Lake Erie and St. Clair River to Detroit River Ecosystem

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Good morning. I am Dan O'Riordan, with the U.S. Environmental Protection Agency, and I am the co-chair of the Lake Erie Lakewide Management Plan Work Group. I am very pleased to be here this morning to present to you some information about the Biological Integrity of Lake Erie and of the St. Clair River - Lake St. Clair and Detroit River ecosystem.

Lake Erie is the most biologically productive of the Great Lakes. The Lake Erie basin includes the Carolinian Zone which has been described as Canada's most endangered major ecosystem. The Carolinian Zone sustains at least 18 globally rare vegetation community types; 36 globally rare species; and 108 vulnerable, threatened and endangered species. The Lake Erie basin is home to endemic species such as the Lake Erie Water Snake; globally rare species such as the prairie white-fringed orchid and the Karner blue butterfly. The Lake Erie and Lake St. Clair drainages are also home to the most species rich freshwater mussel fauna in Canada, including the endangered northern riffleshell. In addition, the Lake Erie basin has a 143 fish species, many of which contribute to a thriving sport and commercial fishery.

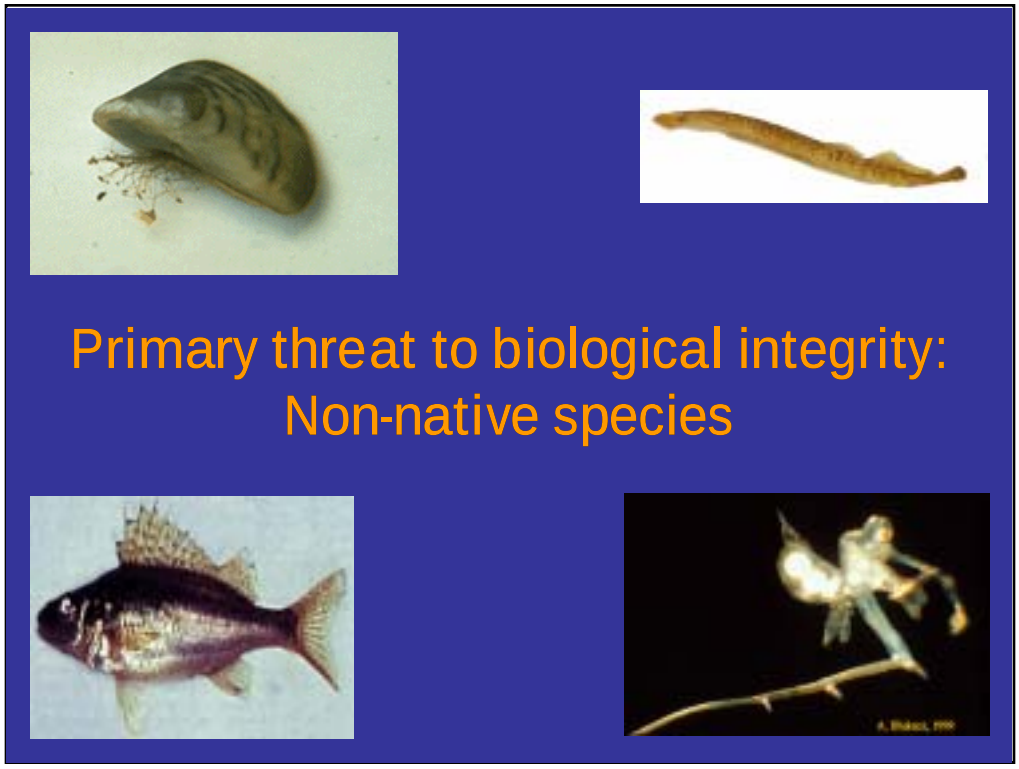
Lake Erie is particularly vulnerable to the introduction and establishment of aquatic non-indigenous invasive species (NIS) because of its geographic location; varied basin morphometry, thermal regimes, chemistry and productivity; high human population; and high volume of shipping traffic with its consequent ballast water discharges at, or upstream of, Lake Erie ports. A minimum of 144 aquatic NIS have been recorded in the Lake Erie basin. Six of the 11 beneficial use impairments in Lake Erie, in part, as a result of the introduction of NIS.

