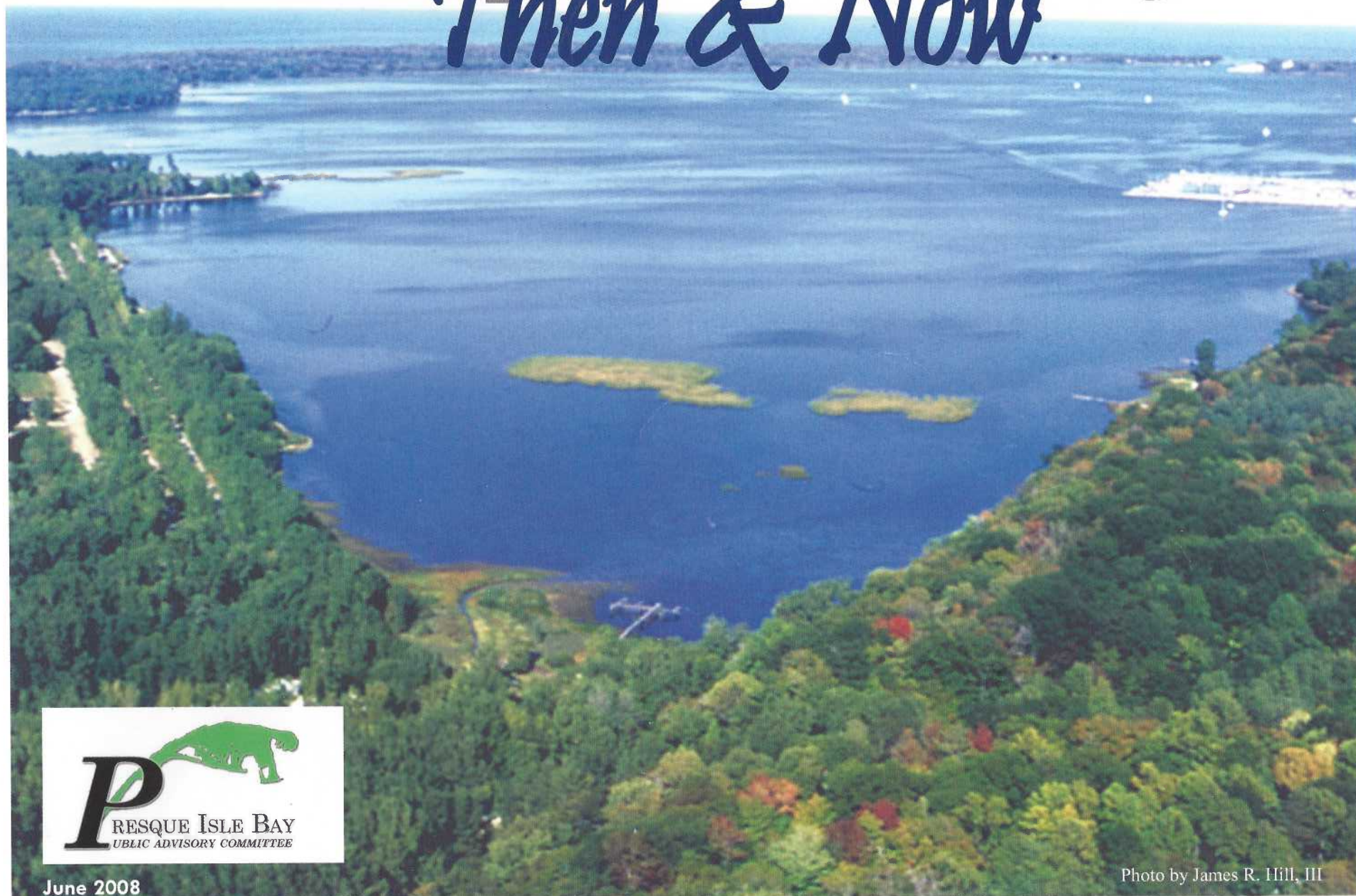


# Presque Isle Bay

## *Then & Now*



June 2008

Photo by James R. Hill, III



# Introduction

## Forward

As chairman of the Presque Isle Bay Public Advisory Committee, I am pleased to invite you to learn about the progress that has been made in advancing improvements to one of our community's most valuable resources — Presque Isle Bay. This water body has been a magnet for the people of Erie and the Commonwealth of Pennsylvania for well over 200 years, and the natural protection of its harbor is a principal reason why Erie played an important part in our nation's history. This document shares how people have been working to give something back to that resource, in the form of steps taken to protect the bay from pollution problems that continue to affect fresh waters throughout the Great Lakes. We can all be proud that it was citizen action that led to the elimination of some of the worst pollution sources to our bay, and that citizens continue to work as guardians advocating for additional improvements to the bay and its watershed.



**J. Michael Campbell, Ph.D.**  
**PAC Chairman**

## Introduction

For those who visit, Presque Isle Bay holds many wonders and possibilities. Located on the southern shore of Lake Erie in Pennsylvania, the bay is formed by a seven-mile, recurved, "flying" sand spit named Presque Isle. This peninsula is home to the most visited park in Pennsylvania, Presque Isle State Park, which welcomes an average of four million visitors each year. To the south, the City of Erie and a portion of Millcreek Township border the 3,718 acre bay.



*Historical image of the bayfront, image courtesy of Jerry Skrypzak.*

In 1988, the citizens of Erie banded together behind the goal of a swimmable Presque Isle Bay. A lot has changed since then. Once a repository of raw sewage and industrial discharges, the bay is now recovering its beauty and environmental quality. Changes in the bayfront landscape from industrial to commercial and tourist attractions; upgrades to the City of Erie's wastewater treatment and conveyance system; new environmental laws regulating air, water, and industrial discharges; and an engaged community have all contributed to this remarkable revitalization. Today, the bay sustains a diverse fishery supporting populations of aquatic animal and plant life. The water is cleaner than it has been in many years and the public has greater access to it. Researchers, regulators, and involved citi-

zens understand more about the physical, biological and chemical process of this ecosystem than ever before.

There are, however, still problems to be understood and addressed. Non-native species have invaded the bay, forever changing the ecosystem; new threats have emerged in the form of viruses such as viral hemorrhagic septicemia (VHS) and bacteria that cause avian botulism; brown bullhead catfish still have tumors; and there are advisories on the amount of fish that should be eaten due to contaminants. In addition, nonpoint sources of pollution such as street and lawn runoff need to be reduced and controlled. These issues are not specific to Presque Isle Bay but, in fact, are being grappled with throughout the Great Lakes.

The history of environmental changes in Presque Isle Bay is, nevertheless, a success story, one that is a result of vigilant partners working together to protect and restore this valuable resource. The following pages summarize the status of key water-quality related improvements, using twenty years of data gathered by government, research, private, and non-profit organizations. This report tells the story of a living treasure, which has been substantially reclaimed by environmental action and awareness.



*Bayfront, 2007, DEP file photo.*

# A Vision for Presque Isle Bay

Established in 1991, the Presque Isle Bay Public Advisory Committee (PAC) serves as the instrument for involving the public in the investigation, restoration, and protection of the bay. Members of the PAC represent local, state, and federal government agencies, environmental and civic organizations, academia, and industry. The PAC provides input and advice to the Pennsylvania Department of Environmental Protection (PADEP) on environmental activities in the bay and its watershed. In 2003, members of the PAC developed a vision statement to define and guide their actions.

## ***Vision Statement***

**By 2015, the bay and its watershed will be a healthier ecosystem, sustained by an educated and responsible citizenry.**

The vision statement was further refined in 2005 into an ecosystem goal describing the long-term vision for the bay and a set of ecosystem objectives to clarify the meaning of the ecosystem goal.

