Western Lake Erie

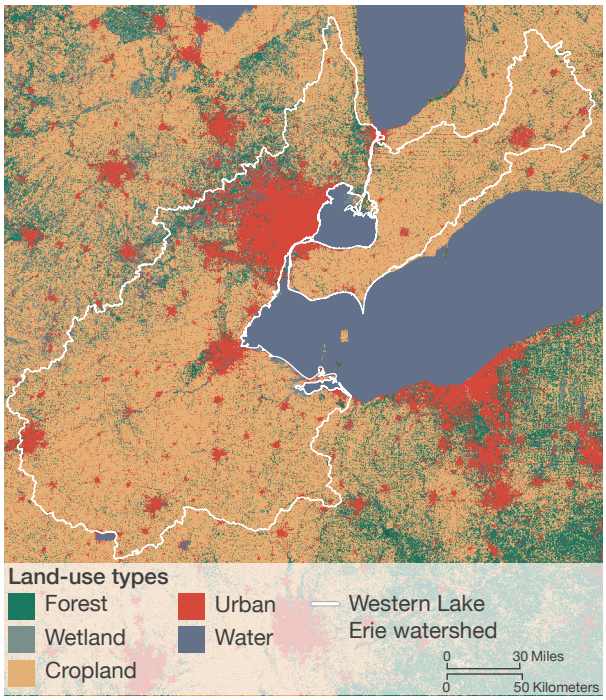
1st Report Card

Understanding Western Lake Erie

An important piece of the Great Lakes Region

About one-third of the total population of the Great Lakes Basin lives within the Lake Erie Watershed. The lake provides drinking water for 11 million residents, and has one of the largest freshwater commercial and recreational fisheries in the world. Lake Erie has three basins which vary by depth. The western basin is the shallowest with an average depth of 24 feet. The Western Lake Erie watershed includes areas of Michigan, Ohio, Indiana, and Ontario. The land, historically home to Native Americans, including the Iroquois, was explored and colonized by the French in the mid-17th century.

Throughout history the lake has been, and continues to be, a central piece of the region's economy. The region's rich soils are widely cultivated for agriculture. The lake and surrounding areas provide many recreation opportunities, such as camping, kayaking, boating, hiking, birding, and fishing. Since the 20th century, Lake Erie has suffered from chronic water quality issues stemming from intensive agricultural land use, large-scale industry, and population growth. Harmful algal blooms generally occur from late July to mid-October in Western Lake Erie. Blooms are more common here because of shallow depth, warm water, and nutrient loading (nitrogen and phosphorus) from the watershed. These blooms can produce toxins dangerous to humans and wildlife. Environmental regulations, management, and restoration have shown some signs of success, particularly in the resurgence of important fish species, but progress in nutrient reductions is lagging.



Land use in the Western Lake Erie watershed is dominated by agriculture (cropland). Data from the Commission for Environmental Cooperation.

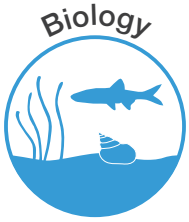
The Western Lake Erie basin is densely populated and supports agriculture, industry, commercial fishing, and diverse recreational opportunities. Urban and residential development increases runoff, and pesticides and fertilizers used on agricultural fields and lawns end up in the rivers and lake. Sediment and toxics pollute the environment. Animal feeding operations in the watershed produce large quantities of manure that can contaminate the water. Excess nutrient loading to Western Lake Erie causes harmful algal blooms that can kill fish, contaminate drinking water, and impact local economies. Algal blooms are also affected by wind, rain, and temperature conditions that vary every year.

Key indicators measure ecosystem health

Report cards are powerful tools used around the world to describe ecosystem status, increase public awareness, and inform decision makers. This is the first Western Lake Erie Report Card, and it reflects the collective effort of dozens of stakeholders in the Western Lake Erie watershed. Important values and indicators of ecosystem health were identified for both the watershed and the western lake basin. Three categories of indicators were assessed for the watershed: water quality, biology, and toxics; and for the lake basin: water quality, fish, and algal blooms (cyanobacteria and non-toxic algae). Within these categories, each indicator was evaluated by comparing data to scientifically-derived thresholds or goals. Each region score was area-weighted to attain an overall score for both the Western Lake Erie basin and Western Lake Erie watershed.

