State of the Lakes Ecosystem Conference 1998

Conference Proceedings

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for the SOLEC 98 Steering Committee

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Table of Contents

DISCLAIMER

THIS IS NOT A SCIENTIFIC DOCUMENT

These proceedings contain a summary of the information exchanged at the 1998 State of the Lakes Ecosystem Conference. Reactions and comments from participants have been summarized, and contributions from keynote speakers have been captured. The intent is to provide the reader an opportunity to evaluate and discuss the ideas presented at the conference. Publication of these proceedings does not imply that the governments of Canada or the United States endorse their contents.

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1. Introduction

1.1 Why 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 one 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 do 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.

1.2 SOLEC 94, 96 and 98

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 focused 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.

In planning for SOLEC 98 the organizers wanted to support further development of easily understood indicators which objectively represent the condition of the Great Lakes ecosystem components (as called for in Annex 11 of the GLWQA). These would be used 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*. The 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.

1.3 What's Next?

The draft suite of 87 Great Lakes basin ecosystem indicators prepared for SOLEC 98 will be revised as necessary based on comments received at the conference and during the period from November 1998 to January 1999. This revised list will then be distributed for a very broad stakeholder review early in the spring of 1999. The proposed Indicator List will be released in the fall of 1999, along with the 1999 State of the Great Lakes report and the Biodiversity Investment Area papers. The indicator list will not be considered 'final', since work on it will continue. In some cases there will be data available for use in reporting on an indicator now, in some cases new data will be necessary before we can report on an indicator, and in other cases further research and development will be required before we will be able to implement data collection efforts and report on an indicator. Determining who will do the necessary research, who will collect and maintain the data for these indicators and when they will start will be a next step. In addition to this process, there will be opportunity at SOLEC 2000 and beyond for further review of the Indicator List with revisions being made as conditions warrant.

2. Key Themes

Indicators

The purpose needs to be clear	It is essential that clear, up-front goals are developed and communicated, regarding the purpose of the indicators.
Refining the list and organizing the indicators	More work is necessary in order to refine the indicators - each indicator must be easily understood, scientifically defensible, and objective. With a broad range of scales, applications, and users/audiences, the long list of SOLEC indicators needs to be organized in order to help focus discussion and implementation. Strong support was expressed for the creation of a tiered or nested list of indicators, making the list more relevant and manageable.
Identifying endpoints	Indicator endpoints are essential to keeping ecosystem objectives in focus and ensuring that targets are clear.
Linkages need to be made	It is essential that the linkages within indicator categories, and between different indicators categories, be identified. These linkages also need to illustrate the connections and consistencies between SOLEC, RAP, LaMP, IJC and other indicators.

Indicators con'd

Need buy in	For the indicators to be of any value, agencies throughout the Great Lakes basin need to commit to the collection of data and generation of information to support reporting on indicators.

Biodiversity Investment Areas

The concept is sound	The BIA concept is generally accepted, with support for moving the concept forward and continuing the nomination process.
Suggestions for refinement	Continue to refine the information content, quality and analysis of BIAs. Explore opportunities to use conservation strategies which integrate ecological, economic, social and cultural considerations.
Links to decision-making is key	Embedding the BIA concept at multiple levels, from local communities to binational structures, is essential. It is also important to provide guidance on how to incorporate the use of the BIA concept into decision-making processes.
Fostering stewardship	The stewardship of local stakeholders is essential to the successful implementation of the BIA concept. Communications should focus on educating stakeholders about BIAs, and emphasizing the importance of protecting areas with high biodiversity.

Implementing Indicators And Biodiversity Investment Areas

Resources need to be committed	Continued funding is essential in order to maintain baseline data collection and to ensure that long-term monitoring continues.
Communication	The information which is communicated needs to make sense and be easily understood. Efforts need to be directed at ensuring that information is packaged so that it inspires pride and encourages action by both individuals and organizations.

Implementing Indicators And Biodiversity Investment Areas con'd

Consistency in methodology	Protocols are necessary in order to initiate basin-wide (bi-lateral) consistency in data collection methodology. This methodology also needs to include direction on data analysis, reporting and sharing so that data are comparable and useable over time.
Capturing the knowledge	Maintenance of a central, easily accessible, GIS compatible database for both indicators and BIAs is important.
The important role of local involvement	The public is an important partner and end user of both BIA and indicator information. Initiatives need to be responsive to public needs, and opportunities for public involvement need to be communicated. Support for this involvement (through financial, staffing, or other means) is also key.
Volunteer monitoring	Volunteer monitoring has a powerful contribution to make to data collection efforts, and support is required to ensure the use of this data is maximized.

Future Science And Policy Challenges

Endocrine disruptors	Understanding endocrine disruptors depends on the availability of solid, supportive research. More information is required on the dose-response linkage, and education and awareness projects need to continue.
Binational toxic chemical reduction	The last 25% of contamination is the most difficult to reduce. Education is key to attaining virtual elimination of toxic chemicals from both individuals and industry. Voluntary programs which strive to go beyond compliance have a large role to play in reduction of toxic chemicals.
Next generation indicators	Suggestions for next generation indicators included: oxygen concentration at the mud-water interface; transparency of water; the relative mass of adult benthic versus adult pelagic fish populations.
Issues for the future	Key environmental issues identified for the future included: the consequences of dropping lake levels; population growth (ecological footprint); full cost accounting for development initiatives; assessment of the impacts of liberalized trade; and the impact of climate change on agriculture.

3. Plenary Presentation Summaries

The proposed SOLEC 98 Indicators and Biodiversity Investment Areas were presented to all SOLEC participants in plenary sessions on the mornings of Wednesday, October 21 and Thursday, October 22. Presenters were the leaders of the seven SOLEC Indicators groups and the authors of the three Biodiversity Investment Area papers.

Other presentations included a retrospective about the development of the 1987 Great Lakes Water Quality Agreement protocol by Ron Shimizu (Environment Canada, Ontario Region) and Peter Wise (Illinois EPA), and a look at the Parties commitment to the Great Lakes Water Quality Agreement by John Mills (Environment Canada, Ontario Region) and David Ullrich (U.S. EPA, GLNPO).

The majority of these presentations can be viewed, with their speaking notes, at the SOLEC web-sites: http://www.epa.gov/glnpo/solec *or* http://www.cciw.ca/solec/.

4. Workshop Summaries

4.1 Indicators

The indicators workshops were developed around several specific questions created by the SOLEC 98 Indicators Core Group leaders. Some sessions held closely to these questions and produced indicator specific comments and suggestions. Other sessions evolved beyond the specific questions into discussions on the roots of SOLEC and the final audiences and uses of the SOLEC indicators.

4.1.1 Basin-wide Overview

Facilitators: Suzanne Barrett, Adele Freeman, Leslie Demal
Resource People: Nancy Stadler-Salt, Paul Bertram

These sessions were offered so that the participants had a chance to discuss the proposed indicators as a whole. Some the workshop objectives were:

- to look at and address information gaps, overlaps, linkages and integration issues;
- to seek feedback on the applicability of SOLEC indicators to organizations' initiatives, plans, decision processes and communities; and
- to receive recommendations on specific, logical next steps for "finalizing" the proposed list of indicators.

"Tiering" or "Nesting" of the SOLEC Indicators

The most frequently suggested way to improve the indicators list was to develop a nesting or tiering system to organize the indicators for the various audiences of SOLEC. There were numerous suggestions as to how to accomplish this, but first it was necessary to actually identify who is the audience for the SOLEC indicators list? The SOLEC audience includes

virtually everyone in the basin. The public, environmental organizations, First Nations, industry, researchers, managers, and elected officials may all benefit from the information that the list provides. However, each group may use the list for very different purposes and on entirely different scales. This is where different methods of "tiering" or "nesting" the indicators will prove useful.

There were several suggestions to effectively group the indicators:

- One would be by scale eg. identifying groups of the SOLEC indicators that would be applicable on a basin-wide scale, others that would apply to a lake-by-lake structure, and others that would be applicable at even a smaller geographic scale, such as Areas of Concern.
- Another grouping would be by the level of detail and information that the indicator can provide. A SOLEC index could begin by identifying indicators that are critical - the key indicators for letting an individual quickly find out the overall health of the Great Lakes basin. This grouping would be the level that could be actively marketed to the public. The subsequent levels would involve increasingly greater detail on more specific aspects of ecosystem health and would be more useful to the managers, industry representatives and finally, the researchers and scientists.
- A third possibility would be to group the indicators by category or theme. Although the SOLEC indicators are already grouped in this fashion, the participants suggested possible alternatives. These categories include water, air, land, sediment, socio-economics and stewardship, while themes could include fish, toxics, habitat, etc. Following division into these categories, the indicators could then be divided into further groupings based on scale as described above.
- Other suggestions to improve compatibility and cohesiveness amongst indicator groups include looking at combining nearshore terrestrial and coastal wetlands and/or combining stewardship and land use. SOLEC could also consider clustering the indicators by three primary groups: a) waters, b) nearshore, c) basin landscape and its management.

Additional Participant Perspectives on the Proposed Indicators

- Emphasize that the indicators will make something happen. They will be used for management purposes to demonstrate the value of investment in a particular field and also to support existing and new approaches to monitoring programs. They can also be used to help implement standardization of monitoring procedures. In addition, the SOLEC indicators may be used for educational purposes and to encourage volunteer monitoring programs.

- The quality of the indicators, not the quantity, should be the primary criteria for indicator selection into the SOLEC list.

- The indicators are not always clearly defined, are not integrated with one another and are missing obvious goals, targets and endpoints. The language that the indicators are presented in should be examined carefully and a process is needed to integrate the indicators, to monitor and update the suite, and to forecast change and future needs. The indicators should be phased in slowly, taking the required time to develop the indicators completely.

- What is the flow of the dynamics between SOLEC, RAP and LaMP indicators? Which supports which, or is it both ways?

- Participants at SOLEC 98 will use the indicators list in a variety of ways. Some will push for program responses, while other citizens and environmental groups will use the indicators as an advocacy tool. From agency point of view, they might be used to measure effectiveness of programs - both to monitor actions and to look at endpoints.

- Public motivation is a key ingredient to making the SOLEC indicators list accepted. With the list in its current format, it is unlikely the public will use or react to it. The public needs to see clearly how it can make a difference locally. The public reacts based on a sense of place, how they are tied to their regions makes a difference in terms of what motivates them. If we bring this process down to a local level (sub-watershed) and use the indicators to help educate people about their role in the broader scheme of things, this should encourage local volunteers, groups, and personal action by showing people where they can connect with their environment.

- One of the next large tasks to get this indicators process off the ground is information management. SOLEC should decide on the appropriate software and systems that could be used for data management, then all agencies would collect data to fit same format thus creating truly basin-wide access to data.

- The indicators can be used in different ways depending on the quality of the system you are working in. In a degraded system, the condition indicators would be more useful, while in a good quality system, monitoring may focus on the stressor indicators because there is a lag time before you see the symptoms.

Gaps

- Indicators reflecting changes in attitudes and behaviours towards the environment. This could be completed using surveys or keeping track of numbers of volunteers and memberships in environmental groups;
- The indicators should reflect more agricultural and forestry practices. The land use indicators are skewed towards urban and economics;
- Recreational access to natural areas;
- Indicators dealing with inland natural areas and tributaries to the lakes;
- The indicators are focused on water *quality*, need to also highlight water *quantity* issues;
- Missing Great Lakes - St. Lawrence River linkages;
- Identify indicators that *have* current monitoring and which ones *need* it;
- Need a thorough rationale explaining how indicators relate to one another.

Highlights

1. The current work is much appreciated and it is a great first start at a large task. SOLEC needs to recognize that there is still a lot of work to do.
2. Clearly identify the type of indicator (state, pressure, response).
3. Goals and Objectives need to be well defined, as do endpoints. When considering endpoints, the question of scale becomes very important.
4. There is the need to know your audience and to understand which indicators are relevant to each audience base. This will lead to the tiering and nesting of the SOLEC indicators.
5. Indicators need to motivate and encourage individual behaviour.

4.1.2 Open Waters

Facilitator: Tom Hersey Jr.
Resource Person: John Gannon

For the purposes of SOLEC 98 the nearshore and open waters are defined as in the SOLEC 96 Nearshore Waters background paper:

> Nearshore waters are "a band of varying width around the perimeter of each lake between the land and deeper offshore waters of the lake. The band begins at the shoreline or at the lakeward edge of the coastal wetlands and extends offshore to the deepest lake-bed depth contour at which the thermocline typically intersects with the lake-bed in late summer or early fall. Also included as nearshore waters are the Great Lakes connecting channels and the reaches of tributaries that are subject to seiche activity. Offshore Waters, as the name implies, are all of the waters beyond the lakeward edge of the nearshore waters."

SOLEC 98 Open Waters Indicators

STATE

6 Aquatic Habitat
8 Salmon and Trout
9 Walleye and *Hexagenia*
17 Preyfish
68 Native Unionid Mussels
93 Lake Trout and *Diaporeia hoyi*
101 Fish Tumors
104 Degradation of Benthos
109a Degradation of Phytoplankton Populations
109b Degradation of Zooplankton Populations
4502 Fish Community Health
4503 Deformities / Eroded Fins / Lesions / Tumors (DELT) in Fish

PRESSURE

18 Sea Lamprey
72 Fish Entrainment
111 Phosphorus Concentrations
112 Trends in Contaminant Concentrations and Loadings of Priority Chemicals in Abiotic Media: Water, Air, Soil, and Sediments
113 Contaminants in Recreational Fish
114 Contaminants in Young-of-the-Year Spottail Shiners
115 Contaminants in Colonial Nesting Waterbirds

Suggested Changes to Existing Indicators

- **Lake Trout and *Diaporeia hoyi* (93)**. Link lake trout with *Mysis* instead of *Diaporeia*;
- **Fish Entrainment (72)**. Fish entrainment does not need to be considered in open waters;

- **Fish Tumors (101) and Deformities/Eroded Fins/Lesions/Tumors (DELT) (4503)**. Many delegates pointed out the similarities between these two indicators and suggested that the two be combined;
- **Contaminants in Young-of-the-Year Spottail Shiners (114)**. This indicator is more important for the nearshore waters because Spottail shiners are only found in nearshore areas;
- **Phosphorus Concentrations (111)** should continue as an important indicator. Existing phosphorus endpoints are set for the open waters and were created 20 years ago. The phosphorus indicator may require separate endpoints for open and nearshore waters, and that endpoint may also differ depending on the lake. Achieving mid-lake concentrations of phosphorus was not enough to address the phosphorus problems in nearshore Areas of Concern. The group should also consider including phosphorus loads, not only concentrations;
- **Trends in Contaminant Concentrations and Loadings of Priority Chemicals in Abiotic Media: Water, Air, Soil, and Sediments (112)**. This indicator should only include trends as the measurement of loadings is too costly. Loadings are important in order to get current information. Surrogates such as spottail shiners or lipid bags could be used;
- **Salmon and Trout (8)**. This indicator could be changed to "predator fish" which may or may not include salmon and trout;
- **Contaminants in Recreational Fish (113).** This might be more appropriate in the Human Health section. Clarify the catch-weighted average component of the indicator;
- There are several indicators that border nearshore and offshore issues. Perhaps we need a third category that integrates and shows the interactions between open and nearshore waters.

Suggested Additions of New Indicators

- Natural self producing lake trout is a key indicator, not just a count of numbers in the lakes;
- Water clarity;
- Exotic species and zebra mussels species (nearshore issue) should be considered in open waters as they coat bottom of lake thus impacting the whole system;
- Agal biomass; and
- Number of salmon and trout.

Identification of Information Gaps

- Why was chlorophyll not included? *[Note: this indicator is included in the Coastal Wetland group, Chlorophyll a Levels (4512)];*
- There appears to be a disconnect between phosphorus and chlorophyll;
- It is not clear what degradation of phytoplankton means;
- There is a lack of information and explanation of how the endpoints were arrived at.

Suggested Deletions

- Fish entrainment (72) is difficult to interpret;
- One sub-group suggested removing the following indicators as they may be contributors, but are not indicators:
  72 - Fish Entrainment
  114 - Contaminants in Young-of-the-Year Spottail Shiners
  4519 (unbounded) - Global Warming: Number of Extreme Storms
  4857 (unbounded) - Global Warming: First Emergence of Water Lilies in Coastal Wetlands
  4858 (unbounded) - Global Warming: Ice Duration on the Great Lakes.

Participant Reaction to the SOLEC 98 Indicators Process

- There is a lack of endpoints for many of the indicators and also a lack of understanding of the objectives SOLEC is trying to achieve;
- Funding must be available for both research and monitoring programs;
- The economic feasibility of implementing the indicators is essential to examine. Agencies may require indicators with multiple uses in order to create a more manageable list of indicators. It would be impossible to monitor all of the SOLEC indicators presented;
- We need to understand the relationship between state/pressure before narrowing down the list of indicators.

Highlights

1. Keep ecosystem objectives in focus and reduce the list of indicators to a more manageable number.
2. Must understand the relationships between state indicators and pressure indicators.
3. Agency dollars need to be allocated to accomplish goals.
4. More peer review is required before endpoints are finalized.

4.1.3 Nearshore Waters

Facilitators: Tija Luste, Marcia Domato, E. Marie Phillips
Resource People: Tom Edsall, Kent Fuller, Dan Bauer

SOLEC 98 Nearshore Waters Indicators

The definition and indicators presented in Section 4.1.2 for Open Waters Indicators also apply to this indicator group.

Suggested Changes to Existing Indicators

- **Fish Entrainment (72)**. This is more a measure of harvest, not impact on nearshore habitat. A change to mass balance of harvest vs production, and addition of other types of harvests including commercial and recreational fishing, would help to improve this indicator. This indicator could also be expanded to include hydropower;

- **Fish Tumours (101)** should be included in **Deformities, Eroded Fins, Lesions and Tumours (4503)**;
- **Contaminants in Recreational Fish (113)** is a duplicate of **Chemical Contaminants in Fish Tissue (4083)**. These indicators should be combined;
- **Aquatic Habitat (6)**. There is a question of what is actually included in terms of habitat. The indicator appears to have a strong dam orientation and this conflicts with the sea lamprey control program. Dams can help to block contaminants and non-native species from moving downstream, thus, their removal would be detrimental to downstream environments and should not be considered habitat rehabilitation;
- **Sea Lamprey (18)** should be broadened to include exotics in general;
- **Degradation of benthos (104)** and **Degradation of algae (109)** both refer to "degradation". Perhaps they should refer to "status" to reflect a more positive situation;
- **Degradation of benthos (104)** needs a broader benthic array.

Suggested Additions of New Indicators

- Ratio of exotic : native species (this would address round goby);
- Cladophora and other attached algae would be good indicators for both nearshore and open waters as they are visible and easily understandable;
- Dissolved oxygen should be considered, not as a basin-wide indicator, but can be monitored for other purposes;
- C^{14} uptake in phytoplankton. This is not being done basin-wide, so there is question of available data. This indicator would require monthly monitoring or there wouldn't be enough data to show trends;
- Add sedimentation to aquatic habitat, or as a specific pressure indicator;
- Dredging could be added as a pressure indicator.

Identification of Information Gaps

- There are too few indicators dealing with habitat issues;
- Missing non-game, non-prey species indicators including gobies and yellow perch;
- Trophic indicators need to be customized to each lake;
- Musky and lake sturgeon are missing from the indicators;
- Incidence of EMS and other fish health measures;
- The relationship between chlorophyll *a* and phosphorus should be explored;
- Incidence of early mortality in fish species;
- An indicator of overall fish health;
- Basin-wide productivity;
- Chironomids might be better than algae as an indicator;
- Exotic benthic and plankton communities;
- Genetic diversity of fish populations.