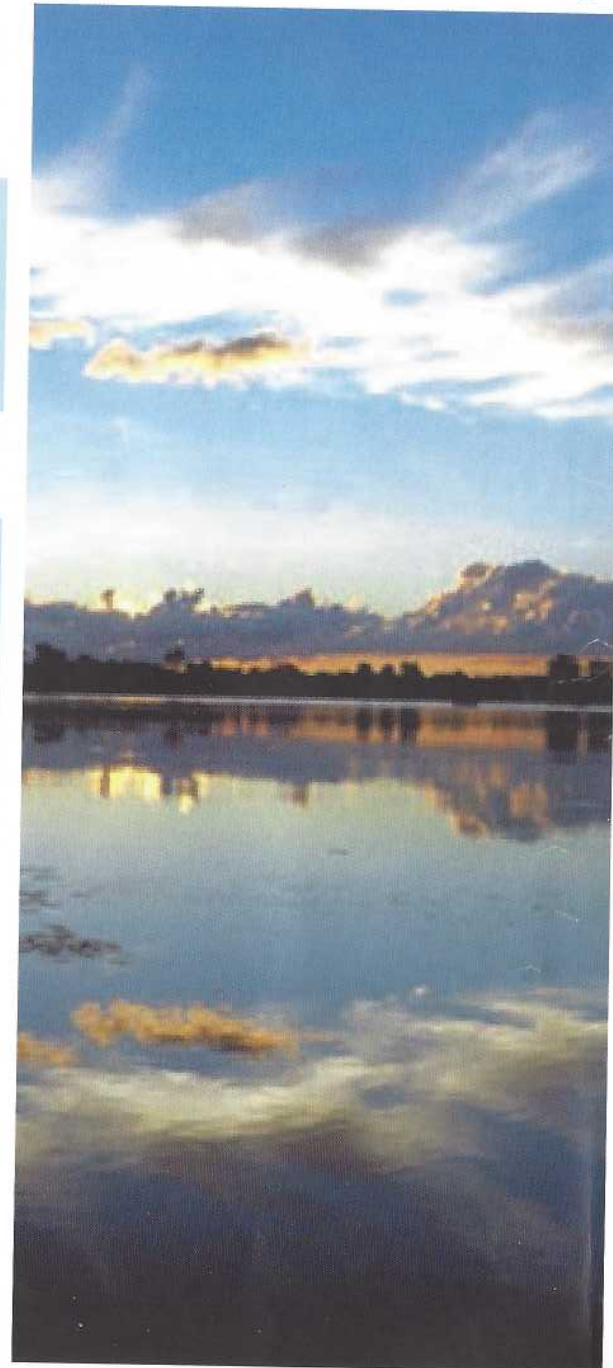
## ***Ecosystem Goal***

**To protect, sustain, and where necessary, restore healthy functioning aquatic ecosystems that are capable of supporting current and future uses.**

## ***Ecosystem Objectives for Presque Isle Bay***



- Protect and preserve recreational uses;
- Maintain and protect the benthic invertebrate community;
- Maintain a quality fishery;
- Protect and improve near-shore habitat;
- Maintain the aesthetic qualities;  
(i.e., prevent algal blooms, unpleasant odors, visual impairments, etc.)
- Maintain and improve water quality conditions; and
- Eliminate the beneficial use impairments in the bay: restrictions on dredging activities and fish tumors or other deformities.





# Citizen Action and the Bay

The story of Presque Isle Bay is a unique one of ordinary, concerned citizens uniting together to accomplish extraordinary things. Since the early 1980s, environmentally-minded citizens have banded together with the common goal of restoring and protecting Pennsylvania's piece of the Great Lakes. It is largely due to their efforts that Presque Isle Bay became an Area of Concern (AOC) under the Great Lakes Water Quality Agreement. This is their story.



*Image courtesy of visiteriepa.com.*

The group responsible for initiating the AOC designation began meeting in 1983. The Erie County Sportsmen's Association, League of Women Voters, and Benedictine Sisters formed the Erie County Environmental Coalition (Coalition) to address local environmental issues as a powerful, unified group. Eventually the Lake Erie Sierra Club, the Presque Isle Audubon Society, the American Lung Association, Zero Population Growth, and the Earth Day Coalition also became members. The Coalition served as the first organized public participation in Erie environmental issues. Coalition members began traveling to other Great Lakes states sharing the concerns they had and bringing back the stories and ideas they heard from other parts of the basin.

In 1986, the Erie County Water Resources Commission appointed an ad-hoc water quality study committee. Their goal was to determine how to return the bay and Lake Erie, within 20 years, to a condition in which they

could be safely used for swimming and fishing without risk of contacting toxic substances or disease-causing agents associated with sewage wastes. This goal was later expressed as a "Swimmable Bay in 20 Years."

In January 1988, members of the Coalition consulted with the International Joint Commission's (IJC) Science Advisory Board on the appropriateness of designating Presque Isle Bay as an AOC. The intent of the Coalition in seeking this designation was to draw attention to the degraded quality of the bay and secure state and federal funding to enhance the environmental and economic quality of life in Erie. A workshop was convened with members of the IJC's Board in February 1988. More than 100 people, representing local and state governments, regulatory agencies, and a variety of business, development, industrial, and environmental interests, attended. The Coalition was encouraged to move forward with a petition to include the bay as an AOC.

In June 1988, Governor Robert Casey came to Erie to attend a town meeting on Great Lakes issues. The conversation covered topics such as Pennsylvania joining the Council of Great Lakes Governors, the potential AOC designation, regulations banning phosphate in detergents, and funding for environmental work in both the bay and Lake Erie on par with the state's commitment to the Chesapeake Bay. The Erie County Environmental Coalition introduced the "Swimmable Bay in 20 Years" slogan at the Governor's meeting and marketed it to the public by distributing T-shirts, buttons, and bumper stickers imprinted with the slogan.

The February 1988 workshop also resulted in the creation of the Erie Harbor Improvement Council (Council). Erie Mayor Louis Tullio and Erie County Executive Judy Lynch jointly appointed members, including representatives from business, industry, academia, development, government, civic, and environmental groups. The Council first met in December 1988 and was charged with developing an action plan to clean up the bay.

Finally, in 1991, Presque Isle Bay was designated an AOC by the United States Department of State. Many expressed concern about the designation and initially opposed the it, fearing that the label would blemish the community's image and would hinder the region's possibilities for future growth and tourism. The Council expanded its objectives to ensure Pennsylvania met its responsibilities under the Great Lakes Water Quality Agreement, including restoration of the AOC, and to address the community concerns by balancing environmental quality with economic revitalization. As part of the AOC process, the Council dissolved and its members became the PAC formed to provide advice to the Pennsylvania Department of Environmental Resources (PADER; now PADEP) on investigation and restoration of water quality within the bay.

The PAC is still an active voice in the investigation, restoration, and protection of Presque Isle Bay. Many of the original members of the PAC continue to participate today, some 17 years later.

In 1972, Canada and the United States responded to the environmental problems seen across the Great Lakes by entering into the Great Lakes Water Quality Agreement. Through this agreement, the two countries pledged to work together in protecting this shared resource. The Agreement was expanded and amended since, with recommendations to use waste reduction as the means to control pollutants, commitments to implement measures to reduce and control atmospheric deposition of toxic substances, and commitments to control the sources of groundwater contamination.

# Beneficial Use Impairments

## Beneficial Use Impairments

The 1987 Protocol amending the Great Lakes Water Quality Agreement (Agreement) defines criteria for identifying AOCs based on the presence of conditions that impair the beneficial uses of aquatic ecosystems. The Agreement defines a beneficial use impairment (BUI) as "a change in the chemical, physical, or biological integrity" of the system that causes one or more of fourteen listed impairments. Fourteen beneficial uses are listed in the Agreement covering issues from wildlife habitat to the ability to swim in, drink, and eat fish that live in the water.



*Confined disposal facility, DEP file photo.*

The reasons for listing the bay were not cited in the 1991 designation so the first step was to determine which of the fourteen beneficial uses were impaired. Analysis of existing data as reported in PADEP's 1993 Remedial Action Plan identified chemicals of potential concern including ten heavy metals, nutrients, and polycyclic aromatic hydrocarbons (PAHs), which is a large class of organic chemicals found in petroleum products and produced during fossil fuel combustion. No BUIs to the water column or fish and wildlife were indicated.

Based upon this analysis of existing data, PADEP believed that only two of the fourteen BUIs were present: (1) fish tumors or other deformities; and, (2) restrictions on dredging activities. Since then, members of the PAC have worked with PADEP to understand the causes and extent of fish tumors and characterize sediment contaminants.

## Restrictions on Dredging Activities

The IJC Guidelines define the "restrictions on dredging activities" BUI to occur when contaminants in sediments exceed standards, criteria, or guidelines such that there are limitations on dredging or disposal activities. PADEP interpreted this impairment to mean that sediments were so contaminated that they should not be disturbed. If, however, dredging were needed for navigational or recreational purposes, restrictions would be required during the actual dredging to prevent re-suspension of the material into the water column.

Since the 1980s, PADEP and local partners like Pennsylvania Sea Grant, Gannon University, Mercyhurst College, and the Erie County Department of Health, collected information on sediment quality conditions within the bay. The sediments were found to contain broad, low-level contamination, primarily metals and PAHs, spread throughout the bay. The investigations also indicated that sediment quality conditions were improving in the bay. As a result, PADEP, in conjunction with the AOC's PAC, determined that monitored natural attenuation, rather than active remediation within the AOC, would provide the most cost-effective and practical method for restoring the "restrictions on dredging activities" BUI. Based upon this conclusion and a decade-long downward trend in both the liver and skin tumors on fish, Presque Isle Bay was re-designated as an "AOC in the Recovery Stage" in 2002. The Recovery Stage designation means that all active remediation is complete and the focus is now on monitoring the bay as it responds to the actions taken.

