



LAKE ERIE QUALITY INDEX

2022 METHODS APPENDIX

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ENVIRONMENT QUALITY



Ohio EPA has expanded assessment and reporting of harmful algae bloom (HAB) conditions in Lake Erie. Several combined data sets, along with advances in the use of satellite imagery to detect, quantify and track algal blooms, allow Ohio to use methods to assess Lake Erie for recreation impairment caused by algae.

In 2017, Ohio EPA requested input from representatives from The Ohio State University Sea Grant College Program, University of Toledo, Bowling Green State University and NOAA to identify metrics that would provide a scientifically relevant determination of impairment. The request stated that the metrics needed to provide a reasonable, objective assessment method for the western basin open water using targets that will meet the goals established by the GLWQA Annex 4 committee and provide assurance that the WQS are met. The results of this method development have been applied to the western basin. This method has been published in the scientific journal Harmful Algae (Davis, et al 2019).

METRIC: HARMFUL ALGAE BLOOMS (HABS)



MEASUREMENT

Remote sensing data from the Ocean Land Colour Imager on Sentinel-3 series of satellites.



GOALS

Based on bloom intensity over time.

See pages F-25 and F-26 in the Ohio Integrated Water Quality Monitoring and Assessment Report 2022 for details.



SCORING

Based on bloom intensity over time.

See pages F-25 and F-26 in the Ohio Integrated Water Quality Monitoring and Assessment Report 2022 for details.



DATA SOURCE

[Ohio Integrated Water Quality Monitoring and Assessment Report 2022](#)

See section F under “Lake Erie Algae” for more information.

ENVIRONMENT QUALITY



U.S. EPA's Great Lakes National Program Office provided the data used to calculate this metric. Each year U.S. EPA's research vessel, the R/V Lake Guardian, collects water samples from an established network around the lake. In most years, these samples are taken once in the spring and once in the summer. Spring values reflect conditions related to major loading events caused by spring runoff and may vary widely based on the timing of these events. Summer values are less variable and more representative of the ambient concentrations in the lake.

Total phosphorus, nitrate+nitrite, and total chloride were measured at stations in the western and central basins. For each year 2000-2019, a basin-wide average for waters in Ohio was computed using data from the individual stations located in Ohio waters. Only offshore stations were used to reduce the influence of shoreline effects. Data presented are average of values in the water column above the thermocline if present.

METRIC: WATER CHEMISTRY



MEASUREMENT

Spring (April) and Summer (August) average water column concentrations of parameters of interest:

- Summer TP
- Spring Nitrate + Nitrite
- Spring Total Chloride



GOALS

No goals are currently established for this metric.



SCORING

This metric is not scored. However, the length of the record makes it possible to observe trends.



DATA SOURCE

Use USEPA Data Portal to access GLNPO/Lake Guardian data: GLENDa database through the Central Data Exchange at:
<https://cdx.epa.gov/>

ENVIRONMENT QUALITY



Data on mayfly density was collected and analyzed by USGS for most of the 2000s. In 2018 and 2019, NOAA collaborated with USGS to continue the survey, and Ohio EPA uses the same methodology at a subset of sites to ensure a continuous record for this key indicator of Lake Erie substrate habitat conditions.

KEY INDICATOR SPECIES: MAYFLIES



MEASUREMENT

Number of nymphs per square meter from a composite of 26 historical sampling sites in the western and central basin of Lake Erie.



GOALS

The desired abundance is 100-400 mayfly nymphs per square meter in the western basin. Lower abundance would not sustain the Lake Erie fishery. Higher densities are a nuisance for people living along the shoreline.



SCORING

Mayflies:

- Imperiled = Above 400
- Good = 100-399
- Fair = 30-99
- Poor = Below 30



DATA SOURCE

USGS, [NOAA-Great Lakes Environmental Research Laboratory](#), [Ohio EPA Division of Surface Water-](#)

ENVIRONMENT QUALITY



Each year U.S. EPA's research vessel, the R/V Lake Guardian, measures temperature and dissolved oxygen from an established network around the lake. There are ten stations in the Central Basin, primarily in the deeper parts of the basin, that have been used to measure temperature and dissolved oxygen since the 1980s. Ohio EPA has been supplementing this work with additional and more frequent sampling transects closer to the shore to provide a more detailed look.

Recent monitoring by Ohio EPA along with models developed by NOAA indicate that the set-up of the low oxygen occurs around the edge of shallower areas, and then migrates to the deeper parts of the Central Basin. Therefore, past monitoring data presents an unclear picture, and efforts are underway at the Annex 4 Subcommittee to determine how best to monitor and track hypoxia in Lake Erie.

METRIC: LOW OXYGEN (HYPOXIA)



MEASUREMENT

Measure amount of Dissolved Oxygen in the bottom part of the Central Basin (below the thermocline).



GOALS

Minimize the area of the bottom part of the Central Basin where dissolved oxygen is below 2 mg/L



SCORING

Undetermined



DATA SOURCE

Use USEPA Data Portal to access GLNPO/ Lake Guardian data: GLENDa database through the Central Data Exchange at <https://cdx.epa.gov/>

Also see USEPA hypoxia data reports: <https://www.epa.gov/great-lakes-monitoring/lake-erie-dissolved-oxygen-monitoring-program-technical-report>

For map of stations: <https://www.epa.gov/great-lakes-monitoring/lake-guardian>

NOAA GLERL has a visualization tool for their Lake Erie Hypoxia Warning System: https://www.glerl.noaa.gov/res/HABs_and_Hypoxia/hypoxiaWarningSystem.html

ENVIRONMENT QUALITY



USEPA's National Coastal Condition Assessment measures concentrations of select contaminants in whole-fish tissues. Results are compared to screening values to evaluate exposure to adverse effects for fish-eating wildlife. This analysis determines the Fish Quality Index that creates ratings of good, fair or poor for each location sampled based upon the degree to which contaminants are found in fish composite samples. Then the number of sites at each rating are added up.

