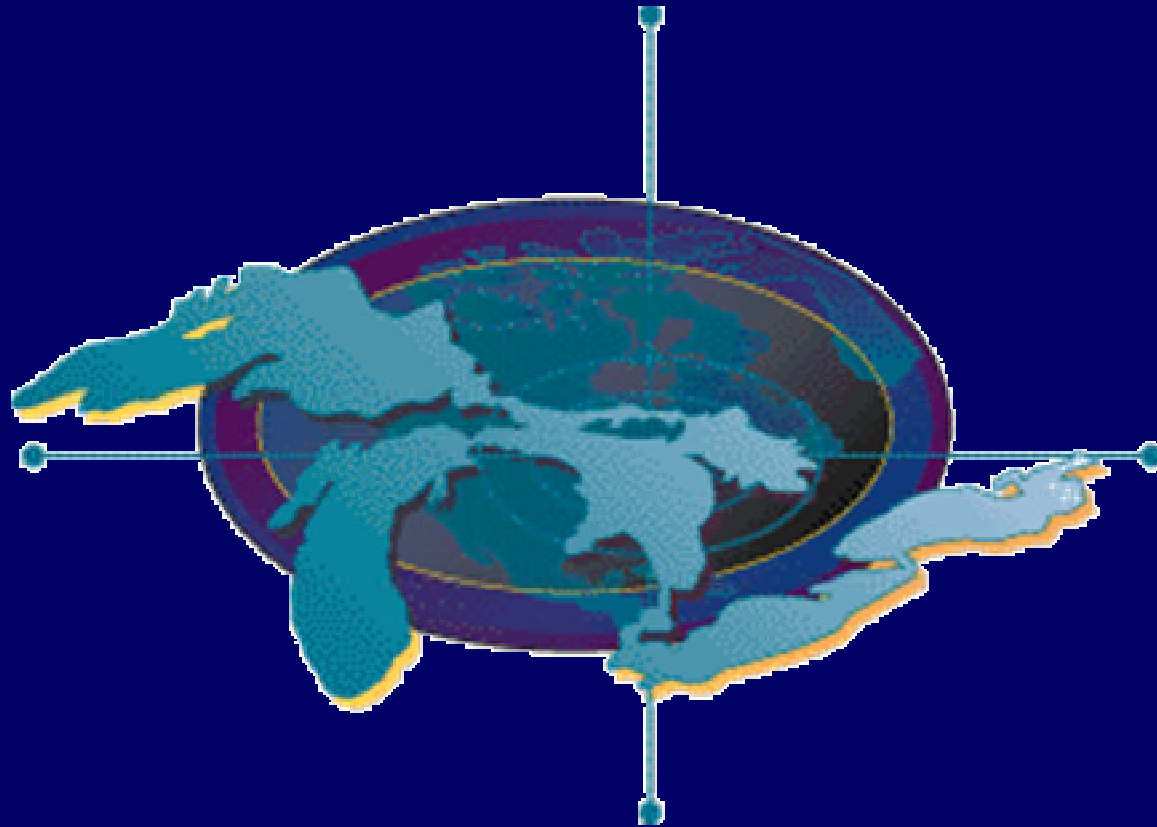


Biological Integrity of the Great Lakes Basin



Presented by: Douglas Dodge

Overview of this Presentation

- Biological Integrity (BI) – Why & What
 - BI 2001 Workshop
 - Interviews
- Results
 - Proposed BI Indicators
- Emerging Issues
- What's Next: at SOLEC 2002 & Beyond

Why Choose Biological Integrity for SOLEC 2002?

- SOLEC is rooted in the Great Lakes Water Quality Agreement (GLWQA)
- Purpose of the GLWQA ... "to restore & maintain the chemical, physical & biological integrity of the waters of the Great Lakes Basin Ecosystem"



- The Basin is an integrated entity and is more than just water
- SOLEC 1998 expanded focus from “waters” to basin ecosystem
- Physical and chemical integrity are forces acting on biological integrity



Great Lakes Ecosystem

80 SOLEC Indicators

Ecosystem Integrity (HEALTH AND RESILIENCY)

Biological Integrity
(Health and Resiliency of Native Species)

Chemical Integrity

Physical Integrity

Other Stresses

Other Stresses

Non-Native Species



What is BIOLOGICAL INTEGRITY?

