State of the Great Lakes

Annual Report
2001

Dedication

This report is dedicated to former Director of the Office of the Great Lakes, G. Tracy Mehan, III, who is now facing his life's most difficult challenge: acute leukemia. We know Tracy will fight this battle with the same energy and determination he exhibited in his endeavors to improve the health of the Great Lakes. Please keep Tracy in your thoughts and prayers.

The cover illustration was painted by blind Michigan artist, ***Michael Sincic,*** *of Traverse City. It depicts the Point Iroquois lighthouse located north of M-28 near Bay Mills overlooking Lake Superior in the Hiawatha National Forest. It operated from 1857 to 1963 to light the channel leading to the Sault Locks.*

A Message from the Governor

One of the best indicators of the health of the Great Lakes ecosystem is perhaps the most appropriate given the events of September 11 – the bald eagle.

This noble creature is the ecosystem's foremost predator and its position at the top of the food chain makes it an excellent indicator for monitoring environmental health. The International Joint Commission has found the bald eagle to be the best avian species for tracking ecosystem changes.

Bald eagle populations were significantly impacted due to widespread use of pesticides and other contaminants in the early 1960s and 1970s. The turnaround has been dramatic. From a low of 50 nests recorded in 1961, the population has soared to a high of 336 occupied nests in 2000. We anticipate this number will climb even higher once the 2001 count is completed.

Furthermore, bald eagle productivity, measured by the number of young fledged per nest, has risen by more than 50 percent since 1961.

Why the dramatic reversal? Hard work, determination and, perhaps most important, strong public support for water resource programs. Consider the following:

- passage of the Clean Michigan Initiative in 1998 which dedicated $165 million to water resource programs;
- aggressive pollution prevention programs which removed significant levels of PCBs and mercury;
- the development of a coordinated, regional strategy to combat aquatic nuisance species such as the zebra mussel and round goby; and,
- the initiation of the Conservation Reserve Enhancement Program, which will reduce non-point pollution entering our lakes and streams.

But, there is danger in complacency. As we look to confront new challenges facing the Great Lakes, 2001 reminds us that *who* manages the Great Lakes is just

as important as *how* we manage them. It is imperative that the Great Lakes states maintain authority over the management of this resource.

For reasons, we need only look at the 2000 census. It reveals that baby boomers are retiring at a rapid rate to more arid states such as California, Arizona, Georgia and Florida. These states face severe water shortages due in part to that explosive growth, but also because they simply don't enjoy the abundance of water available in the Great Lakes basin.

The political consequences of this population shift are significant. The eight Great Lakes states, Michigan, Wisconsin, Minnesota, Illinois, Indiana, Ohio, Pennsylvania and New York, lost a total of 10 congressional seats to these arid states. This increased political clout brings with it a greater ability to control water policy decisions.

As you will read in many of the articles in this edition of the *State of the Great Lakes*, the issue of water diversion and the implementation of Annex 2001 is critical to the Great Lakes region. The central premise of the Annex is to protect the Great Lakes through a common conservation standard and by maintaining water policy decisions within the region, not in Washington.

Meanwhile, as we debate these thorny topics, the bald eagle continues to soar over our magnificent lakes. Just as it stands as a symbol for the strength of our nation, it now also symbolizes the health and vitality of the Great Lakes ecosystem. Long may it fly!

John Engler

John Engler
Governor

Michigan Leads the Way — Again

Michigan broke new ground in August of 2001, when Governor John Engler signed Senate Bill 152, sponsored by Ken Sikkema, a republican senator from Grandville, into law. Despite the complexities of the issue, Michigan was able to boldly go where no state has gone before: ballast water management.

The proliferation of Aquatic Nuisance Species (ANS) in the Great Lakes basin has undoubtedly, albeit unintentionally, been exacerbated by the increase in shipping on the Great Lakes. At last count, there were over 160 ANS in the Great Lakes basin. The shipping industry is a critical part of our Great Lakes economy and even a part of what makes the Great Lakes a special place in which to live and do business. However, we cannot and will not allow further introductions of ANS via ballast water.

Thanks to the shipping industry's willingness to partner with the state to combat ANS, we have marked the beginning of a new era in Great Lakes water resource management. A more detailed description of SB 152, now Public Act 114, is contained in this edition of the *State of the Great Lakes.*

2001 also marked the end of an era for the Office of the Great Lakes. Mr. G. Tracy Mehan, III, the Director of the Office of the Great Lakes for more than eight years, has moved on to bigger things. Tracy has been appointed by President George W. Bush as the Assistant Administrator for Water at the United States Environmental Protection Agency (US EPA). While not a complete loss to the Great Lakes (we hope it will be difficult for Tracy to stay away from Great Lakes issues) it is, without a doubt, a gain for the US EPA and water resources throughout the country. Tracy is also a contributor to this year's report regarding the anti-terrorism efforts of the US EPA.

We wish Tracy the best of luck and a heartfelt THANK YOU for all the hard work and effort in making the Great Lakes a world class resource.

Last but not least, thank you to all the many people who contributed to this year's *State of the Great Lakes*. Many thanks also to our editor, Martha Waszak, for producing yet another exciting report.

David K. Ladd
Director
Office of the Great Lakes

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A Blockbuster Year for Sediment Cleanups

by Russell J. Harding

Holiday-season moviegoers are used to being bombarded with hype surrounding the latest box office "blockbuster."

Yet for all of the slick promotions and Hollywood heavyweights, chances are that it fails to live up to its sensational billing. But there's another show in town. It is called the Clean Michigan Initiative (CMI) and it's getting two thumbs up.

CMI, a $675 million environmental bond proposal by Governor John Engler, is directing money into communities for a variety of environmental, economic, and recreational projects. While CMI already boasts numerous accomplishments during the past four years, 2001 is shaping up as a blockbuster for one particular component of the bond – contaminated sediment remediation.

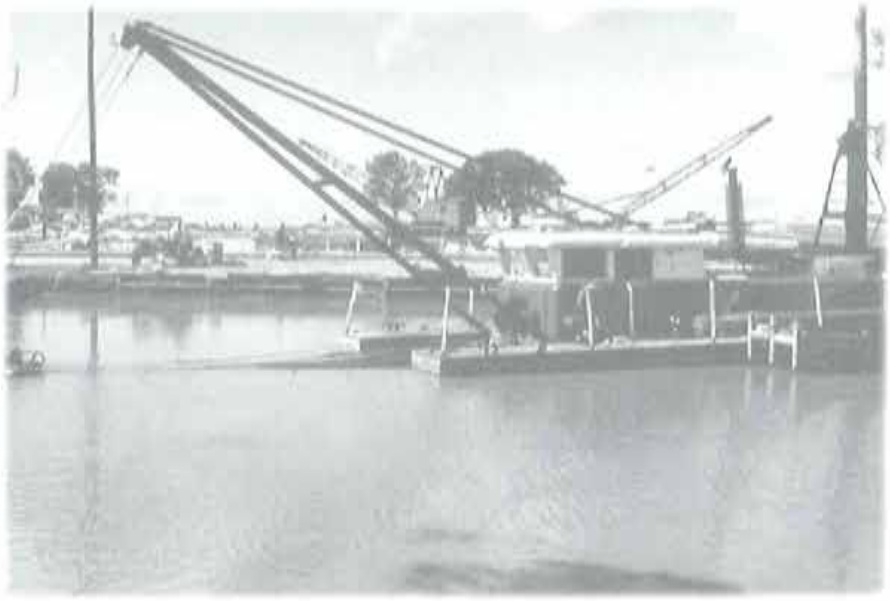
The passage of CMI in 1998 was one of two major events that year that allowed Michigan to begin in earnest to address historically contaminated sediments in Great Lakes basin water bodies.

The first was a $28.2 million cleanup settlement with General Motors and the cities of Saginaw and Bay City to address polychlorinated biphenyls (PCBs) in the Saginaw River. That settlement resulted in the successful removal of about 345,000 cubic yards of PCB-contaminated sediments from the river in the Bay City/Essexville area. The dredging project began in April 2000 and was completed in July 2001.

