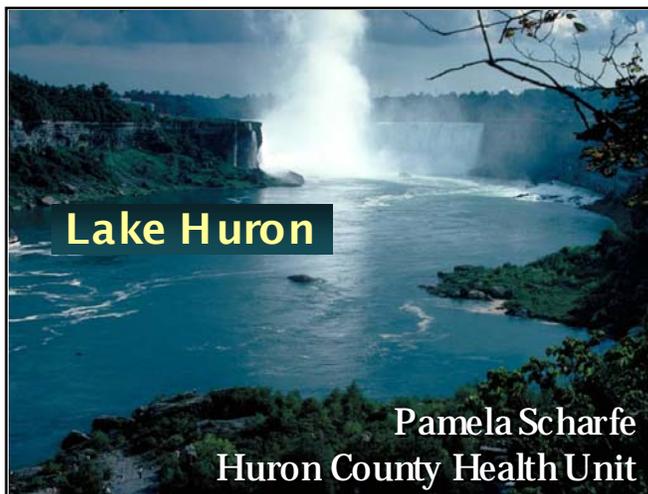
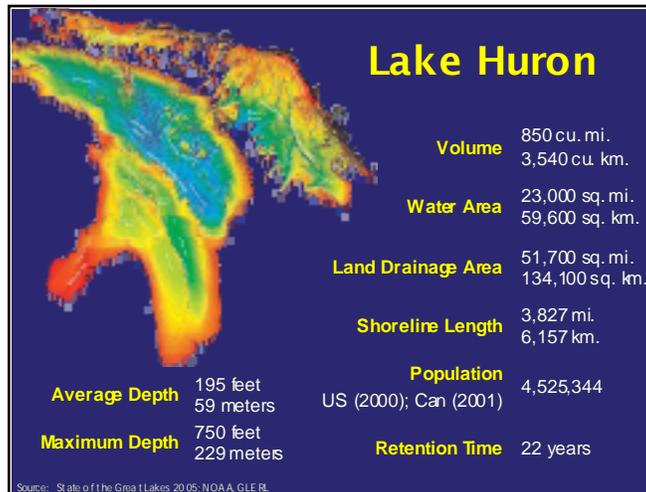


US EPA ARCHIVE DOCUMENT





Lake Huron is the world’s third largest lake, has the longest shoreline (almost 4,000 miles) and has more islands than any other lake in the world (over 30,000).

The islands, along with the low level of human impact on both sides of Lake Huron, create ideal habitat for many unique plants and animals, some even globally rare.

Manitoulin Island ranks as the world’s largest island in any freshwater lake.

Lake Huron is composed of the main basin, Georgian Bay, the North Channel and Saginaw Bay which all have very distinct characteristics. It’s watershed is the largest of all the Great Lakes and a landscape which varies from the forests and rocky areas of the north to the fertile farm land in the south.

Lake Huron’s retention time is 22 years and Maximum depth is 229 metres.

4.5 million people live in the watershed.

## Lake Huron Issues

### Overview:

- Restoration, but mostly protection, stewardship
- Contaminants in fish and wildlife
- Aquatic communities – major changes to food web
- Aquatic and terrestrial habitat – high quality, protection, binational biodiversity strategy
- AOCs
- Other issues: water levels, botulism, VHS
- Beaches – bacteria, algal fouling
- Nearshore focus: bacterial contamination at beaches
- Summary

The following slides will provide an overview of Lake Huron issues, some of which require active restoration efforts. Overall the lake has not suffered the degradation that most of the other Great Lakes have. Many significant high quality areas exist in the lake and watershed that require protection and stewardship.

In recent years we have witnessed some major changes to the food web as well as new diseases and nearshore algal fouling. Beaches are a prominent feature in the southern portion of the watershed and recreational water quality has been an issue in some areas for decades.

This presentation's nearshore focus is bacterial contamination at Lake Huron's beaches.

