Ecosystem Approach to GL Science

Great Lakes Water Quality Agreements (GLWQA)

- Provide common ground for GL science/management-"ecosystem approach"
- Long history of Canada/U.S. cooperation on GL began with Boundary Waters Treaty of 1909
  - "boundary waters and waters flowing across the boundary shall not be polluted by either side to the injury of health or property on the other."
  - Treaty created the International Joint Commission (IJC) to monitor water quantity/quality conditions along the common border and to recommend actions to the federal governments

- GLWQA of 1972: governments recognize phosphorus/nutrient problems
  - Algae and dead fish on beaches, low oxygen levels/dying lakes
  - Treaty commitments funded scientific and management efforts to:
    - Reduce P loadings into GL
    - Build sewage treatment plants (WWTP's)
    - Reduce P in detergents
    - Control urban/rural nutrient run-off (non-point source)
  - P loading targets (10 ug/L) mostly met now
    - Water clarity/ eutrophication conditions much improved basin-wide

- GLWQA of 1978: governments recognized greater threat of persistent toxic chemical contamination
  - "Toxics" bioconcentrate to become dangerous to animals/humans
  - Renegotiated agreement set specific goals and target concentrations for metals, organics, pesticides and persistent toxics (e.g., PCB's, mirex)
  - Two key, far-reaching concepts incorporated:
    - "Ecosystem Approach" to managing the GL: "the interacting components of air, land, water and living organisms, including humans, within the [Great Lakes] drainage basin" are inextricably intertwined and political boundaries are meaningless
    - Philosophy of zero discharge and the virtual elimination of persistent toxics: "The intent...is to virtually eliminate the input of persistent toxic substances in order to protect human health and to ensure the continued health and productivity of living aquatic resources and human use thereof....The philosophy adopted for the control of inputs of persistent toxic substances shall be zero discharge."

- GLWQA Amendments of 1987: citizens and scientists were frustrated that the lofty goals of the Agreement were not being addressed adequately by the governments
  - Studies by the Royal Society of Canada, U.S. National Academy of Sciences, IJC and GLU (Great Lakes United citizen activist group) documented implementation problems
  - Amended Agreement articles now specify purposes, objectives, requirements and programs agreed to by the governments

Detailed descriptions of IJC, WQB (Water Quality Board) and SAB (Science Advisory Board) responsibilities included:

17 Annexes provide details of programs committed to by the governments; e.g.,

Specific Water Quality Objectives
RAPs (Remedial Action Plans), LaMPs (Lakewide Mgmt. Plans)
Phosphorus Control, Non-Point Pollution Sources
Persistent Toxic Substances, Airborne Toxics
Contaminated Sediments, Contaminated Groundwater

Public now must have opportunities for input into GL water quality decisions

Supported/pushed by the public and scientific community, IJC has become proactive to jawbone the governments to live up to the Agreement

IJC language has become pointed, blunt, activist

Pushing for principle of "Reverse Onus"

Rather than agencies/citizens having to prove a chemical is harmful before it is banned, producers should have to prove it is safe for the environment before it can be produced/released

Key GL research areas focus on changes in the GL ecosystem due to persistent toxic chemicals and changes in food web dynamics affecting fisheries

Contaminated sediments: major reservoir of hydrophobic toxics

Research focuses on physical redistribution process (currents, etc.) and remediation (e.g., ARCS program, RAPs)

Food webs: major pathway of dangerous concentrations to humans/birds is eating GL fish

Research focuses on fates and effects, concentrations in tissues

Related fishery issues include:

Balancing predator/prey numbers in an artificial fishery system
Study of key reproductive and nursery habitats (wetlands, tributaries),
Control and effects of persistent (sea lamprey) and new exotic species (zebra mussel, BC, ruffe)

Mass balance models: identify and characterize key reservoirs, fluxes and pathways for contaminants and nutrients in the ecosystem

Studies focus on key management intervention points, atmospheric deposition, and watershed non-point sources

Effects of toxics on organism health

Fish and wildlife effects as indicators of human risk
Effects of GL fish consumption on humans
Endocrine disruptor potential re: reproduction, behavior, immune system

Physical and biological scientists work together in the Great Lakes ecosystem to understand and solve the problems created by human abuse of the system

Governments recognize that an integrated, ecosystem approach to management is critical to understanding and ultimate success

Great progress has been made, but more must be done to restore ecosystem integrity

Goal is to be able to eat self-reproducing fish populations safely = best integrator of ecosystem health