



***Annual
Report
2002***

**State of the
Great Lakes**

Cover: Winter snow cover across North America from February 2-9, 2002
Animations by Cindy Starr, National Aeronautics and Space Administration,
Goddard Space Flight Center, Science Visualization Studio, based upon
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Snow and Ice Science Team

A Message from the Governor

On a map, the Great Lakes define Michigan as they define no other state or jurisdiction. The lakes cradle our two magnificent peninsulas, giving every citizen of the state a personal connection to their beauty and majesty. Now we, the people of Michigan, must play a central role in defining the future of the Great Lakes.



Since the early days of European exploration of the Great Lakes in the 1600s, many men and women have considered them a route to another place. Early explorers thought them a route to the Northwest Passage and trade with the distant nations of Asia. Later, the lakes became an avenue for the shipment of furs that created vast wealth in Europe and eastern North America. In the 1800s and early 1900s, the commercial fishing industry exploded, and Great Lakes fish were shipped to supply markets in distant places. Today, Great Lakes freighters continue to ship iron and grain through the lakes to far-off ports.

While the lakes will always contribute greatly to the economies of both our globe and our Great Lakes region, we have come to think of them not only as economic engines, but primarily as defining features of our home. And in defense of home, the people of Michigan have shown their unflinching commitment to the lakes. Public indignation about pollution led to the overwhelming passage by Michigan voters of a \$335 million clean water bond in 1968. Public outrage about oil spills and the dumping of pollution inspired the Michigan Legislature to pass

a series of strong anti-water pollution laws in the 1970s, including a first-in-the-nation ban on DDT use.

Public support for conservation of Great Lakes waters and protection of these waters from export enabled Michigan to propose the Great Lakes Charter of 1985, which has served as a framework for regional consultation about water uses for nearly two decades.

And now the Michigan public's commitment to the Great Lakes will help a new generation of state and regional leaders cope with the most monumental challenges yet.

As I begin my service as Governor, I hear the clear call of Michigan citizens for action on critical Great Lakes issues.

- We must take decisive action against the continuing and growing threat of exotic species. The continued introduction of nonnative species into the lakes, especially from the ballast water of oceangoing vessels, is an immediate challenge. I will seek regional solutions to close the loopholes in environmental law that prevent effective control of these exotic species. Meanwhile, I will support action to curb the immediate threat posed by such species as the Asian carp which has migrated through the Mississippi River system close to Lake Michigan.
- We must conserve the outstanding habitats and valuable ecosystems that shape the Great Lakes. Public support for habitat protection helped Michigan legislators pass the toughest wetlands law in the nation in 1979. And voters provided permanent Constitutional protection for our Natural Resources Trust Fund, which uses oil and gas revenue to acquire valuable recreational and environmental lands, in 1994. We must deploy our habitat protection tools to assure that our coastal wetlands and beaches and critical fish and wildlife habitats are permanently protected.
- We must continue to control and reduce chemical and conventional pollution of

the Great Lakes. Although implementation of Michigan laws and the federal Clean Water Act have brought about water quality improvements during the last 30 years, many long-banned and toxic chemicals persist in fish and wildlife, posing health risks especially to young children. Sewage continues to close Great Lakes beaches. I am determined to use the full array of policy tools, starting with strict enforcement and including financial incentives, to attack the pollutants that interfere with the Clean Water Act's promise of fully fishable and swimmable waters.

- We must prevent the threat of water exports by becoming the best in North America at conserving water. The International Joint Commission's 2000 study of water exports from the Great Lakes Basin underscores both the fragility of the Lakes and the need for a rational system to prevent their depletion. As the Commission noted, only 1% of the volume of water in the Great Lakes is renewed annually by rain, runoff, and snowmelt. The remaining volume is the enduring gift of the ancient glaciers. Increasing population in the Basin, across North America, and in the world may tempt some to covet the lakes to supply their

water needs. Michigan citizens fiercely oppose exporting Great Lakes water. We must lead by example. By practicing water conservation both voluntarily and in accordance with laws, and insisting that other users of Great Lakes water do the same, we can insure that one-hundred years from now, the citizens of Michigan will still behold the inspiring horizon of the Lakes.

Geography not only distinguishes Michigan on a map, but has also given us an unparalleled source of beauty and economic opportunity in the Great Lakes. Now we must fulfill our special responsibility as citizens of Michigan to lead the way to policies permanently protecting the health of this ecosystem. The history of public support in Michigan for strong Great Lakes policies and the voices of the citizens across this state give me every confidence that we will meet this challenge boldly and successfully.

Sincerely yours,
Jennifer M. Granholm



Governor

A New Direction for Great Lakes Protection

By Ken DeBeaussaert

The Office of the Great Lakes was created by statute over 13 years ago for the purpose of being the lead agency within state government for the development of policies, programs and procedures to protect, enhance and manage the Great Lakes. It is my honor to be appointed as the director of this important office, especially at this time when Great Lakes protection will be taking on a new meaning for the State of Michigan.



The Great Lakes are of unquestionable importance to the State of Michigan and the entire Great Lakes region. Their significance and magnitude are directly linked to the region's environmental health, economic well-being and overall quality of life. The complexity of the Great Lakes system, whether it be physical, chemical, biological or political can have long lasting impacts on the protection, development and use of the resources within the Great Lakes ecosystem.

The Great Lakes, containing some 6.5 quadrillion gallons of fresh surface water, 20 percent of the world's supply and 95 percent of the United States' supply, comprise the world's largest body of fresh surface water. They not only define the geography of the region, but also help define the region's distinctive socio-economic, cultural and quality of life, as well.

As director of the Office of the Great Lakes I will continue to work on the process of implementing Annex 2001 which will protect the Great Lakes and Michigan waters against diversion. I will work with the Michigan congressional delegation to pressure the Environmental Protection Agency to close the loophole in the Clean Water Act that exempts ballast water from treatment requirements and will strive to bring the resources necessary to the Great Lakes to continue work on the Great Lakes Restoration Plan. In addition, I will work for regional cooperation to improve the protections against the introduction of aquatic nuisance species into the Great Lakes.

As director of the Office of the Great Lakes, I will pursue efforts that will work toward the continued reduction of pollutants into the ecosystem, restore the biological integrity and critical habitats that we have lost, and protect those invaluable habitats that are currently sustaining the system. To accomplish these efforts we must work with all aspects of state, federal, local and international governmental agencies and, most importantly, reengage the citizenry in the collective pursuit of sustainability in our day-to-day activities. We need to:

- develop an inclusive process that seeks meaningful input from the range of governmental and constituent groups that will influence, or be affected by Great Lakes policy;
- embrace environmental protection, resource management and economic development of the Great Lakes ecosystem through sustainability principles;
- utilize the institutional resources already available at the state and regional levels to develop joint policies and procedures for protection of the Great Lakes; and
- work with the Michigan Great Lakes delegation to Congress to develop meaningful legislation and programs, including the appropriation of necessary funding to protect the Great Lakes.

Without question, Michigan has an unparalleled responsibility to play a strong leadership role in the protection and restoration of the Great Lakes. In the Great Lakes region, it has long been recognized that the success of any effort is fundamentally dependent on strong partnerships. These partnerships must include other states, the federal government, and our neighboring provinces. It is also essential that the partnership include the people and resources of the State of Michigan. We need the active involvement and participation of our universities, our communities, our public interest groups and our business community to ensure that our Great Lakes policies and programs are pointed in the right direction and accomplish measurable goals toward environmental protection.

In the 2002 State of the Great Lakes Report we highlight some of the key issues that have surfaced and will require attention in the coming years. The issues include:

- progress toward the control of water withdrawals through implementation of Annex 2001;
- the potential invasion of the Asian Carp into the Great Lakes ecosystem and efforts to halt the invasion through the Chicago Dispersal Barrier;
- efforts by the U.S. Coast Guard to develop standards for ballast water to stop the introduction and spread of invasive species; and
- celebration of the 30th anniversary of the Clean Water Act and hopeful anticipation of appropriations for the recently passed Great Lakes Legacy Act.

I would like to thank this year's guest contributors for their insightful thoughts and commentary. With this report we initiate a new effort to bring involvement at all levels into the discussion and public debate of these important issues.

To all those interested in the Great Lakes I offer my commitment to work with you in the coming years toward the restoration and protection of those resources we hold so dear – the Great Lakes.

Sincerely,

A handwritten signature in black ink, appearing to read "Ken DeBeaussaert", with a long horizontal line extending to the right.