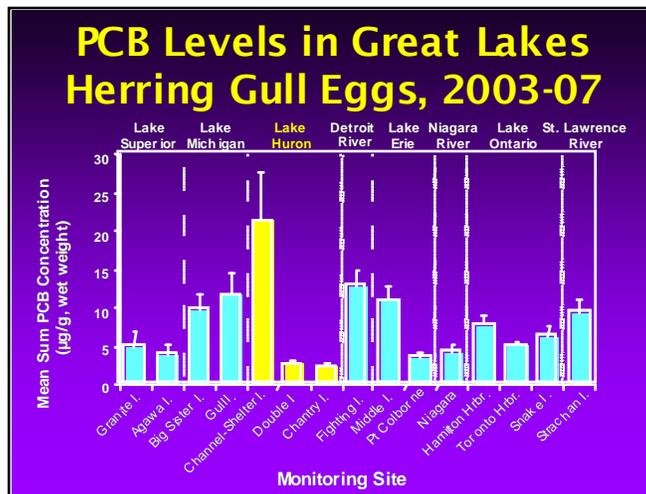


Contaminant concentrations in fish from Lake Huron have been monitored over time in order to assess risk to human and wildlife health. Because certain contaminants bio-accumulate and bio-magnify in the food chain, fish are excellent indicators of pollutants in the aquatic ecosystem.

In comparison to the other Great Lakes, such as Lake Ontario, contaminant concentrations are relatively low in Lake Huron fish. Nevertheless, fish consumption advisories exist for the open lake and all Areas of Concern. Four chemicals are responsible for most of the fish consumption advisories in Lake Huron. PCBs and Dioxins still cause the majority of advisories.

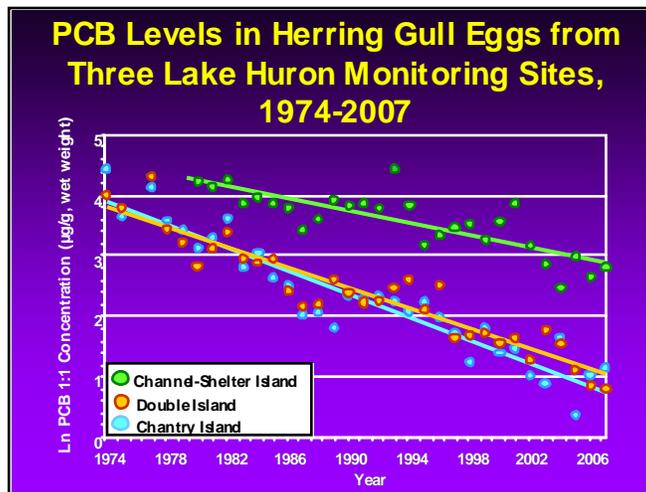
Almost all sport fish exceed the U.S. trigger level for PCBs and about 94% of all Canadian advisories are due to an exceedance of Dioxin, Furans, and “dioxin-like” PCBs. Mercury advisories exist for many inland lakes in the watershed, as well as for some Lake Huron walleye and northern pike.

In the Ontario waters including Georgian Bay, North Channel and St. Marys River, the restrictions on trout, salmon, carp and channel catfish are caused by dioxins/furans/dl-PCBs. Toxaphene had triggered advisories in Ontario waters, but now this chemical accounts for less than 1% of all advisories. Some Ontario fish consumption restrictions have increased however this is due to recent revisions to the consumption guidelines.



These are PCB levels in Herring Gull eggs from the 15 annual monitor sites across the Great Lakes. Starting in Lake Superior and working eastward (downstream).