In the 1998 and 2004 LEQI, nestling bald eagle blood samples from Ohio locations were used to develop the Toxic Compounds metric. This monitoring is not done on a regular basis, and current results for locations in Ohio are not available.

Michigan samples the blood of bald eagle nestlings as part of a wildlife contaminant monitoring program. Compounds measured between 2014-2018 included PCBs and DDE. Sites near Lake Erie included 2 nests in the Detroit River AOC, 3 nests in the River Raisin AOC, and 13 other non-AOC Lake Erie nests.

METRIC: TOXIC COMPOUNDS IN ANIMALS



MEASUREMENT

Whole-fish tissue concentrations of select contaminants.

Measure tissue concentration of PCBs in bald eagle plasma.



GOALS

Fish Quality Index (see NCCA methodology for details)

No effect level for eagle blood plasma concentrations of PCBs



SCORING

Fish Quality Index (see NCCA methodology for details)

Compare to concentrations that are known to adversely affect bald eagle productivity:

- Excellent = 0 µg/kg
- Good = 0-35.4 µg/kg
- Fair = 35.5-80.2 µg/kg
- Poor = >80.2



DATA SOURCE

USEPA NCCA: <https://www.epa.gov/national-aquatic-resource-surveys/indicators-fish-tissue-contaminants>

Also see MI EGLE for eagle nestling data near Lake Erie: https://www.michigan.gov/documents/egle/wrd-swas-bui-wildlife_706450_7.pdf

ENVIRONMENT QUALITY



Secchi data from ODNR, Division of Wildlife, have been collected during routine fish sampling surveys since 1970. These measurements were taken at various locations across the Ohio portion of the western basin of Lake Erie across several seasons (spring, summer, and fall). These surveys generally have been collected monthly, May to October each year. Since 2000, 30-40 sites have been sampled during each survey. Data are pooled across sites and months each year, then further smoothed by using a moving 5-year average to depict long term trends in water clarity.

Average secchi values allowing visibility greater than 5 feet indicate clear water with good light penetration. Annual average values less than 4 feet indicate more visible material in the water and poor light penetration.

METRIC: WATER CLARITY



MEASUREMENT

Secchi disk measurements taken in western basin.



GOALS

Average of 6-foot secchi disk reading.



SCORING

- Good = 5.1 ft and Above
- Fair = 4.2 ft – 5.1 ft
- Poor = Below 4.2 ft



DATA SOURCE

ODNR-DOW; Sandusky and Fairport Fisheries Research Units.

Data and reports for Lake Erie fishing available at <https://ohiodnr.gov/buy-and-apply/hunting-fishing-boating/fishing-resources/fishing-lake-erie>

ENVIRONMENT QUALITY



The Point Sources metric looks at the loading of phosphorus, mercury, ammonia, and biochemical oxygen demand into Lake Erie from all major Ohio dischargers in the basin. A major discharger is one that releases more than one million gallons of wastewater per day has been identified as a significant source of a particular pollutant. These dischargers are required to monitor and report on the amounts discharged under their permits.

Permitted loads are calculated by multiplying the concentration limits times the total water discharged by the facility. Two levels of limits were evaluated: monthly averages, which are lower, and monthly maximums, which are higher.

METRIC: POINT SOURCES



MEASUREMENT

Based on actual discharge of pollutants compared to the volumes allowed under existing NPDES permits.

There are 3 pollutants reported: two nutrients (phosphorus and nitrogen), and one heavy metal (mercury).



GOALS

Goal is to be under the cumulative allowable NPDES permits for major dischargers for each pollutant analyzed.



SCORING

Based on discharge goal for each pollutant.

Good = Meeting Limits
Fair to Poor = Exceeding Limits

(not calculated since all limits are met by wide margins)



DATA SOURCE

Ohio EPA Permittee Reporting Database for eDMR: SWIMS

<https://epa.ohio.gov/divisions-and-offices/surface-water/about/electronic-business-services>

Also available from USEPA Permit Compliance System:

<https://www.epa.gov/enviro/pcs-icis-overview>

POLLUTION SOURCES



Ohio EPA uses an Index of Biotic Integrity, or IBI, to determine a score for fish community health based on how nearly it approaches ideal condition. A fish community's health integrates a wide range of environmental factors (water chemistry, habitat quality, food web structure, etc.).

The IBI uses 12 fish community characteristics based on species numbers, behavior and trophic guilds, and community health. Each community characteristic receives a score of zero, one, three, or five based on how closely the measure approaches natural, undisturbed conditions, with the best condition receiving a score of five. All 12 scores are summed resulting in a total score ranging from 0 (dead) to 60 (undisturbed).

METRIC: SHORELINE & TRIBUTARY BIOLOGY



MEASUREMENT

Based on sediment analysis (number of nymphs per square meter) from a composite of 26 historical sampling sites in the western and central basin of Lake Erie.



GOALS

All IBI scores in nearshore and river mouth sites should score at least a good
All sites were combined to compute a Lake Erie overall average score.



SCORING

Mayflies:

- Imperiled = Above 400
- Good = 100-399
- Fair = 30-99
- Poor = Below 30



DATA SOURCE

USGS, NOAA, Ohio EPA

ENVIRONMENT QUALITY



Ohio EPA evaluates aquatic habitat along the lake shore and within all of Lake Erie's major tributaries in Ohio. They use a method called the Qualitative Habitat Evaluation Index (QHEI). There are two QHEI evaluations used, one for rivers and streams and one for Lake Erie's shoreline and freshwater estuaries or "lacustuaries" (lake affected portions of river mouths).

Rivers and streams are evaluated for the habitat suitability of material on the stream bed, suitable cover for fish, channel shape, nearby land use, riffle/pool structure, and stream channel gradient. Lake Erie habitats are evaluated based on their bottom substrate, suitable cover for fish, shoreline shape, nearby land use, and type/quantity of aquatic vegetation.

