State of the Lake Report

2004

Lake Erie Quality Index

Ohio Lake Erie Commission

As Ohioans, we are fortunate to live in the Great Lakes region. The Great Lakes contain 20% of the fresh surface water on the planet, an incredibly valuable resource. But the Great Lakes are threatened by numerous ecological challenges. This Lake Erie Quality Index helps to define those challenges for our Great Lake. While there has been tremendous improvement since *Time* magazine published Lake Erie's obituary more than 30 years ago, problems remain and new threats hamper the recovery of the ecosystem.

Two reports by the Ohio Lake Erie Commission – the *Lake Erie Quality Index* and the *Lake Erie Protection & Restoration Plan* – help point the way toward specific areas in which we need to focus our efforts to preserve Lake Erie. The work that is detailed in these reports puts Ohio in the forefront of restoration planning. But it is not enough to focus only on Lake Erie. The Great Lakes Governors have embraced an ambitious agenda to protect and restore the Great Lakes. We agreed on priorities that encompass important issues like sustainable use of our water resources, protecting people's health, stopping invasive species, and restoring the ecosystem.

Accomplishing our priorities will take a significant investment. A study by the GAO (the investigative arm of Congress) showed that the States are already spending much more than the federal government on Great Lakes programs. Now, momentum is building for a national commitment to Great Lakes restoration. President Bush has ordered U.S. EPA to work with the Region's mayors and governors on a comprehensive restoration plan. Members of Ohio's Congressional delegation are among many bi-partisan co-sponsors of draft legislation that would commit up to $6 billion to restore the Great Lakes ecosystem. This would be the second largest federal investment in environmental restoration, trailing only the $8 billion Everglades project.

Already we are working to achieve the first priority – sustainable use of water resources. We know that demand for Great Lakes water is only going to grow. We need to ensure that when other thirsty regions look toward the Great Lakes to solve their problems, we have the ability to protect this irreplaceable resource. In addition, I signed an Executive Order that bans oil and gas drilling in Lake Erie along Ohio's coastline, because the risk of damaging our precious water resources is simply not worth the potential gain.

We are so fortunate to live and work near Lake Erie, with its beautiful vistas, its rich fishery, and all of the other advantages delineated in the *Lake Erie Quality Index*. Our work to protect and restore our Great Lake can only be an asset to generations to come. As Co-Chairman of the Great Lakes Governors, I am excited to be part of this important project.

Bob Taft

Governor of Ohio
Co-Chairman of the Council of Great Lakes Governors

Lake Erie is an ecological treasure, a fundamental part of Ohio's economy, and a recreational destination prized by Ohio families. It supplies drinking water for millions of people, provides habitat for endangered species, and serves as a passageway through which Ohio goods reach the global marketplace. Lake Erie tourism is a $7 billion business, supporting well over a quarter-million jobs.

For all these reasons and more, it is vital that we protect and restore our Great Lake. In order to do that effectively, we need a solid understanding of its condition, the ways in which it has recovered, the areas where improvements are still needed, and the changing circumstances that bring new challenges to the Lake all the time.

The Lake Erie Commission released the first *Lake Erie Quality Index* in 1998. That report analyzed Lake Erie from many perspectives, and provided a baseline by which the success of restoration efforts can be measured. Since then, the Commission has worked to fill in the blanks in our knowledge about Lake Erie.

This update of the *Lake Erie Quality Index* contains much new information. It shows that many of our efforts to protect and improve the Lake – especially its value is a recreational venue and a drinking water source – are working. It reminds us that we have a lot left to learn, and much work still to be done.

The companion piece to this update of the *Lake Erie Quality Index* is the update of the *Lake Erie Protection & Restoration Plan*. First released by Governor Taft in 2000, the plan is a strategy for continuing the remarkable rebirth of our Great Lake. In releasing the plan and the quality index together, the state agencies that make up the Lake Erie Commission are reporting in detail to the people of Ohio on our work that impacts Lake Erie and on its degree of success.

This work has gained a new resonance through the work of the Council of Great Lakes Governors, co-chaired by Governor Taft, to develop a plan and secure funding for the restoration of all the Great Lakes. As we pursue that larger goal, the *Lake Erie Quality Index* will serve as an important map leading us toward scientifically sound strategies for protecting the most valuable natural resource in our region.

Christopher Jones
Chairman, Ohio Lake Erie Commission

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Executive Summary

In September of 1998, the first *State of the Lake Report- Lake Erie Quality Index* was released. This *Index* was a status report from the Ohio Lake Erie Commission to the people of Ohio on the condition of the lake in relation to the quality of life enjoyed by those living near or using the lake. It showed that in many ways, Lake Erie and its surrounding Ohio watershed had made remarkable improvements over the previous 25 years. However, there were other components of the lake ecosystem that had not improved and were in great need of attention.

This 2004 version of the *Lake Erie Quality Index* is an update to much of what was presented in the 1998 *Index*. The Lake Erie Commission has expended funds from the Lake Erie Protection Fund, derived primarily from sale of Lake Erie license plates, to help refine our measurements of the condition of the lake. This helps us to understand what additional management decisions are needed to improve and restore Lake Erie as a natural and a recreational resource. Specific metrics that have been modified or added since the 1998 report are: Water Chemistry, Toxic Compounds, Shoreline Hardening, Offshore Plankton Index of Biotic Integrity (IBI), Offshore Fish IBI, Coastal Wetland IBI, Dockage, Boat Launching Facilities, Shoreline Fishing, Beach Availability, and Tourism. The metrics that were developed using Lake Erie Protection Fund money are identified throughout the report with a picture of the Marblehead Lighthouse license plate.

As in 1998, three primary considerations were maintained as central for development of this report. First, the intended audience of the report is the millions of people who live on Ohio's Lake Erie shoreline, drink its waters, play on its beaches, and fish its depths. Although the information presented is of value to experts, the selection of indicators and metrics is based on their importance and interest to most Ohioans.

Second, the metrics and indicators continue to utilize, when possible, existing historical databases and ongoing monitoring programs. Just as important as knowing the current condition of a given Lake Erie resource or parameter is the ability to discern long- and short-term trends. The Commission's goal is to determine whether Lake Erie is getting better or worse. Contained within this report are data sets supplied by all levels of government, academia, and private business. These ongoing monitoring efforts will enable future updates to be produced using methods consistent with this report's data.

Third, this *Index* is designed to reflect the quality of Ohio's Lake Erie waters. Certainly the Commission understands that this portion of the lake is only a small component of the Great Lakes ecosystem. As brought out in this report, Ohio's coastal waters are impacted by activities and practices taking place throughout the world. Still, this *Index* focuses on Ohio's lake resources and the activities taking place within Ohio that affect Lake Erie.

The *Lake Erie Quality Index* is organized into 11 separate indicators. These indicators address several important aspects of the lake including the environment (*Ambient Water Quality*, *Human Exposure Risks*, *Pollution Sources*, *Aquatic Habitat*, and *Biological*), public use (*Coastal Recreation*, *Boating*, *Fishing*, and *Beaches*), *Land Use*, and the *Economy*. These 11 indicators are expanded into 32 separate metrics ranging from 1 to 5 metrics per indicator.

Each metric measures a particular aspect of the overall indicator that is compared to an established goal and scored. Two different scoring systems were created for this report. When parameters were measured against a given numerical goal, the percentage attained was compared to a straight sliding scale. At other times, the data lent itself more to the use of a four-point scoring system. This was especially true of those metrics derived from survey information. For these, a system resembling a grade point average was used.

The scores of the individual metrics are weighted according to their importance, then tallied to produce a rating for the overall indicator. This is the same method that was used in the 1998 *Index*, except that the scoring system was modified so that higher scores were needed to attain the highest rating. The four descriptive ratings that were used in this report are ***Excellent***, ***Good***, ***Fair***, and ***Poor***.

For some of the metrics in the *Index*, no rating or scoring is given. In these cases, the information that was available for the metric was either not recent or there were no established goals to make a meaningful comparison. A discussion is presented for each of these topics, but their score did not influence the overall rating for the indicator. It is hoped that these sections will be updated or more fully developed by the release of the next *Index*.

As seen from the graph on the following page, many of the indicators (Beaches, Boating, Coastal Recreation, Biological) and individual metrics have retained or improved their ratings from the last report. This shows that the State of Ohio is succeeding in maintaining the integrity of these resources.

The indicators that have declined point the way to areas which require improvement and where we need to focus additional attention. For some of these, the lower ratings were the result of alterations in the scoring used. In other cases, there was an actual decrease in the quality of what was being measured. In many instances, the processes that affect the lake and its quality are not well known.

The Lake Erie Protection Fund has been and will be used to support projects to help us better understand the changes that are occurring in the lake in order for state agencies and others to adjust our program and policies to better address problems such as the decline in water clarity or the focal point for contaminated sediment clean up. The Index also allows us to refine the Lake Erie Protection & Restoration Plan and identify priorities for needed support from the federal government or other Great Lake states.

The *Lake Erie Quality Index* is an initiative that will continue to help the State of Ohio better itself as a steward of the lake. Many of the results presented in this report are taken into consideration when developing programs for the state's agencies. The Commission encourages readers to help in this important effort and welcomes feedback on how this *Index* could be improved for its next release. Please contact the Commission with any suggestions at:

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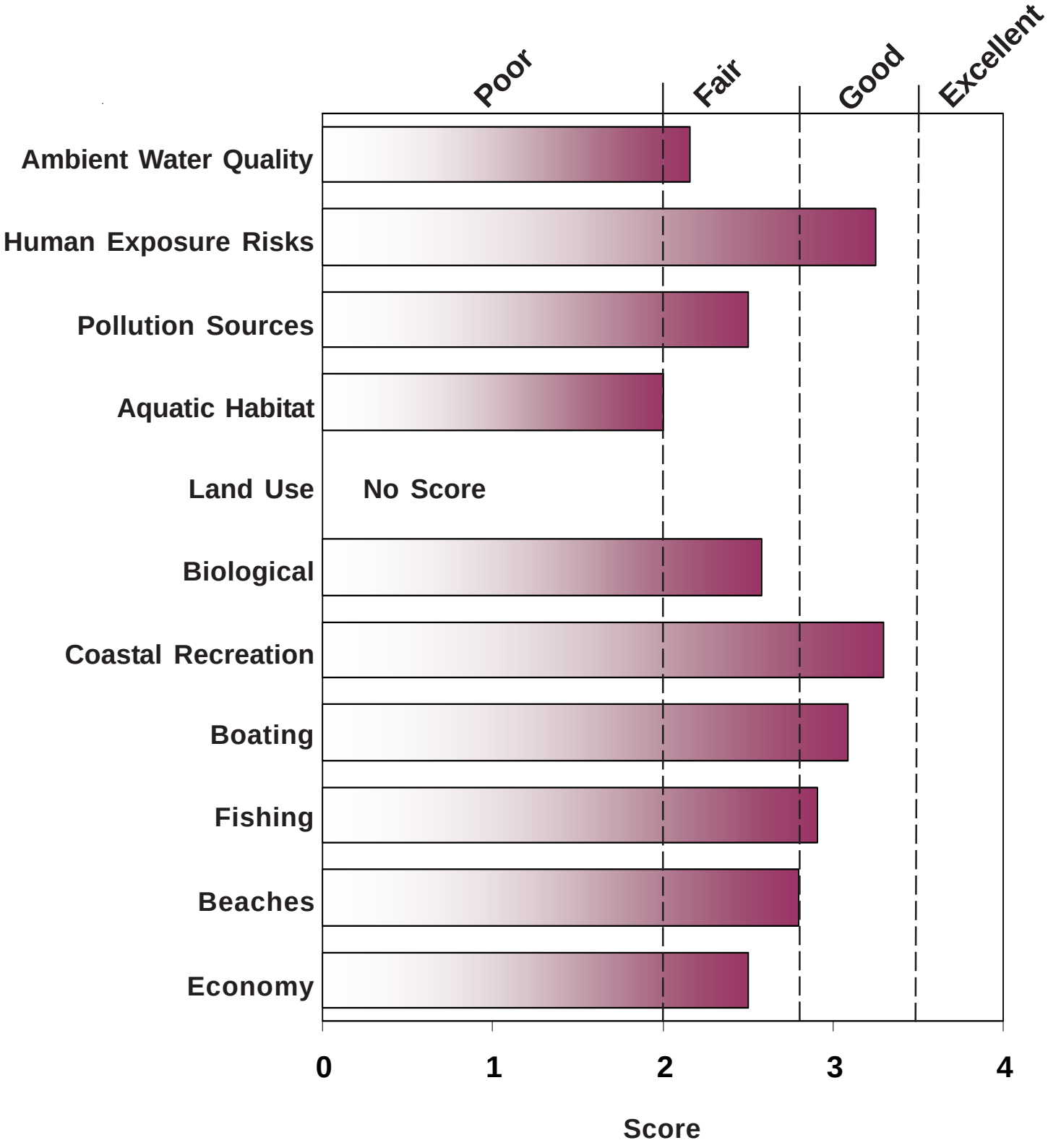
Indicator Ratings



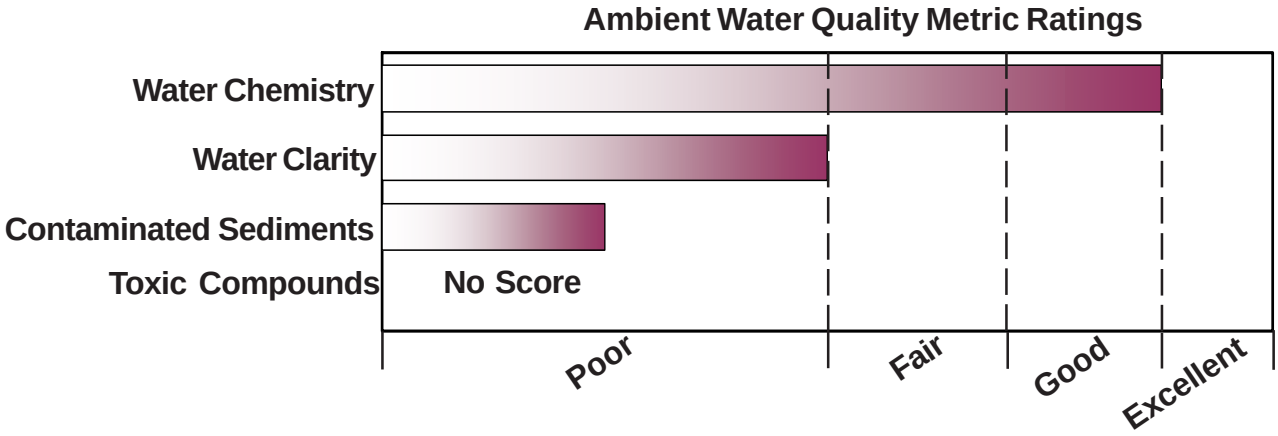
Ambient Water Quality Indicator

FAIR

For many years, Lake Erie suffered from serious pollution problems that threatened its productivity and value as a natural resource. With the passage of the Clean Water Act, the Great Lakes Water Quality Agreement and other efforts, water quality in the lake improved tremendously. However, in recent years, there has been a decreasing trend in the health of the lake. Once again we are seeing blue-green algae blooms, increased attached algae (*Cladophora)* growth along the shoreline, and an increase in the area of low to no dissolved oxygen (anoxia) at the bottom of the central basin. Research is underway to investigate why the lake is changing. Some of the potential causes of the deteriorating conditions are speculated to be lower water levels, changing climate with more intense spring storms, and changes in the internal processes in the lake due to the presence of non-native invasive species (i.e. zebra and quagga mussels, gobies, etc.).

The *Water Quality* indicator for this update of the *Lake Erie Quality Index* has been revised. The 1998 version used a combination of ambient environmental conditions and metrics associated with potential risks to human health. For this report, the *Water Quality* indicator was split into two new indicators: one that would measure ambient conditions such as water chemistry, sediment quality, water clarity and tissue contamination and one that would measure potential risks to human health, such as beach closings, fish consumption advisories and drinking water quality.

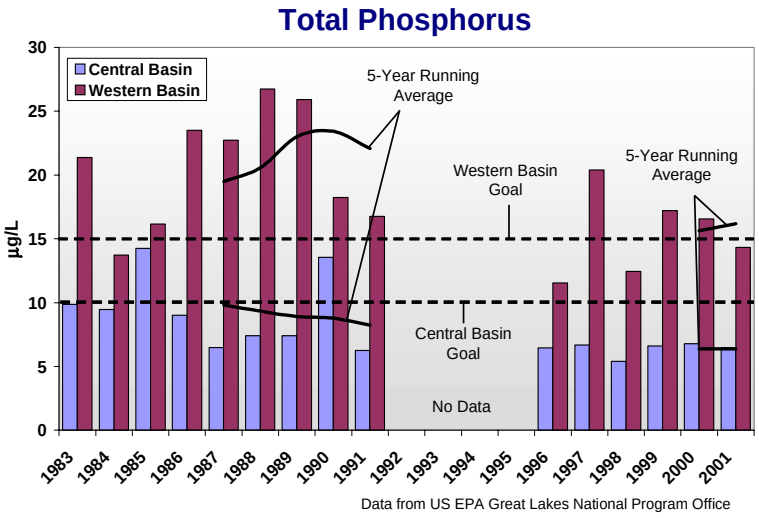
Because the 1998 water quality indicator was based on different metrics, the 2004 results cannot be compared to those results. However, it can be seen that the ambient environmental conditions in the lake are in need of major improvements. Efforts to reduce the amount of pollution that is reaching the lake need to be increased, but this may only be part of the solution. Many of the processes occurring within the lake are not well understood and require further study. Only when these issues are addressed will Lake Erie be on the way to becoming a healthy ecosystem again.



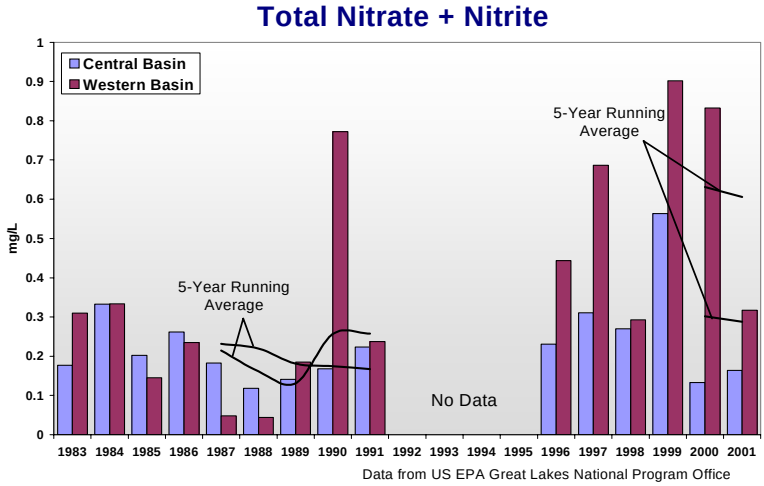
Water Chemistry Metric

EXCELLENT

Water chemistry is one of the most important factors affecting the health of Lake Erie. The presence of nutrients, in the correct ratios, is directly tied to the abundance of many organisms. Phosphorus is the limiting nutrient in Lake Erie, meaning it controls the primary productivity of the lake. Management strategies usually focus on phosphorus availability to limit the growth of nuisance algal populations. When phosphorus is controlled, the role of nitrogen is less important, although extremely high nitrate concentrations can cause problems for animals and humans. Chloride is a conservative parameter, remaining fairly constant from year to year and seasonally. Fluctuations would indicate an input of polluted waters.



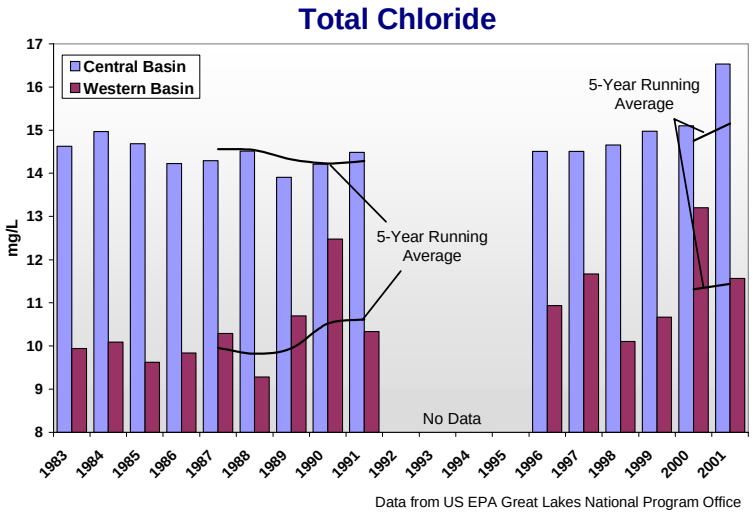
U.S. EPA's Great Lakes National Program Office provided the data used to calculate this metric. Each year U.S. EPA's research vessel, the *R/V Lake Guardian,* collects water samples from an established network around the lake. Spring cruise values reflect conditions related to major loading events caused by spring runoff and offer a prediction of the size of that year's plankton crop. Summer values are much less variable and more representative of the ambient water quality in the lake. Therefore, this section uses summer concentrations to measure lake water quality trends. The parameters of nitrate+nitrite, total phosphorus, and total chloride were all measured during these trips at stations throughout the western and central basins. For each year that was sampled (1983-2001), a basinwide average was computed using data from each of the individual stations. Only offshore stations were used to reduce the influence of shoreline effects.



Of the three parameters measured, only phosphorus has been assigned any target values. Therefore, the *Water Chemistry* metric is based only on phosphorus. Under the Great Lakes Water Quality Agreement, the phosphorus limit was set at 15 µg/L for the western basin and 10 µg/L in the central basin. Models were used to calculate these concentrations as those that would prevent nuisance growths of algae and reduce the area of anoxia at the bottom of the central basin. Meeting this goal is equal to a rating of ***Excellent***. The other ratings were

established by multiplying the goal by the reciprocal of 85% and 70%.

Due to phosphorus controls at sewage treatment plants, a ban on the use of phosphorus detergents, and agricultural conservation practices, Lake Erie achieved the phosphorus concentration goal for the central basin in the mid-1980s. Concentrations in the western basin continue to fluctuate but are very near maintaining that goal. In 2001, the 5-year average for the western basin was 16.2 µg/L, rating a ***Good***. The central basin average was 6 µg/L, equal to ***Excellent***. This gives an overall rating of ***Excellent*** for the lake. However, overall, spring concentrations and loadings to the lake seem to be rising and research is underway to continue to monitor that issue.



The nitrogen concentrations in Lake Erie have varied by basin over the last twenty years. Over this time period, the central basin has shown relatively consistent levels of nitrate + nitrite, the two dominant forms of nitrogen in the lake. The most recent 5-year average was 0.3 mg/L. The western basin, however, has shown a general increase in nitrate over the same period, with a 5-year average of 0.6 mg/L. Both of these concentrations are well below those that have been known to cause harm to organisms, but the increasing trend is of concern.

Total chloride concentrations have increased in both basins in the last twenty years. The most recent 5-year averages were 15 mg/L in the central basin and 11 mg/L in the western basin. The reason for these increasing concentrations may be due to runoff from development and the use of salts on roads in the winter

Although water quality data is available for other contaminants such as metals, pesticides and PCBs, none of these parameters are measured on a regular basis to provide the information needed to develop a metric. Certain contaminants are measured in such low concentrations in the water column that sediment and fish tissue are used as better surrogates of measuring their presence in the Lake Erie ecosystem.

Lake Erie Anoxia

In the past few years, concern has risen about the increasing size of the area of anoxia at the bottom of the central basin. This condition develops in late summer when oxygen in the hypolimnion of the central basin becomes depleted following bacterial decomposition of dead algae and other organic materials. Thermal stratification of the water prevents surface water oxygen from being remixed into the deeper waters. The result is an area in which most organisms are unable to survive. To some degree, anoxia occurs as a natural event, however, the unexpected increase in area suggested something more than natural conditions.

The increased area of anoxia and higher spring phosphorus concentrations in the lake led the U.S. EPA to fnd a two-year study to determine why this is occurring. Numerous researchers on both the U.S. and Canadian sides of the lake are cooperating in this investigation.

Increased phosphorus concentrations in the lake are a suspected cause of the expanded anoxic area. Invasive species such as zebra mussels, quagga mussels, and gobies may also be altering Lake Erie's ecosystem in as yet unknown ways to contribute to the anoxia. Other suspected causes are low lake levels, changing weather patterns, and alterations in the internal processes in the lake.

For more information on water chemistry please contact:
Ohio EPA- Division of Surface Water
Web: www.epa.state.oh.us/dsw
Phone: 614-644-2001

Water Clarity Metric

FAIR

One of the most visible changes in Lake Erie since the 1970s has involved water clarity. Water becomes turbid when particles, like silt or algae, become suspended in it. This in turn, reduces light penetration and reflects light of that color. Therefore, water clarity and color can be useful as an indicator of environmental water quality.

Brown water indicates a suspension of silt and clay sediments from watershed runoff and/or wind-driven wave impacts on nearshore lake bottom areas. Green waters indicate high algal densities resulting from high concentrations of nutrients, especially phosphorus, from runoff of both agricultural and municipal origin. Both of these conditions occur naturally in Lake Erie as a result of weather, lake levels and the availability of materials (sediments, nutrients) in water flows. However, these conditions in Lake Erie have been greatly exacerbated by human influence.

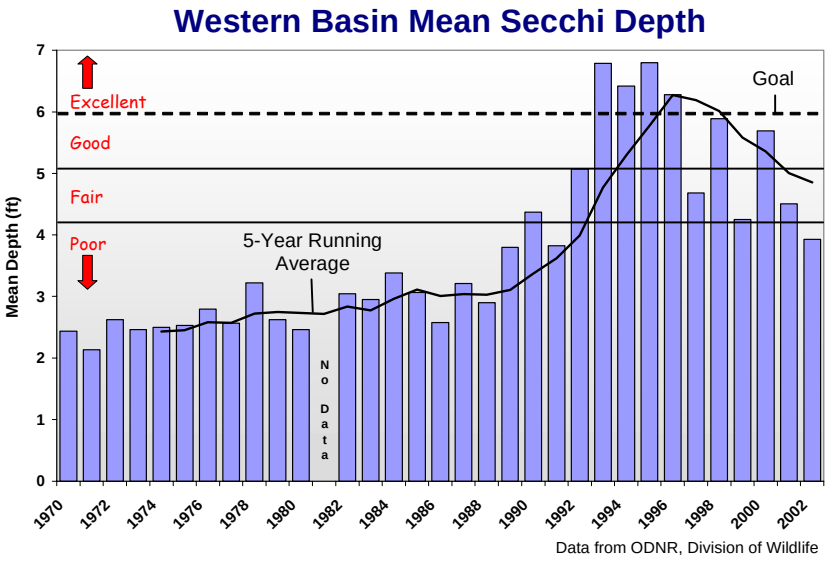
This metric does not explicitly incorporate color but simply uses the depth of light penetration, as measured with a black and white disk known as a secchi disk. These measurements were taken at various locations across the Ohio portion of western Lake Erie across several seasons (spring, summer, and fall). Average secchi values allowing visibility greater than 6 feet indicate excellent water quality. Annual average values less than 4 feet indicate high turbidity and poor water quality. While not a measurable part of the indicator, water color can be used to interpret the causes of change in water clarity.

Secchi data from ODNR, Division of Wildlife, have been collected during routine fish sampling surveys since 1970. These surveys encompass all Ohio waters in the western basin and generally have been collected monthly, May to October, each year at various locations and depths. Prior to the 1990s, about 12 sites were sampled during each survey. From the 1990s on, about 40 sites were 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.

In the 1970s, water clarity was quite low and less than 3 feet in all years. Greenish hues during this period indicated large quantities of algae and excessive nutrients. This situation was greatly changed as a result of the Great Lakes Water Quality Agreement of 1972, which set targets for phosphorus loadings that were ultimately achieved by the early 1980s. Lake Erie began to clear after nutrients were regulated more intensively and water clarity averaged above 3 feet in most years of the 1980s. Water clarity

increased to over 8 feet (on average) in the late 1980s and 1990s, as filter-feeding zebra and quagga mussels became well established in the lake. Moreover, record high lake levels were recorded during this period and the water became exceptionally clear, due to major declines in algae and suspended sediments.

From the mid-1990s on, water clarity has been declining in western Lake Erie owing to increased algae and suspended sediments. Lake levels have returned to normal or below normal levels. Nutrient concentrations are higher than during the previous decade and green water is again prevalent. Current trends in the metric (i.e., the moving average) indicate a water quality rating of ***Fair***.



Decreased water clarity can have a negative impact on the ecosystem in shallower areas of the lake. Light penetration is needed to allow for growth of aquatic plant beds that provide habitat for fish and other animals. When less light is able to travel through the water column, there may be shifts in the types of organisms in those areas.

The decline in the clarity of the water has also had a negative impact on the public's perception of the lake. In an opinion survey that was conducted in 2003, there was a significant decrease in the mean score for the area of satisfaction with water clarity when compared with results from 1997.

Future trends in water clarity will be influenced by a complex set of factors that relate to weather, lake levels, zebra/quagga mussel abundance, and sediment and nutrient loads from tributaries and urban sources. Humans can greatly affect sediment and nutrient loadings, but have little influence on the other factors.

For more information on water clarity contact:
Ohio Lake Erie Commission
Web: www.epa.state.oh.us/oleo
Phone: 419-245-2514
E-mail: lakeeriecommission@ameritech.net

POOR

Contaminated Sediments Metric

Many of Ohio's larger Lake Erie tributaries have been developed as deep-water commercial harbors. Historically, they have supported intensive industrial, manufacturing and shipping activity as well as handling the sewage from highly developed urban areas. The deepened channels served as natural sinks to slow the river flow and allow sediments being carried from upstream to settle out.

Prior to the 1970s, discharge of pollutants was virtually unregulated and many industrial pollutants accumulated at the river mouths. These included contaminants such as mercury, cadmium, chromium, lead, copper, zinc, cyanide, polychlorinated biphenyls (PCBs), polynucleararomatic hydrocarbons (PAHs), phosphorus and ammonia.

Today, discharge of all contaminants is strictly regulated, and most harbors are no longer the industrial centers they once were. However, some areas retain sediments contaminated by past discharges. The artificially deepened channels continue to act as sinks to allow pollutants flowing down the rivers to concentrate there. If contaminants are present in high enough concentrations, they can be toxic to bottom dwelling fish and invertebrates. At lesser concentrations, contaminants can bioaccumulate in the tissues of the organisms living in the mud and then pass into the fish or wildlife that eat them, and then on to the humans that eat the fish or wildlife.