In 2005, PADEP and PAC members assessed the "restriction on dredging activities" BUI from both practical and ecological perspectives. The practical restriction is based on Pennsylvania's laws and regulations, which limit the disposal of dredged material to either a confined disposal facility (CDF) or an upland site, regardless of the presence or absence of contaminants. From an ecological perspective, the sediment was evaluated against a delisting target based on a comparison of discharges from the disposal of dredged material to state water quality standards. Ecosystem health targets also were set to assess the impact of contaminated sediment on sediment-dwelling organisms, fish, and aquatic-dependent wildlife.

Data from a comprehensive sediment survey was used to evaluate the targets. Analysis of the data showed that metals and PAHs, while present, do not or rarely occur in the AOC or study area sediments at concentrations sufficient to affect sediment-dwelling organisms, fish, or aquatic dependent wildlife adversely. More specifically, existing sediment quality conditions are sufficient to support sediment-dwelling invertebrate communities. Also, risks to fish and aquatic-dependent wildlife using habitats in Presque Isle Bay are unlikely to be higher than those for fish or aquatic-dependent wildlife using habitats elsewhere in Lake Erie. Ecosystem health targets were being met in the AOC and there was no evidence that the moderate amount of contamination found was responsible for degrading the ecosystem. It was also found that the primary delisting target for the "restrictions on dredging activities" BUI would be met if dredging were required in any location in the AOC.

Based on those results, PADEP determined that the "restrictions on dredging activities" BUI was no longer impaired. With the PAC's concurrence, this BUI was delisted in 2007. A long-term monitoring plan was developed to ensure the delisting and ecosystem health targets continue to be met. Implementation of the plan begins in 2008.



# Beneficial Use Impairments

## Fish Tumors and Other Deformities

The fish-related BUI is present when the incidence rates of fish tumors or other deformities exceed rates at unimpacted control sites or when survey data confirm the presence of liver tumors in brown bullhead catfish (*Ameiurus nebulosus*). Generally, exposure to contaminated bottom sediment is thought to cause tumors in brown bullhead catfish with most of the research focusing on the role of PAHs. Because these fish live in close contact with sediment, bullheads are an important biological indicator of environmental health.



Brown bullhead with raised mouth lesion, DEP file photo.

In Presque Isle Bay, the problem was first identified in the 1980s when the United States Fish and Wildlife Service began receiving reports from anglers of "tumorous" growths on the bay's brown bullhead catfish. While several small-scale, focused studies were conducted in the 1980s, the first large-scale investigation of bullhead tumors was conducted jointly by PADEP and the Erie County Department of Health in 1991. The external tumor rate was estimated to be 86%. A follow-up investigation confirmed that some of the bullhead also had liver tumors; a strong indicator of exposure to carcinogens in the environment.

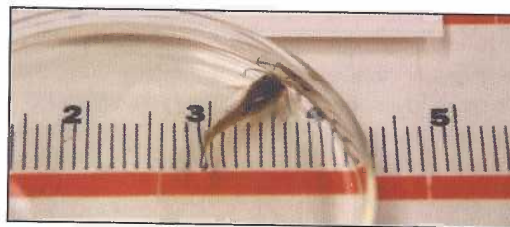
Prior to the "Recovery Stage" designation, tumor rates in the bay's bullhead decreased progressively over time. Liver tumor rates fell steadily from a high of 22% in 1992 to 0% in 1999. External skin and lip tumor rates showed a similar decline from 64% in

1992 to 17% in 1999. During the same period, several significant sources of pollution to the bay had been eliminated, including combined sewer overflows (CSOs) from the Erie Wastewater Conveyance System and a large, coal-fired electric power plant.



Young-of-year brown bullheads, photo by Ben Koncewicz.

Following the 2002 "Recovery Stage" designation, yearly monitoring has continued through 2007. Based on combined monitoring data from 2002-2005, the incidence rate of liver tumors in Presque Isle Bay was found to be 8.1%, a rate that is not statistically different than at other sites examined in Lake Erie (11.0%) or inland northwestern Pennsylvania (5.8%). This is particularly encouraging as liver tumors are thought to be the strongest indicator of exposure to sediment contaminants. Conversely, the incidence of external skin and lip tumors for this four-year period was found to be 28%. Although relatively stable, over the monitoring period, it is a rate that is significantly higher than elsewhere in Lake Erie (9.7%) and other inland Pennsylvania sites (6.4%).



Young-of-year brown bullheads, photo by Ben Koncewicz.

Numerous bullhead studies have been conducted since tumors were first identified in the bay's brown bullhead. In addition to over a half-dozen major sediment quality investigations, bullhead studies over the years have included investigations of tissue contaminant levels, population size and age structure, reproductive success, genetic hybridization, and migration patterns. While the cause or causes of the tumors still remains unclear, much has been learned about the health and biology of the bay's bullhead population. Importantly, fish tagging studies and radio-telemetry work has confirmed that the bullhead are residents of the bay and do not typically enter the open lake. This provides important clues about potential causes of the tumors. Despite the elevated incidence of tumors, the bay's bullheads do not have elevated levels of PCBs, pesticides, heavy metals, or other monitored contaminants in their flesh. Studies have also confirmed that the bullhead are able to successfully reproduce, and young-of-year (baby) brown and closely-related yellow bullhead were collected in small numbers in 2007 at several locations throughout Presque Isle Bay. Finally, as is the case with humans, studies have consistently shown that older fish are more likely to have tumors and other deformities than are younger fish.

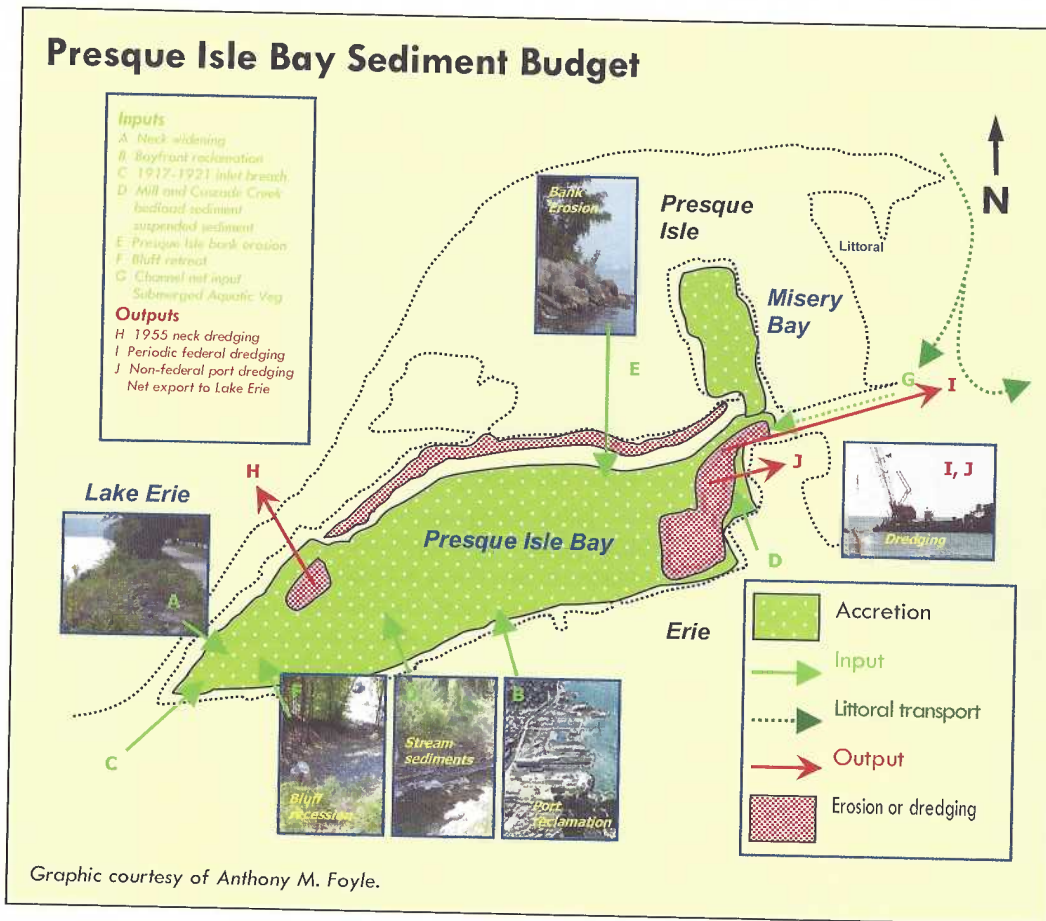
## Research

Research is planned to examine further what causes or contributes to the growth of tumors. A number of factors, including environmental contaminants, viruses, and parasites, are being evaluated. In addition, PADEP and the PAC are in the process of identifying delisting targets for this BUI based on tumor rates at least-impacted reference sites elsewhere in Lake Erie.