Data are provided by decade. Not all sites are visited each year or even each decade.

METRIC: AQUATIC HABITAT



MEASUREMENT

Ohio EPA's Qualitative Habitat Evaluation Index (QHEI) scores for 8 county shorelines, combined Lake Erie Islands, and 12 tributary river mouths, and lacustuaries.



GOALS

The goal is to have all lakeshore or river mouth sites score at least 60 (good) in the QHEI.



SCORING

QHEI Scores:

- Excellent = >80
- Good = 60-80
- Fair = 45-59
- Poor = <49

Split weighting between shoreline, tributaries, and lacustuaries.



DATA SOURCE

QHEI scores supplied by Ohio EPA Division of Surface Water (Bioassessment group)

<https://epa.ohio.gov/divisions-and-offices/surface-water/reports-data/biological-criteria-for-the-protection-of-aquatic-life>

ENVIRONMENT QUALITY



The abundance and kinds of phytoplankton and zooplankton form the basis for the Planktonic Index of Biotic Integrity (P-IBI).

Both phytoplankton and zooplankton communities change throughout the year, so the P-IBI has a specific period (June-August) during which it is measured. It uses five metrics to examine the effects of different types of pollution. Each metric is scored as a one, three, or five, with five representing the least polluted conditions. Metric scores for all the months are then averaged.

The P-IBI scores for this update for the western and central basins of Lake Erie are based on data sets from 2003-2013. Samples were collected, but data are not currently available for the years since 2014. Scores for years prior to 2003 are carried over from the 2004 LEQI.

METRIC: PLANKTON



MEASUREMENT

Index of Biotic Integrity for offshore Lake Erie (Plankton). Separate scores for central and western basins.



GOALS

Western and central basin average score equal to an excellent rating.



SCORING

Scores:

- Excellent = >4
- Good = 3-4
- Fair = 2-3
- Poor = <2



DATA SOURCE

Lake Erie Protection Fund sponsored project: Dr. Douglas Kane. Contact OLEC staff for more information.

ENVIRONMENT QUALITY



The Areas of Concern (AOC) program at OLEC keeps track of the Beneficial Use Impairments (BUIs) and Management Actions to remediate them for each AOC. Contaminated sediment removals have been tracked over the years by USEPA, Ohio EPA, and the AOC local coordinators.

Each AOC group conducts an assessment of conditions, identifies management actions to meet BUI restoration targets established by the Ohio AOC program, and works with many partners to implement those actions. Upon completion of management actions, BUIs are evaluated to determine if the beneficial use is restored and the impairment can be removed.

METRIC: SEDIMENT QUALITY



MEASUREMENT

- Number of BUIs Removed
- Percentage of Management Actions Complete
- Number of Areas of Concern Delisted
- Contaminated Sediment Removed



GOALS

Clean up all sediments, remediate all BUIs, and delist the AOC



SCORING

Undetermined



DATA SOURCE

Dredge Program at Ohio EPA and AOC program at OLEC: <https://lakeerie.ohio.gov/programs-and-projects/areas-of-concern/01-program+overview>

WATERSHED SOURCES



The National Center for Water Quality Research at Heidelberg University measures sediment (as suspended solids) in the Maumee, Sandusky, Cuyahoga, and Grand Rivers. Data are available for the Grand River up to 2006, with estimated amounts after that year. They also measure nutrients, including nitrogen (as nitrate + nitrite) and dissolved reactive phosphorus, and concentrations of the widely used crop pesticide atrazine.

Loadings, which are the total amount of the substance by weight, are calculated by multiplying the concentration times the amount of water moving past the sampling point in the river. The loads fluctuate a great deal from year to year. This reflects the influence of weather, particularly the timing and intensity of storm events relative to the agricultural cycle. Intense storms that occur at times when fields are bare or shortly after pesticides are applied can export such high quantities of material that one storm runoff event can dominate the entire year's load value.

Generally, loads and concentrations are higher for most years in the Maumee and Sandusky Rivers than they are in the Cuyahoga and Grand Rivers. This reflects the larger watershed area of the Maumee and the dominance of agricultural land use in the Maumee and Sandusky. The Cuyahoga and Grand Rivers have more forest and urban land use and smaller amounts of agriculture.

METRIC: SUSPENDED SOLIDS, DISSOLVED PHOSPHORUS, NITROGEN & ATRAZINE



MEASUREMENT

Total loading of suspended solids, dissolved reactive phosphorus (DRP), nitrate, and atrazine from 4 main Lake Erie tributaries: Maumee, Sandusky, Cuyahoga, and Grand Rivers.



GOALS

Reduce the total loading of suspended solids from 4 rivers to 0.5 million metric tons annually.

Reduce the loads of DRP to below GLWQA Annex 4 target levels. See Ohio Domestic Action Plan for more details: <https://lakeerie.ohio.gov/wps/portal/gov/lec/planning-and-priorities/02-domestic-action-plan/02-domestic-action-plan>

Atrazine levels below the Maximum Contaminant Levels for drinking water.



SCORING

Suspended solids:

- Excellent = 0.5 million metric tons or less
- Good = 0.5 – 0.75
- Fair = 0.75 – 1.0
- Poor = greater than 1.0

DRP (based on Annex 4 target concentrations adjusted to loadings):

- Good/Excellent = 650 metric tons or less
- Fair = 649 – 860
- Poor = greater than 860

Atrazine less than 3 ug/L



DATA SOURCE

Heidelberg National Center for Water Quality Research; Dr. Laura Johnson

<https://ncwqr.org/>

HUMAN EXPOSURE RISKS



Ohio EPA and ODNR collect fish samples, and Ohio EPA analyzes edible fillets for contaminants of concern. Low levels of chemicals like polychlorinated biphenyls (PCBs), mercury, and lead have been found in Lake Erie fish. Once a year, Ohio EPA, Ohio Department of Health, and Ohio Department of Natural Resources issue a fish consumption advisory through the Ohio Sport Fish Consumption Advisory Program. The program is based on the Great Lakes Protocol, which uses five levels of fish consumption advice corresponding to the amount of contaminants found in the body of the given species.