Lake Erie Drainage Basin

The greatest threats to biological integrity in Lake Erie and the St. Clair River – Lake St. Clair - Detroit River ecosystem are non-native species, changing nutrient dynamics , and land use alterations that affect the quantity and quality of habitats. I will be presenting to you some specific examples of issues affecting biological integrity, and also some of the activities that we, as a society, might want to consider to reduce the negative pressures on this region.

In the case of Lake Erie, we have witnessed 30 years of continuing improvement in management practices to attempt to maintain the lake's integrity. There have been many successes, however, threats are still ever-present. The seriousness of these threats was underscored both by the LaMP and by the SOLEC 2001 Report, which listed the status of Lake Erie as "mixed to mixed deteriorating" because of continued non-native species impacts, excessive nutrients, and habitat degradation. Today, the status of Lake Erie's biological integrity remains "mixed to mixed deteriorating."

Likewise, environmental improvement within the St. Clair River – Lake St. Clair – Detroit River ecosystem is continuing. However, non-native species, contaminants, quality of habitat, and land use alterations also continue to challenge the biological integrity of this ecosystem. As reported in the State of the Great Lakes 2001, persistent ecosystem pressures, combined with some ecosystem gains in terms of contaminant levels in ambient water and habitat protection, have given the St. Clair River– Lake St. Clair- Detroit River ecosystem an overall status of mixed. This status remains "mixed" for biological integrity.



Today, non-native species are the primary threat to the biological integrity of Lake Erie and the St. Clair River– Lake St. Clair- Detroit River ecosystem. Non-native species are modifying: habitats, water clarity, plankton, fish and wildlife community structures, contaminants, nutrients and energy cycling in the lake. They are impacting migratory fish-eating birds and waterfowl, and are contributing to the extirpation of native species.

Let me share with you now some of the issues and problems we are seeing in these waterbodies.

Non-native species are altering the aquatic food web in both Lake Erie and the St. Clair River– Lake St. Clair- Detroit River ecosystem. There are currently 34 non-native fish species in Lake Erie. These fish directly compete with native species for food, and their presence results in changes in the behavior and productivity of both forage fish and their predators.

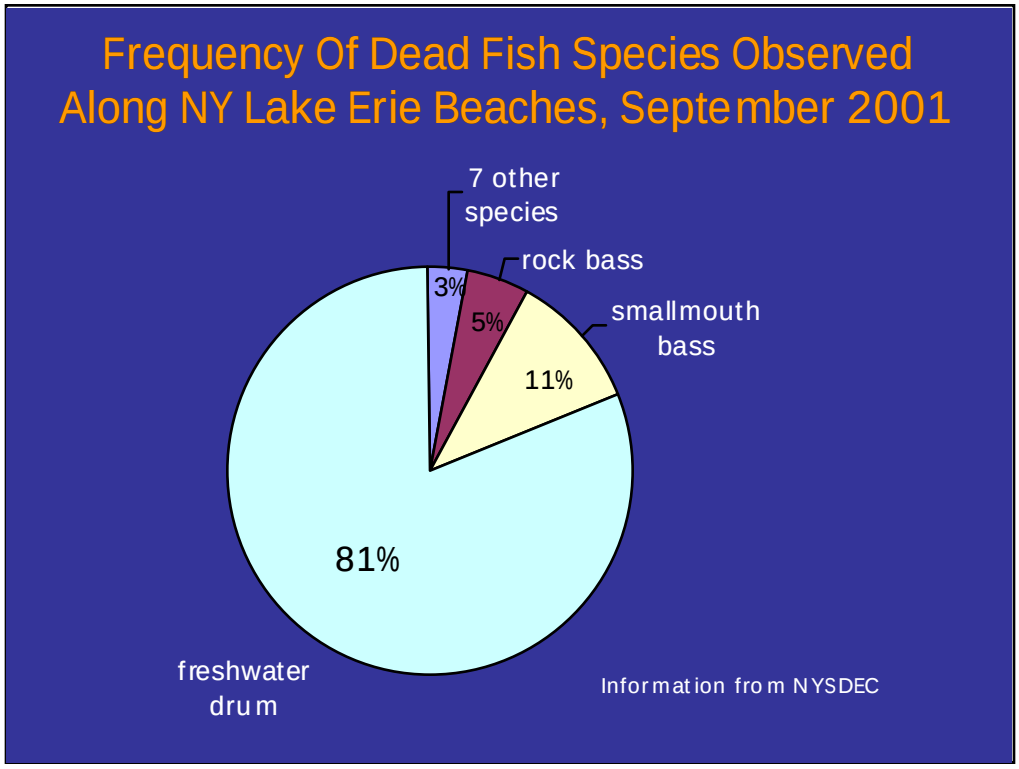
Altered habitats favor non-native species

