Contribution of the International Joint Commission to Great Lakes Renewal

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The Boundary Waters Treaty of 1909 established the International Joint Commission (IJC) as an organization designed to resolve disputes and to avoid conflicts over transboundary environmental matters. Article IV of the Treaty provides the provision that neither party shall cause pollution that would injure the health or property of the other side. In 1972, the Great Lakes Water Quality Agreement (GLWQA) was created with the goal of enhancing and maintaining the quality of the waters of the Great Lakes Basin Ecosystem. The Agreement is considered to be a standing reference under the Boundary Waters Treaty. The signators or "Parties" to the GLWQA are the federal governments of Canada and the United States who commit to collaborate with other governmental jurisdictions within the Great Lakes basin. The IJC does not have authority for implementation of the GLWQA, but serves to alert, advise and assist the governments in achieving their goals under the Agreement. This paper draws on empirical evidence and experiential knowledge to report on the role of the IJC in the GLWQA, and its achievements in advancing the goal of enhancing and maintaining ecosystem health in the world's largest freshwater ecosystem, the Great Lakes.

Key Words: ecosystem approach, virtual elimination, remedial action plans

Introduction

The conviction of those who negotiated the Boundary Waters Treaty was that solutions to the boundary problems should be based on deliberations of a permanent binational and equal institution, rather than through bilateral negotiations of diplomacy (IJC 1980). The IJC promises equity without interfering with national sovereignty (Holmes 1981). The achievement of the common good as a basis for consensus has been the goal of the Commission for over 90 years.

In 1972, the Great Lakes Water Quality Agreement (GLWQA) was created with the purpose to enhance and maintain the quality of the waters of the Great Lakes Basin Ecosystem. The Parties to the GLWQA are the federal governments of Canada and the United States, who commit to collaborate with other governmental jurisdictions within the Great Lakes basin. The two countries hold the primary responsibility for achieving the objectives of the Agreement. To .examine how the IJC has contributed to improvements in the Great Lakes Basin ecosystem, we draw on empirical evidence based on historical records and experiental learning as a consequence of direct contact with the IJC, its staff, its advisory boards, task forces and leaders in the Great Lakes environmental and governance regime.

Structure and Operations of the IJC

The Commission has three principal functions:

Regulatory: It approves or disapproves applications from government, companies or individuals for obstructions, uses or diversion of water that can affect the natural level or flow of boundary water

Investigative: It investigates questions of difference, which

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are referred to the Commission by the two governments, and reports the facts to the two governments with recommendation for action. The governments decide whether or not to act upon the Commission's recommendations

1. Surveillance/Coordination: It monitors compliance with the orders of approval. The IJC can monitor and coordinate actions or programs that result from the governmental acceptance of recommendations made to them by the Commission.

2. Further, under article VII of the Great Lakes Water Quality Agreement, the IJC shall assist in implementation of the Agreement. The most notable contributions of the IJC to Great Lakes protection and improvement derives from this ability to assist the governments in making progress towards the purpose of the Agreement.

3. The Commission has six members, three on the part of the United States appointed by the President, and three on the part of Canada appointed by the Prime Minister on the recommendation of the Governor in Council.

The Commission is considered independent of the governments. It is not a supranational agency with legal authority. It theoretically operates on the principle of the reciprocal good of the resource. Each Commissioner upon the first meeting after being appointed signs a declaration to impartially perform the duties imposed under this treaty (Boundary Waters Treaty, 1909). Further, Commissioners declare to seek the best solution to common problems based objectively on results of joint fact-finding studies. For technical information and policy advice in conducting investigations, the IJC depends mainly on boards or task forces with equal membership from each country. Under the GLWQA, membership has been extended to nongovernmental experts, including representatives of environmental organizations and industry.

The Role of the IJC in the Great Lakes Water Quality Agreement

Nutrients

A major achievement of the Commission during its first 90 years was the study it undertook in 1960 and which led to the signing in 1972 of the GLWQA. These IJC activities were a result of the highly influential 1964 request by Canada and the United States (termed a "reference") to study pollution in Lake Erie and elsewhere in the lower lakes (LeMarquand and Scott 1980). Scientists associated with the IJC found that excessive phosphorus loads from anthropogenic sources were resulting in severe eutrophication of Lake Erie and Lake Ontario (e.g. Vollenwieder 1968). The 1964 reference induced the creation of the GLWQA, one of the most significant contributions of the IJC to Great Lakes revitalization in its history.

The GLWQA was signed by Prime Minister Pierre Trudeau and President Richard Nixon on April 15, 1972. Great Lakes activities now constitute a very important part of the ongoing agenda of the Commission.

The chief objective of the 1972 Agreement was to achieve reductions of phosphorus loadings to the lakes in order to curb eutrophication. Improvements to the degraded lower lakes resulted. This was achieved by enhanced and expanded sewage treatment and a number of programs and policies that were implemented because of the GLWQA. In some instance the interventions exceeded national laws, criteria or standards. Phosphorus content of detergents was dramatically reduced. Programs to improve the quality of stormwater runoff from agricultural applications catalyzed conservation tillage. Algal proliferation began to decline and more beaches were open and open longer for swimming and recreational use.