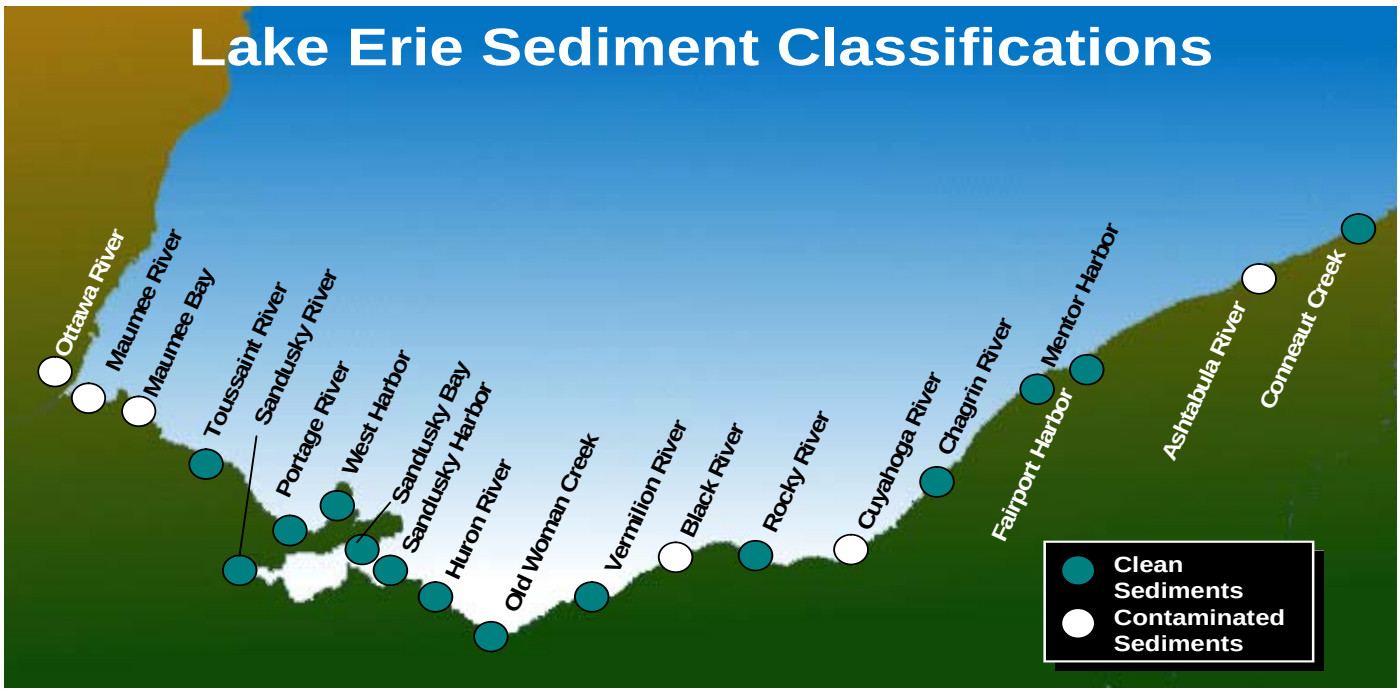
In order to maintain the navigation depths in Ohio Lake Erie commercial and recreational harbors, channels are typically dredged on a fairly regular basis. For many of the larger harbors, the channels are dredged every year or two. Deciding what to do with the dredged sediment depends on the quality of the sediment and the amount that must be disposed. Sands and gravel are usually clean and can be reused. Sediments with no or very low levels of contaminants can be reused or disposed with reduced restrictions. However, sediments that have the potential to violate Ohio water quality standards, exceed concentrations that may produce effects in fish or aquatic life, or exceed guidance in the US EPA/US Army Corps of Engineers Great Lakes Dredging Manual must be managed appropriately. Highly contaminated sediments must be placed in a secure confined disposal facility.

The Great Lakes Testing Manual contains several criteria are used to determine the extent to which sediments are contaminated. These include: concentrations of contaminants in the sediments; measuring the impacts of

exposure to the sediment on aquatic organisms (bioassays); measuring the potential for contaminants in sediment to accumulate in the tissue of aquatic organisms (bioaccumulation); comparing sediment concentrations to background or reference sites; and comparing existing sediment concentrations to those known to cause probable effects. Assessment for the *Contaminated Sediments* metric is based on whether the sediments require confinement.

Since the 1998 *Lake Erie Quality Index*, there have been numerous dredging projects along the lake associated with low lake levels. Almost every marina and harbor, even those that don't usually have to dredge, has had to remove some sediment. Sediment at almost all of these areas was considered clean enough for offshore or upland reuse or disposal.

There are 20 rivers, harbors or bays along the Ohio shoreline of Lake Erie that constitute sites for this assessment. All of these are commercial or recreational harbors and all are designated as federal navigation channels. Some of these are dredged on a regular basis, some rarely, and some not at all. It is not possible to provide a complete profile of sediment quality for the entire shoreline, but these sites provide a fairly good representation of the types of sites and varying sediment quality present. Of these 20 sites, six have sediments that are significantly contaminated. These are the Ottawa River, parts of Maumee Bay, the Maumee River, Black River, Cuyahoga River and Ashtabula River.



The goal established for this metric is for all sediments to be clean enough so they do not cause fish consumption advisories, are not toxic to benthic organisms, and can be reused without restrictions when dredged. Considering six out of 20 sites are contaminated, this translates into an overall rating of 70% - still ***Poor***.

Before contaminated sediments can be cleaned up, the sources of contaminants must be discontinued. Regulating discharges from industry and wastewater treatment plants has reduced the input of pollutants to a large degree. Elimination of other discharges, use of new processes and treatment methods, adoption of pollution prevention and waste minimization practices, remedial actions at waste sites, storm water runoff controls and the ban on the use of certain chemicals, such as DDT and PCBs have also reduced the loadings of contaminants. The net result of these efforts is that the sediments in Ohio's rivers and harbors are getting cleaner.

Remediating contaminated sediments is an expensive and complicated operation. However, a number of projects have been completed or are underway. A great deal of effort has been spent in assessing the Ottawa River. Closure and remediation of a number of old leaking landfills along the Ottawa River have eliminated sources of PCBs and other chemicals to the river. A highly contaminated source to the river, now called Fraleigh Creek, has been cleaned up. Efforts are currently underway to prioritize the remaining contaminated sediment sites along the river and present the options for remediation.

PAH contaminated sediments in the lower Black River, associated with a high incidence of tumors in brown bullheads, were removed in 1990. Tumor incidence has now decreased to nearly background levels. A contact advisory issued in 1983 due to PAHs was lifted by ODH in 2004.

Another major effort is underway by the Ashtabula River Partnership to remove contaminated sediments from the lower two miles of the Ashtabula River. Cleanup of Fields Brook, a Superfund site tributary to the river, has been completed, and river remediation is scheduled to begin in 2005.

For more information on dredging regulations and projects contact:
Ohio EPA- Division of Surface Water
Web: www.epa.state.oh.us/dsw
Phone: 614-644-2001

NO SCORE

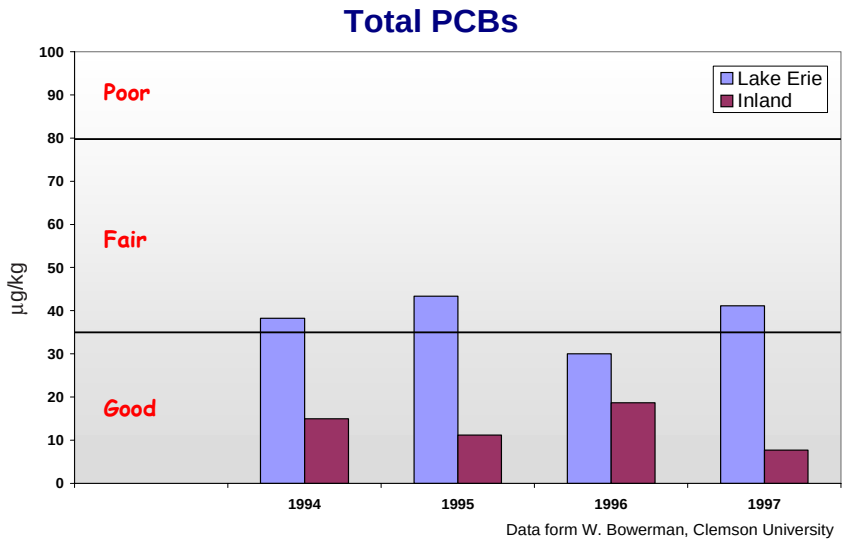
Toxic Compounds Metric

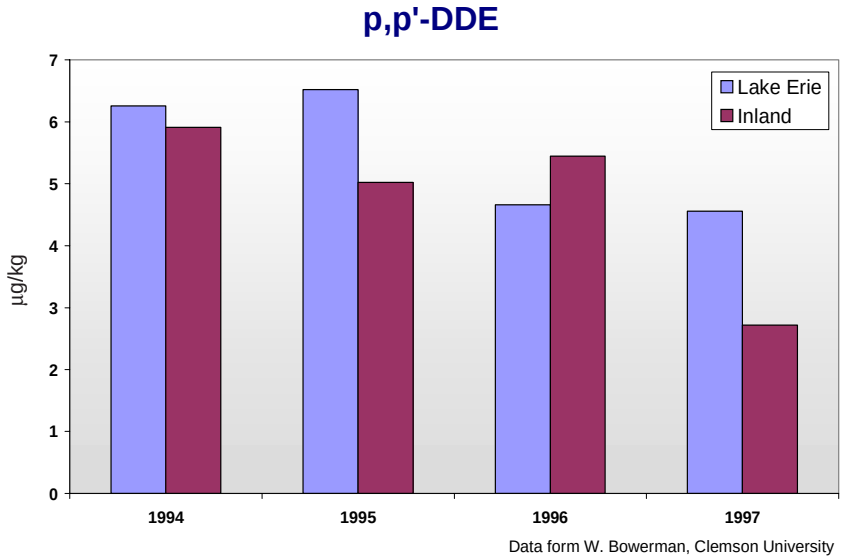
Bald eagles are native to the Lake Erie Basin and are a predator at the top of the lake's food chain. They forage primarily on fish and fish-eating wildlife associated with coastal Lake Erie, riverine, and interior aquatic systems. As bald eagles feed on fish and other wildlife, they accumulate the contaminants that were present in those animals into their own bodies.

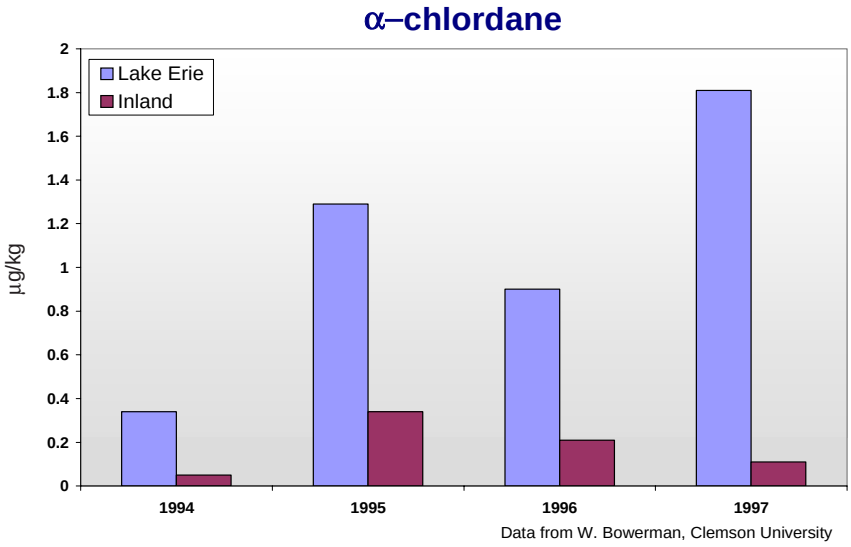
Organochlorine contaminants, such as PCBs, are one category of contaminants that can transfer through the food web. These compounds can cause both acute and chronic toxic effects including reproductive problems, shortened lifespans, and even death. The bald eagle's role as a top predator makes it an appropriate species in which to monitor the presence of these contaminants throughout the Lake Erie basin.

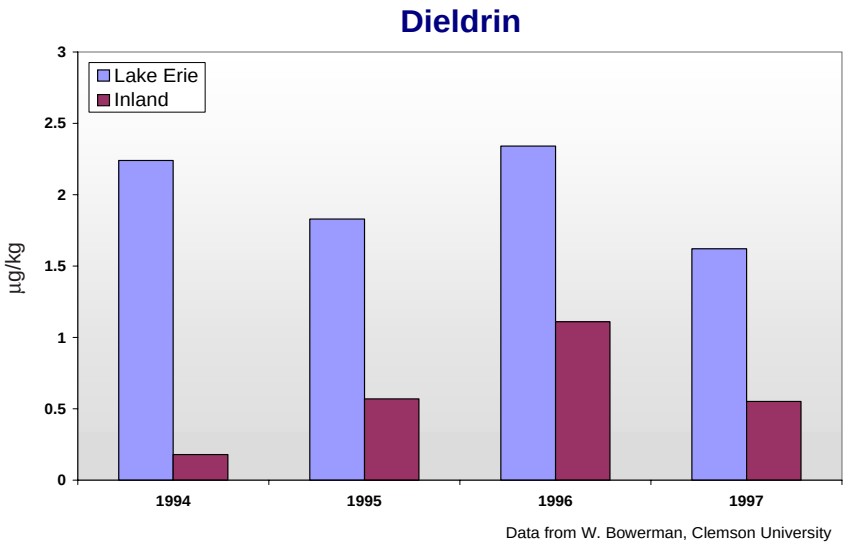
Eagle blood samples were used to develop the *Toxic Compounds* metric. Blood plasma samples of five to seven-week-old nestling bald eagles collected from 1994 – 1997 along the Lake Erie shore and in the inland breeding areas within Ohio were analyzed for total PCBs, DDT, dieldrin, and chlordane, four common organochlorine contaminants. This analysis was funded by a Lake Erie Protection Fund grant.

Total PCBs, p,p'-DDE (a breakdown product of DDT), α-chlordane, and dieldrin were detected in a large percentage of the plasma samples. Total PCBs were found in 99% of the samples and also had the highest plasma concentration of the four compounds. For this reason, it was chosen as the representative compound for this metric. The average concentration of PCBs over the four-year period was 38.2 μg/kg of blood plasma (wet weight) in the Lake









Erie region. This value was significantly higher than the 13.1 µg/kg of wet weight in the inland areas of Ohio.

The PCB concentrations were compared to accepted data on concentrations that have been known to adversely affect bald eagle productivity. Based on this and the data obtained from the eagle study, the rating for the Lake Erie region would be ***Fair***. Since the plasma monitoring is not done on a regular basis and current results for plasma concentrations are not available, the *Toxic Compounds* metric will remain unscored for this report.

As seen from these results, eagles nesting along the shoreline of Lake Erie are being exposed to higher levels of persistent organochlorine contaminants than inland regions. Eagles in this region are foraging heavily on the Lake Erie aquatic food web, whereas, inland region nesting eagles are relying on relatively less contaminated inland aquatic and terrestrial food webs.

Ohio bald eagle populations are increasing at record numbers, meeting the goal of 1.2 fledglings per nest. However, inland populations are growing faster than Lake Erie populations. Inland birds are also living longer than Lake Erie birds. These facts indicate that contaminants are still bioaccumulating in Lake Erie bald eagles at unacceptable levels and additional efforts are needed to clean up remaining sources of contaminants.

Funded by Lake Erie Protection Fund

For more information on the bald eagle populations in Ohio contact:
ODNR, Division of Wildlife- Crane Creek Research Station
Web: ohiodnr.com/wildlife
Phone: 419-898-0960

Human Exposure Risks Indicator

GOOD

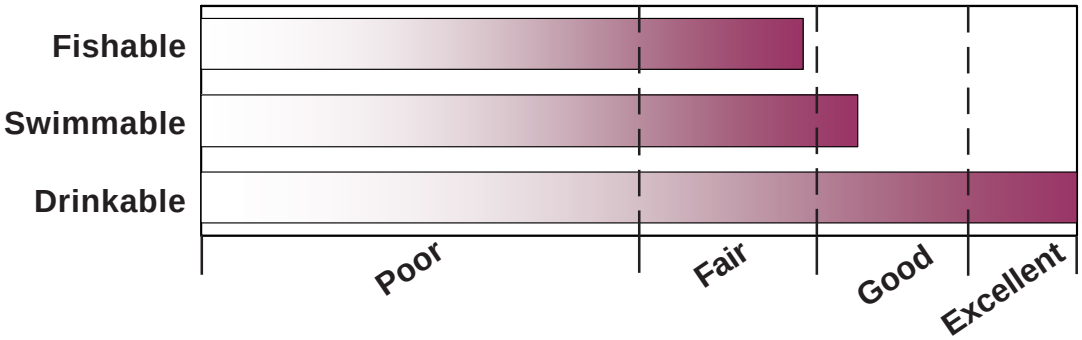
The previous indicator section examined the ambient chemical conditions in Lake Erie's water, sediment, animal tissue and the clarity of the water. The *Human Exposure Risks* indicator examines the potential of the contaminants in the environment to affect human health. This indicator assesses the quality of the lake from the perspective of fishable, swimmable and drinkable.

There are three metrics that comprise this section. The *Fishable* metric focuses on human exposure to PCBs and mercury through the consumption of Lake Erie fish. The *Swimmable* metric examines human exposure to bacteria and other pathogens by swimming at Lake Erie beaches. The potential risks associated with consuming water drawn from public water supply intakes in the lake are assessed through the *Drinkable* metric.

These metrics were presented in the 1998 report, but were all included under the overall water quality indicator as *Toxic Contamination*, *Bacterial Pollution* and *Drinking Water*. For this report, these metrics are separated from measures of ambient water quality conditions to create a distinct indicator that better measures potential risks to human health. The changes in the metrics themselves have varied since the last report. Some success has been achieved in that the *Swimmable* metric has improved to a score of ***Good***, while the *Drinkable* metric remains ***Excellent***. Only *Fishable* has received a lower score, mainly due to alterations in the way the metric data were evaluated. Overall, the *Human Exposure Risks* indicator has received a rating of ***Good***.

Although rated as good, the Lake Erie Commission and its component agencies will continue to address the issue of risks associated with pollution and bacteria in and along Lake Erie in the hopes of achieving an ***Excellent*** rating. When this occurs successfully, people will be able to enjoy the benefits of the lake as a source of food, water, and recreation with no restrictions.

Human Exposure Risks Metric Ratings



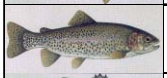
Fishable Metric

FAIR

Every year, millions of fish are caught within the waters of Lake Erie. While most of these sport fish are of high quality and a good food source, low levels of chemicals like polychlorinated biphenyls (PCBs), mercury and lead have been found in the larger fish from certain areas. The use of a fish consumption advisory as a metric is important for two main reasons. First, when fish feed on other organisms in the lake, they can accumulate the contaminant compounds present in those organisms. Therefore, the measure of toxic contamination serves as a surrogate measure for the degree of contamination throughout Lake Erie. The second reason for its use is that the advisories assess the risk posed to humans who consume contaminated fish on a regular basis over a long period of time.

Once a year, Ohio EPA issues 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 corresponding to the amount of contaminants found in the body of the given species. ODNR collects the fish samples, which are analyzed for contaminants of concern by Ohio EPA. Advisories give a recommended consumption frequency, where applicable, for each of these fish species and are intended to protect the most sensitive populations of Ohioans, women and children.

Calculation of Metric Rating

Species		Meal Frequency	Score	Fish Harvest (lbs)	Weighting Factor	Scaled Score	Contaminant
	Walleye < 23"	1 meal per week	3	1,318,670	0.20	0.60	PCBs
	Walleye >23"	1 meal per month	2	353,748	0.05	0.11	PCBs
	Yellow Perch	1 meal per week	3	3,943,800	0.60	1.81	Mercury
	Smallmouth Bass	1 meal per month	2	109,813	0.02	0.03	PCBs
	Steelhead Trout	1 meal per month	2	224,644	0.03	0.07	PCBs
	White Bass	1 meal per month	2	266,188	0.04	0.08	PCBs
	Channel Catfish*	6 Meals per Year	1	330,667	0.05	0.05	PCBs
					Final Score	2.75	***Fair***

* Does not account for the separation of catfish into two size classes. Under the advisory, channel catfish under 16" should only be eaten every other month. Catfish 16" and over fall under the "Do Not Eat" category.

The fish that were chosen for the *Fishable* metric - walleye, yellow perch, smallmouth bass, steelhead trout, white bass, and channel catfish - reflect a wide range of feeding habits and behaviors in the lake.

Scores were assigned based on the consumption advisory for each species. Each species score was weighted according to the annual harvest (in pounds), reflecting the degree of possible exposure that each species represents. Multiplying the advisory score times the harvest-weighting factor creates the individual species rating. The final rating is the sum of all the weighted species ratings.

In 2003, the overall recommendation given by the advisory was to limit fish consumption from all Ohio water bodies to one meal per week for everyone. This is a change from previous recommendations that were given only to women of childbearing age and children under six years of age. There are two major changes since the 1998 report for walleye and channel catfish. Walleye are separated into two size classes. Smaller walleye (less than 23 in.) can be eaten once per week, while larger ones (greater than 23 in.) should only be eaten once per month. Channel catfish larger than 16 in. should not be eaten at all, while those less than 16 in. can be eaten every other month (6 meals a year). Also included in the current calculation was steelhead trout, which can be safely eaten once per month.

The Lake Erie Commission has set a goal that all fish species be safe to eat and free from any consumption advisories. The overall score obtained by the most recent advisory was ***Fair***. This score is lower than the ***Good*** obtained in the last report, mainly because of the division of walleye into two size classes and the inclusion of steelhead trout.

As seen from these results, there still is a great need to decrease the amount of PCB and mercury that is accumulating in fish tissue and posing a potential human health threat. While Ohio EPA and ODH are responsible for informing the public about the degree of contamination in Lake Erie fish, efforts are needed to reduce the amount of contamination before it becomes a health factor. This can occur either by preventing the introduction of harmful compounds into the environment or by cleaning up areas where contamination has already occurred.

For more information on the Ohio Fish Consumption Advisory contact:

Ohio EPA- Division of Surface Water
Web: www.epa.state.oh.us/dsw/fishadvisory
Phone: 614-644-2160
Email: fishmail@epa.state.oh.us

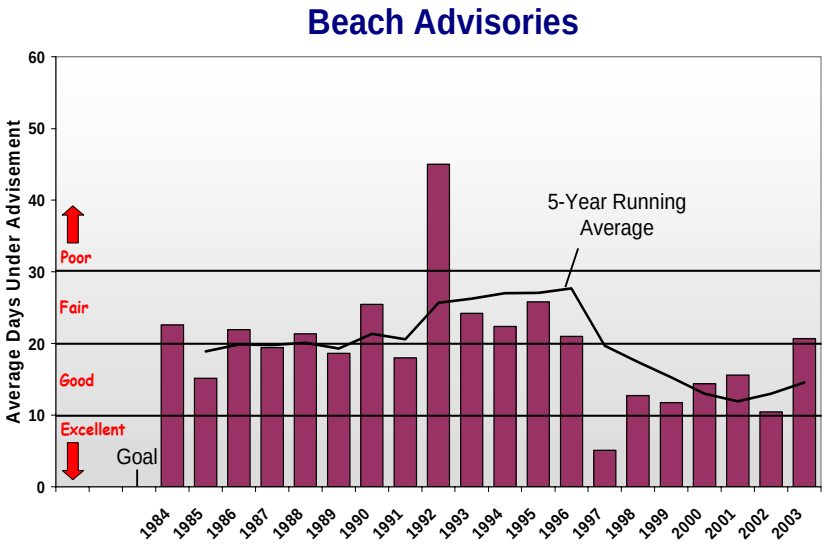
Swimmable Metric

GOOD

During the summer, thousands of Ohioans travel to Lake Erie to enjoy the numerous public beaches that dot the state's 262-mile shoreline. To ensure the health and safety of bathers, the Ohio Department of Health, in cooperation with other state and local agencies, conducts a bathing beach monitoring program. A wide variety of disease-causing microorganisms can be transmitted to humans through contact with contaminated water. Coastal waters can become contaminated through sewer overflows, storm water and agricultural runoff, boating wastes, malfunctioning home sewage systems, droppings from waterfowl and pets, and poor hygienic practices by some bathers.

The most common types of symptoms reported by bathers are flu-like in nature. Infections of the eyes, ears, nose and throat may also occur. The vast majority of the disease agents mentioned above can survive in the intestines of humans. Therefore, the determination of water quality is typically based on testing for surrogates of human fecal contamination: fecal coliform or the bacterium *Escherichia coli*.

The Ohio Department of Health began monitoring Lake Erie beaches in the late 1960s, using fecal coliform as the indicator species. In 1996, the indicator was switched to *E. coli* because it was shown to be a better indicator of potential health risks to humans than fecal coliform. If beach water quality fails to meet the standards set for *E. coli*, ODH recommends the beach be posted to advise against swimming.



*Starting in 1999, Walnut Beach, Fairport Harbor, Camp Perry, Kelleys Island, Lakeside, and South Bass Island were added to the program. Data from Ohio Department of Health

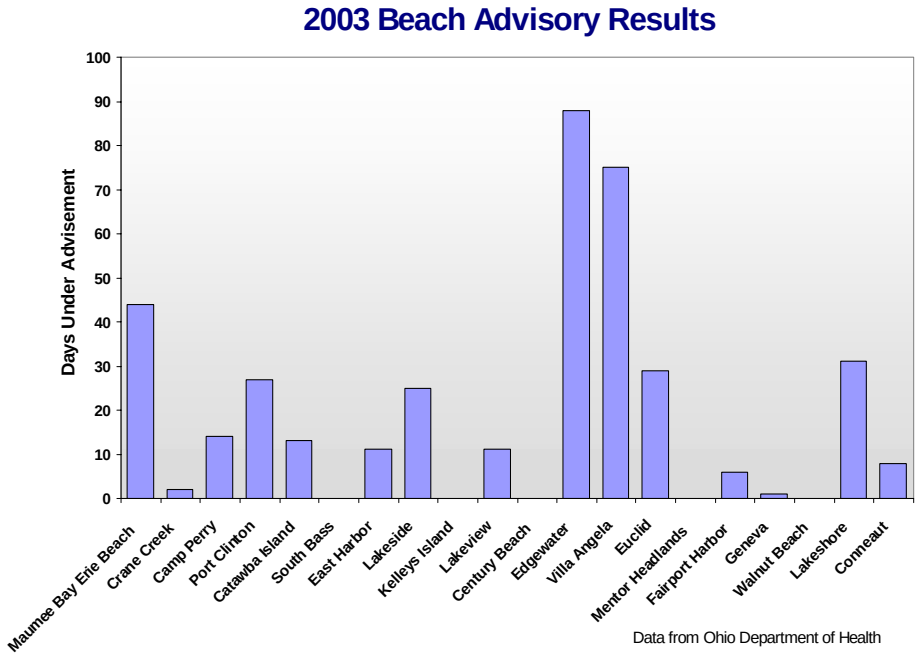
The measurement for the *Swimmable* metric is based on the number of advisories that were posted throughout the summer at 19 beaches along Lake Erie's shoreline. The Lake Erie Commission goal is to have clean beaches all the time so that advisories never have to be posted. From May to September, water samples were collected from these beaches and tested for the presence of *E. coli* bacteria.

Beach postings have been slowly decreasing as shown in the accompanying graph. In addition to sources of contaminants mentioned above, research has shown that higher bacteria counts are

also influenced by rainfall events, high winds that stir up lake sediments, and long calm periods with high temperatures. 2003 had a higher number of closings, mainly due to high rainfall during the summer and to an extended very hot spell with no wind in July. These results give a current rating of ***Good*** for bacterial pollution, an improvement on the ***Fair*** rating received in the 1998 report.

The improvement over time has come from a variety of efforts striving to reduce bacterial pollution. Sewage treatment plants have upgraded the quality of their discharge and many sanitary sewer and combined sewer overflows have been eliminated. Ohio EPA and local health districts have developed funding sources to upgrade or replace malfunctioning home sewage systems.

The Lake Erie Protection Fund has awarded several grants to investigate components that may influence bacterial contamination at public beaches, trace the sources of contaminants via genetic finger-printing, and develop predictive models that can be used by beach managers to determine the probability that bacterial concentrations will exceed a particular value. All of these projects will continue to make Lake Erie's beaches safer for everyone.



For more information on bacterial pollution contact:
Ohio Department of Health
Web: www.odh.state.oh.us
Phone: 614-466-1390
Email: BEH@gw.odh.state.oh.us

EXCELLENT

Drinkable Metric

Lake Erie is an exceptional source of high quality drinking water. The supply is abundant and the concentrations of contaminants in the raw water are relatively low. In the Ohio Water Quality Standards, Lake Erie is designated as an exceptional warm water habitat and public drinking water supply. These are waters that, with conventional treatment, will be suitable for human consumption and meet state and federal criteria for drinking water.

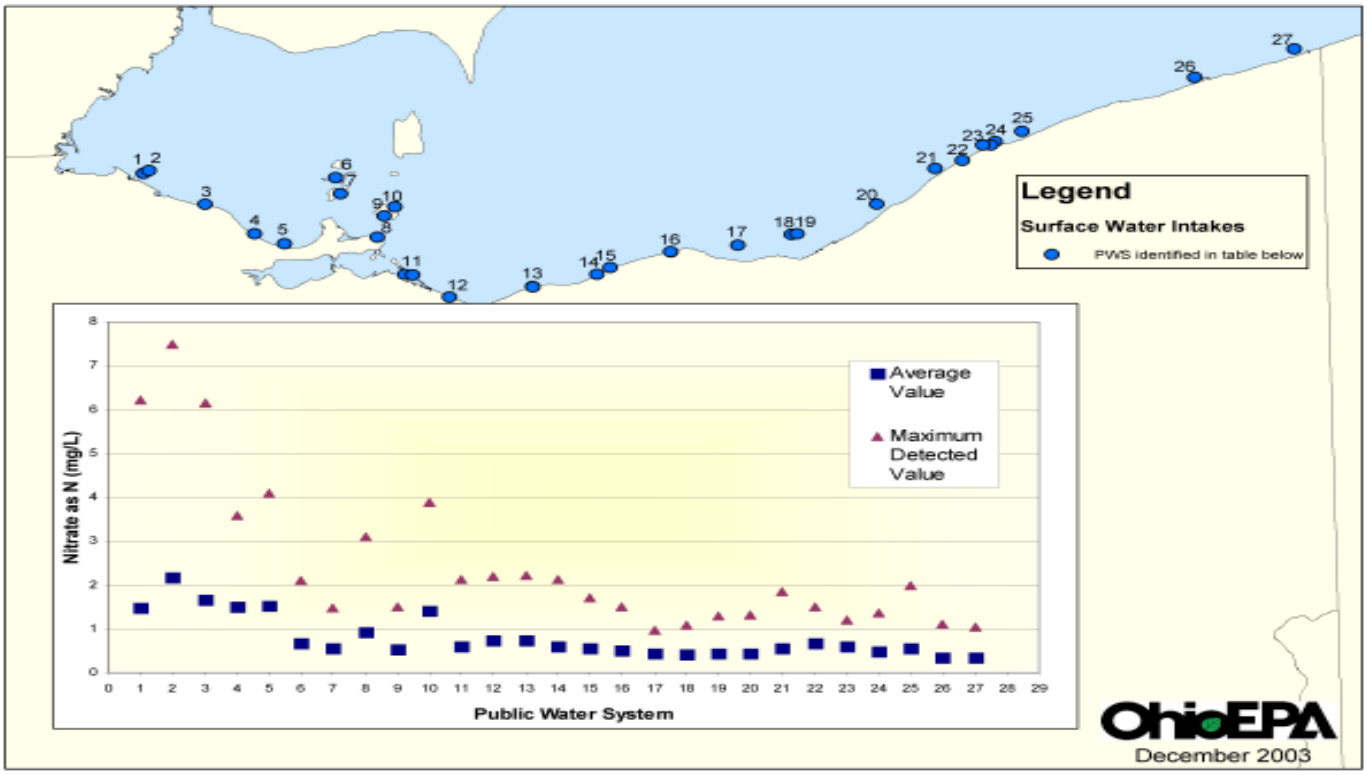
Due to limited raw water data at water supply intake locations and the extensive database of treated water data (Ohio EPA compliance database), treated drinking water quality data has been used to construct the *Drinkable* metric. All water treatment plants must meet drinking water standards, maximum contaminant limits (MCLs), that apply to finished drinking water. For this metric, violations of the primary MCL contaminants were evaluated. Ohio EPA is currently preparing a methodology to evaluate the public drinking water supply designated use and is proposing to use a combination of raw source water quality, treated water quality and violations of the primary MCLs. Subsequent updates of this report will use this methodology to derive the *Drinkable* metric.

