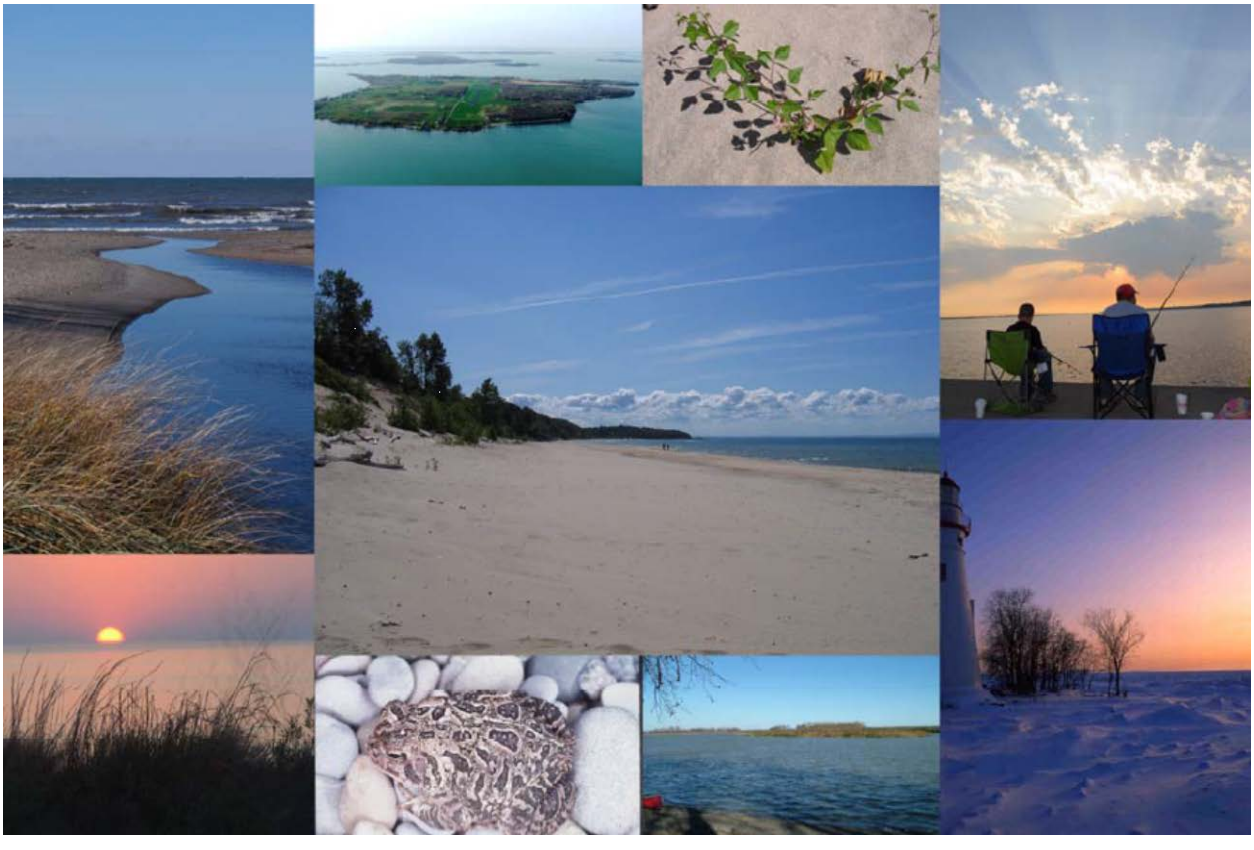
Returning to a Healthy Lake

An International Biodiversity Conservation Strategy for Lake Erie



Technical Report

The Nature Conservancy

Nature Conservancy of Canada

Michigan Natural Features Inventory

Prepared by the Lake Erie Biodiversity Conservation Strategy Core Team

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From top left corner going clockwise: Lake Erie (John Whitney, NRCS District Conservationist, East Aurora, NY); North Bass Island (Williams; Ohio DNR); *Strophostyles helvola* (Mike J. McMurtry); Fairport Harbor (Randall Schieber); Marblehead (Ohio DNR); Woodtick Peninsula from Erie Marsh Preserve (Douglas Pearsall, TNC); Fowler's Toad (Mike J. McMurtry); Headlands Beach (Randall Schieber). Center photo: Beach at Marcy's Woods (Mike J. McMurtry).

