

# The SOLEC *Indicator*

Day 2 Edition: Thursday, October 22, 1998

## INDICATORS FOR GREAT LAKES HEALTH

Dear SOLEC Delegates:

Our second newsletter reports on the first day of SOLEC 98. You will notice when you look inside that we have concentrated mostly on the workshops, rather than reporting on the plenary proceedings. And, you will note, that the workshop proceedings are very abbreviated: the “top three” highlights of your collective deliberations. The workshops were recorded in much greater detail than is provided here. What we are giving you here is just a glimpse into your “top of mind” responses.

And, you were clear in your messages .... **BASIN-WIDE INDICATORS ARE MUCH NEEDED AND NECESSARY**, but... are these the right ones? And, you stressed the need to communicate to various audiences (please see “Basin Wide Indicator Overview session – Communications Triangle on page 3.); that there appear to be too many indicators; and yet we’ll have a challenge to agree on which ones to drop. Discussions ranged from high level process talks, to detailed discussion by indicator number. We identified some “forgotton” indicators, some which cross cut into other areas – such as phosphorus. Several sessions were very full – human health attracted the most delegates. Interestingly, early registrations showed that the Introduction to Indicators session would be fully attended – and yet only 16 participated - thanks to Paul Betram and Nancy Stadler-Salt for an excellent overview in the morning plenary!

So, we’re off to a great start. You may think we’ve only scratched the surface in the indicator discussions but we have a full day today to look at the indicators from a lake wide perspective. On behalf of the SOLEC organizers, we thank you for your participation, and we are looking forward to the results of today’s deliberations.

Sincerely,

Paul Horvatin  
Co-Chair

Harvey Shear,  
Co-Chair

## HIGHLIGHTS

October 21-23, 1998

# HIGHLIGHTS

**The Highlights were put together by members of SOLEC’s Steering Committee. These people met last night and shared common findings and key themes.**

- The need for clear, up front goals, as to what these indicators are trying to show. There is need for clarity on the overall purpose of why we’re developing indicators: Who is the audience? What are these indicators intended to do?
- The need for some sort of tiered or organized structure for the indicators e.g. by scale or by audience needs.
- Linkages both within and between indicator categories are needed.
- Endpoints – the need for refinement, specifics, clarity.

## WHAT’S INSIDE

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## BACK TO OUR ROOTS - The PARTIES COMMITMENT TO THE GREAT LAKES WATER QUALITY AGREEMENT...

Ron Shimizu and Peter Wise – gave a stimulating retrospective – about the history of the GLWQA and its meaning. Ron stressed that developing indicators is more timely and relevant than ever – that the ecosystem approach requires a broader perspective than just water quality. He stated that we need more advanced management practices and noted the significance of these practices since 1987 – e.g. pollution prevention, sustainable development, biodiversity, ecosystem health, and exotic species.

“The Great Lakes are a priceless resource that has suffered much abuse, and in the last 26 years has become a model for change that other nations are looking to replicate.”



**BASIN-WIDE INDICATOR OVERVIEW***Adele Freeman, Facilitator*

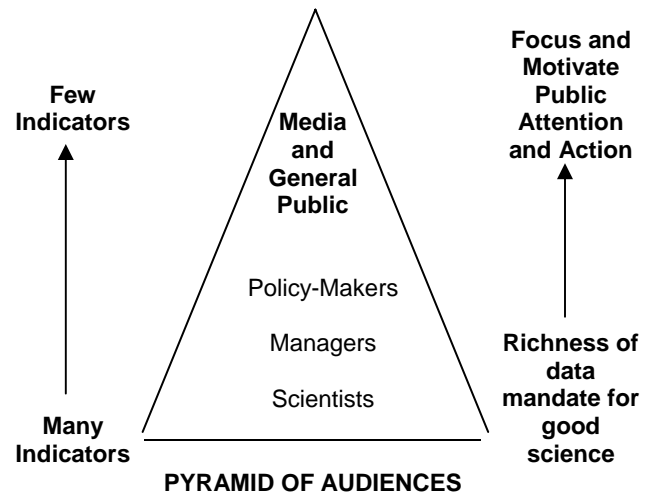
1. All comments that have been provided should be considered in the next steps. A major concern is that some of the information will not be considered.
2. All current work is very much appreciated. Nevertheless, there is still a lot of work to do.
3. Current categorization is good but there is a need for a cross-categorization including linkage to beneficial use.