Suggested Deletions

- **Native Unionid Mussels (68**);
- **Contaminants in Recreational Fish (113)** should be addressed in the human health group (one group for/one against this suggestion);

- **Deformities/Eroded Fins/Lesions/Tumors (DELT) (4503)** should be combined with **Fish Tumors (101)**, therefore one of the two indicators will be deleted;
- **Fish entrainment (72)** demonstrates more local than basin-wide effects.

Participant Reaction to the SOLEC 98 Indicators Process

- The development of a tiered system or nesting of the indicators will help focus monitoring efforts and bring people together to discuss and exchange data;
- There are not always clear targets for the indicators;
- Participants are worried about the feasibility of data collection in general and across the federal, state and provincial borders of the Great Lakes region. It is a very large leap from research to monitoring;
- How will the SOLEC indicators be used and for what purpose? eg. set monitoring direction and focus, assess GLWQA objectives;
- Need to be careful of an over emphasis on the total number of indicators and avoid picking too few and sacrificing others for the sake of achieving a particular number of indicators;
- Current data availability is an important aspect, but not the only criterion for selecting indicators;
- Will choosing these indicators mean that monitoring of everything else is cut?
- Municipal interests could become possible partnerships in habitat monitoring. This may be a powerful indicator to influence elected officials;
- The Ohio State of Lake Erie Report 1998 could be used as a model to report on the SOLEC Indicators;
- Monitoring and research serves a public education function. It is important to promote working together by sharing and making use of data sets collected by others;
- Having publicized indicators will make agencies more accountable to provide data, especially to the public. We need to take appropriate steps now to market the indicators and get buy-in from the public and partners.

Highlights

1. There is a need for a marketing plan for the SOLEC indicators. For example, fewer indicators will be easier to sell to the public and other interested parties. We must begin now to create an effective marketing strategy.
2. A tiering/nesting approach would be helpful to set priorities, avoid duplication and overlap of indicators, and tie things logically together. The list should begin with a few general, important indicators, and then nest the others beneath these making the list more publically digestible.
3. The indicators need to be complementary and not competing, eg. dams and sea lamprey - removing dams vs contaminant spread.
4. There is concern that basin-wide indicators will displace other established monitoring programs.
5. Data availability and feasibility of data collection must be discussed before proceeding with indicator selection.
6. Indicators do not always have clear targets, they need continued refinement and increased specificity.
7. We must keep in mind the goal of SOLEC, we should be looking for **basin-wide** indicators and not site-specific, eg. fish entrainment.

4.1.4 Coastal Wetlands

Facilitator: Sheila Greene, Eric Carlson
Resource People: Duane Heaton, Nancy Patterson

The extent of Great Lakes coastal wetlands fluctuates greatly with natural lake processes which can particularly affect the lake-side boundary. For SOLEC, the inland boundary is the extent of wetlands as far as the 100-year floodline of the Lakes as described in the SOLEC 96 background paper Coastal Wetlands of the Great Lakes.

SOLEC 98 Coastal Wetlands Indicators

STATE

4501 Invertebrate Community Health
4504 Amphibian Diversity and Abundance
4505 Reptile Diversity and Abundance
4507 Wetland-Dependent Bird Diversity and Abundance
4510 Wetland Area
4511 Gain in Restored Wetland Area
4512 Chlorophyll a Levels
4513 Presence, Abundance and Expansion of Invasive Plants
4859 Reproductive Output of Mink

PRESSURE

4506 Contaminants in Snapping Turtle Eggs
4516 Water Quality: Sediment Flowing into Coastal Wetlands
4518 Water Level Fluctuations
4854 Water Quality: Chlorides Flowing into Coastal Wetlands
4855 Water Quality: Nitrates into Coastal Wetlands
4856 Water Quality: Total Phosphorus Flowing into Coastal Wetlands

Suggested Changes to Existing Indicators

- **Wetland Dependant Fish Community (4502)**. Take this indicator back from the nearshore waters and make it wetland specific;
- **Wetland Area (4510) and Gain in Restored Wetland Area (4511).** These indicators could be combined with a sub-category for restored wetlands within the new indicator. Differentiate between wetlands that have been newly constructed and wetlands created by changing water levels. Also, try to include shoreline modification more explicitly;
- **Wetland Area (4510)**. Standardize the measurements between U.S. & Canada;
- **Water Level Fluctuations (4518).** Clarify the nature of the shoreline with the nearshore group;
- **Nitrates into Coastal Wetlands (4855)** and **Total Phosphorus Flowing into Coastal Wetlands (4856)** could be combined as one nutrients indicator;
- **Reproductive Output of Mink (4859)**. Change to another top carnivore instead of mink;
- **Presence, Absence and Expansion of Invasive Plants (4513)**. More emphasis should be placed on indigenous species as they could also indicate quality of wetlands.

Suggested Additions of New Indicators

- Percentage native plant communities (most supported amongst sub-groups);
- Percentage of plant community, including endangered, natives and exotics;
- A different measure of primary productivity;
- Shoreline modification - percentage of shoreline dyked/hardened/modified. *[Note: this is included in Nearshore Terrestrial group, Hardened Shoreline (8131)]*

The following three suggestions were eventually rejected for various reasons:

- Presence/absence of waterfowl, migratory species. These are easy to see in the spring, but too many other variables impact their populations;
- Biodiversity of actual habitat itself (too variable and expensive to monitor);
- Pressure indicator for the use of wetlands eg. number of duck blinds, level of protection, lead shot being added to the wetland; existing use as opposed to future use (controversial, subject of much discussion, maybe the wetlands in question never did support waterfowl).

Identification of Information Gaps

- Buffer zones should be included as a wetland indicator;
- **Wetland Dependant Fish Species (4502)** (retrieve from nearshore group).

Suggested Deletions

- **Reproductive Output of Mink (4859)** (most participants agreed with this deletion);
- **Chlorophyll *a* Levels (4512)**. This might be better addressed by the nearshore group, or more representative of the open water algal community;
- **Chlorides Flowing into Coastal Wetlands (4854)**. This would best be included with the nitrogen and phosphorus indicators as one common nutrients indicator;
- **Contaminants in Snapping Turtle Eggs (4506)**. Some want this kept as this species is a surrogate for contaminants and is found in all coastal wetlands;
- **Reptile Diversity and Abundance (4505)**. Either drop it or include in a special Research and Development section.

Participant Reaction to the SOLEC 98 Indicators Process

- A tiered system of looking at the wetland indicators was suggested. We should tier indicators from the grossest to the finest detail. Tier One would include an indicator of structure of the wetland, an indicator of faunal diversity, and an indicator of abiotic effects. Would start at tier one and if you see problems, then you would go to the next tier;
- Need to avoid programmatic indicators;
- Endpoint conditions are critical, they are our real goals. We need to identify clear goals and objectives and ask “Does your indicator answer that question?”;
- One-half to two-thirds of the coastal wetlands indicators are based on existing data sets, we should try and keep these if possible;
- Some of the indicators identified already have ongoing monitoring while others don’t. There needs to be a way to ensure that you’ve got the monitoring capability to support the

indicators. But if an indicator is not being monitored for already, that doesn't mean it isn't a great indicator; maybe it just needs to have more monitoring devoted to it. And conversely, just because there are programs currently in place for monitoring some of these indicators, doesn't mean that they are the right indicators;
- We can't assume that funding for monitoring will continue indefinitely.

Highlights

1. Group proposed a tiered approach to organizing the indicators (basin-wide to site specific);
2. Group agreed wetland area by type is a critical binational and basin-wide indicator (accounts for changes due to natural processes and human activities);
3. It is essential to have coordination between other indicator groups on following topics: wetland buffers, wetland dependant fish species, hardened shoreline.
4. We need comparable methodologies for basin-wide monitoring and data collection.
5. Work needs to be done at the extensive and intensive levels.

4.1.5 Nearshore Terrestrial

Facilitator: Vicki Barron
Resource People: Ron Reid, Karen Rodriguez

As described in the SOLEC 96 The Land by the Lakes background paper, the nearshore terrestrial ecosystems along the Great Lakes shoreline are defined by the lakes themselves. The physical structure and living communities of the land along the lake's edge are as much a function of the lake's ecosystem as the fish in its depths. The actions of wave and wind shape the beaches, dunes and shore bluffs. These land-forms and the local climatic effects of large water bodies determine the biological communities. These communities, in turn, sustain the amazing diversity of wildlife that enriches the Great Lakes basin. From narrow beaches weathered by wind and waves to inland contiguous forests or dune fields, nearshore terrestrial ecosystems are products of the lakes.

SOLEC 98 Nearshore Terrestrial Indicators

STATE
8136 Nearshore Natural Land Cover
8128 Nearshore Threatened Species
8129 Special Lakeshore Communities
8137 Nearshore Species Stability
8148 Nearshore Endemic Species

PRESSURE
8131 Hardened Shoreline
8132 Nearshore Land Use Intensity
8133 Lake Level Fluctuations
8146 Artificial Coastal Structures
8134 Nearshore Problem Species
8135 Contaminants Affecting Productivity of Bald Eagles
8147 Contaminants Affecting the American Otter

HUMAN ACTIVITIES (RESPONSE)
8139 Community / Species Plans
8140 Agency Dollars Allocated
8141 Shoreline Management Plans Adopted
8149 Nearshore Protected Areas

BASIN-WIDE INDICATORS (includes the entire land area of the Great Lakes basin)
8150 Breeding Birds
8151 Number, Extent and Viability of Endemic Species
8152 Threatened Species

Changes, Questions and Comments on Existing Indicators

- **Nearshore Endemic Species (8148)**. This is a good indicator to keep. Blend this indicator with Nearshore Threatened Species (8128), but report out separately;
- **Natural Land Cover (8136).** Need to define natural land cover and add impervious surfaces including parking lots, buildings etc... What other values could it be surrogate for? eg. insect habitat;
- **Hardened Shoreline (8131)**. Break down this indicator by shoreline types eg. clay banks vs. sand shores and modify the language to incorporate wetland information from wetlands indicator. This needs to be tracked over time and correlated to show shoreline types;
- **Contaminants Affecting the American Otter (8147)**. The otter is not a basin-wide species. Regardless, the indicators need mammals represented somewhere and otters are easier to locate and capture for monitoring. The otter is not as sensitive as mink, but it is a good idea to keep both mink and otter with a better justification for using them;
- **Community/Species Plans (8139)**. It could be difficult to measure whether the plans are acted upon. It might be better to incorporate with the Stewardship group;
- **Agency Dollars Allocated (8140)**. Need to include money from other organizations - private, non-profit and human investment, not just government. It is difficult to determine exactly where the money is spent as there are many cross-overs. The main problem with this indicator is that it could be used to target cuts in government spending. It is an important indicator, but needs refining and may better fit with the Stewardship Group;
- **Lake Level Fluctuations (8133)**. There are so many conflicting interests in lake levels (property owners, shipping, commerce...). It is a very important issue for wetland and terrestrial ecosystems for functioning and sediment movement, but what is the actual indicator? What do you measure and how can it be interpreted? This indicator could be related to Hardened Shoreline (8131);
- **Artificial Coastal Structures (8146)**. What is the difference between this indicator and Hardened Shoreline (8183)? The differences should be clearly defined, or else the two indicators should be merged into one. *[Note: This indicator deals with projections from the shore eg. artificial structures not hardened shoreline]*;
- **Special Lakeshore Communities (8129)**. What is the relationship and overlap with Nearshore Threatened Species (8128)? There is some overlap, but it is necessary. 8129 is more specific to community types, 8128/8136 are more basin-wide. The indicator will look at overall threats to community types across basin, eg. what's threatening dune systems across the basin. The communities need to be prioritized based on impending threats;
- **Nearshore Species Stability (8137)**. This is a difficult indicator to use and requires intensive data collection, therefore need to focus on particular species. We could incorporate breeding bird data which is extensive and can be used regionally to track over

time. Non-migratory species should be used to minimize outside influences and provide better indication of local conditions. A complementary indicator could be created to represent conditions that may not be evident with birds;
- **Nearshore Problem Species (8134)**. This is a basin-wide problem, what can be done about it, what does it indicate, and how do you measure it? Could it be incorporated with Nearshore Species Stability? The indicator is vague and covers too much ground, needs to be narrowed down to focus on select species that need to be determined. Problem species are controversial with many competing interests;
- **Nearshore Land Use Intensity (8132)**. Could this indicator be combined with other indicators eg. community health? Might want to consider indicators by types, ie. marinas, homes, directional drilling, density of structures. Mapping of the nearshore land uses would be good to help identify long term changes. It might be simpler to choose representative areas rather than the whole basin;
- **Threatened species (8128)**. This should be included as an unbounded indicator, but also important species specifically for nearshore terrestrial. The objective and measure are inconsistent and need better definition and clarification. How do you interpret data? What does "number or proportion" mean? We should consider taking a more preventative approach by not only focusing on rarity and ranking species to focus on. A historical comparison will be helpful.

Suggested Additions of New Indicators

- Need something to cover the impact on plants from air toxics;
- Species Abundance;
- Severity of threats to special lakeshore communities, eg. sand dune mining;
- Level of protection of nearshore areas.

Identification of Information Gaps

- Soil quality information, although found in land use, Agricultural Intensity (8111) is not adequate;
- Tributary level indicators are missing.

Suggested Deletions

- **Contaminants Affecting the American Otter (8147).** Either delete or provide a better justification for using it;
- **Lake Level Fluctuations (8133)** (one vote) - doesn't see its usefulness;
- **Agency Dollars Allocated (8140)** should be included under Stewardship (if at all) and incorporate comments above.

Participant Reaction to the SOLEC 98 Indicators Process

- Indicators require further development before they are finalized;
- SOLEC needs to look at the implementation and feasibility of the indicators and of partners who can help with data sharing and collection;

- Hardened shoreline is an important issue, we need to do something about it: education, rally support to prevent hardening, push for more sensitive techniques for hardening.

Highlights

1. The proposed indicators represent a good start.
2. The indicators need to be focused (selecting species, etc.) and cross referencing needs to take place both within the terrestrial indicators as well as between indicator groups.
3. The indicators could next be divided by topics and fine tuned with agencies that are active in the topic to test pilot the implementation.
4. We lack a comprehensive and systematic inventory of the nearshore terrestrial environment.
5. The indicators are not, and are not meant to be, pro-active and responsive. However, some prioritization should take place in recognition of impending change. Management programs are not stemming the loss of the nearshore terrestrial environment.

4.1.6 Land Use

Facilitator: Cathy Keenan
Resource Person: Ray Rivers

The SOLEC 98 project work on indicators for land use is oriented in the recognition that human use of land is the predominant cause of environmental problems in the ecosystems of the Great Lakes basin. SOLEC 96 built on the early work of environmental scientists in highlighting that land use is the major source of environmental stress in the ecosystem of the Great Lakes basin. Unlike previous studies, however, SOLEC 96 focused on the harm that follows urban sprawl, the development form most prevalent in North America.

In spite of considerable evidence of the significant disadvantages of urban sprawl, this development form continues to be the most commonly applied approach to new development. Clearly, as was concluded in SOLEC 96, there is a need for better ways of influencing decision-makers in the Great Lakes basin to make environmentally informed development decisions. These land use indicators are intended to meet that need.

SOLEC 98 Land Use Indicators

STATE
7027 Loss of Natural Features
7042 Quality of Social Aesthetics
7043 Economic Activity
7055 Stream and Wetland Water Quality

PRESSURE
7000 Efficient Urban Density
7002 Land Conversion
7007 Resource Use
7012 Transportation Efficiency
7017 Pollution Levels
7054 Ground Surface Hardening

8111 Agricultural Intensity
8114 Habitat Fragmentation
8142 Streamflow and Sediment Discharge

HUMAN ACTIVITIES (Response)
7006 Brownfield Redevelopment
7028 Sustainable Agriculture
7053 Green Planning Process

Suggested Changes to Existing Indicators

- **Efficient Urban Density (7000)**. Using the concept of efficiency is misleading, in the definition, efficiency is more equal to density. There is a conflict between efficient urban development versus available green space. This type of conflict should be avoided in order to create a compatible and complementary suite of indicators;
- **Land Conversion (7002)**. The use of "net conversion of land back to natural" might be a more positive measure to consider;
- **Brownfield Redevelopment (7006)**. Recovery of buried streams could be included;
- **Resource Use (7007)**. Resource extraction might be a more appropriate indicator and should include forestry and mining practices, and establish bad vs. good practices;
- **Transportation Efficiency (7012)**. A better measure might be the ratio of people using public transportation: using own vehicle;
- **Loss of Natural Features (7027)**. This indicator is too general and overlaps with other areas. It is a quality indicator without defining what quality really is. Should it be a "state" indicator?;
- **Sustainable Agriculture (7028)**. The definition of Sustainable Agriculture needs clarification. The group might consider using the definition from the Great Lakes Commission. The indicator should also include hedge rows, tree rows, and pest management and might include measures such as integrated pest management and lands under one hectare;
- **Quality of Social Aesthetics (7042)**. This indicator needs some clarification and simplification before it can be finalized. Many of the specific items within the indicator are very complicated. There is conflict between percent greenspace and high urban density. The two are not necessarily mutually inclusive, there could be a way to combine them. Percentage greenspace per unit of urban density could be a measure. Consider public and private green space, and the addition of bike and peddle friendly streets as a measure;
- **Economic Activity (7043)**. There was a great deal of discussion regarding the location of this indicator within the other indicator groups, and if GDP is really the best measure of economic activity. Some believed that it might be more suited to the human health group as an indicator of human well-being, or as an unbounded indicator that shows impacts on all parts of the basin;
- **Green Planning Process (7053)**. Green planning process should include reclaimed streets including reserved bike paths, and areas where priority is given to pedestrians;
- **Stream and Wetland Water Quality (7055)**. Many in the group liked this indicator and believe that it should stay in the suite, although the measures may not be appropriate as it presupposes that water gets to streams over land. It may be better as a pressure indicator;
- **Habitat Fragmentation (8114)**. There was debate over the use of a one kilometre zone. Some believe that this is too large, and some think it is too small.

Suggested Additions of New Indicators

- The creation and use of a "land use pie" and its rate of change. This would be easily measured using GIS;
- Number of miles of storm drains and number of sanitary sewers;
- Urban density;
- Measure of urban expansion, urban envelope, expansion of urban infrastructure;
- Total economic disposable income per hectare of urban land;
- Land use policy indicators needed - eg. zoning;
- An index of land value;
- Total economic activity per ha;
- Number of multiple jurisdictions working together, including NGOs and industry.

Identification of Information Gaps

- Most indicators need more definition;
- Resource extraction and resource use other than air and water;
- Forestry land use and practices - land conversion;
- Increase in natural area cover in urban areas should be captured;
- Public access to lakes;
- Area of sub-watershed "un-urbanized".

Suggested Deletions

- There needs to be additional clarification of many of the indicators before final decisions could be made to combine or drop indicators;
- In order to avoid overlapping priorities, the number of indicators needs to be reduced;
- Resource Use (7007) and Pollution Levels (7017) may not belong in land use;
- Economic Activity (7043) should either be dropped or moved into another group. Others strongly feel that the indicator "economic activity" should stay, but drop GDP use as the measure replacing it with real per capita disposable income adjusted to inflation, or a distribution of income;
- Some indicators can be combined eg. ground hardening and land conversion;
- Pollution Levels (7017).

Participant Reaction to the SOLEC 98 Indicators Process

- The indicators should not be bounded by surface hydrology. This is not appropriate for some types of planning and should suit the purpose of the individual indicator;
- The indicators are "too many and too generic";
- SOLEC should consider arranging the indicators in tiers. Some simple key indicators may be more useful, doable and efficient to indicate the state of land use in the basin eg. hardening, land use conversion, and forest cover;
- Many of the indicators are quite conventional in formulation and might be improved by considering the incorporation of sustainable development and Ecological Footprinting;
- Has any effort been made to compare U.S. and Canada federal objectives with indicators currently in development? The U.S. already has set of binational goals (U.S. NEPA). It was

discussed that NEPA does not incorporate the ecosystem approach as outlined in the GLWQA.