At the time of the signing of the GLWQA a particularly important reference was issued to the IJC. The pioneering reference on Pollution from Land Use Activities (PLUARG) produced more than 100 reports over several years. The 1978 final report was the culmination of a five-year comprehensive study of non-point source pollution in the Great Lakes. PLUARG found that the Great Lakes were being polluted from non-point sources by phosphorus, metals, industrial chemicals and pesticides. Atmospheric deposition was identified as a significant

source of pollution to the basin. Intensive agricultural activities were acknowledged as a major pollutant source. The problem of pollution from non-point sources was concluded to be a pressing one for the GLWQA to address.

The main aim of the 1972 Great Lakes Water Quality Agreement was to reverse eutrophication. The chief water quality success was the decline of algae growth and other evidence of slowing of eutrophication that followed reductions of phosphorus loadings (Bertram et al. 1995). This environmental success, stands as an extraordinary example of interjurisdictional cooperation fostered by IJC recommendations that were based on science and impartial fact-finding.

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Air Pollution

The first time the Commission became involved in problems of air pollution was in 1928 when it was asked to investigate and report on the extent of damages in the State of Washington, caused by fumes from a smelter at Trail, British Columbia.

The two governments, in a 1966 reference, directed the Commission to examine the matter of air pollution in the Detroit-Windsor-Port/Huron-Sarnia corridor to determine if air polluted on either side of the boundary caused injury to citizens and property on the other side. The Commission reported to Governments that there was air pollution in the area, quantified the extent and recommended air quality objectives. Since its establishment in 1966, the International Air Quality Advisory Board has generated 24 Progress Reports to the Commission on significant transboundary air quality issues.

A 1975 Reference to the Commission from the Governments of Canada and the United States requested that the IJC report annually on the state of air quality in the Detroit-Windsor and Port Huron-Sarnia areas. Ambient air quality trends and emissions of sulphur dioxide, suspended particulates, and odours were to be the focus of these reports.

In 1983, the Commission noted that domestic regulatory programs and control strategies in the region(s), combined with the decommissioning of some older industrial facilities and the upgrading of pollution control systems at others, had resulted in significant improvements in levels of sulphur dioxide, particulates and odours. While noting these trends, the Commission informed the Governments that reporting solely on these three pollutants did not provide an adequate overview of the atmospheric environment for the region. However, with the objectives of the Reference having essentially been met, the Commission informed the Governments of the effective completion of the Reference (IJC 1984).

In 1988, the Commission was asked by the Governments to report on the hazards posed to human and environmental health from airborne emissions in the Detroit-Windsor region. The Commission formed the International Air Pollution Advisory Board for the Detroit-Windsor/Port Huron-Sarnia Region. Particular expertise on the impact of air pollution on human health was represented on this Board, to allow analysis of the consequences to humans of the emissions and concentrations of selected hazardous air pollutants in the two regions.

This latter Board identified a list of 125 chemicals for consideration and summarized emission and air monitoring data for these pollutants Particular expertise on the impact of air pollution on human health was represented on this Board, to allow analysis of the consequences to humans of the emissions and concentrations of selected hazardous air pollutants in the two regions.. Using this information, the Board was able to estimate how widespread the exposure to specific pollutants could be, while considering toxicity. With respect to carcinogenic potential, the Board identified fifteen chemicals that were of the highest concern regarding direct inhalation. The 1990 Board report to the Commission concluded that the calculated risk of cancer associated with several contaminants in these two regions was significantly higher than the US Clean Air Act benchmark of one-in-one-million lifetime cancers. Following a review of the recommendations of the Board, public comments and written submissions, the Commission issued their 1992 Air Quality in the Detroit-Windsor/Port Huron-Sarnia Region – Report to the Governments (IJC 1992a).

The Commission has alerted governments to matters surrounding the transport, deposition, and impacts of sulfur dioxide, nitrogen oxides, ozone and particulate matter, as well as selected persistent toxic substances. On behalf of the Commission, the Board considers, within a regional context along the boundary where appropriate, related issues regarding binational management, monitoring, modeling,

surveillance, harmonization of standard-setting processes, collaboration with other organizations, persistent toxic reduction strategies, and anticipatory concerns about coal-fired utilities, mobile sources, and energy conservation.

Based on the work of the International Air Quality Advisory Board, the IJC concluded (IJC 2000) that operation of the International Air Deposition Network (IADN) of the two countries is an excellent example of a binational program that generates both comparable and compatible monitoring data for selected toxic substances on both sides of the international boundary. One of those pollutants, mercury (Hg), in its elemental form volatilizes easily. Many of the organic compounds of mercury share this volatility characteristic. Thus, mercury and its compounds are contaminants requiring a "regional background" assessment as a vital piece of information for setting control strategies and regulatory approaches. At that time IADN did not include mercury among the measured pollutants. Therefore, in its 10th Biennial Report the IJC recommended that The Parties should take the following measures to deal with airborne pollutants:

> i) identify both in-basin and out-of-basin sources of atmospheric deposition of persistent toxic substances to the Great Lakes, quantify their contribution to the total burden of these substances to the lakes, and use this information to formulate and implement appropriate prevention and control measures; and
>
> ii) adopt a source-receptor computer model, improve emissions inventory information, and add dioxin and mercury to the Integrated Atmospheric Deposition Network to improve the data bases for these two substances.