Big theme between two sessions: Regroup indicators by scale and by audience.

**BASIN-WIDE INDICATOR OVERVIEW***Suzanne Barrett, Facilitator*

1. We need well-defined end points to focus the key indicators which can be reported. Stressor and activity (response) indicators are useful but they are not end points.
2. There is a need to “know your audience” – to understand which indicators are relevant to general public, government managers, and monitoring scientists etc. Indicators need to MOTIVATE and encourage individual behavior. Don’t lose the richness of information provided by the suite of indicators.
3. When considering end points, the question of SCALE becomes very important: are the end-points local in scale, lake by lake, or basin wide?

Note that many of the proposed indicators are at the local (canoe-view) scale.



**Patch-Disturbance Species:** Any organism which, usually by central place foraging, degrades a small “central place” greatly and disturbs a much larger area away from this central core to a lesser extent. (*Human beings are a particularly adaptive, highly innovative, and therefore competitively successful patch-disturbance species.*)

- Dr. William Rees Key Note Address, SOLEC 98 -

Wednesday’s key note speaker, Dr. William Rees, delivered an energized and thought-provoking address titled “Where on Earth is the Great Lakes Basin?” Contrasting the economic world view with the environmental world view, Dr. Rees identified humans as a “patch-disturbance species” (see definition above) whose consumptive habits are supported by a massive ecological deficit. His ecological footprint analysis translates our consumption habits into a land area measure – a “footprint” which reflects the area required to support that consumption. The Great Lakes Basin population generates an ecological footprint half the area of the lower forty-eight states (or 10 ha per person).

(Insert picture of footprint)

**OPEN WATERS I and II – Tom Hersey, Helen Domske, Facilitators**

1. Keep ecosystem objectives in focus and reduce the list of indicators to a more manageable number.
2. We must understand the relationships between state indicators and pressure indicators.
3. Agency dollars need to be allocated to accomplish goals.
4. Endpoints need to be better researched, and must include peer review.

**NEARSHORE WATERS – Tija Luste, E. Marie Phillips & Marcia Damato, Facilitators**

Common themes from Nearshore Waters I, II & IV:

1. Overall, the purpose of the indicators is still unclear.
2. More specifics and refinement are needed regarding scope and targets for indicators (e.g. exotics – not just sea lamprey; fish entrainment should not stand alone).
3. Prioritized/tiered/nested indicators would help focus and tie actions together, and avoid competing or contradictory indicators (e.g. dams to control sea lamprey, but would also fragment fish diversity).
4. In terms of next steps: I) need to market indicators, get buy-in and start now; ii) there is concern that the basin-wide indicators will displace other established monitoring programs; iii) need a reality check on feasibility of collecting data; some indicators may be appropriate for research at a small scale, but not realistic for basin-wide monitoring.

**COASTAL WETLANDS I – Sheila Greene, Facilitator**

1. Most important indicator is 4510 – wetland area by type. Critical indicator basin wide and binationally. All in agreement. (Natural and human induced changes included).
2. Group proposed having a tiered structure for looking at indicators – look at basin-wide view and then more narrowed (site specific). If you see a trend in tier 1, look at tier II to see why.
3. Certain cross-cutting issues are of critical importance to wetlands but have been handled by other indicator groups, e.g. wetland buffers, wetland dependant fish, hardened shoreline.

**COASTAL WETLANDS II  
Eric Carlson, Facilitator**

1. We need comparable methodologies for basin-wide monitoring and data collection.
2. Wetlands-dependent fish communities are distinct from nearshore fish communities. (“We want the fish back.”)
3. Work needs to be done at the extensive and intensive levels.