# Physical Characteristics and Sedimentation

The physical feature which makes Presque Isle Bay a natural harbor – its sheltered, nearly enclosed basin – also makes it a natural settling basin, and much of the pollutants entering the bay become entrapped in the sediment. The 3,718-acre bay is considered shallow with an average depth of 13 feet. Two-thirds of the water entering the bay comes from three tributaries: Mill Creek, Cascade Creek, and Scott Run. A narrow entrance channel allows the exchange of water with Lake Erie. It takes approximately two and a half years for the bay to “flush” itself. This means that much of the sediment entering the bay remains there, causing the bay to become shallower over time. Studies conducted in the 1990s estimated the rate at which sediment fills the bay at 1 centimeter (cm) per year (yr).

The change in designation for Presque Isle Bay to an “AOC in the Recovery Stage” in October 2002 was based on the decision to allow natural capping of contaminants using cleaner, naturally supplied sediment entering from the watershed and other potential sources. This decision changed the focus of efforts from defining the extent of contamination to reducing the amount of contaminants entering the bay primarily from nonpoint sources of pollution in the watershed. A multi-decade sediment budget was developed to identify the principal sources and relative contributions of sediment to the bay and confirm that the natural capping remedy is the best solution and is working.



and both surface and core sediment samples; areas where sediment accumulates and erodes were identified. Analysis of the data confirmed earlier findings. Sediment generally erodes from the bay-margin shoal areas at an average rate of 1 cm/yr and is also supplied from streams and from offshore. This sediment is swept into the central basin, adding an average of 1-2 cm/yr to the bay floor. Episodic events, like seiches, can temporarily force water into the bay during storm events and raise water levels by several feet. As much as 500 tons of suspended clays may be brought into

the bay during such events. Because clay particles settle extremely slowly (3.5 cm/hr or 1 cm/day under calm conditions), whatever enters the bay during the seiche is likely to be brought right back out to the lake again on the falling “tide.”

The study estimated sediment input from the tributaries to average 25% of the total over the past several decades. Almost twice that amount is supplied by bank erosion and bluff retreat. An additional 20% is supplied from littoral drift from Lake Erie and 12% is from the historical infill and widening of the Presque Isle peninsula neck. The natural remediation is enhanced by these non-tributary sediment sources which supply environmentally clean materials from ancient beach ridges on Presque Isle, ancient sediments from the bluffs deposited by glaciers, and clean nearshore sands from Lake Erie.

The patterns of sediment accumulation and erosion were found to be spatially variable in the bay due to

the number and locations of sediment sources and the hydrodynamic processes that disperse the sediment. The study concluded that ongoing accretion in the bay will cover the majority of the historically contaminated sediment and that the natural cap needs to be at least 10 cm thick to prevent physical actions such as wave action, current scour and boat wakes, and biological processes such as the burrowing of sediment-dwelling organisms from exposing the contaminants to the water column.



# Wastewater Treatment Over Time

The City of Erie, founded in 1792, grew around Presque Isle Bay and its Lake Erie harbor. As was the practice in the 18<sup>th</sup> and 19<sup>th</sup> centuries, much of the wastewater from the City's industries and domestic sources was discharged directly to the bay or its tributaries. Urban streams in Erie were looked at more as sewers than natural resources. In many Great Lakes cities including Erie, water intakes and sewage discharges were in close proximity to each other, causing serious health issues.

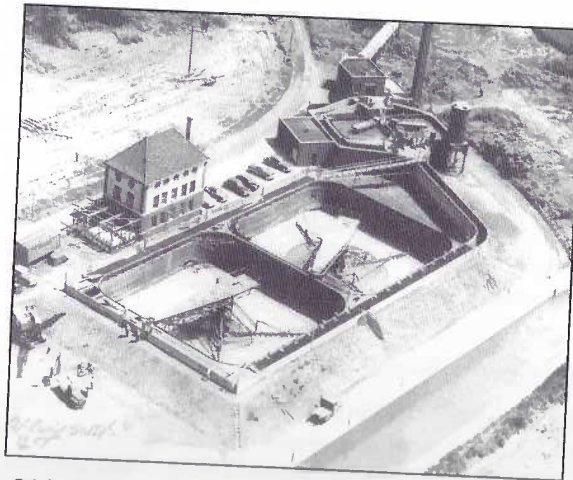


Raw sewage in Garrison Run 1989, image courtesy of Bob Wellington.

Because the north-flowing stream channels that drained into Presque Isle Bay carried surface water runoff and human waste products, water-quality issues related to the City's sewage disposal techniques were widespread. In the early 1890s, the Erie, Pennsylvania Board of Water Commissioners proposed to install an intercepting sewer from the area of Villa Maria Academy east to Garrison Run to divert sewage from the western part of the City into Lake Erie at a point east of the public water intake. Voters did not approve this proposal. A typhoid fever epidemic hit the city due to drinking water contaminated with bacteria, most probably from sewage wastes. The epidemic reached a peak in 1907 with 316 reported cases and 49 deaths. During a six-year period from 1905 to 1911,

the Erie Board of Health officially reported over 1,000 cases of typhoid fever and 147 deaths. In response, in 1908, the City extended its water supply intake pipe almost a mile, crossing under the peninsula into Lake Erie and constructed a treatment plant for the drinking water supply. No further cases of typhoid fever were reported.

Nothing, however, was done to correct the source of contamination until the 1930s, when construction began on the Erie Wastewater Treatment Plant. The first primary treatment plant and outfall, which discharged to the lake outside the bay, were built in 1930; the Erie Sewer Authority was created in 1953; secondary treatment was constructed in 1954; and expansions and upgrades were completed in 1974 and from 1980 to 2000. In spite of these improvements, problems remained due to the discharges into the bay and Lake Erie from combined sewer overflows and the treatment plant itself, particularly during storm events.



Erie's Wastewater treatment plant, 1940, image courtesy of John L. Scott, Scott Historical Aerial Photos.

In 1989, the City of Erie and the Erie Sewer authority entered into a Consent Order with the PADEP. Erie agreed to attain and maintain compliance with the Clean Streams Law and any current or future National

Pollutant Discharge Elimination System (NPDES) permits for the facilities under its control. At the time the Consent Order was signed, there were 52 permitted overflow locations in the Erie sewer system, many of which experienced dry and wet weather overflows that discharged into local receiving waters. In addition, there were many illegal sanitary sewer connections directing untreated wastewater to the storm sewer system. The Consent Order required Erie to determine the extent of pollutants discharged from the sewage collection system, storm sewer system, and treatment plant into the Mill Creek Tube, Presque Isle Bay, and Lake Erie and to evaluate both structural and nonstructural alternatives to reduce these pollutants. The Order served as a turning point for cleaning up the bay.



Erie's Wastewater treatment plant, 2008, DEP file photo.

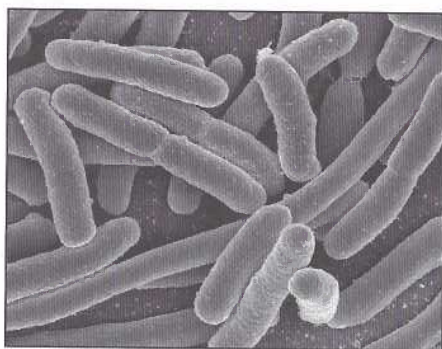
Close to \$100 million was spent upgrading the City's wastewater treatment, collection, and conveyance system. As a result, the number of permitted and illegal combined sewer overflows (CSOs) was reduced from 70 to five; four of the overflows discharge into the bay via the Mill Creek tube and one discharges directly to Lake Erie in the outer harbor. All five CSOs are fitted with screening devices to remove debris and are flow monitored. These improvements have been made to the system while maintaining some of the lowest user fees in Pennsylvania.



# E. coli: Does it affect swimming in the Bay?

## What is *E. coli*?

*E. coli* is the abbreviated name of the bacterium in the family *Enterobacteriaceae* named *Escherichia coli*. The name "*E. coli*" encompasses a wide range of bacteria, some of which help us and some of which hurt us. Approximately 0.1% of the total bacteria within an adult's intestines is represented by *E. coli*. The presence of *E. coli* and other bacteria within our intestines is necessary for us to develop and operate properly.



*Escherichia coli* (*E. Coli*), DEP file photo.

*E. coli* we acquire from our surroundings can sometimes be harmful to us. The majority of *E. coli* associated illnesses are acquired by eating contaminated food, but contaminated drinking water or water swallowed while swimming is another source.