Ken DeBeaussaert, Director
Office of the Great Lakes

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Restoration in Michigan's Areas of Concern

By Steven E. Chester and Richard Hobrla

Michigan truly is the Great Lakes State. We border four of the five Great Lakes (Superior, Michigan, Huron, and Erie), plus Lake St. Clair and three of the four connecting channels (the St. Marys, St. Clair, and Detroit Rivers). Water is one of Michigan's most important natural resources and the Great Lakes contribute mightily to our quality of life. They afford us an abundant source of drinking water; sparkling, sandy beaches on which to recreate; a world-class sports fishery; and a major thoroughfare for our commerce. The restoration and protection of the Great Lakes is vital to Michigan's future.

Unfortunately, our predecessors did not always provide the level of stewardship required



to protect our lakes. Through the latter part of the 1800s and much of the 1900s, we abused our rivers and lakes with industrial wastes and untreated sewage. As a consequence, many places along the Great Lakes are now contaminated with toxic chemicals. Michigan contains 14 of the 42 Areas of Concern designated under the auspices of the Great Lakes Water Quality Agreement. Although much has been accomplished to restore these areas, for many, much work still remains.

We are seeing signs of a renewed commitment to the Areas of Concern program at the federal level. Last year the EPA worked with the states, tribes, and other federal agencies to prepare a comprehensive Great Lakes Strategy. This strategy includes quantitative targets for delisting Areas of Concern. The recent reassignment of the Area of Concern program from the EPA's Water Division to the Great Lakes National Program Office is another indication of increased emphasis.

Michigan increased our investment in the program several years ago. When Michigan voters approved the Clean Michigan Initiative in 1998, we were authorized to spend up to \$25 million to clean up contaminated sediments at several targeted sites. All but one of these sites is within a designated Area of Concern. While a significant commitment, this amount represents only a down payment on the total costs of remediation. We are pleased that the federal government is now stepping forward with the Great Lakes Legacy Act to help in this work. We hope to use the funds from the Clean Michigan Initiative to meet the matching fund requirements for Great Lakes Legacy Act money. We are working together with the EPA to lay out a plan for next year and the year after to efficiently use our collective funding to effectively accomplish cleanups.

In the last several years, we have worked with federal, state, local, and private partners to clean up Areas of Concern. Using a variety of funding sources and government programs, projects to clean up contaminated sediment have been completed on the River Raisin, the Saginaw River, the Manistique River, Portage Creek in the

Kalamazoo River basin, and Newburg Lake in the Rouge River basin. Cleanups are underway on the Pine River in the Saginaw River basin and in White Lake. Cleanup projects are scheduled to begin soon on the Detroit River, the Rouge River, and Muskegon Lake.

Local Public Advisory Councils (PACs) and the Statewide Public Advisory Council (SPAC) have been critical to our efforts. They have helped us to achieve consensus with a variety of stakeholders. They have provided us with a local perspective and disseminated information to property owners and interest groups. They have advocated for the program on a federal and state level. They were a moving force behind the passage of the Great Lakes Legacy Act. Our Water Division is currently investigating funding alternatives to assure that the PACs and the SPAC remain viable. In particular, we hope that PACs and the SPAC will play key roles as we move towards completing cleanups and delisting some of our Areas of Concern.

We have far to go. The Clean Michigan Initiative, the Great Lakes Strategy, and the Great Lakes Legacy Act are all important tools, but our greatest asset is the passion of our citizenry for the Great Lakes. Working through federal, state,

and local governments, through PACs, business and industry, private foundations, environmental organizations, and volunteer groups, the people of Michigan are sending a clear message that the Great Lakes are a national treasure that we all share the responsibility to protect.

Steven E. Chester was appointed Director of the Department of Environmental Quality in January of this year. Prior to that, he served as an attorney with the law firm of Miller, Canfield, Paddock and Stone, and as the Deputy Director for the Environmental Protection Agency (EPA), Office of Criminal Enforcement. Director Chester also served as an Assistant Attorney General for Michigan and as an Assistant Prosecuting Attorney in the Wayne County Department of Public Health.

Rick Hobrla is an Environmental Engineer with 25 years of experience in the water quality program with the Department of Natural Resources and the Department of Environmental Quality. He is currently the Chief of the Inland Lakes and Remedial Action Unit in the Water Division where he has responsibility for managing Michigan's Area of Concern program.

Clean Water Legislation

30th Anniversary of the Clean Water Act

by Congressman John D. Dingell

Three decades ago, when the Clean Water Act was signed into law, Congress declared that every American has a fundamental right to clean water. It was a promise to the American people that their waterways would be clean and safe – for swimming, drinking water, fishing, and the support of aquatic creatures and wildlife. Hailing from the Great Lakes State, I was an early and strong supporter of the Clean Water Act when it was enacted in 1972. At that time, we were optimistic that the nation would fulfill the promise by ending the discharge of pollution into our waters by 1985. The Clean Water Act passed Congress by an overwhelming bipartisan margin, unanimously in the Senate and with only eleven dissenters in the House. The national resolve to clean our waters was firm.

Before the Clean Water Act was adopted, the rivers of this country were treated as little more than open sewers. Industry and government were free to pollute with impunity, and our nation's waterways suffered tremendously. Fisherman derisively renamed Lake Erie the 'Dead Sea.' Industrial discharges into the Detroit and Rouge Rivers caused mercury levels to climb



to dangerously toxic levels. Lakes, rivers, and streams across the country were smothered by untreated wastes, unable to support any form of life.

Since that time, significant progress has been made in cleaning the water. The nation has yet to achieve the "zero discharge" goal, but because of the Clean Water Act, most waters are now safer, the rate of wetlands loss has declined by 75 percent, and the majority of communities across the country have modern sewage control systems. We have invested billions of taxpayers' dollars to achieve these results, restoring many of the country's waters into thriving, healthy ecosystems.

While the Clean Water Act has been a success, we still have a long way to go to fulfill the promise of the Act. According to the U.S. Environmental Protection Agency, for the first time in many years, the nation's waters have actually started to get dirtier. The response to this disturbing news should be a renewal of the nation's commitment to clean water.

Recently, plans have been proposed to issue new regulations limiting the scope of the Act, questioning whether tributaries of navigable waters, many streams, and most wetlands deserve any Clean Water Act protection at all.

Congress made it clear that the Clean Water Act covers all United States waters. I know this because I was there. In 1972, I spoke on the floor of the House about the Clean Water Act and stated for the legislative history that the bill covers all the waters of the United States. What we in Congress said when the law was passed remains true today: in order for the goal of clean water to be met, all waters must be protected for water pollution to be eliminated at its sources.

We in the Congress knew in 1972, as we know now, that the purposes of the Act – to restore and maintain the integrity of the country's waters – could not be achieved if any of the nation's vital waters are removed from the law's scope.

As a conservationist, hunter and avid sportsman, I see a pressing need to protect and

restore our nation's waterways and wetlands. These valuable systems support a diverse array of migratory birds, as well as many other species of wildlife. These waters are also an integral part of the landscape that serves mankind. Wetlands help prevent floods and are natural filters, removing pollutants from drinking water.

Americans today, even more than 30 years ago, appreciate and support the Clean Water Act's goal of making all of our nation's waters clean. It is part of the legacy we must leave for future generations, our children and our grandchildren.

Congressman John D. Dingel, D – Dearborn and ranking member of the Committee on Energy and Commerce, has represented the 15th District of Michigan in the U.S. House of Representatives since 1955.



“Wetlands prevent floods and are natural filters, removing pollutants from drinking water.”

Preserving the Legacy of the Great Lakes

by Congressman Vernon J. Ehlers

In September 2002, the International Joint Commission (IJC) in its Biennial Report on Great Lakes Water Quality clearly defined a continuing problem that Great Lakes policy makers must address – restoration of the Great Lakes has been slow and too many obstacles remain in the way of achieving this goal.



The report cited two main issues that policy makers must address. First, toxic sediments lying at the bottom of lakes and streams in the Great Lakes basin remain a persistent threat to human health. Second, invasive species cause tremendous harm to the Great Lakes economy and ecosystem.

While the IJC report correctly pointed out that progress has been slow in addressing these threats, I am pleased to report that Congress has made substantial progress toward addressing these important issues. In particular, Congress passed and President Bush signed into law the Great Lakes Legacy Act, which I first introduced more than two years ago, in November 2002.

This legislation represents an important step forward in addressing the persistent threat from toxic sediments. This bill authorizes \$50 million

per year for five years for the U.S. Environmental Protection Agency (EPA) to monitor, evaluate and clean up contaminated sediments in Areas of Concern (as defined under the Great Lakes Water Quality Agreement). This funding will be leveraged with state or local funds increasing the potential funding for these projects to \$77 million annually. While this funding will only scratch the surface of what is needed to fully clean up the Areas of Concern, it represents an important step toward demonstrating that we can finally act to clean up these toxins.

The legislation comprehensively addresses other aspects of this issue by authorizing a public outreach program and a research and development program, funded at \$1 million and \$2 million each year, respectively. These two components will help ensure that the public is informed and that we are developing methods and technology to make cleanups faster, cheaper and more environmentally sound.