Zebra Mussels

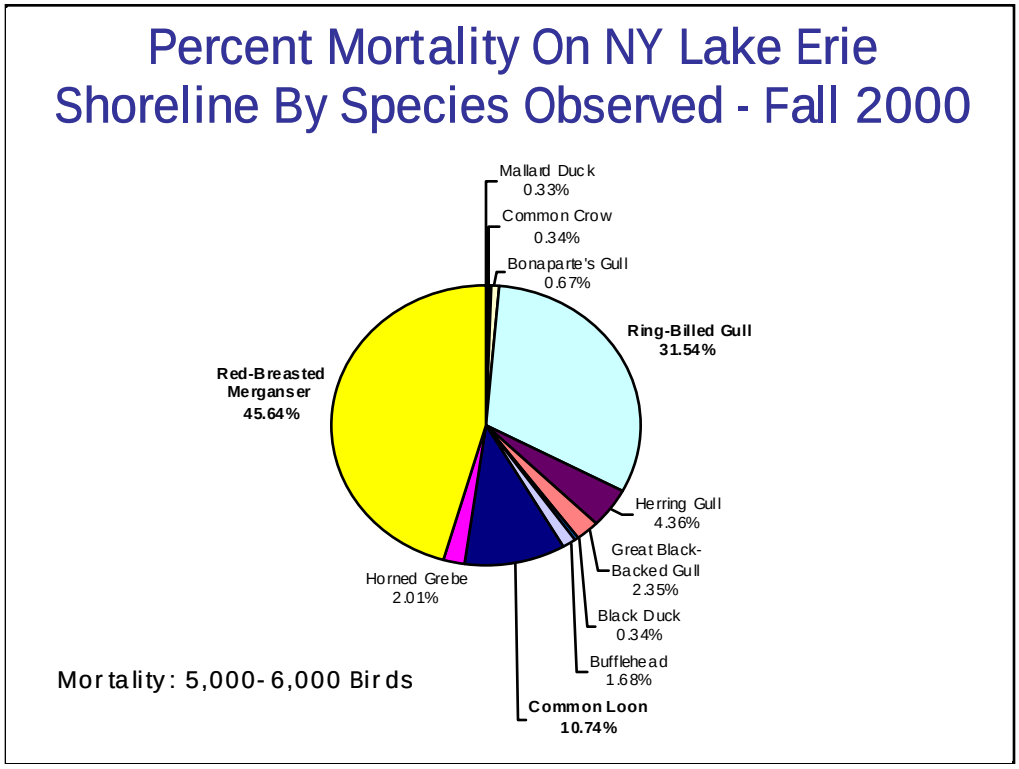
Native Freshwater Mussels

Another impact is that habitats are being altered by non-native species at the expense of native species. The zebra mussel, for example, is thought to be contributing to the steep decline of native freshwater mussels. Native freshwater mussel species were virtually extirpated from the offshore waters of Lake St. Clair by 1994, with similar declines in the connecting channels and many nearshore habitats. The average number of mussel species found in these areas before the zebra mussel invasion was 18. After the invasion, 60% of surveyed sites had 3 or fewer species left alive, 40% of sites had none left, and abundance had declined by 90-95%. In Lake Erie, mussels have declined catastrophically as well. Coastal wetland areas such as Metzger's Marsh, which is a diked wetland, and tributaries in the watershed are the only remaining refuges for many native mussel species.