Highlights

1. Need to simplify the indicators and measures of basin land use.
2. The creation of links across indicator categories (Stewardship, Nearshore Terrestrial) will clarify many of the indicators and expose them to maximum usefulness.
3. What are the cumulative impacts of land use change and population increase in the future?
4. Make land use indicators relevant, measurable, digestible and credible to attract the attention of local level decision makers.

4.1.7 Human Health

Facilitators: Sandra Owens, Marcia Damato
Resource People: Doug Haines and Mark Johnson

For practical purposes, this effort to develop health indicators for SOLEC has focused primarily on indicators of human exposure to environmental contaminants, plus an indicator of geographic patterns and trends in disease incidence. Health effects indicators are also desirable, but will be more challenging to develop because of the difficulty in making cause-effect linkages.

SOLEC 98 Human Health Indicators

STATE
4179 Geographic Patterns and Trends in Disease Incidence

PRESSURE (Indicators of Exposure)
4081 Recreational Water Quality
4083 Chemical Contaminants in Fish Tissue
4088 Chemical Contaminant Intake From All Sources
4175 Drinking Water Quality - chemical and microbial
4176 Air Quality
4177 Chemical Contaminants in Human Tissue
4178 Radionuclides

Comments and Suggested Changes to Existing Indicators

- **Recreational Water Quality (4081)**. Comments were mixed. One participant expressed concern that the indicator is too vague, that E. coli and fecal coliforms are very broad indicators, and that we need more specific human health markers. Beach closings is not a useful indicator on its own. Frequency of monitoring needs to be clearly identified to give perspective to the numbers;
- **Chemical Contaminants in Fish (4083)**. This indicator has not yet been developed. One participant suggested that a good indicator would be the number of consumption restrictions in basin;

- **Chemical Contaminant Intake from all Sources (4088)**. Food Market basket surveys, which provide the basis for these assessments, may not pick sub-populations, eg. First Nations. Therefore, it is important to also assess sub-sets of the population based on their specific diets;
- **4083, 4088, 4177** - We need to also look at new chemicals as they arise, and not just banned chemicals. We should start including biomonitors and biomarkers and identifying new chemicals;
- **Drinking Water Quality (4175)**. There is a need for some sort of comparison (eg. between Canada and the U.S.) in order to have a context for indicators (look at spikes, not averages of chemical and microbial concentrations). We should be able to put Great Lakes into broad context. This indicator looks at finished water quality after treatment which is more reflective of treatment than state - perhaps add one to reflect raw water quality. There should be an indicator of private groundwater sources as well;
- **Air Quality (4176)**. This indicator does not resolve issues, it is primarily outlining data collection and is not yet an indicator. There is no causal connection and it is too general to deal with air quality;
- **Chemical Contaminants in Human Tissue (4177)**. Look at specific groups such as sport fisherman. There is not yet adequate work on endocrine disruptors and biomarkers;
- **Geographic Patterns and Trends in Disease Incidence (4179)**. Want to see maps put back into whole Canadian context in order to see basin in perspective to other geographic areas. Should include neurobehavioural effects, socio-economic well-being, some positive outcomes, public perceptions, diversity of use.

Suggested Additions of New Indicators

- Incidence of cardiovascular/respiratory disease should be included as a SOLEC indicator;
- Bees can be used as an indicator of air pollution deposition;
- Dose response — one hour ozone level would be a good indicator, yet it is buried in Air Quality (4176) - perhaps this should be on its own;
- Indicator of raw water quality to back up Drinking Water Quality (4175). *[Note: It was identified in that session that the current drinking water indicator does address raw water quality.]*

Identification of Information Gaps

- Need a statement about use, true dose and what people are doing to be exposed to contaminants;
- Cardiorespiratory disease appears to be missing in the suite of indicators;
- Exposure indicators do not indicate the STATE OF HEALTH in the Great Lakes basin;
- Difficult to find cause-effect linkages; what is within our scope is to identify current exposure;
- Air toxics appears to be a gap;
- Need to focus on specific populations eg. high risk groups;
- Expectation gaps — Are we creating expectations that we won't be able to fulfill?
- Missing many endpoints such as low level, long-term exposures and effects;
- Pick-up new chemicals to be monitored in place of banned chemicals that are typically monitored for many of the indicators.

Suggested Deletions

- The feeling of many of the participants is that the indicators are not well defined enough to assess if any should be dropped.

Participant Reaction to the SOLEC 98 Indicators Process

- There is a great deal of uncertainty regarding the Human Health indicators, targets and what they will tell us about Human Health in the Great Lakes basin. The purposes of the SOLEC indicators need to be clarified. We should be able to look at the indicators to see how well we are doing;
- Some of the indicators are not actually indicators themselves, but more plans of data collection;
- The indicators need a lot more work before we are at a point where we can have a short list;
- The gathering of data is a huge, expensive, and time consuming effort. The basin was information rich from 70s and 80s, but it is becoming increasingly difficult to access data from individual states, due to legal constraints. The two countries' monitoring efforts need to be coordinated;
- Need to focus on key activities given scarce resources;
- Need public dialogue on what we're measuring;
- Need to move up to level of biomarkers, away from concentrations in the environment;
- Should look at possible synergistic effects; effects of mixtures;
- It is important to look at health consequences of causing public fear by creating dramatic indicators. Risk/benefit analysis eg. benefits of breast feeding vs. contaminant exposure of infant; not eating fish vs. alternative diet (does it replace the nutritional value of fish?);
- Express limitations of indicators and give clear rationales for which ones were chosen.

Highlights

1. Look at all indicators in context of North America, and not just the basin. This will help improve the understandability of the indicators.
2. Choose resilient indicators which are independent of management decisions, eg. The decision of how often to monitor has a direct impact on number of beach closings. We need to adopt indicators that have applicability across borders, sectors, populations. This requires consistent data collection methods so that data area "shareable", comparable, usable over time, space and social structures.
3. We need indicators which treat the public as a partner, and which lead to outreach, buy-in, and partnerships. We need to be aware of the communications opportunities and the messages passed on through indicators. We must not mislead people, and need to be sensitive to the impact that communication of the indicators will have.
4. Not enough time was allowed to answer the questions about the indicators adequately. There needs to be a process set up to assess human health indicators in a systematic, detailed way.

4.1.8 Stewardship

Facilitator: Joanna Kidd,
Resource People: Ron Baba, Mike Finney

A "steward" is someone who manages the affairs of a household or estate on behalf of an employer, owner, or beneficiary. "Stewardship" is a process requiring competence, vigilance, and an ethic of responsibility for the condition of that which is being looked after. In the context of the three categories of indicators that have been defined for the purposes of SOLEC 98 (eg. state of the ecosystem, pressures, and human activities (or response)), stewardship is equivalent to or strongly associated with societal responses, eg. individual and collective actions to halt, mitigate, adapt to, or prevent damage to the environment.

SOLEC 98 Stewardship Indicators *(not reviewed prior to the conference)*

3509 Capacities of Sustainable Landscape Partnerships
3510 Organizational Richness of Sustainable Landscape Partnerships
3511 Integration of Ecosystem Management Principles Across Landscapes
3512 Integration of Sustainability Principles Across Landscapes
3513 Citizen/Community Place-Based Stewardship Activities

Comments and Suggested Changes to Existing Indicators

- In order to communicate these indicators to a wider audience, the language used needs to be clarified, including further description and definition of some new terms used. The public must be able to understand the indicators;
- The indicators are written in a manner that appears top down. They should be re-expressed to show them as bottom-up indicators;
- Need indicators that range from individual efforts all the way to government programs;
- Think of stewardship indicators as the great integrators of everything else (use measures from other groups).

Suggested Additions of New Indicators

- Turnover in partnerships;
- Indicator of individual land owners and managers and their ethics;
- Public acceptance of government policies;
- Use of environment (e.g. angler clubs);
- Land area in local trust or easements;
- Look at ecological footprint (e.g. local trading currency);
- Reinvestment in natural capital eg. acres reforested;
- Need improved measures, eg. number of schools with yard naturalization, companies registered with ISO 14 000;
- An indicator of changed behaviours, attitudes towards the environment and individual values would be valuable. This is measurable by looking at things such as recycling numbers and using polls to ask specific questions;
- Need to consider not only how many people are recycling, but how many people are making money recycling. This addresses economics - one of the multiple dimensions of sustainability.

Identification of Information Gaps

- Define “partnerships” between industry, government, other stakeholders and recognize the broad participation of each;
- Are we reaching our goal? Indices are required to help measure the success of the efforts.

Participant Reaction to the SOLEC 98 Indicators Process

- SOLEC has made a significant step by including a stewardship section and attempting to measure ethics;
- Must ensure that action-based measures are included;
- The public should be inspired by these indicators and use them;
- Indicators should be nested by scale eg. “community”, “landscape”, “ecosystem”;
- Should look at how stewardship meshes with the other indicator groups;
- Stewardship is a tool, not an endpoint, therefore challenging to create indicators.

Highlights

1. There is a need to develop a clear definition of the partnerships we are talking about — they are focused on achieving sustainability and ecosystem integrity in a particular ecosystem based geographic location (eg. a watershed).
2. Stewardship indicators need to operate at varying scales, and for both the horizontal and vertical axis (across landscapes and upwards to government agencies).
3. There is an opportunity to integrate stewardship indicators with those developed by the indicator core groups.
4. Effective partnership organizations are those that: provide individuals with an opportunity to be involved, encourage individuals to take responsibility for their actions, and foster the respect of other participants.
5. The stewardship indicators need to be packaged in a way to inspire pride and encourage action by individuals and organizations.
6. Indicators that measure place-based partnerships are necessary, but not sufficient to capture all aspects of sustainability.

4.2 Biodiversity Investment Area Session Summaries

4.2.1 Nearshore Terrestrial Biodiversity Investment Areas

Facilitators: Sandra Owens, Cathy Keenan
Resource People: Karen Rodriguez, Ron Reid

The SOLEC 96 Land by the Lakes background paper introduced another idea to the Great Lakes Water Quality Agreement process - the idea that some sections of shoreline have exceptionally high ecological values which warrant exceptional attention to protect them from degradation. These areas, mapped at a coarse scale, were coined “Biodiversity Investment Areas” - or BIAs in short form.

Like most ideas, this one is not really new, but rather an extension of previous work and previous thinking in many quarters. But it did garner considerable attention and discussion, and a considerable degree of support. And the concept raised an intriguing question: since the community of agencies with responsibility for managing the Great Lakes has highlighted areas of concern where environmental restoration is a priority, should it also be highlighting areas of special quality - BIAs - where prevention of environmental loss is a common priority?

This report sought to take the discussion of Biodiversity Investment Areas to the next logical step by looking at each of the 20 shoreline BIAs in more detail, summarizing their values, the individual threats to their security, and their current degree of protection. The authors also provide a brief assessment of each area, and initial thoughts on key protection needs. The tentative boundaries of each BIA are also reviewed and adjusted where appropriate. Vignettes of related local and regional conservation activities are also included, as examples of efforts already underway to protect the values of these areas.

Perspectives on the Concept of Terrestrial Biodiversity Investment Areas

- BIAs are a great idea especially since the concept has room to change and incorporate other ideas, and were identified at an appropriate scale (basin level);.
- It is important to recognize that there are significant *areas* and significant *sites*.
- SOLEC should consider combining the three BIA groupings.
- Include areas up into the watershed.
- Consider using indicators to identify and refine the BIA functions, stressors and to establish system of natural heritage linkages.
- The full range of biodiversity in the Great Lakes basin should be included in the BIAs. *[Note: The group looked at rarity: G1-G3 species (global rarity classification system: G1=extremely rare, G2=very rare, G3=rare-uncommon), S1-S3 species (rarity classification in province of Ontario: S1=extremely rare in Ontario, S2=very rare in Ontario, S3=rare-uncommon in Ontario) and Great Lakes endemics]*
- Include how the BIAs will deal with change over time, eg. climate change.

- Implementing the BIA concept is no one organizations' responsibility. It will require orchestration between agencies and individuals.

- The criteria used for selection and a rationale for each area should be better defined so the average person can understand.

- Are BIAs zoos? BIA is not a zoo per se, but are highly involved with protection of gene pool. Zoos could be surveyed and somehow incorporated in this process of biodiversity protection.

Specific Comments

- A number of specific areas were mentioned for consideration of BIA status:
  - ***South shore of Lake Ontario, West of Rochester to Oswego*** - two significant areas of clay bluffs and eight areas of coastal wetlands (TNC has info);
  - ***Niagara Escarpment*** - the escarpment area is designated as an International Biosphere Reserve. The Lakes' connectivity to this area will influence the nearshore environment;
  - ***Southern shore of Georgian Bay***;
  - ***Western Lake Ontario*** - several areas should be considered in this area, including Lynde Marshes, Scarborough Bluffs, Rouge River Valley (mouth), Rattray Marsh;
  - ***Golden Crescent*** - Northern part of Michigan's lower Peninsula needs more consideration;
  - ***Whitefish Point, Michigan*** - inland dunes, ponds, migratory birds, nesting piping plovers - there already exists efforts for preservation;
  - ***Pinery Provincial Park Region/Kettle Point*** - beach, 30 kilometres of sand dunes and oak savanna, geologic feat, old embayment;
  - ***Door County Area*** - include Garden Peninsula and islands in the northern regions;
  - ***Niagara Corridor*** - this area should fit in to one of the three BIA categories. There are a large number of species of birds that use this area;
  - ***Islands in the St. Lawrence***;
  - ***Haliburton Highlands*** - lakes, unique strains of brook and lake trout.
- The term geoecodiversity should be expressed differently;
- It isn't clear if "Biodiversity" includes only plants and animals, or are small and very old organisms included? Should consider lichen, protists, other tiny organisms.

Next Steps

- There is no structure in place to follow through on next steps;
- It is key that SOLEC work with stakeholders. Scientists need to influence the public, who will then influence government decision-makers. To do this effectively the information needs to be packaged effectively to be applicable to the decision-makers process;
- Use RAPs as examples or models for building public support;
- It is important to highlight successes where planning has been successfully implemented as a way of increasing public awareness. Tell people why BIAs are important by providing examples that combine ecology, economics and conservation;
- Using the missing, lost etc. system from the Aquatics BIA paper, would create a classification system that would be valuable for all BIAs;
- Each area has different needs and priorities. It is important to identify what needs to be done

in each area individually;
- More work is needed on identifying the impact of land use on these areas. Land use authorities must work with the scientific community towards a common goal to protect that area through land use planning and protection plans. Concern exists that the decision-makers are the land owners;
- Each BIA should have a local contact person, a science contact, and a display (Environmental Education kiosks);
- A possible resource would be: "Engaging the public on biodiversity" produced by the Biodiversity Project Madison WI.

Highlights

1. Participants liked the concept and scale at which the BIAs were developed.
2. There still needs to be a lot of work done on local level.
3. There needs to be integration with other BIAs.
4. Indicators can be used to characterize the natural systems and refine the identification of BIAs.
5. Participants must recognize the need for adaptive management and refine the identification process through other groups such as local stakeholders. Conservation strategy needs to integrate economic, social, ecological, and cultural considerations.
6. Strive to embed the concept of BIAs at multiple levels, including within local communities and binational structures.

4.2.2 Coastal Wetland Biodiversity Investment Areas

Facilitators: Eric Carlson, Joanna Kidd
Resource People: Pat Chow-Fraser, Dennis Albert

The initial draft of the Coastal Wetlands Biodiversity Investment Area paper builds on the work begun in SOLEC 96. The ultimate objective of the SOLEC 96 The Land by the Lakes paper was to identify areas of the Great Lakes shoreline that contain high quality faunal habitat that could be identified as "Biodiveristy Investment Areas". To achieve this objective, the authors of the Coastal Wetlands BIA paper attempted the following:
- To create a GIS-based inventory of all coastal Great Lakes wetlands.
- To develop a consistent terminology for classifying and describing coastal Great Lakes wetland types, based on both geomorphic context and floristic relationships, for both Canadian and U.S. wetlands.
- To utilize existing U.S. and Canadian data to describe the wetland types for each shoreline reach.
- To delineate coastal reaches of the Great Lakes that support significant wetland types that are ecologically distinctive (**"eco-reaches"**).
- To summarize and compare avi-faunal use of littoral and nearshore areas within all Great Lakes eco-reaches.
- To identify eco-reaches that are known to be exceptionally important habitat for a large number of fish and bird species.

Perspectives on the Concept of "Eco-reaches of high biodiversity"

- The goal of identifying eco-reaches is to provide a useful framework for scientists. The authors want the scientific community to use "wetland eco-reaches as a tool to hang your data on", to describe wetland character, and focus inventories and management. If shared characteristics between reaches can be recognized, time can be saved developing management plans. To address one of the main concerns, this is a classification system - not a prioritization system.

- The Coastal Wetlands eco-reaches were defined based on a number of criteria. They were **not** delineated based on management jurisdictions or land ownership. The boundaries are related primarily to the underlying geomorphology and geology of the areas, and the associated floral and faunal information. This creates reaches that will be different in area, but should contain wetland types that are similar and can be grouped together. Thus the size of reach does not determine importance of diversity in one area.

- Most participants believe this to be an excellent approach to identifying areas, the lines are right where they should be on the U.S. side, the Canadian side may need a second look in some areas.

- There should be separate cut-off levels (p values) for Lake Superior wetlands. The wetlands may not be as diverse, but provide excellent habitat for many species.

- One of the biggest obstacles to completing this project is lack of available and accessible data. There are often several groups working on similar goals with little connection.

- Fish and breeding bird data were the primary sources of information used to determine biodiversity of the eco-reaches. Are the fish and bird species used in the analysis wetland dependant? Only the fish species residing primarily in the littoral part of fish atlas were included in this project based on a presence/absence categorization. The breeding birds information is geographically based, all species that utilize the nearshore were included, not necessarily wetlands. One could go now to these tables and extract specific species known to be wetland dependant. It would be useful to get additional detailed information into accessible database format.

- One of the greatest concerns during the discussions was that areas that don't have high biodiversity value based on fish and bird data, may be just as important for biodiversity, but are not included in this study. Further, lower diversity areas also have important values for habitat and this needs to be captured in the report.

- There is a danger of labelling eco-reaches as very high, or high biodiversity. Other individual, important wetlands might be overlooked and it is likely that bureaucracies will adopt this type of framework as a "fait a compli" and will allocate resources only to top areas. We need to remember that data are incomplete and a lack of information should not be interpreted as "no wetlands of high biodiversity."

- There is a need to instill a sense of stewardship into the local residents and governments. In 1996 when the concept of BIAs was introduced, stewardship was the objective behind the idea. Education is a vital intermediate step for stewardship.

- Although a scientifically based approach is beneficial in many ways, there is a need to include the political agenda. Politicians want to allocate money somewhere and therefore we may need to identify some specific areas for wetland "investment". In order to move forward, we need to keep sight of this political need for conservation of important areas as a place to spend money or focus efforts.

- Special attributes such as high snow or rainfall are important characteristics of an eco-reach that should be captured.

Specific Comments on Proposed Eco-reaches

- Reach E6A/E7 should be moved a bit west;
- The granite/limestone join on Georgian Bay could be broken down into finer detail;
- S7 (south shore of Lake Superior) could be broken down finer;
- E7 is really one geophysical unit;
- The labelling scheme used should be changed to make it more user friendly. The sub-letters a,b,c could be used for reaches that have the same characteristics even in different lakes;
- The Niagara River isn't captured in any of the three BIA groups;
- The entire basin should be included in the delineations.