The second milestone, of course, is CMI. Ten known contaminated sediment sites were targeted for remediation under the bond. Work is already under way at one site and four more are slated for remediation in 2002.

The status is as follows:

- The Pine River impoundment in St. Louis – Using federal Superfund dollars and CMI matching funds, the removal of roughly



A contaminated sediment staging area.

350,000 cubic yards of dichlorodiphenyl trichloroethane (DDT) and PCB-contaminated sediments began in 1999 and should be finished in 2003. About 150,000 cubic yards of the most contaminated sediments have been removed to date.

- South Branch of the Black River – Work will begin in the spring of 2002 to remove approximately 22,000 cubic yards of sediments contaminated with PCBs and heavy metals from the Black River at Bangor. Funding is primarily from a settlement with the potentially responsible parties.

- Black Lagoon – A total of 30,000 cubic yards of sediments in the Black Lagoon in the Trenton Channel of the Detroit River are contaminated with oils, greases, heavy metals and PCBs. Prior to the full remediation in 2002, an innovative technology pilot demonstration involving 5,000 cubic yards of sediments will be conducted. The removed sediments will be heated and the pollutants thermally destroyed by a plant operating on the Detroit Steel Corporation property. The end-product of this operation can be added to cement and sold commercially, which is an environmentally friendly alternative to landfill disposal of contaminated sediments. The Michigan Department of Environmental Quality will spend about $2.4 million in CMI funds and the U.S. Environmental Protection Agency's Great Lakes National Program Office will contribute $400,000.

- Connors Creek – About 150,000 cubic yards of sediments contaminated with PCBs, heavy metals and other contaminants are scheduled for removal in 2002 from this tributary to the Detroit River. The tributary has received combined sewer overflow (CSO) discharges for many years. The cleanup will

be conducted by the city of Detroit primarily with city funds. Project costs also will be augmented by State Revolving Funds that are awarded for sewage treatment and disposal projects, which in this case involve the construction of a CSO basin at the head of the creek to capture such discharges to the creek for treatment.

- Unnamed Tributary to Wolf Creek – About 4,000 cubic yards of mercury-contaminated sediments will be removed from this tributary in Montcalm County. The cleanup will be conducted entirely by the responsible party and will allow CMI funds originally designated for this site to be used elsewhere.

- White Lake/Tannery Bay – The summer of 2002 will see the removal of about 73,000 cubic yards of tannery wastes and contaminated sediments from the Tannery Bay site on White Lake in Whitehall. Funding sources for this project include the responsible party, CMI and the U.S. Environmental Protection Agency.

Both the Saginaw River remediation and the CMI sediment projects have propelled Michigan to the national forefront in terms of tackling historic sediment contamination.

There's no doubt that CMI is a smash hit. And it's coming to a waterway near you.

Russell J. Harding is Director of the Michigan Department of Environmental Quality.

Annex 2001

Assessing the Annex

by Dennis Schornack

Niagara Falls made a most dramatic backdrop for the signing last June of Annex 2001 - a new agreement between the eight states and two Canadian provinces that border the Great Lakes to protect and manage the world's largest concentration of fresh surface water. Will the Annex measure up to the power and majesty of the venue for its execution?

Annex 2001 was developed to accomplish three strategic goals: 1) to protect the Great Lakes, 2) to secure in-basin authority to manage large water withdrawals, and 3) to withstand challenges to that authority under interstate and international trade law. It was created in the context of increasing demands for clean, fresh water by out-of-basin interests, declining groundwater quantity and quality in near-basin communities, and growing frustration with what appears to be an arbitrary, but politically popular "just say no" policy backed by state veto authority under federal law.

The Annex is a voluntary agreement. It is not policy, it is not law, and it does not change the behavior of a single water user inside or outside of the Great Lakes basin. It is in essence, a series of pronouncements and promises that took two years to write. The real action to keep these promises is yet to come by way of establishing binding agreements with the authority of law.

Was the Annex just a fancy press release; a nice photo op; a no-risk opportunity to spout platitudes about protecting the Great Lakes on regional TV? Absolutely not! It is a serious, bi-national, and multi-state commitment to do something entirely new to manage the world's greatest fresh water resource – the Great Lakes.

Buried in the body of Annex Directive #3 – "Establish a new decision making standard" – is the central source of all the controversy. It is the principle that no new, large withdrawals of Great Lakes water should be allowed unless on the whole, the withdrawal project will result in

a net improvement to waters and water-dependent natural resources of the Great Lakes basin.

The resource improvement standard is a line in time that says: "From this day forward, degradation is done." Future generations will enjoy waters and water-dependent natural resources that are better off tomorrow than they are today. Concern for the cumulative impacts of many small withdrawals can be transformed into relief from the restorative effects of incremental improvements. It is an uplifting and compelling vision for the future made possible by a legacy of impairment and profligate use.

The improvement standard is an opportunity to change the debate over diversions from how much damage is acceptable, to how much improvement is enough? It is an opportunity to create a resource-based currency for compensating the inevitable damage done by diverting water out of the basin. In this regard, it is the only way that diversion deals will ever get done – by ensuring that they are good deals that enhance the value of the resources we treasure.

"The improvement standard is an opportunity to change the debate over diversions from how much damage is acceptable, to how much improvement is enough?"

For those increasingly water desperate communities who have been frustrated by the intransigent politics of just saying "no" to any and all diversion proposals, the improvement standard is a path, perhaps the only path, to "yes." And for the leaders of the basin states who properly fear a revolt in Washington, D.C., to repeal their veto power, or an adverse court decision, the improvement standard is the path to justify and validate their authority to manage the Great Lakes. The improvement standard is "high ground" from the perspective of policy and politics.

But not everyone agrees.

Large water users in industry and agriculture fear another layer of regulation and compliance costs. They assert that even a large withdrawal doesn't do significant harm to a system as massive as the Great Lakes. But if the harm isn't significant, then the incremental actions to achieve improvement shouldn't be significant, either.

Regulators complain that they cannot measure resource improvements. They say the science isn't good enough and they would rather stick to the more familiar "no significant adverse impact" standard they use today. But how do they measure harm? And, if you can measure harm, why can't you measure improvement? Where's the logic?

Environmentalists are leery of any policy that would actually permit water diversion deals to move forward. They prefer to just say "no," but their own legal experts agree that this is an unsustainable policy that is tantamount to the arbitrary hoarding of water for economic gain – a definite no-no under international trade law. And despite the angst over the "commodification of water," the U.S. Supreme Court has already ruled that water is an article of commerce that is subject to the laws of trade.

The Annex is a good start on the road to dealing with the persistent and growing demand for water diversions. But much more work needs to be done. We need yardsticks to measure harm and improvement. We need crosswalks between water quantity and water quality. And, we need better science to back our decisions. But above all, we need the creativity, determination, and good will to restore the greatness to our Great Lakes.

Dennis Schornack was for several years the Governor's Special Advisor for Strategic Initiatives. He has recently been appointed by President George Bush as Commissioner and U.S. Chairman of the International Joint Commission (IJC). The IJC monitors whether the U.S. and Canada are meeting their commitments in treaties regarding water quality in the Great Lakes and other boundary waters.

A Business Perspective on Annex 2001

by Jon W. Allan

The State of Michigan is blessed to lie within the single most dynamic and unique freshwater system in the world: the Great Lakes. What a blessing this lake system is - this sweet, sweet sea, with its incredible expanse of shore and horizon, its vast reaches, its endless beaches, its rich history and yes, its immense possibilities. From the very beginnings of our history, the lakes have opened us up to so many possibilities.

We who live here in the Great Lakes Basin, regardless of whether we have been here all of our lives or have just arrived, find that the lakes make up a major part of who we are. We are linked together along this common waterway, across time and through space. In reality, we live in a unique location, a definable place in the world that functions to mold our core ecological, political, and economic identities.