**LAND USE I - *Cathy Keenan, Facilitator***

1. Make land use indicators relevant, measurable, digestible, credible – so they will be endorsed and implemented by local land use decision-makers. (As well, frame the indicators to highlight the costs of urban sprawl).
2. Link land use with nearshore terrestrial, stewardship. Make the links more clear and do more exploration across indicator categories.
3. What are the cumulative impacts of population increase and land-use change that municipalities are planning for the next 20 years. i.e. extra few million in GTA – “What is the big picture”?

**LAND USE II - *Cathy Keenan, Facilitator***

1. Incorporate forestry and mining in indicators – need simpler indicator of state of land use e.g. forest cover, open vs. impervious surfaces, land cover, etc.
2. Make the link between land use and ecological footprint.
3. What are questions indicators are trying to address? Need to start with a very general framework.

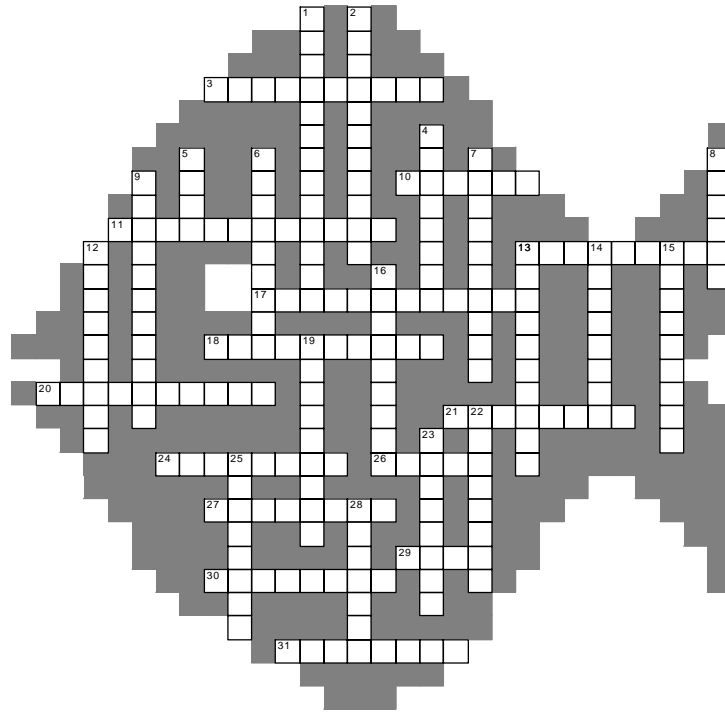
**Human Health I - *Sandra Owens, Facilitator***

1. The group was not comfortable identifying highlights due to the range of opinions and issues raised.
2. There were many different views on the kinds of indicators that would be appropriate: indicators of effects (causal linkages) or exposure; potential of exposure. As a result, the discussion did not focus on the specific indicators, but on broader questions – such as what is the overall purpose of the indicators? Targets or baseline values are needed to measure against (i.e. values in humans, not standards).
3. The group felt strongly that this was an important activity, but that the session did not provide enough time to answer the questions adequately. It was suggested that a process of some kind be set up to assess human health indicators in a systematic, detailed way.

**Human Health II - *Sandra Owens & Marcia Damato (Facilitators)***

1. We need to put the indicators in a larger context to increase understandability. Look at health indicators in the context of North American population (has not been useful to concentrate on Great Lakes effects only).
2. Need to choose resilient indicators which are independent of management and changing resource decisions (e.g. beach closing data depends on having monitoring in place). We need to adopt indicators that have applicability across borders, sectors, populations. This requires consistent data collection methods so that data are “sharable”, comparable, usable over time, space, and social structures.
3. We need indicators which treat the public as a partner, and which lead to outreach, education, 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.