METRIC: EATING FISH



MEASUREMENT

Ohio Fish Consumption Advisories. Metric derived from suite of sportfish: Yellow Perch, Walleye, Smallmouth Bass, White Bass, White Perch, Freshwater Drum, Channel Catfish, and Steelhead Trout (selected for their popularity and to include fish from each feeding regime).



GOALS

All species are safe to eat and free from any consumption advisories.



SCORING

On a 4-point scale:

- Excellent = 3.5 – 4.0
- Good = 3.0 – 3.49
- Fair = 2.5 – 2.99
- Poor = 2.49 and Below

Species were weighted according to their harvest rate. Weighted scores were combined into an overall score.



DATA SOURCE

ODH - Bureau of Environmental Health and Radiation Protection, Ohio EPA, ODNR

Fish Consumption Advisory Council (Ohio EPA ODNR ODH)

Information on sport fish consumption advisory program here: <https://odh.ohio.gov/know-our-programs/Ohio-Sport-Fish-Consumption-Advisory>

HUMAN EXPOSURE RISKS



The measurement for this metric is based on the number of advisories for pathogens as indicated by E. coli that were posted throughout the summer at the 19 most consistently monitored public beaches along Lake Erie's shoreline. Some additional data for E. coli are also available for other public beaches, but these are not reported here since the record is too incomplete. The length of the beach season in Ohio is considered by ODH to be 99 days (June-August).

The locations reported here are the same as those collected and disseminated in the 2004 LEQI. However, in 2009 the sampling frequency for indicator E. coli was increased and the number of samples overall increased. Monitoring for algal toxins was started in 2010. Thus, the average number of days under advisories per season in 2009 and in more recent years is not directly comparable to the average number of days under advisories in 2008 and in previous years.

METRIC: SWIMMING



MEASUREMENT

The average number of days of posting for the 19 beaches, summed by year.



GOALS

Clean beaches all the time (or 0 days under advisement) so that swimming advisories never have to be posted.



SCORING

Based on 99 day season:

Excellent = 0 – 10 (days under advisement)

Good = 11 – 20

Fair = 21 – 30

Poor = 31 and above



DATA SOURCE

ODH oversees the program that monitors Ohio's beaches for bacteria: <https://odh.ohio.gov/wps/portal/gov/odh/know-our-programs/bathing-beach-monitoring/welcome-to-bathing-beach-monitoring>

In 2010, Ohio EPA started monitoring for algal toxins at state park beaches along the lake. See <https://epa.ohio.gov/HAB-Algae>

The Beach Guard web-based reporting system is used to provide information for the public regarding water quality at these beaches. See: <http://publicapps.odh.ohio.gov/beachguardpublic/>

HUMAN EXPOSURE RISKS



Water treatment plants are required to monitor treated water for constituents including organic chemicals, metals, pesticides, disinfection by-products, and disease-causing microorganisms for which maximum contaminant levels (MCLs) have been established.

Ohio EPA has developed a methodology for assessing algae-produced toxin concentrations. Water systems with a history of harmful algal blooms near their intakes are encouraged to conduct routine monitoring for these toxins. Eight Lake Erie water systems now monitor for microcystins, and Ohio EPA routinely monitors five additional Lake Erie water systems. Overall, Ohio EPA has sampled 16 Lake Erie water systems for algae-produced toxins in response to algal blooms on Lake Erie since 2014.

METRIC: DRINKING WATER



MEASUREMENT

Number of violations post-treatment.

Includes algal toxin info.



GOALS

0 violations



SCORING

Because violations are so rare, there is no formal scoring for this metric.



DATA SOURCE

Ohio EPA - Division of Drinking and Ground Waters

More information: <https://epa.ohio.gov/divisions-and-offices/drinking-and-ground-waters/public-water-systems/harmful-algal-blooms>

TOURISM & REDEVELOPMENT



Measures population trends, brownfields restored and natural areas conserved in perpetuity.

State programs that can inform land use trends include the Ohio Brownfield Program in ODOD which addresses contaminated, abandoned sites in urban areas. The Voluntary Action Program (VAP) through Ohio EPA works with property owners to clean up the sites to be available for redevelopment or reuse. Ohio EPA's storm water permit program tracks construction activities that require a stormwater permit.

Population changes can indicate whether an area is experiencing increased or decreased development pressure. These data are readily available from the US Census.

Regional park systems, regional land conservancies, and state agencies such as ODNR continue to identify and protect land where critical habitat and species exist or where linkages exist to protect riparian corridors while providing recreational uses. The Ohio Lake Erie Commission surveyed several regional groups to collect data on acreage of recently conserved lands.

METRIC: LAND USE



MEASUREMENT

Brownfield acres rehabilitated, population change in the Lake Erie watershed in Ohio, and the acres of land put into conservation.



GOALS

No goal



SCORING

Undertermined



DATA SOURCE

NOAA C-CAP

[Ohio Brownfield Program](#) through ODOD and Voluntary Action Program (VAP) through Ohio EPA

US Census Data <https://www.census.gov/data.html>

[Ohio EPA's stormwater permit program](#)

The Nature Conservancy, Toledo and Cleveland Metroparks, Western Reserve Land Conservancy, Black Swamp Conservancy, Ducks Unlimited, and ODNR for conserved land totals.

TOURISM & REDEVELOPMENT



Tourism growth for the Lake Erie region is directly related to the investment in advertising and public relations by the State of Ohio and its tourism partners. The office of TourismOhio at the Ohio Development Services Agency oversees the Ohio. Find It Here. campaign that works with the local visitors' bureaus to help attract tens of millions of visitors a year to the region.

TourismOhio tracks the success of these efforts with the assistance of studies conducted by Tourism Economics.

METRIC: TOURISM



MEASUREMENT

Tourism sales in counties adjacent to the lake and tourism-related jobs information.



