Good morning. It's a pleasure as well as a privilege to be here.

This morning I'll share with you the story of the human impact on the Great Lakes as told by the SOLEC indicators. It's not a new story but it does have some surprises.

Photo courtesy of PA DEP

As Mr. Anderson mentioned, I work with Pennsylvania's Department of Environmental Protection.

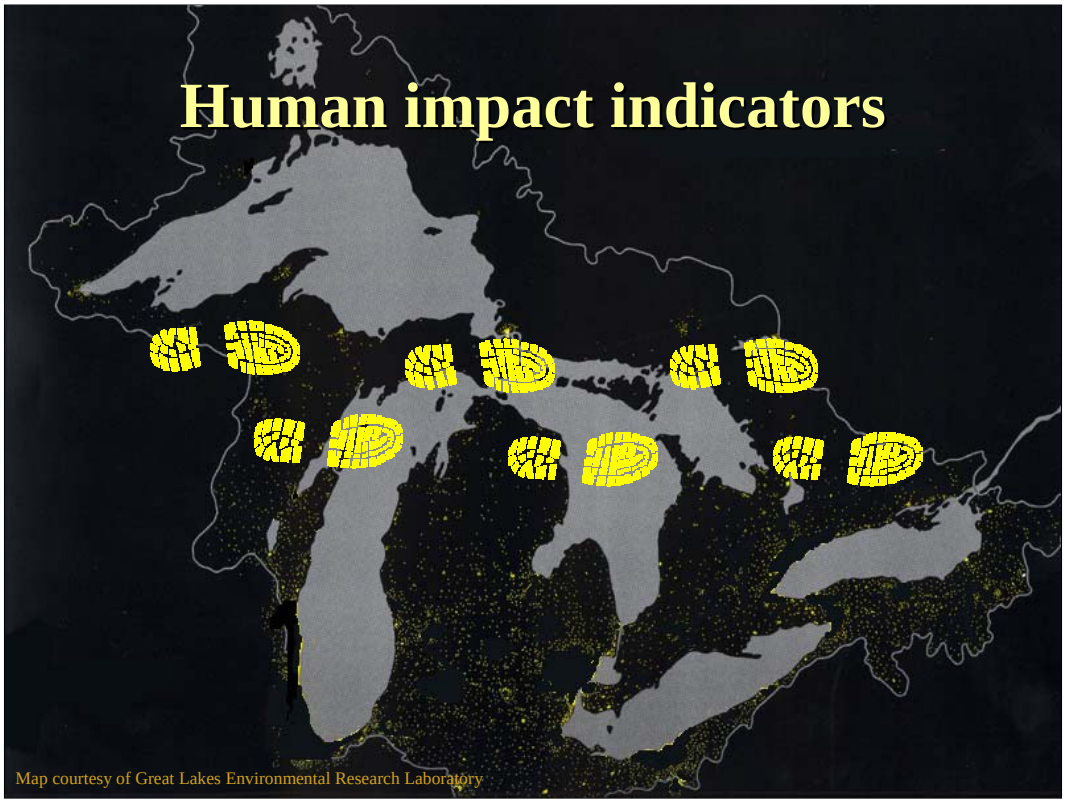
Not many people think of Pennsylvania as a Great Lake state. We have 43 miles of shoreline as the crow flies along Lake Erie – that's 63 miles if you use new math and count the Presque Isle peninsula that you see here.

Land use along our piece of the Great Lakes covers all bases – we have vineyards and farms, the City of Erie, industry, and two state parks – including our newest the Erie Bluffs.

About ¼ million people live in Pennsylvania's Lake Erie watershed.

In our microcosm of the Great Lakes, we've experienced many of the human impacts that I'm going to talk about today. We also face many of the same challenges with regard to managing our impact while continuing to grow as a region.

As is often said for Lake Erie, I think Pennsylvania is also the canary in the coal mine for gauging the human effect on the Great Lakes.



The Human Impact indicators help us to understand the effect of our interaction with the ecosystem. We are an important part of the ecosystem and they way we live has both positive and negative consequences for the creatures we share it with and its resources.

Dr. Rees spoke about the ecological footprint. **(click mouse)**

Now, just imagine that foot with a shoe on it. It could be a heavy-duty combat boot, a sneaker, or a delicate ballet slipper.

As we've seen it's not only the depth of the footprint but the foot size that has an impact as well. To further complicate things and take this analogy even further, imagine our impact as different kinds of shoes of all sizes.

So, what do the indicators say about the current impacts of human activities on the Great Lakes?

General overview

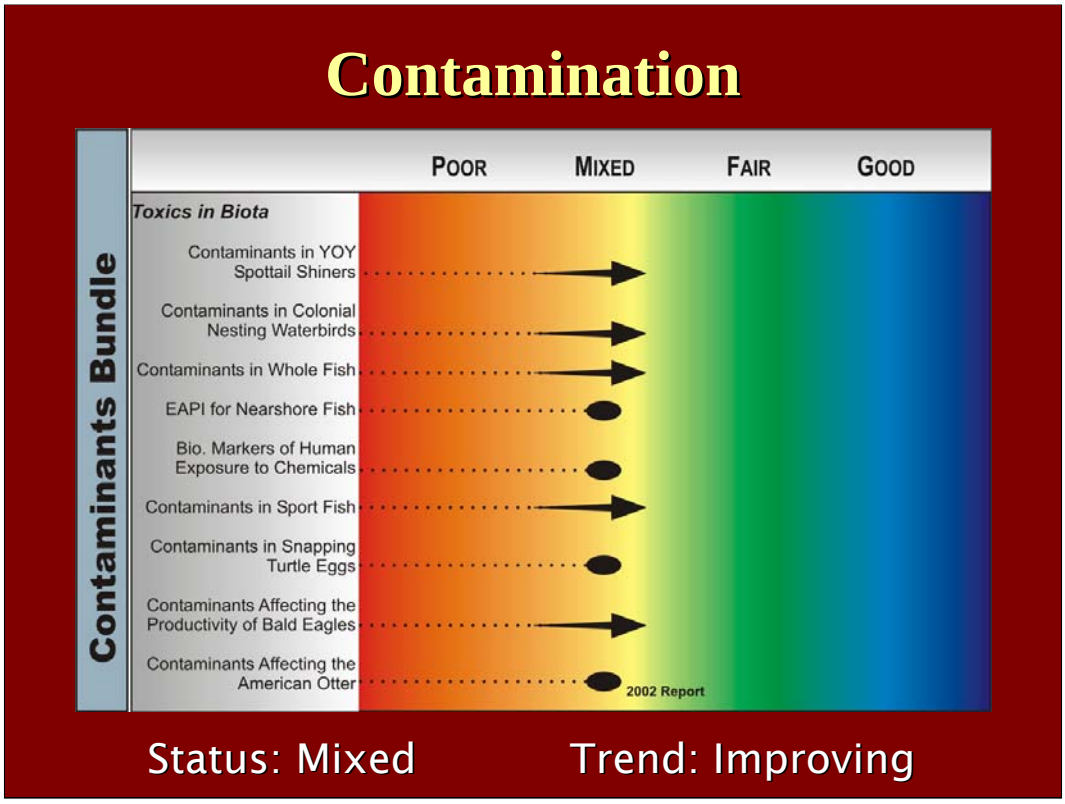
Photo courtesy of PA DEP

Well, this assessment is based on 40 indicators.

These indicators are grouped into three “bundles”: contamination, human health, and land-use/land cover.

There is some overlap with a few indicators like air quality showing up in more than one bundle. And there are several new indicators.

To tell the story of the human impact, I will share the experts overall conclusions for each of the three bundles and look at several indicators within each bundle to better understand what they are telling us.



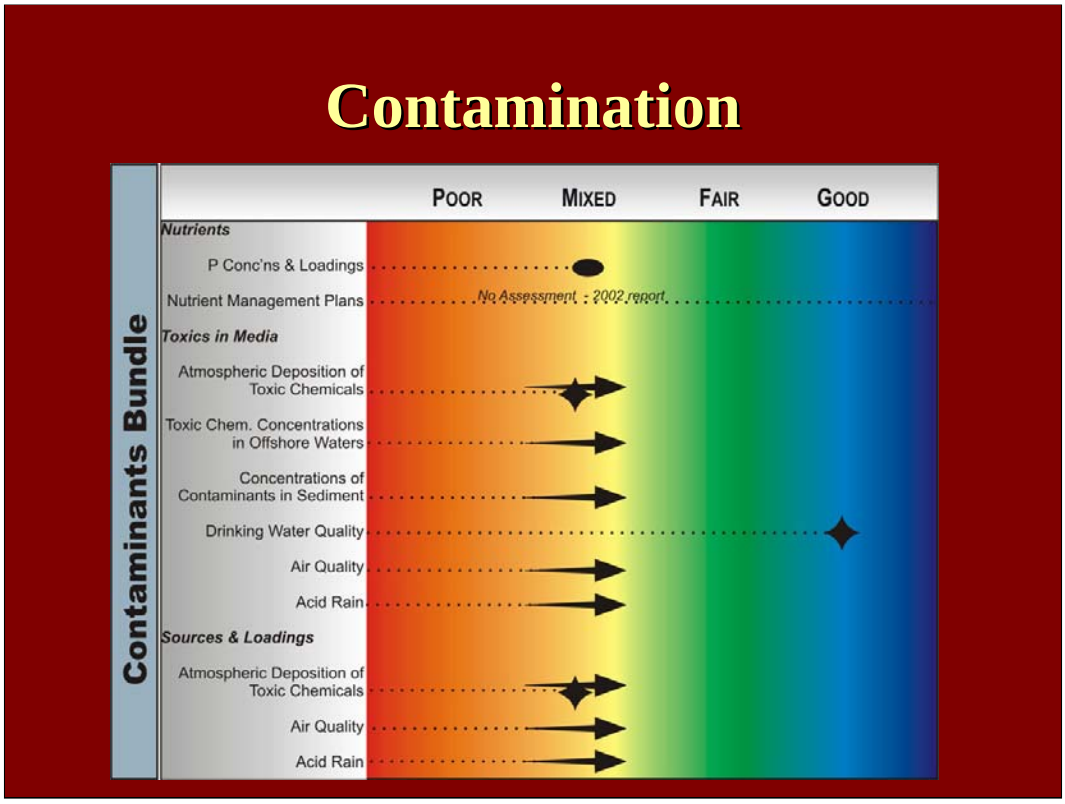
Here is the assessment of the individual contamination bundle indicators. This bundle looks at contaminants in Great Lakes fish and wildlife as well as concentrations in non-living media such as air, water, and sediment.

