

Great Lakes Fish and Wildlife Restoration Act of 1998

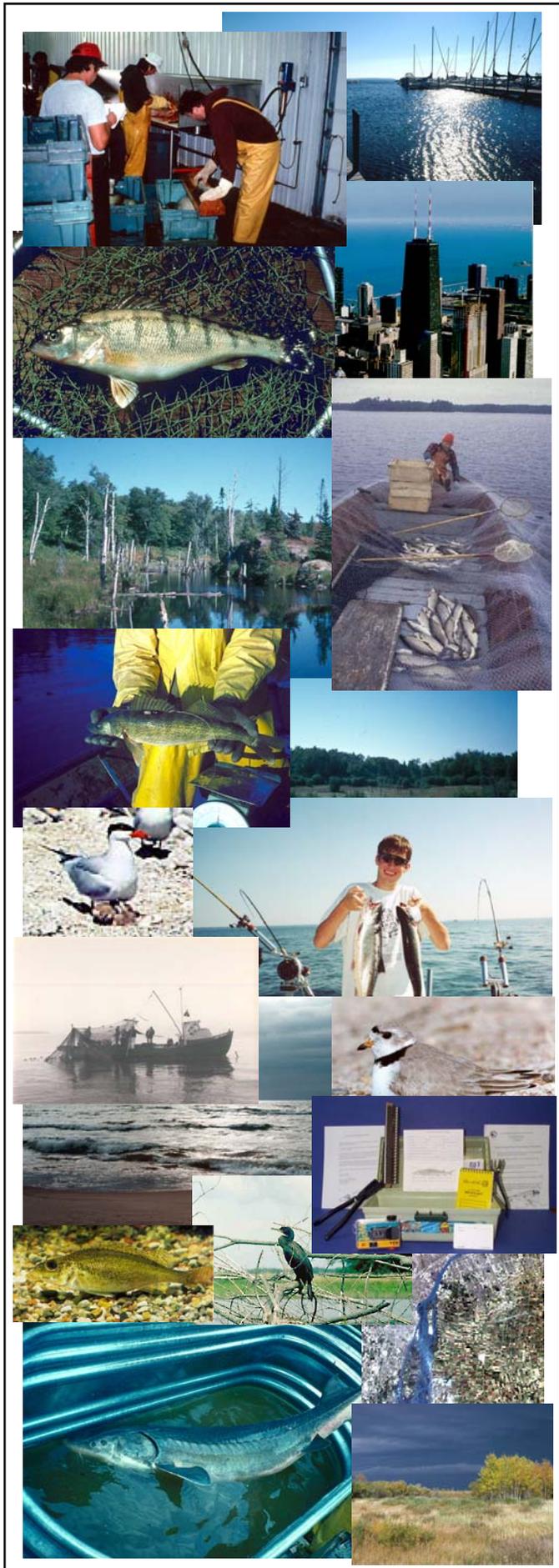
Progress 1998 - 2002



U.S. Fish and Wildlife Service
Department of the Interior



Prepared by
U.S. Fish and Wildlife Service
Great Lakes Coordination Office
Great Lakes Fishery Resources Offices





Executive Summary

About the Great Lakes Fish and Wildlife Restoration Act

The Great Lakes Fish and Wildlife Restoration Act (Act) became Public Law 101-646 on November 29, 1990, with the purpose “to carry out a comprehensive study of the status, and the assessment, management, and restoration needs, of the fishery resources of the Great Lakes Basin; to develop proposals to implement recommendations resulting from that study; and to provide assistance to the Great Lakes Fishery Commission, states, Indian tribes, and other interested entities to encourage cooperative conservation, restoration and management of fish and wildlife resources and their habitat”.

Why the Service prepared this report

When the Act was reauthorized in 1998, Congress included a requirement that the Service submit a report that describes actions taken to solicit and review proposals to address the 32 Great Lakes Fishery Resources Restoration Study Recommendations, the results of proposals implemented, and progress toward accomplishment of the Service’s Great Lakes goals. This report documents the progress that the Service and our Great Lakes partners have made through 2002 and highlights many of the fish and wildlife restoration success stories made possible through the Act.

Our principal findings

The Service finds that the fish and wildlife restoration proposal program authorized under Section 1005 (16 U.S.C. 941c) has become a tremendous success during 1998-2002, with 39 projects funded at a total value of \$3,464,000, including \$1,673,000 in federal funds. These projects have brought 52 state, tribal, federal, university, non-governmental and Canadian organizations together under a unified interagency process - coordinated by the Service and the Great Lakes Fishery Commission - to focus on 20 of the 32 recommendations identified in the Great Lakes Fishery Resources Restoration Study and other Great Lakes management plans.

Additionally, the Service finds that significant progress has been made in addressing the six Great Lakes Restoration Goals specified in Section 1006 (16 U.S.C. 941d). Highlights include: control of sea lamprey populations across the Great Lakes; improved management of lake trout, lake whitefish, lake sturgeon and other native fishes; reclassification of gray wolf from endangered to threatened status; increasing populations of Kirtland’s warbler, Great Lakes piping plover, Karner blue butterfly and other listed species; restoration of wildlife habitat on over 12,000 acres of private land including 7,000 acres of wetlands, 4,000 acres of prairie and over 1,000 acres of coastal wetlands; establishment of Whittlesey Creek National Wildlife Refuge and the Detroit River International Wildlife Refuge; protection, enhancement and restoration of over 76,000 acres of migratory bird habitat; identification of contaminant impacts and restoration activities for the St. Lawrence River, Niagara River, West Branch Grand Calumet River, Saginaw River and lower Fox River River/Green Bay; and many successful law enforcement operations.

Status of Great Lakes fish and wildlife resources and the Act

Fish and wildlife restoration needs in the Great Lakes present a management challenge which is staggering in scope and complexity. The Great Lakes drainage basin encompasses an area of approximately 200,000 square miles, is home to more than 34,000,000 people, and supports a fishery worth around \$5,000,000,000 annually. This report illustrates that significant progress has been made in addressing fish and wildlife restoration needs. However, the scale of resource restoration issues advances continuously, with new challenges arising each day. The Great Lakes Fish and Wildlife Restoration Act has become a central rallying point around which many Great Lakes agencies and organizations can address these challenges together.

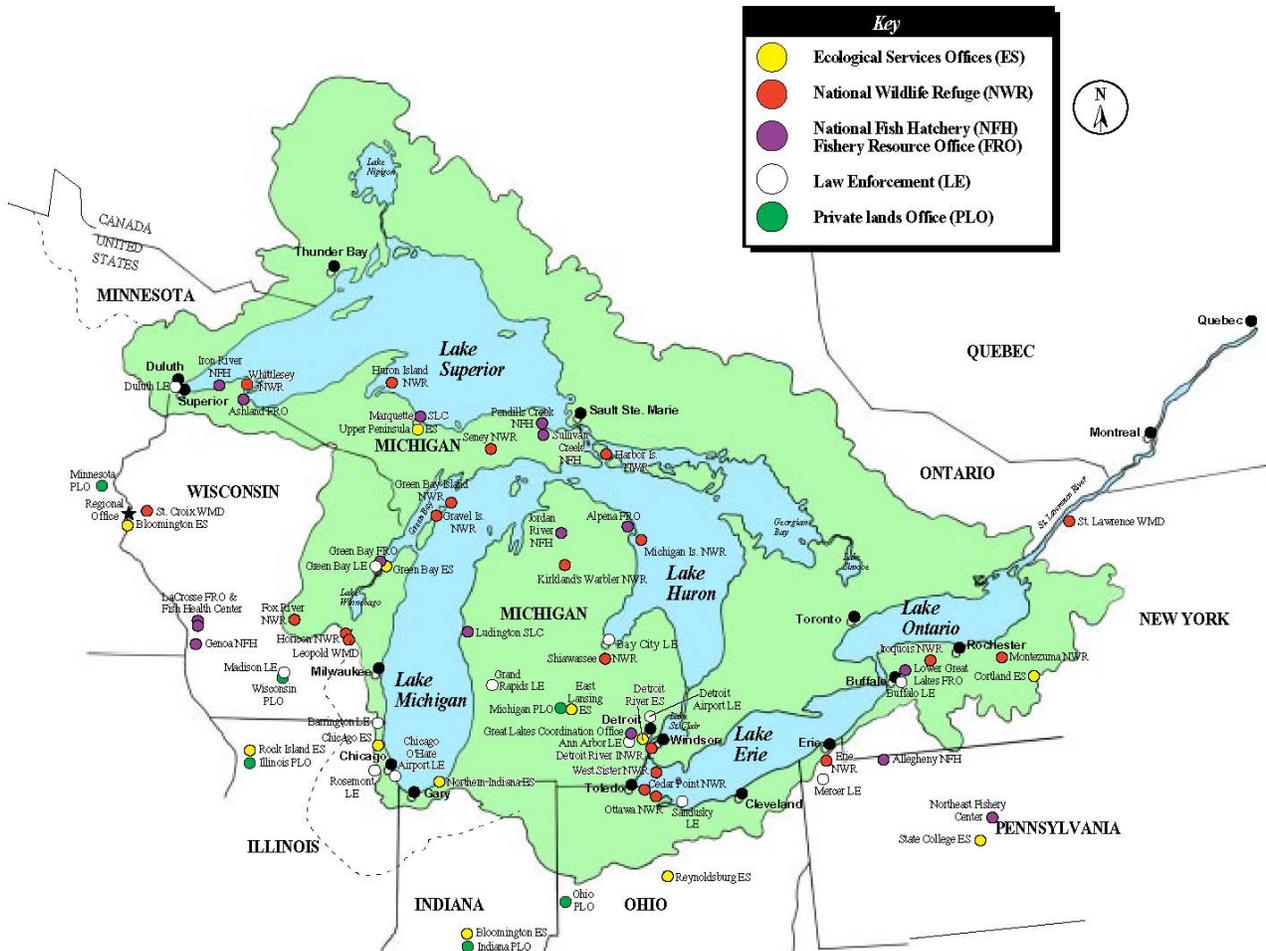
About the Service

U.S. Fish and Wildlife Service- Great Lakes basin field offices

The mission of the U.S. Fish and Wildlife Service is to work with others to conserve, protect, and enhance fish, wildlife, and plants and their habitats for the continuing benefit of the American people. The Service manages the 95 million-acre National Wildlife Refuge System, which encompasses nearly 540 national wildlife refuges, thousands of small wetlands and other special management areas. It also operates 70 national fish hatcheries, 64 fishery resources offices and 78 ecological services field stations. The agency enforces Federal wildlife laws, administers the Endangered Species Act, manages migratory bird populations, restores nationally significant fisheries, conserves and restores wildlife habitat such as wetlands, and helps foreign governments with their conservation efforts. It also oversees the Federal Assistance program that distributes hundreds of millions of dollars in excise taxes on fishing and hunting equipment to State fish and wildlife agencies.

The Service operates 58 field offices which service the Great Lakes basin (see map below). These include 17 Fisheries offices, 13 Law Enforcement offices, 11 Ecological Services offices and 17 Refuges. To expand its effectiveness, the Service initiated an ecosystem-based approach to coordinate the activities of its Great Lakes field stations by forming a Great Lakes Basin Ecosystem Team (Team) comprised of these field stations. Through the Team and its partners in the ecosystem, the Service addresses several landscape-scale resource objectives, e.g. restoration of lake sturgeon populations.

For further information about Service programs and activities in the Great Lakes Basin, visit the Great Lakes-Big Rivers Region website at <http://midwest.fws.gov> and the Northeast Region website at <http://northeast.fws.gov>.





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Acknowledgements

The Service gratefully acknowledges the many contributions of our partners in implementing the Great Lakes Fish and Wildlife Restoration Act during the 1998-2002 reporting period and in preparing this report. The Service conducts virtually all of its activities in the Great Lakes in collaboration with other agencies, organizations and individuals.

In particular, the Service acknowledges the Secretariat of the Great Lakes Fishery Commission for managing the request for proposal process and administering many of our cooperative agreements for fish and wildlife restoration activities. We thank the Council of Lake Committees, the Great Lakes Fish and Wildlife Restoration Act Proposal Review Committee, and member organizations of the committees, for their assistance in developing proposals and recommending fish and wildlife restoration activities to the Director.

The Service acknowledges the involvement of 52 organizations that provided funding, in-kind contributions and expertise in implementing fish and wildlife restoration projects during 1998-2002. These participating organizations are listed on page 13, and also included in the project summaries on pages 14-44.

Finally, the Service acknowledges the involvement and valued contributions of over 200 partners in pursuing our Great Lakes restoration goals. These agencies and organizations are listed on pages 47-49, and are also included in the selected list of accomplishments presented in Appendix II.



Introduction

Purpose

The *Great Lakes Fish and Wildlife Restoration Act* (16 U.S.C. 941) was enacted on November 29, 1990, with the purpose “to carry out a comprehensive study of the status, and the assessment, management, and restoration needs, of the fishery resources of the Great Lakes Basin; to develop proposals to implement recommendations resulting from that study; and to provide assistance to the Great Lakes Fishery Commission, states, Indian tribes, and other interested entities to encourage cooperative conservation, restoration and management of fish and wildlife resources and their habitat”.

The U. S. Fish and Wildlife Service (Service) completed the *Great Lakes Fishery Resources Restoration Study* (Study) in 1995. The Study focused on the status of fishery resources and habitat in the Great Lakes basin, including effectiveness of present management plans and analysis of the impacts and management alternatives for recently introduced non-indigenous species. The Study developed 32 recommendations for actions to restore the fishery resources of the Great Lakes basin to sustainable levels (Appendix I).

The Act was reauthorized in 1998, and Congress created a new process to facilitate the identification, review and implementation of state and tribal proposals for the restoration of fish and wildlife resources based on the results of the Study. Congress also required the Director of the Service to submit a report to the Committee on Resources of the House of Representatives and the Committee on Environment and Public Works of the Senate that describes: 1) actions taken to solicit and review proposals to address the 32 Great Lakes Fishery Resources Restoration Study Recommendations; 2) the results of proposals implemented; and 3) progress toward accomplishment of the Service’s Great Lakes goals.

This report documents the progress that the Service and our Great Lakes partners have made through 2002 and highlights many of the fish and wildlife restoration success stories made possible through the Act.

Great Lakes fish and wildlife resources

The Great Lakes basin stretches across more than 750 miles from West to East, covers a surface area of over 94,000 square miles, includes more than 10,000 miles of shoreline and is the largest system of fresh surface water on earth, containing 18 % (5,500 cubic miles) of the world supply. The basin supports a wide diversity of fish and wildlife and habitats, is home to 142 fish species and is used by more than 500 species of migratory birds. The basin has been colonized by at least 173 non-indigenous species with about 75% of the most recent invaders arriving in ballast water from Eurasia. The Great Lakes contain almost all of North America’s unique alvar ecosystems, supporting many globally imperiled species of plants, insects and land snails. Great Lakes coastal wetlands include sites, such as Long Point, Lake Erie, that are recognized internationally for their outstanding biological significance.

Fish and wildlife habitats and water quality have undergone tremendous change from human impacts as the population of the basin grew from about 100,000 in the 16th century to more than 34,000,000 today. More than 10% of the population of the United States, and 25% of the population of Canada live in the basin and some of the world’s largest concentrations of industry as well as extensive agricultural lands occur in this region. Over two-thirds of all Great Lakes wetlands have been lost since European settlement began, having an enormous impact on fish and wildlife populations. Another important change to the Great Lakes Ecosystem occurred when the Welland Canal was opened in 1829, bypassing Niagara Falls, joining Lakes Erie and Ontario, and allowing the parasitic sea lamprey to colonize the entire basin.

What the Service does in the Great Lakes

The Service's Great Lakes program is implemented by 58 field stations (see map page ii). These offices conduct fish and wildlife restoration activities throughout the basin, including coastal and near-shore habitats, under numerous federal authorities that generally relate to nationally significant migratory species, federally listed threatened and endangered species, and interjurisdictional species and their habitats. We manage approximately 140,000 acres in the basin as part of 17 Refuges under the National Wildlife Refuge system, maintain over 11,000 acres in waterfowl production areas and produce millions of fish each year for interagency restoration programs from 7 National Fish Hatcheries. Our 4 Fishery Resources Offices conduct population assessment and cooperative management of native species and habitats- including efforts to improve fish passage, and help prevent and control aquatic invasive species. The Great Lakes Coordination Office, 2 Fish Health Centers, 2 Sea Lamprey Control Stations, and 1 Fish Technology Center also perform important work in support of managing healthy populations of native aquatic species. Our agents at 13 Law Enforcement offices enforce federal wildlife laws, such as the Lacey Act. At 11 Ecological Services offices we provide consultation and technical assistance services to federal, state, tribal and local authorities, and a variety of non-governmental organizations, toward conserving fish and wildlife, as well as providing expertise toward the identification, restoration and prevention of contaminant and pollution impacts. We also work directly with private land owners who want to restore fish and wildlife habitat on their properties through the Partners for Fish and Wildlife Program.

The Service's Great Lakes operations are coordinated externally through numerous commissions, councils, committees, trusts and other organizations operating in the Great Lakes. The Service also initiated an ecosystem-based approach to coordinate the activities of its Great Lakes field stations by forming a Great Lakes Basin Ecosystem Team. More than 200 organizations have been involved in addressing Great Lakes resource conservation activities with the Service during 1998-2002. These coordination processes and partnerships allow the Service the flexibility to address fish and wildlife conservation needs ranging from site-specific restoration actions to landscape-scale resource objectives. The activities and accomplishments of the Service toward our six Great Lakes goals are provided on page 45 and in Appendix II of this report.

The Service also administers the Federal Assistance in Sport Fish and Wildlife programs, providing direct support to states for the management of natural resources. During the period 1998-2002, the Service provided \$479,000,000 (including \$271,000,000 in Sport Fish Restoration and \$208,000,000 in Wildlife Restoration) to the Great Lakes states for habitat protection, restoration and management, environmental education, hunter education, research aimed at improving fish and wildlife management, monitoring of fish and wildlife populations, development of fishing access and other public facilities, fish hatcheries and more.

Service programs in basin-wide perspective

A recent report from the United States General Accounting Office (GAO) indicated that there are about 200 federal and state environmental programs operating within the Great Lakes, including 50 that specifically address environmental conditions in the basin. The GAO report indicates that Service programs account for about 9% of the expenditures for Great Lakes specific environmental programs by federal agencies. The GAO report further indicates that state program expenditures exceed federal expenditures by about 2.5:1 in the basin.

The states have primary jurisdiction over resident fish and wildlife in the Great Lakes basin and human activities affecting these resources. The Service conducts programs under a variety of authorities, some leading toward site specific activities such as habitat rehabilitation, others providing the

broadest possible perspective such as federal protection of endangered species and meeting tribal trust responsibilities. Our activities often fall into the categories of supporting or augmenting state authorities, filling in gaps in management information, or providing common links between organizations through interagency databases, workshops or similar coordinating processes.

The Great Lakes Fish and Wildlife Restoration Act as an interagency strategy

The Great Lakes basin is large and its fish and wildlife resources extremely diverse. Dozens of fish and wildlife conservation programs have been initiated to resolve the many management challenges faced by agencies in the basin. It is widely recognized that there is need to improve the links between existing resource management programs and activities.

One of the best examples of an interagency strategy aimed at linking fish and wildlife management actions is *A Joint Strategic Plan for Management of Great Lakes Fisheries*, first signed in 1980 and revised in 1997. The *Joint Strategic Plan*, signed by eight states, the Province of Ontario, two intertribal agencies and four federal agencies, is rooted in these strategies: consensus, accountability, information sharing and ecosystem management. Implementation of the *Joint Strategic Plan* is accomplished through the Great Lakes Fishery Commission under a highly effective lake committee structure.

While the *Joint Strategic Plan* is an effective coordination strategy, true interagency management initiatives were lacking until the Great Lakes Fish and Wildlife Restoration Act was implemented. The Act fuels the partnerships embodied under the *Joint Strategic Plan* by providing working funds for actions crossing lines of management authority that would have been difficult to implement for each individual agency. Two examples are the creation of the Great Lakes Fish Stocking Database, which went on-line at the Commission's website in 2002, and the ongoing Great Lakes Geographic Information System initiative, which began in the Lake Huron basin in 2000.

Another example of an interagency strategy to improve fish and wildlife management and restoration is the Great Lakes Regional Collaboration (GLRC) Strategy to Restore and Protect the Great Lakes, which was released in December 2005. The GLRC was established under Executive Order 13340. This Strategy includes recommendations for actions to restore and protect the Great Lakes. The Great Lakes Fish and Wildlife Restoration Act could be an important tool for implementing fish and wildlife restoration actions consistent with these recommendations.

The effectiveness of the Great Lakes Fish and Wildlife Restoration Act as an overarching strategy has increased steadily since 1990, by fueling the existing resource management partnerships coordinated through the Great Lakes Fishery Commission under the *Joint Strategic Plan* and by bringing the activities of the Service together under six common Great Lakes restoration goals. The Act has also opened up new possibilities for international coordination, such as the potential to combine activities under the Fish and Wildlife Restoration Proposal program with those funded under the Canada-Ontario Agreement (COA). Since 1971, the Canada-Ontario Agreements have guided the Parties in their work to improve the environmental quality of the basin by reducing the amount of pollution entering the basin, improving and protecting fish and wildlife habitat, working toward the goal of water that is safe to swim in and drink, and fostering a sense of environmental stewardship throughout the region.

This report provides many details and examples of fish and wildlife restoration activities, accomplishments and partnerships realized through 2002. The Service views the Great Lakes Fish and Wildlife Restoration Act as a vibrant conservation program with unlimited future potential to enhance fish and wildlife conservation in coordination with other environmental restoration programs in the Great Lakes region. It is our goal in this report to accurately communicate the status of the Act and its many programs to the reader.



Restoration Proposal Process

Actions Taken to Solicit and Review Proposals Under Section 1005

The *Great Lakes Fish and Wildlife Restoration Act of 1998* (Act) created a new program to facilitate the identification, review and implementation of state and Indian tribal proposals for the restoration of fish and wildlife resources based on the results of the *Great Lakes Fishery Resources Restoration Study* (Study). The Study presented 32 recommendations addressing natural resource management issues common to all five of the Great Lakes and their watersheds (Appendix I).

The Act also required that fish and wildlife restoration proposals be consistent with the goals of the *Great Lakes Water Quality Agreement*, as revised in 1987, the 1954 *Great Lakes Fisheries Convention*, the 1980 *Strategic Plan for the Management of Great Lakes Fisheries*, the *Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990*, and the *North American Waterfowl Management Plan*.

The Act created the Great Lakes Fish and Wildlife Restoration Proposal Review Committee, operating under the guidance of the Council of Lake Committees of the Great Lakes Fishery Commission, to lead this new process. The Committee's task was to review proposals and recommend to the Director of the Service those proposals that should be funded and implemented.

Milestones and achievements from the State and Native American Tribal restoration proposal program during 1998-2002 include:

- The first proposals were funded under the *Great Lakes Fish and Wildlife Restoration Act* in August, 1998, with the signing of a cooperative agreement between the Great Lakes Fishery Commission and the Fish and Wildlife Service;
- The first formal Request for Proposals (RFP) under the Act was announced in February, 1999, by the Great Lakes Fishery Commission, at the request of the Council of Lake Committees and the Service;
- The Great Lakes Fish and Wildlife Restoration Proposal Review Committee was established by the Council of Lake Committees in April, 1999. The council maintains an active and highly effective oversight of the Committee and the proposal review process;
- The Great Lakes Fish and Wildlife Restoration Proposal Review Committee includes members from each of the Great Lakes states, and Native American governments and resource commissions;
- Recommendations for projects have been transmitted by the Proposal Review Committee to the Service each year since 1999, including lists of alternate proposals to be considered in the event that additional funding should become available (Appendix 3).