The presence of *E. coli* in swimming areas means that other disease-causing microorganisms may be present as well. What makes people sick is often these other organisms, not *E. coli* itself. Health symptoms linked to swallowing water contaminated with bacteria range from no ill effects to cramps and diarrhea (gastrointestinal distress). Two common waterborne diseases are giardiasis and cryptosporidiosis; both cause intestinal illness. The *E. coli* variant known as O157:H7, made famous in several meat contamination cases, has also been associated with drinking contaminated water and can cause severe intestinal illness.



DEP file photo.

Pennsylvania uses a two-tiered system of advisories for Lake Erie beaches, consistent with other Great Lakes states. A swimming advisory is issued if the counts exceed an *E. coli* density of 235 colony-forming units (CFU) per 100 milliliters (ml) of water, but less than 1,000 CFU/100 ml. At this density, people can use their own discretion whether they swim or not. A restricted swimming advisory, where people are not allowed to enter the water, is issued if the counts equal or exceed 1,000 CFU/100 ml.

## Where does *E. coli* come from?

In surface waters, *E. coli* presence is attributed to fecal contamination from agricultural lands and other urban and residential areas. Fecal contamination can come from untreated sewage or feces from animals such as wildlife, waterfowl (especially gulls), domestic pets, and farm livestock.

Bacteria counts in bodies of water tend to be highest just after storm events because rainwater runoff transports bacteria into the lake. During large storm events, water caught in storm drains may overflow into the lake before it can be treated at a sewage treatment plant.

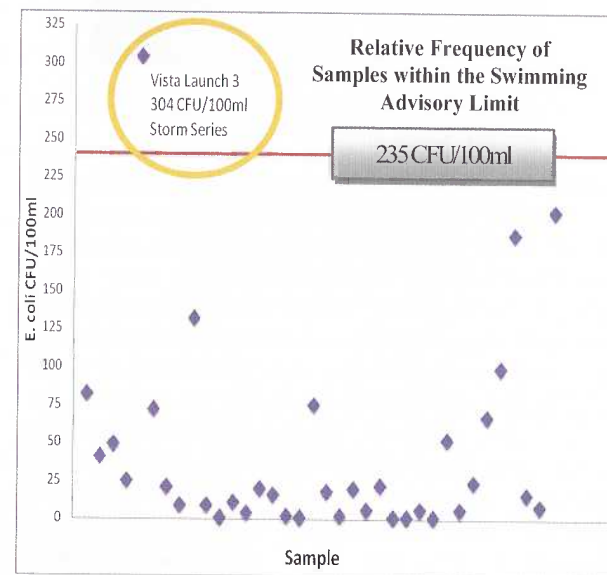
## Bacterial Water Quality Assessment of Presque Isle Bay

Federal and state regulations require testing and monitoring of public bathing beaches. There are no public beaches along Presque Isle Bay, and so, it is not routinely monitored for *E. coli*. The most recent bacterial water quality study done in the bay was the 2007 study by Dr. Jerry Covert and Nicole Phinney, both of the Regional Science Consortium, found that the *E. coli* levels of the Bay were within the accepted levels for swimming in

public waters.

The study was in response to a concern regarding an increase in public swimming area advisories at Presque Isle State Park and closures due to bacterial water contamination across the Great Lakes. These advisories and closures were issued on the basis of standards for concentrations of indicator microorganisms allowed in public waters in several states.

Water samples were taken during the month of August, 2007 from locations on both the City of Erie and Presque Isle State Parks sides of Presque Isle Bay. The sites on the City side were taken at the Erie Yacht Club, Liberty Park, Dobbins Landing, and the South Pier; the sites on the Park side were taken at the Vista Launch 3, Sturgeon Bay, Cookhouse Launch, Marina Lake, and at Perry Monument. A total of four sample sets were taken, two sets during dry periods and two sets following a storm series. The data were processed and statistically analyzed.



The relative frequencies of samples within the swimming advisory.

# Water Quality

Pennsylvania's Water Quality Network is a statewide, fixed station water quality sampling system. PADEP, in partnership with the Erie County Department of Health, has monitored the surface water quality of Presque Isle and the Pennsylvania waters of Lake Erie for over 20 years. Samples are collected approximately every other month from the same exact location, known as a Water Quality Network (WQN) station, allowing the evaluation of the impact of permitted discharges and the assessment of water quality trends. Two WQN stations are monitored in Lake Erie and one WQN is monitored in Presque Isle Bay on a bi-monthly basis, weather permitting. Water samples are collected and analyzed for nutrients and several metals. Other water quality parameters related to the health of the bay ecosystem such as dissolved oxygen, pH, water temperature, and the plankton community are also routinely monitored.

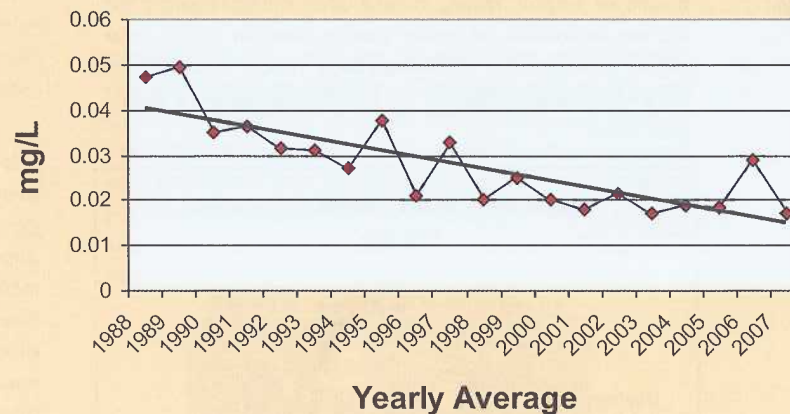
Overall, Presque Isle Bay's water quality has been and remains very good and within the limits established by PADEP's Water Quality Criteria to protect aquatic life and human health. This news is not unexpected considering the changes in the watershed over the last 30 years; particularly the evolution of the bayfront from an industrial to commercial and recreation center and the improvements made to the City of Erie's wastewater treatment, collection, and conveyance system. The following is a brief summary of WQN data collected between 1988 and 2007.

## Metals

Analyses of samples from the bay and open lake stations consistently included nickel, lead, aluminum, copper, and zinc. Arsenic, cadmium, and mercury were sporadically included in the analyses (i.e., less than ten samples since 1988). Of the metals analyzed, copper exceeded water quality criteria in the bay most frequently (8 of 128 samples or 6.3%). All of these samples were collected prior to 1999. Similar results are

seen in the open Lake samples where 9 of 108 or 8.3% of samples had copper concentrations above the water quality criteria.

## Total Phosphorous Trends Presque Isle Bay-WQN 632



## Phosphorus and Algae

Phosphorus is the most critical nutrient driving the bay's food web. It is the single most important fertilizer that grows the microscopic plants (phytoplankton) that form the base of the food web. Most of the phosphorus in the bay and Lake Erie is the result of human activities, such as municipal sewage discharges and runoff from agricultural practices in the watershed. Too much of this key nutrient leads to nuisance levels of aquatic plant and algae growth through over-fertilization.

The bay's existing plankton populations are at a concentration well able to support a healthy food web. In addition, nuisance growths of *Cladophora*, *Microcystis*, and other undesirable algae are not present in the bay. As expected, total phosphorus concentrations have been decreasing in both Presque Isle Bay and the

open lake during the last 20 years. The yearly average of samples are well below the 10 parts per billion target set for the central basin of Lake Erie in the Great Lakes Water Quality Agreement. Reductions in phosphorus loading to the bay as well as the zebra mussel invasion MAY both play a role in this decreasing trend.

## Oxygen

Another important indicator of ecosystem health is the amount of dissolved oxygen in the water. The central basin of Lake Erie is known for the seasonal separation of the water into an upper layer rich with trapped oxygen and lower layer without it. During the summer, dissolved oxygen concentrations can drop to levels that no longer support fish life, creating a "dead zone," which is isolated from the atmosphere.

The Presque Isle Peninsula marks the approximate dividing line between the central and eastern basins of Lake Erie. Unlike these basins, however, the bay does not stratify into a warmer upper lake and cooler lower lake in the summertime. Dissolved oxygen concentrations in the bay average between 4 – 6 mg/L throughout the water column in the late summer when concentrations are expected to be at the lowest levels. In the Lake Erie dead zone, dissolved oxygen levels are between 0 – 1 mg/L at the same time.

As a shallow embayment with an average depth of just over 13 feet, wind energy tends to keep the bay's water well mixed. This is evident by the uniformity in temperature moving down the water column. In addition, as a result of the bay's connection to Lake Erie via the entrance channel, water flows freely between the bay and the oxygen-rich waters of the upper layer of the open lake. Since the bay remains well mixed, adequate levels of dissolved oxygen are present throughout the entire water column to support fish and other aquatic life.