The current assessment of this bundle is mixed, improving.

The contaminant indicators suggest an overall improvement in the ecosystem from thirty years ago. There is a marked reduction in concentrations of toxics in most monitored media, and many indicator species demonstrate improvements.

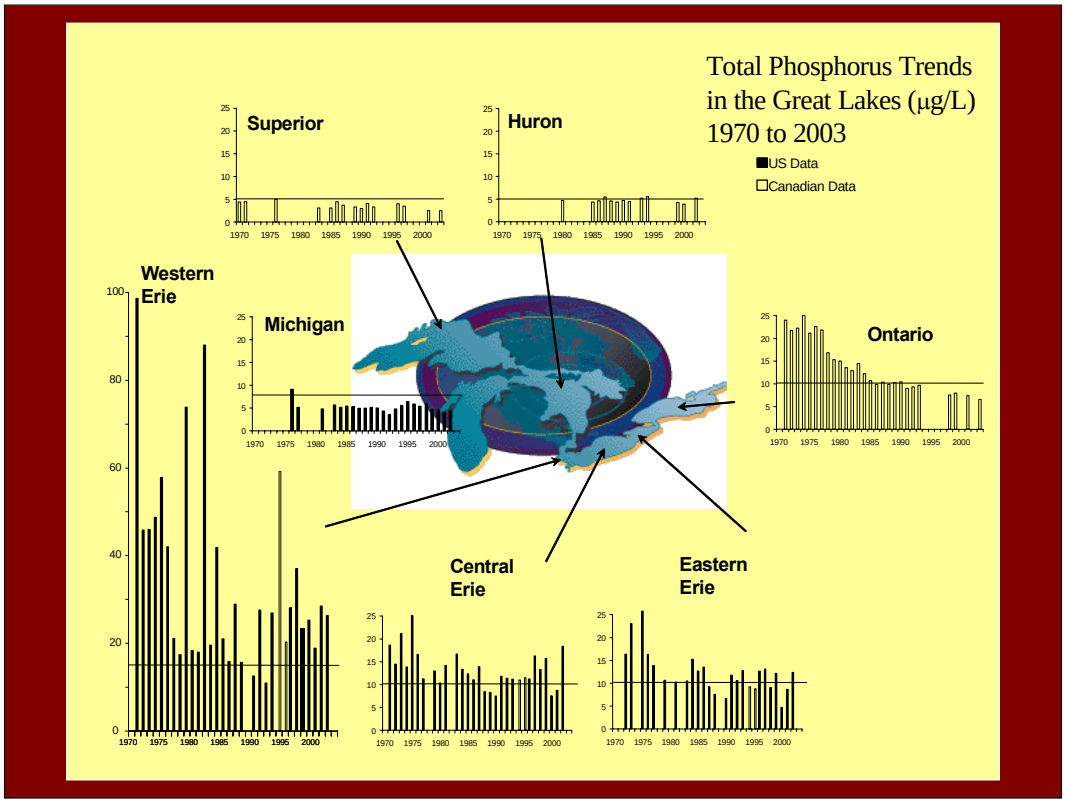
Management activities have resulted in the regulation of many sources of contaminants and the reduction of loadings of these contaminants into the Great Lakes basin.

Contamination



Although the overall health of the ecosystem shows signs of improvements, many ecosystem objectives have not yet been achieved.

Let's take a closer look at a few of the indicators to better understand this overall assessment.



Looking first at nutrients or more specifically phosphorus levels -

Efforts since the 1970s to reduced phosphorus loadings into the Great Lakes have been successful in maintaining or reducing nutrient levels, though some areas continue to exhibit concentrations above the guidelines established in the Great Lakes Water Quality Agreement.

As the graphs show, the average concentrations of phosphorus in four of the five Great Lakes have been at or below the established guidelines in recent years.

In Lakes Huron and Ontario, some offshore and nearshore areas and embayments experience elevated levels which could promote nuisance algae growths such as Cladophora.

Concentrations in Lake Erie's three basins fluctuate from year to year and frequently exceed guidelines. In Erie's western basin, concentrations of total phosphorus greatly exceeded the guideline in recent years. In the central and eastern basins, total phosphorus was more often above than below the guideline.

We've made great progress overall in decreasing the amount of phosphorus in the Lakes, but our growing population is expected to increase phosphorus loadings.

Aquatic food web indicators

Spottail shiner

Photo courtesy of Virginia Tech Department of Fisheries and Wildlife Sciences
Virtual Aquarium web site: Robert Jenkins Photographer

Photo courtesy of PA Sea Grant

Lake trout

Bald eagle

Photo courtesy of Tim Daniels ODNR

Turning to wildlife, many years of monitoring have given us a good understanding of the effect of contaminants that can bioaccumulate in the food web.

We've seen levels of PCBs, DDT and other pesticides decline dramatically in the food web since the 1970s, however, in many cases, levels still exceed health based criteria and/or guidelines.

Let's look more closely at three indicators assessing spottail shiners, lake trout, and bald eagles to get a clearer picture of contamination in the aquatic food web.

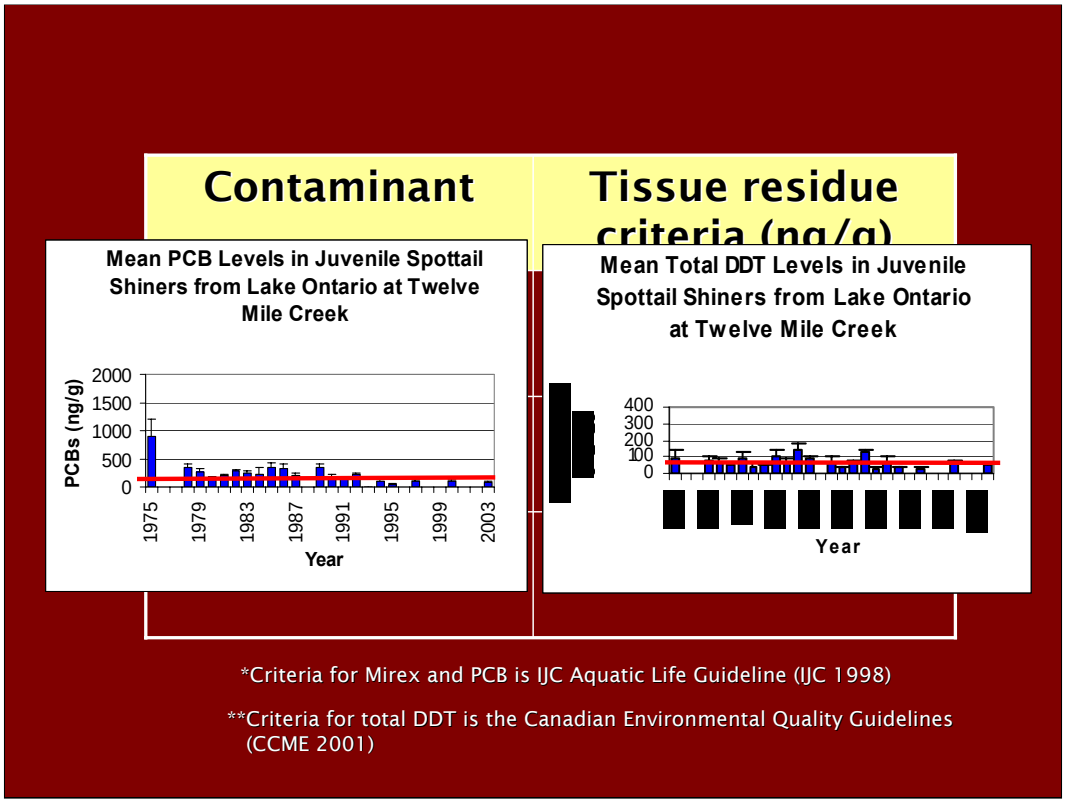
Spottail shiner

Photo courtesy of Virginia Tech Department of Fisheries and Wildlife Sciences
Virtual Aquarium web site: Robert Jenkins Photographer

Young of year spottail shiners are the lowest fish species on the food web monitored for contaminants.

The spottail shiner is common throughout nearshore waters of the Great Lakes.

Because their range is limited, any contaminants in these fish are thought to be bioaccumulated from their local habitat during their first years of life.

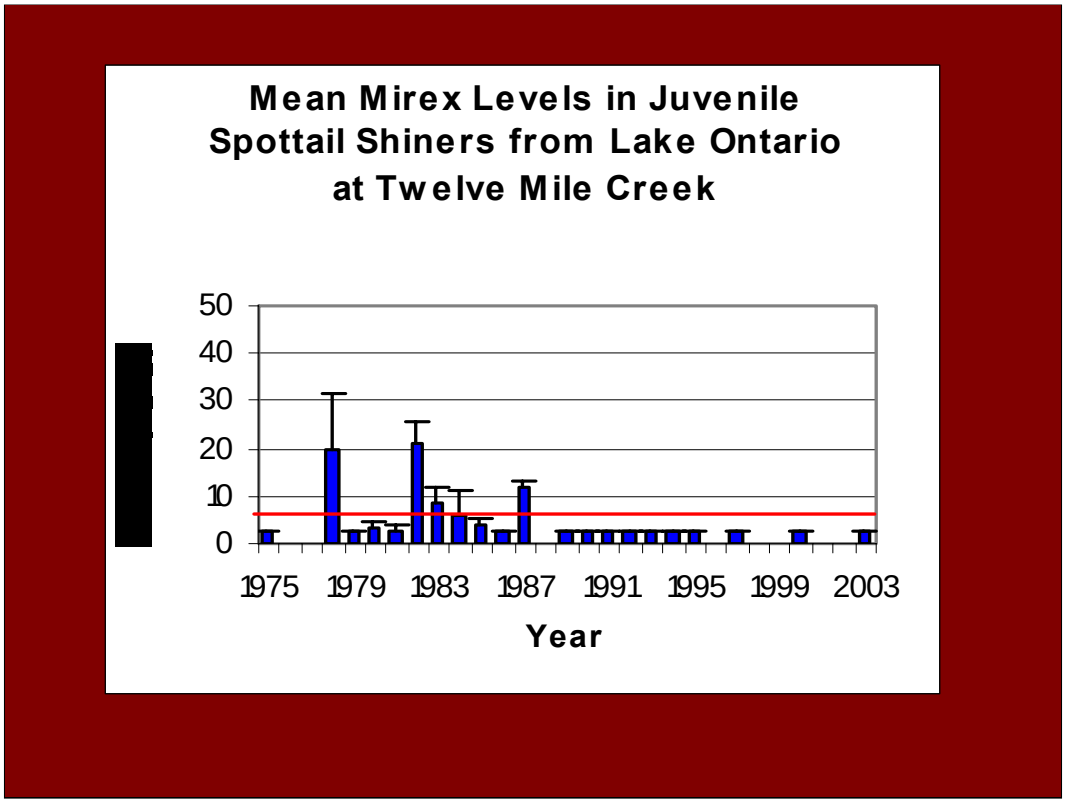


Guidelines for contaminant concentrations are based on the risk to fish-eating wildlife. Since the 2003 SOLEC report, more stringent guidelines – the Canadian Environmental Quality Guidelines – are being used for total DDT concentrations. The new guideline of 100 ppb is half that of the old.