During the first five years of the program, nearly \$7 million in fish and wildlife restoration proposals were submitted for consideration through the Great Lakes Fishery Commission. These 73 proposals brought along with them the promise of leveraging more than \$5 million in non-federal matching funds, representing a potential investment of over \$12 million on Great Lakes fish and wildlife restoration (Table 1).

Table 1. Proposals Submitted For Funding, 1998-2002.

Year	Proposals	Federal funds	Matching funds	Total cost
1998	5	89,000	58,000	147,000
1999	7	150,000	50,000	200,000
2000	20	3,027,000	2,230,000	5,257,000
2001	19	1,742,000	1,892,000	3,634,000
2002	22	1,892,000	912,000	2,804,000
Total	73	6,900,000	5,142,000	12,042,000

In addition to the 73 proposals submitted to date, the Service has received dozens of letters, phone calls and e-mail messages from partners, from the Council of Lake Committees and from the Proposal Review Committee in the course of implementing Section 1005 of the Act. These communications effectively illustrated some of the central issues that have shaped the state and tribal restoration proposal process, as described below.

Demand for proposal funding has greatly exceeded appropriations

During 2000, 2001 and 2002, in addition to submitting recommended projects to the Service as called for in the Act, the Proposal Review Committee provided lists of highly-ranked alternate proposals that would have made valuable contributions to Great Lakes fish and wildlife restoration had additional funding been available (Appendix III). Some of the unfunded proposals were resubmitted and funded in subsequent years.

In 2000, six proposals were submitted as alternates. These projects would have addressed restoration needs including: forage species dynamics and thiaminase deficiency in salmon and lake trout populations, habitat use and requirements for Chinook salmon, factors influencing coaster brook trout restoration in Lake Superior and trends in the management of exotic species introductions through ballast water.

In 2001, eight proposals were submitted as alternates. These projects would have addressed restoration needs including: stream habitat rehabilitation, lake trout and Chinook salmon habitat use and requirements, impacts of contaminants on lake trout reproduction, potential use of pheromones to disrupt round goby reproduction, development of standardized surveys for assessing zebra mussel populations and preparation of a web-based atlas of Great Lakes fishes.

In 2002, seven proposals were submitted as alternates. These projects would have addressed restoration needs including: the potential effects of whirling disease on native fishes in Michigan streams, factors influencing yellow perch and walleye populations and the development of interagency fishery assessment programs and databases to improve management efficiency.

There has been a pronounced emphasis on research

Most of the projects submitted for review, and most of those recommended by the Proposal Review Committee, represent basic investigations intended to assess the status of fish and wildlife populations and identify the factors impacting those resources. The amount of available funding essentially precludes actual restoration activities of significant magnitude. The research being funded will guide future restoration programs and is pre-requisite to an efficient and effective program.

For example, 14 (nearly half) of the projects recommended by the Committee focused on basic questions about the status of fish populations or their habitat use and requirements. Another 7 projects have compiled existing data and developed interagency databases or fishery models through which more effective management decisions could be made. Five projects sought to answer basic questions on the genetics of populations of lake sturgeon, yellow perch and walleye. Finally, 7 projects focused directly on restoration of fish or their habitat during the initial five years of this program.

A key component to an effective Great Lakes ecosystem management and restoration program is an understanding of species interactions and dynamics for the mix of native and non-native species inhabiting this ecosystem. Without a well-funded research program, management decisions are inevitably based on inadequate and outdated information. The complex issues of the Great Lakes require study approaches that are multi-disciplinary, inter-jurisdictional, and large in scope. Studies that use this approach are extremely insightful in developing linkages between aquatic resources and management actions, and accordingly demand sufficient funding. The Great Lakes Fish and Wildlife Restoration Act has been very effective in funding this kind of applied research in a manner that was not possible before its reauthorization in 1998.

New links between Great Lakes activities have been forged through the Act

Another important aspect of the program is that the proposal review process has been linked with compatible programs administered by the Great Lakes Fishery Commission, the Great Lakes Fishery Trust and other entities.

As the administration of the proposal development and review process was being shaped, the Great Lakes Fishery Commission designed a joint process wherein several funding sources including the Act's State and Tribal restoration proposal program, were combined into a unified process. This has the advantage of broadening the number and types of projects considered under each funding source and allowing proposals to be supported in the manner most effective for fish and wildlife restoration. This makes the Act and the Commission's grant program stronger.

The Council of Lake Committees has also interacted with the Great Lakes Fishery Trust to ensure that funding recommendations under the Act complement grants provided by the Trust and do not duplicate effort. For example, work in support of Great Lakes lake sturgeon restoration activities is moving forward more rapidly due to the combined funding from these two sources.

There is strong support for restoration projects and the proposal process

The Act has proven to be extremely efficient and effective in supporting interagency fish and wildlife restoration actions and collaborative decision-making. This is in part because the process draws upon the proven framework of the Joint Strategic Plan for Management of Great Lakes Fisheries, under which state, tribal, federal and provincial management agencies have chosen to work. The Service has received positive comments on the process in a number of letters from our partners – some examples include:

“The Michigan Department of Natural Resources, Fisheries Division finds the proposal solicitation and implementation process to be working satisfactorily. The quality and diversity of research supported by this funding is high, and the research has been directed towards addressing issues dealing with applied management of fish stocks on a basin-wide basis.” (Michigan Department of Natural Resources, February 26, 2003.)

“We, in Illinois, are pleased with the process that has evolved for reviewing and recommending proposals for funding under this Act. The Restoration Act review committee has continued to improve this review process since its inception to insure that not only quality projects are recommended but also that the Lake Committees’ research priorities and the 32 recommendations identified in the 1995 Great Lakes Fishery Resources Restoration Study are addressed.” (Illinois Department of Natural Resources, January 10, 2003.)

“The process for reviewing and selecting research proposals for funding has undergone procedural changes essentially to increase efficiency. The interagency effort in this selection process has resulted in quality submissions and appropriate spatial distribution of projects over all Great Lakes. We are especially pleased that research on Lake Erie has received a relatively high level of funding over this period.” (Ohio Department of Natural Resources, January 14, 2003.)





Results Of Proposals Implemented Under Section 1005

The full \$1,298,000 appropriated for restoration proposals during 1998-2002 has been provided for research and restoration activities as approved by the Director following recommendations from the Proposal Review Committee (Table 2). In addition, the Service contributed \$375,000 (\$75,000 each year from our appropriations under the Act) bringing the total amount of funding available for these projects to \$1.673 million. The addition of \$1.791 million in matching non-federal funds tied to the 39 projects resulted in a total on-the-ground investment of \$3.464 million to date.

Table 2. Projects Funded, Matching Dollars and Total Project Outlay, 1998-2002.

Year	Projects	Federal funds	Matching funds	Total
1998	3	62,000	52,000	114,000
1999	3	63,000	26,000	89,000
2000	9	487,000	597,000	1,084,000
2001	12	486,000	347,000	833,000
2002	12	575,000	769,000	1,344,000
Total	39	1,673,000	1,791,000	3,464,000

The allocation of funding within the Great Lakes basin and number of grants awarded to each area during 1998-2002 are described in Figures 1 and 2.

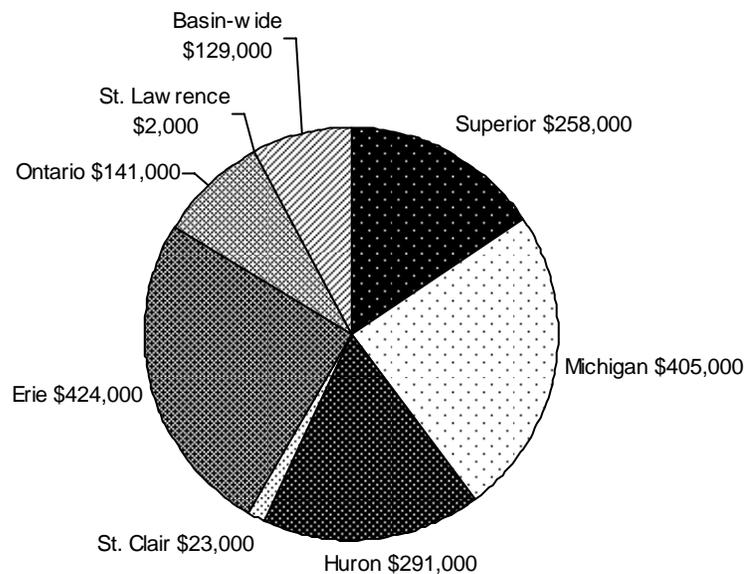


Figure 1. Fund Allocation by Lake Basin.

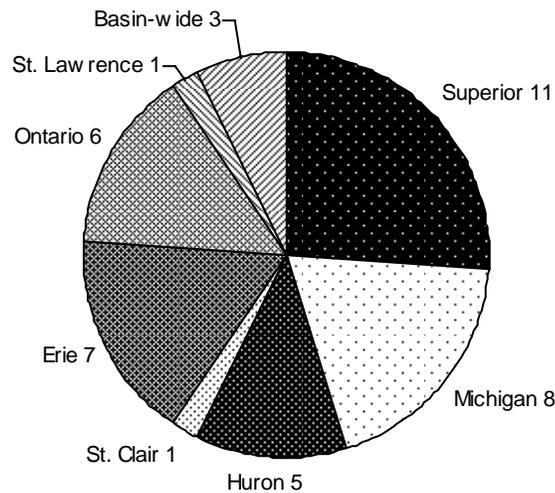


Figure 2. Number of Projects Funded by Lake Basin (total exceeds 39 due to multiple lake focus of some projects).

The basin-wide scope achieved in fund distribution is the result of two decisions reached by the Council of Lake Committees early on in establishing the review process. First, the Council has adopted a stance of identifying basin-wide issues, such as the need for standard markers for lake sturgeon genetics, and prioritizing these during the proposal development process. Second, the Council designed a process that directed the first review and prioritization of proposals through each Lake Committee, and asked the Proposal Review Committee to address the highest priorities of each of the Lake Committees to the extent possible within available funding.



“...the Act has proven to be an extremely effective force for supporting interagency fish and wildlife restoration actions and collaborative decision-making.” - Council of Lake Committees, September 3, 2002



Progress Toward Addressing the Great Lakes Fishery Resource Restoration Study Recommendations

Scope and scale of work needed

The *Great Lakes Fishery Resources Restoration Study Report to Congress* (1995) presented 32 recommendations (Appendix I) which, except where specifically indicated, address issues common to all five of the Great Lakes and their watersheds. When these recommendations were originally developed, there were some informal discussions about the funding levels required to address them; however, no formal estimates were produced or included in the Report.

Resources available and priorities

The Act (1998) authorizes up to \$4.5 million per year to fund restoration proposals, of which Congress appropriated a total of \$1.3 million over fiscal years 2000 – 2002. The Service contributed an additional \$375 thousand over fiscal years 1998 – 2002, making \$1.673 million the total federal funding available for projects since 1998. The Service, Great Lakes Fishery Commission, Council of Lake Committees and the Great Lakes Fish and Wildlife Restoration Proposal Review Committee have created a highly effective request for proposals and selection process, described on pages 5 – 8 of this report, to ensure that only the highest priority and best designed work is done. The proposal process has generated \$1.791 million in matching funds via cost sharing for Great Lakes restoration needs.

Initial focus and progress toward the 32 Recommendations

From 1998-2002 Act funded projects have addressed recommendations to inform the following basic needs: fish community assessment and modeling; ecological monitoring; developing ecosystem management goals; developing and implementing plans for restoring habitats and species; fish health; and fish genetics.

Nearly 80% of the proposals funded during 1998-2002 addressed recommendations that fit

into these categories (Figure 3). This represents a logical starting point; however, it also shows that the majority of recommendations remain largely unaddressed and that significant gaps in inter-agency restoration programs remain. The 32 recommendations are complex and require long term effort, in terms of data collection, implementation of activities, and time to gauge the response of natural systems to our actions. The process of establishing interagency databases, creating geographic information systems and initiating cooperative monitoring programs has in many ways just begun, and will take many more years to be fully established.

A word of caution: the reader might be tempted to relate the number of projects implemented under each recommendation (see next page) as a way to view the rate of our progress toward achieving restoration. The number of proposals addressing each study recommendation is useful information for tracking where Great Lakes states and tribes have chosen to focus restoration work; however, this does not necessarily allow us to chart how far along we are in fulfilling each recommendation.

The results of proposals implemented can be viewed via the project summaries on pages 14– 44 of this report. Each project summary references which *Great Lakes Fishery Resources Restoration Study* recommendations have been addressed by the project. Most projects reference several recommendations due to the fact that many recommendations are overlapping and inter-related.

In addition to progress via Act funded projects, other progress has been made toward these recommendations via Service activities with its partners to achieve the Service's Great Lakes goals as listed on pages 50-65 of this report.

Number of projects completed or in progress contributing to each recommendation

1. Develop and Adopt Aquatic Community and Habitat Goals and Objectives to Support Ecosystem Management – **5 projects**
2. Fully Implement the *Strategic Plan for Management of Great Lakes Fisheries* – **0 projects**
3. Conduct Comprehensive and Standardized Ecological Monitoring – **5 projects**
4. Standardize Fish Community Assessment Data and Establish Comprehensive Fishery Databases – **4 projects**
5. Develop Offshore Capabilities – **1 project**
6. Fish Community Assessment Program – **12 projects**
7. Fish Community Modeling – **12 projects**
8. Coordinate State and Native American Tribal Harvest Monitoring and Management: Measure Commercial and Recreational Fish Catches – **2 projects**
9. Revise Stocking Strategies, as Necessary, to be Consistent with Proposed Aquatic Community and Habitat Goals and Objectives – **4 projects**
10. Ecological Information Clearing-house/Geographic Information System – **2 projects**
11. Identify, Inventory, Protect and Rehabilitate Significant Habitats – **10 projects**
12. Develop and Implement Action, Restoration and/or Enhancement Plans for Exploited and/or Declining Indigenous Aquatic Species – **23 projects**
13. Develop and Implement Action/Restoration Plans for Forage Fish – **2 projects**
14. "Close the Door" on Nonindigenous Species Introductions – **0 projects**
15. Implement and Expand Effective Sea Lamprey Control – **2 projects**
16. Great Lakes Fishery Commission Line Item Funding for Sea Lamprey Control Efforts in the St. Mary's River – **0 projects**
17. Fund Implementation of the Great Lakes Fishery Commission's Basin-wide Sea Lamprey Barrier Plan – **0 projects**
18. Prevent or Delay the Spread of Ruffe – **0 projects**
19. Determine the Impacts of Hydroelectric Facilities and Dam Operations on Fishery Resources – **3 projects**
20. Increase Involvement in the Binational Program to Restore and Protect Lake Superior and Expand this Mechanism to Lakes Huron, Erie, and Ontario – **0 projects**
21. Establish Uniform Tissue and Sediment Contaminant Levels Used by Various Agencies for Ecosystem Health – **0 projects**
22. Broaden the Scope of Current State Antidegradation Policies – **0 projects**
23. Develop and Implement an Action Plan to Analyze Contaminant Level Effects on Aquatic Resources – **0 projects**
24. Participate in Remedial Action Plans, Lake-wide Management Plans, and the Environmental Monitoring and Assessment Program – **0 projects**
25. Salmonine Egg Viability – **1 project**
26. Establish an Isolation or Quarantine Facility – **0 projects**
27. Develop an Epizootic Epitheliotropic Disease (EEDV) Diagnostic Test – **0 projects**
28. Fish Health – **4 projects**
29. Fish Genetics – **6 projects**
30. Lethality of Sea Lamprey Attacks – **1 project**
31. Develop Aquatic Resource Education Programs – **4 projects**
32. Conduct a Cormorant Fishery Predation Study – **1 project**

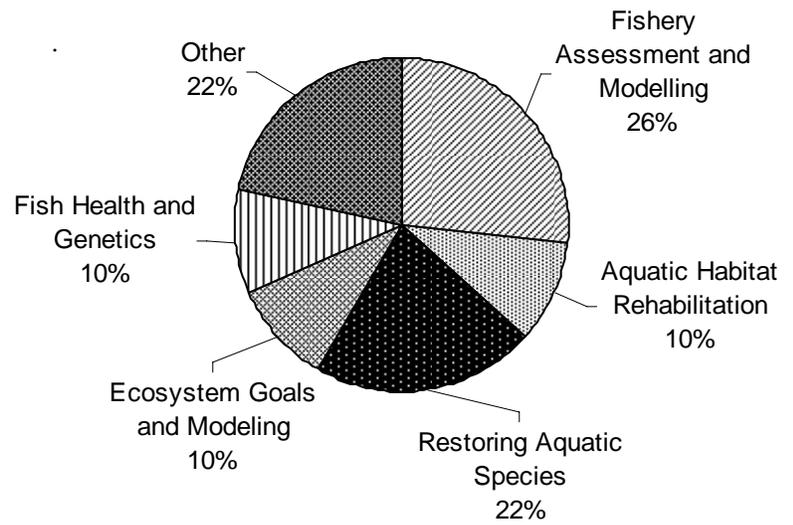


Figure 3. Focus Areas of Act Funded Projects 1998-2002.



Partner List

One of the most important observations upon reviewing the first five years of the fish and wildlife restoration proposal program is the extensive list of partners involved in implementing these projects. The list includes 52 organizations that provided funding and expertise, including 18 universities, 9 state or local agencies, 7 U. S. federal agencies, 6 Native American governments and treaty authorities, 6 Canadian institutions and 3 non-governmental organizations:

State and Local Agencies

Baraga County Road Commission
 Illinois Department of Natural Resources
 Illinois Natural History Survey
 Indiana Department of Natural Resources
 Michigan Department of Natural Resources
 Michigan Natural Features Inventory
 Minnesota Department of Natural Resources
 New York State Department of Environmental Conservation
 Ohio Department of Natural Resources

U.S. Federal Agencies

US Environmental Protection Agency
 US Fish and Wildlife Service
 US Geological Survey - Great Lakes Science Center
 NOAA - Great Lakes Environmental Research Laboratory
 NOAA - National Marine Fisheries Service
 NOAA - National Undersea Research Program
 USDA - Natural Resources Conservation Service

Canadian Institutions

Canadian Heritage
 Environment Canada
 Fisheries and Oceans Canada
 Natural Sciences and Engineering Research Council
 Ontario Ministry of Natural Resources
 Trent-Severn Waterway

Commissions

Great Lakes Fishery Commission

NGOs, Foundations and Public

Interest Groups

Grand River Conservation Authority
 Great Lakes Fishery Trust
 The Nature Conservancy

Native American Governments

Bad River Band of Lake Superior Chippewa Indians
 Keweenaw Bay Indian Community Natural Resources Department
 Little Traverse Bay Band of Odawa Indians
 Walpole Island First Nation

Native American Treaty Authorities

Chippewa-Ottawa Resource Authority
 Great Lakes Indian Fish and Wildlife Commission

Schools, Colleges and Universities

Central Michigan University
 Cleveland State University
 Cornell University
 Michigan State University
 Michigan State University - Sea Grant
 North Carolina State University
 State University of New York - Fredonia
 Sweet Briar College
 Trent University
 University of California - Davis
 University of Illinois
 University of Michigan
 University of Minnesota
 University of Wisconsin- Stevens Point
 University of Wisconsin - Milwaukee
 University of Toronto
 University of Waterloo
 University of Windsor

Others

Detroit Edison Company
 Ontario Power Generation

Summaries for each of the research and restoration projects supported through the Act during 1998-2002 are presented in the following section of this report. The summaries provide basic information including project title, Great Lakes basin focus area, year funded, partners involved, and cost. Restoration Study Recommendations addressed, project highlights and project background are also included.

Project Summaries

	Project 98- 1: Lake-Wide Lake Trout Population 99- 1 Model For Lake Superior 00- 2 01-12	1998 / 1999 2000 / 2001										
Partners:	Chipewa/Ottawa Resource Authority, Michigan Department of Natural Resources, University of Wisconsin-Stevens Point, Great Lakes Indian Fish and Wildlife Commission, Minnesota Department of Natural Resources, Wisconsin Department of Natural Resources, U. S. Geological Survey, Ontario Ministry of Natural Resources, Great Lakes Fishery Commission											
Investigators:	Michael Hansen, Mark Ebener, Joan Bratley and Kevin Kapuscinski											
Funds:	<table border="1"> <thead> <tr> <th data-bbox="488 667 878 703">Restoration Act</th> <th data-bbox="878 667 1388 703">Non-federal match</th> </tr> </thead> <tbody> <tr> <td data-bbox="488 703 878 739">FY 98 \$ 4,500</td> <td data-bbox="878 703 1388 739">\$18,000</td> </tr> <tr> <td data-bbox="488 739 878 774">FY 99 \$31,000</td> <td data-bbox="878 739 1388 774">\$10,400</td> </tr> <tr> <td data-bbox="488 774 878 810">FY 00 \$ 4,500</td> <td data-bbox="878 774 1388 810">\$ 5,500</td> </tr> <tr> <td data-bbox="488 810 878 846">FY 01 \$13,000</td> <td data-bbox="878 810 1388 846">\$ 4,400</td> </tr> </tbody> </table>		Restoration Act	Non-federal match	FY 98 \$ 4,500	\$18,000	FY 99 \$31,000	\$10,400	FY 00 \$ 4,500	\$ 5,500	FY 01 \$13,000	\$ 4,400
Restoration Act	Non-federal match											
FY 98 \$ 4,500	\$18,000											
FY 99 \$31,000	\$10,400											
FY 00 \$ 4,500	\$ 5,500											
FY 01 \$13,000	\$ 4,400											

Restoration Study Recommendations Addressed:

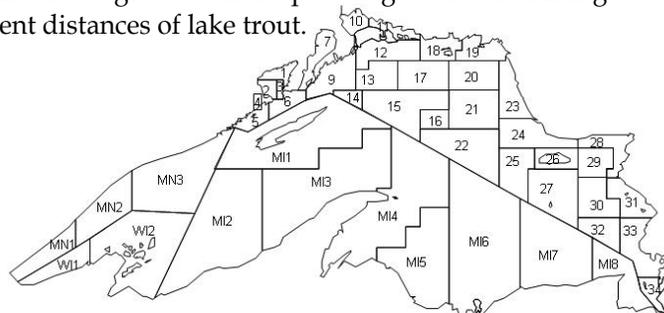
- Fish Community Modelling (Recommendation # 7); Plans for Exploited and Declining Indigenous Aquatic Species (Recommendation # 12).

Highlights:

- This study provides new information on lake trout origin, movement, contribution to the fisheries, and population restoration trends.
- Information from 3,000 tagged lake trout indicates that a large percentage of lake trout are moving across management unit boundaries.
- Movement across management unit boundaries is common for fish originating from spawning reefs nearest to those boundaries.

Background:

More than 46,000 lake trout were tagged at 195 sites in Lake Superior from 1973-2000. Information from nearly 3,000 recaptures was examined and lake trout traveled, on average, about 33 miles between tagging and recovery. Lake trout populations in Lake Superior have been managed using models that assume lake trout do not move between management units. Fishery managers can use this new information to account for lake trout movement in statistical catch-at-age models, determine the degree to which spawning stocks are mixing between spawning events, and predict movement distances of lake trout.