In 2001, equipment was purchased by the governments and installed at the two IADN Canadian Master stations (Point Petre on the eastern end of Lake Ontario and Burnt Island on the southwestern end of Manitoulin Island in northern Lake Huron) to measure gaseous and particulate mercury, as well as mercury in precipitation. The protocols employed are consistent with those of the Canadian (CAMNet) and US (MDN) mercury deposition networks. These data will be used by the IADN Steering Committee to calculate updated mercury loading estimates for the Great Lakes (United States and Canada 2002).

The IJC's International Air Quality Advisory Board, which included expertise on the impact of air pollution on human health enabled the IJC to demonstrate the consequences to humans of the emissions of both conventional and hazardous air pollutants. Unfortunately, the IJC has fallen short calling for the virtual elimination of Hg emissions from coal-fired utilities.

Trace Chemicals

An important achievement of the IJC was the introduction and delineation of profound concepts such as the ecosystem approach, and the virtual elimination of persistent substances, though often political and difficult to operationalize as noted above for mercury. In time, these concepts were included in the new Agreement. Factors that appear to have contributed to this breakthrough include the results of the PLUARG study, the rising concern about toxic contamination, the identification of atmospheric deposition and hazardous waste disposal sites, such as Love Canal, as sources of toxic chemicals to the lakes, in addition to new understanding about contaminated sediment and how toxic substances cycle within the ecosystem (Botts and Muldoon 1996).

Scientific investigations catalyzed by the GLWQA cultivated a broader understanding over the source and toxicity of organic and inorganic contaminants. Greater certainty over the inputs of toxic substances from point and nonpoint sources, including atmospheric pathways, led to evidence of contaminant bioaccumulation in fish and higher trophic levels. As a consequence of increased knowledge of the dynamics and effects of toxic chemicals, the GLWQA of 1978 was signed and codified the use of an ecosystem approach, to achieve the objective that the discharge of all persistent toxic substance be virtually eliminated.

During the 1980s, government programs to decrease direct discharges of toxic chemicals resulted in measurable declines in concentrations in both open waters and fish tissues. Initial concerns about the relationship of fish tumors and abnormal reproduction in wildlife exposed to a wide range of toxic contaminants were extended to growing concerns about the effects on growth and development of human infants and the reproductive capacity of adults. In the 1980s, the Science Advisory Board turned its attention towards determining which of the hundreds of different toxic chemicals that had been detected in the Great Lakes posed the greatest threat to injury. In 1987, a new Protocol

was added to the 1978 GLWQA and new annexes called for more aggressive programs to address these injuries. Notably, Annex 2, based on the work of the Water Quality Board (see below) and Annex 15, stemming from the work of the International Air Quality Advisory Board were added, as were other annexes related to research, monitoring and surveillance. By 1991, agreement was reached on a list of eleven critical contaminants designated for virtual elimination (IJC 1991).

In drafting its Fifth Biennial Report, for release in 1990, the Commission concluded that the Agreement philosophy of zero discharge of persistent toxic substances had to become more than a slogan. The IJC recommended in its Fifth Biennial Report (IJC 1990) that Lake Superior be designated "a demonstration area where no point source discharge of any persistent toxic substance will be permitted." Over the subsequent two years, this recommendation generated enthusiasm and diligence on the part of governments, nongovernmental organizations and individuals to develop such a program. Governments were explicit in their response to the Commission and the public. In an October 1, 1991 public release titled A Binational Program to Restore and Protect the Lake Superior Basin, Governments stated:

> "The challenge to designate Lake Superior as a 'demonstration area where no point source discharge of any persistent toxic substance will be permitted,' is accepted."

Thus, the Governments of Canada and the United States, in cooperation with Michigan, Minnesota, Wisconsin and Ontario, committed themselves to take immediate steps to restore and protect the Lake Superior basin, with emphasis on special designations, pollution prevention and enhanced regulatory programs (IJC 1992), as a consequence of the vision of the Commissioners.

The binational program stimulated by the IJC contains a number of specific provisions to reduce and eliminate point source discharge of persistent toxic substances to Lake Superior. It also includes provisions for a multi-media approach to Lake Superior protection. The 1991 revision to the US Clean Air Act required necessary emission standards or control measures to protect Lake Superior by 1995 (IJC 1992). Ontario prepared new and revised regulations to reduce and eliminate point source discharges of persistent toxic substances under its Municipal and Industrial Strategy for Abatement.