Water treatment plants are required to monitor treated water for nearly 90 chemical constituents (organic chemicals, metals, pesticides, and disinfection by-products) and disease-causing microorganisms, for which MCLs have been established. Numerous other physical parameters, such as pH and turbidity, which may impact treatment operations, are also measured. Of the 27 lake-fed water treatment plants on Ohio's North Coast, none of these plants have measured contaminants in their treated water that resulted in a violation of a maximum contaminant level that can be related to the source water quality of Lake Erie.

One of the most commonly detected contaminants in finished drinking water is nitrate. While no nitrate MCL violations occurred at Ohio water systems using Lake Erie, seasonal values have been detected near 75% of the nitrate MCL of 10 milligrams per liter in finished water from the water systems with intakes located near the outflow of the Maumee River. The figure on the next page presents nitrate data for each of the public water systems along the Lake Erie shoreline. The plots were composed with nitrate detections from treated water samples from Ohio EPA's compliance database for the past five years (1999-2003) and show the average of all values, along with seasonal highs.

In addition, periodic or seasonal taste and odor problems have occurred at some water treatment plants, due largely to blue-green algae blooms and/or zebra mussels. Taste and odor problems also sometimes occur when unusual weather conditions allow bottom waters and sediments to enter the water intake area. These problems are typically controlled by the addition of activated carbon treatment at the plant.

Currently, all of the water treatment plants using Lake Erie as source water are meeting primary maximum contaminant limits for finished drinking water. Based on all of the above information, the rating earned for drinking water is ***Excellent***.



Public Water System Map Identification		
1. City of Toledo	10. Camp Patmos	19. Baldwin-Cleveland
2. City of Oregon	11. City of Sandusky	20. Nottingham-Cleveland
3. Carroll Water & Sewer	12. City of Huron	21. Lake County- West
4. OH ADJGN Camp Perry	13. City of Vermilion	22. Cons. Ohio-Mentor
5. Ottawa County Regional	14. City of Elyria	23. City of Painesville
6. Lake Erie Utilities Comp.	15. City of Lorain	24. Village of Fairport Harbor
7. Village of Put-in-Bay	16. City of Avon Lake	25. Lake County- East
8. Village of Marblehead	17. Crown-Cleveland	26. O.A.W.C- Ashtabula
9. Village of Kelleys Island	18. Morgan-Cleveland	27. City of Conneaut

For more information on drinking water contact:
Ohio EPA- Division of Drinking and Ground Waters
Web: www.epa.state.oh.us/ddagw
Phone: 614-644-2752

Pollution Sources Indicator

FAIR

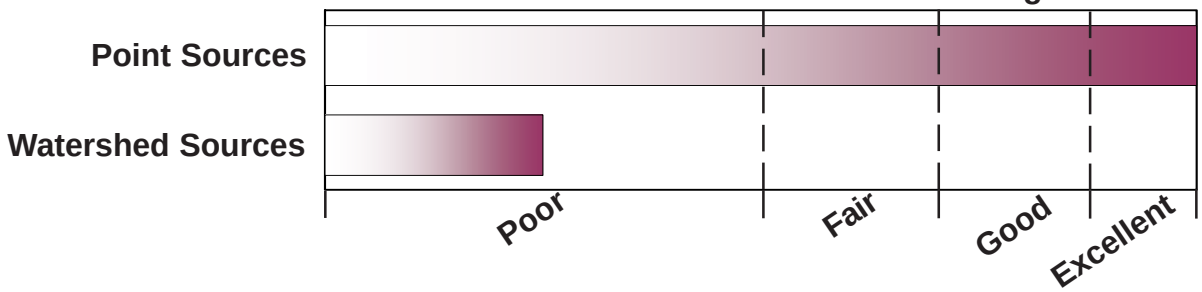
Lake Erie has improved considerably from the 1970s when mats of floating algae and problems with odor and poor aesthetics were all too common. However, problems with pollution continue to this day. Point sources are largely under control, but nonpoint sources continue to be significant as seen by the image of a sediment plume below. These plumes frequently occur in the watershed's larger tributaries following heavy rain events. Increased sediment in the lake leads to poor water clarity, changes habitat conditions and interferes with fish reproduction and primary productivity.

The *Pollution Sources* indicator is comprised of metrics examining *Point Sources* and *Watershed Sources*. The *Waste Site Leakage* metric originally proposed in the 1998 report has been dropped. Waste site leakage, while causing some major localized impacts, is not a significant source of contaminants to Lake Erie. The *Urban Nonpoint Source* metric will eventually include a measure of combined sewer overflow and storm water runoff loading, but has not been developed yet. An *Atmospheric Source/Deposition* metric discussed in the 1998 report has also not been developed yet. Although urban nonpoint sources and atmospheric loading and deposition are significant sources of pollution, insufficient data exist at this time to reliably discern trends or devise goals for these areas.

The two metrics that are included in the *Pollution Sources* indicator show completely different, yet not unexpected, results. For the most part, point sources of pollution have been greatly decreased in the Lake Erie watershed and rate ***Excellent***. Watershed sources of pollution particularly from agriculture, streambank erosion, and construction site runoff continue to be the primary cause of degradation to Lake Erie, rating ***Poor***.

The overall rating for the *Pollution Sources* indicator is ***Fair***. With increased efforts to reduce watershed sources of pollution and the continued success of Ohio's point sources programs, the rating for this indicator can be expected to continue to improve in the future.

Pollution Sources Metric Ratings



Point Sources Metric

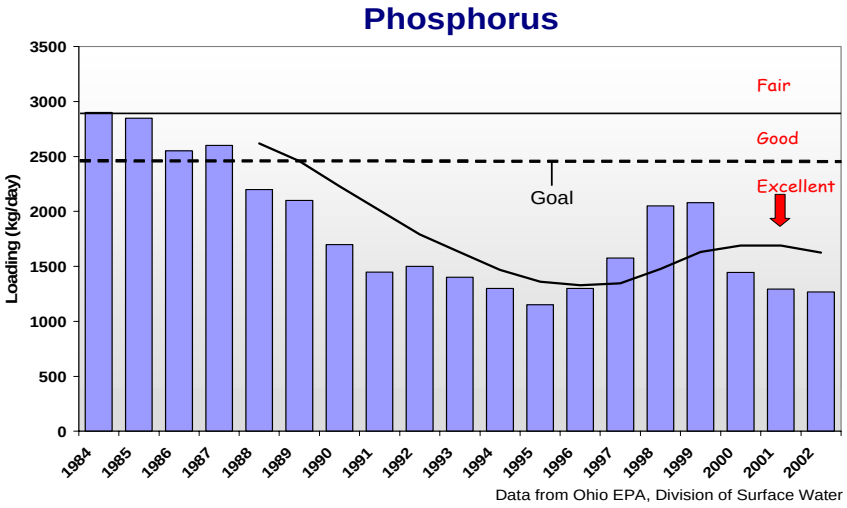
EXCELLENT

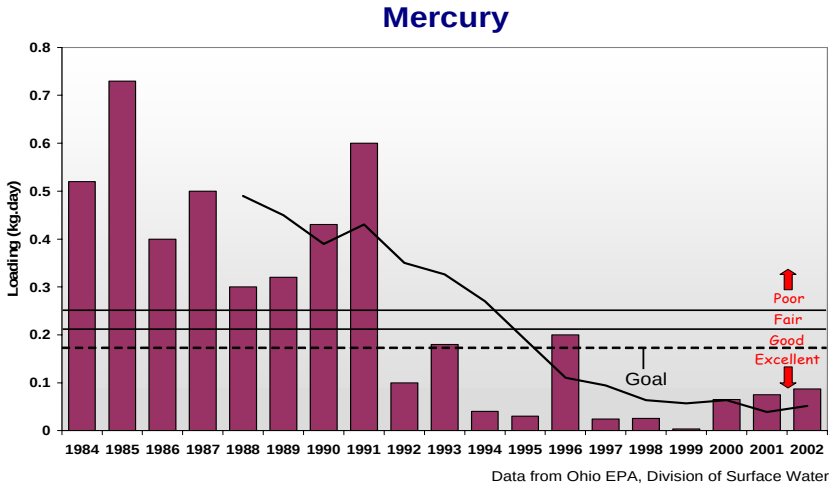
For the last 30 years, there have been significant improvements in the reduction of point source pollution entering Lake Erie. Prior to 1972, point source pollution was a major contributor to the poor health of the lake, as there were few limits on what industries, municipal wastewater treatment plants, and other point sources could release in their effluent.

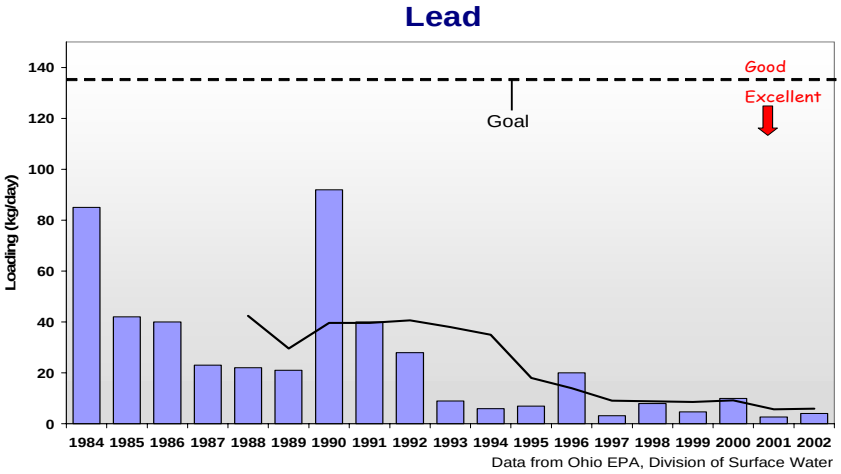
Since the passage of the Clean Water Act, however, these facilities have been required to obtain permits under the National Pollutant Discharge Elimination System (NPDES). These permits regulate the amount of pollutants that can be released into the waters of the United States. The discharge limits were developed using water quality standards, modeling, mathematical calculations and best available treatment technologies. Permits are reviewed and renewed every five years to ensure that the most current technological and research advances are implemented in order to minimize discharges and keep waters clean.

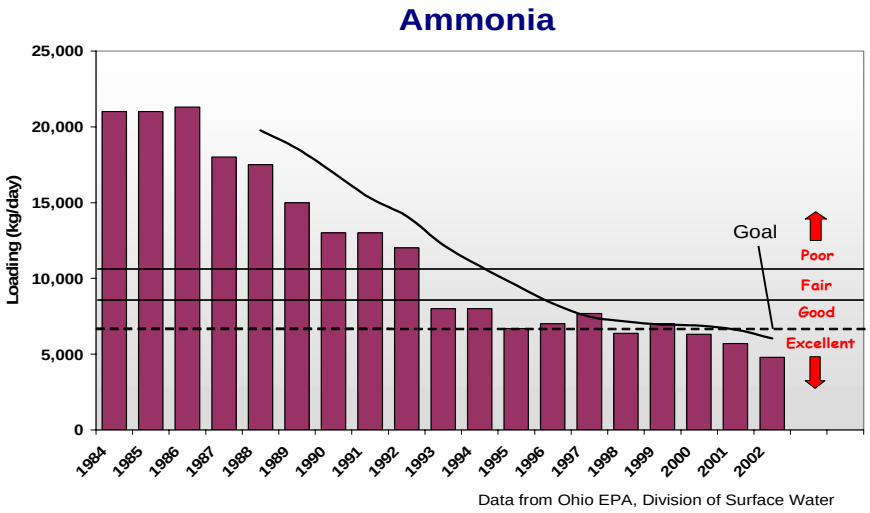
The *Point Sources* metric looks at the loading of phosphorus, mercury, lead, ammonia, and biochemical oxygen demand into Lake Erie from all major Ohio dischargers in the basin. A major discharger is one that releases more than one million gallons of wastewater per day, or has been identified as a significant source of a particular pollutant.

Phosphorus is considered to be the most important of these pollutants because of its role as a limiting nutrient in Lake Erie. When too much of it is present, the result is often over-enrichment, which can lead to algal blooms and low dissolved oxygen levels. Sewage





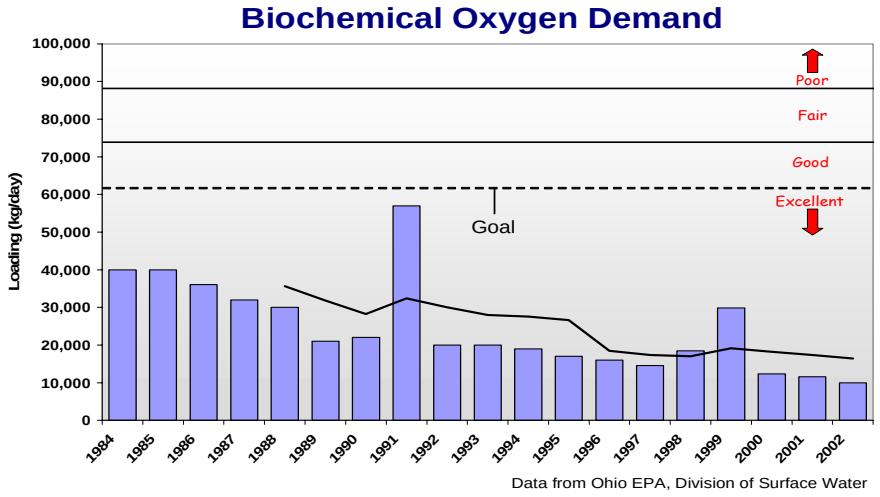




treatment plant discharges are a much larger source of phosphorus than industrial dischargers.
Mercury and lead are often by-products of industrial processes and can cause harm to fish and wildlife populations as well as humans.

Ammonia nitrogen is the result of industrial as well as sewage treatment plants and can be very toxic to aquatic communities when discharged in elevated concentrations.

Biochemical oxygen demand (BOD) is a measure of the amount of dissolved oxygen needed to decompose organic matter in water. It is an indication of pollution because heavy organic waste loads have a high demand for oxygen.



The rating for the metric was determined by comparing the total daily average loading allowable under the NPDES permits with the actual total daily average loading. The goal is to have all of the actual loads meet or be less than the allowable load.

As seen by the graphs, the loading limits for each of these pollutants are currently being met, giving a rating of ***Excellent*** to this metric. This is an improvement over the score that was received in 1998, in which only three of the pollutants were meeting their goals. In the future, this rating is expected to remain the same due to the continued success of the NPDES program.

For more information on point source loading contact:
Ohio EPA- Division of Surface Water
Web: www.epa.state.oh.us/dsw
Phone: 614-644-2001

POOR

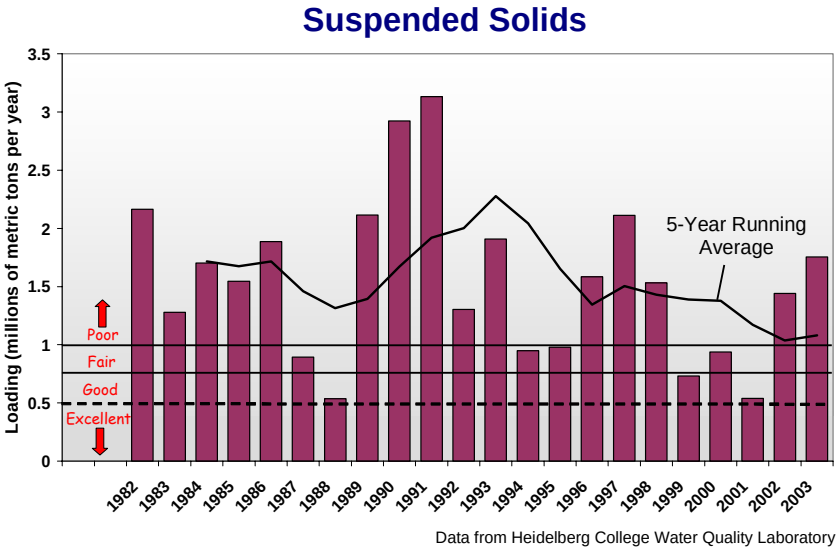
Watershed Sources Metric

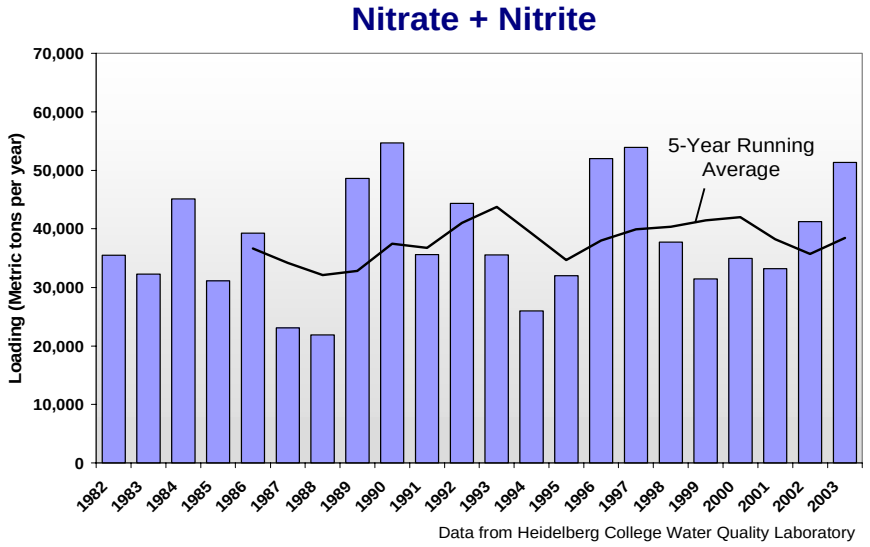
Nonpoint source pollution has the largest impact on Erie. Pollutants such as sediment, phosphorus, nitrate and pesticides can influence the health of the lake by altering water clarity, nutrient cycling, and organism life cycles.

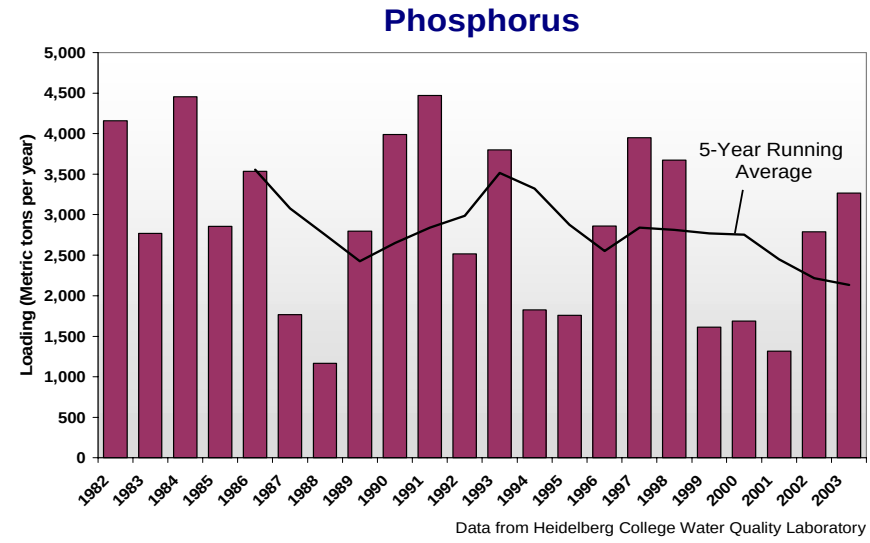
The *Watershed Sources* metric is based on sediment loading in the Maumee, Sandusky, Cuyahoga, and Grand Rivers as measured by the Heidelberg College Water Quality Laboratory. The Lake Erie Commission has set a goal of 0.5 million metric tons of suspended solids per year entering the lake from these rivers. Loadings from other important pollutants such as nitrate + nitrite, phosphorus, and atrazine are also shown, but not scored due to their close association with sediment loading or the absence of any established goals for their reduction.

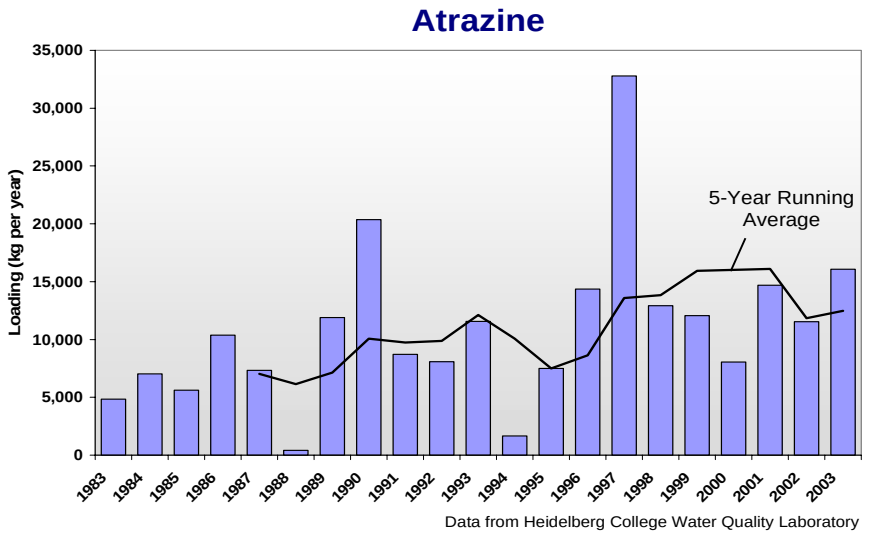
As seen by the following graphs, loading from these pollutants fluctuates a great deal from year to year. For the most part, this reflects the influence of weather, particularly the timing and intensity of storm events relative to the agricultural cycle. Intense storms that occur at times when fields 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.

The four tributaries and the shown parameters tend to oscillate in a linked manner: a high loading year for one tributary and one parameter tends to be a high loading year for all tributaries and all parameters. 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. In addition, the finer soils associated with the lake plains in the western Lake Erie drainage basin are conducive to higher loadings of fine-grained sediment and the phosphorus that is attached to it.









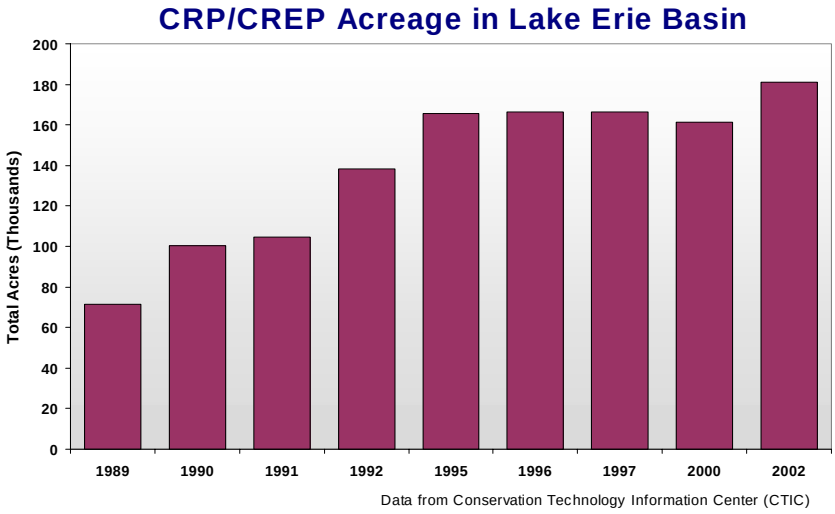
Given the recent renewal of interest in the nutrient status of Lake Erie, it is important to note that the last decade began with three years of relatively low to moderate loads of sediment and nutrients into Lake Erie. This was followed by two years of relatively high loads, especially from the Maumee and Sandusky, and then three years of relatively low loads.

The two high load years (1997 and 1998) have been suggested as one possible cause of higher phosphorus concentrations and renewed anoxia in Lake Erie. These years of high loads primarily reflect weather impacts, and most likely do not reflect a failure of conservation measures. This interpretation is supported by the return to relatively low loads in 1999-2001.

Using a 5-year running average to smooth out variations, the current suspended solids loading to the lake is 1.1 million metric tons per year. This metric is still rated as ***Poor*** even though it is less than the 1.5 million tons reported in the 1998 report.

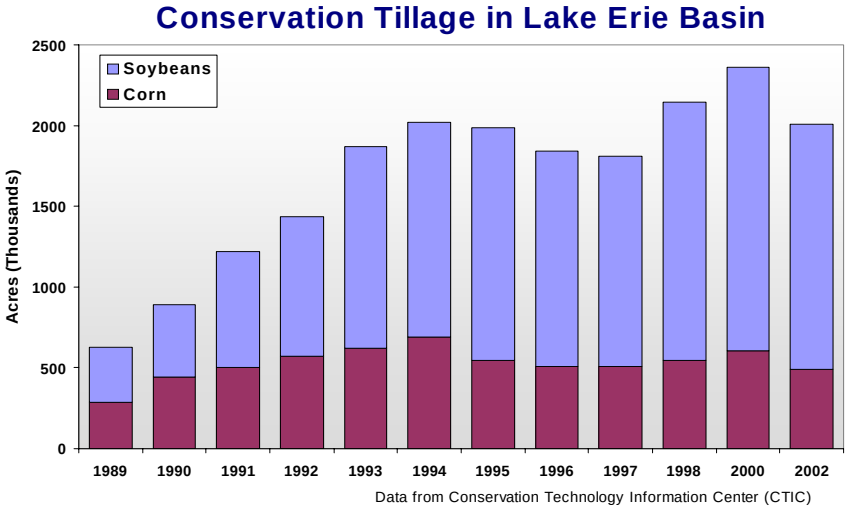
In order to reduce the impacts of watershed sources of pollution to Lake Erie, the annual sediment loading needs to be decreased by approximately 55%. One of the key methods of achieving this reduction is through the use of buffer strips. Buffers are small areas or strips of land that are placed in permanent vegetation along ditches, streams, and tributaries in the Lake Erie watershed. When they are used, buffers reduce nutrient and pesticide runoff, sediment loadings, and

pathogen loadings. These reductions lead to control of erosion, improved water and stream quality, enhanced wildlife habitats, and increased plant and animal diversity.



In 2000, the Ohio Lake Erie Buffer Team was established to market various government assistance programs that deal with the use of buffers in the Lake Erie watershed. This group consists of over 25 federal, state, local, and private agencies. The goal of the Ohio Lake Erie Buffer Team is to enroll 50,000 acres of new conservation buffers into available conservation reserve programs by the end of 2005.

The federal Conservation Reserve Program (CRP) provides incentives for farmers to adopt practices to reduce nonpoint source runoff. An additional program, the Lake Erie Conservation Reserve Enhancement Program (CREP) is a federal/state-combined effort to further increase incentives for installation of buffer strips and other conservation methods. As seen in the accompanying graph, the amount of acreage in both the CRP and CREP programs has increased in the last fourteen years.



Conservation tillage is another means of addressing nonpoint loading into Lake Erie's tributaries. By incorporating conservation residue management practices such as no-till, ridge-till, mulch-till, and reduced-till in crop production, the amount of soil erosion coming from these fields can be greatly reduced. In recent years, there has generally been an increase in the amount of land that is farmed under these practices, with 2 million acres in conservation tillage in 2002.

For more information on watershed loading contact:

ODNR- Division of Soil and Water Conservation
Web: ohiodnr.com/soilandwater
Phone: 614-265-6610
Email: dswc@dnr.state.oh.us

Ohio EPA- Division of Surface Water
Web: www.epa.state.oh.us/dsw
Phone: 614-644-2001

Aquatic Habitat Indicator

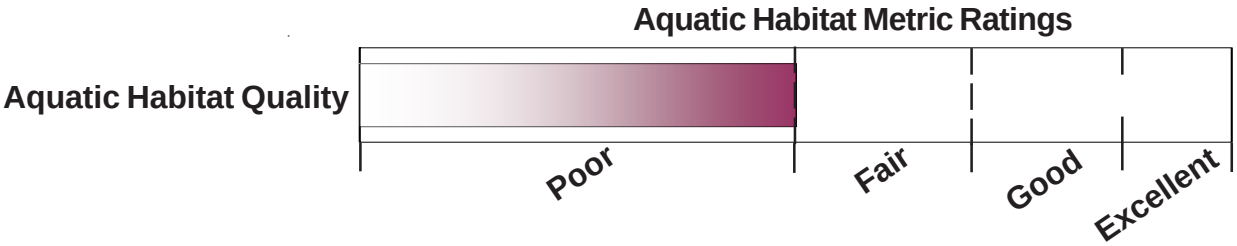
FAIR

The issue of habitat, its quality and quantity, continues to grow in importance in Ohio as it does throughout the world. Lake Erie is no exception to this trend as human populations increase their demands on limited resources. Projects that alter or replace natural habitats in the basin continue to occur. Streams are still being channelized or dredged, wetlands are still drained or filled, and shorelines (both lake and stream) are being hardened. On the other hand, positive activities are also taking place. New habitat is being created, damaged habitats restored, and some existing natural habitats protected.

Although habitat is typically different for every organism, in this report the quality of fish habitat is used as a surrogate measure for all others. Habitat evaluations are done using data gathered by the Ohio Environmental Protection Agency from the lake itself and all of the lake's major tributary basins in Ohio. Unlike the 1998 version, this report uses only Ohio EPA generated data to score the *Aquatic Habitat Quality* metric. Previously, wetland acres were included, but have been moved to the *Land Use* section of this report. In addition, all free-flowing portions of tributaries above the lake effect are included, thus expanding the assessment to the entire basin. Dropped from the report is consideration of dams on streams, as no change has occurred in this habitat variable. Dams of little or no functional use continue to exclude Lake Erie fish from vast areas of spawning habitat.

Most remaining high quality wetlands have been diked off, preventing access by Lake Erie fish and consequently decreasing habitat quality. However, it must be recognized that in the absence of dikes, these wetlands would have the same low habitat quality as the mud flats of Sandusky Bay, Huron River, and other shallow stream mouths in the basin. Creative methods of controlling fish immigration to wetlands are currently being investigated. If successful, these efforts could result in significant improvements in Lake Erie's Northern Pike and Muskellunge populations, along with other species that spawn and live in vegetated waters.

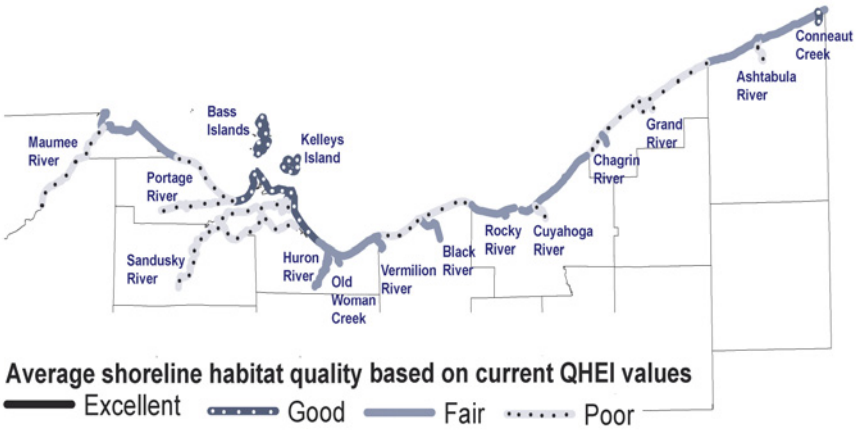
It is hoped that future habitat assessments will be able to show improvements, but at present it is not anticipated that any considerable improvements will be seen in the next decade as significant changes in land use practices are not occurring.



