Great Lakes Fishery Commission

ESTABLISHED BY CONVENTION BETWEEN CANADA AND THE UNITED STATES TO IMPROVE AND PERPETUATE FISHERY RESOURCES

PROTECTING AND RESTORING THE GREAT LAKES FISHERY

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Statement before the
Senate Committee on Environment and Public Works
August 25, 2003
Cleveland, Ohio

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Mr. Chairman and members of the committee, my name is Roy Stein. I am the Vice-Chair of the Great Lakes Fishery Commission. I am also a professor in the Department of Evolution, Ecology, and Organismal Biology at The Ohio State University. On behalf of my Great Lakes Fishery Commission colleagues, I am pleased to be here today to discuss the Great Lakes fishery and to outline some challenges ahead for restoration of this invaluable resource. I commend Senator Voinovich for holding this hearing on the shores of the Great Lakes. The lakes require care and attention and we appreciate all you have done to help protect them for today and for future generations.

THE VALUABLE GREAT LAKES FISHERY

The Great Lakes fishery is a treasure shared by Canada and the United States. The lakes contain 20% of the world's supply of fresh water. The fishery draws millions of anglers to the shores of the lakes each year, supports tribal fishing, and creates tens of thousands jobs in the commercial fishing industry. The fishery generates up to $4 billion in economic revenue to the people of the region each year. Moreover, healthy fish communities are an integral part of a healthy Great Lakes environment. Without the fish communities and a healthy fishery, the Great Lakes lose their luster.

Nevertheless, today, like many shared natural resources, the Great Lakes fishery is stressed. Fish stocks require careful management to prevent depletion, native fish stocks require rehabilitation to levels of self-sustainability, the influx of invasive species that disrupt the ecosystem must stop, and sea lamprey control—the backbone of a healthy environment—must improve. Fishery managers at all levels of government must work together closely to coordinate their activities. The lakes are indeed shared resources and cooperation among managers is the key to ensuring a sustained fishery.

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The Great Lakes is a complex system that spans a large geographical area. As such, it is very difficult to answer a seemingly simple question like "What is the state of the fishery?" The answer to such a question depends on where you are in the basin and in what species you are interested. The following are brief snapshots of the state of the fishery, on a lake-by-lake basis, based on reports from federal, provincial, state, and tribal management agencies.

Lake Superior

Lake Superior supports a significant recreational fishery throughout the basin, and being more sparsely populated than the other Great Lakes, has the fewest recreational anglers. Lake trout comprise the lion's share of the recreational harvest in Lake Superior, though other species, including chinook and coho salmon, rainbow trout, and brown trout are also popular. The lake also supports important tribal and commercial fisheries, mainly of herring, whitefish, and lake trout. Commercial fishing peaked in the 1940s and today, is about one-fifth of what it once was.

Walleye was once an important species in Lake Superior, providing a harvest of thousands of pounds each year. Today, walleye harvest is negligible due to degraded habitat, poor water quality in the walleye's habitat, hydro-electric dams, and disruptions in recruitment. The management agencies on Lake Superior have established a goal to maintain, enhance, and rehabilitate self-sustaining populations of walleye and their habitat throughout their historical range.

The Lake Superior fish community has been permanently altered by invasive species and remains at risk from future introductions. Disruptions in the lower food web are implicated in the poor condition of lake whitefish. Lake Superior, despite its relatively pristine state, remains quite vulnerable to human-induced alterations in habitat and water quality.

Despite these and other problems, Lake Superior has seen some spectacular successes in fishery management. The fish community is reverting to a more natural state, resembling historical conditions and requiring less management intervention. Lake whitefish, a staple of the Lake Superior fishery, remain at high abundances, though concern exists about the overall condition of whitefish. Moreover, the decades-long effort to rehabilitate lake trout in Lake Superior has paid off. Thanks to careful stocking, limited harvest, and sea lamprey control, lake trout are now self-sustaining in most of the lake to the degree that stocking is no longer necessary

Lake Michigan

Lake Michigan supports commercial, recreational, and tribal fishing. Whitefish is the primary commercial species, though at one time, the lake supported smelt, yellow perch, bloater, and alewife fisheries as well. Salmon, trout, yellow perch, and walleye are the most popular sport species and lake trout and whitefish comprise the tribal fisheries.

Total harvest from Lake Michigan peaked in 1985 at 56.6 million pounds. Today, harvest averages 21.6 million pounds, illustrating a downward trend since the late 1980s. One major reason for this downward trend has been a significant imbalance between predators (e.g., salmon, lake trout) and prey (e.g., alewives, sculpins). Since the mid-1990s, management agencies have been working successfully with their stakeholders to strike a balance between salmon stocking and the lake's ability to sustain these predators.

Despite these trends, sport anglers today are relatively pleased with the state of the Lake Michigan fishery. The balance between predators and prey have resulted in more salmon and generally bigger fish. The lake supports a thriving charter boat industry.

The lake does have some significant problems, however. Like the other Great Lakes, disruptions in the lower food web threaten to undermine the success of the fishery. For instance, the sharp declines in *Diporeia*—a native organism that serves as food for larger fish—are linked to invasive species and might be the cause of declines in whitefish abundances and condition. Yellow perch remain at troublingly low levels, thus prohibiting a resumption of commercial yellow perch fishing in Lake Michigan. And lake trout rehabilitation is experiencing extremely slow progress. Sea lamprey abundances (discussed below) remain higher than desired in Lake Michigan, which limits the success of the fishery are impairing rehabilitation.

Overall, the Lake Michigan fishery remains strong and popular. Management agencies work hard to balance salmon predators with their prey. Large-scale changes in the ecosystem, however, threaten to further disrupt an already fragile fish community.