Lake Superior management units.

	Project 98-2: Genetic Population Structure In 99-3 Lake Michigan Yellow Perch		1998 / 1999
Partners:	Illinois Department of Natural Resources, University of Minnesota, Great Lakes Fishery Commission		
Investigators:	Loren Miller and Anne Kapuscinski		
Funds:	Restoration Act	Non-federal match	
	FY 98	\$30,000	\$25,000
	FY 99	\$30,000	\$10,000

Restoration Study Recommendations Addressed:

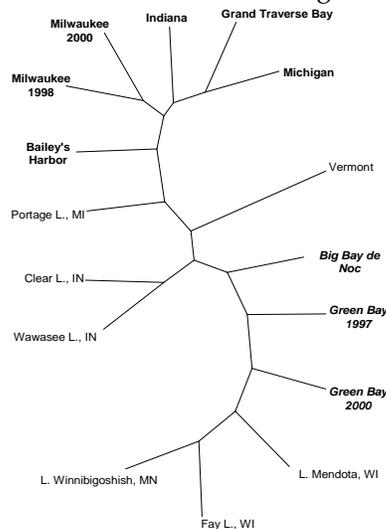
- Fish Genetics (Recommendation # 29); Fish Community Modelling (Recommendation # 7); Plans for Exploited and Declining Indigenous Aquatic Species (Recommendation # 12).

Highlights:

- This study genetically classified 16 populations of yellow perch in Lake Michigan.
- Green Bay spawning groups were found to be genetically distinct stocks from those in southern Lake Michigan.
- These results provide evidence for continued management of yellow perch in Lake Michigan based on separate Green Bay and Lake Michigan stocks.

Background:

Understanding and preserving the genetic diversity of Lake Michigan yellow perch is essential to maintaining strong and productive fish populations. The recent decline in Lake Michigan's yellow perch has prompted interest in the genetic structure of perch populations. This study assessed genetic population structure among 16 yellow perch populations, focusing on spawning groups within Lake Michigan. Little difference was found among spawning groups within southern Lake Michigan or within Green Bay; however, Green Bay spawning groups were found to be genetically distinct stocks from those in southern Lake Michigan.



A cluster diagram of genetic relationships among yellow perch sampled from locations in Lake Michigan and the surrounding region.

	Project 98-3: Eastern Lake Ontario Food Web Studies	1998
Partners:	New York State Department of Environmental Conservation, U.S. Fish and Wildlife Service, Ontario Ministry of Natural Resources, Great Lakes Fishery Commission	
Investigators:	Tom Stewart, Jim Hoyle, Jim Bowlby, Ted Schaner, Andy Smith and John Cassleman	
Funds:	Restoration Act \$27,300	Non-federal match \$9,100

Restoration Study Recommendations Addressed:

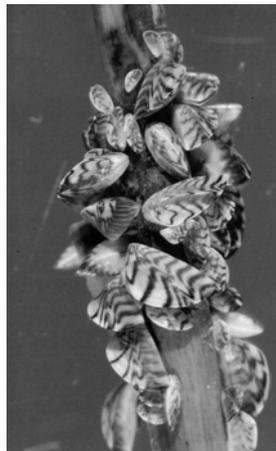
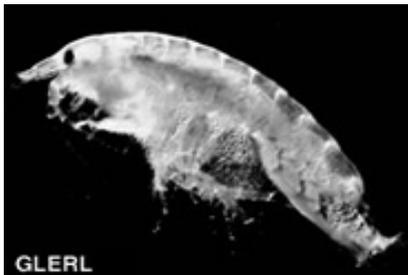
- Fish Community Assessment (Recommendation # 6); Ecological Monitoring (Recommendation # 3); Fish Community Modelling (Recommendation # 7); Other Recommendations Addressed: # 12.

Highlights:

- Angler catch surveys, small mouth bass sampling, and lake whitefish diet sampling were integrated to assess food web changes.
- Smallmouth bass abundance was found to be strongly related to mid-summer water temperatures; while over-fishing, walleye predation, and cormorant predation were not significant factors.
- Results also indicate that declines in the Great Lakes amphipod *Diporeia*, formerly the most important prey item in whitefish diet, have contributed to poor body condition in lake whitefish.

Background:

Changes in the Lake Ontario aquatic food web have resulted in declines in smallmouth bass and lake whitefish populations. The objectives of the study were to augment existing assessment and research programs by filling in major knowledge gaps to better assess the potential impacts of a changing eastern Lake Ontario aquatic food web. Understanding recent changes in the aquatic food web in Lake Ontario will guide fishery management and enhance restoration opportunities.



(Photos and drawing courtesy of Great Lakes Environmental Research Laboratory).

	Project 99-2: Questionnaire Regarding Fish Community Objectives For The St. Lawrence River	1999
Partners:	New York State Department of Environmental Conservation, Ontario Ministry of Natural Resources, Cornell University, Great Lakes Fishery Commission	
Investigators:	Alastair Mathers, Steven LaPan, Tommy Brown	
Funds:	Restoration Act \$2,300	Non-federal match \$5,500

Restoration Study Recommendations Addressed:

- Community and Habitat Goals and Objectives (Recommendation # 1); Fish Community Assessment (Recommendation # 6); Plans for Exploited and Declining Indigenous Aquatic Species (Recommendation # 12); Other Recommendations Addressed: # 31.

Highlights:

- St. Lawrence River angler preferences were gathered through a questionnaire provided at a series of six public meetings during the summer of 2000.
- Results were incorporated into the "*Fish-Community Objectives for the St. Lawrence River*".
- This new public opinion information will help guide effective change in St. Lawrence River fishery management activities.

Background:

The St. Lawrence River ecosystem has undergone dramatic changes recently and public input was needed to realign fishery management activities. Toward meeting this need, a 26-question survey was handed out at a series of six public meetings to define fisheries issues and inform managers of the public's preferences. The results were used to set management objectives and priorities for the St. Lawrence River. These objectives and priorities were then opened to the public for further comment and refinement.

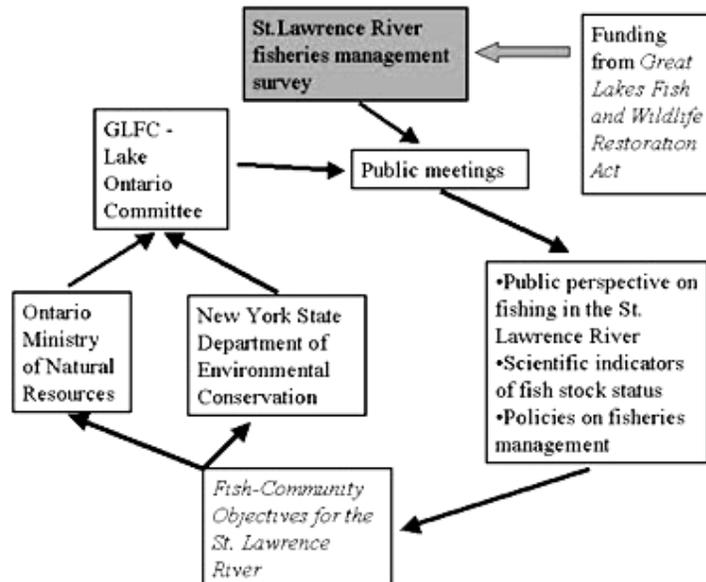


Diagram of the process used to define St. Lawrence River fishery management issues and inform managers of public preferences.

	Project 00-1: Restoration Of Deepwater Cisco 01-1 In Lake Ontario		2000 / 2001
Partners:	New York State Department of Environmental Conservation, Ontario Ministry of Natural Resources, Great Lakes Fishery Commission		
Investigators:	Tom Stewart, Glenn Hooper, Randy Eshenroder		
Funds:	Restoration Act	Non-federal match	
	FY 00	\$37,590	\$12,550
	FY 01	\$ 8,000	\$ 2,700

Restoration Study Recommendations Addressed:

- Plans for Exploited and Declining Indigenous Aquatic Species (Recommendation # 12); Action/Restoration Plans for Forage Fish (Recommendation # 13).

Highlights:

- This project has identified major impediments to the restoration of deepwater cisco, a native prey species in Lake Ontario.
- Two collections of source stock from Michipicoten Bay, Lake Superior have been attempted.
- Additionally, experimental culture methods and facilities have been developed for hatchery production of deepwater ciscoe.

Background:

Over-fishing, sea lamprey parasitism, and competition with smelt and alewives has led to the collapse of the valuable deepwater cisco fishery in Lake Ontario. Reintroduction of deepwater ciscoe, *Coregonus hoyi*, from a healthy donor population is being explored to restore the collapsed fishery in Lake Ontario. Deepwater ciscoe in spawning condition have been extremely difficult to capture because spawning occurs in deep water during the winter. Despite identified impediments, this study indicates that restoration through reintroduction remains a viable option for deepwater ciscoe in Lake Ontario.



Deepwater cisco, an imperiled native prey species in Lake Ontario.
(Photo courtesy of Ontario Ministry of Natural Resources)

Project Summaries

	Project 00-3: Development Of An Age-Structured Yellow Perch Population Model For Lake Michigan	2000
Partners:	Illinois Department of Natural Resources, Michigan Department of Natural Resources, Indiana Department of Natural Resources, Wisconsin Department of Natural Resources, Michigan State University, Little Traverse Bay Band of Odawa Indians, Great Lakes Fishery Commission	
Investigators:	James Bence, Michael Wilberg, and David Clapp	
Funds:	Restoration Act \$58,500	Non-federal match \$20,000

Restoration Study Recommendations Addressed:

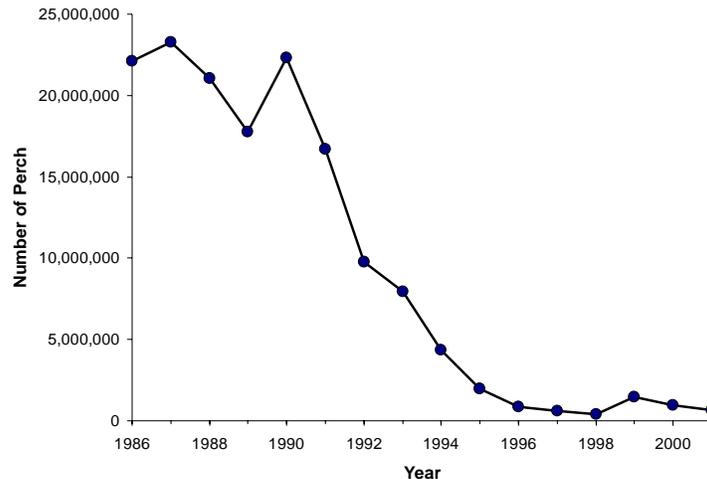
- Fish Genetics (Recommendation # 29); Fish Community Modelling (Recommendation # 7); Plans for Exploited and Declining Indigenous Aquatic Species (Recommendation # 12).

Highlights:

- Preliminary information indicates that yellow perch abundance in Lake Michigan during 2001 was less than 5% of 1986 levels.
- Analysis of available data suggests that high fishing mortality led to reproductive failure and population collapse in Lake Michigan during the mid to late 1990's.
- This study provides the information to model fish mortality and shows a direct relationship between mortality and recovery for Lake Michigan yellow perch.

Background:

Yellow perch abundance declined greatly in the main basin of Lake Michigan during the mid to late 1990's. Our analysis of available data indicates annual mortality rates for mature females between 50 to 94% during 1986-1995. These mortality rates are quite high for a species like yellow perch that can live more than 10 years.



Estimated yellow perch abundance in Wisconsin waters of Lake Michigan from 1986-2001.

	Project 00-4: Restoration Of River And Near-Shore Habitats And Fish Stocks In Eastern Lake Erie		2000
Partners:	New York State Department of Environmental Conservation, Ontario Ministry of Natural Resources, Grand River Conservation Authority, Great Lakes Fishery Commission		
Investigators:	Todd Howell, Brian Shuter, Chris Wilson, and Don Einhouse		
Funds:	Restoration Act \$97,500	Non-federal match	\$368,000

Restoration Study Recommendations Addressed:

- Identify, Inventory, Protect and Rehabilitate Significant Habitats (Recommendation # 11); Plans for Exploited and Declining Indigenous Aquatic Species (Recommendation # 12).

Highlights:

- Information collected in this study builds on previous research to improve the understanding of fish population dynamics in Eastern Lake Erie.
- Water quality data, fish genetic structure, and fish habitat conditions during spawning were compared to evaluate ecological integrity from a system perspective.
- Integration of these ecological attributes has led to a greater understanding of the factors limiting Lake Erie walleye and yellow perch abundance and production.

Background:

Walleye and yellow perch stocks have declined in eastern Lake Erie since the introduction of the zebra mussel due to changes in food availability. This study investigated water quality in major yellow perch spawning tributaries and in near shore habitats, identified and monitored major yellow perch stocks and associated habitats, and further described the population dynamics and ecology of the Grand River walleye stock.



Electrofishing in eastern Lake Erie near-shore habitats
(Photo courtesy of Donald Jackson).

	Project 00-5: Lake Huron Geographic 01-7 Information System (GIS)		2000 / 2001
Partners:	Michigan Department of Natural Resources, Michigan Natural Features Inventory, Ontario Ministry of Natural Resources, The Nature Conservancy, Great Lakes Fishery Commission		
Investigators:	Troy Zorn, James Johnson, Robert Haas, Mark MacKay, Dennis Albert, Dave Reid, and Lloyd Mohr		
Funds:	Restoration Act	Non-federal match	
	FY 00	\$114,500	\$121,000
	FY 01	\$ 92,800	\$ 86,000

Restoration Study Recommendations Addressed:

- Community and Habitat Goals and Objectives (Recommendation #1); Ecological Monitoring (Recommendation # 3); Fish Community Assessment Data and Databases (Recommendation # 4); Other Recommendations Addressed: # 10, 11, 19 and 31.

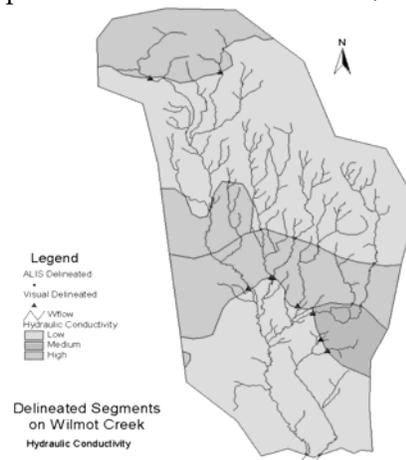
Highlights:

- Habitat and biological information maintained by numerous U.S. and Canadian agencies was integrated into one Geographic Information System (GIS) for use by management authorities in Lake Huron.
- The Lake Huron GIS serves as a pilot for the development of information and management decision support systems in other Great Lake basins.
- Although designed primarily for fisheries managers, this set of information can serve as the foundation for a variety of aquatic or terrestrial conservation efforts in the Lake Huron basin.

Background:

A universal, readily accessible information system describing habitat and biological features across the Great Lakes is prerequisite to holistic management. Most of the existing digital base-maps and ecological classifications for the Lake Huron basin have been compiled into the Lake Huron Geographic Information System (LHGIS). The LHGIS provides comprehensive information for use by management authorities in monitoring natural resources and making decisions affecting the future of resources. Copies of the LHGIS, along with software required to access the information, were provided to management agencies in January 2001.

Example of Lake Huron Geographic Information System output.



	Project 00-6: Development Of A Management Plan For Lake Sturgeon Based On Population Genetic Structure - Development Of Microsatellite Markers	2000
Partners:	Michigan Department of Natural Resources, University of California - Davis, U. S. Fish and Wildlife Service	
Investigator:	Amy Welsh, Marc Blumberg, Bernie May, and Christopher Lowie	
Funds:	Restoration Act \$83,000	Non-federal match \$28,000

Restoration Study Recommendations Addressed:

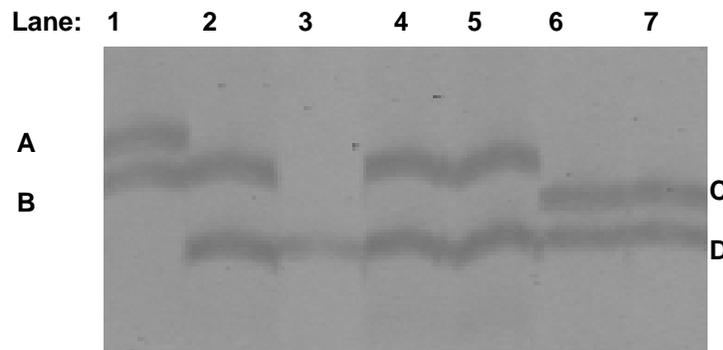
- Fish Community Assessment (Recommendation # 6); Coordinate State and Tribal Harvest Monitoring and Management (Recommendation # 8); Identify, Inventory, Protect and Rehabilitate Significant Habitats (Recommendation # 11).

Highlights:

- Screening of lake sturgeon tissue samples resulted in the development of 10 molecular markers that target DNA microsatellites to allow for stock segregation.
- These markers will allow fishery managers to develop a management plan based on development of distinct lake sturgeon hatchery stocks which will ensure genetic diversity throughout the Great Lakes Basin.

Background:

Lake sturgeon are an important part of both the ecosystem and the culture of the Great Lakes. Lake sturgeon populations are declining due to a combination of overfishing, dams, and pollution. Successful recovery of this unique fish will require restoration stocking. A better understanding of the genetic structure among remaining lake sturgeon populations is needed to guide these enhancement efforts. Without this information, stocking programs could eliminate genetic diversity.



A gel electrophoresis depicting a micro-satellite marker developed in this analysis.

Project Summaries

	Project 00-7: Evaluation Of Steelhead Production In Cattaraugus Creek, New York		2000
Partners:	New York State Department of Environmental Conservation, State University of New York - Fredonia, Sweet Briar College, Great Lakes Fishery Commission		
Investigators:	Robert Roth Jr. and David Orvos		
Funds:	Restoration Act \$ 15,400	Non-federal match	\$17,200

Restoration Study Recommendations Addressed:

- Fish Community Assessment (Recommendation # 6); Coordinate State and Tribal Harvest Monitoring and Management (Recommendation # 8); Identify, Inventory, Protect and Rehabilitate Significant Habitats (Recommendation # 11).

Highlights:

- Steelhead smolt production from the Cattaraugus Creek watershed was described from 1999-2001.
- Maximum catches of emigrating juvenile wild steelhead ranged from 26 to 75 fish per day. One and two year old fish accounted for 73% and 27% of the catch, respectively.
- The information from this study and observations of fishing pressure and habitat conditions will allow for improved management of this fishery.

Background:

Cattaraugus Creek, New York, which supports an important steelhead fishery, was studied to identify factors limiting steelhead production. Lower tributaries were sampled for wild emigrating juvenile steelhead. Results from this study contribute to a better understanding of steelhead production in tributaries of Eastern Lake Erie.



Box trap set up on Spooner Creek in Spring 2000 to capture juvenile steelhead.

	Project 00-8: Development Of A Management Plan For Lake Sturgeon Based On Population Genetic Structure - Mitochondrial DNA Markers	2000
Partners:	Michigan Department of Natural Resources, Michigan State University, U. S. Fish and Wildlife Service, Great Lakes Fishery Commission	
Investigators:	Kim Scribner, Pat Dehaan, Scot Libants and Christopher Lowie	
Funds:	Restoration Act \$ 30,000	Non-federal match \$ 10,250

Restoration Study Recommendations Addressed:

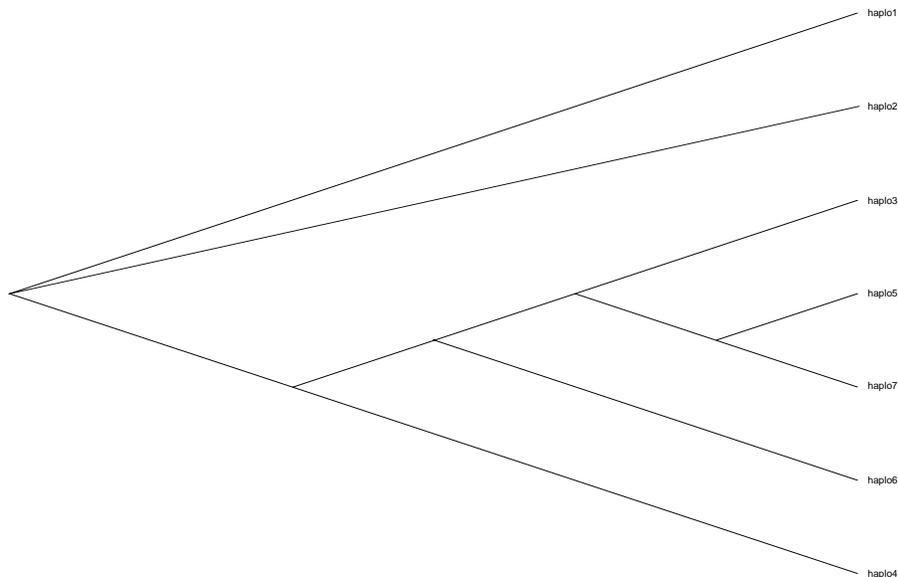
- Fish Genetics (Recommendation # 29); Fish Community Modelling (Recommendation # 7); Plans for Exploited and/or Declining Indigenous Aquatic Species (Recommendation # 12).

Highlights:

- This study developed genetics markers based on mitochondrial DNA to augment markers based on DNA microsatellites developed in a parallel study by Dr. Bernie May (Project 00-6).
- Screening of tissue samples resulted in the development of mitochondrial DNA markers to determine the extent of lake sturgeon stock separation or mixing.
- These markers will allow lake sturgeon hatchery stocks to be developed for restoration stocking while ensuring genetic diversity.

Background:

Since the mid-1800's lake sturgeon populations have suffered dramatic declines coincident with their harvest and the loss and blockage of spawning habitat. Sound stewardship of fisheries resources requires a fundamental understanding of how populations are structured genetically and of the effects of stocking and other anthropogenic forces on genetic diversity. This study will contribute to a better understanding of the genetic structure among remaining lake sturgeon populations which is necessary to guide Great Lakes restoration and enhancement.



Genetic distance tree describing evolutionary relationships among lake sturgeon.

Project Summaries

	Project 00-9: Lake-Wide Acoustic Monitoring 01-10 Program For Lake Superior Pelagic Fishes	2000/2001
Partners:	Minnesota Department of Natural Resources, U. S. Geological Survey, NOAA-Great Lakes Environmental Research Laboratory	
Investigators:	Michael Hoff and Doran Mason	
Funds:	Restoration Act \$45,900	Non-federal match \$15,300

Restoration Study Recommendations Addressed:

- Plans for Forage Fish (Recommendation # 13); Ecological Monitoring (Recommendation # 3); Fish Community Assessment Data and Databases (Recommendation # 4); Other Recommendations Addressed: # 5 and 6.

Highlights:

- Acoustic monitoring is being used to develop fish length and weight relationships for lake herring, bloater, and rainbow smelt to better assess populations.
- Models to differentiate rainbow smelt, bloater, and lake herring will increase useful information and reduce the cost of future acoustic monitoring programs.
- Four hydro-acoustic systems were evaluated, which will lead to recommendations for future acoustic monitoring surveys in Lake Superior.

Background:

Our goal is to develop a standard Lake Superior-wide acoustic assessment program to quantify the abundance of pelagic prey fishes (rainbow smelt, lake herring, and bloater). Mid-water trawl fish sampling and acoustic data collections were performed 50 times in Lake Superior during spring and summer 2001. Four acoustic systems were evaluated, and comparisons of the outputs from the four systems will help us evaluate them for future assessments on Lake Superior.