Aquatic Habitat Quality Metric

FAIR

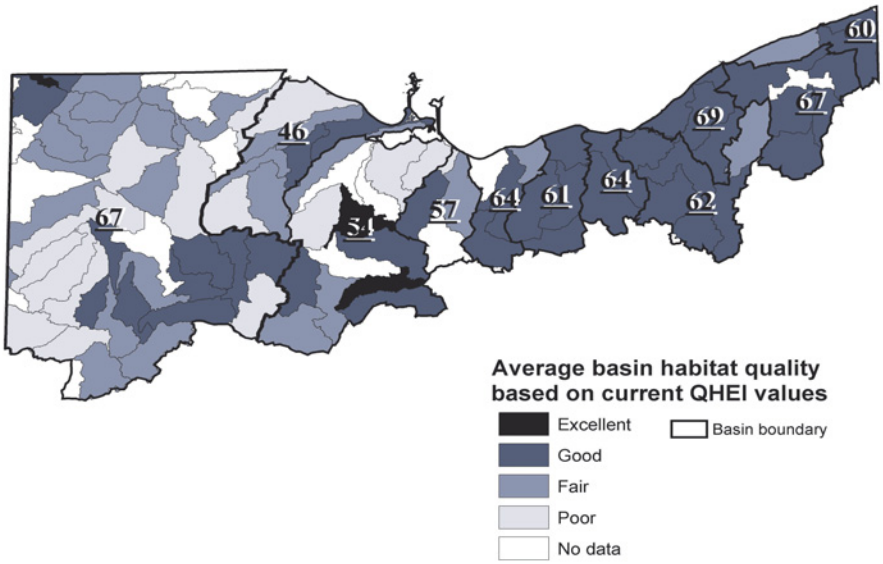
The Ohio EPA uses a habitat evaluation method known as the Qualitative Habitat Evaluation Index (QHEI). There are two evaluation forms used, one for rivers and streams and one for Lake Erie's shoreline and freshwater estuaries (lake affected portions of river mouths). Rivers and streams are evaluated on their substrate (material on stream bed) quality, suitable cover for fish, channel morphology (shape), nearby land use, and riffle/pool structure. Lake Erie habitats are evaluated based on their substrate quality, suitable cover for fish, shoreline morphology, nearby land use, and aquatic vegetation quality.



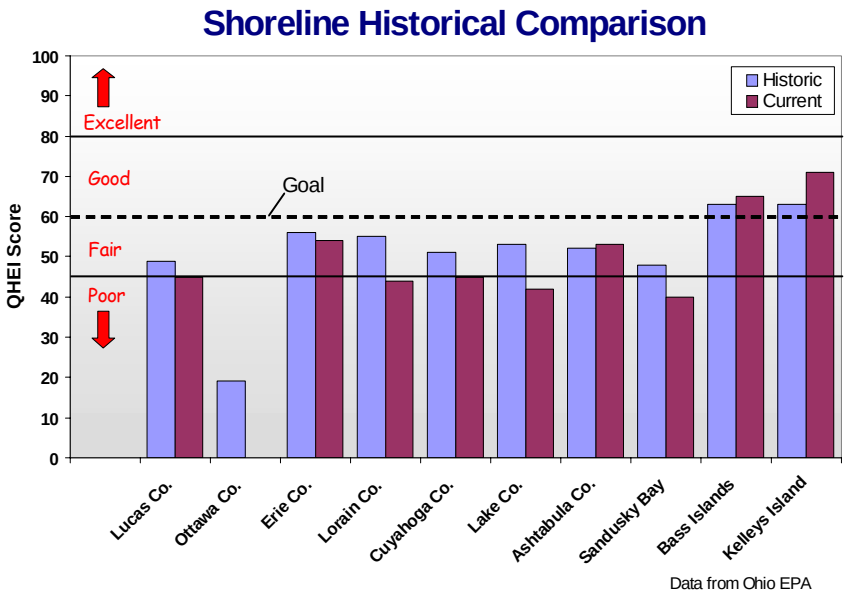
The 2004 assessment differs from the 1998 report in that shoreline habitats are assessed with a newly developed QHEI tailored specifically for Lake Erie. In addition, all rivers above the lake effect zone are evaluated (using the River/Stream QHEI methodology). Scores for each of these areas greater than 80 are considered ***Excellent***, 60-80 ***Good***, 45-60 ***Fair***, and less than 45 are ***Poor***.

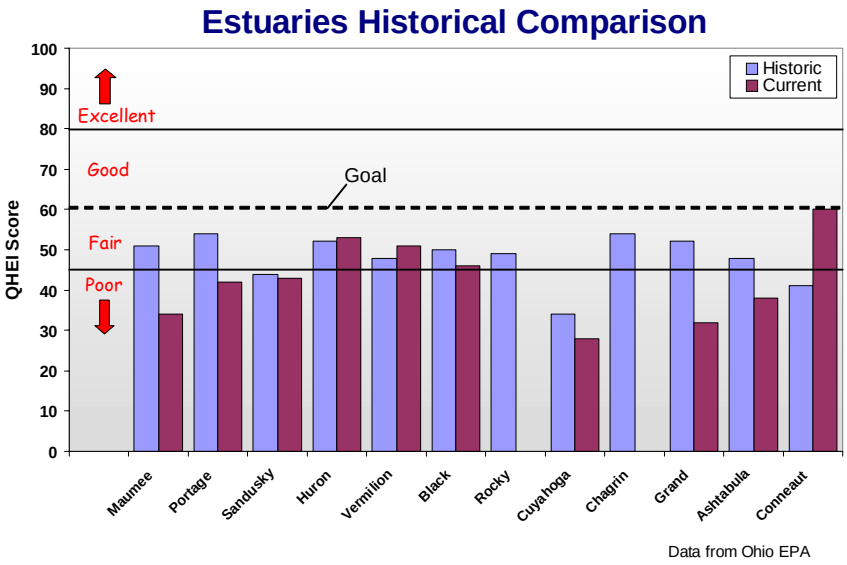
Current conditions in rivers and streams on average are ***Good***. Since these water bodies were not previously assessed no trends are being reported. The lake shoreline on average ranks ***Fair***, displaying no change since the 1998 report. Estuaries have declined to ***Poor***.

The newly developed Lake Erie QHEI scores most of low quality shoreline areas lower than the previous report and high quality areas higher. It is to be expected that a more sensitive evaluation method would give greater separation between high and low quality areas.



The general low quality of shoreline habitat is primarily due to the high degree of human induced disturbance in the area. Some portions of Lake Erie's shoreline have been 100% modified by dikes





and shoreline armoring. There is currently little remaining of the natural physical environment on Lake Erie's shores except around the Bass Islands and Kelleys Island. Though shore stabilization can be achieved in ways that minimize destruction of or enhance habitat quality, these approaches have been little used historically.

A return to healthy habitat conditions in the Lake Erie basin, especially on shorelines, will require land owners to work in cooperation with government and conservation organizations. Past efforts have been dominated by individual projects that have not been coordinated with adjacent land owners, nor designed to minimize destructive habitat alterations. It is ironic that the least environmentally friendly designs are frequently the most likely to fail in a shortened period. Proper design with environmentally sensitive considerations would result in less expensive and more durable structures. Most wetlands that have been diked for their protection are now effectively eliminated as habitat for Lake Erie's fishes. Slight modifications in structure and management could open these wetlands to a multitude of fish species that could then use them for critical life history stages such as spawning and nursery areas.

Scoring of Aquatic Habitat Quality Metric			
	Score	Weighting	Weighted Score
Shoreline	2	0.33	0.67
Estuaries	1	0.33	0.33
Rivers	3	0.33	1.00
		Rating	2.00 *Fair*

For more information on nearshore habitat contact:
Ohio EPA
Web: www.epa.state.oh.us
Phone: 614-644-3020

Land Use Indicator

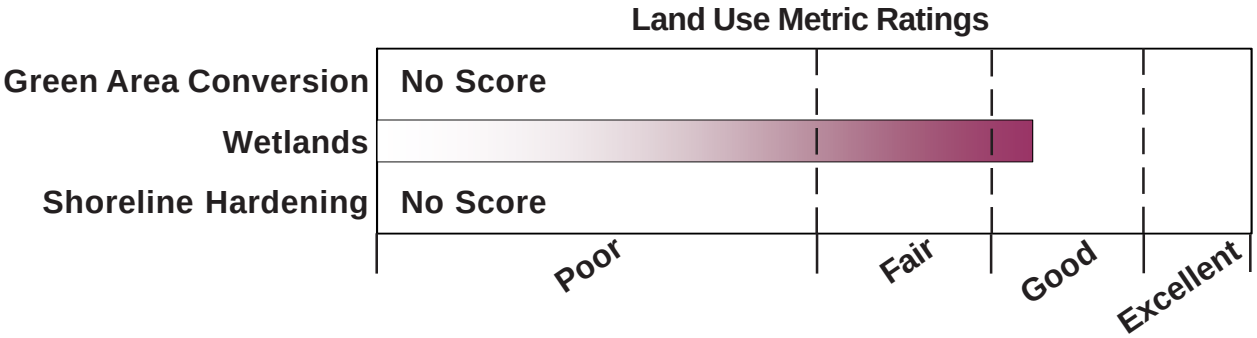
NO SCORE

Land use is considered by many to be one of the most important and controversial areas affecting the health of Lake Erie today. Even though conversion of the natural forests, wetlands and prairies to farmland and urban areas has helped Ohio to establish a thriving agricultural and industrial based economy, it has also had a negative impact on the lake's ecosystem. The continuing trend to further convert farmland to residential areas is creating additional impacts.

Addressing the land use issue is difficult due to the many stakeholders involved. While development is needed to ensure a high quality of life for the citizens of the region, the consequences of the decisions that go into making this development happen need to be taken into account. This is especially true in regard to alterations in the natural hydrology and impacts on historical, social, and cultural resources. Finding a balance between use of the watershed's natural resources and long-term conservation of those same resources is a delicate process that is currently the focus of several projects underway in the state.

Three metrics were developed to address land use in the Lake Erie watershed. The *Green Area Conversion* metric examines changes in natural areas into more urbanized areas over time. Data for this metric has not been updated since 1994. The *Wetlands* metric rates efforts in the watershed to protect and restore these areas. The final metric in this section is *Shoreline Hardening*. It evaluates the effectiveness of shoreline protection structures in preventing erosion, along with biological compatibility, but is unscored. Although the *Wetlands* metric is scored, it alone does not provide an overall picture of land use in the Lake Erie watershed. Therefore, the *Land Use* indicator is unscored.

Updates to the *Green Area Conversion* metric in the next *Lake Erie Quality Index* will help to quantify the important role that land use plays in the Lake Erie watershed and provide direction for future efforts.



Green Area Conversion Metric

NO SCORE

Ohio's Balanced Growth Initiative

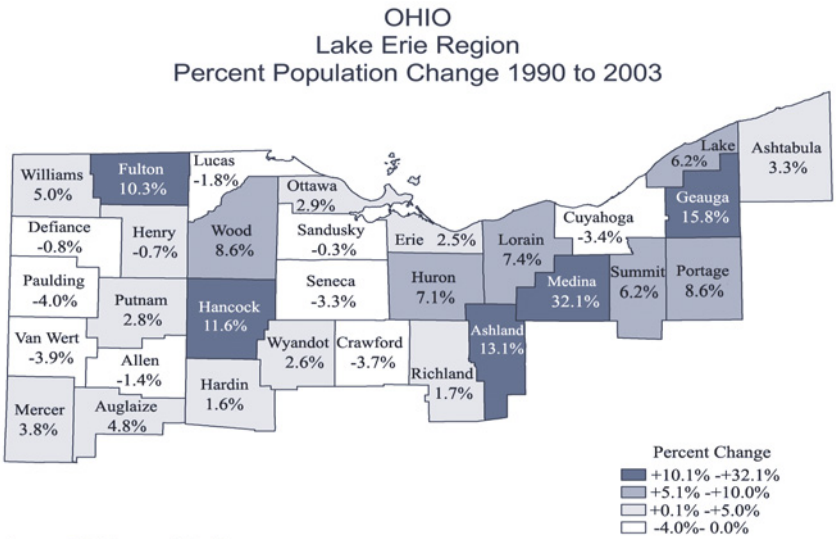
To address the problem of green area loss, the Lake Erie Commission appointed a Balanced Growth Blue Ribbon Task Force in 2001. Balanced Growth is a strategy to protect and restore Lake Erie and its watersheds to assure long-term economic competitiveness, ecological health, and quality of life. The task force, consisted of a wide range of constituencies, including property owners, government officials, business leaders, conservationists, academia, agriculture, and other stakeholder groups. The result of this process was a recommended incentive-based program to focus development and conservation in appropriate areas in the Lake Erie Watershed.

Changes in land use over the last 200 years have drastically altered the landscape in the Lake Erie watershed. Of the 11,649 square mile area in the watershed, over 78% has been altered from its original state. While much of this conversion may have been necessary to support human populations, this loss poses severe challenges for sustaining a healthy ecosystem. Green areas provide habitat for many organisms and also help in storm water management, pollution reduction, and other key functions.

The *Green Area Conversion* metric is based on the amount of natural areas including forests, agricultural lands, wetlands, and scrub that have been converted to urban areas. The map showing land uses in the watershed (see inside back cover) was produced using Landsat MSS Data from 1994. This is the same data used in the last report under the *Land Use* metric. From 1974-1994, about 62,000 acres of new urban areas appeared in the Lake Erie watershed. The amount of land within the urban category was 320,000 acres or 4.3% of the total area. Agriculture accounted for 72% of land use, with 20% being wooded or shrub areas.

Due to a lack of understanding regarding land use characteristics required to sustain the watershed, much less a plan on how to accomplish any needed change, no metric for rating land use was developed by the Lake Erie Commission in 1998. There have been no new updates to land use and conversion trends in the Lake Erie watershed since 1994. For this reason, this metric will remain unscored. It is expected that this data will be updated for the next *Lake Erie Quality Index*.

Although no new information is available regarding the exact amount of land that is lost to urbanization in the watershed, the impacts of this conversion is still apparent. To change this trend, it is thought that there needs to be a new focus on land use and development planning in the major river tributary watersheds of Lake Erie. The goal would be to link land-use planning to the health of watersheds.



Source: U.S. Bureau of the Census

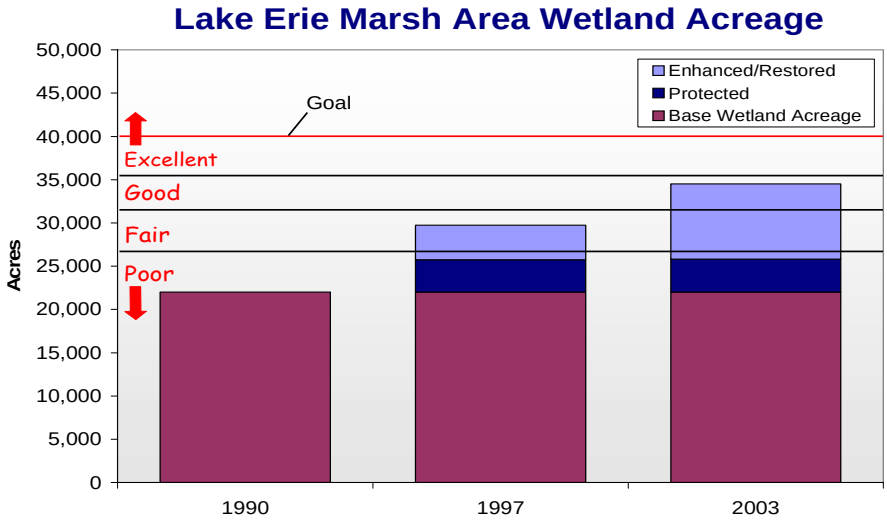
For more information on land use mapping contact:
ODNR- Div. of Real Estate & Land Management
Web: ohiodnr.com/realm
Phone: 614-265-6395
Email: realm@dnr.state.oh.us

For more information on Balanced Growth contact:
Ohio Lake Erie Commission Office
Web: www.epa.state.oh.us
Phone: 419-245-2514
Email: lakeeriecommission@ameritech.net

GOOD

Wetlands Metric

The last couple of centuries have brought about a great decrease in the amount of wetlands existing in the state of Ohio. This loss has been caused by land use changes, urban development, water level fluctuations, the introduction of exotic organisms, water quality changes, shoreline stabilization, and the loss of hydrologic connections. When wetlands are lost, there can be harmful consequences for organisms that live in them, because these habitat areas are important for fish reproduction, growth and survival of young fish, and as feeding areas for a wide variety of species.



The *Wetlands* metric is based on efforts to reverse the trend of wetland loss within the Lake Erie marsh area. In the 1998 report, the goal was to conserve an additional 18,000 acres of productive wetland habitat by the year 2000 in the Lake Erie marsh region from Toledo to Sandusky. As of 1997, only 7,755 acres of the goal had been placed under protection, giving a total of about 30,000 acres in the area and equal to a rating of ***Fair***. No complete inventories have been made to the total wetland acreage in the Lake Erie region since that time. However, it is known that from 1998-2003 Ducks Unlimited and the Ohio Department of Natural Resources have protected another 70 acres and restored/enhanced 3941 acres. Another 766 acres have been restored through the CRP and CREP programs. Although these numbers do not include all wetland protection and restoration projects in the area, they are enough to raise to rating for this metric to ***Good***.

The future health of wetlands is a current focus of ODNR and Ohio EPA. In 1999, the two agencies combined efforts to develop wetland mitigation and restoration strategies. The goal of the project was to develop a plan that identified priority areas throughout Ohio for the development of wetland mitigation and restoration projects. *The Ohio Wetland Restoration & Mitigation Blueprint* that was established as a result describes the current wetland status and trends in Ohio. It also outlines an integrated planning process to be used to identify those critical wetland areas that need to be protected and restored.

For more information on Lake Erie wetlands contact:

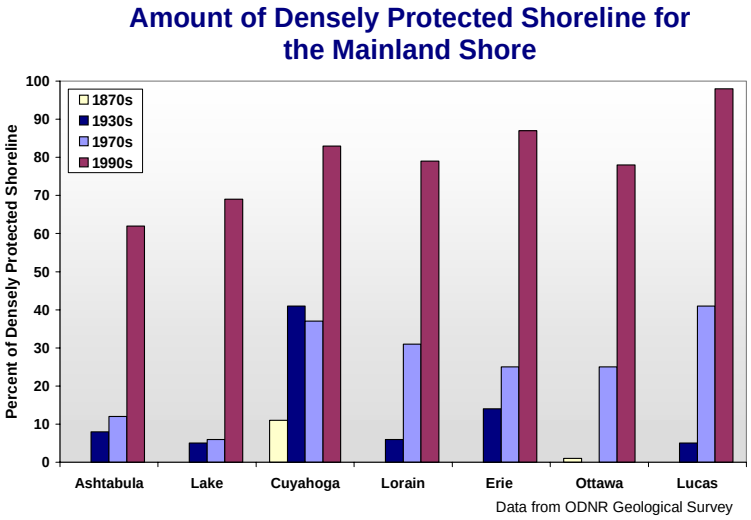
ODNR, Div. of Wildlife- Crane Creek Research Station
Web: ohiodnr.com/wildlife
Phone: 419-898-0960

U.S. Fish & Wildlife Service
Web: www.fws.gov
Phone: 614-469-6923

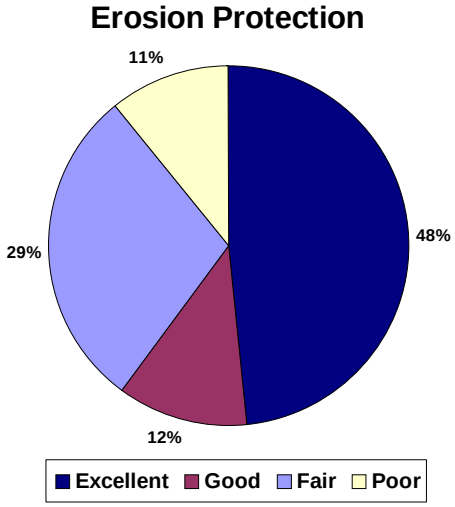
Shoreline Hardening Metric

NO SCORE

The Ohio shoreline of Lake Erie is 262 miles long and is one of the most developed and structurally protected in the Great Lakes. Structural protection began in the early 1800s with the development of harbors, which were designed as aids to waterborne navigation. Although the harbor protection structures allowed river mouths to stay open by reducing littoral sediment transport into the river mouths, the adjacent, downdrift shoreline was deprived of sand. Since sand acts as natural shoreline erosion protection, the loss of littoral sediment accelerated shoreline erosion in these areas. To combat this erosion, lakeshore property owners began armoring the shoreline. However, because each artificial structure can create erosion downdrift of the structure, the affected shoreline, in turn, requires armoring to mitigate the ravages of wave energy directly breaking on the shoreline and bluff as opposed to dissipating along a beach. This "domino effect" of erosion and shoreline armoring continues to this day.



Changes in the density of shoreline armoring along the Ohio coast have been documented since the 1870s. Increasing trends toward a densely armored shoreline since that time indicate that Ohio's coast is approaching a 100% density of armored shoreline at an alarming rate. This forecasted trend is anticipated because private citizens and public entities naturally want to protect their shoreline from erosion. In light of these facts, important questions remain about whether erosion protection structures are effectively protecting the shoreline and how much impact the structures are imparting on nearshore habitat.



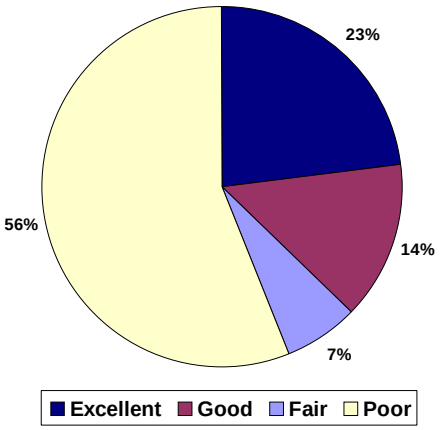
The *Shoreline Hardening* metric, based on measurements of erosion control effectiveness and biological compatibility, attempts to answer these questions. Because no goals have been set on how much of the shoreline can be densely armored while still maintaining a healthy biological community, this metric will not be scored.

The type and the composition of shore structures were first analyzed for erosion protection. The trends for the mainland shore and the open lake islands (Kelleys, South Bass, Middle Bass, and North Bass) indicate that the majority of the shore protection structures (around 50%) were in the ***Excellent*** category, where the structure is a more effective structure type and more effective composition for reducing erosion. Examples of these are shown in the table on the next page. The second highest erosion

effectiveness category was ***Fair***, consisting of a less effective structure with a more effective composition.

The shore structures were also analyzed for biological compatibility in the nearshore habitat. The trends for the mainland shore and the open lake islands indicate that the majority of the shore protection structures (more than 50%) were in the ***Poor*** category, where the structure is non-favorable to the nearshore biological community in both structure type and structure composition. The second highest shore protection category was ***Excellent***, consisting of a favorable structure and composition for the nearshore habitat.

Biological Compatibility



These data indicate that the present shoreline protection along Lake Erie and the open lake islands is generally effective with respect to erosion, but not biologically friendly. This can be seen as detrimental to the aquatic community of the lake, since many organisms use the nearshore habitat during part of their life cycle. Citizens interested in the health of the Lake Erie ecosystem, as well as the protection of their shoreline property, can begin to build and rehabilitate shore protection structures, not only to abate erosion, but also to accommodate the nearshore biological community. This may mean rethinking the type of structure that is built or simply changing the composition of materials used to build an effective erosion control structure.

Erosion Protection			
Structure Type		**Composition**	
More-effective	*Less-effective*	*More-effective*	*Less-effective*
Revetment	Groin	Rip-rap Rubble	Construction Rubble
Attached Breakwall	Jetty	Construction Rabble	Steel Sheet Piling
Offshore Breakwater	Dock	Stone Blocks	Steel Plates
Dike	Pier	Concrete Block	Steel Tanks
Sea Wall	Retaining Wall	Concrete Slabs	Steel Barges
	Boat Ramp	Concrete Modules	Timber Pilings
		Steel Cribbing	Gabions
		Timber Cribbing	

Biological Compatibility			
Structure Type		**Composition**	
Favorable	*Non-favorable*	*Favorable*	*Non-favorable*
Revetment	Sea wall	Rip-rap Rubble	Concrete Poured
Attached Breakwall	Groin	Construction Rabble	Concrete Slabs
Offshore Breakwater	Jetty	Stone Blocks	Steel Sheet Piling
Dike	Dock	Concrete Block	Steel Plates
	Pier		Steel Tanks
	Retaining Wall		Steel/Timber Cribbing
	Boat Ramp		Steel Barges
			Timber Pilings
			Concrete Modules

Funded by Lake Erie Protection Fund

For more information on shoreline protection contact:
ODNR, Geological Survey- Lake Erie Office
Web: ohiodnr.com/geosurvey
Phone: 419-626-4296
Email: Geo.SurveyLE@dnr.state.oh.us

Biological Indicator

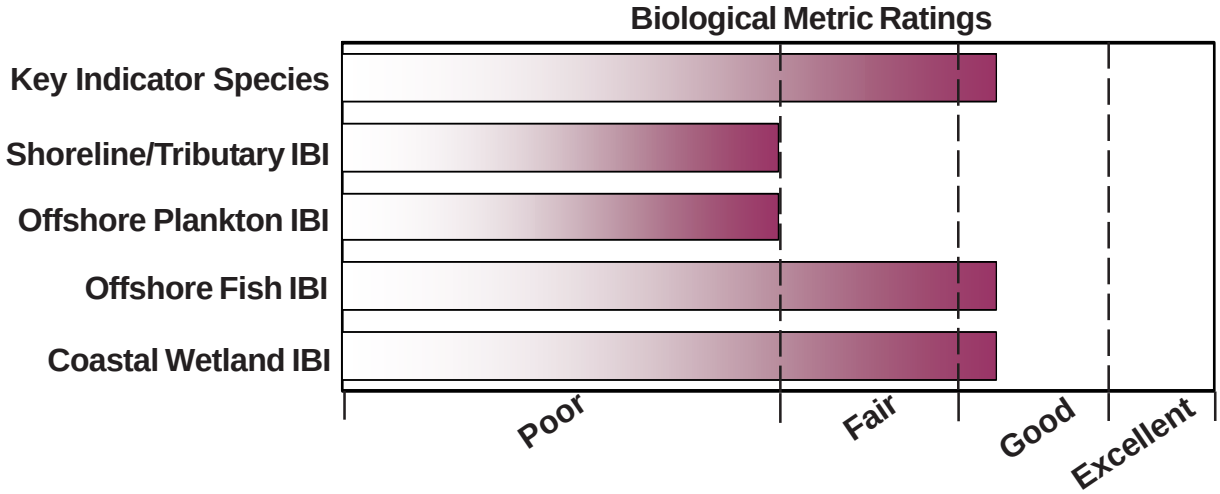
FAIR

The diversity of plants and animals in and along Lake Erie is a key component of the region's uniqueness. From the marsh areas of the western basin to the walleye populations in the open waters of the lake, many people appreciate the rich ecosystem that the region has to offer. Therefore, ensuring the health of these organisms is critical to claim a high-quality lake.

The biological health of Lake Erie is assessed through five metrics, an increase over the two metrics in the 1998 report. The *Key Indicator Species* metric examines three of the most important species in the lake: bald eagle, walleye, and mayfly populations. The other metrics use indexes to measure the integrity of four distinct communities: *Shoreline & Tributaries*, *Offshore Plankton*, *Offshore Fish*, and *Coastal Wetland*.

These metrics show a wide range of responses in regard to the biological component of Lake Erie's ecosystem. Shoreline and tributary areas are still significantly impaired in their capacity to support high quality communities and rate ***Fair***. Offshore plankton also rated a ***Fair***. The key indicator species, offshore fish communities, and coastal wetland vegetation have fared the best in these evaluations, as all have rated ***Good***. The overall rating for this section is ***Fair***.

Improving on this rating will require substantial changes in human-influenced sources of impairment, especially nutrient enrichment, sediment loading, and the destruction of critical habitat areas. The full impact of these activities is also not well quantified in many cases and will require further research before they are completely understood.



GOOD

Key Indicator Species Metric

Bald Eagles

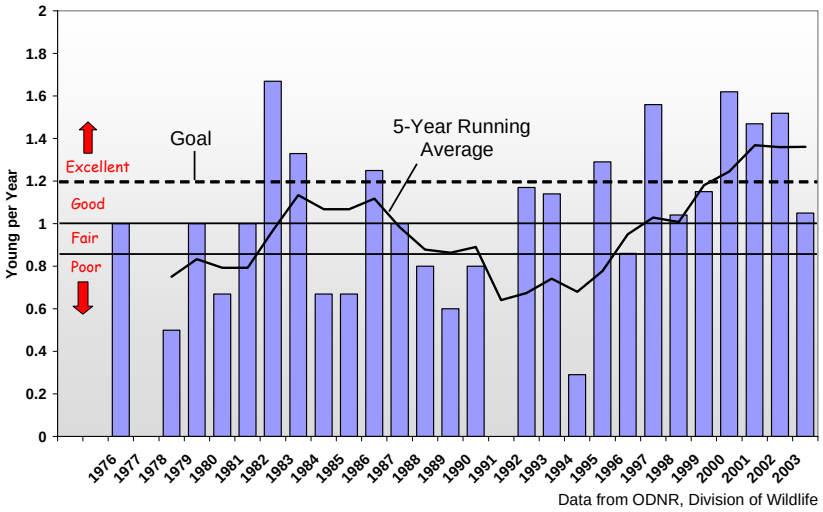
As a top-level predator, bald eagles serve an important role in the Lake Erie ecosystem. They are found mostly in the marsh region of the western portion of the lake, along the Sandusky River and in the north-central part of the state. Bald eagles generally prefer secluded home sites that are near water and food sources. They feed mainly on fish, other birds, and mammals such as groundhogs, rabbits and squirrels. Reproductive success of these birds may be affected by human activities independent of environmental conditions. Because of this, their nesting success is a concern for many and can serve as an indicator of the health of the species and that of other species in the ecosystem.

For many years, the bald eagle has been listed as an endangered species in Ohio. After years of heavy pesticide use and the loss of habitat, eagle populations in the state crashed due to sterility and weakened egg shells. The Ohio eagle population reached a low of four nesting pairs in 1979. Since that time, the banning of DDT and PCB production has lead to the recovery of the bald eagle in the state, but there is still concern about elevated levels of these contaminants in some eagles.

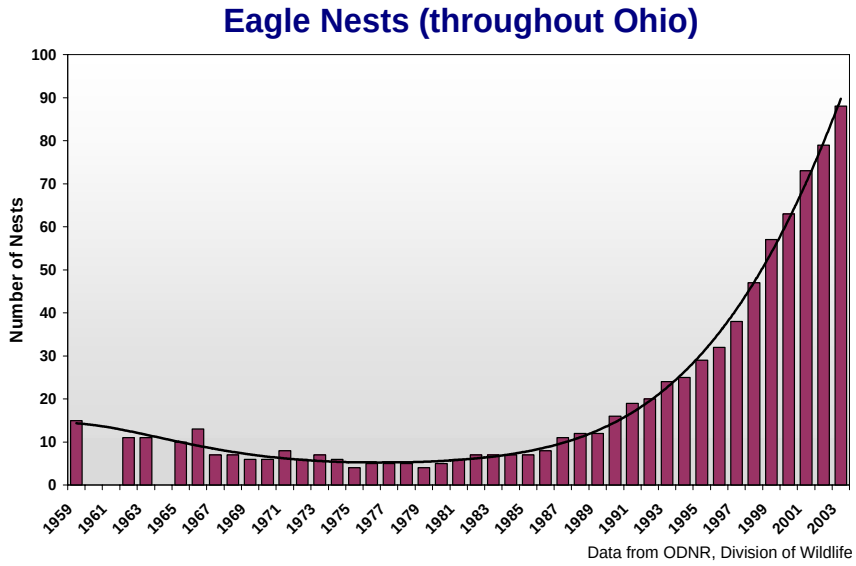
The Lake Erie Commission goal for bald eagle productivity is 1.2 young per nest, a rate that ensures a healthy eagle population. The current productivity, using a 5-year running average, is 1.36 young per nest or ***Excellent***. In the 1998 report, nesting success was lower at 1.03 young per nest. Although this was also considered ***Excellent***, it was based on a lower goal of 1.0 young per nest.

