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Indicators of the Condition of the Great Lakes Basin Ecosystem: A Binational Workshop Convened 17-18 June 1998 by the Indicators Implementation Task Force on Ecosystem Integrity and Diversity

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INDICATORS
OF THE CONDITION
OF THE GREAT LAKES
BASIN ECOSYSTEM

a binational workshop
convened 17-18 June 1998 by the
Indicators Implementation Task Group
on Ecosystem Integrity and Diversity

Indicators Implementation Task Force
International Joint Commission

1998
NOTE ABOUT THE COVER:

On the obverse is Moebius Strip II, a 1963 wood engraving by M.C. Escher. That engraving symbolizes this integrity/diversity workshop and gives it some continuity with the International Joint Commission’s October 1984 workshop, in Philadelphia (also symbolized by a moebius or möbius strip): “Toward a Transboundary Monitoring Network”. That Philadelphia workshop addressed the entirety of the U.S.A./Canada Transboundary Region in which the Great Lakes Basin Ecosystem is embedded.

Ecosystem integrity is symbolized by the fact that the moebius strip has only one side yet is whole. Some observers are initially inclined to see that characteristic of an ecosystem, that wholeness; they see the system as a synplex.

There are some observers who are initially inclined to conceive and/or perceive interconnected components and subsystems in any ecosystem; they see the system as a complex and detect its diversity.

Integrity is about wholeness, oneness, commonality. Diversity is about partness, richness, differentiation. This workshop will address both integrity and diversity as desired outcomes of ecomanagement and will investigate indicators of their conceived and/or perceived variables.

On the long axis of the moebius strip are five pathways, each pathway symbolizing one of the types of ecology which, in this workshop, we employ (among other types of systematic and comprehensive observation) in seeking a better understanding of the Great Lakes Basin Ecosystem. Like the ecological learning process, these observation pathways have no end — if the integrity of the system is not compromised.

On the short axis of the moebius strip are transverse milestones which, like the logs laid together to form a corduroy road, are space–time junctures at which we can observe surrogate measures (indicators) of variables which, in aggregate, cause us to be better informed about the condition of the Great Lakes Basin Ecosystem.

Counting on the moebius strip for life-support are nine monitor ants, one for each of the desired outcomes which the International Joint Commission [IJC] has adopted (at least initially) for prospective use in evaluating the Parties’ progress in their implementation of the Great Lakes Water Quality Agreement. Each ant’s antennae assist it in staying on its chosen pathway for ecological observation; but the antennae are useful, also for finding complementarities on other pathways of its multidimensional world. The monitor ants’ (the IJC’s) strongest inferences concerning integrity and diversity can be made by explicitly examining the integrity of alternative, complementary descriptions of the Great Lakes Basin Ecosystem, descriptions deriving from different types (criteria) for ecological observation.
Governance Context for IJC Workshop:

Parties’ Purpose

The purpose of the Parties is to restore and maintain the chemical, physical, and biological integrity of the waters of the Great Lakes Basin Ecosystem.* In order to achieve this purpose, the Parties agree to make a maximum effort to develop programs, practices and technology necessary for a better understanding of the Great Lakes Basin Ecosystem.

The International Joint Commission shall assist in the implementation of this Agreement. Accordingly, the Commission is hereby given, by a Reference pursuant to Article IX of the Boundary Waters Treaty, the following responsibilities: Collection, analysis and dissemination of data and information concerning the General and Specific Objectives and the operation and effectiveness of the programs and other measures established pursuant to this Agreement. Tendering of advice and recommendations to the Parties in connection with matters covered under Annexes to this Agreement. Provision of assistance in the coordination of the joint activities envisaged by this Agreement. Provision of assistance in and advice on matters related to research in the Great Lakes Basin Ecosystem, including identification of objectives for research activities, tendering of advice and recommendations concerning research to the Parties and to the States and Provenvial Governments, and dissemination of information concerning research to interested persons and agencies. In the discharge of its responsibilities under this Reference, the Commission may exercise all of the powers conferred upon it by the Boundary Waters Treaty.