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Disclaimer

This report reflects the best efforts of the Core Team and contributors to accurately represent the expertise and views expressed by project participants. The Conservation Action Planning process is iterative in nature and the Lake Erie Biodiversity Conservation Strategy should be revisited and updated periodically as conditions and available information change.

EXECUTIVE SUMMARY

Lake Erie is unique among the Great Lakes. Its shallow waters and southern location result in the highest primary production, biological diversity and fish production of all the Great Lakes. This highly valuable resource is also situated in the most altered basin, and has suffered from invasive species, increases in nutrient concentrations, pollution and habitat destruction. These anthropogenic changes have caused wildlife and plant populations to decline and in some locations disappear, changing Lake Erie's natural biological diversity and diminishing many of its ecological services. Through the efforts of many agencies, organizations, and individuals working over decades, Lake Erie has shown the ability to recover, and we expect that future, focused efforts will lead to further restoration of the functions and ecological richness of the lake, and the quality of life for people in the basin.

The Lake Erie Biodiversity Conservation Strategy (LEBCS) is a binational initiative designed to support the efforts of the Lake Erie LaMP by identifying specific strategies and actions to protect and conserve the native biodiversity of Lake Erie. It is the product of a two year planning process involving over 190 from 87 agencies and organizations around the basin[1]. The goals of this planning process included:

- Assemble available biodiversity information for Lake Erie;
- Define a binational vision of biodiversity conservation for Lake Erie;
- Develop shared strategies for protecting and restoring critical biodiversity areas;
- Describe the ways in which conservation strategies can benefit people by protecting and restoring important ecosystem services; and
- Promote coordination of biodiversity conservation in the Lake Erie basin.

By applying a biodiversity focus to synthesize and prioritize existing related efforts, the LEBCS reaffirms and advances many existing complementary plans and initiatives. This project has increased awareness and collaboration among organizations and communities active in biodiversity conservation with the Lake Erie watershed, and provides a lakewide context for local conservation actions.

Designing a biodiversity strategy: Approach, scope and stratification

The Nature Conservancy's Conservation Action Planning (CAP) process – a proven adaptive management approach for planning, implementation, and measuring success for conservation projects – guided the development of the strategy (TNC 2007). This effort was managed by The Nature Conservancy, Michigan Natural Features Inventory and Nature Conservancy Canada, working closely with the Great Lakes National Program Office of the USEPA—funders of the project through the Great Lakes Restoration Initiative. A Steering Committee of 60 representatives from Federal, State, Provincial, and local agencies and organizations advised the Core Team. Involvement of these key individuals, several of whom are part of the Lakewide Management Plan (LaMP), LaMP Forum and Great Lakes Fishery Commission, and other experts and stakeholders throughout the basin was critical to the long-term success of this effort.

[1] The scope of this project included the waters of Lake Erie, St. Clair River, Lake St. Clair, Detroit River and Niagara River, and the tributaries of these watersheds to the extent that they affect the biodiversity of the lake.

The scope of Lake Erie Biodiversity Conservation Strategy includes the lake itself, the Connecting Channels, including Lake St. Clair, St. Clair River, Detroit River and upper Niagara River, the immediate coastal area (roughly 2 km inland from the shoreline), and the watersheds of the tributaries in the basin, to the extent that they affect the biodiversity of the lake.

Assessing information and planning at broad scales, such as an entire Great Lakes basin, can present challenges for developing and tracking a set of successful strategies. Lake Erie has considerable regional variation in shoreline and nearshore ecology, economics, and dominant land use, with the most striking variation found between the Western and Eastern Basins. To address the differences within the Lake and along the coastal zone, we divided the lake into four generally recognized basins for reporting units: The reporting units are: Eastern Basin, Central Basin, Western Basin and Huron-Erie Corridor. We further divided these reporting units into offshore and coastal-nearshore units to facilitate assessments of viability (health) and threats to biodiversity and inform development of strategies.