USGS/RSV Kiyi is used in acoustic monitoring system evaluations (USFWS Photo).

	Project 01-2: Effect Of Thiamine Deficiency On Spawning Migration Of Salmonids In The Great Lakes Basin	2001
Partners:	New York State Department of Environmental Conservation, Michigan Department of Natural Resources, Department of Fisheries and Oceans, U. S. Geological Survey, Great Lakes Fishery Commission	
Investigators:	John Fitzsimons, George Ketola, Dale Honeyfield, Tom Chiotti and Charles Pecor	
Funds:	Restoration Act \$ 43,500	Non-federal match \$ 92,000

Restoration Study Recommendations Addressed:

- Salmonid Egg Viability (Recommendation # 25); Evaluate Ecological Effects of Stocking (Recommendation # 9); Fish Health (Recommendation # 28).

Highlights:

- This study investigated the effects of salmonid thiamine deficiency on in-stream migration and survival.
- A thiamine injection method was used to experimentally raise egg thiamine levels and observe effects on larval mortality.
- Mortality was significantly lower in the eggs of thiamine-injected fish, suggesting that adult thiamine injection may be an effective method for countering Early Mortality Syndrome in salmonids.

Background:

Some Great Lakes salmonids with high alewife diet contents exhibit thiamine deficiency which has been associated with Early Mortality Syndrome (high larval mortality). Using thiamine injection of adult female coho salmon entering the Platte River in Northeastern Lake Michigan, the study indicates that survival of thiamine-injected fish was almost twice that of controls and that injection did not affect the number of fish migrating upstream.



Rainbow trout thiamine injection, Cayuga Inlet, NY
(Photo courtesy of George Ketola).

Project Summaries

	Project 01-3: Cesium 137 Based Estimates Of Energy Conversion In Lake Superior	2001
Partners:	Minnesota Department of Natural Resources, Wisconsin Department of Natural Resources, Ontario Ministry of Natural Resources, University of Toronto, Great Lakes Fishery Commission	
Investigators:	Bryan Henderson, Stephen Schram and Don Schreiner	
Funds:	Restoration Act \$ 11,000	Non-federal match \$ 8,000

Restoration Study Recommendations Addressed:

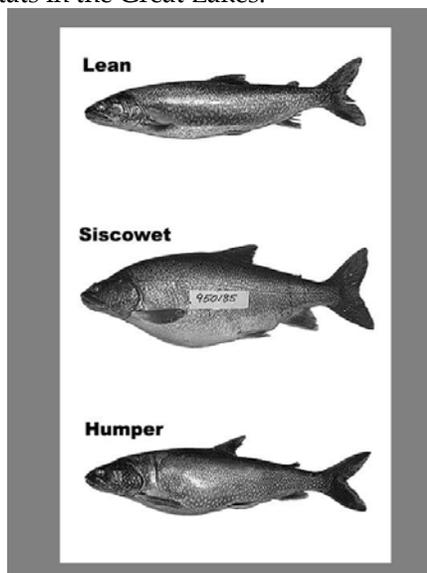
- Fish Community Assessment (Recommendation # 6); Plans for Exploited and/or Declining Indigenous Aquatic Species (Recommendation # 12); Fish Genetics (Recommendation # 29).

Highlights:

- Three phenotypes of lake trout are found in Lake Superior, including one shallow water form (lean) and two deepwater forms (humper and siscowet).
- Growth, maturity, fecundity, age, diet, protein/lipid composition and cesium content were assessed for 50 fish of each type from 3 areas in Lake Superior.
- These characteristics represent adaptations to various depths and habitats and will be compared to determine the best lake trout strains for deep-water restoration.

Background:

Life history characteristics differ markedly between three phenotypes of lake trout and may represent physiological or anatomical adaptations to depth and habitat. Since most of Lake Superior, and much of Lakes Huron and Michigan, are comprised of waters deeper than 50 meters, it is important to consider the option of restoring deepwater habitats with lake trout adapted to deepwater. This lake-wide comparison of Lake Superior lake trout stocks will provide important information to determine the most suitable phenotype for restoration stocking into deepwater habitats in the Great Lakes.



Three different physiological types of lake trout found in Lake Superior (USFWS photo courtesy of Charles Bronte).

	Project 01-4: Spatial And Temporal Dynamics Of The Lake Erie Walleye Fishery		2001
Partners:	New York State Department of Environmental Conservation, Ontario Ministry of Natural Resources, Cornell University, Lake Erie Walleye Task Group		
Investigators:	Patrick Sullivan		
Funds:	Restoration Act \$ 64,000	Non-federal match	\$ 25,600

Restoration Study Recommendations Addressed:

- Fish Community Assessment (Recommendation # 6); Standardize Fish Community Assessment Data and Databases (Recommendation # 4); Plans for Exploited and/or Declining Indigenous Aquatic Species (Recommendation # 12); Other Recommendations Addressed: # 7.

Highlights:

- This study responds to a recent recommendation to use more intricate spatial and temporal data in Lake Erie walleye population models.
- Research allows for full recognition of different sub-populations of walleye within Lake Erie in assessment modeling and fishery management.
- A comprehensive database, exploratory data analysis, and updated fishery management models were prepared and presented in an interagency workshop.

Background:

The nature and timing of the commercial and sport harvest, and the influence of spatial patterns in fishing and fish movement, are not fully understood. Lake Erie supports one of the World's largest and most complex walleye fisheries with numerous contributing stocks managed by four States and Ontario. The Lake Erie Committee relies heavily on the use of fishery models to guide the management and restoration of walleye stocks. A recent peer review of the current approach to walleye management recommended the incorporation of more intricate spatial and temporal data into the existing population and community assessment models.



The Great Lakes walleye fishery
(USFWS photos courtesy of Jerry McClain).

Project Summaries

	Project 01-5: Thermal And Depth Distribution Of Lake Trout In Eastern Lake Superior		2001
Partners:	Great Lakes Indian Fish and Wildlife Commission, Keweenaw Bay Indian Community, U. S. Geological Survey, Michigan Department of Natural Resources, Michigan State University – Sea Grant		
Investigators:	Bill Mattes and Roger Bergstedt		
Funds:	Restoration Act \$ 55,800	Non-federal match	\$ 44,800

Restoration Study Recommendations Addressed:

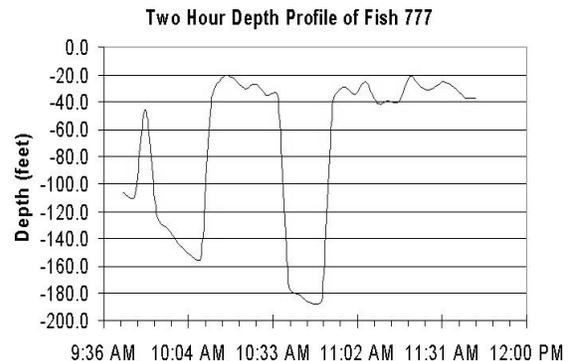
- Fish Community Assessment (Recommendation # 6); Fish Community Modelling (Recommendation # 7); Plans for Exploited and/or Declining Indigenous Aquatic Species (Recommendation # 12); Other Recommendations Addressed: # 15.

Highlights:

- Specialized recording devices were implanted in lake trout in Eastern Lake Superior to collect information on temperatures and depths occupied on a daily and seasonal basis.
- The information will increase the ability to predict lake trout growth and maturity, interactions between fish species, sea lamprey mortality and harvest patterns in Lake Superior fisheries.

Background:

Temperatures and depths occupied by lake trout are important data for understanding feeding and growth, and interactions with other species including parasitic sea lamprey. One hundred archive tags, which record water temperature and depth information continuously for up to three years were implanted into Lake Superior lake trout during November 2001. Once a sufficient number of the tags have been recovered, a full description of temperatures and depths occupied by lake trout in Lake Superior will be provided.



Example depth distribution data for a tagged lake trout in Eastern Lake Superior.

	Project 01-6: Little Silver Creek Habitat Improvement	2001
Partners:	Keweenaw Bay Natural Resources Department, USDA Natural Resources Conservation Service, Baraga County Road Commission, U. S. Fish and Wildlife Service	
Investigator:	Michael Donofrio, Bruce Petersen, Doug Mills, and Henry Quinlan	
Funds:	Restoration Act \$ 20,000	Non-federal match \$ 7,500

Restoration Study Recommendations Addressed:

- Identify, Inventory, Protect and Rehabilitate Significant Habitats (Recommendation # 11).

Highlights:

- A record rainfall during 1968 caused severe damage to fish habitat in Little Silver Creek, a tributary to Lake Superior near L'Anse, Michigan.
- A large culvert was installed at a road crossing to provide fish passage, sediment was removed from the stream and the adjacent banks were stabilized to limit further erosion.
- Stocking and habitat improvements should lead to a sustainable coaster brook trout population in the Little Silver Creek watershed.

Background:

Little Silver Creek is a 2,500-acre watershed located a few miles northeast of L'Anse, Michigan. This stream provides important recreational opportunities for area residents. Little Silver Creek is capable of providing a sustainable "coaster" brook trout fishery for area. The Keweenaw Bay Indian Community has implemented a restoration program including habitat enhancements and the stocking of native brook trout into Little Silver Creek.



New culvert at Little Silver Creek mouth and Keweenaw Bay of Lake Superior, November 2001.

Project Summaries

	Project 01-8: Genetic Assessment Of Steelhead Recruitment And Contribution To Harvests In Lake Michigan	2001
Partners:	Illinois Department of Natural Resources, Michigan Department of Natural Resources, Michigan State University	
Investigator:	Kim Scribner and Meredith Bartron	
Funds:	Restoration Act \$ 88,100	Non-federal match \$ 31,900

Restoration Study Recommendations Addressed:

- Evaluate Ecological Effects of Stocking (Recommendation # 9); Plans for Exploited and/or Declining Indigenous Aquatic Species (Recommendation # 12).

Highlights:

- Genetic markers were used to evaluate the four hatchery strains of steelhead commonly stocked by management agencies into Lake Michigan.
- Steelhead returning to Michigan streams are of different strains, stocked by different states, and sport harvest may not be proportional to stocking efforts.
- Changes in stocking practices have increased the survival of hatchery fish, leading to significant increases in the contribution of hatchery adults in spawning runs.

Background:

Michigan, Indiana, Illinois and Wisconsin spend millions of dollars annually to produce and stock steelhead into the Lake Michigan basin. We have developed capabilities to evaluate the relative contribution of hatchery strains of steelhead using strain-specific genetic characteristics. This information is being used to evaluate the ecological effects of stocking and improve the effectiveness of stocking strategies.

Table indicating relative contribution of hatchery strains of steelhead in Michigan rivers.

River	1983-1984		1998-1999	
	avg. number stocked per year	Proportion wild	avg. number stocked per year	Proportion wild
Betsie	2,588	0.82 (± 0.10)	44,635	0.65 (± 0.18)
Manistee	826	0.88 (± 0.08)	42,781	0.65 (± 0.06)
Little Manistee (± 0.00)	1,400	0.98 (± 0.03)	90	0.67
Pere Marquette	113	1.00 (± 0.00)	9,252	0.87 (± 0.01)
White	4,880	0.88 (± 0.16)	20,178	0.55 (± 0.17)
Muskegon	8,514	0.70 (± 0.28)	52,683	0.21 (± 0.04)

	Project 01-9: Survival Rates Of Lake Superior Lake Trout		2001
Partners:	Minnesota Department of Natural Resources, Wisconsin Department of Natural Resources, North Carolina State University, National Marine Fisheries Service, U. S. Geological Survey		
Investigators:	Kenneth Pollock, Mary Fabrizio, Stephan Schram, Bruce Swanson, and James Nichols		
Funds:	Restoration Act \$ 35,900	Non-federal match	\$ 13,600

Restoration Study Recommendations Addressed:

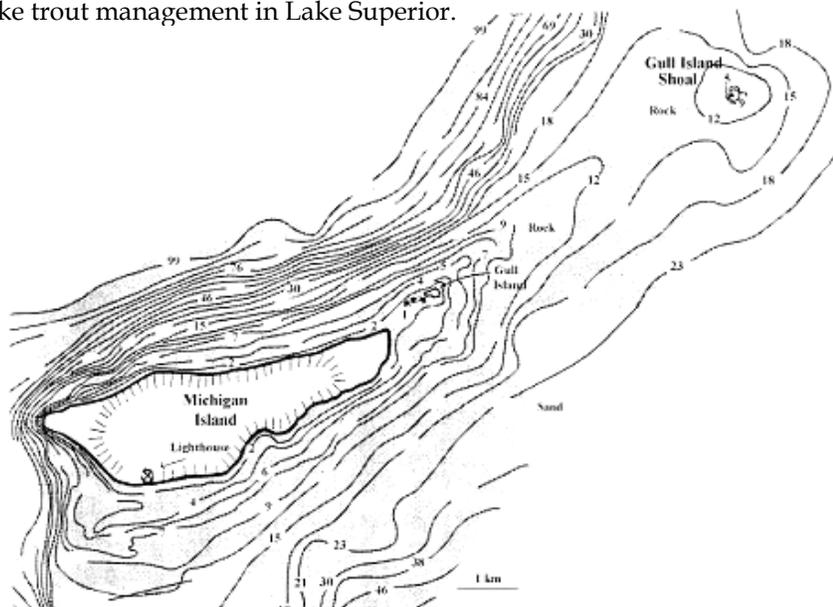
- Fish Community Assessment (Recommendation # 6); Fish Community Modelling (Recommendation # 7); Plans for Exploited and/or Declining Indigenous Aquatic Species (Recommendation # 12).

Highlights:

- Survival rates were calculated for lake trout near Gull Island using data from 54,000 fish tagged during 1969-1995.
- This critical lake trout survival information was used by agencies to update fishery models.
- Research also revealed the usefulness of refuge sites, such as Gull Island Shoal, for lake trout restoration.

Background:

Gull Island Shoal was established as a refuge in 1976 to reduce fishing mortality on one of Lake Superior's most important lake trout spawning stocks. This study analyzed an important long-term data set of lake trout survival near Gull Island and updated several currently used lake trout models. These activities provided new data on lake trout survival and supports interagency efforts to refine lake trout management in Lake Superior.



Contour map showing Gull Island Shoal in relation to Michigan Island, Lake Superior.

Project Summaries

	Project 01-11: Habitat Use By Chinook Salmon 02-01	2001 / 2002
Partners:	Michigan Department of Natural Resources, U. S. Geological Survey	
Investigators:	Ray Argyle, Jim Johnson, and Roger Bergstedt	
Funds:	Restoration Act	Non-federal match
	FY 01 \$ 37,900	\$ 25,000
	FY 02 \$ 34,500	\$ 25,000

Restoration Study Recommendations Addressed:

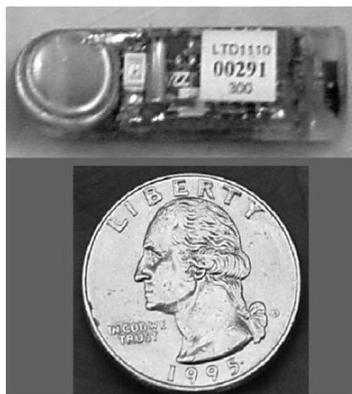
- Fish Community Assessment (Recommendation # 6); Fish Community Modelling (Recommendation # 7); Plans for Exploited and/or Declining Indigenous Aquatic Species (Recommendation # 12); Other Recommendations Addressed: # 15, 28 and 30.

Highlights:

- This research provides new information on Great Lakes chinook salmon depth and temperature preferences, in addition to metabolism, food consumption and growth parameters.
- About 100 chinook from Lake Huron were tagged with programmable, archival temperature and depth recording tags.
- This information will provide a better understanding of: chinook adaptability to the upper Great Lakes, predator-prey relationships and vulnerability of chinook to fishing, disease outbreaks and sea lamprey predation.

Background:

Chinook salmon were first introduced into the upper Great Lakes in 1967, and have become a critically important component of Great Lakes fish communities. Little is known about prey consumption, energy requirements, or depths and temperatures occupied by Great Lakes chinook salmon. Temperature is one of the most important parameters governing fish movement, food consumption, and fish growth. This research focuses on addressing these information gaps to improve management of Great Lakes chinook salmon.



A programmable, archival temperature and depth recording tag used to tag chinook salmon.

	Project 02-2: Port Of Indiana Lake Trout Spawning	2002
Partners:	Illinois Department of Natural Resources, Indiana Department of Natural Resources, Illinois Natural History Survey, University of Illinois	
Investigators:	John Dettmers	
Funds:	Restoration Act \$ 115,800	Non-federal match \$ 38,600

Restoration Study Recommendations Addressed:

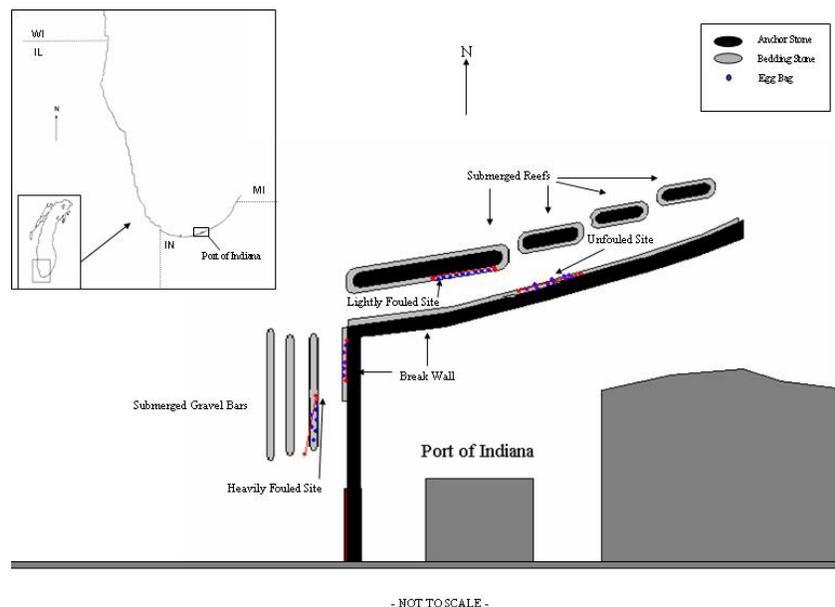
- Evaluate Ecological Effects of Stocking (Recommendation # 9); Identify, Inventory, Protect and Rehabilitate Significant Habitats (Recommendation # 11); Plans for Exploited and/or Declining Indigenous Aquatic Species (Recommendation # 12).

Highlights:

- Recent evidence of possible natural reproduction of lake trout on reefs near the Port of Indiana break-wall has spurred interest from fishery managers.
- Egg nets and fry traps will be deployed at sites at the Port of Indiana and unmarked lake trout will be collected in order to confirm and determine the extent of natural reproduction.

Background:

Lake trout were extirpated from Lake Michigan by the 1950s. Today, an aggressive stocking program exists with the goal of restoring self-sustaining stocks. Lake trout spawned successfully near the Port of Indiana during 1992-1996, and fry were observed during surveys in 1993-1997. During Fall 2001 assessments, Indiana Department of Natural Resources personnel discovered that 18% of collected lake trout were unmarked, indicating that they may be of natural origin. The timing of this observation suggests that these fish may be the first from the 1992-1996 year classes returning to spawn.



Port of Indiana habitat schema showing submerged reefs, gravel bars and egg beds.

Project Summaries

	Project 02-3: An Investigational Model Of Double-Crested Cormorant Impacts On Great Lakes Fish Communities	2002
Partners:	Michigan Department of Natural Resources, Central Michigan University, Michigan State University	
Investigators:	James Gillingham and Nancy Seefelt	
Funds:	Restoration Act \$16,100	Non-federal match \$5,400

Restoration Study Recommendations Addressed:

- Cormorant Fishery Predation Study (Recommendation # 32); Fish Community Modelling (Recommendation # 7); Plans for Exploited and/or Declining Indigenous Aquatic Species (Recommendation # 12).

Highlights:

- Predatory/prey relationships will be examined between cormorants and smallmouth bass in the Beaver Islands, Lake Michigan, and between Cormorants and yellow perch in the Les Cheneaux Islands, Lake Huron.
- Cormorant/fish predatory/prey models will be developed to help unravel the complex relationships between Great Lakes cormorants and fish populations.
- These data sets will be integrated to model the regional impact of double-crested cormorants on fishery resources.

Background:

The Double-crested Cormorant, a deep diving avian fish predator, has substantially increased in numbers in the Great Lakes Basin over the past 20 years. The increased abundance of birds, combined with their fish eating behavior, has led to their implication in declines of sport and commercial fisheries in the Great Lakes. This study will investigate cormorant-prey relationships at two sites in the Great Lakes and integrate information into models for assessing these complex relationships. The Michigan Department of Natural Resources will provide fish population data to support this study.



Double crested cormorant (Photo courtesy of Michigan Department of Natural Resources).

	Project 02-4: Lake Erie Aquatic Habitat Geographic Information System (GIS)	2002
Partners:	Michigan Department of Natural Resources, Ohio Department of Natural Resources, Ontario Ministry of Natural Resources, U. S. Environmental Protection Agency	
Investigators:	Robert Haas, Jeff Tyson and Troy Zorn	
Funds:	Restoration Act \$114,500	Non-federal match \$38,000

Restoration Study Recommendations Addressed:

- Geographic Information System (Recommendation # 10); Identify, Inventory, Protect and Rehabilitate Significant Habitats (Recommendation # 11); Community and Habitat Goals and Objectives (Recommendation #1); Other Recommendations Addressed: # 3, 4, 19 and 31.

Highlights:

- A universal, readily accessible data-base describing habitat and biological features in Lake Erie will be developed to support data sharing and holistic management.
- The Lake Erie GIS will serve as a decision support tool to provide information to address issues identified in the Lake Erie Lake-wide Management Plan.
- The Lake Erie GIS will complement the analogous project completed for Lake Huron and represents one more step toward a Great Lakes-wide GIS.

Background:

The Lake Erie GIS, including Lake St. Clair and connecting channels, will link up with the recently developed Lake Huron GIS and provide comprehensive information on natural resources and habitat over a large portion of the Great Lakes basin. Synthesis of existing habitat inventories is the first step toward sustainable management of natural resources. This inventory will allow for States and Ontario to plan for Lake Erie's future, monitor its status and target the most cost-effective restoration efforts



A Lake Erie GIS basemap.

	Project 02-5: Lake Sturgeon Habitat In The Tributaries Of Lake Superior	2002
Partners:	Bad River Band of the Lake Superior Tribe of Chippewa Indians, U. S. Geological Survey, Great Lakes Indian Fish and Wildlife Commission, U. S. Fish and Wildlife Service	
Investigators:	Rick Huber, Henry Quinlan, Owen Gorman, and Gary Cholwek	
Funds:	Restoration Act \$ 20,000	Non-federal match \$ 22,000

Restoration Study Recommendations Addressed:

- Identify, Inventory, Protect and Rehabilitate Significant Habitats (Recommendation # 11); Plans for Exploited and/or Declining Indigenous Aquatic Species (Recommendation # 12); Community and Habitat Goals and Objectives (Recommendation #1).

Highlights:

- Nursery and rearing habitat use will be quantified in the Bad River, Wisconsin, one of the most important lake sturgeon producing tributaries to the Great Lakes.
- Aquatic habitat in the lower Bad River, and Lake Superior near-shore waters adjacent to the mouth of the River, will be electronically mapped in 2003 using a shallow water hydroacoustic transducer.
- The Bad River is also a major producer of parasitic sea lamprey and an improved understanding of in-stream habitat will lead to more effective sea lamprey control.