SOLEC INDICATORS



- activity
- attainment
- biological
- chemical
- criteria
- data
- data point
- database
- diagnostic
- early warning
- endpoint
- environmental
- feasible
- goal
- illustration
- indicator
- limitations
- measurement
- milestone
- monitoring
- necessary
- objective
- physical
- pressure
- response
- sources
- spectrum
- state
- stressors
- sufficient
- target
- vision

Across

- 3. Enough to characterize ecosystem components
- 10. General description of desired ecosystem condition
- 11. Sensitive to beginning deterioration (2 words)
- 13. Interim target toward objective
- 17. Example of indicator presentation
- 18. Achievement of an objective
- 20. Indicators to analyze causes of ecosystem status
- 21. Human response
- 24. Non-biological, non-chemical components of ecosystem
- 26. Existing condition or status of ecosystem component
- 27. Human reaction to status and pressure indicators
- 29. Recorded measurements
- 30. Stressor
- 31. Within the realm of possibility

Down

- 1. Indicator based on ecosystem measurement data
- 2. Features restricting the usefulness of an indicator
- 4. Set of guidelines for indicator selection
- 5. Qualitative statement of desired condition to be attained
- 6. Single measurement value (2 words)
- 7. Living ecosystem components
- 8. Quantitative end point
- 9. Single quantitative determination of status or condition
- 12. Needed
- 13. Activity to collect environmental data
- 14. Desired reference value
- 15. Statement of condition needed to achieve goal
- 16. Things that influence the status of ecosystem components
- 19. Measureable evidence of environmental quality or trends
- 22. Ecosystem component associated with biological and physical
- 23. Computerized collection of information
- 25. Series of indicator types
- 28. Origins of stressors



## Update on SOLEC 94 and 96 – State of the Great Lakes

SOLEC is currently in a period of transition C changing from the ad hoc indicators developed and used in SOLEC 94 and 96 to a more widely accepted suite of indicators being proposed at SOLEC 98. It was thought that rating the old indicators would lead to confusion. Therefore, presented in this paper are brief updates on past SOLEC background papers without any indicator ratings. Further details will be provided in the 1999 State of the Great Lakes report.

### 1. THE AQUATIC COMMUNITY

All Lakes are still undergoing changes in community structure due to the effects of invasive exotic species and other anthropogenic factors.

#### 1.1 COMMUNITY STRUCTURE:

##### Lake Superior

Lake Superior's lake trout population continues its recovery. However, deep-water cisco populations are decreasing and the recovery of the lake herring population has halted.

##### Lake Michigan

Yellow perch and bloater chub populations are undergoing prolonged reproductive and recruitment failure. Consequently, Lake Michigan's yellow perch fisheries are now at risk at various locations.

##### Lake Erie

*Hexagenia* abundance is increasing in Western Lake Erie, and stronger year-classes of yellow perch and walleye have recently been observed. However, there are concerns about the stability of Lake Erie fisheries due to multiple influences such as increasing densities of zebra and quagga mussels, increasing water clarity, decreasing abundance of smelt, and increasing populations of round goby.

##### Lake Huron

The fish community of Lake Huron has become very stressed due to increased pressure from exotic species, from pathogens introduced from hatchery stocks, and from an increasing incidence of parasites. High abundance of sea lamprey (presumably from the St. Marys River) is suppressing populations of burbot and lake trout. A new control program is beginning for the St. Marys River that promises to reduce the abundance of parasitic phase of sea lamprey in Lake Huron. Bloater chub recruitment is declining as well.

##### Lake Ontario

The biological productivity of Lake Ontario is returning to historic levels as a result of reduced loadings of phosphorus from Lake Erie and Lake Ontario basin sources, together with effects of zebra mussels. Ecosystem dynamics continue to shift as alewife, the principal prey for salmon and trout, and *Diporeia*, an important benthic invertebrate (in eastern Lake Ontario at 25 to 50 m depth), abundances decline, while lake trout reproduction continues to increase. More sightings of deepwater sculpin (*Myoxocephalus quadricornis*), which was thought to be extirpated, have been reported.