Most of us love to think of the days at the beach, days on the water, the glinting sun or the glistening ice. Few can imagine our lives without access to such a resource. We live much of our lives in terms of what the lakes have enabled.

The fabric of our ecological identity, created by living near these great inland seas, and the benefits we derive from our use of this rich resource cannot be disentangled. Yes, they must be balanced, but they cannot be severed.

The economic forces of the Great Lakes undeniably touch our lives every day. We use the Great Lakes to ship our goods, to help manufacture products, to water our crops and livestock, to produce our milk, and to brew our beers and sodas. The Great Lakes provide recreation and tourism, sport and commercial fishing, bird watching and boating – activities that touch us all.

For many, the lakes provide our drinking water. Lake water also supports the generation of electricity — electricity that we expect will be there when we flip the switch. The list could go on and on. We seldom think about the uses of water that occur each and every minute of our lives.

Our economy is deeply dependent on the Great Lakes. Time and again, businesses decide to locate in Michigan expressly so they can utilize Great Lakes water in an environmentally safe manner. The lakes are our magnets and our center of gravity. The lakes are a prominent element of our quality of life. We can use and protect this resource within the context of this quality of life.

"The economic forces of the Great Lakes undeniably touch our lives every day."

The Annex 2001, in its simplest form, is a declaration of, and commitment to provide protection locally for Great Lakes water and to prevent disruptive wholesale diversions. We should not forget that this is its principal purpose. The Annex also recognizes that the responsibility to provide this protection lies with us here — not with others in distant places. On this key point we believe we all can stand together. This common belief forms a fundamental element for our continued stewardship for, and use of Great Lakes water.

We have this responsibility only partly because of proximity. Michigan's two great peninsulas are so profoundly affected by this water. Because we live here, we bear a higher burden for its stewardship than do others. We also willingly bear this greater burden because of our emotional commitment to, and investment in, these waters. For the same reasons, we bear greater risks if we fail in this effort.

Michigan has shown time and again that a vibrant growing, water-dependent economy can flourish within a healthy ecosystem. Michigan has shown that it can enable meaningful ecological protections and support economic vitality at the same time. We should not see use of Great Lakes water as a threat. Instead, we should celebrate the opportunities that the lakes afford us.

Let us not forget that when lake levels were at all-time highs in the 1980s consumption of water was not an issue. Now that water levels have receded, we grow concerned. But the lake levels have not dropped because of these historic water uses. Our current uses do not pose such threats to lake levels. Historically, water use within the basin is sustainable, in relation to the immense inputs of water into the lakes. Of concern are the potential massive, wholesale diversions from these lakes and the possible impact of large-scale diversions on the integrity of the lakes.

The members of the Michigan Chamber support continued work to ensure clean water and the necessary regulations to protect our water resources. We agree that this is our duty. We look forward to an open, transparent process under the Annex 2001 umbrella to achieve these common ends.

The Chamber recognizes that water has been an essential element in Michigan's success, writ large, and believes that water resources throughout the state continues to headline as a draw for new citizens of the state, for new business, jobs, for recreation and tourism, for our quality of life and for those immense opportunities that still lay ahead. This mandates that we must continue to strive for a balance of economic-based usage and environmental protection.

The Michigan Chamber applauds the Great Lakes Governors for their promotion and development of Annex 2001. The Chamber also supports a legally durable and defensible regulatory system that will protect our water from undo abuse or harm, and continue to equitably enable current and future water uses within the state and throughout the region. We fully suggest such a balanced approach.

We envision several key philosophical elements that make up a sustainable and defensible water use protection regulatory structure. Such a schema will need to address issues of regional equity, to recognize (and value) current investments and uses of Great Lakes waters, to utilize scientifically defensible standards for resource protection, to use absolutely clear, unambiguous definitions of what, in fact, constitutes a 'water use' a 'water withdrawal' and an 'out of basin transfer'. The Annex must ultimately be fashioned in a manner that is deeply sensitive to the natural flux and scale of the lakes' hydrological cycle, and must set in place a seamless, fair and consistent implementation plan across the region. We should expect no less from ourselves.

Jon W. Allan serves as Chair of the Michigan Chamber of Commerce Water Working Group as a representative of Consumers Energy Company.

It All Adds Up

by Cameron Davis

Let's put one and one together. First, in the next 25 years, at least 55 percent more fresh water than is now available will be needed to satisfy the growing global population. But other countries aren't the only ones that are thirsty. Los Angeles is now moving toward privatizing public drinking water because demand is fast outpacing supply.

Here's the second part of the equation. The Great Lakes contain nearly 20 percent of the Earth's fresh surface water, but less than one percent of our water is renewed annually. Despite the pollution problems that affect fish consumption and other aspects of human health, Great Lakes water is exceptionally clean for drinking.

Add these up. It's not outrageous to think that our precious Great Lakes could be tapped. In fact, it's already happening. In 1998 a Canadian firm received approval from Ontario to ship millions of gallons of Lake Superior water to Asia though the permit was later cancelled. As you're reading this, Green Bay and Milwaukee suburbs are looking to Lake Michigan for water because their own groundwater supplies are drying up in the face of continued outward sprawl. In another case, Perrier is now building water pumping plants in Michigan's Muskegon River watershed for bottling and shipping outside of the Lake Michigan Basin. These are just a few recent examples of how Great Lakes water is being targeted.

Unfortunately, we may not be able to protect the Great Lakes by "just saying no" to future water withdrawal projects like we've been doing. Under international trade laws and our own U.S. Constitution, we can't arbitrarily restrict the flow of goods—water included—from one state or country to another. To withstand legal challenges under these laws we need objective

decision making standards that don't discriminate between proposals coming from inside the Great Lakes, the Southwestern United States, or overseas for that matter. If we move fast, we can develop standards that will be predictable for the benefit of business while restoring the Great Lakes at the same time. The irony of this is that if we have such standards—even if they risk some water being removed—we can protect the integrity of the Great Lakes as a whole.

Commendably, the Great Lakes governors proposed "Annex 2001" in June to guide the development of state standards governing water withdrawals. The challenge now is for Great Lakes governors, business, civic organizations, municipal water providers, and other interests to come together on standards that are fair, transparent, predictable, and protective of the Great Lakes. With near-record low lake levels as a backdrop, we now have a choice: agree among ourselves in the region to strong standards or relinquish that authority to others who don't work, play, and revere the Great Lakes as we do.

"Unfortunately, we may not be able to protect the Great Lakes by 'just saying no' to future water withdrawal projects like we've been doing."

Cameron Davis is executive director of the Lake Michigan Federation, the oldest citizens' Great Lakes organization in North America. More on water withdrawals is available on the Federation's Web site at www.lakemichigan.org.

Ballast Water

Michigan Takes the Lead in Aquatic Nuisance Species Control

by Senator Ken Sikkema

The Great Lakes have been threatened over the years by many types of pollution and human activity. One of the chief challenges they face today, however, is the damage being done by the presence of non-native aquatic species such as the zebra mussel, sea lamprey, round goby, Eurasian ruffe and others. The negative impact of non-native species on the health and economy of the Great Lakes Basin is so significant that it is considered by many experts to be the single most serious threat to the integrity of the Great Lakes ecosystem. Favorable conditions have allowed these non-native species to proliferate, at the expense of native Great Lakes species. Additionally, non-native species represent a menacing threat to Michigan's $2 billion sport fishery and other industries tied to the Great Lakes. This past summer, the Michigan Legislature enacted Public Act 114. This legislation, which I sponsored, places Michigan as a leader in the Great Lake States and the country in preventing further damage caused by non-native species.

Passage of Public Act 114 caps over 18 months of work. Beginning in February of 2000 the Senate Committee on Natural Resources and Environmental Affairs conducted a series of public hearings on the issue of non-native species in our Lakes. Testimony presented at these hearings, as well as past research, had made two facts abundantly clear: (1) these species are having a devastating impact on the Great Lakes ecosystem, and (2) the source of this invasion is the ballast water discharged from ocean-going vessels.

