

# State of the Lakes Ecosystem Conference 2000



## Conference Proceedings

**State of the Lakes Ecosystem Conference  
2000**

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*Proceedings Prepared by  
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and  
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# State of the Lakes Ecosystem Conference 2000

## Conference Proceedings

### 1. Introduction

#### 1.1 What is SOLEC?

The State of the Lakes Ecosystem Conferences (SOLEC) are hosted by the U.S. Environmental Protection Agency and Environment Canada on behalf of the two countries. These conferences are held every two years in response to a reporting requirement of the binational Great Lakes Water Quality Agreement (GLWQA). The conferences are intended to report on the state of the Great Lakes ecosystem and the major factors impacting it, and to provide a forum for exchange of this information amongst Great Lakes decision-makers. These conferences are not intended to discuss the status of programs needed for protection and restoration of the Great Lakes basin, but to evaluate the effectiveness of these programs through analysis of the state of the ecosystem. Evaluation and redirection of programs are addressed through other means and conferences. Another goal of the conferences is to provide information to people in all levels of the government, corporate, and not-for-profit sectors who make decisions that affect the Lakes.

The conferences are the focal points of a process of gathering information from a wide variety of sources and engaging a variety of organizations. In the year following each conference the Governments prepare a report on the state of the Lakes based in large part upon the conference process.

The first conference, held in 1994, addressed the entire system with particular emphasis on aquatic community health, human health, aquatic habitat, toxic contaminants and nutrients in the water, and the changing Great Lakes economy. The 1996 conference focussed on the nearshore lands and waters of the system where biological productivity is greatest and humans have had maximum impact. Emphasis was placed on nearshore waters, coastal wetlands, land by the Lakes, the impacts of changing land use, and information availability and management. For both conferences ad hoc indicators were chosen and, based on expert opinions, subjective assessments were provided as to the conditions of the Lakes, lands or the stresses on the ecosystem in terms of good, fair, poor, etc.

The indicator development process became more regimented for SOLEC 98 with the development of a comprehensive suite of easily understood indicators which objectively represent the condition of the Great Lakes ecosystem components (as called for in Annex 11 of the GLWQA). The goal is to use these indicators every two years to inform the public and report progress in achieving the purpose of the GLWQA: *to restore and maintain the chemical, physical and biological integrity of the waters of the Great Lakes Basin Ecosystem*, thus initiating a regular and comprehensive reporting system. The suite of SOLEC indicators would reflect conditions of the whole Great Lakes basin and its major components (a general system-wide overview), and they would draw upon and complement indicators used for more specific purposes such as Lakewide Management Plans (LaMPs) or Remedial Action Plans (RAPs) for Areas of Concern. During SOLEC 98 and afterward the suite was thoroughly reviewed and general consensus was obtained that the suite of 80 indicators was necessary and sufficient.

## 1.2 Purpose of SOLEC 2000

Following the general acceptance of the SOLEC suite of indicators was the movement to begin implementing them. The challenge was to see how many of the 80 indicators could be reported on at SOLEC 2000. In some cases this was a fairly “easy” task - data were already available for use in reporting on an indicator (by various agencies). In other cases this task becomes more difficult as new data may be necessary before we can report, or further research and development will be required before we will be able to implement data collection efforts and then report on an indicator. There was opportunity at SOLEC 2000 and through winter 2001 for further review of the Indicator List with revisions being made as conditions warranted.

At SOLEC 2000 the organizers were very pleased to be able to report on 31 indicators. Shortly after SOLEC, reports for two more indicators were added.

## 1.3 Next Steps and Challenges

Although 33 indicators have had reports prepared for SOLEC 2000 and are available on-line at <http://www.on.ec.gc.ca/solec/implementing2000-e.html>, we are still at the beginning of the indicator process. SOLEC 2000 was a *demonstration* of how reporting out on the health of the Great Lakes basin ecosystem *could* work.

At the time of the conference, no agency or organization had formally taken ownership of any indicator, i.e., to accept responsibility for data collection, analysis and reporting. This is a crucial step, however, in order to ensure that the Great Lakes community is committed to making the indicator process work for SOLEC. Following the conference, some key agencies and organizations have accepted the challenge of ownership. For example, a team from U.S. Fish and Wildlife Service and the U.S. Geological Survey have identified which indicators their agencies should own and to which ones their agencies could contribute, and a process was established for seeking approval by upper level administration. The Council of Lake Committees, working with the Great Lakes Fishery Commission, has also agreed to lead the reporting effort for the fishery-related indicators.

Some other important next steps include: 1. Determine who will do the necessary research for the “new” indicators, 2. Determine who will collect and maintain the data for each indicator, and 3. Determine when they will start. However, it is recognized that these steps will require resources to move ahead.

Another step in the process will be trying to compile certain groups of indicators together into indices, so that instead of reporting out on 80 separate indicators, eventually we would be reporting out on 10 to 20 indices. Two examples, the “fishability index” and the “coastal wetland index” were presented at SOLEC 2000 and discussions held in the breakout sessions are included in these Proceedings.

## 2. SOLEC 2000 Highlights

### Conference Results

#### *Real data*

This was the first SOLEC to present data on the indicators from the suite in order to determine the state of the Great Lakes ecosystem. This move beyond the previous “ad hoc” approach to reporting was strongly supported by participants. It also reflected the ongoing efforts of SOLEC to improve the reporting process and be responsive to the feedback and advice received from participants. With a list of indicators “on the table”, many individuals, agencies, and organizations from around the basin worked to identify how their efforts could contribute to, and benefit from, SOLEC efforts.

#### *A link between SOLEC, LaMPS, and RAPs*

This SOLEC showed a strong link between LaMP, RAP, and SOLEC work. This conference encouraged discussions and comparisons of indicator work at three levels - local, lake and basin-wide.

#### *Tangible tools for “making things happen”*

SOLEC participants include experts in “making things happen” - experts that shared their advice on how to start and sustain an initiative. Key success factors identified included: finding common values among different groups of people; identifying a range of benefits that come with environmental protection; engaging small community groups by identifying what appeals to them – and building on it; developing objectives that are clearly understandable; getting the private sector involved; letting people “do their own thing”, without adding bureaucratic layers; recognizing that “resources” means more than money (it includes leadership, volunteers, technical expertise and partnerships); and taking advantage of local government partners.

### SOLEC Process

#### *Broader participation than ever*

This SOLEC fostered a real sense of Great Lakes community. Participation was broader than ever before – including a strong Aboriginal presence. There was a recognition that knowledge involves more than just western science. Focus on the success of local initiatives illustrated and inspired participants, and highlighted the fact that efforts to preserve and restore the Great Lakes will only succeed if we work together in partnership.

#### *Conference delivery – a collective effort*

The agenda for SOLEC 2000 was designed and delivered by more than just federal agency participants. More than ever before, SOLEC discussion topics and presentations were identified and delivered by key

stakeholders from throughout the basin. This reflected the value of the SOLEC process to other organizations and initiatives – who recognize the conference as an opportunity to gain valuable feedback and advice on their activities.

*Keep the discussion going – people want to stay in touch*

SOLEC participants want to keep talking between SOLEC conferences. There was a call for a mechanism or forum to enable this dialogue. Participants are also interested in bringing data to SOLEC, and would like to see a system set up to contribute that data.

## **New and Emerging Issues**

*Biodiversity Investment Areas – a concept embraced*

Participants showed their enthusiastic support for the Biodiversity Investment Area approach, and enhanced the systematic approach to identifying and characterizing BIAs.

*The Great Lakes index concept – an open question*

Feedback on the Great Lakes Index idea varied – from those who think it's an important communication tool for general audiences (the public, politicians), to others who believe the effort is too early, and that there are dangers when the state of the Great Lakes ecosystem is oversimplified. Opportunities for additional thinking include exploring the possibility of geographic (e.g. lake or river) or “thematic” (e.g. fish-food web relationship) indices. Testing the concept was also suggested.

*New indicators identified*

A set of preliminary indicators were identified to help understand the effects of the Great Lakes environment on Great Lakes society. Societal indicators included: economic health, sustainability of resource-based economic sectors, drinking water, public access to water bodies, human health and reproduction, and the health of eagles. A need for upstream “on land” indicators (e.g. forestry) was also identified.



### 3. Conference Opening

deyoihwadogghdóh      ganqhónyohk  
short version              thanksgiving address

ne:dah niggyohgo'dé qswathahsi:yóhs gaihwaet:góh awá:dq'  
now this assembled crowd you will all listen to my responsibility it has become

né:' hédwaihwayé:to shogwayadihs'óh sogwa:wí: ganqhónyohk  
it we will pull from our creator he has given us thanksgiving

ne:'né:' aq:'we:sáht' sge:nó' dwenqhónyoh  
it is rejoicable of well being we are in mind of

ne:'di'né' edwe:hék i:'hyá:' sgá:t edwayé:' ogwa'nigóha'  
and so we will in thought we first as one we will put our minds

sgá:t dedwadatnqhonyó:'  
as one we will greet each other

netogyé: niyohók ogwa'nigóha'  
be it so remain our minds

da:né:' edwa:tro:wí' shéh ohwejáde'  
now this we will talk about existing earth

dwano:há' dedwanqhokwá' né: gwatoh shéh niyéha:  
our mother we refer to it as and also what she holds

ne:'di'né' edwe:hék gwe:góh dedwanqhonyó:' \*  
and so we will in thought everything we will thank

netogyé: niyohók ogwa'nigóha'  
be it so remain our minds

\*shèh niyéha:ʔ  
what she holds

odwənohgrónyáhnəʔ wəhyniyó:taʔ otódonyáhnəʔ odehadó:ni gadí:nyo:ʔ  
growing varieties of weeds hanging berries growing bushes growing trees game animals

ganyadaí:nyoʔ gihédényoʔ ohnawao:dónyoʔ neʔhniʔnéʔ gyənhéhəgh  
lakes streams wells and also our sustenance

né:ʔ gwatóh shèh deyowa:wənye:  
and it also the circulating winds

---

da:né: ədwa:tró:wiʔ hodeihədonýoʔ  
now it we will talk about his assigned duty performers

tatihsnyé:gyeʔs shèh nahawayənáhə  
they look after how much he created

neʔdiʔnéʔ ədwe:hék sɡá:t deyetinghónyo:ʔ  
and so we will mentally as one we will thank them

netogyé: niyohtók əgwəʔnigóhaʔ  
be it so remain our minds

---

da:né: ədwa:tró:wiʔ sədwagowa:néh sɡanyadaí:yoʔ  
now it we will talk about our leader handsome lake

oi:howa:néh atatrihwá:dsʔa:ʔ  
a great worthy commendation he had earned for himself

né:ʔ desahaihwə:twəht shèh nəsqəgwəyehék ohé:dó: haʔwəbnihfradenyó:gyeʔ  
it is he who has seeded the news of how we will conduct ourselves in future days ahead

ne'di'ne' edwe:he:k desedwanqonyo': sedwagowanqeh sganyadalyo'  
and so we will mentally we will thank him our leader handsome late

netogyé: niyohtók ogwa'nigqha'  
be it so remain our minds

---

da:ne: edwa:tro:wí' gel: niyogweda:ge: hadiqhya'kió:nq'  
now it we will talk about the four people of male inhabitants

né: deyokhiye'nyado' sgenq' dwenqhdqnyqh  
it is with their hands guard us well being we are in their minds

ne'di'ne' edwe:he:k deyetingonyo': hadiqhya'kió:nq' deyokhiye'nyado'  
and so we mentally we will thank them heavenly male inhabitants our guardians

netogyé: niyohtók ogwa'nigqha'  
be it so remain our minds

---

da:ne:' edwa:tro:wí' haqha'geh gaqhyade' hanagre' shogwayadifs'qh  
now it we will talk about him who in heaven he lives creator

ne:'isq: to'sqhdqh né' sgenq' ni'dwenqhdqnyo':  
only things dropped down well being in our minds

ne'di'ne' edwe:he:k desedwanqonyo': gaqhyade' hana:gre' shogwayadifs'qh  
and so we will mentally thank him who in heaven he lives our creator

netogyé: niyohtók ogwa'nigqha'  
be it so remain our minds

da:netóh naga:tgwe:ní i'géh agayagghdáhk ganohonyohk  
*this is the best I could do up to me it came out thanksgiving*

da:nétoh  
*that is all*

Address and Cayuga-English translation provided by  
Norman L. Jacobs  
Haudenosaunee Environmental Delegate  
Six Nations of the Grand River

### 3. Conference Opening (con'd)

**Sharing the Haudenosaunee Perspective of the Great Lakes Environment** - Norman Jacobs  
(Haudenosaunee Environmental Delegate)

It is my responsibility to welcome the participants with special thanks to Harvey Shear, Paul Horvatin, to SOLEC 2000 and the Six Nations Territory. You have just experienced a small part of Haudenosaunee culture and tradition on how we relate to the natural world. We give thanks, as I have, at every meeting and every council. Thanksgiving is not just an exercise in spirituality. It is relevant to each of the matters that we are gathered here to consider.

In the past, and even today there are deliberate policies by the Canadian and the United States Governments to destroy our way of life, our culture and traditions.

Therefore the Haudenosaunee Environmental Delegation **without prejudice** reluctantly makes this submission to the State of the Lakes Ecosystem Conference (SOLEC) 2000. The Two Row Wampum Treaty forbids our interference in each other's Governments laws. However the continuance to inadvertently affect our well being and way of life by continuing to disrupt and destroy the earth and the life it supports forces our participation. We must stand and speak for we have silently stood by and watched the pilfering and plundering of earth's natural resources for too long. We stand here offering our hand in friendship to share our knowledge and ideas.

Our leaders in making decisions of law must carefully weigh what impact that decision will have on **future generations, the environment and the natural world**. We believe that everyone in public office should think this way. Not what is good for us today or what will get them elected again. Our legal and political structure was designed to endure. It was designed to spread, to bring Peace to the World within the **Great Peace** and to do so with the persuasive power of the **Good Mind**. It is the combination of these powers, the good mind and the great peace working together, in balance that creates a unity of the minds. They are interdependent. To work, they must work together.

Our leaders are chosen for long service, because someone whose mind is on his next election cannot properly consider the needs of the generations to come. A good mind, working properly, will seek peace, protect peace, and maintain peace. And peace is the beginning of law, and the foundation of governance.

I tell you this, the smallest insect, the tiniest tree, the mighty maple has a right to survive in this world, to survive with their brother humans. It does not matter how few they are or how far up the food chain they are for each of our brothers that is lost, that is destroyed or exterminated is a loss for the entire world, upsetting the balance of nature that is gone forever. That is what our law teaches.

I do not believe that it is necessary to embrace the global economy in order to live a good life in this world.

I believe that the quality of life is not dependent on a standard of living.

I believe good people, caring for each other was the way of the past and is the way of the future.

Our lands are becoming the last refuges of the natural world, of the animals and plants we depend upon. The natural world of which we are a part and which we bear special obligations. Usually, this is viewed as

being closer, a part of nature rather than standing against it. Not on some holy mission to exploit or dominate it.

Today, the natural world continues to struggle to survive, but with a message to the nations of the world it is time to slow down, to care for one another instead of seeking wealth for the few, **to care for Mother Earth** instead of our own pleasures. We are taught that we have rights, rights that are balanced by responsibilities to the natural world as well as to the future generations of the world.

Some non-natives and their government's agencies lead us to several conclusions about the Great Lake Water and they are;

1. They consider environmental factors too little.
2. They consider economic factors too much, leaving too much to chance.
3. We have no right to interfere unduly with the animals and fish that make water their home. Unless there is a demonstrable and pressing need for humans to change any part of its ecosystem, **we must leave it alone.**
4. Though waters have a capacity to heal themselves and to deal with limited amounts of waste, especially organic or natural waste, we have an obligation to prevent the placing in the water poisons, and a duty to limit the natural wastes that are put into the water.
5. Over time the lakes, streams, and rivers have been used as a sewer for human, agricultural and industrial waste. It is part of our obligations as the custodians of the natural world (water) to lead in helping the life it supports. Which means that we must seek a future economic base that respects and does not pollute the water.
6. This is a small world we live in. More than ever, we recognize that what we do in one place has its effects in many other places. We see this in the globalization of business, in the turmoil of politics, we see it above all, in what we are doing to the environment.
7. That they have a separate agenda and that is to sell Great Lakes water in bulk, which we can never, nor will ever agree to.
8. That each scientist will interpret the data collected and give a report which contradicts the others' statement.

Let us now look at what is termed **scientific indicators**. Does it matter whether it can be scientifically proven that human life on earth is in danger? If that possibility exists we cannot afford to ignore that possibility. While SOLEC monitors, gathers information, enters data, strikes committees and prepares budgets, the destruction and desecration of Mother Earth and life as we know it continues. We ask you not only to trust scientists (and what can be scientifically proven), but listen to the wisdom of the people that have lived here since time immemorial.

At this time let me relate to you our oral prophecies which have been passed down since time immemorial - we were told that:

- That trees would die from the top down
- That water would burn
- That we would have to go a long way for water
- That water would be so dirty you could not see the bottom
- That animals thought extinct would reappear
- That birds that once nested on the ground would now nest in trees
- That women past child bearing age would once again bare children
- That there was a web around the world

- That in the future that web was going to rip
- That when that happened there would be chaos storms, floods and high winds

These prophesies came from our ancestors a long way back with no specific date which we take as warnings of things to come. Warning to us, indicators to this group, as to the health of Mother Earth. We must take heed of these as you all know we have seen many of these now.

We must ensure that the natural values and fragile ecology of lakes, streams, and rivers are restored and protected. Protected for the future generations. The Natural World, gifts from the CREATOR are not a commodity, which can be bought and sold.

## 4. Plenary Presentation Summaries

The plenary presentations at SOLEC 2000 covered many topics and involved many presenters (29 presenters in total at the plenary sessions). One over-riding focus of the presentations was indicators of course, and the use of indicators at three different scales.

1. The first day looked at the state of the whole Great Lakes basin using the results of implementing 31 of the 80 indicators discussed at SOLEC 98. There was also a focus on human health, with more detailed presentations on three indicators - swimming advisories, drinking water quality and fish consumption advisories. In addition to applying indicators, there was a presentation about the development and use of indices. Presenters were recognized experts in the fields, not necessarily people involved in the SOLEC indicator process.

2. The second day had a local perspective beginning with a presentation on the integration of the Biodiversity Investment Areas, then looking at how indicators are put to use on a smaller scale. The case studies presented included Hamilton Harbour, Chicago Wilderness, the Marsh Monitoring Program, the Alvar Initiative, and the Wild Rice Program. Presentations on the second day also recognized some of the great restoration and rehabilitation work taking place in the Great Lakes basin: Ontario's Environmental Farm Plan, Saginaw Bay Watershed Initiative Network, the Rural Water Quality Program in the Regional Municipality of Waterloo, Ontario, Ontario Power Generation's Carbon Sequestration and Biodiversity Management Program, Tip of the Mitt Watershed Council, Xerox, and Hamilton Harbour Remedial Action Plan. All of these presentations were made by people who are closely involved in this work.

3. The third day looked at the individual Great Lakes and how indicators are used. The St. Lawrence River presentation focused on biodiversity and non-native species, the presentation on Lake Ontario looked at lake trout rehabilitation as well as indicators, while the rest of the Lakes and the St. Clair-Detroit corridor presentations looked at the state of the ecosystem. Lake Michigan also discussed the state of the fishery. Presenters were people closely involved with the individual LaMPs.

The majority of these presentations can be viewed at <http://www.epa.gov/glnpo/solec/2000/day1> or <http://www.on.ec.gc.ca/solec/solec2000e.html>



## 5. SOLEC 2000 Breakout Session Summaries

### 5.1 Indicators & Indices

#### Open & Nearshore Waters #1

Facilitator: Vicki Thomas, U.S. Environmental Protection Agency

Recorder: Robert Beltran, U.S. Environmental Protection Agency

Number of Participants: 39

#### Highlights of Indicator Discussions:

1. Indicators need to be customized / reported independently for each Great Lake. Need to have objective for indicators. Some indicators are too narrow in scope (for example, DELT needs to cover more than one fish species in one lake).
2. Need habitat / exotics indicators for open lake, nearshore, wetlands, fish / aquatic ecosystem. Need to bring the private sector (i.e., industry) plus non-government organizations and universities into process, including data sharing.
3. Management vision needs to be clarified for:
  1. nutrient loading
  2. native vs. stocked species (planted)
  3. definition of preyfish - natives vs. exotics

#### General Indicator Discussion:

- Walleye have more and better data available for abundance than for harvest.
- Why wasn't reporting on salmon and trout done?
- Some indicators have very sketchy data - scuds, for instance. Also, no data on Lake Superior north shore sea lamprey populations.
- The phytoplankton information used needs to be integrated with data sets from other agencies.
- Additional sediment core data exists for Lakes Superior and Michigan.
- Wastewater Pollutant Loading indicator (#7059) - an explanation is needed as to why this indicator is considered a Tier 3 indicator. Data exists to move this into Tier 1.
- Why does the indicator on Contaminant Exchanges (#120) need to be detached from indicators # 117-119? All of these processes are encompassed under programs such as IADN, both from the perspective of fluxes in and out of the open lakes.
- For indicator #115 (Contaminants in Colonial Nesting Waterbirds), why have sentinel species such as bald eagles been excluded? They should be highlighted not excluded.
- Extend the Phosphorus Concentrations and Loadings indicator (#111) to include a nearshore component and possibly tributaries and embayments components. This is needed in order to put the offshore phosphorus measurements into context.
- Need an indicator related to non-native species.

#### Highlights of Index Discussion:

1. It is good to have understandable indices that clearly express trends, but there is the danger of oversimplifying complex issues.
2. The group generally supports the idea of a data management workshop with trepidation regarding

commitment of resources.

3. Develop a public oriented pilot index for on-line and/or paper publication.

### **General Index Discussion:**

In general, the group supported the concept of the development of indices that combine a series of indicators.

- Could develop indices by geography - i.e., nearshore vs. wetland vs. open lake vs. tributary.
- Need some indices to reflect community conditions.
- Engage decision makers and legislators.
- Develop indicator objectives.
- Develop indices on issues of “drinkability”, “fishability” and “swimmability”.