Lake Huron

The Lake Huron fishery is dominated by chinook salmon, lake trout, brown trout, whitefish, and burbot. Alewives and smelt are the main prey fish. Predators and prey in Lake Huron seem balanced, though agencies are monitoring the fish community closely to ensure that the prey abundances are able to support the stocked trout and salmon. Agencies are working to bolster the mix of species in the lake by establishing diverse salmon and trout communities, improving walleye and yellow perch abundances, managing whitefish at sustainable levels, and rehabilitating sturgeon.

Habitat loss in Lake Huron remains a major concern. Agencies are working to protect and enhance fish habitat and to rehabilitate degraded areas with a goal of no net loss of habitat. Agencies also are concerned about the poor condition of whitefish and the high abundances of sea lampreys (discussed below) in Lake Huron, as sea lampreys are having a significant impact on the Lake Huron fish communities. The Great Lakes Fishery Commission has reduced the number of sea lampreys in Lake Huron, and agencies remain confident that the commission's recent treatments on the St. Marys River will further reduce sea lamprey populations. Disruptions in the lower food web, likely caused by invasive species, continues to threaten the fishery. Encouragingly, natural reproduction of lake trout is increasing.

Lake Erie

The Lake Erie fishery is best known for its walleye and yellow perch. Indeed, these popular fish species attract millions of anglers to the lake each year and support a lucrative commercial fishery. Strong year classes of yellow perch in the years 1996, 1998, and 1999 have helped sustain the yellow perch fishery in the lake. Yellow perch fishing – both sport and commercial – in 2002 was very good in all jurisdictions and the management agencies on the lake expect the good fishing to continue through 2003. However, a long, cold spring in 2002 resulted in poor yellow perch spawning success. Agencies anticipate reductions in yellow perch catch limits in 2004 in response to these poor spawning results.

The management agencies on Lake Erie reported that walleye spawning had been poor in 2000 and 2002 and recommended reducing the walleye catch limit in 2004. All agencies will be closely monitoring the success of walleye spawning in 2003 (early indications are that this will be a successful year for reproduction), though agencies anticipate significant reductions in the 2004 and 2005 allowable harvest.

A major issue affecting the Lake Erie fishery is a recent outbreak of botulism. Tens of thousands of primarily near shore, bottom-feeding fishes (including smallmouth bass, sheepshead, rock bass, stonecats, round gobies, sturgeon, and channel catfish) apparently succumbed to botulism. Gobies and dreissenid mussels appear to have played a role in recent mortalities attributed to botulism. Current thinking is that dreissenid mussels concentrate the toxin. Round gobies feed on the mussels, which are then eaten by fish and migratory birds. Though this is a plausible hypothesis, research is needed to identify the etiology for Type E botulism. There have been no human fatalities in recent years, but the possibility exists. (Indeed, type E botulism from improperly prepared Great Lakes fish caused several fatalities in the 1960s.) The botulism outbreak in Lake Erie is indicative of serious problems in the lake; problems relating to anoxia and the impact of invasive species such as zebra mussels.

The five jurisdictions along the lake have worked together in a highly successful and cooperative manner. The jurisdictions have expressed a great deal of concern about the recent major changes occurring within the ecosystem of Lake Erie, particularly changes driven by disruptions to the lower food web, probably caused by invasive species like zebra mussels. These changes have a profound influence on both the composition and productivity of the fish communities within the lake.

Lake Ontario

Lake Ontario supports a sport fishery comprised mainly of chinook salmon, coho salmon, lake trout, brown trout, and rainbow trout. Other popular species—fished primarily in shallow water—include yellow perch, walleye, smallmouth bass, and northern pike. Lake Ontario also supports some commercial fishing, though primarily in Ontario waters. Commercial species include lake whitefish and yellow perch, though harvest today is a fraction of its historical high in the early 20th century. Fishing in Lake Ontario is dominated by recreational anglers.

The recruitment of American eel, is a major concern in Lake Ontario. America eels have been reduced to 1% of historic recruitment levels. The rehabilitation of this important top predator will require an immediate and coordinated international effort, as American ells are highly migratory (they swim thousands of miles from the Great Lakes during their lives) and are extremely vulnerable during many of their life stages.

Charter fishing on Lake Ontario is extremely popular and the number of charter trips (nearly 8000 per year) remains steady. Although harvest of coho and chinook salmon and brown trout is currently lower than it was in the 1980s, harvest has remained steady for most of the 1990s to today, indicating a relatively stable fishery. Lake trout harvest is a fraction of its peak in the mid-1980s and efforts to rehabilitate the species have yet to be realized. Other popular species, such as smallmouth bass, yellow perch, and walleye, fluctuate in abundance from year to year, but harvest has remained relatively strong and stable. Sea lamprey abundances in Lake Ontario remain extremely low, indicating a successful control program.

COORDINATED FISHERY MANAGEMENT ON THE GREAT LAKES

Like any resource that is shared and stressed, careful management helps ensure equitable use for today and sustainability for the future. The Great Lakes present a management challenge as the lakes are shared by two nations, eight states, the Province of Ontario, and tribal authorities. An international border runs through the center of four of the five Great Lakes. The challenge all agencies face is managing a biologically connected fishery through a politically fragmented regime.