Aquatic non-native species are also affecting contaminant movement potentially affecting the health of fish, wildlife and humans. Round gobies, for example, have created a new pathway for contaminant and energy transfer. In the past decade round gobies have spread throughout Lake Erie and are now among one of the most abundant fish species on rocky substrates, feeding on a variety of organisms ranging from plankton to zebra mussels and other benthic invertebrates. They have become a major prey item for many benthic fish predators, including smallmouth bass, yellow perch, walleye, and freshwater drum.



Non-native species are also thought to be vectors for disease in other organisms. The round goby, for example, is thought to be aiding the spread of botulism type E, affecting amphibians fish, and resident and migratory birds. The disease is caused by a bacterium called *Clostridium botulinum*. Birds such as ducks, gulls, mergansers and loons are paralyzed or die after exposure to a toxin produced by the bacteria. One study showed that botulism-infected birds in Lake Erie had a higher incidence of round gobies in their guts compared with uninfected birds. The apparent role that gobies play in the transmission of the toxin is not clear at this time.



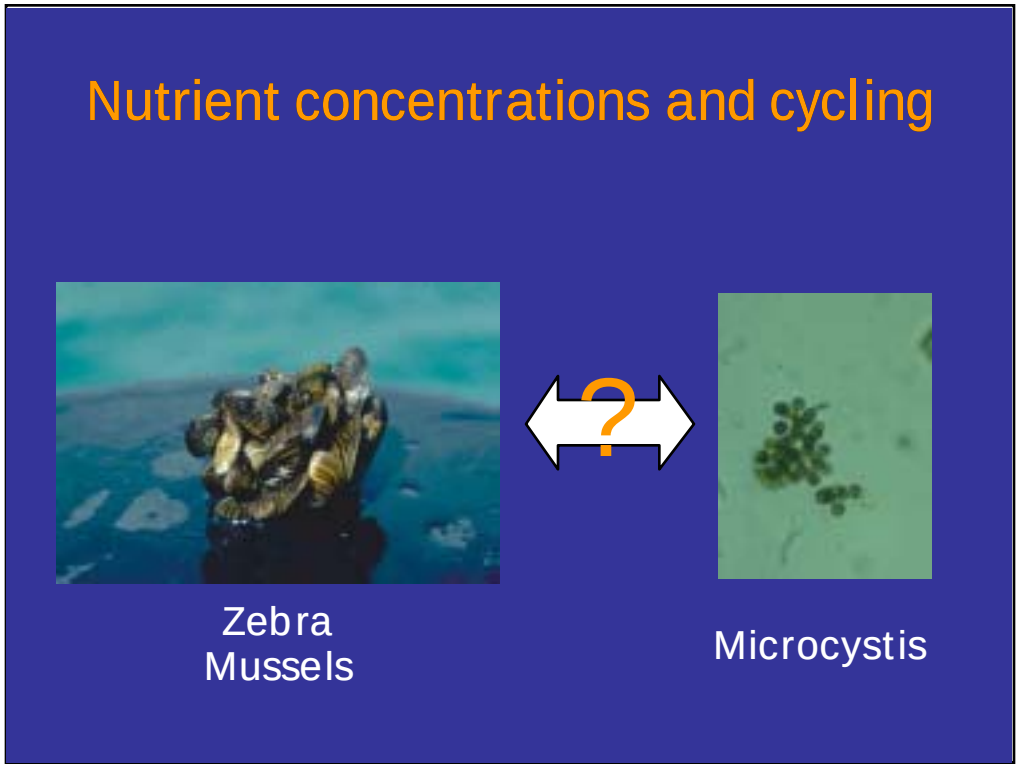
A single event during August and September of 2001, along the Ontario and New York shoreline of Lake Erie resulted in mortalities of loons, mergansers, round gobies, carp, catfish, mudpuppies, and freshwater drum and sturgeon. Estimates of dead loons in New York were over 1000 birds. Also, 27 dead lake sturgeon were found during that time. Botulism episodes have been occurring for the past 4 years in Lake Erie killing thousands fish and birds. The multi-year occurrence of these events is unprecedented, and continues to this day.