At the 2002 SOLEC, PCBs were reported to be the contaminants most frequently found to fail the guideline. Total DDT, while detected, was found at concentrations below the existing guideline of 200 ppb.

(click) The graphs show the latest trends and data for PCBs and total DDT at Twelve Mile Creek, Lake Ontario. Data from other locations and lakes follow these basic trends. The red lines shows the wildlife protection guideline.

As you can see, concentrations of PCBs and DDT have continued to decline or remained the same over time in shiners. However, the new guideline was exceeded for DDT at most locations. Concentrations of PCBs were also at or slightly above the guideline in one or more locations in Lake Huron, Lake Erie, and Lake Ontario.



Mirex – an organochlorine pesticide – was detected only in Lake Ontario, where it exceeds the guideline.

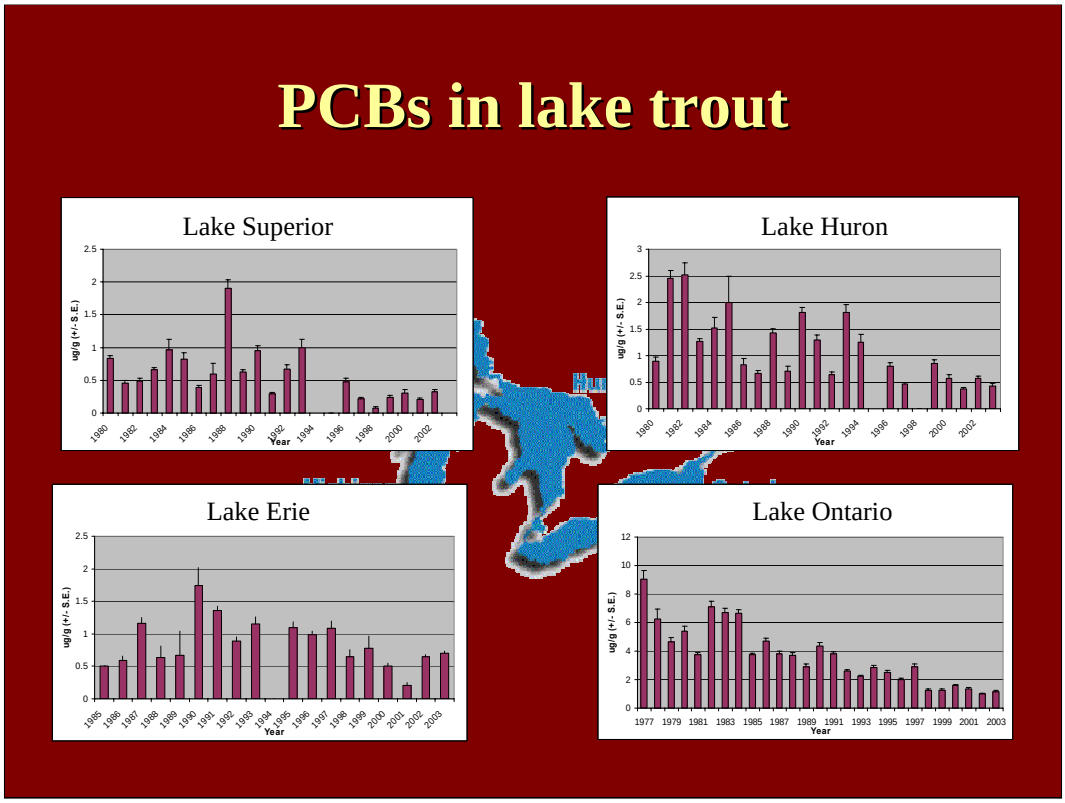
Overall, trends in each of the Lakes for organochlorines have been downward since the initiation of sampling in the mid to late 1970s.

While spottail shiners have been a useful indicator of contaminant levels in the past, this species is more difficult to find than it once was.

The cause of the population decline is not known but it does raise questions about influencing factors such as habitat issues or some larger Great Lakes issue that is having an impact.

Moving up, the concentration of contaminants in large, open water predator fish like lake trout and walleye can indicate the relative availability of the toxic contaminants in the food web on the scale of a whole lake or sub-lake basin.

To increase our ability to follow year-to year trends, fish of similar size or age are used in both the American and Canadian monitoring programs. Both programs look at the whole body concentrations of historically regulated contaminants such as PCBs, total DDT, and mercury.

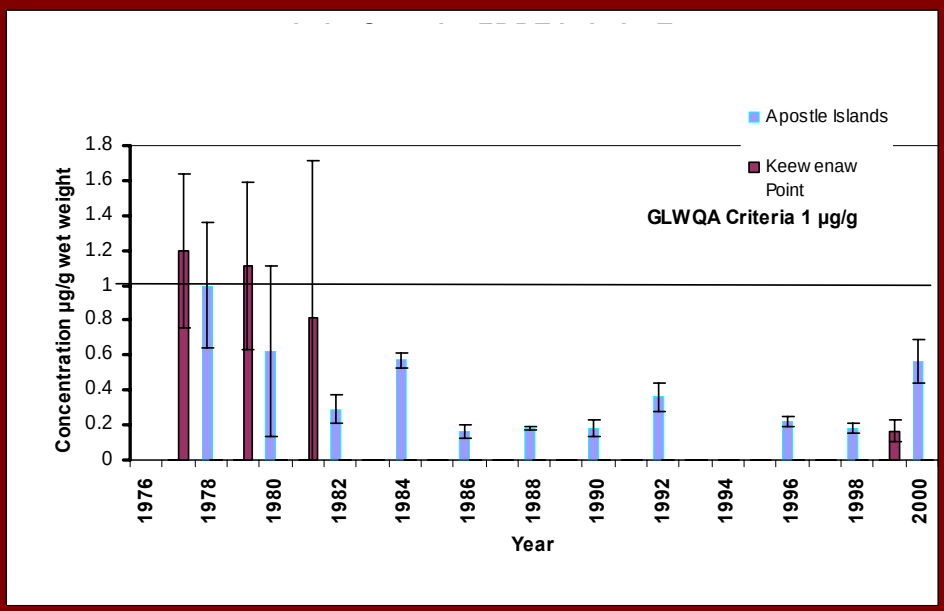


Here we see the most recent survey data and long-term trends in the concentration of PCBs in lake trout for four of the five lakes.

As the graphs show, total PCB concentrations have generally declined in lake trout. The same is true for other predator fish.

However, these lakewide averages remain above the Great Lakes Water Quality Agreement wildlife protection criteria of 0.1 ppm for whole fish in lakes. Some exceptions to this statement are smelt and Lake Erie lake trout collected by Canada's Department of Fisheries and Oceans.

DDT in Lake Superior lake trout



Total DDT concentrations have also declined in predator fish. The graph shows this trend for Lake Superior lake trout.

Only Lake Trout from Lake Michigan remain above the Great Lakes Water Quality Agreement wildlife protection criteria of 1.0 ppm for whole fish.

Lastly, I want to mention mercury. Mercury concentration trends vary from lake to lake. It is important to note that mercury concentrations have never exceeded the Agreement's wildlife protection criteria for whole fish.

Bald eagle

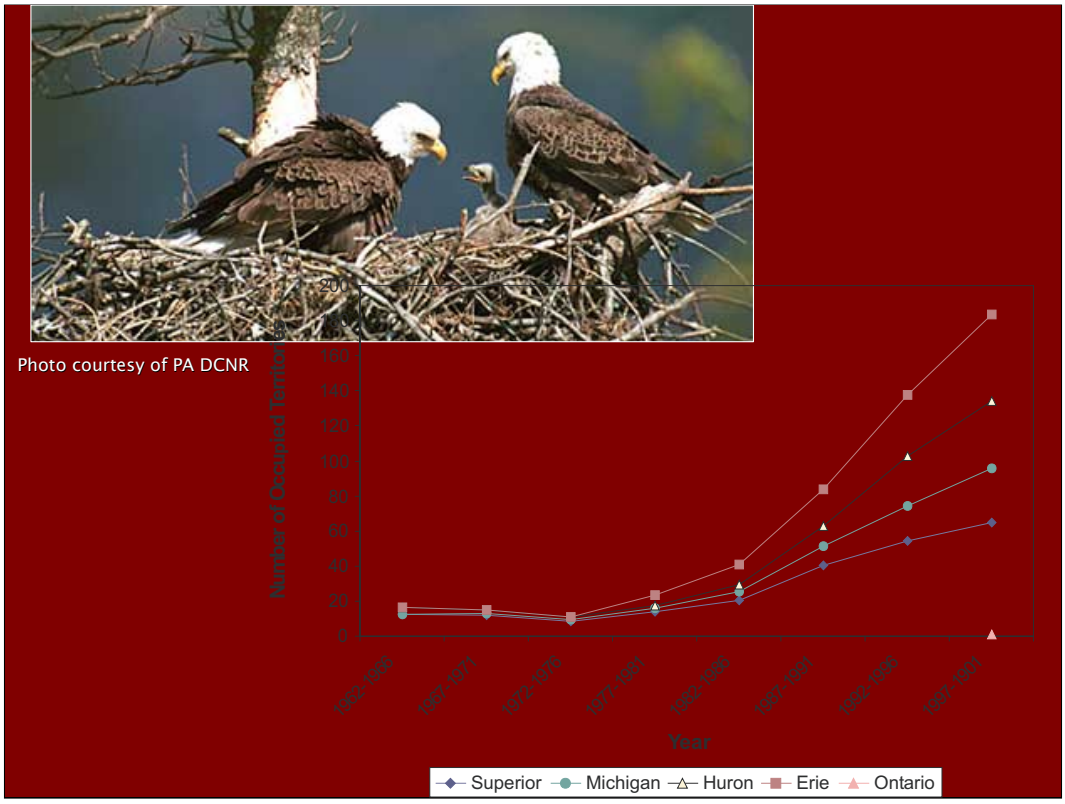
Photo courtesy of Forest County

Continuing to move up the food web, let's look at bald eagles. A true good news story.