Background:

The Bad River, near Ashland, Wisconsin, is an important Lake Superior tributary supporting populations of lake sturgeon, walleye, small mouth bass and other species. Nursery habitat requirements and utilization by young lake sturgeon, and the relationship between habitat and fish production, are not well understood. This study will investigate lake sturgeon nursery activity and habitat in the Bad River. A CD-Rom with the electronic habitat data will be provided to the Lake Superior Technical Committee, and it is expected that this method will eventually be used in each of the 16 additional Lake Superior tributaries that historically supported lake sturgeon.



Lake sturgeon
(Photo courtesy of U.S. Geological Survey/Great Lakes Science Center).

	Project 02-6: The Use Of Unmanned Submersibles To Study Lake Trout Spawning On The Lake Michigan Mid-Lake Reef		2002
Partners:	Wisconsin Department of Natural Resources, University of Wisconsin-Milwaukee, University of Michigan, U. S. Geological Survey, National Underseas Research Program		
Investigators:	John Janssen, David Jude and Thomas Edsall		
Funds:	Restoration Act \$ 28,000	Non-federal match \$ 12,600	

Restoration Study Recommendations Addressed:

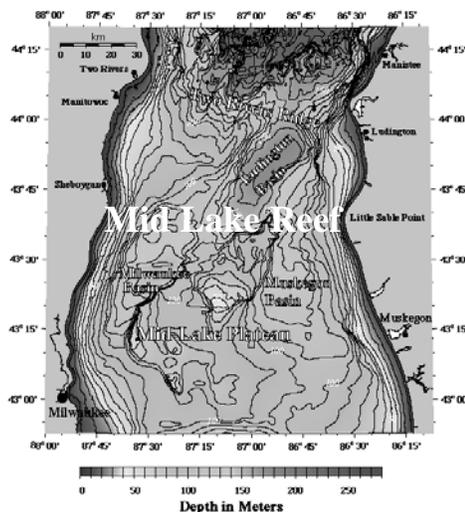
- Evaluate Ecological Effects of Stocking (Recommendation # 9); Identify, Inventory, Protect and Rehabilitate Significant Habitats (Recommendation # 11); Plans for Exploited and/or Declining Indigenous Aquatic Species (Recommendation # 12).

Highlights:

- The Mid-Lake Reef, Lake Michigan, once a major spawning reef for indigenous lake trout, is among the most important locations targeted for restoration.
- A remotely operated vehicle (ROV) and other specialized equipment will be used to collect data on lake trout egg deposition, fry emergence and predator impacts.
- Determining the factors that limit natural production of lake trout at the Mid-Lake Reef and similar sites is essential to rehabilitating lake trout populations.

Background:

Lake trout were extirpated from Lake Michigan by the 1950s, and there has been an extensive restoration program in operation for more than 4-decades. Stocking of lake trout at offshore sites directly over historically important spawning reefs, such as Lake Michigan's Mid-Lake Reef Complex, has been successful in steadily rebuilding lake trout spawning populations. However, recruitment of lake trout to these offshore populations from natural reproduction has yet to be observed. This study will improve our understanding of natural reproduction at this site and factors that may be impeding it.



Bathymetry and habitat at Mid-Lake Reef, Lake Michigan.

	Project 02-7: Lake Erie Walleye Stock Discrimination	2002
Partners	Ohio Department of Natural Resources, Ontario Ministry of Natural Resources, New York Department of Environmental Conservation, Cleveland State University, University of Waterloo, Trent University, Great Lakes Fishery Commission	
Investigators:	Timothy Johnson, Brian Dixon, Carol Stepien and Christopher Wilson	
Funds:	Restoration Act \$62,800	Non-federal match \$65,800

Restoration Study Recommendations Addressed:

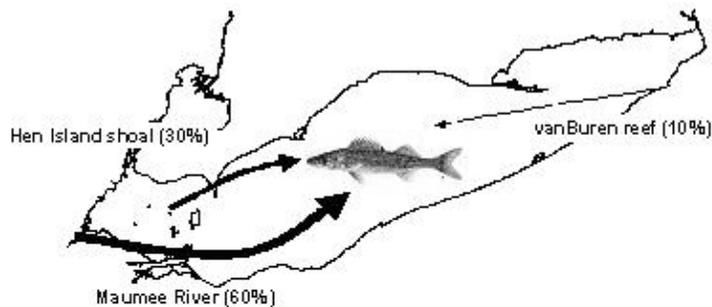
- Fish Genetics (Recommendation # 29); Fish Community Modelling (Recommendation # 7); Plans for Exploited and/or Declining Indigenous Aquatic Species (Recommendation # 12).

Highlights:

- Four popular genetic techniques are currently being used by three independent research labs to identify stocks of yellow perch and walleye and their contributions to fisheries in Lake Erie.
- Tissue samples from known walleye spawning stocks will be provided to the labs in a “blind-sample” experiment in order to directly compare results from the four genetic techniques.
- This will provide an explicit description of the level of confidence expected from each of the techniques in identifying stock contributions from a fishery harvesting several stocks at once.

Background:

Walleye remain one of the most sought after fish by sport, charter, and commercial fishermen in Lake Erie. A recent peer review of walleye and yellow perch management in Lake Erie recommended that management agencies do a better job of identifying separate stocks of fish and manage those stocks independently to reduce the likelihood of over-harvest. Several molecular genetic techniques are being used to address this recommendation, however to date the techniques have not been directly compared. This project will assist us in identifying the accuracy and utility of four genetic techniques for discriminating stocks of walleye and perch in Lake Erie.



Hypothetical population of Lake Erie walleye, with three stocks contributing different proportions to the lake wide total.

	Project 02-8: Comparative Bioenergetic Modeling Of Lake Whitefish Populations In Lake Erie And Lake Ontario	2002
Partners	New York State Department of Environmental Conservation, Ontario Ministry of Natural Resources, University of Windsor, Great Lakes Fishery Commission	
Investigators:	Jim Hoyle, Timothy Johnson, and Tom Stewart	
Funds:	Restoration Act \$ 66,000	Non-federal match \$ 76,000

Restoration Study Recommendations Addressed:

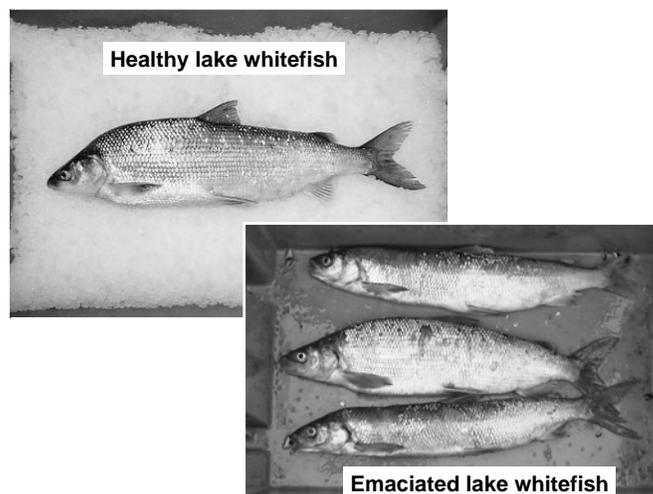
- Fish Community Assessment (Recommendation # 6); Fish Community Modelling (Recommendation # 7); Plans for Exploited and/or Declining Indigenous Aquatic Species (Recommendation # 12).

Highlights:

- Lake whitefish, a native Great Lakes cold-water species, are showing dramatic declines in body condition and growth in portions of Lakes Ontario and Erie.
- These changes have been associated with the disappearance of the Great Lakes amphipod, *Diporeia*, an important prey type in the lake whitefish diet.
- Comparative bioenergetic models will be developed describing growth and diet of lake whitefish for use in fisheries management plans aimed at rehabilitating these stocks.

Background:

Lake whitefish are a prominent member of the Great Lakes cold-water fish community and have been an important component of the fisheries since the early 1900s. The lake whitefish is the last remaining abundant native cold-water species in Lake Ontario, and continued poor growth and failed recruitment threaten the viability of these fish. It is imperative that we understand the causes of the recent declines in these stocks and develop fishery management options to conserve this important native fish.



Emaciated and healthy lake whitefish (Photos courtesy of University of Windsor).

	Project 02-9: A Comparative Study Of Growth Rates, Lipid Dynamics, And Nutritional Stress In Great Lakes Chinook Salmon	2002
Partners:	New York State Department of Environmental Conservation, Michigan State University, Great Lakes Fishery Trust	
Investigators:	Michael Jones, Jim Bence, and Amber Peters	
Funds:	Restoration Act \$ 34,000	Non-federal match \$ 305,000

Restoration Study Recommendations Addressed:

- Plans for Exploited and/or Declining Indigenous Aquatic Species (Recommendation # 12); Fish Health (Recommendation # 28).

Highlights:

- Harsh winter conditions in the Great Lakes cause nutritional stress on chinook salmon and can lead to mortality associated with Bacterial Kidney Disease.
- Fall (end of growth season) energy reserve levels will be compared for chinook stocks in Lakes Michigan, Huron and Ontario as an indicator of nutritional stress.
- A common protocol for chinook salmon nutritional health assessment, including methods, expected precision, and costs, will be developed.

Background:

Chinook salmon have been stocked into the Great Lakes in large numbers since 1967. chinook are not native to the Great Lakes and there is growing evidence that their lack of adaptation to harsh winter conditions makes them highly vulnerable to stresses caused by prey depletion and insufficient energy reserves. Fall lipid levels will be measured and strategies that chinook use for regulating energy reserves during the winter months will be investigated. Occurrences of Bacterial Kidney Disease with nutritional stress will be compared and a common protocol to assess chinook salmon health will be proposed.



Chinook salmon (Photo courtesy of Robert Elliot).

	Project 02-10: Botulism Type E In Lake Erie - Ecology And Lower Food Web Transfer	2002
Partners:	New York State Department of Environmental Conservation, State University of New York-Fredonia, Ohio Department of Natural Resources	
Investigators:	Alicia Perez-Fuentetaja, Theodore Lee, Mark Clapsadl	
Funds:	Restoration Act \$37,000	Non-federal match \$43,900

Restoration Study Recommendations Addressed:

- Fish Health (Recommendation # 28); Ecological Monitoring (Recommendation # 3); Aquatic Resource Education Programs (Recommendation # 31).

Highlights:

- Large mortalities of waterfowl and fish were observed in Lake Erie during 1999-2002 and were connected with botulism type E, a neuroparalytic disease.
- We will describe environmental conditions in areas where botulism type E is present, and analyze the transfer of the disease through the food web.
- Methods to predict, detect and manage the incidence of outbreaks and minimize public exposure to contaminated areas and foods will be identified.

Background:

Botulism type E, a neuroparalytic disease, transmitted through diet and resulting from a toxin produced by the microorganism *Clostridium botulinum*, caused large mortalities of wildlife, including imperiled species such as common loon and lake sturgeon, in Lake Erie during 1999-2002. The pathological mechanisms for the disease outbreak and transmission are not fully understood. This project will examine the conditions associated with the recent outbreaks and provide information to enable lake managers and other authorities to reduce the incidence and minimize public exposure.



Lake Erie bird and fish mortality caused by botulism type E. (Photo courtesy of Pennsylvania Sea Grant).

	Project 02-11: Effects Of Barriers And River Fragmentation On Fish Population Ecology And Genetics	2002
Partners:	Michigan Department of Natural Resources, Trent University, Ontario Ministry of Natural Resources, Ontario Power Generation, Department of Fisheries and Oceans, NSERC, Trent-Severn Waterway, Heritage Canada	
Investigators:	Leon Carl, Chris Wilson, Troy Zorn, and Scott Reid	
Funds:	Restoration Act \$24,000 Non-federal match \$119,100	

Restoration Study Recommendations Addressed:

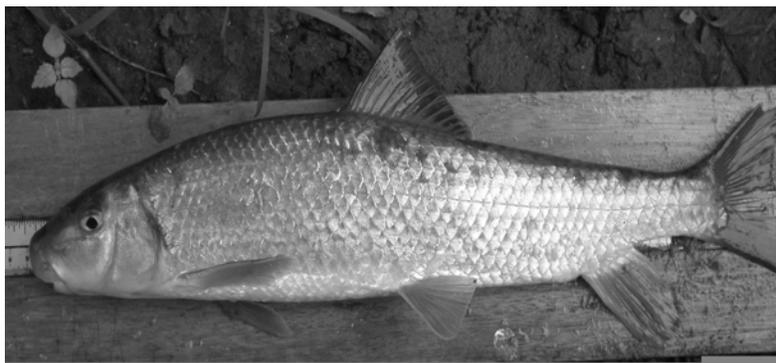
- Determine Impacts of Hydroelectric Facilities and Dams (Recommendation # 19); Fish Community Modelling (Recommendation # 7); Plans for Exploited and/or Declining Indigenous Aquatic Species (Recommendation # 12); Other Recommendation Addressed: # 11 and 29.

Highlights:

- Dam construction can adversely affect fish by altering or limiting habitat, restricting fish movement and limiting gene flow between populations.
- We will compare demographics, genetic diversity and relatedness and describe the spatial population ecology of redhorse in relation to fragmentation by dams.
- This information will aid in assessment of dam construction and/or removal proposals and help us identify opportunities for mitigation through fishways.

Background:

The *Great Lakes Fishery Resources Restoration Study* identified the assessment of impacts of hydroelectric facilities and dam operations on fishery resources as a high priority concern. This project, focusing on the Trent River, a Lake Ontario tributary, will have broad application in understanding the impacts of dams on Great Lakes basin river fish communities and ecosystem function.



Redhorse (Photo courtesy of Trent University).

	Project 02-12: Status Of A Refuge For Native Freshwater Mussels In The Delta Area Of Lake St. Clair		2002
Partners	Michigan Department of Natural Resources, Great Lakes Fishery Commission, Environment Canada, U. S. Geological Survey, The Nature Conservancy, Walpole Island First Nation, Detroit Edison Company		
Investigators:	Janice Smith, Don Schloesser, Paul Marangelo, Michael Williams, Michael Arts and David Zanatta		
Funds:	Restoration Act \$22,800	Non-federal match	\$18,100

Restoration Study Recommendations Addressed:

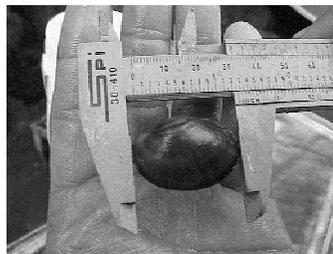
- Identify, Inventory, Protect and Rehabilitate Significant Habitats (Recommendation 11); Plans for Exploited and/or Declining Indigenous Aquatic Species (Recommendation # 12).

Highlights:

- Significant freshwater mussel communities have continued to survive in near-shore areas of Lake Erie and in an important refuge site in the delta region of Lake St. Clair.
- This project will evaluate the health of freshwater mussels in the Lake St. Clair refuge and allow us to understand the conditions most favorable for their survival.
- The results of this study will be used to predict the locations of other natural sanctuaries and to guide management for the preservation of Great Lakes mussels.

Background:

Freshwater mussels are among the most endangered organisms in North America, with nearly 70% of the ~300 native species at risk of extinction. Habitat loss and degradation and the introduction of the non-indigenous zebra mussel have decimated native freshwater mussel populations in the Great Lakes. Significant populations have continued to survive however, including in the delta region of Lake St. Clair, which supports at least 22 of the 32 species once known to occupy Lake St. Clair. We do not clearly understand why native mussels are able to co-exist with the zebra mussel in these “refuge sites”.



Select freshwater mussels of the Great Lakes (Photos courtesy of Environment Canada).



Progress Toward the Service's Great Lakes Restoration Goals

Introduction to Goals I-VI under Section 1006

The Great Lakes Fish and Wildlife Restoration Act states that "In administering programs of the Fish and Wildlife Service related to the Great Lakes Basin, the Director shall seek to achieve the following goals" (listed at right). Through this mandate, Congress has tied together activities authorized under the Act and Service resource management operations authorized and funded via a number of other laws, treaties, agreements, codes and guiding documents.

The Service's mission requires a coordinated effort among our various programmatic offices and our many partners and stakeholders. This coordination is achieved through commissions, councils, committees, trusts and other organizations operating within the Great Lakes as well as through our own Great Lakes Basin Ecosystem Team. The Service's Region 3 also developed Regional Conservation Priorities to help focus and guide conservation strategies for those species of greatest importance.

The Service has achieved many accomplishments under the six Great Lakes goals during 1998-2002. The sections that follow provide summaries of how the Service has addressed the stated goals and describe progress made, outcomes achieved and future priorities. Many of the accomplishments presented in this section were implemented with funds appropriated under authorities other than the Act or through the contributions of partners. For further detail, a selected list of activities conducted in pursuit of the six goals is presented in Appendix II.

Although the accomplishments included in this Report are significant, and substantial progress can be claimed under each goal, the amount of restoration work that remains is enormous.

The Great Lakes Basin is the largest surface freshwater system on earth and contains a great variety of fish and wildlife resources and habitats. More than 34,000,000 people live within the Basin and the impact of their activities on these resources and habitats is immense. Even as agencies achieve desired outcomes at many locations, the scale of current restoration issues advances and new challenges arise. Accordingly, the list of restoration needs is extremely dynamic and great in both scope and complexity.

Goal I:

Restore and maintain self-sustaining fishery resource populations.

Goal II:

Minimize the impacts of contaminants on fishery and wildlife resources.

Goal III:

Protect, maintain, and, where degraded and destroyed, restore fish and wildlife habitat, including the enhancement and creation of wetlands that result in a net gain in the amount of those habitats.

Goal IV:

Stop illegal activities adversely impacting fishery and wildlife resources.

Goal V:

Restore threatened and endangered species to viable, self-sustaining levels.

Goal VI:

Protect, manage, and conserve migratory birds.

The Service's Great Lakes restoration goals and progress toward addressing the 32 Study recommendations

Many of the accomplishments presented under the Service's six Great Lakes goals in this section of the report also represent progress toward addressing the 32 recommendations of the Great Lakes Fishery Resources Restoration Study (Appendix I). The 32 Study recommendations align with and can be considered a subset of the Service's goals for the Great Lakes. This is because the Study recommendations are focused on aquatic resources, while the Service's six Great Lakes goals address conservation of migratory bird populations, terrestrial habitat, endangered species and many other resources in addition to fisheries.

Most of the overlap between the Service's goals and the Study recommendations occurs under goals I and III, and this is where most of the progress in addressing the recommendations can be seen. The Service has made more progress in addressing certain study recommendations including: 9 (Evaluate Ecological Effects of Stocking and Revise Stocking Strategies); 11 (Identify, Inventory, Protect and Rehabilitate Significant Habitats); 12 (Develop and Implement Action, Restoration and/or Enhancement Plans for Exploited and/or Declining Indigenous Aquatic Species); 14 ("Close the Door" on Nonindigenous Species Introductions); 18 (Prevent or Delay the Spread of Ruffe); 19 (Determine the Impacts of Hydroelectric Facilities and Dam Operations on Fishery Resources); 26 (Establish an Isolation or Quarantine Facility); and 28 (Fish Health).

Other agencies and organizations, including the Great Lakes state and tribal authorities, U. S. Geological Survey, U. S. Environmental Protection Agency and the Great Lakes Fishery Commission, are also making progress in addressing these and other Study recommendations. With the exception of the fish and wildlife restoration projects reported in the previous section, those accomplishments are not covered in this report.

Funds authorized and appropriated through the Act from 1998-2002 contributed \$6,390,000 to accomplish work of the Service's Upper and Lower Great Lakes Fishery Resources Offices under the six goals reported in this section. These funds were used to establish the Great Lakes Fish Stocking Database, to evaluate the performance of lake trout stocked by National Fish Hatcheries in pursuit of interagency restoration plans, to coordinate lake sturgeon and brook trout rehabilitation programs, and for many related activities. However, the majority of the activities and accomplishments presented here were supported by Service resource management funds, funds provided via other U. S. and Canadian federal sources and by a wide range of state, provincial, tribal, local government and private sector funds and contributions.

Service aquatic restoration activities in pursuit of the Great Lakes restoration goals are closely coordinated with the fish and wildlife proposals funded under the Act (pp. 14-44). This is ensured by active Service participation in the Lake Committees, Council of Lake Committees, and the Great Lakes Fish and Wildlife Restoration Act Proposal Review Committee. The essential linkages embodied in the Joint Strategic Plan for Management of Great Lakes Fisheries, Fish Community Objectives and the committee processes managed under the Great Lakes Fishery Commission have resulted in continuously improving interagency coordination.

