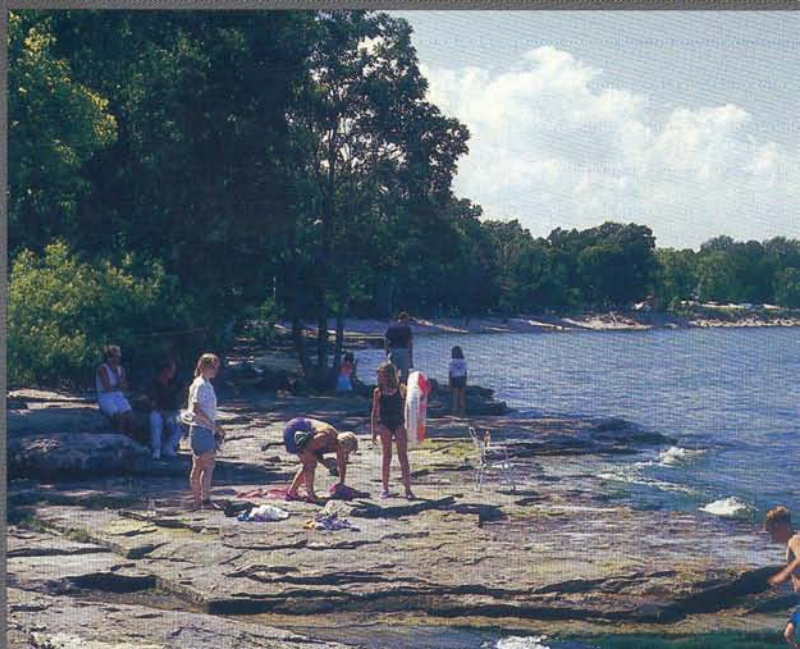


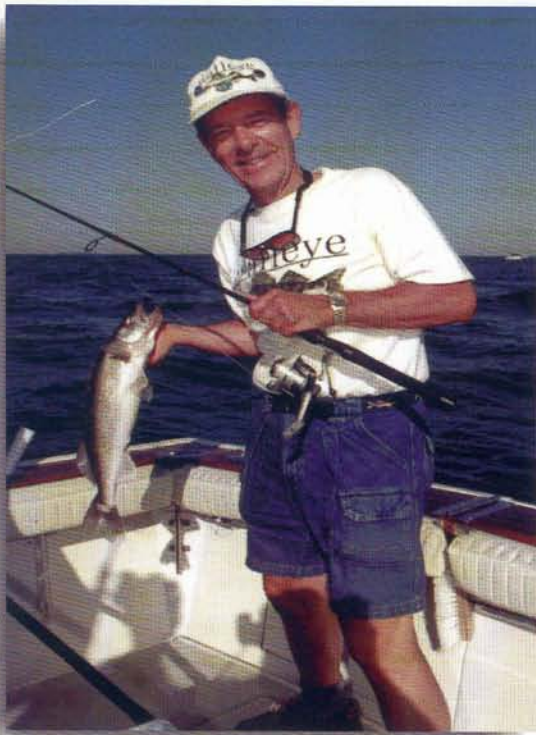
STATE OF OHIO 1998 STATE OF THE LAKE REPORT



Lake Erie Quality Index

Prepared by the Ohio Lake Erie Commission





Lake Erie has been my lifelong companion; I have lived near the lake most of my life. I've seen firsthand both the terrible decline in the lake during the 1960s, and the wonderful restoration that began in the early 1970s and is still underway.

Much of the lake's degradation was the work of mankind. From sewage strewn beaches to huge algae blooms that suffocated sportfish to floating oil slicks and deformed eaglets – all that and more was caused by human activity. As a state legislator in the mid-60s, I opposed a plan to allow oil and gas drilling in the lake, which would have been yet another source of environmental insult.

Today, and indeed for the past 25 years, we are making amends for our past mistreatment of the great natural resource that forms our northern border. I know that the lake is healthier, because I can walk to the shore and see the improvements: clearer water; clean, accessible beaches; a revived boating industry; and the

best sportfishing anywhere. But these are casual observances, not scientific analyses. As Governor, I felt the need to know more, not just that the lake has improved, but in exactly what ways has it improved, and what remains to be done.

The fact is that the improvements in Lake Erie have come at great cost. Communities have spent billions of dollars for improved sewage treatment. Northern Ohio industries have also made substantial investment in treatment systems for wastewater discharges. We've spent nearly \$2 million over the past five years on fish tissue testing to determine if the fish are safe to eat. And in the last two years, we've used our NatureWorks grants program to inject more than \$1.3 million into local projects along the lake for improved boating and fishing access.

Responsible policymakers need to take an unbiased look at what we've achieved in return for all this investment in Lake Erie. Has our money been well spent? Has it been spent on the right things? Is there something more we should be doing? What areas need the most improvement? In our determination to continue the progress, what initiatives will produce the biggest bang for our bucks? And how do we strike the appropriate balance between development and preservation?

These are the questions I asked the Lake Erie Commission. This report provides the roadmap to developing answers. It details our progress since 1992, when I created Ohio's Lake Erie Office in Toledo. It also provides a direction toward those areas in which there is still work to be done to protect Erie, Our Great Lake.

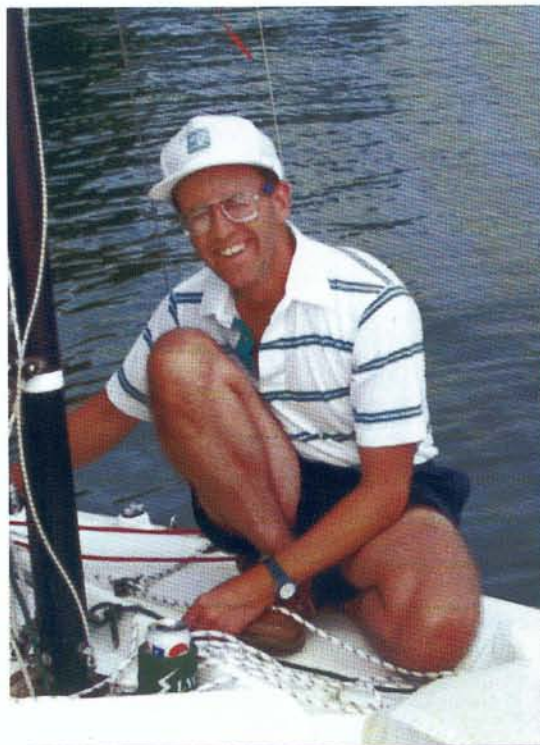
George V. Voinovich
Governor

Twenty-five years ago, people said Lake Erie was "dead." While not exactly true, the lake was indeed heavily polluted, many beaches were closed, and fishing was severely limited. Since that time, much has been done to solve these problems and bring Our Great Lake "back to life."

In 1992, when Governor George V. Voinovich created the Ohio Lake Erie Office, he appointed me to chair the Ohio Lake Erie Commission. For the past six years, we have worked with five other state agencies (Agriculture, Development, Health, Natural Resources, and Transportation) to focus attention on Lake Erie and coordinate state efforts to further improve this valuable resource. The Commission is very proud of what has been accomplished.

The Lake Erie Office has funded extensive research on Lake Erie issues such as zebra mussels, algae blooms, and nonpoint pollution. To help educate citizens about Lake Erie, the office has initiated many public outreach programs. Now, thanks to the Governor and the Lake Erie Office, we have unique events like Ohio's Coastweeks to help us celebrate the lake, and we have a special Lake Erie License Plate program to remind us to keep on caring.

This report outlines the progress we've made, applauds the successes we've seen, and points to the work that remains. While Lake Erie is indeed great, it can be even better. In the coming months and years, state and local government, in partnership with industry and citizens, must continue the work that has been started. Using tools such as the Lake Erie Quality Index to identify critical needs and issues, our goal should be to make Lake Erie the greatest of all.



Donald R. Schregardus

Donald R. Schregardus
Director, Ohio Environmental Protection Agency
Chair, Ohio Lake Erie Commission



Executive Summary

Monitoring Lake Erie's Recovery

The Lake Erie Quality Index is a status report from the Ohio Lake Erie Commission to the people of Ohio on the present condition of Lake Erie. The report provides an objective and open evaluation of 28 separate aspects of *Our Great Lake*.

The Index shows that in many ways, Lake Erie and its surrounding Ohio watershed have made remarkable improvements over the past 25 years. Many high ratings reflect the immense resources that have gone into protecting and restoring the lake from its dismal condition of the 1960s.

The Index also shows that other components of the Ohio Lake Erie ecosystem have not improved and are in great need of attention. The low ratings given within this report highlight the need to continue and perhaps refocus future efforts.

The motivation behind compiling the Lake Erie Quality Index is the realization that there have been no adequate benchmarks to monitor and evaluate progress towards restoring the lake. For that matter, there were many parameters for which precise goals have never been established. This report represents an immense amount of work on the part of many people to accomplish three objectives:

- Determine what is essential to know about Lake Erie
- Design and implement effective measuring systems for these essential factors
- Establish goals and scoring systems that will allow for critical evaluation of progress



As work began on the Index, it was soon evident that there were many different paths that could be followed. After expert consultation, public input, and analysis, three criteria were established for the preparation of this report.

and Establishing a Direction for the Future

First, this report is not designed for experts. It is intended for the millions of people who live on Ohio's Lake Erie shoreline, drink its waters, frolic on its beaches, or fish its depths. The selection of indicators and metrics is based on their importance and interest to most Ohioans.

Second, the metrics and indicators are designed to utilize, when possible, existing historical databases. 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. Whenever possible, the Commission has used information from ongoing monitoring programs. Contained within this report are data sets supplied by all levels of government, academia, and private businesses. 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, as much as possible, 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 10 separate indicators. Four focus on Ohio's Lake Erie environment – *Water Quality, Pollution Sources, Habitat, and Biological*; four address various recreational resources – *Coastal Recreation, Fishing, Boating, and Beaches*; and the last two indicators – *Tourism and Shipping* – deal with components of Ohio's Lake Erie derived economy.

These 10 indicators are expanded into 28 metrics ranging from one to five separate metrics per indicator. Each metric measures a particular aspect of the overall indicator.

For instance, the *Fishing* indicator is divided into four

separate metrics: *Angler Success, Shoreline Fishing Access, Angler Satisfaction, and Fishing Participation.*

The Index shows that in many ways, Lake Erie and its surrounding Ohio watersheds have made remarkable improvements over the past 25 years...

Each metric involves a measurement of a specific parameter 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 creation 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. Four descriptive ratings are used in this report: **Excellent, Good, Fair, and Poor.**

Finally, it is important that the Lake Erie Quality Index be viewed as “work in progress.” There are six metrics in this report for which data are not presently available and goals have not yet been devised. These metrics are rated **Being Developed**. Although all six of these metrics deal with critical aspects of Lake Erie, their design and evaluation need much more work.

The Ohio Lake Erie Commission views the release of this Index as the beginning of a new responsibility. The Commission is not satisfied with its understanding of Lake Erie or with its ability to monitor the lake’s many different components. The Commission views this and future editions of this Index as valuable tools that will provide guidance in identifying the needs of the lake ecosystem and focus continued efforts on improving Lake Erie. To that end, a permanent Lake Erie Quality Index working team has been established within the Commission that will be tasked with refining the methodology, gathering the pertinent data, and producing periodic reports. On the following page is a summary of the entire Lake Erie Quality Index – the ratings for all 10 indicators. The Ohio Lake Erie Commission hopes that each reader will take time to read through this report. There is a great amount of detailed information contained within this report – far more than can be adequately displayed on a single-page summary.

This Lake Erie Quality Index is an initiative which will help enable the State of Ohio to be better stewards of Lake Erie in the future. The Commission encourages readers to help in this effort and welcomes feedback on how this Index could be improved. Please contact the Commission with any suggestions at:

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Lake Erie Quality Index

Indicator

Rating

Water Quality

Good

Pollution Sources

Fair

Habitat

Fair

Biological

Good

Coastal Recreation

Good

Boating

Good

Fishing

Excellent

Beaches

Good

Tourism

Excellent

Shipping

Fair



Water Quality Indicator *Good*

The quality of the water in Lake Erie and its tributaries has undergone a remarkable change in the past 25 years. Lake-lovers with a touch of gray in their hair remember all too well how bad the lake was in the 1950s and 1960s. Those were the days of pea-green waters, closed beaches, combustible rivers, and inedible fish. Those were the days when Lake Erie and its coastal communities bore the brunt of many jokes. Most had given up on Lake Erie – believing that it was beyond hope.

But Lake Erie has come back. Ohioans, along with millions from around the country, became fed up with what had been done to the nation's waters. They insisted that changes be made and money be spent to restore this natural treasure. Today, the water in the lake is purer, and the animals living in and around the lake are healthier.

Lake Erie has not fully recovered from its past legacy of environmental neglect. Many problems still exist that impair full use and enjoyment of Lake Erie. This *Water Quality* indicator focuses primarily on the current chemical and microbiological condition of Lake Erie. However, the current status of these water quality parameters is still influenced by actions of the past century. In three of the metrics measured – *Toxic Contamination*, *Contaminated Sediments*, and *Bacterial Contamination* – goals have not been met. The challenge of removing or remediating contaminated sediments in harbors and rivers is particularly daunting, due to the volume of material in need of attention.

Although there is much reason to celebrate, the Ohio Lake Erie Commission and its component agencies are far from satisfied with the condition of Lake Erie. The Commission will continue to address these issues until the goals are met.

Scoring of Water Quality Indicator

Metric	Score	Weighting	Weighted Score
Toxic Contamination	3.0	.20	0.60
Contaminated Sediments	1.0	.20	0.20
Bacterial Pollution	2.0	.20	0.40
Drinking Water	4.0	.20	0.80
Water Clarity	4.0	.20	0.80
Rating			2.8 <i>Good</i>

Toxic Contamination Metric

Good

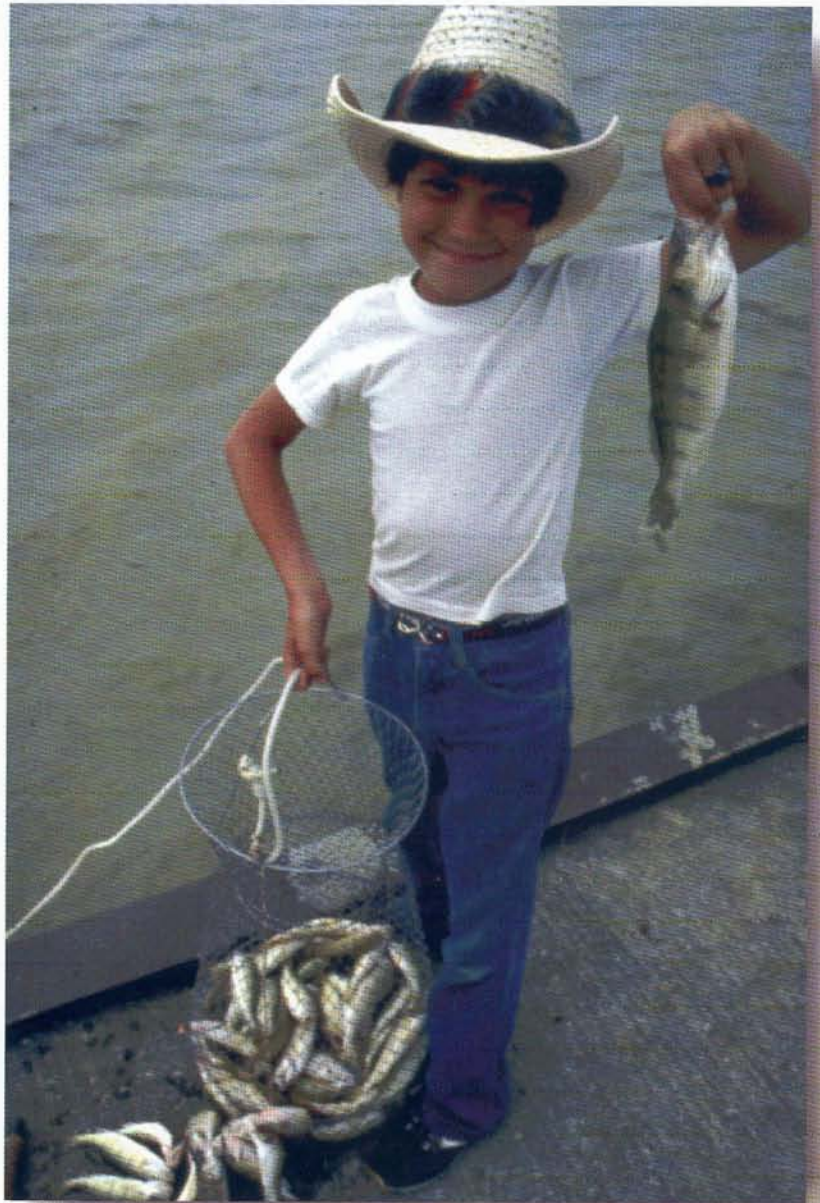
The State of Ohio Fish Consumption Guidelines were selected as a surrogate measurement for the degree of toxic contamination in Lake Erie. Lake Erie sportfish feed on other animals and tend to accumulate any chemical contaminants present in the environment. This measurement also focuses on a question that is crucial to many Ohioans: can I safely eat the fish I catch in Lake Erie?

Consuming most fish species caught in the lake poses negligible health risks for the majority of people. A comprehensive fish tissue sampling program for Lake Erie was started in 1993 through the cooperative efforts of several state agencies. Samples collected by the Ohio Department of Natural Resources and the Ohio Environmental Protection Agency are analyzed by the Department of Agriculture as well as Ohio EPA. The Ohio Department of Health issues advisories based on risk assessments of the analytical results. Advisories are recommended guidelines for reducing exposure to contaminants through the consumption of Lake Erie fish. The advisory includes advice to consumers on the safe number of fish meals per year and instructions for properly cleaning and preparing fish.




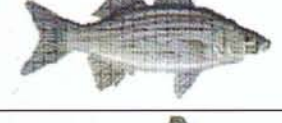

Fish consumption advisories are designed to protect the most sensitive populations of Ohioans (women of childbearing age and children). Contaminants contained in maternal blood can be transferred to the fetus or ingested by the nursing infant. Several studies have followed the offspring of heavy eaters of contaminated fish. These studies suggest that exces-

sive ingestion of contaminants may cause weak reflexes and retarded neuromuscular development, impaired visual recognition memory, short-term memory deficits, low weight at four years of age, poor performance of psychomotor skills, and lower IQ attainment.

The principal contaminants of concern in



TOXIC CONTAMINATION – CALCULATION OF FINAL RATING

Species	Meal Frequency (PCB Advisory)	Score	Fish Harvest (Lbs.)	Weighting Factor	Scaled Score
	Yellow Perch One Meal a Week (mercury restriction)	(3.0)	1,116,463	0.170	0.510
	Walleye One Meal a Week	(3.0)	5,264,885	0.802	2.406
	Smallmouth Bass One Meal a Month	(2.0)	55,411	0.008	0.016
	White Bass One Meal a Month	(2.0)	109,813	0.017	0.034
	Channel Catfish 6 Meals a Year	(1.0)	18,800	0.003	0.003
		Total	6,565,372	Final Score	3.0 Good

the Lake Erie ecosystem are polychlorinated biphenyls (PCBs). Although the manufacturing of PCBs in the United States ceased in 1977, the country is still experiencing the effects of their environmental presence today. PCBs were used in electrical equipment, fluorescent lighting fixtures, paint, hydraulic fluids, and carbonless copying paper. Releases to the air and water occurred through various stages of manufacture, transport, use, and disposal. Contamination still occurs today from spills, or leaching from unsecured landfills. These pathways have combined to produce widespread contamination of rivers, lakes, and streams.

Since PCBs are stable compounds, they do not readily degrade, and may undergo little or no change over time. In an aquatic setting, they will typically settle in the bottom sediments where they become available for uptake by plants and animals. Because of their stability,

PCBs are not easily excreted by individual organisms, but are retained and migrate to fat tissue where they are stored. They can be passed up the food chain, becoming more concentrated at each step. Fish, as top predators, may contain PCBs at levels that cause concern from a public health standpoint.

PCB contamination in Lake Erie fish is declining year by year. For example, a 1988 analysis of western Lake Erie walleye excluding Maumee Bay by the Ohio Department of Agriculture found PCBs to average .254 parts per million (ppm) in the fillet portion. In 1992, the average PCB level seen in these same locations was .192 ppm.

Ohio's fish consumption advisories are based on the Great Lakes Protocol, which recognizes five levels of fish consumption (or recommended meal frequencies) based on the amount of PCBs found in the body of the given species.

The metric is determined by two factors. First, a group of species was selected which reflects a range of feeding habits and behaviors. A species score was assigned based on the consumption advisory for that species.

Second, each species score was weighted according to the annual harvest (in pounds) reflecting the degree of possible exposure that each species represents. The individual species rating is derived by multiplying the advisory score times the harvest weighting factor. The final rating is the sum of all the weighted species ratings.

The fish consumption advisories that apply to the open waters of Lake Erie were used in this metric. Advisories for tributaries or embayments along the lake may exceed the Lake Erie advisories.

A factor that complicates this metric is the recently released advisories concerning mercury. Low background levels of mercury were found in nearly all samples tested from various Ohio bodies of water.

The presence of mercury has prompted the State of Ohio to advise women of childbearing age and young children (age six and under) not to eat more than one meal of Lake Erie sportfish per week. This lowers the rating for yellow perch from "No Restriction" (**Excellent**) to "One Meal Per Week" (**Good**). This, factored into the calculation, reduces the overall rating to 3.0, or **Good**. *The goal of the State of Ohio is that all species be safe to eat and free from any*

consumption advisories.

The main source of PCB contamination comes from leaking dump sites, and contaminated sediments – a legacy of poor waste management in the past. An enormous amount of effort is being spent removing, treating, or sealing these toxins, particularly along severely

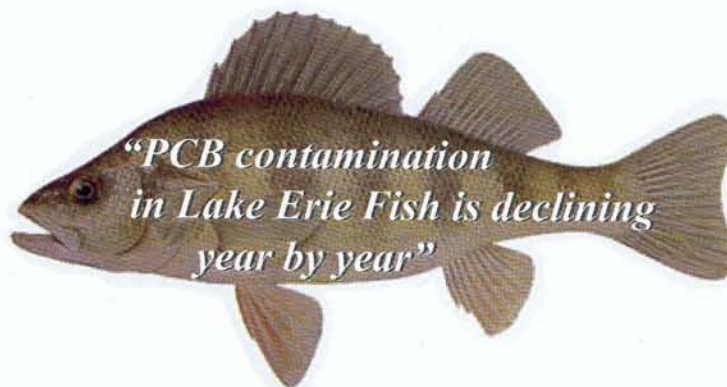
contaminated stretches of the Ottawa (Toledo) and Ashtabula rivers.

Efforts to reduce or eliminate PCB contamination in Lake Erie have been extensive, and cleanup involves all levels of government.

At the federal level, U.S. EPA administers and executes the Superfund program, which identifies and qualifies severely contaminated hazardous waste sites, and follows through with cleanup. There are several Superfund sites within the Lake Erie watershed that are undergoing active remediation.

The International Joint Commission (IJC) has designated four major rivers, including associated tributaries, along the Ohio portion of Lake Erie as "Areas of Concern." These are: the Maumee, Cuyahoga, Black, and Ashtabula rivers.

The Ohio Environmental Protection Agency has established Remedial Action Plan (RAP) work groups in each of these "Areas of Concern." These groups consist of concerned citizens, industry and environmental organization representatives, and officials from all levels of government. Their charge is to restore to these rivers all beneficial uses which have been impaired over time.



For more information on the following subjects contact:

Fish Consumption Advisories	Ohio Department of Health	614/644-6447
Environmental Water Quality	Ohio EPA	614/644-2856
Ohio Fishing Regulations	ODNR - Division of Wildlife	614/265-6300

Contaminated Sediments Metric

Poor

Many of the Ohio Lake Erie rivers and harbors are past and/or present locations of industry and manufacturing. Prior to the 1970s, toxic discharges were virtually unregulated and uncontrolled. It is, therefore, no surprise that many locations along the Lake Erie shoreline have sediments with excessive concentrations of chemical contamination.

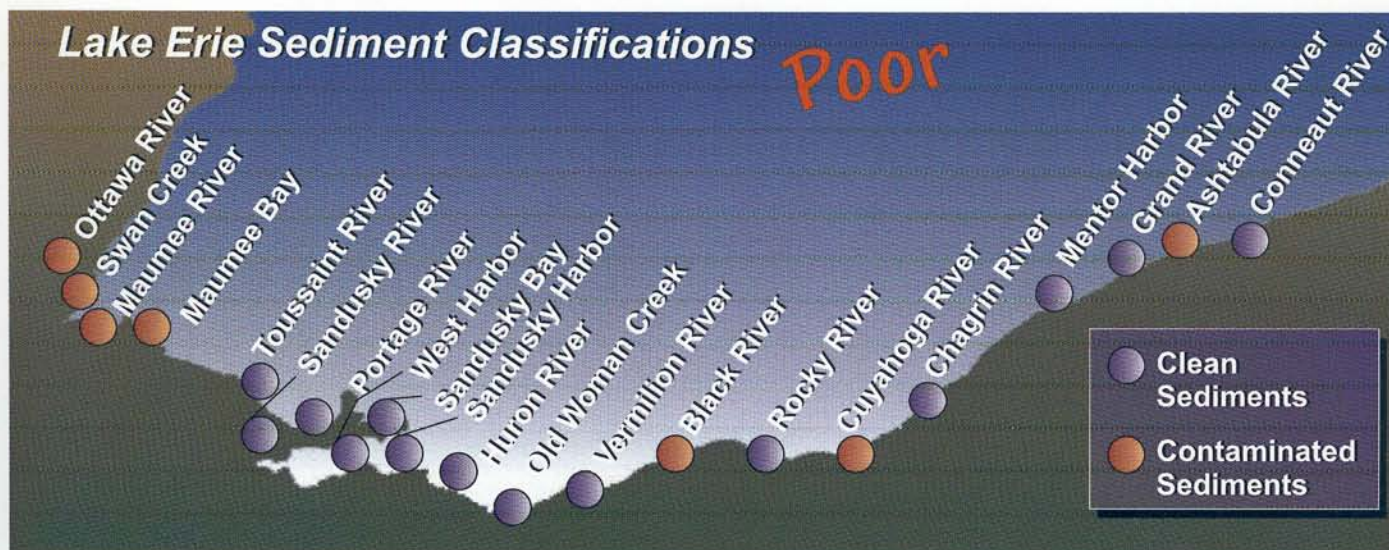
Significant stretches of numerous tributaries, many rivermouths, and some nearshore areas within the lake itself have sediment problems. These include elevated levels of nutrients (particularly phosphorus); metals (mercury, cadmium, lead, chromium, cyanide, copper, and zinc); and industrial contaminants (primarily polychlorinated biphenyls (PCBs) and

polyaromatic hydrocarbons).

The primary problem with contaminated sediments is that the chemicals of concern do not remain on the bottom. Small invertebrates living in the sediments will take these compounds into their bodies. Small fish feeding on these invertebrates can likewise absorb these chemicals into their tissues. These chemicals may continue up the food chain until the contamination originating from the sediments accumulates at unhealthy levels in fish, wildlife, and humans.

To assess the degree of sediment contamination along the Ohio Lake Erie shoreline, 21 sediment "sites" were identified. A site corresponds to U.S. Army Corps of Engineers dredging project locations which have had a





comprehensive sediment analysis. For this purpose, a “clean” site is one where the sediments are clean enough to allow disposal into the open waters of Lake Erie (the least expensive method of disposal.) A “contaminated” site is one where the dredged sediments must be confined and segregated from the lake.

The Corps uses several criteria to determine if sediments are contaminated. These include looking at chemical concentration levels, performing exposure tests on various aquatic species, comparing contaminant concentrations in the sediment to those normally found in the sediment, and looking for the lowest contaminant levels that cause some measurable environmental effect.

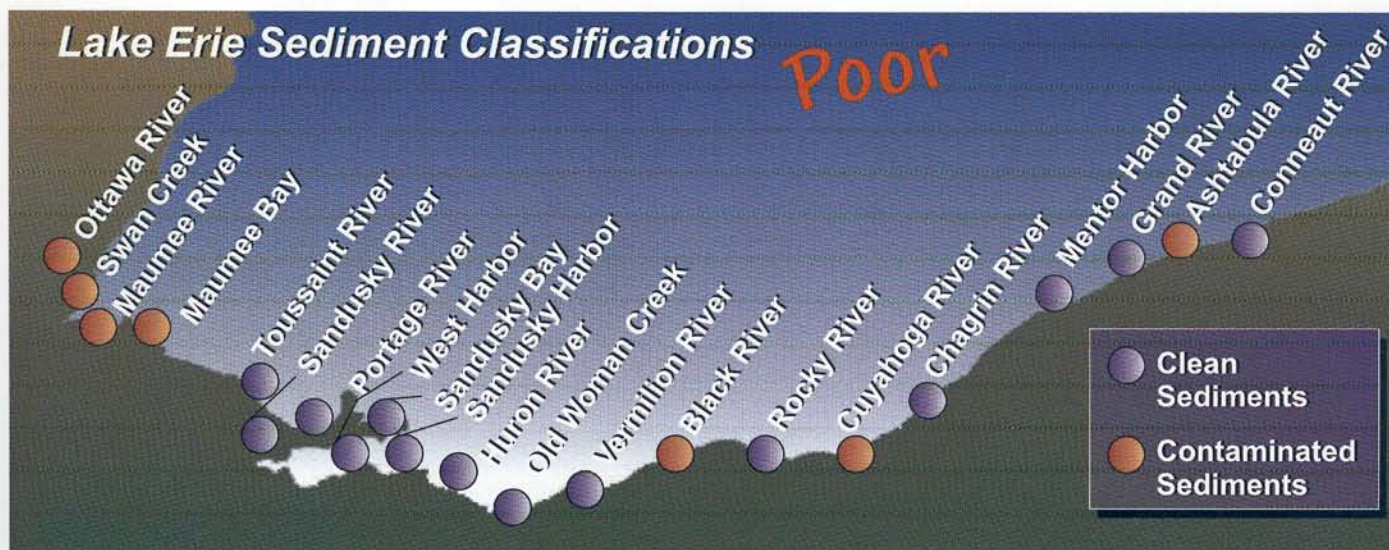
There are 21 rivers, harbors, or bays along the Ohio shoreline of Lake Erie that constitute “sites” for this assessment. Some of these are dredged on a regular basis, some rarely, and some not at all. The sites that are dredged on a regular basis are the man-made harbors and artificially deepened navigation channels at the river mouths. The increased depth causes the river flow to decrease and much of the sediment load the river is carrying settles out at that point. The 21 sites are presented above along with their evaluation.

Of these 21 sites, seven have sediments that are considered to be contaminated. These sites are the Ottawa River, Maumee Bay, Maumee River, Swan Creek, Black River, Cuyahoga River, and Ashtabula River. Once the sediments are cleaned up, it is highly probable that the sites would remain clean.

*The goal established for this indicator is for all sediments to be clean enough that they do not cause fish consumption advisories, are not toxic to organisms living in the sediments, and can be disposed of anywhere (in the lake or on land) when dredged. Considering that seven of the 21 possible sites assessed are problem sites, this translates into an overall rating of 67% – **Poor**.*

Before contaminated sediments can be cleaned up, the sources of the pollutants must be discontinued. Permitting and regulating discharges from industry and wastewater treatment plants have reduced the input of pollutants to a large degree. Elimination of discharges, use of new processes and treatment methods, and adoption of pollution prevention/waste minimization practices have also reduced the loading of contaminants into the waters.

The net result of these efforts is that the sediments in Ohio’s rivers and harbors are



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The net result of these efforts is that the sediments in Ohio’s rivers and harbors are

generally getting cleaner. For example, sediments removed from the Huron River once needed to be placed in a confined disposal facility. They are now clean enough for open lake disposal or for use in building up adjacent beaches.