- For SOLEC 2002

“Biological integrity is the capacity to support and maintain a balanced, integrated & adaptive biological system having the full range of elements [the form] & processes [the function] expected in a region’s natural habitat”

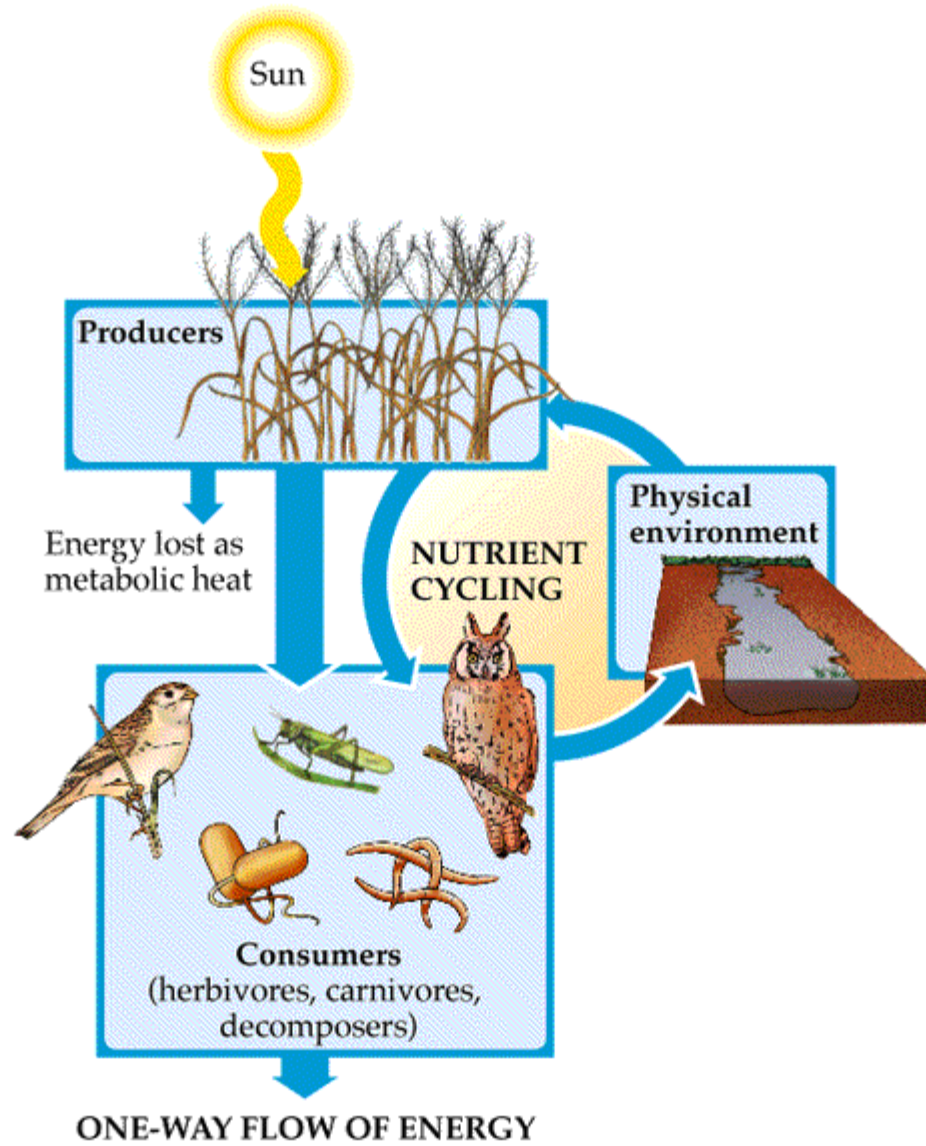
James R Karr, 1991(modified)

AND

Why is Biological Integrity Important?