Non-native Zooplankton

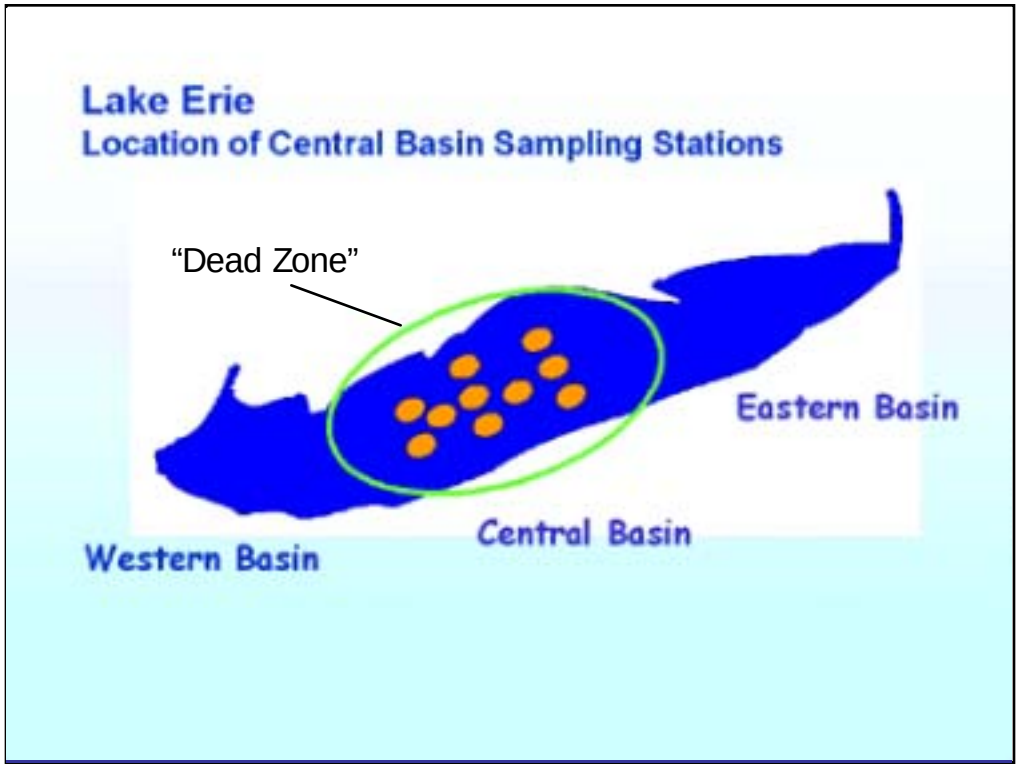
Cercopagis

Additional invasions by non-native species have been forecasted. Two zooplankton species, *Cercopagis pengoi* and *Daphnia lumholtzi,* for example, were predicted as likely to invade Lake Erie in 2000. Both species have been confirmed to be well established in the western basin near the Detroit River inflow. Because *Cercopagis* is large in size compared to native zooplankton, it likely will affect both phytoplankton and zooplankton populations and might even compete with young of the year fish for prey. *Daphnia* has the ability to avoid predation and will likely become well established as well.

Aquarium, water garden, and baitfish introductions are also an important vector of non-native species to Lake Erie and the connecting channels. Of nine fish species associated with aquarium and water garden trade in Ontario, three species have been reported in Lake Erie: goldfish, pacu, and suckermouth catfish. In 2000, a Chinese bighead carp was sighted in the western basin of Lake Erie. This filter feeder, if established, will compete with native fishes for plankton.



Along with non-native species, changes in nutrient concentrations and cycling in the food web are significantly stressing both Lake Erie and the St. Clair River-Lake St. Clair-Detroit river ecosystems. Blooms of the toxic blue-green algae called *Microcystis*, have been linked to the feeding habits of the zebra mussel. Blooms were formerly common in the nutrient-rich western basin of Lake Erie, and a phosphorus abatement program was initiated in the early 1970s. It is hypothesized that today, zebra mussels induce a shift in algal abundance by ingesting all algae except *Microcystis*. Recent blooms were seen in 1998, but forecasting future blooms remains unpredictable.