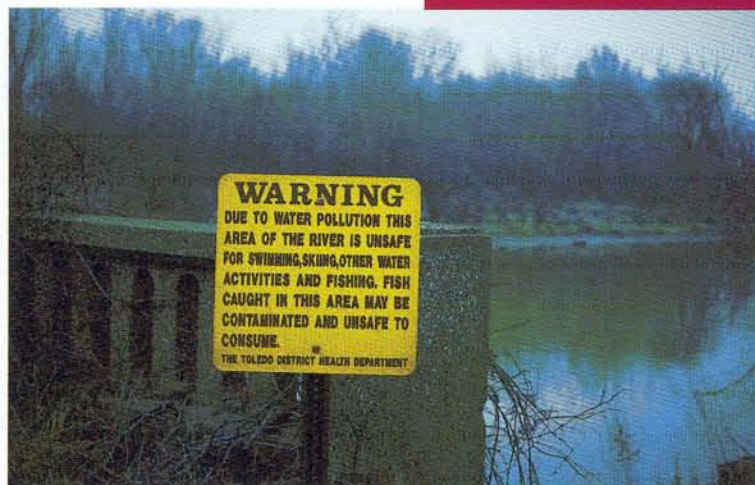
Remediating contaminated sediments is an expensive and difficult operation. However, a number of remediation projects have been completed or are underway. A great deal of effort is being spent in remediating the sediments of the Ottawa River – undoubtedly Ohio's most severely contaminated sediments. Closure and remediation at several old, leaking landfills along the Ottawa River have eliminated sources of PCBs and other chemicals to the river.

A severely contaminated stretch of the Ottawa River is currently being remediated. Several segments of the river bottom will be covered with a compound called "Aqua-Bloc," which is designed to isolate the contaminated sediments and prevent them from moving further downstream.

Sediments contaminated by polyaromatic hydrocarbons (PAHs) associated with a high prevalence of fish tumors were dredged from the Black River in 1990. The results of the removal of these sediments has been remarkable. Since 1990, the tumor incidence in this area has decreased to nearly zero.

A major effort is underway by the Ashtabula River Partnership to remove PCB-contaminated sediments from a two-mile segment of the lower river and harbor. Cleanup of the Fields Brook site, a tributary that was the main source of contamination to the Ashtabula River, is being conducted under the Superfund program. The goal is to accomplish this cleanup by the year 2000 and remove the Ashtabula River as one of the "Areas of Concern" on the Great Lakes.

Ohio EPA is currently implementing a sediment sampling program in the Lake Erie watershed to provide a better understanding of the distribution and background levels of contaminants in sediments and potential connections to aquatic biological communities.



Ottawa River Cleanup

Preventing the continued entry of toxins into aquatic organisms by way of sediment contamination is a top priority of the Ohio Lake Erie Commission. The Commission is presently a partner in funding numerous projects on the Ottawa River - the largest local source of PCB contamination in the Lake Erie watershed. These projects aim to remove, treat, or seal the polluted sediments along a significant stretch of the river. This is an encouraging step toward the remediation of this area's sediment problems.

For more information on the following subject contact:

Dredging Regulation and Projects

Ohio EPA - Division of Surface Water

614/644-2856

Bacterial Pollution Metric *Fair*



monitoring Lake Erie beaches in the late 1960s. At that time, Ohio tested for the presence of fecal coliform bacteria. Water at selected beaches was tested on a weekly basis for 15 weeks beginning around Memorial Day and continuing through Labor Day each year.

The samples were analyzed in local laboratories and the results were compared with a standard developed by the National Technical Committee of the Federal Water Pollution Control Administration in 1968.

Each year, thousands of Ohioans travel to Lake Erie to enjoy the numerous public bathing 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, stormwater and agricultural runoff, industrial discharge, boating wastes, 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, and sporadically do, survive in the intestines of humans. Therefore, the determination of water quality is typically based upon testing for surrogates of human fecal contamination: fecal coliform or the bacterium *Escherichia coli*.

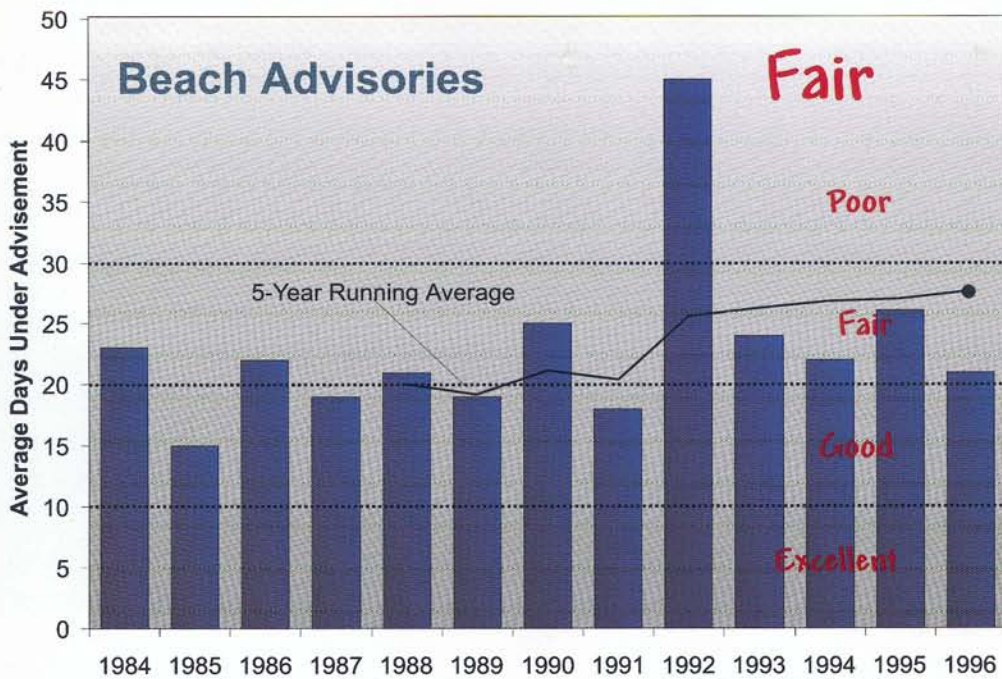
The Ohio Department of Health began

When the standard was exceeded, the Department of Health would notify the appropriate authorities associated with the beach and recommend that warning signs be posted to alert bathers that the bacteria levels were elevated.

Following the advent of improvements in laboratory technology, and at the urging of interested parties both in government and the scientific communities, the beaches sampled in 1996 were analyzed for *E. coli* content instead of fecal coliform. Studies have shown that *E. coli* bacteria is more specific to humans, and a better indicator of potential health risks.

For this metric, a composite of 11 selected beaches along the Lake Erie shore is used (see graph on next page). These particular beaches were selected because they cover the entire length of Ohio's North Coast and represent both high and low population locations. The metric looks at the average number of days that swimming advisories are posted at the 11 beaches.

Setting a goal for this metric was simple. *The goal is to have clean beaches all the time (or 0 days under advisement), so that swimming*



* In 1996, ODH changed its testing protocol from fecal coliform to E. coli analysis.

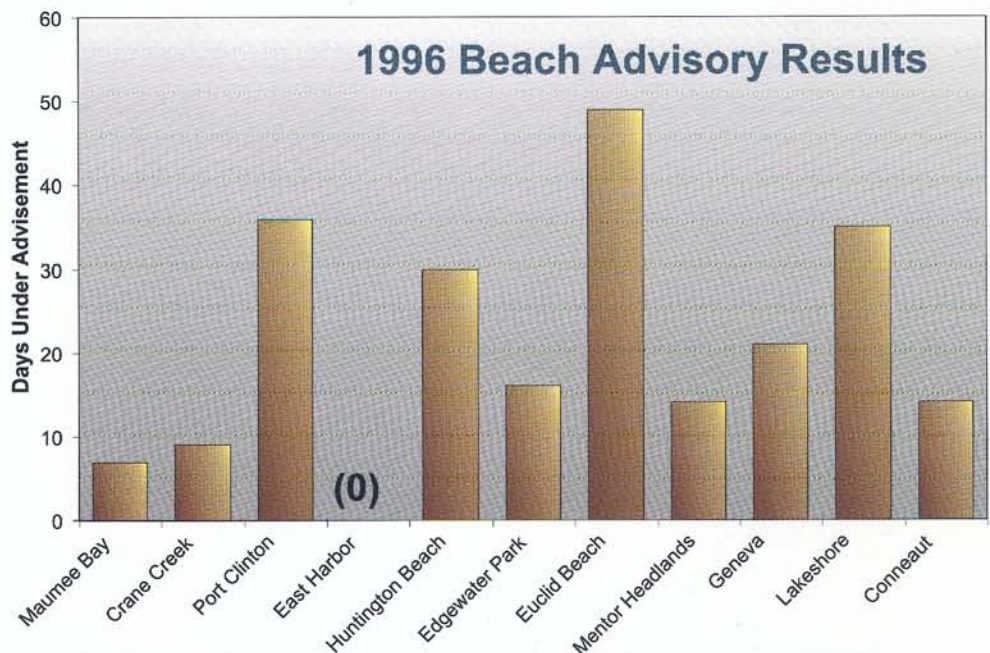
climate conditions, and can mask any short-term improvements that may be occurring with improving water quality.

This metric does not use data earlier than 1984, because prior to that year not all 11 beaches of this composite were regularly sampled. However, individual beaches during the 1970s were routinely under advisement more than 50% of the time. Others (Edgewater Park and

advisories never have to be posted. As the beaches are open an average of 100 days each year, a simple 10-point scoring scale was constructed. A score of 0-10 days under advisement would rate an **Excellent**, 11-20 days a **Good**, 21-30 days a **Fair**, and greater than 30 days a **Poor**. To smooth out the variability of the data, a five-year running average line was plotted. For 1996, the number of days under advisement was 27 days – **Fair** (read from the running average line).

Euclid Beach) were not even open due to polluted waters. These long-term improvements have been brought about through large investments over the past 30 years in upgraded sewage treatment facilities, construction of water storage basins and retention tunnels, and the connection of non-sewered communities and businesses into local sanitary systems.

No clear trend can be drawn from the past 13 years of data. Beach bacterial counts are elevated by natural factors such as water temperature, wind velocity and direction, and rainfall. Thus, the number of days under advisement for any given year is strongly influenced by local weather and



For more information on the following subject contact:
Bacterial Contamination

Ohio Department of Health

614/466-1390

Drinking Water Metric

Excellent

Lake Erie is an exceptional source of high quality drinking water. The supply is abundant and the concentrations of contaminants in the water are 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 federal criteria for drinking water.

Limited sampling data from the public water supply intakes in Lake Erie indicate that the previous drinking water quality standards were consistently met. However, the available data were not sufficiently complete to support a metric based on the quality of raw intake water.

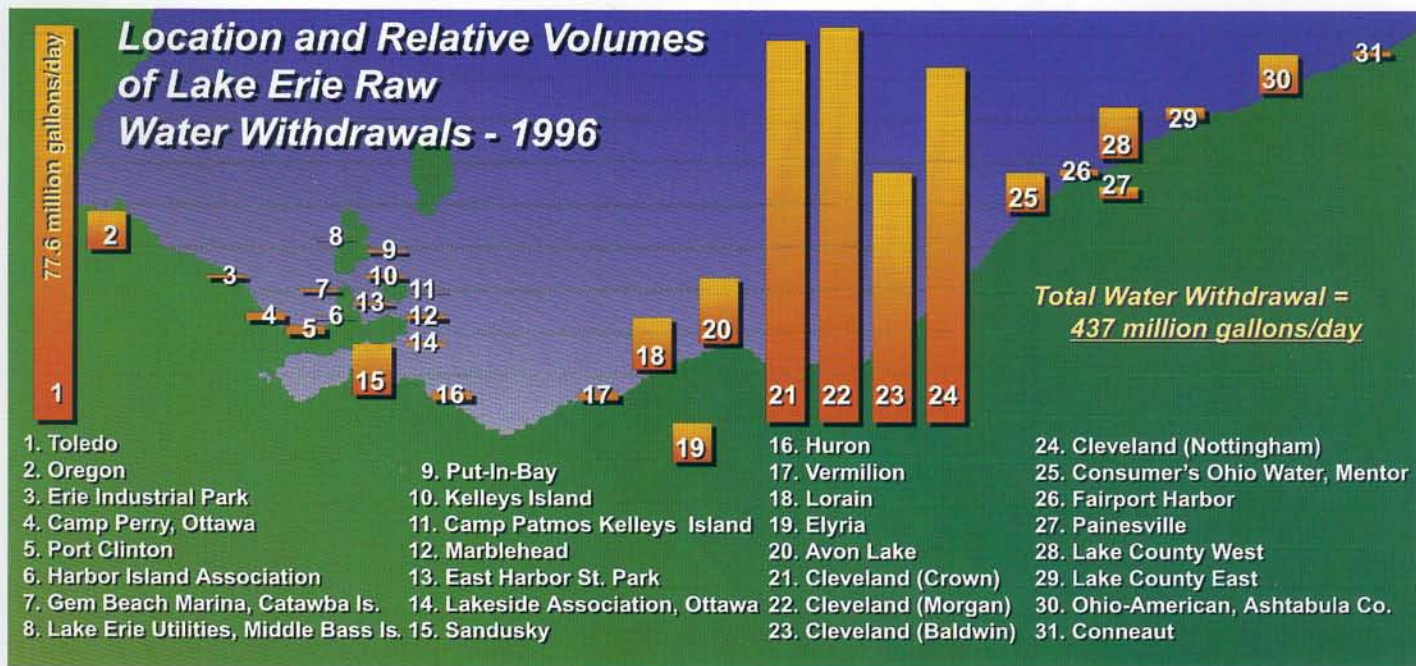
There are also drinking water standards that apply to treated drinking water. All water treatment plants must meet these criteria in their finished water. Due to a more complete database, this information has been used to construct the *Drinking Water* metric.

Water treatment plants are required to monitor finished water for a long list of organic chemicals, metals, pesticides, physical characteristics (such as

turbidity and pH), and disease-causing microorganisms. The water treatment plants are also required to monitor for byproducts, created as a result of chlorination, that may be harmful to human health.

There are 31 lake-fed water treatment plants on Ohio's North Coast. None of these plants has measured contaminants that exceed drinking water standards for finished water. There are periodic or seasonal taste and odor problems 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 all water quality standards for finished drinking water. An assessment recently completed under the Lake Erie Lakewide Management Plan process concludes that the use of Lake Erie as a drinking water supply is not impaired. Based on all of the above information, the rating earned for drinking water is **Excellent**.



For more information on the following subject contact:

Drinking Water

Ohio EPA - Division of Drinking and Ground Waters

614/644-2752

Water Clarity Metric

Excellent



To most people, the greatest improvement that has taken place in Lake Erie over the past 10 years is the remarkable clarity of the water. Not long ago, the lake would maintain a greenish cast and visibility was less than a foot. Now the lake often takes on a brilliant crystal blue hue and one can see the bottom from many feet above.

Part of this improvement has been brought about by all of the efforts during the past 25 years to reduce the input of pollutants into the lake – particularly excessive amounts of phosphorus. The rest has been accomplished by the collective filtering of the billions and billions of zebra mussels now making Lake Erie their home.

The Ohio Lake Erie Commission is including the historical trends in secchi disk depth from Hatchery Bay (the water body comprising the boat harbor at Put-In-Bay) to illustrate how clarity has improved. A secchi disk is a black and white disk which is lowered into the water. The secchi disk depth is simply the depth at which it disappears from sight.

The Hatchery Bay data are derived from annual average secchi disk depths from dozens of measurements taken throughout the ice-free year.

The graph on the following page shows the secchi disk depth in Hatchery Bay increased from 2.5 feet in 1983 to around nine feet in 1995 – a 350% improvement. *The goal for the*

nearshore Ohio waters of Lake Erie is a secchi disk depth of six feet. This goal is currently being met.

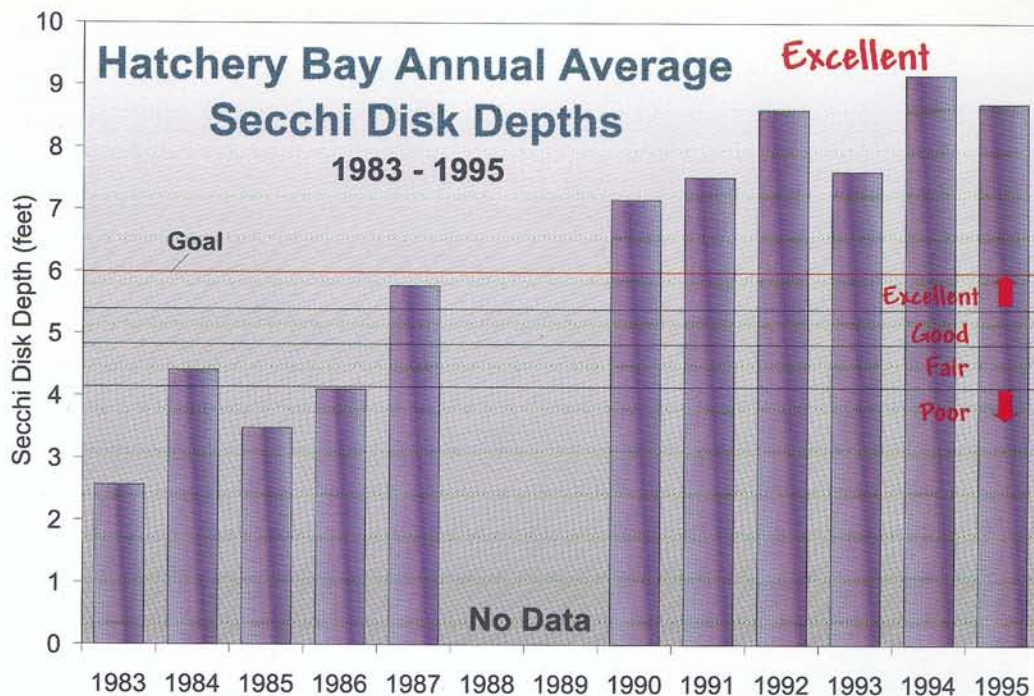
The fact that water clarity has increased dramatically in Lake Erie over the past 15 years has significantly impacted the lake's ecology. The most obvious impact has been the enhanced beauty of the lake. People universally have an attraction to clear water. Focus groups conducted by the Ohio Lake Erie Commission

confirmed that the primary factor driving the public's perception of Lake Erie was water clarity.

The lake's clearing has brought about a remarkable improvement in people's attitudes about their lake and also the amount of time and money spent on lake activities. Whether measured in Ohio's North Coast property values, tourism revenues, park attendance, or new development, people once again want to be on the lake.

As the water becomes clearer, light extends down much deeper in the water, reaching all the way to the bottom in the shallows of the lake for the first time in more than half a century. Sport fishermen saw an immediate impact from the increased light levels. Walleye, a light sensitive species, have found that deeper and darker waters or the shadows of reefs and holes are more to their liking, making walleye much more challenging to catch.

Where the waters are shallow and moderately still, the penetration of light at the bottom has allowed for growth of aquatic weed beds. Vast areas of Lake Erie are being transformed from muddy bottom to jungles of rooted plant life, extending from the bottom to the surface. This return of lost habitat is ideal for species such as northern pike and smallmouth bass,



* Data provided by Ohio Sea Grant

and may cause a shift in the composition of the Lake Erie fishery.

There are other changes taking place in Lake Erie that are not so apparent. As light penetrates further into the Lake Erie waters or reaches the sediments, the heat budget of the lake may be altered. The input of nutrients, the building blocks of life, continues to be reduced through pollution abatement programs on many fronts. Finally, zebra mussels that vacuum the water of edible microscopic algae, are expanding their range in Lake Erie. Where zebra mussels were once restricted to the hard surfaces of the lake bottom, recent observations confirm they are now also colonizing vast expanses of the lake's muddy bottom.

Where are all these changes leading? Unfortunately, it is impossible to predict. Lake Erie is undergoing a huge uncontrolled experiment. The changes occurring in the lake are unprecedented and largely unpredictable. A great deal of research, including many projects supported through the Lake Erie Protection Fund, is currently underway to document these changes and predict the type of lake that these changes are producing.

For more information on the following subject contact:

Water Clarity

Ohio Lake Erie Commission

419/245-2514



Pollution Sources Indicator

Fair

The prior indicator, *Water Quality*, looked largely at the present condition of the Lake Erie ecosystem. This indicator focuses on efforts to restrict the current input of pollutants into the lake.

The bulk of the effort to clean up the lake over the past 25 years has centered on limiting the discharge of pollutants that reach the lake through a pipe – or point source pollution. Many billions of dollars have been spent in Ohio and around the Great Lakes in the construction of facilities to treat both domestic and industrial wastewater. Nowhere have the results been more spectacular than in the removal of phosphorus from Ohio's wastewater streams. Phosphorus concentrations from treated sewage that once averaged seven milligrams per liter have now been reduced to less than half the 1.0 milligram per liter limit established by the International Joint Commission .

Progress towards reducing pollutant loading through other pathways has not enjoyed the same success. Until recently, limited resources have been expended toward reducing the input of nonpoint pollutants – particularly from agriculture, streambank erosion, and construction runoff. Reductions have been achieved in the decrease of individual pollutants – phosphorus in particular. Yet the primary nonpoint pollutant of concern – sediment – still causes damage to Ohio's streams and rivermouths. Excess sediment silts over valuable underwater habitat and chokes out needed aquatic plant growth in rivermouths and nearshore areas.

A significant amount of contamination is reaching the lake from leaking landfills and waste sites – a legacy from past generations of unregulated domestic and industrial waste disposal. The enormous cost of restoring these sites has delayed their remediation. The metrics *Waste Sites Leakage*, *Urban Nonpoint Sources*, and *Atmospheric Sources* will be discussed, but not rated. Although all are very significant contributors to the continued loading of pollutants, insufficient data exist at this time to reliably discern trends or devise goals.

Scoring of Pollution Sources Indicator

Metric	Score	Weighting	Weighted Score
Point Sources	3.6	.50	1.80
Watershed Sources	1.0	.50	0.50
Waste Sites Leakage	No Score	-	-
Urban Nonpoint Sources	No Score	-	-
Atmospheric Sources	No Score	-	-
		Rating	2.3 Fair

Point Sources Metric

Excellent



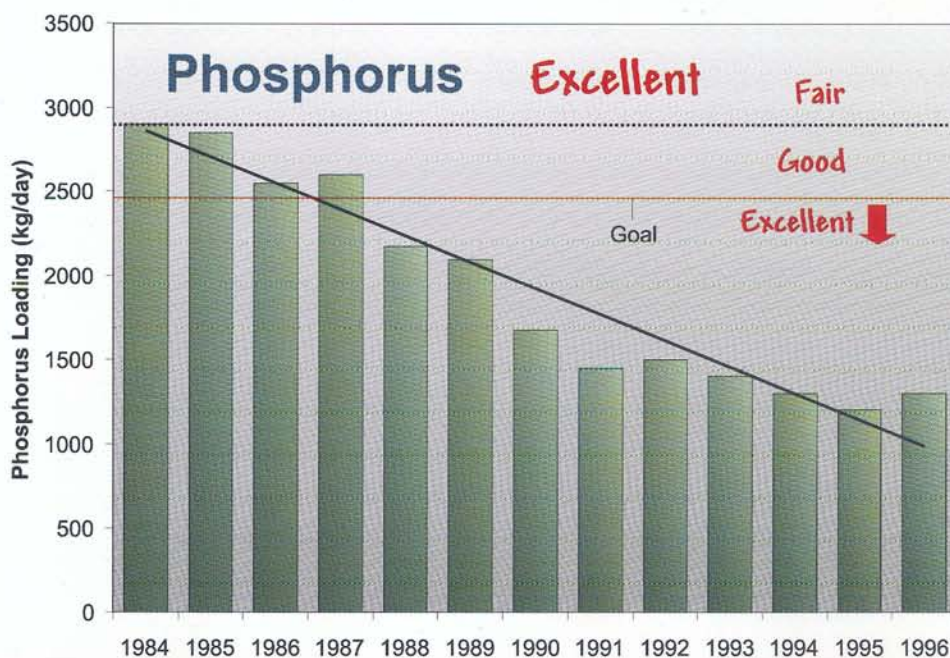
became more stringent. Pollution prevention and waste minimization practices were encouraged. Now, such practices are required wherever possible to reduce the use of chemicals or polluting substances before they have a chance to get into the waste stream.

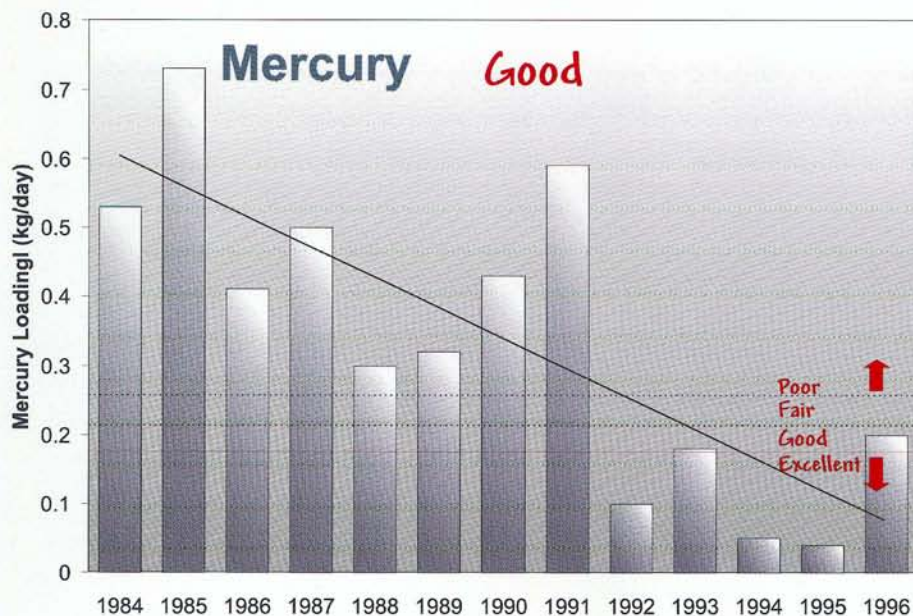
There are many water quality parameters in Ohio Water Quality Standards for which discharge is now regulated through NPDES permits. NPDES permits are reviewed and renewed at least every five years to ensure that the

Historically, municipal wastewater treatment facilities and large manufacturing facilities were significant sources of pollutants to the Lake Erie basin. With the passage of the Clean Water Act in 1972, these facilities were required to obtain permits under the National Pollutant Discharge Elimination System (NPDES), which restricted the amounts of pollutants that could be discharged into the open waters of the United States. Water quality standards were developed to provide a basis for setting discharge limits. Modeling and mathematical calculations were formulated to determine allowable chemical loadings that were protective of the aquatic community.

Over the years, more information has become available on the impacts of various pollutants, and technology allowed for more advanced treatment of wastewaters. Water quality standards and effluent limits

most current technological and research advances are implemented in order to minimize discharges and keep waters clean. This particular metric covers only a small number of those parameters. However, those selected are common to many dischargers, have a fairly long-term historical database, and have been shown to have measurable impacts on Lake Erie. These pollutants include phosphorus, ammonia,





plating operations, and other manufacturing processes. It was also a component of many paints and was emitted through the combustion of leaded gasoline. High levels of both mercury and lead can be damaging to fish and wildlife as well as human beings.

Ammonia nitrogen is a byproduct of many industrial processes and a main component of sewage. It 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 indicator of pollution since heavy organic waste loads have a high demand for oxygen.

This metric considers the total point source loading of the above pollutants discharged by all major Ohio dischargers in the Lake Erie basin. A major discharger releases more than one million gallons of wastewater per day, or has been identified as a significant source of a particular pollutant.

mercury, lead, and biochemical oxygen demand (BOD).

Phosphorus has long been determined to be a critical pollutant in Lake Erie. An overabundance of phosphorus in the lake accelerated the eutrophication (or aging) of the lake, turning it murky and green. Huge algae blooms fed by phosphorus consumed most of the dissolved oxygen in the lake, severely stressing the ecosystem. Target values for reductions in phosphorus loadings for the entire lake were set in the Great Lakes Water Quality Agreement of 1978, and amended in 1983 and 1987. These targets have been factored into the NPDES permits granted in Ohio.

Mercury was used in a number of industrial and medical practices, and was often elevated in municipal sewage treatment plant effluents due to the number of industries that were tied into the plants. High levels of mercury closed the Lake Erie fishery in the western end of the lake in the early 1970s.

Lead is a contaminant that was used in many metal-

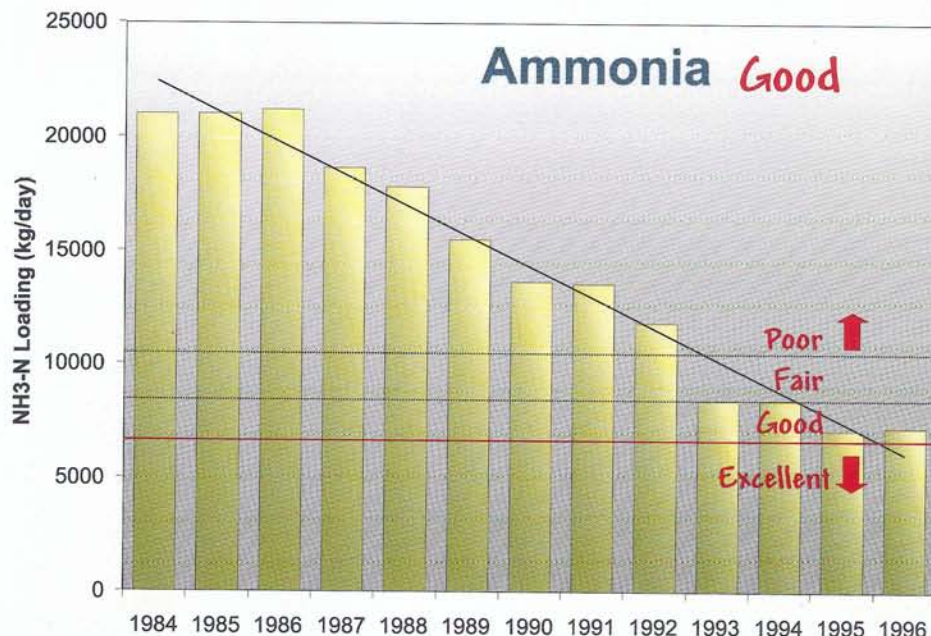


The rating for this metric was determined by comparing the total daily average loading allowable under the NPDES permits with the actual total daily average loading. Where the actual load meets or is less than the allowable load, the rating assigned is an **Excellent**.

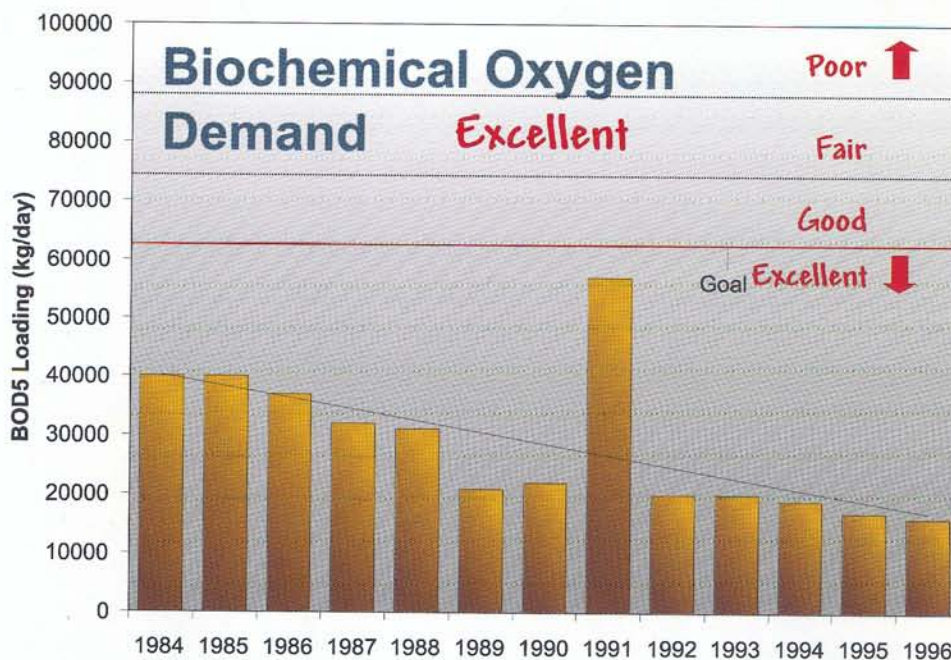
The other ratings are established by multiplying the loading goal by the reciprocal of 85% and 70%. The scores for each of the five pollutants assessed are presented in the accompanying graphs. The score is taken from the 1996 actual load.