Public Act 114 will help protect the Great Lakes from further introduction of aquatic nuisance species from the discharge of ship ballast through established ballast water management practices and treatment of ballast water prior to discharge. It requires the owner or operator of a vessel to file a report with the Michigan Department of Environmental Quality (MDEQ) so the state

can determine whether the vessel is in compliance with these requirements. Shipping companies complying with the standards will be listed on the Internet and published widely throughout the shipping industry. In addition, shipping companies and businesses using non-complying ships would not be eligible for grants, loans, or awards administered by the MDEQ.

Great Lakes freighters

Public Act 114 has the significant potential to stop the introduction of non-native species into the Great Lakes. This legislation combines the economic power of the marketplace with government regulation. It creates an incentive for ocean-going vessels to want to use ballast water treatment technology, not because government requires them to do it, but because their clients will not hire them if they do not. This legislation will set us on a course to solve this problem and stop the introduction of new species.

One of the most often repeated criticisms of our legislative efforts was that state action was "not appropriate" and that control of ANS was "a federal issue." Though we eventually reached a consensus on what the bill contained, it became clear to me that my instincts to move forward with a state approach were justified.

"We have no greater conservation task before us than to take the steps necessary to protect our Lakes."

It is clearly appropriate that we take on a leadership role to safeguard these interests, particularly so in light of the continued exemption for ballast water from regulation under the Clean Water Act. This exemption leaves open a gaping hole in the nation's most comprehensive water quality law and allows continued pollution of this vital natural resource — our Great Lakes. Until that exemption is closed by Congress, and even after it is closed, state action must chip away at this and similar federal roadblocks.

Michigan is the only state in the Great Lakes basin that is wholly contained within the Lakes. Our state and its citizens are defined by the Lakes, and our Constitution demands that "the Legislature protects its natural resources from pollution, impairment, and destruction." The citizens of this state, as evidenced by the recent round of hearings conducted by the Senate Great Lakes Conservation Task Force, have shown a deep passion for protecting the Lakes. We have no greater conservation task before us than to take the steps necessary to protect our Lakes. Michigan must remain a leader in this pursuit.

State Senator Ken Sikkema is Chairman of the Senate Committee on Natural Resources and Environmental Affairs.

Exotic Species in Ballast Water – Why Not Use Biocides?

by Bill McCracken

Billions of dollars are being spent to deal with the effects of zebra mussels and other exotic species in the Great Lakes. Every day that passes brings the possibility of invasion by some new creature from across the sea, carried here in ships' ballast water. The time to initiate strong actions to prevent this problem is now, and I want to explain what the Michigan Department of Environmental Quality (MDEQ) is doing about it.

About two years ago, legislation was introduced in the Michigan Senate which would have required the DEQ to issue permits for the discharge of ships' ballast water, and to ensure that the discharges were sterilized. When I heard about that, my first comment was, "Why not just add chlorine to ballast tanks?" After all, we use various forms of chlorine to disinfect our drinking water, to remove pathogens from treated sewage, to make our swimming pools safe, and to make sure our white shirts look "bright as new" when they are laundered. It is not quite that simple — there are questions that need to be answered before chlorine (or other chemical biocides) can be used for general treatment of ballast water. However, those of us at the MDEQ working on this issue still believe that chemical biocides are the most promising method which could be quickly implemented to minimize the problem.

Michigan is now carrying out a Ballast Water Treatment Evaluation project. The project is intended to be a field demonstration, supplemented by laboratory studies, to show whether hypochlorite (a form of chlorine which avoids the use of dangerous chlorine gas) and copper ion are practical ballast water biocides. Both hypochlorite and copper ion are known to have powerful biocidal properties. The questions about their practicality include:

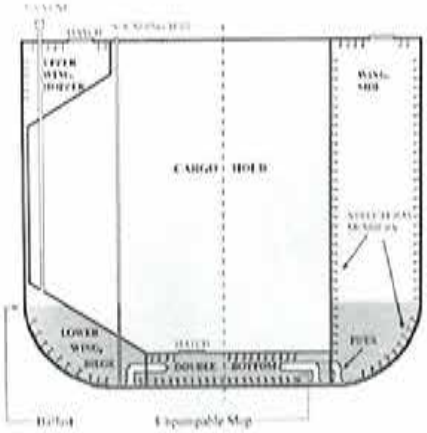
- Are they effective in sediment-laden ballast water?
- Are they corrosive to ballast tanks?
- Are they acceptable to regulatory agencies at discharge concentrations needed for biocidal efficacy?

- Are they safe for the ships and their crews?
- Are there any other practical problems for their use on ships?

The project is largely a result of recommendations from Michigan's Ballast Water Work Group. The Work Group is composed of technical experts, mostly from the shipping industry, assembled by the MDEQ to find the best way currently available to minimize the introduction of exotic species into the Great Lakes via ships' ballast water. The Work Group concluded that:

- Management practices and biocides are the only two methods currently available to deal with this problem.
- Improved management practices should be implemented as soon as possible to minimize sediment in ballast water.
- Hypochlorite and copper ion are potentially currently available ballast water biocides, which should be field tested as soon as possible.

The Dirty Guts of the Ship:
The Ballast Tanks and the Enemy Down Below



Results from this project will help the MDEQ fulfill its statutory obligation under Michigan Public Act 114 of 2001, to determine whether there are any treatment methods which could be used by oceangoing vessels to prevent the introduction of exotic species into the Great Lakes. Therefore, it was imperative that the ship-board field work be completed during the 2001 shipping season.

The shipping company, Fednav, Ltd., provided a ship, the *Federal Yukon*, for the shipboard field trial. Fednav invested in a copper ion generating system to add this biocide to the ballast tanks of the ship. Fednav also modified the decant tank, a smaller deck tank, to simulate the environment in the ballast tanks for the hypochlorite testing.

There are numerous ship design and operational issues being considered in this project. For example, there must be effective mixing of biocides within the labyrinth of structure that makes up a typical ballast tank. Also, when a ship is fully loaded, all ballast water is pumped overboard. These ships are considered to have "no ballast on board" (or NOBOB). However, an unpumpable residual, which may amount to 2% of the total volume, remains in the bottom of the ballast tanks. This NOBOB residual can be heavily laden with biological matter.

The project consists of three components: the shipboard trial, the laboratory toxicity testing, and the laboratory corrosion testing. As of this writing, only the shipboard trial has been completed. It consisted of a four-step process:

Port #1 — Lisbon, Portugal – October 23-25, 2001: This is an ocean port in a salt water environment where cargo was off-loaded, and ballast water was taken on.

Port #2 — Antwerp, Belgium – November 4, 2001: This is an ocean port where cargo was taken on, and the ballast water from Port #1 was discharged, creating a NOBOB condition.

Port #3 — Burns Harbor, Indiana – November 25 - 27, 2001: This is a Great Lakes, fresh water port where cargo was off-loaded, and ballast water was taken on.

Port #4 — Superior, Wisconsin – December 3-4, 2001: This is a Great Lakes port where cargo was taken on, and the ballast water from Port #3 was discharged.

The shipboard trial included on-board biological and chemical analysis and qualitative observations of the practical issues related to applications of these biocides. The laboratory toxicity testing will provide better controlled tests of copper ion and hypochlorite efficacy on a wider range of species than the shipboard testing. The laboratory corrosion testing will provide the information necessary to determine whether the biocides cause unacceptable damage to ballast tanks.

We expect to have results from this project in time to use them in making our determination regarding ballast treatment in March 2002 as required by Act 114. If our determination shows that there is a biocide that can be used to treat ballast water, Act 114 provides economic incentives to shippers who use it. As further research is done in future years on ballast water controls, methods which are superior to biocide applications may be found. Thus, if biocide usage is implemented, it may be an interim approach which is replaced later. However, the potential environmental damages of new exotic species in the Great Lakes make interim measures essential.