Assessing Lake Erie's biodiversity

Eight focal targets were identified that define the biodiversity of Lake Erie:

1. **Open Water Benthic and Pelagic Ecosystem** (offshore waters deeper than 15 m)
2. **Nearshore Zone** (waters less than 15 m in depth, including the coastal margin)
3. **Native Migratory Fish** (Lake Erie fish with populations that require tributaries for a portion of their life cycle, including lake sturgeon, walleye, suckers and sauger)
4. **Lake Erie Connecting Channels** (Huron – Erie Corridor and Upper Niagara River)
5. **Coastal Wetlands** (wetlands with historic and current hydrologic connectivity to, and directly influenced by, Lake Erie)
6. **Islands** (including both naturally formed and artificial islands)
7. **Coastal Terrestrial Systems** (upland systems within ~2 km of the shoreline)
8. **Aerial Migrants** (migrating birds, insects, and bats dependent on the Lake Erie shoreline)

Engaging numerous experts and employing recognized Key Ecological Attributes (KEAs) and indicators of health, the current viability status of each of the eight targets was identified by assessment unit, reporting unit and lake wide. These assessments provide a snapshot of the status of biodiversity in Lake Erie and their desired state. Lakewide viability is presented in Table a, which also shows viability by each reporting units and by target. The long-term goals for each target are summarized in Table b. *Fair* is the predominant rating, except for Aerial Migrants where viability is *Good* in the western half of the lake. Islands have *Good* viability in the Central Basin. While this summary gives us an overall picture of Lake Erie, we also recognize that important differences exist at finer scales and provide a more detailed assessment in maps of each target in Chapter 4, and tables for each attribute assessed in Appendix E. In considering the work needed to be done to rehabilitate these targets to reach the goals presented in Table b, it will be important to consult the finer-scale assessment, as well as focusing on those attributes most impaired.

Table a: Lakewide viability assessment summary

Target	Huron-Erie Corridor	Western Basin	Central Basin	Eastern Basin	Lakewide
Nearshore Zone	Fair	Fair	Fair	Fair	**Fair**
Aerial Migrants	Good	Good	Fair	Fair	**Good**
Coastal Terrestrial Systems	Fair	Fair	Fair	Fair	**Fair**
Coastal Wetlands	Fair	Fair	Good	Fair	**Fair**
Connecting Channels	Fair			Fair	**Fair**
Islands	Fair	Fair	Good	Fair	**Fair**
Native Migratory Fish	Fair	Fair	Fair	Fair	**Fair**
Open Water Benthic and Pelagic Ecosystem			Fair	Fair	**Fair**
Overall Biodiversity Health	**Fair**	**Fair**	**Fair**	**Fair**	**Fair**

Table b: Summary Goals for 2030 to assure long-term viability

Targets and Goals
Open Water Benthic and Pelagic Ecosystem By 2030, to assure that the Open Water Benthic and Pelagic zone of Lake Erie is characterized by a more stable food web that supports a diverse fishery and is resilient to invasive species: • Native fish will comprise 50% of the prey biomass; • Lake trout will maintain self-sustaining populations in each major area of the offshore; • Self-sustaining populations of native predators (such as yellow perch, walleye, lake whitefish and lake trout) maintain relatively stable populations consistent with Fish Community Objectives.
Nearshore Zone By 2030, to assure adequate water quality for sustaining native plants, fish, and invertebrates: • Based on multi-year averages, reduce the load of dissolved phosphorus by 50% by 2030 in at least the priority watersheds. HAB toxin measures will be reduced to the point that no HAB advisories at public beaches will be recorded and issued. The native fish community will have abundant populations of smallmouth bass, walleye, yellow perch, northern pike, muskellunge, rock bass, emerald shiners, white sucker and cyprinids.
Native Migratory Fish By 2030, to provide adequate access to spawning habitat: • At least 50% of the total length of each type of stream is connected to the lake; • Each river-spawning Lake Erie fish species is represented by at least two viable populations in each applicable region (i.e. assessment unit) of the lake. • Tributary connectivity is maximized for Lake Erie migratory fish, while increased risk of aquatic invasive species spread and proliferation is minimized.