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## **Open & Nearshore Waters #2**

Facilitator: Vicki Barron, Credit Valley Conservation Authority

Recorder: Dan Hopkins, U.S. Environmental Protection Agency

Number of Participants: 18

### **Highlights of Indicator Discussion:**

1. In general, the group agreed with the need/usefulness for all the indicators presented and were in general agreement about the assessments (e.g. poor, mixed, good) for each of the indicators. Notable exceptions, however, were the indicators for zooplankton and phytoplankton populations. The group concluded that these indicators are essential (necessary), but that more data is needed to make meaningful assessments.
2. The group believed that other sources of data could be tapped. They suggested that a useful vehicle for doing so was the SOLEC website. Specifically, they suggested that anecdotal information could be collected through the website and would be useful information to have (hexagenia density was used as a case in point).
3. Related to indicators in general, the group had two suggestions for improvement:
  - that the assessment of each indicator would be better described/supported with trend information and an assessment of its “absolute value” or relationship to a “threshold”; and
  - that graphics should be used to portray the data showing the spatial distribution of the information, e.g. (hexagenia recovery in Great Lakes).

### **Comments on Specific Indicators:**

- Walleye and Hexagenia (#9). A good indicator, but it is questionable whether there is sufficient data to represent whether the conditions are “improving” or “mixed”. There was a discussion about whether there were other data sources for this indicator. It was suggested that the SOLEC website be used to enable anecdotal information about hexagenia to be captured. Also, the Ontario Ministry of Environment has a group that is assessing walleye population. This group might be a good source of information in the future.
- Preyfish Populations (#17). One group member pointed out that the ‘principal author’ of this indicator didn’t agree that preyfish are a good indicator. Others argued that it is difficult to assess the individual

species constituting the indicator “preyfish” and that there is a lack of information with which to assess community or population level conditions.

Another asked, “when we talk about ‘biomass’, then which species are we discussing? If we’re talking about salmon, then we need alewives as a primary forage base. If alewife population is low, then salmon don’t do well. If we want a good sportfish population, then the relevant forage fish base is needed.”

The group seemed to accept the suggestion that “changes in native preyfish” might be a better indicator, but there needs to be clarity about what (sportfish) the native preyfish is an indicator for. The endpoint needs to be better defined for this indicator to be very useful, otherwise it is too hard to characterize.

- Spawning-Phase Sea Lamprey Abundance (#18). A better measurement would be the number of lampreys or a lamprey wounding rate. The group thought that trap catches of lamprey shouldn’t be dropped, but recommended adding wounding rate. Also sea lamprey population might be a good indicator of tributary condition.
- Lake Trout (#93). This indicator should include the success of native trout as well as the health of stocking success. Because both fishing pressure and lamprey are the principal sources of lake trout mortality, fishing pressure should be considered a measure for the indicator.
- DELT in Nearshore Fish (#101). DELTs are a good indicator, however, data is only available for Lake Erie. In order to report out, need more data. *This discussion led to a general conclusion that it would be preferable to have trend information and a threshold value included with the assessment of an indicator.*
- Phytoplankton Population (#109). One of the members believed that the reason the indicator measure is “uncertain” is that there is no agreed upon endpoint. The group believed that it was legitimate to include this indicator, but that there was a need for more data about it.
- Phosphorus Concentrations and Loadings (#111). The group agreed that this indicator should be included and also agreed with the assessment “mixed”. *This discussion also led to a general conclusion though, that (at least for some indicators) it is better to have graphics showing spatial distribution of an indicator subject, rather than an assessment such as the word “mixed” - it’s just not sufficiently descriptive to be meaningful.*
- Contaminants in Colonial Nesting Waterbirds (#115). The group believed that this indicator is necessary. They also agreed that the assessment was OK.
- Zooplankton Populations (#116). The group recognized that zooplankton population is an important indicator, however, it needs work to be useful. The group suggested that the status of this indicator be changed to “Tier 3”. It was noted that there are no agreed upon endpoints or metrics. Zooplankton population is subject to fluctuations that make it difficult to establish endpoints. How should it be measured? With sufficient data, we could get useful information on conditions and trends.
- Atmospheric Deposition of Toxic Chemicals (#117). The group agreed that it should be an indicator, and agreed with the assessment for it.

- Toxic Chemical Concentrations in Offshore Waters (#118) - The group agreed that it should be an indicator, and agreed that the assessment for it was OK.

#### **Additional Recommended Indicators:**

The group identified several indicators that they felt should be included in the suite but weren't.

- Dissolved Oxygen (D.O.). D.O. was thought to likely be only an issue for the middle basin of Lake Erie. Some group members thought that D.O. should be a nearshore indicator arguing that there are local pockets and areas where D.O. is low and caused by morphology and specific sources (e.g. aqua farming such as in Georgian Bay).
- Bacterial Loading in Nearshore Waters. This indicator could be used to describe the result of loading from sources such as black/gray water, recreational boats, and aqua culture.
- Chemical Concentration in Nearshore Great Lakes Waters. The group thought this indicator could be used to describe water column conditions.
- Chemical Contaminants in Whole Fish.

#### **Highlights of Index Discussion:**

Indices might be useful provided:

- more than one are used to describe ecosystem effects;
- they have a geographic focus (e.g. Detroit area or Lake), but not used to integrate over the Lakes;
- combining of indicators are done on a "theme" basis (e.g. fish-food web relationship, pollutant loading for water quality, or trophic states);
- must know who you are communicating the value of the index to; and
- they must be defensible and meaningful. The user must understand the basis for the index.

#### **General Index Discussion:**

The question was asked "what about indicators being of the same weight within the index?"

One of the group said that it (use of an index) was an issue of resolution. He used an analogy of flying an airplane to illustrate his point. He posed the question - "if you were flying an airplane, would you be willing to have the instrument panel consist of warning light gauges to show a malfunction, or would you rather have gauges that register specific readings of barometric pressure, airspeed, etc. in order to fly the plane?"

Another participant used a different analogy, saying "if you mix grapes, bananas, apples, and pears, what do you get besides fruit salad? Is it defensible and meaningful?"

One of the participants suggested that such indices can be useful to scientists, but to be useful they must be written in a plain and understandable way. Another participant pointed out that an index can be useful, citing the example of an air quality index. "People may not understand the various parameters or indicators that comprise the index, but if they know that when the index reaches a certain level, more people are admitted to their hospital, then it can be understandable".

The group felt that to be meaningful an index had to have an appropriate geographical scope. The use of an index on a Lake-by-Lake basis might work, but they doubted whether a single index could be used to describe the condition of the entire basin. Also, if indices are used on a Lake-by-Lake basis, then you really

must use more than just one index. Further, that the indices should be grouped thematically (e.g. by food web relationships, by air/water pollutant loading or air/water quality, or by trophic status). It may be hard to set endpoints.

Another participant said that indices are OK provided that they are useful for those who wish to use them. However, you really need to understand who you are communicating with and it is necessary for you to know how the index was derived. If we were to prioritize indices, then prioritize Diporeia population/condition.

The group took a vote about whether the use of indices made sense. The group split 5 yeah, 5 nay, and 2 undecided.

The last discussion captured other index (indices) work:

- University of Wisconsin, Green Bay is using clustered indicators as a tool for the RAP (“remedial action plan”). This has a geographical focus - the southern half of Green Bay;
- IBI has a large literature base; and
- Ohio uses a Lake Erie Quality Index.

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## Coastal Wetlands

Facilitator: Tim Henry, U.S. Environmental Protection Agency

Recorder: Dave Cowgill, U.S. Environmental Protection Agency

Number of Participants: 65

### Highlights of Indicator Discussion:

1. The Great Lakes Wetlands Consortium holds much promise to fill wetlands data gaps, to develop a consistent approach to monitoring wetlands and to develop compatible data sets throughout the basin.
2. The existing data needs to be viewed within the proper context because:
  - S the natural variability and fluctuations of wetlands may or may not affect apparent results;
  - S the short-term nature of data sets makes it hard to draw trend conclusions, and
  - S it is critical for data consolidation to create any kind of index.
3. We don't know where the “gas gauge” is. We still need more and better data as well as objective endpoints. We cannot, but should be able to, tell the story well to either decision-makers or the general public.

### General Indicator Discussion:

- We need a communication strategy that parallels the development of the wetlands indicator developments.
- We need to link indicator development with the Great Lakes priority places.

**Session Goal:** The purpose of this session was to review the fourteen coastal wetland indicators presented in the SOLEC reports and/or conference presentations, and make recommendations on improvements, information sources, research needed, and the potential for the development and use of an index.

The indicators were critiqued, and sorted into the following categories:

**Tier 1** (have data for the indicator, can report):

- 4504 - Amphibian Diversity and Abundance
- 4507 - Wetland-dependent Bird Diversity and Abundance
- 4861 - Effects of Water Level Fluctuations

**Tier 2** (monitoring/data collection program is funded and ready to go):

- 4501 - Coastal Wetland Invertebrate Community Health
- 4502 - Coastal Wetland Fish Community Health
- 4506 - Contaminants in Snapping Turtle Eggs
- 4510 - Coastal Wetland Area by Type
- 4513 - Presence, Abundance and Expansion of Invasive Plants
- 7055 - Habitat Adjacent to Coastal Wetlands

**Tier 3** (indicator needs research and/or an advocate):

- 4503 - DELT in Coastal Wetland Fish
- 4511 - Gain in Restored Coastal Wetland Area by Type
- 4516 - Sediment Flowing into Coastal Wetlands
- 4860 - Nitrates and Total Phosphorus Into Coastal Wetlands
- 8142 - Sediment Available for Coastal Nourishment

Points raised in this session include:

- 1) The importance of time as a dimension of indicators - are we measuring variability over a short period of time, or a true trend?
- 2) The importance of sound science in all indicators.
- 3) The possible use of a “keystone species” for invertebrate indicators.
- 4) How much data is needed (minimum) to report a result?
- 5) We need indicators of coastal wetland function and value, not just quantity and type.
- 6) Data sources should be referenced.
- 7) If a numerical index is used, we should include our confidence in that number.
- 8) Land Use Cover should be added.

Potential sources of information mentioned include:

- 1) The Nature Conservancy
- 2) U.S. Army Corps of Engineers
- 3) U.S. Environmental Protection Agency
- 4) Environment Canada
- 5) Sierra Club
- 6) National Oceanic and Atmospheric Administration
- 7) State Agencies
- 8) Canada Department of Fisheries and Oceans
- 9) Ontario Ministry of Natural Resources
- 10) Local Conservation Authorities (Canada)
- 11) U.S. Geological Survey
- 12) National Park Service (U.S.)
- 13) U.S. Fish and Wildlife Service
- 14) U.S. Department of Agriculture (Natural Resources Inventory)

- 15) Ducks Unlimited
- 16) North American Herpetile Association

### **General Index Discussion**

Issues related to the use of an index include:

- c Some indicators are “indices”, others just indicators.
- c With an index, you might oversimplify already simplified data. Weighting factors might be needed.
- c There is a risk of people drawing their own conclusions (incorrectly) if data are not summarized and interpreted for the public.
- c All indices are dangerous, because they are subject to abuse.
- c An index for a given area is only good if done for a range of water levels, due to the extreme variability of coastal wetlands attributable to fluctuating water levels.
- c We should consolidate our effort around the solid indicators, and build research around these.
- c In communicating indicators, it is desirable to include multiple levels of detail (a “headline”, a story line, and the “article”).
- c The SOLEC indicators are useful.
- c In reporting on indicators and indices, qualifiers could be added to ranking factors (e.g., lo-med-hi, Best Professional Judgment, Established Monitoring Program, A One-Time Research project, extrapolated to a larger area, etc.).
- c It is critical that we find a way to explain the findings of SOLEC to the public, so we effectively communicate to them. Otherwise, the message might be misinterpreted.

In general, there was not much support in this session for reducing an index down to a number. There was a mixed reaction to the “amoeba diagram” approach. The group tended to prefer the approach that listed indicators with color-coded shading to convey information in both a text-based and graphical manner.

The point was made strongly in this session that the binational Great Lakes Wetlands Consortium holds much promise to fill wetlands data gaps, to develop a consistent approach to monitoring wetlands and to develop compatible data sets throughout the basin.

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## **Land (including Nearshore Terrestrial and Land Use)**

Facilitator: David Smith, Lura Consulting

Recorder: Philip Gehring, U.S. Environmental Protection Agency

Number of Participants: 42

### **Highlights of Indicator Discussion:**

1. The indicators for “artificial coastal structure” and “extent of hardened shoreline”, are essentially the same and should be welded together.  
There was also concern expressed about the criteria (or lack of) for developing, selecting, negating indicators, and the need for clarification of endpoints.
2. Groundwater needs to be considered as an indicator.
3. Water level fluctuations impacts include:
  - c stream flows



- c impervious area (land conversion) should be added, data may be limited to 80's from NASA, no new data being generated?
4. Need more involvement between SOLEC events - i.e., Forums for getting together to continue discussions.

The first breakout session began with two brief presentations on agricultural land use programs in Canada and the United States. The presenters were Peter Roberts, Ministry of Environment, Canada and Roger Nanney, U.S. Dept. of Agriculture. Mr. Roberts discussed the Ontario Environmental Farm Plan, a voluntary program of risk assessment of farming activities. Over 15,000 Ontario farmers were exposed to the program through local workshops. Web page information is also available. The program consists of 23 modules to evaluate environmental risks in farming practices. Mr. Nanney presented a description of the Conservation Reserve Program and the voluntary Environmental Quality Incentive Program in the United States. The Conservation Reserve Program has twelve areas of activity. Some of the areas include erosion control, tillage, waste management and conservation buffers. The Environmental Quality Incentive Program helps the farmer to identify projects and practices that can be used to improve environmental impacts and some assistance in carrying out approved plans.

Discussion of indicators was limited due to time constraints and the participants having little time and/or exposure to the background materials.

Are the indicators in the set for this breakout session still necessary and sufficient? If not, what should be changed / added / deleted? :

- c indicators #8131, Extent of Hardened Shoreline and #8146, Artificial Coastal Structures should be melded together into a single indicator;
- c a new indicator should be developed to evaluate impacts of land use on groundwater volume and quality, particularly impacts on drinking water supplies;
- c water levels and flow variations due to land use activities should also be developed into an indicator;
- c the increase of impervious surfaces attributed to urban sprawl could be a key indicator.

The participants expressed a lack of understanding of criteria for establishing or removing an indicator from the suite. The use of peer review was suggested.

What research needs can you identify to further develop or implement the indicators in this set? :

- c Governments must take leadership role to connect community resources.
- c Define clear simple QA/QC criteria.
- c Utilize volunteer monitoring resources.
- c Provide "Chat Room" location for organizations to ask questions, report data, request equipment and resources, and provide for training and workshop announcements. Perhaps SOLEC could support the "Chat Room".
- c A number of databases are available. A center to collect a list of the data bases and how they can be accessed is needed. Databases must also be documented for QA/QC to be most useful. The U.S. Army Corps of Engineers has data on structural armoring of lakeshore, U.S. Geological Survey has hydrological data, and the Lake Michigan Monitoring Council has data to share. Every community/county has a Five Year Plan or something similar that could be tapped.
- c Biological data is very limited.



A “Position” with staff is needed, possibly 3 people to cover biotic, physical, and chemical types of databases related to land use. Another suggestion was to have a core group for land use indicators with a volunteer to work on each indicator. A forum for discussion of indicator topics should be established to provide a continuum between SOLEC conferences and to provide a base of informed individuals to work with interested conferees in the future.

**Does *an* index approach make sense? :**

In general the group felt the index approach made sense. There was considerable discussion of reservations for using indices. Over-simplification, loss of scientific integrity, hidden controversial issues and political bias concerns were some of the reservations expressed.

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## **Human Health - General**

Facilitator: Heraline Hicks, Agency for Toxic Substances and Disease Registry

Recorder: Carolyn O’Neill, Environment Canada

Number of Participants: 35

### **Highlights of Indicator Discussion:**

1. Women and especially minorities, are less likely to know about fish consumption advisories in the Great Lakes basin.
2. While exposure levels are much lower now than they were 20 years ago, and the effects observed are subtler, the fish eaters study being carried out in Ogwego, NY, is replicating the Jacobsons’ Michigan study findings. More time is needed to determine the long-term significance of these findings.
3. Older adults (50 +) exposed to PCBs through fish consumption are at risk for neuropsychological impairment (lower scores of verbal memory and learning).

The Agency for Toxic Substances and Disease Registry’s (ATSDR) Great Lakes Human Health Effects Research Program (GLHHERP) was initiated in 1992 and is designed to characterize exposure and investigate the potential for short- and long-term adverse health effects from exposure to persistent toxic substances (PTSs) via consumption of contaminated Great Lakes fish. This research program focuses on the “eleven critical Great Lakes pollutants” identified by the International Joint Commission as well as other chemicals of concern in the Great Lakes basin. The program assesses human exposure to these toxic chemicals and associated potential health effects including behavioral, reproductive, developmental, neurologic, endocrinologic, and immunologic end points.

The ATSDR’s GLHHERP have identified several human populations who may be at particular risk because of greatest exposure to Great Lakes pollutants via fish consumption. Predisposition to toxic injury in these populations can be due to behavior (e.g., degree of contaminated fish consumption), nutritional status, or physiology (e.g., developing fetuses), and other factors. These communities of concern include subsistence fish anglers, American Indians, Asian Americans, pregnant women, fetuses, nursing infants of mothers who consume contaminated Great Lakes sport fish (GLSF), young children, the elderly, the urban poor, and those with compromised immune function.

Over the past four years, the program has made significant progress in reporting and evaluating findings that address public health issues from exposure to contaminants in the basin. One primary reason for this progress is the program has focused its research efforts on assessing sensitive health outcomes in vulnerable, i.e., at-risk populations. The Human Health breakout session at SOLEC 2000 described and discussed research findings in 3 areas - socio-demographics, exposure data, and human health outcomes.

Other recent exposure findings indicate the following:

- c At-risk populations in the basin continue to be exposed to PTSs;
- c Body burden levels of some PTSs in at-risk populations are higher than in the general population. Body burdens for some of these contaminants are 2 to 4 times higher than those of the general U.S. population;
- c Residents in the Great Lakes basin ate more fish than the 6.5g/day often estimated for the U.S. population; and
- c Men consume more fish than women; men and women eat Great Lakes sport fish during most of their reproductive years.

In terms of socio-demographics, certain trends and behaviors have been identified in some of the at-risk populations. A recent survey estimated that 4.7 million people consumed Great Lakes sport fish (GLSF) in a given year; 43.9% of the respondents were women. Approximately 50% of the respondents who had eaten GLSF were aware of a health advisory for fish, and awareness differed significantly by race, sex, educational attainment, GLSF consumption level, and state of residence. For example, fish advisory awareness was greatest for the individual who is a white male with a college degree, consumed greater than 24 GLSF meals a year, and lived in either Wisconsin or Michigan. To the contrary, 80% of minorities who had eaten GLSF were unaware of the fish advisory, and awareness was especially low among women.

In addition, research indicates that fish is an essential component of the diets of minority populations and Native Americans, and their choice of fish and cooking practices may increase their exposure to contaminants in fish. When we examine exposure levels in these populations, we find a significant trend of increasing body burden with increased fish consumption.

Some of the health findings describe included the following:

- c Significant menstrual cycle reductions were indicated in women who reported consuming more than 1 meal per month of contaminated Great Lakes sport fish.
- c Maternal consumption of Great Lakes sport fish for 3 to 6 years was associated with reduced fecundability.
- c Neurobehavioral and developmental deficits have been observed in newborns (12 to 24 hours after birth and again 25 to 48 hours after birth) of mothers who consumed approximately 2.3 meals per month of contaminated Lake Ontario fish. In these newborns the relationship between prenatal exposure to PCBs and performance on the Neonatal Behavioral Assessment Scale (NBAS) was assessed. The results indicated significant relationships between the most highly chlorinated PCBs and performance impairment on the habituation and autonomic tests of the NBAS at 25 - 48 hours after birth. No significant relationship was found between PCBs of lesser chlorination, DDE, hexachlorobenzene, mirex, lead or mercury on any NBAS performance test. The exposed newborns are now three years of age and initial test results for memory, verbal, and perceptual performance indicate their score is lower than children from mothers who consumed low amounts or no Great Lakes sport fish.
- c Self-reported liver disease, diabetes, and muscle/joint pain may be associated with exposure to PCBs and other contaminants via fish consumption. PCB concentrations were significantly

associated with poorer pegboard performance in this sport fish consuming population. The pegboard performance test evaluates visual motor coordination and spatial orientation.

- c PCBs and dichlorodiphenyl dichloroethene (DDE) were markedly elevated in an adult fish-eating cohort. Exposure to PCBs, not DDE was associated with lower scores on several measures of memory and learning.

### **Public Health Implications**

There is good news. Pollutant levels in the environment have declined substantially, particularly from the 1970s and into the 1980s. More recent trends however, are less clear, indicating a possible plateau as well as an increase in pollutants from outside the basins via atmospheric transport. But overall, this is a success story of primary prevention; pollution prevention through a partnership among regulatory agencies, health agencies, and industry. They have all put technologies in place to reduce emissions into the environment. Unfortunately, that good news is tempered by the fact that body burden levels of some PTSs in vulnerable populations are 2 to 4 times higher than those of the general U.S. population. We also recognize that body burdens of key pollutants in the general population have been identified at levels that are within an order of magnitude that produces health effects in experimental settings.

Vulnerable, i.e., susceptible, populations are at risk for adverse health effects. These populations are at risk because of elevated exposures as well as possibly intrinsic physiologic sensitivity. Sufficient evidence is available to demonstrate that exposures to certain toxic substances can cause harmful health effects. Therefore, without public health interventions, strategies and risk communication efforts, future exposures will continue to harm human health.

With respect to the future, the time has come to promote the need for a strong surveillance system merged with an effective environmental contamination monitoring program. There is also a need for continuing research. Much still needs to be learned about adverse neurodevelopmental deficits in newborns, cognitive deficits and reproductive health effects in adults from exposure to PTSs. These adverse health effects as well as others need further investigation. Finally, we cannot lose sight of the fact that the benefits from fish consumption should be considered when evaluating the health implications of fish consumption. Fish provide a diet high in protein and low in saturated fats, and some studies suggest that eating fish each week is helpful in preventing heart disease.

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## **Human Health - Swimming Advisories**

Facilitator: Gary Kohlhepp, Michigan Department of Environmental Quality

Recorder: David Barna, U.S. Environmental Protection Agency

Number of Participants: 23

### **Highlights of Indicator Discussion** *(note, this session focused on one indicator):*

1. There is a need to develop consistent and timely monitoring methodologies and protocols with respect to sampling frequencies, methods and analytical procedures. An emphasis needs to be on developing a quantitative rapid *E. coli* assay (within 2 hours) - in order to get real-time information.
2. At this time, *E. coli* is a good indicator for "Swimmability", recognizing that other pathogens need to be considered also.