Bill McCracken is Chief of the Permits Section, Surface Water Quality Division, Michigan Department of Environmental Quality

Co-operation Works!

by Georges H. Robichon

On August 6, 2001, *Act No. 114* of *Public Acts of 2001* (introduced by Senator Ken Sikkema as Senate Bill 152) took effect in Michigan with practical application throughout the Great Lakes. This Act represents a considerable re-thinking of the ballast water issue in Michigan (from that espoused in the earlier Senate Bill 955 introduced in February 2000), and reflects a determined effort on the part of Michigan legislators and the shipping industry to cooperate in crafting compromise legislation that should prove to be a significant step in the fight against the further introduction and spread of aquatic nuisance species (ANS) in the Great Lakes.

Suffice it to say that the Great Lakes shipping industry, both international and domestic, had, prior to February 2000, been singularly ineffective in conveying to state authorities the significance of developments taking place, primarily at the international level, to address a problem that is by no means unique to the Great Lakes. The shipping industry had little time and some distance to go in establishing its credibility with the state legislators but acted quickly to demonstrate its commitment to working with governments at all levels in seeking an effective and workable solution to the ANS problem. These legislators were pleasantly surprised to learn that the ballast water management practices, now incorporated by reference into the new Michigan law, were already in force and effect in many vessels trading into the Lakes, if for no other reason than it makes no commercial sense for a vessel, with the draft limitations in the Seaway and the current low water levels, to carry anything but the absolute minimum amount of ballast when fully loaded, as is the case for most vessels entering the Seaway.

Fednav Limited, the predominant international carrier in the Great Lakes, played a leading role in working with the legislators in Michigan to craft *Act No. 114* and backed up the intent and wording of that Act by installing in one of its new Seaway-size bulk carriers, the *Federal Yukon*, a prototype copper ion ballast water treatment system, which is a modified version of an existing system used for anti-fouling purposes in the cooling pipes of a number of vessels trading worldwide, including Fednav's ice-breaker, the *Arctic Kalvik*. The *Federal Yukon* has also been made available-having had its decanting tank reconfigured-to

test the safety and effectiveness of hypochlorite in treating ballast water.

Lieutenant Governor Richard Posthumus, tours the* Federal Yukon, *which was outfitted with a prototype ballast water treatment system.

The credibility of the testing of these two possible treatment options is ensured as the testing is being conducted under the direction and control of the Michigan Department of Environmental Quality with scientists on board the *Federal Yukon*, which, as of the writing of this article, has made her third voyage into the Great Lakes, having departed fully loaded from Antwerp, Belgium, in early November, with her cargo discharged at Great Lakes ports during late November and grain loaded in the first week of December.

Again as of the writing of this article, another state, Wisconsin, has introduced similar legislation to *Act No. 114*. Fednav has taken the position with Wisconsin, and will do so with any other state or province that deems it necessary to introduce parallel legislation to what is now law in Michigan, that such initiatives are unnecessary and indeed could be counterproductive in that, as a practical matter, the Michigan law and industry's response thereto, benefits the entire Great Lakes region; indeed, could well have benefits throughout North America and aboard. Having potentially different reporting and testing requirements in each Great Lakes state will only frustrate ship owners, who instead should be encouraged to make their vessels available so that as many technologies as possible can be tested by a single, credible authority, using recognized, consistent criteria to determine whether the technologies are safe, workable, practical, environmentally acceptable, and, above all, effective in combating the ANS problem. Doing so will allow the ANS problem to be addressed in a consistent, multi-jurisdictional manner.

One lesson that one hopes both government and industry have learned from the experience in Michigan is that much more can be gained by working to find a solution to the ANS problem in a co-operative, non-regulatory context with regional application.

Georges H. Robichon is a senior vice-president and a director of Fednav Limited and a member of the board of directors of The St. Lawrence Seaway Management Corporation.

Exotic Species

An Invasion to Remember

The history of the invasion of aquatic nuisance species (ANS) began with the settlement of the Great Lakes region by European settlers covering a period of four centuries. As settlers began to make their way from the east coast to the untamed region of America's largest source of freshwater, they paved the way for the dispersal of non-native species through the development of roads, canals, and railroads, connecting the Great Lakes to the Atlantic Ocean. Various mechanisms of introduction occurred over time as the settlers began to develop the landscape to suit their lifestyles. Historically, ballast discharge by ships has been the leading cause for introductions beginning with solid ballast made of rocks, mud and animal fodder which harbored plants and animals.

Prior to the 1930s, an estimated 55 species were introduced and established in the Great Lakes. During this time purple loosestrife, an invasive wetland plant with purple flower spikes, and various other plants were distributed along canal banks and other shoreline areas where some dominate today. Another species that has historically plagued the Great Lakes is an eel-like fish known as the sea lamprey. Predation by the sea lamprey, combined with over-fishing, devastated lake trout populations in the 1950s and 1960s, dissolving commercial, sport, and recreational fishing. The sea lamprey was thought to have hitched a ride in the hull of boats or migrated through the extensive canal systems.

The opening of the St. Lawrence Seaway in 1959 was the turning point for ANS. With deeper canals, ships could take on more ballast; thus the amount of ballast released increased dramatically as did the risk of future introductions of ANS. Increased trade and deballasting led to a current count of at least 160 species found in the Great Lakes basin. Initially, aquatic nuisance fish and plants received the most attention for control, management, and prevention. In the last decade, the focus has moved toward microscopic organisms such as protozoa, nematodes, and sponges. Since the late 1980s, the ANS issue has received more attention due to the unintentional introduction of the zebra mussel, a

finger-nail sized mollusk which colonizes mainly hard substrates clogging water intakes for power plants and drinking water. This issue evolved from primarily saving the fisheries to protection of the economic, ecological, societal, and public health interests of the Great Lakes through prevention of future introductions.

While little can be done to curb the spread or control an established viable population of ANS, Michigan has passed various pieces of legislation that aid in both of these areas. In 2001, the state of Michigan took the lead when Public Act 114 was put into law which asks shippers traveling on the Great Lakes to voluntarily report best management practices (BMPs) for ballast water and ballast water treatment methods (BTMs). The Office of the Great Lakes has developed an on-line reporting program for both BMPs and BTMs to be implemented in 2002 and 2003.

So, with the support of extensive resources within the state, the battle continues against the biological invasion of the Great Lakes. The stakes are high. Even the smallest amount of sediment discharges from a ballast tank has the potential of harboring thousands of resting life stages of nonnative species that may have highly invasive characteristics. The future is in prevention.

Are the Great Lakes Experiencing 'Invasional Meltdown'?

by Dr. Anthony Ricciardi

The cumulative number of species invasions in the Great Lakes is increasing at an accelerated rate. Since 1970, one new invader has been recorded every eight months. The most probable cause of this trend is a change in inoculation pressure (greater numbers of organisms being introduced) from increased shipping activities. However, the number of invaders documented in the 1990s (15 species) does not differ from the 1980s, despite regulations requiring inbound ships from freshwater and estuarine ports to exchange their ballast on the high seas. Ballast water exchanges are often incomplete; consequently, not all organisms are purged from the tanks and some survive contact with diluted seawater. Furthermore, most ships aren't carrying significant quantities of ballast water and are thus exempt from regulations, even though their tank sediments likely contain resting stages of exotic organisms (see Hugh MacIsaac's article in this report).

An additional explanation for the rapidly growing number of Great Lakes invaders is offered by a new theory about the dynamics of species invasions. Interactions among invading species have long been assumed to be competitive and mutually detrimental. For decades, our understanding of invasion dynamics was influenced by the theory of "biotic resistance," which predicts that as ecosystems accumulate, more species competition for available resources will increase, and so the rate of invasion will decrease over time. However, invading organisms may actually facilitate one another's establishment and survival. Dan Simberloff and Betsy Von Holle of the University of Tennessee have proposed an alternative theory: the "invasional meltdown" model. Their model predicts that ecosystems subject to chronic inoculation pressure will become progressively easier to invade, because each attempted species introduction may disrupt the resident community and (or) change the physical environment to the benefit of some other potential invaders. And by enhancing the survivorship and abundance of an invader, facilitative interactions may increase the magnitude of its impact on other species.