ODNR has been the lead in eagle recovery efforts in Ohio. In 1979, 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. All of these have contributed to the continued expansion of the bald eagle population in the past twenty years. In 2003, there were a reported 88 nesting

Eagle Young per Nest (Lake Erie Region)



Data from ODNR, Division of Wildlife



pairs of eagles throughout the state. This has surpassed the Northern State Bald Eagle Recovery Plan goal of 20 nesting pairs by the year 2000. The bald eagle restoration project continues today and is funded by the sale of the Ohio Bald Eagle License Plate and contributions to the state income tax check off program for Wildlife Diversity and Endangered Species.

Walleye

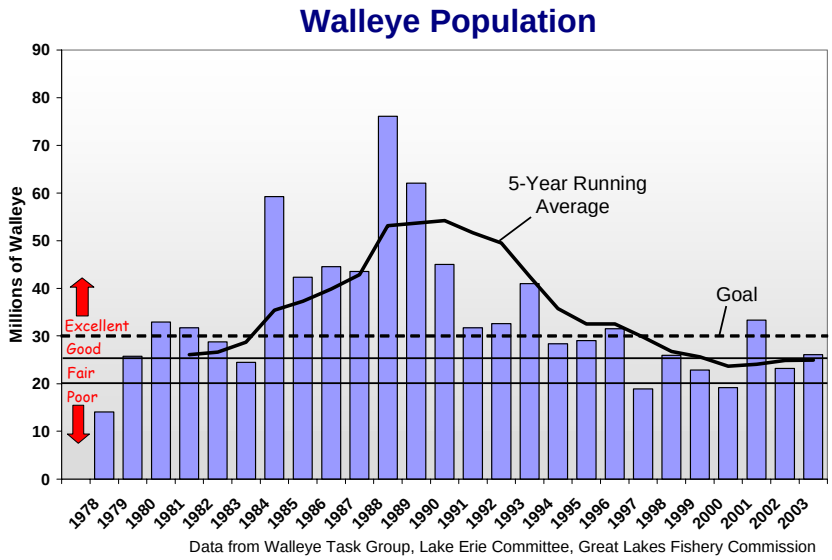
Members of the perch family, including walleye, yellow perch, and sauger, have been important in the Lake Erie ecosystem for hundreds of years. These species are usually productive in cool-water communities considered ideal for Lake Erie. The walleye, like the bald eagle, is a top predator and keystone species in this type of community, and is clearly favored by a majority of Lake Erie users.

Spawning success is a critical phase in determining the health of walleye populations. There are many factors that contribute to the success of walleye hatches. These include lake and river temperatures, wind and storm events, water current and flow rates, and the availability of food for young walleye to survive and grow into juveniles. The diet of walleye changes as they age, with young walleye dependent on zooplankton (microscopic animals), aquatic insects, and other young fish. The diet of older walleye, however, is composed completely of small forage fish. A healthy and intact forage base is needed to ensure a healthy walleye population.

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. One of the Committee's goals is "to manage walleye as a keystone species within a harmonic percid community on a sustainable yield basis for a broad distribution of benefits." The Committee desires a walleye population of at least 30 million catchable fish to attain that goal.

Estimating the numbers of adult walleyes in Lake Erie is a challenging exercise and new methods are

periodically used to evaluate abundance estimates. Since the 1998 report, a new method has been developed and adopted by the Lake Erie Committee for estimating walleye abundance in the lake. Under these new estimates, the walleye population was short of the Committee's goal of at least 30 million adults in 5 of the past 6 years due to weather-related impacts on reproduction. Interagency rehabilitation efforts are in effect. The current rating for this species is ***Fair***, with improvement expected in the near future.

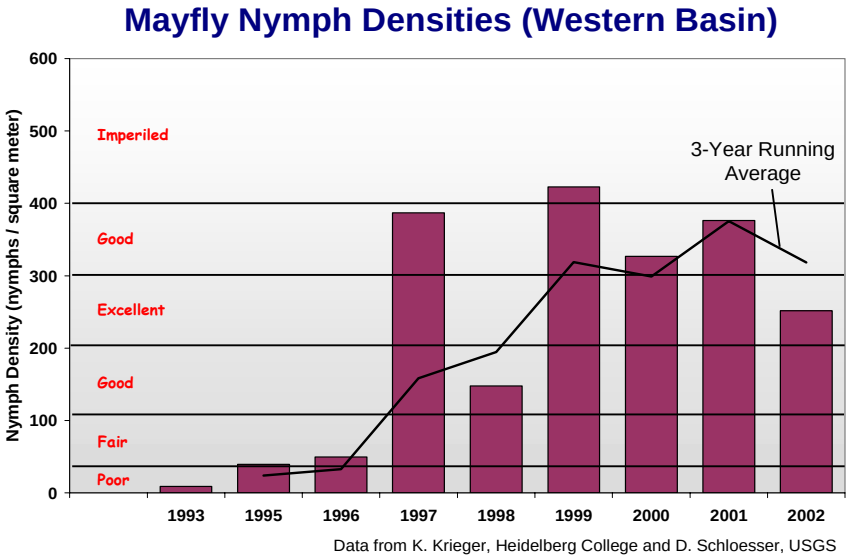


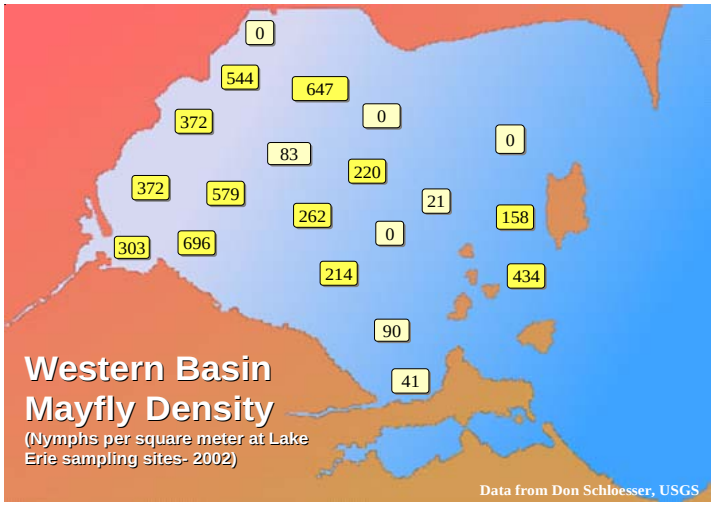
Mayflies

Mayflies are the third indicator species chosen to represent the biological health of Lake Erie. These insects do well in shallow productive lakes with soft, organically rich sediments and clear water. They are important in the diets of Lake Erie sport and commercial fish such as yellow perch, freshwater drum, channel catfish, trout perch, spottail shiner, and mooneye.

In the past, the emergence of mayfly swarms during the summer was an annual event on the lake. In the 1950s, however, the mayfly population failed, most likely due to a lack of oxygen in the lowest layer of the water column. In the 1990s, the mayfly began to reappear in the western basin of Lake Erie. This is thought to be a result of an increase in oxygen concentrations near the lake bottom throughout the year in response to lower nutrient levels.

For the 1998 *Lake Erie Quality Index*, the mayfly metric received a score of ***Good***. This was based on a Lake Erie Commission goal of 500 nymphs per square meter in the western basin. Since that time, the goal and scoring for this metric have been modified. The current scoring is centered on a goal abundance of 201-300 mayfly nymphs per square meter. A lower abundance than this range would be too small to sustain the Lake Erie fishery. However, mayfly densities that are too high create a nuisance situation for humans along the shoreline.





Samples have been collected in both the western and central basins in recent years, but only the western basin was used for determination of the rating. A 3-year running average was used in the scoring of this metric instead of a 5-year average because of the limited number of years since mayflies have returned to the lake. This better reveals trends that may be occurring. The most recent 3-year running average population of 318 mayfly nymphs per square meter is equal to a rating of ***Good*** under the new scoring system.

Although the rating for this species is ***Good***, the evidence indicates that at present, the mayfly population in much of the western basin is threatened with extirpation each summer as the result of fluctuating dissolved oxygen concentrations. Any increase in the inputs of limiting nutrients (phosphorus) will probably yield an increase in primary and secondary productivity, which in turn, could lead to catastrophic declines in dissolved oxygen concentrations in summer. Because hypoxia has been recorded in parts of the western basin in the 1990s and early 2000s, even the 3-year moving averages from 1999 to 2002 (ranging around 300 to 400 nymphs per square meter) appears to reflect excessive oxygen demand in the western basin.

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The central basin has shown a different trend than the western basin in recent years. From 1997-2000, mayfly nymphs spread eastward in nearshore sediments. In the last few years, however, there has been a return to low densities of nymphs in the central basin. These results indicate that a major change in conditions, such as an intrusion of oxygen-depleted water into shallower waters, may have occurred during some point to disrupt the population.

Scoring of Key Indicator Species Metric			
	Score	Weighting	Weighted Score
Bald Eagles	4	0.33	1.33
Walleye	2	0.33	0.67
Mayflies	3	0.33	1.00
		Rating	3.00 *Good*

For more information on bald eagle populations contact:
ODNR, Div. of Wildlife- Crane Creek Research Station
Web: ohiodnr.com/wildlife
Phone: 419-898-0960

For more information on walleye populations contact:
ODNR, Div. of Wildlife- Lake Erie Fisheries Unit
Web: ohiodnr.com/wildlife
Phone: 419-625-8062

FAIR

Shoreline & Tributary Index of Biotic Integrity Metric

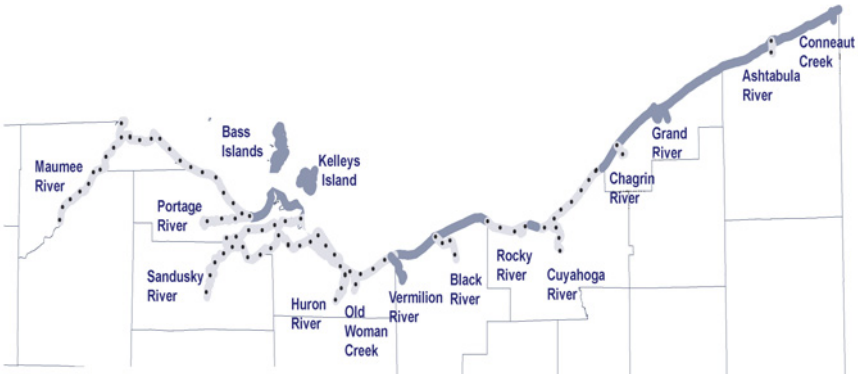
The ability of Lake Erie to sustain life is one of the most crucial evaluative factors concerning the lake's ecosystem. Past actions such as the release of industrial and municipal waste, agricultural pesticides, home chemicals, and atmospheric deposition have caused substantial degradation to habitat and stressed associated communities. This is in addition to habitat losses resulting from development along many streams and shoreline areas in the region.

The biological integrity of Lake Erie's nearshore areas continues to be monitored by Ohio EPA using fish communities as an indicator of overall ecosystem health. A fish community's health integrates a wide range of environmental factors (water chemistry, habitat quality, food web structure, etc.) and can be easily measured using the Index of Biotic Integrity, or IBI.

The IBI uses 12 fish community characteristics based on species numbers, behavior and trophic guilds, and community health (previously detailed in the 1998 *Lake Erie Quality Index*). Each community characteristic was ranked as a zero, one, three, or five based on how closely the measure approached natural, undisturbed conditions, with the best condition receiving a score of five. All 12 scores are summed resulting in a score ranging from 0 (dead) to 60 (undisturbed). The three areas that were scored include the nearshore zones (right along the shore), river mouths, and freshwater estuaries. An estuary is a transition zone in a river that flows into a freshwater lake and is the portion of river affected by the water level of the lake.

Average shoreline quality based on current IBI values

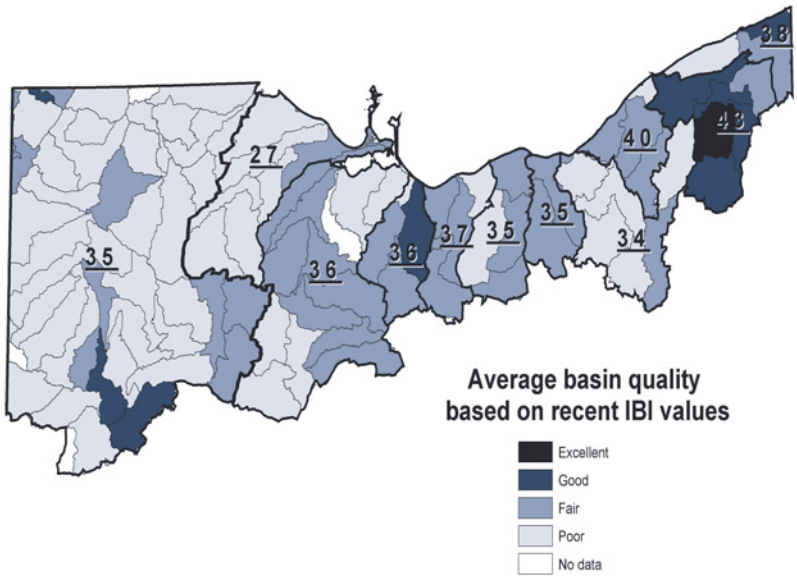
Excellent Good Fair Poor



Average shoreline quality based on pre-1998 IBI values

Excellent Good Fair Poor

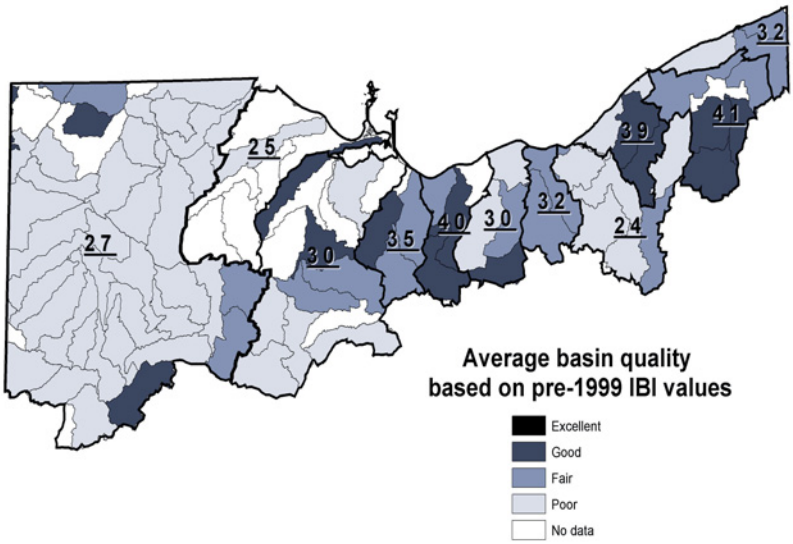
The overall status of the Lake Erie basin IBI metric has remained in the ***Fair*** classification (1998 LEQI IBI = ***Fair***). An examination of historic data has revealed that database and computer calculation errors yielded an IBI of 33.5



when in fact the 1998 IBI should have scored a 29.2. This would have classified the 1998 Lake Erie IBI metric as ***Poor***. The 2004 LEQI results also differ from the 1998 results in having all data from all of the Lake Erie tributaries included.

The reexamination of the historic data and examination of current data shows that Lake Erie basin fish communities have undergone an average improvement of 4.7 points. This general improvement is also seen in the breakdown of the data for the lake proper (+4.9 points), the estuaries (+9.0 points), and the rivers and streams (+3.7 points). These improvements are likely real and due to reductions in nutrients and lower lake water levels. Some individual areas did show declines in their IBI value, but the declines were mostly very small and may not be significant, while several areas that showed improvements showed gains of over ten points.

Of the three water body groupings, estuaries ranked the lowest quality (***Poor***) as evaluated using this metric. On average, the rivers and streams ranked ***Fair***. The lake proper also ranked ***Fair***, and improvement over the ***Poor*** received in the last report. Estuaries, rivers, and streams continue to suffer from excess nutrient enrichment, sediment runoff and habitat destruction.



With nearly two decades of data collected in the Lake Erie basin, it is beginning to appear that good IBI conditions will not be achieved until large scale nonpoint pollution runoff from urban and agricultural areas is greatly reduced or mitigated. It should be pointed out that the nutrients and sediments impacting the nearshore and tributary habitats are also contributing to environmental stresses such as anoxia conditions, algal blooms, and fish community alterations in Lake Erie's Western and Central open water basins.

Lake Erie IBI Scores					
Area	Current IBI	Grade	Pre-1999 IBI	Grade	IBI Change
Lake Erie	**37**	**Fair**	**29**	**Poor**	**8**
Lucas County	33	Fair	25	Poor	8
Ottawa County	22	Poor	27	Poor	-5
Erie County	33	Fair	21	Poor	12
Lorain County	41	Fair	30	Poor	11
Cuyahoga County	37	Fair	29	Poor	8
Lake County	36	Fair	30	Poor	6
Ashtabula County	38	Fair	34	Fair	4
Sandusky Bay	18	Poor	19	Poor	-1
Bass Islands	41	Fair	35	Fair	6
Kelleys Island	40	Fair	40	Fair	0
Estuaries	**27**	**Poor**	**24**	**Poor**	**3**
Maumee	23	Poor	23	Poor	0
Portage	31	Fair	29	Poor	2
Sandusky	18	Poor	19	Poor	-1
Huron	20	Poor	21	Poor	-1
Vermilion	----	----	35	Fair	----
Black	43	Good	28	Poor	15
Rocky	----	----	27	Poor	----
Cuyahoga	26	Poor	15	Poor	11
Chagrin	----	----	28	Poor	----
Grand	38	Fair	34	Fair	4
Ashtabula	45	Good	30	Poor	15
Conneaut	39	Fair	30	Poor	9
Rivers	**36**	**Fair**	**32**	**Fair**	**4**
Maumee basin	35	Fair	27	Poor	8
Portage basin	27	Poor	25	Poor	2
Sandusky basin	36	Fair	30	Poor	6
Huron basin	36	Fair	35	Fair	1
Vermilion basin	37	Fair	40	Fair	-3
Black basin	35	Fair	30	Poor	5
Rocky basin	35	Fair	32	Fair	3
Cuyahoga basin	34	Fair	24	Poor	10
Chagrin basin	40	Fair	39	Fair	1
Grand basin	43	Good	41	Fair	2
Ashtabula/Conneaut basins	38	Fair	32	Fair	6

For more information on Lake Erie fish communities contact:

Ohio EPA
Web: www.epa.state.oh.us
Phone: 614-728-3388

ODNR- Division of Wildlife
Web: ohiodnr.com/wildlife
Phone: 614-265-6300
Email: wildinfo@dnr.state.oh.us

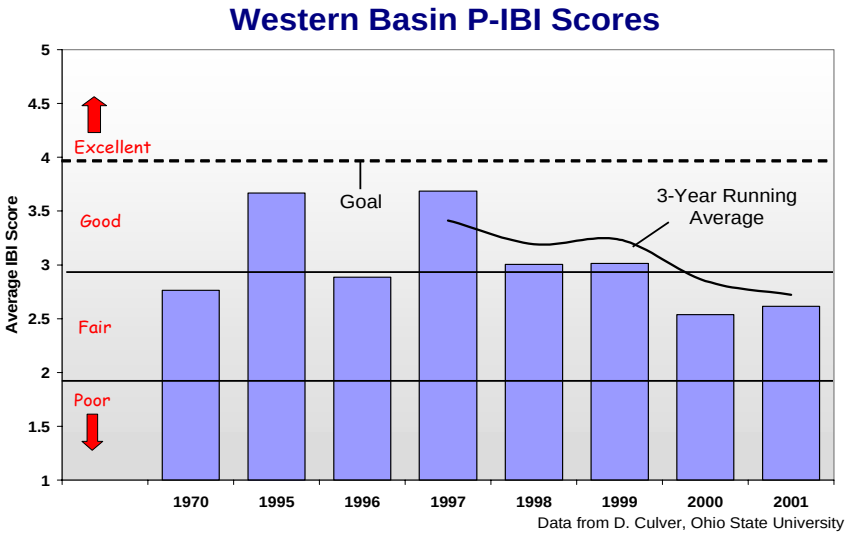
Offshore Plankton Index of Biotic Integrity Metric

FAIR

One measure of the biological integrity of offshore waters of Lake Erie is the Planktonic Index of Biotic Integrity (P-IBI). This multimetric index, developed by Dr. David Culver, Doug Kane, and other students at the Ohio State University, is based on the abundance and kinds of microscopic floating plants and animals, collectively known as plankton. Phytoplankton (plants) serves as the energy base of the Lake Erie food web and is consumed by zooplankton (animals). In turn, many species of fish (especially young-of-year) consume zooplankton.

Phytoplankton and zooplankton are good indicators of changes in nutrient pollution over time in Lake Erie because they respond quickly to changes in nutrient input to the lake. Further, they can be sampled extensively in many locations with relative ease. The major anthropogenic stressors that affect zooplankton and phytoplankton communities include pesticides, PCBs, metals and nutrient enrichment.

Contaminant and nutrient loadings differ among each basin of the lake and can be expected to result in different measurements of health. Because of the greater size of the watershed and amount of land used for agriculture in the western basin, it typically has higher loadings of the herbicides atrazine, alachlor, metolachlor than the central basin does. Contaminant loadings of metals and PCBs in Lake Erie are detected in decreasing concentrations in surficial sediments from west to east. Phosphorus loading is typically greatest in the western basin, including the Maumee and Sandusky Rivers, and less in the central basin.

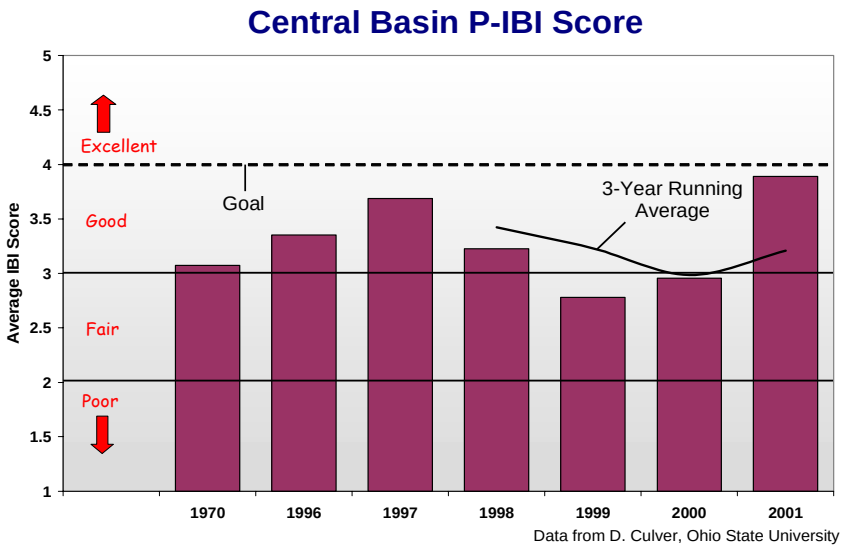


The P-IBI integrates information about both phytoplankton and zooplankton communities in the open waters of Lake Erie to measure water quality. It uses 5 metrics, detailed on the next page, to determine the effects of different levels of pollution by nutrients, especially phosphorus. Each metric is scored as a one, three, or five, with five representing the least polluted conditions.

Because both phytoplankton and zooplankton communities change throughout the year, the P-IBI has a specific time period (June-August)

during which it is measured. Metric scores for all the months are then averaged. Scores greater than 4 are considered ***Excellent***, between 3 and 4 are ***Good***, between 2 and 3 are ***Fair***, and less than 2 are ***Poor***.

The data used in the scoring of these metric are based on data sets from 1970 and 1995-2001 and were collected from May-September. The 1970 data reflect Lake Erie when it was most eutrophic (high nutrient levels), while the more recent data reflect the lake at a more moderate state, as measured by total phosphorus concentrations.



The P-IBI suggests the overall condition of Lake Erie's offshore waters for the two basins that border Ohio (central and western basins) for the most recent years can be considered as ***Fair***. The P-IBI was ***Fair*** in 1970 and improved to ***Good*** in the mid-1990s, before declining to ***Fair*** in the late 1990s.

Trends in the western basin P-IBI are similar to the lake-wide trends, with data from 2000 and 2001 also giving a ***Fair*** rating. For the central basin, the P-IBI scores in the ***Good*** range for each year except 1999 and 2000, when it was in the ***Fair*** range.

In the 1950s, eutrophication (increases in nutrient concentrations) of the lake led to increases in phytoplankton abundance and increases in species favored by those higher concentrations. Loading of phosphorus in recent years above the limit set in the 1970s and the return of large areas of anoxia in the central basin has been seen as an indicator of the re-eutrophication of the lake. This is not yet evident in the plankton communities in the central basin, but is supported by the decreasing integrity of those in the western basin. Future monitoring of Lake Erie's plankton dynamics will enable continued evaluation of the water quality of the lake's offshore waters.

Offshore Plankton IBI

June Metrics

Biomass of edible algae taxa
% *Microcystis*, *Anabaena*, and *Aphanizomenon* of total phytoplankton biomass
Zooplankton ratio

July Metrics

***Limnocalanus macrurus* density**

August Metrics

Zooplankton ratio
Crustacean zooplankton biomass

Funded by Lake Erie Protection Fund

For a copy of the Offshore Plankton IBI report contact:
Ohio Lake Erie Commission Office
Web: www.epa.state.oh.us/oleo
Phone 419-245-2514
Email: lakeeriecommission@ameritech.net

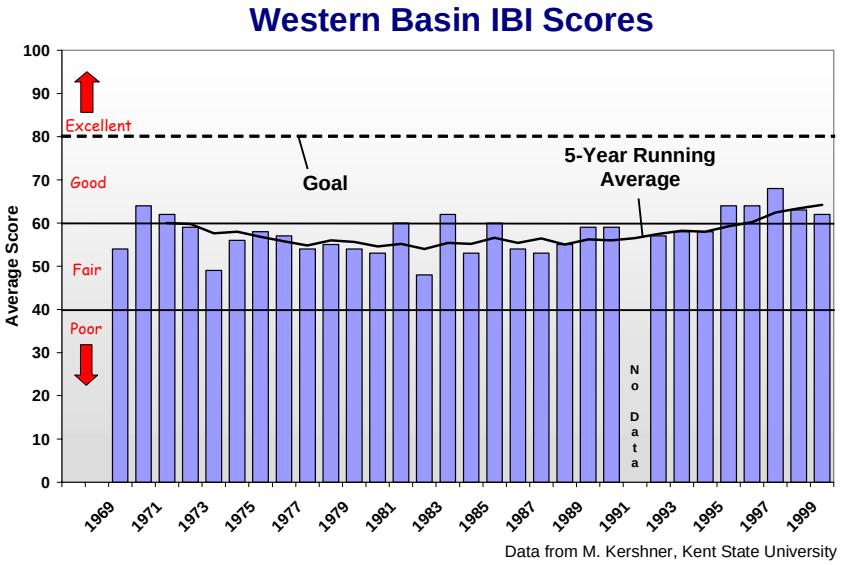
Offshore Fish Index of Biotic Integrity Metric

GOOD

During the past three decades, environmental quality in the open Lake Erie ecosystem has gone through significant changes. As recently as the late 1960s and early 1970s, Lake Erie was referred to as "dead" because of the negative effects of increased pollution. These effects included low dissolved oxygen levels, dense algal blooms and poor water clarity, all of which altered the availability of both food and habitat for fishes. The ultimate result of these changes was major declines in native fish species.

With the implementation of phosphorus controls, phosphorus loading into the lake declined dramatically by the 1980s. This also resulted in reduced production throughout the lake. These changes, coupled with reductions in contaminant loading and commercial fishing pressure, have greatly modified the fish community during the last 30 years.

There is strong evidence that the Lake Erie fish assemblage is recovering to something closer to its natural condition. Species such as channel catfish, white crappie, and the common carp that are tolerant of turbidity have become less abundant, while fish that prefer clear water (smallmouth bass, rock bass, and burbot) have increased in abundance.

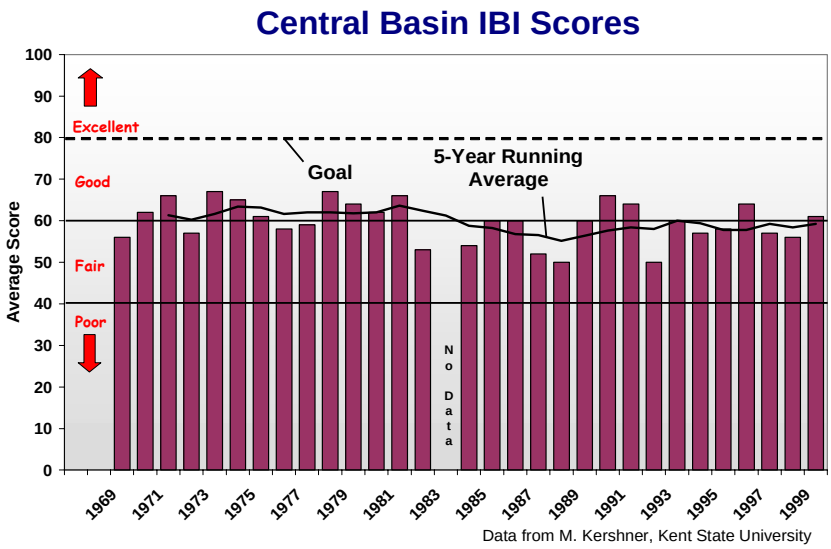


Data from M. Kershner, Kent State University

The *Offshore Fish* metric was created by Dr. Mark Kershner and his students at Kent State University. The metric is based on the use of an index of biotic integrity (IBI). This index characterizes the annual variability of water quality and habitat availability for different fish species and/or groupings. 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 on next page for details regarding the measures used). These measures differ from those used in the shoreline/tributary IBI, and provide for a better overview of fish community structure in the open lake. Scoring for the index can range from a low of 0 to a high of 100.

Funded by Lake Erie Protection Fund

To establish a rating for this metric, the IBI was applied to trawl data compiled by ODNR over a 30-year period in both the western and central basins of the lake. Results from the study indicate that the measures used are fairly sensitive to environmental change. Some individual measures show clear evidence of system recovery. Other measures show little evidence of improvements until the 1990s. After this time there appear to be positive trends associated with the measures.



Only three of the measures show trends associated with reductions in system integrity. These measures (number of exotic species, % exotic individuals, % omnivorous individuals) are driven by common exotic species such as white perch and round goby and reflect the negative impact invasive species have had in the lake.

Despite the negative effects of exotic species, the overall trend in the lake appears to be one of rehabilitation and recovery for the offshore fish community. This is best reflected in overall IBI scores. Prior to 1990, both the central and western basins showed no apparent trends. However, there has been a consistent increase in scores in the western basin during the 1990s.

Overall, the IBI score in the lake has been in either the ***Good*** or ***Fair*** category for the period 1969-1999. The most recent 5-year average score for the western basin was equal to a rating of ***Good***. The central basin was slightly lower at ***Fair***. The average score for both basins is 62 or a rating of ***Good***.