3. There is a need for additional epidemiological research to further define what is a harmful exposure and what other organisms (virus, etc.) could be considered as indicators.
4. Recognition that beach monitoring should be strongly encouraged by local entities, with funding available from state/provincial/federal support.
5. Use the U.S. Environmental Protection Agency National Survey as a starting point to summarize U.S. Beach data for SOLEC reporting. U.S. Environmental Protection Agency should be the lead agency for this indicator.
6. Index needs to be normalized to reflect the number of times the beach is monitored (number of monitoring days), so entities are not penalized for more frequent monitoring. This may require more than one type of index (specific to the beach, i.e. different weighting factors)

The session began with presentations from Marcia Jimenez, First Deputy Commissioner, Department of Environment, City of Chicago and Dr. Richard Whitman of U.S. Geologic Survey concerning a comprehensive research project conducted at a Chicago area beach. Dr. Whitman outlined the elements of the massive, yet unpublished, research project attempting to identify what are the controlling independent factors affecting *E. coli*. Extensive weekly sampling was conducted, including replicate and duplicate samples, throughout the day to document daily variations. A weather station was established and continuous monitoring of 20 parameters was performed. The research project is developing a predictive model to identify the best predictive variables. Initial results have identified six physical parameters in a predictive model yielding a relatively high predictive relationship. Ms. Jimenez concluded with a discussion on how to manage waterfront areas and how to communicate effectively health risks of swimming advisories to the public. Important elements include: identify sources of negative impact to water quality; analyze these sources and eliminate negative impacts; establish a monitoring program; team up with local health officials; establish a protocol for informing the public of health risks; and, “think out of the box”.

### **Reactions and comments to the Tier 1 indicator *E. coli*.**

#### ***E. coli* as a Human Health Indicator:**

- It is a useful indicator.
- There is a need to identify the relevance of *E. coli* to human health.
- Epidemiological studies are lacking.
- It’s the best indicator we have, good for prudent public policy.
- There is no ‘perfect’ indicator, so let’s get on with using *E. coli* and get focused in a common direction.

#### **Monitoring/Sampling/Analytical Procedures:**

- There is a need for rapid (within 2 hours), quantitative *E. coli* in the U.S. and other testing procedures to give decision makers timely information.
- The variability of data is affected by the frequency of sampling and time of day sampling occurs.
- Analytical instrumentation is costly. Perhaps passage of the “Beach Bill” in may expedite the development and funding of these needed analytical technologies. There is a need to “pressure” the scientific community to develop these quantitative, rapid techniques.
- There is a need to establish good, representative sampling devices and procedures.
- There is a need to establish standard operating procedures for monitoring activities in order to generate comparable data. This needs to be consistent throughout the Great Lakes basin.

- Ontario *E. coli* maximum is 100, U.S. risk number is too high.
- Basin-wide data collection is also needed (currently mainly urban beaches are monitored).
- Miles of swimmable beaches.
- Popularity of beach.
- At a lifeguarded beach the public perception is that public health is being protected. At a minimum, public beaches that are guarded (lifeguards) should also be monitored.
- There is a need to normalize beach closure days with the number of sampling days.
- The Great Lakes Beach Conference was held in Chicago, IL on Feb. 6-8, 2001 as a forum to discuss the science and technology behind beach monitoring and closure.
- What's happening at night to affect *E. coli* levels? Resuspension, reproduction, resuscitation.

#### **Beach Management:**

- Beach managers “need to know their beaches”.
- There is a need to standardize and profile local beach conditions and parameters.
- U.S. Environmental Protection Agency is compiling beach management information in its National Health Protection Survey of Beaches.
- The way the survey is done is important, so is how the information is communicated to the public (which beaches are monitored and why it is important). How to best convey information to the public? Educate public - risk communication.

#### **Who/What Entities are Involved:**

- Mostly local Health Departments, Park Districts, etc. It is important to note that they have resource constraints.
- Major recreational beaches in U.S. and Canada are monitored.
- Michigan law does not require mandatory beach monitoring.
- U.S. “Beach Bill” may establish a framework for monitoring.
- There was agreement that monitoring should be done by local entities, with a requirement from higher authorities. These entities should have a public health component/authority.

#### **What is Needed:**

- There is need for a requirement that public beaches have monitoring (laws).
- Need power for ‘pre-emptive’ closure authority (i.e. after a heavy rainfall event).
- Build capacity/incentives for local entities to become more involved. Consider using a “star” ranking for beaches (e.g. dry cleaners 5 star program, cruise ship star rating for sewage system on ships). Possibly hook in with the Environmental Protection Agency beach survey, based on index (multiple component e.g. 5 star if you have a source control program, or a 5 star rating can mean that you’re confident the County Health Dept. is certain of beach health based on excellent monitoring or another factor).

#### **Monitoring - is more “better”?**

- Some entities are hesitant to monitor more. More monitoring may lead to more closures.
- But, is it worse not to monitor? It may look bad to the public if there is no testing.
- There was agreement that governments have to set policy and standards.
- Liability needs to be considered (if one is not required to monitor and a swimmer gets sick, is a beach manager liable?)
- More monitoring may follow public pressures for access and the concept that recreational beaches are an economic benefit.

#### **Opportunities to Address Issues:**

- Implement Great Lakes Commission recommendations basin-wide. Work out monitoring protocols.
- Signing of U.S. “Beach Bill” will give states the opportunity for grant funding of programs.
- Partner with local industries for support.
- Bring issue before Great Lakes Governors – sell them on economic benefits of clean/healthy recreational beaches.
- Need for a consolidated approach, as many entities are involved.
- U.S. Environmental Protection Agency’s Great Lakes National Program Office (GLNPO) funding of programs.

#### **How Should Data Be Reported as a SOLEC Indicator?**

- Use the U.S. Environmental Protection Agency “National Survey” as a basis/framework to compile/collate data.
- Need to integrate data into a riparian ecosystem approach.
- This is not an isolated issue, however it is disconnected from other environmental issues on Great Lakes. With loadings of fecal coliforms, we can infer other loadings, e.g. pharmaceuticals.
- Need to consider what *E. coli* is doing to fish, benthos. It could be part of a nearshore index tied to contaminated sediment disposal issues, animal runoff, septic, etc. May need another organizational level to address this. Maps/GIS are ways to integrate all of this data. Need to stop looking at these indicators in isolation.
- Need to identify quality of data reported (like metadata).
- Tap GLNPO as a source to fund a reporting mechanism.

#### **General Discussion on “Index” Approach:**

- One respondent stated that it doesn’t make sense, the general public won’t relate to scientific jargon.
- Indicators used in an overall index are based on many factors which impact its validity.
- Need to give appropriate weights to factors forming an index.
- With respect to beach closure, need to consider the number of swimming days, and the number of monitoring days.
- Consider beach-miles.
- Need to normalize with the number of monitoring days.
- A need was recognized to consider the audience for indicators/indices (public; beach managers) – there may be a need for different indicators/indices for different audiences.
- Tie in “swimmability” with other human health indicators (number of fish advisories, drinking water, etc).
- There is a need for a ‘management indicator’, to rank the quality of monitoring programs (e.g. are we eliminating sources?).
- Three factors for a closure/monitoring index were considered including: percent of miles monitored; percent of swimmable days, and percent of monitoring days.

## **Human Health - Drinking Water**

Facilitator: Joanna Kidd, Lura Consulting

Recorder: Bill Spaulding, Eial Dujovny, (*both of*) U.S. Environmental Protection Agency

Number of Participants: 15

#### **Highlights of Indicator Discussion:**

1. There is not much good raw water data. A method for collecting and reporting it needs to be developed.
2. Protection of source water needs to be emphasized.
3. To get consistent monitoring, we need to standardize data collection methods and ensure data is available.

**Question:** Should there be a standard for raw water?

- Need to develop tool/mechanism to assess raw water e.g. U.S. Environmental Protection Agency protocol.
- Ontario Ministry of Housing - setting reporting protocol for private wells.

The discussion focused on the Drinkability Indicator (#4175) description. During the first part of this session, questions were discussed concerning the drinkability indicator. The second part of the session looked at the index approach.

**What is your reaction to the write-up and presentation on the drinking water indicator?**

The group was asked for its reaction to Rod Holme’s presentation during the morning plenary session. Consensus was that it was a good presentation. Source water assessment and protection needs to be emphasized. States are in the assessment mode.

Before we implement protection activities we need to define source water assessment and protection areas, then do the protection.

- Sediments from dredging activities could have a significant impact on intakes and also are a possible source of contaminants.
- Some systems have problems with algae (i.e., Bay of Quinte). Because of high algae bloom concentrations, much higher chlorine concentrations must be applied. More chlorine creates trihalomethanes which are linked to cancer in humans.
- Climate change could be another factor/concern.

The group felt that Rod Holme’s presentation seemed to infer that there is not much difference between the 3 primary parts of public water: raw source water quality, treated water quality at the entry point to the distribution system, and treated water quality in the distribution system.

**Drinking Water Quality**

- Raw water conditions can vary widely and are generally site specific to intake locations. Some water quality is naturally better than others. Conditions can not be reliably projected to accurately reflect overall Great Lakes water quality. The mechanics of assessing overall raw water quality in the Great Lakes is difficult.
- Electricity generating stations generate heat and warm up lakes. How does this affect drinking water quality?
- Raw source water quality for drinking water systems needs to be at safe levels. Raw water quality is typically not assessed for toxic chemicals and information is not available to the public.
- According to the Michigan Department of Environmental Quality, the Saginaw/Midland public water system has chemical data and has offered it to anyone who wants it, but other agencies didn’t want it or were not interested in receiving it. Available data sources should be identified and the data should be



compiled.

- River and groundwater quality data is missing. It is important to improve river water quality so that drinking water sources which are likely to be impacted by them are protected. The science of groundwater movement is poor and the interaction between groundwater and surface water needs to be more clearly understood. Should there be a protocol for reporting groundwater conditions?
- Agricultural runoff is a significant source water protection concern.
- Private wells are not covered.
- What do you monitor in raw water to adequately satisfy the public need for information and promote consumer confidence in public drinking water quality?

The existing indicator for drinking water appears to be adequate. The primary drinking water challenge for Great Lakes water systems: We need to develop a tool for assessing raw water quality and develop approaches for protecting source water quality.

### **How do we get consistent and regular reporting?**

There is data, but the way in which water quality is monitored and reported is not consistent. A consistent monitoring and reporting format and protocol is needed.

Ontario just enacted a regulation in August 2000 which requires that monitoring results be posted on the web. Ontario maintains a drinking water system surveillance program. The quality of data in the Canadian drinking water data base is good, the issue is accessibility. The U.S. maintains a database (Safe Drinking Water Information System) of treated drinking water information, but data retrieval is problematic. Discussions between Ontario and the U.S. on data consistency and reporting would be beneficial.

Getting raw water quality data from water systems may be difficult. It's in different formats and parameters. Ontario requires records be kept 5 years. Most are in hard copy. The issue of archiving needs to be addressed.

What is the best way to assess raw water quality?

### **Are the “purpose”, “ecosystem objective”, and “measure”, etc. OK as written in the indicator description?**

Does the language in the ecosystem objective for the Drinking Water Quality indicator (#4175) accurately reflect source water protection concerns?

Most thought that the indicator should not measure water quality solely at the plant. The ultimate measure of the quality of the product provided to the consumer is at the tap. There was a consensus that water quality should be tracked at 3 locations: raw water quality at the intake, treated water quality at the plant as it enters the distribution system, and at the tap.

Some water contamination (e.g. radionuclides) is naturally occurring.

Taste and odor is generally considered a secondary contaminant. That means that standards exist, but they do not cause adverse health effects and are not enforceable. Telling the public that taste and odor is an “aesthetic” condition frustrates and angers the public. Taste and odor in their minds is a real problem.

### **Summary Statement:**

Water processed through public drinking water systems should be of high quality, beginning with raw water,



then during and after treatment, and ultimately at the tap.

### **Supporting recommendations:**

A uniform database is needed for storing drinking water quality data for these three focus areas, using available data. Avoid setting up parallel data collection systems.

### **Highlights of Index Discussion:**

1. Indices may be useful if you define well, the question to be answered.
2. Need to be careful about the definition of index and the selection of indicators should recognize linkages.
3. Indices are an approach that can be a useful communication tool for decision makers and the public.

### **What do the participants think about an index approach?**

- c It is a good communication device. Vector mapping works well in different areas. It is another way to show progress.
- c It is a simpler way of presenting data so that the public can have a scorecard of what the situation is at the moment.
- c Indices should not replace indicators. Yet, it is an effective and visual communication card. A way to meet basic communication issues.

### **Clarify what is meant by an index.**

- c An index is a numerical value that relates to a complex situation and can be tracked over time. Examples include Dow Jones Index and the Air Quality Index in Ontario.
- c Ohio River has a water index. It is a state index that is combined with data from Ohio and Kentucky. It looks at rainfall, combined sewer overflows, *E. coli*, weather forecasts, etc.
- c The question of scale needs to be addressed. A whole basin approach?
- c A *water index* (not just a *drinking water* index) was suggested.
- c It is important that there be a trend.

### **What other indices are known to the group?**

- c The World Business Council for Sustainable Development has an index approach that looks at sustainable development.
- c There has been some academic work on this subject from York University and Statistics Canada.
- c Nortel has an environmental performance index.
- c Used widely in industry as a means for quality control.

### **What are the limitations for Indices?**

- c Indices need to be defined as an aggregate process. The level represented by the index needs to be known. This is a question of scale. This can lead to a higher level of abstraction and/or synthesis.
- c Indices show and hide something. Shows a number that shows the situation.
- c There is the question of causality between indicators and indices. Some indicators are not specific to specific zones. Designed to be user friendly, not necessarily scientific.
- c An index is a synthesis. They should not be constructed to create a trigger level. More for the consumption of the general public. Indexes are an early warning system.
- c The indicators have already been chosen.

**Is the goal a harmonized index across the Great Lakes? Perhaps there needs to be a separate index for each lake? Once again, this is a question of scale.**

- c Walleye, for example is a good indicator since it is a good integrator.
- c Some people have a problem with it since it is negatively affected by cleaner water.
- c Fish consumption is an example of an index that is too complicated. Different fish species and fish sizes have different consumption advisories. There is also the issue of synergistic effects.
- c Use the Great Lakes Water Quality Agreement as the guideline for what is needed. Use indicators and indices to answer these questions.

**What about drinking water? Should it be part of any index?**

**If you take a chemical approach, what would be included in a water index?**

- c The next step is not the selection of indicators for an index, but rather how they link together. There are synergistic influences and relevancies to each other that need to be considered.
- c Need to be certain that indices provide value.
- c There is a problem with getting something to a higher level of analysis. The question is not clear.
- c Need to consider other approaches such as the benchmark approach employed in Oregon.

**Index Discussion Summary:**

- c Indices are premature and need to first be fleshed out in a different form.
- c Needs to be better defined.
- c Need to be careful about what exactly is being communicated.
- c Need to ensure that indices add value.

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## **Human Health - Fish Consumption Advisories**

Facilitator: Adele Freeman, Toronto and Region Conservation Authority

Recorder: James Schardt, U.S. Environmental Protection Agency

Number of Participants: 26

**Highlights of Indicator Discussion:**

1. An education component is an important aspect of communicating the significance of the advisory - people must be made aware of the risk of not heeding the fish consumption advisories.
2. The indicator developed (with concentrations and interpretation based on most sensitive population) is a good approach to a basin-wide indicator.
3. There is still a question about how this overall indicator relates to actual fish consumption advisories in the basin. A SOLEC indicator needs to address how jurisdictions interpret the data - maybe in another indicator.
4. There are data / models out there for incorporation and use in this indicator.
5. There needs to be a greater consideration of how this indicator will address the different fish consumption advisories which exist, in order for this indicator to be interpreted by the public.

## **Part 1: SOLEC Indicator #4083 - Contaminants in Edible Fish Tissue**

### Discussion of Fish Consumption Advisories Indicator

- c Indicator presents a “Space Shuttle” overview of fish consumption advisories; it is unclear how it relates to more local, “biplane” scale.
- c It is unclear how the target thresholds relate to locally implemented fish consumption advisories.
- c This indicator is part of a suite of indicators that would indicate progress on clean-up. Overall program effectiveness would need to be confirmed with other indicators.
- c This is a human health indicator (samples are skin on fillets). An ecosystem health indicator should also be developed (whole fish).
- c The indicator uses a target level based on most sensitive populations. However, it is not clear how the exposure was determined. There is a need to standardize the exposure component.
- c Figures should clarify that the data is from skin on fillet.
- c It is not clear how fish contaminant loads translate into “can you eat the fish?”.
- c The endpoint of the indicator was questioned. Will this be comprised of the advice published in existing advisory booklets?
- c The indicator may not address the most sensitive populations: special populations with enhanced chemical sensitivity.

### Discussion of how to expand data set and share the indicator:

- c The data set should be made available on the U.S. Environmental Protection Agency internet site.
- c A list of federal, state, and tribal contact people for fish consumption advisories should be provided.
- c Laboratories should be surveyed to see if there is more data available.
- c Indicator should reflect the fish that is being consumed the most, probably not lake trout/coho.
- c Indicator should report on mercury concentrations as well.
- c Need to clarify terms, there is confusion with the difference between a contaminant level indicator and a fish consumption advisory indicator.
- c The objectives of the indicator should be stated. Is the indicator only reporting on contaminant level trends or is it making a statement on human health?
- c The relationship between toxic substances and consumption should be made clear in the presentation of the indicator. What are the ill effects from the toxic substances? For example, what does mercury do in humans? How does this vary between individuals?

### Discussion of Overall Approach:

- c Indicator should report on contaminant levels in fish and assess against a common benchmark.
- c It was noted that there is a lack of consistency across jurisdictions.
- c Indicator should indicate when/how often fish are fit for consumption.

## **Part 2: Pilot Study to Test Indicator on Lake Superior**

### 1. Issues

- c The existence of a different fish consumption advisory for each of the jurisdictions “screams” of inefficiency.
- c There is a need to make fish consumption advisory information more understandable.

### 2. Existing data sets:

- c Great Lakes Indian Fish and Wildlife Commission has one year of data on four fish species (using composite samples) from the south shore of Lake Superior, for organic compounds and mercury.

- c Ontario Ministry of the Environment has data on lake trout, whitefish, and suckers for 12-13 locations on Lake Superior.
- c Department of Fisheries and Oceans Canada has 20 years of data for whole fish (including lake trout and smelt) at four sites. Data includes organic compounds, PCBs, mercury, and other metals.
- c U.S. Environmental Protection Agency Great Lakes National Program Office (GLNPO) data set.
- c CORA has 10 years of data (Lake Superior is monitored every third year). Includes lake trout and whitefish. Has data on fillets (skin-on, skin-off).
- c Also should have data from U.S. state, Tribe and academic sources.

### 3. Fish “Edibility” Indicator

- c Two Components: Trends in contaminant levels, and evaluation of the contaminant levels to make a judgement about edibility.

#### Defining the Pilot Objective:

- c This is an indicator. This is not fish consumption advice.
- c Possibly could have different health benchmarks.
- c What form do we want the data? Length, weight, etc.
- c Database protocol needed.
  1. sample type (i.e. fillet skin-on, skin-off)
  2. quantification method for toxaphene
- c Need an open forum to bring public into process.
- c Relationships needed with other Great Lakes data coordination.
- c Peer Review? QA? / QC?
- c Need someone to store / assemble data, e.g.: a university or GLIFWC.

#### **Discussion of the Index Approach:**

Generally, the reaction to index development was mixed. The following are participants comments about the index approach:

- c Good idea, but concern over the incomplete status of most indicators in their present state.
- c Bad idea, the weighting of indicators to develop an index becomes a “black box.” It is too easy to create an index that states the message you want it to.
- c There is a loss of sensitivity with an index. It may obscure our ability to detect changes in the environment.
- c Professional judgment is needed in interpretation of the data.
- c The Netherlands have developed indexes, including product life cycle indexes. These could be a model.
- c Suggest reporting on 10 key indicators with a separate score for each one.
- c Indices simplify the data too much.
- c Can we use existing indicators; do we need to re-invent them?
- c It is questionable if this is the use of “sound” science, but it is timely to translate the science into something more understandable.
- c It might be a good way to give the public a simple message – it paints a picture.

#### **Summary of Fish Consumption Advisory Sessions**

1. Regarding the draft indicator:
  - It is good harmonize the exposure methodology and use a sensitive population for the benchmark.
2. Regarding the development of the pilot study:

- There is some interest in a pilot study for Lake Superior.
  - Although there is some question on what is the value of doing things differently. We need a better definition of what we are trying to do.
3. Regarding important parameters needed to expand data set:
1. Age / length & weight
  2. Sex
  3. Lipids
  4. Fillet vs. sample technique dorsal – conversion
  5. Season
  6. Location – Precise
4. Regarding the development of an index:
- The general consensus is that it isn't the right time to develop an index. The indicators need to be better developed before looking at how to summarize them.

## **Societal**

Facilitator: Suzanne Barrett, Waterfront Regeneration Trust  
 Recorder: Michael Russ, U.S. Environmental Protection Agency  
 Number of Participants: 40

These two sessions focussed on discussions of the effects of environment on society.

### **Effects of Environment on Society:**

Causes: - resource degradation

- resource limitation
- increasing population

Effects: - influence on economic systems

- shift in distribution system
- number of disputes, especially for limited resources
- rising costs of resources
- opportunities / recreation / native awareness
- separation between the 'haves' and 'have nots'
- understand points of pollution
- permits indication of prosperity
- behavioural needs and responsibilities (e.g. recycling)
- perception of environmental quality
- growth of NGO's
- shifts in spending
- power imbalances
- public health - child health
- shifts in employment
- change in education
- urban - suburban population shift

- ethnic population - different requirements and values
- shift inland / coastal
- effects on arts community and their work
- regulatory responses, change in demands from government, down-loading, arguments about rights - responsibilities should be focus
- disconnection of people from natural world
- spirituality and religion

### **Suggested Indicators**

#### 1. Public access to water body

- Quantity (kilometres of access).
- Quality of the resource.
  - S Beware riparian rights.
  - S Beware degradation by the recreational users.

#### 2. Eagles

- Native ceremonies (increase due to increased number of eagles).
  - S National bird.
  - S Symbol of “happiness” and indicator of ecosystem health.

#### 3. Human health and reproduction

- Fertility, family size, population density, demographics all tied together (increased population puts pressure on environment, endocrine disrupting chemicals may affect fertility).
- Obesity in children - an impact of environment on kids.

#### 4. Drinking water

- Use of tap/bottled water/personal treatment devices.
  - S Why? Perception of environmental quality, trust in water.
- True costs (consider both costs of treating water and costs of bottled water).

#### 5. Economic health

- Property values.
- Sustainability of resource based economies.