# Trophic State

Scientists who study lakes use the term "trophic state" to characterize how biologically productive a water body is, and recognize three categories along a continuum ranging from oligotrophic to mesotrophic to eutrophic. The least productive lakes are called 'oligotrophic'. These are typically cool and clear, and have relatively low nutrient concentrations. The most productive lakes are called 'hypereutrophic' and are characterized by high nutrient concentrations, which result in algal growth, cloudy water, and low dissolved oxygen levels. Mesotrophic is an intermediate trophic state with characteristics between the other two.

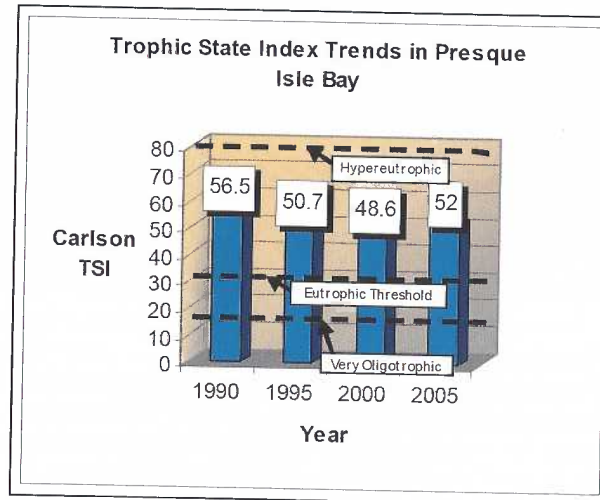


Image courtesy of visiteriepa.com.

Most natural lakes are destined to become shallower and more productive (more eutrophic) as they age and gradually fill. Some lakes are also naturally more eutrophic than others due to geological factors and the kinds of soils and vegetation that occur in their watersheds. Lake Erie is unusual in having three distinct basins (Western, Central, and Eastern) that become progressively deeper and naturally less productive (more oligotrophic) proceeding from west to east. Eutrophic lakes often have rich fisheries, since the higher nutrient levels work their way up the food chain to increase the quantity of organisms at the top. Since Presque Isle Bay is a relatively shallow enclosure along the shore of the lake, it has a natural tendency to be more eutrophic than the adjoining open lake.

The term eutrophication is applied to water bodies that experience *acceleration* of the natural aging/successional process. This results from human activities that increase "loading" of nutrients or organic matter, which can lead to undesirable overgrowth of aquatic plants and/or algae and seasonal exhaustion of dissolved oxygen concentrations in the water column.

The Trophic State Index (TSI) is a tool developed by lake scientists to gauge where a lake falls on the continuum of trophic states, based upon measurements for various indicators of water clarity, nutrient levels, and algae abundance. TSI values may range from 20 for very oligotrophic lakes to 80 for "hyper" or very eutrophic lakes.



The trophic state of Presque Isle Bay has changed over time. In 1990, the TSI was 56.5, solidly in the "eutrophic" category. With the elimination of combined sewer overflows and the invasion of zebra mussels, this score dropped progressively during the 1990s resting at a low of 48.6 in 2000, the upper end of the "mesotrophic" range. However, the most recent TSI result determined in 2005 was a score of 52, placing it again in the low eutrophic range.



Image courtesy of visiteriepa.com.

This score indicates that the bay has good biological productivity and, as local anglers know, supports a good fishery. The TSI score also signifies that the balance of nutrients in the bay is good and needs to be maintained. Increases or decreases in the concentrations of nutrients from stormwater runoff or as a result of other pollution could change that balance and have negative consequences on the ability of the bay to support aquatic life.

## What activities cause eutrophication?

Since eutrophication is increased nutrient input, any activity in the watershed of a lake that increases nutrient input causes eutrophication. Nutrients like phosphorus are found naturally in tributaries and run-off waters. Contributions from sewage treatment plant effluent, agricultural runoff, and industrial processes can speed up eutrophication.

Other activities that contribute to eutrophication are lawn and garden fertilizers, faulty septic systems, erosion, dumping or burning leaves.

# The Presque Isle Bay Fishery

Presque Isle Bay is among the most diverse and productive fisheries in Pennsylvania. The bay owes much of its fish diversity to the unique habitat formed by the Presque Isle peninsula.

Based on surveys by the Pennsylvania Fish and Boat Commission (PFBC) and the PADEP, 54 species of fish have been documented in the bay. Many rare and unique species of fish live in the bay, including "living fossils" like bowfin (locally known as "dogfish") and gar. Five of these species (bigmouth buffalo, eastern sand darter, Iowa darter, warmouth, and spotted gar) are listed as endangered in Pennsylvania. One species, spotted gar, occurs nowhere else in the Commonwealth outside of Presque Isle Bay.



*Spotted gar, DEP file photo.*

The bay supports a very popular sport fishery. Although most anglers indicate that they fish for "anything that bites," the most sought-after game fish include yellow perch, largemouth bass, "sunfish," and steelhead. The Presque Isle Bay fishery is truly a year round phenomenon. In the spring, the bay offers trophy fishing opportunities for northern pike, muskellunge and migratory springtime smallmouth bass from Lake Erie. During both the spring and fall, anglers target bass, northern pike, and steelhead. During the cold winter months the bay supports one of the most popular and productive ice fisheries in Pennsylvania.

Perch are among the first fish to spawn in the spring, when they attach their sticky egg masses to submerged aquatic plants. Spring water level fluctuations can greatly impact the reproductive success of yellow perch in any given year. Over the past twenty years, the number of perch caught during PFBC surveys has stead-

ily decreased.

The Pennsylvania waters of Lake Erie, including Presque Isle Bay, are subject to PFBC's "big bass" regulation, imposing 15" minimum size limit and four fish daily creel limit on black bass (smallmouth and largemouth bass) catches. Largemouth bass populations seem to be responding well to this regulation and anglers are seeing an increase in the number of larger fish. According to Presque Isle State Park officials, over 30 bass tournaments are held in the bay each year.

Sunfish, including crappie, bluegill, and pumpkinseed, are also found in the bay. Crappie and pumpkinseed populations appear to be on the decline as a result of habitat and food alterations caused by zebra mussels and predation from round goby. However, these habitat changes appear to have favored bluegill, as they are the most common sportfish collected in PFBC trap-nets.



*Largemouth bass, DEP file photo.*

The most abundant fish populations are minnows and other small forage fish. Brook silverside, quite abundant in the bay, is actually a state endangered species that is relatively uncommon outside of Presque Isle Bay. The SONS of Lake Erie operate a cooperative fish hatchery on the Erie Waterworks property at the foot of Chestnut St. The SONS rear yellow perch and walleye, both native species, for stocking in Presque Isle Bay. In 2006, they stocked 800,000 walleye fry and 1,000,000 yellow perch fry into Presque Isle Bay.

While the routine trapnet surveys by the PFBC provide some measure of the bay's fish diversity, several species of fish are no longer found. Species such as stone-

cat, golden redbreast, and white bass that were frequently collected during previous sampling efforts have not been seen since 1991. These changes coincided with the habitat changes brought on by the establishment of zebra mussels.



*Northern pike, DEP file photo.*

## A Potential Threat to the Bay's Fishery

While there have not been any reported incidents yet, Presque Isle Bay is vulnerable to a disease sweeping across the Great Lakes. VHS, or Viral Hemorrhagic Septicemia, is one of the most serious diseases of fin fish. While not a threat to humans, this virus is known to affect nearly 50 species of fish, 28 of which are found in Lake Erie. A new, non-native strain of VHS was first documented in the Great Lakes in 2005 when it caused a large kill of freshwater drum (sheepshead). In response, the US Department of Agriculture's Animal and Plant Health Inspection Service (APHIS) issued an emergency order prohibiting the export of 37 species of live fish from any Great Lakes state in October 2006. In January 2007, the PFBC issued an emergency order prohibiting the transfer of live fish outside of

Pennsylvania's Lake Erie watershed. Permanent rulemaking to this effect went into effect January 1, 2008.



# Eat fish, but choose wisely!

## Fish Consumption Advisory

Beginning in the 1980s, the local community including organizations like SONS of Lake Erie and the Erie County Environmental Coalition advocated for public information on the health impacts of eating local fish. Initially "eat or don't eat" advisories were issued which later changed to become more specific, listing recommended amounts of fish to eat. PADEP has collected information on the level of contaminants in fish tissue since 1979.