To address the aquatic invasive species threat, I, along with several key colleagues, have introduced legislation that creates a comprehensive regulatory, prevention and research program. One central theme drives this entire bill – “an ounce of prevention is worth a pound of cure.” If we spend millions preventing aquatic invasive species from entering our waters, we can avoid spending billions trying to control and manage them once they are here.

The bill creates three main programs fitting with this theme:

“One central theme drives this entire bill – an ounce of prevention is worth a pound of cure.”

- A comprehensive program to address the threat of ships bringing invasive species into our waters;
- A comprehensive screening program to keep potential threats from ever entering the United States, and

- A comprehensive research program to support and inform the regulatory program envisioned by this legislation.

Congress has just begun work on this issue, and I expect more action during 2003.

As we move forward, our challenge is clear – we must fully fund the Great Lakes Legacy Act and Congress must pass comprehensive legislation to address the threat of invasive species. Only by undertaking these tasks can we realize our goal of restoring the Great Lakes.

Congressman Vernon J. Ehlers, R-Grand Rapids, was re-elected in November, 2002, to his sixth term in the U.S. House of Representatives. He served as chairman of the House Science Committee's Subcommittee on Environment, Technology and Standards in the 107th Congress. He holds a Ph. D. in physics and served as a science advisor to President Gerald R. Ford.



An Innovative Government Partnership for the Great Lakes

by Thomas V. Skinner

In the spring of 2002, against the backdrop of the U.S. Environmental Protection Agency's 180-foot research vessel Lake Guardian, the Great Lakes governmental partners celebrated a major achievement: the release of



our Great Lakes Strategy. A culmination of over three years of work, the Strategy presents a comprehensive, coordinated multi-year approach for protecting and restoring the Great Lakes basin ecosystem. The Strategy will also help us implement the United States' responsibilities under the U.S.-Canada Great Lakes Water Quality Agreement. While we recognize that the work of governmental agencies is just one component of the effort needed to protect and restore the Great Lakes for future generations, the Strategy outlines an ambitious schedule of actions that we will pursue over the next several years.

The Strategy was created by a group called the U.S. Policy Committee – a forum of senior-level representatives from the federal, state and tribal agencies responsible for environmental protection and the natural resource management of the Great Lakes. I serve as co-chair of the Committee, which meets twice a year to coordinate

governmental efforts on the Great Lakes. We also work with our Canadian colleagues to implement shared binational programs such as Lakewide Management Plans and Remedial Action Plans in the binational connecting channels.

The Committee identified multi-lake or basin-wide environmental priorities, including air deposition, contaminated sediments, fish consumption advisories, habitat protection and restoration, agricultural land use, wet weather events, human health, beach closings and invasive species. The Strategy presents a road map of how we will use our existing programs and future efforts to tackle these tough issues. Over 120 specific actions – most with deadlines and measurable targets – will be implemented in the coming years.

It is important to understand that while the Strategy focuses on comprehensive issues, the Lakewide Management Plans, or "LaMPs," will still serve as the main forum addressing issues specific to a given lake. Similarly, the Remedial Action Plans, or "RAPs," will address issues at Areas of Concern. These programs will continue to coordinate activities for pollution reduction and habitat rehabilitation on a geographic basis. Both processes are key components of our ongoing effort to involve all Great Lakes stakeholders in decisions and actions affecting the Lakes. I can't overemphasize the point that government cannot do the job alone – we need everyone's help! That's why the Strategy, LaMPs and RAPs complement rather than duplicate each others' efforts.

The Strategy benefited from extensive public consultation. Workshops were held throughout the basin – in Duluth, Chicago, Detroit and Niagara Falls – to solicit comments from local governments, industry, non-governmental environmental organizations and the public. Together we have developed a shared, long-range vision for the Great Lakes.

We are working toward a Great Lakes ecosystem where:

- All Great Lakes beaches are open for swimming;

- All Great Lakes fish are safe to eat;
- The Great Lakes are protected as a safe source of drinking water; and
- The Great Lakes Basin is a healthy natural environment for wildlife and people.



“The goal is to safeguard those international treasures that are the Great Lakes.”

Now that the Strategy has been developed, I can assure you that it will not simply “sit on the shelf.” It is a means to an end, but not the end. The goal is to safeguard those international treasures that are the Great Lakes. The U.S. Policy Committee will use the Strategy to guide activities over the next decade. Implementation of the Strategy will be tracked by measuring progress toward the specific goals identified in the document. The Strategy will provide a much-needed foundation for an ongoing, adaptive approach to the environmental management of the Great Lakes.

My thanks to everyone involved in the development of the Great Lakes Strategy. We look forward to working with you to implement our shared goals, to advance the protection and restoration of the Great Lakes, and, ultimately, to achieve our vision for the Great Lakes.

Further information on the Strategy can be found at: <http://www.epa.gov/glnpo/gls/index.html>

Thomas V. Skinner is Regional Administrator, U.S. Environmental Protection Agency Region 5, which includes the Great Lakes states of Illinois, Indiana, Michigan, Minnesota, Ohio and Wisconsin. He is also EPA Great Lakes National Program Manager. In this role he serves as U.S. chairman of the Binational Executive Committee for the Great Lakes, the main forum for United States-Canadian discussion of Great Lakes issues.

Water Resources Management Decision Support System Project

by Dick Bartz

In 2000, the Great Lakes Commission (GLC) started an ambitious project called the Water Resources Management Decision Support System (WRMDSS) Project. The impetus for this project was the Great Lakes Governors and Premiers' 1999 Statement on Protecting the Great Lakes. In that statement the Governors and Premiers called for securing funds to develop a better base of Great Lakes water use data. Without a good base of data, they recognized that it is difficult to make sound decisions.



As a result, the Great Lakes Protection Fund awarded the GLC a two+ year grant to focus on several objectives:

1. a status assessment of water resources data collection efforts;
2. an inventory of water withdrawals and use; and
3. an inventory of information on ecological impacts.

Midway through the project, the Great Lakes Charter Annex 2001 was signed. The states requested that some of the project funding be reprogrammed to begin to address some

items in the Annex 2001: consumptive water use coefficients, water conservation practices, and resource improvement objectives of the Annex 2001.

The main emphasis of the project was to review what data and models were available for future use in a WRMDSS and where we need to put additional efforts for a stronger decisions process in the Great Lakes. The project was not to actually build a WRMDSS. That will be some future phase of this effort and will be determined to a great extent by the effort of the Governors and Premiers to implement the Annex 2001.

The project process was open and inclusive. The GLC served as project secretariat. A project management team was created which included representatives from all states and provinces, and from US and Canadian federal agencies. A stakeholder advisory committee was created that represented over 20 interest groups. The last several meetings of the project management team were held jointly with the stakeholder advisory committee.

Over 30 recommendations have come out of the project. The final report is finished and available on the internet on the Great Lakes Commission's web site at <http://www.glc.org/wateruse/wrmdss.html>. At the risk of omitting some important aspects, I would like to summarize some of preliminary findings and recommendations.

Status Assessment of Water Resources

Many agencies collect data on water resources in the Great Lakes basin. There certainly is a wealth of information about the levels and flows on the Great Lakes and in the tributaries to the lakes. Various needs have driven current hydrologic/hydraulic data collection. Because each type of data is generally designed for a specific purpose, it should be evaluated within the context of a WRMDSS that is to be developed.

Uncertainties (errors) associated with current measurement approaches of Great Lakes levels and flows are of greater magnitude than all likely withdrawals summed together. As a result, it is

difficult to show in terms of measured changes in levels or flows the effect that withdrawals have on levels and flows. However, models can show how all these likely withdrawals, when taken together, affect system levels and flows. In other words, one cannot directly measure a withdrawal effect on the system's levels and flows, but one can model it and quantify the changes.

Common standards for data quality, data reporting, and data access throughout the basin would help decision makers understand the system as a whole.

Water Withdrawal and Use Data and Information

In the 1985 Great Lakes Charter, states and provinces agreed to develop and maintain a common base of data and information regarding the use and management of basin water resources. They were also to collect and maintain in a comparable form data regarding the location, type and quantities of water use, diversion, and consumptive use and information regarding projections of current and future needs. The findings from this work element would indicate that the states and provinces still have not met this goal. The recommendations all focus on the actions the states and provinces need to take to meet this objective of the Great Lakes Charter.

Inventory of Information on Ecological Impacts Associated with Water Withdrawal and Use

While many models show ecological impacts, no single model is available that can show the range of ecological impacts that result from a particular withdrawal. A direction that could be pursued is a linked model framework for various withdrawal scenarios.