Watershed Indicators

Dissolved phosphorus and **total phosphorus** are indicators of excess phosphorus in the water. Dissolved phosphorus is easily used by aquatic plants and algae—it immediately acts as fertilizer when discharged into the water. **Total nitrogen** and **nitrite+nitrate** are indicators of excess nitrogen in the water. Too many nutrients in the water can lead to algal blooms. **Total suspended solids** is a measure of how many particles are floating in the water. This can impact plants and animals, and often means higher concentrations of nutrients, bacteria, and some toxins, and poor ecosystem water quality.

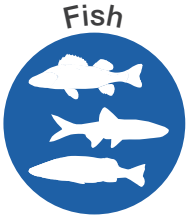


Macroinvertebrates (worms, snails, insect larvae) provide an important food source for fish and other animals. The presence or absence of macroinvertebrates is used to indicate clean or polluted water. **Fish** are ecologically important in streams, and are impacted by environmental change and land use. The relative abundance and community of fish is an indicator of ecosystem condition. The **habitat** quality index provides information on a stream's ability to support healthy fish and macroinvertebrate communities by evaluating in-stream habitat and the land nearby.

Microcystins are toxins produced by cyanobacteria and can have negative impacts on human health. The **source toxin** indicator evaluates the presence of microcystin within pre-treatment (raw) source drinking water drawn from rivers in the watershed. **Fish consumption** advisories warn people about which fish are unsafe to eat. Fish can contain industrial contaminants and heavy metals that are harmful to humans when ingested. **Pesticides** can pollute streams through groundwater and runoff. These chemicals are toxic to plants, animals, and humans. Further analysis is needed to include this indicator in the report card.

Lake Indicators

Dissolved phosphorus and **total phosphorus** are indicators of excess phosphorus in the water. Dissolved phosphorus is easily used by aquatic plants and algae—it immediately acts as fertilizer when discharged into the water. **Total nitrogen** and **nitrite+nitrate** are indicators of excess nitrogen in the water. Too many nutrients in the water cause algal growth and blooms that block light and when they die and decay they reduce oxygen for fish and other organisms. **Chlorophyll *a*** is used as a measure of phytoplankton (algae) biomass. High algae levels lead to low water clarity, low dissolved oxygen and poor ecosystem water quality.



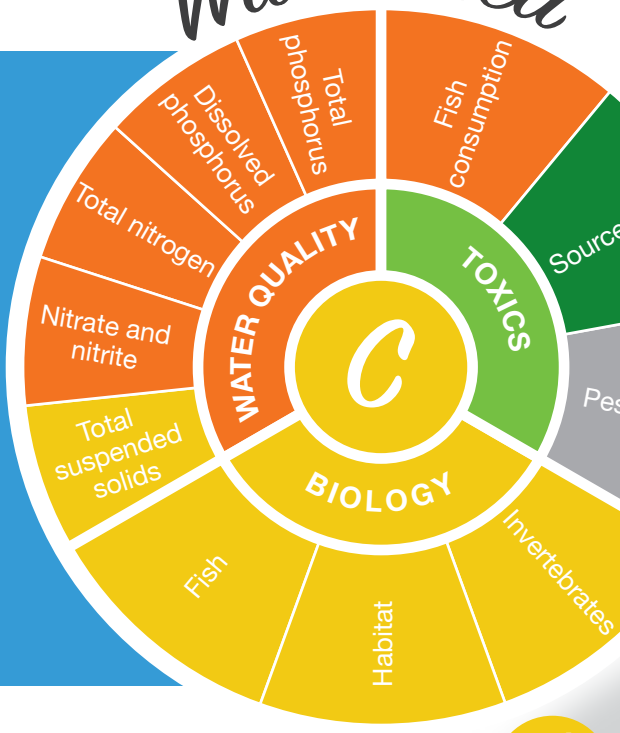
Walleye are large, predatory fish native to Lake Erie. Economically, walleye support a large commercial and recreational fishery. This indicator measures walleye abundance. **Yellow perch** are important predatory fish within the lake. Economically, yellow perch support a large commercial and recreational fishery. This indicator measures yellow perch abundance. **Emerald shiners** are commercially harvested and sold as bait for fishing. They are an important forage for sport fish. This indicator measures emerald shiner abundance.