Once bordering on extinction due to pesticides which contaminated their food sources, the resurgence of the eagle population is a great success.

This indicator is more of a population measure. But as the top avian predator in the nearshore and tributary areas of the Great Lakes, looking at the Bald Eagle tells us about contaminant stresses as well as something about habitat quantity and quality.

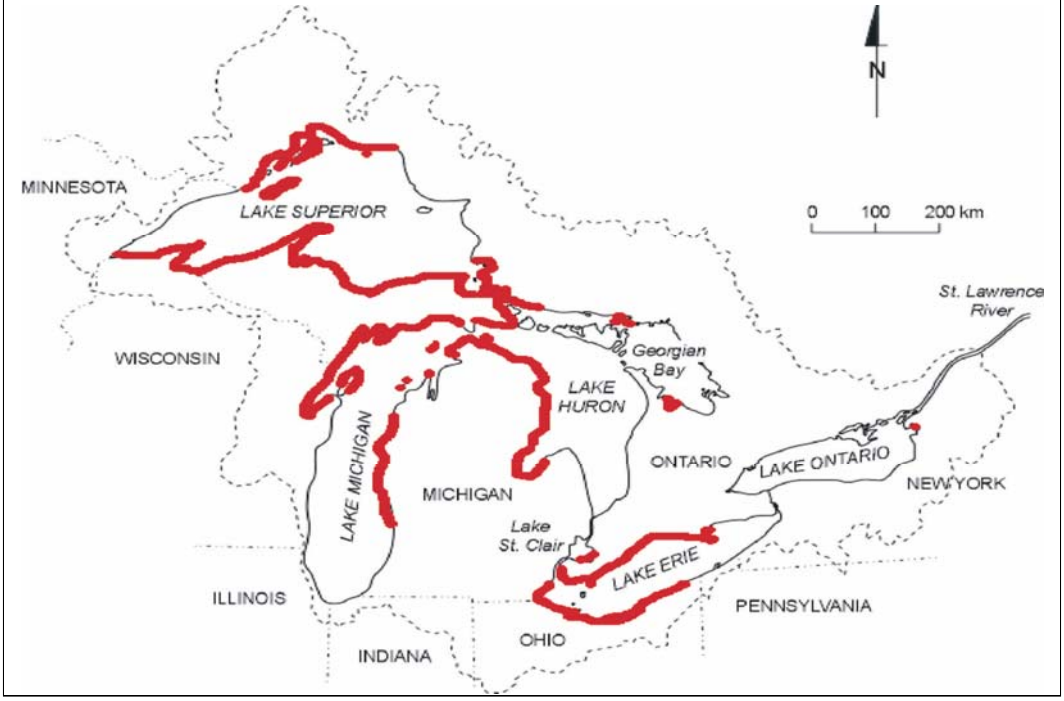
Data on reproductive rates in the shoreline populations implies that widespread effects of persistent organic pollutants – most notably DDE and PCBs – have decreased.



And, the number of active bald eagle territories has increased markedly from the depths of the population decline caused by DDE.

Established territories in most areas are now producing one or more young per territory indicating that the population is healthy and capable of growing.

Bald eagle shoreline distribution



As the red areas on the map indicate, bald eagles are now distributed extensively along the shoreline of the Great Lakes. Pennsylvania's portion of the Great Lakes supports two known eagle nests.

Relatively large habitat units are necessary to support eagles and continued development pressures along the shorelines of the Great Lakes constitute a concern.

However, continued expansion of Bald Eagle populations into previously unoccupied areas is encouraging and may indicate that there is still suitably undeveloped habitat available, or that the Bald Eagles are adapting to increasing alteration of the available habitat.

To understand how the contaminants get into the food web, let's take a quick look at sources and loadings.

Data for air, water, and sediment contamination shows that there has been significant progress in reducing both sources and loadings of most chemicals of concern in the Great Lakes basin.

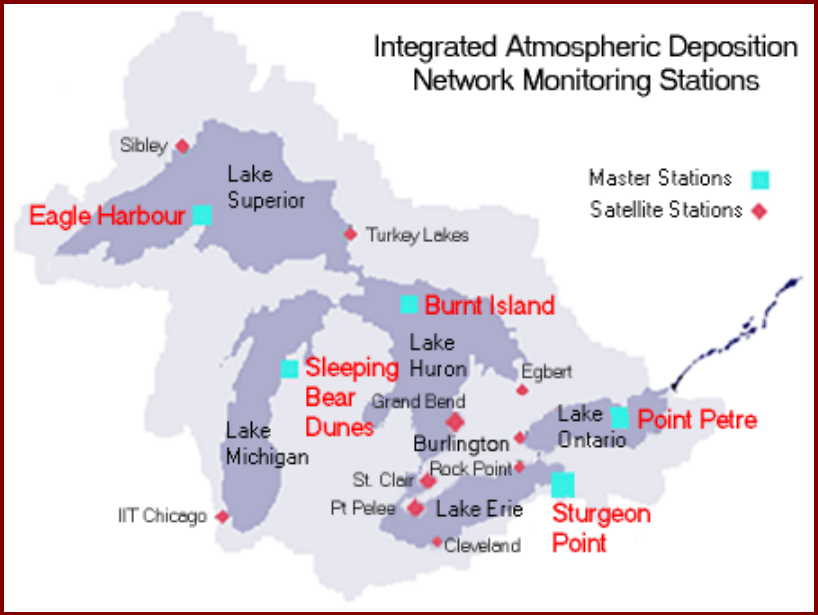
Collaboration between governments and the private sector has been largely responsible for source reductions of lead, sulfur dioxide and carbon monoxide.

Voluntary pollution prevention activities, technology-based pollution controls, and chemical substitution have aided in the reduction of toxic substances into the Great Lakes.

Conditions now are better than they were twenty years ago, though progress has not been uniform.

As you will see, our work is not done.

Atmospheric deposition

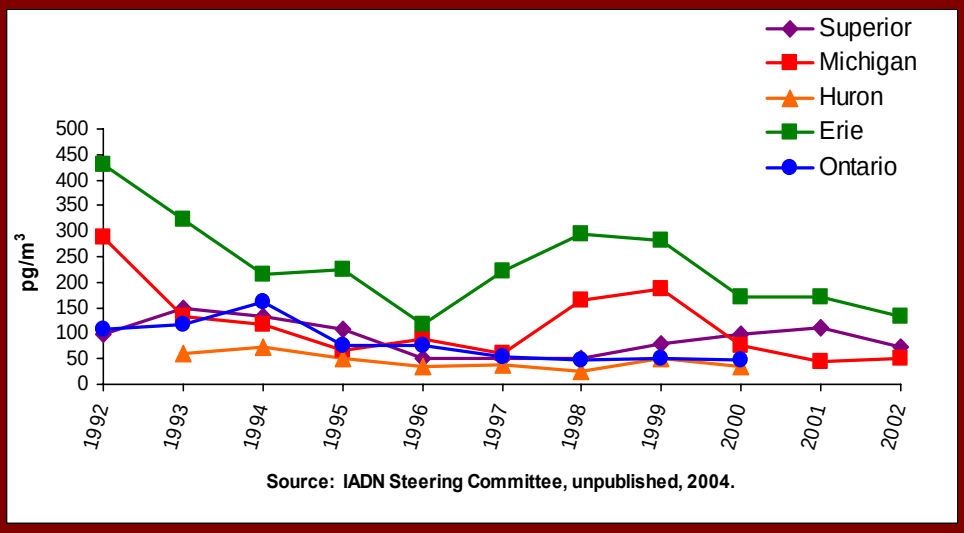


Let's take a quick look at air - the primary pathway by which persistent bioaccumulative toxics reach the Great Lakes.

Once they reach the lakes, they can and as we've seen do, bioaccumulate in fish and other wildlife.

Since 1990 five master sampling sites and several satellite sites have been recording concentrations of contaminants in the air and the atmospheric loading – which is the amount of pollutant entering the lakes from the air.

Gas phase concentrations of total PCBs



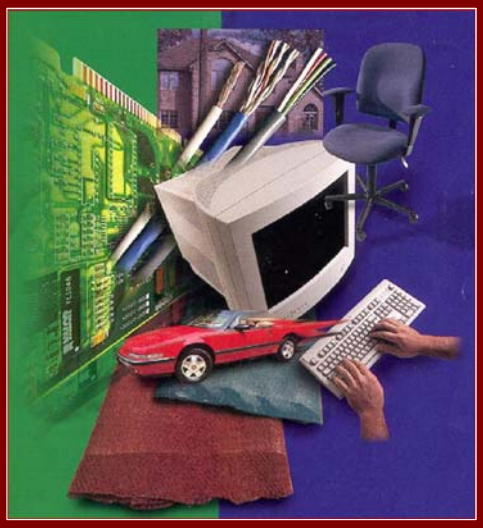
As we've seen reflected in the food web and shown on the graph, concentrations of PCBs are decreasing over time. PCB loadings are also continuing to get smaller. Likewise, concentrations and loadings of banned or restricted pesticides and concentrations of dioxins and furans continue to decrease over time.

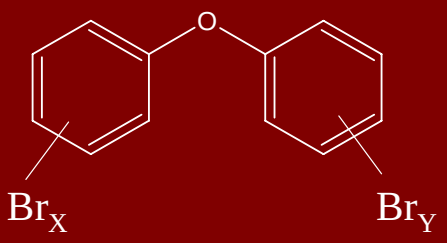
PAHs and total gaseous mercury concentrations have, however, remained relatively stable. Loadings of PAHs have remained constant over time which is consistent with the combustion sources of these chemicals.

Atmospheric deposition of toxic compounds to the Great Lakes is likely to continue into the future. Residual sources will continue to affect ambient concentrations.

Further reductions in emissions are necessary to address the concentrations and loadings of contaminants in the air.

PBDEs





While a lot of what you just heard is encouraging, the problem of toxic contaminants in the Great Lakes has not been resolved. I would be remiss if I didn't mention a growing concern regarding polybrominated diphenyl ethers or PBDEs.

This class of compounds is used in a wide variety of manufactured products. But probably best known for its use as a flame retardant.

It's chemical features are like PCBs. Although we have some evidence of their toxicity, we don't know how toxic these compounds are. We do know that they bioaccumulate and are resistant to degradation in the environment.

We also know that they are being found throughout the aquatic food web and in the air, water, and sediment.

The good news is that the largest manufacturer of the two PBDE compounds of most concern has voluntarily stepped forward and begun to phase them out.