### **General Discussion on the SOLEC Societal Indicators:**

- The SOLEC Economic Prosperity indicator (#7043) needs to be more than a measure of unemployment.
- Measures for Partnerships (indicators #3509 & #3510) could include:
  - S existence
  - S capacity
  - S results
- Considerations for Financial Resources Allocated to Great Lakes Programs indicator (#8140):
  - S Resources from whom?
  - S What defines a Great Lakes program? (not just related to social issues)
  - S Spent on what? Categories? Trends in spending for representative and total program. Are we robbing Peter to pay Paul?

- S Spending by agency.
- S Money spent by industry.
- S How much money is required to meet objectives?
- S Spending on prevention vs. remediation; science vs education.
  
- Integration of Ecosystem Management Principles indicator (#3510).
  - S media content analysis
  - S curriculum
  - S percentage of population that knows about ecosystem management principles.
- First need to define “ecosystem management principle” - see the 14 impaired beneficial uses.
  - S Industry measure (e.g. ISO 14001 of environmental stewardship).
  - S Municipal/and other planning policies.
  - S Province and state resource allocation.
  
- Sustainable Landscape Partnerships indicator (#3510)
  - S define “landscape” - inclusiveness.
  - S partnerships are important.
  - S capacity = organizational richness
  - = representative of community
  - = vision/mission/goals/objectives/policies/evaluation
- Number of partnerships in the basin
- Participation by industry: resources and results

**Other Considerations:**

- Revisit titles of the indicators when components are done.
- What’s the vision of an ideal society? Swimmability, fishability, drinkability?
- Environmental Justice
- Social justice / equity

**Next Steps for SOLEC 2002 - Recommendations to the SOLEC Steering Committee**

- Form work group to:
  - (i) decide on societal indicators; and
  - (ii) allocate leadership for reporting.
- Involve broad based group (including social scientists and economists).
- Facilitated by a neutral party.
- Start by reviewing/surveying global literature.
- Re-name the indicators later.
- Participants to use website to provide/continue input.

**Ecological Indices**

Facilitator: Anne Kerr, Environment Canada  
 Recorder: Glenn Warren, U.S. Environmental Protection Agency  
 Number of Participants: 45

**Highlights of Session:**

1. The majority of the participants were in favour of the indices presented in this session by Don Mackay and Paul Bertram.
2. There is still a question of which audience and what uses the indices that are most useful for.
3. We should look to other disciplines (epidemiology, graphic design experts) to help with presentation and reporting of the indices.
4. We should try some of these indices, get the information out to the public and gauge their reaction.
5. Diagrams were much preferred to a single number to represent an index.
6. The dialogue on the notions of indices, audience and use, must continue.
7. We don't want to lose the information (and monitoring programs) behind the indices.

Dr. Donald Mackay presented the ELP, or equilibrium lipid partitioning index. The ELP attempts to take all concentration data for a chemical, measured in different media, and put them into comparable units based on lipid partitioning. With the ELP, one could then combine and consolidate toxic concentration data for each chemical and each lake from all monitored media.

The ELP-converted contaminant concentrations from all media would not be equal, but would be comparable. What could we learn? As examples, if the fish ELP were higher than the water ELP, then biomagnification would be occurring; if the air ELP is less than the water ELP, then the water is most likely losing contaminant to the air.

A conclusion is that we must do a better job of reporting contamination levels to the public, as many believe that contamination is getting worse.

The discussion, which followed, had several main topics. The first of these was, "who is the intended audience?" The intended audience is environmental agency managers and the public. It was believed that the public could digest the index. The use, or usefulness of the index is the reporting of a single number that could be used to develop a target to be aimed for. Another question was whether to focus on one medium. The consensus was that the more information (media) used for the index, the more robust it would be. A supporting comment was that each individual data set was somewhat "flaky," while this problem was suppressed when many data sets were combined.

Dr. Paul Bertram presented a fishability index in graphical form. He stated that the intended audience for individual indicators is environmental managers or those who have a management role, while that for indices is upper level administrators and the public. The fishability index was a quadrilateral with an axis each for habitat, walleye populations, walleye tissue PCB concentration and preyfish. The vertices of the figure represented the desired state, and another figure inscribed within the quadrilateral represented present conditions. This makes it possible to see how far along the scale of management objectives we are.

In the discussion that followed, a concern was raised that we would end up with "a hundred of the polygons," which would be an overwhelming amount of information (ie. for different fish species, different



contaminants and different lakes).

The majority of the group were in favor of pursuing an index such as that presented by Dr. Bertram, but the question again arose of which audience to aim for. The group also favored development of Dr. Mackay's ELF. A discussion of a graphical presentation of the index versus a single number resulted in support of the graph.

Other suggestions from the discussion included:

- c We should look to other disciplines to help with data reporting and presentation.
- c We should try some of the indices and get the information out to test reactions to the information.
- c We don't want to lose the monitoring programs which provide information used for the indices.
- c The dialogue on this notion of indices, audiences and uses must continue.

## 5.2 The Indicator Toolbox - Local Initiatives

### Hamilton Harbour Area of Concern: Commitment, the Key to Success

Facilitator: Mark Sproule-Jones, McMaster University

Recorder: Wendy Leger, Environment Canada

Number of Participants: 39

#### Highlights of Session:

1. Water quality in Hamilton Harbour responds quickly to sewage changes. In the past improvements have been seen as a result of process improvements to the Hamilton Waste Water Treatment Plant (WWTP, improvements made 20 years ago). Hamilton Harbour is currently seeing improvements as a result of process optimization at the Burlington WWTP. However, Remedial Action Plan (RAP) targets for water quality are not being met yet and further improvements are required.
2. The Region of Hamilton/Wentworth (soon to be the new City of Hamilton) has set priorities to optimize WWTPs, to address deteriorating infrastructure and to reduce CSOs (combined sewage overflows). Worked with partners (including RAP, BARC, BAIT and others) to achieve the goals. Water and treated wastewater is not cheap. Must look at water pricing as a way of funding.
3. Through the Marsh Restoration Project, Cootes Paradise is improving. This program includes replanting, building of carp barriers, and water monitoring programs. Over the past 3 years there has been a decline in carp population, an increase in aquatic plant density and improved plant species richness.

This session was structured with three presentations followed by a question period.

#### Presentation 1: Water Quality in Hamilton Harbour, Murray Charlton, Research Scientist at Environment Canada's National Water Research Institute

- c water quality will respond quickly to sewage changes.
- c we have seen water quality improvements caused by process improvements made 20 years ago to the WWTP.
- c we are currently seeing water quality improvements due to process optimization at the Burlington WWTP.
- c therefore, we should be able to get further improvement at Hamilton.
- c RAP targets are not yet being met.

#### Presentation 2: Treatment of Water and Associated Costs, Leo Gohier, Director of Water and Wastewater, Region of Hamilton

The Region of Hamilton has a 15 year plan which includes the building of CSO storage facilities (currently 5 have been built, 8 remaining).

Three regional priorities have been set - these include:

- c optimize the WWTPs;
- c address deteriorating infrastructure; and
- c reduce CSOs.

Water and wastewater are not cheap. In Hamilton/Wentworth there are 3100 km of pipes (at a cost of \$5

billion). Also looking at modular expansion of plants (costs money). Where do you find money to maintain and improve the infrastructure if you don't raise taxes? Could increase the water bills.

Cost of water (comparison):

25 L of water	=	\$0.01
25 L of bottled water	=	\$15
25 L of milk	=	\$22
25 L of pop	=	\$25
25 L of beer	=	\$85
25 L of wine	=	\$500

Questions & Answers:

Q1: Is tap water as pure as bottled water?

A1: City water has to meet more standards. Bottled water does have to travel through pipes.

Q2: What is the federal role in funding?

A2: Virtually none. Work is based on funding from water bills only. Subsidy programs that are currently in place cause the consumer to take water for granted. Consumer doesn't know the true costs of water.

Q3: What tests are done on water intakes?

A3: Measure - do a suite of tests on raw water. Inspection of intakes (intake about 1 km out).

Q4: Is there a time lag between when the test is take and when it can be communicated?

A4: Some tests provide results within the same day, others take a day or two. Some take even longer (ie. testing for metals - the results take weeks or a month). The critical tests can be communicated within 48 hours. Reports are submitted to the provincial government monthly.

Q5: Do you test effluent for toxic substances?

A5: Yes, on a quarterly basis. Currently there are discussions taking place with the RAP and BARC (Bay Area Restoration Council) to test on a regular basis so they can analyze for trends and patterns.

Q6: Do you test for copper sulphate from drain cleaner (e.g. Draino).

A6: No. There is no limit on what you can test for, therefore it is important to prioritize.

Q7: Are there special agreements with large polluters?

A7: There are compliance agreements for large polluters. If the problem is treatable, then they must treat it. If the problem is not treatable then there is an agreed upon timeframe for them to reach compliance.

Q8: What effect have zebra mussels had on the infrastructure?

A8: Zebra mussels can do damage to intake pipes. Currently, chlorination is the preferred method of control, however chlorination of intakes may introduce TFMs. Would like to move away from chlorine.

### **Presentation 3: Fish & Wildlife Habitat Restoration Project in Cootes Paradise, Len Simser, Natural Lands Steward, Royal Botanical Gardens**

c in 1800s Cootes paradise was a completely vegetated shallow water marsh

c in 1934 there was 85% coverage by emergent vegetation, this was reduced to 15% in 1985

c loss of diversity occurred with the loss of vegetation

- c currently have a replanting program
  - c staff and volunteers
  - c have own nursery
  - c plant approximately 60,000 plants annually
- c Carp (a non-native fish species) is a major stress to the ecosystem (churn up sediment and affect turbidity, destroy aquatic plants, destroy habitat...)
  - c carp barriers became operational in 1997 (small fish can go through, large fish like carp cannot)
  - c in Grindstone Creek native large fish are sent into baskets to get past carp barrier, carp are excluded
  - c carp population is declining
- c due to the replanting program and the carp barriers the aquatic plant density is increasing and the plant species richness is improving
- c in Grindstone Creek, a tributary to Cootes Paradise, they have also initiated recycled Christmas trees as flow retardants, and are seeing the growth of wild rice

**In Summary:**

- c there has been a 90% reduction in carp populations
- c suspended sediment levels have dropped by 110%
- c water clarity has improved by 100%

For more information visit the website at [www.rbg.ca/fwhrp/](http://www.rbg.ca/fwhrp/)

**Questions and Answers**

Q1: Is one of your indicators bottom feeding fish?

A1: yes, we are collecting information on them.

The marsh is in an urban area and has other stressors such as high nutrient levels, turbidity, high water levels (since Lake Ontario has regulated water levels).

Q2: Fishways - how are they paid for and sustained?

A2: These are dependent on DFO (Department of Fisheries and Oceans), internships and staff for research.

Q3: Steel Plant - does Environment Canada monitor emissions?

A3: The steel company monitors discharge, this is done through MISA. Data is sent to MOE and published on the website.

## **Launching and Maintaining an Urban Ecosystem Initiative**

Facilitator: John Perrecone, U.S. Environmental Protection Agency

Recorder: Shannon Daher, Environment Canada

Number of Participants: 20

**Highlights of Session:**

1. Find common values among different groups of people. Even if people may appear different, they may share common values (i.e. the “yuppie” and the “joe 6-pack” may both want to preserve land for the future).
2. You can reach some people with nature, but for a lot of people we need to try a different approach - lay out the other things that go with urbanization, i.e. sprawl, traffic congestion, flooding, lack of open

space and decrease in biodiversity.

### **Effective Tools for Launching and Maintaining an Urban Ecosystem Initiative:**

- Need to talk to the small community group.
- Let people do their own thing - don't add a bureaucratic layer.
- See what appeals to different groups, i.e. recreation/aesthetics.
- Get the private sector involved.
- Education - i.e. geese/deer may be a nuisance and we need to communicate why.
- Expand with partners that may be locally available (i.e. U.S. Environmental Protection Agency and other federal staff in Chicago).
- Think "grand".

### **Session Summary:**

- This session looked at human uses in urban area with a focus on the Chicago Wilderness.
- If you "let an area go" - it doesn't necessarily become nature.
- It takes political will to restore/preserve urban ecosystems.
- Need the money to do it. In the case of the Chicago Wilderness funding came from the US Forest Service, US Fish and Wildlife Service, The Nature Conservancy, and Congressional support.
- Good science is needed - significant ecosystems/communities.
- What role can "you" play towards biodiversity was asked.
- Outline of the documents.

Q1: How do you convince people/congress that biodiversity is important?

A1: Biodiversity group from Wisconsin communicates this well and have helped them. Also, many people want to preserve for the future - find common values among people.

Q2: "Connectivity and Trails" - How important was it?

A2: Not overly important, the actual science of conservation was the key.

Q3: How do you encourage citizens to keep biodiversity in their yards?"

A3: There is a program in Chicago. We have found it works best at community level/city council level.

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## **Leveraging Resources for Environmental Results**

Facilitator: Richard Mariner, U.S. Environmental Protection Agency

Recorder: Laura Lodisio, U.S. Environmental Protection Agency

Number of Participants: 15

### **Highlights of Session:**

1. Must invest in the process, in order to get results (i.e. invest in marketing to develop partnerships).
2. Resources means more than just money. Resources include:
  - leadership
  - volunteers
  - technical expertise
  - partnerships

3. Objectives must be clearly understood by all in order to get buy in to leverage resources.

**Effective tools for leveraging resources:**

Use the Chicago Wilderness Initiative as a model to create a metropolitan-wide initiative operating through existing volunteer organizations, without creating a new bureaucracy.

**Chicago Wilderness Case Study**

Overview of Chicago Wilderness:

- c Lead by The Nature Conservancy (TNC) - initiated coalition
- c Able to pull in other organizations
- c MOU (Memo of Understanding) between organizations
- c Leveraged resources from:
  - TNC
  - U.S. Fish & Wildlife Service
  - U.S. Forest Service
  - County Forest Preserve
  - U.S. Environmental Protection Agency / Great Lakes National Program Office
  - Local governments
  - Local Planning Organizations
  - Field Museum
  - Brookfield Zoo
  - Others
- Coalition formed through “partnerships”
- Congressional support (assisted in obtaining federal monies - \$700,000 per year from both US FWS and the US Forest Service, for a total of \$1.4 million/year)
- \$13 million in funds over 5 years - including matching funds
- Lead to local funds in addition to federal funds
- “Member” contributions total up to 37% (including in kind contributions and funds)

Categories of Membership:

- General membership
- Council membership - requires a commitment of staff, resources

Membership does not yet include private business/industry. Chicago Wilderness is hopeful that this will happen and when it does happen they will create a Industrial/Business Corporate Council. The benefits to Business/Industry include:

- Native landscape of Corporate campuses; and
- “Clean Corporate Citizen” status.

Chicago Wilderness does not have tax-exempt non-profit status. Funding goes to individual organizations, Chicago Wilderness provides grants each year.

What is the “marketing niche” of Chicago Wilderness?

- Must provide benefit to all.
- Must be broad and flexible.
- Utilizes high quality outreach tools such as:
  - Quarterly magazine
  - Biodiversity “Atlas”
  - Colour/Glossy Brochures

- Museum displays
- c Had to defend public image because of “mis-perception” of burns, etc... (lack of education).

What was it about Chicago Wilderness that made it work and made it cohesive?

- natural alignments
- strong leadership
- build off “small successes”
- built on historical preservation efforts

Must have a common focus (i.e. Everglades, Chesapeake Bay, etc...) that draws in a greater area (i.e. State of Florida) - ownership of project must go beyond the boundaries.

What does an organization get from being part of the Chicago Wilderness?

- Matching funds
- Networking
- Communication
- Partnerships

Chicago Wilderness realizes there is a limit to federal funding. Need to reach out to foundations and other funding sources.

Developing the process was key in that it allows the “coalition” to do more than what the individual organizations could have done.

It’s all about relationship building, partnerships, etc...

Important to partner with influential “non-government” organizations. (ie. the Brookfield Zoo, Field Museum, ....)

Biodiversity “Recovery” Plan (recent), 4 committees formed:

- Policy
- Education
- Science
- Land Management

Grant Program:

- Illinois Conservation Foundation is fiduciary organization to manage funds and issue grants.
- Chicago Wilderness shouldn’t be “cloned” in other areas, but certain aspects can be used as a “model”.
  - There are “elements of success” that can be used elsewhere.

## **Collection and Analysis of Monitoring Data**

Facilitator: Vicki Thomas, U.S. Environmental Protection Agency

Recorder: Duane Heaton, U.S. Environmental Protection Agency

Number of Participants: 34

### **Highlights of Session:**

1. Issue of scale - is there an appropriate “best management plan” to support the implementation of SOLEC indicator?
2. Quality assurance and standard protocols are necessary for indicator implementation success.
3. Scale - must define appropriate scale for monitoring.
4. Which of the indicators are truly the most important for assessing the health of the Great Lakes (maybe not all 80).

### **Effective tools for the Collection and Analysis of Monitoring Data:**

1. Define questions
  2. Develop measures and methods
  3. Identify assumptions
  4. Perform analysis and interpretation
- 

## **Volunteer Recruitment and Retention**

Facilitator: Cathy Keenan, U.S. Department of Agriculture

Recorder: Sandra Hellman, U.S. Environmental Protection Agency

Number of Participants: 21

### **Highlights of Session:**

1. Marketing strategy - need to identify why, who and how.
2. Recognition (and appreciation) of volunteers in and out of the Program.
3. Training of volunteers - meeting the needs of both the organization and the volunteer.

There are two Questions to apply to all components of a volunteer monitoring program:

- 1) How do you **build** a volunteer monitoring program and its various components?
- 2) What **ideas** will make the program work?

### Focus questions on how to **build a recruitment** program:

- a) What should a recruitment plan include?
- b) What questions should be addressed when building a recruitment plan?
- c) Is the location of the volunteering attractive to volunteers? If not, how can this issue be addressed?
- d) First contact – pros and cons of written versus verbal communication with potential volunteers.
- e) Cost benefit issues of advertising – where is advertising most effective (e.g. wide range advertising effort vs. targeted groups)

### Participant comments on how to **build a recruitment** program:

- c Identify whom you want to contact. Identify all groups and parties you want to contact. Need good communication strategy to cover whole community. Use groups to network and get the word out.



- c Target the audience, if you do have a specific audience in mind. But also attach information about the program in general news programs. Need to be media savvy, with an understanding of media available (radio, TV, newspapers).
- c Volunteers need to know the time commitment. Is it short term, long term, yearly?
- c Put the task in perspective with larger global picture (identify how the task fits into a larger picture). Adding scale gives people a good feeling about being involved with the cause.
- c Don't reinvent the wheel. Use volunteer groups that already exist. Contact other volunteer groups.

Focus questions to produce **ideas** to make the **recruitment** program work:

- a) What can we offer volunteers?
- b) Material versus social incentives.

Participant comments on **ideas** to make the **recruitment** program work:

- c Before you communicate, you need to identify your goals and vision statements. Develop a clear message about the goals and skills required. If you don't have the skills, we will provide them.
- c Sell to the community that it's a worthwhile program.
- c "Give to get." Make sure people are aware of what they can get out of it. For example, Cub Scouts can do work towards a badge. Contact people already organized as a group – they may want things to do.
- c Need to identify physical capabilities needed up front.
- c Identify each individual's skills and strengths. Do an assessment of skills so you know what you have in your group.
- c Know how many volunteers are needed and what resources are available.
- c Recruit from an associated company.
- c Utilize high school students who have mandatory volunteer requirements. Provide access to educational opportunities.

Focus questions to **build** a **training** program:

- a) Are training sessions required or are written instructions sufficient?
- b) How often should training sessions take place for return volunteers?

Participant comments on how to **build** a **training** program:

- c Identify the skills you need and match recruitments to that. Use skills assessment and match.
- c Need to train people because you need to standardize data collection so that the quality of data is assured. Many volunteers see the training session as a social reward. They get to meet the other volunteers and discuss results. Can market training as a form of education. Training can be rewarding or career building. If you have a long-term project, training in the first year is a good investment.
- c Trainees can become trainers. Government staff train volunteers, these volunteers now run the workshops.

Focus questions to produce **ideas** to make the **training** program work:

- a) How should training sessions be approached? (e.g. lecture type, hands on)
- b) What sort of props or activities would help make the training session a success?

Participant comments on **ideas** to make the **training** program work:

- c Make the training fun.
- c Celebrity access for volunteers.

Focus questions to **build** a volunteer monitoring program that will **retain** participants:

- a) How often should volunteers receive feedback (keeping in mind the variety of forms feedback can take)?
- b) How do volunteers' expectations change over time as they continue with the program?

Participant comments on how to **build** a volunteer monitoring program that will **retain** participants:

- c Follow up with what you're doing –show the volunteers the results. This is important for volunteer satisfaction.
- c You need to assess volunteer satisfaction.
- c Career building opportunities and job skills – know your volunteers. For example, are they right out of high school?
- c Recognize your contributors or sponsors.
- c Let them know expectations up front. People like a project with a beginning and an end.
- c Offer additional opportunities.
- c Keep them informed about how the project is progressing.
- c Have people involved in decision and planning.
- c With time, increase responsibilities for volunteers.
- c Get feedback from volunteers.

Focus questions to produce **ideas** to help **retain** volunteers:

- 1) List ideas for recognizing volunteer efforts (formal, informal, material, non-material)

Participant comments on **ideas** to help **retain** volunteers:

- c Always thank your volunteers. Give them recognition: a) verbal recognition; b) certificates; c) local newspapers; d) publish results achieved; e) give out reports (newsletters); f) radio; g) get sponsorship of meal or t-shirts or hats (don't date t-shirts or hats) – these all point to volunteer appreciation.
- c Write a bio on an excellent volunteer and put it in the local paper. Go outside the program with acknowledgements.
- c Family appeal - keep it family friendly.

Focus questions to **build** a method on how to **assess** volunteer satisfaction:

- a) How often should feedback be invited?
- b) How should suggestions be acknowledged?
- c) Written versus verbal feedback from the volunteers (also, within organization individuals versus independent contractors conducting surveys.)
- d) What sort of questions might one ask to assess volunteer satisfaction and to obtain unbiased opinions about the program?
- e) What sort of questions might be useful with regards to the background of the volunteers (i.e. what sort of information might be useful in focusing future recruitment efforts)?

Participant comments on how to **build** a method on how to **assess** volunteer satisfaction:

- c Point out volunteer contributions and how it fits into the bigger picture.
- c Point out the value of what they're doing.
- c Adopt and recognize good ideas.
- c Send a letter from the director outlining what person did so that they can put it in their resume.

## Determining Priority Conservation Places

Facilitator: Joanna Kidd, Lura Consulting

Recorder: Greg Jenish, Lura Consulting

Number of Participants: 20

### Highlights of Session:

1. Good start, need to conserve Great Lakes communities. Worthy of continuing efforts (e.g. a workshop on this specifically).
2. Need to involve people. Need a vehicle to communicate with people, but also involve them.
3. Integrate information through many new tools (GIS and maps). LAMP maps + GIS + U.S. EPA watershed identification. Key: some of the tools we now have permit us to do integration; we may not have been able to do this before.