Although significant reductions in loadings of nutrients have been achieved, phosphorus concentrations in Lake Erie appear to be rising again, and may be linked to a zone of oxygen depletion in the Central Basin. This last summer, a consortium of universities and agencies from both the US and Canada began an intensive special study to investigate the changing and complex nutrients dynamics of the Lake. They have been measuring the biological and chemical processes, which should contribute to improving our understanding of the changes in Lake Erie.

HABITAT	WHERE IMPAIRED
Islands	OH, likely in ON
Sand/Cobble Beaches	Sand: OH, PA, NY, ON; Cobble: ?
Unconsolidated shore bluffs	PA, likely in NY, ON
Interdunal wetlands	OH, PA, ON
Sand dunes	OH, PA, NY, ON
Submerged macrophytes	PA, NY, ON
Floating macrophytes	NY, ON, likely OH, PA
Emergent macrophytes	MI, PA, NY, likely OH, ON
Wet meadow	OH, PA, NY, ON
Mesic prairie	OH, ON, likely PA
Shrub swamp	OH, ON, likely NY, PA
Bogs and fens	OH, PA, NY, ON
Upland marsh	OH, NY, likely PA, ON
Mesic forest	NY, ON, oak-hickory in OH, beech-maple in PA
Swamp forest	OH, PA, NY, ON

In addition to non-native species and nutrient concerns, land use conversion is reducing the availability of good quality habitat for native plants and animals. The *Degraded Wildlife Populations and Loss of Wildlife Habitat Report* produced in 2001, assessed 15 Lake Erie habitat types and more than 300 species for evidence of impairment. All 15 habitats, including sand beaches and dunes, aquatic habitats, and wetlands, are impaired in one or more state or Ontario because of historic or present land use alterations.

Endemic Species

Lake Erie

Water Snake

Some species in Lake Erie are endemic to either the Great Lakes or the Lake Erie watershed, that is, are found only here and nowhere else in the world. As such, there is a high stewardship responsibility for these species. The Lake Erie water snake, for example, is a semi-aquatic reptile entirely dependent on specialized western Lake Erie island habitat. It has disappeared from four islands it originally inhabited and has declined significantly, in some places up to 80%, on other islands. The decline is due to its habitat being severely altered from development such as wetland infilling, quarry mining and marina construction, and to human intervention, including an extermination program on one island. *On a positive note, it was confirmed this summer that the Lake Erie water snake has returned to Green Island.*

There are substantial areas in the Detroit River, specifically the Trenton Channel, where benthic communities are limited by degraded sediment quality as indicated by the high number of worms and midges. Although progress toward reducing contaminant loading has been achieved, some contaminants such as mercury, arsenic, dioxins, PAHs, and PCBs, continue to cycle through the sediments and the food web. Mercury still exists in sediments in the St. Clair River, and PCBs are known to be widely distributed throughout the sediments of the Detroit River.