Partner List

The Service acknowledges the following partners both within and outside of the Great Lakes basin, who have made valued contributions toward pursuing the Service goals under the Great Lakes Fish and Wildlife Restoration Act:

State Agencies and Institutions

Alabama Department of Conservation and Natural Resources
 Alaska Department of Fish and Game
 Arkansas Game and Fish Commission
 Connecticut Department of Environmental Protection
 Delaware Division of Fish and Wildlife
 Florida Game and Fresh Water Fish Commission
 Georgia Department of Natural Resources
 Hawaii Division of Forestry and Wildlife
 Illinois Department of Natural Resources
 Illinois Natural History Survey
 Illinois Nature Preserve Commission
 Indiana Department of Environmental Management
 Indiana Department of Natural Resources
 Iowa Department of Natural Resources
 Kentucky Department of Fish and Wildlife Resources
 Maine Department of Inland Fisheries and Wildlife
 Maine Department of Marine Resources
 Maryland Department of Natural Resources
 Massachusetts Division of Fisheries and Wildlife
 Michigan Department of Attorney General
 Michigan Department of Environmental Quality
 Michigan Department of Natural Resources
 Minnesota Department of Natural Resources
 Mississippi Department of Wildlife, Fisheries and Parks
 Nebraska Game and Parks Commission
 Nevada Division of Wildlife
 New Hampshire Fish and Game Department
 New Jersey Division of Fish, Game and Wildlife
 New York Sea Grant
 New York State Canal Corporation
 New York State Department of Environmental Conservation
 New York State Office of Parks, Recreation and Historic Preservation

North Carolina Wildlife Resources Commission
 Northeastern Illinois Planning Commission
 Ohio Biological Survey
 Ohio Department of Natural Resources
 Division of Natural Areas & Preserves
 Ohio Department of Natural Resources, Division of Parks
 Ohio Department of Natural Resources
 Division of Soil & Water
 Ohio Department of Natural Resources
 Division of Water
 Ohio Department of Natural Resources
 Division of Wildlife
 Ohio Department of Transportation
 Ohio Environmental Protection Agency
 Ohio Office of Administrative Services
 Ohio Sea Grant
 Pennsylvania Fish and Boat Commission
 Pennsylvania Game Commission
 Pennsylvania Sea Grant
 Tennessee Wildlife Resources Agency
 Texas Parks & Wildlife Department
 Vermont Department of Fish and Wildlife
 West Virginia Division of Natural Resources
 Wisconsin Department of Agriculture, Trade and Consumer Protection
 Wisconsin Department of Justice
 Wisconsin Department of Natural Resources
 Wisconsin Department of Transportation

Native American Governments

Bad River Band of Chippewa Indians
 Bay Mills Indian Community
 Fond du Lac Band of Chippewa Indians
 Grand Portage Band of Chippewa Indians
 Grand Traverse Band of Ottawa and Chippewa Indians
 Keweenaw Bay Indian Community
 Little River Band of Ottawa Indians
 Little Traverse Bay Band of Odawa Indians
 Menominee Indian Tribe of Wisconsin
 Oneida Tribe of Indians of Wisconsin
 Red Cliff Band of Chippewa Indians
 Red Lake Band of Chippewa Indians
 Saginaw Chippewa Tribe
 Sokaogon Chippewa Community
 St. Regis Mohawk Tribe

Native American Treaty Authorities

1854 Authority
 Chippewa-Ottawa Resource Authority
 Great Lakes Indian Fish and Wildlife
 Commission

U.S. Federal Agencies

U.S. Air Force, Niagara Falls Air Reserve
 Station
 U.S. Air Force, Peterson Air Force Base
 U.S. Army Corps of Engineers
 U.S. Army Corps of Engineers, Marine
 Design Center
 U.S. Bureau of Indian Affairs
 U.S. Coast Guard
 U.S. Customs
 U.S. Department of Agriculture,
 Conservation Reserve Program
 U.S. Department of Agriculture, Natural
 Resources Conservation Service,
 Timberland RC&D
 U.S. Department of Agriculture,
 Forest Service
 U.S. Department of Agriculture, Animal
 and Plant Health Inspection Service
 U.S. Department of Commerce, National
 Oceanic and Atmospheric Administration
 U.S. Department of Defense, U.S. Army 10th
 Mountain Division and Fort Drum Division
 of Natural Resources
 U.S. Department of Justice, Assistant
 United States Attorney, Timothy O'Shea
 U.S. Environmental Protection Agency
 U.S. Federal Aviation Administration, Balti-
 more
 U.S. Federal Communications Commission
 U.S. Geological Survey, Great Lakes
 Science Center
 U.S. Geological Survey, Midcontinent
 Ecological Science Center
 U.S. Geological Survey, Patuxent Wildlife
 Research Laboratory
 U.S. Geological Survey, Upper Midwest
 Science Center
 U.S. National Park Service

Canadian Institutions

Canadian Wildlife Service
 Department of Fisheries and Oceans
 Environment Canada
 Ontario Ministry of Natural Resources
 Province of Quebec

Schools, Colleges and Universities

Ascension Lutheran School
 Central Michigan University
 Clemson University
 Concordia Lutheran School
 Cornell University
 Lake Superior State University
 McGill University
 McMasters University
 Michigan State University
 Michigan Technical University
 Northern Illinois University
 Northland College
 Notre Dame University
 Ohio State University
 Otterbein College
 Purdue University
 State University of New York at Buffalo
 State University of New York at Oswego
 State University of New York College
 of Environmental Science and Forestry
 University of Michigan
 University of Minnesota
 University of Wisconsin

Local Institutions and Organizations

Black Swamp Bird Observatory
 Chicago Park District
 City of Buffalo Parks Department
 City of Chicago
 City of Cuyahoga Falls
 City of Toledo
 Cleveland Metroparks
 Columbus Zoo and Aquarium
 Coshocton Soil and Water Conservation
 District
 Crystal Lake Park District
 Elkhart Environmental Center
 Erie County Department of Environment
 and Planning
 Erie County Soil and Water Conservation
 District

Restoration Goals

Field Museum of Natural History
 Holden Arboretum
 Ionia County Drain Commission
 Jimtown Historical Museum
 John G. Shedd Aquarium
 Lagrange County Parks Department
 Lake Metroparks
 Lenawee County Soil and Water
 Conservation District
 Lenawee and Hillsdale County Soil and
 Water Districts
 Monroe County Health Department
 Niagara County Soil and Water
 Conservation District
 O'Hare International Airport
 Orleans County Soil and Water
 Conservation District
 Put-in-Bay Port Authority
 Rosamond Gifford Zoo
 Seneca Park Zoo
 St. Charles Park District
 Summit County Metroparks
 Toledo Metropolitan Park District
 Toledo Port Authority
 Toledo Zoo
 Whitefish Point Bird Observatory

NGOs, Foundations and Public

Interest Groups

American Fisheries Society
 American Fisheries Society, Ohio Chapter
 Atlantic Flyway Council
 Audubon Society
 Bird Conservation Network
 Central Flyway Council
 Chicago Audubon
 Defenders of Wildlife
 Ducks Unlimited
 Fox Valley Land Foundation
 Fish Creek Natural Resource Damage
 Assessment Trustee Council
 Green Tree Garden Club
 International Crane Foundation
 Izaak Walton League of America,
 Ohio Division
 McGraw Wildlife Foundation
 Michigan United Conservation Clubs
 Mississippi Flyway Council
 Mussel Mitigation Trust
 National Audubon Society

National Fish and Wildlife Foundation
 National Wildlife Federation
 Natural Resources Foundation of Wisconsin
 Ohio Environmental Education Fund
 Ohio Farm Bureau Federation
 Ohio Federation of Soil and Water
 Conservation
 Ohio Lepidopteran Society
 Ohio Wetlands Foundation
 Operation Migration
 Pacific Flyway Council
 Pheasants Forever
 Pheasants Forever, Lenawee County Chapter
 Pheasants Forever, Erie-Ottawa-Sandusky
 Chapter
 Shirley Heinze Environmental Fund
 Sturgeon of Tomorrow
 The Conservation Fund
 The Nature Conservancy
 The Nature Conservancy, Ohio Chapter
 Trout Unlimited
 Water Management Association of Ohio
 Wisconsin Society for Ornithology

Commissions

Great Lakes Fishery Commission
 International Joint Commission

Others

A&E Television
 Grand River Partners Inc.
 Great Lakes Carrier Association
 Great Lakes Power LTD
 Hull and Associates
 Information Design Group
 Sault-Edison Electric Company
 United States Steel Corporation
 The Mead Corporation Paper Division,
 Woodlands Department

Goal I: Restore and maintain self-sustaining fishery resource populations.



Primary Operational Authority and Guidance

- Great Lakes Fish and Wildlife Restoration Act of 1998
- Nonindigenous Aquatic Nuisance Species Prevention and Control Act of 1990
- U. S. District Court Consent Decree of 2000, 1836 Treaty waters
- Convention on Great Lakes Fisheries, 1954
- Great Lakes Fishery Act of 1956
- Joint Strategic Plan for Management of Great Lakes Fisheries
- Federal Power Act
- Fish and Wildlife Act of 1956
- Fish and Wildlife Coordination Act
- Endangered Species Act of 1973

Service Programs

- Fishery Resources Offices provide fish & wildlife management technical assistance to federal agencies, state agencies, tribal governments and non-governmental organizations
- Conservation of natives fishes to avoid Endangered Species Act listing
- National Fish Hatchery propagation to support native fish rehabilitation
- Aquatic Invasive Species surveillance and control
- Sea lamprey control
- Fish passage restoration to improve migration and access to habitat
- Coordination and consultation with federal and state regulatory agencies
- Wild and hatchery fish health monitoring and evaluation
- Partners for Fish and Wildlife and Coastal program restoration activities
- Law enforcement

Progress 1998-2002

Working closely with our partners, the Service has made substantial progress toward improving the status and management of native species using a variety of tools and expertise. Lake trout, brook trout, lake sturgeon and Atlantic salmon are prime examples of species whose populations have progressively increased within the Great Lakes fish community. Examples of Service accomplishments leading to the improved status of these species are provided in Appendix II.

Improving the management of Great Lakes fisheries depends on better understanding the dynamics of a large and complex ecosystem and how native species react to habitat changes and other pressures to their populations. The Service's Fishery Resources Offices continue to lead or assist efforts to develop fish community goals and objectives and to assess, monitor and research fishery resources to characterize how to best manage and restore native fish species. Sometimes changes in fisheries management are called for, such as reducing mortality of lake trout through measures identified in the 2000 Consent Decree. Service biologists are conducting fishery assessments in the 1836 Treaty waters of Lakes Superior, Huron and Michigan to help tribal fishery managers minimize the by-catch of lake trout in their whitefish fisheries. Until adequate reproduction is documented,



stocking of fish is required to maintain populations; the Service's National Fish Hatchery system plays a key role in providing species such as lake trout and brook trout for recovery efforts in the Great Lakes.

Often the key to restoring populations is improved access to habitat, habitat restoration, or otherwise countering the impacts of human activities in the basin. Our habitat based programs restore fish passage, improve stream corridor habitat and help implement best management practices in headwaters and riparian areas (see also Goal 3). Service staff serve on the Board and the Scientific Advisory Team of the Great Lakes Fishery Trust, a private charitable foundation established in 1996 as part of a settlement for fish lost from operation of the Ludington Pumped Storage Hydroelectric Project in Lake Michigan. Since 1998 the Trust has provided grants totaling over \$17,000,000 and many have contributed greatly to the restoration of lake trout, lake sturgeon and other species.

The Service has also addressed the impacts of Aquatic Invasive Species that impede progress toward restoring self-sustaining fish populations. For example, we have successfully identified the introduction, spread and impacts of ruffe, round goby, zebra mussel, bighead carp and silver carp, and communicated to stakeholders the seriousness of further invasions and the need for actions to prevent further range expansion. Our highly successful sea lamprey control program, under the administration of the Great Lakes Fishery Commission, is among the most important factors in maintaining and restoring Great Lakes fisheries. For example, reduction of sea lamprey populations in the St. Mary's River through successful control operations in 1999 created an opportunity to repopu-



late prime habitat in Lake Huron with lake trout reared in National Fish Hatcheries. Finally, the Service has focused efforts on fish health surveys using the latest technology to monitor wild fish populations and fish in state, tribal and federal fish hatcheries. Thousands of fish were screened for health status during 1998-2002 and progeny from 4 native lake trout stocks and 2 native brook trout stocks were certified and brought into the National Fish Hatchery System to provide fish for inter-agency restoration programs.

Selected Outcomes

- Effectively controlled sea lamprey populations across the Great Lakes, with Fisheries and Oceans Canada and the Great Lakes Fishery Commission.
- Improved the status of lake trout populations by stocking more than 4 million lake trout yearlings annually in lakes Huron, Michigan, Erie and Ontario.
- Improved management of lake trout and lake whitefish in the 1836 Treaty waters in partnership with 5 tribes, Michigan and the Chippewa-Ottawa Resource Authority.
- Improved information for fisheries management by creating a Great Lakes Fish Stocking database to house information from all management agencies.
- Improved information for management of the health of wild fish populations and hatchery stocks through assessment of more than 16,500 fish from 31 species.
- Improved information on genetic diversity, abundance and habitat conditions for lake sturgeon by coordinating projects and workshops basin-wide.
- Improved information on invasive ruffe and round goby populations and led efforts toward limiting their spread into additional Great Lakes habitats.
- Operated two isolation facilities to verify the health of lake trout and brook trout and brought progeny from 15 collections from wild stocks into National Fish Hatcheries.
- Provided information on movement of bighead and silver carp up the Illinois River toward Lake Michigan and led the initiative to construct a fish barrier near Chicago.

- Restored fish passage at 11 Great Lakes Basin tributary sites through the replacement of undersized culverts at road crossings and removal of other obstructions
- Improved instream flow and habitat conditions and provided fish protective measures at non-federal hydroelectric projects in Great Lakes tributaries.

Priorities for the Future

- Improve information on priority species, habitat and threats to restoration.
- Identify effective restoration techniques, activities and locations.
- Monitor fish health status and trends in wild and hatchery stocks.
- Restore self sustaining lake trout populations across the Great Lakes.
- Restore self sustaining brook trout populations in Lake Superior.
- Restore lake sturgeon populations across the Great Lakes.
- Restore yellow perch populations in Lake Michigan.
- Restore walleye populations in Lake Huron.
- Restore Atlantic Salmon populations in Lake Ontario.
- Restore American eel populations in Lake Ontario.
- Improve management of fisheries for lake whitefish and walleye.
- Control sea lamprey populations across the Basin.
- Control the spread of ruffe and round goby populations.
- Block bighead and silver carp access from the Illinois River into Lake Michigan.



Goal II: Minimize the Impacts of contaminants on fishery and wildlife resources.



Primary Operational Authority and Guidance

- Clean Water Act
- Fish and Wildlife Coordination Act
- Comprehensive Environmental Response, Compensation and Liability Act
- Oil Pollution Act
- Endangered Species Act of 1973

Service Programs

- Technical Assistance to federal, state, and tribal partners on ecotoxicology and ecological risk assessment
- Realty Preacquisition Surveys to prevent contaminant impacts to National Wildlife Refuge System lands
- Pesticide Use Proposal Program to minimize use of pesticides on lands of the National Wildlife Refuge System and to apply Integrated Pest Management practices wherever possible
- Participation on U.S. EPA-sponsored Biological Technical Assistance Teams



(BTAGs) for design and selection of clean-ups at National Priority List (NPL; "Superfund") sites

- Oil and hazardous substances spill prevention planning and response
- Clean Water Act coordination through technical assistance to U.S. EPA and states
- Natural Resource Damage Assessment (NRDA) and restoration
- Scientific investigations and surveillance
- Endangered Species Act consultation

Progress 1998-2002

Working closely with our partners, the Service prevents contaminant and pollution impacts to fish, wildlife, plants and their habitats, and restores those resources which have been impacted. Using its unique expertise in wildlife and aquatic toxicology, the Service develops resource management actions which would prevent adverse effects of contamination.

Where contamination already occurs, the Service performs scientific investigations to identify the effects and then develops management actions to eliminate contaminant-related injuries. Examples of Service accomplishments toward minimizing the impacts of contaminants are provided in Appendix II.

The Service has reduced or minimized the effects of contaminants on threatened or endangered species by consulting with state and federal agencies on contaminant effects under the auspices of the Endangered Species Act. We consult with state and federal agencies on water quality to ensure that criteria and standards are protective.

The Service has identified injuries to resources caused by contamination and has implemented activities to restore those resources. Using authorities as trustees for natural resources under the Comprehensive Environmental Response, Compensation and Liability Act (the "Superfund" law), where injuries have occurred in the past, or are not preventable, the Service identifies injuries, pathways to exposure, and parties responsible for such injuries to

enlist their cooperation to restore both the injured resources and their associated public benefits.

The Service minimizes or reduces the effects of oil and hazardous material spills through technical assistance in contingency planning and during spill response to minimize the adverse effects of spills. The Service has restored resources lost due to spills by performing natural resource damage assessments and implementing restoration projects.

The Service minimizes or eliminates contaminant effects by integrating consideration of contaminant effects into all other Service activities, including management of refuge lands, conservation of endangered species, fish hatcheries and fishery management activities, habitat restoration, and law enforcement. The Service's contaminants specialists work in partnership with other agencies and organizations, which have come to rely on our expertise.

The Service contributes to other agency's efforts to minimize contaminants by offering expertise and assistance in the areas of ecotoxicology and ecological risk assessment. We identify contaminant sources, pathways, and effects of exposure. We coordinate and cooperate with, and provides technical assistance to, virtually every other state and federal agency which may deal with or consider contaminant effects.

The Service contributes to the goal of virtual elimination of persistent toxic substances in the Great Lakes Basin through participation in the Great Lakes Binational Toxics Strategy. Also, the Service directly contributes to several indicators of environmental quality including, among others, natural lake trout populations, sea lampreys, and bald eagle reproduction. We contribute to these indicators under the auspices of The State of the Lakes Ecosystem Conferences (SOLEC).

Selected Outcomes

- Characterized the contamination of approximately 4 miles of the West Branch Grand Calumet River and 30 acre Roxana Marsh in 2002, that will lead to a remediation and restoration implementation plan.
- Determined the relative effect of contamination and habitat limitations on the Great Lakes bald eagle population through analysis of tissue samples collected over a 12 year period.
- Determined injury levels to lake trout, walleye and brown trout in Green Bay resulting from polychlorinated biphenyl compounds that were introduced into the lower Fox River by paper mills in the early 1970s via extensive fishery investigations as part of the Lower Fox River/Green Bay Natural Resource Damage Assessment.
- Made progress toward restoration of wetland, stream, littoral, riverine and upland habitats that have been adversely affected by contaminant releases at sites such as Love Canal, 102nd Street, Forest Glen, Wide Beach, ALCOA and General Motors via the St. Lawrence Environment and Niagara Natural Resource Damage Assessments.



Restoration Goal II

- Ongoing consultation (under Section 7 of the ESA) on national water quality criteria to ensure that U.S. EPA's criteria are protective of listed species and working with U.S. EPA, Region 5, to implement the terms and conditions of our 1995 Biological Opinion on the Great Lakes Water Quality Guidance to ensure that the Guidance is protective of listed species.
- Continuing assistance to the Service's National Wildlife Refuge System to investigate and eliminate contaminant effects on Great Lakes coastal influenced Refuges.

Priorities for the Future

- Continue scientific investigations of the effects of contaminants at Great Lakes Areas of Concern (AOCs) and pursue natural resource damage assessment (NRDA) to identify management actions and restoration projects which would restore a fully functioning ecosystem.
- Continue to assist with recovery efforts of Great Lakes endangered species by identifying and eliminating ecological stressors caused by contaminants.
- Continue to assist the National Wildlife Refuge System and the Fisheries Program to identify and eliminate contaminant as a limiting factor to the natural resource conservation and management goals.
- Continue and increase technical assistance to partners by providing expertise on fish and wildlife toxicology and ecological risk assessment.



Goal III:
Protect, maintain, and, where degraded and destroyed, restore fish and wildlife habitat, including the enhancement and creation of wetlands that result in a net gain in the amount of those habitats.



Primary Operational Authority and Guidance

- National Wildlife Refuge System Improvement Act of 1997
- Fish and Wildlife Coordination Act
- National Wildlife Refuge System Administration Act
- Executive Order 12996
- Refuge Recreation Act
- Endangered Species Act of 1973
- Clean Water Act
- Federal Power Act

Program Areas

- National Wildlife Refuges and Wetland Management Districts
- Restoration assistance on private lands



- Partners for Fish and Wildlife and Coastal Program restoration activities
- Coordination and Consultation with Federal and State regulatory agencies
- Wetland and grassland restorations on Service lands
- Migratory bird banding
- Invasive species control
- Natural resource research
- Law enforcement
- Prescribed burning
- Hunting and fishing
- Environmental education and interpretation
- Wildlife observation and photography

Progress 1998-2002

Working closely with our partners, the Service implemented fish and wildlife protection and restoration projects on federal, state, tribal and private lands. Each Service office in the basin serves as a cornerstone in researching, evaluating, scoping, and implementing habitat improvement projects. The Service is often a leader of projects and initiatives, lending expertise, staffing, and resources to high-priority Basin-wide habitat projects such as the Great Lakes Coastal Program, which has restored or protected more than 1,000 miles of coastal habitat. It also serves as the lead federal agency in implementing on-the-ground habitat projects which benefit at-risk, threatened and endangered species in the Basin, such as completing over 350 habitat restoration projects to benefit the federally endangered Karner blue butterfly.

The cumulative efforts of these stations and staff have resulted in hundreds of accomplishments during this period (see Appendix II). The protection and restoration of thousands of acres have benefited dozens of fish and wildlife species throughout the Basin -- game and non-game, migratory and resident, endangered and non-endangered. Many of these same projects have yielded increased educational and recreational opportunities for Great Lakes area residents.

Restoration Goal III

In addition to our own work, the Service helped other government agencies plan projects such as roads, flood control, renewable energy (hydroelectric), and navigation projects to avoid harming fish, wildlife, and their habitats in a cost-effective way while still meeting project purposes. Through authority of the Clean Water Act, the Service reviews proposed projects that may affect wetlands and provides assistance in designing projects to avoid impacts to fish, wildlife, and sensitive natural areas. The Service also pursues habitat restoration through settlements under authority of the Comprehensive Environmental Response, Compensation, and Liability Act and Oil Pollution Act to address injuries to fish and wildlife resources resulting from contamination. Settlements have led and will lead to habitat restoration at various locations throughout the Great Lakes Basin.

Selected Outcomes

- Protected and restored wildlife habitat on over 12,000 acres of private land including 7,000 acres of wetlands, 4,000 acres of prairie, and over 1,000 acres of coastal wetlands.
- Through fish passage and stream restoration projects, provided fish access to over 180 miles of river spawning, rearing and feeding habitat.
- Protected and restored Lake Superior trout and salmon habitat through the establishment of Whittlesey Creek NWR in 1999.
- Working in partnership with others, completed nearly 700 Challenge Cost-Share Program habitat projects valued at more than \$11.5 million dollars. These projects on federal, state, tribal and private lands protected or restored migratory bird habitat in wetland, upland, and riparian areas while also increasing public recreational opportunities.
- Protected an important migration corridor for hundreds of species of fish, raptors, neotropical birds and migratory waterfowl through the establishment of the Detroit River International Wildlife Refuge in 2001. Also acquired Mud Island through a donation by National Steel Corporation.
- Protected critical fish spawning and nursery shoals and colonial bird habitat through the acquisition of Little Charity and a portion of Big Charity Island in Lake Huron's Saginaw Bay.

Priorities for the Future

- Continue to work in partnership with private landowners to conduct voluntary habitat protection and restoration projects on their property.
- Strengthen and expand our partnerships with states, tribes, and industry to continue our habitat protection and restoration work, both on and off Service lands.
- Continue to support watershed health through active participation in aquatic and terrestrial invasive species control projects throughout the basin.
- In combination with habitat projects, optimize the educational and recreational benefits available to local residents through programs at the Detroit River International Wildlife Refuge and other refuges in the basin.
- Provide more public use and interpretation opportunities through National Wildlife Refuge and National Fish Hatchery visitor services programs.
- Leverage our scientific capabilities and those of our partners to develop complementary short and long-term resource management strategies which will improve and sustain the biological health of the basin.
- Continue to review federally authorized or funded projects that may substantively affect high priority fish and wildlife habitat to ensure project impacts are identified and addressed.



Goal IV: Stop illegal activities adversely impacting fishery and wildlife resources.



Primary Operational Authority and Guidance

- Lacey Act
- Endangered Species Act of 1973
- Convention on International Trade in Endangered and Threatened Species (CITES)
- Migratory Bird Treaty Act
- Bald and Golden Eagle Protection Act
- National Wildlife Refuge System Administration Act

Service Programs

- Special Agent Program
- Wildlife Inspection Program
- National Wildlife Forensics Laboratory

Progress 1998 - 2002

Working closely with our partners, the Service strives to stop illegal activities adversely impacting fish and wildlife resources. Efforts include: detecting and deterring crimes involving the illegal take, trade, and trafficking of protected species; investigating activities involving habitat destruction and environmental contaminants; and preventing the introduction of invasive species via international trade and travelers. The Service's Great Lakes Region Office of Law Enforcement takes primary responsibility for the protection and conservation of fish and wildlife through the enforcement of federal wildlife laws and treaties and, as such, is an integral part of the overall management effort of all Service programs within the Great Lakes Basin.

The Office of Law Enforcement is comprised of special agents, wildlife inspectors, regional and field support, and supervisory personnel. The Special Agent Program is made up of a force of plainclothes criminal investigators who target the most severe cases of illegal activity. Wildlife Inspection Program personnel are positioned at strategic locations within the Midwest and are the first line of defense in stemming illegal international shipments of wildlife in the Great Lakes Basin. Service personnel work hand in hand with the Customs and Border Protection officers to insure that fish and wildlife traveling into or out of the country is shipped in compliance with appropriate laws. Wildlife inspectors are becoming increasingly vigilant in detecting the entry of injurious fish or wildlife into the Great Lakes Basin.