State, provincial, and tribal authority

Primary fishery management on the Great Lakes rests with the states, the province of Ontario, and two U.S. intertribal agencies. Each of these sub-national entities has an independent right to manage its portion of the fishery in the manner it chooses. This sub-national management authority has been long established, through common law and court cases. For instance, although the British North America Act gives the Canadian federal government control over inland fisheries, the provinces retain ownership of lake and river beds and, it has been ruled, the riparian rights to the fish. Through the federal Fisheries Act, the Canadian government maintains the right to make and enforce fisheries regulations and policies pertaining to the conservation of fish stocks within Canadian waters. Much of the authority to implement these policies and to enforce these regulations has been granted to Ontario. In the United States, early Supreme Court decisions have upheld the states' ownership of lake and riverbeds and, thus, the fish in those waters.

In the U.S., tribes have management authority on their reservations and in waters ceded through treaties. In Canada, there are still many unresolved and emerging issues with First Nations' fishery management and, thus, the rights of First Nations to manage their own fishing activities is less developed than in the United States.

Great Lakes Fishery Commission

Because the lakes are shared by the United States and Canada, binational governance is required. As such, in 1955, the two nations created the Great Lakes Fishery Commission by treaty. The commission has management authority for sea lampreys but limited authority over the Great Lakes fisheries, largely because, for decades, the states and the province were reluctant to cede management authority to a bi-national body. The commission is made up of 4 Canadians appointed by the Privy Council and 4 American (plus one alternate) appointed by the President of the United States.

It was largely the destructive power of the sea lamprey (described below) in the mid 20th Century that prompted the governments to seek a binational fishery management treaty. The Great Lakes Fishery Commission is charged with several responsibilities including: coordinating fisheries research on the Great Lakes; carrying out sea lamprey control; making recommendations to governments about fish stocks of common concern; and, at the request of the sub-national governments, facilitating the implementation of *A Joint Strategic Plan for Management of Great Lakes Fisheries* (Joint Strategic Plan), discussed below.

Federal Authority

The federal governments of Canada and the United States also have a management authority on the Great Lakes. Several federal agencies in both nations work with the sub-national agencies to support the management of the fishery.

The commission conducts sea lamprey control by contract with federal agencies. Under state approval, the federal agencies carry out rehabilitation initiatives, most notably, lake trout stocking. The federal agencies contribute to the generation of information through scientific research. They also negotiate bi-national agreements, support the common good through budget and other initiatives, and have the trust responsibility toward tribes.

Cooperative management

Through the Joint Strategic Plan, the Great Lakes Fishery Commission has the responsibility to facilitate cooperative management on the Great Lakes. Indeed, the commission is keenly interested in helping all management agencies on the Great Lakes develop shared fishery objectives and manage the lakes as an ecosystem.

Together, the bi-national, national, and sub-national management agencies approach the Great Lakes from the same general perspective and with the same goals in mind. These perspectives and goals include:

- Working to sustain the Great Lakes fish stocks;
- Protecting diversity;
- Understanding and maintaining the balance between predators and prey;
- Adhering to science-based management; and
- Balancing the interests of stakeholders, including sport anglers, commercial fishers, tribal fishers, the environmental community, and many others.

Despite a generally common approach to Great Lakes fishery management, the various agencies had managed the Great Lakes fishery with little or no formal cooperation for decades. With the states, the province, the tribes, and the federal governments often doing their own thing, it is not difficult to envision a situation where consultation was minimal, common objectives non-existent, and agencies working at cross purposes, even, at times, on the same lake.

By the late 1970s, the agencies realized that some mechanism was needed to facilitate cooperation among the jurisdictions. In 1978, the eight states and the province of Ontario joined with the Great Lakes Fishery Commission to develop the Joint Strategic Plan. The plan was adopted in 1981 and has been updated regularly, most recently in 1997.

In recent decades, particularly under the Joint Strategic Plan's direction, fishery agencies have been successful in resolving—or partially resolving—many fisheries management problems. Even so, many issues remain unresolved and new issues continually emerge. To assist fishery and environmental agencies in dealing with these problems, agencies, through the Joint Strategic Plan, have identified broad procedures that foster cooperation. The procedures suggested in the Joint Strategic Plan are:

- Consensus
- Accountability
- Information Sharing
- and Ecosystem Management.

Consensus: Agencies agree to reach consensus on management practices before they implement major initiatives. To help achieve consensus, agencies have developed common fish community objectives accompanied by operational plans, plans against which management decisions can be weighed. These objectives outline the goals for the fishery and how to achieve those goals. Agencies also agree that any change in fishery management practice that affects other jurisdictions must be agreed to by the other jurisdictions. In the rare instance where consensus cannot be achieved, the Joint Strategic Plan contains provisions for conflict resolution through the Great Lakes Fishery Commission or third parties.

Accountability: Fishery managers are accountable for implementing the decisions made under the Joint Strategic Plan. They implement the decisions through their own agencies. To promote accountability, the Joint Strategic Plan calls for the production of a decision record—primarily through the publication of meeting minutes. The Joint Strategic Plan also highlights the need for agencies to submit periodic reports about initiatives on each lake and the need for regular reports on progress toward reaching agency objectives.

Information Sharing: Information useful to management is something all agencies need. Information sharing has been difficult at times because the jurisdictions have a history of generating a variety of data in a variety of formats. To maximize information sharing, the Joint Strategic Plan calls for the development and implementation of standards for recording and maintaining fishery management and assessment data. Access to information is critical to the management agencies and to the public. The Joint Strategic Plan calls for agencies and the Great Lakes Fishery Commission to take the steps necessary to publish information and make it available through convenient means, such as the internet. Finally, under the Joint Strategic Plan, agencies pledge to share their data with other agencies.

Ecosystem Management: A guiding principle on the Great Lakes is that managers must look at the Great Lakes as a whole. This means that fishery mangers need to look beyond fishery management activities and respond to all issues that affect the Great Lakes. In particular, the Joint Strategic Plan calls for a heightened interest in environmental issues—such as Lakewide Management Plans or the Great Lakes Water Quality Agreement—in developing, achieving, and assessing the progress on fish community objectives. The Joint Strategic Plan also recognizes the incredible problem the entire ecosystem faces with exotic species and calls upon the agencies to promote procedures to protect the resource.