As the graphs show, Ohio has met and surpassed its point source goals for three of the five critical pollutants measured. Since 1984, all five pollutants have been reduced by at least half, with the loading of lead and mercury reduced more than five-fold. Truly, the efforts of industry and communities across Ohio's North Coast have paid off.

In the future, as a more extensive database is assembled, it will be possible to include ratings for a number of additional pollutants. The Ohio Water Quality Standards were revised in October 1997 and include new guidelines under the Great Lakes Initiative. This will most likely lead to more stringent goals for point source pollutant loadings into Lake Erie.



Scoring of Point Source Metric			
Measure	Score	Weighting	Weighted Score
BOD	4.0	.20	0.80
Ammonia	3.0	.20	0.60
Lead	4.0	.20	0.80
Mercury	3.0	.20	0.60
Phosphorous	4.0	.20	0.80
Total Score			3.6 Excellent



For more information on the following subject contact:

Point Source Loading

Ohio EPA - Division of Surface Water

614/644-2001

Watershed Sources Metric

Poor

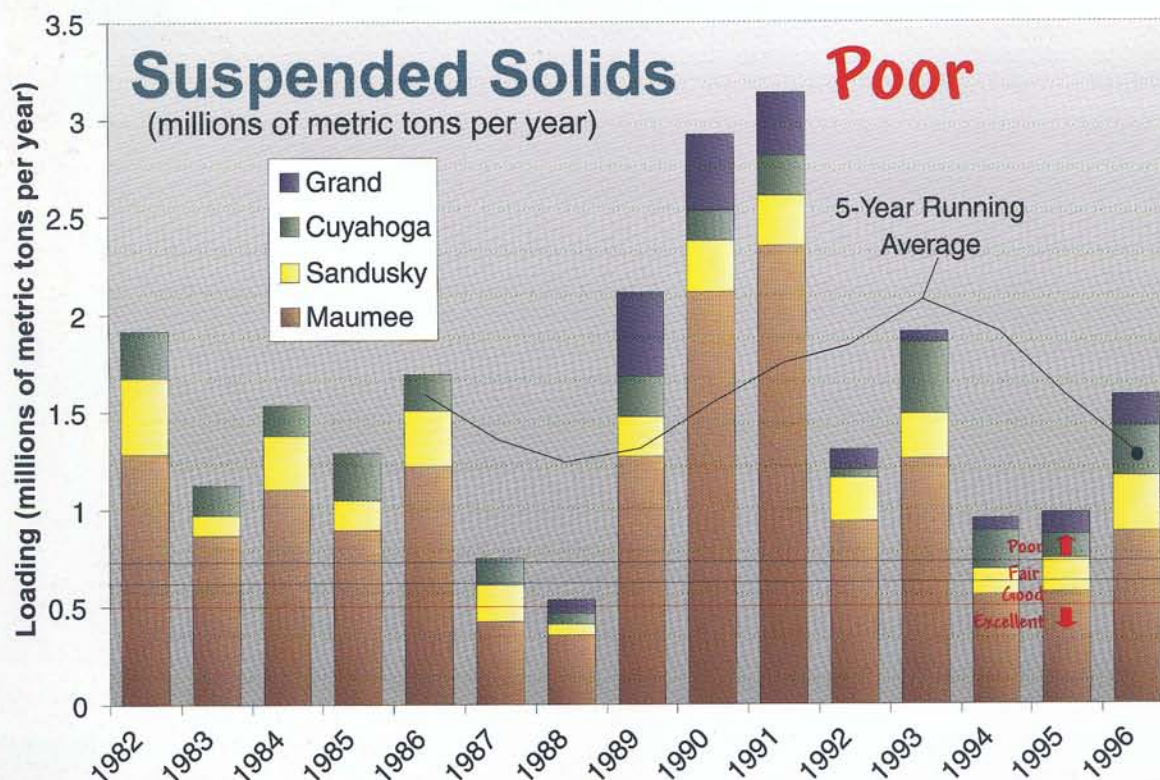
Ohio, as well as the nation, has made dramatic progress in reducing loading from point sources of pollution over the past 25 years. The same level of success has not been achieved with nonpoint sources. Today, nonpoint pollution is the primary cause of continued degradation of Lake Erie and is the area that needs the most focused attention.

Nonpoint pollution is defined as any pollutant source other than the end of a pipe. This includes many processes that continually wash materials off every acre of the watershed and eventually carry them into Lake Erie. These include runoff of soil particles, fertilizers, and pesticides from farms; erosion and the collapse of exposed streambanks; the washing away of soil from unprotected construction sites; and the



washing of salts, metals, and other chemicals from hardened surfaces of Ohio's cities and towns.

The state maintains the most extensive long-term watershed monitoring network in the country.



Heidelberg College's Water Quality Laboratory has continually monitored stream flow and analyzed thousands of water samples for several Ohio rivers for many years.

For this purpose, a composite of three rivers across the North Coast (the Maumee, Sandusky, and Cuyahoga

ivers) was taken. The Grand River was added beginning in 1988 for illustration purposes only. Loadings for the Grand were not included in the cumulative totals, but will be included in this metric in future years. These four rivers were selected because they geographically cover the entire shoreline; they represent the various land use practices in Ohio watersheds; and finally, they come with the most extensive data sets of any rivers along Lake Erie.

This metric is based solely upon suspended solid loading information. This is legitimate, since sediment loading is the primary nonpoint loading problem. Also, the loading of the other pollutants is closely associated with the amount of suspended solids. Reducing the amount of sediment loading into the lake will reduce the other nonpoint contaminants as well.

A very ambitious goal has been set for the amount of sediment reduction to be attained. It is not satisfactory to merely reduce the loading by what is thought to be currently possible using present-day nonpoint pollution prevention technology. Rather, an ecological health viewpoint was adopted, with the objective of returning Lake Erie's river mouths to a healthy and productive condition. This means restoring sufficient water clarity so that healthy submerged macrophytes (aquatic rooted plants) can be re-established. More precisely, the goal is to increase water clarity – by reducing sediment loading – to allow for submerged macrophyte growth in up to six feet of water.

The water clarity necessary for this objective was computed in terms of secchi disk depth. The secchi disk reading necessary to achieve this clarity was computed as 4.25 feet.

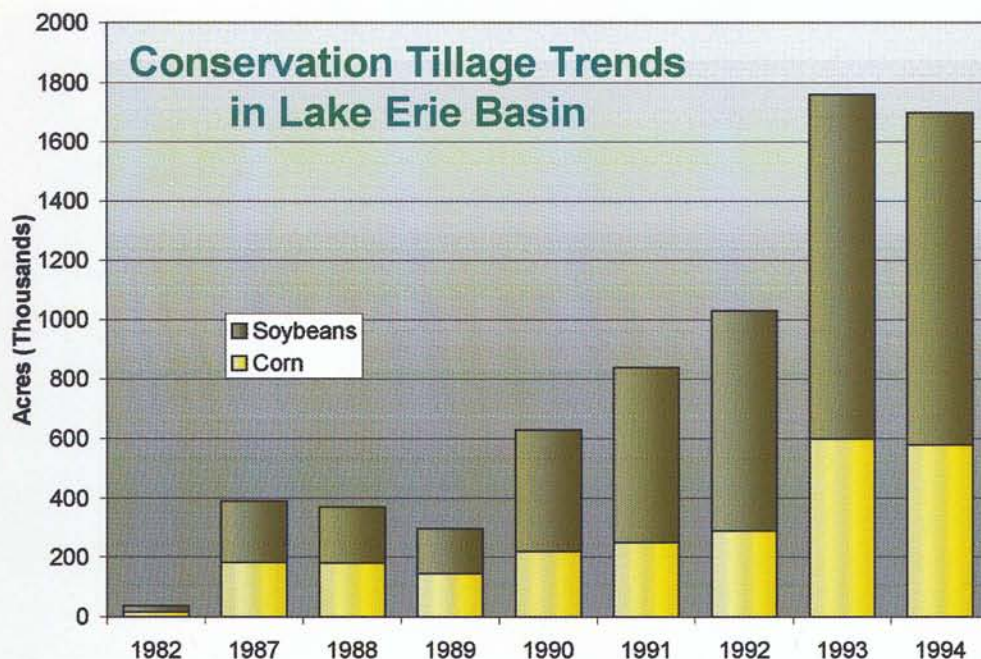
Correlating this desired secchi disk depth clarity with observed suspended solid measurements taken in Ohio's river mouths, it was calculated that the suspended sediment load needs to be reduced by 67%. Since the long-term average for the loading of suspended solids is around 1.5 million tons per year, *the desired loading goal has been set at 0.5 million tons per year.*

The suspended loading graph on the preceding page shows that the annual loading is extremely variable. It is largely dependent on annual precipitation levels, particularly spring storm events. This is the time of year when the soil is most exposed and can be easily washed away with a heavy spring rain. To eliminate some of this annual variability, a five-year running average line was constructed. The actual score is taken from the five-year running average. For 1996, the three-river composite total is right at the long-term average – 1.5 million tons of sediment per year. This is three times greater



Managing wetlands on farmland and establishing native grasses along rivers and streams are just some of the Lake Erie Protection Fund supported projects working on reducing nonpoint pollution into Lake Erie and its waterways.

Researchers are focusing on how wetlands built on farmland can recycle sediment agricultural runoff into Lake Erie and its tributaries and protect natural resources. Through the creation of wildlife corridors using filter strips and flood plain seeding, the amount of sediment loading into area streams and Lake Erie is greatly reduced.



**Percent Acreage
in Conservation
Tillage - 1994**

Allen	51
Ashland	35
Ashtabula	17
Auglaize	56
Crawford	50
Cuyahoga	0
Defiance	68
Erie	38
Fulton	63
Geauga	19
Hancock	56
Hardin	56
Henry	47
Huron	26
Lake	4
Lorain	22
Lucas	57
Marion	55
Medina	20
Mercer	38
Ottawa	60
Paulding	34
Portage	36
Putnam	45
Richland	42
Sandusky	48
Seneca	44
Shelby	43
Stark	49
Summit	24
Trumble	39
Van Wert	55
Williams	58
Wood	44
Wyandot	34

than the goal, and rates a **Poor**.

Significant progress is being made to address watershed nonpoint pollution. A major component of this effort has been the voluntary adoption of conservation tillage practices on Ohio's farms. Instead of the age-old practice of plowing the fields each fall and spring, which completely exposes the soil, farmers are leaving their fall stubble in the field.

Efforts by Ohio's 88 local Soil and Water Conservation Districts to transfer technical knowledge to the farmer, and monetary assistance programs such as Ohio EPA's cost-sharing program for new conservation tillage equipment, have helped

accelerate implementation of these new practices throughout the Lake Erie watershed.

Additional strategies are being used to reduce other sources of nonpoint pollutants. Stream vegetative filter strips, wetland and streambank restoration projects, new regulations on construction sites, and improvements in stormwater sewer systems have reduced the amount of sediment entering the lake.

The goal will not be reached, however, without extra effort. New and innovative technologies must be implemented to add to Ohio's current toolbox of nonpoint best management practices.

For more information on the following subject contact:

Watershed Loading	ODNR - Division of Soil and Water Conservation	614/265-6610
	Ohio EPA - Division of Surface Water	614/644-2001

Waste Site Leakage Metric

Being Developed

A major source of contamination in the Lake Erie basin is leaking waste sites and landfills. Dotting the watershed are hundreds of actual or potential sites where pollutants are continually leaching into adjacent waterways or the groundwater. These areas are the result of many decades of lax or nonexistent standards for how waste materials were to be disposed of or stored. These relic sites include huge municipal landfills that were lined improperly or not at all. Numerous brownfield sites (abandoned properties that remain abandoned due to environmental contamination) are former industrial or manufacturing centers where waste disposal and product spillage have saturated the soils beneath. Some sites are former neighborhood dumps – a legacy from a time when it was thought that swamps and ravines could serve no other useful purpose. Finally, some sites were intentionally created by people looking for a quick fix to their waste disposal problems.

Contained in these waste sites littered

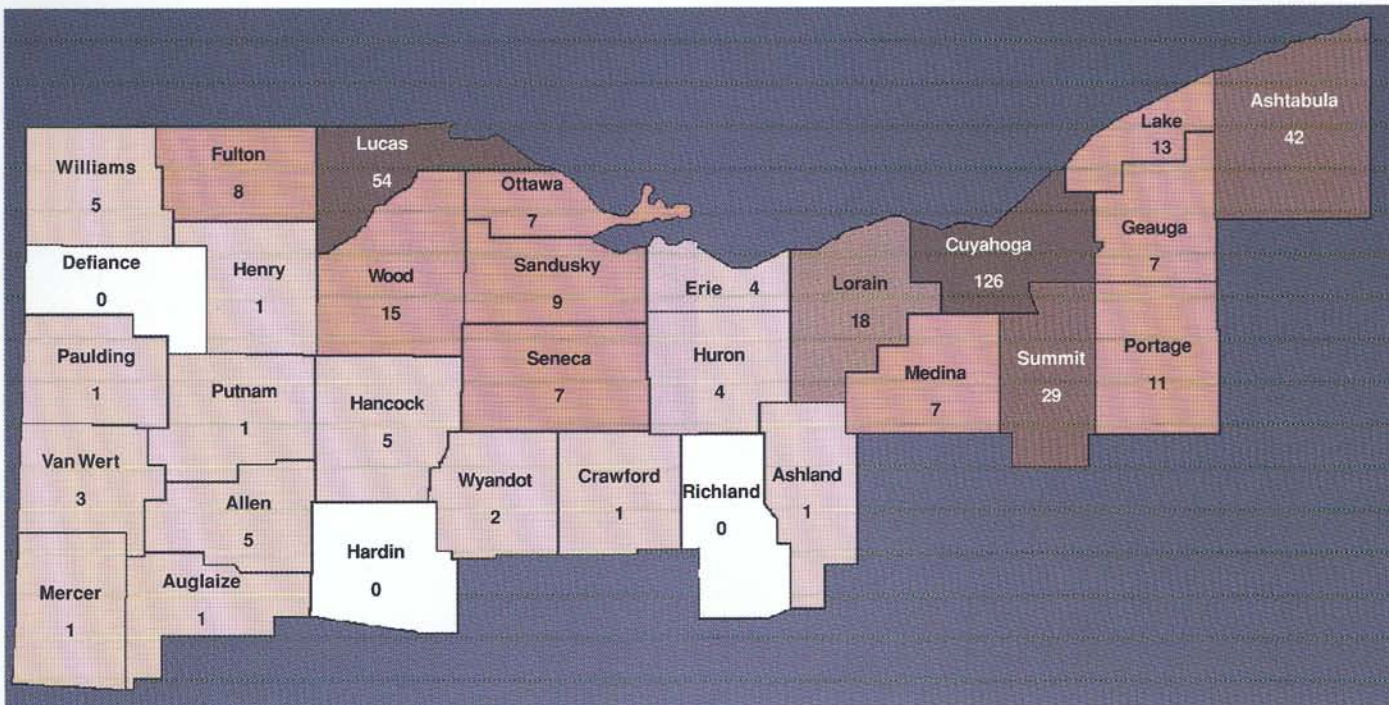
throughout the watershed is a chemical smorgasbord of many industrial and household compound produced over the past century. Most prevalent are oils and other petroleum products that show up after a heavy rainfall as a rainbow sheen on the water's surface. What is most damaging are metals such as chromium, arsenic, and mercury, along with environmentally persistent chemicals such as PCBs. These contaminants quickly settle into the sediments, where they may enter the food chain for many years to come.

The Ohio Master Sites List (MSL) is used for the listing, tracking, and reporting of potentially contaminated sites in Ohio and is maintained by Ohio EPA's Division of Emergency and Remedial Response (DERR).

As of December 31, 1996, there were 1,192 sites listed on the MSL statewide. The list is comprised of sites in Ohio where there is evidence of, or it is suspected that waste disposal may have resulted in the contamination of air, water, or soil –

and there is a confirmed or potential threat to human health or the environment. The MSL is an evolving database with provisions for the listing and delisting of sites. All information on delisted sites is retained for future reference. Inclusion or exclusion of a site on the MSL does not represent a determination of any party's liability, nor does it represent a finding that any response action is





necessary or unnecessary. As information about a site changes, the database is updated. Specific information on MSL sites can be obtained by contacting the appropriate Ohio EPA district office.

In the Ohio Lake Erie basin, there are a total of 434 sites which are either currently listed or have been delisted. There are 60 active sites (presently under remediation or assessment), 328 inactive sites (no action presently underway), and 46 delisted sites. The original intent was to score this metric by comparing the number of remaining MSL sites with the number that have been delisted. Upon further inspection, there was insufficient knowledge of the degree of contamina-

tion, if any, of many of the sites listed.

At this time, it is believed that any metric based on the MSL could be misleading. Investigation of each of the MSL sites will allow for the completion of this metric in the future.

Ohio EPA, in conjunction with the Ohio Department of Development and others, are promoting the cleanup and economic reuse of sites through use of the Voluntary Action Program (VAP) and available financial incentives. There is a need for additional resources to investigate suspected sites, and where necessary, conduct remediation (particularly at abandoned sites). The State of Ohio's 1998-99 budget established a task force to look at resource needs and funding sources for cleanup of sites.

For more information on the following subject contact:

Ohio Master Sites List

Ohio EPA - Division of Emergency
and Remedial Response (DERR)

614/644-2924

Urban Nonpoint Sources Metric

Being Developed

Urban runoff results from rain or snowmelt coming into contact with surfaces such as parking lots, roads, rooftops, lawns, and other city and suburban surfaces. Most urban land surfaces are less permeable than woodland or cropland, which results in greater volumes of runoff being discharged to drainage systems and streams over less time. The increased volume of water contributes to localized flooding and erosion of natural stream channels. Stream systems in urban areas may be highly modified, sometimes even completely replaced by underground storm sewers. As a result, the pollutants in urban runoff are usually discharged directly to Lake Erie tributaries or nearshore waters with little or no treatment.

Urban runoff also carries with it a wide variety of pollutants from many different sources. These contaminants originate not only from land activities, but also from atmospheric

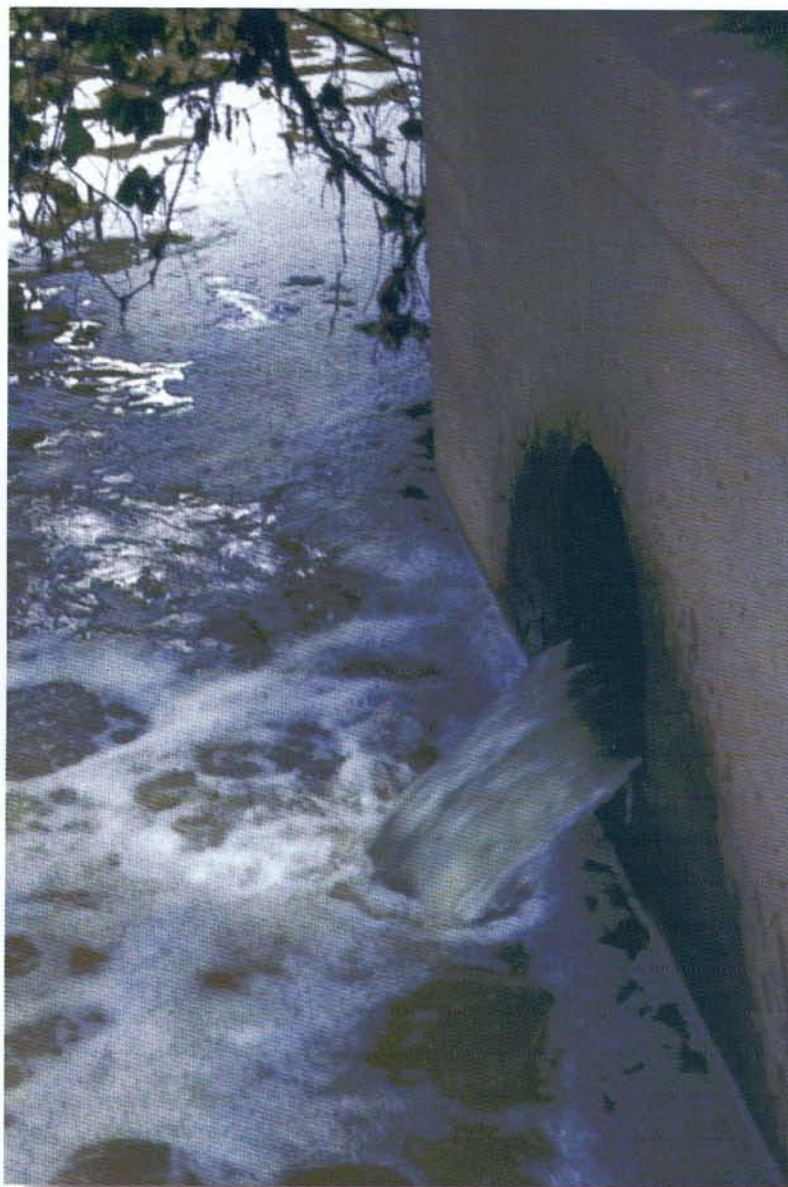
deposition. Trash and debris littering streets or flood areas often get washed into storm sewers and ultimately end up in the lake.

The most contaminated urban runoff generally is in the first flush of water during a heavy rainfall. In

Toledo and Cleveland, underground tunnels have been constructed to store this initial runoff until it can be sent to wastewater treatment plants during lower flow periods.

While the concentrations and loads of pollutants from agricultural areas of the Lake Erie basin are well documented, much less effort has been spent on defining the constituents and impacts of urban runoff. Water quality data exist to characterize urban runoff in some of the Lake Erie basin (e.g., U.S. EPA's work as part of the National Urban Runoff Program), but these data have not been compiled and analyzed to give a clearer picture of the seriousness of the urban pollution problem. As other portions of this report point out, urbanization is the greatest threat to the lake's

remaining wetlands and natural habitat. Compiling existing water quality data and developing better monitoring programs to assess both the chemical and



physical impacts of urban runoff must be a high priority.

Programs to combat the negative impacts of urban runoff have also been slow in coming to communities in the Lake Erie basin. After extended development and review, U.S. EPA promulgated the National Pollutant Discharge Elimination System (NPDES) stormwater regulations in November 1990. These regulations represent the most comprehensive program to date for controlling stormwater runoff, but they apply only to separate municipal storm sewer systems that serve communities of more than 100,000 people. They also apply to stormwater runoff at 11 industrial sites. The regulations do not address the hundreds of smaller communities throughout the Lake Erie watershed.

Another challenge in implementing NPDES

stormwater regulations lies in the great number of discharges, active construction sites, and industrial storage areas to inspect. Improving the effectiveness of urban stormwater pollution control depends heavily on increasing the commitment to water quality protection at the local level and increasing local inspection and enforcement capabilities.

For many areas, the number and location of storm sewer outfalls are known. Yet there is no comprehensive database detailing the volume of flow, frequency of discharges, or the concentrations of contaminants. Until this information is available, assigning a rating to this particular category is not possible. In the future, goals will be set and a monitoring program established so an accurate assessment can be made.

Urban Runoff Pollutants		
Category	Pollutant	Possible Sources
Sediments	Total Suspended Solids Turbidity Dissolved Solids	Construction Sites Urban/Agricultural Runoff Combined Sewer Overflows
Nutrients	Nitrate/Nitrite Ammonia Organic Nitrogen Phosphorus	Urban/Agricultural Runoff Landfills, Septic Fields Atmospheric Deposition Erosion
Pathogens	Total Coliforms Fecal Coliforms <i>E. coli</i>	Urban/Agricultural Runoff Septic Systems Illegal Sanitary Connections Combined Sewer Overflows Boat Discharges Animal Wastes
Organic Enrichment	Biochemical Oxygen Demand Chemical Oxygen Demand Total Organic Carbon	Urban/Agricultural Runoff Combined Sewer Overflows Landfills, Septic Systems
Toxic Pollutants	Metals Oils and Grease Petroleum Products Pesticides PCBs Solvents	Urban/Agricultural Runoff Lawn and Garden Maintenance Underground Storage Tanks Hazardous Waste Sites Landfills Illegal Oil Disposal Industrial Discharges Vehicle Exhaust and Corrosion Combined Sewer Outfalls
Salts	Sodium Chloride	Road Salt

For more information on the following subject contact:

Urban Nonpoint Pollution Sources

Ohio EPA - Division of Surface Water

614/644-2001

Atmospheric Sources Metric

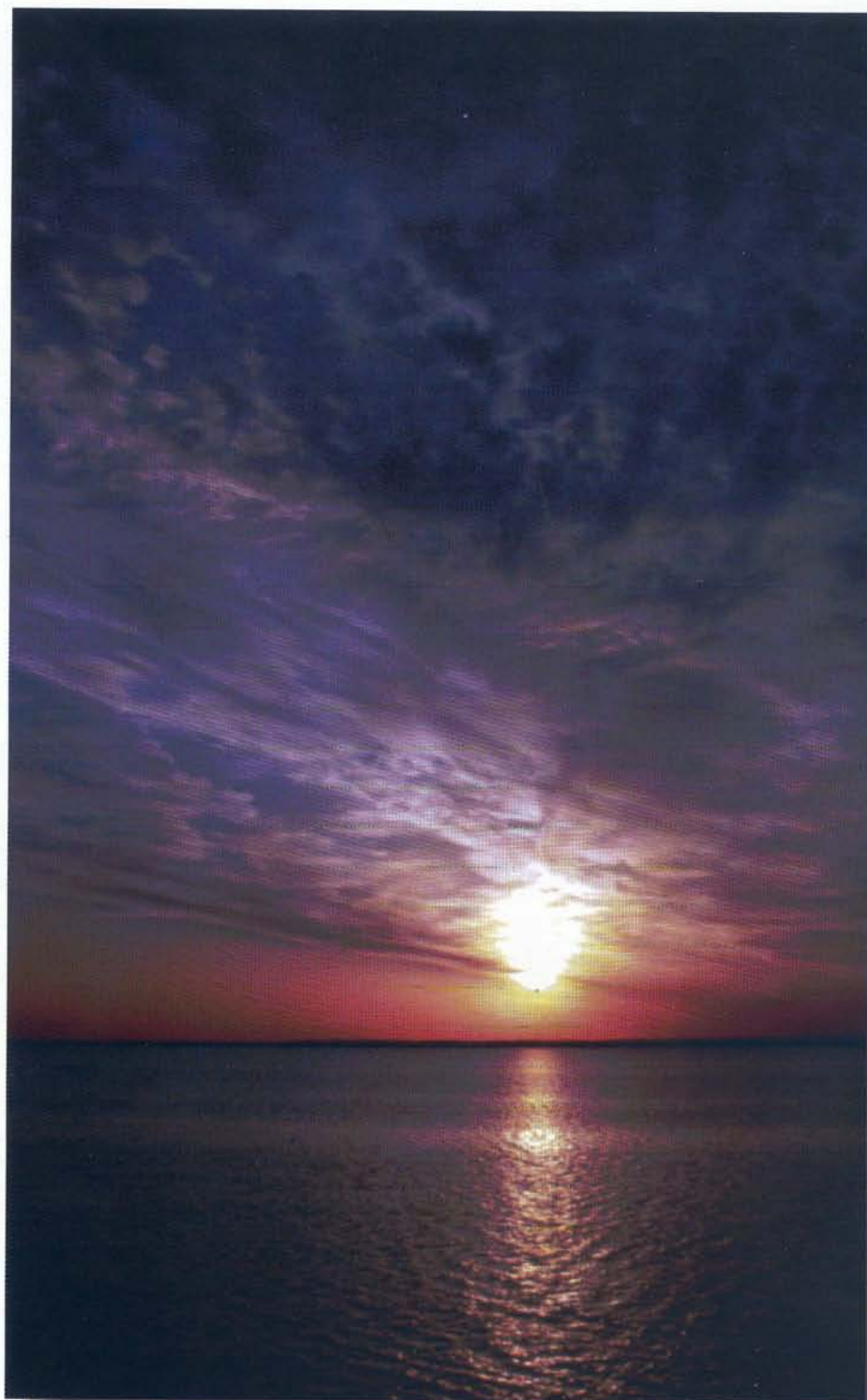
*Being
Developed*

Up to this point, the sources of pollution loading into Lake Erie have been fairly obvious. Point sources, nonpoint watershed sources, leakage from waste sites, and even urban nonpoint sources are highly visible and relatively easy to measure and quantify.

The deposition of pollutants from the atmosphere is usually invisible, extremely difficult to measure, and has not yet been quantified to a high degree of confidence and reliability.

Extensive research, however, has shown that pollutants entering from the atmosphere are an important, and for some toxic chemicals, the predominant pathway into the Great Lakes. For Lake Superior, a large remote lake with few sources within its drainage basin, an estimated 90% of the PCB loading comes from the atmosphere.

The sources of air pollutants include evaporation of pesticides and fertilizers from farmland, direct inputs from smokestacks, automobile emissions, furnace emissions, and even evaporation and recycling from the lake surfaces themselves. Once airborne, contaminants fall out as dry particles or are washed out with the next rain or snowfall.



What is also apparent is that some pollutants are entering the Great Lakes ecosystem from sources thousands of miles away. DDT for instance, still enters the lakes via the air even though its production and use were eliminated from the watershed many years ago.

It has been shown that the Great Lakes receive much of their DDT load from its continued use as an agricultural pesticide in Third World countries in Central and South America. The role of atmospheric loading of pollutants into Lake Erie is considerable, but proportionately smaller than in Lake Superior.

Although considerable quantities of pollutants enter Lake Erie from the atmosphere, most contami-

nants still enter the lake from its tributaries. By far, the largest source is the Detroit River, which carries chemicals drained from the entire upper Great Lakes watershed.

The table below illustrates the results from a study on Lake Erie atmospheric contaminant loading conducted by Ohio EPA and the Battelle Institute. The contribution of pollutant loading from the atmosphere ranges from a low of 8% for arsenic to a high of 59% for cadmium.

No rating is being posted for the *Atmospheric Loading* metric in this report. As yet, there are insufficient monitoring and historical data available to design and calculate a metric. This information is planned for inclusion in future reports.

Estimated Annual Atmospheric Loading into Lake Erie (in Kilograms Per Year)

Chemical	Pathway		
	Detroit River	Lake Erie Tributaries	Atmospheric Loading
Total PCB	512 (51%)	229 (23%)	257 (26%)
Total PAH	41,000 (79%)	- (0%)	10,870 (21%)
Mercury	2,050 (62%)	534 (16%)	728 (22%)
Lead	369,000 (67%)	53,400 (10%)	124,000 (23%)
Arsenic	102,000 (80%)	15,200 (12%)	9,909 (8%)
DDT	61 (47%)	31 (24%)	37 (29%)
Cadmium	7,170 (34%)	1,523 (7%)	12,329 (59%)

For more information on the following subject contact:

Atmospheric Loading

Ohio EPA - Division of Air Pollution Control

614/644-2270

Habitat Indicator Fair

The land comprising the Lake Erie watershed would be unrecognizable to the people who originally settled here. Today, most of the forests have been cleared and the wetlands have been drained to make room for farms and communities. Streams and rivers have been straightened, rerouted, dredged, and bulkheaded. Finally, much of the shoreline has been straightened, filled in and armored. On one hand, all of this activity has allowed for the building of a thriving industrial and agricultural economy over the past 200 years. On the other hand, it has severely impaired portions of our natural environment.

The Great Black Swamp once stretched from Sandusky to Fort Wayne, and was the largest continuous wetland ecosystem in the Great Lakes. Over time, about 90% of it has been drained and either tilled or paved. The mouth of the Maumee River was essentially a giant stand of wild rice, a plant thriving on very clean, pure water. Today, the Maumee carries more sediment than any other tributary of the Great Lakes.