Next Steps

- Most importantly, the eco-reach delineations need to be finalized by getting feedback on the boundaries as they currently stand. The reaches need to be looked at more closely on a lake by lake basis, possibly by the LaMPs workgroups;
- There needs to be a written description of each eco-reach;
- Identification of wetlands that are representative from each eco-reach;
- More faunal studies need to be incorporated into this paper. The amphibian study done by the Long Point Bird Observatory includes vegetation and breeding bird information. There are also other breeding birds atlases under development that were not available at the time for use in this study, that might be included;
- The Canadian data need some refinement;
- A main concern is how will this information get out to the managers, researchers and scientists who will benefit from this framework? First of all, we need people to identify themselves as having valuable information and bring forward their data. The most accessible way is on the Internet, in a GIS querriable format. WIRENET, a consortium of research and educational people housed at McMaster University could be a start for collection of data (http://www.cciw.ca/glimr/wirenet). It is already equipped with a GIS based database of wetland information that could be easily added to. Unfortunately, it has lost funding and GIS technician time would be desperately needed to keep the database. Thus our database needs a good home. Suggestions of CCIW and GLNPO were volunteered;
- One challenge is to keep any and all databases updated. Keeping up to date on every species is simply not possible. In order to be successful, there needs to be simplification of the database and it would only be updated every 5 or 10 years;
- All interested parties need to agree on what is important for basin-wide management;
- Several participants agreed that it would be beneficial to integrate the three Biodiversity Investment Area geographical areas (Coastal Wetlands, Nearshore Terrestrial, Aquatics). This would allow more general data to be used and would avoid some overlap in data

collection and organization. In the long run, if this concept is implemented, it will be simpler to implement one program as opposed to three separate components of the program. One participant believe that more time should be spent on developing the connectivity between the three groups, not on the lines of the reaches;
- Could the focus of the next SOLEC be to carry this on? If so integration of the three geographical units should be highlighted as well as the inclusion of head water wetland biodiversity which makes an impact on the lakeshore wetlands.

Uses of Eco-reaches

- The classification of eco-reaches by wetland type will be useful for further development of key wetland indicators such as wetland type and areal extent of wetlands;
- This framework will help managers focus research management. Eventually BIAs will suggest areas where wetlands should be protected, thus helping focus regulation and restoration and identification of base-line areas;
- Use "wetland eco-reaches as a tool to hang your data on", to describe wetland character, and to focus your inventories and management. If you can recognize shared characteristics between reaches, you can save time developing management plans;
- Biodiversity Investment Areas will help encourage local stewardship activities. People living in the area need to know about the biodiversity where they are living and working. Public education is very important so that the public will understand the importance of biodiversity and convey their concerns to their elected officials and government agencies.

Highlights

1. Participants support the approach and understand need for refinement at a local level.
2. The eco-reaches are a classification systems, not a priority system.
3. The value of this initial draft is in the informational framework rather than the identification of BIAs.
4. Data collected for this project should belong to the community, not an agency.
5. It is very important that the data be easily accessible basin-wide in a GIS format.

4.2.3 Aquatic Biodiversity Investment Areas

Facilitator: Suzanne Barrett
Resource People: Joe Koonce, Ken Minns, Heather Morrison

In the draft report the authors reported on initial efforts to identify and validate candidate Aquatic Biodiversity Investment Areas (ABIAs) across the Great Lakes basin ecosystems. The ABIA concept is linked to its terrestrial shorelands counterpart, Lands by the Lakes, reported at SOLEC 96 and placed in context with other national and international biodiversity initiatives. The working definition of an ABIA used in this study is: a specific location or area within a larger ecosystem that is especially productive, supports exceptionally high biodiversity and/or endemism and contributes significantly to the integrity of the whole ecosystem.

Perspectives on the Concept of Aquatic Biodiversity Investment Areas

- The Aquatic Biodiversity Investment Area approach is early in development. In order to continue, it will be important to find out what the ultimate purpose of the "ABIA list" is.

- Some of the participants prefer the approach of the Aquatic BIAs to the other groups.

- There are pros and cons of using a survey to obtain information. Some of the limitations include a lack of communication between experts, incomplete survey results and comparisons of results between lakes. The survey nominations need investigation and validation in order to bring objectivity in to the identification process. If the survey approach is expanded, amend it to deal more explicitly with other biota in addition to fish. Contact each of the technical committees (GLFC, LaMPs) in order to get some consolidated information.

- What are the implications of not being on the BIA list? There is concern that if a candidate were not selected, that area might lose any potential to be protected. Those areas that were identified are special places, but there are many others that need protection.

- The BIAs are a good counter to balance RAPs and AOCs by creating positive public communication about the resources at our doorstep.

- The term investment implies that money will be allocated in ABIAs instead of other important locations. It is important to clarify what this designation really means in terms of resources and government intent. Perhaps the use of "investment" should be reconsidered.

- SOLEC should re-think whether this approach will be really useful in protecting habitat. There may be a need for a suite of tools to protect habitat, not just BIAs.

Specific Comments

- Consider whether parasites are an important component of biodiversity. Parasites in fish can tell us about ecosystem health and balance.

Next Steps

- There are three important next steps in identifying ABIAs:
  - identify places (nomination process started this)
  - complete habitat supply analysis to indicate "hot spots" in a scientifically defensible manner
  - compare the survey results with the habitat supply analysis;
- Agencies should be formally solicited to recommend potential ABIAs;
- Consider including the entire system (tributaries, etc.) when completing the habitat supply analysis;
- A letter to all conference participants, fishery commission, LaMP people, seeking individuals with expertise (State wildlife people and agencies, endangered species folks, nature conservancy, land trust);

- Refine information gathering to include more than fish;
- Refine criteria for the process and outline how nominees will be screened;
- Examine whether ABIA designation exposes non-ABIAs to ongoing destruction;
- Use the ABIA website to convey information (http://129.22.156.152/ABIA/index.htm);
- Local involvement it needed to move forward with important land use decisions and management;
- Education is essential to let people know the value of these areas. First, build strong advocacy, and then these advocates will take on the cause.

Highlights

1. Complete the habitat supply analysis focusing on the entire system, including tributaries.
2. Identify how the information will be used for decision making and what the relationship is between BIAs and non-BIAs.
3. The identification of ABIAs should not be entirely based on fish species, but should be expanded to include other important residents of the aquatic ecosystem *[Note: it was recognized that the focus on fish emerged because i) information on fish is available; and ii) often when you protect fish, you protect other species.]*
4. Need to develop specific criteria for selecting the BIAs.
5. Aquatic BIAs should be designated and conveyed to influence local decision-makers, and build local support.

4.3 Lake-by-Lake Session Summaries

These sessions were organized and unfolded differently for each individual lake. In addition to discussions on each of the five lakes, sessions on the St. Lawrence River and the Connecting Channels ensured that people from the entire basin had a chance to discuss issues regarding indicator development, implementation, and most importantly, the applicability of the SOLEC indicators to their region.

4.3.1 Lake Superior

Facilitator: Adele Freeman
Organizer: Darrell Piekarz and Jake Vander Wal

The Lake Superior session was designed to discuss the compatibility between the SOLEC Indicators and the 1995 discussion paper, Ecosystem Principles and Objectives, Indicators and Targets for Lake Superior (EPO). The reason for completing this work was twofold:

- Assess the extent to which ecosystemic indicators that are potentially applicable to the entire Great Lakes watershed also can be used in the Lake Superior basin; and
- Provide feedback to SOLEC regarding the potential utility of the general, Great Lakes-wide indicator list.

The two documents were compared and contrasted in six different categories: Habitat, Terrestrial Wildlife, Aquatics, Chemical Contaminants, Human Health, and Sustainability. All groups looked for correspondence between the indicators, gaps in the SOLEC indicators, and the applicability of the SOLEC indicators to the Lake Superior basin. Handouts comparing four of the groups were distributed (these are available from the Lake Superior Binational Program Office).

Summary results from each group discussion are below:

Aquatics

- Two of the SOLEC Nearshore and Open Water indicators were found to be highly applicable to three of the Lake Superior indicators.
- The Lake Superior Aquatics Community Committee was not formally assembled at the time of SOLEC. The committee will do a more formal evaluation of the SOLEC indicators in the future.

Terrestrial Wildlife

- This group evaluated 16 of the October 1998 SOLEC indicators from the Coastal Wetlands and Nearshore Terrestrial Core Indicator groups.
- Each of the SOLEC indicators was designated an applicability measure of “high”, “medium”, or “low” (some with modifications) with respect to the Lake Superior basin.
- 9 of the 16 indicators were designated “high” or “medium” (4 with modifications), while the remaining seven had “low” applicability to Lake Superior.

Habitat

- SOLEC indicators from the Nearshore and Open Waters, Coastal Wetlands, and Nearshore Terrestrial groups were compared against 10 corresponding Lake Superior habitat indicators.

- 9 of the 10 were found to be “highly” applicable to the Lake Superior indicators, while one was designated “medium/low”.

For the three groups above, there are several SOLEC indicators from the Nearshore and Open Waters, Coastal Wetlands, and Nearshore Terrestrial groups that do not fit directly with the Lake Superior indicators, but were also given an applicability designation. The majority of these designations were “high or high/medium”.

Human Health

- The Lake Superior Human Health Committee provided a comparison of the eight SOLEC Human Health indicators against the LaMP indicators.
- The indicators proposed by SOLEC match those identified by the Lake Superior Binational Program (LSBP).
- After this analysis, the LSBP endorsed the human health SOLEC indicators.

Chemical Contaminants

- The SOLEC indicator 112 - Trends in Contaminant Concentrations and Loadings of Priority Chemicals in Abiotic Media: Air, Soil and Sediment - relates very well to several of the Lake Superior indicators and monitoring recommendations for water and sediments. The example given for fish should be deleted form this abiotic indicator.
- There does not appear to be any SOLEC indicators that reflect the Lake Superior sub-objective indicators for Zero Discharge.

Sustainability

- The Lake Superior Developing Sustainability Committee initially looked at the June 1998 draft of the SOLEC indicators to compare to the Lake Superior EPO document.
- They found a high level of applicability in the June draft. Unfortunately, in the October draft, a number of changes to the list created some incompatibility between the two sets.
- This group also noted a number of inconsistencies within the SOLEC document that need to be addressed before the SOLEC list is finalized.

During each of the group discussions, SOLEC participants offered relevant and important advice to consider while continuing with the SOLEC indicators process:

- An identifiable ecosystem is required. This can be identified by the people that live in it;
- Ecosystem objectives are required before indicators are written;
- It is important to partner with existing projects and efforts;
- Discussion drafts are a valuable tool for receiving feedback from the community;
- Indicator development and selection is a lengthy and on-going process;
- SOLEC should endorse other groups of indicators that are not basin-wide;
- The SOLEC endpoints and objectives need to be defined more clearly and consistently with separate endpoints for different lakes;
- The SOLEC indicators need much more development and fine-tuning before monitoring programs can be developed based on the indicators;
- The Great Lakes community needs an accessible compendium of current monitoring efforts throughout the basin *[Note: this is being worked on by the IJC]*. The information made available through this IJC work and that already available through the Council of Great Lakes Research Managers, an inventory of monitoring and research for the Great Lakes

(http://www.ijc.org/cgi-bin/w3-msql/boards/cglr/ri98.html) should be referenced in SOLEC materials.

Highlights

1. Selecting basin-wide indicators does not mean that the lake-specific indicators are unimportant.
2. There is a key gap - SOLEC doesn't have indicators for tributary watersheds. Taking this point further, SOLEC indicators are not cross-cutting for the whole basin.
3. SOLEC needs to clarify its role in the nesting of indicators: SOLEC/LaMPs/RAPs.
4. We need to recognize that there will be different endpoints for each lake.
5. Need to clarify who is the audience for the SOLEC indicators.
6. We need a process for finalization of the indicators. SOLEC is just a beginning, not an end.
7. Indicators will need to be peer reviewed as well as additional collaboration with stakeholders.

4.3.2 Lake Michigan

Facilitator: Sheila Greene
Organizer: Judy Beck

Participants in this session discussed and provided specific feedback on the Lake Michigan LaMP's matrix approach to indicators and objectives which involves six goals:

- Fish
- Drinking the Water
- Beach Closings
- Habitat
- Public Access
- Land Use/Recreation

Participants discussed ways of incorporating the SOLEC indicators into indicators for the LaMP goals while realizing that the two will be different.

Highlights

1. We need an accurate link between the current LaMP activity and condition indicators. The stressor is the link.
2. Taste and odour problems in water and fish should be added as indicators.
3. More specificity is needed for the condition indicators.
4. Consistency of measures by indicator will enhance uniformity.
5. Use the SOLEC indicators where appropriate, and also draw on the work done by the IJCs' Indicators Implementation Task Force.
6. There is a need for standardization between local/state/tribes on: fish advisories, beach closing criteria, and analytical methods for fish contaminant monitoring.
7. Need creative ideas on indicators for drinking water and beach closures.

4.3.3 Lake Huron

Facilitator: Leslie Demal
Organizer: Jim Bredin

The Lake Huron breakout session attendees were provided a summary report regarding Lake Huron. This report included information on background conditions, water quality, fish, birds and exotic species. It also included a preliminary review of potential critical pollutants and beneficial use impairments, and identified potential indicators. Most of the information provided in the summary report was derived from previous SOLEC reports.

The breakout session attendees were asked to respond to two questions:

- Do you feel that the suite of indicators proposed in the paper is useful for Lake Huron?
- How should we proceed to address Lake Huron issues?

The attendees of the session were informed that the suite of indicators proposed in the summary report were derived directly from previous SOLEC reports and were not specifically developed for the purposes of SOLEC 98.

In responding to the question of the usefulness of the indicators identified in the summary report, the following responses represent the issues identified by the groups:

- Even though we have general goals and objectives from the GLWQA, indicator identification is inappropriate and premature prior to identifying lake goals and objectives;
- Indicators presented are not adequate - they do not respond directly to impaired beneficial uses, lack linkage and specificity, and do not address all stressors/dynamics covering the full range of Lake Huron issues;
- It would be appropriate to consider regional indicators - Georgian Bay, Saginaw Bay, North Channel, Main Basin; and
- Recommended indicator additions: water diversion, shoreline cottage and residential development, island development, waterfowl nesting, and others.

In responding to the question of how should we proceed to address Lake Huron issues, the following responses represent the recommendations from the groups:

- Establish a forum to discuss Lake Huron issues;
- Fish community objectives for Lake Huron have already been developed by the Great Lakes Fisheries Commission, potential use of the Commission's Lake Huron Technical Committee for advancing future efforts;
- Real problem - interest may be around the table, but agencies are hesitant because of the very limited resources (money, staff, expertise);
- May be another way of undertaking a LaMP (to address the overwhelming resource issues): look at partnerships, NGOs, others and use a combination approach - top down, bottom up;
- Need to include stakeholders early in the process to identify agency/public concerns and interests with respect to Lake Huron;
- It would be appropriate to consider regional efforts - Georgian Bay, Saginaw Bay, North Channel, Main Basin.

***Quote of the Day (regarding a LaMP-type process for Lake Huron)* — "the bus is in the station and ready to go"**

4.3.4 Lake Erie

Facilitators: Helen Domske and Tom Hersey
Organizers: Sandra George and Francine Norling

Introduction:

The Lake Erie Lakewide Management Plan (LaMP) is in the process of developing ecosystem objectives to guide future management actions for Lake Erie. It is expected that indicators of progress will be derived from these objectives, once the objectives are finalized. However, for the purposes of SOLEC, the goal of the workshops was to discuss the SOLEC indicators that may be applicable to Lake Erie, given current knowledge about environmental conditions in Lake Erie.

Key Questions for workshop participants:

To orient the participants to the workshop topic, the LaMP Workgroup co-chairs gave an overview of the current status and future direction for the LaMP. In addition, an overview of the ecosystems objectives process was provided, including a discussion of a modeling process using a fuzzy logic cognitive map. After these presentations, the workshop participants were provided with a list of preliminary LaMP indicators, and asked the following questions:

- What criteria should be used to integrate SOLEC indicators with Lake Erie LaMP ecosystem objectives?
- What changes could be made to improve the preliminary LaMP list of indicators?
- Specifically, are there any obvious gaps in the indicators list? Should any be dropped or added?

Highlights:

1. Land use is a major factor influencing the Lake Erie ecosystem, and indicators need to be developed for this factor (such as rate of conversion, total amount of conversion, percent of impervious surfaces).
2. Different types of indicators are needed for the government agencies than for the public, keeping in mind the pressure-state-condition categories of indicators (public prefers "state-condition" information, while agencies need all three categories to manage programs). Those indicators developed for the public need to be easily understood by the public (such as the presentation of indicators in the Ohio Lake Erie Report).
3. Ecosystem objectives need to be established before a detailed discussion of Lake Erie indicators can occur.
4. While the ecosystem objectives and indicators are being established, progress to correct known problems should continue (exotics pollution prevention, habitat preservation).
5. The SOLEC Committee needs a mechanism for achieving consistency between SOLEC objectives/indicators and LaMP objectives/indicators.

4.3.5 Lake Ontario

Facilitators: Vicki Barron and Tija Luste
Organizers: Barbara Spinweber and Janette Anderson

The breakout sessions for the Lake Ontario LaMP was made up of two major elements: presentations on the current status of a number of potential ecosystem indicators and a

presentation on the Ecosystem Goals and proposed Ecosystem Objectives included in the Stage 1 LaMP. The purpose of the breakout session was to present information on the current status in the following subject areas: Benthic Communities; Fish Communities; Wildlife Communities; Water Quality; and Wetland Habitat. The presentations were given by State, Federal and Provincial agency representatives with expertise in the respective subject area. Short descriptions of these presentations are summarized below:

Lake Ontario Benthos: Disturbance in the System (Steve Lozano, EPA)

Benthic invertebrates play a critical role in the Lake Ontario ecosystem including carbon transfer up the food chain and cycling of nutrients between the sediments and water. The recent invasion of Dreissena polymorpha and D. bugensis into Lake Ontario has brought about dramatic changes in abundance and distribution of important benthic species. One of the key indicator organism for the Great Lakes, Diporeia spp., has shown the most dramatic decline. Based on recent findings, populations of native species have been extirpated from a contiguous zone around the lake. This zone extends as far as 26 kilometers offshore and as deep as 200 meters, encompassing over 40% of the total surface area of soft sediments in Lake Ontario. The cause of the above situation is unresolved but it has been shown that Dreissena and Diporeia do not co-exist in most areas of the lake. It appears that Dreissena has disrupted the Lake Ontario food chain with major consequences on benthic invertebrate species and forage fish that depend upon Diporeia for food. The decline of Diporeia in the nearshore waters of Lake Ontario coincided with the declines in prey and sport fish populations.

Fish Communities (Bob Lange, NYSDEC)

The Lake Ontario fish community has changed significantly this century. Historic habitats of forested watersheds, undisturbed wetlands, free-flowing rivers, variable water levels, and low nutrient loading provided habitat for numerous Lake Ontario fish species that are no longer found in the Lake including Lake Trout, Atlantic Salmon and Blue Pike. As a result of community stressors such as dams, deforestation, overfishing, wetland destruction and non-native organisms, the Lake Ontario fish community has been significantly altered. Today, common lake species include alewife, smelt, carp, round goby, and sea lamprey. Even the once abundant alewife are decreasing. On the positive side, a few species, like wild trout, are showing signs of a comeback since 1994 and there are other species including lake whitefish, lake herring, and deepwater sculpin, that do have the potential to rehabilitate in Lake Ontario.