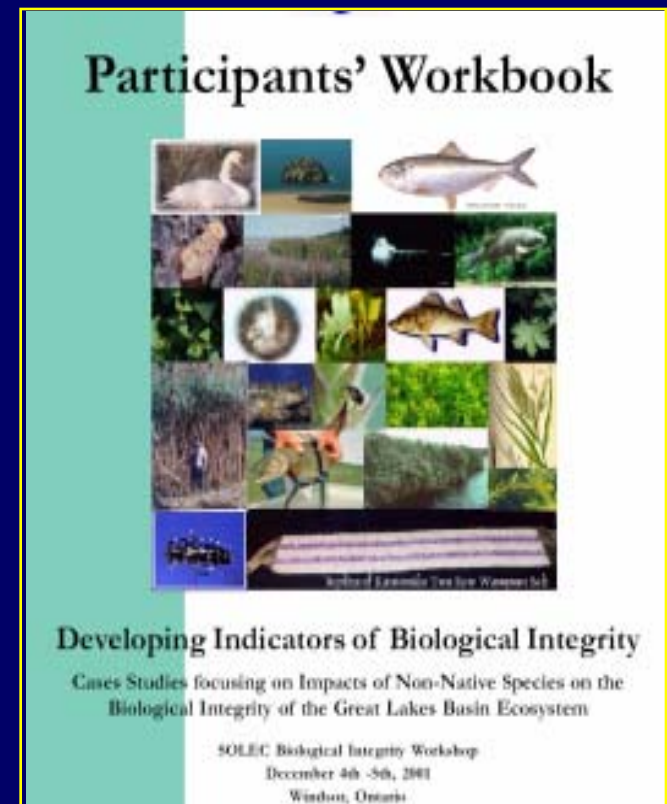
© 1990 Mark Thomas



When a system is challenged by stresses outside what the biota have experienced, biological integrity can be compromised.

2001 Biological Integrity Workshop

- Focused on non-native species as a pervasive stress on native species
- Tested the 2000 suite of indicators for applicability and robustness to measure biological integrity
- Developed scenarios for avian, terrestrial and aquatic communities
- First Nations/Tribal perspective



2001 Biological Integrity Workshop

- State of knowledge
- Do current indicators measure biological integrity?
- Do we need new indicators?
- Other factors affecting biological integrity

2001 Biological Integrity Workshop

- Other factors combine with non-native species to intensify stress
- Options for management
- Issues & questions for further work at SOLEC 2002

James Karr on the Biological Integrity Workshop “Approach”

- Think gradient
- Understand baseline condition
- Think holistically

James Karr on the Biological Integrity Workshop “Approach”

- Understand the importance of two questions:
 - What to measure?
 - How to decide?
- Be careful of habitat goals
- Keep in mind, that the goal is assessment, not monitoring