Targets and Goals

Coastal Wetlands

By 2030, so that Coastal Wetlands provide adequate ecological functions and habitat for native plants and animals:

- The average wetland macrophyte index for Coastal Wetlands around the lake will reflect good condition;
- Coastal Wetland area around the lake will have increased by 10% compared to the 2011 wetland area.

Connecting Channels

By 2030, so that Lake Erie Connecting Channels continue to improve as critical habitat for the full diversity of native species:

- Shoreline hardening is below 50% along both shores;
- Coastal Wetlands in the Detroit River comprise at least 25% of historic area;
- At least one viable refuge for native mussels persists in each connecting channel;
- Spawning of river-spawning migratory fish continues to show an improving trend.

Islands

By 2030, to ensure that Islands remain as intact and sustainable ecological systems:

- A minimum of 60% of Lake Erie islands are owned and managed for conservation;
- A minimum of 80% of Lake Erie islands are in natural land cover;
- The abundance and richness of colonial nesting waterbirds is maintained within 1990-2010 range of variation;
- All islands are protected by quarantine from known vectors of invasive species;
- Maintain island habitat in an undeveloped condition to support colonial nesting waterbirds, including cormorants, on the islands that have been historically used by nesting colonial nesting waterbirds.

Coastal Terrestrial Systems

By 2030, to assure that Coastal Terrestrial System is of high quality and of sufficient extent to provide habitat for native plant and animal species:

- At least 40% of the Coastal Terrestrial System will be in natural land cover;
- Viable populations of priority nested targets are adequately represented across the lake (adequate representation will be determined at a later date;
- At least 5% of the Coastal Terrestrial System will be in good to excellent condition;
- The average artificial shoreline hardening index will be below 20%;
- All high priority biodiversity areas in the Coastal Terrestrial System are minimally affected by shoreline alterations.

Aerial Migrants

By 2030, so that Lake Erie remains a globally significant stopover area for migrating birds:

- At least 30% of the 2 km coastal area comprises high quality stopover habitat for migrating landbirds;
- At least 10% of the coastal area comprises high quality stopover habitat for migrating shorebirds;
- At least 50% of the 2 km coastal area including coastal wetlands comprises high quality stopover habitat for migrating waterfowl;
- At least 80% of the 2 km coastal area that is high quality stopover habitat for all bird groups is in conservation ownership or management.

Identifying critical threats

To assess threats to biodiversity, the Core Team compiled a list of threats from previous lake-wide and regional CAPs, and the Steering Committee provided additional suggestions to complete the initial list. We then developed online surveys, one for each of the five reporting units, inviting experts to rate the threat to each target in that reporting unit, and document their level of confidence with each rating. Threats were ranked according to scope (size of area), severity of impact (intensity of the impact), and irreversibility (length of recovery time). We received 40 responses and using a weighted-averaging approach that considered the respondent's expertise level, we calculated overall threat-to-target ranks and also calculated ratings for threats across all targets and overall threat ratings for each target.

Threats ranked *Very High* or *High* by reporting unit:

- **Huron – Erie Corridor**: aquatic invasive species; shoreline alterations; pollution (agricultural); terrestrial invasive species; housing & urban development; climate change; point source pollution (industrial);
- **Western Basin**: shoreline alterations; non-point source pollution (agricultural); aquatic invasive species; terrestrial invasive species; housing and urban development; climate change;
- **Central Basin**: non-point source pollution (agricultural); aquatic invasive species; terrestrial invasive species; climate change;
- **Eastern Basin**: shoreline alterations; non-point and point-source pollution (urban and household); non-point source pollution (agricultural); aquatic invasive species; terrestrial invasive species; housing and urban development; climate change; contaminated sediments.