Thus, facilitation produces positive feedback cycles that cause the ecosystem to become increasingly unstable and difficult to manage.

Which of these models, biotic resistance or invasional meltdown, best applies to the Great Lakes? I examined this question in a recent study published in the *Canadian Journal of Fisheries and Aquatic Sciences* (December 2001). I found, in many cases, that the success of invaders is enhanced by previous invasions, contrary to the biotic resistance model. The numbers of documented interactions among invaders suggest that facilitative interactions (cases of mutualism and commensalism) are more common than purely negative interactions (competition and amensalism). Moreover, many exotic predator-prey and host-parasite relationships appear to benefit the predator/parasite population at negligible expense to the prey/host population. For example, zebra mussels provide food (in the form of mussel feces) and shelter (within clumped shells) to the invading amphipod crustacean *Echinogammarus ischnus*, which was discovered in the Detroit River several years after the zebra mussel and has now become common throughout the lower Great Lakes. Experiments show that *Echinogammarus* abundance is nearly 20 times higher in the presence of zebra mussels. Zebra mussels thereby stimulate food resources for another invader, the round goby. Juvenile gobies feed mostly on *Echinogammarus* and other amphipods, while adult gobies feed on the mussels themselves.

Zebra mussels

Synergistic effects of multiple invasions

Another prediction of the invasional meltdown model is that multiple invasions may interact in synergistic ways to alter the rules of existence for other organisms. This is demonstrated by two case histories from the Great Lakes. The invasion of the parasitic sea lamprey in the mid-20th century severely reduced the abundance of top predators, such as lake trout, thereby paving the way for the population explosion of alewife—which subsequently outcompeted native planktivorous fishes and caused a decline in fishery productivity. The zebra mussel invasion in Lake St. Clair produced a dramatic change in water clarity that initiated a cascade of effects, ultimately causing exotic weeds to flourish and the fish community to shift from dominance by commercially-important walleye to bass and pike.

This phenomenon has also been documented in marine environments. An alarming example is occurring on the

subtidal rocky coast of Nova Scotia, where an introduced bryozoan (a colonial invertebrate) has infested kelp blades, rendering them brittle and susceptible to wave damage. As a result, the kelp canopy has diminished, allowing a competitor, the Japanese alga *Codium fragile*, to become established and prevent the kelp canopy from regenerating. It is not clear what consequences this major alteration to the subtidal community will have on the urchin and lobster fisheries.

Round Goby

What are the management implications of invasional meltdown?

At the very least, facilitative interactions among introduced species will reduce our capacity to predict fishery yields. If the invasional meltdown model is valid, an increased frequency of species introduction will lead to an accumulation of invaders and synergistic impacts, which will cause the ecosystem to become increasingly unstable and difficult to manage. This is a theoretical argument for reducing inoculation pressure; it refutes the claim that strict controls on ballast water discharge are unwarranted if some future invasions are inevitable through other, less active vectors. Even a partial reduction of inoculation pressure may slow the buildup of feedback cycles that result in high ecological and economic costs.

Dr. Anthony Ricciardi is assistant professor of biodiversity at McGill University, Montreal, Canada.

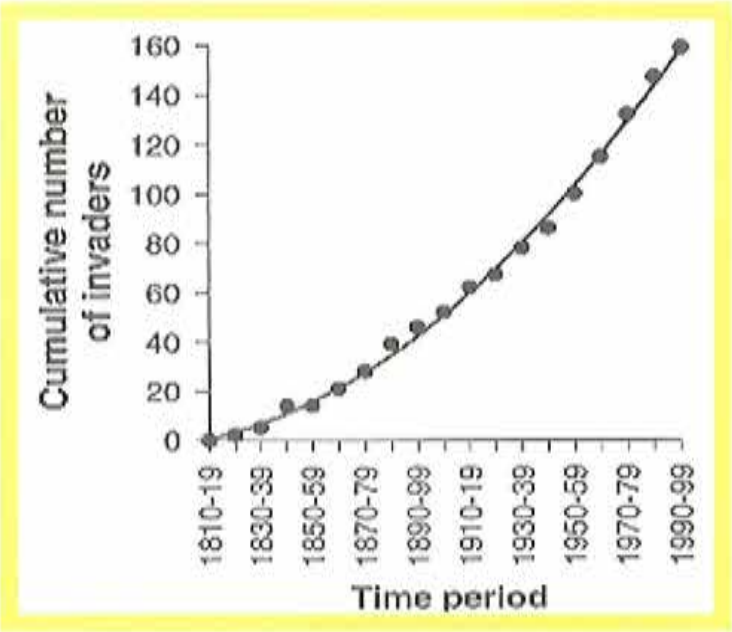
Lake Superior: a Biological Invasion 'Hotspot'?

by Dr. Hugh MacIsaac

Human activities are profoundly affecting the earth's support systems. Among the most surprising and troubling of these stressors is the unintentional introduction of nonindigenous, invasive species (NIS). NIS are species that are introduced to ecosystems to which they are non-native, mainly from other continents. NIS are expected to impact biodiversity in lakes more profoundly than any other environmental stressor during the coming century (Sala et al. *Science* 2000). Many introductions of NIS occur with little adverse effect, although others spread widely in their new habitat, often with strong adverse effects on human, plant or animal health, economic systems, or on the ecosystems they invade.

The Great Lakes have a long history of invasion by NIS. Many vectors transport NIS to the Great Lakes, although one mechanism – ballast – deserves special mention. The primary vector of introduction for the past 100 years has been ballast discharged by intercontinental, commercial ships. Ballast is loaded in the port of origin to provide stability and trim to vessels with no or little cargo when traveling on open seas. Prior to 1890, vessels carried solid ballast including soil, sand and stone. Most of the species that initially invaded the Great Lakes were terrestrial plants and insects, whose seeds and eggs contaminated ballast. Since 1890, intercontinental vessels have employed liquid ballast. The USA receives discharges of 2 million gallons of ballast water per hour by visiting foreign ships! Not surprisingly, ships have been the predominant vectors of invasion to the Great Lakes since 1960, primarily via the release of contaminated ballast water. At least 160 NIS have been confirmed established in the Great Lakes (Ricciardi 2001; Figure 1), although the actual number of invaders could be much higher since most of the species that have been identified are large or otherwise conspicuous (e.g. invertebrates and fish). Little attention has been paid to identification of NIS of bacteria, viruses, protozoa and microalgae. NIS pose a very significant economic, ecological and human health risk to the Great Lakes. For example, zebra mussels have reconfigured Great Lakes ecosystems in myriad and often unpredictable ways, thereby precluding effective management of the ecosystems by government officials.

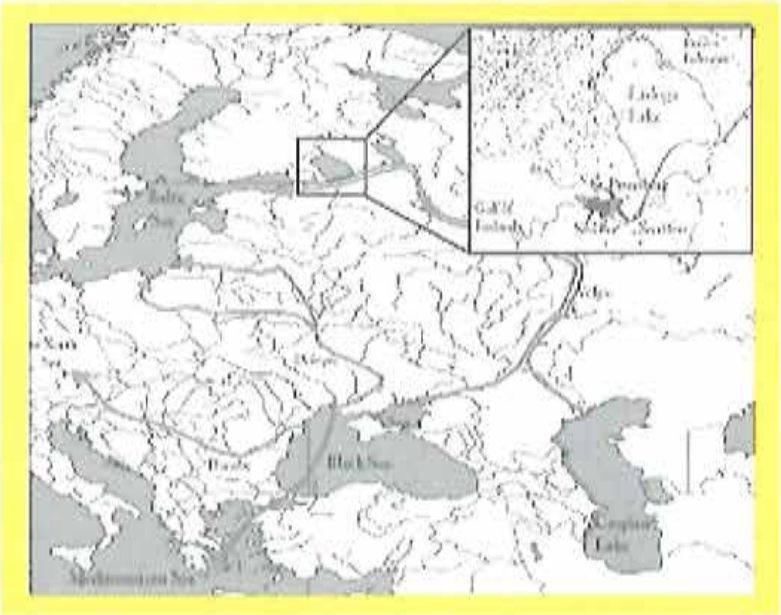
The present NIS threat posed by ships to the Great Lakes can be divided into two categories: vessels entering the lakes loaded without cargo but fully loaded with Ballast On Board (called BOB ships), and those that enter fully loaded with cargo (called NOBOB or NO Ballast On Board ships). Coast Guard regulations require that ballasted vessels discharge only saline, open-ocean water in the Great Lakes. Inbound vessels containing ballast water collected in foreign brackish (i.e. partly salty) or freshwater ports must undergo ballast exchange – purging the ballast tanks (and organisms in them) and then refilling them with saline water – before entering the Great Lakes. Salt water should kill freshwater individuals left in the ballast tanks. Consequently, the perceived risk of invasion by BOB ships should be low but not zero. BOB vessels have diminished in importance over the past 25 years, and now constitute only approximately 10 percent of inbound traffic to the lakes, because this mode of operation is economically inefficient.