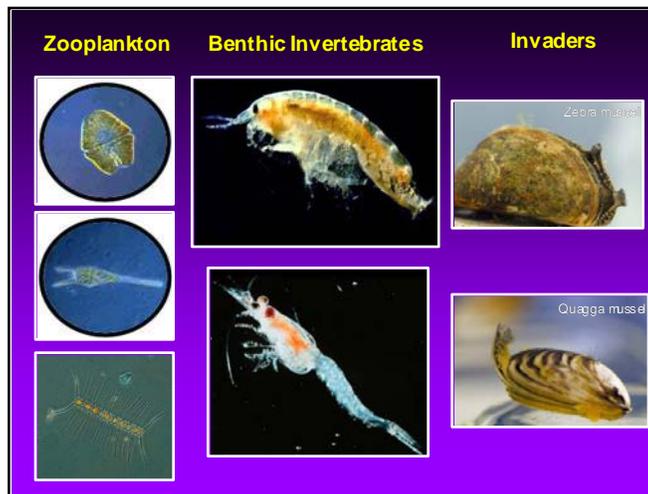
Note that gull eggs from Lake Huron are both the most contaminated for PCBs (at Channel-Shelter Island in Saginaw Bay) and the least contaminated at Double Island in the North Channel and Chantry Island along the south-east shore in Ontario.



This Figure shows the temporal trends, depicting significant declines, of PCBs at the three Lake Huron annual Herring Gull monitoring sites.

Note the near identical rates of decline for the eggs from Double and Chantry Islands.

The rate of decline in eggs from Channel-Shelter Island is slower, the slope of the regression line is not as steep, and the PCB concentration in eggs is greater than in eggs from the other two colonies.



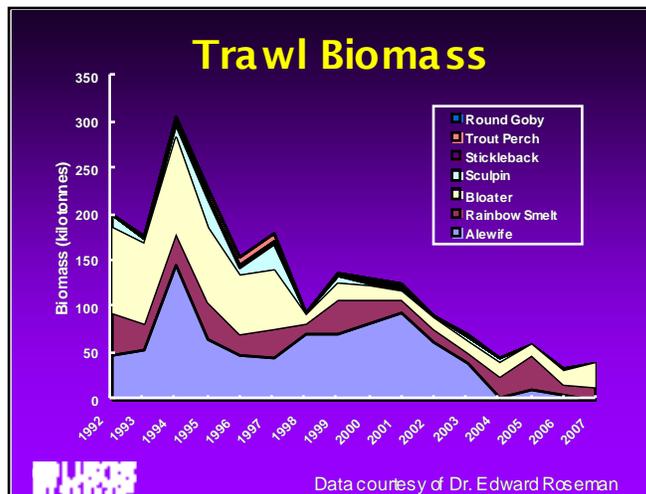
In the aquatic community ....

Changes are happening at almost all trophic levels of Lake Huron.

By 2003 major declines occurred in zooplankton which are important to prey fish.

Mysis and diporeia have declined, they were once important for moving energy off the bottom to predators higher in the water column and now less energy flows to predator fish since it is trapped in in zebra and quagga mussels at the lake bottom.

It is uncertain if declines in zooplankton were due to lack of food or due to predation by fish and exotic invertebrates, or a result of both top down and bottom up pressures.



Prey fish biomass is lower in recent years compared with the 1990's.

This is primarily due to collapse of the alewife population, but many other species have declined as well, possibly due to an overall loss in system productivity that has been manifested in food web collapse.

Zebra and quagga mussels may be using energy or nutrients that formerly supported fish production.



Declines in prey fish have resulted in declines in predator species such as Chinook salmon.

The top left photo is of a typical Lake Huron Chinook salmon prior to the collapse of alewife while the bottom right picture shows the condition some of these fish that have been seen recently.



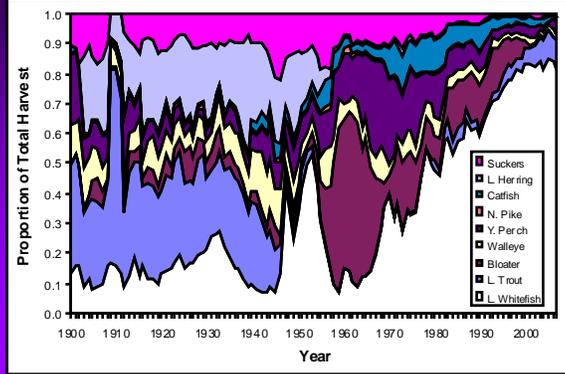
Although overall fish biomass is lower, there are some positive trends.