Lakewide, the most critical threats to biodiversity are: aquatic invasive species; climate change; terrestrial invasive species; non-point source pollution (agriculture and forestry); housing and urban development, shoreline alterations; contaminated sediments, point source pollution (industrial, urban and household), dams and other barriers.

To address the most critical threats to biodiversity and restore badly degraded conservation targets, the Core Team hosted a strategy development workshop in Detroit in December, 2011. In the workshop, participants brainstormed and identified priority strategies and, for the top one to three strategies, developed objectives and measures for five topics; the sixth topic, dams and barriers, was addressed through subsequent webinars and conference calls:

1. Agricultural non-point source pollutants
2. Invasive species (aquatic and terrestrial)
3. Housing and urban development and shoreline alterations
4. Urban non-point and point source pollutants
5. Dams and barriers

While recognized as a critical threat, climate change was not addressed in isolation at the workshop. Rather, we worked with participants in the groups above to identify key climate-related vulnerabilities

of targets, and ways in which factors like increases in temperature or increases in peak storm intensities should influence the framing or relative priority of strategies.

Developing conservation strategies

Developing conservation strategies requires a thorough understanding of how critical threats and their causal factors influence the health of biodiversity features. We created conceptual models to illustrate visually how social, political, economic, and environmental elements act together to perpetuate direct and indirect threats to biodiversity targets of Lake Erie. Based on these models, workshop participants identified specific strategies to abate these threats, identified highest priority strategies, and developed a detailed set of outcomes for at least one. The final set of eight featured biodiversity conservation strategies for Lake Erie are presented in Table c in the third column.

Climate change was a key consideration in several of the above strategies. For example, the likely increases in the intensity of storm events is an important consideration in planning for non-point source pollution management , and improving connectivity helps fish and other aquatic species respond to-increasing temperatures.

Priority areas

To complement the lake-wide strategies and better direct conservation action at the local scale, we conducted an analysis of ecological significance analysis to rank smaller coastal units and islands in Lake Erie. We were able to rank priority areas for four of the seven biodiversity targets. For Coastal Terrestrial and Coastal Wetland targets, we conducted a novel analysis of biodiversity significance and condition. For Aerial Migrants and Islands, we used two recently completed research studies that identified priority areas. Priority areas are not relevant to the Open Water Benthic and Pelagic zone, and while relevant to Native Migratory Fish and the Nearshore Zone, we lack sufficient data to do this type of analysis.

The Rondeau Point coastal watershed unit (CWU), located on the Canadian side of the Central Basin received the highest Coastal Terrestrial biodiversity score. Other units that fell into the very high category included: Lower Portage River and Cedar Creek, both located in the Ohio portion of the Western Basin; Canard River on the Ontario side of the Detroit River; Lake Erie North on the Ontario side of the Eastern Basin; and South Otter Creek located in the Ontario portion of the Central Basin just west of Long Point. The top seven coastal watershed units (CWU) with the highest Coastal Terrestrial condition scores are all located in Canada. The Tyrconnell Creek unit located in the Central Basin received the highest score.

Only two of the units with high terrestrial biodiversity scores, Rondeau Point and South Otter Creek CWUs, both located on the Canadian side of the Central Basin, also had relatively high terrestrial condition scores. The only unit with high biodiversity values and low condition scores is the Canard River unit. This unit is located on the Ontario side of the Detroit River and appears to have high potential for ecological restoration.

