State of the Lakes Ecosystem Conference 2004

Highlights from Indicator Reports

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Overview

As parties to the Great Lakes Water Quality Agreement, the governments of Canada and the United States are responsible for accurate reporting on the state of the Great Lakes. The State of the Lakes Ecosystem Conference (SOLEC) is a result of this commitment for reporting. With the establishment of a consistent suite of ecosystem indicators, the health of the Great Lakes basin can be objectively assessed. Regular reporting of a core set of indicators will promote more efficient and successful management, as well as create more accessible information for policy makers and the public.

SOLEC 2004 will continue to update and assess the state of the Great Lakes using the suite of indicators. Indicator reports were prepared for 56 of the 81 indicators presently in the Great Lakes suite. To accommodate the increasing number of reports, the indicators have been assembled into 9 groups: Contamination, Biotic Communities, Invasive Species, Coastal Zones, Aquatic Habitats, Human Health, Land Use – Land Cover, Resource Utilization, and Climate Change. Several sub-groupings are also contained within the major categories, and several indicators are included in more than one bundle or sub-bundle.

Indicator Assessment

Authors of the indicator reports were requested to assess, in his or her best professional judgment, the overall status of the ecosystem component in relation to established endpoints or ecosystem objectives, when available. Four status categories were used, designated here by colour:

Good. The state of the ecosystem component is presently meeting ecosystem objectives or otherwise is in acceptable condition.

Fair. The ecosystem component is currently exhibiting minimally acceptable conditions, but it is not meeting established ecosystem objectives, criteria, or other characteristics of fully acceptable conditions.

Poor. The ecosystem component is severely negatively impacted and it does not display even minimally acceptable conditions.

Mixed. The ecosystem component displays both good and degraded features.

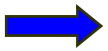
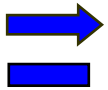
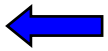
Four categories were also used to denote “trajectory” or current trends over time of the ecosystem component that the indicator addresses, designated here by shape:

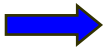
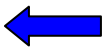
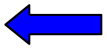
Improving. Information provided by the report shows the ecosystem component to be changing toward more acceptable conditions.

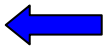
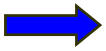
Unchanging. Information provided by the report shows the ecosystem component is neither getting better nor worse.

Deteriorating. Information provided by the report shows the ecosystem component to be changing away from acceptable conditions.

Undetermined. Data are not available to assess the ecosystem component over time, so no trend can be identified.

Category	Indicator	Purpose/Ecosystem Objective	Assessment	State of the Ecosystem	Current and Future Pressures
Contamination	Contaminants in Whole Fish	• Great Lakes waters should be free of toxic substances that are harmful to fish and wildlife populations and the consumers of these biota		• Since the late 1970s, levels of historically regulated contaminants such as PCBs, DDT and Hg have generally declined in most fish species monitored • A group of brominated flame retardants have been reported in fish tissues for several years throughout the Great Lakes basin	• One of the most immediate pressures relates to the increased proliferation of non-native species, altering fish community composition and food web energy flows, thereby altering bioaccumulation rates • Some chemical manufacturers have already begun voluntary phase-out of brominated flame retardants
	Atmospheric Deposition of Toxic Chemicals	• The Great Lakes should be free from materials entering the water as a result of human activity that will produce conditions that are toxic to human, animal, or aquatic life		• Mixed Improving for (PCBs), banned organochlorine pesticides, and dioxins and furans • Mixed Unchanging for polycyclic aromatic hydrocarbons (PAHs) and mercury • In general, concentrations of banned or restricted pesticides are decreasing over time in air and precipitation • PCBs continue the trend of volatilizing out of the Lakes but tending towards equilibrium	• Residual sources of PCBs remain in the U.S. and throughout the world; therefore, atmospheric deposition will still be significant at least decades into the future • Even though emissions from many sources of mercury and dioxin have been reduced over the past decade, both pollutants are still seen at elevated levels in the environment • Voluntary pollution prevention activities, technology-based pollution controls, and chemical substitution (for pesticides and industrial chemicals) can aid in reducing the amounts of toxic chemicals deposited to the Great Lakes
Biotic Communities	*Diporeia*	• To maintain a healthy, stable population of *Diporeia* (a benthic macroinvertebrate) in offshore regions of the main basins of the Great Lakes.		• Populations are currently in a state of decline in portions of Lakes Michigan, Ontario, Huron and Eastern Lake Erie • In areas of the Lakes where *Diporeia* are still present, abundances are much lower than in the 1970s and 1980s • Declines coincide with introduction of non-native mussel species • Only in Lake Superior do their numbers appear stable	• As populations of non-native mussels continue to expand, it may be expected that declines will be more extensive • Declining populations of *Diporeia* may have detrimental effects on lake whitefish and salmon, which feed on them extensively
	Walleye	• To restore and protect historically important habitats that support natural stocks of walleye as the top fish predator		• Reductions in phosphorus loadings in the 1970s and fishery management programs in the 1980s lead to increased adult survival, especially in Lake Erie • Declines in populations occurred after the mid-1990s through 2003 in most areas due to shifting environmental states and changing fisheries; however, conditions are still improved from the 1970s	• Degradation and loss of adequate spawning and nursery habitats is the primary concern for the future health of walleye populations and can result from both human causes and natural environmental variability
	Lake Sturgeon	• Lake sturgeon is an important native species that is listed in the fish community objectives for all of the Great Lakes. Presence of lake sturgeon in abundance in the Great Lakes will indicate a healthy ecosystem		• Lake sturgeon populations are known to be abundant in the connecting waterways of the Great Lakes • Very little information exists on juvenile lake sturgeon • In many systems, access to spawning habitat has been blocked, and other habitats have been altered • There are remnant populations in each basin of the Great Lakes, and some of these populations are large in number (tens of thousands of fish)	• Barriers that prevent lake sturgeon from moving into tributaries to spawn are a major problem • Predation on eggs and newly hatched lake sturgeon by non-native predators may also be a problem • The presence of high densities of round gobies and the spread of Botulism Type E produced a die-off of lake sturgeon in Lake Erie in 2001 and 2002 and perhaps in Lake Ontario in 2003