Signs of recovery

- ✓ Continued ecosystem improvement
- ✓ Reduction in toxic contaminant concentrations
- ✓ Improvements in indicator species
- ✓ Reduction in toxic contaminant loadings

There were a lot of indicators we did not talk about in this bundle. But allow me to give you a general summary of where we are.

First, the good.

Analysis of contaminant indicators suggest an overall improvement in the ecosystem from thirty years ago.

There is a marked reduction in concentrations of toxics in most monitored media and species since the beginning of Great Lakes monitoring programs.

Management activities have resulted in the regulation of many sources of contaminants and, reduction of loadings of these contaminants into the basin.

More specifically, as we've seen this morning, levels of PCBs, DDT and other pesticides have declined in spottail shiners and lake trout. Bald eagle territories continue to recover.

Concentrations and loadings of organochlorines in air have decreased.

Signs of degradation

- Many ecosystem objectives not achieved
- Progress is disjointed
- Indicator species still have PBTs above guideline concentrations
- Phosphorus levels continue to exceed targets in Lake Erie and embayments

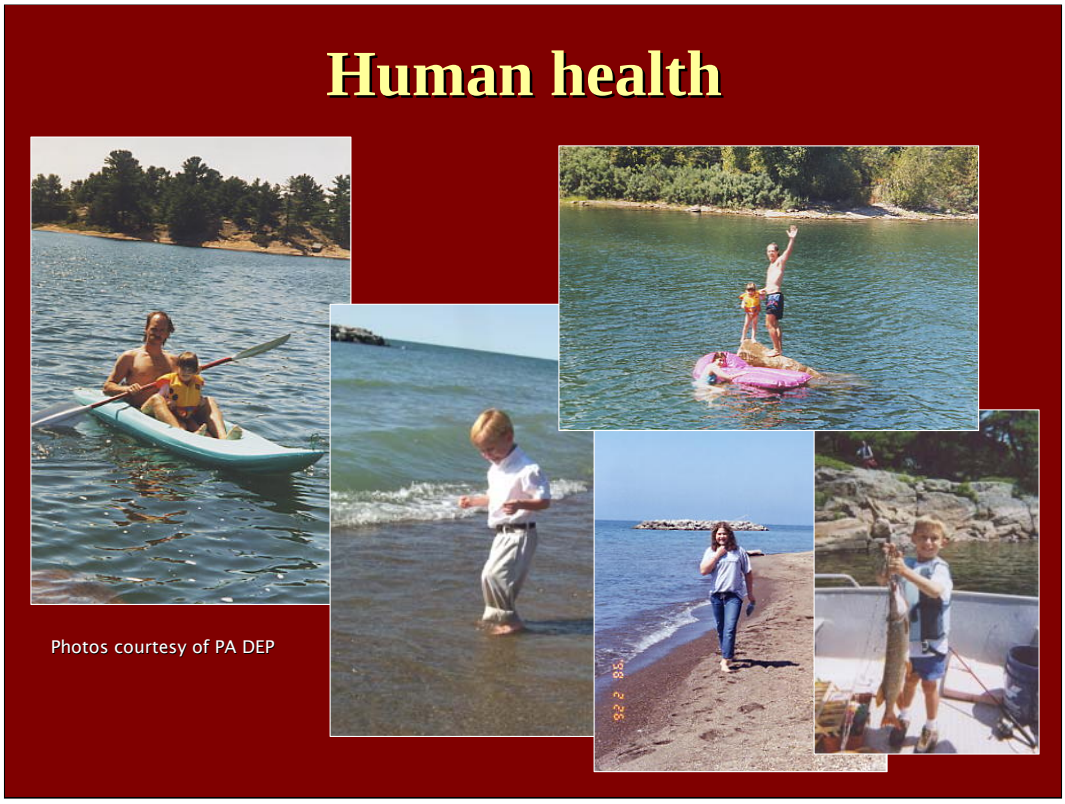
Now the not so good.

Although the overall health of the ecosystem shows signs of improvement, many ecosystem objectives have not been achieved.

The progress within the ecosystem is disjointed as various environmental and historical factors affect the ability for recovery. Many indicator species still display concentrations of persistent bioaccumulative toxics above established guidelines; and, concentrations of phosphorus within certain areas of the Great Lakes continue to exceed targets.

Additional factors will place future pressures on the ecosystem. Reductions in the emissions of contaminants are expected to decelerate as a result of population growth and urban sprawl.

Global conditions, such as climate change and long range transport, will illustrate the limits in the ability of one jurisdiction to effect change in isolation. And the pervasiveness of new chemicals of concern, like PBDE, are raising concerns as we grow to understand their effects on the health of the ecosystem and all of its inhabitants.



Now let's move on to the human health bundle of indicators.

These indicators address the fundamental questions people living, enjoying, and working in the Great Lakes basin ask:

Should I drink the water

Should I swim in the water

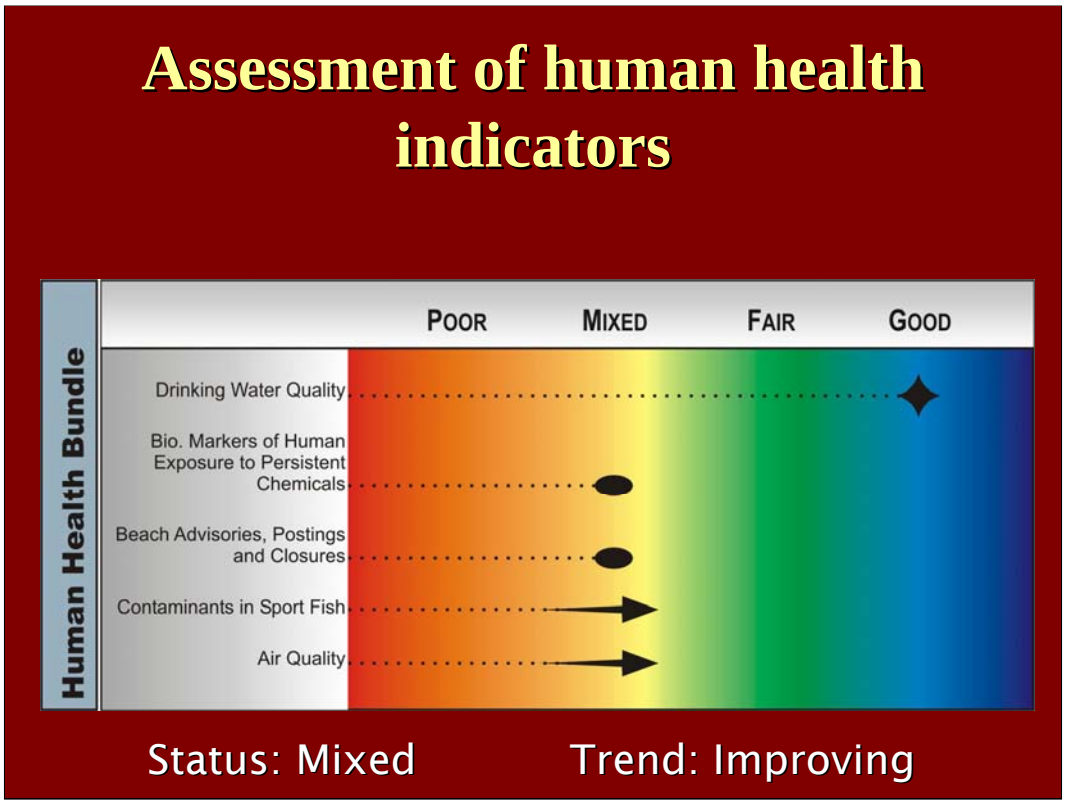
Should I eat the fish

Should I breath the air

In the eyes of the public, these are the more tangible and observable indicators of the health of the lakes.

They see the impact first hand when they can't go swimming or the amount or type of fish they can eat is limited.

Their impression of the lakes is formed based on the answers to these questions.



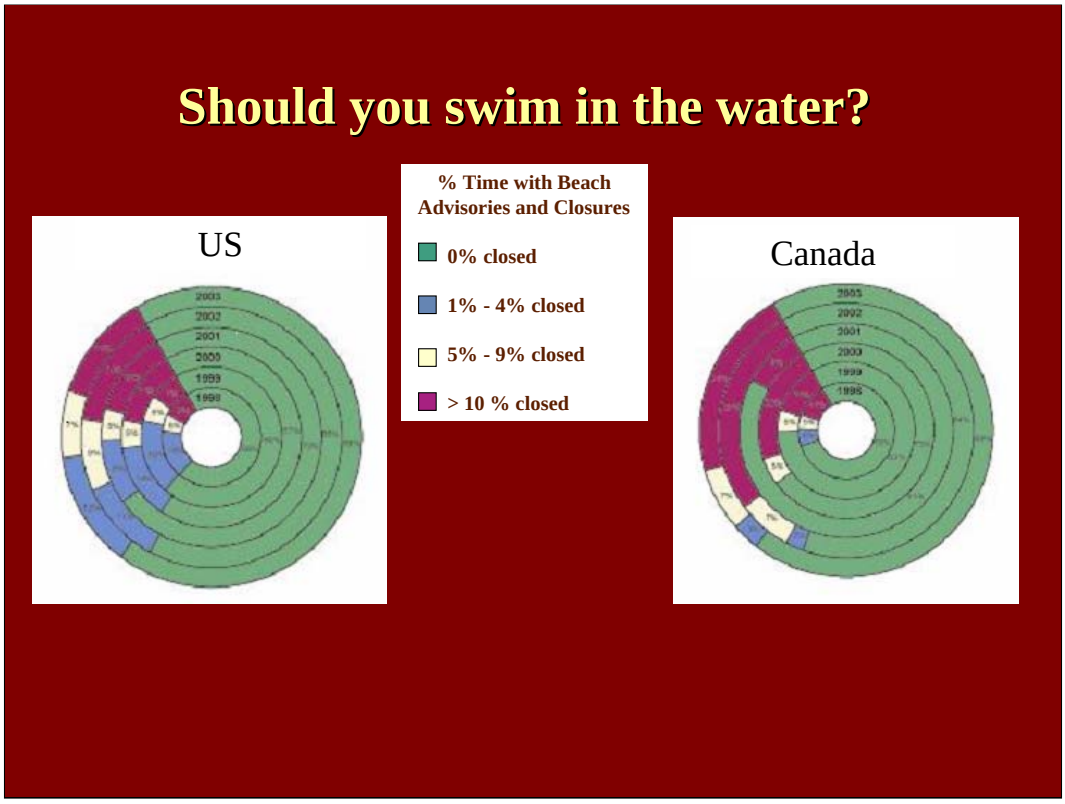
Here is a quick look at the assessment of the six indicators making up the human health bundle. The overall assessment is mixed and improving.