### Effective Tools for Determining Priority Conservation Places:

- c Use the internet as a means of exchanging information and involving people.

### The Alvar Initiative - Presentation by Heather Potter

This is a prioritization effort by The Nature Conservancy (TNC) - scientific approach. It may look like a very deliberate linear process.

5 components:

1. Terrestrial species and community
2. Alvar and community
3. Declining & vulnerable birds
4. Aquatic systems
5. Amphibians and reptiles

Process:

- 1) Identify conservation targets.
- 2) Develop conservation goals.
- 3) Assess viability.
- 4) Select sites.
- 5) Identify data gaps.

271 places (species, aquatic systems) identified - of these 60 (or about 1.5 million acres) have some combination of owners/strategies in place.

61% of these biodiversity areas are irreplaceable. 95% are not fully protected - only 5% are fully protected.

Questions to Heather:

Q1. How did you identify the starting points?

A: Through an eco-regional approach and using all the occurrences of species and site viability rankings. Go down the matrix, look at clusters (i.e. St. Clair River) then proceeded additively.

Q2. Concerned about the additive nature of the data; what about well studied areas vs less studied areas?

- A: Data from natural heritage programs in the south are better than the north. For example, forest types are not well known and the Northern basin in the states is poorly identified.
- Q33 Linkages and corridors in and out of basin? (i.e. going beyond isolated islands of info).
- A: Larger connectivity valid (64 ecoregions being developed within U.S.), region-to-region stitching together.
- Q4. Have you considered looking at sturgeon - they are a threatened and endangered species that are not just here now, but where here historically. What about rehabilitation and restoration for them?
- A: We need to look at this (restoration strategies).
- Q5. What about work on the Canadian side?
- A: TNC has the funding and is getting underway. The Canadian portion will be completed in the next 1.5 years.
- Q6. How do you choose priorities?
- A: Need to protect the full range of biodiversity. Therefore, all areas are considered equal. TNC is dedicated to working in local communities first, then look at capacity and resources.

Questions asked to session participants:

- 1) How have other organizations identified conservation priorities?
- 2) How can we coordinate/integrate efforts to achieve greater and more efficient success in conserving priority places?

Response to Question #1 (identifying conservation priorities)

- c Clients, environment, economics, community and laws all factor into objectives.
- c How much participation from native/community groups? Spend a lot of time building trust and breaking down resistance.
- c Cost-sharing incentives sometimes involved.
- c It is important to address the future (i.e. future sturgeon spawning areas).
- c Ducks Unlimited - next couple of months they are compiling activities and trends. Same process for wetlands. U.S. will be enabling next year.
- c Great Lakes Commission - fish community objectives developed and will be on the agenda for the next couple of years. Meet fish community goals for trout, pike, etc. Environmental objectives will be developed next (species, habitats, etc.).
- c Great Lakes Indian Fisheries and Wildlife Commission have been invited to participate in TNC's Alvar Initiative.
- c Native peoples of Walpole Island recognize that: (1) all life is important, and (2) there are cultural and community values and considerations.

Response to Question #2 (coordination & integration of efforts)

- c Lakewide Management Plans (LaMPs) - very valuable overlay map.
- c Incorporate strategic objectives in Lakewide Plans (another resource). Lake Superior LaMP working with TNC - incorporate specific strategies/projects.
  - Identification of specific streams.
  - Local priority for conservation.
- c Use map of TNC + Biodiversity Investment Areas + others maps to help make priority decisions.
  - Issue of scale, local community needs and wants.
  - Community staff on community level (work on project in their neighbourhood) what they can do where they like.
- c We need to know how to communicate and we need to communicate with the wider community.
- c Does TNC have a website? Post on the website?

[ecoregion scale]

[lake basin scale]

[local scale]

- c TNC is open to thinking about how to meet the target. Get TNC paper on website. A lot more work needs to be done. TNC document is a living document.
- c EPA perspective - went through by state on a watershed basis in order to determine priority watersheds for restoration). TNC, EPA and states trying to conserve resources.
- c Overlay TNC map or EPA map on LaMPs map - would seem practical.
- c Michigan: Clean Michigan initiative - funding for protection of high quality water.
- c Federal legislation, Department of the Interior (the CARA Act) - could bring money to invest in state coastal areas, offshore oil drilling money.
- c W.I.I.F.M. 'What's in it for me?' - Ensure that it is a win-win situation at the local involvement level.
- c Draw on First Nations for communication/education.

## **Wild Rice Ecology and Management**

Facilitator: Peter David, Great Lakes Indian Fishery and Wildlife Commission

Recorder: Ann McCammon Soltis, Great Lakes Indian Fishery and Wildlife Commission

Number of Participants: 23

### **Highlights of Session:**

1. Rice is an important cultural resource with high nutritional value.
2. The value of traditional knowledge about harvesting rice was recognized by the State of Wisconsin in that they adopted regulations similar to the tribes for state harvesters.
3. There appears to be a broad interest from tribal and non-tribal people in restoring wild rice in other parts of the Great Lakes basin.

### **Session Summary:**

Participants identified areas of particular interest including management, restoration and harvesting, wild rice's nutritional value, research needs, rice's historic range (particularly in the eastern Great Lakes), and rice as a potential indicator.

Jim St. Arnold gave a short presentation about the cultural and spiritual value of manoomin (wild rice). Wild rice is a sacred food that is used at all feasts, and historically tribal communities were established near wild rice lakes. Tribes have demonstrated that the traditional management of rice is most appropriate for the resource. As a result, in Wisconsin, wild rice harvest regulations for both Indians and non-Indians are based upon traditional tribal management techniques and opening dates for harvest on regulated lakes are determined jointly by the state and the tribes.

Peter David, GLIFWC Wildlife Biologist, gave an ecological overview of wild rice, discussed abundance and harvest monitoring, restoration and management techniques, and research. He suggested that wild rice could be an indicator of naturally functioning ecosystems. Rice demands that natural ecological processes be intact, especially hydrological processes.

The greatest interest among many of those participating in the workshop was to learn more about successful rice restoration techniques, and much of the subsequent discussion centered on people's goals and experiences in this arena. It is clear that the interest in restoration covers a wide geographic portion of the

Great Lakes basin, and that there is a need to assemble and disseminate information on effective restoration approaches.

The potential of wild rice as an indicator was discussed briefly among the larger group, mostly in terms of data availability issues. Rice distribution has been mapped in northwest Ontario. Harvest is also tracked more closely in Canada because of the different regulatory scheme in place there. Harvest and abundance monitoring is done in Wisconsin. Formal monitoring in other states is less extensive. However, the high interest in this resource has many individuals interested in expanding and coordinating monitoring efforts across rice range. In addition, since a fair amount of rice monitoring is already taking place, and since monitoring is not particularly expensive, it should be feasible to establish broader, coordinated monitor programs without great expense.

*Note: Great Lakes Indian Fishery and Wildlife Commission (GLIFWC) has guidelines for wild rice re-seeding - interested individuals can contact GLIFWC for details.*

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## **Shoreline Biodiversity Investment Areas (BIAs)**

Facilitator: Adele Freeman, Toronto and Region Conservation Authority

Recorder: Melissa Hulting, U.S. Environmental Protection Agency

Number of Participants: 35

### **Highlights of Session:**

1. In general, there was enthusiastic support for the BIA approach. However, there were some concerns about the methodology and rankings. Those with comments about the methodology and rankings should submit them as soon as possible to Nancy Stadler-salt (nancy.stadler-salt@ec.gc.ca) or to Paul Bertram (bertram.paul@epa.gov).
2. A companion piece to the BIA integration paper should be issued. This companion paper would include information on current conservation activities, land use, current protective designations, and threats to ecosystems, and other information if available. Much of this information is in the 1998 Nearshore Terrestrial BIA report.
3. An outreach and implementation plan must be developed to move this concept forward. A formal binational designation should be considered for the BIAs (similar to RAPs/AOCs). EPA and EC should perform outreach to local communities and designate a "local champion" in each area who will be responsible for mobilizing action. This champion could be an agency, individual, or NGO, as appropriate (support may be required).
4. Periodic status reports should be issued on the progress in BIAs.

### **Overview of the BIA Integration Paper** (presentation by Ron Reid):

The starting point for the analysis was a set of 70 shoreline units. These units were developed using the coastal eco-reaches from the 1998 Coastal Wetlands BIA paper, which were subdivided using 1998 Nearshore Terrestrial BIA boundaries and nearshore aquatic zone information from The Nature

Conservancy work by Higgins.

Nearshore terrestrial areas are those generally within one kilometre of the lake. Nearshore coastal waters are those that extend offshore to the point where the thermocline intersects with the bottom of the lake.

Three criteria for the integrated BIAs are Species or Communities of Special Interest; Diversity of Habitats, Communities, and Species; and Productivity and Integrity. Multiple factors and datasets were used to determine values for each criterion. There were other datasets that could have been used, but may not have been included due to limited availability (e.g., data for only one country) or coverage. Finding applicable databases for the entire basin was problematic.

Charts within the report show how the data were compiled and ranked. The rankings were used to create maps for each criterion.

Comments are welcomed regarding the rankings or the process by which they were determined. Submit all comments to Nancy Stadler-Salt ([nancy.stadler-salt@ec.gc.ca](mailto:nancy.stadler-salt@ec.gc.ca)) or Paul Bertram ([bertram.paul@epa.gov](mailto:bertram.paul@epa.gov)).

Rankings for Criterion 1 (Species or Communities of Special Interest) were determined using data on rare species and communities, identified high-quality habitat areas, the number and extent of coastal wetlands, and important bird areas. Criterion 2 (Diversity) rankings were determined using the shoreline diversity index, the shoreline complexity rating, and the fish use index (which used Atlas of Great Lakes Fishes data). The hardened shoreline index, trophic degradation rating, and historic wetland loss rating were the basis for rankings of Criterion 3 (Productivity and Integrity).

Ratings for all 3 criteria were overlaid, and the results are shown in chart form and as a map. The shadings on the map indicate the integrated ranking—darker shading indicates a higher ranking.

Readers are encouraged to look at the case studies at the end of the BIA Integration Paper. They examine very different areas. For example, Long Point has been studied quite a bit and has formal designations as a protected area, whereas the Les Cheneaux coastal wetland area hasn't been studied as intensively. All three case studies demonstrate the strong link between watersheds, tributaries, and lake water quality. They also illustrate the value of these relatively pristine areas as benchmarks.

Land use was not specifically examined as part of the ratings. Some information on land use was considered in the 1998 Nearshore Terrestrial BIA paper. The authors would like to use land use data in future refinements of the integrated BIAs. Some of the integrated BIAs identified in the paper are pristine, and some are degraded.

Since the identification of AOC's, there has been a focus on very degraded areas; we need to pay the same level of attention to fairly pristine areas through the BIA concept. One purpose of the BIA concept is to encourage public participation in conservation in those areas (and in others). What should the next outreach step be - a website?

The higher ranking of Western Lake Erie may come as a surprise since there are several cities there, however, it is due to the wetlands that exist in that area - there are a series of marshes in close proximity to each other, fish spawning areas, etc., leading to a number of overlapping high criteria values.

The BIAs should not be perceived as the ONLY important areas in the Great Lakes basin. It should be



noted that this paper only looked at nearshore areas. It is also important to note that some of the higher-ranked shoreline units already have conservation activity going on, and some don't.

The BIA designation should not be used "incorrectly" to discriminate against action in more degraded areas. It may be possible and desirable to restore lower-ranked areas.

#### Next Steps

It is hoped that this paper creates conservation dialogue where it doesn't yet exist and encourages dialogue that is already going on.

It was suggested that a companion piece to the integration paper be developed. This document would describe the status of the areas in terms of intactness/land use pressures, current conservation activities and capacities, protective designations currently existing, etc. Some of this information is contained in the 1998 Nearshore Terrestrial BIA paper. The information gathering for the 1998 paper should be done for each high-ranking shoreline unit (BIA); this would make up the majority of the companion piece. We need to look at activities and status in the entire landscape surrounding the identified areas.

The BIA concept could be used to guide other processes; making sure environmental factors are sufficiently considered in EIS efforts, for example. It could also help areas get additional protective designations in the future.

#### Comments from Participants:

- c One member of the discussion group noted that the OS7 unit (Eastern Lake Ontario) was not included in the upper tier of units. Many barrier beaches exist along that stretch, and he thought that it was important.
- c The authors were complimented on their approach to BIAs; "In 1998, people were just throwing out ideas for locations. This is a much more systematic approach."
- c A participant wondered who "owns" this report? Who will issue the report? Are there any additional commitments from individuals, agencies, and/or groups? Recommendations could be issued and the BIA concept endorsed by Environment Canada and U.S. EPA. Some sort of action plan is needed. (Response: The data provided in the BIA paper (and in the companion piece) would be there for organizations, particularly local groups, to take advantage of. Environmental Groups need this information to push for ecosystem protection; and it could be ammunition for local folks. Some of these people may not know about SOLEC. We need to go out into the BIAs and perform outreach where there isn't any activity going on.)
- c The BIA designation could be made a formal part of an international/binational agreement to give it more status. Could it be made an annex of the Great Lakes Water Quality Agreement? A binational designation could bring attention and resources to these areas, similar to that mobilized by the RAPs. The BIA designation could be one more criteria used in making funding decisions.
- c Perhaps the Great Lakes Coast Wetland Consortium that was just created could look into studying these BIAs?
- c We would need to implement activities for the BIAs at different levels of the community and government. Funding would be needed from government and private companies.
- c Natural hydrology would need to be restored in coastal areas.
- c Progress toward protecting and restoring BIAs should be periodically reviewed (every 3 or 4 years?).
- c How will we motivate local groups and leverage resources? We need to go into these areas and talk to local people. Designating a local leader for each BIA would be a good idea.
- c The BIA document and identification of high quality areas can be used in the face of pressures for



development.

- c Identification of BIA “Tier” can be added to funding applications to attract resources for protection and rehabilitation.

## 5.3 Lake Sessions

### Water Quantity in the Great Lakes-St. Lawrence River Basin

Facilitator: Michael Keating, Sustainability Reporting Program

Recorder: Rimi Kalinauskas, Environment Canada

Number of Participants: 20

#### Panel Presentations:

John Kangas (International St. Lawrence River Board of Control and U.S. Army Corps of Engineers)

- c Water levels in the Great Lakes have been measured since 1860.
- c The Great Lakes/St. Lawrence River is a dynamic natural system with long term fluctuations over decades.
- c Based on historical records, water levels in the Great Lakes fluctuate on a seasonal and annual basis as well as cycles extending over decades (30-35 years).
- c Seasonal water level fluctuations result in higher summer water levels and lower winter levels.
- c The recent extreme high and low water levels that have been experienced on the Great Lakes are within the historical range.
- c Regulation of Lake Superior and Lake Ontario has changed the water regime, dropping the peaks by approximately 0.5 m and raising the water level by 0.5 m.

Frank Quinn (National Oceanic and Atmospheric Administration)

- c The potential impact of climate change on Great Lakes water levels has been modeled. Predictions range from slightly higher levels (UK model) to dramatically reduced levels (up to 3 m decrease) (Canadian model).
- c Consensus opinion is that effects could be felt earlier than previously predicted.
- c Climate change will change the seasonal cycle (currently 30-33 year cycles).

Doug Wilcox (U.S. Geological Survey, Biological Resources Division)

- c Based on sediment records, water levels in the Great Lakes have fluctuated on a long term cycle of approximately 160 years as well as a shorter 30-33 year cycle for the last 3000 years.
- c Water level fluctuations are very important for wetlands biodiversity and productivity.
- c Great Lakes shoreline ecosystems are dependent upon natural disturbance processes, such as water level fluctuations, if they are to function as dynamic systems.
- c Occasional high and low lake levels near the extremes of the historical record are required on all lakes in order to maintain wetland ecosystems.
- c Regulation of Lake Ontario has had a negative impact on wetlands.

Christiane Hudon (Environment Canada, Quebec Region)

- c Climate change will have a major impact on the water levels of the St. Lawrence River.
- c Water levels on the St. Lawrence River have been very low in recent years and the effects have been compounded due to human activity.
- c Can't control climate but can foresee major impacts, for example: smaller flows (up to a 2 m change in levels), higher frequency of droughts and heavy rains, salt water intrusion further upstream, shorter duration of ice cover and longer growing season. This, in turn, may cause changes in concentrations and flow of nutrients and contaminants, changes in the types and areas of wetlands, changes in species and distribution of plants, increases in zebra mussels, increases in fish parasites, loss of recreation areas (due

to more aquatic plants and reefs).

Richard Gaudreau (St. Lawrence Economic Development Council)

- c Lower water levels are having a negative impact on the shipping industry.
- c Low water levels affect the amount of cargo that can be transported by ship and affect profit margins directly. For example, for an average container ship that sails from Montreal to Europe, a drop of one foot means that 260 fewer containers can be shipped per vessel. This translates to a loss of approximately \$200,000 per trip per vessel.
- c Extra costs are also being incurred for dredging. Increased fees are being charged by the ports and the St. Lawrence Seaway.
- c Lower water levels are already affecting the shipping industry. If water levels continue to decline, the amount of traffic through the St. Lawrence Seaway will be further reduced.

Steve Thorp (Great Lakes Commission)

- c 17 metropolitan areas account for 80% of the population in the basin.
- c Industrial water use has declined in the basin. Changes in manufacturing processes have meant that it is less important for manufacturing to be on the waterfront.
- c For commercial navigation, water levels are a critical factor that affect vessel draft and thus the “bottom line”. A one inch drop in level could mean a load reduction of 100 tons.
- c Water levels also affect recreation (docks, need for dredging, etc.)

**Group Discussion:**

- c On the use of “water levels” as an indicator of the State of the Lakes: There were mixed reactions. Some felt that changing water levels are a natural phenomena and as such did not “fit” the SOLEC categories very well. There are conflicting interests, what are the “optimum levels”? Generally, extreme high levels and extreme low levels are seen to be bad, as long as the water levels are in the middle range they are seen to be OK. Durations are important. (Note that the current SOLEC Indicator #4861, Effect of Water Level Fluctuation, only applies to Lake Superior and Lake Ontario).
- c What is the government position on further regulation of the Great Lakes? No more regulation, focus now is on improving existing regulation. Lake Ontario will be looked at first.
- c Can we forecast water levels? No, not really, we need to understand climate first. We are going toward probability forecasts (much like weather forecasts). Analogy given was to treat current forecasts of water levels, much like the 5-day weather forecast.

In summary, humans have a limited ability to control water levels. From a management/ sustainable development perspective we should: move towards integrated management; be proactive rather than reactive through forecasting; make enlightened choices between conflicting user groups; identify environmental and other consequences of management decisions; and mitigate impacts through punctual interventions or global water resources management (Christiane Hudon, Environment Canada).

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## Lake Ontario

Facilitator:

Recorder:

Number of Participants:

Session Summary: *Not available at this time*

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## Lake Erie

Facilitator: John Perrecone, U.S. Environmental Protection Agency

Recorder: Melissa Hulting, U.S. Environmental Protection Agency

Number of Participants: 31

Two presentations were given during this session:

1. The Big Picture Project by Don Gordon of Carolinian Canada
2. The Ohio GAP Program by Donna Myers and Melissa Haltuch of U.S. Geological Survey, focusing largely on the aquatic mapping with mention of other projects in Lake Erie jurisdictions. A summary of the Ohio GAP presentation was handed out to workshop participants.

Questions posed to presenters:

1. How effective are these databases at identifying the link between upland habitats, current land use, and aquatic habitats, particularly in terms of habitat function?
2. Can these databases provide a basis for LaMP managers to prioritize restoration activities in the Lake Erie basin?
3. How effective can these databases be at predicting or understanding changes in ecosystem components based upon natural resource management decisions?
4. How can this data be presented to land managers (including managers representing agriculture, industry, and urban areas) so it can be used for practical decision-making?

### **The Big Picture Project** - Don Gordon, Carolinian Canada

Carolinian Canada, a coalition of non-government organizations and conservation agencies in Southern Ontario, was formed in 1983. It has identified 38 unprotected areas (islands of green) in the Carolinian Zone of Ontario and has worked to secure those areas through purchase, zoning, etc.

Islands of green are fairly ineffective in conserving biodiversity; these islands need to be connected. This can be difficult since southern Ontario is fairly developed. Currently the region has about 15% natural cover. About 30% is needed in order to preserve the full suite of biodiversity. The goal of the Big Picture Project is to increase natural cover to 30% (retained/restored) in the Carolinian Zone through the connection of existing protected areas and an increase in interior/core area.

“Green areas” were mapped using several GIS data layers, including First Nation areas and provincial and national parks. A point system was applied based on forest cover, species richness and diversity, connectivity and linkages, barriers between woodlots, etc. Green areas of greater than 400 hectares in size were identified. Most were isolated from other green areas. Low cost possible linking areas were determined—waterways, railways, utility corridors, etc. Other restoration/linking opportunities may exist for areas near highways, cities, active quarries, major roads, and high-value agricultural land, however, these would be at a higher cost. A cost grid was developed, showing high and low cost corridor areas. An

algorithm was run to determine lowest cost connections between existing green areas, when high cost barriers were “hit” then an alternative route would be examined. “Metacore” areas, which would round out edges to core areas (buffer cores outside of 200 m), were identified. “Metacorridor” areas, which would make corridors wider, were also determined. This produced a final grip of cores and corridors. Areas with good restoration potential—with good soil types, for example, were also shown on the final Big Picture map.

A more detailed description of the Big Picture Project and methodology can be found on Carolinian Canada’s website. Link to <http://www.carolinian.org/Big%20Picture.htm>. Carolinian Canada is exploring potential partnerships to expand this analysis to cover much of the remaining area in Southern Ontario (parts of Lake Ontario, St. Lawrence River, and Lake Huron/Georgian Bay watersheds) and also to do outreach to local groups to encourage protection and restoration of natural areas.

Question #1 (linking habitats): Yes, the final map shows linkages between upland and aquatic habitats. Valuable terrestrial areas are often near water.

Question #2 (basis for prioritization): Yes, this project can help prioritize restoration areas.

Question #3: This work cannot predict changes in ecosystems - it was not designed as a modeling tool.

Question #4 (presentation of data): A complete communications strategy has been devised for the Big Picture Project. Land managers are targeted, including players involved in development projects. Carolinian Canada is seeking ways to incorporate some of this work into official plans and other land use planning initiatives in municipalities.