	Contaminants Affecting Productivity of Bald Eagles	• To assess the potential harm for wildlife eating contaminated prey, and to assess the success rates of nesting attempts and the number of developmental deformities in young bald eagles		• Concentrations of organochlorine chemicals are decreasing or stable but still above No Observable Adverse Effect Concentrations (NOAECs) for the primary organic contaminants DDE and PCBs • The number of bald eagle territories has increased markedly from the depths of the population decline caused by DDE • The percentage of nesting pairs producing one or more fledgling and the number of young produced per territory have risen, indicating that the population is healthy and capable of growing	• Relatively large habitat units (territories) are necessary to support eagles and continued development pressures along the shorelines of the Great Lakes constitutes a concern • Eagles are relatively rare and contaminant effects on individuals can be important to the well-being of local populations
Invasive Species	Sea Lamprey	• To control sea lamprey populations in support of fish community objectives, in particular objectives for lake trout, the top native predator		• The first complete round of stream treatments with the lampricide TFM, as early as 1960 in Lake Superior, successfully suppressed sea lampreys to less than 10% of their pre-control abundance in all of the Great Lakes • Recent increases in sea lamprey in the Great Lakes have caused an increase in stream treatments, which will take another 2-4 years to see any significant effect on lamprey populations	• The potential for sea lamprey to colonize new locations is increased with improved water quality and removal of dams • New control techniques in addition to lampricides are also being used, including: sterile-male-release technique, the installation of barriers to stop the upstream migration of adults; and pheromone treatments
	Aquatic Non-native Species	• Reporting non-native species introductions into the Great Lakes ecosystem will highlight the need for more effective safeguards to prevent the introduction and establishment of new non-native species		• Contrary to expectations, the reported invasion rate has increased following initiation of voluntary guidelines in 1989 and mandated regulations in 1993 • Ship ballast water is the major vector transporting unwanted organisms into the Great Lakes • Silver and bighead carp escapees from southern U.S. fish farms have been sighted 20 miles below an electric barrier in the Chicago Sanitary and Ship Canal, which connects the Mississippi River and the Great Lakes	• Introductions of non-native species will continue because of increasing global trade; new diversions of water into the Great Lakes; fast growing aquaculture industries; and changes in water quality and temperature • Increasing world trade and travel will elevate the risk that new species will continue to gain access to the Great Lakes ecosystem
Coastal Zones	Coastal Wetlands Area by Type	• Reverse the trend toward loss of Great Lakes coastal wetlands, ensuring adequate representation of wetland types across their historical range		• Coastal wetlands totaling 216,545 ha have been identified within the Great Lakes and connecting rivers up to Cornwall, Ontario • Wetlands serve as a refuge for native mussels and fish that are threatened by nearby non-native invasive species • Despite significant loss of coastal wetland habitat in some regions of the Great Lakes, the lakes and connecting rivers still support a diversity of wetland types • The St. Clair River delta, where the St. Clair River outlets into Lake St. Clair, is the most prominent single wetland feature accounting for over 13,000 ha	• Reductions in wetland area are continuing from filling, dredging and draining for conversion to other uses such as urban, agricultural, cottage development, shoreline modification, adjacent land use, non-native species invasions and climate change • Global climate variability and change have the potential to reduce water levels in the system in addition to changing seasonal storm intensity and frequency, water level fluctuations and temperature
	Amphibian Diversity and Abundance	• To maintain diversity of Great Lakes wetland amphibian communities, and to sustain breeding amphibian populations across their historical species range		• From marsh monitoring programs, 13 species were recorded during 1995-2002 • Statistically significant declines in occurrence trends were detected for American Toad, Chorus Frog, Green Frog and Northern Leopard Frog • Anecdotal and research evidence suggests that wide variations in occurrence of many amphibian species at a given site is a natural and ongoing phenomenon	• Habitat loss and deterioration remain the predominant threat to Great Lakes amphibian populations