With these four procedures for cooperative fishery management in mind, how, exactly, does the Joint Strategic Plan function? Long before the Joint Strategic Plan, each lake had its own "Lake Committee," a loose set of Great Lakes Fishery Commission committees designed informally to help the commission and agencies focus on particular issues on each lake. When the agencies produced the Joint Strategic Plan in 1981, they decided to expand the use of the lake committees and use them as more formal means to carry out the Joint Strategic Plan.

Under the Joint Strategic Plan, high-ranking managers from agencies on each lake meet as a committee to address the issues of importance to that lake. For example, managers from jurisdictions on Lake Huron—which include Ontario, Michigan, and the Chippewa-Ottawa Resource Authority—meet as the Lake Huron Committee. A Council of Lake Committees—comprising all members of the lake committees—looks at Great Lakes fishery issues from a basin wide perspective.

The Joint Strategic Plan is designed to be a bottom-up process, where management decisions are driven by science generated by field researchers. To foster that design, each lake committee has a technical subcommittee to conduct and digest research and to report those findings to lake committee members. This structure allows the field researchers and assessment biologists to come to a common understanding of the science, free from policy issues considered by the lake committees. Lake committee members then use that bottom-up-produced science as the basis for their management decisions.

The Joint Strategic Plan also provides for a coordinated approach to law enforcement. While each national and sub-national jurisdiction maintains its own law enforcement capabilities and responsibilities, there is considerable need on the Great Lakes for law enforcement agencies to work together. Indeed, because the Great Lakes is an ecosystem, it would make little sense for agencies to stop their pursuit of lawbreakers at a political line. To facilitate coordinated law enforcement, a Law Enforcement Committee develops and works to implement common law enforcement initiatives. This committee reports to the Council of Lake Committees.

Finally, to facilitate interagency cooperation, the Great Lakes Fishery Commission also supports the Great Lakes Fish Health Committee and the Fish Habitat Conservation Committee. The Fish Health Committee studies issues relating to fish disease spread, prevention, and mitigation. The Fish Habitat Conservation Committee—whose members are appointed by the commission—comprises government and non-government habitat experts to study and recommend measures for ensuring fish habitat protection.

Lake committee meetings are held annually, in public. They serve as a forum to develop common objectives for the lake, to share scientific information, and to allow agencies a place to make decisions on such things as stocking, harvest, law enforcement, and environmental management. It is important to note that all decisions made through the lake committee process must still be implemented by the individual agencies. That is, managers agree to take lake committee actions back to their own jurisdictions for implementation. Thus, the consensus-based lake committee process is non-binding and only as successful as the willingness of the individual agencies to adhere to the collective decisions. Even so, this process is highly effective as it serves to maximize cooperative management and minimize conflict. Figure 1 illustrates the lake committee structure.

Figure 1: Lake Committee Organization

The Great Lakes are widely viewed as the best example of cooperative fishery management anywhere on earth. Lake committees are clearly the strength of the Joint Strategic Plan. As expected with any shared resource, issues about fairness of the allocation of the fishery, management responsibilities, and transparency arise on the Great Lakes. The Joint Strategic Plan and the lake committee process are capable of handling these challenges. In the absence of this process, agencies would retreat to parochialism, with management chaos ensuing.

INVASIVE SPECIES: THE PRIMARY THREAT TO THE GREAT LAKES FISHERY

One particularly important issue facing the Great Lakes Fishery Commission and the lake committees is invasive species. Invasive species—undesirable plants and animals not native to a system—have been increasing steadily in numbers, particularly as commerce in the Great Lakes region has become more global and dynamic. Invasive species cause enormous ecological and economic damage to the region. Invasive species such as sea lampreys, zebra mussels, Eurasian ruffe, *Bythotrephes*, and round gobies have changed the very nature of the Great Lakes forever.

According to published reports, 162 non-native species have become established in the Great Lakes region since the late 1800s. Twelve of these species have entered the Great Lakes since 1990, around the time ballast water exchange—designed to protect the lakes against invasion—went into effect. Once a species invades and takes hold, the species becomes a permanent fixture of the ecosystem.

Since the 1950s, when the St. Lawrence Seaway opened the lakes to direct foreign shipping, ballast water has become a dominant means by which new species enter the system. Today, the vast majority of invasive species in the Great Lakes originate from Eurasia and arrive in ship ballast. Invasive species have the potential to enter the lakes through other channels as well, including the Chicago Sanitary and Ship Canal and through the commerce of live food, bait, and aquarium fish.

Concurrent reports from the United States General Accounting Office and the Auditor General of Canada, released in October, 2002, brought major attention to the invasive species problem. The reports provide little reason for optimism. Among the findings of both reports:

- The federal governments of Canada and the United States have not responded effectively to the invasive species threat;
- Invasive species are a leading cause of biodiversity loss and economic loss, costing billions of dollars each year;
- Measures put into place to prevent aquatic introductions (such as ballast water monitoring and ballast water exchange) have not prevented new introductions;
- Canada and the U.S. have neither a binational approach to invasive species nor do they have a single agency in charge of managing the problem; and
- Effective ballast water management techniques may require at least 10 years to develop and implement.

The Great Lakes remain extremely vulnerable to new invaders, underscoring the critical need to (1) prevent the introduction of new organisms, (2) address the ballast water vector, (3) stop transmigration of species through the Chicago Sanitary and Ship Canal, and (4) address the trade of live organisms from outside and within the region. As one view of the importance of this problem, most scientists and stakeholders working in the Great Lakes today will list invasive species as the most pressing issue the region faces.