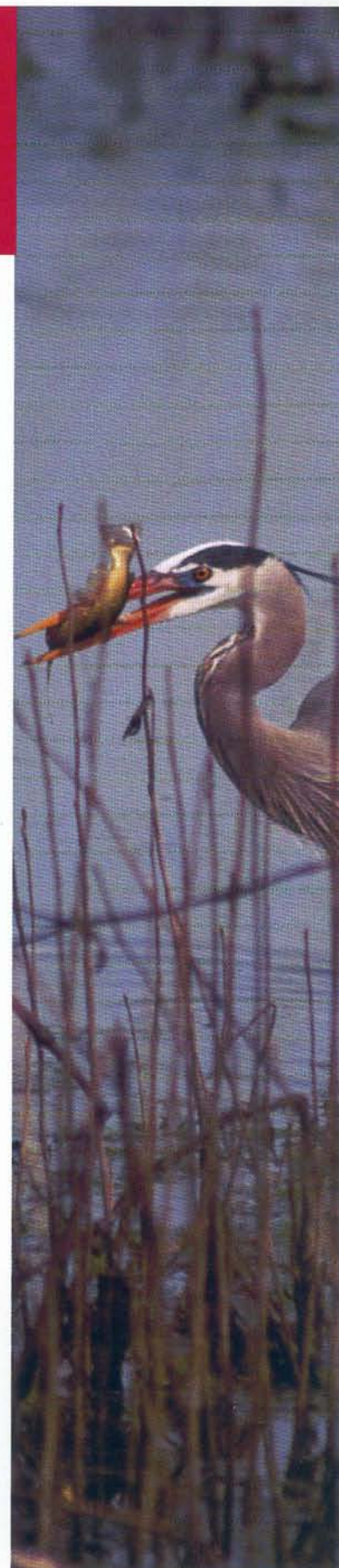
The damage to shorelines and waterways is reflected in impaired aquatic communities throughout the North Coast. Many stretches of shoreline, rivermouths, and streams can no longer support healthy, biologically diverse communities of fish, invertebrates, or plant life. Many species dependent on high water quality or rare habitat have been drastically reduced in numbers or are absent altogether.

Protection and restoration of valuable habitat in the Lake Erie watershed are a prime concern along Ohio's North Coast. Yet pressures from competing uses such as industrial and commercial development, housing, and public lake access make land use decisions for coastal communities difficult.

These four *Habitat* metrics show that improvement has occurred in the Lake Erie watershed in recent years. This section also shows that a great deal of work lies ahead before the watershed is again healthy.

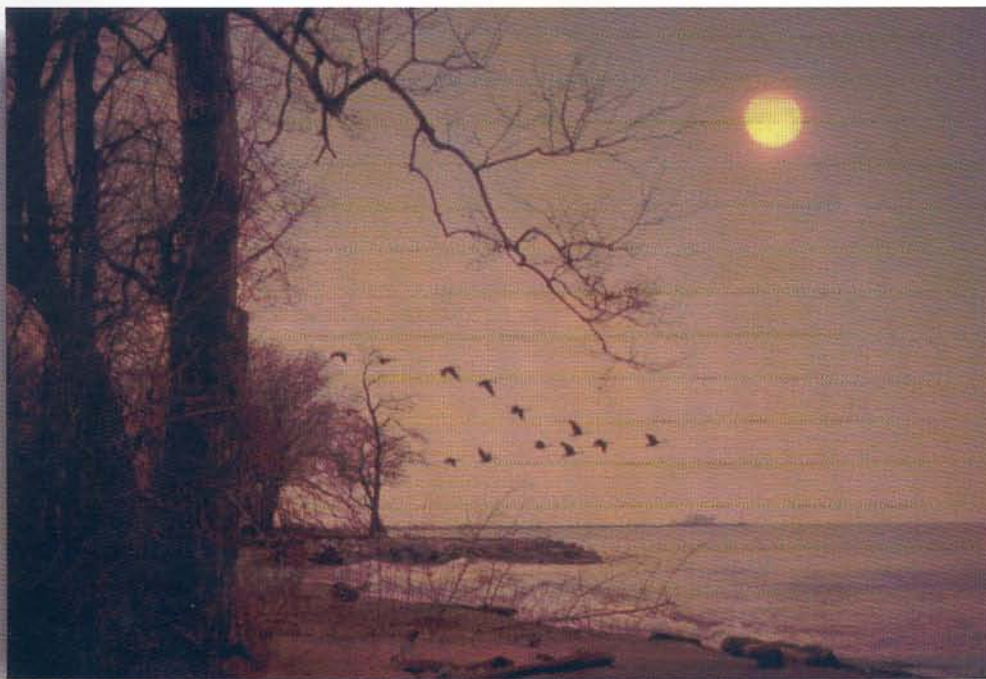
Scoring of *Habitat* Indicator

Metric	Score	Weighting	Weighted Score
Aquatic Habitat Quality			
Shoreline	2.0	.25	0.50
Rivermouths	1.0	.35	0.35
Wetlands	2.0	.40	0.80
Land Use	No Score	-	-
		Rating	1.7 Fair



Aquatic Habitat Quality Metric

Fair



The nearshore areas of Lake Erie have been evaluated by the Ohio Environmental Protection Agency for their habitat quality using the Qualitative Habitat Evaluation Index (QHEI). Habitat is a critical factor in the establishment of healthy and diverse biological communities. The QHEI is used to evaluate the complexity and quality of waterbody habitats (primarily rivers and streams).

The QHEI uses six general habitat characteristics: bottom texture (i.e., sand, gravel, mud, etc.), cover, extent of modification by human activity, land use surrounding the water body, riffle/pool development, and gradient (slope). Each of these six categories is comprised of a set of sub-units which are scored and tallied to give a category score. These category scores are then totalled to give a single QHEI score.

Free flowing rivers, with riffles and gradient, can score a maximum of 100 points. The higher the score, the greater the habitat quality. For lakeshore sites (because there are no riffles or gradient), the

maximum possible score is 80 points. For rivermouths, the maximum score is 86 points.

Ratings are reported as averages for lake shores by county, Sandusky Bay, and the islands. River spawning habitat is reported by river system. Average ratings are also calculated for the total lake shoreline and all river spawning habitat areas.

River spawning habitat ratings are based on the quality of habitat found in the rivermouth sections and adjusted by the length of free flowing river ("Stream Miles Available") located between the first fish passage obstruction

(dams) and the start of lake-like conditions. If a river has 10 or more miles of stream accessible to spawning for Lake Erie fish downstream of the first dam, the rivermouth rating is raised one category; if less than 10 miles exist, the rating is lowered one category.

For both rivermouths and the lakeshore, a QHEI value of 60 to 86 is considered **Excellent**, 59 - 55 **Good**, 54 - 50 **Fair**, and less than 50 is considered **Poor**. The overall lakeshore and river habitat scores were computed as an average of all of the individual scores.

The overall condition of Ohio's Lake Erie shoreline habitat is **Fair** (QHEI=53.4). Evaluation of rivermouth data reveals an average rating of **Poor** (QHEI=47.2). The addition of free flowing river sections does not improve this rating and it remains **Poor**. Examination of the Lake Erie shoreline by county reveals that the two counties in the western basin (Lucas and Ottawa counties) and Sandusky

Bay rate **Poor**, the lowest rating of the nine areas. These three areas are naturally low in substrate texture and do not rate high in the substrate category. Historically, habitat quality was much higher in these areas when aquatic plants were common. Presently, aquatic plants are greatly reduced in Lake Erie's shoreline areas and only those areas protected by dikes retain healthy plant communities. Unfortunately, dikes isolate Lake Erie fish communities from use of these wetlands and they provide no effective spawning habitat. The Ohio Department of Natural Resources is currently researching ways of allowing Lake Erie fish communities beneficial access to wetlands while still protecting them from the negative impacts of non-native species.

These lower scores in the western basin appear to be due to the greater influx of nutrients and sediment being derived from high intensity agricultural activities in the tributaries of the area. Sediments have a disruptive effect on plant communities by increasing turbidity in river and harbor mouths, thus reducing available light to submerged plants and critical spawning areas.

South Bass, Middle Bass, Kelleys, and Gibraltar islands score the highest of all Lake Erie

QHEI Scores - Lake Erie Shoreline		
Area	QHEI	Rating
Lucas County	49.1	Poor
Ottawa County	19.0	Poor
Erie County	56.0	Good
Lorain County	55.6	Good
Cuyahoga County	51.0	Fair
Lake County	53.4	Fair
Ashtabula County	52.1	Fair
Sandusky Bay	48.5	Poor
Lake Erie Islands	63.2	Excellent
Lake Erie Shoreline Average	53.4	Fair

areas, attaining an **Excellent**. The islands of Lake Erie are the only region which has not experienced extensive shoreline modification. Erie and Lorain counties, in the western portion of the central basin, are both rated **Good** while Cuyahoga, Lake, and Ashtabula counties are **Fair**. The western half of Ohio's central basin has a greater abundance of cobbles and boulders. The eastern half has more bedrock areas and high cliffs comprised of clay.

The best overall river spawning habitat is found in the Maumee and Grand rivers (rated **Good**) due to their longer free-flowing sections and the retention of some undisturbed shoreline. The Sandusky River gets the lowest rating (**Poor**), suffering from the same problems as Sandusky Bay and the presence of a dam that leaves only 2.3 miles of free flowing stream.

The Portage, Huron, Cuyahoga, and Chagrin



ivers are also **Poor** as a consequence of pollution and shoreline modifications. The Cuyahoga rivermouth is rated **Poor** because of extreme shoreline modification and is brought up by the 13.9 miles of free-flowing stream. The Portage, Huron, and Chagrin rivermouths, although initially rating as **Fair**, are downgraded to a **Poor** rating. This reduction is due, in each case, to the existence of a dam near the free-flowing river's confluence with its rivermouth. Four tributaries (Vermilion, Black, Ashtabula, and Conneaut) have rivermouths rating **Poor** and are brought up to **Fair** by long stretches of undammed stream.

There are two basic types of environmental impacts affecting Lake Erie habitat: shoreline modification and nonpoint pollution. Attention is being directed at nonpoint pollution by numerous federal and state agencies which have begun programs to address runoff pollution. Stream channelization, dam construction, shoreline modification, marina development, diking, and other activities that alter the natural structure of the lakeshore, rivermouths, and associated wetlands continue to occur. Some efforts directed at restoring wetland habitat exist on the federal, state, and private level, and Ohio EPA is requiring more environmentally friendly shoreline modifications. Restoration of previously modified rivermouth habitats is not being addressed. Also, efforts should be made to assess removal of non-beneficial dams which obstruct upstream fish spawning migrations.

Currently, only three of nine lakeshore areas and two of the 11 major rivermouths possess habitat suitable to support healthy biological communities.



Historical records show that Western Lake Erie was once surrounded by 300,000 acres of marsh and swamp. Today, less than 10% of these original wetlands remain, and efforts are focusing on restoring these natural resources and increasing plant and animal biological diversity. Through the Lake Erie Protection Fund, the Ohio Department of Natural Resources is restoring 20 acres of coastal wetlands within Maumee Bay State Park to create a larger continuous corridor of habitat that will benefit many wetland-dependent wildlife species.

QHEI Scores for Lake Erie Rivermouths

Rivermouth	Rivermouth QHEI/Grade	Dam Location	Stream Miles Available	Composite Score
Maumee River	50.9	32.2	17.4	Good
Portage River	54.2	20.8	5.8	Poor
Sandusky River	43.6	18.0	2.3	Poor
Huron River	52.1	14.6	4.3	Poor
Vermilion River	48.0	23.7	21.8	Fair
Black River	49.9	No Dam	N/A	Fair
Rocky River	48.5	No Dam	12.1	Poor
Cuyahoga River	34.0	20.7	13.9	Poor
Chagrin River	53.7	4.8	3.4	Poor
Grand River	52.4	30.9	26.7	Good
Ashtabula River	48.2	No Dam	N/A	Fair
Conneaut River	41.0	20.4	18.9	Fair
Rivermouth Average	47.2	N/A	N/A	Poor

For more information on the following subject contact:

Nearshore Habitat

Ohio EPA - Northeast District Office

330/963-1200

Wetlands Metric

Fair

Since its original settlement, Ohio has lost 84% of its original wetland acreage – dropping from five million acres to 800,000 acres. Within the Lake Erie marsh area, it is estimated that there were originally about 300,000 acres of wetlands. By 1987, wetlands in this zone were reduced to about 22,793 acres. Factors which led to this reduction included community and agricultural development, and natural weather events which destroyed many of the diked marshes and nearly all of the non-diked marshes in 1972.

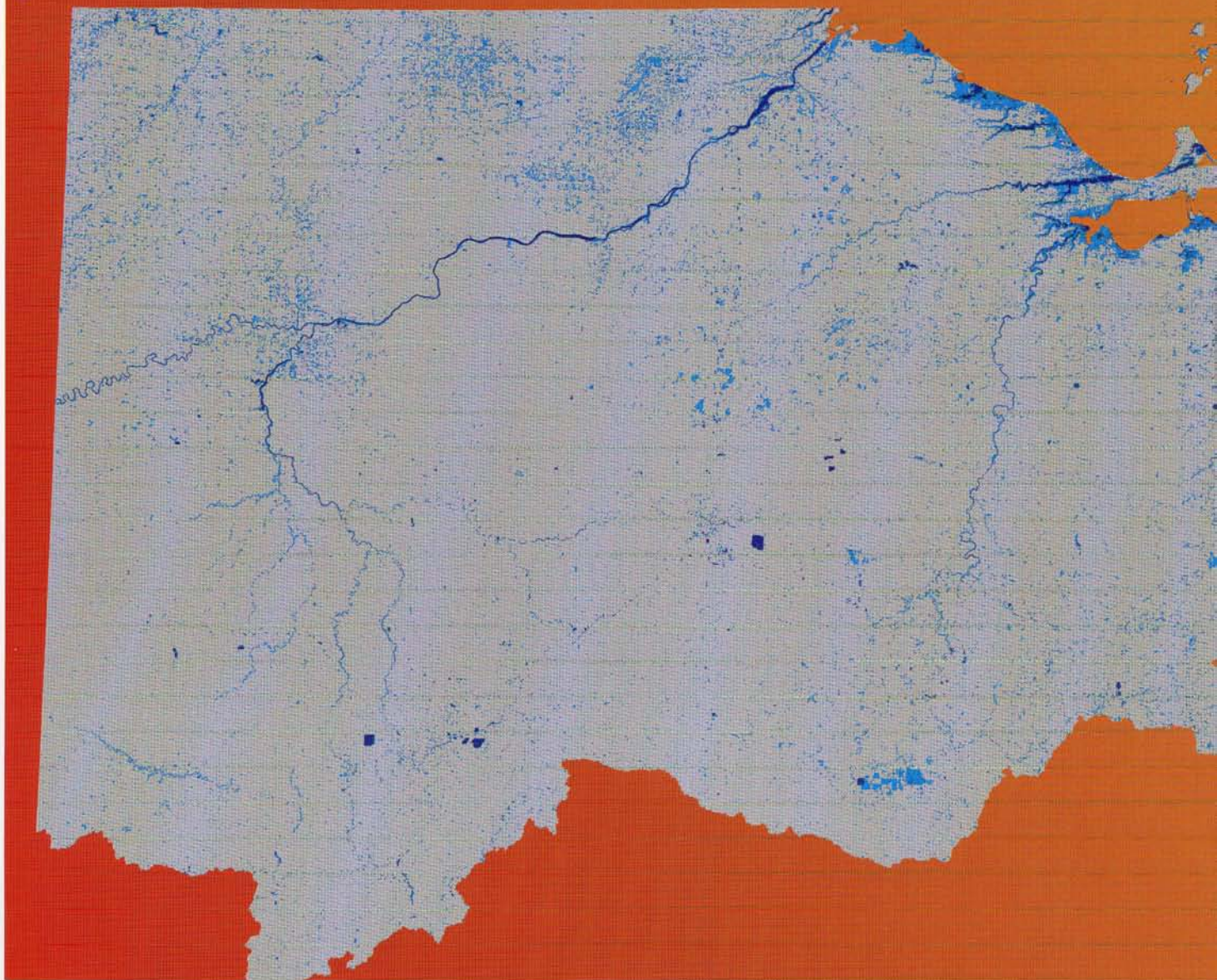
Coastal wetlands of the Great Lakes are highly productive and diverse communities, which provide the biological interface between the land and the water. Productive wetlands are dynamic and multi-functional systems that provide, among other things: flood control, shoreline erosion protection, ground water recharge, sediment/toxin filtration, nutrient uptake, wildlife habitat, and nutrients for the aquatic food web. The most obvious and unique feature of a productive wetland is its characteristic vegetation, which provides cover and food for fish and wildlife.

Ohioans receive additional benefits from Lake Erie's wetlands through recreational opportunities and the industries and services this recreation supports. In addition, the remaining Lake Erie wetlands are of paramount importance to a variety of wetland wildlife, including 37 of Ohio's threatened and endangered species. Unfortunately, these unique systems are fragile and susceptible to damage from both natural and human impacts. Such disruptions have eliminated most of the wetlands over the past 200 years.

The Lake Erie marshes are

situated in the most rapidly developing area of the Great Lakes. Since the 1970s, the ecological revival of the lake and its various fisheries has caused an explosion in development of marinas, subdivisions, condominiums, and support industries. Many small wetlands have been lost to development, larger



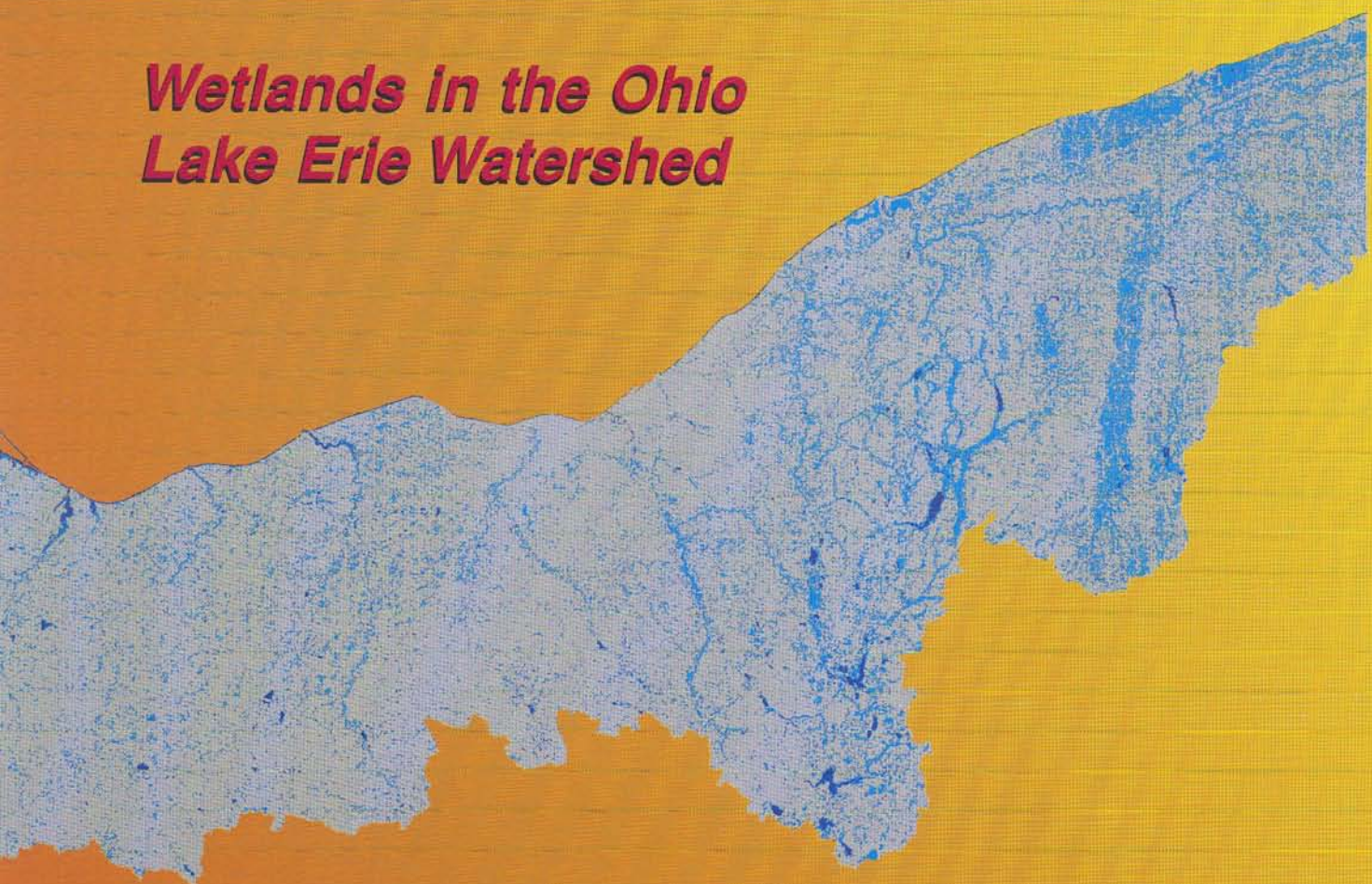


marshes have been encroached upon, and remaining restorable wetland sites are in great danger of being lost because of their high monetary value for development.

New wetland rules, developed by Ohio EPA, are scheduled for adoption in 1998. These rules will bolster the state's ability to protect remain-

ing wetlands by placing more stringent requirements on potential developers. The rules also assign greater value, both environmentally and economically, to high quality wetlands adjacent to the lake and rivers. Finally, the new rules will provide a more objective, uniform, and predictable permitting process than currently exists.

Wetlands in the Ohio Lake Erie Watershed



Legend			
Class Names		Acres	% of Area
Land		7,257,959.12	97.35
Open Water		44,224.18	0.59
Non-Forested Wetlands		153,281.15	2.06
Total		7,455,464.45	

The Wetland Reserve Program and the Conservation Reserve Program have provided financial incentives for landowners to maintain or restore wetlands on their property. The Wetland Reserve Program has restored 6,616 acres of wetlands statewide since 1995. Of these, 3,319 acres are located within the Lake Erie basin.

The factors that affect the quality of wetlands

are extremely complex, and the Ohio Lake Erie Commission's understanding of these factors is constantly improving. Currently though, there is no universally accepted metric for monitoring the quality of wetlands – although such a system is currently being developed. For this report, the *Wetlands* metric focuses on ongoing efforts to reverse the trend of wetland loss within the Lake Erie zone. Since

1988, the Ohio Division of Wildlife has been working in conjunction with many other agencies, organizations, and private land-owners toward a goal of conserving an additional 18,000 acres of productive wetland habitat by the year 2000 in the Lake Erie marsh region from Toledo to Sandusky.

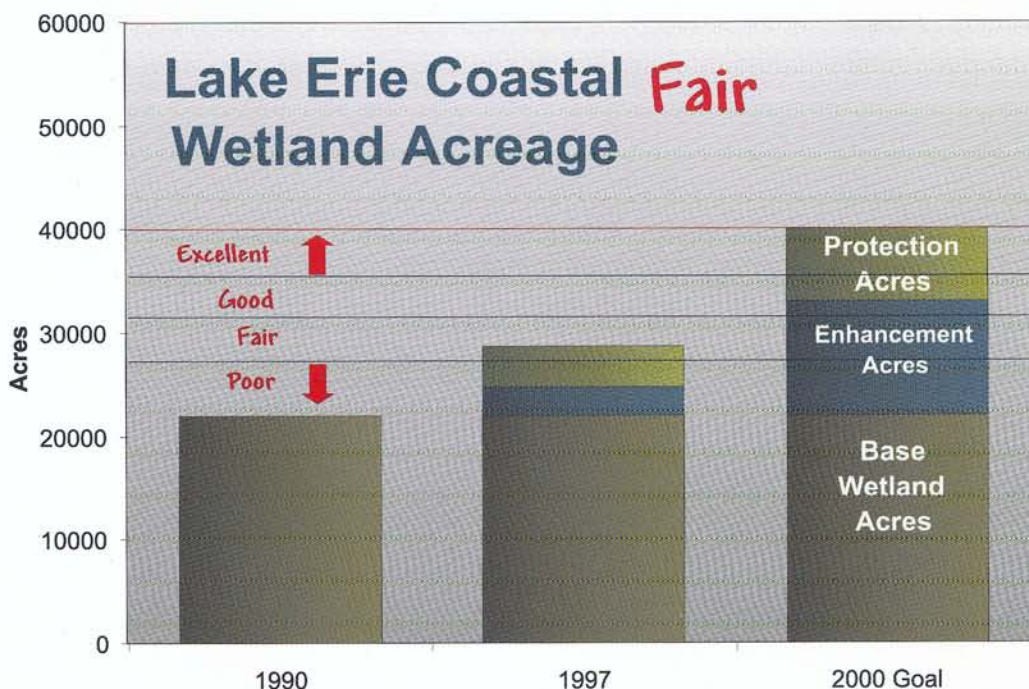
Combined with the base of 22,000 acres, this goal would provide approximately 40,000 acres of wetlands in this area. To achieve this goal, two major objectives were identified: 1) wetland habitat protection; and 2) wetland habitat enhancement.

Protection is defined as any legal arrangement resulting in the conservation of a wetland tract. Examples include legislation, tax breaks/incentives, fee title acquisition, mitigation, and leases. *The protection objective is 11,000 acres.* It is estimated that about 3,750 acres have already been protected – 1,050 acres through fee title acquisition, and 2,700 acres through conservation easements.

Enhancement includes efforts to increase the acreage and/or the productivity of existing wetlands. *The enhancement objective is 7,000 acres.* It is estimated that approximately 4,005 acres have been

enhanced to date.

Presently, acreage goals are being approached for restoration, enhancement, and conservation easements but are falling far short for acquisition. It has been an easier task for agencies and organizations to improve existing privately owned land than to acquire additional funding to increase the land base under protection. To date, an estimated total of only 7,755 acres of the 18,000-acre goal has been achieved. Adding significant acreage to this goal by the year 2000 will require new funding sources and an increase in existing state and federal funding programs.



For more information on the following subjects contact:

Lake Erie Wetlands

ODNR - Ohio Division of Wildlife:

-Crane Creek Research Station

419/898-0960

-Sandusky Fish Research Station

419/625-8062

U.S. Fish and Wildlife Service

614/469-6923

Ottawa National Wildlife Refuge

419/898-0014

Ducks Unlimited

419/898-4148

Wetland Inventory

ODNR - Division of Wildlife

614/265-7046

ODNR - Office of Real Estate and Land Management

614/265-6769

Land Use Metric

Being
Developed



Ohio's portion of the Lake Erie watershed encompasses 11,649 square miles and includes portions of 35 counties. Of this land, over 72% is in active cultivation, 20% is wooded, and just over 2% remains as wetland. The developed environment – industrial, commercial, residential, quarries, transportation, and institutional uses – accounts for 4%, and the remaining 1% is covered by inland lakes and rivers.

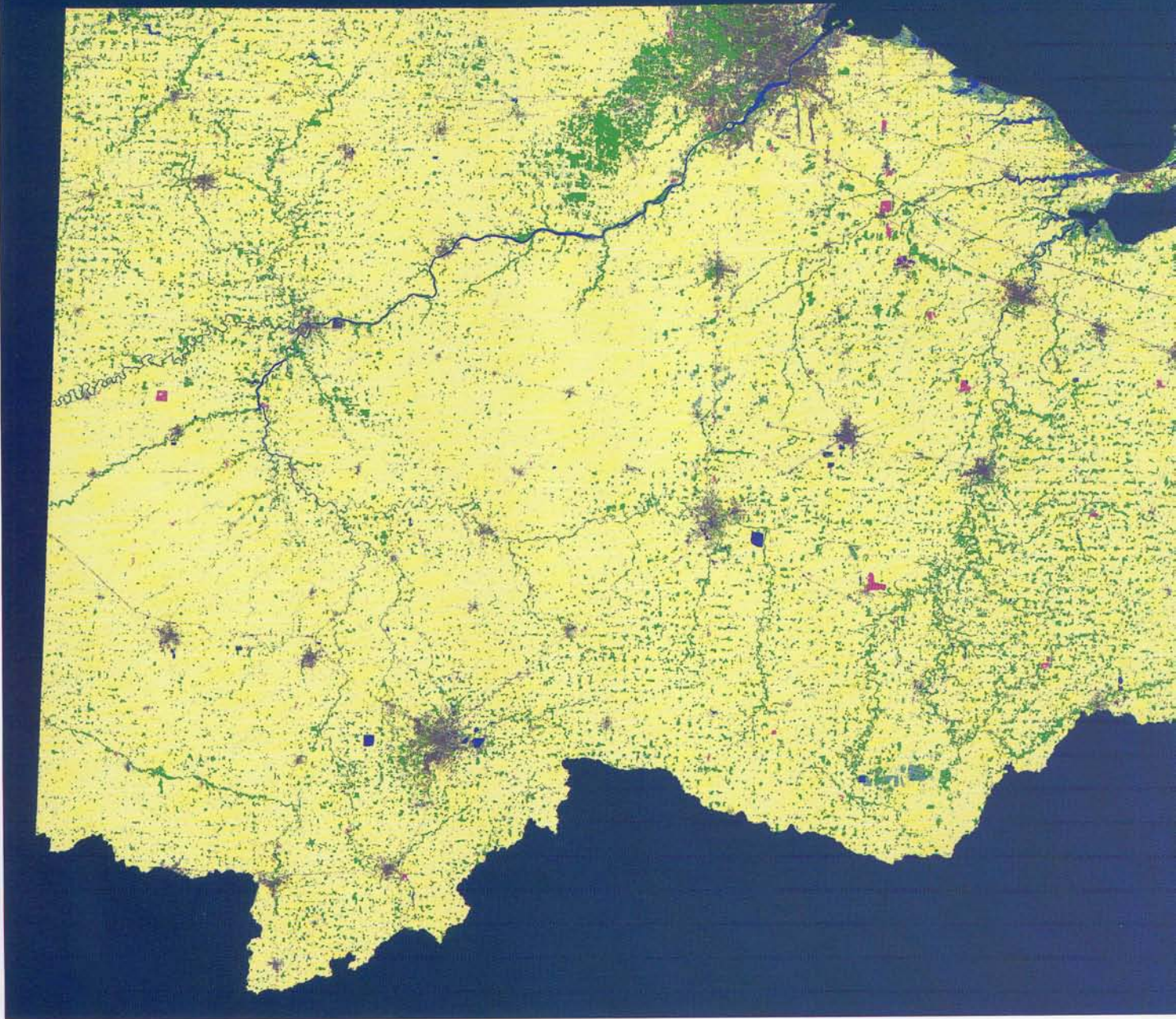
These percentages indicate the enormous amount of human activity taking place in Ohio. It also indicates a watershed that has been altered from the dense wetlands and lush upland forests that were once here.

What has been gained over the past 200 years of development is a thriving agricultural and industrial based economy. This gain has come at a cost, however. Many of the preceding metrics

demonstrate that the environmental quality of Lake Erie's tributaries, rivermouths, and shoreline is not acceptable. They have lost their ability to support healthy and diverse biological communities.

The major change in land use over the past 20 years has been the conversion of farmland and woodlands to industrial and residential uses. This urban sprawl has been most conspicuous in the Cleveland and Toledo metropolitan areas. Each new development increases the demand for new infrastructure, including roadways and utilities. It also increases waste discharges, reduces the ability of the land to store water, and eliminates natural habitat.

The issue of land use is among the most controversial environmental issues. It potentially impacts individual rights and freedom. Society reacts vigorously to any attempt to restrict the use of private property.