The **Bloom** Severity **Index** is based on the peak size of the harmful algae bloom over a 30 day period (usually mid-August to mid-September). Lake Erie blooms include cyanobacteria that can produce microcystin. Microcystins are toxins and have the potential to negatively impact human health. The **source toxin** indicator evaluates the presence of microcystin within pre-treatment (raw) source water drawn from the lake to produce drinking water. Exposure to microcystins can occur through recreational activities like swimming, boating, or other water-related activities. The **recreational toxin** indicator evaluates the presence of microcystin for contact during recreational activities.

In 2018, the Western Lake

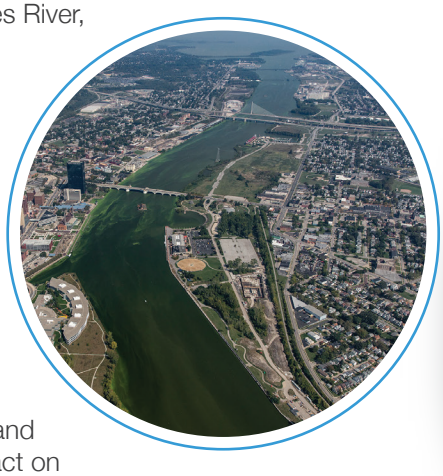
Watershed

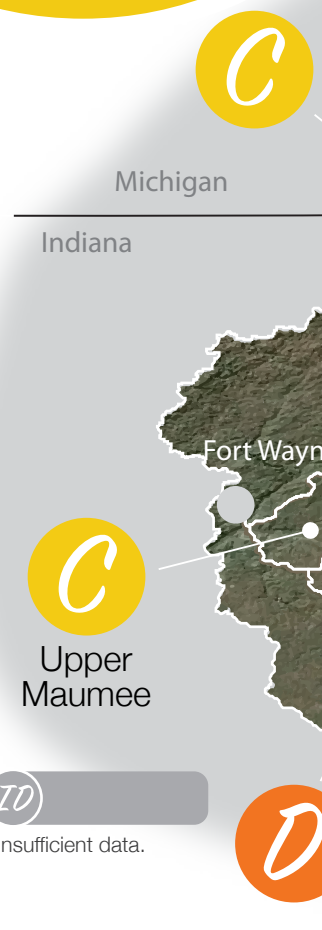
In 2018, the Western Lake Erie watershed scored 49%, a C, a moderate score. Category scores ranged from poor (water quality, 35%) to good (toxics, 61%). Biology indicators had a moderate score (51%). Water quality indicator scores were all poor except for total suspended solids which was moderate. All biology indicator scores were moderate. The fish consumption indicator was poor and source toxin indicator was very good. The pesticide indicator is important for evaluating toxics in the watershed, but more work needs to be done before it can be included. Most region scores were poor or moderate. The highest scoring region was Tiffin, with 51%, a C. The lowest scoring region was Essex with 28%, a D. Overall, excess nutrients are a big issue for the Western Lake Erie watershed. This leads to lower quality habitat for fish and animals that live there. Microcystin (the source toxin indicator) was not an issue in 2018, but there is a legacy of toxic contaminant pollution that has made fish consumption dangerous due to high levels of heavy metals.



Reducing nutrient inputs from the Maumee River will improve Western Lake Erie health

The Maumee River has the largest watershed of any Great Lakes River, draining portions of Indiana, Michigan, and Ohio before it enters Western Lake Erie at Maumee Bay in Toledo, Ohio. Land use within the watershed is predominantly agriculture. While the Maumee River only contributes about 5% of the flow into Lake Erie, it contributes over 40% of the phosphorus load. Because of this, the Maumee River watershed is the priority watershed targeted in the Great Lakes Water Quality Agreement. This bi-national agreement seeks to reduce phosphorus inputs to Western Lake Erie to combat the growing threat of toxic and nuisance algae. In response, the US and Canada adopted several phosphorus reduction targets for Lake Erie, including a 40% reduction in spring phosphorus loads from the Maumee River. Reducing nutrients will improve ecosystem water quality and habitat for fish and other wildlife. It will also have a positive impact on drinking water supplies and recreational opportunities.





What do the scores mean?

A 80–100%
All indicators meet objectives. Indicators in these locations tend to be very good, most often leading to preferred conditions.

B 60–<80%
Most indicators meet objectives. Indicators in these locations tend to be good, often leading to acceptable conditions.

C 40–<60%
Some indicators meet objectives and others do not. Indicators in these locations tend to be moderate, leading to sufficient conditions.