Although a number of federal statutes provide the authority to protect wildlife in the Great Lakes Basin, three principal laws are most extensively used. Non-game migratory birds as well as game birds and waterfowl are protected by the Migratory Bird Treaty Act and its regulations. The Lacey Act allows for the apprehension of illegal imports of injurious live wildlife, and the Lacey Act Amendments provide strong federal protection to wildlife and extends federal assistance to the states and foreign governments for the enforcement of wildlife laws. The Endangered Species Act not only protects endangered and threatened species, but includes CITES enforcement authority as well as the framework for the Service's Wildlife Inspection Program.

Over the last 5 years through investigations, prosecutions and outreach efforts (see Appendix II for list of accomplishments), the Service has made progress toward ensuring a sustainable harvest of game species, ensuring that the United States meets species specific international obligations, preventing introduction of invasive species, and maintaining habitat conditions necessary for healthy aquatic communities.



Selected Outcomes

- Reported illegal and non-permitted activities impacting wetlands and listed species to improve Great Lakes resource protection and secure mitigation for impacts.
- In the last 10 years, average criminal fines have increased 125 percent and average civil penalties have had a corresponding rise- reflecting an increase in the scope and complexity of wildlife investigations.
- Prosecuted one of the largest-ever illegal commercialization of Great Lakes fresh water mussels felony cases.
- Conducted special waterfowl hunting enforcement activities near the beginning of hunting season each Fall in the basins of lakes Ontario, Erie, St. Clair and Huron, often in collaboration with state and provincial conservation officers in New York, Ohio, Michigan and Ontario, Canada, as part of joint waterfowl task force operations;
- Discovered that waterbird by-catch, particularly of the Common Loon and the Lesser Scaup, is believed to be a significant problem in the Mackinac Straits-St. Martin's Bay-Cedarville region of Michigan, and in the vicinity of Whitefish Point, Michigan.

Priorities For The Future

- Continue rebuilding the Service law enforcement program and maintain an effective presence in the Region by regularly hiring new agents to offset mandatory retirements.
- Focus enforcement efforts on potentially devastating threats to wildlife resources such as; illegal trade, unlawful commercial exploitation, habitat destruction, introduction of invasive species and environmental contaminants.
- Continue and strengthen border inspection efforts to control illegal import and export of wildlife at the five main border crossings and two international airports in the Great Lakes Basin.
- As part of the Service's national program, utilize improved intelligence gathering and analysis of the illegal wildlife trade to support wildlife law enforcement and resource protection in the Great Lakes Basin.



Goal V: Restore threatened and endangered species to viable, self-sustaining levels.



Primary Operational Authority and Guidance

Endangered Species Act of 1973

Service Programs

- Listing and candidate recovery - Identify species that are or could become endangered and protect them under the Endangered Species Act; work with government and private partners to find ways to preclude the need to list species.
- Consultation - provide expertise to other Federal agencies to adapt projects so they can be carried out successfully without harming listed species or their habitat.
- Recovery - Develop plans to recover listed species and work with partners to implement needed recovery actions.
- Grants to states and Private Stewardship - provide grants to states to work on federally listed species; assist private landowners to implement conservation actions.

Progress 1998-2002

Threatened and endangered species often forewarn of threats to the ecological health of an area and the Great Lakes are no different. In close coordination with a multitude of partners, including the basin's sportsmen and women, private landowners, local, state, and tribal governments, industry, and nongovernmental organizations, the Service identifies threats to listed species and those in decline but not yet listed, implements conservation actions to address these threats and needs, and assists other

Federal agencies in their consultation and species recovery responsibilities. As the lead agency for federally listed threatened and endangered species, the Service has made tremendous progress in recovering listed species and preventing future listings through flexible and innovative programs and techniques to restore the more than 30 species listed under the Endangered Species Act (ESA) that occur within the basin. Examples of Service accomplishments toward restoring threatened and endangered species are provided in Appendix II.

Initiating and implementing actions to help preclude the need to list species in decline represents an important component of the Service's Listing program. The Service and a multitude of agencies and institutions have made progress in pursuing restoration of the lake sturgeon, the only sturgeon species endemic to the Great Lakes basin. These interagency efforts have determined the size of some spawning populations, as well as reproductive success, genetic identity, and use and suitability of existing habitat to facilitate development and implementation of management actions. A number of dams have been removed to provide passage for sturgeon and flows have been improved downstream of dams resulting in increased spawning success. The Service and state agencies are formulating Candidate Conservation Agreements to protect the Eastern massasauga rattlesnake the on publicly owned land. The massasauga, a Candidate species since 1999, is declining throughout its range.



We have also made substantial progress in restoring listed species. The gray wolf has been restored as a top predator in the north woods ecosystem of Minnesota, Wisconsin, and Michigan. We initiated a program in 2001 to reestablish a migratory flock of the endangered whooping crane in the eastern United States using captive-reared cranes led from Necedah National Wildlife Refuge in Wisconsin to wintering grounds in the Gulf coastal marshes of Chassahowitzka National Wildlife Refuge in Florida. Coordinated efforts to manage habitat that mimics the effects of wildfire, and efforts to control cowbird parasitism, have resulted in an increase in the number of singing male Kirtland's warblers. A variety of efforts to restore Great Lakes piping plover (once numbering only 12 breeding pair) were conducted with many partners and volunteers to protect nesting birds and track movements throughout their migrations. We are also working closely with private landowners to protect beach habitat for plover while enabling them to proceed with their development plans. Although numbers of the plover remain perilously low, recovery has progressed due to intensive conservation programs. Portions of oak savanna and pine barrens ecosystems that support the threatened Karner blue butterfly are gradually being restored and full recovery of the species is on the horizon. Finally, the threatened Eastern prairie fringed orchid inhabits wet prairies, bogs, and fens, habitats that were once abundant but are now rare due to drainage and conversion to agriculture. The Service, State partners, and volunteers continued efforts to protect and restore these important habitats and to hand-pollinate this species.



The ESA provides opportunities to assist and, at times, fund activities of others. ESA funding sources include the Cooperative Endangered Species Conservation Fund, through which the Service has provided many grants to Great Lakes states, and the Private Stewardship Program that provides funding to partners for voluntary conservation projects involving candidate, proposed, and listed species. The Service provided more than \$6 million in grants for projects to conserve candidate and listed species during 1998-2002. Other tools and voluntary programs include Habitat Conservation Plans, Safe Harbor Agreements and the Service's own habitat-based programs that lend site-specific technical and funding assistance.

Selected Outcomes

- Worked on projects with partners to restore lake sturgeon, the only sturgeon species endemic to the Great Lakes basin.
- Worked with eight states to develop Candidate Conservation Agreements for Eastern massasauga rattlesnake and preclude the need to list this species.
- Reclassified the gray wolf from endangered to threatened in the eastern United States, providing flexibility to States and tribes to manage wolves.
- Initiated reestablishment of a Midwestern migratory flock of whooping cranes using captive-reared cranes based at Necedah National Wildlife Refuge.
- Increased the number of singing male Kirtland's warblers from 800 in 1998 to more than 1,000 in 2002 through habitat management and cowbird control.
- Increased the number of breeding pairs of the Great Lakes piping plover from fewer than 25 in 1997 to 51 in 2002 and expanded breeding range into Wisconsin.
- Stabilized and expanded populations of Karner blue butterfly.
- Stabilized Eastern prairie fringed orchid and increased several populations.

- Increased numbers of the threatened Lake Erie water snake through habitat management and educating the public to prevent intentional killing of snakes.
- Improved coordination and shared information on management strategies under an International Framework to manage cross-border species with Canada.
- Developed agreements with private landowners for dozens of projects to benefit listed species.
- Performed 2,300 informal consultations with other federal agencies on projects to provide technical assistance to minimize or avoid harm to listed species.

Priorities for the Future

- Propose delisting the gray wolf.
- Propose delisting the bald eagle.
- Increase the number and expand occupied breeding range of the Great Lakes piping plover and propose reclassification from endangered to threatened.
- Increase the number and expand occupied breeding range of the Kirtland's warbler and propose reclassification from endangered to threatened.
- Increase the population of the Lake Erie water snake and reduce threats to the extent that the species can be delisted.
- Remove threats to existing massasauga rattlesnake populations and increase their numbers to the extent that listing this species is no longer necessary.
- Remove threats to lake sturgeon to stabilize and increase the number of populations and preclude listing.
- Continue efforts to reestablish a migratory flock of whooping cranes in the eastern United States with a goal of 25 breeding pairs.
- Increase partnership efforts with private land owners to conduct activities to recovery listed species and preclude listings.



Goal VI: Protect, manage, and conserve migratory birds.



Primary Operational Authority and Guidance

- Migratory Bird Treaty Act
- Fish and Wildlife Conservation Act
- North American Waterfowl Management Plan (Upper Mississippi River and Great Lakes Joint Venture)
- Partners in Flight landbird conservation plans (Great Lakes Physiographic Areas)
- U. S. Shorebird Conservation Plan (Upper Mississippi Valley/Great Lakes regional plan)
- North American Waterbird Conservation Plan (Upper Mississippi Valley/Great Lakes regional plan)

Program Areas

- Migratory Bird Program
- National Wildlife Refuge System
- Ecological Services Program
- Private Lands Program
- Law Enforcement Program
- Fisheries Program



Progress 1998-2002

The wide-ranging nature of migratory birds necessitates a collaborative approach to their management, and in the Great Lakes our Migratory Bird Program works with other Service programs (see above) as well as Federal, state, provincial, and tribal agencies, nongovernmental organizations, universities, industry, and private citizens to conserve the region's avifauna. Birds are an important component of the Great Lakes ecosystem; nearly 500 species breed or winter in, or migrate through, the Great Lakes. Millions of people watch, feed, and hunt migratory birds, and these recreational pursuits have a significant economic impact. Birds are challenged by a number of limiting factors, including habitat loss and degradation, contaminants, disease, predators, and collisions with obstacles like communications towers. One of the Service's major trust responsibilities is to maintain and enhance healthy bird populations and habitats for the continued use and enjoyment of the American people.

The Service has identified about 70 bird species that are of special concern in the Great Lakes because of declining numbers, recreational importance, or "nuisance" problems, and many of our conservation efforts focus on these species. We conduct, coordinate, and fund work in a number of areas. Following are examples of activities in each of these areas that illustrate the scope of our bird conservation efforts in the Great Lakes. Appendix II provides a detailed list of accomplishments from 1998-2002.

A number of cooperative population monitoring programs have been established to collect information on the status, trends, and distribution of birds in the Great Lakes. One of the most significant is a bi-national survey of colonial waterbirds that is done periodically in conjunction with other Federal, state, and provincial agencies to census gulls, terns, herons, egrets, and cormorants using standardized protocols. The last survey, done in the late

1990s, found approximately 400,000 pairs of 15 waterbird species nesting at 450 sites in the U. S. Great Lakes.

The Service supported research activities through the U. S. Geological Survey, state agencies, universities, and others to obtain information that allowed us to better understand the biology and limiting factors of Great Lakes birds. Research findings were used to improve our management of several species of concern, including the Common Tern, Common Loon, Double-crested Cormorant, American Woodcock, and Northern Goshawk.

The North American Waterfowl Management Plan (NAWMP), through the Upper Mississippi River & Great Lakes Region Joint Venture (JV) and adjoining JVs, has worked in the Great Lakes since 1986 to protect, restore, and manage habitats for waterfowl and a variety of other bird species. JV partners have been very active in habitat conservation in the Great Lakes watersheds, working through state and local partnerships.

In addition to the NAWMP, other international bird conservation plans were developed and stepped down to address the needs of landbirds (Partners in Flight), shorebirds, and waterbirds in the Great Lakes. These plans identified priority bird species, habitats, and conservation strategies.

Through our Great Lakes field stations and partners, we worked to promote awareness of the value of migratory birds and their habitats through presentations, publications, displays, curricula, workshops, and events.

Selected Outcomes

- Identified 85 sites in the U. S. Great Lakes that provide important habitat for terns, gulls, herons, and egrets; these sites will be the focus of protection efforts by the Service and its partners in the future.
- Increased our understanding, through cooperative research efforts, of Double-crested Cormorant impacts on fish populations, the distribution of Great Lakes Common Terns, the effects of hunting on American Woodcock, and the importance of Great Lakes shorelines and coastal marshes to migrating songbirds and shorebirds.
- Protected, restored and enhanced over 76,000 acres of bird habitat in the Great Lakes since 1990 through the Upper Mississippi River & Great Lakes Joint Venture and North American Wetlands Conservation Act grants that provided over \$19 million in grant funds and leveraged \$54 million in partner funds.
- Worked with partners to develop four Physiographic Area Landbird Conservation Plans to address the needs of hundreds of species in the Great Lakes, and stepped down the U. S. Shorebird Conservation Plan to a regional plan for the Great Lakes.
- Educated thousands of people about birds through International Migratory Bird Day events at five National Wildlife Refuges and two zoos in the Great Lakes.



Priorities for the Future

- Continue to take a leadership role in implementing and integrating conservation plans for waterfowl, landbirds, shorebirds, and waterbirds in the Great Lakes.
- Use landscape-level tools like Geographic Information Systems and modeling to synthesize information from bird planning efforts and identify geographic focus areas where partners can most effectively protect and restore migratory bird habitat in the Great Lakes.
- Increase population surveys for poorly-monitored species like marsh and shorebirds, and continue binational efforts to track the status of colonial waterbirds in the Great Lakes.
- Address priority Great Lakes bird research needs through cooperative studies, focusing on limiting factors for species of concern.
- Work with state agencies, USDA Wildlife Services, and others to implement the Double-crested Cormorant Management Plan to address biological and social concerns associated with this species in the Great Lakes.
- Implement the Service's Strategic Plan for Migratory Bird Conservation by enhancing partnerships and using sound science to monitor and manage bird populations, conserve habitat, and provide bird-related recreational opportunities in the Great Lakes.



Discussion and Recommendations

Discussion

This report illustrates how the activities supported through the Act have been a tremendous success from 1998 to 2002. Progress has been made toward nearly all of the 32 recommendations of the Fishery Resources Restoration Study, through the fish and wildlife restoration proposal process and under the activities conducted by the Service with our many partners.

Because of the Act, the partnerships are growing and becoming more effective, as evidenced by the fact that more partners and stakeholders join in the restoration programs each year. We have shown that 52 organizations participated with the states, tribes and the Service in fish and wildlife restoration projects. The list of partners contributing toward the Service's six Great Lakes restoration goals continues to expand steadily and now includes more than 200 participants.

Statements of support for the Act from our partners, as referenced in this report, speak volumes. In particular, the fish and wildlife restoration proposal process is considered an outstanding success because it provides state and tribal management authorities with critical resources to pursue cooperative restoration activities within the framework provided by the Joint Strategic Plan for the Management of Great Lakes Fisheries. Partners have expressed strong support for increasing restoration projects and partnerships.

Much of the work completed during 1998-2002 focused on research into the status of fish and wildlife populations, on the conditions impeding their restoration, and on establishing a framework, including geographic information systems and interagency databases, to help bring management authorities together as a combined force. This has been an important contribution in the ongoing process of establishing an adaptive, science-based approach in restoring Great Lakes resources.

Restoration programs implemented for the south Florida ecosystem and Chesapeake Bay watershed have shown the importance of taking an adaptive, science-based approach with science informing management of the appropriate restoration options and strategies. It is understandable that it has taken longer for such an approach to develop in the Great Lakes because of the great size of this ecosystem; the complexity of its restoration challenges, ranging from invasive species to environmental contaminants; and the international interjurisdictional context in which this work must be accomplished. The Act is helping management authorities produce the science that is necessary to approach restoration needs more effectively.

Being significantly greater in size than the South Florida ecosystem or Chesapeake Bay watershed, the Great Lakes ecosystem has generated many programs to resolve problems at the international, federal, state, provincial and local levels. This jurisdictional diversity has made an overarching restoration strategy difficult to devise. The Government Accounting Office (GAO) recently released a report citing 148 federal and 51 state environmental programs funding environmental restoration activities in the Great Lakes Basin. These programs support diverse activities including flood plain, shore and coastal zone management; dredging and construction of public facilities; agriculture and forestry; soil, water, air and watershed management; farmland protection and management; education; research; technical assistance and extension services; biological and geological information monitoring; environmental monitoring and assessment; pollution prevention and remediation; fish and wildlife resource management and many others.

Discussion and Recommendations

Among these programs, those focusing on fish and wildlife resource conservation and on environmental conditions and restoration in the Great Lakes are of the most direct relevance to the Act. The link between fish and wildlife conservation and environmental restoration has yet to be effectively established. That is, there has been a dichotomy in Great Lakes programs with one side focusing on environmental conditions affecting human health and another on managing fish and wildlife resources, which are important to our quality of life and are certainly also impacted by environmental quality in the same way that human health is. These two types of government programs have developed in separate channels, and one of the current challenges is to bring them closer together. This may be part of what lies behind the assertion in the GAO report that “Strategies for the Great Lakes do not provide an overarching restoration approach.”

To illustrate this, many of the natural resource conservation activities in the Great Lakes focus on fisheries and aquatic habitats, because these waters support some of the World’s largest fisheries. Fish community goals have been established for each lake through processes administered by the Great Lakes Fishery Commission, and management agencies are well along the path toward inter-agency management under the framework of the Joint Strategic Plan. However, the links between fish community goals, fishery management, and essential environmental conditions necessary to restore and maintain fisheries are only now being pursued in detail by the management agencies. Additional effort is needed to ensure a long-term connection between environmental and fishery resource-based planning.

On the other hand, the Great Lakes Water Quality Agreement and associated monitoring systems to measure restoration progress are of primary relevance to the Act. To accomplish the goals of the Agreement, State of the Lakes Ecosystem Conferences (SOLEC) have been organized biennially since 1994. The SOLEC process has resulted in the identification and tracking of physical, chemical and biological indicators covering a broad spectrum of conditions under a voluntary process where information resides in many different sources and agencies. As pointed out by GAO “current indicators do not provide an adequate basis for making an overall assessment of restoration progress.” Included in the indicators is information on the status of fishes, such as lake trout and lake sturgeon, but at a superficial level that has yet to draw a clear link between the status of these indicators and the broader spectrum of environmental indicators, human health, and restoration actions.

As in the South Florida ecosystem, new programs are being implemented to address the many physical alterations that have affected Great Lakes fish and wildlife resources. Most noteworthy, the US Army Corps of Engineers has been authorized to implement a Great Lakes Fishery and Ecosystem Restoration (GLFER) program, which will support construction projects to remediate physical environmental conditions that have impacted fisheries and aquatic habitats.

Recently, new Great Lakes restoration programs have been proposed through legislation introduced in the United States Congress. How these new programs would fit together within the existing management framework, and how they would relate to the Act, are important considerations.

Parallel restoration efforts are ongoing in Canadian waters. For example, the most recent Canada-Ontario Agreement will bring significant support for restoration activities in Canadian waters of the Great Lakes. Coordination between U.S. and Canadian environmental restoration programs in the Great Lakes is well established in some areas but much room for joint progress remains.

The Great Lakes Fish and Wildlife Restoration Act programs are helping to fill gaps in the complicated management structure within the Great Lakes in several ways. The Act has helped provide resources for states and tribes to move forward with research questions about the status of popula-

tions and habitat, and cause-and-effect relationships, at a scale that would not be possible for each individual authority. It has facilitated the development of decision-support processes and databases which have in turn stimulated more work toward bringing resource management and environmental objectives together.

Resources provided through the Act have helped forge stronger links among the programs administered by the Service. For example, Service fishery biologists supported through the Act have helped document contaminants impacts to fisheries through the natural resource damage assessment program under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). Similarly, Service fishery biologists have implemented many restoration actions to preclude the need to list Great Lakes fishes under the Endangered Species Act of 1973.

Moreover, the Act provides a focal point for coordination between Service, state and tribal fish and wildlife restoration and management activities on the one hand and those supported through related programs such as GLFER and, on a bi-national front, the Canada-Ontario Agreement. As such, the Act provides part of the answer to the need for an overarching strategy for Great Lakes restoration as called for by the GAO.

Recommendations

The following recommendations are consistent with comments from an inter-agency and intra-agency review of this report, and reflect major needs for future improvement of the Act.

1. **Activities carried out under the Act should, where practicable, be consistent with the recommendations of the Great Lakes Regional Collaboration -**

In December 2005, the Great Lakes Regional Collaboration, established under Executive Order 13340, released the "Great Lakes Regional Collaboration Strategy to Restore and Protect the Great Lakes". This Strategy includes recommendations for actions to restore and protect the Great Lakes. The Strategy recommendations focus on: aquatic invasive species; habitat conservation and species management; coastal health; areas of concern associated with contaminants, pollution and excessive habitat loss; non-point source pollution; toxic pollutants; indicators and information; and sustainable development. The Service recommends that future activities carried out under the Great Lakes Fish and Wildlife Restoration Act be consistent with these recommendations, to the extent that these activities can be achieved within current budget levels.

2. **Update the 1995 Great Lakes Fishery Resources Restoration Study -**

The 1995 Great Lakes Fishery Resources Restoration Study is out of date and should be updated to reflect current environmental conditions in the basin, progress toward achieving restoration goals since 1995, and existing interagency fish and wildlife objectives for the basin. The revised study should generate a new estimate of restoration costs to guide future funding authorized through the Act. A new estimate of costs should also include the costs of administering the restoration proposal process and projects funded.

3. **Continue to support the state and tribal restoration proposal process -**

This process has been an outstanding success and has become a primary force in supporting interagency restoration activities under the Joint Strategic Plan for Management of Great Lakes Fisheries. The demand for funds to support high priority fish and wildlife restoration proposals greatly exceeded available resources during 1998-2002. This is a testimony to both the high demand for and success of the restoration proposal process.

4. **Refocus the Act toward adaptive resource management processes and sustainability** -

Because the Great Lakes are seriously degraded and not in a balanced or self-sustaining state, they are not finite resources that can be restored with a one-time-fix approach. Great Lakes fish and wildlife resources are in a state of continual flux as influenced by many factors acting together in an extremely complex relationship. The actions of resource management agencies often have the desired effect; however, the results may be minimized or mitigated by confounding influences and may therefore be short lived. By continually monitoring the status of populations, their habitat and influencing factors, and adjusting management programs accordingly, we may be able to achieve some measure of balance and sustainability of resources in these ecosystems over the long-term.

5. **Strengthen focus on interagency databases and decision making tools** -

Research and monitoring to answer basic questions about the problems impeding our restoration efforts must continue indefinitely because of the complexity of issues involved and the unbalanced nature of the Great Lakes. In order to support an adaptive, science-based approach, we need to increase interagency focus on tools to support decision-making such as geographic information systems and cooperative resource monitoring programs. This focus will allow us to track fish and wildlife resources and to measure progress toward our restoration goals. Infrastructure to host interagency databases and decision-making tools is lacking and could be created through the Act.

6. **Programs should reflect/embrace the bi-national scope of restoration work** -

Fish and wildlife restoration projects undertaken through the Act have naturally and appropriately gravitated toward bi-national perspectives and involvement. This aspect should be examined and formally acknowledged in the future of the program. Border-blind application of U. S. and Canadian funds is not an easy task; however, the pooling of Canadian and U. S. resources has proven to be among the most strikingly successful aspects of the Act. We view the participation of Canadian entities in fish and wildlife restoration projects funded through the Act as a positive program evolution. The continuing involvement of Canadian organizations in restoration proposals should be encouraged, and an agreement to facilitate cooperative work jointly funded by the Act and the Canada- Ontario Agreement, could be explored.