**Ohio Gap Analysis Program (GAP)** - Donna Meyers and Melissa Haltuch, U.S. Geological Survey  
The national GAP program started about 10 years ago, mainly in the western part of the U.S. where much of the land is in public ownership. Since land in the eastern part of the country is much more developed, the application of the GAP program may be somewhat different than in the west. The goal of the program is to provide an objective method for identifying gaps in higher-biodiversity areas and prioritizing restoration/conservation areas.

This presentation focused on the aquatic GAP, given that the Big Picture Project has a terrestrial focus.

The aquatic GAP has been funded over the last 3 years. This project is using landcover mapping (1999 LANDSAT 7) data to model both terrestrial and aquatic species. The GAP focuses on common species, not necessarily endangered and threatened species.

The elements of the GAP concept are:

1. Identifying and classifying types of biological diversity (ecosystem, vegetation, and habitat types, etc.)
2. Examining existing and proposed systems of protected areas and land management units
3. Determining which elements of biodiversity are under represented in the existing system of conservation areas

The work done involves:

- c Mapping existing natural/semi-natural land cover
- c Developing a habitat affinity database for all species (to identify hotspot areas)
- c Modeling terrestrial and aquatic species distribution

- c Mapping land stewardship areas and potential areas of value
- c Analyzing the gaps between conservation lands, biodiversity hotspots, and habitat types
- c Publishing reports and data for use by land managers

The terrestrial GAP analysis will look at terrestrial vertebrate species in Ohio and vegetation classification at the alliance level (dominant and co-dominant species). Vegetation alliances were developed by the Nature Conservancy.

The aquatic GAP analysis will examine hotspots of fish, crayfish, freshwater mussels, and macroinvertebrates. Streams were classified into Valley Segment Types (VSTs) by the Nature Conservancy. The analysis showed that long stream reaches make up less than 1% of the total kilometres in the area of study. Wetlands will be classified and mapped. Riparian areas will also be mapped.

Goals and Timeline: In 2000-2001—map land cover, develop animal databases for terrestrial and aquatic analyses, classify VSTs, and map riparian areas. For 2001-2002—develop habitat affinity information (to go with species distribution), model animal distributions, and publish CD on VSTs with all data layers included. For 2002-2003—publish land cover map, terrestrial and aquatic species distributions map, and riparian area map.

Detail on Aquatic GAP:

Ecoregional Drainage Units (EDUs—like watersheds) in Ohio are the basic assessment unit. VSTs are classified based on EDUs, stream order, temperature, bedrock type, type and thickness of glacial drift, gradient, and sinuosity.

A preliminary analysis was done for the area around Cleveland. Ohio EPA performed fish sampling for the analysis. The data was divided into quartiles based on average species richness. The 4<sup>th</sup> quartile has the highest potential for restoration (high species richness but low number of species). Sites in the 4<sup>th</sup> quartile for species richness were examined to determine their VSTs. Many of these high richness areas were closer to Lake Erie. To determine areas with high restoration potential, areas with the same VST as the high richness areas were identified. Few of the high richness/high restoration potential areas were on public lands.

Conclusions from this preliminary analysis:

- c 19 VSTs out of 968 have at least 25 species of fish
- c Most of these 19 VSTs are in large streams near the lake
- c Sites with low species richness, but with the same VST as high-richness sites, have restoration potential
- c The high-richness VSTs have high conservation value

Other efforts in the Lake Erie basin, including those by the Nature Conservancy (Chicago Great Lakes office), Ontario Ministry of Natural Resources, Michigan Department of Natural Resources/University of MI, and SUNY, use VSTs. The Pennsylvania Fish Commission is using small watersheds instead of segments/VSTs.

For more information on the Ohio GAP Program contact:

Donna Myers, U.S. Geological Survey  
614-430-7715  
dnmyers@usgs.gov

or visit one of the following websites:

National GAP analysis homepage is at [www.gap.uidaho.edu/gap/](http://www.gap.uidaho.edu/gap/)

Ohio GAP homepage is at [www.oh.er.usgs.gov/~rhaefner/ohgap.html](http://www.oh.er.usgs.gov/~rhaefner/ohgap.html)

Question #1 (linking habitats): Where rivers meet shorelands are the most important and what happens upland determines its health.

Question #3: The data could present some info. on “Do something” or “Do not do something” scenarios. These models are not dynamic and they are not models of ecosystems, so they would not be able to predict changes. They are management tools for making decisions in sensitive/high value areas (zoning designations, etc.).

GAP analysis could be used for species recovery plans.

Question #4: Land use and stewardship information (including Ohio Dept. of Natural Resources (DNR) and municipal lands, conservation easements) will be mapped.

### **General Discussion:**

- c Separate stream reaches separated by dams were assigned a different code.
- c Low species richness areas may still be high quality areas. These areas may have had low richness to begin with (ie. inland areas as compared to near the lake).
- c Non-native species were not included in the species richness analysis.
- c Spend money on those things that are causing the problem - as opposed to large watershed plans.
- c Organisms for coastal wetland GAP analyses include all nesting birds. The Nature Conservancy’s vegetation classification system will be used, since it includes wetland types. Floristic survey data will be matched with remote sensing data, and it is hoped that remote sensing can be used for the remainder of the state that has not had intensive floristic survey work.
- c Use these products to be proactive vs. reactive - this approach has worked in local Ontario Municipal Board hearings and in local environmental assessments with success. Use corridor data to be proactive and not reactive. Create the early “vision”.
- c Similar to forested habitats in Ontario, 30% is also a magic number in aquatic habitat landscapes (based on analysis).
- c Land stewardship map - used for both aquatic and terrestrial habitats.
- c GAP analysis only conducted on public conservation lands. However, many high-richness and rare species areas occur off of publicly owned lands. Work from Ontario shows that current public lands do not coincide with hot spots. How will we deal with lands not in public ownership? How are parks managed vs. preserves? A: When we have identified core areas, go to the fine resolution - help with municipal planning (local managers). The results of this project should be presented to local managers (since most decisions about land use are made at the municipal level). Designated lands should be recognized in planning documents. Incentives for conservation (ie. lower property taxes) could be used. For example, Carolinian Canada is working with Middlesex County to complete natural heritage mapping in order to include it in the next Official Plan. Also work on adding/improving buffers and corridors by examining Conservation Tax relief program eligibility.
- c Where the lake and rivers meet, there is high biodiversity. We also need to protect upland areas that feed into those rivers.
- c Ohio’s Transportation Needs - Vision 2020 Plan. The results of the GAP analysis can be used proactively to aid this program (to help locate new roads). Ohio Transportation 2020 may have a huge impact on biodiversity.

- c Proposal: Profile outfalls to Lake Erie with sources and loadings upland.
- c Identifying smaller areas of high biodiversity is useful since smaller areas are more easily managed. However, the watershed approach is being pushed now for degraded watersheds. How do we balance protection of small areas vs. planning for the whole watershed?
- c Ohio DNR data will be used to ground-truth the models to make sure identified areas truly do have high value or potential. The Ohio data is rich in terms of fish species distribution (4000 fish collection sites).
- c Donna Myers noted the need for a decision support system for data manipulation.

Follow-up, especially concerning the four discussion questions and other available datasets that could be used in these efforts, should be directed to the presenters and coordinators: Donna Myers (USGS), Lauren Lambert (Ohio EPA, lauren.lambert@epa.state.oh.us), Madeline Austen (EC, madeline.austen@ec.gc.ca), and Don Gordon (Carolinian Canada, vanhemdo@execulink.com).

## St. Clair Corridor

Facilitator: Rose Ellison, U.S. Environmental Protection Agency  
 Recorder: David Cowgill, U.S. Environmental Protection Agency  
 Number of Participants: 24

**Session Goal:** To identify corridor-wide ecosystem issues in the Huron-Erie corridor and corresponding actions that address them and support ongoing restoration efforts in the corridor and its watershed. There were four presentations in this session.

The first presentation, given by John Marsden of Environment Canada, focused on the recent “Four Agency Letter of Commitment”. The “Compendium of Position Papers - A Four Agency Framework of Roles and Responsibilities for Implementation of the Detroit River, St. Clair River and St. Marys River Areas of Concern Shared Remedial Action Plans”, Feb. 2, 2000 can be found at: [http://www.on.ec.gc.ca/glimr/raps/connecting/detroit/detroit\\_compend12.pdf](http://www.on.ec.gc.ca/glimr/raps/connecting/detroit/detroit_compend12.pdf).

Matt Doss of the Great Lakes Commission gave a presentation on the identification of overarching ecosystem issues in the Huron-Erie corridor (using Beneficial Use Impairments). Attempts were made to identify overarching issues common to various portions of the corridor.

The third presentation was also given by Matt Doss but looked at the identification of ecosystem issues for Lake St. Clair in order to guide restoration and protection efforts. Participants were briefed on the conference held on November 30, 2000 and December 1, 2000, entitled, “Lake St. Clair: Its Current State and Future Prospects”. The Conference Summary Report for this conference has been published by the Great Lakes Commission, and can be found at: <http://www.great-lakes.net/lakes/stclair.html>. This document provides substantial detail about use impairments in Lake St. Clair and includes a number of recommendations from the conference.

It was noted that a number of commitments have been made related to Lake St. Clair. These include the inclusion of Lake St. Clair in the Four Agency Agreement (between Environment Canada, the U.S. Environmental Protection Agency, Michigan Department of Environmental Quality, and Ontario Ministry of the Environment and Energy), a new authority for the U.S. Army Corps of Engineers to prepare a management plan for Lake St. Clair, the commitment by the U.S. Environmental Protection Agency to



support a biennial conference on Lake St. Clair, the inclusion of Lake St. Clair in SOLEC conferences and reports, and the commitment of funds by the U.S. Environmental Protection Agency to support outreach for Lake St. Clair, grant support to the Wildlife Habitat Council from the U.S. Environmental Protection Agency to develop a biodiversity atlas for the Lake St. Clair corridor, and a new web page for Lake St. Clair on the Great Lakes Information Network.

Issues identified in the session included: habitat loss, beach closings, human health issues, air quality monitoring issues, impacts of non-native species, undesirable algae/eutrophication, lake level issues, lack of public access to the lake, excessive aquatic plant growth, a shortage of information to judge beneficial use impairments, sediment resuspension, changes to the fishery, urban sprawl, hardening of the shoreline, dredging, and the need to identify pollution sources.

Allen Melcer of the U.S. Environmental Protection Agency gave the final presentation which looked at identification of actions and associated mechanisms to address corridor-wide issues. Activities identified that might help the integration into a corridor-wide effort include: the Eastern Habitat Joint Venture of the North American Waterfowl Management Plan, the biodiversity atlas, the St. Clair Channel Keeper, the bluegill monitoring research being done by Oakland University and the U.S. Army Corps of Engineers, and the Southeast Michigan Green Ways effort.

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## **Lake Huron- St. Marys River**

Facilitator: Jim Bredin, Michigan Office of the Great Lakes  
Recorder: Vicky Thomas, U.S. Environmental Protection Agency  
Number of Participants: n/a

The Lake Huron session was introduced by Jim Bredin, Michigan Office of the Great Lakes, with James Schardt, U.S. Environmental Protection Agency-GLNPO, providing a description of the SOLEC Indicators process. Jim provided the breakout group with a draft list of proposed indicators for Lake Huron (see Appendix F). Jim indicated that the proposed list was being reviewed through the Lake Huron Initiative and that he was looking for any comments from the breakout group based on discussion brought to light during the SOLEC 2000.

The following comments regarding the proposed list of indicators were discussed during the breakout session:

1. Add whitefish as an indicator as it is consumed more. Focus on lake trout as a sentinel species. Look at contaminants in amphibians as well as in snapping turtles. Add contaminants in humans, i.e. women and children.
2. Look at shifts from seasonal residence to permanent residence. Look at communities with setback ordinances. Look at the density of septic systems/zoning. Consider recreational pressure. Look at extent of shoreline development.
3. Add herpetiles in wildlife communities. Sea lamprey is an important indicator for Lake Huron.

Additional issues for consideration in Lake Huron indicators:

- c Where does the St. Mary's River fit in?
- c Should bass be included as an indicator for Georgian Bay?
- c Intensive agriculture is a big issue.

Jim encouraged all interested to provide specific comment on the draft list of indicators.

Draft list of proposed Lake Huron Indicators can be found in Appendix F.

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## **Lake Michigan**

Facilitator: M. Williams, Walpole Island Heritage Centre

Recorder: Laura Evans, U.S. Environmental Protection Agency

Number of Participants: n/a

### **Presentation on the Great Lake Commission's Lake Michigan Project - Ric Lawson:**

1. Lake Michigan Tributary Monitoring Project (see <http://www.glc.org/monitoring/lakemich/>)
2. Lake Michigan Monitoring Coordination Council

This project is a joint initiative between U.S. Environmental Protection Agency, Lake Michigan Team (provided project leadership and primary funding support) and the Great Lakes Commission (GLC), a binational agency directed by the eight states and two provinces (GLC provided administration, research and reporting on the Tributary Project and secretarial support for the Monitoring Council).

The goal is to create a framework for future monitoring and inventory the ongoing collection of data. This is an effort to understand the extent and breadth of existing monitoring and determine the gaps. The inventory will include federal, state, and local monitoring programs in collaboration with 14 tributary groups, and an analysis of LaMP indicator monitoring.

The monitoring inventory process included an inventory survey, phone calls and data search. The final report was a database of monitoring projects from the 14 tributary groups, open lake monitoring and monitoring from 9 other categories (listed below). The report identified the extent and range of monitoring coverage as well as identifying the gaps and overlaps. Two types of gaps were found: the monitoring programs/data was out there but they just couldn't access them, or , the monitoring program/data just wasn't available. Also included in the final report were recommendations.

#### **9 Analysis Categories:**

- 1) 18 LaMP Pollutants
- 2) Nutrients and Bacteria
- 3) Meteorological and Flow
- 4) Sediments
- 5) Fish
- 6) Benthos
- 7) Air
- 8) Wildlife
- 9) Land Use

### Summary of Key Findings:

- c Gaps in Inventory: include geographic coverage of fish populations, aquatic nuisance species, benthos, terrestrial wildlife and habitat. Also gaps in academic research inventory.
- c Gaps in Monitoring Coverage: include wetlands measures, habitat changes, atmospheric deposition and diversity measures. Also gaps in groundwater monitoring.
- c Underutilized Resources: include volunteer and local agency monitoring
- c Compatibility and Coordination: lack of data, method standardization and coordinated networks. There is a need for a single source linking the monitoring information.

The second phase of the Tributary Monitoring Project is an on-line database.

- c This will be an internet-based GIS database of monitoring information.
- c It will be searchable geographically or by type of monitoring.
- c Entries will have links back to the monitoring organizations for better awareness and access to monitoring data.

Information to be held in database includes:

- Program name
- Organization
- Contact information
- Link to data site
- Monitoring purpose
- Location description
- Parameters collected
- General methodology
- QA/QC characteristics

Lake Michigan Monitoring Coordinating Council (LMMCC)

- c Council is structured along watershed (not political) boundaries.
- c Broad ecosystem approach, not only water quality monitoring.
- c Membership includes federal, state, local, tribal, non-government organizations (NGO), industry and academic organizations.
- c Focus on improving monitoring standards, coverage, coordination, dissemination and awareness.

LMMCC Activities:

- c Developing guidance documents
- c Establishing pilot network
- c Advising on the monitoring inventory
- c Designing IAGLR (International Association of Great Lakes Researchers) and regional conference sessions
- c Creating education and outreach materials

### General Discussion:

- c Want to catalog long-term ongoing projects.
- c Collect baseline information.
- c Monitoring implies that it is ongoing; otherwise it is more like sampling.
- c An inventory gap is terrestrial monitoring, especially on private forestry land.
- c Potential contacts were discussed for terrestrial monitoring, crayfish population information, and fish stocking.
- c For information on Land Conservation (pg 136 of the report), it was suggested to look to at the Natural Resources Conservation Service, U.S. Dept. of Agriculture website ([www.nrcs.usda.gov/prms](http://www.nrcs.usda.gov/prms)).
- c Need to look at habitat monitoring for a 10-mile radius for pipeline. The pipeline will be in before we have any information on habitat. Do not have inventory of habitat.

**Indicators discussion:**

- c Need to determine the indicators we want to use and whether monitoring is available.
- c The LaMP needs to focus on what are appropriate indicators.
- c Put SOLEC indicator numbers on LaMP indicators, so they are compatible.
- c Indicators can be confusing. We should look at it as if we have training wheels on.
- c A recommendation was made that one person cross-walk with Ric Lawson / GLC work and fill in what we know. It may need more than one table.
- c The recommendation then, to improve the table and fill it in was made. Do not use all 80 indicators.
- c A process or way to prioritize is necessary. Monitoring activities will help with indicators.
- c On-shore and off-shore aquatic habitat important.

For more information:

1. The report on the Lake Michigan Tributary Monitoring Project can be found at:  
[www.glc.org/monitoring](http://www.glc.org/monitoring)
  2. The Lake Michigan Monitoring Coordinating Council web-site is: [wi.water.usgs.gov/lmmcc/](http://wi.water.usgs.gov/lmmcc/)
  3. The Great Lakes Information Network website: [www.great-lakes.net](http://www.great-lakes.net)
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**Lake Superior**

Facilitator: Jim Cantrill, Northern Michigan University, Marquette  
Recorder: David Rockwell, U.S. Environmental Protection Agency  
Number of Participants: n/a

Jim Cantrill, Darrell Piekarz (Environment Canada) and Ken Cullis (Ontario Ministry of Natural Resources) each gave a brief presentation on the status of the Lake Superior LaMP. Then the floor was opened and the remainder of the session was a question and answer period between the participants and the panelists. More information on the Lake Superior LaMP can be found on-line at <http://www.on.ec.gc.ca/glimr/lakes/superior/>

**Session Highlights:**

1. We need to be able to provide information on impairments to the public, in a way that the public can understand. This could help to obtain more resources in order to meet and remediate the impairments.
2. We need more interagency coordination.
3. We need to more closely mesh (more linkages) monitoring programs.

**General LaMP Presentations:**

- c All issues are being considered - this is a basin wide approach.
- c Geographic data: Lake Superior is comprised of 1/3 Canadian water, 2/3 U.S. water, although the watershed (land mass) is mostly Canadian due to Lake Nipigon.
- c Nine chemicals, discharge elimination by 2020 - well on way to achieving this.
- c There are 24-members in public forum to advise the LaMP.
- c A LaMP report will be published every two years. The last one was LaMP 2000.
- c Discussed the Lake Superior "best bet" indicators. What is being monitored for? What should be

monitored for?

- c Further along in developing indicators, (including the interpretation of indicator meaning) than any of the other LaMPs.
- c A workshop on monitoring in the Lake Superior basin was held in Oct. 1999 and a proceedings report has been produced.

#### **Questions and Answers:**

Q1. Monitoring seems to be missing for various contaminants - why?

A1. Herring Gull contaminant program saves a lot of expense since easier to monitor at the top of the food web. Water monitoring is highly variable and expensive. Should be looking for new (emerging) chemicals.

Q2. Currently we are looking at 10% of contaminant loading from point sources and 90% from air sources - where should we be directing attention?

A2. It is very expensive to monitor local mills. They may be releasing. Watching chemicals decline and level off. Point sources are pretty well covered.

Q3. Where is it coming from?

A3. It may be due to atmospheric loadings. Combination of variables. Burn barrels. Sediments. Seems to be a lack of attention to sediment interchange.

Q4. Do we have an example of a chemical that falls into this characterization (percent).

A4. Dioxin.

#### **General Discussion:**

- The discussion then turned to the difficulties of multi-national controls over contaminants transported from a long distance. Seeking controls. Seeking to control the in-basin sources which then become part of the out-of-basin problems.
- Discussed how information is collected on hexachlorobenzene and reported.
- There was a complaint about fish advisory reports. The fish reports contain two year old data. Long term reporting for fish monitoring data is needed in Lake Superior according to one attendee. Old data or no data available in some areas where the attendee fished frequently.
- Lake Superior binational monitoring workshop's goal was to beef up monitoring.
- The Great Lakes: An Environmental Atlas and Resource Book, 3rd edition (1995), was praised as useful in providing information. It was suggested that each of the theme groups may want to funnel their information into reports like the Great Lakes Atlas. Also, the Great Lakes Atlas should be updated and released again.

#### **Indicators Discussion:**

- Talked about adopting SOLEC indicators for Superior, but Superior indicators are different. e.g. swimmability issue is not key in Lake Superior.
- Looked at the Lake Superior indicators short list of indicators - see <http://www.on.ec.gc.ca/glimr/lakes/superior/> for more information. Asked who can help monitor these and report to the Lake Superior workgroup.

1. Developing Sustainability Indicators.

- Under Quality of Human Life indicators - recreation and cultural opportunities. New program tracking camping trail permits. Canadian input discussed.

- Minnesota counties can contribute to Resource Consumption indicators - solid waste generation & recycling programs.
- Great Lakes Commission may have input for Quality of Human Life indicators - transportation and communication infrastructure.
- What are the demands for social services? Answer - Alcohol rehabilitation.
- Question: Are we going to be sensitive to First Nation sensibilities? i.e. home ownership not a big deal on the reservation.
- Human health needs to be an end point more so than other life forms.

## 2. Terrestrial Wildlife Indicators.

- Want to cover all wildlife forms. Number of deer to number of deer carrying capacity. Could look at auto body shop repairs for cars damaged by hitting deer.
- Critical to look at the big picture, for example the natural range shift of ungulates causes a huge change in total numbers. Sometimes herds are overlooked in the counts because they have moved outside the range of the watershed.

## 5.4 Cross-Cutting Great Lakes Issues

### Presenting Environmental Trend Data

Facilitator: Michael Donahue, Great Lakes Commission

Recorder: Mitch Sauerhoff, Sauerhoff & Associates

Number of Participants: n/a

Speakers: Don MacKay (Trent University, Environmental Modeling Center), Joe DePinto (Limno-Tech Inc.), Gail Krantzberg (Ontario Ministry of Environment)

Panelists: Andy Buchsbaum (National Wildlife Federation), Kelly Burch (Pennsylvania Dept. of Environmental Protection), Jay Means (Head, Department of Chemistry, Western Michigan University)

Introduction (M. Donahue) - SOLEC is about improving ecosystem integrity and monitoring our progress through a coordinated matrix of measurements. Once data is collected, how do we analyze the information and draw conclusions?