GOALS

Goal is for the trend to continue to increase.



SCORING

Based on trend in economic data.

- Good = Up
- Fair = Flat
- Poor = Down



DATA SOURCE

Data and analysis from ODOD
- Tourism: <https://ohio.gov/tourism/>

WILDLIFE & RECREATION



ODNR has been the lead in eagle recovery efforts in Ohio. Intensive efforts to increase production took place from 1979-1987. The Division of Wildlife began a bald eagle restoration project that included placing eaglets from zoos and the U.S. Fish and Wildlife Service into nests in Ohio where eggs had failed to hatch.

Additional actions to restore the population focused on education about the importance of the eagle to the state's ecosystem and rehabilitation of injured birds. As a result, Ohio's eagle population has been increasing and expanding its range since the early 1980s.

METRIC: BALD EAGLES



MEASUREMENT

The number of eagle nests and eagle young per nest in the Lake Erie Region



GOALS

Goal of 1.2 eagle young per nest per year (US F&WLS national goal)



SCORING

Bald Eagles nest productivity:
Excellent = 1.2 and above

- Good = 1.0 – 1.2
- Fair = 0.85 – 1.0
- Poor = below 0.85



DATA SOURCE

ODNR Wildlife: <https://ohiodnr.gov/home/additional-resources/division-of-wildlife/bald-eagles-promo>

WILDLIFE & RECREATION



ODNR Division of Wildlife collects fish population data through research trawls.

The Great Lakes Fishery Commission's Lake Erie Committee- comprised of fisheries managers from Ohio, Michigan, Pennsylvania, New York, and Ontario- jointly manages the walleye fishery in Lake Erie. The Committee's stated vision in the 2020 Fish Community Objectives is that the Lake Erie basin "will consist of diverse fish communities that support ongoing societal benefits, including thriving commercial and recreational fisheries, improved fish habitat and desirable ecosystem performance, and reduced adverse impacts from invasive fish." Walleye are identified as an intensively managed species with an objective of maintaining "populations that support sustainable commercial and recreational fisheries".

The Walleye Management Plan 2015-2019 was reviewed and determined to be a success and was extended for 2020-2024. The Lake Erie Committee has identified a population of between 26-40 million walleye with a diverse age structure within the population to attain the "Maintenance" category for that goal.

METRIC: WALLEYE



MEASUREMENT

Estimated Lake Erie catchable walleye population based on ODNR trawl surveys
Includes 1-year projection.



GOALS

30 million catchable walleye (based on G.L. Fishery Commission – Lake Erie Committee – models on harvest data)



SCORING

Walleyes:

- Excellent = Above 30 million
- Good = 25 – 30 million
- Fair = 20 – 25 million
- Poor = below 20 million



DATA SOURCE

Great Lakes Fishery Commission: <http://www.glfc.org/state-of-the-lake.php?lake=4>

WILDLIFE & RECREATION



It is the goal of the ODNR Division of Wildlife to have a diverse and productive fishery, supported by an ecologically rich and abundant community of native fish species.

Because habitat and species interactions are complex, it is helpful to evaluate the overall integrity of the offshore fish community in Lake Erie by using an index of biotic integrity (IBI).

The Offshore Fish IBI presented here is based on the Karr biological integrity assessment approach (not the Minns as in LEQI 2004). Twelve measures, focusing on species richness (number of different species) and composition, behavior and trophic guilds (groups of species that use similar resources), and community health and fish abundance, comprise the IBI (see box for details regarding the measures used).

To establish ratings for this metric, fisheries researchers at ODNR Division of Wildlife applied trawl data compiled by ODNR for the period 1990-2019 in both the western and central basins of the lake to the IBI scoring system.

METRIC: OFFSHORE FISH OF BIOTIC INTEGRITY



MEASUREMENT

Index of Biotic Integrity for offshore Lake Erie fish. Separate scores for central and western basins.



GOALS

Western and central basin average score equal to a Good or Excellent rating.



SCORING

Kershner & Hopkins (Karr) Off-shore Fish IBI:

- Excellent = 42.75-60
- Good = 28.5-42.74
- Fair = 14.25-28.4
- Poor = <14.24

See LEPF 01-09 for details.



DATA SOURCE

ODNR Wildlife

WILDLIFE & RECREATION



Routine fish, macroinvertebrate, and other collections continue each year, and occasionally these efforts uncover non-native species not previously found. This metric is not quantified because it is not possible to know exactly when a species is introduced, and data on the rate of introductions are not readily available.

ODNR Wildlife is following the [Lake Erie Grass Carp Response Strategy 2019-2023](#). Please see that document for more details on methodology.

METRIC: AQUATIC INVASIVE SPECIES



MEASUREMENT

Number of new species introduced, or population numbers of key species of concern (e.g. Grass Carp)



GOALS

Zero new AIS introductions. Prevent introduction and expansion of reproductively viable (diploid) Grass Carp beyond western Lake Erie and the Maumee and Sandusky rivers. Prevent Grass Carp populations in Ohio waters from reaching levels that compromise aquatic communities.



SCORING

Undetermined



DATA SOURCE

[ODNR Wildlife, Ohio EPA, other state and federal surveys.](#)

WILDLIFE & RECREATION



Because wetlands are very diverse in their vegetation, structure, and other visible characteristics, it has been difficult to measure location and extent of wetlands across the entire Lake Erie watershed in a consistent way over the years. Multiple agencies at both the federal and state level have responsibilities for delineating, tracking, and reporting on wetland acreage.

The U.S. Fish and Wildlife Service established the National Wetlands Inventory to provide resource managers with maps and information on the location, extent, and types of wetlands. The original inventory for Ohio was created in the late 1970s to early 1980s using aerial photos. Using aerial imagery from 2006-2007 supplemented with field work, Ducks Unlimited led a multi-agency effort that updated Ohio's National Wetlands Inventory. Ohio is currently working with USFWS on updating this data set.