Results of the Biological Integrity Workshop

Indicators with Proposed Minor Modifications

- Naturalized Salmon and Trout
- Walleye
- Preyfish Populations



Steve Geving, Minnesota
Department of Natural Resources

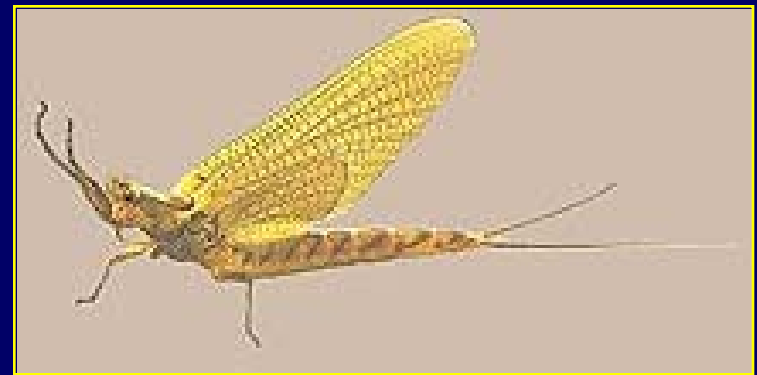
Proposed Minor Modifications

- Lake Trout
- Benthic Biomass
- Zooplankton Populations
- Land Use



Proposed Major Modifications

- Fish Habitat
- Hexagenia
- Diporeia

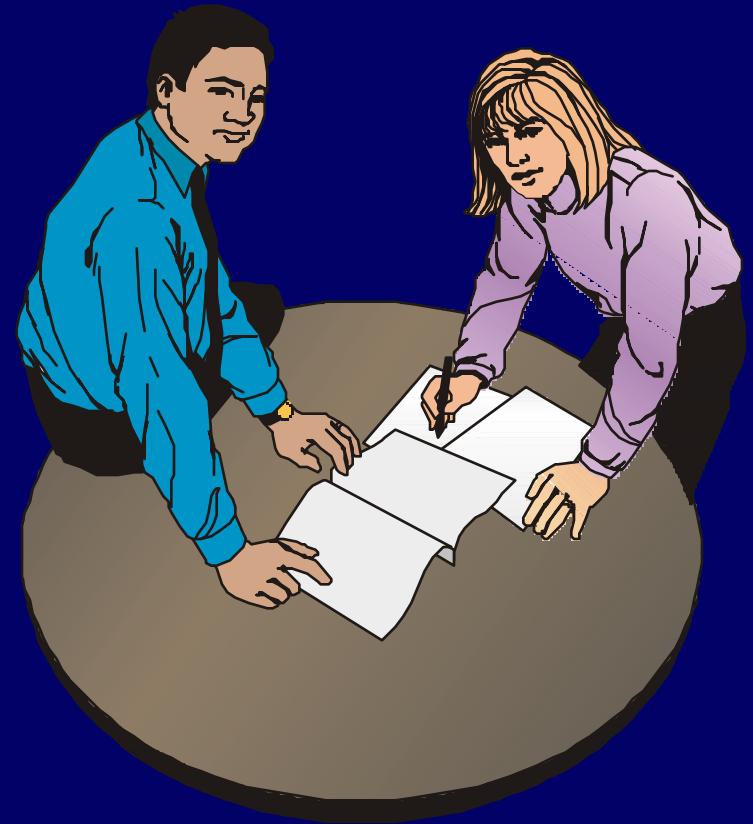


Proposed New Indicators

- Health of Terrestrial Plant Communities
- Landscape Ecosystem Health
- Status and Protection of Special Places & Species

2002 Survey of Lake Experts

- Lake by lake + 2 connecting channels
- Science issues
- Indicators & indices
- Managerial actions
- Potential (new?) invaders



Additional Indicators

- Nominated 31 Great Lakes indicators
- Many revised by BI Workshop participants
- Groupings and indicators do not stand alone
- Interconnected as form and function change

Impacts from Non-Native Species

- Sea lamprey



- Presence, Absence & Expansion of Invasive Plants

- Non-Native Species



Changes in Communities

(Benthos and Plankton; Fish; Birds; Parasites; Diseases)

- Salmon & Trout
- Walleye
- Hexagenia
- Preyfish Populations
- Native Freshwater Mussels
- Lake Trout & Scud