PADEP regularly tests species of sport fish from Presque Isle Bay and Lake Erie. Many of these fish are contaminated with persistent, bioaccumulative, toxic substances like mercury and polychlorinated biphenyls (PCBs). Mercury and PCBs are considered to be critical pollutants in Lake Erie and have triggered public fish consumption advisories in the bay and throughout the lake. The Pennsylvania advisories are developed through a partnership of the Fish and Boat Commission and the departments of Environmental Protection, Agriculture and Health.

Prior to being banned from production in 1979, PCBs were widely used in electrical transformers, and in other products like cutting oils, adhesives, paint additives, inks, and fire retardants. PCBs break down very slowly (or "persist") in the environment for long periods of time. They can be transported long distances by wind or through water, and are found even in the most remote corners of the earth. Potential health effects range from immune system suppression to reproductive problems to cancer.

Mercury is a naturally occurring element found in many rocks, including coal. When coal is burned for heat or power production, mercury is emitted into the air. Most people are actually exposed to mercury as a result of the fish they eat. That's because the mercury pollution in the air eventually settles onto the land and then washes into the water. Therefore, the source may be many miles away from the affected waters. Once in

the water, microscopic bacteria convert the mercury into a highly toxic form known as methylmercury. Toxic methylmercury builds up in the fish and shellfish—and in the people that eat them. Methylmercury poses the greatest risk to the developing brain and nervous system of fetuses, infants, and young children.

The level of contaminants in Lake Erie fish varies depending on the particular species, the food that it eats, and its size and age. In general, large, long-lived top predators, especially fatty predators like lake trout and steelhead, tend to have the highest levels of contaminants in their flesh. On the other hand, smaller, leaner fish such as yellow perch tend to have lower levels of contaminants.



*Yellow perch, DEP file photo.*

## Benefits of Fish Consumption

It's important to remember that fish are high in protein, heart-healthy omega-3 fatty acids, and other nutrients important to good health. In an effort to balance the benefits of eating fish with the risks posed by contaminant ingestion, consumers should eat fish, but select species that have lower levels of contaminants.

The most restrictive consumption advisories for bay fish are based on the presence of PCBs in several species. The current advisory recommends no more than 1 meal per month of the following fish species: smallmouth bass, northern pike, white perch, freshwater drum (sheepshead), bowfin (dogfish), carp, coho salmon, and steelhead (rainbow trout).

## Trends

There are a few discernable trends in tissue contaminant burdens in the bay species analyzed. One noteworthy trend, however, is a decrease in mercury in largemouth bass. As a result, the consumption advisory for this species was reduced from 2 meals per month to 1 meal per week.

## Comparison to Lake Erie Fish

Several species of fish are common to both the bay and the open waters of Lake Erie (e.g., smallmouth bass, white perch, yellow perch, and freshwater drum). Consumption advisories for these species are now no more restrictive in the bay than in the open waters of the lake. An analysis of yellow perch, a popular sport fish with no specific consumption advisory, revealed that levels of mercury and PCBs in bay perch are no different than in Lake Erie perch.

Trimming away the belly meat and any dark lines along the sides or back of the fish can reduce your risk of exposure to many contaminants in fish since many environmental contaminants tend to build up in the fat. Mercury, however, binds to the meat itself and can't be trimmed away with the fat. Therefore, it's important to follow the specific fish consumption advisories for Presque Isle Bay and for all other waterways.

## For More Information

In Pennsylvania, it is recommended that consumption of sport fish caught in the state's waterways be limited to one, half-pound meal per week. However, certain species have more restrictive consumption advisories or shouldn't be eaten at all. Detailed consumption Advisories can be viewed on-line at <http://www.depweb.state.pa.us>  
DEP Keyword: Fish Advisories.

# Invasive Species: Who is here now?

Presque Isle Bay is home to 54 species of native fish as well as crustaceans, mollusks, amphibians, and reptiles. This delicate ecosystem, however, has been threatened since the 1800s by polluted stormwater run-off as well as untreated industrial, commercial, and residential wastewater escaping from combined sewer overflows and discharging into the bay. While great strides have been made to remove and mitigate these human sources of pollution, the bay became a target for another dangerous type of pollution: biological pollution in the form of aquatic invasive species (AIS). AIS are non-native or alien species whose introduction causes or is likely to cause economic or environmental harm, or harm to human health.

Beginning in the early 1900s, these foreign invaders began to call Presque Isle Bay home, and the numbers continue to rise. Today there are more than 160 documented invasive species in the Great Lakes, and scientists predict one to two new species will be introduced every six to eight months. These species arrive primarily through shipping. Until 1825, when the Erie Canal was completed, Niagara Falls acted as a natural barrier to invasive species. It was the construction in 1829 and later deepening of the Welland Canal in 1921 that by passed Niagara Falls and allowed for the passage of larger ships. The canal also opened the door for invasives like the sea lamprey, rainbow smelt, and gizzard shad to enter into Lake Erie and Presque Isle Bay.

More recently, discharges of ballast water from ocean-going freighters have introduced a host of invaders into the Great Lakes. The shipping industry is one of the primary pathways for long distance movement of aquatic invasive organisms, particularly from the discharge of ballast water. Ballast water is the most prominent vector for invasive species in the Great Lakes, including some of the most destructive invasive species: the round goby and zebra and quagga mussels, which were carried over in shipping vessels from the Black Sea. All of the following invasive species

have had a profound effect on the bay's habitat and fishery.

Presque Isle Bay has been invaded by species of fish, mollusks, crustaceans, reptiles, and plants. Some of the earliest Bay invaders include those that were introduced as aquarium plants, such as Eurasian watermilfoil.



*Eurasian watermilfoil, DEP file photo.*

## **Eurasian watermilfoil**

Eurasian watermilfoil was collected in Presque Isle Bay for the first time in the 1950s. It is an aggressive plant that competes to displace and reduce the diversity of native aquatic plants. It can spread quickly with the ability to reproduce by fragmentation; even the

smallest piece of material could float downstream and form into a new plant. Eurasian watermilfoil has less value as a food source for waterfowl than the native plants it replaces. It also forms dense mats of plant material that restrict swimming, fishing, and boating.

## **Sea Lamprey**

The sea lamprey is a primitive fish that uses a suction-cup mouth to parasitize its prey. Its introduction, combined with water pollution and overfishing, resulted in the decline of lake trout and other native species populations. The sea lamprey, however, provides a successful story for control. Beginning in the late 1950s, sea lampreys were controlled by use of a lampricide, a chemical agent



*Sea lamprey, DEP file photo.*

that kills larval lampreys in their stream habitats. As a result, commercial fisheries have shown some recovery,

the sea lamprey's impact on native fishes has been reduced, and it is now fairly uncommon to see a lamprey in Presque Isle Bay.



*Zebra mussel, left; Quagga mussel, right, DEP file photo.*

## **Zebra and quagga mussels**

The zebra mussel was discovered in Presque Isle

Bay in 1989, and following not too far behind was its cousin, the quagga mussel in 1994. The filter feeding habits of these invasive mussels deplete vital plankton populations from the base of the aquatic food web, affecting water clarity and aquatic plant growth through their tremendous water filtering ability. They cause harmful algal blooms, facilitate bioaccumulation of toxins, and deplete native mussel populations. These mussels also clog intake pipes at power and water facilities, costing Great Lakes water users millions of dollars in monitoring and control costs yearly. Additionally, in Presque Isle Bay, the loss of 12 of the original 17 native mussel species is attributed to zebra mussel colonies.



*Round goby, DEP file photo.*

## **Round goby**

In 1996, a small fish known as the round goby was introduced into Lake Erie and by 2000 had established reproducing populations in Presque Isle Bay. Round gobies are aggressive and voracious feeders. They feed on

native fish eggs, reducing native fish populations, defend spawning sites used by native fish, and are a nuisance to fishermen in Presque Isle Bay, as they will aggressively steal bait from hooks. They are also extremely rapid reproducers. They can spawn several times in one season, producing 300-5,000 large eggs per year.



# Invasive Species: Monitoring efforts

Preventing the introduction of invasive species is the first line of defense against invasions; however, even the best prevention efforts will not stop all invasive species introductions. Early detection and rapid response efforts increase the likelihood that invasions will be addressed successfully while populations are still small and localized. There are currently two important monitoring efforts taking place in Presque Isle Bay: the Pennsylvania Zebra and Quagga Mussel Monitoring Network and the Hemimysis Monitoring Network.

The Pennsylvania Zebra and Quagga Mussel Monitoring Network is a state-wide joint effort between PADEP and Pennsylvania Sea Grant to monitor and track the distribution of invasive mussels in Pennsylvania's waterways. When new infestations are found, nearby power companies and water utilities are advised to take precautions to avoid intake pipe fouling. The Hemimysis Monitoring Network is a basin-wide effort to monitor for the latest invasive species to enter the Great Lakes, the Bloody Red shrimp (*Hemimysis anomala*). Pennsylvania Sea Grant is monitoring four

locations within Presque Isle Bay, and so far, there has been no sighting of the invasive shrimp.