*Having learned more about integrity since the Agreement was first signed, the practice of the Parties (e.g., in their State-Of-the-Lakes Ecosystem Conference) has been to go beyond a concern with the “integrity of the waters” to a concern with integrity of the set of all components and subsystems comprising the Great Lakes Basin Ecosystem.
Parties’ Focus (to date)

“Great Lakes Basin Ecosystem” means the interacting components of air, land, water, and living organisms, including humans, within the drainage basin of the St. Lawrence River at or upstream from the point at which this river becomes the international boundary between Canada and the United States;

“Great Lakes System” means all of the streams, rivers, lakes, and other bodies of water that are within the drainage basin of the St. Lawrence River at or upstream from the point at which this river becomes the international boundary between Canada and the United States.[1]

— Article I, Definitions, Revised Great Lakes Water Quality Agreement of 1978

Great Lakes-St. Lawrence Basin: The watershed, including all land and freshwater (both surface and groundwater) within the confines of the drainage area defined by topographic high points surrounding the five Great Lakes and the St. Lawrence River to Beaupré, Québec.

— Ecosystem Charter for the Great Lakes-St. Lawrence Basin

Rhetorical questions (in watershed ecology) to initiate an inquiring mode in this workshop:

How comprehensive an integrator for the Basin is the River at Beaupré, Québec?

What more can we learn about Integrity/Diversity from other types of integrators?
Indicators of the Condition of the Great Lakes (Basin) Ecosystem [GL(B)E]

~ an exploratory workshop convened by the IJC’s Indicators Implementation Task Group on Ecosystem Integrity and Diversity ~

WORKSHOP PROGRAM

Tuesday, 16 June 1998 (6:00pm-7:30pm)
Informal Reception (optional icebreaker)

Wednesday, 17 June 1998 (8:00am-8:30am)
Registration with the aid of Lynne Witty; Coffee available

Wednesday, 17 June 1998 (8:30am - 6:00pm)
Formal Program

PLENARY SESSION I: OPENING REMARKS

Welcome
(8:30am-8:35am)
Thomas P. Behlen, Director, International Joint Commission’s Great Lakes Regional Office

The Charge
(8:35am-8:45am)
Gary Gulezian, U.S. Co-chair, Indicators Implementation Task Force [IITF]; Douglas P. Dodge, Canadian Co-chair, IITF, and Chairman, Indicators Implementation Task Group’s [IITG’s] Workshop on GL(B)E Integrity and Diversity

Background and Workshop Format
(8:45am-8:55am)
Bruce L. Bandurski, Director, IITG’s Workshop on GL(B)E Integrity and Diversity

Support Arrangements
(8:55am-9:00am)
Doug Alley, Secretary IITF and Secretary IITG
The essential character of ecology's subdisciplines is scale-dependent

— Timothy F.H. Allen and Thomas W. Hoekstra, Toward a Unified Ecology
<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
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<tbody>
<tr>
<td>9:00am-9:20am</td>
<td>Plenary Presentation 1</td>
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<tr>
<td></td>
<td>Anthony W. King, “A GL(B)E Monitoring Framework: Measures and Indicators for Operationalizing Ecosystem Integrity Notions”</td>
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<tr>
<td>9:20am-9:40am</td>
<td>Plenary Presentation 2</td>
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<td>Henry A. Regier, “Encompassing our considerations of Cultural Integrity in Evaluations of Natural System Integrity for the GL(B)E”</td>
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<tr>
<td>9:40am-10:00am</td>
<td>Plenary Presentation 3</td>
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<td>10:20am-10:40am</td>
<td>Break</td>
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<td></td>
<td>Discussion Amongst the Three Presenters Constituting the Panel</td>
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<td>Moderated by Douglas P. Dodge</td>
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<tr>
<td>10:40am-11:10am</td>
<td>Period of Open Questions Amongst the Workshop Participants</td>
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<td>Facilitated by Jim Martin</td>
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<tr>
<td>11:10am-11:30am</td>
<td>Plenary Presentation 4</td>
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<td>Anders W. Andren, “The Art of the Possible in Visualization and Monitoring at GL(B)E Scale”</td>
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<tr>
<td>11:30am-11:50am</td>
<td>Plenary Presentation 5</td>
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<td>Harold T. Garabedian, ““How Comprehensive an Indicator of the Integrity of the GL(B)E could be “an integrator” located in Vermont?””</td>
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<td>11:50am-12:10pm</td>
<td>Plenary Presentation 6</td>
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<td>James R. Karr, “The St. Lawrence River as Sentinel: Prospective use of its biology and ecology to guide Ecomanagement in the GL(B)E”</td>
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1-HOUR LUNCH BREAK

<table>
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<tr>
<th>Time</th>
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<tr>
<td>1:10pm-1:15pm</td>
<td>Commentary on the IJC’s Indicators Initiative/Expectations</td>
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<td></td>
<td>Susan B. Bayh, IJC Commissioner</td>
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<td>1:15pm-1:35pm</td>
<td>Discussion Amongst the three Presenters Constituting the Previous Panel</td>
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<td></td>
<td>Moderated by Douglas P. Dodge</td>
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<tr>
<td>1:35pm-2:05pm</td>
<td>Period of Open Questions Amongst the Workshop Participants</td>
</tr>
<tr>
<td></td>
<td>Facilitated by Jim Martin</td>
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</tbody>
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Break
Changes in a system defined by one [set of] criteria may have little impact on observations of that same system defined by other criteria. ... Translating ecosystem integrity from one perspective to notions of integrity for another can be problematic. ...