#### Presentation (D. MacKay) - "Contaminant Trends in Great Lakes Ecosystems"

What are the general trends for contaminant levels in the Great Lakes ecosystem? Trend analysis includes both short-term and long-term evaluations. There are three strategies (minimal, qualitative, and quantitative) which can be applied for trends analysis. The minimal strategy makes use of a simple linear plot of the data, with respect to time, to see if trends are discernible. The qualitative strategy utilizes semi-log plots of the data to view declines as first order relationships with respect to time. This is a reasonable strategy since most contaminant decay rates are dependent on lake contaminant levels at time of observation and therefore exhibit first order decay relationships. But a truly quantitative strategy postulates a mechanism of action and utilizes mathematical models to track historic or current trends and is useful for predicting future contaminant levels. Once verified, a model allows regulators and others to predict outcomes of management actions and to test them for effectiveness and cost/benefit.

PCB levels in Lake Ontario lake trout are decreasing about 5-10% per year. PCB levels in the entire Great Lakes ecosystem are decreasing, slowly decontaminating with time. The challenge is to report these data so that the declines can be clearly shown. Most data is not reported so that these trends can be readily discerned. IADN is a notable exception. These reports regarding Atmospheric Deposition into the Great Lakes provide examples of excellent data analysis procedure application.

Over the years, many media have been sampled including air, fish, water, and gull eggs. There has been a lack of consistency in the use of data analysis techniques. With low and variable concentrations, in water for example, it is difficult to discern data trends. Due to variability, eight-to-ten years worth of data are needed to establish valid trends. Biotic changes and food levels will influence short-term trends. In addition to the lack of meaningful data interpretation, there has also been a lack of timely reporting of data.

In order to facilitate an understanding of trends analysis, an analogy can be developed by visualizing a water tank being simultaneously filled from the top and emptied from the bottom. The tank, initially empty, is gradually filled when input exceeds output. The water level continues to rise until input equals output due to the weight of water or pressure on the bottom of the tank; a condition referred to as steady state. In this analogy, the water level represents the increasing levels of contaminants into the

environment. This was the condition 25-30 years ago. As the contaminant load decreases (the rate at which water is being added to the tank), the level of contaminants in the ecosystem will decrease (water level in the tank goes down), but in a time frame later than the inputs. Where contaminant inputs are reduced by a factor of 3 to 4 times, the concentration of contaminants will decrease rapidly. That is the picture we have seen with contaminants in the ecosystem. At this time, we now see a slow, and over time, steady decrease of contaminants in the ecosystem (as the water level in the tank decreases slowly).

As noted above, there are three strategies for reporting on contaminants in Great Lakes biota.

- Report levels and the times the measurements were taken (the minimal linear graph approach);
- Present data using a first order rate constant semi-log plot (the qualitative presentation); and
- Analyze data through a quantitative mechanistic assessment and/or develop equations describing a dynamic mass balance.

Strategy three is more complicated and expensive but is the preferred approach for complex problems involving long-term commitment of attention and resources. Input values for this technique include the following data: tank size/values; properties of water; and water input rate. The rate of change (water level) per hour is calculated. The analysis is validated by comparing the calculated values with actual levels in the tank. By analogy, the water in the tank represents levels of contaminants in the ecosystem. The future can be predicted by knowing the input rates.

In reality, the Great Lakes are really two tanks - the water and the sediment. There are various inputs (air, point sources, etc.) and the two tanks are connected. Water levels of contaminants increase first, then slowly, contaminant levels in sediment catch up. Water levels of contaminants decrease first, and slowly, contaminant levels in sediment catch up. Contaminant levels in water will increase or decrease rapidly, sediments far more slowly.

In analyzing the contaminants trends data from a mass balance point of view, there are some difficulties. The inputs are not known accurately. Contaminant levels in the ecosystem years ago are not known. The water properties (temperature for example) change seasonally. Using the tank analogy, there may be several interconnected tanks. Even with these problems, mass balance analysis of contaminants in the Great Lakes can be accomplished. Key sources can be identified. Observed trends can be explained. The mass balance analysis gives important predictive capability - in other words, how the system will behave in the future. Mass balance analysis also shows what data inputs (point source, atmospheric) are most important from a loading point of view. A testable hypothesis can be developed that gives value and purpose to the data and demonstrates understanding. To provide a practical illustration of the conceptual model, a mass balance diagram of 2,4,5-TCP was presented showing various system inputs.

Researchers now analyzing contaminant trends data generally employ minimal-to-qualitative strategies. Noted exceptions are the previously mentioned IADN reports and the EPA Lake Michigan Mass Balance Project. With the exception of the Lake Michigan Mass Balance project, there appears to be little or no enthusiasm for quantitative analysis approaches. Certainly, the minimal strategy should not be employed. The IJC 9<sup>th</sup> Biennial Report recognizes the importance of modeling contaminant trends data and government support for model development. The government of Canada has not responded appropriately to the IJC recognition. The stage of science needs to progress with respect to contaminant level trends analysis. The persistent toxic substance issues in the Great Lakes merit the quantitative approach. They are long-term, complex issues requiring long time horizons for solutions and investment



of significant time and financial resources. The cost of a strong factual/information basis for decision making is dwarfed by the cost of the management action that must be taken. To ensure efficient use of these valuable resources, decisions making processes must be supported by the quantitative approach.

**Presentation (J. DePinto) - "Understanding Exponential Decline of PBT's (Persistent, Bioaccumulative & Toxic substances) in Great Lakes Water, Sediments, and Biota"**

The quantitative analysis of contaminant trends data will, of course, provide modeling information well beyond what is characterized in the water and tank analogy. Models consider and provide information regarding the following:

- c The life-cycle of typical PBT's in Great Lakes;
- c The loading phase;
- c The declining or wash-out phase;
- c Mass balance model outputs and a means of interpreting trends (through first-order kinetics);
- c Mass balance concepts and model linearity; and
- c Examples of trend interpretation (role of Lake characteristics and "apparent slowing in rate of decline").

Typical Great Lakes PBT's are hydrophobic, associated with particulate matter in the water, semi-volatile (have an atmospheric exchange component), very bioaccumulative, and human exposure is generally through fish consumption.

The typical life cycle of Great Lakes PBT's is characterized by high emissions and loading during the 1940's through the 1960's, significant decreases in loading during the 70's and 80's with corresponding, but on a differing time scale, decreasing levels in biota.

Without the influence of natural processes, loading of PBT's to Great Lakes increases contaminant levels in water rapidly, with a slower sediment response. The water column levels arrive quickly at steady state while sediments are still on the increase. Sediment levels will still be increasing, not having reached steady state, while loading decreases. When loading decreases, the water column responds quickly, the sediments respond far more slowly.

The typical pattern of sediment loading can be examined by looking at sediment cores. The history of loading is in the core. PCB sales in the U.S. correlate with core history. Questions can be formulated from examination of core histories.

PCB's in lake trout data (1970's through the present) were presented. Why did PCB levels in biota decline at an exponential rate and then apparently slow down? PCB in herring gull eggs data (five Lakes) was presented. How is this data to be interpreted?

Equations were shown describing a first-order rate process. Trends data can be plotted on either linear or semi-log coordinates. The decrease in concentration is a linear function of the concentration itself. If a log-linear plot of concentration versus time demonstrates a straight line, then the decrease can be confirmed to be a first-order process. What does a first-order process mean? It means that the rate of decline is dependent upon the level of the contaminant present at that particular time. The change in concentration versus time data reveals that a constant fraction decreased per unit of time. The same fractional decrease will occur in the same time period. This is often expressed as a half-life, or the amount of time required for the concentration to decrease by one half.

First-order regression analysis can be applied to concentrations of PCB's in Lake Ontario lake trout.

EPA data covers almost a thirty-year time span (1970's through 1998). Graphing the data demonstrates a half-life of 8.7 years (time for the concentration to decrease by one half). The annual rate of decrease is about 8% per year. Some would incorrectly interpret this to mean that loading is decreasing 8% per year. From this graphical analysis, a reconstruction of loading history through the 1980's is possible. The half-life during this time frame was 5.5 years, or about an annual decrease of 12%. The correct interpretation is that loading of PCB's was decreasing faster than the decrease in PCB concentration in lake trout.

How can we connect loading of PCB's to Lake Ontario with concentrations in lake trout? In fact, a mass balance concept model is required. The model allows development of a relationship between loading of PCB's and lake trout concentrations. Equations can be written that keep track of the transfer processes. First-order processes govern persistent bioaccumulative substances transport and transformation processes. Mass balance equations were shown that characterize the processes. Mass balance models are linear, lake loading limits the rate at which PCB's levels in fish decline.

A history of PCB loading can be reconstructed with mass balance models. The outcome or forecasts of different loading scenarios can be predicted.

Toxaphene washout data from Lake Michigan and Lake Ontario were presented. There were some differences in washout rates because of physical differences in the Lakes. These are temperature, lake geometry, hydrology, and solid dynamics. Lake Ontario responds more quickly. Models are needed to understand and explain these relationships. Use of a minimal data trend assessment approach will lead to wrong conclusions.

PCB concentration trends in Lake Walleye were presented. Changes in ecosystem structure affect the rates of decline. Why does the curve appear to go flat? The explanations are in the lake biology. Again, models are needed to understand and explain these dynamics.

In summary, PCB's in the Great Lakes ecosystem decrease at a first-order rate. The rates of decline and changes over time depend on the properties of the Lake. Mass balance models are needed to define these trends.

**Presentation (G. Krantzberg) - "Policy Implications of Trend Data Analysis"**

Governments have set policies around PBT's in the Great Lakes basin. Policies have been based on the Great Lakes Water Quality Agreement, legislation and regulations, and management objectives.

The Great Lakes Water Quality Agreement provides tools to guide management of PBT's in the basin. Article II includes a provision for no direct discharges. Annex I states that discharges will be virtually eliminated using best available technology. Technology advancements imply ongoing abatement efforts. Article IV indicates that achievement assessments are to be based on statistically valid sampling data focusing on Areas Of Concern and critical pollutants.

The Binational Toxics Strategy is working toward the virtual elimination of PBT's.

The UNEP POPs program focuses on decreases or elimination of PBT's. The issue is -- does this allow a risk/managed approach or employment of the precautionary principle.

In the legislation/regulation arena, Municipal Industry Strategy Abatement (MISA) requires no lethality

at the end of the pipe and virtual elimination of PBT's.

Virtual elimination requires a real analysis of the data. The raw data itself, as made available through the minimal approach, is not useful for decision making. Policy development must be grounded in fact. Agencies should be open to techniques in data analysis.

Accuracy in data measurement and data analysis is important because it allows identification of sources of PBT input. It will allow for a prediction of the time need to reach zero PBT's in the Great Lakes basin. It will identify processes that require more quantification (i.e. mass balance efforts).

Two scenarios should be considered. If the time to virtual elimination cannot be predicted, then more investigation of sources is required. If concentrations of PBT's continue to decline, the continued drive for virtual elimination is based on the precautionary principle, and we cannot lessen abatement initiatives. However, while the time to zero may be based on science, abatement decisions must include socio-economic parameters. From the socio-economic standpoint, what is an acceptable virtual elimination time frame? Data is needed to make proper interpretations.

**Panelist Reaction (A. Buchsbaum)** - Looking at the presentations this afternoon, trend analysis depends on and is governed by the audience. The audience may be policy makers, scientists, and/or the public. From a policy perspective, the questions are basic. How bad is the contamination now? Is it improving or getting worse? How long will it take to eliminate the contaminants? How much will it cost to eliminate contaminants? The trends data do not show the goals or objectives of virtual elimination. Virtual elimination is a concept, not actually a numerical limit. But the goal of virtual elimination requires that we implement water quality standards that protect human health and wildlife. EPA has done that through the Great Lakes Initiative (GLI) standards. These numbers are so low as to be close to virtual elimination. For example, the GLI mercury limit is set at almost the pre-industrial level. Virtual elimination is driven by science. The key for policy makers is to understand where we are now and where we want to go. There is a need to see trend data at lower exposure levels. Models can answer basic scientific questions. Current Total Maximum Daily Load (TMDL) modeling efforts in the U.S. are significant for mercury. Other sources of loading must be understood. Loading may continue or may actually be increasing. It is unclear if we have reached steady state. It is imperative that caution is exercised and we take action now to reduce loading of PBT's to the Great Lakes and not wait for the modeling results.

**Panelist Reaction (K. Burch)** - From what we've heard today, it appears that 8-10 years worth of data are generally required to establish trends. Scientifically this may be valid, but this time frame is too long for the general public. The public wants a more immediate response to its questions and oftentimes trends analyses are too difficult for the layperson to understand. In order to make informed decisions, however, the public requires more than just the simple presentation of raw data. It's also been my experience that they seem to place a greater degree of trust in outside experts to perform the scientific analyses and put forth recommendations along with their conclusion. In addition to data analysis, the governments have an obligation to meet the publics' demand for monitoring to ensure restoration targets are achieved. Once again, turnaround time for presenting the data must be acceptable to the public. This suggests that the qualitative approach is the best strategy. The public has long been the driving force for setting policy at both the state and federal level. Having set the policy, we, as government agencies, evaluate the science necessary and issue regulations or guidelines to carry out the policy. There will always be scientists on both sides of the trends analysis issue to argue that levels of contaminants will continue to fall vs. a new plateau has been reached. In the end, politicians will continue to respond to public pressure and allow the government agencies to decide on the appropriate science.

**Panelist Reaction (J. Means)** - Which way will the trends analysis curve go from here? Will it flatten out or even increase? A great deal is at stake here: ecological health; human health; levels of concern about chemical contamination increasing; dollars; the public; industry; etc. Why are the trends analysis unclear? There are analytical concerns. Do we really know the inputs of PBT's to the Great Lakes? Do we fully understand the biological processes of the Great Lakes? Strategies must be integrated. Are we measuring the correct components of the mixtures? Measuring total PCB's vs. the most toxic congeners may be a better way to go. Do we understand the hydrodynamic processes, where is the water really going? There are critical biological endpoints, like endocrine disruption, that have not been modeled. Our goal is to eliminate harm. Should we be focused on toxicological endpoints rather than chemical concentrations?

### Questions/Answers/Comments

1. **Q:** At the end of SOLEC 98, there were discussions about building a data catalog, did this happen? **A:** The catalog is being built, however, the date for completion is unclear.
  2. **C:** At some point, decisions have to be made with the available data. Achieving virtual elimination may come at great costs.
  3. **C:** Policy decisions must be based on available information. The virtual elimination policy goal looks at PBT's. There is a cost of the status quo. There are financial consequences for actions and inactions. Recreational fishing produces huge revenues for the basin.
  4. **C:** Model output can always be compared to endpoints. At times, the desired endpoints are unclear. Even with no additional input of PCBs, it will take 30-40 years to achieve a 0.05 ppm level of PCB's in Lake Ontario fish. It will take longer for Lake Michigan. Models will help us identify the most cost-effective remedy. Without models all we can do is guess. It takes models to tell us what the outcomes from our actions will be.
  5. **Q:** We have heard in this session that there are 3 basic analysis strategies for trends data. Can we agree that strategy 1 (minimal) is not useful? **A:** Andy Buchsbalm said, "It all depends on the audience. I can't think of an audience for which the minimal approach would not be useful, but there may well be one. I can't rule out using the minimal approach." The other panelists did not respond verbally. Although there was some nodding of heads from some panelists, suggesting agreement, consensus was not expressed on the question.
  6. **C:** It is very expensive to collect data. Running a model analysis is, by comparison, cheap. The value added for quantitative analysis is enormous.
  7. **Q:** An earlier speaker (Thursday morning session) stated that levels of PCB's in the Great Lakes are no longer decreasing. That earlier speaker was wrong? **A:** Viewed on a linear scale, small decreases are difficult to see. Levels continue to decrease in Lake Michigan.
  8. **C:** Data collection and modeling, using the data, are necessary.
  9. **C:** A balance needs to be achieved between spending money on modeling vs. spending money on pollution prevention.
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## Naturalized Knowledge Systems

Facilitator: Dave Dilks, Lura Consulting

Recorder: Mike Russ, U.S. Environmental Protection Agency

Number of Participants: 25

Presenters: Henry Lickers, Mohawk Council of Akwesasne

Rod Whitlow, Chiefs of Ontario

James St. Arnold, Great Lakes Indian Fish & Wildlife Commission

Dean Jacobs, Walpole Island Heritage Center

### Naturalized Knowledge Systems (NKS) - Henry Lickers

In literature, there are 1000 names for traditional knowledge. Some other points to consider are:

- Only native people can hold traditional knowledge.
- It is not static.
- How do you map it?

Henry Lickers prefers the term Naturalized Knowledge Systems (NKS) rather than Traditional Ecological Knowledge (TEK) as it refers to the way in which people (all people) and their knowledge adapt, or become “naturalized”, to the land upon which they live or depend.

NKS keeps knowledge and passes it on to others and other generations.

#### Basic NKS Principles

- Earth is our mother.
- Cooperation is the way to survive.
- Knowledge is powerful only if shared.
- Spiritual world is not distant from earth.
- Responsibility is the best practice.
- Everything is connected to everything.

H. Lickers 1994

All communities living close to the land share these principles.

Charge - How can NKS contribute to SOLEC?

#### Native/non-Native Relations:

The presentation highlighted the need for respect, equity, and empowerment in Native/non-Native relations. Aboriginal people will not be able to fulfil their responsibilities to the land, and thereby demonstrate and share their knowledge on how to do so, without sufficient respect for Aboriginal knowledge being afforded by non-Native society, and in particular by government agencies. This respect must be used to develop equity in Native/non-Native relations through empowering First Nations with the resources they need to work on an equal footing with non-Native organizations.

Balance of:		
<u>Respect</u>	<u>Equity</u>	<u>Empowerment</u>
Understanding	Finances	Application
Communication	Knowledge	Authorship
Consensus	Networks	Credibility
Mediation	Personnel	Partnership
Honor	Social Power	Responsibility

### **A Case Study in the Use of NKS - Rod Whitlow**

The EAGLE (Effects on Aboriginals from the Great Lakes Environment) project provides an example of a long term study that utilized both western science and TEK for understanding human health in the Great Lakes basin. The EAGLE Project started in 1990 and it was based on the First Nations early indicators: deformities in bald eagles and other species, and changes in taste and texture of fish and game tissues. The mission of the EAGLE project was to identify continuing effects and thereby provide First Nations with data and strategies for environmental health of future generations.

There are 63 First Nations in Ontario. 47 participated in the EAGLE project.

Conventional environmental studies with Aboriginals didn't fully involve, or report back to, the communities.

EAGLE had full partnership with communities, including long term involvement and confidentiality.

Research components include social cultural effects. This is not generally distributable to the public. Some are elements sacred to the local community.

Principles of EAGLE research protocol:

- Research ethics ensured community control.
- Researchers to adhere to protocols.
- Community and study participants must understand the research tools.
- Respect for the culture, language, values and knowledge is essential.
- Aboriginal and community peer review and consultation important.
- Post study resources and support included (unique).

Socio-Cultural Research

The goal of combining community-defined wellness indicators with standard social indicators. This is very difficult.

Land use - Being out on the land is central to well-being.

Lessons Learned from the EAGLE project:

- Mandatory post study support essential.
- Governments and First Nation leaders have a responsibility to the community for environmental justice.

Other Issues:

- First Nations should not have to justify their world view and expectations.
- How can western science and TKS inter-relate?

- It was felt that TKS should not be pressure state response. Burden should be on polluter.

**Great Lakes Indian Fish and Wildlife Commission - James St. Arnold**

Great Lakes Indian Fish & Wildlife Commission (GLIFWC) is an organization which resulted from federal court recognition of tribal hunting and fishing rights. A portion of the treaty areas are within the Great Lakes basin. Within GLIFWC, spiritual and medicine people have important roles to play, as do the Elders, in making resource management decisions. GLIFWC can not give answers on behalf of tribes, but must go back to Elders and communities.

- Elders seek to have spirituality (how they live from birth to death, 24 hours a day) brought in to discussions and plans.
- Education is important. The Tribal perspective is brought to Federal and State governments. Tribes seek to educate bureaucrats - but need not show them everything.
- Heavy metal analysis - included full knowledge of how Tribal fishermen fished, filleted, etc.
- Input to Resource Management Plans. Input to US Fish & Wildlife Service and others. Medicine people are protective of their plants. Respect of Aboriginal knowledge is required. Sometimes may say “Don’t go there” even without need of saying why.
- Important to note that NKS is an ongoing process. One cannot expect to have a full explanation of NKS in a 15-20 minute presentation. There is no “instant” TEK.
- Look to the Spirit to tell you what needs to be said. In discussing Forest Management, led to say what was the most important thing - RESPECT.
- Spirituality tie-in is a key. SOLEC should identify/develop spirituality.
- SOLEC should continue the work with Aboriginal people, but should not expect Aboriginal people to do it all at once - need to start with concerns and indicators.

**Walpole Island TEK Study - Dean Jacobs**

Stewardship is central to governance and relationship with land and water. Understanding and respecting Aboriginal values is important (need to understand what they are and why they are important). TEK can contribute to protection and restoration in the Great Lakes basin.

The land view is all-encompassing and demands stewardship. Governance differs from domination and control. People, instead, are subject to the land’s dominion. TEK relays information about the relationship between people, land and resources.

Value of TEK:

- Oral tradition can have value and basis.
- Plans, mitigation may need to reflect traditional use.

Questions bearing on traditional use (used in an environmental assessment for the siting of a pipeline):

- traditional fishing and hunting areas
- traditional collection/use of plants
- traditional travel routes
- traditional ceremonial or spiritual areas
- traditional burial sites or other sacred places
- traditional important past events
- traditional names of geographic sites and areas



This information was gathered by interviews (open ended questions), audio recordings and mapping (GIS).

Conclusions:

- Impacts noted. Feast held after study to thank participants. Results brought to community.
- It is possible to do study quickly (2 months) and well if adequately resourced.
- No instant TEK, but if traditional values are recognized, it is possible to work together.

#### **General Discussion:**

After the four presentations the floor was opened to the session participants. The following are questions from participants to SOLEC organizers:

- Can the next SOLEC start with prayer and pipe ceremony?
- Activity for SOLEC to examine itself - a process indicator.
- Can SOLEC be in a First Nation location?
- How involved are Tribes in RAPs and LaMPs? Mixed. Only governments allowed on writing team. In some cases Tribes are recognized as a government.
- First Nations may not be comfortable as an indicator.

In summary:

- SOLEC showed how it is hard even just to talk with each other
- Stakeholder. I see a whole bunch of people who want to work together for future generations. Spiritually, economically, environmentally, ...

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## **Endocrine Disrupting Chemicals & Pharmaceuticals**

Facilitator: Anne Kerr, Environment Canada

Recorder: Dan Hopkins, U.S. Environmental Protection Agency

Number of Participants: n/a

The session began with presentations from each of five distinguished panel members. Dr. Mark Servos (Environment Canada) began with a presentation on endocrine disrupting chemicals (“EDCs”) in the environment, providing a background piece and context for the workgroup discussion.