The Great Lakes Fishery Commission is deeply encouraged by the introduction of the National Aquatic Invasive Species Act (NAISA—S. 525, H.R. 1080 and H.R 1081). I join with my fellow commissioners in commending Senator Levin and Congressmen Ehlers and Gilchrest for introducing these important bills and thanking Senator Voinovich for being an original co-sponsor of the Senate legislation.

These bills, if passed as written, will be a major step forward in efforts to address the invasive species problem. In particular, the commission believes NAISA includes important safeguards for the Great Lakes, establishes clear deadlines for action, and addresses vital needs such as strong ballast standards for ocean-going vessels, investigation of invasion pathways, rapid response, the construction of a dispersal barrier system near Chicago, and research, just to name a few.

The commission strongly urges Congress to pass this legislation. The sooner the bills are passed, the sooner we will be addressing these pressing problems. We cannot afford to wait a day longer: The next oceanic vessel entering the Great Lakes could have the next "zebra mussel" on board. Asian carp are swimming their way steadily towards the Great Lakes. Millions of potentially harmful fish are sold live in the Great Lakes basin. This legislation will address these and other problems, but we must act now.

The commission also notes that the International Joint Commission (IJC), in its previous two biennial reports, has requested a reference from governments to address the invasive species problem. The commission believes the IJC is an appropriate body to investigate this issue on a binational level and, therefore, urges the governments of Canada and the United States to grant this reference to the IJC.

SEA LAMPREYS AND THEIR DEVASTATION

Let us focus, now, on one particular invasive species: the sea lamprey. Among the more than 162 exotic species that have become established in the Great Lakes basin, the most detrimental to the basin's fisheries has been the sea lamprey, a parasitic fish native to the Atlantic Ocean. Sea lampreys entered the Great Lakes in the early part of the

20th century through federally constructed shipping canals and by 1937 had infested waters of all of the Great Lakes. Unlike the other invasive species we contend with, sea lampreys can be controlled.

During its lifetime, each sea lamprey, by attaching to fish and feeding on their body fluids, can kill and consume 40 or more pounds of fish. By the mid-1940s, sea lamprey predation, combined with overfishing and other problems, destroyed many extremely valuable fisheries in the Great Lakes. Losing predators such as lake trout and burbot and subsequent sea lamprey predation on other species, has led to catastrophic declines in the economic value of Great Lakes fisheries.

The declines in the Great Lakes fishery can hardly be exaggerated. Before sea lamprey control began in the 1950s, nearly 85% of the fish in the Great Lakes exhibited sea lamprey wounds and the harvest, which had been about 20 million pounds of fish annually before the sea lamprey invasion, collapsed.

The sea lamprey literally destroyed a way of life for the people of the Great Lakes region and threw the environment into chaos. Even with sea lamprey control measures in place, the lampreys continue to pose a significant threat to the fish. In some areas, sea lampreys still kill more fish than are harvested by humans. We also know that if sea lamprey control were to be relaxed—even briefly—the species would spring back quickly and in deadly fashion.

Sea Lamprey Control

By the early 1950s, the governments of Canada and the United States, in addition to the province of Ontario and the states, agreed that the sea lamprey problem must be addressed at the highest level if the Great Lakes fishery were to survive. To that end, the federal governments negotiated and ratified the 1955 *Convention on Great Lakes Fisheries*, which created the Great Lakes Fishery Commission. The commission was charged with developing and implementing a sea lamprey control program and with coordinating fisheries research, duties the commission maintains to this day.

The commission actively manages the program and works in partnership with Fisheries and Oceans Canada, the U.S. Fish and Wildlife Service, and the U.S. Army Corps of Engineers to deliver sea lamprey control. The commission continues to insure that fishery management on the Great Lakes is carried out on an ecosystem basis and in the spirit of binational cooperation. The *Convention* remains a highly successful blueprint for cooperative fishery management. Canada and the United States each consider the working relationship on the Great Lakes to be a model of successful binational resource management.

Sea lampreys are controlled on the Great Lakes using a number of innovative, effective techniques. The primary management tool is a lampricide, called TFM. TFM is applied in Great Lakes streams where sea lampreys live as larvae. The lampricide is selective to lampreys, meaning it kills lampreys with little to no impact on non-target species. TFM has been applied to Great Lakes streams since 1958 and is fully registered with the Environmental Protection Agency. Streams with sea lampreys present require TFM treatments every 3-6 years, depending on the stream's productivity. Between 60 and 70 streams are treated annually with TFM.

The commission also relies on other alternative, non-chemical techniques to control sea lampreys. Sea lamprey barriers are used to prevent sea lampreys from reaching their spawning grounds. Once a barrier is constructed in a stream, the stream generally does not require lampricide treatments above the barrier. Sea lamprey traps are used to remove lampreys from the system before they spawn. The lampreys caught in traps are used in the innovative sterile-male-release-technique, a technique where spawning male sea lampreys (which are past their feeding stage and, therefore, are not actively destroying fish) are sterilized and released back into the system. The sterilized males compete with fertile males to spawn, thus wasting the female's spawning potential.

Together, these sea lamprey control techniques comprise the tools in the commission's arsenal to combat this destructive pest.

The Success Of Sea Lamprey Control

The commission's sea lamprey control program has been a tremendous success—probably successful beyond the expectations of those who negotiated the *Convention on Great Lakes Fisheries*, and stands as one outstanding example of environmental damage mitigation.