So, let's answer the questions.

Should you drink the water?

Yes. The quality of treated drinking water in the Great Lakes Basin is good. Chemical and microbial contaminant levels rarely exceed standards in finished water throughout the basin.

Highly efficient water treatment and controlled monitoring makes sure our drinking water is drinkable. And they are working.



Should you swim in the water?

For the vast majority of the time, yes. As reflected by the green portions of the circle charts, since 1998, at least two-thirds of the beaches monitored in Canada and the US were open the entire swimming season.

Only 14 percent of the US beaches and 27% of the Canadian beaches were closed for more than 9 days during the 2002 season. In Canada, that number decreased to 21 percent in 2003.

The mixed assessment of this indicator is based upon an increase in the number of beaches monitored and an increase in the number of beaches reported making it difficult to determine trends.

And science further complicated this assessment. Discoveries of sources of E.coli not from fecal contamination but algae like cladophora have lead scientists to seek new bacterial indicator tests and to link rapid test methods directly to human health effects.

Some of the rapid test techniques are promising and in the future it may be possible to post closings 2-4 hours after sampling.

Currently, most of the beaches in the Great Lakes Basin are monitored and have quality public notification programs in place.

Should you eat the fish? A qualified yes. As with any food or health product, there are risks to consumption.

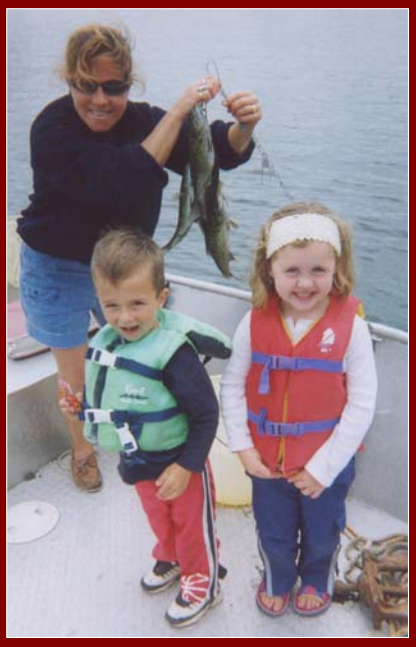
Fish consumption advisory programs are well established in the Great Lakes.

Since the 1970s, there have been declines in many toxic chemicals like PCBs, mercury, and dioxin in the Great Lakes Basin. But, as we saw in the contamination bundle, these chemicals because of their ability to bioaccumulate and persist in the environment, continue to be a significant concern.

We are seeing concentrations of organochlorine contaminants decrease in fish. However, all the lakes currently have advisories in place for PCBs.

On a side note, Pennsylvania will issue a snapping turtle consumption advisory in 2005. This advisory is based primarily upon PCB levels in the turtles – turtle soup is a Pennsylvania favorite.

Mercury, dioxin, toxaphene, chlordane, and mirex are the cause for fish advisories in some of the Great Lakes.

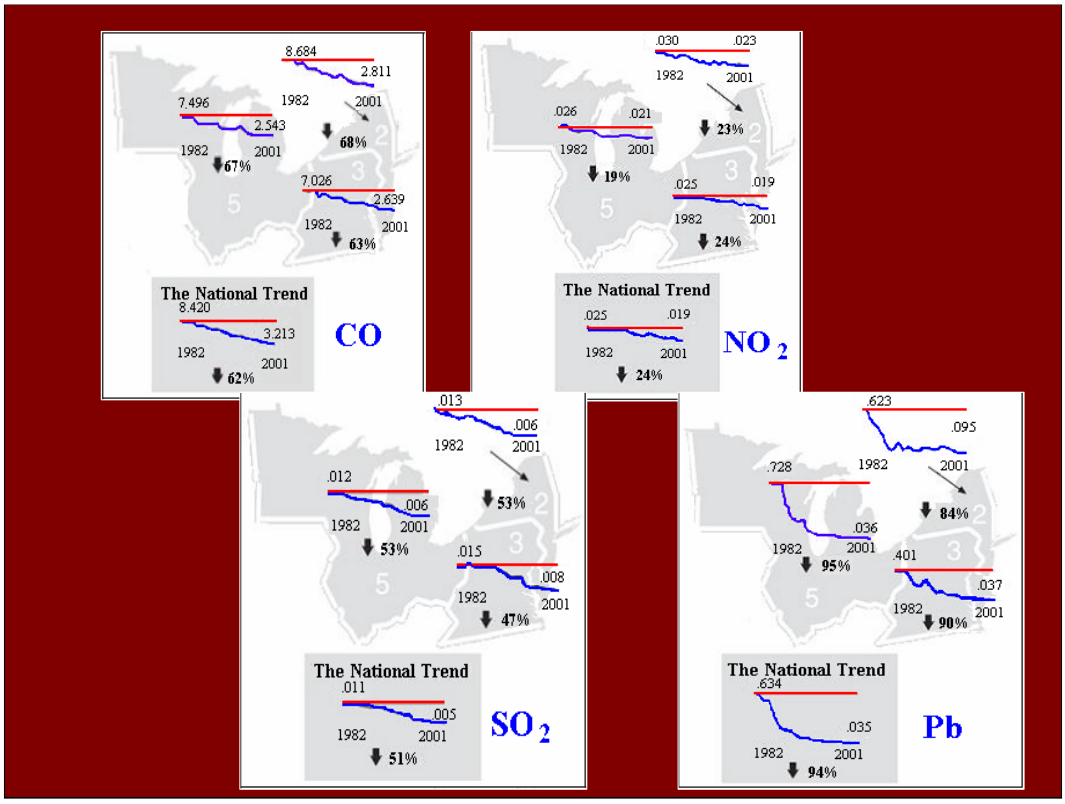


Photos courtesy of PA DEP

Mercury is becoming a more important contaminant of concern In the United States. In March, the Food and Drug Administration and EPA jointly released a consumer advisory on methylmercury in fish for sensitive populations.

Overall, the number of advisories has increased over time. This is due to the increased amount of monitoring that is done and improvement of scientific methods to detect lower and lower levels of contaminants.

So, yes you can eat the fish. You should, however, pay attention to advisories and follow proper cooking and cleaning advice to further reduce the amount of contaminants present.



Should you breathe the air? Well, of course the answer is yes. What is your alternative?

But seriously, there is good news. Significant progress has been made in improving the Air Quality in the Great Lakes region.

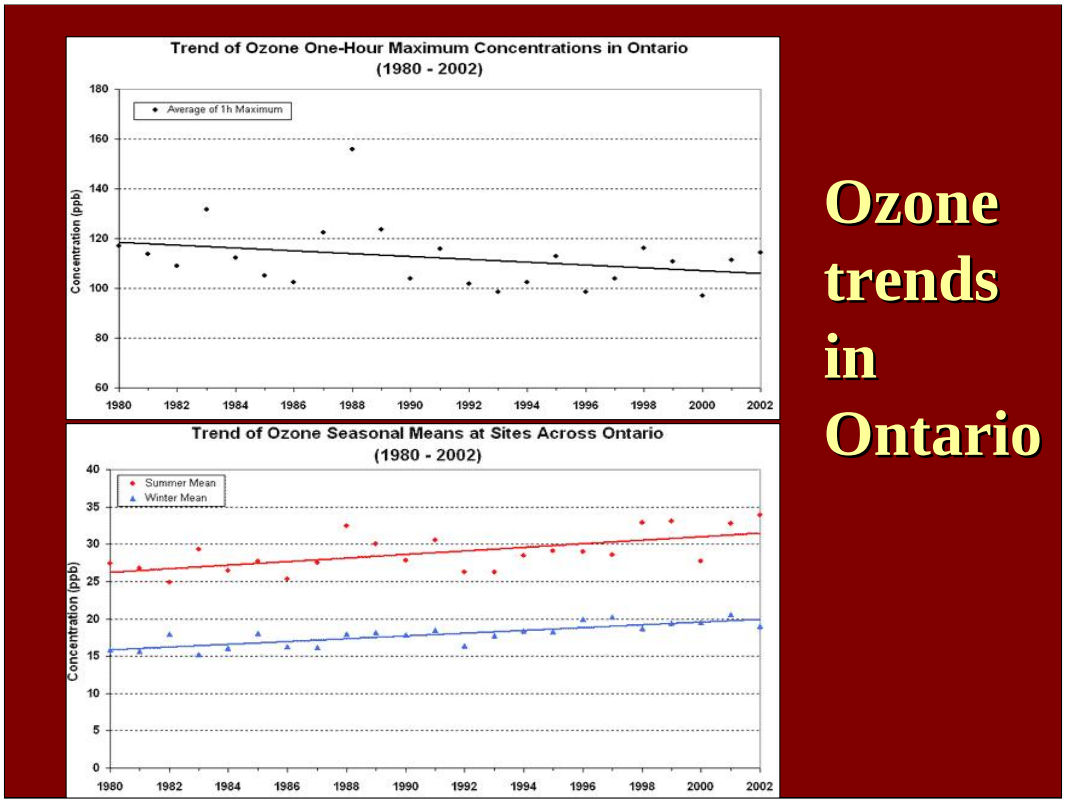
In these diagrams, the red lines represent baseline conditions in 1982 and the blue lines represent the decreasing concentrations.

As shown, average ambient air quality concentrations of nitrogen dioxide, sulfur dioxide, carbon monoxide, particulate matter, and lead have decreased significantly since the 1970s throughout the United States.

These trends are mirrored in the Great Lakes basin.

This progress has been achieved through the successful implementation of emission control programs. Emissions have been reduced from a variety of sources including vehicles, industrial facilities, and power plants.

The rate of progress, however, has slowed in recent years.



This is especially true for ozone.

Recent monitoring data for ozone and fine particulate matter of the size that more deeply penetrates the human lungs, indicate that these pollutants can be transported long distances and still remain a human health concern.