Additional data come from the National Oceanic and Atmospheric Administration's Coastal Change Analysis Program (NOAA's C-CAP). This program produces national standardized land cover and land cover change products from satellite data for coastal regions of the U.S., including the Great Lakes. This includes both coastal and inland wetlands, with the goal of monitoring changes in these habitats.

Because the methods for locating and delineating wetlands vary over time and between the watershed-wide datasets, these values are not directly comparable. Wetland acreage from NOAA's C-CAP was much greater than the estimate from the NWI. This is most likely due to the greater difficulty in determining wetland locations from a satellite image as opposed to the aerial imagery supported by groundwork.

METRIC: WETLANDS



MEASUREMENT

Number and area of wetlands identified in 2006-07 NWI.

Area of wetlands identified in the NOAA C-CAP dataset.



GOALS

No net loss in wetlands acres.



SCORING

Undetermined



DATA SOURCE

USFWS NWI website
<http://www.fws.gov/wetlands/Data/Mapper.html>

NOAA C-CAP
<https://www.fisheries.noaa.gov/inport/item/48336>

WILDLIFE & RECREATION



Information on coastal wetlands is available from both Ohio and federal sources for this report. These two sources are not directly comparable. However, each survey provides two survey time periods and can give a partial picture of broad trends in coastal wetland vegetation quality over the last 20 years.

Ohio EPA and researchers at The Ohio State University developed and modified a vegetation index of biological integrity specific for coastal wetlands that are hydrologically connected to Lake Erie (VIBI-C).

Twenty plots in fifteen coastal wetlands were evaluated using the Ohio EPA/OSU survey from 2000-2004. This cohort of sites consists of small, historically persistent, but largely unmanaged (i.e. not diked) coastal wetlands. Most of these sites were located within or around the western basin of the lake, which has historically had the greatest acreage of coastal wetlands in Ohio. The VIBI-C scores determined for these wetlands at that time serve as a baseline for reference. These sites were resampled in the spring and summer of 2014 to determine status and trends in coastal wetland quality.

A separate, more recent survey (2011-2019) using a different methodology called the Great Lakes Coastal Wetland Monitoring Program (CWMP) has been developed at Central Michigan University. In addition to plant community composition metrics, a thorough examination of all the various components of coastal wetlands including plants, animals, and water is conducted and all components are scored separately. This effort has funding from the Great Lakes Restoration Initiative for use across the Great Lakes as part of the State of the Great Lakes ecosystem indicator series. The State of the Great Lakes indicators are used to help track progress under the Great Lakes Water Quality Agreement between the United States and Canada.

For the CWMP, 14 of the coastal wetlands that are monitored are located in Ohio. Two sites, Old Woman Creek and Plum Brook, overlap with the previous work conducted by the state of Ohio. Nine of the sites in Ohio have been visited at least twice. These nine sites represent a broader range of types including large coastal wetland remnants, historically persistent, and generally heavily managed with the assistance of dike networks that can be used to manipulate water levels.

For the purposes of this LEQI, only the vegetation scores from the CWMP for the coastal wetlands in Ohio are presented.

METRIC: COSTAL WETLANDS



MEASUREMENT

Index of Biotic Integrity for coastal wetlands (VIBI-C)

Great Lakes Coastal Wetland Monitoring Program for vegetation at sites in Ohio.



GOALS

Average score greater than 50 on the VIBI-C. No goal for CWMP.



SCORING

Coastal Wetland VIBI-C:

- Excellent = 62-100
- Good = 50-61
- Fair = 25-49
- Poor = 0-24

CWMP:

- Extremely Degraded = 0.0-0.79
- Degraded = 0.80-1.69
- Moderately Degraded = 1.7-2.59
- Moderately Impacted = 2.60-3.39
- Mildly Impacted = 3.40-4.19
- Reference Conditions = ≥ 4.2



DATA SOURCE

VIBI-C: Performed by Cleveland Museum of Natural History as a Lake Erie Protection Fund project for OLEC.

CWMP: Performed by Central Michigan University faculty, students, and partners. More info: <https://great-lakeswetlands.org/Home.vbhtml>

WILDLIFE & RECREATION



ODNR completed a statewide comprehensive outdoor recreation plan (SCORP) in 2018. This plan was developed with input from individuals, recreational user groups, government agencies and public-spirited organizations throughout Ohio and outlines strategies and recommendations to enhance recreational opportunities in the state.

Part of the basis for this plan is a survey of Ohio residents about their recreation activities and needs, which was conducted in 2017 and asked respondents about their recreation activities in 2016. We draw from some of the information in this survey to describe recreation at or near Lake Erie. Because this survey is not designed to quantify the demand for coastal recreation, no score is assigned.

METRIC: COASTAL RECREATION



MEASUREMENT

Public survey conducted for the Statewide Comprehensive Outdoor Recreation Plan



GOALS

No goal



SCORING

Undetermined



DATA SOURCE

ODNR SCORP:
https://ohiodnr.gov/static/documents/real-estate/2018/SCORP_Appendices.pdf

WILDLIFE & RECREATION



The ODNR Division of Parks and Watercraft has a visitor survey form that is collected from park visitors. Since 2007, from 500-2000 park visitors per year have rated items about beach quality for public beaches in the state parks along Lake Erie. The categories surveyed included cleanliness of beach restrooms, condition of beach house structure, cleanliness of beach area, safety/security of the beach, and informational signs.

Data were summarized from the seven Ohio state parks along the Lake Erie coastline, including on the Lake Erie islands, that include public beach access.

METRIC: LAKE ERIE BEACHES



MEASUREMENT

Public opinion survey which rates various aspects of beach quality along the Lake Erie shoreline.



GOALS

Obtain a score of good to excellent on the survey.