In the Great Lakes, sea lamprey abundances are near or below target levels in Lakes Ontario and Erie. Sea lamprey abundances are slightly above targets in Lakes Superior and Michigan and significantly above target in Lake Huron. The high abundances of sea lampreys in Lakes Michigan and Huron are because of high sea lamprey production in the St. Marys River. The commission began an aggressive, on-going sea lamprey suppression program for the St. Marys River in 1999 and expects the sea lamprey abundances in Lakes Michigan and Huron to approach acceptable levels. Sea lamprey abundances in Lake Superior are a bit higher than we find acceptable and, therefore, the commission will be stepping up its treatment work in that lake.

Overall, the sea lamprey control program has been a phenomenal success. The Great Lakes Fishery Commission and its partners have reduced sea lamprey populations by about 90 percent from their historical abundance. Because sea lamprey eradication is impossible, the control effort is ongoing.

The successful sea lamprey control program is the cornerstone of a healthy and vibrant fishery. Sea lamprey control allows provincial, state, federal, and tribal fishery management agencies to stock fish and implement other restoration activities with confidence, knowing that their fish will likely survive to reproduce or be caught by humans.

Sea lamprey control allows agencies to make substantial progress in their efforts to re-establish self-sustaining populations of our rare, valuable, native species.

Sea lamprey control promotes a healthier Great Lakes fishery, creates a more stable environment, and provides significant economic and recreational benefits to the people of the region.

Sea lamprey control has increased the popularity of sportfishing in the Great Lakes since the early 1960s, protects tribal fishing, and supports thousands of commercial fishing jobs.

Sea lamprey control is indeed the foundation of a fishery that has rebounded from the most dire conditions of the 1940s. Today, the fishery again is a highly valued resource to the people of North America. The millions of people who fish the Great Lakes recreationally, tribally, and commercially demand the delivery of an effective sea lamprey control program. Investments in sea lamprey control are investments not only in today's fishery, but also are investments in the fishery that future generations will enjoy.

Alternative Sea Lamprey Control And The Lampricide Reduction Goal

Despite the importance of the lampricide TFM in the sea lamprey control effort, the commission set a goal to reduce lampricide use by 50 percent by the year 2010. Lampricides are costly and the commission is sensitive to concerns about the use of pesticides, even safe and proven pesticides like TFM. Furthermore, successful pest management programs rely on several techniques working together to achieve target levels of suppression.

To reach its lampricide reduction goal, the commission has invested in alternative, non-chemical means to control lampreys including the aforementioned barriers, traps, and the sterile-male-release technique. Already, the commission has reduced lampricide use by more than 35% from the peak use of the 1980s.

Achieving the lampricide reduction goal is possible, but only through continued investment in alternative controls. The commission has been committed to making that investment by devoting greater percentages of the lamprey control budget to alternative techniques. In 2003, the commission will apply approximately 25 percent of its sea lamprey budget to alternative controls. This is an increase from only about 15% devoted to alternative controls just a few years ago.

Reductions in lampricides through the research into and the development of alternative techniques is providing real program savings today. Lampricide reductions since the late 1980s are now saving the commission more than $1 million per year in lampricide and treatment costs, while still allowing for the same level of sea lamprey control. Furthermore, sea lamprey control on the St. Marys River depends on alternative controls. Continued reductions in the amount of lampricides used will take place and the commission will remain vigilant that these reductions do not compromise the effectiveness of sea lamprey suppression.

The commission also has a vision to develop and implement at least one new sea lamprey control technique by the end of the decade. The commission is highly encouraged by the success of alternative control techniques (e.g., the sterile-male-release-technique) and believes it is imperative to research and develop new techniques.

New research into sea lamprey pheromones—another major initiative—will help the commission reach its goal. Pheromones are natural attractants sea lampreys use to indicate to spawning lampreys which streams are suitable for spawning or to attract mates once in the spawning stream. By understanding how sea lampreys use pheromones, scientists seek to direct lampreys into traps or disrupt sea lamprey spawning behavior in some fashion. The commission believes pheromones have much promise to transform sea lamprey control in the Great Lakes basin and, therefore, views enhancing its development and application as a high priority. The commission will undertake major field trials for pheromones as soon as spring 2004.

Sea lamprey control is only as successful as the governments' willingness to fund the effort. Currently, the program receives enormous support in both Canada and the United States, though the control effort is still underfunded. The commission received $12.2 million in fiscal 2003, nearly $1 million less than the fiscal 2002 level and a full $4 million less than was requested by the commission to deliver a full program. The commission requires adequate funding if it is to maintain the successful sea lamprey control effort and devote full attention to lampricide reduction.

ASIAN CARP: AN IMPENDING INVASION

Sea lampreys have been the bane of the Great Lakes for more than 80 years. Asian carp, which are at our doorstep, threaten to be the next "sea lamprey." Two species of Asian carp are making their way toward the Great Lakes—the silver and bighead carp. A third species of concern—the black carp—escaped into the Mississippi River in 1994, but to date, only one has been detected in the wild. Biologists are monitoring the resource carefully for occurrences of the black carp.

The silver and bighead carps were imported, in the early 1970s from Asia by fish farmers in southern states, to control plankton blooms in channel catfish production ponds. Both species escaped into the Mississippi River in the 1980s. Biologists believe that major floods in the early and mid-1990s allowed the carp to significantly expand their range. Currently, bighead and silver carp are found near the Chicago Sanitary and Ship Canal, which connects the Mississippi River to the Great Lakes. The carp are now within 50 miles of Lake Michigan. The silver and bighead carp have a remarkable ability to spread and proliferate. In some areas of the Mississippi, Asian carp now already comprise 95% of the biomass.