Wildlife Communities (Chip Weseloh, Env. Canada) - *summary not available at time of printing.*

Water Quality, Including Niagara River (Don Williams) - *summary not available at time of printing.*

Assessment of Habitat Impairments in the Lake Ontario Ecosystem (Kofi Flynn-Aikins on behalf of D. Busch, USFWS)

A habitat classification system was used to describe aquatic habitats and evaluate the habitat degradation in Lake Ontario. Computer databases and a Geographic Information System were used to quantify stream habitats currently available to migratory fish in the Lake Ontario watershed.

Because data on biological, chemical, and physical anthropogenic changes to Lake Ontario were scattered, patchy, and disjointed, the Delphi technique was used to evaluate the degree of

functional habitat impairment for 29 habitats in the Lake Ontario ecosystem. The criteria for the impairments were the severity of the ecological impact and its permanence. The amounts of functional degradation were averaged by habitat categories for each habitat and multiplied by the estimated areal proportion of that habitat in the ecosystem. It was estimated that during 1970-1990, Lake Ontario's ecosystem health was degraded by 58%. Impairments were caused almost equally by anthropogenic stresses from biological, chemical and physical sources.

Spatial tributary length data from the U.S. side of Lake Ontario watershed were obtained from the U.S. Environmental Protection Agency's Reach File database. The tributary length data were combined with a matching map projection database containing dam locations obtained from the U.S. Army Corps of Engineer's National Inventory of Dams to assess and quantify historic and currently accessible stream habitats. Historically, there were 30,085 km of stream habitat, which have been currently reduced to only 5,392 km by the presence of 328 dams in the watershed. These dams have reduced the accessibility of migratory fish to important spawning habitats. The loss of habitats would ultimately lead to reduction in fish populations in the Lake Ontario basin.

Ecosystem Goals & Objectives (Dick Draper, NYSDEC)

This overview included a presentation of the Lake Ontario LaMP Stage 1 Process, the LaMP Goals, the proposed Ecosystem Objectives and Indicators. One of the objectives of the session was to have discussion and comments on the proposed Objectives, and the Potential Indicators in light of the SOLEC theme.

The Proposed Ecosystem Objectives (focusing on Aquatic Communities, Wildlife, Human Health, Habitat and Stewardship) were presented for discussion and comments on whether the objectives were complete and appropriate and if the potential indicators would be appropriate for measuring progress towards achieving the Objectives.

Highlights

1. More effort is needed to involve local residents and share the lessons learned from the other LaMPs that are further along.
2. The limited workshop discussion focused on the completeness of the LaMP objectives. There was general agreement with the objectives however, it was felt that effort will be required to develop the indicators that will be used to measure the LaMP objectives.

4.3.6 St. Lawrence River

Facilitator: Anne Kerr
Organizer: Jean Burton

Please note: In section 4.3.6 "basin-wide" refers to the Great Lakes/St. Lawrence basin.

The St. Lawrence River system is an integral part of the Great Lakes ecosystem. The Great Lakes basin accounts for only 55% of the combined Great Lakes/St. Lawrence basin, with the St. Lawrence River extending over 1000 km beyond the international border at Cornwall. The following topics were proposed for discussion during the breakout sessions:

1. To identify the issues that could be better understood and addressed through a basin-wide approach, and specifically the three most important ones;

2. To identify mechanisms, processes and the appropriate organizations needed for a basin-wide approach;
3. To answer the question whether basin-wide sets of indicators would be useful for these issues and what changes or improvements, if any, should be made to the proposed indicators to make them applicable basin-wide.

Three major basin-wide issues were identified are outlined below from the point of view of the St. Lawrence River system.

Water Levels and Flows

The overview included issues such as the influence of water level regulation in Lake Ontario on flow in the St. Lawrence, the conflicting interests both upstream and downstream, and on different stakeholders (hydro generation, shipping, pleasure boating, shoreline properties, domestic water supplies, aquatic and wetlands ecosystems). “Balancing the needs of the same stakeholders in different parts of the Great Lakes/St. Lawrence system, of different stakeholders in the same or different parts is very difficult. The situation would be even more difficult with the effects of climate change.” (Paraphrased). The role of the International Joint Commission could be expanded in this area. Participants were asked to consider whether common goals and objectives for the whole Great Lakes/St. Lawrence basin would be useful?

Toxic Contaminants

PCBs and mercury originate from the St. Lawrence system (much of it from the Cornwall/ Messina area), while pesticides like atrazine largely come from upstream. There have been significant reductions in loadings and levels of contaminants in recent years (PCBs, mercury, other metals). The question posed for toxics, in view of their transport through the whole system of the Great Lakes/St. Lawrence, is whether a common approach, goals, and indicators would be most appropriate.

Exotic Species

Control of ship ballast water and how to deal with zebra mussels is seen as the main concern. A common approach was suggested for the control of ballast water as an example for basin-wide cooperation. Participants were asked whether basin-wide objectives and indicators for the control of exotics would be useful.

The participants of the two breakout sessions identified the following issues, approaches and organizations:

1. Issues that could be better understood and addressed through a basin-wide approach:

- Water levels and flows (use conflicts, local impacts on wetlands and other ecosystems, impacts of climate change);
- Exotics (particularly tracking);
- Toxic contaminants (particularly fluxes, air transport and air loadings, effects on human health);
- Impacts of climate change;
- Develop mechanisms to resolve conflicts over water levels and flows (particularly in anticipation of the impact of climate change);
- Impacts of turbidity on fish productivity; and
- Environmental impacts of the use of the Seaway (e.g. opening and closing dates).

2. Mechanisms or processes needed and organizations to be involved in a basin-wide approach:

- The geographic boundary for a basin-wide approach should include the Gulf of St. Lawrence (although the boundaries might differ for different issues);
- Extension of the Great Lakes Water Quality Agreement to the Quebec and maritime portion of the St. Lawrence was seen as politically difficult, probably not feasible. A less formal agreement was suggested;
- SOLEC was suggested as an appropriate organization to approach the larger basin; There was a role for the IJC Science Advisory Board and Great Lakes Research Managers Council;
- Representatives from Atlantic Canada may have a role to play;
- Involvement of Great Lakes United, and the Great Lakes Fisheries commission (to consider the continuity of the ecosystem) was suggested;
- Expansion of the terms of reference of the St. Lawrence Board of Control to include ecological considerations;
- Development of a management plan for the whole St. Lawrence River equivalent to the LaMP; and
- Development of consistent and comparable monitoring, measuring methods and data treatment for the whole of the Great Lakes and St. Lawrence (particularly for toxic chemicals; seen as Environment Canada's responsibility).

3. Usefulness of indicator sets common to Great Lakes and St. Lawrence and suggested changes as a result:

- Some may be useful, others may not apply to river systems;
- Areas for potentially useful common indicators: contaminants (water quality, loadings and mass balances, effects), wetlands, biodiversity, exotics, fish consumption and human health;
- Indicators to monitor and understand local impacts;
- Common or consistent targets or endpoints;
- Biodiversity Investment Areas for the St. Lawrence (maybe);
- Recommendation that indicators should be compatible, to move towards common indicators, recognizing differences where they are basic.

Highlights

1. The whole St. Lawrence River should be considered as an integral part of the Great Lakes/ St. Lawrence system.
2. SOLEC indicators should be extended where appropriate.
3. The key issues are: (a) water levels and flows, (b) toxics, (c) exotic species, (d) climate change.
4. SOLEC itself may be well placed to coordinate extension and to develop joint indicators; other bodies may be Environment Canada, a joint Research Council, or an IJC with expanded terms of reference.
5. River Management Plans, analogous to LaMPs should be developed for the St. Lawrence.
6. The impact of climate change on the whole Great Lakes/St. Lawrence system should be investigated, signals of change monitored, and responses planned.

4.3.7 Connecting Channels

Facilitator: E. Marie Phillips
Organizers: John Gannon and Gary Johnson

Introduction

The Great Lakes connecting channels include the St. Marys River, St. Clair River, Lake St. Clair, Detroit River, Niagara River, and St. Lawrence River. All of these areas continue to play important roles in the economy and ecology of the Great Lakes. In spite of their prominence in transportation and municipal and industrial development, these large rivers and Lake St. Clair generally have not received as much attention by governmental and non-governmental agencies, politicians, scientists, and the public as the Great Lakes proper. Similarly, insufficient attention is given to the unique ecological attributes in these areas and the threats to them from human perturbations.

Are More Specific Indicators Needed?

There was broad consensus that the answer to this question is "yes". Most of the SOLEC indicators were developed for the Great Lakes proper; many do not apply to the connecting channels (e.g., plankton) and others would require modification (e.g., benthos). The strong influences of hydrodynamics, sediment transport, and the transient nature of water, suspended sediment, and much of the biota require a rethinking of indicators specific for the connecting channels. It was also noted that each of the connecting channels possesses unique ecological characteristics and environmental problems. Consequently, a "cookie cutter" approach to indicator development was not recommended.

Will the Indicators be Useful in Implementing RAP Goals?

In general, there was concern that there is a disconnect between the SOLEC indicator process, environmental regulatory programs, and RAP activities. To be truly useful, indicators in the connecting channels should be able to assess environmental conditions as well as measure progress towards achieving goals (e.g., restoration of beneficial uses, delisting Area of Concern status, etc.). Because of the dynamic nature of the connecting channels, these indicators must be sensitive to rapidly occurring changes. In general, biological and sediment indices which integrate effects over time will be more effective than traditional water quality indices. Moreover, indicators must be linked to the institutions with regulatory and natural resource management responsibilities or they may never be implemented. Binational cooperation and coordination in indicator development and implementation is especially important in the connecting channels where the international border is so close to U.S. and Canadian shorelines.

Are New Mechanisms Needed to Obtain the Necessary Monitoring Data for SOLEC Indicators?

The strong currents and short residence time of water in the connecting channels pose special scientific challenges in designing a monitoring program for indicators. High spatial and temporal variability may mask long-term trends. It was recommended that attention be given to these scientific challenges as well as overcoming the political barriers for developing a mutually agreed upon binational suite of indicators and their measurement.

Highlights

1. Connecting channels are so ecologically different from the Great Lakes that they require their own research and development on indicators.

2. Binational agreement is required on the protocols for monitoring (data collection, sharing, analysis, and reporting) the indicators in the connecting channels.
3. Linking the SOLEC indicators to RAPS and regulatory and natural resource management programs is necessary to maximize implementation of indicators and associated monitoring programs in the connecting channels.

4.4 Cross-Cutting Issues Session Summaries

4.4.1 Implementing Indicators

Facilitator: Gail Krantzberg
Organizers: Doug Dodge, Doug Alley

Session Format

Four sub-groups within this session deliberated one of two issues:

- Process for Adopting the Indicators; or
- Process for Tabulating and Reporting on the Indicators (data considerations)

for one of two indicators:

- PCBs in Lake Trout, (an indicator which supports both the "biotic integrity and ecological diversity" and "virtual elimination of toxic substances" desired outcomes); or
- Boil Water Orders as an indicator of the desired outcome of "drinkability".

The central challenge to participants was to delineate the steps that need to be taken to make a particular indicator applicable and work. The products anticipated of the session were:

- A heightened awareness by the stakeholders of the complexity, resource demands, and required level of cooperation necessary to implement indicators in the Great Lakes basin; and
- A draft "critical path analysis" for at least one potential indicator.

The first product was clearly achieved among the participants, and several steps towards producing the second product were identified.

General Observations from Both Indicators:

1. Any indicators exercise, including that of IITF (Indicators Implementation Task Force), must be responsive to public needs.
2. IITF should examine ways to articulate the desired outcomes to turn them into good communication tools.
3. For both "test" indicators, the matter of scale in reporting is important. Loss of information in reporting basin-wide obscures real challenges. For example, drinkability of water from a basin-wide perspective may indicate general conditions, however, advisories tend to be local in nature and are highly relevant to local populations. Similar findings were pointed out by groups examining PCBs in Lake Trout.
4. As a corollary of the above, the "top-down/bottom-up" tension surrounding indicator selection and reporting was echoed in this session, as in other SOLEC break-out groups.
5. Experts within the Parties (and jurisdictions) presently have ownership of the data. Leadership is sought jointly with the IJC and the Parties (through BEC) to focus on priority

outcomes of the GLWQA. Motivating factors that encourage lateral and vertical information transfer need to be identified and activated.

6. It is critical to develop and demonstrate compatibility between the IJC indicators for the desired outcomes and the SOLEC products.
7. Specific task teams that have the relevant expertise in the measurements and interpretation of the indicators should be assembled for each indicator to analyze and report on the two key questions discussed in this workshop.

INDICATOR 1: PCBs IN LAKE TROUT

Data considerations

Whole fish: applicable to track virtual elimination/biodiversity. Recommend a coordinated federal approach that measures individual fish, rather than relying on composite samples. Since within-lake levels are variable, sample and report by sub-basin. Relate tissue residues to effects on individuals/populations in order to use the whole-body data to examine implications for biodiversity.

Fillet data: applicable to "edibility". Data can be normalized to account for differences among methodologies across jurisdictions. Reporting should be according to percent frequency of occurrence of an advisory as a proportion of stations sampled. Improve speed of reporting, following analysis.

Process for adopting the indicator

Use SOLEC to report on the indicators. Federal coordination of methodology and reporting could be enhanced, as could provincial/state coordination through SOLEC.

Examine current Strategic Planning Processes in the U.S., which include Memoranda of Agreement Authorities, Environmental Round Tables. In Canada, coordinate through the Canada/Ontario Agreement process. Consider as a model Performance Partnership Agreements, and existing Acts.

Use expert, technical staff through a bottom-up process that builds on existing protocols and maintains flexibility while gradually moving to standardization.

A value-added role for the IJC is to build a common understanding of the indicator, help establish the "preferred" protocols, demonstrate the savings possible through sampling and reporting efficiencies, encourage the strengthening of existing program linkages.

INDICATOR 2: BOIL WATER ORDERS

Data considerations

Although one "mock" indicator was put forward, ensure the suite of indicators is broad enough to track the desired outcome.

"Boil water orders" are easily accessed in the U.S., not in Canada. The Canadian Council of Ministers of Environment (CCME) Subcommittee on Drinking Water could be used to coordinate a repository for the information.

Details on the specifics surrounding "boil water orders" is required. Discussion surrounded the

different events that would be tracked when reporting "boil water orders" for water that is derived from surface as compared to groundwater sources in the basin.
To track "drinkability", rapidly report on status of drinking water using current methods, while designing a process to improve the quality of the data within and across jurisdictions

Process for adopting the indicator

Identify the variety of agencies involved, including representatives at the local level.

Demonstrate the benefit for larger scale reporting so that local data will be made more readily available at higher levels of organization (eg.: need a motivator for vertical reporting)

A value added role for the IJC would be to convene a symposium that scopes out the "big picture", defines the goals through a discussion of the desired outcome, thereby improving collective ownership of the indicators and encouraging data sharing and complementarity.

IITF should provide their analysis and advice to SOLEC. SOLEC provides the opportunity for a team of agencies and stakeholders to nail down what indicators can be used now, those for future development, and how to interpret the data trends. SOLEC can also identify the benefit to the participants and the public for reporting beyond the local scale.

Conclusion

As described in the General Observations: this was a starting point for discussion. The complexity of the matters were readily apparent. To fully address each of the two questions for any indicator, an expert-lead panel with hand-picked participants is recommended. The venue is secondary, but has some logical overlaps with SOLEC, and existing Agreements, Committees, and Authorities.

4.4.2 Applying Indicators - a RAP Perspective

Facilitator: Jim Bredin
Organizer: John Hartig

The primary purpose of Remedial Action Plans (RAPs) is to restore beneficial uses in Great Lakes Areas of Concern. The Great Lakes Water Quality Agreement outlines 14 specific use impairments. These use impairments have provided a template to help RAP teams and public advisory councils reach agreement on a comprehensive problem definition and report out on status, quality, and trends of key indicators.

Because many RAPs have been involved in indicator development, collection of data, and reporting on trends for over 12 years, this provides a good opportunity to share successes and lessons learned. This SOLEC breakout session focused on indicator trends and lessons from RAPs. Four data rich presentations were given to demonstrate application of the indicator concept in RAPs:

- macrobenthic invertebrate indicator trends in the St. Clair River (Gary Johnson, Ontario Ministry of Environment);
- liver tumor trends in bullheads from the Black River, Lorain, Ohio (Paul Baumann, U.S. Geological Survey);
- fish community indicator trends in Hamilton Harbour, Ontario (Bob Randall, Fisheries and Oceans Canada); and

- aesthetic indicator trends in the Rouge River, Michigan (Noel Mullett, Wayne County Department of Environment).

The presentations were very well received. A facilitated discussion was held around two questions.

What are the current obstacles to more effective use and broad-based application of indicators?

Participants identified the following obstacles: lack of watershed and whole system studies; lack of an integrated approach; limited acceptance of indicators concept; limited acceptance of the use of community, as well as population level indicators; lack of acceptance of the use of Index of Biological Integrity (IBI) for littoral habitats; inconsistent use of indicators; cost of monitoring; inconsistent resource support for monitoring; applicability at local community level; evolving nature of indicators; and fragmented responsibility for monitoring.

What are the critical factors for successful application of the indicators concept in RAPs?

Participants identified the following success factors: scientifically-defensible, objective, and measurable; validated; a high priority must be placed on monitoring; local involvement and support; indicators must make sense and be easily understood; site-specific; clearly communicated; consistency with beneficial uses in Great Lakes Water Quality Agreement; flexibility; and must be cost effective.

Participants recommended the following as advice to SOLEC, LaMPs, and others:

- share successful experiences more frequently, including information on value and benefits;
- LaMPs and RAPs (and BIAs) should be asked to report out on indicators at SOLEC 2000;
- there is a need to focus on a relatively short list of indicators that can be easily understood and communicated;
- SOLEC indicators should be built upon the work of LaMPs and RAPs;
- develop community and stakeholder support;
- ensure that indicator data are used to make management decisions;
- much greater attention must be given to the resource implications of SOLEC indicators. Make a recommendation in the SOLEC 98 report for adequate government resources to be able to implement fully the indicator concept;
- a lakewide scale may be the best one for integrating and reporting out on indicators (LaMPs should be empowered to lead in this area);
- GLIN and GLIMR should be used to share experiences on application of indicators;
- there is a need to continue to fund basic research on indicators;
- volunteer monitoring is no substitute for scientific monitoring; and
- ensure that all future SOLECs present state of the Lakes based on agreed upon indicators.

4.4.3 Endocrine Disruptors

Facilitator: Anne Kerr
Organizers: John Goldsmith, Mark Johnson, Heraline Hicks, Paul Horvatin

The following is the session closing presented by Dr. Heraline Hicks from the Association of Toxic Substances and Disease Registry in Atlanta, GA.

A hypothesis has been proposed that certain chemicals may disrupt the endocrine system. These chemicals have been called "endocrine disruptors" because they are thought to mimic natural hormones, inhibit the action of hormones, or alter the normal regulatory function of the immune, nervous, and endocrine systems.

Evidence has been presented that a number of environmental chemicals, both synthetic and natural, have the potential of disrupting endocrine systems in aquatic life and wildlife. The problem is characterized by varied adverse effects on the endocrine system in a wide range of species. These adverse effects include abnormal thyroid function, sex alteration, decreased fertility, alterations in behavioral functions, and reduced growth, to name a few. The evidence that has accumulated in the scientific literature is compelling - endocrine systems of aquatic life and wildlife have indeed been disturbed by chemicals that contaminate their habitats.