The IJC's Virtual Elimination Task Force was constituted in July 1990 to "investigate the requirement of the amended Great Lakes Water Quality Agreement to virtually eliminate the input of persistent toxic substances into the Great Lakes Basin Ecosystem." In 1993 the Task Force Final Report presented a conceptual framework for a virtual elimination strategy, presented its evaluation of the various elements comprising the strategy, examined the application of the strategy to three examples -- PCBs, mercury, and chlorine as a feedstock -- from which general principles can be gleaned, to apply to other persistent toxic substances. The Task Force believes its advice to the Commission provides a firm basis for the Commission's advice, in turn, to governments regarding virtual elimination of the input of persistent toxic substances to the Great Lakes.

The report also stated that the virtual elimination strategy for persistent toxic substances must be guided by a vision. The Task Force's vision was ecosystem integrity, characterized by a clean and healthy Great Lakes basin ecosystem and by the absence of injury to living organisms and to society. The Task Force stated that the strategy to achieve this vision must be compatible with and foster healthy, sustainable, economic activity. A special strategy for the virtual elimination of persistent toxic substances was called for because these substances continue to damage ecosystem health, including subtle effects to the endocrine, immune, reproductive, and other sensitive biological systems. This injury to living organisms continues to occur because of society's failure in the past -- and to a large extent even today -- to recognize fundamental differences between persistent toxic substances and other contaminants, especially their ability to resist degradation and, for some, to bioaccumulate in living organisms. A traditional assimilative capacity approach thus is not applicable to persistent toxic substances because even minute, undetectable quantities may build up over time to levels that cause biological injury (VETF 1993).

Another innovative concept promulgated by the IJC is the principle of reverse onus that stands among recommendations aimed at preventing the further releases of persistent toxic substances into the environment. In its 1994 Seventh Biennial Report the Commission made it clear that characteristics of persistent toxic substances make them much less amenable to traditional pollution control efforts such as discharge limits to set acceptable levels in the environment, end-of-the-pipe technology and disposal regulations. The idea of a non-zero "assimilative" capacity

in the environment or in our bodies (and hence allowable discharges) for such chemicals was considered no longer relevant or tolerable. The Great Lakes Water Quality Board supported this view, concluding that there is no acceptable assimilative capacity for persistent, bioaccumulative toxic substances.

Consequently, the Commission argued, vigorous policy was needed to eliminate all sources of persistent toxic substances, except in very specialized, unavoidable, controlled and temporary applications. The Commission concluded that organochlorines were a major class of pollutants that should be addressed collectively due to their large number and the egregious characteristics of many of them. In the Seventh Biennial Report (IJC 1994) the Commission recommended that governments consult with industry and other interests to develop timetables to sunset the use of chlorine and chlorine-containing compounds as industrial feedstocks, and examine the means of reducing and eliminating other uses, recognizing that socio-economic considerations must be taken into account in developing the strategies and timetables.

While scientific uncertainties remain, the IJC's biennial reports in the first half of the 1990s reflected a growing burden of evidence of the risk to the health of humans, fish and wildlife. The Seventh Biennial report concluded that "there is sufficient evidence now to infer a real risk of serious impacts in humans." Citing evidence of the dangers of persistent toxic substances, the Commission in its Eighth Biennial report concluded that such evidence justified concerted and effective action.

The 1996 Eighth Biennial Report reiterated the call for a reverse onus approach (IJC 1996). The 1996 report stated that the weight of evidence approach should be used to trigger reverse onus procedures rather than leaving the burden of proof to environmental management agencies. Both approaches, the report said, will further the prevention, or precautionary approach, that is necessary if society is to succeed in averting the damage that could be caused by toxic substances.

The Commission has noted in many of its reports that one of the main ways humans are exposed to persistent toxic substances in the Great Lakes basin is through consuming Great Lakes fish. Existing evidence demonstrates that the consumption of contaminated Great Lakes fish prior to and during pregnancy is associated with decreased birth weight and deficits in cognitive function in infants and children (IJC 2000). Great Lakes fish contain many neurotoxins, including PCBs and methyl mercury, which can also produce interactive effects. These substances accumulate in the tissues of women and are transferred to the fetus during pregnancy and to infants during breast-feeding. Developing fetuses and nursing infants receive higher doses of toxic substances than at any other time in their lives. The subpopulations at greatest risk include First Nation and tribe members, sport fish anglers, and certain population groups who eat large quantities of Great Lakes fish. The IJC in the 1990s was at the forefront of international efforts to deal with the discharge of toxic chemicals into the Lakes. Much of their work set the context for the 1997 Great Lakes binational Toxics Strategy of Canada and the United States.

As a consequence of increased knowledge of the dynamics and effects of toxic chemicals, the GLWQA codified the use of an ecosystem approach, to achieve the objective that the discharge of all persistent toxic substance be virtually eliminated.

Contaminated Sediment

Since the signing of the 1972 Great Lakes Water Quality Agreement, the IJC has been intimately and regularly involved in matters related to contaminated sediment. The continued IJC involvement has enabled the development and implementation of several significant programs and actions to address contaminated sediment.

