Just after sunset, these 1–3 cm crustaceans (related to pillbugs and krill) swim hundreds

of metres towards the surface to hunt planktonic prey. The Mysis gather in a layer spanning nearly the entire area of Lake Ontario. Despite the darkness, many Mysis are eaten by the small fish they compete with for food, giving Mysis an important place in the food web. When the sky begins to brighten, the Mysis retreat to the depths.

During the 2013 CSMI, scientists found that Mysis continue to use light levels and temperature to choose their nightly feeding depth. Estimates suggest there are 7,000 metric tons of Mysis within the lake during the summer sampling, representing an enormous conversion of plankton resources into high-energy biomass available to small fish, which feed larger fish such as Lake Trout and Salmon.



Tray of *M. diluviana* from a sample taken on July 19, 2013. Credit: Annalee Tweitmann.

Addressing Challenges

Nutrients Assessment and Management

EC's Great Lakes Surveillance shows that concentrations of phosphorus in Lake Ontario have declined over time in offshore waters and are now well below targets of 10 µg/L. At the same time, there has been a resurgence of nearshore nutrient enrichment in many areas. In 2013, the Ontario Ministry of the Environment and Climate Change (OMECC) launched the Multi-Watershed Nutrient Study (MWNS) to examine the relationship between agricultural land use and management on nutrient loadings to streams in the Great Lakes Basin. Work done under the MWNS will examine several agricultural watersheds that have been the subject of previous comprehensive studies of nutrient loading, land use and land management in such a way that our findings can be compared to generate a "then-and-now" analysis. EC is also working with partners including the OMECC and the Toronto Region Conservation Authority in the Western Durham Nearshore Monitoring Program to establish consistent methodologies, share expertise/data on nearshore water quality and explore linkages to the lake's offshore waters.

In 2011, the U.S. Environmental Protection Agency (EPA) began a program with the USGS to monitor, evaluate and interpret data from major tributaries of Lake Ontario to determine nutrient loads. The sites include the Genesee, Salmon, Black and Oswego rivers, and Allen, Oak Orchard (two sites), Eighteen-mile, Irondequoit and Honeoye creeks. Annual loads of total phosphorous and orthophosphate were computed to assess the relative contributions from each basin, and allow direct comparison between the monitored basins. High total suspended solids at some sites were attributed to agricultural land use in highly erodible soils. These data will support the Great Lakes Water Quality Agreement's Nutrient Annex priorities for nutrient management, and will provide valuable comparisons between major drainage basins to Lake Ontario in New York State.

Niagara River Update

In addition to ongoing monitoring in support of the Niagara River Toxics Management Plan (NRTMP), EC and USGS continue to collaborate on several monitoring initiatives in the Niagara River. The USGS started a year-long (pilot) monitoring program at 2 sites, one near Ft. Erie, Ont. (upstream), and another near Lewiston, N.Y. (downstream). The U.S. sampling is funded through EPA's GLRI and will measure 209 legacy chemicals, dioxins/furans, polycyclic aromatic hydrocarbons, a suite of emerging contaminants and hormones, major ions, nutrients, total dissolved solids, total suspended solids, mercury, dissolved organic carbon and microplastics. These data will complement recent analyses by EC of long-term trends in major ions and nutrients, such as chloride, which has increased by 12–13% since 1995, and total phosphorus, which still frequently exceeds the interim Provincial Water Quality Objective of 30 ug/L set by the OMECC to prevent excessive plant growth. EC is continuing to monitor dioxins/furans in both water and suspended sediment to better understand the temporal trends since the 1980s. In 2015–16, EC is planning to conduct a cross-sectional survey of the Niagara River to validate nutrient and major ion concentrations in addition to deploying passive samplers to investigate possible intermittent releases of legacy contaminants and the presence of other bioavailable pollutants in the water.

Habitat Restoration Efforts

Great progress in the Credit River Estuary wetlands!