Assessment of ecosystem integrity is strongly dependent upon the perspective from which observations are organized. Definitions and measures of ecosystem integrity from one perspective may complement, contradict, or be largely independent of those from other perspectives. Care must therefore be taken to define the perspective used in making statements about ecosystem integrity and in making inferences about integrity from other perspectives. The strongest inference can be made by explicitly examining the integrity of alternative, complementary descriptions of an ecosystem. ...

Indicators of ecosystem integrity should include indicators from as many different perspectives and system descriptions, as practical. Those associated with human value judgements, like economics or aesthetics, should not be excluded by a prejudice for natural, ecological, or scientific perspectives.

— Anthony W. King, “Considerations of Scale and Hierarchy” in Ecological Integrity and the Management of Ecosystems
CONCURRENT SESSION 1: EVALUATIONS OF ECOSYSTEM INTEGRITY
(2:20pm-6:00pm)

Ecosystem integrity -- a concept which cannot be defined in a linear closed way -- addresses three major factors: (1) the ability to maintain normal operations under normal conditions, \textit{i.e.}, ecosystem health; (2) the ability of the ecosystem to cope with exogenous change; (3) the ability to continue the dynamic process of self-organization on an ongoing basis, \textit{i.e.}, to continue to evolve, develop, and proceed with the cycle of birth, growth, death, renewal.

DISCUSSION:
Facilitated by Jack Manno (Great Lakes Research Consortium)

Question 1: What is known about GL(B)E integrity indicators?
Question 2: What is not known about GL(B)E integrity indicators? (and why)
Question 3: What could be known about GL(B)E integrity indicators?
Question 4: What should be known about GL(B)E integrity indicators?

ON-SITE PARTICIPANTS FOR CONCURRENT SESSION 1:

Anders Andren, University of Wisconsin
Robert V. Bartlett, Purdue University
Pietro Bertollo, Wilfred Laurier University
Patrick T. Collins, Minnesota Department of Natural Resources
Paul L. Freedman, Limno-Tech, Inc.
Harold T. Garabedian, Vermont Agency of Natural Resources
Gary Gulezian, Great Lakes National Program Office, U.S. EPA
Isobel Heathcote, University of Guelph (Rapporteur, Concurrent Session 1)
James R. Karr, Institute for Environmental Studies, University of Washington
Anthony W. King, Environmental Science Division, Oak Ridge National Lab
Michael T. Mageau, Maryland International Institute for Ecological Economics
Henry A. Regier, designated observer from SOLEC
Laura Westra, University of Windsor & Global Integrity Project
Health is a state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity.

— World Health Organization’s official definition of health, coined in 1948
CONCURRENT SESSION 2: EVALUATION OF ECODIVERSITY TRENDS
(2:20pm-6:00pm)

“Ecodiversity” refers to the variation in life forms, genetic makeup, biological processes, ecological niches, and physical habitat.

DISCUSSION:
Facilitated by Gail Krantzberg (International Association for Great Lakes Research)

Question 1: What is known about GL(B)E ecodiversity indicators?
Question 2: What is not known about GL(B)E ecodiversity indicators? (and why)
Question 3: What could be known about GL(B)E ecodiversity indicators?
Question 4: What should be known about GL(B)E ecodiversity indicators?

ON-SITE PARTICIPANTS FOR CONCURRENT SESSION 2:

Dennis Albert, Michigan Natural Features Inventory
Susan B. Bayh, International Joint Commission, U.S.A. and Canada
Wesley Brown, University of Michigan
Dave Cotter, University of Windsor
Douglas P. Dodge, Ontario Ministry of Natural Resources
Clayton J. Edwards, North Central Forest Experiment Station, USDA
George Francis, designated observer from SOLEC
Christiane Hudon, St. Lawrence Centre of Environment Canada
Michael D. Jennings, Biological Resources Division, Geological Survey, USDI
Jeremy T. Kerr, York University
Jim Martin, Kapur & Martin Associates (Rapporteur, Concurrent Session 2)
Harvey Shear, Ontario Region, Environment Canada
Since taxa are the core of biodiversity, names for taxa are the most critical component of any language of biodiversity.