We have learned over time that animals are sentinels of human and environmental health. Animals provide insights to human health events that could occur from exposure to chemical contamination. Based on what we have learned from animal studies, the recent data emerging from human health studies also indicate adverse effects on the human endocrine system from exposure to chemical contamination in our environment. For example, data from the Agency for Toxic Substances and Disease Registry's Great Lakes Human Health Effects Research Program indicates that exposure to persistent toxic substances (PTSs) can cause disturbances in reproductive parameters and demonstrate neurobehavioral and developmental deficits in newborns between 12-24 hours and 25-48 hours after birth. Research findings indicate that a specific set of PCB congeners are the agents responsible for at least part of the observed neurodevelopmental outcomes. Other human studies outside the Great Lakes basin and in other countries have observed similar adverse effects in newborns, young children, and adults.

The story of lead in children that demonstrated the consequences of in-utero exposure to lead through the work of a host of investigators indicated both neurobehavioral and the increasingly significant social consequences of that in-utero exposure. Is there a similar scenario occurring from exposure to persistent toxic substances that disrupt the endocrine system?

As a public health agency we feel enough information is available, based on the weight of evidence, to call for new health promotion strategies and risk communication methods to ensure that citizens are able to make informed decisions about the potential health risks and potential benefits from exposure to PTSs, eg. breast feeding children of mothers who consume contaminated fish. Additionally, pollution prevention strategies remain the key to reducing toxic chemical loading to the environment.

Lastly, we need more research to help identify the chemical specific etiology of adverse effect(s) from endocrine disrupting chemicals. Therefore, we applaud the EDSTAC process by the U.S. EPA, which brought all parties together, eg. private sector, industry, federal agencies, academicians, and environmental groups to help clarify this issue of endocrine disruption.

4.4.4 Citizens Indicators/Great Lakes United

Organizer: Margaret Wooster

Great Lakes United presented a session on "citizen indicators" of Great Lakes ecosystem health based on a preliminary analysis of over 300 testimonies and 50 hours of tape from 10 citizen hearings across the U.S. and Canadian Great Lakes basin during the summer and fall of 1998. Indicators ranged from impacts to health and local economies due to environmental contaminants to budget cuts in state and provincial programs for research, monitoring and enforcement of existing regulations. Unanimous support was found for implementation, not renegotiation of the Great Lakes Water Quality Agreement.

The session had two components: 1) a panel discussion of several of the major themes raised across the 10 hearings; and 2) break out sessions to discuss how to move forward on zero-discharge, RAP clean-up, and full implementation of the GLWQA.

The panel discussion included presentations by four citizen activists each presenting a summary of a different major theme recurring throughout the hearings:

- Diane Heminway, Assistant Director of Citizens' Environmental Coalition, New York reported on testimony from citizens and scientists, including Dr. Theo Colborn and Pierre Beland, on human and wildlife health effects associated with toxics in the Great Lakes environment, including endocrine disruption and childhood cancer clusters.
- Elaine Kennedy, Chair of the Ontario Public Advisory Council, reported on failures and frustrations in implementing RAPs in AOCs particularly on issues of contaminated sediments and combined sewer overflows.
- John Jackson of the Ontario Toxic Waste Research Coalition related citizens' views on the importance of the language of the GLWQA as it stands and concerns that renegotiation would only weaken the Agreement. The perceived problem is the failure to implement.
- Margaret Wooster of Great Lakes United summarized testimony on the lack of progress towards the Agreement's goal of zero discharge of persistent toxic substances, including, in some communities, significant increases in toxic releases since 1993, permit review backlogs, and major cuts in programs and staff for monitoring and enforcement.

After a Q&A period, attendees broke into three groups to discuss obstacles and opportunities for 1) zero-discharge, 2) RAP implementation, and 3) full implementation of GLWQA.

Common obstacles cited in all three sessions: a lack of governmental commitment to confronting and resolving toxics issues; deregulation and downsizing of needed programs and staff; and the need for funding clean production, remediation and disposal technologies. Also raised were issues pertaining to labor in a free trade environment ("job blackmail"); political lobbying interference/inequities; and lack of multi-jurisdictional coordination.

The opportunities and recommendations to move forward included: improve leadership ("agencies should use SOLEC to feedback their knowledge in ways that political leaders can understand"); improve dialogue with influential constituents like labor; establish penalty/reward systems as incentives to clean production ("make it economical not to use toxics"); improve understanding of the economic benefits of healthy environments; improve quality of and public access to information; and shift burden of proof to polluters and risk assessments to a weight of evidence approach. Citizens need to get their messages to political leaders; agencies and scientists need to advocate on the policy implications of their findings.

4.4.5 Volunteer Monitoring

Organizers: Dan Bauer and Bill Clemens

Introduction

Across the Great Lakes basin, volunteers are extensively monitoring the condition of streams, rivers, lakes, reservoirs, coastal waters, wetlands, and wells. The number and variety of these projects are continually on the rise as well as the complexity of the monitoring volunteers conduct and the uses of the data they collect. However, at the current time, the use of volunteer monitor data varies widely with agency and individual from no use to extensive use of the data. A major challenge, therefore, to this session was to initially evaluate and discuss the existing Great Lakes volunteer monitoring programs and then to describe methods to more effectively utilize the volunteer monitor data with the Federal, State, and Provincial data.

A major issue confronting volunteer monitoring programs today is data credibility. Potential data users are often skeptical about data collected by volunteers – they may have doubts about the goals and objectives of the volunteer project, about how volunteers were trained, about how samples were collected, handled and stored, and how the data were analyzed and reports written.

This session discussed and evaluated our existing volunteer monitor programs in the United States and Canada and looked forward to our next important steps.

Brief History of Volunteer Monitor Movement — U.S. and Canada

The talk depicted an extensive history of volunteer monitor programs in the Great Lakes region with several selected examples of the various programs noted below. Primary elements of ecological volunteer monitoring programs include:

- teach inter-relationships and patterns;
- view that humans are part of the system;
- demonstrate that ecosystem are not static, but change over time;
- introduce concepts of carrying capacity and sustainability;
- use natural organization units such as watersheds or ecoregions;
- illustrate the links between community, local, regional and national systems;
- promote an ethic or behaviour that encourages quality of health and well being;
- include the study of human and ecosystem health;
- promote long term study and understanding;
- use a strong experiential component;
- encourage a strong partnership and collaboration with agencies, institutes and volunteers;
- develop a strong alliance with other youth; and
- use technology tools like computers to assist in data management and links to others.

Example Volunteer Programs

- **Stream and Rivers Program - State of Michigan**
  Multi-level program approach used for teachers, students, and adults.
- **Student Monitoring Program - Lake Michigan Area**
  Lake Michigan river mouth with data being collected from 1986.
- **Fishery Monitoring Programs - Georgian Bay, Canada**
  Program consists of all volunteers looking at fish species, size, community index population, etc. The effort is completed on annual basis and has been ongoing for 5-10 years.

- **Fish Way Monitoring, Ontario, Canada**
  - Dams / Fish Ladders – evaluate fish as they move through dams eg. how healthy, etc.
  - Report back on annual basis with an extensive program in Province of Ontario.
  - Program extensively uses volunteers and has been active for 3-4 years.
- **Buffalo State College - Great Lakes Center**
  College students visit local schools volunteer monitoring sites to interact with local kids and help with overall QC (quality control) for the site.
- **Marsh Monitoring Program**
  - Across Great Lakes, binational, covering 36 of 42 AOC's, and conducted since 1995.
  - Other item included in program: newsletter, WEB page, scientific reports, membership mailing list, and participant training kit.
- **Buffalo Creek, NY Studies**
  - Area of study is a nature preserve (wetland) in Buffalo, NY area.
  - Elements of program: insects, aquatic invertebrates, fish population, turtle traps, field chemistry, and trees.
- **ECOWATCH** - the volunteer and school environmental monitoring component of EMAN (Ecological Monitoring and Assessment Network of Environment Canada) in partnership with the Canadian Biodiversity Educational Alliance.
  This program is designed to*:*
  - provide hands-on experience of collecting environmental data, in order to educate youth to understand and appreciate the environment, how it relates to our health, and create the future generation of responsible stewards of the Earth;
  - provide extensive environmental data that can be used by scientists to further their investigations about Canadian ecosystems;
  - provide youth with an appreciation of the capabilities and necessity for technology (communications and science) in addressing environmental challenges, and the connection with the use of these technologies in future careers;
  - provide information to communities for better decision making on social and environmental issues.

Ensuring Quality in Volunteer Monitoring Programs

- Volunteer program efforts need to be internally consistent (ie. use the same methodology).
- Some variations can be expected between volunteer programs.
- Concern expressed by attendees of lack of overall support for staff to coordinate and run volunteer program efforts. Good example is the MARSH program which has only two permanent staff members for 2000 volunteers.

Michigan Prototype Effort

- Effort just underway stressing benthic and aquatic habitat areas;
- Prototype includes: source variability, sample collection/identification conducted at each site before sampling initiated;
- Field Strategy: Volunteers as a group assess a site while professional staff also do an assessment of the same site, then the results/assessments are compared;
- Some consideration given to the timing of sample effort and consideration of weather conditions;
- Sampling return period – return on at least an annual basis or in the same season;
- Volunteer identification "JAR" – individual jars to spot-check training needs, etc;
- Quality checks are not grading individuals doing "bad" job but rather to make corrections, etc.

Where Do We Go from Here? Our next Steps and Goals

- **Government Commitment** - Support needed for volunteer monitor efforts, eg. funding, support staff, inkind amounts, etc.
- **Coordination Support** - Volunteer programs need to be centralized and there needs to be a data repository of volunteer information.
- **Data Repository** - Majority of volunteer monitoring groups in Great Lakes region need to place information in computer using compatible format. We therefore need to plan, develop and implement a master data repository for the majority of volunteer monitoring data.
- **Website Linkage of Great Lakes Programs** - Linkage via WEB of majority of volunteer monitoring programs in Great Lakes region.
- **QA/QC** - The majority of volunteer programs need to use approved QA/QC procedures for field, analysis, and storage of information. There needs to be certification acceptance of data similar to what is currently used in the "GREEN" program. There also needs to be expanded trust of volunteer data and continued testing of volunteer data for overall quality.
- **Education Programs** - Accelerate use of volunteer monitoring courses by schools in U.S. and Canada.
- **Volunteer Data Usage** - Strive for volunteer data to be jointly used with Federal, State, and Provincial Data.
- **Indicators** - Determine indicators that can be emphasized for volunteer efforts.
- **Procedures/ Methods** - Stress consistency and ensure a good review process is used along with more overall "BINATIONAL" volunteer efforts.

4.4.6 Modelling Summit

Connecting Ecosystem Objectives and Indicators Through Modelling

Organizers: Joe DePinto, Gary Sprules, Dave Dolan

Introduction

The achievement of an ecosystem objective is tracked by the selection and reporting of one or more indicators that quantitatively monitor ecosystem response. A good indicator of ecosystem health and integrity integrates a wide range of environmental factors (or stressors) into a single attribute that reflects the response of the system to those stressors. Ecosystem models that relate the response of an ecosystem to the cumulative impact of multiple stressors can provide the theoretical basis for indicator selection and application.

Key Questions

1) What ecosystem objectives are you interested in addressing? 2) For each ecosystem objective identified in 1) above, suggest an indicator. What data would need to be collected to allow reporting of that indicator? 3) Have you heard of a model or modelling approach that you wish to know more about? 4) What case studies can be described which have ecosystem objectives, indicators and models already in place?

Participant Perspectives

The participants were interested in knowing why models were needed to interpret indicators. Two examples were presented to show that indicators cannot be used in the absence of understanding. Models are successful in providing that understanding when the response variables are selected to coincide with the desired outcomes.

Session Outcomes

- Models should be constructed in a way that allows new species to be handled.
- We have good models of various parts of the ecosystem, but we need to work on the linkages. For example, we need better linkages 1) amongst air, land and water; 2) between nearshore and offshore; and 3) between the upper and lower food chains in lakes. If these linkages can be achieved, models can help sort out competing multiple outcomes.

Next Steps

Models cost only 1 to 1.5% of what control actions cost. We need to sell modelling as part of Great Lakes management. The suggested approach is to:

1. Provide examples of successful modelling in support of indicators
2. Show how indicators can be misinterpreted in the absence of models
3. Show how models can resolve conflicts among indicators
4. Show how models can predict when indicators are likely to respond
5. Show how managers can be involved in defining desired outcomes for lakes

4.4.7 Next Generation Indicators

Facilitator: JoAnna Kidd
Organizer: Henry Regier

The following is a summary from the organizers of this session regarding the topics that were presented to, and discussed by, the SOLEC participants during the Next Generation Indicators session at SOLEC 98:

Great Lakes ecosystems are subject to stresses with interacting local, bioregional and global dynamics, and especially turbulent dynamics, that are poorly understood. These stresses include contamination by organohalides, introduction of exotic species, climate change and urbanization. The stresses tend to impinge on our basin ecosystems most forcefully and in highly unnatural ways during episodic events, notably storms. Ecological effects of different stresses interact, sometimes synergistically. The more severe impacts cannot be accommodated by these ecosystems without major disruptions of ecosystemic organization and adaptive phase shifts to more tolerant but less desirable kinds of ecosystems. The relevant science is primitive and available indicators are insufficient to monitor these phenomena.

An important policy issue relates to the mobility (or fugacity) of contaminants, both within and between ecosystems. Contaminants both enter and leave these ecosystems en masse, as well as being re-activated strongly within them, during particular kinds of storm episodes. In the context of regional and global dynamics, are the basin ecosystems inactivating and losing contaminants at net rates and to asymptotic endpoints that are politically acceptable? Data on the concentrations of particular contaminants in particular indicator species or selected physical media have long been used to address this question. Such data are related to the practical issue stated above in complex and poorly understood ways. In particular, the fugacity coefficients and episodic aspects of contaminant dynamics have seldom been considered. Also an ecosystemic phase shift (see below), from pelagic dominance with short food chains to benthic dominance with long food chains, may lead to temporary trends in contaminant concentrations different in sign from the overall long-term trend in amounts of contaminants in a lake.

Speakers Ray Hoff, Brendan Hickie and Dan Smith used different, though compatible, models to examine whether the total amounts of various contaminants in these ecosystems were changing. They agreed that the amounts were falling at rates that could be quantified approximately. A century from now the contaminant problem may have "gone away." Perhaps climate change might increase both water temperatures and storm intensities and thus expedite the export of contaminants northward.

In the second part of the session the emphasis was on complex ecosystemic responses to some stresses other than chemical contamination. James Kay sketched relevant theory from the fields of complex systems and thermodynamics. Using long time series of monitored data, Bill Schertzer and Brian Shuter identified some key variables and traced some sequential relationships between meteorological, hydrological and biological phenomena with respect to climate change, teleconnections to the El Nino/La Nina Southern Oscillation and volcanic eruptions like Mt. Pinatubo.

"Whole system" ecosystemic responses to certain exotic species were demonstrated: for carp in Cootes Paradise by Vic Cairns, for zebra mussels in Lake Erie by Mohi Munawar and for sea lamprey in oligotrophic lakes by Randy Eshenroder. Long-term ecosystemic phase shifts due to a particular cultural stress such as eutrophication, and to an interacting set of intense cultural stresses, were sketched by Henry Regier. In all of these cases there is a search for appropriate integrative indicators with diagnostic and prognostic capabilities, in the face of inadequate scientific understanding and lack of clarity of political objectives.

According to the Kay and Regier biphasal heuristic model, an aquatic ecosystem may be perceived to be dominated either by a benthic attractor or by a pelagic attractor. Pristine Great Lakes ecosystems - terrestrial, wetland and aquatic - were mostly in an "old growth" state. Pristine aquatic ecosystems were dominated by the native benthos while the severely degraded ecosystems of the 1960s and 1970s were dominated by the pelagos. The latter was quite artificial with numerous exotic species. The phase shifts in numerous shallower parts of the basin from benthic to pelagic dominance were due to combinations of interacting stresses: over-exploitation, enrichment, chemical contamination, biological contamination by exotics, physical restructuring, etc. Following partial remediation, the degraded aquatic ecosystems are now rehabilitating toward dominance by a quite artificial benthic association.

Our Great Lakes basin culture is contributing to biospheric degradation and is in turn impacted by global debasement. Future scientific and monitoring capabilities should strongly emphasize large scale, episodic and complex phenomena. Stress-specific, ecosystemic and biospheric studies should all be inter-related explicitly. The environmental challenges are now greater than they were in 1972 and 1978 when the Great Lakes Water Quality Agreements were signed. Some implications of the 1987 Protocol to the GLWQA, and of IJC's report on the reference on levels and flows relate to what is advocated here. With at least a century of environmental travails and disasters before us, we should try to forecast at least some of those coming in order to limit their bad effects.

4.4.8 Environmental Issues for the Future

Chairperson: Michael J. Donahue
Organizer: Carolyn O'Neill
Resource People: Doug Cuthbert (Water Quantity), Steve Thorp (Land Use), Heather Auld (Climate Change)

In addition to the participants listed above, approximately 25 individuals from government, industry and NGOs participated in this session.

Environmental issues of the future were defined as either newly emergent issues or long standing issues that are changing in nature and character. Water quantity, land use and climate change were pre-selected for presentation during the first part of the session given the integrative and integrated nature of these issues:

We have tremendous effects on Great Lakes water levels through our own activities. For example, dredging the shipping channel through the St. Clair system reduces Upper Lake levels by 11 inches. At the same time our intentional Lake level regulation dams provide a much smaller degree of control than is usually assumed - not enough to compensate, from a shipping perspective, for this year's 30 to 45 cm reduction in water levels due to lower precipitation and higher evaporation in the Great Lakes system.

Climate change and variability scenarios, and predicted increases in demand for Great Lakes water indicate that we will need to become better at evaluating impacts and trade-offs, and in managing land use practices on the shores of the Lakes rather than relying on our limited ability to manage water levels.

The Great Lakes basin generally experiences changeable weather - storms blow at us from all directions. How are we going to react to the anticipated changes in this changeable weather - the higher temperatures, less persistent winter ice cover; changing storm tracks, etc.? Humans will have to adjust through changed building codes and altered agricultural practices, etc. Although very little is really known about them, there appear to be particularly significant impacts for the Great Lakes basin ecosystem under climate change scenarios.

Overall, climate change will add to other human made stresses. Strategies to help natural ecosystems adapt to future climate change need to move beyond single-issue management and consider in an integrated fashion the changing suite of atmospheric and hydrologic stresses. It will be important that all indicators we choose to work with carry an appropriate climate change signal.

The 17 large metropolitan areas in the basin now account for four-fifths of the population. Urban/suburban sprawl, and its associated environmental impact, has been described by many as the leading environmental stressor in the Great Lakes basin. At present there is no indication that this land use trend is moderating, although efforts at brownfields redevelopment and associated greenfields preservation are accelerating.

Break out groups built on the themes above and discussed other issues they felt warranted attention, and indicators development and use. A complete list of all the issues raised in the break out sessions is given below.

STRESSES

- exotic species
- chemical substitution
- nuclear energy
- water diversions
- increasing water consumption
- increased irrigation
- salination
- aquifer depletion
- increase in pathogens
- land use
- climate change and variability
- stratospheric ozone depletion
- increasing complexity of issues
- difficulties in involving society in decisions
- loss of social cohesion
- a rise in environmentally rooted conflicts
- subsidized urban and economic growth
- liberalized trade and globalization
- all issues driven by population growth

RESPONSES

- environmental education
- expertise in conflict resolution
- adaptive management
- re-engineered planning
- full cost accounting
- zero population growth strategies
- new housing forms
- segmented land market
- binational debate on growth issues
- public policy on growth
- behaviour shift to environmental/land ethic

STRESS & RESPONSE INDICATORS

- social progress
- environmental conflict
- ecological footprint
- green GDP
- birth and immigration rates
- climate change factored in to all indicators

A group by group analysis reveals that each group took a unique perspective in looking at the stresses, responses and indicators. The first group looked at our current economic system; the second group focused at the societal level and the third focused more at the level of the individual and changing behaviour.