Next, Dr. Michael Wade of Environment Canada’s Health and Environmental Communication and Safety Branch described what EDCs are, the effects caused by EDCs, and some evidence of a potential relationships and trends between exposure to EDCs and observed effects in humans.

Dr. Cliff Rice discussed analytical results of testing for alkyl phenol ethoxylates (“APEs”) in sediments and fish samples near waste water treatment plants. He described in detail a variety of chemical structures for several APE compounds and the importance of characterizing these structures through chemical analysis. Dr. Rice stressed that APEs are not the only EDCs found in waste water, but that they appear to be important ones.

Dr. Sheridan Kidd Haack - presented information about pharmaceutical chemicals and emerging issues related to stream waters in the United States. She presented information about antibiotics found in ambient U.S. stream waters. Her data represented 32 (thirty two) of 145 (one hundred forty five) samples. She cautioned that there may be some change pending the completion of the analyses.



Dr. John Geisy - Dr. Geisy expressed the view that wildlife can be sentinels for the effects of EDCs. He identified the term “signal transduction” effects in regard to the ability of EDCs to mimic natural hormones. He cautioned that we should think more broadly about using more than one endpoint because we aren’t that sure about the mechanism causing a particular effect.

Shortly, he expected to have toxicity data for nonylphenol and nonylphenol ethoxylates.

He questioned whether resistance to drugs is occurring or not, adding that more assessment is needed. Related to effects on human beings, he said the environmental levels of some of the pharmaceutical chemicals is 1/1000 (one one-thousandth) to 1/200,000 (one two-hundred thousandths) the concentration necessary to have a therapeutic effect. However, whether these chemicals accumulate in wildlife and whether there is an associated adverse effect, we don’t yet know.

He said that the next challenge will be to find more environmental information and conduct more screening tests.

*The expert panel took questions & comments from the workshop participants.*

Question: What is NP (“nonylphenol”) used for?

Response: used as a surfactant in cleaning agents, as an adjuvant (a substance that non-specifically enhances the immune response to an antigen) in pesticides and spermicides.

Question: Can you put into context “dose” and “threshold” in terms of low level effects?

Response (Geisy): The idea of a “low dose” [for a particular EDC] can be confounded by the existence of multiple chemicals. There is some confusion about dose and threshold - some agents don’t have an effect below a threshold. The trouble comes in the statistical interpretation of when an effect is discerned.

(Wade): Also, related to potency, some chemicals, such as 17-beta-estradiol can exhibit activity at very low doses. Human fetuses are already on a dose-response curve because of exposure to natural hormones during pregnancy. He cited a statistic that a fourth child is much less likely to develop testicular cancer than is a first born. Added exposure from chemicals adds to the existing risk.

Question: What is the current research on low dose effect or no effect at higher dose?

Response (Wade): Effects seem to be demonstrated below dose levels, however, these relationships have yet to be confirmed - they are difficult to reproduce.

(Geisy): Related to nonylphenol and fish, he has seen “U” shaped curves - in trying to interpret effects based on potency and concentration of NP, the potency was much lower by itself than the natural hormone, but the existence of the NP appears to have increased the concentration of the natural hormone.

Comment: One participant asserted that SOLEC consider advocating the use of the “precautionary principle” as it relates to endocrine disrupting chemicals, as opposed to waiting for the results of a lengthy and uncertain process of evaluating EDCs.

Comment: Another participant argued that SOLEC is not the appropriate venue to advocate use of the precautionary principle. *Long after the meeting ended, this topic continued to be discussed. It was apparent that participants were irreconcilably divided about this issue and wanted SOLEC organizers to be aware of it. It was specifically requested by one participant that the organizers have a discussion about the applicability of the precautionary principle as it relates to EDCs.*

Comment: One of the participants asserted that more work needs to be done to evaluate what kinds of additional controls could be implemented at waste water treatment facilities.

Comment: In response to a discussion about pulp and paper discharges containing EDCs, one of the pulp and paper industry representative questioned whether enough was known to draw conclusions about the endocrine disrupting effects of pulp and paper process effluent. He asked whether evidence existed to show that reduced gonad size affects a fish's ability to reproduce; whether reduced gonad size occurs in all cases of exposure to EDCs; and that because pulp and paper effluents are not estrogenic that whatever may be causing the observed effects are unlikely to be of bleach plant origin.

Comment: One participant offered an opinion that SOLEC should continue to discuss indicators and should also continue to present information about Endocrine Disruptors.

## 5.5 Memorable Quotes

The following quotes were heard within the SOLEC 2000 breakout sessions and captured by the session recorders.

1. Regarding indices: “If you mix apples, pears, bananas and grapes, then what will you get besides fruit salad?”
2. Regarding the creation and use of indices for decision-making purposes: “Resistance is **NOT** futile!!”
3. Regarding indices: “How we use the numbers/indicators scares me.”
4. Regarding indices: “We have not considered the social issues.”
5. Regarding indices: “One Index for the Great Lakes?”
6. From the general human health session: “Has the fetus become the unfortunate mining canary of the 1990’s?”
7. From the swimming advisory session: “Managers need to know their beaches.”
8. From the fish consumption advisory session: “The way we are doing things, with different advisories all over the place, it screams inefficiency.”
9. From the societal session: “Either drop the Societal Indicators, or do something.”
10. From the Hamilton Harbour Area of Concern session: “Water in Hamilton Harbour is clean.”
11. From the Hamilton Harbour Area of Concern session: “Water and treated wastewater is not cheap.”
12. From the Hamilton Harbour Area of Concern session: “Pay 1 cent per 25L of tap water versus \$15 per 25L of bottled water, versus \$85 per 25L of beer.”
13. From the Hamilton Harbour Area of Concern session: “City water has to meet standards, bottled water does not.”
14. Regarding indicators: “‘MEGO’ - My eyes glaze over - in relation to too much information from indicators.”
15. Regarding the Biodiversity Investment Areas: “We’ve been focussing on degraded areas - now we have to pay attention to high quality areas as well.”

## 6. SOLEC 2000 Success Story Recipients

The SOLEC Steering Committee believes that it is important to recognize organizations within the Great Lakes basin that have demonstrated a strong commitment to the environment. For SOLEC 2000, the following criteria were used to select the award recipients:

- Showed improvement in the Great Lakes Ecosystem;
- Forged linkages among economy, environment, and community;
- Created a “win-win” situation;
- Formed strong partnerships;
- Established sustainability as a goal;
- Fostered broad stakeholder involvement; and
- Demonstrated adequate monitoring of effectiveness.

The seven organizations that were selected as SOLEC 2000 Success Story recipients, were chosen based on the above criteria.

### **Ontario’s Environmental Farm Plan**

Over 85% of Ontario’s farmland is in the Great Lakes basin, and there has been a history of cooperation with the Ontario farm community on Great Lakes water quality management programs. The Environmental Farm Plan (EFP) is a highly successful partnership engaging over 30 farm organizations under the umbrella Ontario Farm Environmental Coalition, together with a number of federal and provincial agencies with responsibilities relating to agriculture, natural resources and environment. Under the EFP, farmers voluntarily attend two workshop sessions in the course of completing a workbook and developing an environmental action plan for their farm. To date, 7889 farmers have completed action plans. Innovative technologies are being developed and implemented on farms throughout the Great Lakes basin. Farmers see opportunities for the adoption of sustainable farm practices that improve the environment and enhance economic viability. Improvements in local ecosystems such as reduced pesticide residues and nutrient loadings to Great Lakes tributaries are a result of this plan.

### **Saginaw Bay Watershed Initiative Network**

The Saginaw Bay Watershed Initiative Network (SBWIN) is a voluntary, non-regulatory partnership that was launched in 1996 to protect and enhance the quality of life in this watershed. SBWIN is a partnership between Dow Chemical and the Saginaw Bay Watershed communities, and is facilitated by the Conservation Fund. Over 90 resource group members are involved with SBWIN and 13 area foundations work together as a Network to support various projects. This network has brought people and resources together to balance environmental, economic, social, recreational, and historic priorities, and leverage ideas and resources toward a common goal - the greater good of future generations. SBWIN has launched projects to protect habitat, improve access to the bay, foster nature-based tourism, inform people about non-point source pollution, and support sustainable agriculture. SBWIN has also initiated the development and implementation of numerous sustainable development plans encompassing both the entire watershed and individual communities within this watershed.

### **Rural Water Quality Program**

The Rural Water Quality Program (RWQP) provides financial assistance to farmers implementing projects to improve water quality in priority surface and groundwater areas in the Regional Municipality of Waterloo, Ontario. Types of projects approved by the RWQP include clean water diversion, manure storage, nutrient

management plan, milk house drain, fencing, erosion control, buffer strip, fuel storage, and cover crops. Certain practices (e.g., strip cropping, nutrient management plans, stream buffer strips and fragile agricultural land retirement) are also eligible for performance incentives. This program has received strong support from other jurisdictions outside of the Region. Numerous municipalities, conservation authorities, provincial government agencies, and farm groups have praised the program in terms of the variety of projects supported, the link to the Environmental Farm Plan, and the extent of partners involved in program design and development. This program acts as a model for similar programs in other areas of the Province. Over the past two years, the RWQP has prevented an estimated 4,700 kilograms of phosphorus from reaching local rivers and creeks. Over 60% of this reduction is attributed to nutrient management planning.

### **Ontario Power Generation**

Ontario Power Generation (OPG) will plant 1.6 million native trees and shrubs over the next five years as part of its carbon sequestration program. This will sequester in the order of 560,000 tons of CO<sub>2</sub> over the lifetime of the trees. Tree planting and carbon sequestration efforts can offset greenhouse gas emissions, while OPG pursues other technological solutions and alternative energy generation. The value of combining tree plantings for carbon sequestration with habitat restoration work for the conservation of biological diversity, is tremendous. Strategically planting appropriate native species can achieve both greenhouse gas offsets and address important regional recovery efforts for species that are in need of our help through habitat restoration. This program exemplifies how industry can be successfully engaged in the pursuit of sustainability and the triple bottom line of economy, environment and social benefits. OPG demonstrates that industry can act as a catalyst for the enhancement of long-term ecosystem health.

### **Tip of the Mitt Watershed Council**

Formed in 1979, the Tip of the Mitt Watershed Council is a nonprofit corporation whose purpose is to protect and enhance water resources, including inland lakes, the Great Lakes, streams, rivers, wetlands, and groundwater. The Watershed Council promotes these goals through education, water quality monitoring, monitoring activities that could impact water quality, supporting sound environmental policy at all levels, technical services, and providing capacity building consultation to other organizations. The Watershed Council programs focus on providing essential information and forming partnerships with landowners, local businesses, and government. The Watershed Council operates many programs that serve to protect water resources and aquatic habitats. The Biotechnical Shoreline Erosion Control Program began in 1994 and has prevented 270 tons of sediment from entering the Great Lakes basin to date. These programs have a powerful synergistic effect that can serve as a model for other initiatives.

### **Xerox**

In the early 1990's Xerox made a commitment to become a Waste-Free company. The Xerox Waste-Free goal states: "Waste-Free products, manufactured in Waste-Free factories, that enable our customers to achieve Waste-Free offices." That commitment by Xerox has resulted in programs that reduce waste through entire product life cycle - during manufacturing, use by customers and at product end-of-life. The program includes four critical elements including: sustainable product design, re-manufacture and parts reuse, return programs and efficient use of paper. Xerox has achieved a 90% reduction in solid waste to landfills, 90% reduction in air emissions, and a 90% reduction in hazardous waste. In 1999, the equipment and parts re-manufacturing and recycling program prevented more than 145 million pounds of material from entering landfills. The program provides cost savings to Xerox, its customers, and the community at large. Xerox also publishes "Business Guides to Waste Reduction and Recycling" to share its experience gained through the Waste-Free office goals. The Waste-Free factory is an ongoing commitment and will increase focus on reducing waste generation. One way that Waste-Free factory goals are implemented is through pervasive use of environmental management systems. All of Xerox' major manufacturing operations

worldwide are registered to the ISO 14001 environmental management standard.

### **Hamilton Harbour Remedial Action Plan**

The Hamilton Harbour Remedial Action Plan (HHRAP) was completed in 1991. Various representatives, including citizens, academics, landowners, and representatives from government agencies, municipalities, environmental organizations and industry, formed the RAP Stakeholder group. Hamilton Harbour's problems were addressed on a number of fronts; water quality, access and aesthetics, urbanization and land management, bacterial contamination, stresses on fish and wildlife, and toxic contamination. The HHRAP has some notable successes to date including improvement in water quality, creation of fish and wildlife habitat, increase in public access and protection of the watershed. The Bay Area Restoration Council (BARC) is an incorporated, non-profit, charitable organization established in 1991 to promote, monitor and assess the implementation of the HHRAP. BARC's roles include increasing community involvement, public outreach, and assessing the implementation of the RAP. To date, BARC has involved over 1200 volunteers in activities that help in the clean up and restoration of Hamilton Harbour. BARC's largest event to date involved 625 volunteers for a planting project at the new Hamilton Harbour Waterfront Trail. The trail has increased public access to the harbour and has created new habitat areas for fish and wildlife. BARC encourages citizens to participate in volunteer activities and educates the community about the clean up efforts at Hamilton Harbour.

## 7. Conference Closing Remarks

John Mills  
Regional Director General  
Environment Canada, Ontario Region

Frank Lyons  
Regional Administrator  
U.S. Environmental Protection Agency, Region 5

Delivered on Thursday, October 19, 2000

[JOHN] This is my fourth SOLEC, and I really feel that SOLEC has come of age. This is the most successful SOLEC to date, because of three factors. In my opinion, these are the highlights. First, the substantive content that we heard gives us a sharp focus around the indicator work. Our thanks go to all the presenters and the Steering Committee for their hard work and dedication. Secondly, the participation was impressively broad and again our thanks. Thirdly, the organization of this SOLEC was exceptional, and we would particularly like to recognize the efforts of two individuals who actually conceived SOLEC, have breathed into it and kept it on track: Paul Horvatin and Harvey Shear.

[FRANK] This is my first SOLEC. During the time I have been here, I have been very impressed with the dedicated efforts of all individuals who have made this conference such a raging success. What we have heard over the last three days is very encouraging. A diverse group of committed partners is working to assess the health of the Great Lakes. These efforts are crucial. They allow decision makers and responsible agencies to set goals and priorities, adjust them where necessary, and measure results.

We have three things that we want to talk to you about this afternoon: commitment, the importance of partnerships, and SOLEC itself.

[JOHN] First, commitment. SOLEC started out as an experiment – a bench scale test if you like. It grew into the pilot stage in 96-98 and now, it is a mature process but it is still a work in progress. At SOLEC 1998, we talked about the Parties' commitment. By our collective efforts, from then until now, we have demonstrated that commitment. The momentum in the room is an indicator of this. And, I can assure you, the federal government will continue to be major players in the Great Lakes program. We commit to take what we've heard and learned here and integrate it into our programs, and we encourage other partners to do likewise. We will be discussing our plans for future SOLECs at our upcoming Bi-national Executive Steering Committee meeting in Chicago in December. We welcome the offer of support from the U.S. Fish and Wildlife Services as we heard last night and we invite those of you who are on the outskirts of this stage of the SOLEC process to join us at centre stage, so that we will have and can implement, the best set of indicators that we possibly can.

[FRANK] Last SOLEC we challenged the Great Lakes community to "take the indicators on the road", and obtain buy-in and uptake from a broader audience. This SOLEC demonstrates that we have indeed done that - the representation here at SOLEC 2000 is exceptionally diverse and broad – we are extremely pleased about that. Secondly, partnerships are essential to meet our objectives. This has been that most engaging SOLEC to date. We have seen more substantive representation from a diverse group of

stakeholders. We would like to recognize the presence of First Nations and Tribes and thank them for their participation and contributions at this conference. Especially, the contributions of Henry Lickers and Elder Norm Jacobs. This conference has demonstrated the importance of work at the local level. It has also reinforced the message that governments cannot do this work alone.

[JOHN] The third thing I want to talk about is SOLEC. Science is more than just data – we must share knowledge from community, First Nations and Tribal peoples and embrace it into our thinking. This way, we can create balanced and sustainable partnerships. Both western science and naturalized knowledge systems recognize that knowledge is more than science. We need to take the best from all worlds in constructing and implementing SOLEC indicators. The possibilities of a beneficial relationship between the LaMP and SOLEC indicator processes were demonstrated here today with our Lake presentations. It was exciting for me to see the integration and the “win-win” that exists between SOLEC, LaMP, RAP fisheries plans and other processes. With this SOLEC we have together set up the framework for success, but as I mentioned earlier, we need to keep working at it, to build a formula for success.

[FRANK] Let me say in closing how deeply we appreciate the commitment, dedication and knowledge that you all bring, to the task of restoring the physical, chemical and biological integrity of the Great Lakes basin ecosystem. There are many uncertainties in this effort of course. But, we can state with total certainty, that we will only succeed if we work together in partnership. Federal governments, states, provinces, Tribes and First Nations, municipalities, grass roots organizations, and industry must all be players.

[JOHN] Thank you for coming and have a safe trip home. We look forward to your continuing participation and contributions to build a solid base of indicators that we can use for reporting against the state of the Great Lakes, and for the next State of the Lakes report, which will be published in 2001. We will continue to strengthen and build the SOLEC partnership to implement indicators. As individuals and collectively, we have much to contribute, so, with apologies to Nancy and Paul, make sure that you restore SHEMO to health and “Don’t let your good ideas float by on a banner attached to a cream pie”.

Now I would like to invite Norm Jacobs to give us a closing Thanksgiving prayer.

*Note: the Thanksgiving prayer can be found on the following page. The following paragraphs are a summary of the closing remarks made by Norm Jacobs after the Thanksgiving prayer. These have been paraphrased - sincerest apologies to Mr. Jacobs if the meaning has been misconstrued.*

Thanks to SOLEC organizers for inviting First Nations and Tribes to participate in the conference and to be a part of it. The conference shared a lot of what can be done.

When I came, I had commented that we were extending our hands in friendship. Now, talking about indicators – when you can take someone’s hand, that’s an indicator – but we don’t shake it with our right hand, we shake with our left hand, so close to the heart. (Mr. Jacobs invites Harvey Shear and Paul Horvatin to the stage and shakes hands with both of them.)

When we look at what we did contribute, we’ve not given credit to the agricultural products, no acknowledgment. We’re not just freeloaders – we pay taxes.

We’re offering our knowledge, what we know, we’ve lived here since time immemorial.



deyoihwadogēhdōh ganq̄hōnyōhk  
short version      thanksgiving address

ne:dah nigēkyohgo'dē gihswadōhōhsiyōhs gaihwaet:gōh sawá:dō'  
now this assembled crowd you will all listen again to my responsibility it has become again

né:' hejidwaihwayēhētó' sbogwayadihs'ōh sōgwa:wí: ganq̄hōnyōhk  
it we will pull from again our creator he has given us thanksgiving

ne:'né:' aq:'we:sáht' sge:nō' dwēngōhdōnyōh  
it is rejoiceable of well being we are in mind of

ne:'di'né' ēdwe:hék i:'hyá:' sgá:t ejidwayé:' ogwa'nigōha  
and so we will in thought we first as one we will put again our minds

sgá:t dejidwadatnōhōnyō'  
as one we will greet each other

netogyé: é:' niyohōk ogwa'nigōha'  
be it so again remain our minds

da:né:' é:' ejidwa:tro:wí' shēh ohwejáde'  
now this again we will talk again about existing earth

dwano:há' dedwanōhōkwá' né: gwa:ōh shēh niyéha:'  
our mother we refer to it as and also what she holds

ne:'di'né' ēdwe:hék gwe:gōh dejidwanōhōnyō:' \*  
and so we will in thought everything we will thank again

netogyé: é:' niyohōk ogwa'nigōha'  
be it so again remain our minds

da:né: é:ʔ ɛdwa:tro:wiʔ hodeihodonyoʔ  
now it again we will talk about his assigned duty performers

tatihnyé:gyeʔs shéh nahawayenánhe  
they look after how much he created

neʔdiʔnéʔ ɛdwe:hék sgá:t dejetinqhonyoʔ  
and so we will mentally as one we will thank them again

netogyé: é:ʔ niyohók ogwaʔnigóhaʔ  
be it so again remain our minds

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da:né: é:ʔ ejidwa:tro:wiʔ sedwagowa:néh sganyadaí:yoʔ  
now it again we again will talk about our leader handsome lake

oi:howa:néh atatrihwá:dsʔa:ʔ  
a great worthy commendation he had earned for himself

né:ʔ desabaihwa:twáht shéh naqsaogwayehék ohq:dó: haʔwehnihfradenyo:gyeʔ  
it is he who has seeded the news of how we will conduct ourselves in future days ahead

neʔdiʔnéʔ ɛdwe:hék deʔsedwanqhonyoʔ sedwagowanéh sganyadaí:yoʔ  
and so we will mentally we will again thank him our leader handsome lake

netogyé: é:ʔ niyohók ogwaʔnigóhaʔ  
be it so again remain our minds

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da:né: é:ʔ jidwa:tro:wiʔ gei: niyogweda:gé: hadiohyaʔkió:nqʔ  
now it again we will again talk about the four people of male inhabitants

né: deyokhiyeʔnyadóʔ sgenóʔ dwenqhodonyoh  
it is with their hands guard us well being we are in their minds

neʔdiʔnéʔ ɛdwe:hék dejetinqhonyoʔ hadiohyaʔkió:nqʔ deyokhiyeʔnyadóʔ  
and so we mentally we again will thank them heavenly male inhabitants our guardians

netogyé: é:ʔ niyohók ogwaʔnigóhaʔ  
be it so again remain our minds

da:né:ʔ é:ʔ gjidwa:tror:wíʔ haqhaʔgéh gaqhyadéʔ hanagréʔ shogwayadihsʔq̄h  
now it again we will again talk about him who in heaven he lives creator

ne:ʔtsq̄: toʔsq̄hdq̄h néʔ wgenq̄ʔ aidwəŋq̄hdq̄nyq̄:ʔ  
only things dropped down well being in our minds

neʔdiʔnéʔ q̄dwe:hék detsedwanq̄honyq̄:ʔ gaqhyadéʔ hana:gréʔ shogwayadihsʔq̄h  
and so we will mentally again thank him who in heaven he lives our creator

netogyé: é:ʔ niyohtq̄k q̄gwaʔnigq̄haʔ  
be it so again remain our minds

da:netoh nq̄saga:tgwe:ní iʔgéh sagayagebdáhk ganq̄honyq̄hk  
this is the best I could do again up to me it again came out thanksgiving

da:netoh  
that is all

Address and Cayuga-English translation provided by  
Norman L. Jacobs  
Haudenosaunee Environmental Delegate  
Six Nations of the Grand River