Native fish species comprise a larger proportion of the lake biomass than in previous years.

These species include yellow perch and walleye, Cisco and bloater and emerald shiner.

Lake trout showed some signs of increased natural reproduction but the most recent data indicates that those encouraging signs may have been short-lived.

### Proportion of Total Harvest



## Questions about the aquatic ecosystem

- Why are declines occurring in lower trophic levels?
- Will lack of mysis and *diporeia* for food result in continued high predation on zooplankton?
- Will alewife recover?
- Will native species continue to recover?
- What impact will more recently introduced species have? (e.g. round goby)

Major uncertainty exists about the future of the Lake Huron aquatic ecosystem.

Some of the major questions that will need to be considered are:

- Why are declines occurring in lower trophic levels?
- Will lack of mysis and *Diporeia* for food result in continued high predation on zooplankton?
- Will alewife recover?
- Will native species continue to recover?
- What impact will more recently introduced species have?

## Aquatic and Terrestrial Ecosystems

- High in biological and landscape diversity
- Many rare and threatened species
- Coastal wetlands in the north rank among the best in all Great Lakes
- Biodiversity under stress - opportunities for protection should be pursued



The biodiversity of the Lake Huron watershed is under stress from a number of factors, such as invasive species, loss and fragmentation of habitat, rapid residential and industrial growth.

Degradation and loss of historical habitat is identified as a major stressor to Lake Huron and its watershed and was identified as a priority for action by the Lake Huron Binational Partnership.

## Biodiversity Conservation Strategy

- Define threats to biodiversity features
- Strategies to abate these threats
- International action plan
- Priority sites for strategy implementation
- Indicators to measure health and integrity of conservation targets

The collage includes the following labeled images:

- Islands:** Aerial view of a lake with several islands.
- Coastal terrestrial:** A rocky coastline with sparse vegetation.
- Tributaries:** A river flowing into a larger body of water.
- Coastal wetlands:** A marshy area near the water's edge.
- Nearshore:** A view of the shoreline with rocks and shallow water.
- Native fishes:** A close-up of a fish underwater.
- Open lake system:** A wide view of a lake with a sailboat on the water.

The Lake Huron Biodiversity Conservation Strategy will develop strategies for conserving and restoring the biological diversity of Lake Huron, including its native species, coastal habitats, open waters, benthic zones, tributaries, and coastal terrestrial systems.

The Biodiversity Conservation Strategy will build on existing efforts around the watershed to protect these critical habitats.

### Areas of Concern

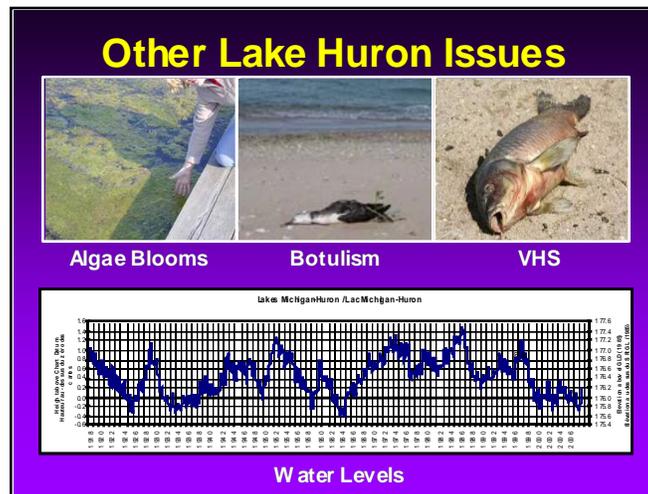
- Canada:
  - Collingwood Harbor: Delisted 1994
  - Severn Sound: Delisted 2003
  - Spanish Harbor: Area in Recovery 1999
- U.S.A.:
  - Saginaw Bay
- Binational:
  - St. Marys River



In 1987, four Areas of Concern (Collingwood Harbour, Severn Sound, Spanish Harbour, and Saginaw River/Bay) were identified within the Lake Huron watershed, as well as the binational St. Marys River.