D 20–<40%
Few indicators meet objectives. Indicators in these locations tend to be poor, often leading to degraded conditions.

F 0–<20%
Very few or no indicators meet objectives. Indicators in these locations tend to be very poor, often leading to unacceptable conditions.

ID
Insufficient data.

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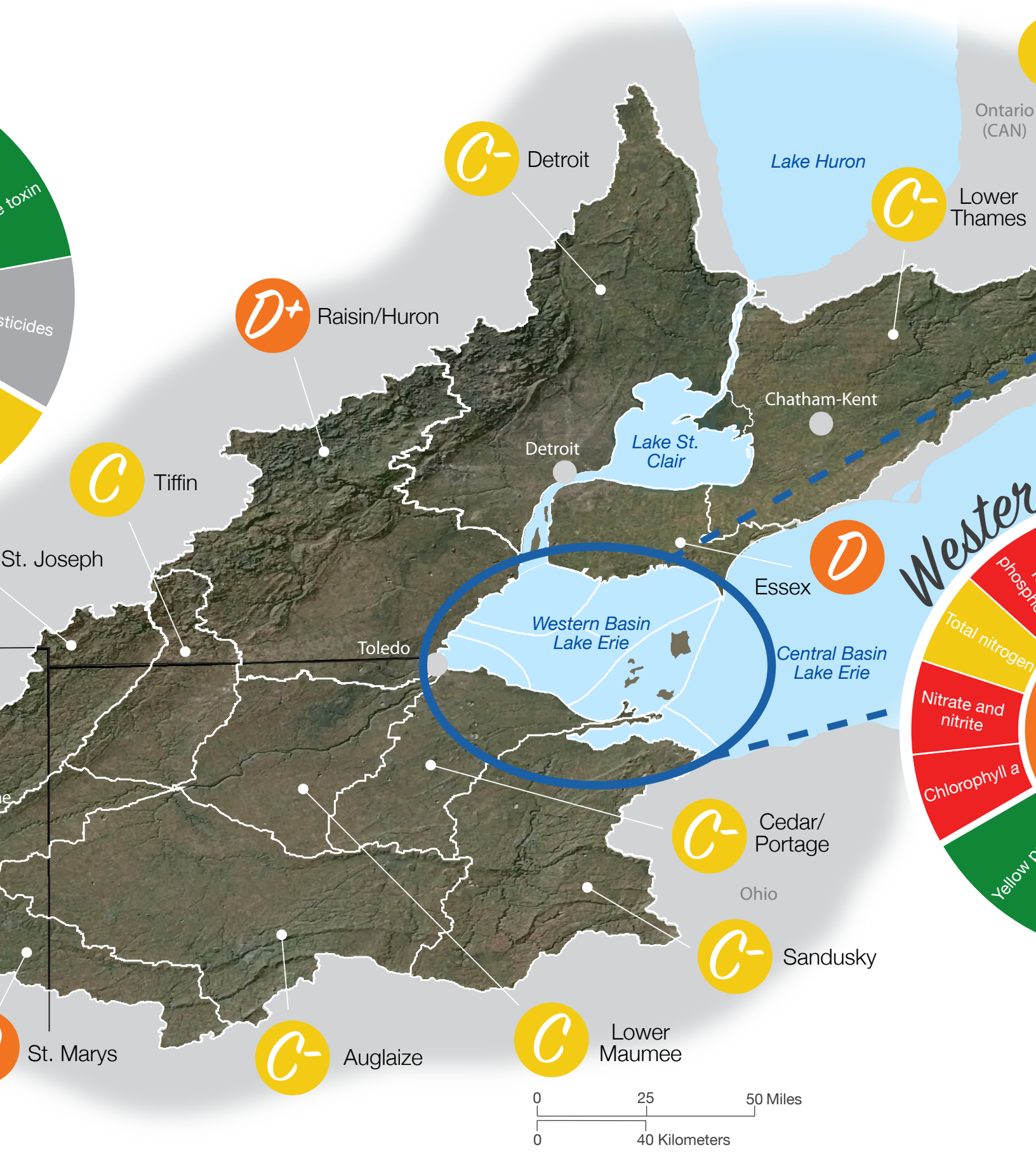
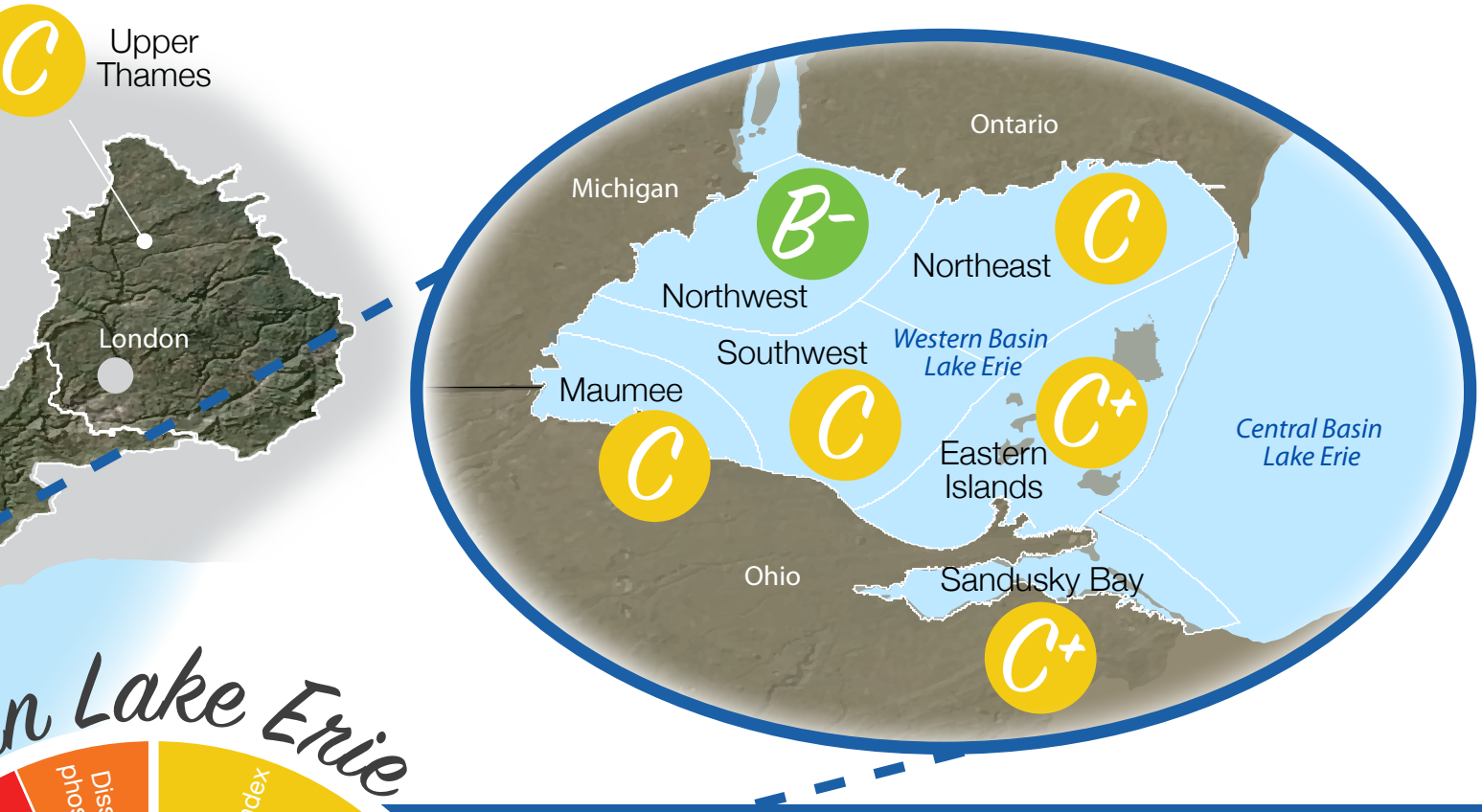