A list of "essential questions" was developed as part of the project that could be used in



"The difficult part is continuing to develop the programs that we as Great Lakes states and provinces will need to support better decision making about the long term use of the Great Lakes waters."

reviewing any project proposal for ecological impacts. This list should be further refined to maximize its value in any future decision support system.

Ecological sensitivities need to be addressed through thresholds, where an ecological effect begins (or ends) in specific watersheds. Indicators and thresholds of ecosystem impact should be developed to support findings of "significance" with regard to a given withdrawal. The relationships between water withdrawals and ecological impact for various types of ecosystems (i.e., large lakes, inland lakes, streams and rivers, and groundwater) need to be developed.

Water Conservation

A greater level of water conservation, and particularly a regionally coordinated approach to conservation, is needed if the region is to demonstrate that it is making an effort to responsibly manage its water resources. This should be a significant step for addressing out-of-basin water proposals.

Resource Improvement

Several definitions in the Annex 2001 related to resource improvement need to be refined so all parties involved in discussions are clear about concepts and issues that are to be addressed as part of water withdrawal proposals. The geographic location of the improvement in relation to the withdrawal and the amount of time during which an improvement occurs both need to be considered when evaluating a project.

As with most efforts, identifying what has been done and what needs to be done is the easy part. The difficult part is continuing to

develop the programs that we as Great Lakes states and provinces will need to have to support better decision making about the long term use of the Great Lakes waters. Such will require the continuing support and diligence from all of the Great Lakes states and provinces.

Dick Bartz is Assistant Chief, Division of Water, Ohio Department of Natural Resources, and Chair of the Project Management Team of the Water Resources Management Decision Support System.

Aquatic Nuisance Species

Aquatic Nuisance Species: A Continuing Plague on the Great Lakes

It is hard to describe the damage that aquatic nuisance species (ANS) have done to the Great Lakes, using language suitable for the State of the Great Lakes Annual Report. Tremendous, awful, horrendous, terrible, and nightmarish come to mind as weak substitutes. Many of the species already here, and many threatening to arrive soon, are much more than just nuisances. They are plagues on our waters.

Fortunately, Michigan is continuing to arm itself in this biological battle. In 2002, the state continued implementation of its ballast water management reporting legislation; updated the state management plan; held an Aquatic Nuisance Species Prevention Day for the legislature; distributed thousands of informational pieces on ANS; participated in federal, regional, and local prevention and control efforts; funded research on ballast water controls and ecological research; established Michigan's Aquatic Nuisance Species Council; focused the Michigan Great Lakes Protection Fund on ANS and responded to many public requests for information.

Updating the state management plan was a centerpiece of the work in 2002. Michigan produced an update to the Nonindigenous Aquatic Nuisance Species State Management Plan, approved in 1996 as Michigan's plan under the auspices of the National Invasive Species Act. The 2002 updated plan is titled: Michigan's Aquatic Nuisance Species State Management Plan Update: Prevention and Control in Michigan Waters. It provides a framework for action and

outlines critical steps necessary to prevent and control aquatic nuisance species in the state. It also provides potential cost savings due to the coordination among state, federal, and local agencies and organizations called upon to take actions.

To develop this update, an Aquatic Nuisance Species Action Team consisting of the directors of the Michigan Departments of Environmental Quality, Natural Resources and Agriculture was convened by the director of the Office of the Great Lakes in March, 2002. Three committees were established to recommend actions needed to address the problem of prevention and control of ANS in Michigan's waters. The committees addressed legislation/policy, information/education, and research/monitoring. Approximately 40 people, representing more than a dozen public agencies and private institutions participated in drafting the update.

Several key recommendations of the plan have already been implemented. For example, Michigan now has a new Aquatic Nuisance Species Council consisting of the directors of the Departments of Environmental Quality, Natural Resources, Agriculture and Transportation, plus four members from stakeholder agencies and organizations. This new Council was created in November, 2002, by Executive Order 2002-21 of the Governor and is chaired by the director of the Office of the Great Lakes. Its charge is to advise the Office of the Great Lakes and the Departments of Environmental Quality, Natural Resources, Agriculture, and Transportation on:

- The implementation of Michigan's Aquatic Nuisance Species State Management Plan Update of 2002;
- The state's efforts to prevent and control aquatic nuisance species introductions and spread within Michigan, in order to minimize the economic and environmental impacts of aquatic nuisance species by maximizing interdepartmental coordination of existing aquatic nuisance species programs;

- Issues pertaining to the prevention and control of the spread of aquatic nuisance species within the state for new aquatic nuisance species programs;
- Information and education activities about aquatic nuisance species;
- The coordination of research and monitoring activities pertaining to aquatic nuisance species; and
- Revising and updating Michigan's Aquatic Nuisance Species Management Plan, as necessary.

The updated plan was released to the state legislature on October 2, during another highlight of 2002, Aquatic Nuisance Species Prevention Day. The purpose of the day was to publicize the release of the updated state management plan to legislators, researchers, agency staff and stakeholders, as well as highlight Michigan's commitment to address the ANS problem through legislation, research and monitoring, and education. Prior to the event, both the Michigan House and Senate passed resolutions formally designating ANS Prevention Day.

The day kicked off with displays including live sea lamprey, zebra mussels, round goby, purple loosestrife and a frozen big head carp. Among the participants were Michigan Departments of Environmental Quality and Agriculture, Michigan Sea Grant, Michigan Lake and Stream Association, Great Lakes Fishery Commission, Great Lakes Science Center, Great Lakes Environmental Research Lab and U.S. Fish and Wildlife Service. Researchers, agency staff, and interested parties were available to provide information and answer questions related to management, control, prevention, and identification. During the noon hour, keynote speakers shared their thoughts on ANS in the Great Lakes and the imperative need to prevent future introductions via ballast water.

Michigan will continue the fight. There is no end in sight for the vigilance we must all have to prevent the plagues threatening our waters from gaining the upper hand.

The updated management plan can be found at: <http://www.deq.state.mi.us/documents/deq-ogl-ANSPlan2002.pdf>

"Frankenfish" and the Great Lakes

by Dr. Walter R. Courtenay, Jr.

On May 18, 2002, an angler caught a strange-looking fish in a 4.5 acre retention pond behind a strip mall in the town of Crofton, Maryland, south of Baltimore.

Having never seen a fish like this one, he took two digital photos of his 17 inch catch



and released the fish back into the pond. Some weeks later, he brought his photos to Maryland Department of Natural Resources headquarters in Annapolis. Biologists there recognized the fish as an exotic snakehead, but had no idea what species it was. One of the photos was sent by e-mail to the U.S. Geological Survey's Center for Aquatic Resources Studies in Gainesville, Florida, where it was identified as *Channa argus*, the northern snakehead, native from the Yangtze River, China, northward to the Amur River and its tributaries along the China-Siberian border. Maryland officials were notified that this fish was a voracious airbreathing predator that, in recent years, was being imported and sold as a live food fish in certain Asian markets in the U.S. and

Canada, and could easily overwinter throughout much of North America, even under ice. Signs were posted around the pond advising the public that if such a fish was caught again, it should be killed and reported to Maryland DNR.

Hope that this fish was alone in the pond vanished when another angler caught a 27 inch northern snakehead on June 30. The same angler returned to the pond with his daughter the evening of July 8 and dipnetted eight juvenile snakeheads. On July 11, Maryland DNR collected over 100 juvenile northern snakeheads by electrofishing near the pond shore. It was clear that this species had reproduced and was established, within 75 yards of the Little Patuxent River. It was locally dubbed "Frankenfish" after the Frankenstein monster. The objective became eradication of this fish, and that happened in early September, but at substantial cost.

The person who released the fish into the pond, a Crofton resident, was found. There has long been belief in many parts of Asia that eating freshly killed snakehead, either in a soup or mixed with noodles, can cure several illnesses. It seems that the individual, an immigrant from Hong Kong whose sister was ill, purchased two northern snakeheads from an Asian market in New York City. By the time he obtained the fish his sister had recovered. He supposedly placed them in an aquarium, later releasing them into the pond in Crofton in 2000 or earlier. The statute of limitations against introducing a non-native fish to Maryland waters had expired by the time the person was identified, and his fine, had he been caught when the introduction occurred, would have been about \$40.

His purchase of two (probably three) fish he released into the pond in Crofton cost about \$40. Cost to the State of Maryland to eradicate the northern snakehead was possibly close to \$250,000. Over 1,100 pounds of native fishes died but so did over 1,300 snakeheads! Had the northern snakehead escaped from the pond into the Little Patuxent or been captured by anglers who felt this fish



might become a good gamefish if moved to other waters, potential for causing massive alterations in native fish communities could have been substantial and impossible to correct.