Collingwood Harbour and Severn Sound in Canada were delisted in 1994 and 2003, respectively. Monitoring is ongoing in the AOCs to ensure that environmental quality is maintained.

Each of the remaining Areas of Concern (AOCs) is being addressed through on-going programs.



Other Lake Huron issues include:

- Concern over blue-green algae blooms and potential human health risks from cyanobacteria for example in Sturgeon Bay, just north of Parry Sound.
- Increased Water Clarity from the filtering action of zebra mussels has been linked to algal blooms, die-offs, lower oxygen, loss of nutrients to the foodweb and appears to be related to botulism. Since 1998, outbreaks of Type E botulism have been recorded on beaches between Sarnia and Tobermory.
- Viral Hemorrhagic Septicemia (VHS) has been confirmed in Lake Huron as early as 2005. This disease does not pose any threat to public health. The disease was confirmed in lake whitefish, walleye, and Chinook salmon collected from northern Lake Huron in 2006. Special regulations have been implemented in Michigan in an attempt to prevent the spread of the disease.
- Water levels for Lake Huron from January 1918-on have not shown a consistent long-term trend. Instead, they have alternated irregularly between higher and lower conditions. It remains to be seen whether the recent low water level conditions signal the beginning of a longer trend or are just another phase in the lake’s periodic swings between low and high water level conditions.

### **Nearshore Focus: Bacterial Contamination at Beaches**

- Bacterial Contamination at Michigan Beaches
- Bacterial Contamination at Ontario Beaches
- Multiple Pollution Sources
- Predictive Modeling
- Communicating to the Public
- Impact of Climate Change

The last portion of my presentation is on the Nearshore Focus of Lake Huron: the Bacterial Contamination at Beaches.



Lake Huron's beaches are scattered along the coast of Lake Huron. The green on the map indicates where there are beaches—so as you can see there are a lot of beaches, albeit, they are not all sand beaches, some are cobblestone.

First I will be speaking about U.S. Beaches and then Ontario Beaches.

In the Michigan portion of the Lake Huron basin there are 158 public beaches. Intensive monitoring of Michigan beaches on the Lake Huron shoreline began in 2001.

In 2006, 16 closure events were reported at 17 different beaches in 5 counties totaling 48 days. The percentage of samples exceeding the E. coli standard in Michigan ranges from 2.2 to 4.9%.



Recently, excessive algal growth or "muck," has covered the shoreline in Saginaw Bay and in some Ontario beaches, with a perceived increase in duration and spatial distribution compared to past years. A new development, the detection of human fecal indicators in the material has resulted in public concerns related to the potential human health implications associated with contact with the material.

The "muck" is predominantly comprised of the algae *Cladophora* which is now becoming more abundant because of invasive species, i.e. zebra mussels and quagga mussels. The subsequent degradation of the aesthetic value of the beaches has resulted in great concern among the public, especially local homeowners.

These photos are from the southeast shore of Lake Huron.



In 2006, the Michigan Department of Environmental Quality organized a science committee to address potential human health risks associated with the muck on the shores of Saginaw Bay. The science committee was asked the science committee to address the E. coli and pathogen risks and specifically address citizen concerns on the presence of E. coli in material in the Saginaw Bay area. Because there has been only limited sampling of the muck, the report recommended that a comprehensive environmental sampling plan be developed to better characterize sources, potential health risks and management strategies.

The science committee report identified the need for broad public outreach on methods to reduce the exposure to the muck. Local health departments have issued advisories indicating the importance of avoiding contact with the muck, good hygiene when coming in contact with the muck, washing the skin after contact and avoiding the muck altogether if a person has cuts or open sores. In addition the Michigan Department of Community Health is working with the local health departments to encourage the public to report to the local health department any illness that they believe might be tied to exposure to the beach, muck or water.