ere in moderate condition



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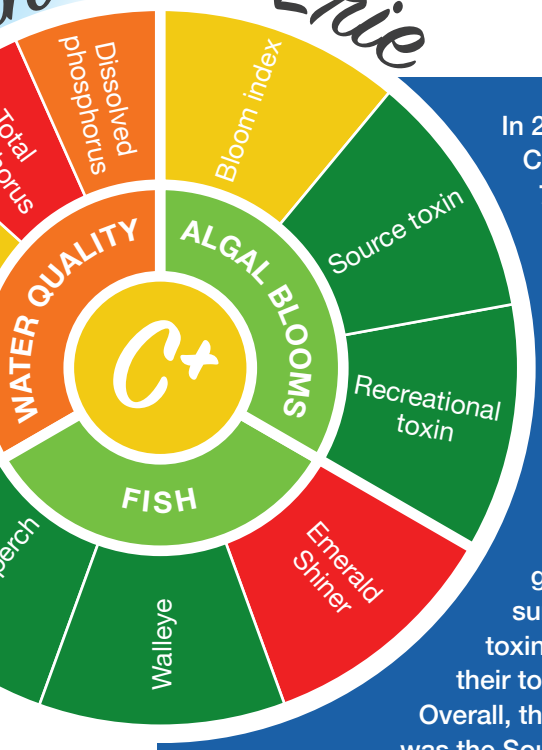


In 2018, the Western Lake Erie basin scored 58%, a C+, which is a moderate score. Category scores ranged from poor (water quality, 28%) to good (algal blooms, 78%). The fish category had a good score (67%). Water quality indicators were poor or very poor except for total nitrogen, which was moderate. These scores reflect nutrient loading which is negatively affecting environmental health. Fish population scores were mixed: walleye and yellow perch had very good scores while emerald shiner had a very poor score. The abundance of emerald shiner, a forage species, has declined since 2011. Both walleye and yellow perch adjusted their diets, and their populations remain in good health. The bloom index had a moderate score (78%). Source toxin and recreational toxin indicators evaluate microcystin levels; both had very good scores, reflecting that water quality was good in the pre-bloom half of the recreational season and that overall, the 2018 bloom was smaller than in most recent years. However, the good score for algal blooms does not discount the intense bloom conditions and surface scums experienced in some locations over several days in 2018. Even when toxin concentrations are low on average, under certain conditions cyanobacteria and their toxins may become highly concentrated at the surface and should be avoided. Overall, the highest-scoring region was the Northwest, (B-), and the lowest-scoring region was the Southwest (C+). Most regions were in moderate condition in 2018.

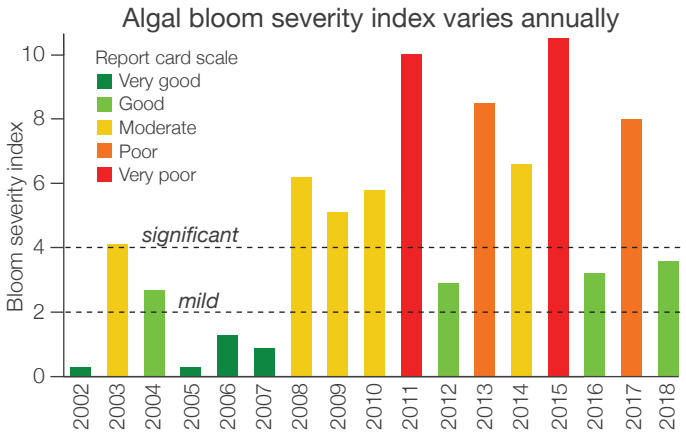
Future monitoring can help give Lake St. Clair a grade

Lake St. Clair is an important conduit between Lake Huron and Lake Erie via the St. Clair and Detroit Rivers. Covering 430 mi², Lake St. Clair is sometimes referred to as the sixth Great Lake. But indicator data from active monitoring programs were limited, so this lack of consistent data resulted in no scoring for Lake St. Clair. In the future, Lake St. Clair can be incorporated into the report card with additional monitoring data.

Highlights from Western Lake Erie

In 2018, harmful algal blooms were less severe in Western Lake Erie

Harmful algal blooms plague Western Lake Erie every year. Factors that affect the location and severity of blooms include rainfall, water temperature, wind, and nutrient inputs. Warm, wet years produce larger blooms as precipitation washes nutrients into the lake. Early warming can cause blooms earlier in the year which may result in smaller blooms that last longer. Windy conditions can mix lake waters and move algae around, reducing the overall severity of blooms by diffusing the effects. 2018 was an unusual year, with an early bloom onset and strong westerly winds that resulted in the bloom being pushed offshore into the eastern islands region (Bass Islands). From year to year there is a lot of variability in conditions, which lead to more or less severe blooms. Future blooms can be diminished if there are less nutrient inputs from commercial fertilizers and manure.



The algal bloom severity index has strong variability from year to year. Colors correspond to report card scores. Data from NOAA, Heidelberg Univ., U.Mich-NCSU-GLERL, and Limnotech.