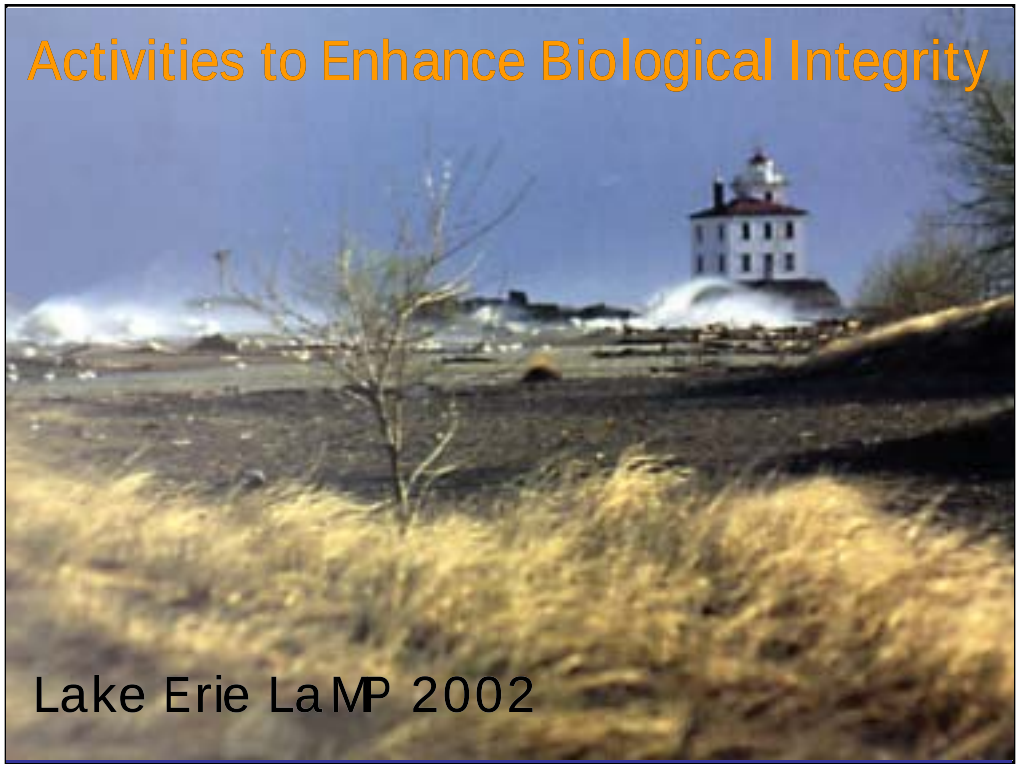
Researchers believe that in the past Lake St. Clair and the Detroit River probably supported extensive beds of rooted aquatic plants in nearshore areas which provided habitat for abundant populations of bluegill, pumpkinseed sunfish, and muskellunge. As habitat was destroyed and degraded, these nearshore fish communities were severely altered. Today, surveys reveal that these nearshore habitats are still degraded and are characterized by the preponderance of non-native fish such as common carp, quillback suckers, bowfin, freshwater drum, and white sucker.

Lake Sturgeon - Making A Comeback

One example of work to improve habitat is the growing success regarding lake sturgeon. In 2001, 21 sturgeon were reported in Ohio waters. One recaptured fish was tagged from a current monitoring project in the Lake St. Clair-Detroit River, the first recapture outside of this system. Since 1995, more than 4000 sturgeon have been tagged. Evidence of spawning grounds in Lake Erie have not yet been found, but two adult sturgeon caught in the Maumee River last year could be an indication that sturgeon are returning to these streams.

In the western basin of Lake Erie increased populations of mayflies have provided forage for many fish species. Trout-perch, another benthic species that declined in the 1950s, seems to be making a comeback. This suggests that the historic benthic-feeding community may be beginning to recover.

The burgeoning double crested cormorant population remains a concern in Lake Erie. Although not conclusive, evidence indicates the cormorant impact on fish populations may be minimal, however, cormorants do pose other biological threats. They physically displace other colonial waterbirds, kill trees and vegetation with their feces, and affect the ecological balance of a site. Of particular concern are the island habitats in Lake Erie. A national cormorant management plan for the US was developed to enhance the flexibility of natural resource agencies to deal with resource conflicts caused by the birds as well as ensure healthy and viable populations of the birds.



Lets turn briefly now to a series of activities that are underway to restore or protect biological integrity of Lake Erie and of the St. Clair - Detroit River ecosystem. LaMPs, RAPs, the St. Clair Initiative, and other watershed management initiatives and practices are combining science with public consensus to restore and protect biological integrity.

The Cuyahoga RAP has initiated stewardship programs in the Big Creek and Yellow Creek watersheds. Three workshops that targeted decision makers were held on streamside management, and five model streambank restoration projects were completed.

Activities to Enhance Biological Integrity

- St. Clair River habitat and non-point source improvement projects
- Lake St. Clair Coastal Habitats Restoration Conservation Project
- Ontario Environmental Farm Plan & Ontario Rural Clean Water Programs

The St. Clair River RAP is engaging interested landowners in habitat and non-point source improvement projects that have leveraged more than $1 million in local matching funds.