## Bacterial Contamination at Ontario Beaches

Main pollutants:

- Pathogens
- Nitrogen and Phosphorus



Algal Fouling



Beach Postings



The Ontario side of Lake Huron and Georgian Bay contains well over 100 public beaches. Annual monitoring programs which are conducted by local municipal Health Units have found that the average amount of time beaches throughout Lake Huron are posted each year is only 2 to 3 days per swimming season. However within the Canadian southeast shore area which runs between Southampton and Sarnia, more prolonged beach postings have been occurring and investigations have been ongoing to try and determine causes.

In order to address this issue a Southeast Shore Working Group comprised of various federal and provincial government agencies, local health units, conservation authorities and other key stakeholders was formed to determine, coordinate, and implement appropriate management actions.

And in February 2004, the Lake Huron Science Committee, led by the Ontario Ministry of the Environment, was initiated to conduct a science-based examination of bacterial inputs to beaches of the Huron County Shoreline.

The Ontario Ministry of the Environment, along with Environment Canada, continue their work to determine the causes and environmental conditions leading to algal fouling. Initial findings show two species of green algae *Cladophora* and *Chara* with distinctly different ecologies responsible for the shoreline fouling. Fouling by *Cladophora* is localized near areas of suspected nutrient discharge. Fouling by *Chara* is more widespread, seemingly recent and without clear cause at this time, however, nutrient enrichment has not been ruled out as a contributing factor to the problem.



In response to national negative publicity in the late fall of 2003 regarding poor beach water quality at Huron County beaches, the County of Huron established the County of Huron Water Protection Steering Committee in the spring 2004. The Committee set three goals:

1. To bring together representatives of agencies, groups and municipalities, including Planning, Health Unit, Municipalities, Conversation Authorities, MOE, OMAF, agriculture, manufacturing, tourism, cottage associations, watershed groups, etc.;
2. To prioritize and recommend implementation measures to participating agencies; and,
3. To coordinate activities at a broad level, subject to the resources of the participating agencies.

To date, over 1.7 million dollars has been leveraged for water protection activities directly related to the coordinating efforts of the WPSC.

## Beach Water Sample Results “Old News”

*If you swam yesterday, you're O K  
The water was fine!  
Today might be okay too, but we won't  
know because we won't be sampling  
again until next Monday.*



Beach Water Sample Results are “Old News”. This slides tells it all of the way we have been doing beach water monitoring in Ontario.

If you swam yesterday, you're OK.

The water was fine!

Today might be okay too, but we won't know because we won't be sampling again until next Monday.

Because it takes 24- 48 hours to get beach sample results out to the public due in part to - all day sampling; time & distance to transport to the lab; sample water filtered and plated; 18-22 hrs in incubator; time required to analyze data and then get our websites and info-lines updated; get media releases out; and then do interviews with the media....

By then it is old news.

Huron County Health Unit has been looking closely at our U.S. counterparts and investigating and piloting predictive modeling for beach water quality as the public is not served by the current Ontario recreational water management protocol.

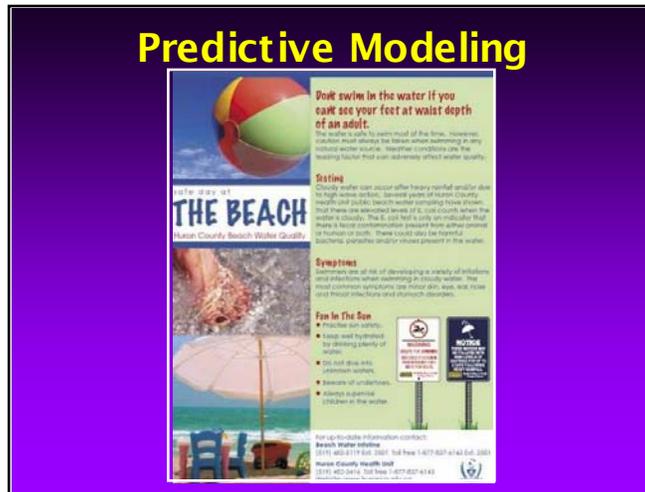


Huron County is identified in red.