Raising these scores will require improving the overall health of Lake Erie by reducing pollutant loadings (primarily nonpoint sources) and restoring spawning and nursery habitat in our rivers and nearshore areas. Better controls on exotic species can also help by minimizing the impact of these fish on community structure and integrity.

Offshore Fish IBI

Species Richness/Composition Measures

 # Native Species
 # Pollution Intolerant Species
 # Benthic (Bottom dwelling) Species
 # Phytophilic (Vegetation-Loving) Species
 # Exotic Species
 # Native Cyprinid (Carp) Species

Behavior/Trophic Guild Measures

% Omnivores (Eat plants and animals)
% Top Carnivores
% Pollution Tolerant Individuals
% Non-indigenous Individuals

Community Health/Fish Abundance Measures

# of Individuals
# of Native Individuals (Belong to species native to Lake Erie)

For a copy of the Offshore Fish IBI report contact:
Ohio Lake Erie Commission Office
Web: www.epa.state.oh.us/oleo
Phone: 419-245-2514
Email: lakeeriecommission@ameritech.net

For more information on fish communities contact:
ODNR, Division of Wildlife-Sandusky Fish Research Unit
Web: ohiodnr.com/wildlife
Phone: 419-625-8062

Coastal Wetland Index of Biotic Integrity Metric GOOD

Although the loss of wetlands throughout the Lake Erie watershed is generally known, the affect of human activity on those that were not converted to other uses has not been well quantified. The few wetlands that remain with a natural hydrological connection to the lake are of great ecological importance, as they best represent what was once the natural habitat and geography occurring between Lake Erie and inland Ohio. Since wetlands are known to be important habitat for reproduction, growth and survival of fish of various species, measuring changes in their functions can indicate how well fish communities can be supported, as well as the influence of human disturbances.

Plants are often used to measure a wetland's condition because of the number of contributions (serving as the base of the food web, providing habitat, removing contaminants, etc.) they make to the ecosystem. An emergent vegetation index of biotic integrity was originally developed by Ohio EPA to measure inland wetlands in the state. Dr. David Johnson, Eugene Braig, and students at The Ohio State University modified this index to be more specific for those wetlands that are hydrologically connected to Lake Erie. This new coastal vegetation IBI (VIBI-C) includes seven metrics that measure the quality of wetlands by quantifying important plant species and characteristics in those areas.

Coastal Wetland IBI

Metrics

- **Number of perennial species**
- **Number of species in Cyperaceae family**
- **Number of dicotyledon species**
- **Number of shrub species**
- **Number of plants with a Facultative Wet (FACW) or Obligate (OBL) wetland indicator status**
- **Floristic Quality Index Score**
- **Relative cover of *Phalatis arundinacea*, *Phragmites australies*, and *Typha* species**

Each metric is scored as a one, three, five, seven, or ten, with ten representing the least disturbed conditions. Each of the metric scores is added together to produce an overall score for the VIBI-C, which can range from 0 to 70. A score greater than 50 is considered ***Excellent***, between 33 and 50 is considered ***Good***, between 17 and 33 is ***Fair***, and less than 17 is ***Poor***.

Twelve coastal wetlands along the southern shore of the lake were evaluated during the summers of 2000, 2001, and 2002 to determine the rating for this metric. Most of these sites were located within or around the western basin of the lake and represent a gradient of environmental impacts. Because of its large size, two locations were used at Old Woman Creek. The site at North Pond was used as a reference because it remains in its most natural state of all the locations and is also protected from the effects of Lake Erie.

The results from the evaluation of these wetlands showed that the condition for most was in either the ***Excellent*** or ***Good*** range. West Street

Marsh near downtown Huron is dominated by urban forms of human disturbance and this is evident in its rating of ***Fair***. Potters Pond scored the lowest of the sites at ***Poor***. Although it is located within the Cedar Point National Wildlife Refuge and mostly undisturbed by human activity, it is completely unprotected from the wave action of the lake and, as a result, has poor plant community development.

One important point raised during the study of the coastal wetlands was that the data was collected during a period of average water levels for Lake Erie. Significant changes in lake levels may alter the composition of plant communities, and therefore, the scoring of the VIBI.

Lake Erie VIBI-C Scores

Wetland Name	Score	Condition
1. Potters Pond	16	Poor
2. Fox's Marsh	41	Good
3. Middle Harbor	54	Excellent
4. North Pond	70	Reference
5. Meadow Brook	45	Good
6. Plum Brook	37	Good
7. Sheldon's Marsh	54	Excellent
8. West St. Marsh	25	Fair
9. Dupont Marsh	34	Good
10. Old Woman Creek	64	Excellent
10. Old Woman Creek W.	29	Fair
11. Beulah Beach	61	Excellent
12. Arcola Creek	54	Excellent

In addition, because there are no historical comparisons available, the coastal wetland VIBI differs from the other IBIs that were used. Instead, the conditions that were established for these wetlands will serve as a baseline for reference in the future to measure changes. Continuing to sample locations all along the shoreline, including the addition of sites in the eastern part of the state, will help to more accurately determine trends in human disturbances of Lake Erie's coastal wetlands.

Funded by Lake Erie Protection Fund

For a copy of the Coastal Wetland IBI report contact:
Ohio Lake Erie Commission Office
Web: www.epa.state.oh.us/oleo
Phone: 419-245-2514
Email: lakeeriecommission@ameritech.net

For more information on wetland communities contact:
Ohio EPA Wetland Ecology Group
Web: www.epa.state.oh.us/dsw/wetlands/wetland_bioassess.html

Coastal Recreation Indicator

GOOD

The natural beauty of Lake Erie and its unique locales often make the region a top destination for people wishing to take part in recreational activities. This has been especially true as a result of improvements to the lake over the last 30 years. According to a recent survey of Ohio residents, a large percentage (70%) have visited the lake at one time or another in their lives. Almost half of those who have visited the lake have done so within the last year.

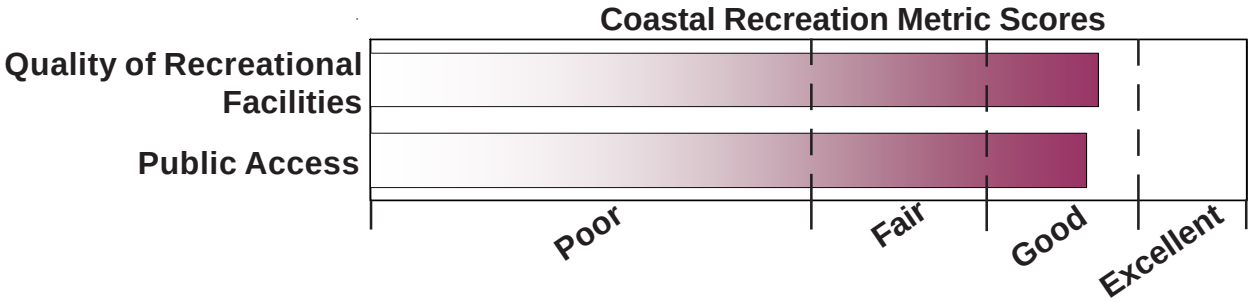
With the increased popularity of Ohio's North Coast, many people are enjoying all that the lake has to offer in numerous seasonal and year-round activities. The majority of those surveyed feel that the lake is an important recreational site throughout the year.

In the summer, people can enjoy swimming, fishing, biking, camping, picnicking, and bird watching. During the winter, ice fishing, hunting, trapping, skiing and snow mobiling are also popular. Year-round activities include visiting entertainment, cultural, and historical attractions.

Measuring Lake Erie's coastal recreation requires examining the public's opinion about quality and accessibility. Participants in a telephone survey were asked questions related to these areas with their responses contributing to *Quality of Recreational Facilities* and *Public Access* metrics.

Both of these metrics scored well with Ohio's citizens and rated ***Good***. This rating was given to the *Coastal Recreation* indicator as a whole and is the same as that achieved in the last report.

The popularity of Lake Erie as a recreation site is indicative of the success that local governments, the Ohio Department of Natural Resources, and the private sector have had in meeting the needs of Ohio's citizens. These groups will continue to address quality and access issues related to the management of parks, trails, beaches, preserves, and other areas in the hopes of continuing this success for years to come.



GOOD

Quality of Recreational Facilities Metric

In order to assess the quality of Lake Erie as a coastal recreation destination, The Strategic Research Group, a marketing research firm, was selected to conduct an inquiry into the attitudes and behaviors of Ohio residents toward the lake. To achieve this objective, a telephone interview of over 1200 randomly selected adults was conducted. Participants in the survey were asked questions regarding quality, accessibility, and availability of a variety of lake-related activities. The scope of the study was primarily limited to those residents who have actually visited the lake. However, attitudes were also solicited from residents not considered to be lake users.

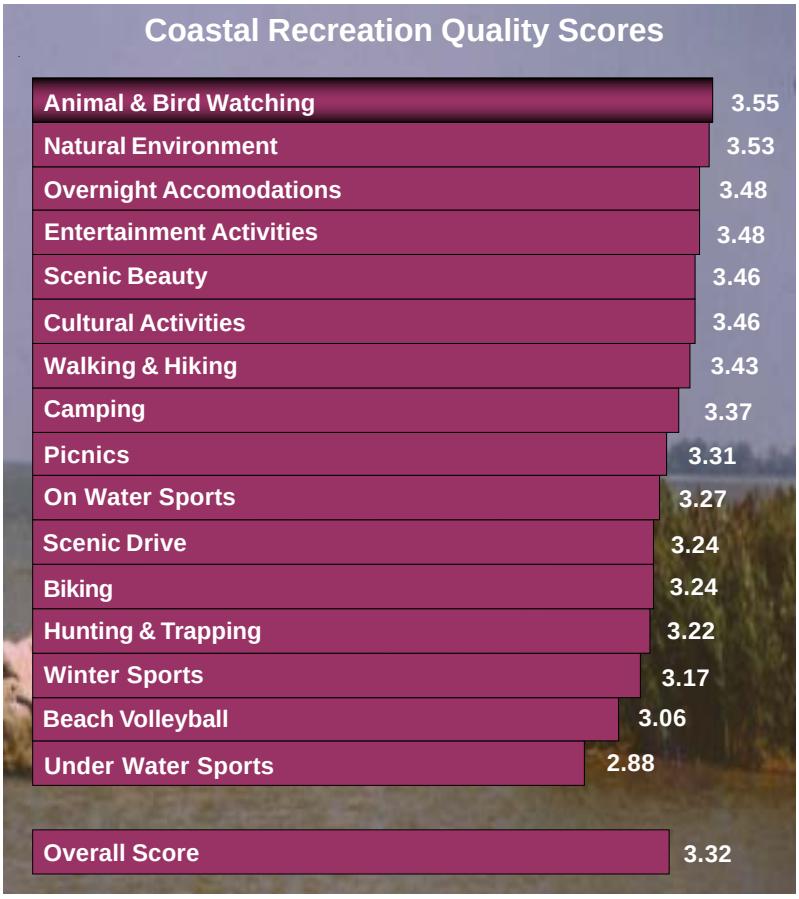
Ratings for the survey questions were computed on a point scale where 4= Very Satisfied, 3= Somewhat Satisfied, 2= Neither Satisfied or Dissatisfied, 1= Not Very Satisfied, and 0= Not Satisfied At All.

The most frequently reported lake activity in the opinion survey was visiting entertainment attractions such as Cedar Point, a restaurant, or a night club. Of all lake users, 77% reported attending activities designed for entertainment. A close second among activities was taking a scenic drive along the lake (75%). Third among the most frequent activities was visiting cultural/historical attractions, with 67% of lake users reporting having visited such places while at the lake. The fourth most frequent lake activity was picnicking, with 58% of users reporting doing so.

When combining all lake-related activities, the vast majority of lake users were somewhat satisfied with the lake as a recreational site, with 39% being very satisfied. Two of the activities, animal & bird watching and visiting nature preserves, wetlands, or other natural areas were rated as ***Excellent***. All of the other activities were given quality ratings of ***Good***.

In comparison with the last report, most of the activities scored higher in 2003. The only exceptions to this were camping and enjoying the scenic beauty of the lake, both with lower scores, and entertainment activities with the same score of 3.48. The overall score received for this metric was 3.32 or ***Good***. This is higher than the 1998 score of 3.04 for the same activities.

The results from the survey showed a correlation between the number of participants in an activity and its quality. Activities such as beach volleyball and hunting were rated as being of lower quality, but also had a lower number of individuals responding that they take part in them. Likewise, the higher rated activities had a higher percentage of participation. Because of



this, the cause for the lower scores may actually be the result of lower quality facilities. However, it is also possible that because not as many opportunities exist for these activities, they are only perceived as being of lower quality.

In addition to those who use the lake, attitudes about the quality of recreational facilities were also solicited from people who have never or infrequently use the lake. In general, non-lake users gave lower ratings for the quality of all activities. For some activities, the score given was significantly lower than lake users. This was particularly true for the quality of the natural environment. These findings suggest that non-users may have lower expectations for the lake as a recreation site and, for this reason, do not visit it as often.

Improving the quality of coastal recreation facilities is one of the goals of the State of Ohio and is being addressed by the Department of Natural Resources. ODNR has recently completed a statewide comprehensive outdoor recreation plan (SCORP). 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. Other related activities by ODNR include acquiring high priority coastal parcels for recreation purposes, protecting habitat areas for use as viewing, and upgrading existing parks and other facilities.

Funded by Lake Erie Protection Fund

For more information on the Strategic Research Group Survey contact:
Ohio Lake Erie Commission Office
Web: www.epa.state.oh.us/oleo
Phone: 419-245-2514
Email: lakeeriecommission@ameritech.net

GOOD

Public Access Metric

A second area of coastal recreation addressed by the opinion survey was public access to facilities. The Lake Erie shoreline may have high quality recreation opportunities available, but if these areas are not accessible, then their use will not be optimized.

Survey questions were asked regarding the accessibility of each of the assessed activities. The overall score for accessibility was 3.27. This is slightly lower than the score for quality, but is still equal to a rating of ***Good*** and is an improvement over the score of 3.07 received in the 1997 survey.

Entertainment activities was the only measure that rated ***Excellent*** in this portion of the survey. This is not surprising since it was also listed as the most frequently reported lake activity by survey participants. The accessibility scores for most of the rest of the activities were in the range of ***Good***. The exception to this, with a score of ***Fair***, was beach volleyball. This was one of the areas that also scored lower in the quality section of the survey.

The State of Ohio continues to work towards providing increased and better access to Lake Erie's shoreline. Specifically, the Office of Coastal Management at ODNR is addressing this issue by administering both the Coastal Management Assistance and Great Lakes Coastal Restoration Grants Program. The grants awarded through these programs are designed to protect and preserve the coastal region of Lake Erie. This includes increasing public access to the lake and other public places in the coastal area.

Funded by Lake Erie Protection Fund

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Boating Indicator

GOOD

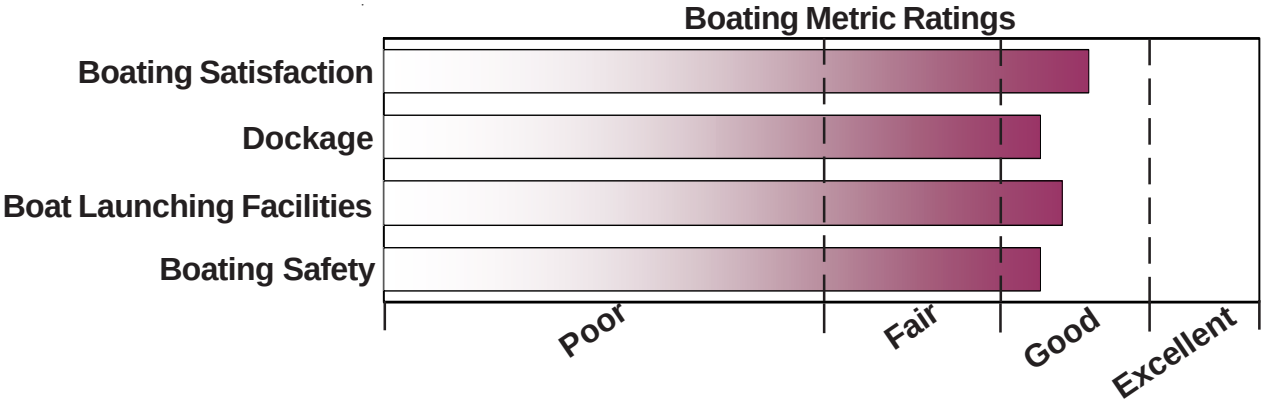
Boating is one of the most popular activities on Lake Erie. Many Ohioans enjoying spending a summer afternoon cruising the lake in motor and sail boats or experiencing the thrilling challenge of personal watercraft. In the opinion survey conducted by The Strategic Research Group, 47% of lake users participated in boating activities while at Lake Erie. Motorboats were the most popular type of craft, used by over 90% of boaters. Personal watercraft, such as a Jet Ski or WaveRunner, were the next most popular used by 23% of boaters.

There are a wide range of factors that can affect the quality of boating on Lake Erie. Foremost among these is the general satisfaction of boaters with quality, accessibility, and availability of rental locations, car-top boating (canoeing, kayaking, windsurfing), marinas, anchorages and moorings, and other aspects of boating. These areas are addressed in the *Boating Satisfaction* metric.

Previously, *Dockage* and *Boat Launching Facilities* were identified as areas in need of improvement. The problem cited most often has been the lack of availability of docks and ramps. Measurements of success in these areas are based on the public's opinion of their number along Lake Erie's shoreline.

Finally, safety is a concern for boaters that frequent the lake. Law enforcement, boating safety education, improved boat building technology and public awareness all play a role in affecting the number of boat-related accidents. Their effectiveness as measured by Ohio's ranking in the nation is discussed under *Boating Safety*.

The four metrics used show that Ohio boaters are generally satisfied with all of these areas. The scores ranged between 3.00 and 3.22. The overall rating for the boating has not changed since the 1998 report and is equal to ***Good***.



GOOD

Boating Satisfaction Metric

Boater satisfaction is essential in keeping Lake Erie a high-use boating location. Users of the lake expect high quality boat ramps and docks that are easy to access. They also want boat rentals and other marina services, including desired amenities such as fuel, water and electricity, and waste disposal facilities, to be widely available. Without such resources, boaters will focus their time and money outside of the Lake Erie region.

The rating for the *Boating Satisfaction* metric for Lake Erie users was determined using results obtained from the public opinion survey. Questions were asked on a range of areas dealing with boating quality, accessibility, and availability. An overall score for the indicator was computed by averaging the scores for each of the individual categories. The availability of docks and public launching facilities was not included here, but is examined as separate metrics given their high importance to boaters.

Of the three areas surveyed, quality rated the highest with an average score of 3.31 or ***Good***. Car-top boating rated the highest in the range of ***Excellent***. Most of the other categories were rated as ***Good***, while the quality of anchorages and moorings was lower in the range of ***Fair***.

The accessibility scores were also ***Good***, but with a slightly lower average score (3.27). While survey participants were most satisfied with the ease in which they could get to places to canoe, kayak, windsurf, or use personal watercraft, they were least satisfied with the accessibility of places to rent such watercraft.

Availability of boating and related services scored the lowest of the three areas (3.15), but was still considered ***Good***. Several of the measures in this section rated ***Fair*** (boat rental facilities, anchorages & moorings, and storage facilities), but all of the rest were ***Good***. Once again, car-top boating received the highest score of any area.

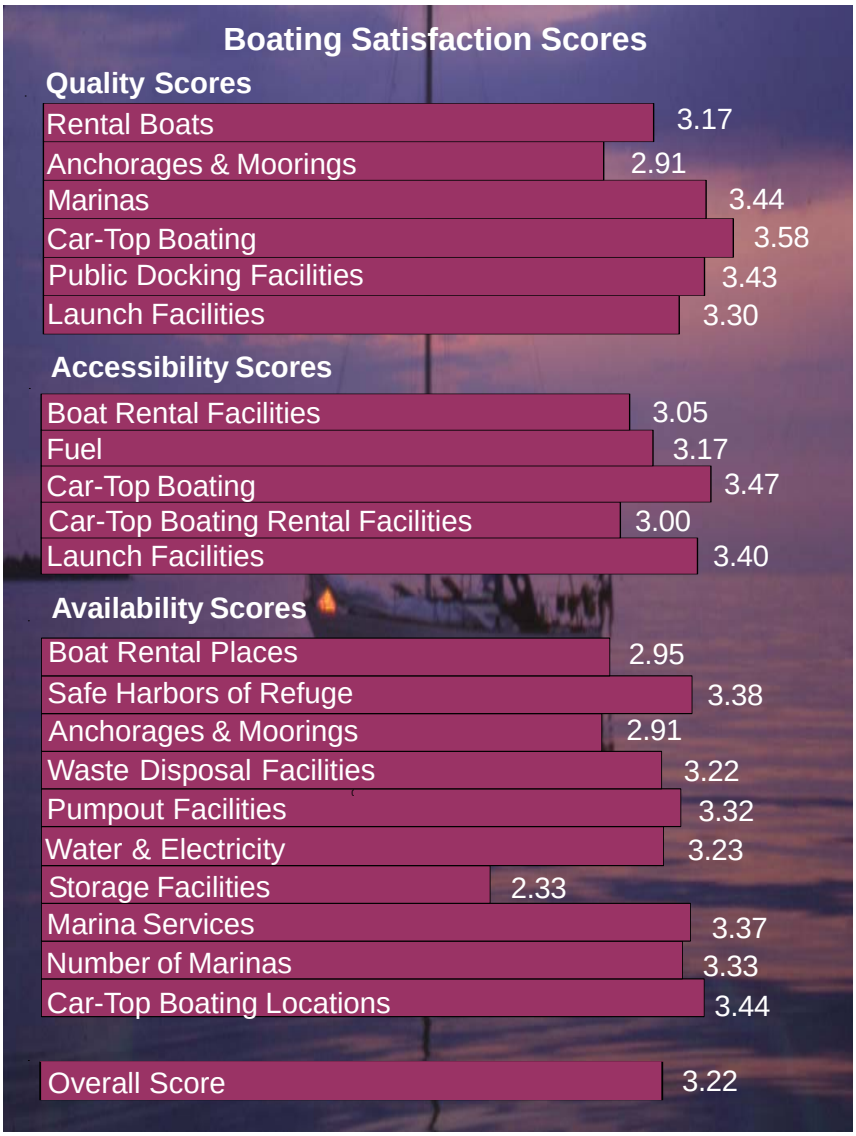
The overall score for this metric is 3.22, equal to a rating of ***Good***. This score is slightly higher than the 3.20 received in the 1998 *Lake Erie Quality Index*.

Funded by Lake Erie Protection Fund

Issues related to boating satisfaction in Ohio are currently being addressed by ODNR's Division of Watercraft Resource Planning Section. This section is composed of planning professionals who work to continually improve the quality of boating in Ohio. They award and administer boating facility

grants, gather and analyze statistical boating data, and coordinate cleanups of rivers, streams, and lakes.

The Resource Planning Section recently completed the *Boating on Ohio Waterways Plan*. This plan, which includes ongoing input and assistance from many interested citizens, boaters, organizations, and agencies, established a framework for future local and state planning efforts. Areas of greatest need for facilities were identified and lake management guidelines developed on a statewide basis. Other major areas addressed include boater wants and needs, ease of boating access, current regulations, and opportunities to create a more favorable boating environment. The plan will be reevaluated in the future to incorporate any major changes that are needed.



Ohio Clean Marinas Program

Ohio has recently joined other states in the nation in developing a Clean Marina Program. This program recognizes those marinas that adopt "Best Management Practices" to help Ohio achieve its nonpoint pollution plans goals. Areas of concern that are addressed by the program include siting and design, and marina and boat operation and maintenance.

An additional component of the project is the Clean Boater Program. By establishing an educational program to make boaters aware of the Clean Marinas Program and how they can implement "Best Boater Practices," the negative impacts that boating has on Lake Erie and other water bodies will be reduced.

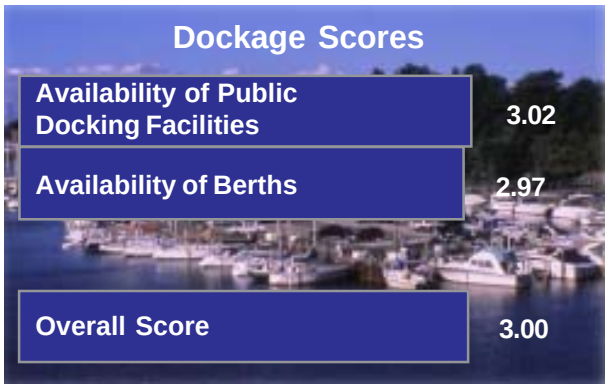
For more information on boating contact:

ODNR- Division of Watercraft
Web: ohiodnr.com/watercraft
Phone: 614-265-6480
Email: watercraft@dnr.state.oh.us

GOOD

Dockage Metric

In order for people to be able to enjoy Lake Erie boating, they need a place to keep their boats. Whether at in-water spots or dry racks, measuring the availability of dock space is an important aspect of boating. According to field surveys conducted as part of ODNR's Division of Watercraft Facility Inventory in 2000, there are almost 40,000 docks available along Lake Erie. This number is lower than that stated in the 1998 report due to a more accurate counting method. Most of these docks are located in the western part of the state, mainly because of better lake access in that region.



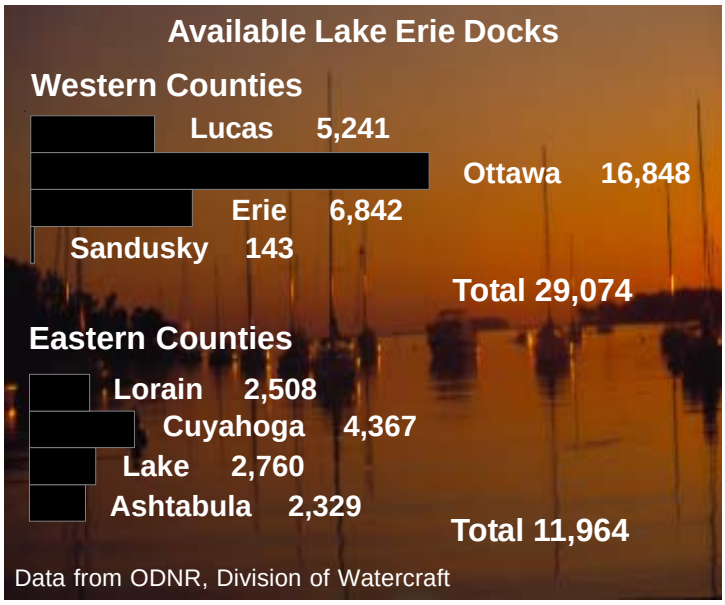
While the total number of available docks is known along the shoreline, demand for them is not. A more accurate picture of dockage can be gleaned from the public's perception of availability. Therefore, the *Dockage* metric is based on results from the public opinion survey conducted by The Strategic Research Group. Participants in the survey were asked questions about the number of publicly available docking facilities and the number of berths available at each of those facilities.

Funded by Lake Erie Protection Fund

It was found from these results that Ohio's citizens give a ***Good*** rating to dockage availability. The number of public docking facilities scored 3.02, while the availability of berths was slightly lower at 2.97.

One initiative in Ohio that is working towards increasing dockage is the Boating Infrastructure Grant (BIG) Program. Funds through this program are available to public and private agencies and marinas and other facilities that provide transient tie-up opportunities for non-trailerable (26' or over in length) recreational boats.

ODNR is also trying to increase the availability of dockage in the Lake Erie region. One example of this is the recent purchase of 124 acres on Middle Bass Island that included an existing marina harbor. This area has been developed as a state park with the marina, including transient docks, as a key component.

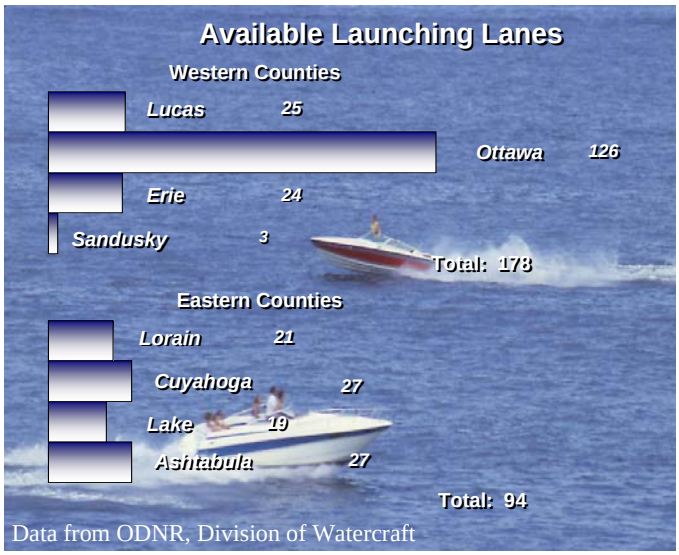


For more information on capital improvements contact:
ODNR- Division of Watercraft
Web: ohiodnr.com/watercraft
Phone: 614-265-6480
Email: watercraft@dnr.state.oh.us

Boat Launching Facilities Metric

GOOD

Of equal importance to dockage is the availability of boat launching facilities. Having a high number of ramps to allow quick and easy access can be directly related to a boater's satisfaction with the lake. The field studies conducted as part of ODNR's Division of Watercraft Facility Inventory in 2000 show that there are 272 boat ramps along the Lake Erie shoreline. Once again, most of these are found in the western half of the state.



Data from ODNR, Division of Watercraft

The *Boat Launching Facilities* metric measures boaters' perceptions on the ability to directly access the waters of Lake Erie. Participants in the opinion survey that was conducted were asked about their satisfaction with the number of launch facilities that were available to them. Results from the survey show that Ohioans rate the availability of boat ramps as ***Good***. The score of 3.02 that was received was higher than the 2.95 in the last survey.

One of the components of the *Boating on Ohio Waterways Plan* completed by the Division of Watercraft's Resource Planning Section was an evaluation of all state-operated launching facilities. The condition and distribution of facilities were analyzed to determine the need for new or improved publicly owned launch access facilities. Based on this analysis, some of the key priorities for improvement include expanding the number of launching lanes, increasing available parking, improving lighting and security, and improving access roads and signage.

Funded by Lake Erie Protection Fund

Improvements to boat launching facilities have also been occurring through the Cooperative Boating Facility Grant Program, part of the Waterways Safety Fund. A percentage of money obtained through the Ohio Marine Fuel tax and boater registration and title fees helps to fund this program. The goal is to provide financial assistance for local and state government agencies trying to improve and create new access for boaters. Priority is given to those projects that offer access to waterways which support significant opportunities for recreational boating.

For more information on capital improvements contact:
ODNR- Division of Watercraft
Web: ohiodnr.com/watercraft
Phone: 614-265-6480
Email: watercraft@dnr.state.oh.us

GOOD

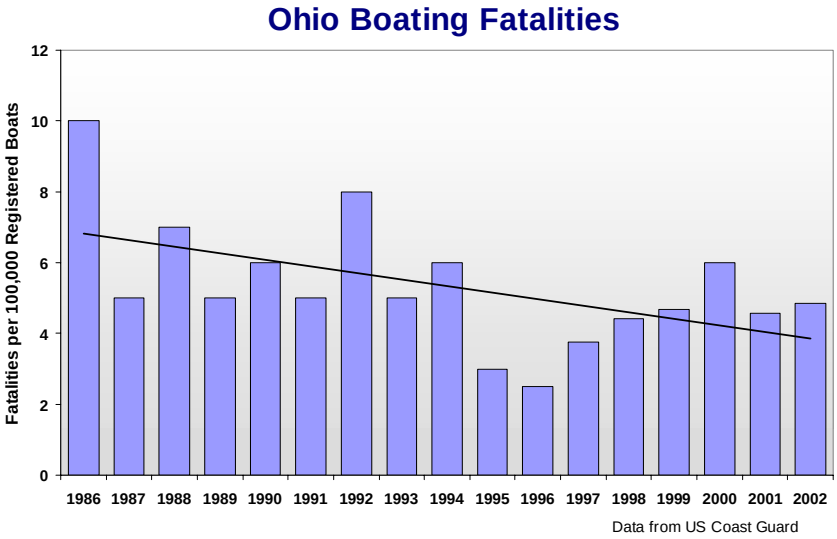
Boating Safety Metric

Each summer, thousands of Ohioans travel to Lake Erie in order to take advantage of its excellent boating opportunities. Whether for fishing, water sports, or other recreational activities, boating safety is important in order to ensure the enjoyment of everyone who is on the lake. This is especially true given the recent increase in the number of boats on the lake.