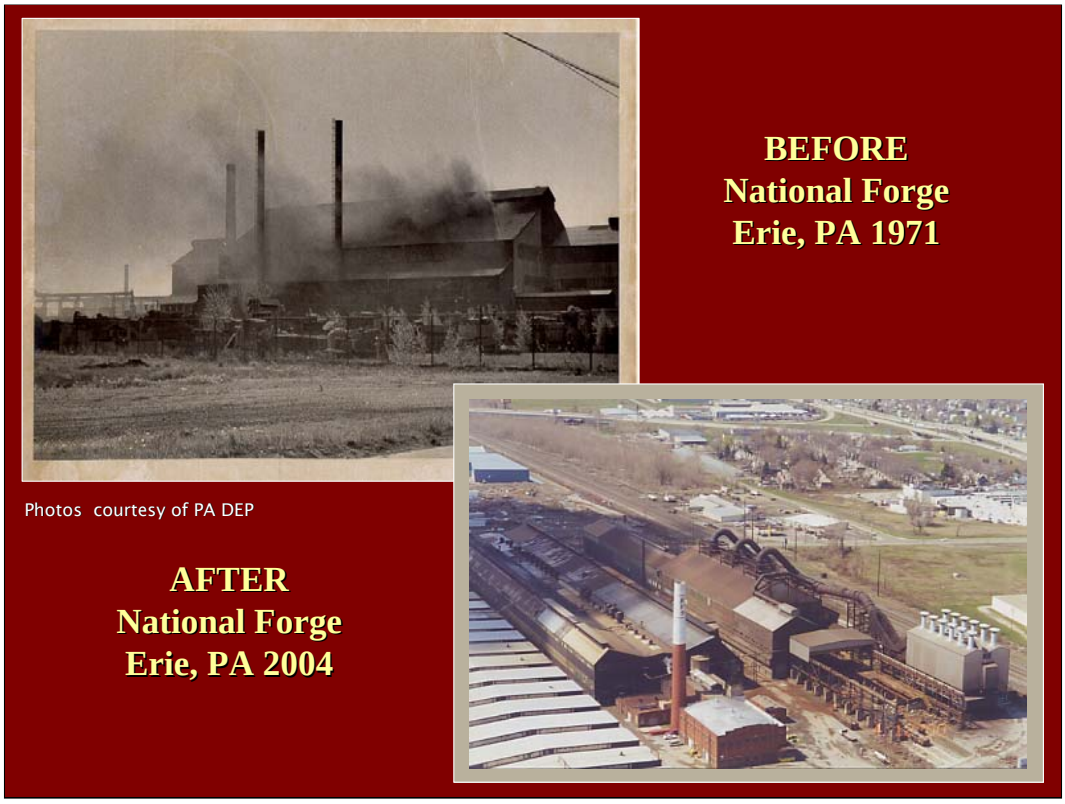
The top graph shows that in Ontario, the average maximum concentrations of ozone have decreased since 1980.

But, looking at the bottom graph, the average summer and winter ozone means in Ontario have been increasing since 1980.

So basically, while the maximum is going down, the seasonal means are increasing.

At this time there is no clear indications as to why this is so. Some point to increasing background levels, while others point to decreased ozone scavenging from reduced NOx emissions.

In the US, we've seen improvements in maximum ozone concentrations in many urban areas but the concentrations of ozone have remained relatively stable in rural areas.



Both countries are focused on improving ambient air quality and emission data on fine particulates and toxic air pollutants.

The before and after pictures seen here show the marked difference control measures made in emissions from the National Forge facility in Erie

Major pollution reduction efforts are also continuing through the implementation of new ambient air quality standards for particulate matter and ozone, and an added focus on the threats of toxic air pollutants.

The good news…

- ✓The water is drinkable
- ✓The water is swimmable
- ✓The fish are edible
- ✓The air is breathable

Back to our four questions: The answer to each is yes, but it is a qualified yes.

Yes, you can drink the water. If it's been treated. We have highly efficient treatment and monitoring systems in place on both sides of the border and they are working.

Yes, you can swim in the water but you do need to check postings. More beaches than ever are being monitored which has resulted in more advisories, postings, and closings. Yet, almost 70 percent of the beaches in both Canada and the US were open the entire 2002 swimming season.

Yes, you can eat the fish. You do need to pay attention and follow advisories. Again, we are seeing more advisories but this is due to increased monitoring and better science.

Yes, the air is breathable but some cities do have advisories. The air quality in the region has and continues to improve mostly through emission control programs.

Work to be done….

- Need more consistency in monitoring and benchmarking
- Need to continue efforts to inform the public more quickly
- Need to address pressures from climate change, population growth, and land use

But, and there always seems to be a but, there is still work to be done.

We need to improve and in some cases better standardize our monitoring, data collection, and benchmarking efforts. This is particularly true for fish consumption advisories which may vary on the same lake depending upon where you are fishing.

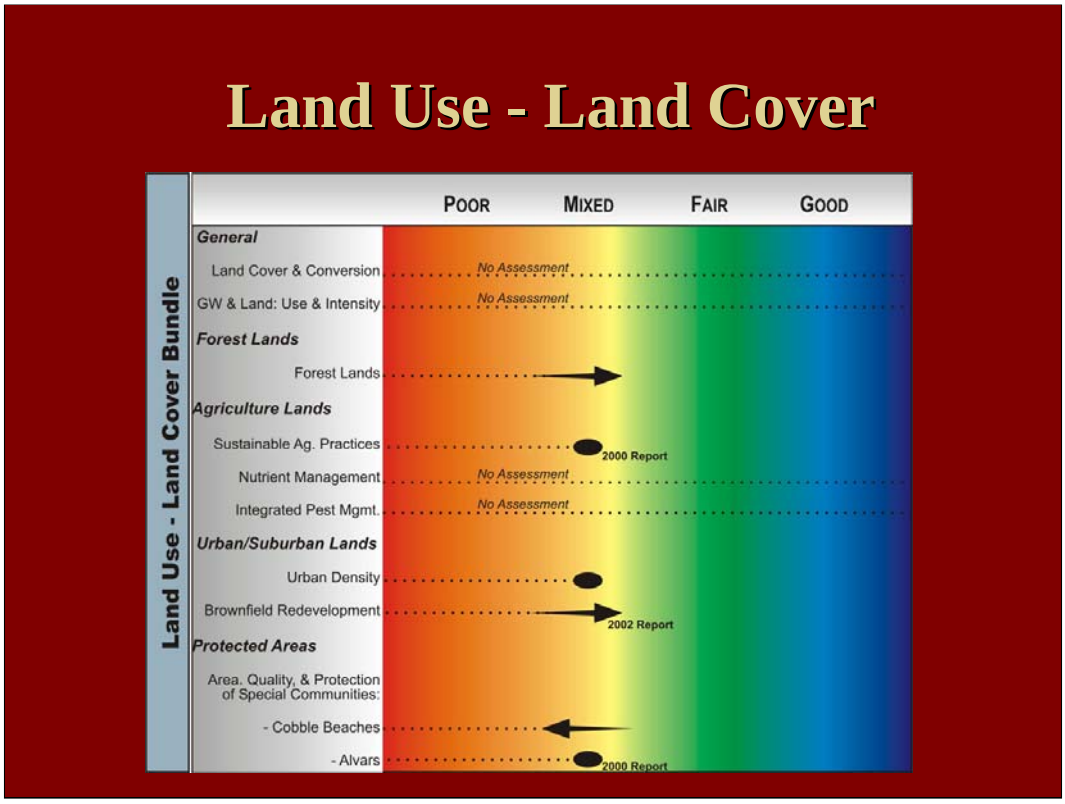
We still need to continue efforts to inform the public as quickly as possible when it is not safe to drink the water, swim, or eat the fish.

While the concentration of organochlorines in fish are decreasing, emissions of principal air pollutants like nitrogen dioxide have been reduced, and great improvements have been made to address combined and storm sewer overflows, pressures from population growth, climate change, and increased land use will continue to add limitations to our ability to drink the water, swim, eat the fish, and breathe the air.

Land Use – Land Cover

So far we've talked about the impact of contamination on fish and wildlife, its sources and loadings, and the effects on human health. Now we turn to the front lines of the collision between the Great Lakes as a resource and the humans who inhabit it.

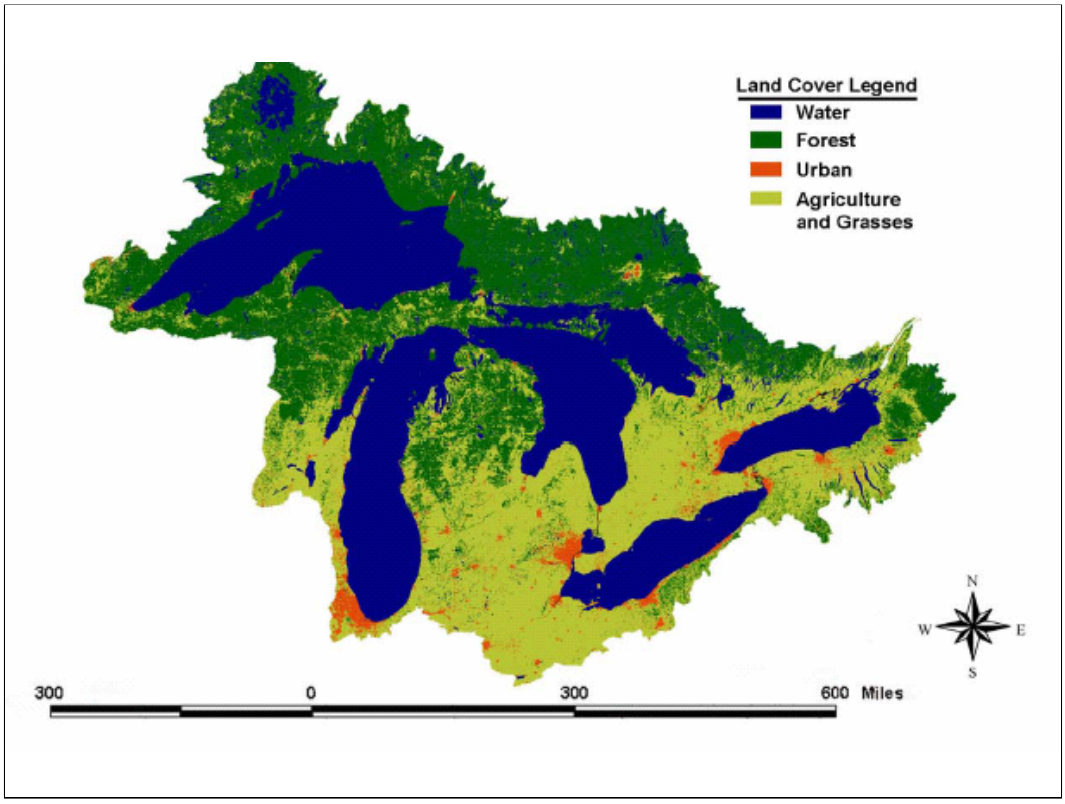
Most of the indicators in the land use/land cover bundle are new. This part of the story is more of a description of the current status.