Starting in the Summer of 2002, NOAA and the Greats Lakes Commission initiated the Lake St. Clair Coastal Habitants Restoration Conservation Project. This is a two year program to characterize Lake St. Clair's coastal habitat and develop a coastal restoration conservation plan for the Lake.

The Ontario Environmental Farm Plan and Ontario Rural Clean Water Programs are tools involving broad stakeholder involvement from farm groups to the government to implement actions to improve environmental conditions in agricultural areas. These projects integrate aquatic and terrestrial habitat conservation practices and water quality improvement on private lands.

The Detroit River Heritage River Initiative initiated a habitat visioning process and completed an inventory of possible natural habitats along the shoreline of the lower Detroit River. In December 2001, the US passed legislation to establish an International Wildlife Refuge along the river. This 18-mile refuge will stretch from Zug Island south to Sterling State Park in Monroe County, Michigan.

Several land purchases over the last two years have set aside significant areas as preserves. The Nature Conservancy of Canada purchased Middle Island, which is managed through Parks Canada. The Michigan Chapter of The Nature Conservancy has protected 8-acre Calf Island, one of the last undeveloped marshes in the Detroit River. Other purchases are protecting more than 800 acres of island shoreline and forests that are home to rare bird species throughout the Lake Erie basin.

What actions are needed to understand and improve the biological integrity of Lake Erie and the St. Clair River to Detroit River Ecosystem?

The ecosystem has responded to non-native species, habitat losses and contaminant impacts by altering its dynamics to maintain ecosystem function. Species composition has changed, but ecosystem function continues. In the St. Clair River – Lake St. Clair – Detroit River ecosystem, for instance, the number of walleye is reduced but the number of bass has increased. Though compensation is an inherent capability of the ecosystem, non-native species, habitat loss and persistence of contaminants have ecologically profound implications. Therefore, what actions are needed to understand and improve the biological integrity of Lake Erie and the connecting channels. I suggest that the following managerial actions are essential.

Actions Needed

1. Minimize and control non-native species.

First and foremost we need to control the greatest threat to the biological integrity of Lake Erie and St. Clair River-Lake St. Clair and Detroit River ecosystems: non-native species. Foreseeable future actions must include trans-jurisdictional legislation and actions to prevent further introductions as well as control of species already present if possible.

Actions Needed

2. Promote the protection and restoration of habitats across jurisdictions.

Land use alterations continue to result in habitat loss. Habitat protection and restoration needs to occur across all jurisdictions. This will increase chances of survival for species impacted by stressors.

Actions Needed

3. Implement activities that manage nutrients.

The implementation of activities to manage nutrients inputs, particularly from non-point sources, will improve the quality of our nearshore and tributary habitats.

Actions Needed

4. Improve data collection to facilitate informed decisions.

Monitoring should be based on specific indicators and the linkage of monitoring and assessment programs to endpoints, such as impairments to beneficial uses within the Areas of Concern.

Biological Integrity

Lake Erie:

mixed to mixed deteriorating

St. Clair River – Lake St. Clair - Detroit River Ecosystem:

mixed

In conclusion, the biological integrity ranking of Lake Erie remains "mixed to mixed deteriorating," the same as the 2001 ranking for the entire ecosystem. The ranking for the St. Clair River–Lake St Clair and the Detroit River remains "mixed." These rankings are based on the continued threat of non-native species, increased nutrient loadings, land use alterations and reduction in quality of habitat that are not yet being satisfactorily offset or stopped by all of the good work being done.

Some changes to the Lake Erie and connecting channels ecosystems have been irreversible, others are not. To ensure the greatest recovery and minimize risk of future impairments to biological integrity, we must focus on the most critical stressors. Comprehensive and integrated management practices that include broad public support are needed to realize the vision of biological integrity called for in the Lakewide Management Plan and the Lake St. Clair Initiative plans. Time is of the essence to prevent additional biological degradation and ensure that the integrity of the Lake Erie and St. Clair River to Detroit River ecosystems improve.