Table c. Summary of featured strategies in the Lake Erie Biodiversity Conservation Strategy

Strategy	Key factors in situation analysis	Strategies selected for focus in workshop
1. Reducing the Impact of Agricultural Non-Point Source Pollutants;	• Erosion • BMP funding issues • BMP implementation • Cropping trends/prices • Drainage • Altered hydrology • Freshwater pollutants • Nutrient management/Fertilizer application • Climate change – more intense storms, drought stress	a. Target and intensify adoption of nutrient management BMPs to reduce Soluble Reactive Phosphorus loadings to Lake Erie • Identify where to target implementation of best management practices (priority watersheds) • Increase adoption of 4 R's (right place, right time, right rate, and right type) to guide fertilizer application (likely by fertilizer retailers); provide knowledge to support 4 R's; certification program b. Promote in-field management of water and management of surface and subsurface drainage and management of surface drainage channels to moderate discharge extremes and limit nutrient losses (to be developed)
2. Preventing and Reducing the Impact of Invasive Species (aquatic and terrestrial);	• Risk/vulnerability because of degradation • Trade/consumer demand • Vectors – forage/seed, retail practices, transportation, human movement of forest products, bait • Climate change/range expansion • Lack of funding, awareness, knowledge, capacity • Inadequate coordination • Ecosystem impacts • Regulatory structure • Need for surveillance • Lack of control methods	a. Develop a common framework for aquatic invasive species control and management for Lake Erie • Establish a basin-wide working group • With increased political support, establish new policy and regulations for control and prevention • Form basin-wide response team • Demonstrate effectiveness of ecological restoration in controlling and managing AIS b. Assemble key regional partners to create a coordinated action plan for Common Reed and other priority terrestrial invasive species • Apply control • Coordinate regulation to improve efficiency and rapidity of control • Improve coordination for early detection and rapid response to Common Reed

Strategy	Key factors in situation analysis	Strategies selected for focus in workshop
3. Coastal Conservation: Preventing and reducing the impacts of Incompatible Development and Shoreline Alterations	• Awareness/understanding • Political: lack of will and funding/incentives to protect shoreline, emphasis on growth/tax base • Sociocultural and socioeconomic: demand, property values, aesthetic/recreational values, commercial development pressure, ability to participate in decision making, lack of clarity for ownership responsibility • Knowledge: cumulative effects, long term costs, research, monitoring, accessibility of information • Planning: scale of decision making, lack of comprehensive plans, priorities, professional experience	a. Build a business case for coastal conservation • Specific conservation goals and associated costs, key stakeholders, and right scale of analysis are determined • Economic and social benefits of conservation alternatives are evaluated • Stakeholders ,affected sectors, and decision makers all support conservation alternatives • Funding and incentives for coastal protection established • With needed funding, integrated coastal zone adaptive management plans created and implemented; impacting local decision making b. Develop a comprehensive education and outreach program for healthy shorelines • Shoreline processes and land owner behavior understood • Comprehensive toolbox created that provides decision support for prioritization, contractor training, demonstration sites, and economic assessments • With foundation of support for healthy shorelines, updated regulations developed and implemented, and applied where needed
4. Reducing the Impacts of Urban Non-Point and Point Source Pollutants	• Imperviousness/storm water • Lack of enforcement • Emerging contaminants - untreated • Legacy pollutants/marina contaminants • Municipal land use regs • Dredging/disposal • Resuspension • Increase in coal burning • Climate change – more intense storms • Urban NPS • PS – sources – industrial, municipal, household	a. Improve municipal storm water management throughout the basin to mitigate impacts • On developed lands through enforcement and retrofit • Through prevention on newly developed lands (through regulations/zoning that requires BMPs and protection of sensitive features) • Assumes individual municipalities can benefit from pooling resources to meet storm water permit requirements by collaborating with other watershed partners and stakeholders

Strategy	Key factors in situation analysis	Strategies selected for focus in workshop
5. Improving Habitat Connectivity by Reducing the Impact of Dams and Other Barriers	• Pressure to keep barriers include financial cost of removal, aesthetic values, risk of further invasive species spread • Pressures to remove or improve barriers: risk of failing infrastructure and associated costs, management objectives to improve fisheries and/or ecological conditions, and aesthetics	a. Increase connectivity to Lake Erie, focusing on first barriers • Initially focuses on development of evaluation criteria and decision tool to assess ecological benefits and risks, economic costs and benefits, cultural and social values associated with a barrier, and opportunity • The decision tool would be used to influence four pathways to barrier removal – use by international management groups, incorporation into watershed management plans, and directing of funding resources to barriers, as well as individual municipal decisions on barriers

The highest scoring units for Coastal Wetland biodiversity are Cedar Creek and Pickerel Creek CWUs both located in the Ohio portion of the Western Basin, and the Swan Creek CWU located on the northwest portion of Lake St. Clair in Michigan. Units with the highest Coastal Wetland condition scores are Mill Creek/Black River and Swan Creek both located in Michigan in the northern portion of the Huron-Erie Corridor.