The northern snakehead is one of 28 currently recognized snakehead fishes, native to Asia and Africa. Some species have been in the U.S. aquarium fish hobby for several decades. One species had been established in Hawaii since the late 1800s. Two northern snakeheads were caught in the St. Johns River in Florida, in 2000, and the bullseye snakehead, *Channa marulius*, a subtropical to warm temperate species, was discovered established in southeastern Florida in 2001. That the northern snakehead and perhaps two other species were being sold in live food fish markets, fish that were at or near sexual maturity, came as a wakeup call in 2001 to consider prohibiting importation and interstate transport of all snakehead species. Although many snakeheads are tropical to warm temperate fishes, there are habitats in each of our states, except Alaska, where at least one of these

fishes could become established if introduced, and that includes the Great Lakes area.

Could the northern snakehead, a fish that grows to nearly five feet in length, become established in the Great Lakes? Yes, in the southern Great Lakes, particularly in vegetated areas of rivers and shallows of lakes. The northern portion of its introduced range in Kazakhstan parallels the latitude of Minneapolis. Where it was introduced into the former Soviet Union, it caused serious declines in native perch species (zander, an European relative of walleye, and European perch, close cousin to yellow perch). This snakehead would almost certainly also prey on trouts, introduced salmon, alewives, ciscoes, whitefishes, and smelt. Its most likely predators would be pikes which, unlike snakeheads, do not produce as many young or protect them from predators, and lack ability to build large populations to prey effectively on snakeheads. In short, this is not the kind of fish that would be welcome to Great Lakes ecosystems, and one that could create far more problems than now exist. A United States ban on importation and interstate transport of live snakeheads became effective on October 4, 2002, although possession of snakeheads in states bordering the Great Lakes, except Illinois, Indiana, Michigan, and Pennsylvania, remains legal. Snakeheads, like Asian carps, are being sold in live food fish markets in Canada. Until the United States and Canada work cooperatively and collectively in restricting importations of temperate nonindigenous fishes, the Great Lakes will continue to face the probability of unwanted fishes in already heavily insulted waters.

Rapid Response in Michigan

The Office of the Great Lakes in the Michigan Department of Environmental Quality has begun the task of developing a plan for rapid response to new and threatened introduction of aquatic nuisance species to Michigan waters, such as the northern snakehead. The work is being coordinated with the Departments of Environmental Quality, Natural Resources, Agriculture, and Transportation as well as with other organizations in the state through Michigan's Aquatic Nuisance Species Council. The plan is also being developed in phases, with phase one being an assessment of the tools, regulations, agency coordination, and decision support systems needed for rapid response.

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Dr. Walter R. Courtenay, Jr. is Professor Emeritus of Zoology, Florida Atlantic University, Boca Raton, and currently biologist with U.S. Geological Survey in Gainesville. Primary focus of his research over the past three decades has been introduced nonindigenous fishes.

Asian Carp and Their Potential Threat to the Great Lakes

by Jerry L. Rasmussen

Two new species of Asian carp, the bighead (*Hypophthalmichthys nobilis*) and silver (*Hypophthalmichthys molitrix*), threaten to become the Great Lakes' next alien invaders. These fish didn't hitch rides aboard ocean-going vessels, but instead were imported by Arkansas fish farmers in the early 1970s as a biological means of removing excess foods and plankton from the water. They subsequently escaped to the wild, and have established large, nuisance populations over much of the Mississippi River Basin, including the Illinois River and Waterway.



Most recently, they have been collected at the confluence of the Illinois and Kankakee rivers (Figure 1), and are expected to be within reach of Lake Michigan by mid 2003. Biologists are concerned that the cool waters of the Great Lakes may provide desirable habitats for the two carp species because they both prefer water temperatures ranging well below 50°F (Figure 2). Also, the locations of their native home ranges in Northern China and Siberia, when projected onto a map of North America (Figure 3), suggest that the two species could colonize all connecting waterways as far north as Hudson Bay!

Figure 2. Preferred climate (temperature range) of three Asian carp species compared to those of several well known North American species.

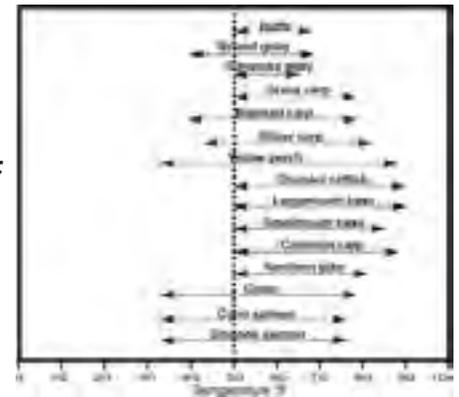




Figure 3. Native distribution of bighead and silver carp projected onto North America.

Should such an invasion occur, the two carp species will first be observed by the public as large jumping fish, easily startled by boat movements. A few years later, as carp numbers increase, biologists will likely begin noticing impacts on plankton populations and on plankton feeding fish. Numbers of other plankton feeders will likely start to decline in the face of competition from growing numbers of the larger carp. Most North American freshwater plankton feeding fish tend to be relatively small as adults, thus providing a food source for larger predators. But because the bighead and silver carp grow so fast, reaching lengths of up to 12 inches in one year of life, they quickly exceed the size usable as food for any North American predatory fish. Also, the two carp species grow to very large adult size (Figure 4), reaching maximum weights in excess of 100 lbs. In the process, they consume large quantities of plankton and tie up huge amounts of biomass in their bodies, especially when they occur in large numbers.

Figure 4. Twenty-six pound bighead carp collected from the Illinois River near La Salle in June 2002.



So the fear is that bighead and silver carp will enter Lake Michigan in large numbers via the Cal-Sag and Chicago Sanitary and Ship Canal, quickly form schools, and begin spreading throughout the lakes. They will then find suitable food supplies in the lakes' plankton populations, and when the time comes, find suitable spawning habitats in the tributaries. Three to five years later, successful spawns will become evident. With time, larger and larger numbers of young carp will hatch and survive in the tributaries, migrate back to the lakes, form schools, feed and grow, and then return to the tributaries to spawn in ever increasing numbers. Ultimately, large schools of large bighead and silver carp could become established in all of the lakes, displacing other plankton feeding fish, and possibly causing some populations to collapse. Soon after the collapse of small plankton feeding species, the larger predatory fish populations (i.e. salmon and trout) would feel the impact and begin to be threatened. If they, in turn, collapsed, the lakes could be left dominated by Asian carp!

The impact of such a disaster on the Great Lake's sport fishing industry would be devastating. Some would say, "Why can't we just fish for Asian carp?" Besides not being desired species, the two carps are plankton feeders, and thus do not take a bait. Instead, they simply swim about with their mouths open, straining suspended materials and plankton from the water. Any bighead or silver carp that might be caught would be taken as the result of accidental snagging or fouling - not something that lends itself well to a sport fishery! It is hoped that this dire prediction can be avoided by decision makers who have the wisdom, fortitude, and political will to take whatever measures are necessary to stop the carp in the canals before they reach the lakes.

Jerry Rasmussen is Coordinator for Large River Activities for the 28-state Mississippi Interstate Cooperative Resource Association (MICRA). He has worked for various state, multi-state and federal agencies on conservation and natural resource related issues pertaining to interstate and interjurisdictional rivers in the Mississippi River Basin since 1971.

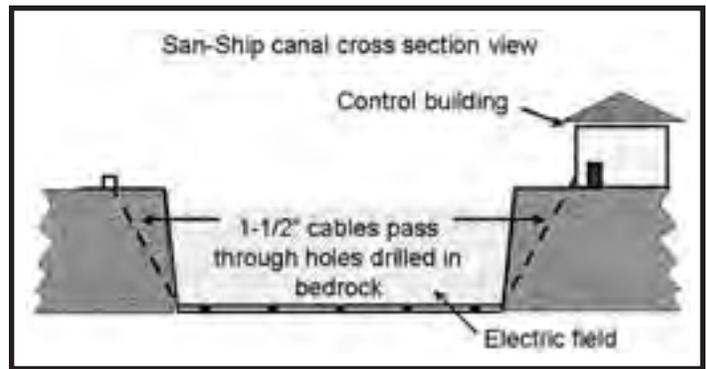
The Chicago Sanitary and Ship Canal Aquatic Nuisance Species Dispersal Barrier - A Step Toward Invasive Species Control

by Dr. Philip B. Moy

The Chicago Sanitary and Ship Canal system (San-Ship Canal) forms the sole aquatic link between the Great Lakes and Mississippi River drainage basins. This important transportation corridor is a potential route for range expansion of invasive species presently inhabiting either the Great Lakes or the Mississippi River.