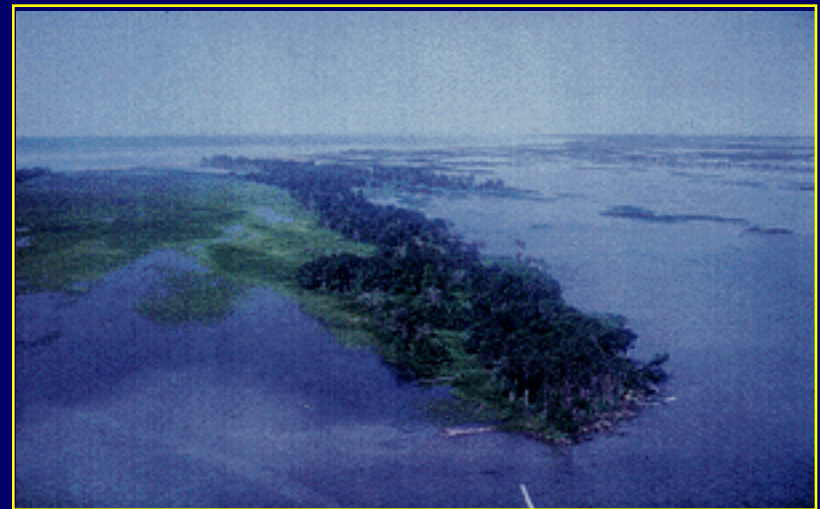
Changes in Communities

- Deformities, Erosion, Lesions & Tumors in Nearshore Fish (DELT)
- Benthos Diversity/Abundance
- Phytoplankton Populations
- Zooplankton Populations
- Wetland-Dependent Bird Diversity & Abundance
- Community/Species Plans



Habitat Alterations related to Fragmentation; Lake Levels; Wetland Losses; Sand Dunes

- Aquatic Habitat
- Coastal Wetland Area by Type
- Sediment Flowing into Coastal Wetlands
- Water Level Fluctuations



Habitat Alterations related to Fragmentation; Lake Levels; Wetland Losses; Sand Dunes

- Habitat Adjacent to Coastal Wetlands
- Habitat Fragmentation
- Extent & Quality of Nearshore Land Cover
- Stream Flow
- Nearshore Protected Areas

Changes in Contaminants & Nutrients

A. Contaminants in:

- Recreational Fish
- Young-of-the-Year Spottail Shiners
- Colonial Nesting Water Birds
- Fish Tissue
- Snapping Turtle Eggs



Contaminants affecting:

- Productivity of Bald Eagles
- The American Otter

B. Nutrients

- Phosphorus Concentrations & Loadings



Summary & Emerging Issues

Non-native species:

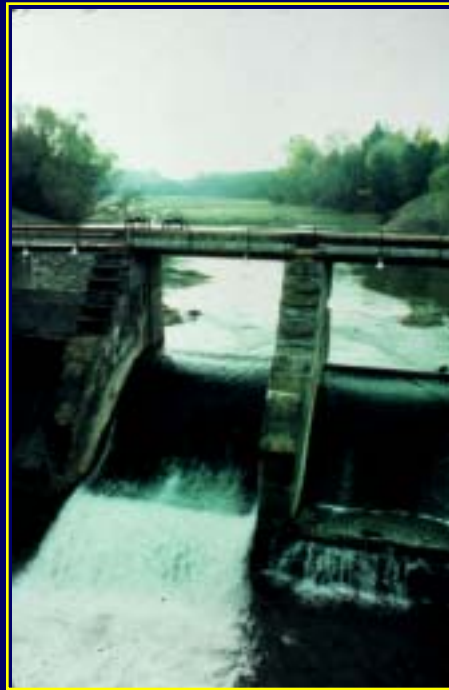
- Impede the restoration and maintenance of biological integrity of the Basin
- Are implicated in deterioration and loss of native species
- Change trophic dynamics nutrient availability, habitat, and the flow and sequestering of contaminants
- May increase vulnerability to parasites and diseases
- Have significant economic impact

Non-Native Species

- What species is the next invader?
 - How to prepare?
 - Parasites/Diseases
 - Tench, Asian Carp & Snakehead
 - Species extinction is forever; so is the introduction of non-native species



Habitat Modifications



Nutrient Quality & Quantity



Cladophora glomerata

Type E Botulism



The Challenge for SOLEC 2002 & Beyond...

- Develop indicators that:
 - Integrate information
 - Combine and recombine
 - Lead to the development of indices

The Challenge for SOLEC 2002 & Beyond...

- Break Out Session
 - Scientific
 - Relevant
 - Necessary
 - Sufficient
 - Feasible
- Reporting the State of Biological Integrity in the Great Lakes Basin at SOLEC 2004