Conditions in Sandusky Bay differ from the rest of the basin

Sandusky Bay is shallow and isolated from the open waters of Lake Erie. Its wetland systems support a productive fishery, and the bay provides opportunities for recreation and tourism. Excessive nutrient and sediment loading, low flows, and algal blooms have resulted in a reduction of water quality in Sandusky Bay. There is an almost year-round (March–December) bloom of the cyanobacteria *Planktothrix* in Sandusky Bay. Unlike the open waters of Western Lake Erie, nitrogen levels in the bay tend to be low, especially in the late summer. When algal blooms caused by excess nutrients die off, they are eaten by bacteria, which create oxygen-free (anoxic) conditions. This results in almost constant internal phosphorus loading when phosphorus is released from anoxic sediments.

Researchers conduct sampling in Sandusky Bay. Photo by Brad Phalin, Bowling Green State University.

Proven reductions in nutrient pollution

Ontario Greenhouse Vegetable Growers took action to help the lake

Greenhouse vegetable operations—where crops are grown in nutrient rich water without soil—are an important part of the agricultural sector in Canada. Historically, this water was discarded into the environment and contributed to nutrient pollution in Western Lake Erie. In recent years, Ontario Greenhouse Vegetable Growers began efforts to reduce fertilizer use and invest in green technology. Fertilizer consumption was reduced by 40%, and 90% of greenhouse acreage wastewater is now recycled.

The Detroit Wastewater Treatment Plant successfully reduced nutrients

The Detroit Wastewater Treatment Plant that discharges into the Detroit River is the largest single-site wastewater treatment plant in the United States. Wastewater from the plant accounts for about 5% of Western Lake Erie's total phosphorus load. Upgrades and phosphorus management resulted in >90% reduction in phosphorus loading from the plant. This shows that Lake Erie can meet its phosphorus goals when sufficient effort is made.

You can help improve the health of Western Lake Erie

Western Lake Erie has a large, complex watershed, and solving some of its problems will take hard work and investment by all levels of government and non-government groups. Achieving a clean, healthy Lake Erie takes individual action too. Here are some things you can do to help improve and maintain the health of Western Lake Erie.

Protecting Lake Erie is a daily exercise.

Remember: what goes on the land eventually goes into the water.

- Choose non-toxic household cleaning products.
- Pick up after your pets. Pet waste is a contributor of bacteria and nutrients.
- If your home has a septic system, follow recommended maintenance to keep it operating efficiently.
- Use fertilizers properly. Reduce lawn area, and use landscaping and lawn care that slow runoff and keep sediment and nutrients out of waterways.
- Choose locally grown produce, dairy, and meat from farmers who use sustainable practices.
- Reduce plastic use. Plastics pollute the lake and local waterways.

Take action and advocate for clean water.

Find out who's working for clean water and healthy habitats in your neighborhood and community. Become a member, attend an event, or make a donation to show your support. Working together with people throughout the watershed builds stewardship and solves environmental challenges.

The US and Canada work together to reduce nutrient pollution

The 2012 Great Lakes Water Quality Agreement called for targets to be established for nutrient reductions. In 2016, the target of 40% reduction in total and dissolved phosphorus was created. To assess progress towards this goal, the United States and Canada have committed to tracking and reporting seasonal and annual phosphorus loads. Initial efforts have been focused on two priorities:

1. Developing a monitoring strategy and network for collecting data to evaluate progress towards meeting the phosphorus targets.

2. Developing a system to routinely and reliably track and report loads.

Ohio, Michigan, Indiana, and Canada-Ontario produced Domestic Action Plans that are updated to track the progress of phosphorus reduction. Each jurisdiction is committed to developing performance measures to track the implementation of their plans. To achieve target reductions and pave the way for a healthier Lake Erie, it is imperative that everyone holds each other accountable, and progress continues to be made toward reaching these goals.

Acknowledgments

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Cover photos, clockwise from upper left: The Southernmost Tip of Canada, Point Pelee National Park, Leamington, Ontario, Canada by Ken Lund on Flickr; Boats on the Maumee River by Destination Toledo on Flickr; Thames River London, Ontario by Denise Sparks; Maumee River Bridge by cmh231fl on Flickr. Maumee River photo by Zachary Haslick, Aerial Associates Photography, Inc. via NOAA GLERL.

Learn more at:
www.LakeErieReportCard.org