In 1996, the National Invasive Species Act (NISA) directed the Chicago District U.S. Army Corps of Engineers to evaluate potential methods for creating an aquatic nuisance species dispersal barrier in the Chicago Sanitary and Ship Canal. A 35 agency-member Advisory Panel assembled to assist in the effort, envisioned a barrier consisting of a failsafe system of two arrays in a single canal reach separated by several hundred

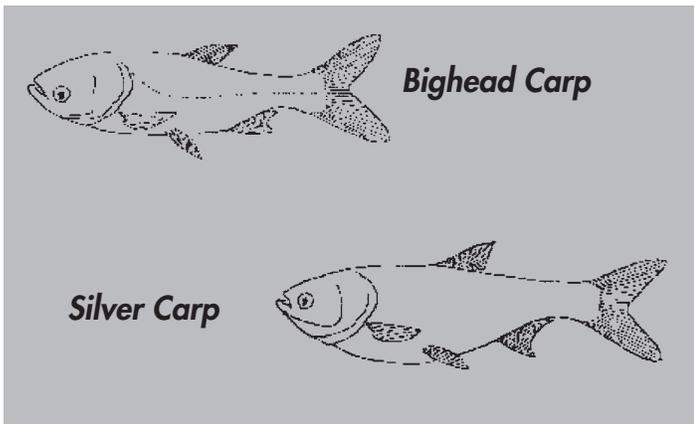


yards. Though there are five inlets to the San-Ship Canal from Lake Michigan, there is a seven mile-long section of the canal that forms a choke point in the system near Romeoville, Illinois, through which all the water (and organisms) must pass.

The Panel members identified constraints (sanitary discharge and commercial navigation) and obstacles (permits and safety) to creation of an invasive species barrier in the canal. After identifying and ranking over a dozen potential barrier options, the Panel decided an electric barrier had the greatest chance of success, was commercially available, had the least safety concerns and would be the easiest for which to obtain permits. Chemicals, though considered effective, would be expensive, difficult to permit and were recommended for use only as a stopgap measure.

Construction of the first electric array was completed in December 2001; the array was energized in April 2002. Due to budget constraints and Corps of Engineers' interpretation of verbiage in NISA (1996) that termed the barrier a "demonstration study", this array has an expected service life of only about three years and was constructed without back-up power.

The discovery of bighead and silver carp in the Des Plaines River less than 30 miles from the barrier site has focused new attention on the barrier project. As a result, the Great Lakes Fishery Commission, the International Joint Commission and US Environmental Protection Agency have now contributed funds to begin work on a second array and to purchase a back-up generator for the first barrier array. In November, 2002, the Metropolitan Water Reclamation District of Greater Chicago provided a back-up generator to the project for use until a permanent



generator can be secured. The temporary generator was installed December 4, 2002, and provides an extra level of security in the protection of the Great Lakes from the range expansion of these two species of Asian carp as well as other fishes.

Additional barrier technologies that appear promising for the canal include an infrasound bubble screen system that traps the sound in the bubbles to create a “wall” of noise. Fish may be better able to associate the direction of the sound in conjunction with the physical effect of the electric field for a more effective barrier. Monitoring of radio-tagged fish at the barrier by the Illinois Natural History Survey will help determine the response of fish to the barrier and whether the barrier is effective in deterring movement of fish through the canal.

Electric fields and bubble arrays will only affect actively swimming organisms such as fish and potentially large benthic invertebrates; planktonic organisms will not be deterred. Work remains to be done to create a fully effective barrier. In the near term we need to fortify the barrier with a second array and additional barrier approaches. In the long term a more permanent solution may be required such as reestablishment of the hydrologic separation between Lake Michigan and the Mississippi River basins.

Control of invasive species range expansion addresses a symptom but does not treat the disease. We must prevent introductions of non-native, potentially harmful invasive species. Unintentional introductions through ballast water are but one facet of the problem. We need to address intentional importation and use of non-native species in commercial activities such as open-pond aquaculture as well as other potential vectors.

Located in Manitowoc, Wisconsin, Dr. Moy is the fisheries and nonindigenous species specialist with Wisconsin Sea Grant. He currently co-chairs the Dispersal Barrier Advisory Panel and was the manager of the dispersal barrier project from 1996 to 1999 when he worked for the Chicago District Army Corps of Engineers.

Creation of Coast Guard Standards for Ballast Water—Will They be Effective in Controlling New Introductions to the Great Lakes?

by Ron Martin

Ballast water is recognized as a major pathway for the introduction and spread of aquatic nuisance species (ANS) into the Great Lakes, as well as coastal waters and fresh waters of North America. Since 1993, the U.S. Coast Guard has required all vessels entering the Great Lakes to exchange their ballast water on the high seas so that the resulting ballast water has a minimum salinity of 30 parts per thousand. Vessel operators can choose to retain the ballast water on board or they can use an environmentally sound alternative, though none yet exists.



Despite these regulations, new ANS introductions continue to occur. Are technologies available that would be more effective than ballast water exchange? What standards can be established that will greatly reduce the risk of new invasions in the short-term and eliminate them in

the long-term? To address these issues, Congress directed the Coast Guard to issue regulations and guidelines on ballast water management practices to prevent ANS introductions to the Great Lakes and United States waters. To comply with this daunting task, the Coast Guard provided several approaches to setting standards in the March 2002 Federal Register.

The proposed approaches fall into two categories: one limits organism size and the other requires a percent organism removal. Each approach has drawbacks. It is not clear whether the size-limited standard would be based on biology or on current technological capabilities; it should be biologically based. Furthermore, a size standard may direct ballast water treatment toward filtration when in fact the intent is not to favor one treatment technology over another. The second approach, based on a percent reduction (for example, 95% reduction in organisms), also has shortfalls. In areas with extremely high organism concentrations, a 95 percent reduction could leave enough organisms to create an unacceptably high risk of ANS introductions. The basis for this concern lies in our incomplete understanding of invasion risk given an initial inoculant concentration. Species-based standards beg the question of which species will be selected and whether a single species array is appropriate for both fresh and saltwater applications.

The Great Lakes Panel on Aquatic Nuisance Species (responsible for prevention and control efforts in the Great Lakes-St. Lawrence system) provided specific comments to the Coast Guard's Federal Register notice; those comments are summarized here. It is important to immediately implement an interim standard to stimulate development of ballast water treatment technologies. As a first step, the Panel recommended that an interim standard should require removal, kill or inactivation of at least 95 percent of vertebrates, invertebrates, and plankton using the best available treatment technologies. The interim standard should be based on the best available research and technology and an ambitious timeframe must be part of the process. As the knowledge base of aquatic nuisance species invasion research and technological capabilities expand, the interim standard should

be revised and strengthened. These standards need to apply to vessels in all ballast conditions.

Much remains unknown about the science of ANS invasions. However, action is imperative - interim standards must be implemented now to begin the process. The risks of inaction far outweigh the risks of making a decision based on incomplete information. Although their effort to date is incomplete, the Coast Guard is to be commended for moving the process forward.

Will the Coast Guard standards be effective in controlling new ANS introductions to the Great Lakes? Standards based on current available technologies will not be effective in removing all organisms. However, implementing the approach of 95% removal of all organisms would be a positive step towards eliminating future ballast water introductions and probably an improvement over the current practice of ballast water exchange. It is important to recognize that achieving the ultimate goal of zero discharge of



“Since 1993, the U.S. Coast Guard has required all vessels entering the Great Lakes to exchange ballast water on the high seas...”

ANS in the Great Lakes basin will take time, but we must keep a clear vision of that goal and the path that will take us there.

Ron Martin is the aquatic exotic species coordinator for the Wisconsin Department of Natural Resources in the Bureau of Watershed Management. He is also the Chair of the Great Lakes Regional Panel on Aquatic Nuisance Species and formerly served as an ex-officio member on the national Aquatic Nuisance Species Task Force.

Michigan’s Ballast Water Research

Stimulated by Michigan’s Ballast Water Reporting Legislation, Public Act 114, the Michigan Great Lakes Protection Fund awarded a grant to Fleet Technology Limited to further explore the use of hypochlorite as a biocide for ballast water treatment. This study is a follow-up to a shipboard demonstration project conducted in 2001 testing hypochlorite and copper ion as ballast water treatments.

Over the next nine months, Fleet will study the effects of hypochlorite on the ship’s protective coatings, along with other questions that arose from the previous ship board demonstration project such as hypochlorite’s interaction with sediment.