SCORING

On a five point scale :

- Good/Excellent = > 3.5
- Fair = 2.75 – 3.5
- Poor = less than 2.75



DATA SOURCE

ODNR Parks survey data for state owned beaches

WILDLIFE & RECREATION



As of July 2007, all Shore Structure Permits are issued through the director of ODNR, and the Office of Coastal Management tracks the number of shore structure permits issued each year for projects that are new structures, structures built to replace failing structures, or modifications that add on to existing structures.

A [Temporary Shore Structure Permit](#) program was implemented by ODNR Office of Coastal Management in May of 2018. This program was issued for the installation of emergency erosion control measures and valid for two years after which a standard [Shore Structure Permit](#) must be obtained.

METRIC: SHORELINE HARDENING



MEASUREMENT

Shore structure permits issued annually.



GOALS

All structures to provide erosion protection while remaining compatible with habitat use.



SCORING

Undetermined



DATA SOURCE

[ODNR Office of Coastal Management](#)

WILDLIFE & RECREATION



Beach Cleanups are organized by several non-governmental organizations, where local citizens can receive training and assistance to clean local beaches.

Quantities of materials collected are recorded and provided to the International Coastal Cleanup. Each year, all the totals for materials collected are reported out. Data area also available directly from the local organizations participating in various beach cleanups.

Please go to the web links below to find beach cleanups near you and to sign up to participate.

METRIC: BEACH CLEANUPS



MEASUREMENT

Shore structure permits issued annually.



GOALS

All structures to provide erosion protection while remaining compatible with habitat use.



SCORING

Undetermined



DATA SOURCE

[Adopt-a-Beach](#) and [Partners for Clean Streams](#)

WILDLIFE & RECREATION



ODNR Division of Watercraft issues and tracks boat registrations. Registrations are required for every recreational boat in Ohio, including powerboats, sailboats, canoes, kayaks, pedal boats, and inflatable boats. Registration assists with ensuring safe boating and provides funding to enhance boating related resources such as dockage and launches.

Additional information was extracted from the results of the 2017 SCORP. This survey of recreation in Ohio asks a series of questions including how many people go boating in Ohio and how frequently.

METRIC: BOATING PARTICIPATION



MEASUREMENT

Number of boat vessel registrations and boating related metrics in the SCORP for coastal counties.



GOALS

Increasing trend of number of boat registrations.



SCORING

Undetermined



DATA SOURCE

ODNR Watercraft

Find out more about boating in Ohio here: <https://ohiodnr.gov/discover-and-learn/safety-conservation/about-ODNR/division-parks-watercraft/boating-paddling-Ohio>

WILDLIFE & RECREATION



This data is obtained from the United States Coast Guard. The Coast Guard uses the number of boating related fatalities per 100,000 boats as the main measure of boating safety for each state. A five-year period is used to reduce the influence of changes in states with lower numbers of boats. This metric is different than any other metric used in this report because it uses statewide data, instead of just Lake Erie. This allows a state-by-state comparison.

METRIC: BOATING SAFETY



MEASUREMENT

Based on the number of fatalities (# of fatalities per 100,000 registered boats) for the entire State of Ohio. Actual score is the ranking of Ohio compared to all other 50 states. Rankings are determined for a five year period.



GOALS

The goal is for Ohio to be ranked in the top 10 states nationally



SCORING

Ranking among the nation's 50 states (excluding Alaska, including Washington DC):

- Excellent = 1 – 10
- Good = 11 – 20
- Fair = 21 – 30
- Poor = lower than 30



DATA SOURCE

USCG: https://uscgboating.org/statistics/accident_statistics.php

WILDLIFE & RECREATION



ODNR Division of Watercraft regularly evaluates the condition of available dockage. They use this information in part to allocate public funds dedicated to new or improved dock facilities owned by local jurisdictions. Each marina is given dock condition scores for each type of dockage that is available (lease, transient, or tie-up). Overall dock condition for the types of docks within each marina is scored as good (3), average (2), or poor (1).

METRIC: DOCKAGE



MEASUREMENT

ODNR data on number of dockage spaces and dockage quality.



GOALS

Increasing trend of number of facilities.

Maximize the number of facilities in fair to good condition.



SCORING

Based on condition score range:

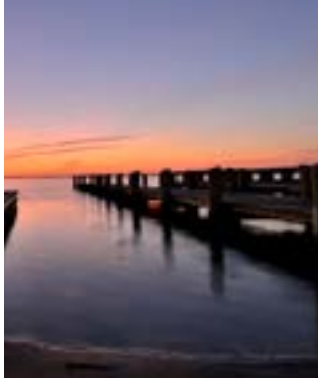
- Good = 2.3 - 3
- Fair = 1.7 - 2.29
- Poor = <1.7



DATA SOURCE

ODNR Division of Watercraft Facility Inventory:
<https://ohiodnr.gov/discover-and-learn/safety-conservation/about-odnr/division-parks-watercraft/boating-paddling-ohio/boat-access-amenities-ohio>

WILDLIFE & RECREATION



ODNR Division of Watercraft regularly evaluates the condition of launching facilities. They use this information in part to allocate public funds dedicated to new or improved publicly owned boat launch facilities. Each location is given condition scores for each type of ramp that is available (concrete or other). Overall condition for the ramps at each location is scored as good (3), average (2), or poor (1).

METRIC: BOAT RAMPS



MEASUREMENT

Number and quality of available facilities.



GOALS

Increasing trend of number of facilities.

Maximize the number of facilities in average to good condition.



SCORING

Based on condition score range:

- Good = 2.3 - 3
- Fair = 1.7 - 2.29
- Poor = <1.7



DATA SOURCE

ODNR Division of Watercraft Facility Inventory:
<https://ohiodnr.gov/discover-and-learn/safety-conservation/about-odnr/division-parks-watercraft/boating-paddling-ohio/boat-access-amenities-ohio>

WILDLIFE & RECREATION



ODNR Division of Wildlife conducts annual surveys of people returning from fishing trips to estimate the hours spent fishing by Ohio Lake Erie anglers.

Although a range of data are collected in these surveys, this metric is calculated on total boat fishing hours.