Shortly after the 1972 Great Lakes Water Quality Agreement was signed, the International Working Group on the Abatement and Control of Pollution from Dredging Activities was formed. In their report of 1975, they concluded that the potential impacts from dredging could be significant. The working groups recommended that a binational Great Lakes register of dredging activities be established and that a common means of assessing sediment contamination be established. Shortly after, the IJC's Research Advisory Board Expert Committee on Engineering and Technological Aspects of Dredging was established to look at the use of Confined Disposal Facilities for contaminated dredge spoils. This work led to the wider development and use of Confined Disposal Facilities as a more environmentally sound means of dealing with contaminated sediment (SedPAC 1997).

The 1978 Great Lakes Water Quality Agreement prescribed the formation of a Dredging Subcommittee, reporting to the Great Lakes Water Quality Board. This group was responsible for the establishment and publication

of the first (and subsequent) binational Great Lakes dredging register, which provided a considerable degree of public information on sediment contamination, dredging projects and the disposal/reuse of dredge spoils. This group also invested substantial effort examining the comparability of the different ways sediment contamination was assessed in Canada and the United States. As a result of this work, and the ecosystem approach focus called for in the 1978 Agreement, the Science Advisory Board established a Contaminated Sediment Task Force to examine the assessment and potential remediation of contaminated sediment, beyond navigational dredging interest. To edify the analysis, this group involved experts from many other countries. Meanwhile, the Water Quality Board, taking a closer look at monitoring and surveillance in Areas of Concern, produced a guidance document that included a more detailed assessment of contaminated sediment and incorporated much of the earlier work of the Science Advisory Board Task Force.

In 1986, the terms of reference for the Dredging Subcommittee were expanded to include a responsibility for non-navigational sediment, which led to the subsequent formation of the Sediment Work Group. This group remained very active over a number of years and produced several documents on sediment assessment and remediation. They also became intimately involved with RAP efforts, making several site visits and sponsoring symposia of international experts to evaluate progress, provide advice and direction, and transfer techniques and technology to the RAP program.

In 1995 the IJC directed the establishment of the Sediment Priority Action Committee (SedPAC) to examine the Parties progress in managing contaminated sediment; identify the obstacles remaining to resolving any remaining problems; and identify how the Commission could assist the Parties in the issue.

SedPAC reported that there is a consensus among diverse sectors in the Great Lakes Basin (e.g., government, industry, nongovernmental organizations, Remedial Action Plan groups) that contaminated sediment is a major cause of environmental problems and a key factor in many of the impairments to beneficial uses of the Great Lakes. All 42 Great Lakes Areas of Concern have contaminated sediment based on application of chemical guidelines. This universal obstacle to environmental recovery in Areas of Concern can potentially pose a challenge to restoring 11 of the 14 beneficial use impairments identified in the Great Lakes Water Quality Agreement (SedPAC 1997)

If significant progress is to be made in restoring ecosystem integrity in Areas of Concern and other areas throughout the basin, SedPAC argued that substantially greater progress must be made in overcoming obstacles in order to advance the management and cleanup of contaminated sediment. To assist in developing a broad-based understanding of this complex problem, major obstacles to sediment remediation were identified and grouped into the following six categories: limited funding and resources; regulatory complexity; lack of a decision-making framework; limited corporate involvement; insufficient research and technology development; and limited public and local support.

In examining the decision making process for sediment management, SedPAC concluded that bioassessment frameworks have evolved substantially, and in many cases large data sets have the required elements for developing a sediment management strategy. Equally important to the collection of data, however, is that sufficient attention be placed on thorough and comprehensive interpretation of the data. By employing scientifically sound methods of data interpretation, the information from an intensive sediment assessment can finally be integrated to make a decision to intervene (i.e., remediate contaminated sediment) or pursue source control and natural recovery as the preferred remedial option.

In 1999, SedPAC released a report with the primary intent to share advances in data interpretation tools regarding sediment management decision-making with RAP practitioners (Krantzberg et al. 1999). The report concluded that presently, a great deal of data have been collected on the physical, chemical, and biological elements that modify contaminant bioavailability and ecological effects. Krantzberg et al. (1999) noted that there are currently few, if any, simple or proven methods to predict recovery of use impairments based on sediment cleanup. The IJC agreed that more research is needed to quantify the relationships between contaminated sediment and known use impairments. The concept of ecological benefit forecasting (i.e., predicting ecological benefits and restoration of beneficial uses) is an important management need, which if accomplished, would be a substantial step forward.

Finally, the decision to intervene and undertake active mitigation is embedded with multiple elements. Data interpretation tools and techniques are a central element in developing the sediment management strategy. The Commission agreed with SedPAC's conclusion that much more effort should be placed on forecasting and assessing

ecological recovery of an Area of Concern, as well as beneficial use restoration consistent with Annex 2 of the GLWQA. The work of the IJC highlighted that much greater emphasis be placed on post-project monitoring of effectiveness of sediment remediation (i.e., assessment of effectiveness relative to restoration of uses, with appropriate quality assurance/quality control). Based on this work Krantzberg et al. (2001) advised the Commission that there continues to be a need for methods to interpret and integrate multiple pieces of information on sediment chemistry, biological information from field monitoring and laboratory sediment bioassessment in an ecologically meaningful way.