The Swan Creek CWU in Anchor Bay was the only unit to score relatively high for both biodiversity value and condition. However, this unit has relatively high building and road densities as well as one of the highest percentages of artificial shorelines in Lake Erie. The Cedar Creek and Pickerel Creek CWUs in Ohio were the only two units in Lake Erie with a high biodiversity score but very low condition score.

The Aerial Migrants target is based on a study developed by Ewert et al. (2012 draft) to model and assess migratory bird stopover sites in the Great Lakes Basin. The preliminary results of the modeling study highlight the Western Basin, Huron-Erie Corridor (strong emphasis on the Canadian side), and the Ontario portion of the Eastern Basin as containing significant habitat for both shorebirds and waterfowl during spring migration.

For the Islands target, we used the results from a recent study (Henson et. al. 2010) that assessed the biodiversity value of all Great Lakes islands. Key islands for biodiversity conservation in Lake Erie include: Pelee Island, Pointe Aux Pins, Long Point, and Turkey Point all located in Ontario, and Kellys Island in Ohio. Key islands in the Huron to Erie Corridor include Harsens Island in Michigan, and Walpole Island, Squirrel Island, St. Anne Island Complex, and Johnston Channel Island Complex all located in Ontario.

Ecosystem services

While the LEBCS strategies are intended to address threats to and restore biodiversity, experts around the lake clearly agree that the strategies are very likely to have positive effects on human well-being. We conducted two surveys to: 1) identify the 10 most important ecosystem services provided by Lake Erie and its coastal area, and 2) estimate the potential effect (in qualitative terms) of the proposed conservation strategies on those important ecosystem services.

Participants from all five Lake Erie basin states and the province of Ontario, representing public agencies at all levels of government, as well as private organizations and others, completed the survey. Recreation and wildlife habitat were identified as the two most important ecosystem services, and, not surprisingly, supplying fresh water, purifying water, and the water cycle were all among the top ten. Other benefits in the top ten included primary productivity, aesthetics, nutrient cycling, “sense of place”, and climate regulation.

Among the recommended strategies, reducing impacts from agricultural and urban non-point and point source pollution were estimated to have the greatest positive effect on these ecosystem services, followed by coastal conservation. Services that were identified as most likely to be improved included wildlife and fish habitat, recreation, and aesthetics. There were no strategies that were thought to have negative effects on ecosystem services, and no ecosystem services that were predicted to be degraded by the recommended strategies.

Implementation recommendations

The LEBCS presents key components of a common vision for the conservation of Lake Erie biodiversity. The strategies (with associated goals, objectives and measures) are designed to augment efforts to fulfill obligations of the Great Lakes Water Quality Agreement (GLWQA) as updated in 1987 and 2012, the Great Lakes Restoration Action Plan, and a host of other local and regional priorities (see Appendix K). We conclude this report with several general recommendations to facilitate implementation of the LEBCS. These recommendations include:

1. The Lake Erie LaMP adopts the LEBCS and affirms a common vision and priorities.
2. Lakewide organizations review and restructure to meet implementation needs.
3. Expand stakeholder engagement to include corporate and industrial sectors, as well as local-regional government.
4. Leader and stakeholders adopt a common vision and agenda and then develop an Implementation Plan.
5. LEBCS is viewed as a living document and is regularly updated using adaptive management as a standard component of the review, analysis, and business planning processes.
6. Align funding streams to achieve LaMP priority outcomes.