Grey Bruce County is located to the north of Huron County.

Lambton County is located to the south of Huron County.

The 3 counties have 3 different approaches to beach water monitoring.



The quality of Lake Huron water can change dramatically day to day, hour to hour or even minute to minute with either heavy rainfall or high wave action or both. The Huron County Health Unit encourages recreational users of Lake Huron to read the signs to reduce health risks and not to swim if:

You can't see your feet when standing in waist deep water and/or

A heavy rainfall event two days prior to swimming.

Because of the delay in obtaining water results and by then the water may have changed to either safe or unsafe for swimming. It is for this reason, and based on several years of consistent water sampling data, that the Huron County Health Unit posts beaches on a seasonal average.

To further assist the public each beach has a volunteer rainfall volunteer.



As we know all too well there are multiple pollution sources – too many to mention but a few of the top ones are:

- Storm sewer
- portlands,/marinas
- Agriculture and wildlife
- Algae growth
- Contaminated sand in the swash zone
- High wave action
- Faulty septic systems

These need to be identified; researched and remediated.



Heavy rainfall events usually during summer thunderstorms cause the land to be flushed picking up multiple pollution sources that lead to watersheds that feed Lake Huron.

Over thirty years of beach sampling have shown that the southeast shore of Lake Huron has elevated counts of E.coli for up to two days following a heavy rainfall event but when the water is calm and clear it is a safe day for swimming.

Southeast shore photos in a 24 hour span show:

Top Left – calm before the storm

Bottom Left – summer thunderstorm rolling in

Top Right – 24 hours and the water is quite muddy

Bottom Right - beach is littered with corn cobs, corn stalks and straw - this is where agriculture meets tourism

## Communicating Beach Results and Health Risk

- What do we do with all that data?
- When do we post/close beaches?
- How do we notify the public?



TALK TO THE PUBLIC

What do we do with all that data?

When do we post/close beaches?

How do we notify the public?

Talk to the public.

## Climate Change Impact on Beach Water Quality?

Temperatures

Precipitation

Seasonal Changes

Water Levels

What impact will climate change have on beach water quality:

(Temperatures)

- Above normal air and lake temperatures
- In the fall (Canadian Thanksgiving weekend Oct. 2007 and 2008) – SE shore beaches were busy – only difference from a July weekend were the leaves blowing down the beach.
- People are swimming outside of traditional swimming seasons

(Precipitation)

- More severe rain storms especially in the summer months bringing frequent periods of pollution to the lake when the land is flushed

(Seasonal Changes)

- Colder springs and warmer falls are causing people to change their recreational beach use

(Water Levels)

- Lower lake levels are providing wider beaches, attracting larger numbers of birds (i.e. seagulls, geese) which produces more contamination to beach sand and lake water
- Wider beaches also attracts more people – increase in feeding seagulls which results in more birds

## Beach Water Quality

Need to seek out partners to strengthen our beach water monitoring programs and water quality standards:

- Predictive modeling to determine and report accurate and timely beach water quality
- Inform the public in a clear and timely way
- Conduct research as to what are the pollution sources & their impact
- Identify and implement remediation strategies

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## Summary

- How we are dealing with the issues:
  - direction – remediation – protection?
- Stewardship and working with local communities
- Principles of Framework – awareness, support community projects, take action, monitor and adapt
- How we need to adapt to changing ecosystems?

How we are dealing with the issues: direction – remediation – protection?

Stewardship and working with local communities.

Principles of Framework – awareness, support community projects, take action, monitor and adapt.

How we need to adapt to changing ecosystems?

## Acknowledgments



Janette Anderson, Environment Canada  
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Chip Weseloh, Environment Canada  
Dave Moore, Environment Canada  
Greg Mayne, Environment Canada

In closing I would like to acknowledge and thank these people for their contribution to this presentation on Lake Huron.

Thank you for your attention and I look forward to your participation in this afternoon's discussion session on Lake Huron.