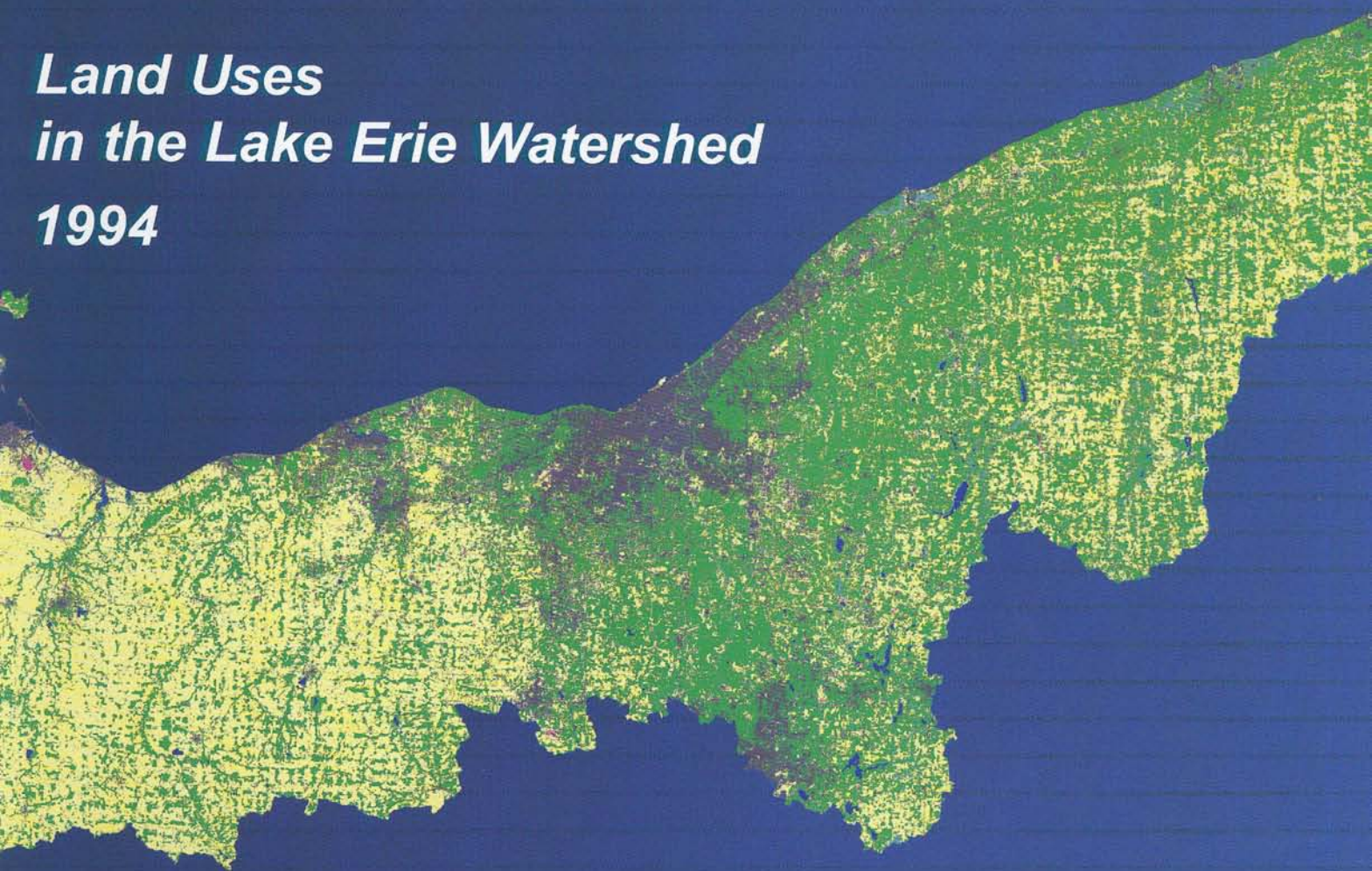


Many initiatives are currently studying land use patterns in Ohio and seeking solutions to the continued encroachment of sprawl and restoring natural functions to the Ohio landscape. Foremost among these efforts are the

Governor's Farmland Preservation Task Force and the Brownfields Redevelopment Program.

At this time, the Commission cannot devise a metric to rate the current status of

Land Uses in the Lake Erie Watershed 1994



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	

land use in the Lake Erie watershed. To do so requires an understanding of what combination of land use is required to sustain the

watershed and a plan on how to accomplish the needed change. Neither of these two factors is currently known.

For more information on the following subject contact:

Land Use Mapping

ODNR - Office of Real Estate and Land Management

614/265-6769

Biological Indicator *Good*



The *Biological* indicator focuses on what is really crucial – the ability of the Lake Erie ecosystem to sustain life.

This issue will be examined in two ways. First, the population or reproduction trends of three key species have been plotted and then compared to desired goals. Each of these species is important to the Lake Erie ecosystem and provides a crucial piece of information concerning the health of the entire lake.

Bald eagles have made a remarkable comeback over the past 20 years – from near extinction in the mid-1970s to their present population of 41 nesting pairs throughout the state. The difficulty they experienced on the lake was primarily due to contaminant accumulation in their tissues and a loss of suitable habitat for nesting and foraging. Thus, trends in their ability or inability to reproduce are a good barometer of contamination levels and habitat availability along the North Coast.

People who have been around the western portion of the lake in late June understand all about mayflies (*Hexagenia*) making a comeback. Mayflies were all but eliminated from the western basin of Lake Erie in the 1950s as much of the lake bottom became anoxic (absence of oxygen) because of the over-productivity of the lake. The resurgence of mayflies is a good surrogate indicator on the reduced nutrient loads in the lake and reoxygenation of its bottom waters.

The indicator species walleye is the most important sport and commercial fish in the lake. It is also a top predator in the Lake Erie ecosystem, and an effective indicator of the overall productivity of the lake.

The second measurement, *Index of Biotic Integrity*, is a more fine-grained look at the ability of the ecosystem to support healthy and biologically diverse communities. The results of this index show that many areas of the shoreline are still significantly impaired in their capacity to support high quality communities.

Scoring of *Biological* Indicator

Metric	Score	Weighting	Weighted Score
Key Indicator Species	3.7	.50	1.85
Index of Biotic Integrity	2.0	.50	1.00
		<i>Rating</i>	2.9 Good

Key Indicator Species Metric

Excellent



BALD EAGLES

Bald eagles are exclusively native to North America and play an important ecosystem role as a top-level predator. Ohio's bald eagle population declined beginning in the 1950s, and decreased to a low of four nesting pairs in 1975. Destruction of wetland habitat by development and agricultural activities, and habitat degradation due to environmentally persistent toxic chemicals (e.g., PCBs, DDT) contributed to the decline. Another reduction in reproductive success occurred in the early 1990s and may have been related to the vast physical changes that occurred in Lake Erie after the introduction of zebra mussels.

Intensive efforts to increase production from wild nests in Ohio began in 1979, and Ohio's eagle population has been increasing and expanding its range since the early 1980s. These efforts centered on fostering captive-reared

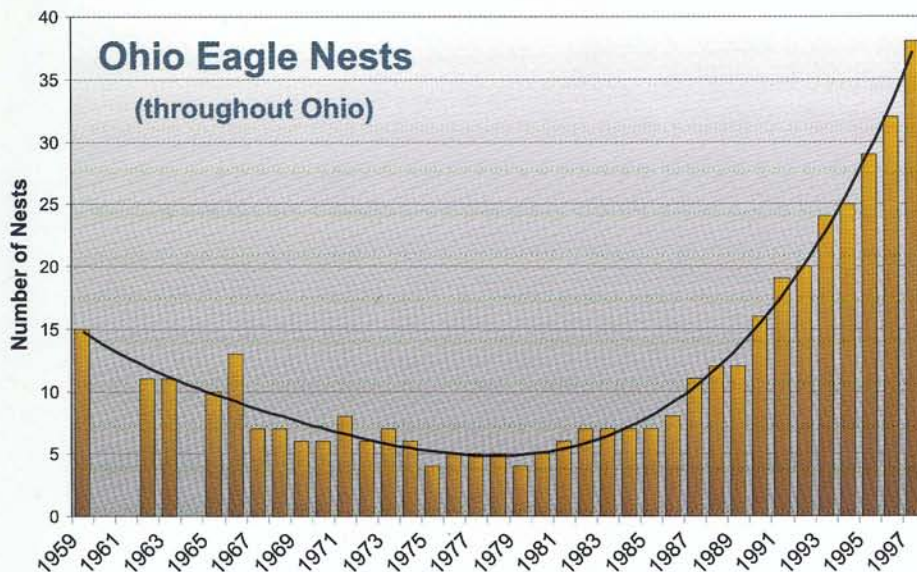
young to wild nests, striving for nest tree improvement and protection, educating the public on habitat needs and protection, and rehabilitating injured birds. In 1997, Division of Wildlife personnel and volunteers monitored 37 active nests in Ohio. These nests fledged 49 eaglets (average = 1.32 eaglets/nest). The Northern State Bald Eagle Recovery Plan goal for Ohio was 20 nesting pairs by the year 2000, with some of these nests occurring inland from Lake Erie.

Many variables play a part in the ability of a popula-

tion to survive. Reproductive success may be influenced by environmental conditions during the nesting season and may involve season-long variables such as temperature, precipitation, and food availability. Unusual circumstances such as an intense storm event can also have a significant impact on reproductive success.

Finally, reproductive success may also be affected by human activities independent of environmental conditions. Despite the many factors involved, reproductive success is a good measure of the health of a species (i.e., how well it is doing), and can be an indicator of that and other species' future in the ecosystem.

The effects of environmental toxins on bald eagle reproduction are well documented. Recent data analyses by the U.S. Fish and Wildlife Service suggest a correlation between toxin levels in adult eagles and reproductive success during harsh winters (i.e., adult eagles metabolize toxins from body fat during harsh weather which is transferred to the eggs, thus decreasing



1996. These poor nesting seasons are associated with hard winters that may magnify the impacts of any toxic compounds. Other sub-populations in the State of Ohio have not shown these fluctuations and have steadily increased. The trend for the Lake Erie eagles at this time is increasing and met the goals in 1997, rating **Excellent**.

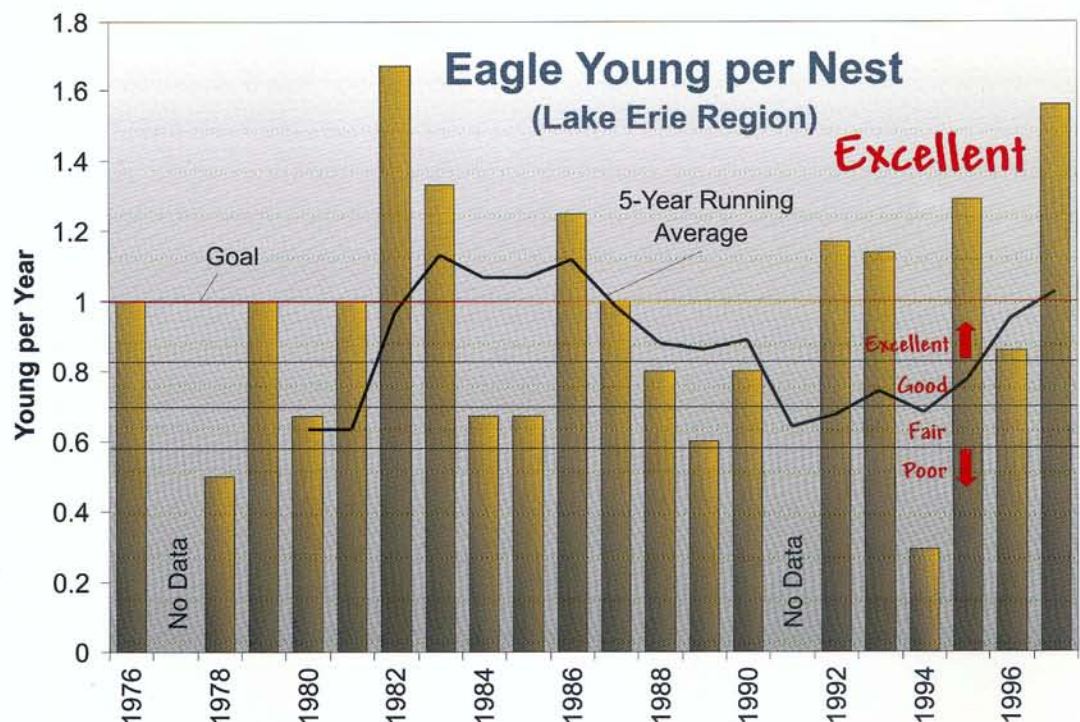
WALLEYE

Members of the perch

family, including walleye, yellow perch, blue pike, and sauger, have been important in the Lake Erie ecosystem for hundreds of years. These species are usually productive in cool-water communities – ideal for Lake Erie. The walleye, a terminal predator in this type of community, is clearly favored by a majority of Lake Erie users. As such, walleye are a keystone integrating species within the lake community.

the hardness of the egg and the eaglet). Because of the tremendous variability in reproductive success of bald eagles, a five-year running average line was constructed. The actual score was taken from this line. The minimum reproductive rate needed for a stable population is 0.7 eaglets fledged/nest. The minimum for a healthy, growing population is 1.0 eaglets fledged/nest. *The goal of this metric is the healthy population objective of 1.0 eaglet fledged/nest.*

The bald eagle metric has the potential to fluctuate from year to year in spite of using a five-year running average. The early 1990s have seen a large decrease in Lake Erie eagle nests and a rebounding during the last half of the decade. This dip is a result of near total failure of the Lake Erie nests in 1991 and moderate to poor success in 1994 and



The success of any given walleye hatch is dependent on lake and river temperatures, current and flow rates, and the availability of food for young walleye to survive and grow into juveniles. Young walleye eat zooplankton (microscopic animals), aquatic insects, and other young fish. As walleye grow older, they switch completely to a diet of small forage fish. The abundance of each year's hatch is therefore dependent on a healthy and intact food chain.

The Lake Erie Committee – comprised of fisheries managers from Ohio, Michigan, Pennsylvania, New York, and Ontario – jointly manage the walleye fishery in Lake Erie. *One of the Committee's goals, in part, 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 Ohio Division of Wildlife's Strategic Plan 1995-2000, lists its objective "to maintain a walleye population of 30-70 million catchable walleye." This goal has been met or exceeded since 1982 and scores an **Excellent** rating.



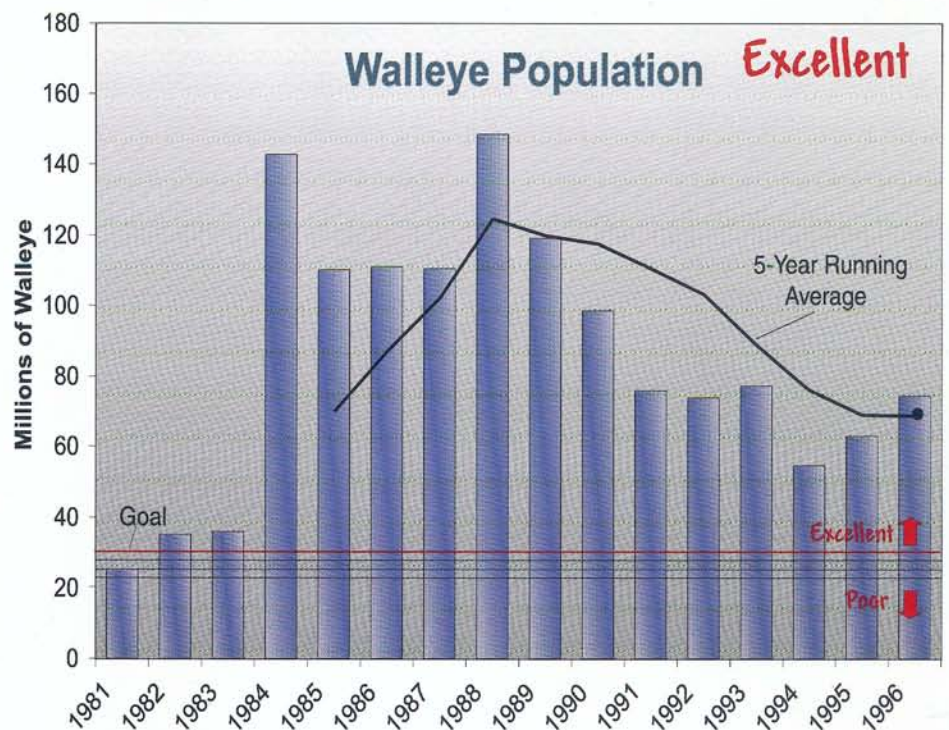
sediments. In other words, the western basin of Lake Erie is perfect for mayflies.

The sediments are where mayflies spend the majority of their life cycle. During the longest stage of their lives, the nymph stage, *Hexagenia* will burrow into the sediments and feed for one or two years. In late June, the nymph will swim to the surface, shed its covering, and take wing as an adult. During the next day or two, the adults will mate, drop their eggs back into the water, and then die. The direction from which the wind is blowing will determine whether they wind up on the shores of Canada or

MAYFLIES

It may be surprising that the return of clouds of mayflies onto the shores of Lake Erie is really good news. For those unfortunate enough to be caught in the middle of a mayfly swarm, it is probably difficult to understand what all of the excitement is about.

Mayflies, (*Hexagenia*) however, are an excellent indication that Lake Erie is coming back. Native to the Great Lakes, mayflies do well in shallow productive lakes with soft, organically rich



on the sidewalks of Port Clinton.

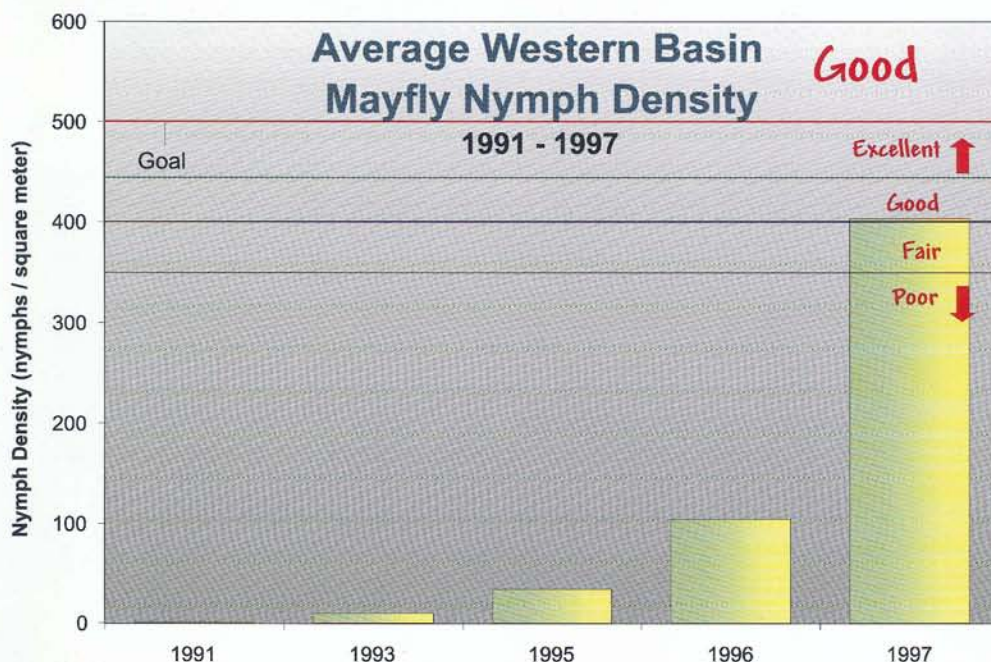
Until the early 1950s, people were resigned to the annual inundation of mayflies. Some actually looked forward to the invasion of the "Canadian Soldiers." In 1954, however, the mayflies never appeared.

With the overproductive algae growth in the lake due to excessive nutrient inputs, and an unusually hot and still summer the year before to turn and mix the waters, dead algae sank to the bottom of the lake and decomposed, consuming all of the available oxygen. This effectively suffocated all of the mayfly nymphs, along with nearly everything else living on the lake bottom.



Hexagenia (Mayflies)

Improved water quality has led to a rapid recovery of mayflies in Lake Erie, and densities are expected to increase in coming years. A demonstration project in Port Clinton funded through the Lake Erie Protection Fund is focusing on a comprehensive collection and composting plan for these lake-borne insects that descend upon the city, accumulating under lights and on sidewalks and streets as they die.



Efforts to reduce nutrient inputs into the Great Lakes gradually reduced the fertility of Lake Erie during the past 25 years. It wasn't until 1993, however, that significant densities of mayflies were detected in the bottom sediments of the nearshore western basin. In 1995, mayfly nymphs began to appear in the offshore sediments as well. During the past four years, the densities of mayfly nymphs have exploded in the western basin, increasing from an average of one per square meter in 1991, to 404 in 1997.

For this metric, the data used were obtained by Dr. Kenneth Krieger at Heidelberg College who

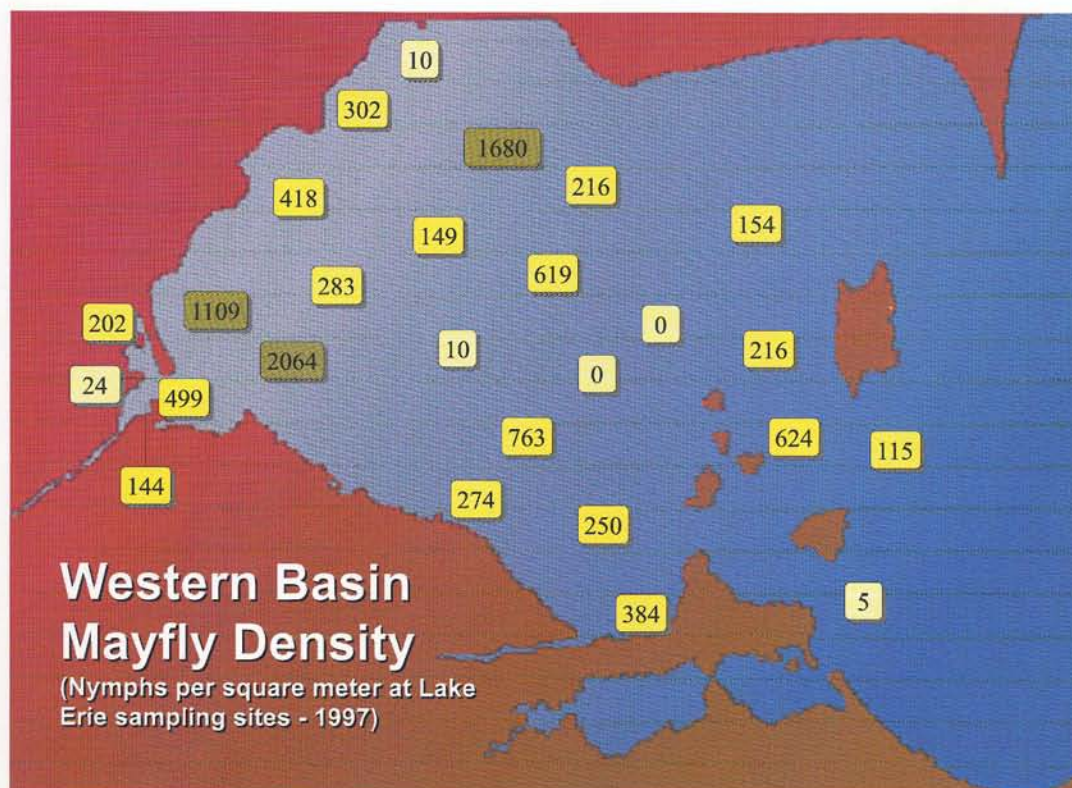
Scoring of Key Indicator Species Metric

Measure	Score	Weighting	Weighted Score
Bald Eagles	4.0	.33	1.33
Walleye	4.0	.33	1.33
Mayflies	3.0	.33	1.00
		Rating	3.7 Excellent

has extensively sampled the western basin sediments for *Hexagenia* for the past three years. To establish a goal, scientific literature and historic densities before the 1954 crash were studied.

The best available data, from 1930 to the early 1950s, indicate average densities of up to 500 nymphs per square meter. *The Lake Erie Commission has set a goal of re-establishing mayfly*

*nymphs in the western basin of Lake Erie to this average density of 500 nymphs per square meter. It is noted that this is a tentative number which may increase or decrease in the future as more is learned about Hexagenia and its role in the Lake Erie food chain. Our present average density of 404 nymphs per square meter in Lake Erie's western basin rates as **Good**.*



For more information on the following subjects contact:

Bald Eagle Population Data	ODNR - Division of Wildlife	
	-Crane Creek Research Station	419/898-0960
Walleye Population Data	ODNR - Division of Wildlife	419/625-8062
Wetland Habitat Information	ODNR - Division of Wildlife	614/265-6300
Toxic Chemical Levels	U.S. Fish and Wildlife Service	517/351-0263

Index of Biotic Integrity Metric

Fair

The biological integrity of the nearshore areas of Lake Erie has been evaluated by Ohio EPA using fish communities as an indicator of overall ecosystem health. Community health integrates a wide range of environmental factors (water chemistry, habitat availability, food web structure, etc.) and can be easily measured.

The index that has been produced is the *Index of Biotic Integrity*, or IBI.

The IBI uses 12 characteristics (metrics) which are detailed in the table at the end of this metric. Note that the metrics vary slightly for Lake Erie nearshore zones (right along the shoreline) and Lake Erie rivermouths. Each metric is scored as a zero, one, three, or five based on how closely it approaches natural, undisturbed conditions, with the best condition receiving a five.

The 12 individual metric scores are then totaled. A maximum of 60 points is possible for truly diverse and productive ecosystems. Such areas would harbor rare and endangered species and abundant populations of top carnivores, such as bass and pike. Sites devoid of all fish would score a zero.

A score of 50 or greater is considered **Excellent**, 49 to 40 rates a **Good**, 39 to 30 is **Fair**, and less than 30 is considered **Poor**. *It should be*

*noted that Ohio EPA considers any area receiving a rating lower than **Good** as impaired by environmental disturbances.*

The overall condition of Ohio's Lake Erie shoreline fish communities is **Fair** (IBI=33.5).

Lakeshore sites have been sampled only once since 1993 and trends cannot yet be developed.

Some rivermouths have been sampled twice since 1982 and it is possible to see significant changes. Historically, rivermouths rated **Poor** (IBI=28.5). Evaluation of the most recent data reveals that many now rate **Fair** (IBI=32.0).

Examination of the Lake Erie shoreline by county reveals that the two counties in the western basin (Lucas and Ottawa counties) score **Poor**, while all counties in the central basin score **Fair**. The lower western basin scores appear to be due to the greater influx of nutrients and sediment from high intensity agriculture and the subsequent silting over of aquatic vegetation in shallow waters.

The texture of habitat as determined by rocks, aquatic plants, and dead trees in the water is a critical factor in determining the quality of fish communities. Without aquatic plants, western basin shores have been reduced to primarily low texture sandy beaches and muddy bottoms.



Fish communities in Sandusky Bay rank **Fair**. Although aquatic plants have been lost from the bay, logs and rocks along the shoreline still provide some fish habitat. Kelleys and Gibraltar islands score the highest of all Lake Erie areas, ranking **Good**. Though they are in the western basin, their distance from western basin tributaries has isolated them from the effects of pollutants, and shoreline habitat is still natural.

Six rivermouths – the Maumee, Vermilion, Black, Cuyahoga, Chagrin, and Ashtabula – showed improvements. The improvements are all associated with reductions of point source pollution (pollution coming from pipe discharges).

Only two rivermouths have shown significant declines in the quality of their fish communities. The Huron River has steadily declined from **Fair** in 1982 to **Poor** in 1993. The cause of this decline is unclear. The Rocky River has displayed cyclical trends. In 1982, when point source pollutants were at high levels, this rivermouth rated **Poor**. By 1992, point source pollution had been reduced and a rating of **Fair** was attained. Since then, a loss of habitat to marina development and increased boat activity have caused the fish communities to

Lake Erie IBI Scores

Area	IBI Scores	Grade	Prior Scores
Lake Erie Overall Average	33.5	Fair	
Lake Erie Nearshore Average	32.6	Fair	
Lucas County	30.5	Fair	
Ottawa County	28.5	Poor	
Erie County	33.3	Fair	
Lorain County	34.9	Fair	
Cuyahoga County	33.0	Fair	
Lake County	33.3	Fair	
Ashtabula County	33.3	Fair	
Sandusky Bay	34.2	Fair	
Lake Erie Islands Average	37.2	Fair	
South Bass Island	35.2	Fair	
Gibraltar island	40.2	Good	
Middle Bass Island	33.3	Fair	
Kelleys Island	40.0	Good	
Lake Erie Rivermouths Average	32.0	Fair	28.5 ('82)
Maumee River	31.7	Fair	25.2 ('86)
Turtle Creek	23.0	Poor	
Toussaint River	31.2	Fair	
Portage River	38.2	Fair	
Sandusky River	32.6	Fair	
Muddy Creek	24.3	Poor	
Little Muddy Creek	16.6	Fair	
Huron River	28.5	Poor	32.1 ('89)
Old Woman Creek	31.0	Fair	
Vermilion River	40.8	Fair	35.3 ('88)
Black River	33.1	Fair	23.3 ('82)
Rocky River	23.5	Poor	22.5 ('82)
Cuyahoga River	22.3	Poor	5.5 ('84)
Chagrin River	37.3	Fair	29.2 ('88)
Grand River	33.4	Fair	
Ashtabula River	36.2	Fair	33.4 ('89)
Conneaut River	33.0	Fair	36.2 ('89)

decline once again to **Poor**.

Though open lake fish communities have been rated **Excellent** using walleye and mayflies as measures, it should be noted that species associated with nearshore wetland areas (species such as northern pike and muskellunge) are still missing from the lake. Indeed, a large number of rare fish species in Lake Erie are associated with wetlands. Numerous scientists who studied fish in Lake Erie have concluded that the damage to nearshore areas, especially wetlands, has negatively affected the types of fish presently found in the lake.

Three broad categories of environmental impacts affect the fish of Lake Erie: nonpoint pollution, habitat loss, and point source pollution. Much effort has been expended on the control of point source pollution. Improvements in Lake Erie

fish communities can be directly attributed to these efforts.

Attention is now being directed at nonpoint pollution. Numerous federal and state agencies have begun programs to address agricultural pollution, and cities are working on controlling urban runoff, especially from combined sewer overflows. Habitat loss will be a challenging problem to solve. Stream channelization, shoreline modifications, marina development, and other activities that alter the natural structure of the lakeshore, rivermouths, and associated wetlands are usually permanent changes that are difficult to correct.

Efforts to restore wetlands are discussed separately in this report. The restoration of rivermouth habitats however, needs to be addressed, as such habitats continue to disappear.

Ohio EPA IBI Metrics

Nearshore Metrics

Rivermouth Metrics

Species Number Metrics

Number of Species

Number of Sunfish Species

Number of Bottom Dwelling Species

Number of Plant Loving Species - Number of Minnow Species

Behavior/Trophic Metrics

Percentage of Top Carnivores

Number of Intolerant Species

Percentage of Alien Individuals

Percentage of Tolerant Individuals

Number of Tolerant Species

Percentage of Lake Individuals - Percentage of Plant Loving Individuals

Behavior/Trophic Metrics

Percentage of Diseased Fishes

Relative Numbers (includes non-indigenous individuals and excludes gizzard shad)

For more information on the following subject contact:

Lake Erie Fish Communities

Ohio EPA

614/728-3388

ODNR - Ohio Division of Wildlife

614/265-6300



Coastal Recreation Indicator

Good

The Lake Erie shoreline is host to an endless array of activities and events, from nature walks and picnicking to ice fishing and scuba diving. The natural beauty of the North Coast draws Ohioans and visitors alike to its shoreline to participate in their favorite pastimes throughout the year.

Enjoying the scenery around Ohio's Great Lake is by far the most popular coastal activity. Watching a breathtaking sunset or counting the sailboats are just some of the special scenes lake visitors remember long after the summer months have passed.

Summertime obviously attracts the most visitors to Ohio's 262 miles of Lake Erie coastline. Waterskiing, swimming, fishing, boating, biking, camping and hiking are ideal lakeside activities. But Lake Erie is more than a warm weather destination. Its appeal lasts throughout the year.

Ice fishing, hunting, and trapping are popular winter Lake Erie activities, along with continuous entertainment and cultural events held all along the shoreline in communities from Toledo to Conneaut. Fall festivals and springtime activities keep the Lake Erie coast bustling as well, making the North Coast a popular destination year-round. One of the largest amusement parks in the world – Cedar Point Amusement Park – is located on Lake Erie. Cedar Point's prime location alongside Lake Erie further enhances its appeal.

The State of Ohio takes great pride in its coastal recreation resources. The Ohio Department of Natural Resources' Division of Parks and Recreation oversees nine state parks along Lake Erie's shoreline. The Ohio Division of Wildlife manages shoreline wildlife areas and nature preserves, which provide North Coast visitors with a chance to explore unique coastal habitats.

The Ohio Lake Erie Commission and other state agencies are committed to continued improvements to Lake Erie's coastal resources to make each and every lake visitor's experience more enjoyable than the last.