In addition to the Chicago canal system as a vector, fish are routinely imported live into the region for sale as food and are a popular fish at live-fish markets in the Great Lakes basin. For instance, more than 900,000 pounds of live Asian carp are trucked each year into Ontario from the United States, to be sold at fish markets on the shores of the Great Lakes. Fish markets exist, for instance, in Toronto, Chicago, and New York.

Moreover, millions of juvenile fish are sold as baitfish or as aquarium fish in the Great Lakes basin. Like the carp sold in fish markets, aquarium and baitfish are trucked into the basin (and in some cases reared in the basin) and sold live. Once these live fish are sold, they are out of the control of the sellers. For example, there is a serious risk that once an angler is finished fishing for the day, the angler might release invasive fish (such as Asian carp) that are mixed in with the rest of his or her unused bait.

If the Asian carp are allowed into the lakes, they will likely become a permanent, noxious feature of the Great Lakes environment. They have several characteristics that make them "invasive." They are fecund and they grow rapidly. They are well suited to the climate of the Great Lakes; their native range in Asia is similar to the conditions in the

Great Lakes region. There is little doubt that the carp will survive in the Great Lakes and compete directly with the lakes' native fish for zooplankton (small animals in the water column that form the base of the food web).

Tremendous efforts are underway to prevent an Asian carp invasion. To date, these efforts have centered on blocking the migration of carp from the Mississippi River system into Lake Michigan. An experimental electric barrier constructed by the U.S. Army Corps of Engineers to control invasive species migration began operation on April 9, 2002. This electrical barrier serves as the only line of defense against the Asian carp. A second barrier is currently being built through a partnership with the Great Lakes Fishery Commission, the International Joint Commission, the U.S. Army Corps of Engineers, and the State of Illinois.

In addition to work on the Chicago canal system, there is also significant work to prevent entry via the trade of live organisms. The Council of Lake Committees (composed of provincial, state, and tribal management authorities), and the Great Lakes Law Enforcement Committee (provincial, state, federal, and tribal law enforcement officials, have been working with governments to encourage sub-national laws banning the possession of live Asian carp (and other potentially injurious exotic species). Already, several states have banned the possession.

The U.S. federal government, along with state and local governments, have spent millions of dollars to help prevent the Asian carp invasion. These investments in the Chicago Sanitary and Ship Canal, while costly, are necessary to the protection of the entire Great Lakes basin and are a fraction of the economic harm these carp could cause to both nations if they are allowed into the system. The commission has several specific recommendations to address the Asian carp problem:

1. Support an annual appropriation (from the U.S. Army Corps of Engineers' budget) for operations and maintenance of the existing invasive species barrier on the Chicago Sanitary and Ship Canal.

2. Support the construction of a second dispersal barrier by supporting section 107 of the National Aquatic Invasive Species Act, by inserting language into the Water Resources Development Act, or by supporting language in the Energy and Water appropriations bill that authorizes the second barrier at full federal cost. (This authorization should appear in the legislative vehicle most likely to move quickly through Congress.)

3. Support research into a permanent and innovative biological separation of the Great Lakes and Mississippi River watersheds.

4. Support the provision in the National Aquatic Invasive Species Act that calls upon the Corps of Engineers to investigate the effectiveness of dispersal barriers in preventing the spread of invasive species via canals.

5. Support the provision in the National Aquatic Invasive Species Act that establishes a screening process for the importation of new organisms.

6. Support applying the Lacey Act to list as injurious the three species of Asian carp—the black, silver, and bighead carps—in order to ban the importation and transportation of these species.

7. Support the development of a "clean list" (as opposed to a "black list") of species acceptable for live trade. This puts the onus on the importer to prove that the species will do no harm, as opposed to the onus being on society to prove that it will.

8. Urge the states and the Province of Ontario to ban immediately the possession of live Asian carp and other species (e.g., the snakehead) that have the potential to invade the Great Lakes system.

9. Support the application of the Canadian Wild Animal and Plant Protection and Regulation of International and Interprovincial Trade Act (WAPPRIITA) and the Ontario Fish and Wildlife Conservation Act, to prohibit the importation of live Asian carp into Ontario. Seek the application of these laws to other species.

GREAT LAKES RESTORATION AND THE CORPS OF ENGINEERS

The Great Lakes are our region's treasures and they deserve restoration. The Great Lakes fishery, which remains stressed, stands to benefit tremendously from a comprehensive restoration effort. Although significant progress has been made in cleaning up and protecting the Great Lakes, a recent report by the General Accounting Office (GAO) concluded that binational, federal, and state strategies to restore the lakes are underfunded and not coordinated as well as they should be. The report points out that restoration efforts in other regions of the country—particularly efforts to protect the Everglades and the Chesapeake Bay—are more sophisticated than restoration efforts in the Great Lakes region and are guided by more effective strategies. The Great Lakes Fishery Commission concurs with the GAO's conclusions and has strongly supported the development of a Great Lakes restoration strategy.

One major fishery restoration initiative is the Great Lakes Fishery and Ecosystem Restoration Program (GLFER), a program authorized by the *Water Resources Development Act of 2000*. The commission notes that Senator Voinovich was the principal author of this provision and we commend the Senator for his vision to restore the Great Lakes fishery. The program authorizes the Corps of Engineers (COE) to partner with federal, state, and local agencies and the Great Lakes Fishery Commission to plan, implement, and evaluate projects supporting the restoration of the fishery, ecosystem, and beneficial uses of the Great Lakes. The COE has an authorization to spend up to $100,000,000 for this program. Examples of projects might include removal of unnecessary barriers in Great Lakes tributaries, creation of fish passage devices, riparian habitat stabilization, and restoration and creation of wetlands.