Changing Lake Erie Trophic Status - "The Dead Zone"

by Dr. Gerald Matisoff

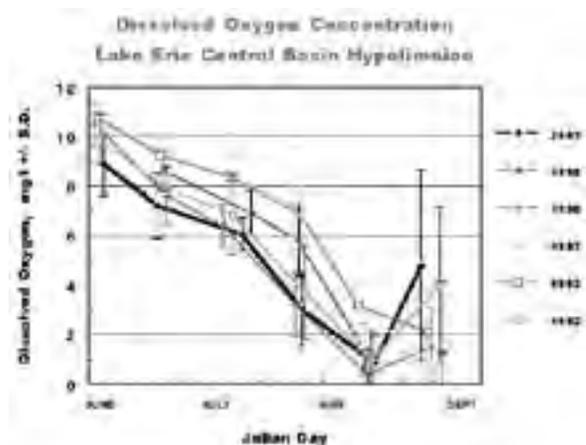
The Great Lakes Water Quality Agreement (GLWQA) and its subsequent amendments established a target phosphorus loading for Lake Erie to eliminate anoxia (low oxygen levels) in the hypolimnion (deep waters) of the Central Basin (the 'dead zone') and to ensure optimum conditions for fish. Those target goals have, with some exceptions, generally been met for the last 15 years or so, and there were indications, especially during the late 1980s that the water quality in the Lake was improving in response to decreased phosphorus inputs. However, recent anoxia in the Central Basin hypolimnion, increases in dissolved phosphorus, despite a relatively constant phosphorus input, and blooms of nuisance and toxic algae, such as *Cladophora* and *Microcystis*, respectively, are indications of a significant decline in water quality. What's happening?



Data obtained during U.S. Environmental Protection Agency's (EPA's) central basin monitoring cruises indicates that dissolved oxygen (DO)

concentrations have been below 2 mg/L during the late summer in almost every year during the last decade and during several years the DO concentrations were below 1 mg/L. By comparison, the target for meeting the GLWQA objectives is 4 mg/L. Furthermore, the Central Basin DO depletion rate, which seemed to be declining from the 1970s to the 1990s appears to have increased since 1990 and in some years (1998 and 1999) reached depletion rates as high as observed during the 1970s (3.5 to 4 mg/L/mo). Total phosphorus (TP) concentrations appeared to be declining throughout the 1970s and 1980s and reached the GLWQA target of 10 $\mu\text{g/L}$ by the late 1980s. In fact, because the TP concentrations were below the GLWQA target, there were actually some calls for increasing phosphorus loading to the lake. Since 1990, the data do not indicate any further decrease and in some years TP concentrations have actually been as high as during the 1970s ($>15 \mu\text{g/L}$). These higher phosphorus concentrations are not reflected in an increase in algal standing crop; in fact, chlorophyll-a concentrations and summer algal biomass have declined since the 1970s, although there are indications of a recent (post-1995) increase in algal biomass.

These observations seem inconsistent with predictions and dynamics of models developed previously to guide management of Lake Erie's nutrient budget. There are a number of possible explanations for these changes in the water quality of Lake Erie. First, such situations may be a natural occurrence for Lake Erie, and the Lake



EPA's dissolved oxygen monitoring data. Note that the goal is for the dissolved oxygen concentrations to remain above about 4 mg/L. From Rockwell (2002).

may have experienced such variation before the monitoring programs were established. In other words, this is just 'Lake Erie being Lake Erie'. Lake Erie is by far the shallowest of the Great Lakes and the water has only a 3 year residence time. Consequently, the Lake is much more dynamic and responsive to natural and human perturbations than the other lakes, and these water quality variations may just be a reflection of that.

Second, these conditions could be caused by a reduced size or increased persistence of the central basin hypolimnion, possibly accompanied by increased sediment oxygen demand. Natural weather variation can produce these changes. For example, an earlier establishment or later breakdown of the thermocline (the layer between the cold deep water and warm surface water) can lead to oxygen depletion because of a longer period of lake stratification. Similarly, lower lake levels can lead to a thinner hypolimnion resulting in decreased oxygen. A warmer than normal summer or greater water heating due to clearer water or greater ultraviolet (UV) light will also result in less hypolimnetic oxygen. Finally, another weather-induced cause could be from unusually strong autumn storms in recent years. These storms could cause significant inputs of phosphorus, independent of loading estimates due to increased runoff from the watershed (non-point sources) or erosion and resuspension of sediments in deltas.

A third possible reason for these observations is from reduced primary production caused by grazing pressure, limited nutrients, trace metal limitation and/or photosynthesis inhibition caused by increased UV light due to atmospheric ozone depletion.

Finally, another possible cause for these conditions is increased rates of organic carbon accumulation in the central basin hypolimnion. For example, it is possible that zebra and quagga mussels have increased grazing, changed the food web, and transferred organic carbon from the nearshore epilimnion (surface water) to the nearshore sediment surface. That carbon is subsequently transported to the offshore hypolimnion where it leads to increased central basin hypolimnetic oxygen demand. This organic

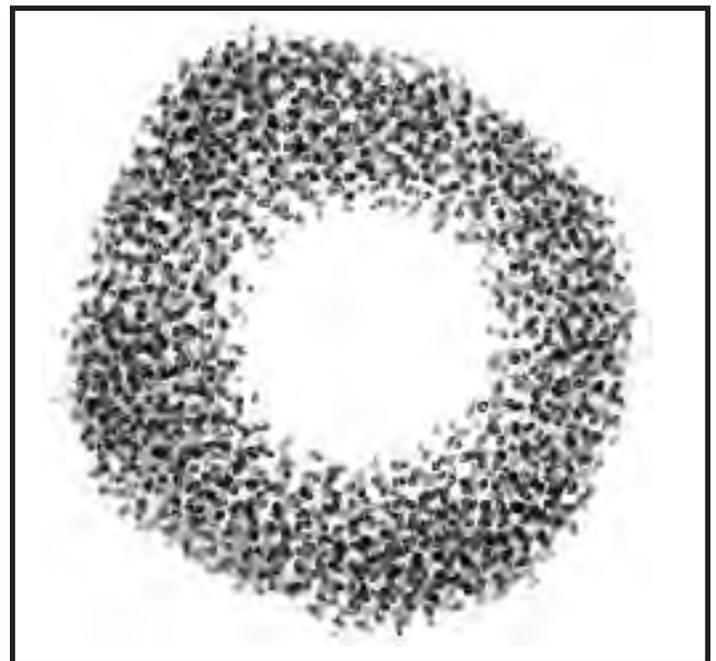
carbon focussing has been termed the 'nearshore shunt model' (R. Smith et al. Univ. of Waterloo).

To characterize the distribution and movement of materials (phosphorus, carbon, oxygen) to Lake Erie, to clarify mechanisms and extent of internal phosphorus loading within Lake Erie, and to quantify the biomass and transfer at different food web levels, a collaborative study by 27 scientists from 18 institutions was recently begun. This project, termed the 'Lake Erie Trophic Status' project is funded by EPA's Great Lakes National Program Office and will continue through 2003.

Dr. Gerald Matisoff is Professor and Chair of the Department of Geological Sciences, Case Western Reserve University.



A satellite image showing a Microcystis bloom in the Western Basin of Lake Erie. From <http://www.glerl.noaa.gov/pubs/brochures/mcystisflyer/mcystis.html>.



Microcystis, cyanobacteria (blue-green algae). From <http://www.durr.demon.co.uk/microcystist.html>.

Michigan Represented at National Youth Watershed Summit Meeting (The Experience of a Lifetime)

by *Suzanne West*

I have heard that the United States ecology movement has evolved from two major “waves” or schools of thought. The first wave occurred when Theodore Roosevelt helped create our national parks system. Combined with the publication of photographs and writings by John Muir, the first wave dominated the early twentieth century. The second wave resulted from the “Silent Spring” documentations cited by Rachel Carson in the early 1960s. I can proudly say that I am a product of the second wave. The ‘60s and ‘70s were characterized by a “save the whales” passion. Unfortunately, until recently, that passion for the earth seems to have waned. Working with many wonderful students year after year as a high school educator, I am convinced that today’s youth really do care about environmental issues like water quality. I believe that a third wave is beginning to form from student awareness of environmental protection.

Last spring, four talented and very bright Forest Hills Central High School students were invited to participate with other states at a National Youth Watershed Summit Meeting held in the Baltimore, Maryland, area in October, 2002. The summit meeting was sponsored by America’s Clean Water Foundation in conjunction with the designation of the year 2002 as “the Year of Clean Water” in honor of the adoption of the Clean Water Act in 1972.



Liz Jiang, Hui Zhang, Tim Maurer, and Jennifer Powers, along with me, their environmental science teacher, spread the good news that conservation and ecology are alive and well in Michigan. Water quality in our state is better than we expected.

To qualify to represent Michigan, we had to compete against other schools

by submitting to the Department of Environmental Quality a proposal for a summer study plan. We were thrilled to learn last May that we were selected to be the Michigan ambassadors. We felt honored to know that our idea for a site-based watershed study was considered good enough to use as a presentation at the national meeting.

Selecting the project idea was very difficult. Michigan has many water resources. All of them are important and valuable. Narrowing down our study topic was a challenge. We brainstormed many ideas ranging from the study of aquatic invader species to eutrophication of lakes and ponds. We decided to present a study of our nearest and neighboring body of water, the Thornapple River and its watershed.