The score for the *Boating Safety* metric was developed using data 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. The State of Ohio believes this information is useful since, historically, a large portion of the accidents and fatalities have occurred on Lake Erie.

The Lake Erie Commission has set a goal of being in the top 10 of all states for the least number of fatalities. If this occurs, then a rating of ***Excellent*** is given. A ranking of 11-20 is considered ***Good***, 21-30 ***Fair***, and lower than 30 is ***Poor***.

Ohio ranked 16th among the states for the time period from 1998-2002, the most recent data that is available. (Note: Alaska is not included, as there are no "state" waters for statistical comparison.) During this period, there was an average of 4.8 deaths per 100,000 registered boats. This correlates to a score of ***Good***, which is the same as that obtained in the last report. For the 5-year period used in that scoring, the average number of deaths was slightly higher at 4.9 per 100,000 boats.



The current rating shows that while improvement is occurring, there is still a need to lower the number of fatalities occurring on the lake. Two important ways of reducing the number of accidents include safety education and increases in patrols by watercraft officers.

State Rankings (1998-2002)

1. Iowa 2. Minnesota 3. South Dakota 4. Michigan 5. Pennsylvania 6. Wisconsin 7. Georgia 8. Kansas 9. Illinois 10. New Mexico	**Excellent**
11. Indiana 12. New York 13. South Carolina 14. Nebraska 15. Oklahoma 16. Ohio 17. Missouri 18. Connecticut 19. California 20. North Dakota	**Good**
21. New Jersey 22. Tennessee 23. Mississippi 24. Maryland 25. Massachusetts 26. New Hampshire 27. Vermont 28. North Carolina 29. Delaware 30. Florida	**Fair**
31. Arizona 32. Hawaii 33. Alabama 34. Dist. Of Columbia 35. Maine 36. Texas 37. Virginia 38. Nevada 39. Oregon 40. Arkansas 41. West Virginia 42. Rhode Island 43. Utah 44. Kentucky 45. Colorado 46. Idaho 47. Washington 48. Montana 49. Louisiana 50. Wyoming	**Poor**

One example of how boaters may not be as knowledgeable about safety is by looking at the use of personal floatation devices (PFDs). In 2003, there were 19 fatalities throughout the entire state. In each of these accidents, PFDs, which could have helped prevent some of these deaths, were either not worn, not worn properly, or there were not enough on board. This indicates that many people may be unclear about the need and benefit of these devices.

ODNR is improving boating safety knowledge through the Division of Watercraft's Waterways Safety Fund. This fund, which started in 1982, awards grants between $500 and $30,000 to qualified applicants to establish, develop, expand, maintain and promote boating safety programs in the state and help younger boaters meet the provisions of Ohio's mandatory boater education law. The money for this fund comes from boater registration, a portion of the state gasoline tax, and the United States Coast Guard. In 2003, grants totaling over $150,000 were given to various organizations in the Lake Erie region. For 2004, this total increased to over $290,000.

The second means of reducing accidents is also being addressed by ODNR. In the last several years, the Division of Watercraft has made an effort to increase the presence and activity of state and local law enforcement on Lake Erie. This included establishing a watercraft officer in Ashtabula.

Grants are also available through the Division of Watercraft Marine Law Enforcement Assistance Grant Program to assist with establishment or operation and maintenance of marine patrols in the state. It is hoped that increases in marine patrols will help foster safer boating on the waters of Lake Erie and lead to tighter enforcement of boating operations, equipment, and education regulations. As a result of these actions, more patrol hours have been logged recently on the lake than in any other time period.

For more information on boating safety contact:

ODNR- Division of Watercraft
Web: ohiodnr.com/watercraft
Phone: 614-265-6480
Email: watercraft@dnr.state.oh.us

Fishing Indicator

GOOD

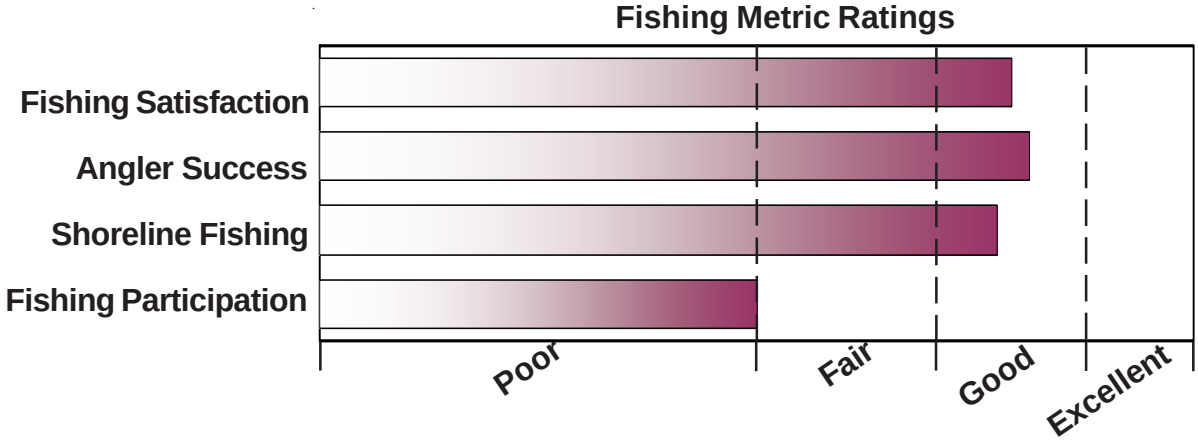
The fisheries of Lake Erie provide a valuable recreational and economic resource to the state of Ohio. Each year, hundreds of thousands of anglers from the state and throughout the world travel to the lake to try their skill at landing the "big one." Some of the most popular species in Lake Erie include walleye, yellow perch, white bass, smallmouth bass, and steelhead trout.

According to a recent U.S. Fish and Wildlife Service survey, the economic value of Lake Erie sport fishing is estimated to be in the hundreds of millions of dollars. Although down from the nearly billion dollar estimate given in the 1998 *Lake Erie Quality Index*, this activity is still a major contributor to the North Coast's economy.

Managing the fisheries in the 2.24 million acres of Lake Erie under Ohio jurisdiction is a challenging task. Fish populations must be monitored and carefully evaluated to maintain optimal populations. Other important activities, such as enforcing regulations and developing access points from which to fish, are needed to allow as many people as possible to experience the joys of sport fishing.

The current state of Ohio's Lake Erie fisheries can be assessed through goals derived by the Ohio Department of Natural Resources, Division of Wildlife as associated with four metrics: *Fishing Satisfaction, Angler Success*, *Shoreline Fishing*, and *Fishing Participation*.

The first three of these metrics show that Ohio is well on its way to meeting its goals, as all have rated in the ***Good*** range. Only fishing participation was rated lower at ***Fair***. The reduction in the number of fishing hours by lake users and a change in the scoring system have lowered the overall rating for the section from the ***Excellent*** received in the 1998 report to ***Fair***.



Fishing Satisfaction Metric

GOOD

As with boating, fishing satisfaction is essential in keeping Lake Erie a top destination for anglers around the world. The best means of measuring this satisfaction is to ask those who actually use the lake for fishing. Therefore, the rating for this metric was developed using the results from the public opinion survey conducted by The Strategic Research Group. Participants in the survey were asked questions about various aspects of Lake Erie fishing pertaining to quality, accessibility, and availability of the overall lake fishing, ice fishing, and supplies. Shoreline fishing, which was included under this section in the last report, is measured as a separate metric.

The overall rating received for the evaluated areas was 3.17 or ***Good***, indicating the public's general satisfaction with Lake Erie fishing. All of the measures scored between 3.03 and 3.34 on a scale from 0-4. The highest score went to quality of Lake Erie fishing, with availability of fishing supplies as the lowest. These scores, for the most part, are higher than those received in the last survey. Only the quality of ice fishing and the availability of fishing supplies were lower.

The continuing process of restoring Lake Erie will help in maintaining the lake as a high quality fishing location. Healthy fish populations, which lead to fishing success and a better public perception of Lake Erie, require clean waters and suitable habitats. Through the Lake Erie Protection Fund, many projects are currently underway to study fish populations in the lake. Some of these include evaluations of the critical habitats for young fish in coastal areas, the genetic stock structure of yellow perch and walleye, and the role of round gobies in the ecosystem. Results from these projects will help in guiding management decisions for Lake Erie fisheries.

Funded by Lake Erie Protection Fund

For more information on fishing contact:
ODNR, Division of Wildlife
Web: ohiodnr.com/wildlife
Phone: 419-625-8062

For more information on the Strategic Research Group Survey contact:
Ohio Lake Erie Commission Office
Web: www.epa.state.oh.us/oleo
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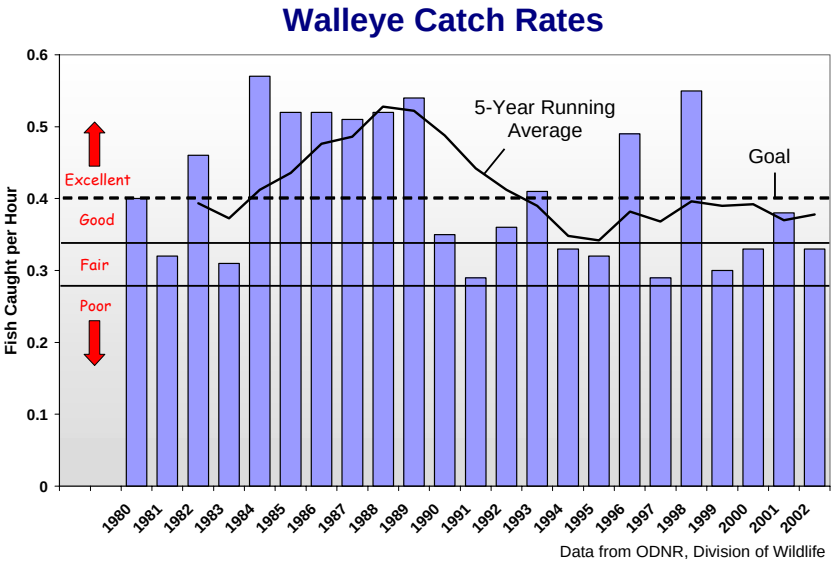
Angler Success Metric

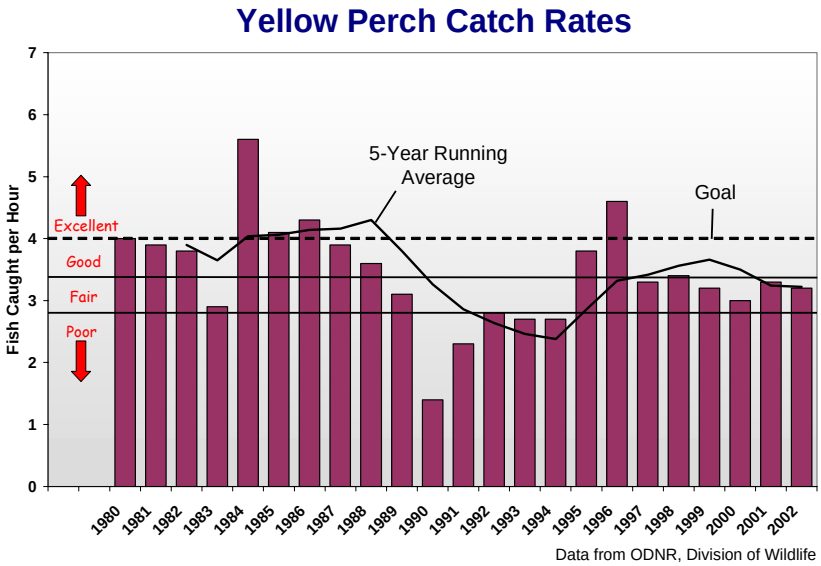
GOOD

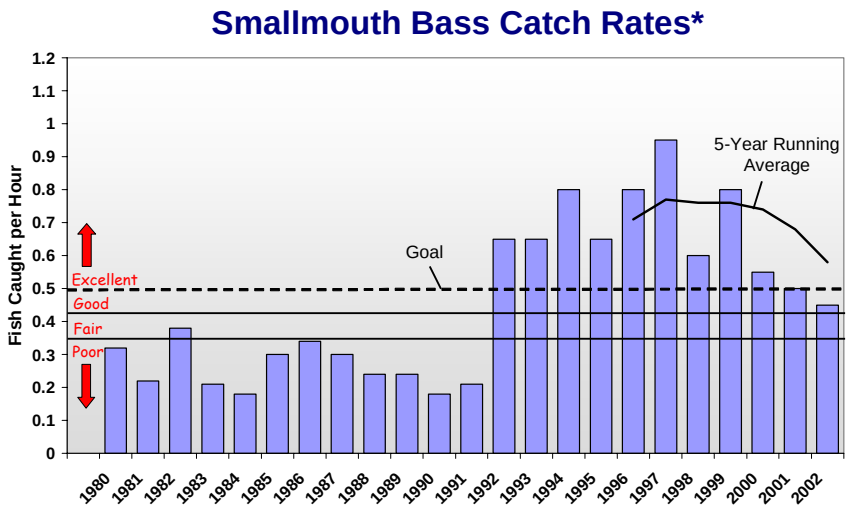
Success to most anglers means catching fish, particularly of the species that is desired. Anglers seeking walleye are equipped to fish for walleye and are unlikely to fish for other species on the same trip. The ODNR, Division of Wildlife surveys Lake Erie anglers and estimates the amount of fishing time expended toward catching each species and the number of each species harvested.

Goals for each of the lake's major species have been set by the ODNR, Division of Wildlife to measure angler success. Catch rate, the measure used to assess these goals, 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. The goals that were derived for each species are based on long-term characteristics in the 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.

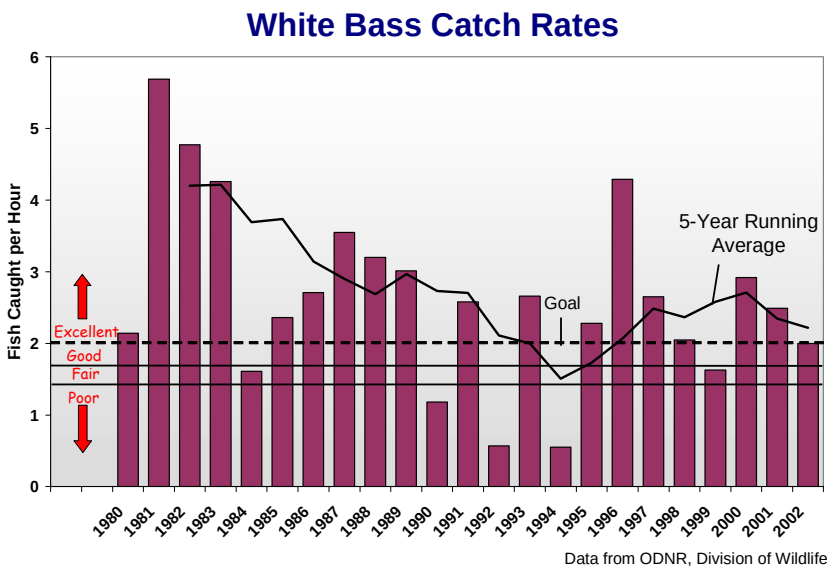


Catch rates are influenced by a number of factors, including fish abundance, the size and age structure of the fishable populations, availability of natural food items, weather, fishing technique, and angler skill. Catch rates tend to be highly variable because of these factors, but still can provide useful insight into angler success when interpreted properly. To smooth out the annual fluctuations in the data, a five-year running average line was constructed and used to determine catch rate scores. 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





*Data from 1992-2002 includes 80% catch and release rate. Five-year averages computed only for years 1992-2002. Data from ODNR, Division of Wildlife.



Data from ODNR, Division of Wildlife

anglers voluntarily practice catch-release on this species.

As the graphs show, people are successful at catching fish in Lake Erie. Walleye catch rates in recent years have been typical of the 1990s and are rated ***Good***. Yellow perch catch rates in recent years are just below average and rate ***Fair***. Smallmouth bass catch rates have been declining since 1996 but still rate ***Good***, while white bass are being caught at ***Excellent*** rates. The overall rating for the metric is ***Good.***

These results show that angler success varies among species and across years in Lake Erie. However, these catch rates surpass those observed for the same species in other waters both within Ohio and in other regions of North America and indicate the importance of the lake as a fishery resource.

Scoring of Angler Success Metric			
	Score	Weighting	Weight Score
Walleye	3.0	0.25	0.75
Yellow Perch	2.0	0.25	0.50
Smallmouth Bass	4.0	0.25	1.00
White Bass	4.0	0.25	1.00
		Rating	3.25 *Good*

For more information on angler success contact:
ODNR, Division of Wildlife
Web: ohiodnr.com/wildlife
Phone: 419-625-8062

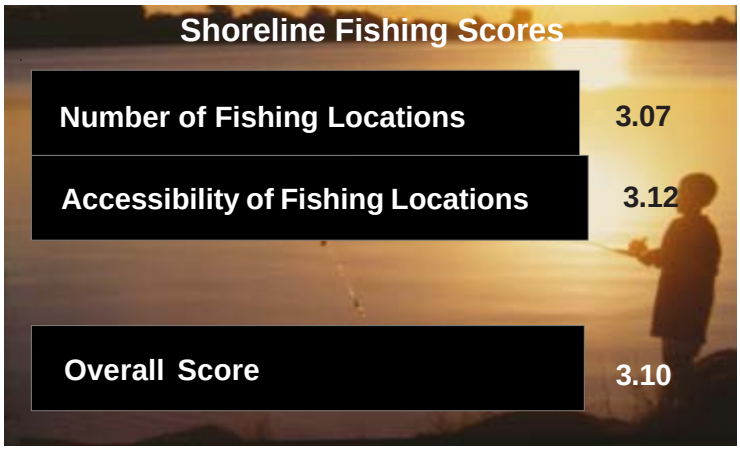
GOOD

Shoreline Fishing Metric

Although a large portion of fishing on Lake Erie comes from boat anglers, fishing in shoreline areas is still a popular pastime, either by necessity or choice. According to the public opinion survey conducted by The Strategic Research Group, 22% of those who fish Lake Erie do so exclusively from the shoreline. Another 37% fish both from the shoreline and on the lake. The most popular fish that are sought along the shore include walleye, yellow perch, and channel catfish.

In the last *Lake Erie Quality Index*, the *Shoreline Fishing* metric was based on the number of access sites that were available to the public. Although no goals were set for the locations, 70 access sites was considered ***Excellent***, based on the limited amount of shore-based sport fishing.

For this report, the metric examines angler responses to the number of fishing locations available along the Lake Erie coast and the accessibility of these locations. The number of locations received a 3.07 on a scale from 0 to 4, while accessibility of these locations received a score of 3.12. Both of these scores are improvements over the scores from the last opinion survey and are equal to a rating of ***Good***. Because of this, the metric as a whole will also be rated as ***Good***.



The Division of Wildlife is responsible for many of the fishing access areas along the shore of the lake. While these areas appear to be meeting the needs of Lake Erie anglers, there is always room for improvement. Increasing the quality of shoreline fishing facilities requires addressing the accessibility, aesthetics, and safety of these sites. Specific areas that can be improved include installing weather protection structures such as roofs and wind blocks, making approaches and fishing areas more handicap accessible, adding restroom facilities and cleaning tables, and providing natural landscaping for facilities and surroundings. The Division is currently working on evaluating all state fishing facilities and prioritizing funding for areas that need the most improvement.

For more information on shoreline fishing contact:
ODNR, Division of Wildlife
Web: ohiodnr.com/wildlife
Phone: 419-625-8062

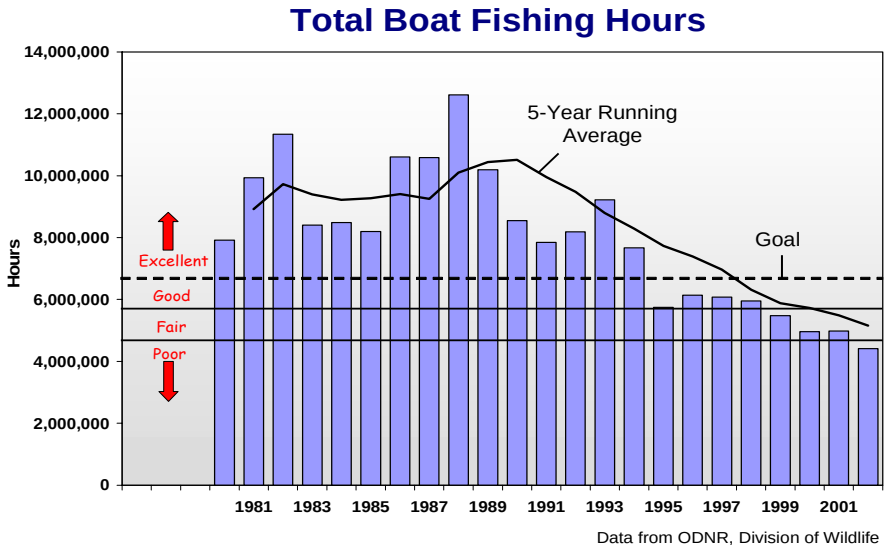
Fishing Participation Metric

FAIR

One measure of the quality of fishing in Lake Erie is the amount of time that is spent by individuals taking part in it. When the quality of fishing is high, both new and returning anglers should participate. This metric, based on total boat fishing hours, compares the fishing effort on Lake Erie to goals determined by the ODNR, Division of Wildlife.

The Division of Wildlife conducts annual surveys to estimate the hours spent fishing by Ohio Lake Erie anglers, also known as "effort". Annual fishing effort since 1980 has averaged over 7.5 million hours, but has dropped below this level every year since 1998. The value of 4.6 million hours in 2002 was the lowest in the time period and below a target of 6.7 million hours set by the Division of Wildlife. Based on a 5-year running average, the current rating for this metric is ***Fair***. Efforts are underway to better understand what is driving this decline in participation and how it can be reversed.

One program that is currently being used by the Division of Wildlife to increase the number of anglers in the state is "Hooked on Fishing- Not on Drugs." The Division of Wildlife became involved in this program in the early 1990s in the hopes of using interest in fishing and the outdoors to keep children from using drugs and alcohol. Through this program, the division provides free workshops and training materials to educators throughout the state. Once trained, these people can apply for grants to support their educational efforts or may become eligible to receive fishing equipment donations. So far, over 1300 educators have been trained through "Hooked on Fishing- Not on Drugs", with the program expected to continue in the future.



For more information on Lake Erie fishing contact:
ODNR, Division of Wildlife
Web: ohiodnr.com/wildlife
Phone: 419-625-8062

Beaches Indicator

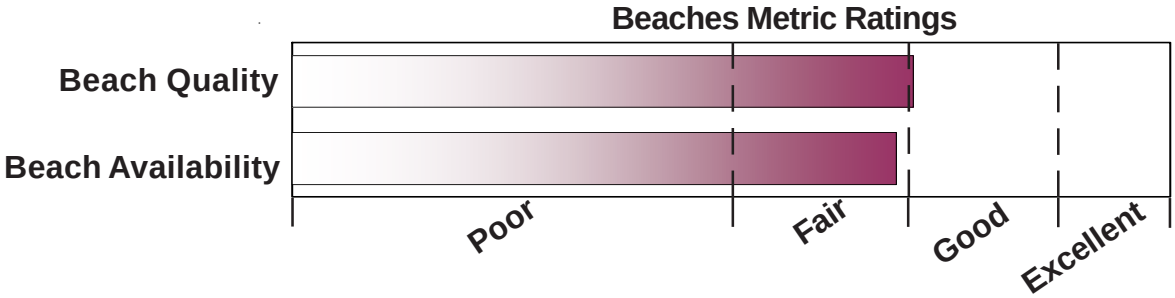
GOOD

Ohio's portion of the Lake Erie coastline is home to 23 beaches that are open to the public. Eight of these beaches, at Maumee Bay, Crane Creek, East Harbor, Cleveland Lakefront, Headlands, Catawba Island, Kelleys Island and Geneva, are part of Ohio's State Park system managed by the Department of Natural Resources. Other beaches are run by cities and counties and are present in many locations along the North Coast. All of these beaches provide excellent opportunities for swimming, sunbathing, building sand castles, volleyball, and of highest importance to many people, relaxing.

The metrics that were used for the *Beaches* indicator in the 1998 report were modified to account for the public's view on how well Ohio is doing in regard to these areas. The two metrics that make up the current *Beaches* Indicator are *Beach Availability* and *Beach Quality*. These measures examine two important aspects of Lake Erie beaches: (1) if there are enough beaches to satisfy the needs of the public and (2) if the beaches that do exist are of high enough quality to ensure the enjoyment of those that visit them. Quality measures that were evaluated included physical parameters of the beach as well as safety and facility conditions.

From these measures, it is evident that the current system of beaches along Lake Erie can be improved. Although *Beach Quality* is rated as ***Good***, *Beach Availability* rated as only ***Fair***.

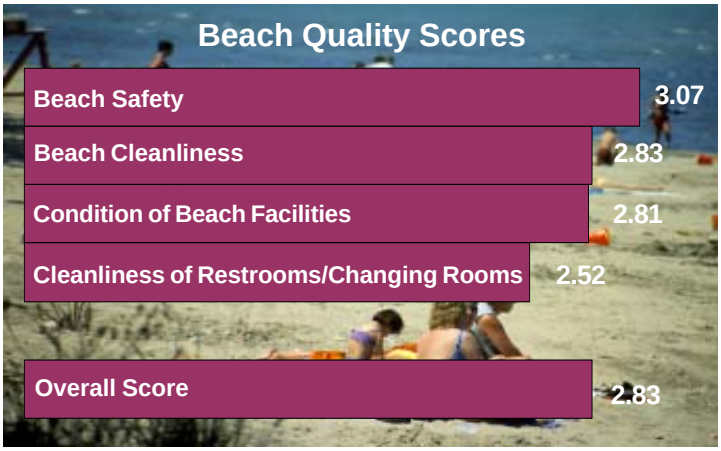
Providing the citizens of Ohio with enough high quality, safe beaches is one of the priorities of ODNR's Coastal Management Program and the Divisions of Real Estate & Land Management and Parks & Recreation. Many of their programs focus on increasing the availability of public beaches along the shoreline. They are also trying to increase the quality of those beaches by improving access, parking, concessions, services, and security to existing beaches and to develop new publicly accessible beaches. All of these activities will contribute to the goal of ensuring that as many people as possible enjoy Lake Erie's coastline.



Beach Quality Metric

GOOD

Even though only 3% of the Lake Erie coastline is available to the public as beaches, spending the day there is still a common activity. In a survey of people who had visited Lake Erie in the last five years, 40% reported having gone to a beach at least once. Beachgoers enjoy swimming, volleyball, and sunbathing at many of the state parks and private beaches along the North Coast.



For the *Beach Quality* metric, the users of Lake Erie beaches were surveyed on their views about beach cleanliness, the condition of beach facilities, and beach safety. Scores for the surveyed areas ranged from 2.52 to 3.07 on a scale of 0 to 4. Beach safety had the highest score, while the cleanliness of restrooms/changing facilities was the lowest. The overall average of these scores was 2.83, equal to a rating of ***Good*** for the metric. This score is an improvement on the score of 2.72 that was received in the last report for the same four measures.

Improving on the quality of Lake Erie beaches requires the effort of many people. In recent years, ODNR's Division of Parks and Recreation has been conducting surveys to determine what other amenities people desire at beaches. The responses from those surveys have been used to prioritize projects. The division has also organized sponsorship opportunities for local civic, school and corporate groups to take increased responsibility for beach cleaning, facility improvement and customer satisfaction. As a result, "Friends" groups at Maumee Bay and East Harbor have contributed to park facility improvement projects, while on Kelleys and South Bass Islands, numerous beach cleanup days have been held.

Funded by Lake Erie Protection Fund

Other cleanups have also taken place through the Coastweeks Programs coordinated by the Ohio Lake Erie Commission Office. Coastweeks is a month-long event consisting of beach cleanups and a variety of other coastal activities. In 2003, cleanups were held in 18 locations ranging from Maumee Bay Park to Euclid Beach Park. Approximately 300 volunteers cleaned 21 miles of beach and collected over 3000 pounds of garbage to make these places more enjoyable for the public to visit.

For more information on beaches contact:
ODNR- Division of Real Estate and Land Management
Web: ohiodnr.com/realm
Phone: 614-265-6395
Email: realm@dnr.state.oh.us

For more information on Coastweeks contact:
Ohio Lake Erie Commission Office
Web: www.epa.state.oh.us/oleo
Phone: 419-245-2514
Email: lakeeriecommission@ameritech.net

FAIR

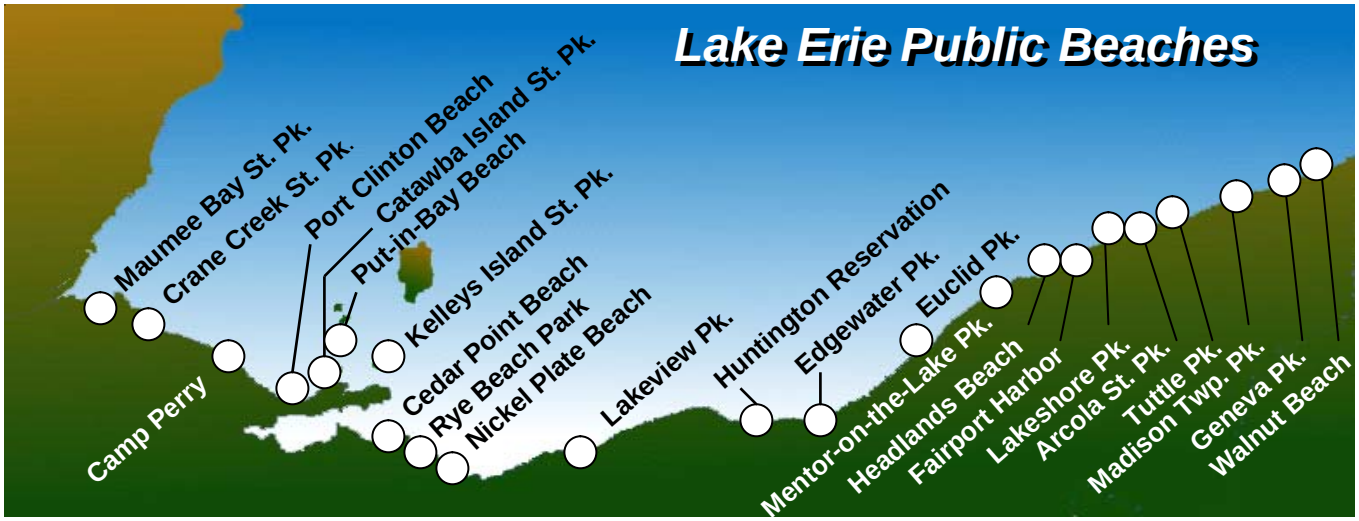
Beach Availability Metric

In 1998, the *Beach Availability* metric was listed as still being developed. Since that time, it has been decided that availability should be measured by what the public thinks is appropriate in order to fulfill its needs. Therefore, this metric is rated according to beach users views on the number of beaches available along the Lake Erie shoreline.