The IJC invested considerable time and expertise to examine the Parties progress in managing contaminated sediment; identify the obstacles remaining to resolving any remaining problems; and identify opportunities to overcome the obstacles. Unfortunately, the Commission has not engaged government or corporate leaders in direct dialogue to stimulate active intervention and ecosystem recovery.

Ecosystem Modeling

In 1993, the IJC established the Lake Erie Steering Committee, later called the Lake Erie Task Force, to advise it on the consequence of various anthropogenic pressures affecting the health of Lake Erie. In particular, the Task Force turned its attention to the adverse effects of numerous stressors on benthic and fish communities. The Lake Erie Task Force undertook an extensive integrated modeling approach to marshal tools of decision support so the Parties could fulfill their agreement "to make a maximum effort to develop programs, practices and technology necessary for a better understanding of the Great Lakes Basin Ecosystem". The Lake Erie Task Force in 1997 concluded that the most recent iteration of its Lake Erie Environment Model warranted a place in the suite of models, which must be interlinked in order to ascertain where the understanding of the Lake Erie Ecosystem is robust and where the gaps in understanding lie.

Through its work on the Lake Erie model during the two biennial cycles, the Task Force developed considerable insight regarding the effort to develop a comprehensive, ecosystem model for Lake Erie. They developed an ecosystem model for Lake Erie which was deemed useful for the Lake Erie LaMP and the Lake Erie Committee of the Great Lakes Fishery Commission. The Task Force contributed to the LaMP process as a result of IJC efforts. The modeling work generated by the IJC created a new understanding of the complex ecosystem dynamics of Lake Erie and contributed to the suite of available models for whole lake decision making and policy formulation.

Nuclear Matters

In 1995, the IJC authorized a "Nuclear Task Force" to review, assess and report on the state of radioactivity in the Great Lakes, including a review and assessment of the status of radioactivity in the Great Lakes. The Task Force determined that an "Inventory of Radionuclides" for the Great Lakes was essential to address the "state of radioactivity" in the Lakes.

In December 1997, the IJC released the report of its Nuclear Task Force, Inventory of Radionuclides for the Great Lakes. The report presented data on the sources of various radioactive isotopes and used a material balance approach to organize this information to permit assessments of the movement and distribution of radionuclides within the Great Lakes. One component of the material balance was the radionuclide burden within biota of the various biological communities within the Great Lakes. The Task Force report examined in detail bioaccumulation of elements in freshwater aquatic biota and selected species of terrestrial plants (mosses) and wildlife (caribou). According to the Task Force report, many elements perform their physiological function as part of interconnected metabolic systems, and therefore, one must examine the behavior of several elements as a suite before assuming that a given bioaccumulation factor is appropriate (IJC 1997).

While contributing to the knowledge on the behaviour and effects of radionuclides, in recent years the IJC has not commented on the future of nuclear power generation in the face of peak oil.

Alien Aquatic Invasive Species

Since the 1980s, the International Joint Commission has issued alerts about the threat of aquatic alien invasive species to the Great Lakes-St. Lawrence River basin ecosystem and economy. Initial efforts by the IJC to address its concerns for AIS led to the 1990 IJC-Great Lakes Fishery (IJC/GLFC 1990) Commission joint report

on exotic species and the shipping industry.

Reeves (1999) noted that the GLWQA has been primarily focused on chemical contaminants, although exotic species and ballast water are mentioned in Annex 6; "Review of Pollution from Shipping Sources". The general purpose of the GLWQA is "to restore and maintain the chemical, physical, and biological integrity of the waters of the Great Lakes Basin Ecosystem. Yet despite more than a decade of international attention and regional action, the IJC has gone on record to state that this "biological pollution" continues at both great ecological and economic cost and is being inadequately addressed.

Research in 1999- 2001 by the Water Quality Board (WQB 2001) supported the conclusion that the Great Lakes invasion by a succession of nonindigenous aquatic species, is displacing important native species, interfering with beneficial uses of the Lakes and costing billions of dollars to control. Sources of alien invasive species to the Great Lakes basin include cargo vessels, aquaculture, escapes from aquaria, ornamental ponds, research and educational facilities, canals and diversion water flows, and release of live bait.

The discharge of ballast water from vessels coming from outside the US and Canadian Exclusive Economic Zone was identified as the single most important source for alien invasive species entering the Great Lakes basin. In view of the serious environmental and economic consequences associated with nonindigenous or alien aquatic species becoming established in the Great Lakes via ballast water exchange and the role of vessels with no ballast on board (NOBOBs) the WQB and the Commission have made numerous recommendations to government.