Image courtesy of PA Sea Grant.

Partners from various organizations are also working together with the Pennsylvania Invasive Species Council to develop a model rapid response plan for Pennsylvania. Once this plan is developed and in place, agencies will be able to more efficiently coordinate and pool together resources when a new invasive species is detected.

## What can YOU do to help?

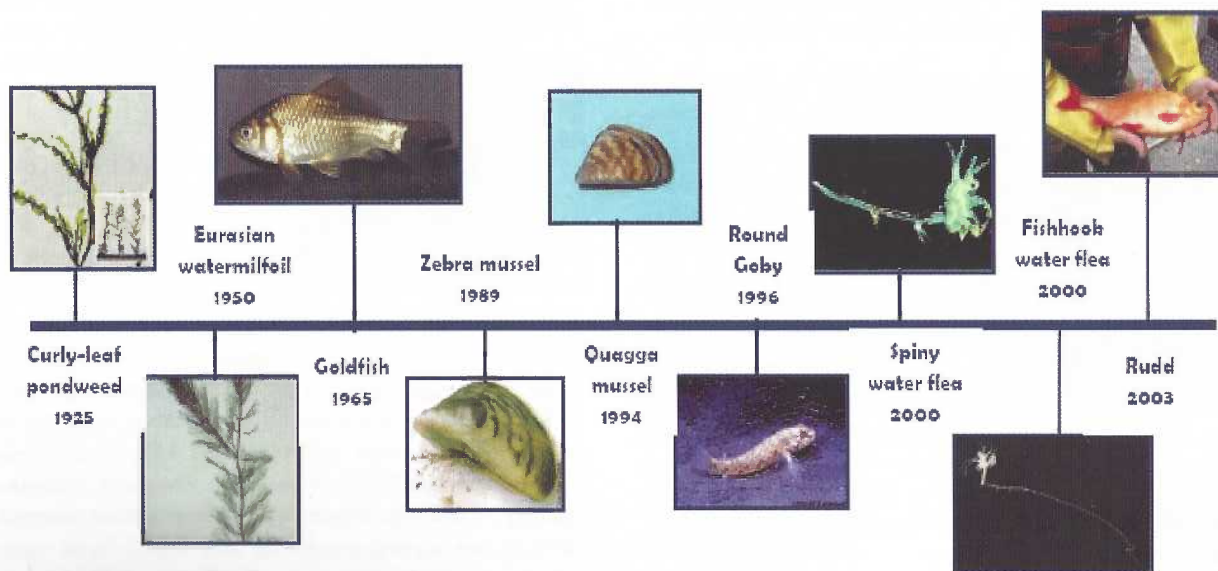
While ballast water discharges are the most prevalent vector for invasive species in the Great Lakes, intentional and unintentional spread by anglers and boaters is particularly important in Presque Isle Bay. Did you know that it's illegal to transport or release live zebra mussels, gobies, and certain other invasive species in Pennsylvania?



Image courtesy of PA Sea Grant.

Here are some steps you can follow to help protect Presque Isle Bay and other waters. When you leave a body of water:

- Inspect** your boat, trailer, and equipment and remove any visible aquatic plants, fish, animals, and mud.
- Drain** water from bait buckets, livewell, bilge, transom, and motor.
- Dispose** of unwanted live bait and worms in the trash.
- Spray/Wash** your boat, trailer, and equipment with high pressure or hot water before going to other waters.
- Dry** everything for at least five days.
- Report** immediately if you find anything suspicious.



# Public Access Partnerships

Presque Isle Bay has in large measure defined the economy and history of Erie since the 18<sup>th</sup> century. Beginning with a French military fort, the bayfront landscape has changed over time to support shipping, fishing, manufacturing, and commercial industries. The most significant transition has occurred in the last 20 years with the replacement of industry on the bayfront with commercial and recreational facilities. Removal of railroad tracks and the construction of the Bayfront Parkway in the late 1980s made the bay much more accessible to the public. The improving environmental quality of the bay also made it a more desirable place to visit.



*Public Fishing Platform. This new structure was placed at the East Canal Basin, and replaced an older platform in the West Canal Basin, where a transient boat docking facility was constructed. DEP file photo.*

Presque Isle State Park, which forms the northern boundary of the bay, offers many opportunities for the public to access the bay directly for fishing, boating, and other recreational activities. Access on the city side has increased significantly in the past ten years due to a number of public and private partnerships. Boat launch ramps, fishing piers, sidewalks around marinas and yacht clubs, and transient docks are a few examples of the projects undertaken by state and local partners such as the Pennsylvania Department of Conserva-

tion and Natural Resources, PADEP, Erie-Western Pennsylvania Port Authority, Pennsylvania Fish and Boat Commission, Pennsylvania Department of Transportation, and Pennsylvania Historical and Museum Commission. Organizations like the SONS of Lake Erie, as well as private citizens have supported the policy of public access throughout the development of the bayfront.

Federal partners, including the United States Fish and Wildlife Service, Federal Highway Administration, and National Scenic Byways Program, provided funding for parking spaces, multi-use trails, and other public access enhancements. The key source of public funding consistently supporting these efforts is the Coastal Resources Management Program administered by PADEP. Since 1978, this grant program, funded by the National Oceanic and Atmospheric Administration has invested more than \$1 million for public access enhancements along the bayfront. Grant recipients and their partners have matched that amount.



*South Pier adjacent to the Erie Channel. Benches, tables, and pavilions were placed here to allow visitors the opportunity to rest, eat and fish while enjoying the water. Parking lot improvements also included paving and the placement of landscaped islands. DEP file photo.*

The pooled resources of these partners have made more than 30% of the six miles of property that makes up the south shore of the bay available to the public for direct access to the water or other forms of recreation along the bay and its bluffs.



*Chestnut Street Boat Launch Ramp. The existing boat house was renovated and launch ramp improvements were made. DEP file photo.*



*Presque Isle State Park. Boat Launch improvements at the Marina included the lengthening of concrete pads and shoreline stabilization. DEP file photo.*



# Celebrating a Milestone of Progress

## Conclusion

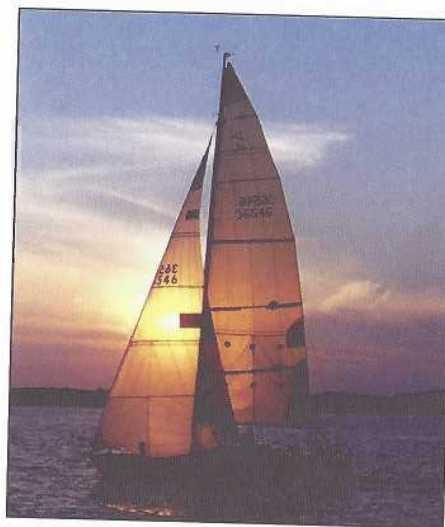
With the publication of this document, the citizens of Erie and Commonwealth of Pennsylvania celebrate a major milestone of progress, having achieved the goal of a "Swimmable Bay in 20 Years." Although Pennsylvania's portion of the Great Lakes ecosystem is small compared to other Great Lakes states, Erieites can be proud of the fact that the research and remediation activities completed here, as well as ecosystem health targets developed for our Area of Concern (AOC), are viewed as useful models for AOCs in other Great Lakes communities. We are fortunate to have skilled professionals and government agencies that actively advance the mission of protecting our natural resources. We also have been very well served by an engaged citizenry and individuals willing to donate time and talents to advance that goal.



*Bicentennial tower, courtesy of visiteriepa.com.*

Presque Isle Bay is a healthier ecosystem today than it was two decades ago, but the work of the PAC and its partners is not yet finished. We still face the challenges of reducing non-point sources of pollution of bay waters, keeping a close watch on the health of fish and wildlife, trying to curtail the onslaught of new invasive species, and maintaining an upward trajectory in sediment and water quality improvement. This work will require the continued involvement of concerned citizens, and the PAC invites any and all interested businesses,

individuals, and non-profit organizations to join the group. Contact Lori Boughton at the PADEP Office of the Great Lakes at 814-332-6816 to find out how you can get involved!



*Photo courtesy of visiteriepa.com.*

## Acknowledgements

Making Presque Isle Bay a safer water resource for people to enjoy would not have been possible without the dedicated efforts of many individuals and organizations that worked together get the job done. The Presque Isle Bay Public Advisory Committee acknowledges the work of individuals who provided leadership to this endeavor in the past: Peter Yeager, James Rozakis, Sr. Pat Lupo, David Sterrett, Kelly Burch, Dr. Rick Diz, and Richard Kubiak.

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