Scoring of Coastal Recreation Indicator

Metric	Score	Weighting	Weighted Score
Customer Satisfaction	3.18	1.00	3.18
		Rating	3.2 Good

Customer Satisfaction Metric

Good



To assess the overall quality of Lake Erie as a recreational resource, The Strategy Team, a marketing research firm, was selected by the Ohio Lake Erie Commission to research the attitudes and behaviors of Ohio residents toward the lake. To achieve this, The Strategy Team conducted a telephone interview of randomly selected adults: 400 residing in the State of Ohio, 200 residing throughout the state who have visited Lake Erie within the past three years, and 200 from counties adjacent to Lake Erie who have visited the lake within the past three years.

The preliminary findings support the contention that Lake Erie is Ohio's number one recreation destination. Fully 71% of all Ohio residents have visited the lake in their lifetime. Of the people who have visited, about half have been to the lake within the past year.

The general findings of this study conclude:

- Lake users tend to visit the lake several times a year, with the majority visiting regularly.
- Not surprisingly, lake users from counties bordering the lake recreate on the lake more

often than other lake users. Not only do they use the lake more often, they also tend to rate the lake as more important for recreation than those lake users across the state.

- People perceive Lake Erie's water quality as **Fair**, with water clarity receiving the lowest rating and water quality receiving the highest. In addition, lake users statewide tend to rank water quality and water clarity significantly higher than do lake users from coastal counties.

The first objective of the survey was to assess how many people participated in each of the

20 different coastal recreational activities listed. Of all the things that people do when on the lake, the most popular activity was simply enjoying the beauty of Lake Erie. This could be watching a sunset from a park bench, skipping stones across its surface or any of a number of simple activities people enjoy. Almost all respondents (99%) stated that viewing the lake was important and a frequent pastime for them.

The second most frequently reported lake activity was visiting entertainment attractions, from a weekend at Cedar Point to a night of entertainment at the Flats of Cleveland. Of all lake users, 78% reported attending entertainment attractions. A close third was taking a scenic drive along the lake (72%).

In addition to assessing which activities Ohio residents engage in most while visiting Lake Erie, it was also important to determine how they feel about the quality of the facilities they frequented. To assess attitudes toward lake activities, respondents were asked a variety of questions about each activity and asked to rate each in terms of its availability, accessibility, and quality.

Ratings were computed on a point scale

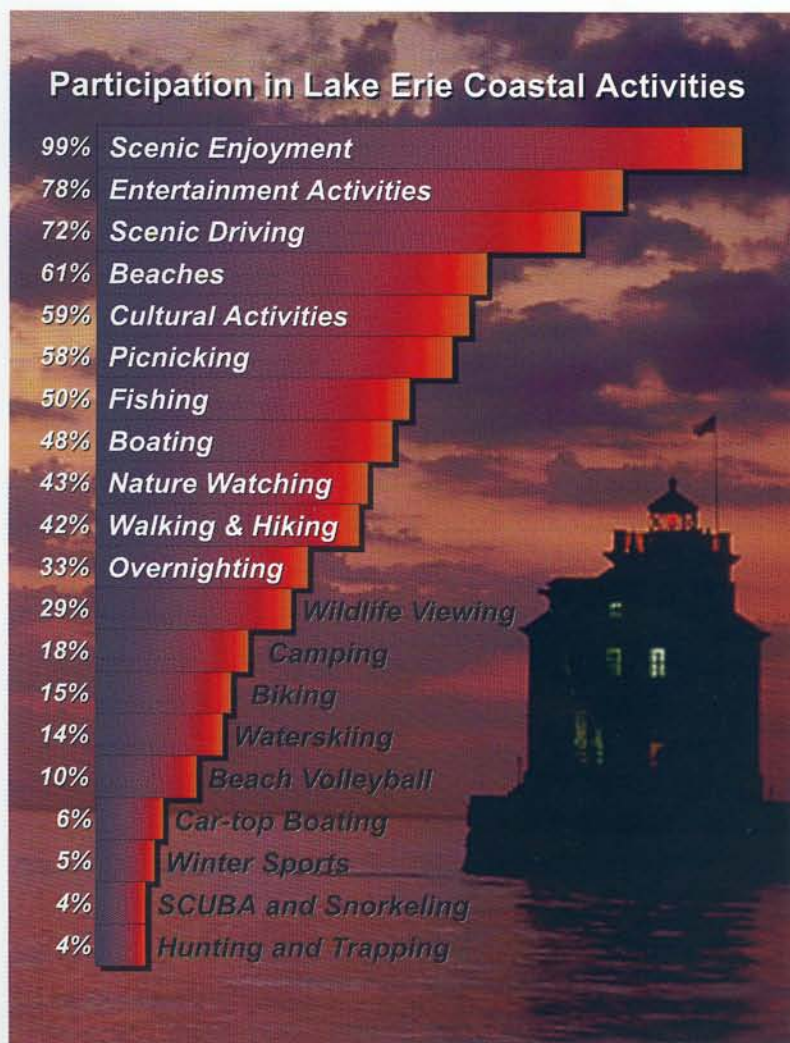
where 4 = Very Satisfied, 3 = Somewhat Satisfied, 2 = Neither Satisfied or Dissatisfied, 1 = Not Very Satisfied, and 0 = Not Satisfied At All.

Finally, the questions were weighted so that the composite of responses concerning facility quality comprised one-third of the overall rating. Responses associated with facility availability or facility accessibility were likewise worth one-third of the overall rating. The overall activity rating (combined score across all activities) is 3.18 or *Good*.

Users of Lake Erie's recreational resources are generally pleased with the overall quality of these facilities. Seventeen of the 20 activities surveyed are rated *Good*, with only three receiving a rating of *Fair*. The highest rated activities on Lake Erie, all rating in the very high *Good* range, are entertainment activities (3.41), camping (3.38), scenic viewing (3.36), overnight accommodations (3.31), cultural activities



Lake Erie and its shoreline are valuable in many ways to Ohioans of all ages. Ohio's Coastweeks program, held each September, allows everyone the opportunity to participate in the effort to protect and restore our natural treasure. The Center for Marine Conservation coordinates the Coastweeks program internationally, assisting U.S. states and foreign countries to rid the world's shorelines and waterways of environmentally damaging debris. The Ohio Lake Erie Commission coordinates Ohio's annual Coastweeks program, which features a variety of environmental, educational, and recreational events planned by organizations, groups, and businesses throughout the state.



(3.26), and picnicking (3.25). At the other end, the only three activities which rated *Fair* are SCUBA and snorkeling (2.54), beach volleyball (2.54), and hunting and trapping (2.35).



Some key pieces of information can be gleaned from the numbers. First, facility availability ratings generally score the lowest while facility quality score the highest. This suggests that Ohioans feel

that existing recreation facilities are of high quality, but there may not be enough available to meet the demand.

Second, with the exception of camping, the highest scores are given to more passive activities (entertainment activities, scenic viewing, overnight accommodations, picnics, and cultural activities). Finally, non-lake users generally give lower ratings for Lake Erie, particularly water quality and the quality of its beaches in contrast to lake users.

These findings suggest non-users may have less favorable impressions of the lake and may not be aware of water quality improvements that have occurred in the lake over the past 25 years.

The State of Ohio has a mandate through its newly adopted Coastal Management Plan to thoroughly review and assess the availability of recreational facilities on Lake Erie. Through public meetings, The Strategy Team survey, and other research initiatives, the Department of Natural Resources is evaluating how Ohio's coastal recreational resources can be improved.

For more information on the following subject contact:

The Strategy Team Survey

Ohio Lake Erie Office

419/245-2514

Boating Indicator *Good*



From windsurfers to cabin cruisers, boating is among the most popular recreational activities on Lake Erie, playing a key role in the state's economy and tourism appeal. An Ohio Sea Grant survey estimates that boating annually generates approximately \$850 million for the North Coast economy.

The image of boating as an exclusive sport for the yacht-owning rich is a misconception. In Ohio, the average boater is middle class and middle-age (48.6 years old) with an income of around \$35,000. Most boaters are married with families of dual incomes living in rural or suburban Ohio.

Many major boating events are held annually on Lake Erie, attracting Ohioans and visitors of all ages. The Inter-Lake Yachting Association (ILYA) sponsors Junior Race Week at Put-In-Bay as well as Bay Week, the largest single sailing regatta in the Great Lakes. The ILYA is comprised of yacht clubs along Lake Erie and all the Great Lakes.

Other popular boating events include Cleveland Race Week in July, the Parade of Lights in the Cleveland Flats, the Greater Cleveland Boating Association Rendevous, and the July 4th fireworks displays in coastal communities all along the North Coast.

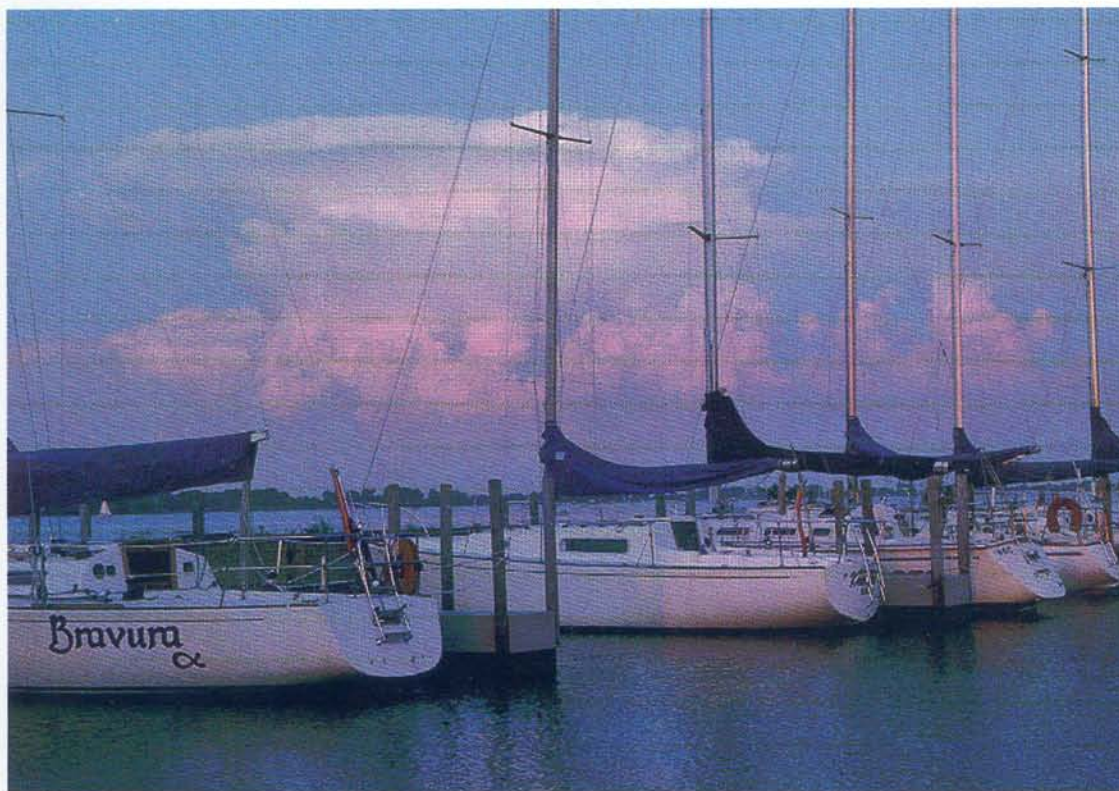
Land-based events that attract many recreational boaters include the National Air Show in Cleveland, Unity Days in Ashtabula and Harbor Days in Fairport Harbor. In addition, there are many fishing tournaments, sailing regattas, and other community events held on Lake Erie during the spring, summer, and fall, providing Ohioans and visitors even more opportunities to enjoy the many facets of Lake Erie's recreational boating experience.

Scoring of Boating Indicator

Metric	Score	Weighting	Weighted Score
Available Dockage	No Score		
Boat Launching Facilities	No Score		
Boating Safety	3.0	.50	1.50
Boating Satisfaction	3.2	.50	1.60
		<i>Rating</i>	3.1 Good

Available Dockage Metric

Being
Developed



A key component of the quality of boating on Lake Erie is the availability of dock space along the North Coast. This metric quantifies all in-water docks found at both private and public marinas and clubs which have direct access to the lake. Also included are available spaces at the many dry rack storage facilities which store, launch, and retrieve boats on a routine basis.

Not included in this metric are the many private residential berths which are solely for the use of the landowner. The source of the data is the Ohio Department of Natural Resources' Office of Real Estate and Land Management's 1990 Statewide Comprehensive Outdoor Recreation Plan (SCORP) report.

According to this report, Ohioans have nearly 46,000 docks available for Lake Erie boating. Whether the number is sufficient to meet the present demand is unclear.

Demand varies significantly along the shore-

line. In the far western counties, there presently is an excess of available docks with many marina businesses unable to rent all of their available slips.

At many facilities in the Cleveland area and east however, multi-year waiting lists force boat owners to travel long distances for available berths or postpone their boat purchases altogether.

ODNR's

Division of Watercraft is currently working with the Office of Real Estate and Land Management on the Lake Access Project. This effort will update data on the current facilities and assist in planning for future needs. The projected completion date is the year 2000. The ability to rate this criteria will be reviewed as more information becomes available.

Many of the Division's goals support increasing access to Lake Erie. Some grants given to communities do involve new dockage. However, providing substantial increases in dockage through new marinas or harbors along Lake Erie is a complex issue.

New marina construction involves millions of dollars as opposed to several hundred thousand dollars for a new launch ramp. This type of funding to local communities through grants or other means is not available through the state at this time.

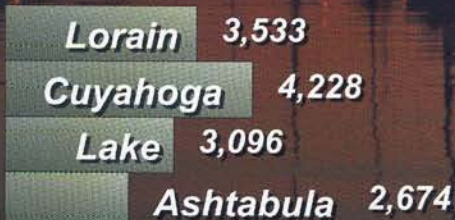
The issuance of low interest loans is a possibility for the future. Funding and issuance of

Available Lake Erie Docks*

Western Counties



Eastern Counties



*Data from 1990

Total: 13,531

these loans to communities and/or private enterprises are part of a long-term plan that will not be available for at least 10 to 15 years.

Grant funds of \$1 million for each of the next three bienniums are being proposed by the Division of Watercraft for Lake Erie. If provided in future budgets, a minimum of \$3 million would be available over the next six years in boating access funds that can be awarded to Ohio's North Coast communities.

Any new facility, whether it is a launch ramp, courtesy dock, etc., requires land and shoreline available for development. New opportunities are becoming less available along Lake Erie, especially when considering areas such as the eastern half of the Lake Erie shoreline, where steep banks and bluffs limit new development.

The Division's goal is to increase communi-

ties' awareness of needs in their respective areas, the availability of grant funds, and the process for applying for grant funding. New facilities are only feasible with the cooperative efforts of local communities.

New facilities would definitely enhance the existing boating business all along the Lake Erie shoreline. The number of annual boating events in Ohio is endless. These events not only bring tourists to the state, but also reap economic benefits in jobs, as well as income and tax dollars for the local communities in which they are held.

Local communities are encouraged to contact the Division of Watercraft to request a Cooperative Boating Facility Application packet. The Division of Watercraft administers the Lake Erie Access portion of the NatureWorks Bond Fund.

For more information on the following subject contact:

Capital Improvements

ODNR - Division Of Watercraft

614/265-6497

Boat Launching Facilities Metric

Being Developed

The public continually identifies boating access as a high priority. The Division of Watercraft held a series of 18 public meetings statewide during 1996, asking consumers what they felt to be the most important issues facing boating.

Consumers identified boating access as their number one concern. They were equally concerned that existing launch facilities be repaired and/or improved.

ODNR held similar public meetings during 1997, asking consumers to identify a broader range of issues relating to recreational opportunities. Again, access to recreation opportunities rated among the top issues.

This metric deals specifically with boaters' ability to directly access the waters of Lake Erie. For this measurement, "boat launch facility" refers to the total number of launch lanes. The number of launch lanes per facility may vary from a single lane to six or more.

The number of launch lanes counted includes boat launch lanes that are accessible for a fee or without charge to the general public, or to members of an organized group or club. It does not include launch ramps on private property for the exclusive use of the property owner or guests. The source of these data is the Office of Real Estate and Land Management's 1990 SCORP report.



Available Launching Lanes

Western Counties

Lucas 30

Ottawa 134

Erie 28

Sandusky 11

Total: 203

Eastern Counties

Lorain 18

Cuyahoga 28

Lake 31

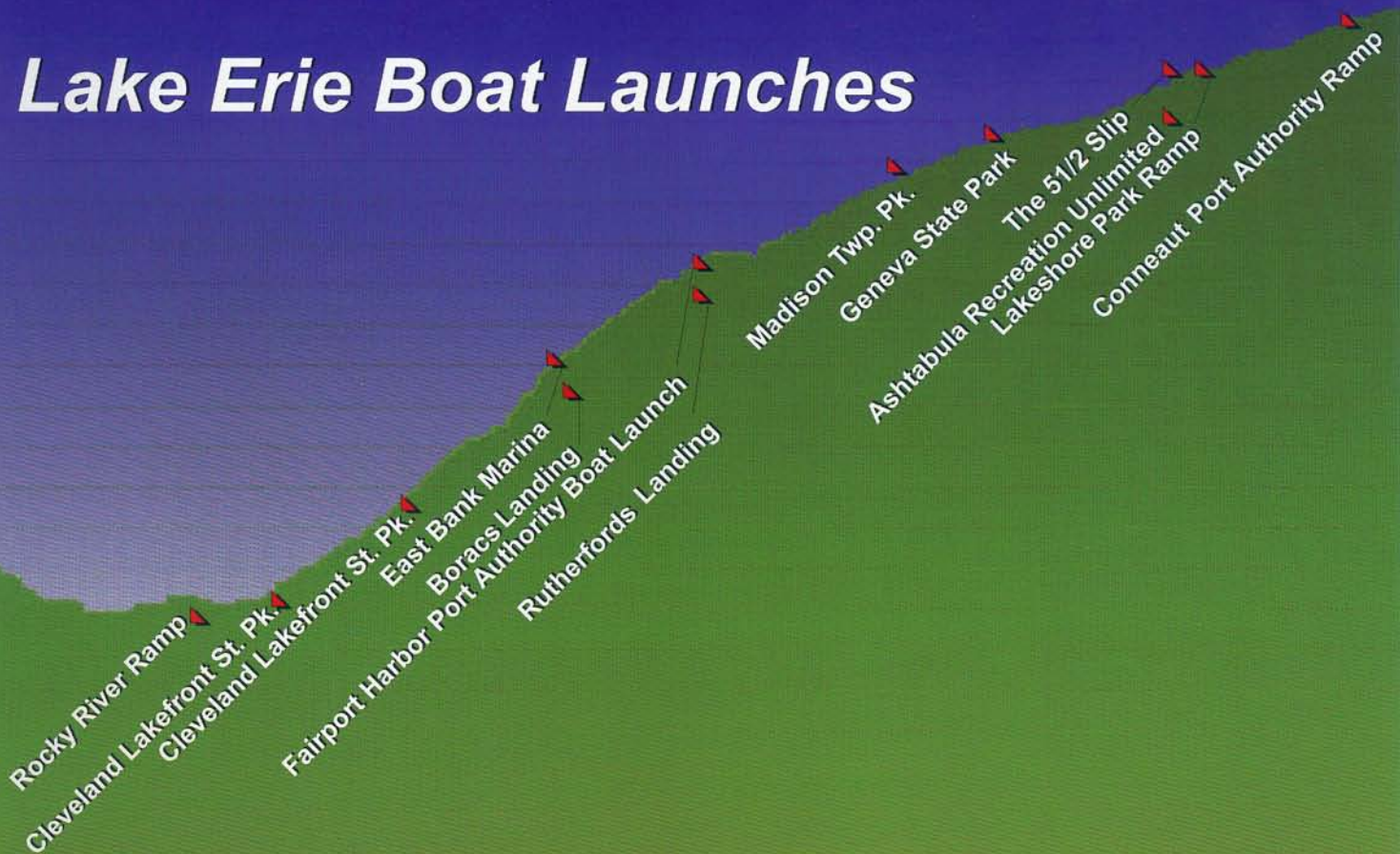
Ashtabula 49

Total: 126

These data show there are a total of 329 launching lanes along Ohio's entire North Coast. Like the distribution of docks, the majority are located in the western counties. Greater demand for more launching lanes exists in the Cleveland area and eastern counties.

What can be done in the future to provide more and better boating access to Lake Erie? As mentioned, customer input identified boating access as the top issue for the Division of Watercraft's strategic planning process.

Lake Erie Boat Launches



Boating Safety Metric

Good



There are several factors involved in measuring the relative safety of recreational boating. The unit of measure at the national level that has been used historically by the U.S. Coast Guard is number of boating-related fatalities per 100,000 boats.

Nationally, the number of recreational boating fatalities has decreased from 25 per 100,000 boats in 1962 to 5.9 per 100,000 boats in 1996. In Ohio, this number has declined from 23 per 100,000 boats in 1962 to 2.5 in 1996. These facts show that the combination of boating safety efforts at the federal level, state boating safety programs, education courses by volunteer organizations, improved technology of building safer boats, public awareness,

etc., has accomplished a great deal to reduce the number of fatalities that occur.

It is equally important to note that this reduction in boating-related fatalities has occurred during a time when more boats are being purchased and used. In Ohio alone, the number of registered boats has grown from 134,105 in 1962 to 399,516 in 1997.

Since this *Boating Safety* metric is for Lake Erie, the next logical task would be to determine the number of boats that use Lake Erie and list a similar comparison. However, the actual number of boats on Lake Erie is unknown. The data currently available are not reliable for long-range planning.

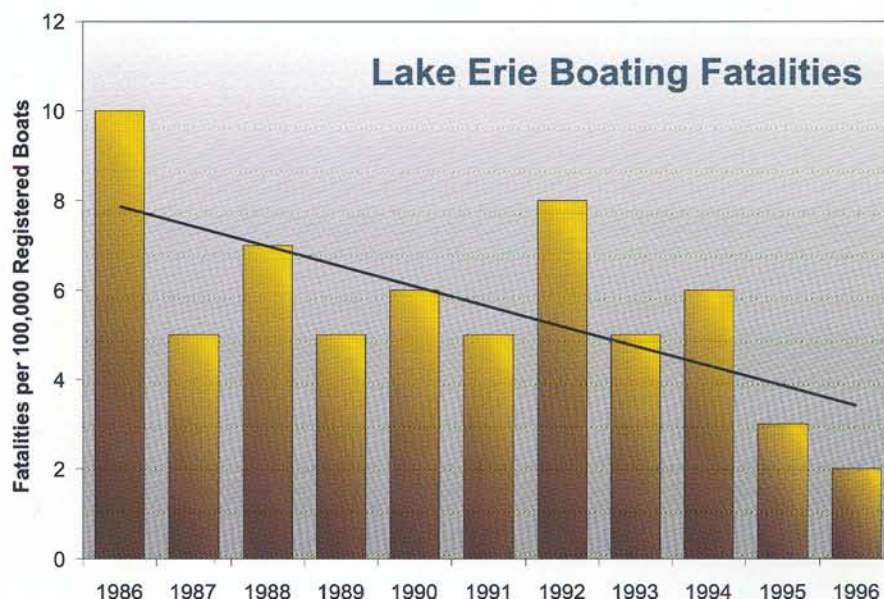
Five-Year National Ranking of Boating Fatalities

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

Therefore, this metric is different than any other metric in the Lake Erie Quality Index in that it incorporates data pertaining to the entire state. The State of Ohio believes this information is still valid, since historically a large portion of the accidents and fatalities have occurred on Lake Erie.

When compared to other states, Ohio ranks 11th nationally in the number of fatalities over the past five years. The states were divided into four groups and assigned scores. In doing so, Ohio scored a **Good** rating. (Note: Alaska is not included, as there are no "state" waters for statistical comparison.) *The goal for this metric is for Ohio to be ranked in the top 10 states nationally.*

The adjoining chart depicts the trends of recreational boating fatalities on Lake Erie during the past 10 years. The number of recreational boating fatalities and fatal accidents have slowly declined over the past decade, while the number of registered boats statewide and on Lake Erie has increased. While the actual graph will continue to vary year to year, the State of Ohio will continue to work toward further reducing the number of fatalities and accidents that occur on Lake Erie and throughout the state.



Despite this steady decline of recreational boating fatalities, boaters themselves may not feel safer when on the water. Do they feel comfortable with other boaters' abilities, knowledge, etc.? Do user conflict issues exist that cause boaters to feel less safe? These questions relate to the efforts nationwide to institute new and innovative programs, such as mandatory laws for boater education or licensing. The Ohio Department of Natural Resources' Division of Watercraft, as part of its strategic planning process, has identified safety as an important issue. The Division has formed two workgroups to study boating safety issues. Recommendations from these groups will be completed by July 1998.

For more information on the following subject contact:

Capital Improvements

ODNR - Division Of Watercraft

614/265-6497

Boating Satisfaction Metric

Good

The level of satisfaction for people who use Lake Erie for their boating activities is dependent on many factors: features of the body of water itself, availability of resources needed for boating, and the safety of boating in a given area.

To fully understand how satisfied boaters are on the lake, a number of detailed questions concerning boating were developed. This survey was then conducted by The Strategy Team (see *Coastal Recreation Indicator*). As seen in the graph on the next page, the boating public appears solidly satisfied with their boating pursuits on Lake Erie, rating this metric a 3.2 – **Good**.

Regarding boating quality, respondents gave launch facility parking the highest rating, followed in

decreasing order by overall marina satisfaction, quality of marinas, boat ramps, and public dockage. Boating safety and available anchorages ranked the lowest, with a rating of 3.15, which is still a favorable assessment.

Boating accessibility also received favorable reviews. Those surveyed ranked launch facilities with a 3.32 score overall, while fuel access came in at 3.17.

Eleven categories were surveyed pertaining to resource availability. Boating supplies, water and electricity marina services, the number of marinas, dockage and waste disposal facilities received the best ratings – all more than 3.0. The lowest ratings were assigned to the availability of



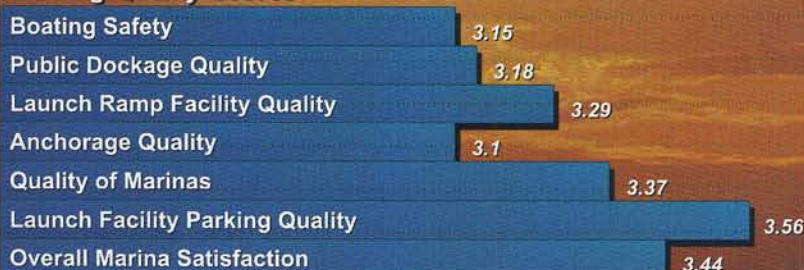
public docking facilities and pumpout stations. These findings are in agreement with other surveys and focus groups conducted by the Ohio Department of Natural Resources' Division of Watercraft.

The Division is actively engaged in assessing the needs of the Lake Erie boating community and finding ways to make needed improvements. The results of this report will help focus the Division's work.

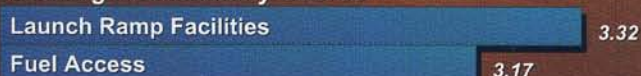


Boating Satisfaction Scores

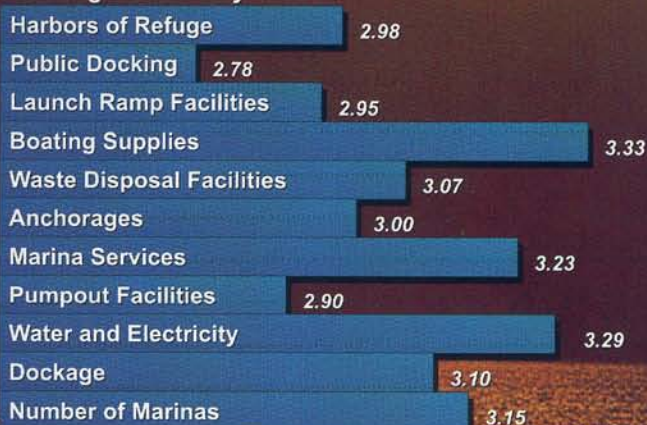
Boating Quality Scores



Boating Accessibility Scores



Boating Availability Scores



Overall Score

3.20 **Good**

Underwater cleanups held along Ohio's North Coast have resulted in the removal of tons of debris from Lake Erie, improving the recreational enjoyment of boaters from Toledo to Conneaut. The majority of lake debris consists of personal items traced back to recreational boaters or lakeside visitors, from food wrappers and aluminum cans to household items such as aspirin bottles and car batteries. Boaters and other lake visitors are encouraged to secure personal items on their watercraft and ensure their trash doesn't find its way to the lake's bottom so visitors and residents alike can enjoy cleaner Ohio waters.

For more information on the following subject contact:

Capital Improvements

ODNR - Division of Watercraft

614/265-6497



Fishing Indicator Excellent

Fishing in the Ohio waters of Lake Erie is a vital recreational activity for millions of Ohioans and has a significant impact on the economies of many Lake Erie communities. The warm, shallow, and productive waters of the lake combined with the countless reefs, mudflats, and rivermouths account for the most diverse and abundant fishery of any of the Great Lakes. The sport fishery for Lake Erie walleye, yellow perch, and smallmouth bass is world class.

Millions from Ohio and around the country come to the lake to test their luck on the abundant stocks of walleye, yellow perch, white bass, smallmouth bass, and steelhead trout. Other sport species such as catfish, white perch, freshwater drum, crappie, largemouth bass, rock bass, and sunfish are also caught in great numbers.

Facilities for shoreline access, boat launching ramps, charter boat fishing, and ice fishing access abound all along Ohio's North Coast. In recent years, Lake Erie sport fishing has been estimated to generate nearly \$1 billion in economic value annually. Quality fishing is essential to the continuation of healthy North Coast economies and the satisfaction of Ohio anglers.

Ohio shares fishery resources in Lake Erie with three other states and the province of Ontario. Fish management efforts consist of implementing fishing regulations, monitoring and evaluating fishing population characteristics, improving habitat, and developing fishing access.

This assessment of the current state of Lake Erie's fishing quality was measured against goals established in the Ohio Department of Natural Resources' Division of Wildlife's Strategic Plan for 1995 - 2000. Four metrics have been selected: *Angler Success*, *Angler Satisfaction*, *Shoreline Fishing Access*, and *Fishing Participation*. Practically all of the goals set for fishing were fully attained in 1996, earning an overall indicator rating of **Excellent**.

Scoring of Fishing Indicator

Metric	Score	Weighting	Weighted Score
Angler Success	3.8	.45	1.71
Shoreline Fishing Access	4.0	.05	.20
Fishing Participation	4.0	.25	1.00
Angler Satisfaction	3.0	.25	.75
Rating			3.7 Excellent

Angler Satisfaction Metric

Good

This metric focuses on assessing the quality of recreational fishing on Lake Erie based on the opinions of the “experts” – Lake Erie anglers. Respondents were surveyed on *Fishing Satisfaction* regarding Lake Erie.

Interviewers sought citizens’ evaluations of fishing quality, fishing accessibility, and fishing availability to gauge sports anglers’ satisfaction levels with their fishing experiences.

Overall, *Fishing Satisfaction* was given a rating of 3.07 – **Good**, indicating anglers’ favorable reviews of Lake Erie fishing. There is, however, room for improvement in all of the areas surveyed and state officials are seeking ways to improve anglers’ sport fishing experiences even more.

In fishing quality, respondents ranked



Lake Erie in this category in three ways: fishing success, quality of Lake Erie fishing, and ice fishing quality. The quality of Lake Erie fishing ranked the highest, with a rating of 3.19, while ice fishing came close behind with 3.12. Fishing success ranked a score of 2.94.

Regarding fishing accessibility, respondents ranked shoreline fishing as a 3.06, while ice fishing accessibility rated a score of 2.91. In fishing availability, fishing supplies were rated 3.30, while the number of shoreline locations received a score of 2.87.