Cumulative number of identified NIS established in the Great Lakes. Ballast water discharge is responsible for a majority of the invasions since 1960.

Data courtesy of Dr. A. Ricciardi (in press).

Canals and rivers serve as 'corridors' allowing species from the Black, Azov and Caspian Seas to spread to key European ports, where other ships then bring them to the Great Lakes. From MacIsaac, Grigorovich and Ricciardi (in press). About 70 percent of NIS introduced to the Great Lakes since 1985 originated from south-eastern Europe, including zebra mussels and round gobies.



NOBOB vessels constitute the majority (approximately 90 percent) of inbound vessel traffic to the Great Lakes largely because they carry cargo in each direction, maximizing economic efficiency. NOBOB vessels operating on the Great Lakes are presently exempt from Coast Guard ballast regulations because, officially, they carry no ballast water. However, these ships typically carry between 2600 – 13000 gallons of residual ballast water and the

A

B

C

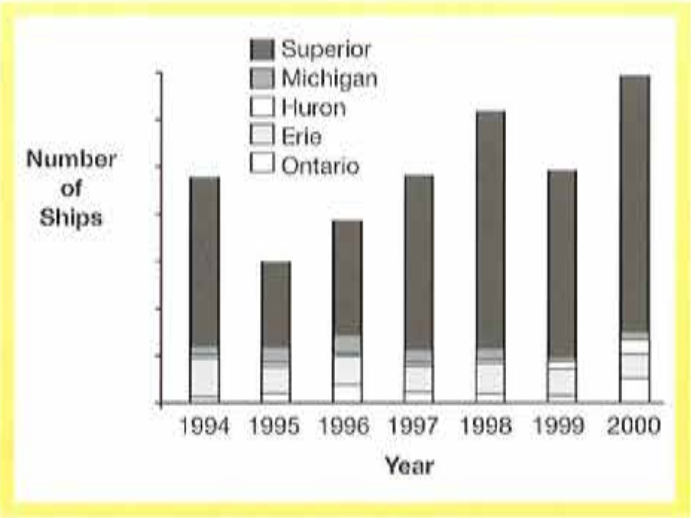
A: Resting eggs of an invertebrate species collected from sediment in a ballast tank of a NOBOB ship on the Great Lakes. B and C: Sediment accumulation in the bottom of ballast tanks of a ship sampled on the Great Lakes. Images courtesy of Dr. David Reid, GLERL (Ann Arbor) and Sarah Bandoni, GLIER (Windsor).

organisms contained in it. Ballast tanks also accumulate fine sediment that may harbor 'resting stages' of invertebrates. These resting stages often resemble apple seeds, and are produced by species when environmental conditions deteriorate. Resting eggs may remain viable even after burial in sediment for 50 years or more! NOBOB sips pose an invasion risk because as they go upstream, discharging cargo (usually steel) at various ports, they load Great Lakes ballast water in with their residual water. This may allow species living in the tanks to reproduce and stimulate resting eggs to hatch. This water is discharged at the terminal port-of-call where the ship loads outbound cargo (e.g. wheat). My laboratory has conducted a review of ballast water discharge patterns for vessels entering the Great Lakes between 1975 and 2000. A majority of both BOB ships and NOBOB ships discharge ballast into Lake Superior. Consequently, this lake should be at greatest risk of new invasions. Few invasions have in fact been reported in this lake first, possibly because most biologists who study this issue reside near and work on Lakes Erie, Ontario and Michigan. With the assistance of the Michigan Office of the Great Lakes, we initiated a study during summer 2001 to determine if previously unidentified NIS have established in Lake Superior.

Specifically, we sampled ten locations around Lake Superior, first at the end of June (spring conditions) and again in late August (summer conditions). Two sets of samples were collected from the Duluth – Superior area and the Thunder Bay area because these are the ports used most extensively by ships. At each site, we collected samples close to shore and farther offshore. In addition, we collected net plankton (i.e. water) and benthos (i.e. sediment) samples at each site. This degree of intensive sampling virtually ensures finding any unidentified NIS that may exist in the lake. All samples were preserved in alcohol.

We have just begun phase two of the project, which involves two different approaches to identify invertebrate animal NIS. First, Dr. Igor Grigorovich, a research associate at the Great Lakes Institute, is presently examining all of the plankton samples and, using classical taxonomy, will determine whether NIS exist in the lake. This approach will be augmented by a molecular 'probing' technique, whereby we will subdivide plankton samples and take one fraction for homogenization. Mitochondrial DNA from this sample will be probed for the D-loop fragment and the cytochrome B gene. We anticipate all locations that

share the same species will present with identical sequences in the homogenized sample, whereas NIS isolated to one specific region of the lake will have additional sequences not shared with any other homogenized sample. This technique will allow us to focus additional attention on unique samples, thereby easing the hunt for established but previously unidentified NIS in the lake. The same techniques will be employed with benthic samples to identify invertebrate animal NIS that live on or in lake sediment.



NOBOB vessels discharge mainly into Lake Superior.

From Collautti et al. (2002).

This study is the first to employ a systematic strategy to identify NIS in Lake Superior. Identifying these species represents the first stage of a management and containment strategy to prevent these species from spreading to inland lakes through the Great Lakes region.

Dr. Hugh MacIsaac is professor of biology at the Great Lakes Institute for Environmental Research, University of Windsor.

Monitoring Michigan's Beaches

by Dr. Shannon Briggs

Michigan beaches were busier than ever this past summer.

Swimmers were able to enjoy most of Michigan's beaches every day since there were few reported beach closings.

This is great news especially since monitoring activities around the state have increased substantially over the past few years. Since 1995, there has been a steady increase in the number of health departments that are regularly monitoring their beaches.

In 1995, ten counties were regularly monitoring their beaches. That number jumped to 20 counties in 1998, 24 counties in 2000, and 36 counties in 2001.

Over the past seven years, the number of beaches closed each year due to bacterial contamination varied from 16 to 276. Variation in the number of beach closings is due primarily to the number and intensity of rain events during the summer. Intense and frequent rainfall can lower the water quality at many beaches because it washes debris from the beach into the water. Some of the debris comes from gulls, geese, ducks, and other waterfowl. The birds are pleasant to look at on the beach, but what they leave behind gets washed into the water by the rain, which can dramatically affect water quality. Mammals are also potential sources of bacterial contamination.

The water at a beach can also be impacted by combined sewer overflows and sanitary sewer overflows. Intense rainfall creates large volumes of water that may enter a sewer system. The added volume of rainwater can cause an overflow of the sewer system, and untreated or partially treated water spills into lakes, rivers, and streams. The Michigan Department of Environmental

Quality (MDEQ) is working with communities throughout Michigan to improve sewer systems so that large volumes of rainwater do not overburden a system's capacity. Turbidity caused by the overflow also affects water quality by protecting bacteria from ultraviolet light. In less turbid water, ultraviolet light is able to penetrate the water and kill bacteria. After bacteria levels peak due to a rain event, they tend to decrease due to environmental factors, such as ultraviolet light, and water quality typically improves within 24 to 48 hours.