## 1.2 SPECIES IN THE NEWS:

- **Zebra and quagga mussels:** Zebra and quagga mussels continue their range extensions in the Great Lakes. Soft sediment colonization has become extensive.
- **Ruffe:** Ranges of this nuisance fish species in Lake Superior and Lake Huron appear to be expanding.
- **Round goby:** The round goby continues to increase in abundance in the Great Lakes. Its rate of increase in Lake Erie is more rapid than any other exotic species. Local densities in Lake Erie have become so high that native sculpins are being displaced.
- **Diporeia:** *Diporeia* is an amphipod found in deep-water habitats of the Great Lakes and is an important component of the food chain. Their decline in abundance has been most noticeable in eastern Lake Erie where beds of quagga mussel have become established on soft sediments. *Diporeia* decline has also been observed in the Bay of Quinte and eastern areas of Lake Ontario, in southeastern Lake Michigan.
- **Hexagenia:** The recovery of the mayfly of the genus *Hexagenia* in western Lake Erie is quite dramatic. The mayfly recovery was observed in 1993 and showed major advances in 1996 and 1997.

## 2. NUTRIENTS

Concentrations of nutrients remain relatively stable throughout the open waters of the Great Lakes. However, chlorophyll *a* concentrations, an indicator of biological productivity, are generally much reduced, probably due to effects of zebra mussel infestations.

### Total Phosphorus

Concentrations of total phosphorus in the open waters of the Great Lakes have remained nearly stable since the mid-1980's. Observed concentrations in the western basin of Lake Erie continue to fluctuate widely, while those in the central and eastern basins slightly exceed expected concentrations based on annual target loadings of phosphorus. Concentrations in Lakes Superior, Michigan, Huron, and Ontario are at or below expected levels.

### Nitrate-Nitrite

Concentrations of nitrate plus nitrite nitrogen in 1996 and 1997 have generally remained stable from those of previous years. A small increase was observed only for the eastern basin of Lake Erie.

### Chlorophyll *a*

Summer chlorophyll *a* concentrations in 1996 were lower throughout the Great Lakes than were observed from the mid-1980's to early-1990's. The reductions were especially evident for all three basins of Lake Erie and for Lake Michigan.





### 3. TOXIC CONTAMINANTS

After a decade or more of decline, the concentration of some contaminants appears to be leveling off whereas other contaminant concentrations are fluctuating. Concentrations of toxaphene-like chemicals and mercury appear to be increasing in Lake Superior.

#### Mercury

- Concentrations of mercury in fish have not changed significantly for most of the Great Lakes in the last decade. There is little difference in mercury levels for lake trout between Lakes. Mercury levels in forage fish species such as smelt tend to be higher in the upper Great Lakes.

#### DDT

- Concentrations of DDT in fish have remained relatively stable for the last several years. DDT levels are still highest in Lake Ontario fish and lowest in those of Lake Superior. There are currently no fish consumption advisories for DDT in Great Lakes fish.

#### PCB

- Although total PCB concentrations in top predator fish (lake trout, salmon and walleye) remain at levels approximately one-tenth that of their peak in the mid-1970's, concentrations are still so high that fish consumption advisories remain in place for all five Great Lakes. Fluctuations in PCB concentrations that have been observed in Lake Erie and Lake Michigan fish may be caused by changes in the composition of the food web.

#### Toxaphene

- Elevated concentrations of toxaphene-like chemicals in fish from Lake Superior have caused fish consumption advisories to be issued. Research is currently underway to investigate potential sources and pathways for this group of chemicals to enter Great Lakes= food webs. Analysis of current fish samples and retrospective analysis of archived samples has identified an increase in Lake Superior lake trout toxaphene burdens since 1986.

### 4. NEARSHORE TERRESTRIAL ECOSYSTEM

Upon reviewing the factors contributing to shoreline physical structure and the diversity of living communities in the nearshore terrestrial ecosystem, the conclusion drawn at SOLEC 1996 was that the health of the land by the lakes, nearshore terrestrial ecosystems, is degrading throughout the Great Lakes. The situation two years later remains the same. However, there are a number of efforts underway to help strengthen our understanding of ecosystem processes and functions in order to better identify the requirements for protecting and restoring biodiversity:

- The Chicago Region Biodiversity Council produced The Chicago Wilderness Biodiversity Atlas.
- The Ontario Natural Heritage Information Center published Rare Communities of Ontario: Freshwater Coastal Dunes in their winter 1997-1998 newsletter.