Aquatic Habitats	Groundwater: Base Flow	• To assess the contribution of groundwater to total stream flow and to detect the impacts of anthropogenic factors on the quantity of the groundwater resource		• There is a diversity of groundwater conditions within the Great Lakes basin, and there is significant contribution of groundwater discharge to flow within the tributaries of the Great Lakes • Groundwater is typically a high quality water supply that is used by a significant portion of the population, particularly in rural areas where it is often the only available source of water • Base flow due to groundwater discharge is critical to the maintenance of water quantity and quality and the integrity of aquatic species and habitat	• Increasing the extent of impervious surfaces and installation of drainage to increase agricultural productivity may reduce recharge and ultimately discharge • Groundwater discharge may be impacted by activities such as the channelization of water courses • Further analysis is required to determine if the lower values of base flow index that occur in various locations around the basin are the result of geologic factors, urban development, or the intensive use of groundwater
Human Health	Beach Advisories, Posting and Closings	• To assess the number of health-related swimming advisories, beach closures and posting days for freshwater recreational areas (beaches) in the Great Lakes Basin		• In the U.S. and Canada, as the frequency in monitoring and reporting increases, more advisories, postings and closures are also observed, especially after 1999 • In 2000, both U.S. and Canada experienced a doubling of beaches that had advisories or closings for more than 10% of the season	• Additional point and non-point source pollution at coastal areas due to population growth and increased land use may result in additional beach closings and advisories • Conditions required to post Ontario beaches as unsafe have become more standardized due to the 1998 Beach Management Protocol, but the conditions required to remove the postings remain variable
	Contaminants in Sport Fish	• To assess potential human exposure to contaminants through consumption of popular sport species (e.g., Coho Salmon)		• Each state or province is responsible for developing fish advisories for protecting the public from pollutants in fish and tailoring this advice to meet the health needs of its citizens • All Great Lakes have consumption advisories based on PCBs, dioxin and mercury • Toxaphene, chlordane and mirex trigger advisories in some lakes	• Organochlorine contaminants in fish in the Great Lakes are generally decreasing • As these contaminants decline, mercury is becoming a more important contaminant of concern regarding the edibility of the fish
Land Use – Land Cover	Forest Lands	• To describe the extent, composition and structure of Great Lakes basin forests		• Forests cover 27.8 million hectares, or about half (51%), of the land in the Great Lakes basin • Maple-beech-birch is the most extensive forest type, representing 7.6 million hectares, or 27% of total forest area in the basin • Aspen-birch forests constitute the second-largest forest type, covering 6.5 million hectares, or 23% of the total	• Urbanization, seasonal home construction and increased recreational use – driven in part by the desire of an aging and more affluent population to spend time near natural settings – are among the general demands being placed on forest resources nationwide
Resource Utilization	Water Withdrawal	• The rate of water withdrawal can be used to evaluate the sustainability of human activity in the Great Lakes basin		• Water was withdrawn from the Great Lakes basin at a rate of 46,046 million gallons per day (MGD) in 2000, with almost two-thirds withdrawn in the U.S. side (30,977 MGD) and the remaining one-third in Canada (15,070 MGD) • Self-supplying thermoelectric and industrial users withdrew over 80% of the total • Groundwater was withdrawn at a rate of 1,541 MGD in 2000, making up 3% of total water withdrawals • There is currently no net loss of water due to diversions	• In the immediate future, the greatest pressure will come from communities bordering the basin, where existing water supplies are scarce or of poor quality • There is no clear trend in forecasting regional water use • Reducing withdrawals, or at least mitigating further increases, will be the key to lessening consumptive use