Under state law, health departments have the authority to test the water at public beaches and close the beach if necessary. The water at beaches is tested by collecting three individual water samples at one time. A water sample of at least 100 milliliters (ml) is taken one foot below the water surface from an area that is three to six feet deep. The individual samples are put on ice in a cooler and taken to a laboratory within six hours. The lab will process the samples within two hours of delivery and results are available within 18 to 24 hours. The time delay for obtaining the results is due to the method that is used to quantify the bacterial indicator, *Escherichia coli (E. coli)*. Privately owned beaches may be monitored and tested in the same way by the owner.

Michigan beaches are a major tourist attraction.

The geometric mean of individual water samples is compared to the water quality standard. The daily bacterial standard for the protection of surface waters for full body contact is 300 *E. coli* per 100 ml. This standard is used as a comparison when three water samples are taken on the same day. The monthly bacterial standard for full body contact is 130 *E. coli* per 100 ml. This standard is used as a comparison when at least five sampling events are done within a 30-day period. If the daily or 30-day geometric mean exceeds the *E. coli* standard, then it is up to the health department to determine whether to close the beach.

Over the past two years, the MDEQ has provided $293,000 in Clean Michigan Initiative-Clean Water Fund grants to health departments to assist them in developing and strengthening their beach monitoring programs. To assist health departments in posting their beach monitoring data, the MDEQ has created a centralized, state-wide *E. coli* database. Health departments can enter their data directly into the database at any time. As soon as data are entered, they are available to the public via the "Michigan Public Beach and Waterway Information" website, which can be accessed through www.michigan.gov/deq. The website is a great resource for information, such as the location of public beaches, current and historical monitoring data, whether the beach is open or closed, and who to contact at the health department for more information.

The testing of water at beaches is expected to be better in the near future because new methods for quantifying *E. coli* are being developed. It may be possible to get test results in an hour. The availability of real time results coupled with the accessibility of the data on the MDEQ website will provide the public with the most up-to-date information for public beaches in Michigan.

Dr. Shannon Briggs is the coordinator for beach monitoring for the Surface Water Quality Division of the Michigan Department of Environmental Quality. Her responsibilities include managing Clean Michigan Initiative-Clean Water Fund grants for beach monitoring and providing information to health departments and the public.

Drinking Water – Counter-terrorism

Excerpted from remarks by G. Tracy Mehan, III, Assistant Administrator for Water, U.S. Environmental Protection Agency (EPA), to the International Joint Commission's Public Forum on Great Lakes – St. Lawrence Water Quality, Montreal, Quebec, October 20, 2001

Because of the urgency imposed by recent events, I'm going to address first the question of drinking water safety. Until recently, most public questions about drinking water safety focused on the quality of source water or compliance with standards for microbial or chemical contaminants. The events and aftermath of September 11 have immediately and drastically changed the focus of those questions to one of the fundamental security of our drinking water systems from malign threats.

Building on existing efforts, we are rapidly taking steps to ensure that all drinking water providers and wastewater systems possess tools to assess, minimize and respond to all potential threats to the safety of drinking water and wastewater treatment facilities.

We are working on five specific fronts: tools, training, secure information, an expanded knowledge base, and networking. Let me review these areas of activity very briefly.

- ***Tools:*** We are developing tools to safeguard water in concert with numerous partners, public and private. These include:
  - Immediate Notices sent to all utilities and local law enforcement outlining security measures to be put in place expeditiously.
  - Initiating cross-checks of utility employees with the FBI's watch lists.
  - Vulnerability assessments and Remediation Plans for systems.
  - Emergency Operations Plans for drinking water systems.
- ***Training:*** We are developing training programs for utilities, including general managers; security officers and consultants; State/EPA Regions/ Tribes.
- ***Secure Information Sharing:*** We are pursuing rapid information sharing for alerts of threats, notices of vulnerability, and incidents using the FBI's secure information system to notify all drinking water utilities as well as a Virtual Center to coordinate among utilities, EPA Regions, States, and local emergency and drinking water contacts.
- ***Improving Knowledge:*** We are pushing new and ongoing research and analysis for a better understanding of the range of potential contaminants and how to respond to them, including the nature of the contaminants; detection of the contaminants; how the contaminants

respond to treatment; and the fate and transport of the contaminants – within the environment and within the treatment system.

- ***Networking:*** EPA realizes that the safeguarding of the nation's drinking water is not entirely in our hands, although we play a critical role. We will continue to improve coordination, dialogue, and information dissemination with other Federal Agencies, with the EPA Regions and States, and with the principal water organizations responsible for frontline defense.

Recently, EPA Administrator Whitman announced the formation of a Water Protection Task Force to help federal, state and local partners to expand their tools to safeguard the nation's drinking water supply and wastewater treatment facilities from terrorist attack. While EPA already has a strong coordinated partnership program for protecting our drinking water, this task force will expand EPA's service to the community water systems and wastewater treatment systems, while intensifying our security efforts.

And in this vital area of protecting citizens from terrorist threats, the US and Canada are working closely together on many fronts. We are increasing our consultations and coordination by federal agencies such as EPA and Environment Canada, and are intensifying cooperation to protect people in both countries related to potential threats of hazardous and toxic chemicals that could contaminate fresh water supplies and air.

Nevertheless, I hasten to add that physical destruction, not exotic biological or chemical threats, remain the biggest threat to reservoirs, aqueducts, chlorine tanks, and the like. So physical security must remain the responsibility of the private and public sectors.

Michigan Great Lakes Protection Fund Update

The Michigan Great Lakes Protection Fund (Fund) is administered by the Office of the Great Lakes in the Michigan Department of Environmental Quality. The mission of the Fund is to provide scientifically valid and reliable information to Great Lakes managers to preserve, enhance, and restore the Great Lakes and their component ecosystems through research and demonstration projects.

Each year the Michigan Great Lakes Protection Fund provides grants for research in support of implementing the Great Lakes Water Quality Agreement and the Great Lakes Toxic Substances Control Agreement. The big picture is that over the past 11 years the Fund has provided funding for 125 research projects totaling $9,407,173. This represents much valuable information available to Great Lakes managers for protection and restoration of the Great Lakes

A breakdown of funded projects provides some insight on uses of the Fund since its inception. Research on toxic substances has been the subject of 54 percent of the projects funded, representing the majority of the Fund's use. Within the toxics category, about half, or 45 percent, of the projects have been on sources and loadings. Within the sources and loadings category, 50 percent of the projects have been on atmospheric interactions. Of all the Fund's projects, 70 percent have been to universities. Therefore, if there was such a thing as a typical project, it would be research on sources and loadings of toxic substances related to the atmosphere and conducted by a university.

However, there really is no such thing as a typical project. A wide range of research has found its way through the grant funding process. In addition to the toxics research projects, 16 percent of the grants have been for ecological studies, 12 percent have been for policy and planning studies, 10 percent have been for economics research and the remaining 8 percent have been for emerging issues such as exotic species.

The Fund will be re-focusing its efforts over this next year to ensure that research conducted is of practical significance to management of the Great Lakes. Projects will demonstrate the following:

- Management Relevance - projects address those issues most relevant to Michigan Great Lakes management concerns. Specifically, funding is directed to projects that are most useful to managers for improvement in ecosystem restoration and protection of the Great Lakes.
- Bias for Action - projects foster activities to improve environmental quality and reduce exposure to pollution affecting people, Great Lakes fish, waterfowl, and other organisms.

The Fund will also step up efforts for dissemination of results and final reports to Great Lakes managers to ensure usefulness of the research. The Fund is planning a forum in 2002 with presentations of results from selected projects and all final reports for current projects will be on-line when completed.

In the years to come, the Michigan Great Lakes Protection Fund will continue to provide substantial financial support for Great Lakes research, leaving a legacy of valuable information for Great Lakes managers.

More general information on the Fund can be obtained from the Michigan Department of Environmental Quality web site at: http://www.michigan.gov/deq

Acknowledgements

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