— F. Christian Thompson, “Names: The Keys to Biodiversity” in Biodiversity II: Understanding and Protecting Our Biological Resources
Wednesday, 17 June 1998 (Informal Program)

Break
(6:00pm-6:40pm)

Dutch-treat Dinner [with IJC Commissioner, IITF Co-chairs, and Workshop Organizers]
(6:40pm-8:00pm)

Hospitality Suite for On-site Participants [attendance optional, but recommended]
(8:00pm-9:30pm)

[Workshop Review Session for IITF Co-chairs and Workshop Organizers; Scott Green of IJC’s Windsor Office will take notes at this review session.]
(8:00pm-9:00pm)

Thursday, 18 June 1998 (8:30am - 2:50pm)
Formal Program resumes

PLENARY SESSION II: FINDINGS AND INITIAL CONCLUSIONS ABOUT INDICATORS OF GL(B)E INTEGRITY AND DIVERSITY

A. Chair With A View: Workshop Chairman’s View of the Concurrent Sessions and of the Tasks Remaining in and Subsequent to this Workshop
(8:30am-8:40am) A brief overview by Douglas P. Dodge (et al., if necessary)
(8:40am-8:45am) Support Arrangements/Rearrangements; Announcements

B. Findings and Conclusions from Concurrent Session 1; Q & A
(8:45am-9:30am) A report by Isobel Heathcote

C. Findings and Conclusions from Concurrent Session 2; Q & A
(9:30am-10:15am) A report by Jim Martin

Break
Yin and yang, differentiation and integration, community and individuality, these binaries are not so much opposites as complements --- the diversity of life rather than its unity.  

[paraphrasing] Joined, both halves of each binary and all the binaries summed yield what Loyal Rue calls a federation of meaning.

— Connie Barlow, *green space, green time*
D. Discussion (Prospective Integrity and Ecodiversity Indicators for Evaluations by the IJC)
(10:35am-11:50am) Facilitated by Jim Martin

1-HOUR LUNCH BREAK

E. Using Indicators for Evaluation of Agreement Progress and for Alerting in a Systematic and Comprehensive Ecosystem Approach
1. Being systematic, how close can we come to comprehension? To comprehensiveness?
(12:50pm-1:10pm) A view presented by Robert V. Bartlett, Department of Political Science, Purdue University

2. Ecodiversity & Health: The Coin’s Other Side Whose Reverse is Impoverishment and Disease/Injury
(1:10pm-1:30pm) A view presented by Michael T. Mageau, Maryland International Institute for Ecological Economics

F. The Land Ethic and Governance Suitably Dynamized in Desired Outcomes
1. Is Moral Considerability a Sufficient Ethical Basis for a Systematic and Comprehensive Ecosystem Approach? What definition of “integrity” at the global level would serve as a necessary-and-sufficient context for considerations of GL(B)E integrity?
(1:30pm-1:50pm) A view presented by Laura Westra, University of Windsor & Global Integrity Project

2. Some Implications for Resilient GL(B)E Governance
(1:50pm-2:10pm) A view presented by George Francis, designated observer from SOLEC

G. Discussion of The Relational Question which fomented this workshop -- Given desired outcomes (goals) in resilient governance, what are the prospects for appropriately-firm yet dynamic connectedness amongst:
   (a) ethical bases for GL(B)E ecomanagement;
   (b) virtuous appreciation of diverse and healthy (not just impaired) ecosystems at all scales -- and of integrity at GL(B)E scale;
   (c) selection-and-use of indicators by the IJC for its evaluations?
(2:10pm-2:40pm) Moderated by Douglas P. Dodge

WORKSHOP 1 WRAP-UP: Gary Gulezian, Co-chair of IJC’s IITF
(2:40pm-2:50pm)
SCHEDULE-AT-A-GLANCE FOR IITG WORKSHOP