Participants in the session on 'Environmental Issues of the Future' agreed that researchers and policymakers must be aware of, and prepared to respond to emerging issues as well as established ones. Such issues are complex and multidimensional, requiring attention from economic, public policy and social science perspectives as well as the physical, chemical and biological perspectives. The use of indicators in the identification, assessment and resolution of such issues has great merit.

4.4.9 Binational Toxics Strategy

Organizers: Susan Nameth, Liz LaPlante

The Canada-U.S. Binational Toxics Strategy was signed by EPA Administrator Carol Browner and then Minister of the Environment Sergio Marchi on April 7, 1997. The Strategy calls for the reduction and virtual elimination of persistent, toxic and bioaccumulative substances from the Great Lakes basin, within set time frames. Since the time of signing, the U.S. and Canada have focused developing and initiating an implementation plan for the Strategy. The SOLEC session focused on the implementation process and structure of the Strategy, as well as some of the obstacles and barriers to implementation that the two countries are facing.

The Implementation Plan of the Binational Strategy calls for substance-specific workgroups, with U.S. and Canadian co-leads, for the Level I "virtual elimination" substances. These workgroups are comprised of stakeholders from all sectors -- local, state and federal governments, industry, environmental groups, Tribes/First Nations, Provinces, and the general public. Some of their responsibilities and tasks include tracking the challenge goals, helping to establish and track baselines, developing activities and actions that move toward reductions of these targeted substances, and bringing critical industry partners to the table.

Each of the workgroups will be working toward fulfilling the "Four-Step" Analytical Framework found in the Strategy -- gathering and analyzing information, assessing regulatory gaps and barriers, developing options and recommendations for reductions. Three Reports in support of the reduction challenges will be issued by December 31, 1998: The Alkyl-Lead "no use" in Gasoline Report, the Pesticides "confirm no more use and release" Report, and the Octachlorostyrene "no-use or release" Report.

Some of the barriers to implementation include lack of general knowledge about the Strategy and its components, allocation of scarce resources on the part of both industry and governments, budgetary constraints such as severe budgetary cutbacks, lack of participation on the part of critical industrial sectors and environmental partners and competing initiatives and priorities.

5. SOLEC 98 Success Story Recipients

Prior to SOLEC 96, the SOLEC Steering Committee agreed on the importance of recognizing organizations from around the Great Lakes basin that have demonstrated a strong commitment to the environment. In 1996, seven projects ranging from responsible industrial land-owners to active local citizens groups, were chosen as SOLEC Success Story recipients. For SOLEC 98, the following criteria were used to select award recipients. The project must encompass all or most of the following:

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

Based on the criteria, the following five projects were selected for SOLEC 98 recognition:

Brantford Division of Union Gas Limited

When it came time for a new customer service building in Brantford, Ontario, the management at Union Gas felt it was important to implement a philosophy of sustainable development into the building design and the surrounding landscape. Lands around the property, known as the Brant Prairie, were restored to their natural state, including Tall Grass Prairie, an oak-maple forest and sedge marsh. Rare indigenous plant species were identified during the naturalization process, including the Fringed Gentian and the Partridge Pea. The latter had been recorded in Ontario but not seen for 80 years.

Because it is a naturalized landscape, the Brantford customer service centre requires no mowing, watering, spraying or fertilizing. The local marsh provides habitat for various species of plans, birds, butterflies, frogs and wildlife. School groups and other visitors can explore trails on the site, and learn about natural heritage, biodiversity and sensitive ecosystems through the outdoor classroom.

The City of Buffalo

Industrial decline and restructuring have been particularly pronounced in Great Lakes cities like Buffalo where industrial activities have been concentrated on the waterfront. Buffalo faces enormous economic, social and environmental challenges and many of these challenges are tied directly to brownfields. More than 10,000 acres are vacant and/or under-utilized. The City of Buffalo is a notable success in overcoming formidable obstacles to improve the Great Lakes ecosystem by removing threats to human health and the environment and returning contaminated lands to productive use.

A series of successful brownfields redevelopment projects have resulted in the excavation and bio-remediation of over 17,000 cubic yards of petroleum soaked oil. The site now houses 18 acres of high-tech hydroponic tomato greenhouses and exemplifies the efforts underway to help the community make a transition from a heavy-industry based economy to a more diverse and sustainable economic base.

The city of Buffalo does not and cannot separate its brownfields strategy from its overall long range development strategy for sustainability. Several long-term plans are currently being developed and implemented to promote job creation, provide long-term environmental protection, improve ecological conditions and provide the region with a strong economic base. These include a Northeast Parkway/Industrial Corridor Plan; the South Buffalo Brownfields Redevelopment Plan; the Main LaSalle Redevelopment Plan; and the Amherst Buffalo Corridor Initiative.

Buffalo River Habitat Restoration Sites

The Buffalo Fish and Wildlife Habitat Restoration Demonstration Project, initiated by Erie County with a grant from the Great Lakes National Program Office of the U.S. EPA, has transformed over 10 acres of former brownfield property into a string of three pocket parks along the river. This collaborative effort brought together not only Erie County and the EPA, but also the City of Buffalo and New York State agencies, local community organizations and industry.

In line with EPA Environmental Justice initiatives, the Buffalo River Habitat Restoration Demonstration Project sites are designed to benefit urban neighbourhoods as well as wildlife. The Buffalo River waterway can develop into an unexpected jewel that could become a major part of Buffalo's urban heritage. The River awaits boaters, canoeists, fishermen, naturalists, picnickers and folks who just want to get away from it all.

Rondeau Bay Rehabilitation Program

In response to the ban on lead, this Chatham based environmental group mounted its first "take a little lead out" project last summer to encourage fishers to exchange their lead jigs and sinkers for non-toxic alternatives. The Rondeau Bay group collected just over 100 kilograms of lead sinkers, jigs, and slip shot. With a supply of alternative materials left over, the group hopes to continue the exchange program through the coming summer and winter.

The Watershed Rehabilitation Program has teamed up with local bait shops and sporting good stores to offer the alternative materials free of charge. Meanwhile, two students hired to survey fishers' catches took time to point out the benefits of using alternative metals. Local radio stations helped out with public service announcements and reduced-rate advertising, while a number of fishing and wildlife organizations spread the word to their members. Besides offering the new sinkers and jigs in stores, the Watershed Rehabilitation group attended outdoor community events.

The Waukegan Harbour Citizens Advisory Group

The Waukegan Harbor Citizens Advisory Group was recognized for its progress in the Waukegan Harbor Area of Concern. Support for the nomination as a SOLEC 98 Success Story is exemplified in its broad stakeholder involvement and progress in recently completing its Stage 3 report documenting follow-up monitoring efforts. Monitoring efforts have documented reduced contaminant levels in harbour fish which allowed the removal of fish consumption advisory signs at Waukegan Harbor in February, 1997. Sign removal was a major milestone showing environmental improvement following remediation of harbor sediments in 1993.

Strong public participation and cooperation of many stakeholders has continued since the advisory group was formed in 1990. A brownfield pilot was initiated through efforts of the advisory group and the City of Waukegan has recently applied for a U.S. EPA brownfield grant to further this effort. Additional dredging of the harbour for navigational purposes is being pursued with the U.S. Army Corps of Engineers.

6. Participant Feedback - Surveys & Questionnaires

In total there were 102 surveys / questionnaires returned to the SOLEC 98 conference organizers. The largest number came from the Indicator Workshops (44 returned).

The **SOLEC 98 Delegate Survey** related to the objectives of SOLEC and to the overall conference. Delegates felt that the best met objective was "providing a forum for improved communications and networking regarding Great Lakes issues and opportunities for change" while the least met objective was "contributing to the development of a consistent, easily understood set of indicators that will enable effective reporting on the state of Great Lakes and on progress toward the goals of the GLWQA at the basin-wide scale." Although the development of a basin-wide set of indicators was one of the least met objectives, some respondents added that SOLEC 98 had taken an important first step towards this objective, but more work was needed.

There were many positive comments regarding the organization and content of the conference. The overall themes of indicators and BIAs were well received. They liked the basin-wide scope, the balanced approach between themes / issues and attendees, and the wide stakeholder participation. In fact *"this was the best SOLEC conference yet"* was a common response. Some of the highlights of the conference included the plenary presentations, Bill Rees's talk, networking with others and the conference organization.

The **Indicator Workshop** surveys related to both the individual core groups of indicators and to the whole suite of indicators. Although responses were varied, most suggested that after revamping some of the indicators (eg. determining the objectives and endpoints as well as removing the duplication) then a reorganization was necessary and important so that the indicators could be tiered or nested in many different ways. These responses have been sent to the individual core group leaders and have also been discussed at a core group meeting held mid January 1999. The SOLEC 98 Indicators list will be revised based on these comments and those discussed at the breakout sessions.

The **Biodiversity Investment Area** surveys showed a favourable response to the concept but indicated that some adjustments were necessary to the process and to the selected sites. In addition buy-in from stakeholders was extremely important. These responses have been sent to the authors of the BIA papers. The papers will be revised based on these comments and those discussed at the breakout sessions.

The lake by lake sessions varied widely in their content and in the questions asked in the **Lake by Lake** surveys. One comment was about *"promoting a 'core set of indicators' which are common to each of the lakewide management plans and the SOLEC indicators for the basin"*. Another comment discussed the *"disconnect between Lake Erie LaMP and SOLEC indicator development. The SOLEC indicators are a good start but they need to be made consistent with the process of developing indicators for the LaMPs."* The participants in the connecting channels workshop and the St. Lawrence River workshop felt that an integrated suite of indicators would be quite useful, however, it must be recognized that these features are quite different from the Lakes and would require some unique indicators. The comments have been sent to the organizers of these breakout sessions.

SOLEC 98 Survey/Questionnaire	Number Returned
SOLEC 98 Delegate Survey	32
Indicator Workshop Questionnaires	44
Open Waters Indicator Workshop	(3)
Nearshore Water Indicator Workshop	(3)
Coastal Wetlands Indicator Workshop	(2)
Land Use Indicator Workshop	(8)
Human Health Indicator Workshop	(5)
Stewardship Indicator Workshop	(4)
Basin-wide Overview Indicator Workshop	(9)
Biodiversity Investment Area Questionnaires	8
Open Water BIA Workshop	(1)
Coastal Wetlands BIA Workshop	(4)
Nearshore Terrestrial BIA Workshop	(3)
Lake-by-Lake Questionnaires	17
Lake Michigan Workshop	(3)
Lake Huron Workshop	(2)
Lake Erie Workshop	(3)
Lake Ontario Workshop	(5)
St. Lawrence River Workshop	(3)
Connecting Channels Workshop	(1)
Cross-Cutting Issues Questionnaires*	1
Implementing Indicators Workshop	(1)
Total Number of Questionnaires Returned	**102**

** Note - some of the questionnaires for the cross-cutting issues workshops may have been taken by the session organizers, other cross-cutting issue sessions did not have questionnaires*

7. Closing Remarks

John Mills
Regional Director General
Environment Canada, Ontario Region

Delivered on Friday October 23, 1998.

Good Morning. Even after working you hard over two days, I see there is still energy in this room. I want to take a few minutes to talk with you about commitment, some impressions of this session, and indicators - particularly SOLEC indicators. My comments are those of both Parties. Dave Ullrich (U.S. EPA) is aware of them.

Firstly, commitment. I want to reiterate quite strongly that the governments of Canada and the United States are fully committed to the Great Lakes Water Quality Agreement.

Commitment. We are committed to SOLEC as part of the Great Lakes reporting process. It helps identify the science base for emerging issues and it helps us adjust our programs accordingly. This is the third SOLEC. Each one has been an improvement on the last. It is appropriate at this stage to do a third party review of how well SOLEC is meeting its objectives and how it fits in to the great mosaic of Great Lakes activities. We need to look at how SOLEC fits in with the International Joint Commission's biennial meetings and make sure they are compatible and work together. We must take a closer look at our engagement with the citizens of the basin, from citizen groups and individual citizens to industries and agencies. All of the people of the basin share in the responsibility of cleaning up and restoring the Great Lakes and must be engaged in this process.

Now to my impressions of this session. Clearly, there is a need for indicators, however, it is difficult to come up with an agreed upon suite of indicators. There is also a desire to get on with it: to make it happen. My other impression relates to the issue of new science. We are doing world class science in the basin and the content of this SOLEC confirms this impression. Developing the concept of Biological Investment Areas (BIAs) is new and challenging, pushing the boundaries of these scientific investigations.

And now a few words on indicators. The first day we had the image of the Great Lakes as seen from the shuttle, the plane, and the canoe. This gave us a sense of the differing perspectives on the Great Lakes. We also have to recognize that we have two audiences, the first, and most important, is the citizens of the basin. They need indicators which speak to the fishability, drinkability and swimmability of the Great Lakes. Managers from the different agencies in this room need more specific indicators, so that they can make decisions and adjust their work accordingly. The existing work of LaMPs, and RAPs provides us with an excellent starting point. We are trying to move from the indicators that were created using the expert judgement of participants at previous SOLECs, to something that is more robust, measured in science and understandable.

Where to from here? To be useful the indicators have to be owned and used by the people, groups and agencies who are doing the monitoring in the basin. Because of our bottom up approach, we realize that we are going to have to take the work done here, "on the road". We need to dialogue with the agencies to ensure that there is coherence and buy-in to a suite of

indicators that makes sense. It will help us to identify where the ambiguities are; where we don't have it quite right yet. I expect by SOLEC 2000, we will have the first report against that preliminary set of indicators.

I used to be a weather forecaster so let me predict the future. I would predict that in 10 to 15 years, when we look back at SOLEC 98, we will recognize that we made a significant move forward in how we look at and deal with the issues of the Great Lakes basin ecosystems.

Finally, SOLEC is about the "State of the Lakes". So how are they? They are in better shape now than they have been in the past 50 years. We have addressed some of the easier issues - as David Ulrich says when he uses the analogy of the human body - we have stopped some of the bleeding, bound some of the lacerations, and repaired some of the bones. But the body is still not healthy. Toxics, including the long range transport of toxics and their impact on wildlife are major concerns. The impacts of exotic species, urbanization and land use and how it is affecting the nearshore in particular are three major areas of concern.

We have a lot of work to do to return this body to a healthy state. The dedication shown by all of you in terms of your individual work and collective work shows that this is attainable. Together we can make it happen. I want to end by saying thank you very much for your participation, for your engagement, for your ideas, and for your hard work.

APPENDICES

to the SOLEC 98 Conference Proceedings

SOLEC '98

What's it all about?

The Parties to the Great Lakes Water Quality Agreement (the governments of Canada and the United States), want to establish a consistent, easily understood *suite of indicators* that will objectively represent the state of major ecosystem components across all Great Lakes basins and on which they can report progress every two years. This suite of indicators should also be used to assess the Parties regarding achievement of the purpose of the Agreement. The acceptance and use of a core set of indicators will also drive data collection activities throughout the basin.

The first two SOLEC conferences reviewed the state of various components of the Great Lakes ecosystem through the use of indicators and subjective assessments. These indicators were developed through the best judgement of the scientists involved. SOLEC '98 is taking this work a step further and has pulled together a list of ecosystem indicators for *discussion* at the conference.

In addition to the indicator work, SOLEC '98 is also suggesting areas of high biodiversity - worthy of protection, preservation and/or restoration. These *biodiversity investment areas* include aquatics, coastal wetlands and the lands by the Lakes.

SOLEC '98

Steering Committee

Steering Committee members represent a wide variety of agencies from around the Great Lakes:

Agency for Toxic Substances and Disease Registry

Council of Great Lakes Industries

Environment Canada

Great Lakes Commission

Great Lakes Fishery Commission

Great Lakes States

(Michigan, Minnesota, New York, Pennsylvania)

Great Lakes United

Health Canada

International Joint Commission

Ontario Ministry of Agriculture, Food & Rural Affairs

Ontario Ministry of Environment

Ontario Ministry of Natural Resources

U.S. Environmental Protection Agency

U.S. Fish and Wildlife Service

U.S. Geological Survey

There are many other individuals, and representatives from environmental groups, academia and the local level of government who have participated in the work necessary to develop this conference.

For additional information please contact:

Office of Regional Science Advisor
Environment Canada - Ont. Region
867 Lakeshore Rd.,
Burlington, Ontario L7R 4A6
ph: 905-336-6270

Great Lakes National Program
Office - US EPA
77 West Jackson Blvd.,
Chicago, IL 60604
ph: 312-886-4360

SOLEC '98

State of the Lakes Ecosystem Conference

Great Lakes Indicators and Biodiversity Investment Areas

October 21, 22, & 23, 1998

Buffalo Convention Center

Buffalo, New York

Hosted by:

Environment Canada
&
United States Environmental Protection Agency

Tuesday October 20, 1998

An evening reception will take place in the lobby of the
Buffalo Convention Center
Hor d'oeuvres provided - Cash bar

Sponsored by Great Lakes Commission

DAY ONE - Wednesday October 21, 1998

8:30 Welcome / Opening Remarks

9:00 Presentation of Indicators List by Subject Groups:

- Nearshore & Open Waters
- Coastal Wetlands
- Land by the Lakes
- Socio-Economics / Land Use
- Stewardship
- Human Health

30 minute break is scheduled at 10 am.

12:00 Lunch
Guest Speaker: William Rees, Univ. of B.C., *"Our Ecological Footprint"*

2:00 & 4:00 Workshops: Indicator Subject Groups
Resource people will be available at each workshop to explain the SOLEC Indicator List in more detail. Participants may select two different workshops.

30 minute break at 3:30 pm. Adjourn at 5:30 pm.

6:30 Evening Reception
In amongst the displays.
Hot hors d'oeuvres provided. Cash Bar

DAY TWO - Thursday October 22, 1998

8:30 Plenary Session: State of the Lakes
This session will update the information presented at SOLEC '94 and SOLEC '96 and in the corresponding States of the Great Lakes reports.

9:00 BIA Presentations:
Highlights of the papers will be presented for

- Aquatic
- Coastal Wetlands
- Land by the Lakes

30 minute break is scheduled at 10 am.

10:30 Workshops: Lake-by Lake Sessions
The intent of these sessions is to discuss the applicability of the SOLEC Indicators to each lake. These sessions are being run in conjunction with the LaMPs (where applicable). There will also be a session for the St. Lawrence River.

12:00 Lunch
Guest Speaker: Dave Bennett, Canadian Labour Congress, *"Just Transition"*

1:30 Workshops: Lake-by-Lake and BIAs:
These sessions will discuss the lakes (see 10:30 timeslot) and will also discuss the findings of the Biodiversity Investment Area papers. Where the right areas selected? Did we miss a special area? What are the implications of selecting an area?

3:30 Field Trip or SOLEC 5 km Fun Run
Visit some of Buffalo's restoration sites or be really active and participate in the SOLEC 5 km Fun Run!

7:00 Dinner
Guest Speaker: Hays Bell, Eastman Kodak, *"Environmental Responsibility"*
Success Story Recognitions

DAY THREE - Friday October 23, 1998

8:30 Plenary Session

8:45 Workshops: Cross-Cutting Issues
These sessions will discuss the cross-cutting issues. These include:

- IJC indicators work
- Citizen's indicators
- Modelling summit
- Endocrine disruptors
- Volunteer monitoring
- Applying indicatorsRAP perspective
- Next generation indicators
- Fish community objectives

11:45 Feedback for the Future - Students Perspective of SOLEC 98

12:15 Closing Plenary - Where do we go from here?

12:30 Conference adjourns

Please note:

The display area will be open for viewing throughout the day on Wednesday and Thursday.