- The Ontario Natural Heritage Information Center has also tracked the status of the arctic-alpine communities along the north shore of Lake Superior (1998).
- The Federation of Ontario Naturalists and The Nature Conservancy's Great Lakes Program convened at the Great Lakes Alvar Conservation Workshop.
- The first State of the Great Lakes Islands Report compiled for the U.S.-Canada Great Lakes Islands Project of Michigan State University is being released in the fall of 1998.

#### 4. LAND USE AND DEVELOPMENT

The effects of urban sprawl and rural development continue to be dominant stresses on the environment. Development pressure is still radiating outwards from city centers, moving to rural areas encroaching onto fertile agricultural land. City centers are suffering from deteriorating economies as a result and available agricultural land for food production is shrinking. Wildlife populations and wetlands are being severely affected by widespread development.

##### Population.

- Within the last two years the human population of Ontario has increased by almost seven percent. This rate is much higher than that predicted at SOLEC 1996, i.e., a growth of 20% over the next 20 years.

##### Development.

- Sprawl continues as the conversion of land to urban uses greatly exceeds the rate of population growth. Automobile distances driven per capita and highway congestion increase as sprawl continues.

#### 5. HUMAN HEALTH

There is growing awareness of the endocrine disruptor issue.

- U.S. legislation in 1996 requires U.S. EPA to evaluate up to 80,000 chemicals for their ability to act as endocrine disruptors. The Endocrine Disruptors Screening and Testing Advisory Committee (EDSTAC) was formed, and a report was released in 1998. Recommendations were proposed for developing a process to prioritize, screen and test chemicals for endocrine disrupting activity.

There is strengthening evidence of the relationship between ambient air pollution and health effects as measured by cardiorespiratory hospital admission.



**STEWARDSHIP – Joanna Kidd, Facilitator**

Animated discussions were held on stewardship indicators. Many suggestions were made on indicators, metrics, ways to improvement communication, and potential next steps to further develop indicators.

**Stewardship I**

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 (e.g. 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.

**Stewardship II**

1. 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.
2. Indicators that measure place-based partnerships are necessary, but not sufficient to capture all aspects of sustainability.
3. The stewardship indicators need to be packaged in a way to inspire pride and encourage action by individuals and organizations..
4. Metrics should measure change in individuals over time (awareness/beliefs/actions).

**NEARSHORE TERRESTRIAL I - Vicki Barron, Facilitator**

1. The proposed indicators represent a good start however, the participants did not consider in their comments and input the issues of implementation and feasibility. These need to be considered after indicators are more focused.
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. Next steps – the indicators could be divided by topics and fine tuned with agencies that are active in the topic to test pilot the implementation.

**NEARSHORE TERRESTRIAL II - Vicki Barron, Facilitator**

1. Generally speaking the proposed indicators are good. However, it appears there is overlap in indicators both within the nearshore terrestrial as well as with other workshop topics.
2. The indicators are not, and are not meant to be, proactive 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.
3. We lack a comprehensive and systematic inventory of the nearshore terrestrial environment.

## QUOTES

From the Recorder to the facilitator – “where is everybody?”

“The stewardship indicators are on an intellectual plane that is too high for the public to grasp.”

“A good indicator will draw money” David Rockwell

“If you measure it, they will come” – Joe De Pinto

“We agree to delete mink (laughter)– not the species, but the indicator!” (CW)

“Just because there are programs for monitoring in place, it doesn’t mean they are the right indicators” – Dave Ullrich

“Wetlands are the indicator of Great Lakes ecosystem health”.

“There is a danger when you use language to describe a system – ecosystem does not pause out like the English language”.

“What we need in economic terms, is an “index” made up indicators, made up of measurements”.