The 2020 estimates were not complete due to pandemic limitations. The estimate for boat trips and angler trips was not able to be calculated in the same fashion as other years

METRIC: FISHING PARTICIPATION



MEASUREMENT

Annual creel survey from ODNR Division of Wildlife



GOALS

Target for boat fishing hours is 6,675,000 hours annually



SCORING

Scoring based on reaching a percentage of stated goal:

-
- Good = >0.85
- Fair = $0.70 - 0.84$
- Poor = below 0.70



DATA SOURCE

[Data obtained and compiled by Division of Wildlife - Ohio Lake Erie Fisheries](#)

WILDLIFE & RECREATION



Data summarized from Ohio's Lake Erie Fisheries 2017 report by ODNR Fisheries. This report included a summary of the fishing satisfaction questions that are asked as part of the creel surveys. These data are not collected every year. During the 2017 angler survey, anglers were asked to rate the success of their fishing trip on that particular day of fishing. Anglers were asked to rate their fishing trip as: (1) successful, (2) not successful or (3) not sure. Angler responses were grouped by fishery, district fished and target species. Data was collected from June 1 to the end of the survey in October (N=4,007). Seventy eight percent of the responses came from the private boat fishery (N=3,110) and 22 % from the charter boat fishery (N=897; Table 4.1.23).

METRIC: FISHING SATISFACTION



MEASUREMENT

Annual creel survey from
ODNR Division of Wildlife



GOALS

No goal



SCORING

Undetermined



DATA SOURCE

Data obtained and compiled
by Division of Wildlife - [Ohio
Lake Erie Fisheries](#)

WILDLIFE & RECREATION



The ODNR Division of Wildlife has established catch rate goals for each of the lake's major species to measure angler success. Catch rate is the number of fish caught in an hour by an angler seeking that species. If an angler catches one fish each hour, the catch rate is 1.0. If the angler catches one fish every two hours, the catch rate is 0.5; one fish caught every three hours results in a catch rate of 0.33. Catch rates are influenced by a number of factors, including fish abundance, the size and age structure of the fish populations, availability of natural food items, weather, fishing technique, and angler skill. Catch rates tend to be highly variable because of these factors, but still can provide useful insight into angler success when interpreted in relation to these known factors.

The goals that were derived for each species are based on long-term characteristics in the ODNR Division of Wildlife's Lake Erie data set and therefore apply only to Ohio portions of Lake Erie. Goals were not set as the measure of an individual's daily fishing success, but as a measure of the average angler's success for each individual species over the entire fishing season.

Annual catch rates for four popular sport fish in Lake Erie are used to rate this metric: walleye, yellow perch, and smallmouth bass. A five-year running average was used to smooth out the annual fluctuations in the data. For most species, catch rates are based only on fish that are kept. However, both kept and released numbers are used for smallmouth bass because most anglers voluntarily practice catch-release on this species.

METRIC: ANGLER SUCCESS



MEASUREMENT

Annual creel survey from ODNR Division of Wildlife



GOALS

LE Committee catch rate targets:

- Walleye – 0.4 fish/hr
- Yellow Perch – 4.0 fish/hr
- Smallmouth Bass – 0.5 fish/hr
- White Bass – 2.0 fish/hr



SCORING

Scoring based on reaching a percentage of stated goal:

Good = >0.85
Fair = 0.70 - 0.84
Poor = below 0.70



DATA SOURCE

Data obtained and compiled by [ODNR Division of Wildlife -Ohio Lake Erie Fisheries](#)

MARITIME ECONOMY



In early 2021, Ohio Sea Grant and partners from The Ohio State University conducted the eighth survey of the Ohio Lake Erie charter fishing industry, focused on business characteristics and economic data. Questions were formulated from previous surveys and input from partners from the Ohio Department of Natural Resources Division of Wildlife and Lake Erie Charter Boat Association. The survey was conducted electronically using Qualtrics software. All Ohio guides who were licensed during the 2020 season were sent invitations to participate, with the first contact being through mail and three reminder emails. Based on the Qualtrics distribution summary, the audience size over email was 787, and the response rate was 46%.

METRIC: CHARTER BOATS



MEASUREMENT

Numbers of businesses,
number of boats, and revenue.



GOALS

No goal



SCORING

Undetermined



DATA SOURCE

[Ohio Sea Grant College
Program Surveys](#)

MARITIME ECONOMY



Data for this metric are obtained from the Waterborne Commerce Statistics Center of the Army Corps of Engineers which is reported by year.

Additional information was obtained from a survey of ports across the Great Lakes, a study by Martin Associates for the Lake Carriers Association and other shipping industry groups.

METRIC: SHIPPING



MEASUREMENT

Tons of each type of cargo moving through each Ohio commercial port.



GOALS

No goal



SCORING

Undetermined



DATA SOURCE

Data obtained from Waterborne Commerce Statistics Center <https://www.iwr.usace.army.mil/About/Technical-Centers/2-WCSC-Waterborne-Commerce-Statistics-Center/WCSC-Waterborne-Commerce/>
Lake Carriers Association: <https://lca-ships.com/>

ODOT Maritime & Freight Programs: <https://www.transportation.ohio.gov/programs/maritime-freight#page=1>

OUR MISSION

The Ohio Lake Erie Commission (OLEC) was established to preserve Lake Erie's natural resources, to protect the quality of its waters and ecosystem, and to promote economic development of the region. The director of the Ohio Environmental Protection Agency serves as the Commission's chairman. Additional OLEC members include the directors of the state departments of Transportation, Health, Development Services, Agriculture, and Natural Resources. There are also seven public members appointed by the governor.

LAKE ERIE LICENSE PLATE

The Commission administers the Lake Erie Protection Fund, which is supported in part by sales of the Lake Erie license plate series.

Thank you to our license plate subscribers for supporting the protection and restoration of Lake Erie. You can purchase a license plate wherever plates are sold from one of our three designs.