The indicators in this bundle reflect more of the ecosystem's physical appearance. We don't have all the data to link these physical factors to specific impacts. For example, we know that urban sprawl effects surface water quality but we haven't quantified that effect yet.

Packaged together, these indicators do give us a snapshot and a starting place in beginning to understand how our historical and current choices are shaping the physical integrity of the lakes.

These indicators will open our eyes wider and hopefully energize us to work harder in mitigating the problems resulting from urbanization, population growth, climate change and our reaction to them.



Let's look at the current picture.

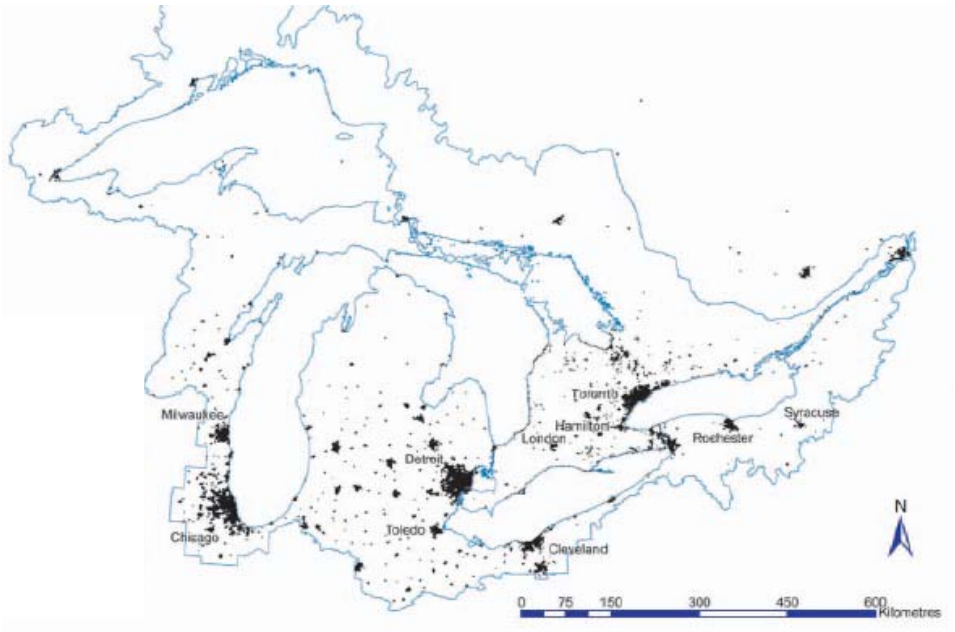
Using data sets from the 1990s the map shows the four major land use classes in the basin – water, forest, urban, and agriculture and grasses

The dark green shows that forest covers about 51% of the Great Lakes basin: 47% of the US's portion and 57% of Canada's.

Total forest areas appear to have increased in the basin over the past decade. Among other things, we are seeing a positive impact on surface water quality.

Agriculture and grasses – the lime green color - is the second largest land use.

Major urban areas within the Great Lakes Basin



Population in both countries has been increasing over the past five to ten years with a definite increase seen in metropolitan areas.

This map from the IJC's 12th Biennial Report shows the major urban areas within the basin.

The amount of land being developed is escalating at a greater rate than the population growth, particularly in metropolitan areas.

In other words, growing urban areas in the Great Lakes basin seem to be increasing their geographical area at a faster rate than their population.

In Pennsylvania, our statistics show that since 1980, we've been conserving about 65 acres a day and consuming 330 acres a day. That's a five to one ratio.

It follows that sprawl is increasingly becoming a problem in rural and fringe areas of the Great Lakes basin, placing a strain on infrastructure and consuming habitat in areas that tend to have healthier environments than those that remain in urban areas.

So, if we continue unchecked where are going?

Urbanization and sprawl as expected will exacerbate other problems, such as increased consumption of fossil fuels, longer commute times from residential to work areas, and fragmentation of habitat.

For example, at current rates, residential building projects in the western end of Lake Ontario (or the golden horseshoe) will consume some 1,000 square kilometers of the countryside – an area double the size of Metro Toronto, by 2031.

Gridlock would add 45 percent to commuting times and air quality would suffer with a 40 percent increase in vehicle emissions.

Land use and intensity also has the potential to affect both groundwater quality and quantity. Urban development such as paving roads and building structures intercepts precipitation and reduces groundwater recharge of shallow aquifers.

Additionally, increased water use and demand due to low rainfall years and population growth can impact the sustainability of groundwater supplies.

Is there any good news? As it happens, yes. The governments of the US and Canada have both been making efforts to ease the strain caused by pressures of urban sprawl. For example, policies that encourage brownfield redevelopment within urbanized areas will reduce sprawl.

Bringing brownfield or previously used properties back to life is a success story for so many cities in the basin. The pictures show one close to home.

On the left is a coal fired power plant on the shore of Presque Isle Bay in Erie. It is now a library, museum, and Pennsylvania's resting place for the Brig Niagara.

All eight Great Lake states, Ontario and Quebec have programs to promote cleanup and redevelopment of brownfield sites. Data from the eight Great Lake states and Quebec indicates that more than 24,000 sites have participated in brownfields cleanup programs since the mid-1990s, although the degree of remediation varies considerably.

Data also indicates that the majority of cleanups in the Great Lakes states and provinces are occurring in older, urbanized areas, many of which are located on the shoreline of the Great Lakes and in the basin.

Definitely a step or perhaps even a leap in the right direction.

A few last thoughts on the landscape

Without a doubt the Great Lakes basin is home to some of the most beautiful places in the world. Areas that need to be protected and cherished.

I want to briefly mention two that could be threatened if we don't pay attention to how we grow in the basin and how far the human touch reaches.

First, did you know that there are over thirty thousand islands in the Great Lakes. The islands range in size from no bigger than a large boulder to the world's largest freshwater island, Manitoulin – shown here.

Though not well known, the Great Lakes contain the world's largest freshwater island system, and are globally significant in terms of their biological diversity.

Islands are especially vulnerable to the introduction of non-native species.

Some of the Great Lakes islands are among the last remaining wildlands on Earth and they play a particularly important role in the storehouse of Great Lakes coastal biodiversity.

For example, Michigan's 600 Great Lakes islands contain one-tenth of the state's threatened, endangered or rare species while representing only one-hundredth of the land area.

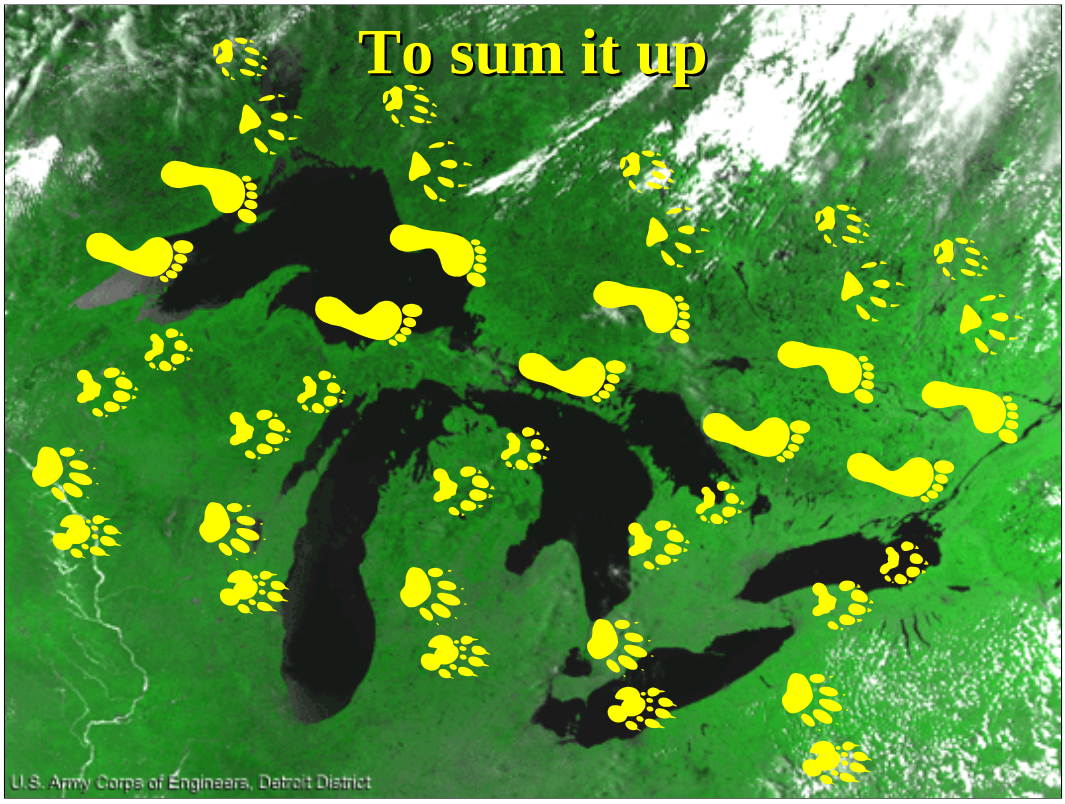
New research indicates that nearshore island areas in the Ontario waters of Lake Huron account for 58 percent of the fish spawning and nursery habitat and thus are critically important to the Great Lakes fishery.

Cobble beaches

Second are cobble beaches. They have always been a part of the Great Lakes shoreline. Every lake has miles of cobbled beaches. They cover 20% or 595 miles of the Lake Superior shoreline and 2% or almost 17 miles along Lake Erie.

They have a wide variety of vegetation surrounding them. They also serve as homes to plants that are prevalent to the Great Lakes shoreline. Some of these plants are rare and endangered species.

Both the islands and cobble beaches are being threatened and lost by development. Along with the development comes increased human activity resulting in damage to the rare plants and surrounding area and ultimately loss of terrestrial biodiversity.



Well, we've come to the end of this story. The last section seemed to foretell of great doom. But, remember that there was plenty of good news.

If you do walk away with just one thought, let it be this -- We as humans are part of the Great Lakes ecosystem. Our task is to live, use, and enjoy it in a sustainable way.

I'm reminded of the hikers creed – take only memories, leave only footprints.

Our goal should be to leave the smallest and softest footprint imaginable.

I think it's not only doable but we are on the right track. And I for one expect a happy ending.

Thank you.

Acknowledgments

My thanks to the following agencies who provided the indicator assessments presented in this report:

Canadian Wildlife Service
Clemson University
Department of Fisheries and Oceans
Environment Canada
Great Lakes Commission
Minnesota Department of Health
Northeast-Midwest Institute
Ontario Ministry of the Environment
USEPA's Great Lakes National Program Office