Registration Tuesday October 20, 6:30pm-9:00pm
or
Wednesday October 21, 7:30am-12noon

For further information on SOLEC visit our web site at **http://www.cciw.ca/solec/**

Appendix B. Core Group Leaders and Biodiversity Investment Area Paper Authors

Indicators Core Group

Co-Chairs:	Paul Bertram (U.S. Environmental Protection Agency) Nancy Stadler-Salt (Environment Canada)
Nearshore & Open Waters:	Tom Edsall (U.S. Geological Survey)
Coastal Wetlands:	Lesley Dunn (Environment Canada) Duane Heaton (U.S. Environmental Protection Agency) Nancy Patterson (Environment Canada)
Nearshore Terrestrial:	Ron Reid (Bobolink Enterprises) Karen Rodriguez (U.S. Environmental Protection Agency)
Land Use:	Ray Rivers (Rivers Consulting)
Human Health:	Doug Haines (Health Canada) Mark Johnson (U.S. Environmental Protection Agency)
Stewardship:	Ron Baba (Oneida Nation)

Biodiversity Investment Area Paper Authors

Nearshore Terrestrial:	Ron Reid (Bobolink Enterprises) Karen Rodriguez (U.S. Environmental Protection Agency)
Coastal Wetlands:	Dennis Albert (Michigan Natural Features Inventory) Pat Chow-Fraser (McMaster University)
Aquatics:	Joe Koonce (Case Western Reserve University) Ken Minns (Fisheries and Oceans Canada) Heather Morrison (Fisheries and Oceans Canada)

Appendix C. Participant Profile

Participation by Country

Country	Number of Registered Delegates	Percent
United States	253	59.25
Canada	171	40
Mexico	1	0.25
Sweden	1	0.25
Lithuania	1	0.25
Total	**427**	**100**

Participation by Sector

Sector	Number of Registered Delegates	Percent
Federal Government	154	36.07
Provincial / State Governments	60	14.05
Academia / Research	38	8.9
IJC	32	7.5
Industry	30	7.0
Environmental Groups	20	4.68
Municipal / Regional Governments	19	4.45
Recreation / Wildlife / Conservation / Fishing	18	4.2
Native / Aboriginal Groups	10	2.34
Public Advisory	10	2.34
Health	5	1.17
Media	4	.94
Agriculture	2	.47
Other	26	5.85
Total	**427**	**100**

Appendix D. Student Presentation/Great Lakes Student Summit

Student Presentation

Students and teachers from local area schools were invited to SOLEC 98 to participate in the plenary sessions and workshops, and were asked to present their perspective to the SOLEC delegates at the closing plenary session. The students read from a vision statement that had been presented at the IJC Biennial Public Forum. Student involvement evolved from their participation in the Great Lakes Student Summit - a program of the Erie County Department of Environment and Planning.

Participation from the East Aurora School District included: **John Newton** (teacher), **James Ricci** (5th grade), **Cindy Cicarell** (5th grade), **Nathan Newton** (5th grade), **Angela Barranello** (5th grade), and **Aren Hall** (11th grade). Participation from the West Seneca School District included: **Gail Hall** (teacher), **David Walter** (5th grade) and **Kristina Czechowski** (5th grade).

About the Great Lakes Student Summit

The Great Lakes Student Summit (GLSS) began in 1995 as an opportunity for students in grades 5-9 from throughout the Great Lakes basin to learn about environmental issues affecting their communities (and have fun at the same time!). Over 250 students and teachers participated.

The second GLSS, held in 1997 involved more than 275 students and teachers from the US and Canada. Project exhibition ranged from posters outlining pollution prevention strategies, to skits detailing environmental awareness and even a full-scale functional watershed model!

The highlight of the 1997 event was the development and presentation of a vision statement for 2022. This vision statement was then officially presented at the IJC Biennial Public Forum held in Ontario, Canada.

The theme for the 1999 summit, “Your Concerns, Our Concerns, Areas of Concern”, focuses on environmental issues facing the Great Lakes states and provinces and is designed to motivate student interest and involvement in their local communities. As with the past two Summits, students will have an opportunity to showcase research and environmental projects they are involved with in their areas of the Great Lakes basin.

The Summit will feature several field trips that are designed to educate the students about the geological, biological and chemical make-up of the Great Lakes ecosystem.

The ultimate goal of the 1999 GLSS is to encourage students to utilize their education and experiences gained at the Summit and apply these new-found skills and knowledge back home. By teaching children to take “ownership” and promote stewardship of their watersheds in their communities, we are giving them the personal responsibility of protecting the Great Lakes resource and almost guaranteeing Great Lakes protection into the future.

Appendix E. Keynote Speakers

Welcoming remarks - *Wednesday October 21, 1998*

- Paddy Torsney, Government of Canada
- William Muszynski, Deputy Regional Administrator, EPA Region 2

Lunch Speaker - *Wednesday October 21, 1998*

William E. Rees, PhD
University of British Columbia
"Where On Earth is The Great Lakes Basin?"

Abstract
Ecosystems management in the Great Lakes Basin (GLB) should begin by recognizing that human beings are the region's dominant consumer organism and that they greatly affect the structure and function of their supportive ecosystems. This paper estimates the total load imposed on these ecosystems by the human population of the GLB using 'ecological footprint (EF) analysis.'

EF-analysis is an extended form of trophic analysis. It assesses not only total metabolic requirements of the region's human population, but also its 'industrial metabolism' and converts relevant material and energy flows to a corresponding ecosystems area. Thus, the ecological footprint of the GLB human population is the total area of terrestrial and aquatic ecosystems required to produce the resources consumed and to assimilate the wastes produced by that population.

This approach shows that the average per capita eco-footprint of GLB residents is between seven and ten hectares. Assuming a population approaching 40 million, the total eco-footprint of the region may therefore be as high as ***four million square kilometres***. This is five times larger than the geographic area of the basin itself, or approximately half the area of the lower 48 states. In terms of their ecological impacts, the residents of the GLB thus 'live' mostly outside the region. The sustainability of the region's human population and lifestyles therefore depends more on sound management of ecosystems outside the basin than on the internal management regime. Similarly, exemplary management efforts to improve GLB regional environmental quality may actually reduce global sustainability if the effect is to further off-load the impacts of local consumption (eg. further extend the region's ecological footprint) onto ecosystems elsewhere in the world.

For further information on Ecological Footprint Analysis, Dr. Rees has published several articles on the subject, as well as the following book:

Mathis Wackernagel and William Rees. 1996. Our Ecological Footprint: Reducing Human Impact on the Earth. New Society Publishers. 176 pp.

Lunch Speaker - *Thursday October 22, 1998*

Dave Bennett
Director, Health and Safety, Canadian Labour Congress
"Just Transition"

The Canadian Labour Congress (CLC) represents 2.3 million workers in both public and private sectors across Canada. The CLC as a national organization has been on the fringes of consultations over Great Lakes water quality, so this is very much an outsider's view of the drive to clean up the Great Lakes.

The CLC is, however, a regional as well as a national organization. Local unions and Labour Councils have been instrumental in environmental control and remediation measures and they have, above all, taken the lead within workplaces to institute pollution prevention and toxics use reduction measures.

Some of the characteristics of the efforts to improve Great Lakes air and water quality are 1) bold and ambitious aims on the part of the International Joint Commission and its scientific advisory bodies; 2) a long history of the failure of implementation moves on the part of governments at all levels; 3) a focus on zero discharge and the sunsetting of selected chemicals as the key to pollution abatement moves; and 4) labour as very much a junior partner among stakeholders.

The "Just Transition" movement arose because of the profound changes in industrial structure that would arise out of a true sunsetting program. The status of sunsetting programs is less prominent than it was, except that tangible programs are being replaced by chlorine campaigns and the like. Any moves to eliminate chlorine from industrial production would require a very, very strong and comprehensive transition program.

Labour's aim is to make "Just Transition" an integral part of sunsetting campaigns and programs. But first some background on transition itself.

Workers have a history of dealing with transition measures through economic conversion schemes that have, among other things, tried to provide compensation, retraining and reemployment for workers displaced from "sunset" industries. These projects and measures had little to do with sustainability, environmental protection or the impact of environmental change on the different industrial sectors.

In North America, transition issues became a reality with proposals to ban, phase out, eliminate or "sunset" specific toxic chemicals or classes of chemicals, such as the ozone depletors, chlorinated chemicals, heavy metals, asbestos, or lists of chemicals such as the "Dirty Dozen" pesticides, all in the name of sustainability, sustainable development, or the protection of ecosystems. Unions developed, and are still developing, an ideology and a program of "Just Transition" to deal with the industrial disruptions caused by the banning of major feedstock or other industrial chemicals. The disruptions would be major and the transition measures to deal with them, ambitious and comprehensive.

Among the options for transition programs are: 1) an equitable program of industrial restructuring and retraining to recruit laid-off workers from the affected industries to the new alternative industries or ventures; 2) a program of retraining and reemployment in the affected

industries, and 3) a placement system inside and outside the affected industries, which may include severance pay, counselling, retraining, adjustment programs, and a placement service. A placement service for laid-off Canadian Steelworkers, for instance, has had a very high placement rate of 85 to 90 percent, the record over income maintenance being somewhat less impressive.

Among the problems associated with the program are that the changes are deep and "societal," placing a very heavy responsibility on the state for inaugurating and implementing or overseeing the program — all this in a time when the planning functions of governments are under siege. This has led for calls, including from some segments of labour, for modesty in the environmental change program and a corresponding modesty in the transition program needed. There is, for instance, a problem of increasing complexity and difficulty, where the program deals with (i) a single employer; or (ii) an industry with multiple employers, all having a responsibility for transition measures but with uneven responsibilities for implementing the environmental change concerned; or (iii) a whole range of different industries, such as energy producers, some of which gain and others of which lose in the event of major industrial change.

To finance a transition program, a lot of revenue is needed, going into billions of Canadian dollars annually. Among the proposals for revenue raising, to finance transition, advanced by Canadian labour are 1) green taxes, including a carbon tax; 2) the budgeting of all major environmental programs to include a transition scheme and revenue for transition purposes; and 3) investments from labour's own investment funds ("Solidarity Funds").

Pollution Prevention

I now want to step back a bit. It strikes this outsider that the sunsetting program is not the prime key to Great Lakes water quality. The first stage should be a concerted and coordinated toxics use reduction program on the part of all jurisdictions that have an authority over Great Lakes water quality. Toxics use reduction programs such as those in Massachusetts, New Jersey, and Oregon have a proven track record in reducing emissions by sound pollution prevention methods. They, more than any other venture, have put us firmly on the path towards zero discharge. It is lamentable, therefore, that none of the jurisdictions surrounding the Great Lakes are at the top of the league table of toxics use reduction programs. Some have no legislated program at all. Why not ?

The situation in the United States is puzzling. The EPA has the clear constitutional power to make environmental laws for the whole country, allowing lower jurisdictions to make their own rules under conditions laid down by the federal government. But the Pollution Prevention Act, in a rare exception to the rule, does not do this. The result is a patchwork of state pollution prevention and toxics use reduction laws, some very good, most mediocre and a few terrible. I can only conclude that business pressure forced the United States into a weak and timid federal pollution prevention law.

The case of Canada is less clear and more complex, because the environmental powers of the federal government are weaker than in the United States. The result has been a pretense that the federal government is doing anything serious to make pollution prevention into a practical national goal. The CLC has proposed a division of federal and provincial responsibility over pollution prevention, which reflects political reality while urging the federal governments to institute economic instruments to promote a national standard of pollution prevention in the form of a uniform toxics use reduction program. Such a program would:

- Protect both the work environment - workers' health and safety - and the external environment at the same time ;
- Promote industrial efficiency as well as environmental protection: all toxics use reduction moves are cost-effective; they differ only in the payback time for the toxics use reduction investment;
- Be flexible and performance-based; unlike sunsetting, it does not impose rigid and specific requirements on employers;
- Not be an all-or-nothing proposition; it mandates progressive changes instead of requiring a big initial step, and is therefore unlikely to leave us at square one after the program has been launched; and
- Enable workers to play a full part in the design and implementation of the program at the workplace level.

Dinner Speaker - *Thursday October 23, 1998*

Dr. Hays Bell
Vice President, Environment, Health and Safety, Eastman Kodak
"Environmental Responsibility in the New Millennium"

Good evening ladies and gentlemen. I'm pleased to address this important audience attending the 3rd State of the Lakes Ecosystem Conference. The Great Lakes are a valuable natural resource. As a member of the Council of Great Lakes Industries, Eastman Kodak Company (in particular, Kodak Park in Rochester, NY and Kodak Canada, in Toronto) are pleased to participate as stakeholders within the Great Lakes States and Provinces. We support the protection and responsible use of the natural environment of our Great Lakes Region knowing that a healthy and competitive regional economy is dependent on this environmental responsibility.

I am going to speak about Environmental Responsibility. First...how is it defined? I define "Environmental" in the broadest sense with a capital "E" to include health, safety, and environment. "Responsibility" is a duty and obligation that no one company, government, or organization can do alone, hence, it is a shared responsibility.

Today, the best way for a company to be environmentally responsible is to have an effective environment, health, & safety (EHS) management system in place. Many companies have effective EHS management systems; since I am from Kodak, I'll share Kodak's system with you.

Our EHS Management System at Kodak is one we're proud of. We have senior management support and we are structured to proactively address regulatory conformance worldwide and to quickly react to issues both at the Business Unit and Regional level. Additionally, our internal standards and procedures are utilized worldwide because it is not just complying with the law that matters - we realize this is a way to be successful at doing business.

As an industry, we have learned that the way we manage our health, safety, and environmental issues actually enables our business activities. The Business Value Chain is a traditional way of illustrating how a company adds value in the various stages of product and service delivery. Stop and think about some obvious examples of how EHS fits into the everyday routine of carrying out business activities...from procurement, manufacturing, and distribution, to

marketing, sales, and service. **The bottom line is that EHS enhances the way we look at and the way we do our business.**

Also, maintaining the vision is key to a company making responsible decisions. What is Kodak's "vision" of Environmental Responsibility? As a "photographic and imaging" company, it is especially important to us to project a world class "Environmental Image". Our obligation to the Environment not only impacts the sales of our products and perception by our customers, but also has a direct influence on costs associated with production and distribution of these products. So, we strive for continual improvement... every day... every month... every year. As we track our performance, we measure our progress - please review our annual EHS report for 1997 to see the progress for yourself.

When we think of how environmental responsibility is evolving, we think of pollution prevention versus pollution control. Today, the effective EHS management system is evolving beyond the "operations control" stage to one that is more "system" oriented - one that looks at the entire product life-cycle - from invention to end-of-life. A "product focus" versus "operations focus" approach.

The best way to learn this approach is to partner and learn from each other. Kodak has done just that:

We were very pleased to participate in EPA's Technology Transfer Project. This was a two-year voluntary project to evaluate a new EPA-developed test methodology and accompanying computerized software "tool kit." The result - potential hazards and waste can be avoided at the R&D stage of product development - pollution prevention in lieu of pollution control.

Kodak also participated in the development of the Green Chemistry Challenge, a program that is part of the U.S. EPA's Design for Environment initiative. The program promotes fundamental research in the development of chemistry and chemical synthetic processes that are safer and more environmentally responsible.

Environment Canada also offered some opportunities to industry. ARET stands for Accelerated Reduction and Elimination of Toxics and is a voluntary, non-regulatory program that targets 117 toxic substances including 30 that persist in the environment and may accumulate in developing organisms. ARET has long- and short-term goals and Kodak Canada has volunteered reductions in two categories. ARET is an important program because it is the precursor to the present Binational Toxics Strategy.

Partnering with Environmental Groups is also important. The World Wildlife Fund is one example. WWF increases the understanding of biodiversity issues through an education program called Windows on the Wild (WOW). WOW is a partnership among WWF, Kodak, schools, and the nation's nonformal educational institutions (including zoos, aquariums, nature centers, botanical gardens and museums). Since initiated, more than one million students, teachers, and members of the public have been exposed to this unique program. This program is unique not only in topic, but because it is an excellent example of an environmental group sharing expertise by forming a funding partnership with industry.

International Standards for environmental management are now available. These ISO 14000 standards are intended to provide organizations with the elements of an effective environmental management system and can be integrated with other existing management requirements. The

overall aim of the standards is to "support environmental protection and prevention of pollution in balance with socio-economic needs." Consequently, many companies, including Kodak, have ISO 14001 registration goals.

And that brings us to another example of evolution - the "new" versus "traditional" business value chain.

The new Business Value Chain includes an "R&D" and "end of life" phase, in addition to procurement, manufacturing, distribution, marketing, and sales/service. Environment, Health, and Safety is an integral part of Kodak's business value chain in that EHS functions enable these business activities and therefore contribute to our company's success. I'll use an example of Product Stewardship to illustrate how effective Environment, Health, and Safety Management can help a company achieve it business goals while being "environmentally responsible."

Kodak's single-use cameras (SUCs) were introduced in 1987 to meet the needs of a specific customer base - those who wanted an inexpensive camera to take pictures that might otherwise be missed. The quality of the pictures was outstanding and the cameras were an immediate success. Customers needed to return the entire product (containing the film) to the photofinisher in order to get their prints. Essentially, they used the camera a single time and "disposed" of it. Popular Science Magazine selected one of our single-use cameras for a "Best of What's New" award for science and technology. Environmental groups however were calling the Kodak Fling camera "ecologically offensive." While our new product was hugely successful, it did not measure up to Kodak's own environmental benchmark - so it went back to the drawing board to begin one of the most successful worldwide efforts for redesign of a consumer product.

A Design for Environment activity occurred during the R&D stage that included elimination of the sonically welded camera to a redesign for easy disassembly - where the camera could be taken apart and the parts re-used to make new cameras. Procurement was engaged during the redesign of the camera body to include selection of a plastic that could be recycled to make new cameras or other products. Special labels were purchased - made from a material that has a high-quality printing and adhesion characteristic but that could also be reground and pelletized along with the front and back covers of the camera for recycling. Manufacturing adjusted their procedures so many small parts and the camera frame could be reused. Distribution channels were utilized to enable industry-level exchange partnerships and to enable our recycling programs worldwide. Additionally, the camera was and still is marketed with an eco-label, the Kodak e-mark, to bring attention to the product recycling program. Finally, the camera has significant end of life opportunities that include the intent that these cameras are designed to be recycled up to ten times.

Overall, the SUC program clearly enhanced Kodak's sustainable development efforts, because it led to a formal "Design for Health, Safety & Environment" program to investigate the recycling and remanufacturing opportunities of all new products.

I mentioned earlier that environmental responsibility is a duty and obligation that no one company, government, or organization can do alone. This is evidenced by reviewing those activities that move us towards the future - a future with a product stewardship focus. Some activities that move us toward the future are:

- **academic research**
  provides the innovation for industry and business to invent new products
- **substance substitution**

eliminating less friendly substances in new and existing product formulations

- **design for environment**
  a pollution prevention practice that ultimately reduces the need for pollution control
  sustainable development practices
  making certain we address the needs of the future generations
- **leadership in EHS management**
  the mechanism that not only enables regulatory compliance, but improvements in EHS performance as well
- **and an open dialog among all publics**
  the only way to achieve this task is to work together and the best way to work together is to share information.

In summary, environmental responsibility today is a shared responsibility; one that is shared by business, government, academia, and other publics. We'll move environmental responsibility into the new millennium by taking steps together. For industry, it is not our satisfaction in performance that moves us to the future state. Rather, it is the progression of steps through good EHS management systems, partnerships, product stewardship programs, and acting on opportunities for continual improvement that moves us forward.

Speaking for members of the Council of Great Lakes Industries, I challenge all of us to work together to move toward the future, by getting better at Environmental Responsibility... every day... every month... every year.

Thank you.

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