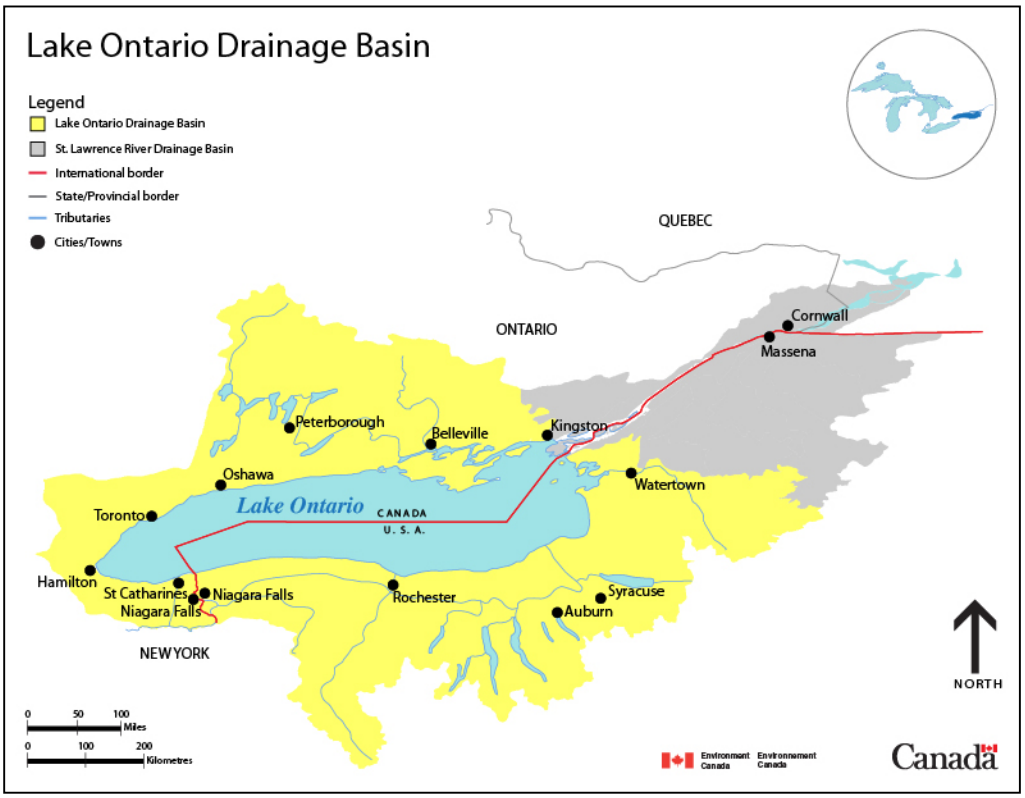
Credit River Estuary in Mississauga, Ontario, contains 22 hectares of coastal marsh wetland complex. It is an

important corridor connecting Lake Ontario to the Niagara Escarpment and Oak Ridges Moraine. This area is the terminus of the 9,300-hectare Credit River watershed, and a Priority Action Site (PAS) in the BBCS. One of the largest ongoing threats to the estuary is the invasion of non-native species. The Credit Valley Conservation Authority developed a short list of essential habitats for biodiversity restoration, and proposed an approach to restoration of coastal wetland biodiversity by engaging local residents and non-governmental organizations. This project aligns with the Credit River Watershed Restoration and Lake Ontario Integrated Shoreline Strategies.

Big things are happening in Braddock Bay!

Braddock Bay and 4 coastal ponds are located just east of Rochester, N.Y. in the Rochester Embayment Area of Concern. This is the largest coastal wetland complex along Lake Ontario's south shore and is identified as a PAS in the BBCS. It provides vital migratory, feeding and nesting habitat for diverse bird species, and extensive submerged aquatic vegetation beds supporting many fish species such as Northern Pike. US$10 million is now being invested in coastal wetlands restoration work in the area. The 6 projects, including construction of a 2,000-foot headland beach structure to replace the lost barrier beach across the mouth of the bay, will restore or enhance over 590 acres of coastal wetlands. Enhancements include opening 15 acres of pools and 28,000 feet of connecting channels in wetlands impacted by dense stands of cattails; and 485 acres of surrounding riparian buffer lands have been protected through acquisition or conservation easements. With 2,450 acres of public land in or adjacent to the wetlands, this area is a resource treasured by people across the region.

Lake Ontario Basin Map



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