Along Lake Erie, Ohio has nine state parks that are managed by the Ohio Department of Natural Resources. All provide great coastal areas for shoreline fishing, and the majority have boat ramps for those who enjoy escaping from

Record Lake Erie Fish

Species	Weight	Length	Angler	Date
Smallmouth Bass	9 lbs. 8 oz.	N/A	Randy VanDam	6/16/93
Burbot	11 1/4 lbs.	33.66 inches	Harry McCall	6/11/97
Yellow Perch	2 lbs. 12 oz.	14 1/2 inches	Charles Thomas	4/17/84
Chinook Salmon	29 1/2 lbs.	42 7/8 inches	Walter Shumaker	8/4/89
Coho Salmon	13 lbs. 10 oz.	34 3/4 inches	Barney Freeman	12/1/82
Sauger	7 lbs. 5 oz.	24 1/2 inches	Brian Wicks	3/10/81
Brown Trout	14.65 lbs	29 1/4 inches	Timothy Byrne	7/15/95
Rainbow Trout	21 lbs	36 1/2 inches	Mike Shane	10/2/96
Lake Trout	16 lbs. 11 oz.	N/A	Daniel Wilson	6/6/93
Walleye	15.95 lbs.	33 inches	Mike Beidel	3/24/95

the mainland. The marinas located along Lake Erie are a fisherman's haven, along with the variety of bait and tackle shops scattered among the scenic shoreline towns.

Meanwhile, efforts continue to increase the number of fishing access areas to accommodate every fisherman's needs. The Sport Fish Restoration Program has helped fund many fishing access development projects along Lake Erie since 1978. These federal dollars have helped finance numerous shoreline projects. The amount of funding available to the state is based on the number of fishing licenses issued and the size of the state.

Ohio's share of federal funding through this program has fared well in past years, with only six states receiving more funding. The Sport Fish Restoration Program is funded by taxes on fishing tackle and marine fuel. The Ohio Department of Natural Resources, through its Lake Erie Access Program, identifies areas to be developed for access sites such as public boat launching and shoreline fishing facilities, and works to enhance existing access sites.



Studying Lake Erie's fish communities and how they adapt to their environment has been a significant area of research over the past several years. The Lake Erie Protection Fund is presently supporting extensive research into identifying genetic diversity and distribution in native Lake Erie walleye and yellow perch populations. Such information will ensure healthy and diverse fish stocks in the future. Studies are also underway to determine the impact round gobies have on Lake Erie's fish community. This exotic species was first discovered in Lake Erie in 1993.



For more information on the following subject contact:

Fishing
Customer Satisfaction

ODNR-Division of Wildlife
Ohio Lake Erie Office

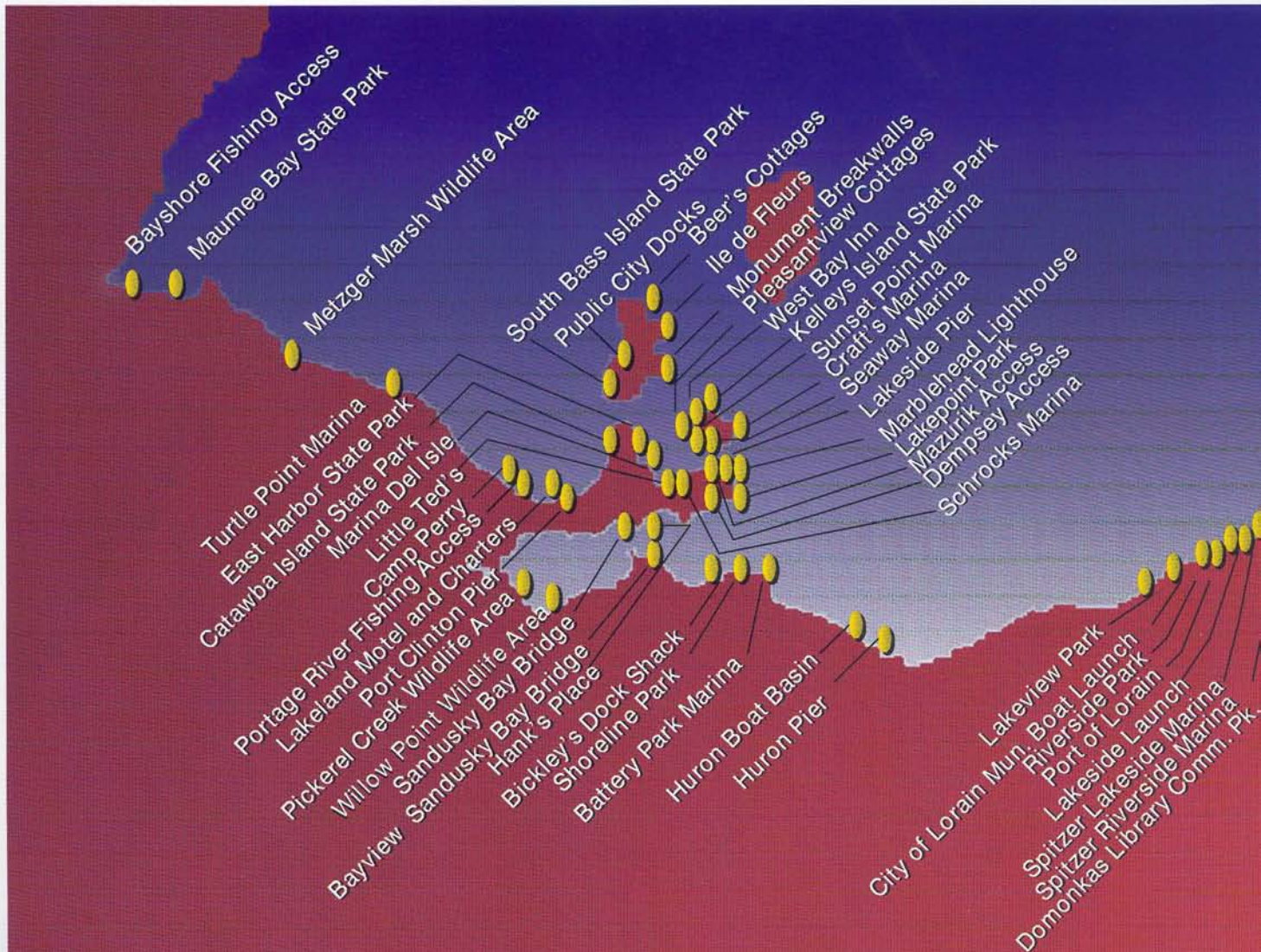
614/265-6300
419/245-2514

Shoreline Fishing Access Metric

Excellent

While more than 90% of the total annual Lake Erie fishing effort is attributable to boat anglers, there are many who either by choice or by necessity fish from the shore. Shoreline fishing can be exceptional for walleye, yellow perch, channel catfish, and a variety of other species. With extensive shoreline access from Toledo to Conneaut, it is not necessary to have a boat to enjoy Lake Erie fishing.

The Ohio Division of Wildlife has developed numerous fishing access areas along Lake Erie. Many of these areas provide boat launching facilities, courtesy docks, fishing piers, and



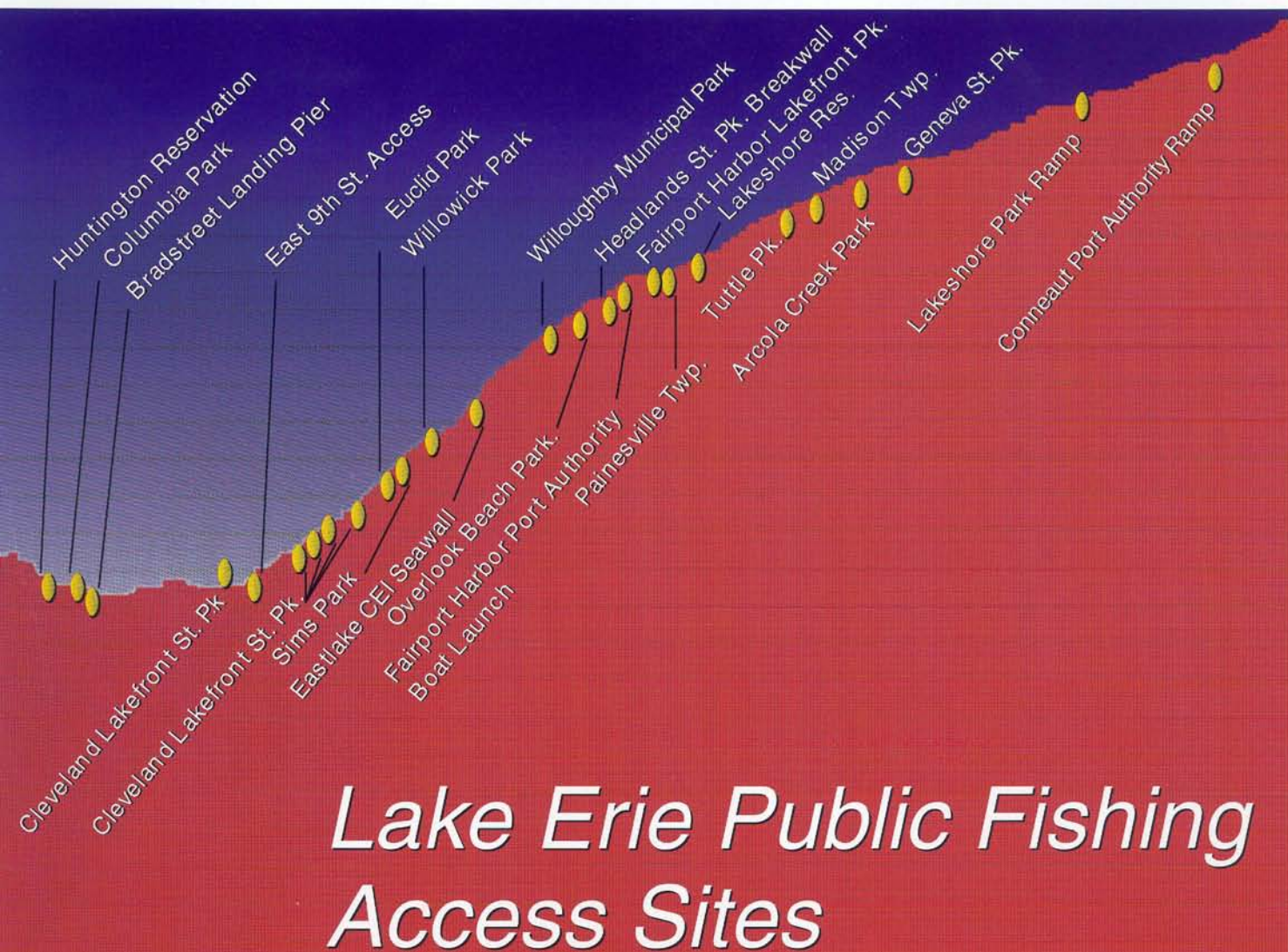
restrooms. The fishing access areas are free, open year-round, and are usually lighted for night-time use. These facilities are also accessible to people with disabilities.

This metric measures the facilities available for shorefishing compared to the demand for such access sites.

The Division of Wildlife has measured shoreline angling effort from 1975 to 1977, from 1980 to 1984, and in 1993. During the 1975 to 1984 period, shorefishing comprised an average of 8.4% of the total fishing effort. By 1993, the shorefishing effort was only 47% of the total fishing effort, the lowest percentage ever measured. There are no goals for number of shorefishing access locations, but the Division has identified 70 public access sites in its Lake

Erie Fishing Guide. Although shorefishing opportunities may be restricted in some localized areas, the limited amount of shore-based sport fishing does not appear to warrant significant expenditures for additional access areas. *Therefore, the present level of 70 access sites will serve as the goal.* The score of this metric, therefore, rates as 100% – **Excellent.**

Traditional western basin shoreline fishing hot spots are found in Huron, Sandusky, Marblehead, Catawba, Metzger Marsh Wildlife Area, and the Lake Erie islands. These locations include Huron City Pier, Nickleplate Pier in Huron, Sandusky City Pier, Battery Park in Sandusky, Lakeside Community Pier, Mazurik Fishing Access on Marblehead, Catawba State Park Pier, and Metzger Marsh Wildlife Area Pier.



Angler Success Metric

Excellent



Lake Erie sport fisheries are highly targeted, both seasonally and by the fishing gear utilized, toward a specific fish. For example, fishermen seeking walleye are equipped to fish for walleye and are unlikely to fish for smallmouth bass or yellow perch on the same trip. The reverse is also true.

Yellow perch anglers are unlikely to be actively seeking another species during their fishing trips. Some overlap does occur. But in general, the Division of Wildlife is able to survey fishermen and their catches and accurately estimate the amount of fishing time expended toward catching each species, and the number of each species harvested.

Goals have been set for each of the major species to measure angler success. Catch rate – the number of fish caught by an angler seeking that species in an hour – is the measure used to assess goal attainment. Simply stated, 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.

To smooth out the annual fluctuations in the data, a five-year running average line was constructed. All

scores, except smallmouth bass, were read from the five-year running average line. In 1992, the Division of Wildlife began to include fish which were caught and released by anglers in the annual catch rate data. This is the preferred manner of fishing for smallmouth bass in Lake Erie,

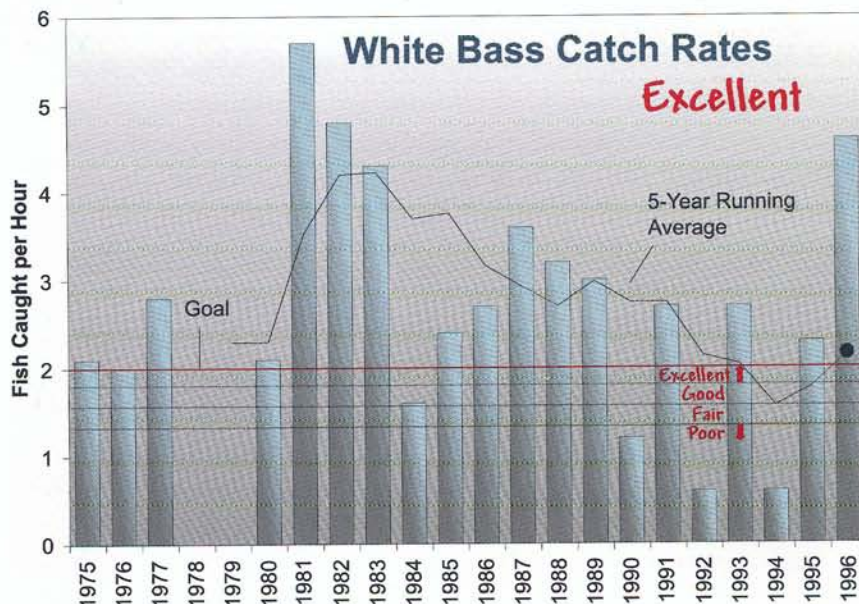
Catch Rate Goals

Walleye	One fish every 2.5 hours	0.4
Yellow Perch	Four fish every hour	4.0
Smallmouth Bass	One fish every 2 hours	0.5
White Bass	Two fish every hour	2.0

accounting for 80% of the catch rate.

These goals are not set as the measure of an individual's daily fishing success, but as a measure of the entire season's success for each individual species. Again, only data from anglers seeking a specific species were used to assess the catch rate for that species.

As seen from the graphs, people have been very successful at catching sportfish in Lake Erie. White bass are being caught at rates surpassing ODNR's established goals and receive a rating of **Excellent**. Although the catch rate for walleye in 1996 exceeded the goal of 0.4 fish per hour, their five-year running average plot came out at 95% of the goal – still **Excellent**. Yellow perch scored at 85% of the four fish per hour goal – a rating of **Good**. Smallmouth bass were caught at over twice the goal of 0.5 fish per hour in 1996. Because only years 1993 through 1996 include catch and release information, the value used for the metric was the average catch rate during that five-year period (0.86 fish/hour) – an **Excellent**.

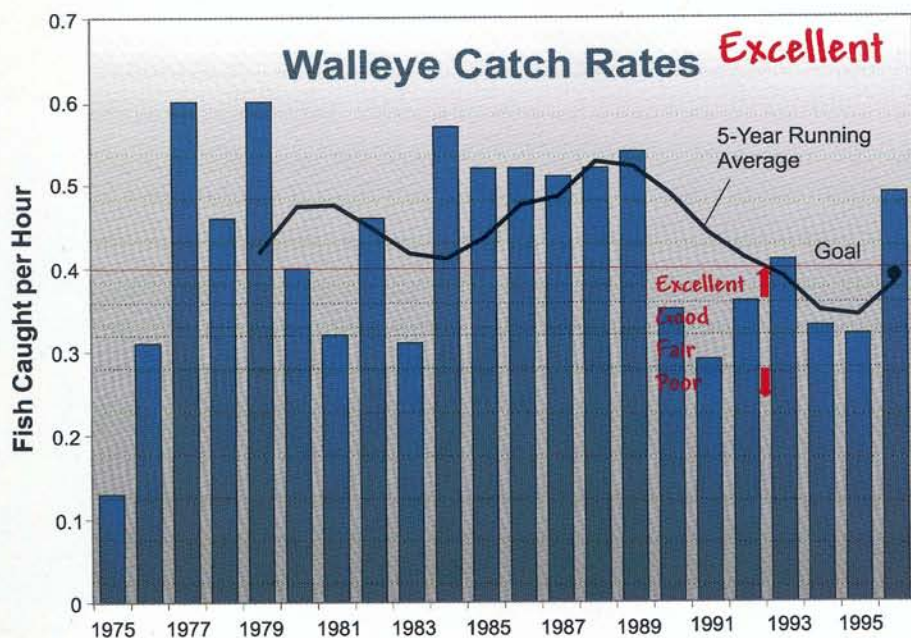


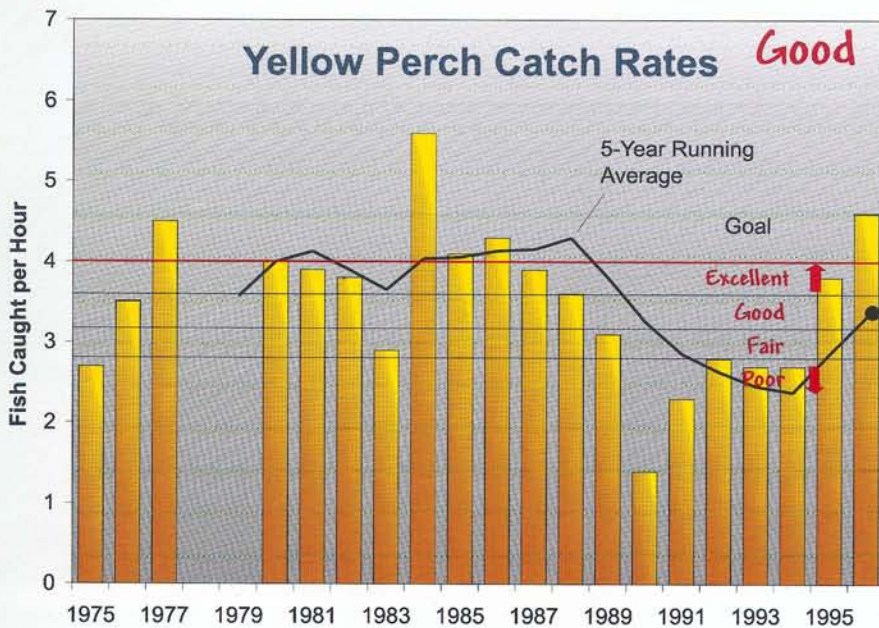
Trends in catch rates for the major fish species are shown in the following four charts. For walleye, yellow perch, and white bass, the catch rates are for numbers harvested. For smallmouth bass, the values are for fish actually caught. The smallmouth fishery has become about 80% catch and release; i.e. most of the fish caught are returned to the lake.

Sport anglers caught nearly 5.7 million yellow perch in 1996, the first year for the 30-perch daily bag limit rule. This was up from 4.3 million perch taken during 1995 when no bag limit existed.

The Ohio Division of Wildlife established the current bag limit to assure compliance with yellow perch harvest allocations established through an international shared management agreement. The limit went into effect on March 1, 1996.

The majority of yellow perch range in size from seven to 10 inches and are from the 1993, 1994, and 1995 year classes. Larger fish are more abundant in the central basin. The best yellow perch fishing usually occurs from





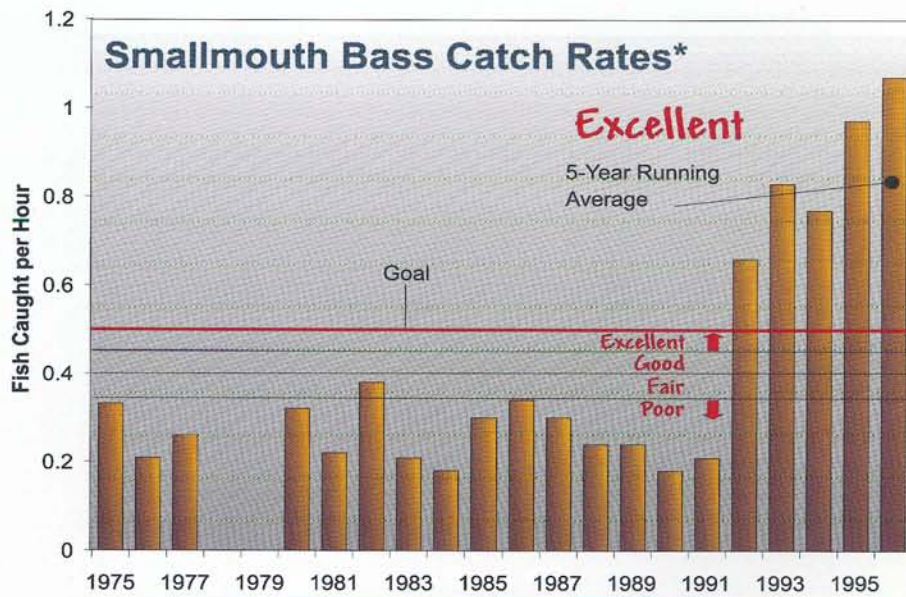
dominating the harvest. Best fishing months for this species are May, June, August, and September, with the Bass Islands area and rocky areas along the mainland providing the most productive fishing. With improved water quality, fishing for smallmouth is rapidly becoming more common on Lake Erie. As water clarity continues to improve and weed beds develop in more shallow areas, more and more suitable habitat is available for this species. The daily bag limit for smallmouth bass is eight.

August through October, according to the Division of Wildlife.

Good walleye reproduction in five of the last seven years has sustained this fish population in Lake Erie. The majority of fish range in size from 16 to 22 inches and are from the 1991, 1993, and 1994 classes.

Peak harvest for walleye is typically May through July in the western basin and June through August in the central basin. In November and December, walleye can be taken from the shoreline in the evening hours. For hardy souls, walleye along with yellow perch are the primary targets of ice fishermen during periods of safe winter ice. The daily bag limit for Lake Erie walleye is 10.

Smallmouth bass in Lake Erie averaged 12 to 15 inches in length for the 1997 season, with the 1991 and 1993 classes



**Data from 1992-1996 includes 80% catch and release rate
Five-year average computed only for years 1992 - 1996.*

Scoring of Angler Success Metric			
Measure	Score	Weighting	Weighted Score
Walleye	4.0	.25	1.00
Yellow Perch	3.0	.25	0.75
Smallmouth Bass	4.0	.25	1.00
White Bass	4.0	.25	1.00
Rating			3.8 Excellent

For more information on the following subject contact:
Angler Success **ODNR - Ohio Division of Wildlife**

614/265-7046



Beaches Indicator

Good

Lake Erie beaches are host to a variety of outdoor activities, providing abundant entertainment and recreation opportunities for Ohioans and visitors of all ages. From swimming and kayaking to sunbathing and family outings, Ohio's 23 Lake Erie public beaches are favorite summer destinations.

The most popular Lake Erie beaches are part of Ohio's State Parks. They are located at Maumee Bay, Crane Creek, East Harbor, Cleveland Lakefront, Headlands Beach, Kelleys Island, and Geneva. These beaches collectively span about three miles along the Lake Erie shoreline. In 1996, more than 1.4 million people visited the seven state park beaches, according to the Ohio Department of Natural Resources' Division of Parks and Recreation.

As discussed earlier in this report, significant steps have been instituted to restore the water quality of Lake Erie. As a result of these improvements, hundreds of thousands of Ohio citizens once again flock to beaches along the shoreline each summer to escape the heat in the lake's cool water, sunbathe, build sand castles, play volleyball, or just sit on the sandy beaches to relax. These beaches are special places that add to the quality of life for families throughout Ohio.

The two metrics comprising the *Beaches* indicator are *Beach Availability* and *Beach Satisfaction*. Providing enough high quality beach miles for the enjoyment of its citizens has been challenging for the State of Ohio. The predominance of high cliffs along the shoreline, a scarcity of sand, and recent high water levels severely limit the locations where beaches can be created and maintained. The fact that the majority of Ohio's North Coast is privately owned further hinders any new beach development. Beaches that are open to the public were evaluated in great detail for overall quality. This evaluation included not only the physical parameters of the beach, but also important factors such as safety, cleanliness, and accessibility.

Providing enough high quality, safe beaches is a key component in both ODNR's Coastal Management and Outdoor Recreation strategic priorities. The State of Ohio intends to ensure that future generations of Ohioans can continue to enjoy Lake Erie.

Scoring of *Beaches* Indicator

Metric	Score	Weighting	Weighted Score
Beach Availability	No Score		
Beach Satisfaction	2.90	1.00	2.90
		Rating	2.9 Good

Beach Availability Metric

Being Developed

The first metric under the *Beaches* Indicator looks at the availability of beaches for Ohioans and visitors to enjoy the warm waters of Lake Erie. Unfortunately, finding an available beach on the lake is not always an easy thing to do. Along the entire shoreline there are only 23 beaches, totaling 6.7 miles in length that are accessible to the general public – either free or on a daily fee basis. As Ohio's Lake Erie coastline measures 262 miles in length, this accounts for only 3% of the shoreline.

Public beaches are a rare commodity in Ohio for a number of reasons. First and foremost is the scarcity of sand. Many of the state's beaches need to be regularly supplemented with outside sources of sand or they would quickly disappear.

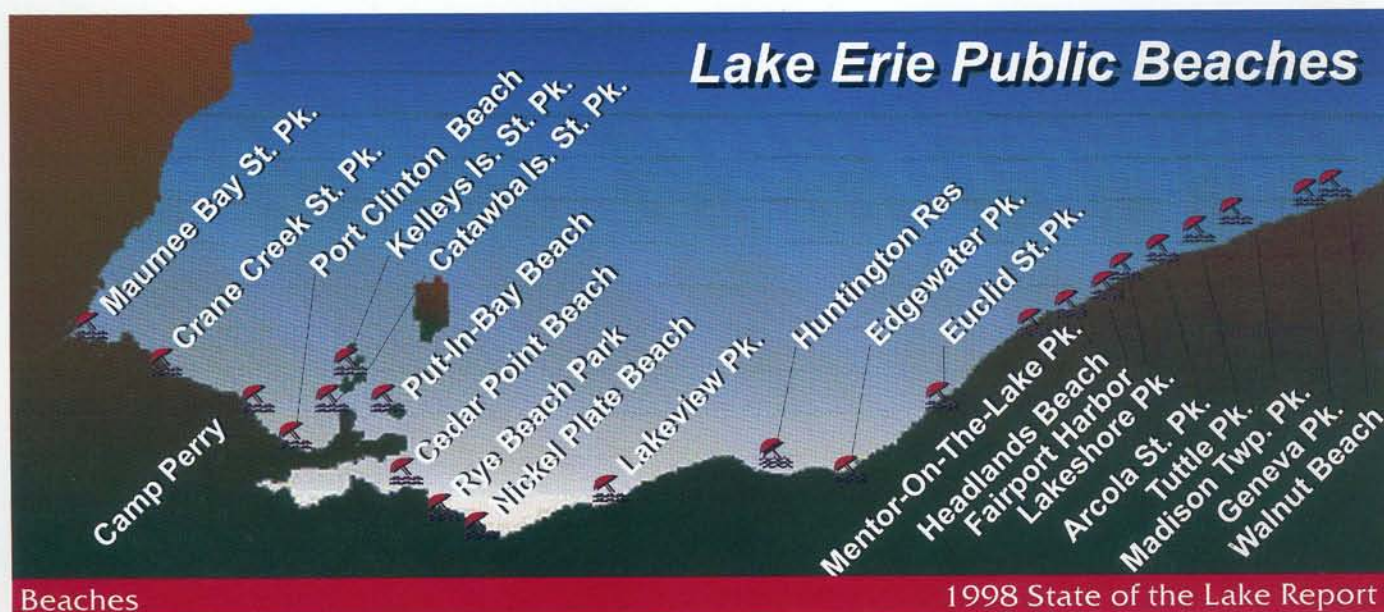
Second, the Lake Erie shoreline from Huron eastward is primarily cliffs, which drop abruptly to the lake below. Abnormally high lake levels that have been experienced in recent years further limit sites where beaches can be developed and maintained.

Finally, much of the beachfront that does exist is private property. The lakefront has always been a highly desirable place to live – even more so



for beachfront property.

In the future, this metric will be scored by comparing the present shoreline mileage of public beaches against an accepted goal for Lake Erie. *That goal has not yet been established.* The Ohio Department of Natural Resources, through the Coastal Management Plan and Outdoor Recreation Initiative, is undertaking an in-depth study of potential sites for additional public beach development and the future demand for beach access. This information will be used to determine a goal and rating for this metric in the future.



Beach Satisfaction Metric

Good



The metric concerning public satisfaction with Lake Erie beaches is again a component of The Strategy Team's coastal activities survey. While the overall metric rating is **Good** (2.9) there is a great deal of variability among its component scores.

The highest scores are awarded to the ease of getting to Ohio's beaches. As many beaches are a component of the state park system, the access routes are well marked and in good repair.

The quality of the existing facilities also scores well. People are largely satisfied with the condition or cleanliness of the beaches themselves and attendant facilities (parking, concession stands, and changing rooms). The responses here indicate that the existing beaches are well maintained, clean,

and enjoyed by those who visit them.

Questions seeking opinions on the availability of beaches and changing rooms rate only **Fair**, indicating the scarcity of beaches across the lake. Respondents indicated that they are displeased with crowded conditions on peak days and the lack of beaches available.

Finally, the lowest scoring question deals with people's attitudes concerning safety – which scores a 2.3. This question incorporates safety concerns both in the water (water hazards, availability of lifeguards, etc.) and other concerns (theft and assault from other users). Solutions to these problems are being actively sought by ODNR's Division of Parks and Recreation.

Each year, dedicated groups of Ohioans of all ages make a concerted effort to keep Lake Erie's beaches and shoreline clear of unsightly and environmentally damaging debris. From Boy Scout troops to community groups, many citizens team up to participate in cleanup events along the shoreline each year. At beach and land cleanups, these volunteers pick up trash along the shoreline. At underwater cleanups, certified divers and other volunteers coordinate their efforts to clear debris from lakefront marinas, boat docks, and bathing beaches.

While many organizations and individuals organize local cleanups in their communities year-round, others are held in conjunction with an international cleanup effort called Coastweeks. The Center for Marine Conservation coordinates this cleanup effort in all 50 U.S. states and 80 foreign countries.

The Ohio Lake Erie Office serves as the Coastweeks cleanup coordinator for Ohio. In 1996, more than 10 tons of debris were removed from Lake Erie and its shoreline during Ohio's Coastweeks cleanups. More than 1,800 volunteers and nearly 650 underwater divers and snorkeling enthusiasts have participated in Ohio cleanups between 1992 and 1996, collecting nearly 137,500 pounds of debris along the North Coast.



By employing intense sampling surveys and sophisticated DNA fingerprinting technologies, researchers are seeking the sources of disease-causing bacteria on Lake Erie beaches. In recent years, high levels of fecal bacteria have resulted in Lake Erie beach postings warning people to enter the water at their own risk. Two Lake Erie Commission funded projects, one at Maumee Bay State Park and one in the Cleveland area, are working to identify and eliminate the sources of these pathogens. The goal is to ensure the health of all who enjoy our Lake Erie beaches.



For more information on the following subjects contact:

Beaches
Cleanups

ODNR - Office of Real Estate and Land Management
Ohio Lake Erie Office

216/265-6413
419/245-2514

Tourism Indicator

Excellent

The beauty and excitement of Lake Erie – enhanced by improvements in water quality, boating, fishing, and swimming – attract more Lake Erie visitors each year. Whether exploring the unique island communities or enjoying the lively nightlife of the Cleveland Flats, tourists are drawn to the unique and appealing activities offered along Lake Erie.

According to the Ohio Department of Development, the direct sales from tourism in Ohio's seven Lake Erie counties amount to more than \$1.5 billion annually. In 1996, tourism spending supported 50,000 Ohio jobs in this seven-county region alone. The marketing efforts of many agencies and organizations have dramatically improved North Coast tourism and the overall economic vitality of the Lake Erie shoreline.