In the public opinion survey completed by The Strategic Research Group, the score for the number of beaches was 2.81. This is higher than the 2.67 received in the last survey, but is still rated ***Fair***. As indicated by this rating, there is a need to increase beach availability to the public. This task, however, is a challenging one for several reasons. In the eastern part of the state, a large portion of the shoreline is comprised of cliffs that are unsuitable for beach development. Another problem is that much of the shoreline belongs to private owners, and therefore, must be acquired through voluntary sale to the state before being made open to the public.

The Division of Parks and Recreation is currently attempting to address the issue of beach availability in Ohio. In a recent survey on recreation, it was found that swimming and beach areas were viewed as one of the higher priorities for the establishment of new facilities in the state. The study also found that Ohio citizens favored increasing funding towards the purchase of land for recreation. Because of this, there are currently three actions being undertaken by the division to address this issue. These actions include acquiring priority tracts of Lake Erie beach properties, seeking partnerships with local governments and organizations to provide public access to beaches, and reestablishing or maintaining new public beaches using beach nourishment technologies.

Funded by Lake Erie Protection Fund



Economy Indicator

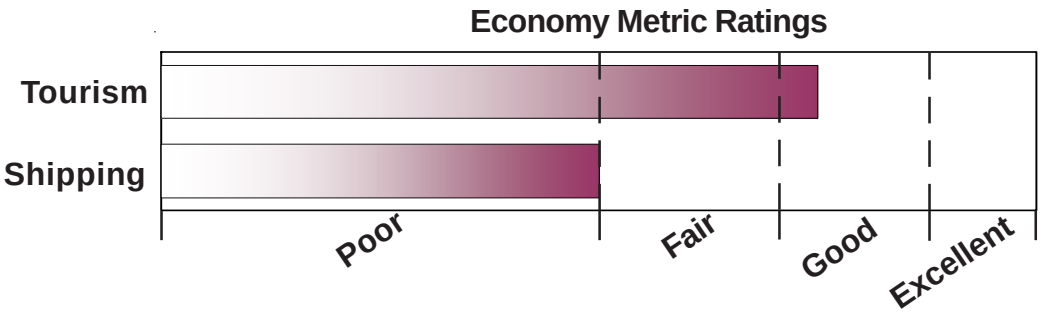
FAIR

One significant impact that Lake Erie has on the region is through the economy. The beauty and excitement of the lake draws millions of visitors to it each year. They come to experience the rich maritime history, walk its windswept beaches, canoe scenic tributaries, and climb beautiful lighthouses. In addition to direct expenditures, the effect of visitors taking part in these activities is the creation of more than 130,000 jobs and the generation of more than $400,000 in state and local taxes.

Shipping through Lake Erie's ports also has major benefits for the region's economy. The ports along Ohio's portion of the Lake Erie shoreline serve as a destination for raw materials and a distributor of finished goods associated with mining, steelmaking, construction, power generation, and many support industries throughout the world.

The Tourism and Shipping indicators from the 1998 *Lake Erie Quality Index* have been combined into one indicator that measures the impact that the lake has on the region's *Economy*. The *Tourism* metric looks at the influence of tourists in the region as measured through direct expenditures. The *Shipping* metric examines the amount of activity occurring in Lake Erie's ten major ports and takes into account the degree of handling necessary to move each type of cargo.

Under new methodology, the *Tourism* metric has rated ***Good***, while *Shipping* remains at ***Fair***. Both of these areas have shown declines within recent years. The effects of the 2001 terrorist attacks on the United States and the overall downward trend of the economy have led to this decline. Better marketing of the unique locale of Lake Erie, a refocusing of resources throughout the basin, and an upswing in the country's economy can all be expected to bring recovery for both of these areas in the near future. This can already be seen in the rise in tourism expenditures in 2003.



Tourism Metric

GOOD

The Lake draws people to it. The open water and the numerous activities it affords have a large value in the quality-of-life for many Ohioans. Every weekend finds more and more people driving to the lake for recreation and recharging.

The economic value of this natural asset can be seen in the numbers and the dollars that are generated by the tourism sector of the lake counties. In 2003, tourism generated enough economic activity to support 130,800 jobs, with traveler expenditures in the seven lake counties topping $7.4 billion. These values were determined from an Economic Impact, Performance and Profile study conducted by Rovelstad and Longwoods International for the Ohio Department of Development. This study is conducted every two years, with regional breakouts completed when funds are available.

The current tourist economic impact is equal to a rating of ***Good***. This is a significant improvement over the data for the year 2001. At that time, there was a ten percent decline from the previous year in a key market segment, overnight stays. The decline that occurred was the result of many factors. The entire travel industry suffered as a result of the September 11, 2001 attacks on the United States, the subsequent terror alerts, and the recent SARS scare; however, both business and leisure travel in the United States were declining as early as late-2000. These tragic events expedited an economic downturn already underway. Because tourism is closely connected with consumer confidence and disposable income, a serious economic downturn generally impacts the number and length of trips taken.

Although the challenges during the past few years have been unprecedented, tourism has also been challenged by shifting consumer preferences and trends. The travel patterns of Baby Boomers and Generation Xers are vastly different than those that came before them. In addition, most people don't have the time to travel as much as they'd like due to other time demands and responsibilities. These trends and others

Lake Erie Tourism				
	1999	**2000**	**2001**	**2003**
Traveler Expenditures	$7.37 billion	$7.38 billion	$6.05 billion	$7.45 billion
Employment (fulltime equivalents)	175,800	173,800	142,300	130,800
Wages	$2.51 billion	$2.48 billion	$2.02 billion	$2.24 billion
State Tax Generated	$255 million	$266 million	$219 million	$344 million
Local Tax Generated	$265 million	$262 million	$223 million	$202 million

Methodology for measuring Tourism impacts has changed since the publication of the first Quality Index. A major improvement was the introduction of the day trip market, which constitutes 78% of Ohio's travel market. 1999 was the first year this new methodology was implemented. However, the 1999 data was derived from older surveys and should not be used to determine trends.

have transformed the tourism marketplace drastically in a very short time, creating shorter trips and trips closer to home.

The State of Ohio has also experienced a declining market share in recent years. There are not only fewer travelers out there, but also Ohio is not getting its share of them. The lack of marketing muscle due to a lack of marketing dollars is one reason why the state has experienced a regional market share decline of 28% in the last eight years.

Tourism growth is directly related to the investment in advertising and public relations by the State of Ohio and its tourism partners. Marketing outreach is conducted by a number of unique agencies in the Lake Erie region. Each county has a convention and visitors bureau that is funded through a locally approved bed tax. In addition, the State of Ohio has a division of Travel and Tourism at the Ohio Department of Development which oversees the "OHIO - SO MUCH TO DISCOVER" program. Another part of the effort is the new Lake Erie Coastal Ohio organization, which coordinates a heritage and nature-based multi-county tourism effort along the Lake Erie coastline.

In the future, the goal for Lake Erie will be to differentiate itself in an increasingly competitive market and to develop tourism products in demand by the traveling public. By working together, the historic and natural sites of Lake Erie can leverage the awareness of their importance to our local economy, job creation, and tax revenues. There is optimism that the decline experienced by Ohio will stabilize and possibly reserve given the combination of current events causing resurgence in regional travel and recent increases in the Ohio Division of Travel and Tourism budget. With additional marketing resources and an improving economy, tourism should experience an upswing of four to six percent annually over the next five years.

Funded by Lake Erie Protection Fund

For more information on tourism contact:

Lake Erie Coastal Ohio
Web: www.coastalohio.com
Phone: 419-609-0399
info@coastalohio.com

Ohio Department of Development, Division of Travel
Web: www.ohiotourism.com
Phone: 1-800-BUCKEYE

FAIR

Shipping Metric

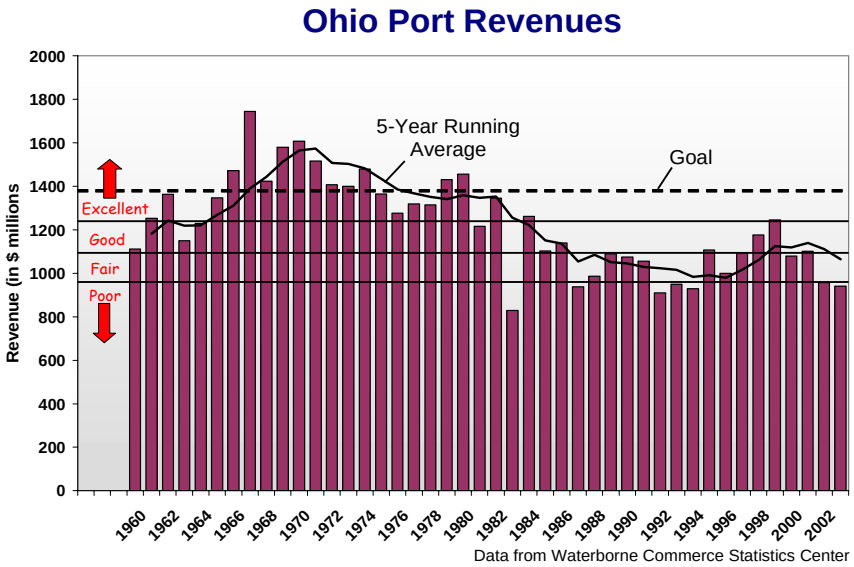
The ten major ports along Ohio's portion of Lake Erie provide a considerable boost to the region's economy. This has especially been true over the last 45 years as international trading has been able to take place through the St. Lawrence Seaway navigation system.

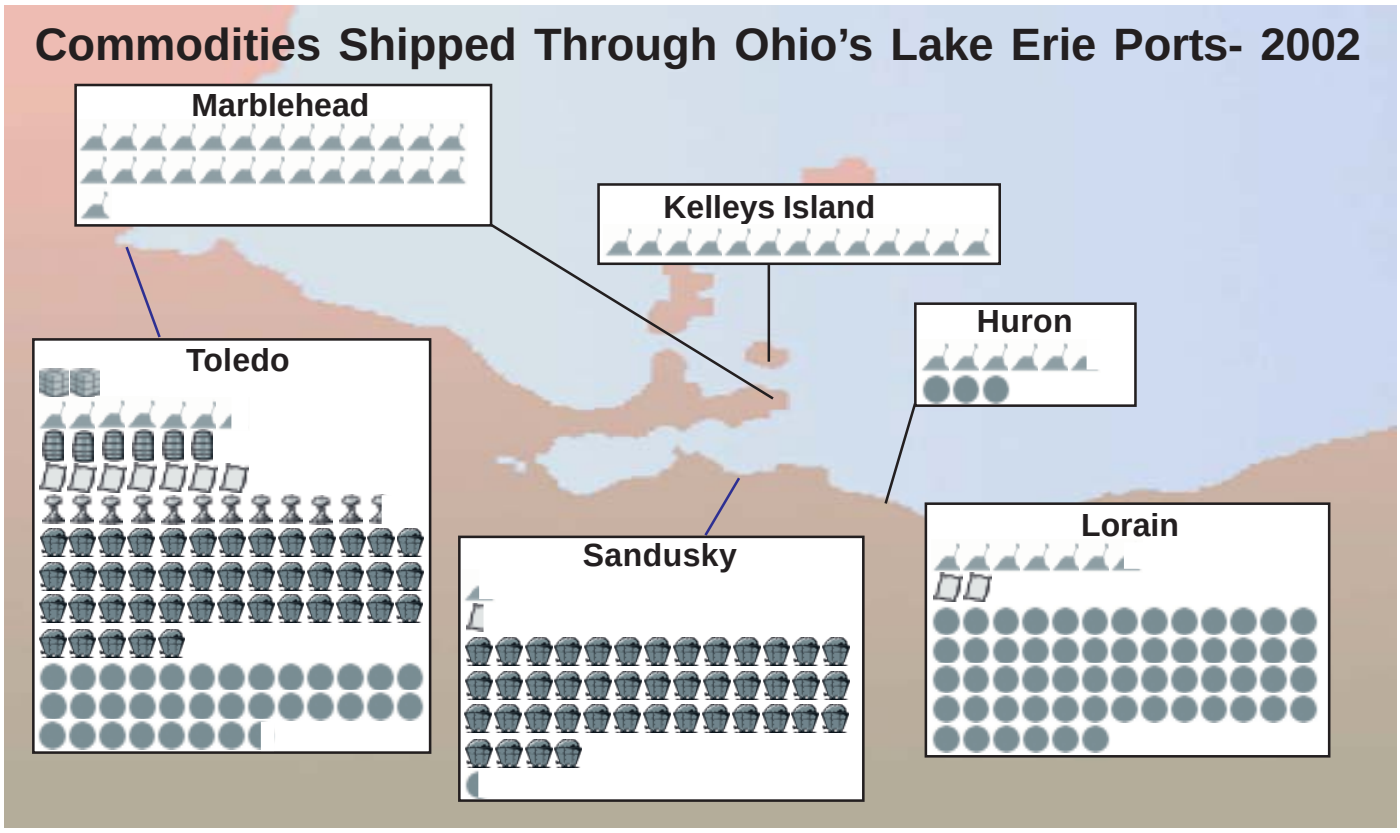
The ports of Cleveland and Toledo are the two largest in the state, with a major portion of their shipping traffic coming from iron ore and coal. Marblehead, Fairport Harbor, and Cleveland all transport large quantities of limestone each year. Other important commodities shipped in the region include cement, salt, sand, petroleum products, and grain. In 2002, the total amount of shipments moving through the Ohio Lake Erie system of ports was over 62 million tons.

The rating for the *Shipping* metric was developed using methodology from the St. Lawrence Seaway Development Corporation to measure the economic impacts in individual cities throughout the Seaway. This methodology was applied to data on shipping in Ohio's Lake Erie ports obtained from the Waterborne Commerce Statistics Center of the U.S. Army Corps of Engineers.

The first step in determining total Ohio shipping revenues was to compile for each port the total annual tonnage moved by type of cargo. The tonnage per cargo classification was then multiplied by a revenue multiplier corresponding to the amount of handling necessary to move a particular type of cargo. Steel, for example, has a high multiplier since each roll or beam of steel must be individually slung, forklifted, and trucked into place. Ore, on the other hand, has a very low multiplier as the entire movement off the ship and into the rail car is completely automated and accomplished in huge volumes.

Next, all of the cargo classifications were added together to acquire the total revenue generated at each port. Finally, the revenues from all of the Ohio ports were totaled to give the annual composite economic benefit to the state



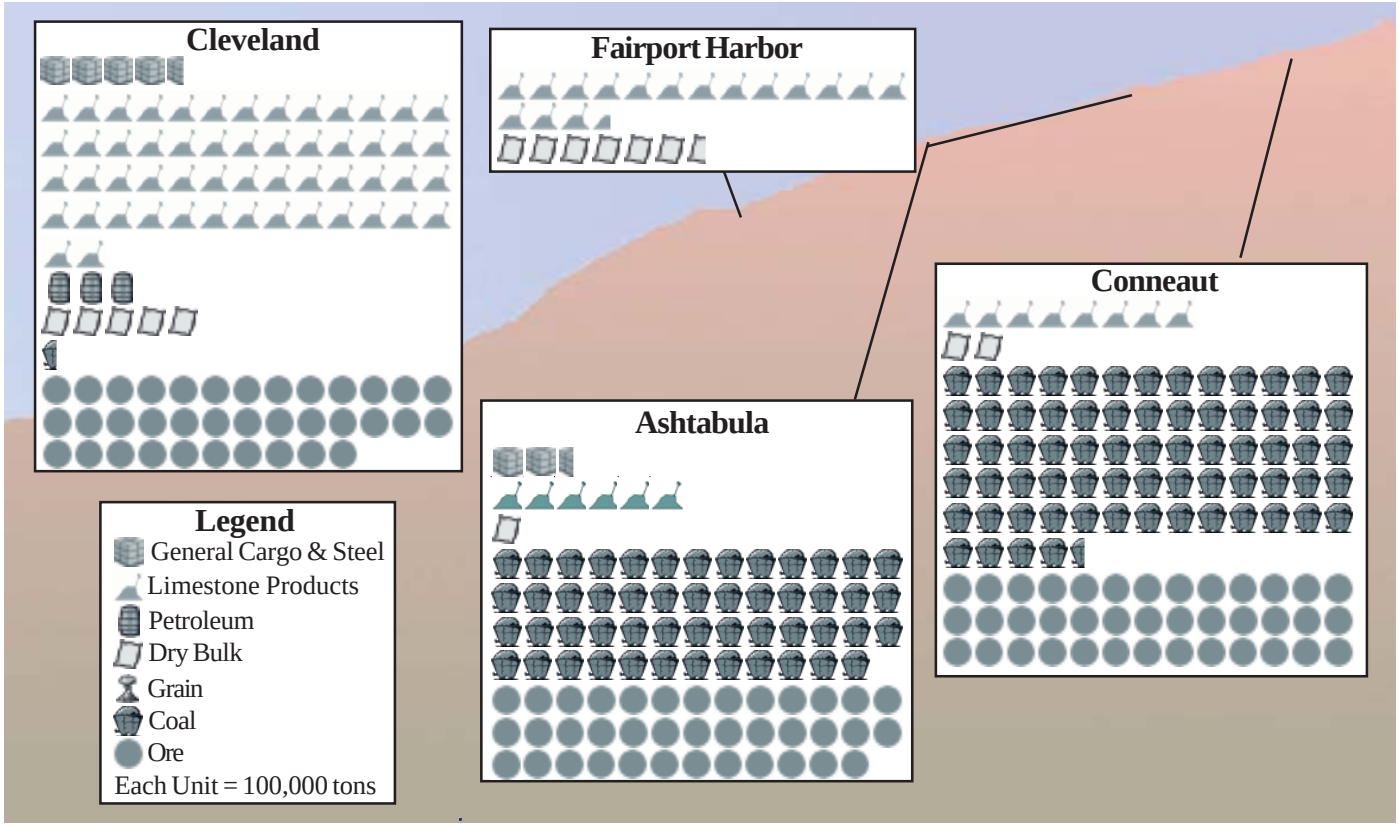


from the Lake Erie shipping industry. The impacts were measured for activity at both public and private facilities at each of the Ohio ports. Also, the impacts were estimated for all cargo moving through Ohio ports, both within the Great Lakes and through the St. Lawrence Seaway. All totals are expressed in 2001 dollars to allow comparisons between different years. Because of the year-to-year fluctuations in shipping, a five-year running average was calculated from the data and used to determine the metric rating.

Revenue Multipliers (per metric ton)	
Steel	$156
General Cargo	$73
Liquid Bulk	$49
Grain	$18
Petroleum	$16
Cement	$16
Coal	$15
Dry Bulk	$14
Stone/Aggregates	$14
Ore	$11

The previous goal for this metric was $1.2 billion. This value was adjusted for inflation to give a new goal of $1.38 billion for this report. Port revenues in 2002, the most recent data available, were $942 million. This continued a declining trend that started in 1999. However, the five year average ($1.06 billion) showed a slightly stronger market trend and provides an overall ranking of ***Fair*** for the metric. This is the same rating that was received in 1998.

One of the main reasons that shipping revenues have declined in more recent years is that steel production and revenues are directly related. Since the use of steel has been lower recently, there is less total cargo being moved through Ohio's ports. Another cause for lower revenues is the recent decline in the strength of the U.S.'s economy.



Increasing the revenue that is generated through Lake Erie's ports requires addressing needs to increase efficiency at the local level, but also as part of the larger St. Lawrence Seaway system. Identifying other opportunities to expand the market for Ohio's products is also critical.

In 2003, the *Nexus Ohio* study was completed by the Ohio Departments of Transportation and Development in conjunction with the Ohio Rail Development Commission and the U.S. Army Corps of Engineers. This study identified Ohio's water transportation system needs and opportunities to improve on multi-modal opportunities.

The same year, the U.S. Department of Transportation, U.S. Army Corps of Engineers, and Canadian Department of Transportation initiated a study of Great Lakes-St. Lawrence Seaway navigation system to evaluate actions and funding required to maintain the existing navigation system through the year 2060. The findings from both of these studies will help Lake Erie and the rest of the Great Lakes remain integral parts of the international shipping industry.

For more information on shipping contact:

Ohio Department of Transportation
Web: www.dot.state.oh.us
Phone: 614-466-8981

Ohio Department of Development
Web: www.odod.state.oh.us
Phone: 1-800-848-1300

Summary of Indicator and Metric Scores

	Metric Weighting	2004 Score	2004 Rating	1998 Score	1998 Rating	Scores: Improved	Declined	Same	Not Comparable
Ambient Water Quality		2.16	Fair	2.8	Good				X
Water Chemistry	0.33	3.5	Excellent						#
Water Clarity	0.33	2	Fair	4	Excellent		X		
Contaminated Sediments	0.33	1	Poor	1	Poor			X	
Toxic Compounds		NS							#
Human Exposure Risks		3.25	Good						
Fishable	0.33	2.75	Fair	3	Good				X
Swimmable	0.33	3	Good	2	Fair	X			
Drinkable	0.33	4	Excellent	4	Excellent			X	
Pollution Sources		2.5	Fair	2.3	Fair	X			
Point Sources	0.5	4	Excellent	3.6	Excellent	X			
Watershed Sources	0.5	1	Poor	1	Poor			X	
Aquatic Habitat		2	Fair	1.7	Fair				X
Aquatic Habitat Quality	1	2	Fair	2	Fair				X
Land Use Indicator		NS							
Green Area Conversion		NS							
Wetlands		3	Good	2	Fair				
Shoreline Hardening		NS							#
Biological		2.65	Fair	2.9	Good				X
Key Indicator Species	0.3	3	Good	3.7	Excellent		X		
Shoreline/Tributary IBI	0.175	2	Fair	1	Poor				X
Offshore Plankton IBI	0.175	2	Fair						#
Offshore Fish IBI	0.175	3	Good						#
Coastal Wetland IBI	0.175	3	Good						#
Coastal Recreation		3.3	Good	3.2	Good				X
Quality of Facilities	0.5	3.32	Good			X*			
Public Access	0.5	3.27	Good			X*			
Boating		3.09	Good	3.1	Good				X
Boating Satisfaction	0.25	3.22	Good	3.2	Good	X*			
Dockage	0.25	3	Good	NS					
Boat Launching Facilities	0.25	3.1	Good	NS					
Boating Safety	0.25	3	Good	3	Good			X	
Fishing		2.91	Good	3.7	Excellent				X
Fishing Satisfaction	0.25	3.17	Good	3	Good	X*			
Angler Success	0.45	3.25	Good	3.8	Excellent		X		
Shoreline Fishing	0.05	3.1	Good	4	Excellent				X
Fishing Participation	0.25	2	Fair	4	Excellent		X		
Beaches		2.8	Good	2.9	Good				
Beach Quality	0.5	2.83	Good			X*			
Beach Availability	0.5	2.75	Fair	NS					
Economy		2.5	Fair						
Tourism	0.5	3	Good	4	Excellent				X
Shipping	0.5	2	Fair	2	Fair		X		

* When comparing same survey questions as 1998
#= new metric
underline= comparable higher rating
bold italic = comparable lower rating
NS= No Score

Scale
0.00-1.99= Poor
2.00-2.79= Fair
2.80-3.49= Good
3.50-4.00= Excellent

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OHIO LAKE ERIE COMMISSION

Our Mission

The Ohio Lake Erie Commission was created for the purposes of preserving Lake Erie's natural resources, protecting the quality of waters and ecosystem, and promoting economic development. The Commission is comprised of the Directors of the Ohio Environmental Protection Agency and the Departments of Natural Resources, Agriculture, Development, Health, and Transportation. The staff administers commission business and executes many programs such as the Lake Erie Protection Fund, Lake Erie License Plate Sales, Ohio's Coastweeks, the Lake Erie Protection & Restoration Plan, and the Lake Erie Quality Index. The Lake Erie Commission meets quarterly and these meetings are public forums in which individuals and groups interested in Lake Erie issues are strongly urged to attend.

Lake Erie Protection Fund and License Plate Program

The Ohio Lake Erie Commission has awarded over $7.5 million in Lake Erie Protection Fund (LEPF) grants for nearly 200 projects that help the lake by:

- Enhancing Lake Erie fish populations
- Promoting coastal tourism & recreation
- Improving Lake Erie water quality & boating opportunities
- Reducing pollution sources throughout the region
- Seeding buffer strips for farmers/consumers
- Protecting coastal wildlife habitat

Revenue for the protection fund is generated from monies received through the Lake Erie License Plate Program and through Ohio's participation in the Great Lakes Protection Fund. For more information about how you can purchase your own "Erie...Our Great Lake" plate featuring a design by Ohio artist Ben Richmond, please visit www.oplates.com or call 1-866-OPLATES.

Coastweeks

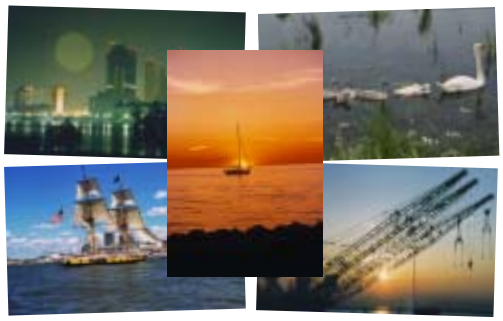
Ohio's Celebration of Lake Erie

For the past 10 years, the Ohio Lake Erie Commission has developed an effective Coastweeks program to increase public awareness of Ohio citizens on the value and fragility of Ohio's largest natural resource ~ Lake Erie and its shoreline. Year's past activities included tours, hikes, kayaking fun, beach cleanups, and storm drain stenciling, just to name a few. If you would like to plan an event or get involved in Coastweek's exciting activities, visit our web site or call our office.

Ohio's COAST WEEKS
CELEBRATE EDUCATE PARTICIPATE

Life on Lake Erie

Photography Contest



Each year, the Ohio Lake Erie Commission sponors an amateur photo contest during the Coastweeks celebration. Participants are encouraged to capture views of the delicate, yet powerful relationships between the Lake Erie environment and the people, plants and animals that enjoy our Great Lake. Contest winners are honored during the fall. Winning photos are also featured as part of a traveling display along Ohio's North Coast. Visit our web site for more information.

For more information please contact:

Ohio Lake Erie Commission
Working Together for Lake Erie

One Maritime Plaza
Toledo, Ohio 43604
Phone: 419-245-2514
e-mail: lakeeriecommission@ameritech.net
web site: www.epa.state.oh.us/oleo

WORKING TOGETHER FOR LAKE ERIE

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Human Exposure Risks Indicator
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Mike Saletra, Photo Contest

Pollution Sources Indicator
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Land Use Indicator
Ohio Lake Erie Office
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Biological Indicator
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Patricia Snider, Photo Contest
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Boating Indicator
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Lee Karns, Photo Contest
Kami Marquardt, Photo Contest

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Mike Saletra, Photo Contest
Arnold Ehrsam, Photo Contest
Rose Marie Keyes, Photo Contest
Pat O'Connell, Photo Contest
Arnold Ehrsam, Photo Contest

Beaches
Dennis Hale, Photo Contest
Arnold Ehrsam, Photo Contest
Kami Marquardt, Photo Contest

Economy Indicator
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Arnold Ehrsam, Photo Contest
Zoe Enyedy, Photo Contest

Lake Erie Commission
Mike Saletra, Photo Contest (2)
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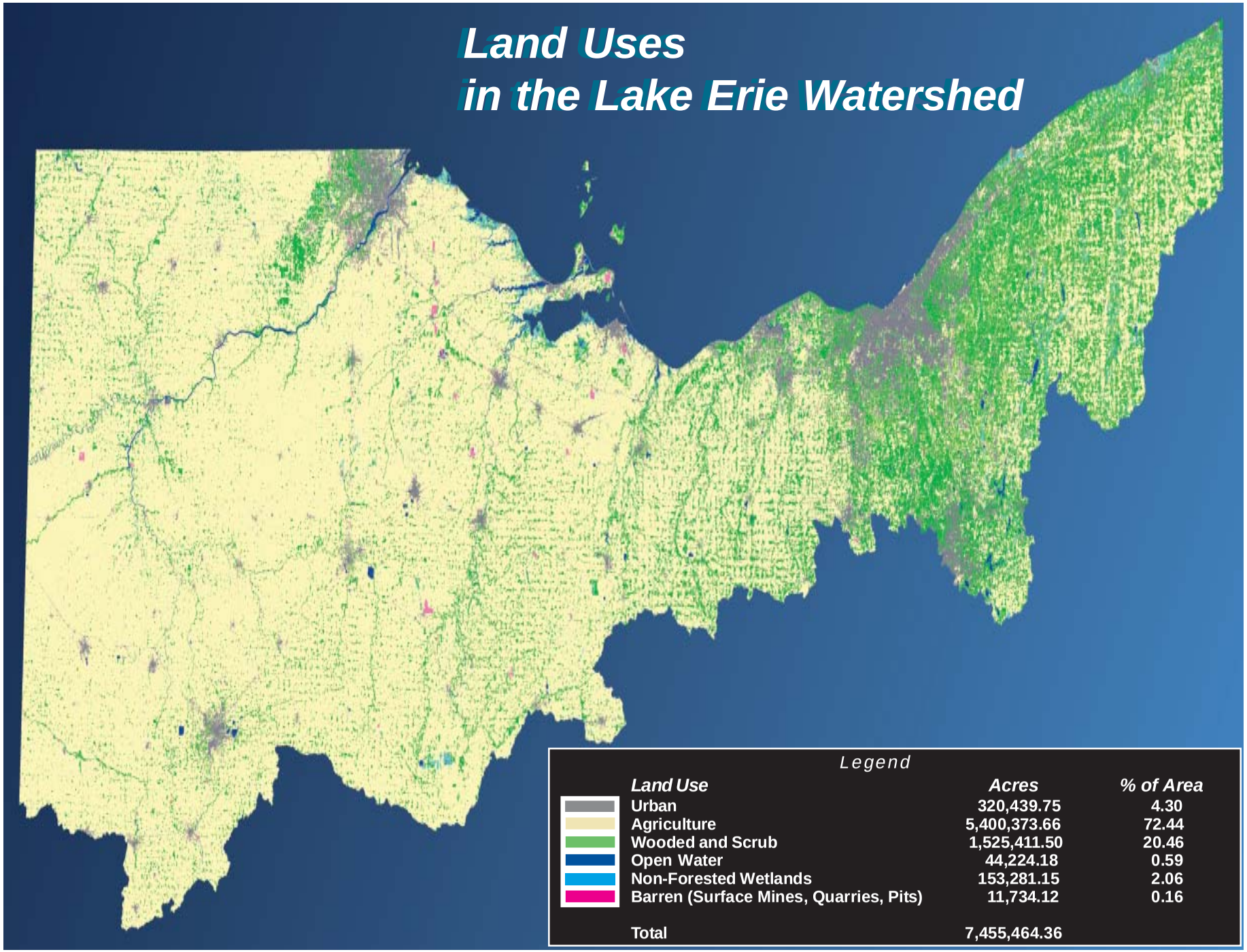
Brid Wills, Photo Contest
Arnold Ehrsam, Photo Contest

Land Uses in the Lake Erie Watershed



Legend

Land Use	Acres	% of Area
Urban	320,439.75	4.30
Agriculture	5,400,373.66	72.44
Wooded and Scrub	1,525,411.50	20.46
Open Water	44,224.18	0.59
Non-Forested Wetlands	153,281.15	2.06
Barren (Surface Mines, Quarries, Pits)	11,734.12	0.16
Total	7,455,464.36	