At each site, we made detailed notes of the surrounding stream bank morphology and development near the sites of both stream sides. Weather conditions at the time, as well as in previous days, were recorded.

Air temperature, water temperature, stream flow rate, water color, stream depth, and stream width were also noted. Dissolved oxygen readings were taken at each site. Measurements of nitrate levels, nitrite levels, and phosphate levels were logged. Turbidity was measured using a specially designed test kit.

The favorite study parameter, however, was what we called “critter picking.” It was great



Teacher Suzanne West, and her students measure crab exoskeletons in the Chesapeake Bay.

fun to see who could find the most stoneflies or who could find the greatest diversity in caddis fly housings. Whenever one of the students or I discovered a specimen that had not been documented before by our group, it became the focus of the team to find more of that creature. As the students quickly learned, whenever

species are diverse, the habitat tends to be very desirable.

When October 6, finally arrived, it was time to fly to Baltimore to attend the National Youth Watershed Summit meeting.

We spent two days of the summit experience doing field work at a nearby Smithsonian research facility. Smithsonian scientists guided us through studies of Chesapeake Bay blue crabs aboard research boats in the bay, tree canopy studies done from a hanging bucket held 100 feet from the ground by an industrial crane, forest studies using state-of-the-art forestry instruments, and fish migration studies after canoeing upriver to study sites.

A summit fair was held while we were in Maryland at the Smithsonian Environmental Research Center. Students participating in the summit meeting presented their summer projects in a science fair format. It was interesting to move from display to display while talking to other students about their research projects. We found that throughout the United States the

prognosis for water quality is really quite good. There were overlapping concerns. Most notable, were the need for more management of land development in response to the need for slowing urban sprawl and the need to create and maintain more riparian boundaries or corridors along rivers and streams in all states. Other hot topics of concern included management of agricultural runoff and feed lot runoff as well as maintaining sport fishing habitats in trout streams.

Finally, following a day of sightseeing in Washington, D.C., we were taken to our departure airports and flown back to all of our respective states.

What an experience it was! I wish all educators could have the opportunity to work, study, and touch the lives of our young environmental enthusiasts. I will always remember this adventure. I know that my students will remember it, too. It truly was the "experience of a lifetime."

Suzanne West is an environmental education teacher at Forrest Hills Central High School in Grand Rapids, Michigan.

The Michigan delegation to the National Youth Watershed Summit: Tim Maurer, Hui Zhang, Suzanne West (teacher), Jennifer Powers, Liz Jiang.



"Paddle to the Sea"

When Sault Ste. Marie elementary teacher Linda Donaldson was looking for a way to engage her fifth-grade students at Lincoln Elementary School in the study of water and its sources, uses, forms and movement, she did what she would have wanted her students to do. She went to the library.

Librarian Deb White came up with the idea to use *Paddle-to-the-Sea*, the 1941 classic book by Holling Clancey Holling, as a way to demonstrate the science lesson to the students. The class would launch its own version of Paddle in the St. Mary's River and see how far the currents would take it.

Donaldson agreed that Paddle would make a great lesson, and she took it from there. She contacted wood carver Wendell Hoover of Gaylord who agreed to carve the canoe.

Ginny Johnson, Sault Schools art teacher, assisted by painting the carving, and Soo Locks Area Engineer Stan Jacek contacted the U.S. Coast Guard to arrange for the launching.



Wendell Hoover presents "Paddle" to Linda Donaldson's fifth grade class.

Wednesday, June 5, 2002, just below the Soo Locks. The launching took place from the deck of the USCG Buckthorn.

The students boarded the Buckthorn at 9 a.m. Capt. Skip Sawyer added to the science lesson by showing the students around the ship, then taking them to lock through, upbound and downbound, before bring the ship to a stop in the current and allowing Hoover to put his creation to sea.

The original Paddle-to-the-Sea, which Holling detailed as being carved by a Native American boy in the Lake Nipigon region, was launched from a snow drift into a spring melt stream that eventually flowed into Lake Superior. So the students' version received a bit of a head start.

Also, while the original Paddle's progress was unknown to its owner until it reached the ocean, Donaldson's students hope to keep track of the canoe's travels through a website they created (<http://sun.lssu.edu/~lindado/paddle>). The students have moved on to sixth grade and middle school, but Donaldson maintains the website and has sent postcard updates to the students when she has received e-mail notes from people who have found the canoe and have helped it along the way.

The canoe has a brass plate imbedded in its hull that reads, "I am Paddle from Soo, MI. Lincoln School would like to hear of my undertaking. Email them at lindado@eup.k12.mi.us. Help me onto the sea."

Since he began his journey, Paddle has been seen only twice. The first time was on the day he was launched, when U.S. Army Corps of Engineers worker Charlie Lampman found the wooden character near the Sugar Island ferry, just downstream from the launch site. Later in the week, the Gimpel family of Sault Ste. Marie found Paddle in the middle of Lake Nicolet, several miles downstream from the Soo.

Although Paddle's current location is uncertain, based on their studies of the movements of water, Donaldson's students remain convinced that their creation is well on its way to the Atlantic Ocean.

For more information, or to report a 'Paddle sighting,' please contact Donaldson at lindado@eup.k12.mi.us.

"Paddle" is launched into the St. Mary's River from the deck of the USCG Buckthorn.



The Michigan Great Lakes Protection Fund Update

The Michigan Great Lakes Protection Fund (Fund) has evolved over more than a decade into a dynamic program focusing on the environmental needs of the state through innovative and ground-breaking research to further our understanding of the Great Lakes system. Despite a variable economy, the Michigan Great Lakes Protection Fund has and will continue to support research that strives to restore the greatness to the Great Lakes.

In March 2002, the Fund held its first research symposium in an effort to better disseminate research results. The event was well attended by researchers, students, resource managers, and various interested parties. Topics for discussion ranged from rapid detection of

E. coli to speed up beach closures in Michigan to the loss of genetic diversity in lake trout due to fish stocking and disruption of Great Lakes systems by exotic species.

Over \$1.2 million was awarded in grants in Fall 2002, including research dealing with human and environmental health, persistent bioaccumulative toxics and aquatic nuisance species. This year marked the largest allocation of funds toward research and projects focusing on aquatic nuisance species prevention, control, and monitoring in the Fund's 12 year history. The Fund awarded almost \$600,000 in grants dealing with topics such as control and management of round gobies using pheromones, ballast water biocide treatment, and impacts to the foundation of the Great Lakes foodweb, *Diporeia*. The Fund has changed its direction to targeting needs of resource managers and policymakers and will continue to do so.

Research results, as well as more general information on the Fund, can be obtained from the Michigan Department of Environmental Quality at <http://www.michigan.gov/deq>

Michigan Great Lakes Protection Fund Projects Awarded in 2002

Study to Address Issues Raised by MESB Critical Review of a Ballast Water Biocide Treatment Demonstration Project Using Hypochlorite and Effects of Hypochlorite on the Integrity of Ship's Ballast - David T. Stocks, Fleet Technology Limited

Patterns of Aquatic Nuisance Species Distribution and Abundance Related to Multi-scale Environmental Properties of Great Lakes Shorelines - Reuben R. Goforth, Michigan Natural Features Inventory/Michigan State University

A Model GIS Assessment of Nonindigenous Invasive Species in Michigan Waters - Sarah Whitney, Great Lakes Commission

Investigations of Diporeia and Lake Whitefish in Lake Huron - Thomas F. Nalepa Greta Lakes Environmental Research Lab / National Oceanic and Atmospheric Administration

The Identification of Reproductive Pheromones Used by the Round Goby in Michigan Waters Where the Survival of Indigenous Fishes is Threatened - Weiming Li, Michigan State University

Microbial Source Tracking for Michigan Environmental Health Managers - Jeffrey L. Ram, Wayne State University

Micrometeorological Measurements of Air-Water Exchange Rates of PBTs in Lake Superior - Judith Perlinger, Michigan Technological University

Development of a Michigan Mercury Monitoring Network - Joy Taylor-Morgan, Michigan Department of Environmental Quality, Air Division and University of Michigan

Integrated Economic Development and Environmental Protection Assessment for the Muskegon River Watershed - Eileen van Ravenswaay, Michigan State University

The Influence of Forest Management on Stream Communities in the Upper Peninsula of Michigan - Casey J. Huckins, Mich. Technological University

Michigan Wetland Inventory - Amy Lounds, Michigan Department of Environmental Quality, Geological and Land Management Division

Acknowledgements

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Dr. Walter R. Courtenay, Jr., *U.S. Geological Survey*

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Congressman Vernon J. Ehlers, *U.S. House of Representatives*

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<http://www.michigan.gov/deq>

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