Tuesday, 16 June 1998
6:00pm-7:30pm Reception

Wednesday, 17 June 1998
8:00-8:30  Registration/Coffee
8:30-8:35  Welcome
8:35-8:45  The Workshop Charge (note the need to keep to a strict schedule; note the use of self-introductions)
8:45-8:55  Background and Workshop Format
8:55-9:00  Support Arrangements
9:00-9:20  Plenary Presentation 1
9:20-9:40  Plenary Presentation 2
9:40-10:00 Plenary Presentation 3
10:00-10:20 Break
10:20-10:40 Discussion amongst the three Presenters constituting the Previous Panel
10:40-11:10 Period of Open Questions (from the On-site Workshop Participants and Others)
11:10-11:30 Plenary Presentation 4
11:30-11:50 Plenary Presentation 5
11:50-12:10 Plenary Presentation 6
12:10-12:30 Lunch Break
1:10-1:15  IJC Commissioner's Commentary on the IJC’s Indicators Initiative/Expectations
1:15-1:35  Discussion amongst the three Presenters constituting the Previous Panel
1:35-2:05  Period of Open Questions Amongst the Workshop Participants
2:05-2:20  Break
2:20-6:00  Concurrent Sessions (Session 1: Ecosystem Integrity; Session 2: Ecodiversity)
6:00-6:40  Break
6:40-8:00  Dutch treat Dinner (with IJC Commissioner, IITF Co-chairs, and Workshop Organizers)
8:00-9:30  Hospitality Suite for On-site Participants (attendance optional but recommended)
[8:00-9:00] Workshop Review Session for IITF Co-chairs and Workshop Organizers (including facilitators)
[Scott Green of IJC’s Windsor Office will take notes at this review session.]

Thursday, 18 June 1998
8:30-8:40  Workshop Chairman’s Overview of the Concurrent Sessions and of Task Remaining
8:40-8:45  Support Arrangements/Rearrangements; Announcements [Workshop Chairman (et al., if necessary)]
8:45-9:30  Report on Findings and Conclusions from Concurrent Session 1; Q & A
9:30-10:15 Report on Findings and Conclusions from Concurrent Session 2; Q & A
10:15-10:35 Break
10:35-11:50 Discussion on Prospective Integrity and Ecodiversity Indicators* for Evaluations by the IJC
11:50-12:50 Lunch Break
[12:50-1:30] Indicators for Evaluation/Alerting in a Systematic/Comprehensive Ecosystem Approach
12:50-1:10  (1) Being systematic, how close can we come to comprehension? To comprehensiveness?
1:10-1:30  (2) Ecodiversity & Health: The coin's other side whose reverse is ... disease/injury
[1:30-2:10] The Land Ethic and Governance Suitably Dynamized in Desired Outcomes
1:30-1:50  (1) Is moral considerability a sufficient basis...? What definition of “integrity” at the global level...
1:50-2:10  (2) Some Implications for Resilient GL(B)E Governance
2:10-2:40  Discussion of The Relational Question which fomented this workshop
2:40-2:50  Workshop Wrap-up by IITF Co-chair (U.S. Section)

*What should be known:
(A) about these indicators prior to their selection by the IJC for use in Agreement evaluations;
(B) about criteria for IJC’s de-selecting these indicators and replacing them with more representative indicators as time goes on, thus losing data/information continuity;
(C) about criteria for IJC’s change (including recombining) of its set of desired outcomes — outcomes pertaining to ecosystem integrity and ecodiversity & biodiversity.
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(Windsor, Ontario; 17-18 June 1998)

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Non-specialists often lump Earth's life forms into two kingdoms: plants and animals. For many years biologists have recognized five: plants, animals, monera (including bacteria and blue-green algae), fungi and protists, which include protozoa. Now DNA studies suggest there are at least two kingdoms of bacteria and four of protists. Compared to bacteria and two protist groups, plants and animals are newcomers.
Good policy design relies upon concepts and methodologies for the organized treatment of the unknown, the missing, and the intentionally “left out”. Any useful analysis is based on an abstraction of reality. Such analyses therefore will always be incomplete. Attempts to “include everything” result in ambiguity, confusion, and intractability.

The irony is that the more rigorous and organized the attempt to abstract a useful portion of reality for analysis, the more tempting it is to presume that those features left out of the analysis are unimportant. The more effectively the known is analyzed, the more likely it is that decisions will be based upon the analysis. But the unknown cannot be ignored, and any attempt to do so is bound to end in unpleasant surprises and policy failures...

For effective policy design, it is therefore critically important to emphasize that what is left out at each stage of the analysis is much more important than what is kept in. ...

We must “look outward” from the known to the unknown. If the bounding process has been effectively accomplished, then it should be clear, at least, which known systems or known phenomena have been intentionally left out. ... An organized treatment of what is left out is the minimum requirement for a strategy of creatively managing the unknown.

— Adaptive Environmental Assessment and Management, edited by C.S. Holling