Particularly noteworthy about this program is that the COE is directed to work with signatories of *A Joint Strategic Plan for Management of Great Lakes Fisheries* and with the Great Lakes Fishery Commission to identify and implement restoration projects. In formulating this program, the COE is also directed to use existing documents (such as the Fish Community Objectives, Lake Management Plans, and Remedial Action Plans) as the foundation for identifying priorities.

Since the passage of this legislation, the Great Lakes Fishery Commission has worked closely with the COE to get the program up and running. The commission has been very proud to be the local sponsor for the development of the support plan, the first step in implementing this program. The development of the support plan, as called-for in the legislation, has been done in close consultation with federal, state, and tribal agencies. The management agencies signatory to the Joint Strategic Plan are quite enthused about this program.

As of this date, the support plan is in the final stages of its internal review. Once this support plan is completed, restoration projects may commence. It is envisioned that the signatories to the Joint Strategic Plan will identify priority projects, similar to how they identify projects under the successful *Fish and Wildlife Restoration Act*.

This program is an enormous opportunity for the Great Lakes. The program will rely on the Joint Strategic Plan process for its success, a major recognition of the importance of cooperative management. The commission urges Congress to appropriate at least $10 million per year under this authorization so that the COE and the management agencies can partner on restoration efforts.

CONCLUSION

The Great Lakes fishery defines our region and is a key indicator of the overall health of the system. Indeed, the first question people often ask about the Great Lakes is "how are the fish?" Management agencies and the Great Lakes Fishery Commission work very hard to sustain the fishery for today and for the future, to improve the habitat upon which the fish depend, to stop the influx of invasive species, to control sea lampreys, and advance our scientific understanding of the resource.

Sportfishing on the Great Lakes remains extremely popular; commercial fishing remains economically viable. The lakes need constant attention from Congress if they are to sustain this $4 billion fishery, keep sea lampreys in check, and stop the biological invasion that is taking place. New initiatives like the Great Lakes Fishery and Ecosystem Restoration Program and the National Aquatic Invasive Species Act aim to improve and protect the resource. Time-honored institutions like the Great Lakes Fishery Commission and the *Joint Strategic Plan for Management of Great*

Lakes Fisheries strive to maintain the cooperation that is so critical to the ecosystem approach to management. And a commitment to the resource—to the fishery and the environment—by the millions of people who live in the Great Lakes basin will help ensure that the lakes' resources are passed on to future generations.

We thank the committee for focusing its attention on the Great Lakes and we look forward to working with Congress on ways in which we can—together—restore these invaluable treasures.

SOURCES

1979. Minutes of the annual meeting of the Council of Lake Committees, *In* G. L. F. Commission, (ed.). Great Lakes Fishery Commission, Ann Arbor, MI.

DesJardine, R.L., T. Gorenflo, R.N. Payne, and J.D. Schrouder. 1995. Fish-Community objectives for Lake Huron. Great Lakes Fishery Commission, Ann Arbor.

Dochoda, Margaret R., and Michael L. Jones. 2002. Managing Great Lakes fisheries under multiple and diverse authorities. In *Sustaining North American salmon: Perspectives across regions and disciplines*, edited by K. D. Lynch, M. L. Jones and W. Taylor. Bethesda: American Fisheries Society Press.

Eshenroder, R.L., M.E. Holey, T. Gorenflo, and R.D. Clark. 1995. Fish-community objectives for Lake Michigan Special publication 95-3. Great Lakes Fishery Commission, Ann Arbor.

GLFC. 1997. A Joint Strategic Plan for Management of Great Lakes Fisheries. Ann Arbor: Great Lakes Fishery Commission.

GLFC. 2002. A Joint Strategic Plan for Management of Great Lakes Fisheries: Cooperation at its best (Brochure). Ann Arbor: Great Lakes Fishery Commission.

Horns, W.H., C.R. Bronte, T.R. Busiahn, M. Ebener, R.L. Eshenroder, T. Gorenflo, N. Kmiecik, W. Mattes, J.W. Peck, M. Petzold, and D.R. Schreiner. 2003. Fish-community objectives for Lake Superior. Great Lakes Fishery Commission, Ann Arbor.

Mills, E.L., J.H. Leach, J. Carlton, and C. Secor. 1993. Exotic species in the Great Lakes: A history of biotic crises and anthropogenic introductions. Journal of Great Lakes Research 19:1-54.

Piper, Don. 1967. *The international law of the Great Lakes*. Durham, NC: Duke University Press.

Rasmussen, J.L. 2002. The Cal-Sal and Chicago Sanitary and Ship Canal: A perspective on the spread and control of selected aquatic nuisance fish species. U.S. Fish and Wildlife Service, Rock Island, IL.

Reid, D., H.J. MacIsaac, J.E. Gannon, and J. Hartig. 2002. Research and management priorities for aquatic invasive species in the Great Lakes [Online]. Available by International Association for Great Lakes Research http://www.iaglr.org/scipolicy/ais/ais_iaglr02.pdf.

Ricciardi, A. 2001. Facilitative interactions among aquatic invaders: Is an 'invasional meltdown' occurring in the Great Lakes? Canadian Journal of Fisheries and Aquatic Science 58:2513-2525.

Ryan, P.A., R. Knight, R. MacGregor, G. Towns, R. Hoopes, and W. Culligan. 2003. Fish-community objectives for Lake Erie. Great Lakes Fishery Commission, Ann Arbor.

Stewart, T.J., R.E. Lange, S.D. Orsatti, C.P. Schneider, A. Mathers, and M.E. Daniels. 1999. Fish-Community objectives for Lake Ontario Special Publication 99-1. Great Lakes Fishery Commission, Ann Arbor.