In its Eleventh Biennial Report (IJC 2002) the Commission stated that despite more than a decade of national attention and regional action, the introduction and spread of aquatic alien invasive species continue to impair the biological integrity of the Great Lakes-St. Lawrence River basin ecosystem. The Eleventh Biennial Report recommended that a reference be given to the Commission to develop binational standards and the most appropriate methods for implementing those standards. The reasons for requesting that reference persist. Both the Canadian and United States governments responded that progress was being made and that the technical aspects of the issue were best left to existing bodies such as the Ballast Water and Shipping Committee of the Aquatic Nuisance Species Task Force.

The Twelfth Biennial Report (IJC 2004) also called on governments to issue a reference on aquatic alien invasive species to the International Joint Commission to, among other things, help identify the most effective ways to coordinate binational prevention efforts and harmonize national plans, particularly those dealing with residual ballast water and sediment in ballast tanks and evaluate the effectiveness of current institutional arrangements.
While the Commission has been extremely vocal champions ready to assist the Parties to stem the rate of invasions from all vectors of entry, the Parties have not provided a reference to the Commission to do so.

Annex 2

Since 1973, the Water Quality Board, in its annual assessment of water quality in the Great Lakes identified specific areas, such as harbours, river-mouths, and connecting channels, which have serious water pollution problems. The WQB, in its 1977 Annual report, again listed the problem areas; described the nature of the problem, identified dischargers of one or more substances that were probably causing the problem, and commented on progress toward compliance with jurisdictional enforcement programs. The report also described remedial programs in the drainage basin of each problem area and progress towards meeting boundary water quality objectives. In 1983 the WQB determined that classifying areas of concern was difficult due to the lack of specificity of the criteria used to classify the areas and the guidelines to be used for their evaluation. This led to difficulties in data interpretation for the purpose of defining the problems and deducing trends in environmental quality. In order to overcome these difficulties, the Board developed a procedure for data assessment and identification of Areas of Concern. The unique experiment in place-based remediation and protection called for in the 1987 Protocol emerged directly from recommendations of the WQB (Great Lakes Water Quality Board 1985).

In 1985, the WQB identified 42 degraded Areas of Concern around the Great Lakes. Areas were characterized by some or all of the following conditions:

- restrictions on fish and wildlife consumption
- tainting of fish and wildlife flavour degradation of fish and wildlife populations

- fish tumors or other deformities
- bird or animal deformities or reproduction problems
- degradation of benthos
- restrictions on dredging activities
- eutrophication or undesirable algae
- restrictions on drinking water consumption, or taste and odour problems
- beach closings
- degradation of aesthetics
- added costs to agriculture or industry
- degradation of phytoplankton and zooplankton populations
- loss of fish and wildlife habitat

According to the language of the Great Lakes Water Quality Agreement, these are referred to as impaired "beneficial uses". With the signing of the 1987 Great Lakes Water Quality Agreement, Canada and the United States agreed to restore these areas by developing and implementing RAPs. They also agreed to address these impairments for each lake, through the development and implementation of Lakewide Management Plans (LaMPs). The identification of an AOC is based on a change in the chemical, physical, or biological integrity of the Great Lakes system sufficient to cause any of the 14 beneficial use impairments or other related uses covered by Article IV, such as the microbial objective for waters used for body contact recreational activities.

The Agreement calls for the federal governments, in cooperation with state and provincial governments, to ensure the public is consulted throughout the development and implementation of the RAPs. Despite organizational and fiscal resource hurdles, several RAPs are being applied and as a result, there are notable advances in remediation and prevention programs. Essential elements that characterize successful initiatives include true participatory decision making, a clearly articulated and shared vision, and focused and deliberate leadership (Krantzberg 2003). The first comprehensive review of progress in developing and implementing RAPs was released by the IJC in 2003 (IJC 2003).

The "restoration experiments", as suggested by Sproule-Jones (2002), promise a way in which resource users, regulators, and those interested in restoring the local ecosystem can collaborate towards a common purpose. They promise to empower local stakeholders to determine their own solutions to ecological degradation, and open new venues for collaboration.

With the assistance of governments, residents in most AOCs formed an advisory council/committee to work with federal/state/provincial technical and scientific experts. These committees typically have or had representatives from diverse community sectors, including, agriculture, business and industry, citizens-at-large, community groups, conservation and environment, education, fisheries, health, labour, municipal governments, native peoples, shipping, tourism and recreation. Engaging stakeholder groups in the plan design minimizes the risk of future polarization (Samy et al. 2003). A key premise is that community residents possess important knowledge, and can provide an informed perspective of the social impacts of the decisions (Harris et al. 2003). The importance of involving communities in participatory democratic governance was one of the strongest and most consistent messages coming forward from a recent conference in Hamilton, Ontario (Managing Shared Waters 2002). It is a matter of recognizing the value of traditional knowledge and the public's anecdotal and experiential expertise. Good public processes use plain language to communicate clearly, are supported by commitments in institutional workplans, demonstrate clearly how public input will be used, include mechanisms to resolve disputes, provide the community with access to technical experts, celebrate successes and train community leaders (Krantzberg 2003).