From the state level down to local city government, many agencies and organizations are continually making a concerted marketing effort and successfully attracting new tourism dollars to the shoreline region.

These organizations seize every viable opportunity to promote Lake Erie's exciting events and activities, from recreational sports and favorite outdoor pastimes to historic lighthouses, monuments, and battlefields. Efforts are also orchestrated throughout Ohio and beyond to promote events further inland. These include cultural festivals, musical and theatrical shows, aromatic wineries, covered bridges, state parks, and much more.

The Ohio Department of Development's Division of Travel and Tourism furthers these efforts with its free Calendar of Events publications and toll-free information line, 1-800-BUCKEYE.

Scoring of Tourism Indicator

Metric	Score	Weighting	Weighted Score
Lake Erie Tourism	4.0	1.00	4.00
		<i>Rating</i>	4.0 Excellent



Lake Erie Tourism Metric

Excellent



*Lake Erie Commission's goal of \$1.6 billion in annual direct sales (estimated direct sales divided by the goal)—rating a solid **Excellent**.*

A goal for the future is set at 4% annual growth. This is slightly above the current rate of inflation while

A key indicator of the vitality of Lake Erie is the direct sales generated from tourism in the counties surrounding the Lake. Lake Erie tourism is big business, with estimated direct sales of over \$1.5 billion, direct employment of over 50,000, and a direct payroll of approximately \$638 million.

The quality of tourism on Lake Erie received an **Excellent** rating based on total estimated direct sales generated from tourist activities in Ohio's coastal counties. These figures represent the initial value of goods and services purchased by tourists. Tourism, according to the Ohio Division of Travel and Tourism, is defined as "a temporary visit to a place 50 miles or more from one's usual work or home environment in one day, or out-of-town one or more nights, for non-business purposes." The breakdown for the coast is contained in the pie chart on the next page.

Total estimated direct sales were \$1,545,737,000 in 1996. *This is 97% of the Ohio*

still taking into account seasonal, capacity, and weather-related constraints.

Direct sales estimates were derived from a regional input-output analysis. Primary input data were collected from a 1996 telephone survey administered by MarketVision Research, Inc. to a sample of randomly selected businesses across the Lake Erie region. The sample was taken from several sectors: transportation, lodging, entertainment-recreation, gift shops, and restaurants. Income and wage data were drawn from both state and federal agencies.

Besides robust sales indicators, discussions with convention and visitors bureaus in Ottawa, Sandusky, and Erie counties support Lake Erie's high score. These counties were chosen because their tourism trade is more lake dependent than larger counties like Cuyahoga and Lucas. The Ottawa and Sandusky-Erie County Visitors Bureaus stated that the number of tourists is increasing and

that their contentions are backed up by additional bed tax collections and the number of inquiries to their offices. Ottawa reports that tourism has almost tripled in the last 10 years. Sandusky-Erie said – except for a downturn due to bad weather in the summer of 1997 – there has been steady tourism growth over the past five years.

Tourism has reportedly increased in all segments in these counties. Ottawa County has experienced an increase in development, providing tourists with more things to see and do. They recently hosted 800 bird-watchers and also reported a big boom in sport fishing. Sandusky and Erie counties have also had increases in building and in the range of activities offered to tourists today. For instance, there are now more options as far as island cruises and Cedar Point attractions.

Positive reviews from tourists are a key reason why more people keep coming, according to the Ottawa County Visitors Bureau. Word-of-mouth is extremely important in generating more tourism, and visitors are obviously pleased with what they have discovered.

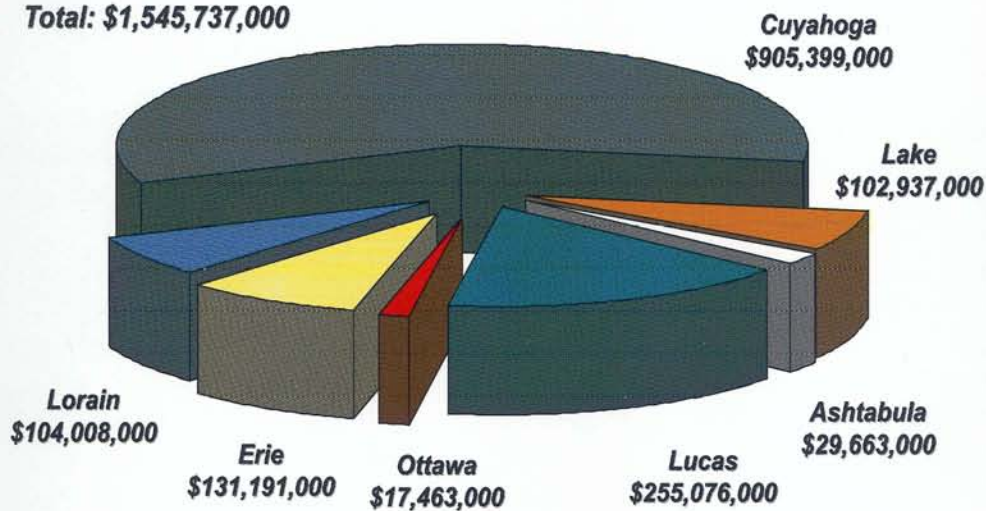
Increased water clarity has had a very positive effect on Ottawa County activities, too. Besides generally improving the quality of life in the area, it has been a boost to many sports, such as boating, swimming, and fishing.



The Lake Erie Circle Tour promotes the 200-mile driving tour along Ohio's Lake Erie coastline. The Tour's distinctive road signs mark the scenic roads and highways that offer the best views of the lake. This marketing initiative is the result of the collaborative efforts of the Ashtabula, Erie, Lake, Lorain, Ottawa, and Sandusky visitors bureaus along with the Greater Toledo and Greater Cleveland convention and visitors bureaus. Because of its outstanding contributions toward enhancing Lake Erie, The Lake Erie Circle Tour was selected as the 1997 recipient of the *Ohio Lake Erie Award*, presented by the Ohio Lake Erie Commission.

Total Direct Tourism Sales Lake Erie Counties - 1996

Total: \$1,545,737,000





Besides having more for tourists to do, the Sandusky-Erie County Visitors Bureau attributes some of the increase to the advertising they are doing in national magazines such as *McCall's* and *Better Homes and Gardens*. Local marketing efforts

supplement extensive efforts by the Ohio Department of Development's Division of Travel and Tourism. For instance, 1-800-BUCKEYE provides valuable information regarding the lake, as do several free travel and tourism publications.

For more information on the following subjects contact:

Statewide Travel Information

1-800-BUCKEYE

Information Regarding Individual Regions:

Ashtabula County Convention & Visitors Bureau
 Convention & Visitors Bureau of Greater Cleveland
 Lake County Visitors Bureau
 Lorain County Visitors Bureau
 Ottawa County Visitors Bureau
 Greater Toledo Convention & Visitors Bureau
 Sandusky/Erie County Visitors Bureau

440/576-4707
 1-800-368-5253
 440/354-2424 or 1-800-368-5253
 440/245-5282 or 1-800-334-1673
 419/734-4386 or 1-800-441-1271
 419/321-6404 or 1-800-243-4667
 419/625-2984 or 1-800-255-3743

Shipping Indicator Fair

The benefits of Great Lakes shipping affect nearly every segment of the U.S. economy, and yet many people are unaware of the magnitude and efficiency of the lakes' trade. The largest vessels working the lakes can, in just one voyage, deliver enough iron ore to make the steel needed to build 60,000 cars. When a vessel arrives in an Ohio Lake Erie port, it carries cargo that helps sustain hundreds of thousands of jobs in mining, steelmaking, construction, power generation, and a host of support industries. Environmentally, waterborne commerce produces the least emissions of any transportation mode.

A variety of cargo moves across the docks of Ohio's Lake Erie ports. Ohio is the second largest steel-producing state in the nation, so iron ore leads the list of cargo. Toledo, Sandusky, Ashtabula, and Conneaut traditionally account for the lion's share of coal loaded on the Great Lakes.

Marblehead is one of eight U.S. stone-loading ports on the Great Lakes. In addition to being a major port of call for vessels in the iron ore and coal trades, Toledo is an international port serving the export grain trade. Ships of many flags call on Toledo to load corn, soybeans, and wheat for shipment overseas. Further strengthening Toledo's connection with the Great Lakes is the full service shipyard located along the Maumee River. Cleveland and Fairport Harbor are the largest U.S. salt-loading ports on the Great Lakes. Cleveland and Toledo are major cement-receiving ports.

The dedication of the St. Lawrence Seaway in 1959 opened Ohio's Lake Erie ports to ships of all flags. This vital link provides for the transportation of raw materials and finished goods between Ohio's North Coast and trading partners around the world. Saltwater vessels deliver general cargo – primarily steel – to Cleveland and Toledo and depart with grain loaded at the Maumee River terminals. Cleveland has also been the port through which huge stamping presses and other production machinery have been delivered to equip Ford, Chrysler, GM, and Honda automobile plants throughout Ohio. By promoting and supporting Great Lakes shipping, Ohio will solidify the economic base from which it can build into the next century.



Scoring of Shipping Indicator

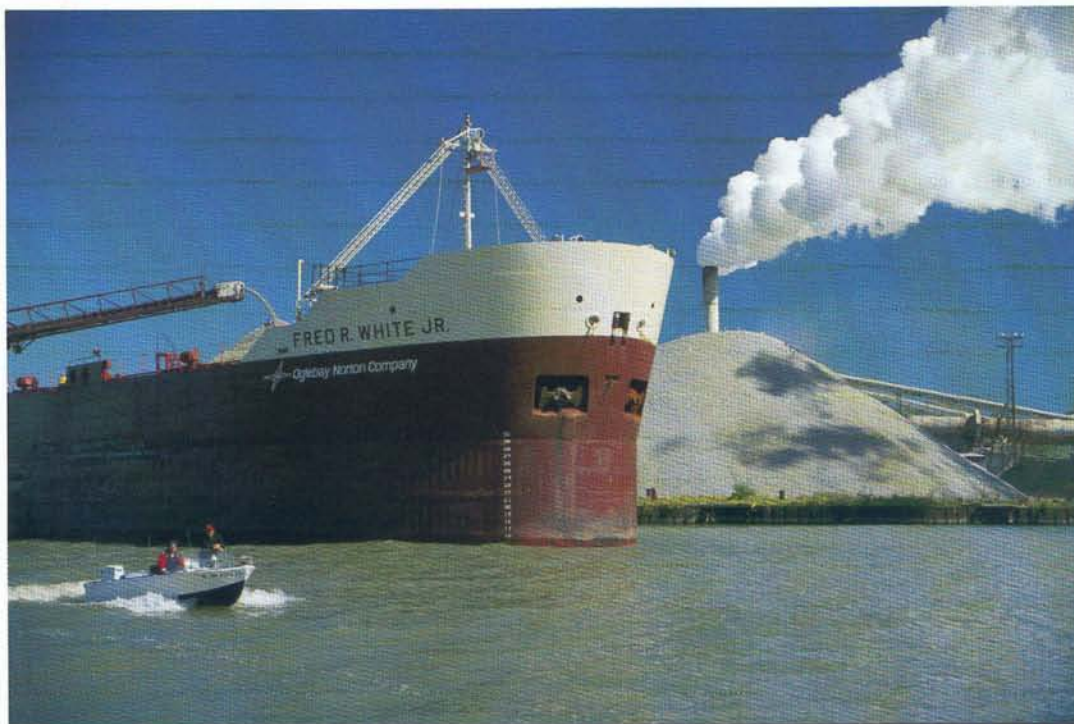
Metric	Score	Weighting	Weighted Score
Shipping	2.0	1.00	2.00
Rating			2.0 Fair

Shipping Metric

Fair

Ohio ports contribute to the local and state economies by providing employment, tax revenues, and business to companies engaged in the handling, shipping, and receiving of cargo. The breadth of businesses involved in the vessel transportation industry includes: freight forwarding; ship supply; ship towing and pilotage; fueling; marine surveying; chemical testing; launching; ship repair and other shipyard services; employment of longshoremen; terminal facility operations; warehousing; container leasing and repair; automobile servicing; trucking; banking; insurance; and port authorities.

The *Shipping* metric was constructed using



accepted methodology developed by the St. Lawrence Seaway Development Corporation to measure the economic impacts in individual port cities throughout the Seaway. The first step was to compile by port the total annual tonnage moved by

classification of cargo. These data were obtained from the U.S. Army Corp of Engineers (Buffalo District) Annual Reports for Great Lakes Shipping. Reports were obtained from 1958 through 1995.

Next, the tonnage per cargo classification was multiplied by a revenue multiplier corresponding to the degree of handling necessary to move a particular type of cargo. For instance, steel has a very high multiplier since each roll or beam of steel must be individually slung, forklifted, and trucked into place.

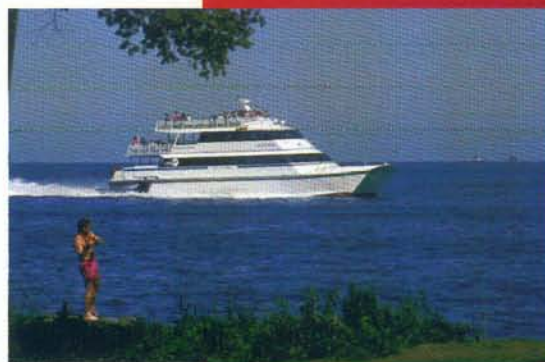
Ore, on the other hand, has a very low multiplier as the entire movement off the ship and into the rail car is

Shipping-Related Employment at Ohio's Lake Erie Ports - 1995

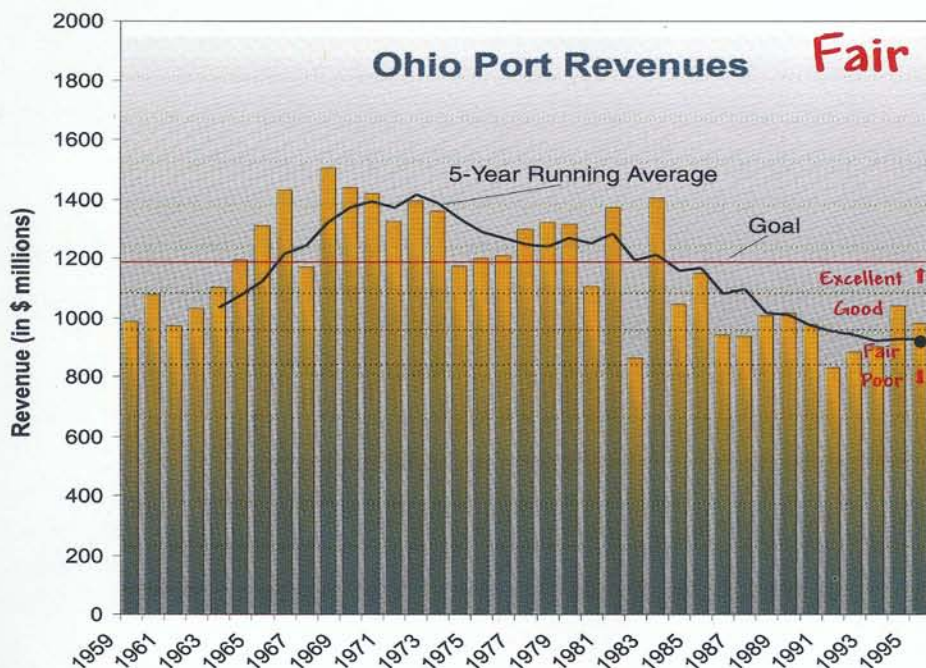


completely automated and accomplished in huge volumes. The revenue multipliers for each classification of cargo are (per metric ton):

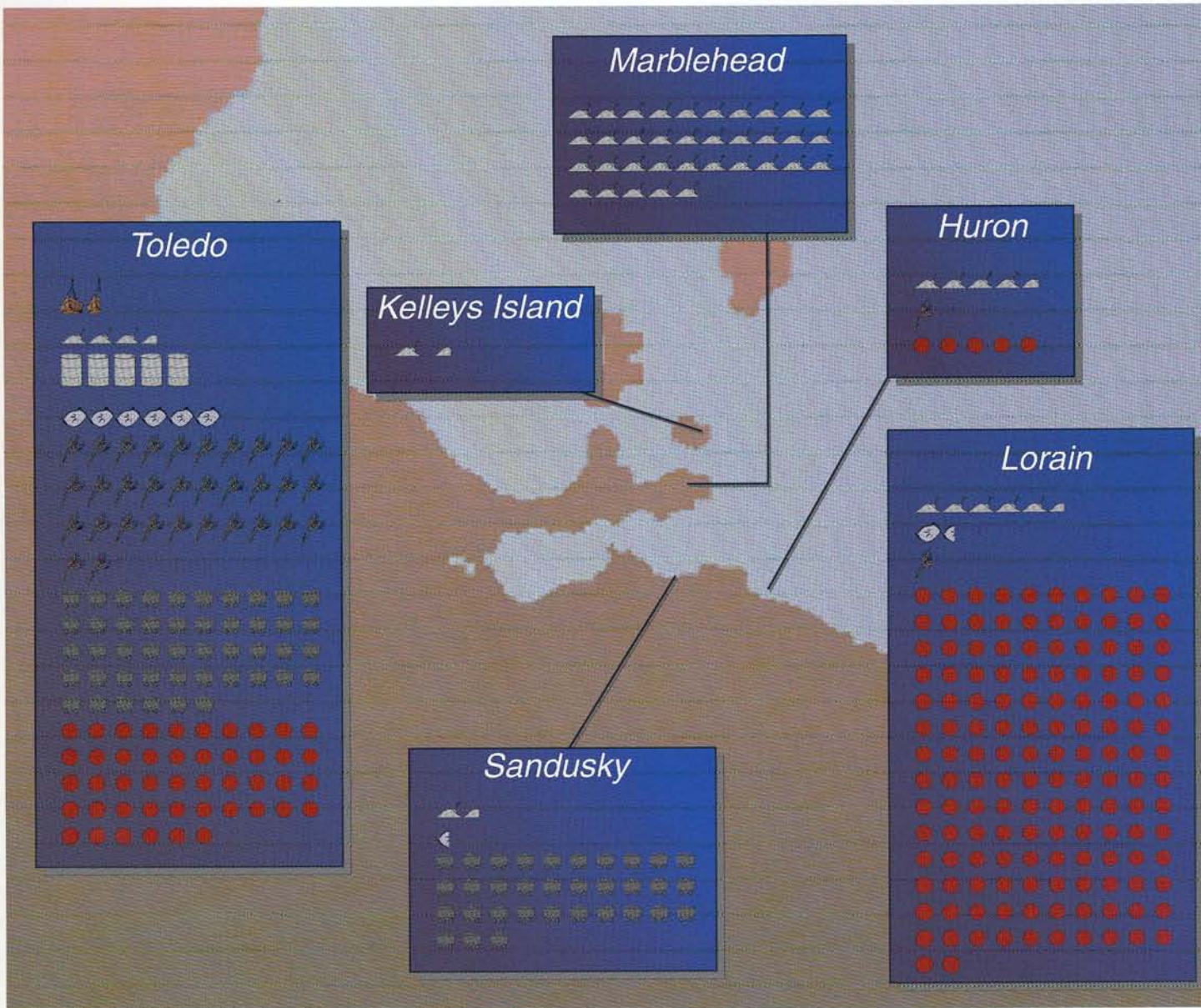
◆ Steel	\$250
◆ General Cargo	\$98
◆ Liquid Bulk	\$24
◆ Dry Bulk	\$24
◆ Grain	\$17
◆ Coal	\$15
◆ Stone/Aggregate	\$11
◆ Petroleum	\$11
◆ Ore	\$7
◆ Cement	\$3



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 Ohio 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 1995 dollars. Because of the year-to-year fluctuations in shipping, a five-year running average was calculated from the data. The actual score was taken from the five-year running average line.



Following 50 years of inactivity, the Great Lakes passenger cruise industry has been resurrected. The new cruise ship, the *M/V Columbus*, completed its first season on the Great Lakes last October with three 10-day sellout cruises. The German ship, which is the largest and most elegant vessel to travel the Great Lakes in decades, is returning to the lakes in 1998 with six cruises and possibly a full season in 1999. The U.S. flag vessel, *Nantucket Clipper*, made its second appearance on the Great Lakes last summer, completing two 12-day cruises with stops in Windsor, Ontario, and other U.S. and Canadian Great Lakes ports. These successes have been made possible through a cooperative Great Lakes marketing campaign – in which the Ohio Lake Erie Commission has played an active role.

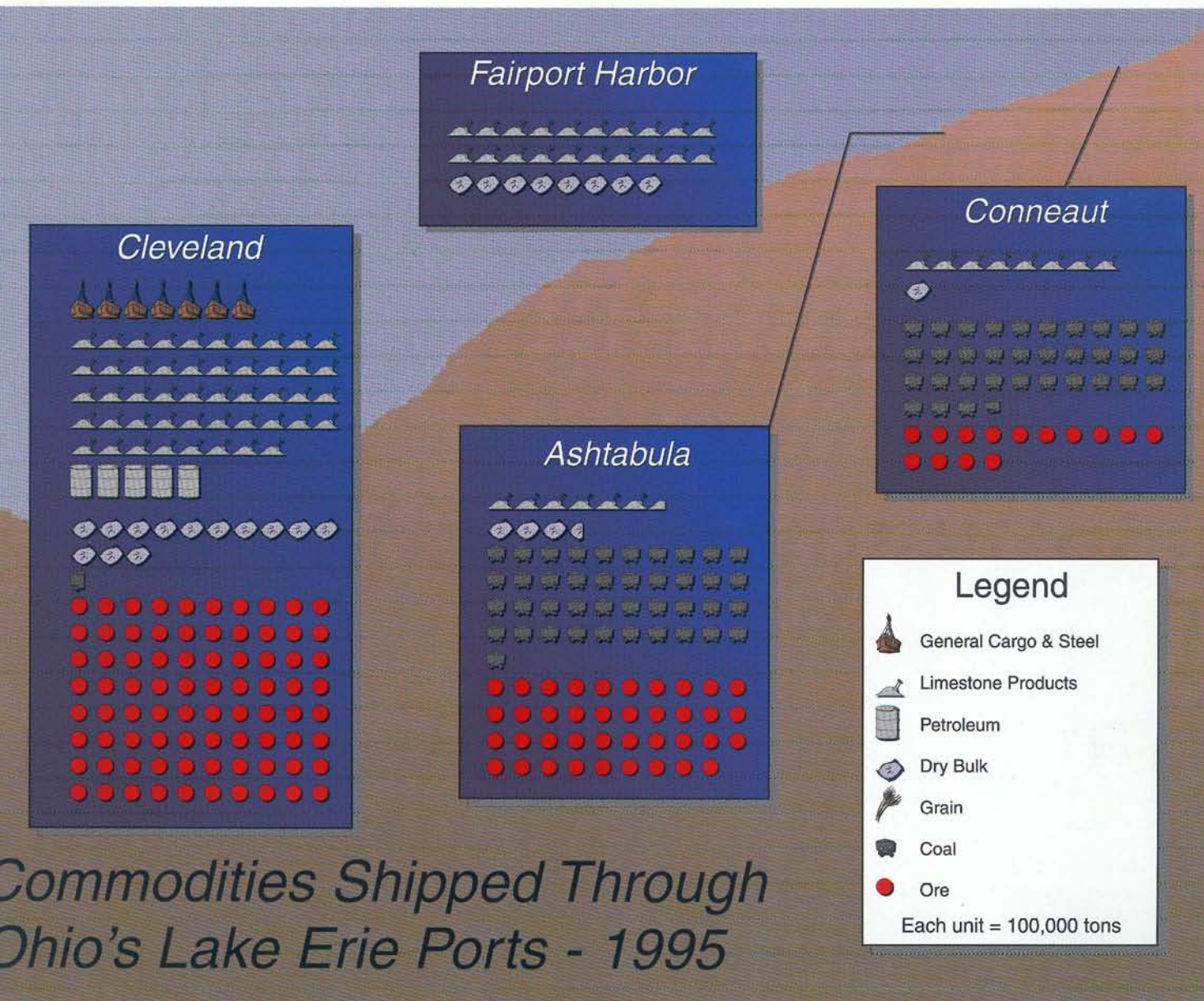


In 1995, Ohio's Lake Erie ports generated slightly over \$1 billion in revenue for the economy of Ohio (read as \$900 million on the five-year running average line). *The goal set by the Lake Erie Commission for that year (and future years) was set at \$1.2 billion.* This goal is believed to be ambitious yet realistic. It implies a need to develop new markets and services, and to modestly expand present port infrastructure. The shipping industry rated a 75% – **Fair**.

While the revenues in 1995 amount to a

short-term increase from an all-time low in 1992, they were still well below the dollars generated in the early 1970s and 1980s. The reasons for this decline are many and largely outside the control of Ohio port managers.

Ships that used the St. Lawrence Seaway at its opening in 1955 have been increasingly replaced by much larger vessels – vessels that no longer fit through the smaller locks of the Seaway. Overseas cargo that once was shipped through Toledo and Cleveland is now railed to East Coast ports for international shipment.



Nationally, stricter environmental regulations have decreased the demand for and subsequent shipment of Appalachian coal out of the ports of Conneaut, Ashtabula, Sandusky, and Toledo. These and other changes in global and regional transportation patterns have substantially reduced traffic through Ohio's ports.

The single greatest opportunity for the port industry is for redevelopment of the vacant brownfield sites within Ohio's industrial harbors. Industries dependent on the input of raw materials

and international export of finished products are finding ideal locations at abandoned port properties.

On a smaller scale, the State of Ohio can directly participate by directing state commodity shipments through Ohio ports and assisting these ports with building future infrastructure needs.

The port industry believes that the future is bright and business will continue to improve. Through the improving business climate of northern Ohio and modest infrastructure improvements to the ports, the Commission's goal can be realized.

For more information on the following subject contact:
Shipping Ohio Department of Transportation

614/466-8981

Lake Erie Commission's Commitment to

Ohio Lake Erie Commission

The Ohio Lake Erie Commission, established by the Ohio General Assembly in 1990, was created to focus additional attention and resources on protecting and restoring Lake Erie. The Commission is comprised of the Directors of the Ohio Environmental Protection Agency and the Ohio Departments of Natural Resources, Agriculture, Health, Transportation, and Development.

Ohio Lake Erie Office

The Ohio Lake Erie Office was formed by a directive from Governor Voinovich and opened January 1, 1992, in Toledo to serve the Ohio Lake Erie Commission in protecting and developing Lake Erie's resources. The Ohio Lake Erie Office acts as the Commission's staff, administering the Lake Erie Protection Fund, organizing Ohio's annual Coastweeks celebration and preparing the Governor's State of the Lake Report. The Office also administers the Lake Erie License Plate Program and represents the State of Ohio in local, state, regional, national, and international forums.

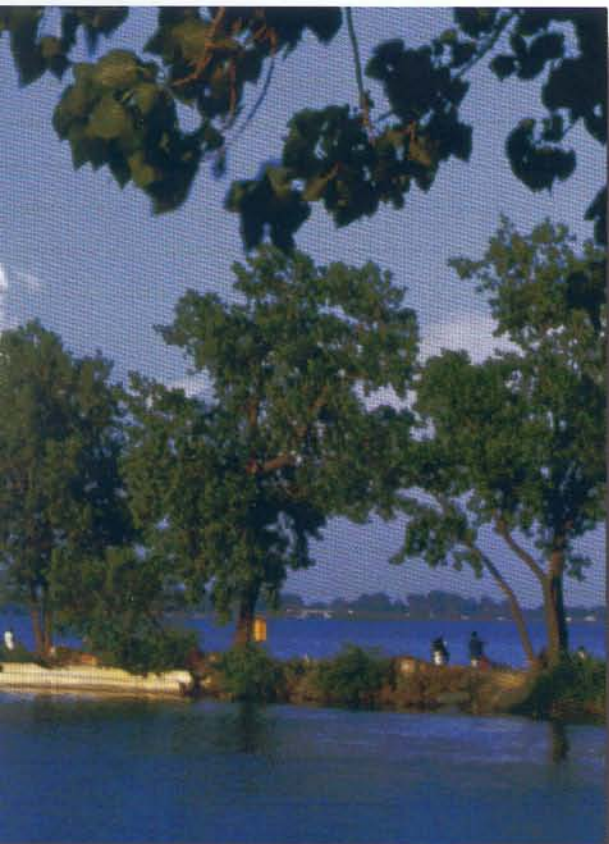


Lake Erie Protection Fund: Dedication to Continued Progress & Success

The quality of Lake Erie and its shoreline has increasingly improved over the past 25 years. Efforts continue to further enhance this great natural resource. Ohio's Lake Erie Protection Fund is a key factor in these efforts, providing monies to preserve, protect, and restore Lake Erie. During the last six years, more than \$3.5 million has been awarded through this program to successful and worthwhile Lake Erie projects. Through the Lake Erie Protection Fund, grants are awarded on a regular basis for specialized scientific research and valuable implementation projects. All of these projects are committed to improving the quality of Lake Erie, Ohio's greatest natural resource.

The Lake Erie Protection Fund has helped finance 90 Lake Erie related research, restoration and implementation projects from 1992 through 1997. Monies for this fund are secured through the proceeds of the Lake Erie License Plate sales and the "Erie... Our Great Lake" credit card program. In addition, monetary donations and gifts from the public and private sector are added to this fund to help ensure that Lake Erie remains a source of pride for all Ohioans.

Protecting Ohio's Waters & Shoreline



Coastweeks

Ohio's Celebration of Lake Erie

Lake Erie and its shoreline are valuable in many ways to Ohioans of all ages, and the Coastweeks program allows everyone the opportunity to celebrate, educate, and participate in protecting our Great Lake. Ohio's Coastweeks is a three-week celebration featuring environmental, recreational, and educational events along Ohio's North Coast. Coastweeks '98 will be held from August 29 through September 21. Ohio's Coastweeks events include beach and underwater cleanups, nature walks and hikes, recreational races, tours, and trips. To get involved, call the Ohio Lake Erie Office at 419/245-2514.

Show Your Support for Lake Erie

Lake Erie License Plates

Ohioans take great pride in their Great Lake, and the Lake Erie License Plate Program drives home this fact. The Lake Erie License Plate features the Marblehead Lighthouse (designed by artist Ben Richmond), one of the shore's most historic landmarks.



In the last four years, Ohioans have purchased over 195,000 of these specialty

plates, generating more than \$2.9 million for the Lake Erie Protection Fund to finance projects that improve the quality of Lake Erie and its

waterways. Whether driving along the shoreline or just around

town, Lake Erie License Plates prominently display your support of the lake. For more information on these plates, call 1-888-PLATES3.

Life on Lake Erie Amateur Photography Contest

For those who enjoy capturing the special scenes of Lake Erie and its shoreline, the *Life on Lake Erie* Photography Contest is designed especially for you.

Participants are encouraged to take slide photos in and around Lake Erie depicting natural resources, recreation, commerce and transportation or what life

on Lake Erie means to them.

Call the Ohio Lake Erie Office at 419/245-2514 to obtain a photo contest brochure and entry form. To enter, submit slides taken between September 1, 1997 and August 31, 1998 for this year's contest. Prizes are awarded to four grand prize and eight honorable mention winners.

Acknowledgements

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Dean Hoard, Coastweeks Photo Contest

Ruth Rittichier, Coastweeks Photo Contest

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Shipping Indicator

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Arnold Ehrsam, Coastweeks Photo Contest

Toledo-Lucas County Port Authority

Ohio Lake Erie Commission

Arnold Ehrsam, Coastweeks Photo Contest

***Our regrets to any individual or organization inadvertently not listed*

An Average Day on Ohio's North Coast

Did You Know...

During the fishing season, anglers bag more than 31,000 pounds of walleye and yellow perch daily

North Coast tourism generates \$4.2 million daily

During the shipping season, over 185,000 tons of cargo are shipped to and from Ohio's Lake Erie ports daily

More than 62,000 Ohio vehicles sport the Lake Erie specialty license plate

The Ohio Lake Erie shoreline is eroding at an average rate of 4/100 of an inch per day

A volume of water equivalent to the entire western basin of Lake Erie (west of Sandusky) is filtered by zebra mussels every 2 to 3 days

The average daily income of North Coast residents is \$97.84

437 million gallons of water are pumped from Lake Erie each day for public consumption