Stakeholders have been instrumental in helping governments be more responsive to and responsible for improving environmental quality and quality of life in AOCs. Further, the engaged citizenry has been the primary catalyst for implementing actions which have resulted in ecosystem improvements. Such broad-based partnerships among diverse community practitioners can best be described as a step towards grassroots ecological democracy in the Great Lakes Basin (Hartig and Zarull, 1992). The collective objective is to work with governments and develop a plan to revitalize ecosystem health and implement the plan to achieve agreed-upon targets that indicate when

beneficial uses are re-established.

The Water Quality Board's 1985 recommendation has resulted in a new, participatory regime for Great Lakes recovery that builds the capacity for sustainable communities.

Conclusions

A major accomplishment of the IJC and the GLWQA is the very process of bringing together a diverse cross section of society in a neutral venue to address issues -- environmental, political, societal -- in a forum and a venue that is not possible within jurisdictional constructs. The committee structure under the WQB and the SAB facilitated this work. Complex issues were addressed, and supported by reasonably good access to data and information. The IJC structure successfully circumvented much of the necessary but cumbersome government bureaucracy by enjoying direct access to, and involvement of those with the knowledge and expertise necessary to make progress (Bratzel 2004, Pers. Obs.).

Another major accomplishment of the IJC under the GLWQA was public participation. PLUARG for example offered a public involvement process that helped nurture or at least encourage public participation efforts of other organizations. The IJC provided a practical, effective model.

Public participation stimulated by the IJC has not been restricted to environmental non-government organizations but extended to other members of civic society. The IJC builds bridges with industry. One example is industrial involvement with the SAB, allowing the IJC to explore the information that these constituencies had and also to view issues -- and solutions -- from other perspectives. By way of another example we have noted the Virtual Elimination Task Force.

While discussions were heated at times, the process was most beneficial because, to a greater or lesser extent, people better understood and appreciated the views and perspectives of their colleagues.

Another achievement of the IJC under the GLWQA has been its work with aquatic ecosystems and especially human health. Experts laboured valiantly to compile information about the chronic and acute impacts of persistent toxic substances on fish, wildlife, birds, and especially humans. The IJC's Indicators Evaluation Task Force and the Indicators Implementation Task Force set a standard for indicator reporting on human and ecosystem health that continues to stand as a model for the Parties to emulate.

Using the binational approach inherent in the GLWQA scientific information is being shared among scientists and with the broader Great Lakes community. Shared knowledge in turn has led to concerted support for policies and programs to achieve Agreement goals in both countries.

To help support the process and to advise, alert and assist the governments in the implementation of the GLWQA, many of the related IJC activities are the responsibility of the Great Lakes Regional Office as described in Article 7 of the GLWQA. The office was established by the governments with a binational staff in a central location in the watershed, across the river from Detroit in Windsor, Ontario. The office provides scientific, technical, and secretariat services to the Water Quality Board, the Science Advisory Board, the Council of Great Lakes Research Managers, and the International Air Quality Advisory Board. The regional office also coordinates public information services, such as public meetings and hearings on progress under the GLWQA and the production and distribution of the IJC newsletter Focus.

The office fosters an environment of binational collaboration among staff and the Board and Council advisors. While interagency demands can at times constrain creativity, the open, professional forum afforded to Board and Council members, supported by the experts at the GLRO, fosters innovation and excellence. From the start of the 21st century, the future of the GLRO became uncertain, as the Commissioners continually debated budget and staffing needs. As a consequence, there has been little or no successional planning, and the GLRO lays vulnerable to collapse. With that collapse would come the collapse of the binational collaboration among staff and the Board and Council advisors.

The GLWQA has been viewed as a commitment to prevent and control Great Lakes degradation. The GLWQA rather provides a framework within which the governments, with the advice and assistance of the IJC can manage the Great Lakes basin ecosystem (Sproule-Jones 2002), or at least the waters of the ecosystem

The two governments recognize the political advantages to be had through the existence of a binational body to which difficult riparian or environmental disputes can be referred. This helps defuse trans-border conflicts which, if left untended, could degrade bilateral relationships.

The Commissioners and their technical experts from both nations deliver findings and recommendations that are untainted by purely partisan national concerns. These impartial conclusions can be used by the two government to defuse entrenched interests that are parochial in origin and scope and to legitimize the settlement of transboundary disputes (Nosall 1981).

Throughout its history, the IJC has endeavored to carry out its responsibilities to reflect the spirit of cooperation between sovereign nations. The problems have been and continue to be complex and difficult at times, resulting in discordant deliberations among Commissioners and restrained recommendations on particularly divisive issues, such as transboundary air quality and injury to health as a consequence of exposure to chemicals. The Commission continues struggles with the interpretation of its "assist" function under the GLWQA. Nevertheless, the institution is sound in principle and theory, and has proven itself to be a moral authority for the Great Lakes during periods of particularly strong and concordant leadership.

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