7. **Authorize the involvement of partners and stakeholders** -

The number and diversity of stakeholders and partners involved in restoration activities far exceeds what was envisioned under the Act in 1998. States and tribes have frequently opted to serve as sponsors for restoration work by passing funds through to a partnering organization that may be in a more advantageous position to conduct the work. This has added an administrative layer to the restoration proposal process that may not be necessary. Consideration should be given to an expanded authority to implement projects directly through partners such as universities, environmental organizations and local authorities.

8. Focus on environmental education and public involvement –

The diversity of stakeholders involved with Great Lakes resources is immense and we have barely begun to tap into the interests, energy and resources they could bring forward. Consideration could be given to new authority to conduct outreach through public venues such as National Fish Hatcheries, National Wildlife Refuges and the existing network of Great Lakes visitor centers. It may also be possible to employ these facilities as centers to create new public partnerships to facilitate restoration work at the local level.

Final Statement

The Great Lakes, the largest surface freshwater system in the World, are Canadian and U.S. national treasures. Increasing stress on the system from climate change, population growth, demand for water, continuing impacts to water quality, pollution and contamination, habitat alteration and destruction, fish and wildlife diseases, invading species and changes in native species community and structure, will result in increasing conservation challenges.

The Great Lakes Fish and Wildlife Restoration Act offers powerful and effective tools to address these challenges and help resolve the fish and wildlife conservation side of environmental restoration programs in the Great Lakes region. The Act has the capacity to provide consistent funding of interagency initiatives and open new possibilities for international conservation programs. Continuing investment in the Act will yield direct benefits to the more than 34 million people living within this unique region.



... successful collaboration for conservation!

Great Lakes Fishery Resources Restoration Study: Report to Congress (1995)

Recommendations

1. Develop and Adopt Aquatic Community and Habitat Goals and Objectives to Support Ecosystem Management.

Create a mechanism to promote strategic planning, monitoring, and coordination of management activity on a lake by lake basis. This will require reconsideration of the central role of objective setting. Various agreements mandate the development of *Ecosystem Objectives*, *Fish Community Goals and Objectives*, and *Environmental Objectives* for the Great Lakes. Ambiguities associated with these objectives, however, have made derivation of indicators and end points nearly impossible and forced managers to make policy choices. Ideally, objective setting represents social preference for tradeoffs of user interests as balanced by responsible stewardship for the natural resources of the Great Lakes. A more strategic approach requires: 1) viewing the development of ecosystem objectives as a progressive, vision clarifying process; 2) developing end points from objectives; and 3) including explicit milestones to gauge progress toward the objectives as part of the objective setting process. In cooperation with the International Joint Commission, Great Lakes Commission, Great Lakes Fishery Commission, other interjurisdictional agencies, the states' resource agencies and Native American tribal partners, Aquatic Community and Habitat Goals and Objectives should be developed and adopted.

2. Fully Implement the *Strategic Plan for Management of Great Lakes Fisheries*.

The *Great Lakes Fishery Convention* and the *Strategic Plan for Management of Great Lakes Fisheries* provide institutional frameworks for coordination of fishery management on the Great Lakes, and linkages to environmental management of the Great Lakes. However, the parties signatory to these agreements need to increase their commitment to implementing these frameworks if the agreements are to be successful. In addition, the Great Lakes Fishery Commission and U.S. and Canadian Federal Governments should quickly propose and provide arbitration procedures acceptable to all signatories of the plan including an evaluation process. If funded at authorized levels, the Act could support the efforts of the signatory parties.

3. Conduct Comprehensive and Standardized Ecological Monitoring.

Lack of sufficient ecological information exists to make well advised decisions. Limited ecological monitoring at different trophic levels is occurring, however, this needs to be broadened among states, provinces and agencies, and in time and space. Using improved methods and techniques that are currently being developed, monitor all offshore, nearshore and tributary areas and trophic levels of the ecosystem. Efforts should include density and diversity measurements of the aquatic community, especially phytoplankton, zooplankton, and benthic organisms.

4. Standardize Fish Community Assessment Data and Establish Comprehensive Fishery Databases.

Compatibility of assessment data between management agencies is required to meet future needs of the Great Lakes fish community. Usefulness of collected assessment data must be enhanced by establishing database systems that enable maintenance of data integrity among all agencies. The Service should work with other Federal and non-Federal agencies, as appropriate, to develop a uniform, comprehensive lake-wide database containing all available information on: commercial and recreational catch in U.S. waters; fish stocking; stock assessment; coded-wire tagging; and mark-recapture statistics. These databases should be updated on a timely basis in concert with the Lake Technical Committees and individual jurisdictions to achieve data quality and uniformity, as well as continuity with historic data. Programs that will benefit from data standardization include lake-wide creel census programs, lake-wide assessment surveys, stocking programs and recovery of externally and internally marked fish including those with binary coded-wire tags. Protocols for data collection, storage and analyses will be developed along with a database management system that will make information accessible to all agencies.

5. Develop Offshore Capabilities.

One or more capable offshore research vessels should be deployed on Lake Superior to gather information on offshore and pelagic fish stocks. Construction of the vessel already funded by the U.S. Congress should be completed without further delay. Midwater trawling and hydroacoustics should be incorporated with bottom trawling to better estimate total species biomass and distribution in all areas of the lake.

6. Fish Community Assessment Program.

The need to move to fish community management will require fish community research and monitoring. Many current monitoring programs target a single species, often in limited areas. New methods of sampling need to be developed to assess fish communities and their use of available habitat. Understanding fish recruitment mechanisms and the interaction between species before recruitment, will enable managers to develop strategies that will promote self-sustaining fish populations. Ongoing assessment of forage species with hydroacoustic and trawling gear needs to be expanded to include assessments of predator and inshore species. Due to limited vessels to conduct lake-wide assessments, the testing and development of new techniques would require a multi-agency effort. Incorporating existing monitoring programs, such as those using binary coded-wire tags, into a lake-wide fish community assessment also needs to be evaluated. Development and testing of new sampling gear and subsequent protocols will likely take a minimum of five years, after which a specific annual assessment program could be initiated.

7. Fish Community Modeling.

Population models combining ecological theory and population dynamics information from assessment programs are useful tools for testing our knowledge of Great Lakes fish community functions and predicting responses to management actions. Recent modeling exercises such as SIMPLE (Sustainability of Intensively Managed Populations in Lake Ecosystems) and IMSL (Integrated Management of Sea Lamprey) have provided valuable insight on species interactions in Lake Michigan, but these models need to be adapted for use in the other Lakes. Further development of population modeling coupled with an enhanced lake-wide assessment program will provide a powerful and necessary tool for the rehabilitation and management of Great Lakes fisheries.

8. Coordinate State and Native American Tribal Harvest Monitoring and Management: Measure Commercial and Recreational Fish Catches.

The Service should assist state and Native American tribal governments in coordination of harvest monitoring and management to ensure that the fishery resource is protected, consistent with the sovereignty and rights of the respective governments. Standardized commercial catch and effort databases need to be developed and historical catch and effort data needs to be integrated with these standardized databases. In addition, fishery agencies should fund and conduct a basin-wide survey to estimate commercial catch and effort, and repeat the survey annually. Currently some agencies conduct recreational fishery surveys while others lack resources to do so. Standard basin-wide creel surveys provide biological, social and economic information for planning and evaluating management actions. A basin-wide creel survey should be conducted to estimate recreational angler catch and effort, the survey should be repeated at intervals sufficient to detect trends in the recreational fishery. The Service should work with the states and Canadian agencies to promote complete creel survey coverage of a uniform quality throughout the Great Lakes.

9. Evaluate Ecological Effects of Stocking and Revise Stocking Strategies, as Necessary, to be Consistent with Proposed Aquatic Community and Habitat Goals and Objectives.

Stocking is used throughout the Great Lakes, however the effects of stocking large numbers of fish on the ecosystem and its ability to sustain those fish is not clearly understood. One technique contributing to the evaluation of the ecological effect of stocking is marking all stocked fish. Marking provides an indirect means of measuring natural reproduction by comparing the contribution of marked and unmarked fish in the fisheries, and a means of evaluating the effectiveness of stocking programs. Where stocking is deemed necessary for restoration or to support local fisheries, stocked fish should be distinctively marked to distinguish them from wild fish of the same species.

10. Ecological Information Clearinghouse/Geographic Information System.

To evaluate net loss or gain of fish and wildlife habitat, establish a uniform, comprehensive basin-wide ecological database containing all available information linked to physical location in each of the Great Lakes. In consultation with the International Joint Commission, Great Lakes Commission, Great Lakes Fishery Commission, other interjurisdictional agencies, the states' resource agencies and Native American tribal partners, provide, for each Lake, a single clearinghouse for compiled ecological information to meet research and management needs. It is envisioned that this effort would consist of a distributed network, with each agency maintaining its own data in-house and shipping updated files to the ecological information clearinghouse as necessary in read-only format (this process could be made automatic and transparent). For each of the Great Lakes, a comprehensive Geographic Information System would house the ecological information. Several initiatives have made progress in the development of Geographic Information System databases, but more effort is required. This effort would focus on determining lake-wide Geographic Information System needs for each Lake and consolidating/interfacing existing Geographic Information System efforts to ensure comparability.

11. Identify, Inventory, Protect and Rehabilitate Significant Habitats.

Significant habitats necessary for self-sustaining populations of fish and wildlife are threatened or impaired. Actions should include: identifying and protecting habitats used by fish and wildlife for spawning, breeding, nesting, rearing and feeding; and rehabilitating degraded habitats to be utilized by a diverse community. Service Coastal Refuges present an opportunity to contribute significantly to this effort.

12. Develop and Implement Action, Restoration and/or Enhancement Plans for Exploited and/or Declining Indigenous Aquatic Species.

Action, restoration and/or enhancement plans are important tools for maintaining integrity and biodiversity of the ecosystem. The Service should support appropriate Lake Committees and stakeholders in the development of action, restoration and/or enhancement plans for declining indigenous species (including unionid mussels, American eel, Atlantic salmon, lake trout, brook trout, coaster brook trout, shortjaw cisco, lake whitefish, walleye, yellow perch, arctic grayling, lake sturgeon, northern pike, muskellunge, smallmouth bass, largemouth bass, common loon, mink and river otter) and exploited species (including steelhead, chinook and coho salmon). The plans should be developed to be consistent with the proposed Aquatic Community and Habitat Goals and Objectives. Strategies might include, but not be limited to: continuing and expanding monitoring of populations and/or harvest; standardizing assessment procedures; setting harvest limits to protect exploited populations; and identifying and protecting sensitive habitats.

13. Develop and Implement Action/Restoration Plans for Forage Fish.

Action plans are an important tool for maintaining integrity and biodiversity of the ecosystem. The Service should support appropriate Lake Committees and stakeholders in the development of an action plan for forage fish consistent with the proposed Aquatic Community and Habitat Goals and Objectives.

14. "Close the Door" on Nonindigenous Species Introductions.

Public agencies and non-governmental organizations should cooperate to prevent transport and release of viable organisms into the Great Lakes. Pathways of introduction include ballast water transport, bait bucket transfer, releases from aquaculture or stocking practices and boating. Solutions must be biologically effective, as well as practical, and be based on engineering, operational, regulatory, economic and safety factors. For example, research and development is needed on potential ballast water management options that have already been identified in collaboration with the maritime industry. The studies must be interdisciplinary, involving biologists and engineers, business operators and government personnel. To support research and monitoring of management options, it will be necessary to develop techniques for bio-sampling of ballast tanks on Great Lakes and ocean-going ships.

15. Implement and Expand Effective Sea Lamprey Control.

The U.S. State Department and Fisheries and Oceans Canada, parties to the Great Lakes Fisheries Convention, should meet obligations according to agreed upon funding formulas and fund the Great Lakes Fishery Commission's mandated program. In its Strategic Vision for the Decade of the 1990s, the Great Lakes Fishery Commission has pledged to support fishery management goals by providing "an integrated sea lamprey management program that supports the Fish Community Objectives for each of the Great Lakes and that is ecologically and economically sound and socially acceptable". Fundamental to meeting the vision is an accelerated research program to develop alternative controls to reduce dependence on chemicals, implementation of a control program on the St Mary's River, evaluation of the sterile male release program, and an increase in assessment activities to meet program objectives.

16. Great Lakes Fishery Commission Line Item Funding for Sea Lamprey Control Efforts in the St. Mary's River.

The sea lamprey population in the St. Mary's River has been identified as the most serious impediment to sea lamprey control in the Great Lakes. It is also considered one of, if not the most significant, impediments to restoring a healthy fish community in Lake Huron. The

size of the river precludes conventional treatment methods and requires the development of specific control strategies. Funding for sea lamprey control has been marginal, at best, over the last several years and has allowed only routine treatments of major lamprey producing tributaries in the upper Great Lakes, excluding the St. Mary's. To ensure proper attention to the most serious problem area, additional funding specifically identified for the St. Mary's River is needed.

17. Fund Implementation of the Great Lakes Fishery Commission's Basin-wide Sea Lamprey Barrier Plan.

Construction of low-head dams and electrical barriers to block migrations of spawning adults can reduce lampricide use and provide more effective control by limiting habitat available to lamprey and removing spawning adults at traps. Of the U.S. Great Lakes tributaries regularly treated with lampricide, many have sites where barriers could be constructed. These U.S. projects have the potential to reduce basin-wide lampricide use, cut treated stream mileage, and significantly reduce populations of parasitic lampreys.

18. Prevent or Delay the Spread of Ruffe.

The Ruffe Control Program, the first such program to be prepared under the Nonindigenous Aquatic Nuisance Prevention and Control Act, should be implemented by appropriate government and private entities. The program is an integrated plan that addresses each of the ways by which ruffe may spread. Range reduction by chemical treatments, prevention of ballast water transport and education to prevent movement via anglers and bait dealers are all essential to containing the ruffe and must be supported by vigilant monitoring and surveillance. Portions of a control program have been implemented.

19. Determine the Impacts of Hydroelectric Facilities and Dam Operations on Fishery Resources.

Fishery resources are impacted by dams inhibiting upstream and downstream passage, creating unstable habitat and causing entrainment-related mortalities. The extent of these impacts on the aquatic community is unknown. Specifically, the following impacts need to be determined: dewatered areas and minimum flow requirements; water-level fluctuations on fish spawning, fecundity and condition, aquatic vegetation and invertebrates; and entrainment on fish communities.

20. Increase Involvement in the Binational Program to Restore and Protect Lake Superior and Expand this Mechanism to Lakes Huron, Erie, and Ontario.

Fishery managers should increase their involvement with the Binational Program.

21. Establish Uniform Tissue and Sediment Contaminant Levels Used by Various Agencies for Ecosystem Health.

Contaminant levels are inconsistent or absent among agencies. Uniform levels are needed to prevent reproductive, aesthetic, and consumptive impairments. Specific strategies should include evaluation of agency programs that established the current contaminant levels and conducting additional studies to address information gaps.

22. Broaden the Scope of Current State Antidegradation Policies.

Current state water quality antidegradation policies do not specifically address biological integrity. These policies should be reviewed and revised, if necessary, to clearly state their goal of biological integrity as the Clean Water Act and Great Lakes Water Quality Agreement intend.

- 23. Develop and Implement an Action Plan to Analyze Contaminant Level Effects on Aquatic Resources.**
Monitoring of contaminants and analysis of their effects occurs on a limited basis throughout the basin. A plan should be developed to include the following: establishment of regular monitoring at standard locations; identification of effects on fish reproduction, egg development, fry emergence and larval survival; identification of effects on plants, plankton, macro-invertebrates and piscivorous wildlife; and determination of rates of bioaccumulation within the food web.
- 24. Participate in Remedial Action Plans, Lake-wide Management Plans, and the Environmental Monitoring and Assessment Program.**
As remedial action projects are implemented, their effects on the fish and wildlife community need to be assessed. Fishery managers should increase their involvement with Remedial Action Plans and contribute to the Monitoring and Assessment Program planning process in the Great Lakes.
- 25. Salmonine Egg Viability.**
The viability of lake trout eggs and Pacific salmon eggs from Lake Michigan, has been a point of concern. Cause and effect relationships need to be explored through research efforts. In addition, the effect of poor egg survival needs to be monitored from a rehabilitation and management perspective, to determine the overall effect on Lake Michigan fish communities. The viability and hatching success of lake trout or salmon that mature in Lake Michigan will provide an indicator of the health of the Lake Michigan ecosystem. A monitoring program needs to be designed to provide a systematic measure of the egg viability of key fish species in Lake Michigan.
- 26. Establish and Isolation or Quarantine Facility.**
Management agencies are concerned about maintaining wild genetic strains in hatchery broodstocks of lake trout and possibly coaster brook trout. To accomplish this, wild gametes must pass disease clearance in an isolation facility prior to introduction to hatchery systems. Such a facility should also be designed to support imported adult salmon and other fish from outside the Great Lakes Basin for broodstock development and should be capable of isolating six lots of fish.
- 27. Develop an Epizootic Epitheliotropic Disease (EEDV) Diagnostic Test.**
A diagnostic test for EEDV is needed to expedite determination of disease in lake trout eggs and young fish for the purpose of establishing lake trout broodstocks from wild Great Lakes stocks.
- 28. Fish Health.**
Low egg viability and diseased salmonids are examples of the problems that develop when recruitment of these predators is dependent on intensive aquaculture. Maintenance of fish health within the hatchery has been well researched. Wild fish health and its potential to be an indicator of ecosystem health is a field of study that is not as well developed. Appropriate indicators of fish health should be developed for key fish species in the wild. An example is the recent decline of chinook salmon in Lake Michigan where a lack of knowledge concerning fish health in the wild exists.

29. Fish Genetics.

Since the collapse of indigenous Great Lakes fish and fisheries in recent decades, the rehabilitation of indigenous fishes is an attempt to recolonize the Lakes, a phenomenon that occurred historically following periods of glaciation. The extinction of gene pools adapted to the Lakes for species like lake trout and possibly lake herring, raises concern over the ability of available genetic strains to effectively recolonize all of the available habitat. Analyses of available genetic strains and their survival in the Lakes are crucial for indigenous species restoration efforts.

30. Lethality of Sea Lamprey Attacks.

Research is needed to evaluate the effects of sea lamprey wounding on mortality of fish species other than lake trout. For example, attacks on chinook salmon are extensive, but the timing of these attacks and their contribution to overall mortality is not known. Research has been conducted with lake trout to quantify mortality resulting from sea lamprey attacks but similar work is needed with other species, especially in light of burgeoning lamprey populations in northern Lake Huron.

31. Develop Aquatic Resource Education Programs.

Education programs focusing on the values, functions and dynamics of ecosystems are needed so that society understands their role in the system and makes informed decisions. Education programs should focus on issues such as the prevention and control of nonindigenous nuisance species introductions, the role of deliberately introduced nonindigenous self-sustaining and supplementally-stocked species, indigenous species restoration (e.g. lake trout, lake sturgeon), habitat restoration, and endangered species.

32. Conduct a Cormorant Fishery Predation Study.

A fishery predation study to determine the diet of the Great Lakes cormorant population, similar to that started in 1992 by the Fish and Wildlife Service, Canadian Wildlife Service and New York State Department of Environmental Conservation should be conducted for each of the Great Lakes to quantify fishery predation and generate recommendations to decrease predatory impacts on newly-stocked fish, if necessary.

A Selected List of Accomplishments 1998-2002 Toward the Service's Great Lakes Restoration Goals

Goal #1 Restore and maintain self-sustaining fishery resource populations.

MANAGING NATIVE SPECIES TOWARD SELF-SUSTAINING LEVELS

LAKE TROUT

Lake Superior

- Coordinated research to determine if splake are reproducing and crossing with lake trout in Michigan waters of Lake Superior.
- Senior-authored article, "*Reestablishing a Spawning Population of Lake Trout in Lake Superior with Fertilized Eggs in Artificial Turf Incubators.*" 2002 North American Journal of Fisheries Management 22: 796-805.
- Co-authored article, "*Historic and Modern Abundance of Wild Lean Lake Trout in Michigan Waters of Lake Superior: Implications for Restoration Goals.*" North American Journal of Fisheries Management 23:100-108.
- Collected gametes from three stocks of lake trout in Lake Superior to develop and manage hatchery brood stocks for rehabilitation efforts in the Great Lakes.

Lake Huron

- Led an effort to develop and implement a standardized database to house all interagency Lake Huron lake trout coded-wire tag data.
- Coordinated research to help quantify predation effects of round goby on lake trout rehabilitation efforts in northern Lake Huron.
- Authored three editions of "*Study Plan for Coordinated Evaluation of Strain Performance, Early Life Stage Stocking, and Movement of Lake Trout in Lake Huron*", which serves as the guiding document for numerous coded-wire tagging studies, including the evaluation of improved quality yearling lake trout stocked from our National Fish Hatcheries.
- Processed coded-wire tags from lake trout collected in tribal assessment and commercial fisheries, state assessment and recreational fisheries, and Service assessment fisheries in U.S. waters of Lake Huron to evaluate lake trout rehabilitation efforts.

Lake Michigan

- Co-authored article, "*Lake Trout Movements in Northwestern Lake Michigan.*" 2002. North American Journal of Fisheries Management 22: 737-749 that.
- Coordinated a multi-agency lake trout spawn assessment project to evaluate the success of stocking strategies to colonize over 30 spawning reefs in Lake Michigan.
- Processed coded-wire tags from lake trout collected throughout Lake Michigan by all agencies to evaluate progress being made towards lake trout restoration.
- Mapped lake trout spawning habitat in the Beaver Island area of Lake Michigan using state-of-the-art LIDAR (laser technology deployed from aircraft), to measure depth distribution and bottom surface texture to assist in identifying quality spawning habitat.

Appendix II

- Fished assessment gill nets at three lake trout spawning reefs in Lake Michigan to measure abundance of trout returning to the reefs to spawn, the level of sea lamprey predation, and to collect eggs to evaluate occurrence of early mortality syndrome.

Multi-Lake and Basin-Wide

- Expanded stocking of lake trout eggs in Lake Michigan and Lake Huron as part of an effort to evaluate the use of early life stage stocking as a strategy for lake trout rehabilitation (over 20 million eggs have been stocked in northern Lake Huron since 1992 in collaboration with the Chippewa-Ottawa Resource Authority).
- Evaluated the relative survival of two different study groups of lake trout stocked in Lakes Huron and Michigan to determine which group resulted in greater abundance of lake trout for rehabilitation.
- Propagated and stocked more than 13 million yearling lake trout into Lakes Huron and Michigan during 1997-2000 as part of fish community management plans coordinated through the Lake Committees.
- Operated the 1985 vessel M/V Togue to stock yearling lake trout in Lakes Huron and Michigan, and to conduct fall assessment of spawning stocks at offshore reefs in Lake Huron.
- Raised and stocked 620,000 lake trout yearlings annually in Lakes Erie and Ontario as part of the Great Lakes lake trout rehabilitation effort.
- Researched the potential cause of Early Mortality Syndrome in lake trout and co-authored article, "Effect Of Dietary Ampromolium On Egg And Tissue Thiamine Concentrations In Lake Trout." 1998. American Fisheries Society Symposium 21:172-177.
- Cooperated with Michigan State University and the University of Minnesota to evaluate genetic integrity of hatchery lake trout brood stocks.
- Produced a *Great Lakes Lake Trout Brood Stock Management Plan* to protect and maintain genetic diversity of strains managed in the National Fish Hatchery System for lake trout rehabilitation in the Great Lakes.
- Participated in the implementation of provisions of the 2000 Consent Decree resulting in protection for the interagency lake trout rehabilitation effort while conserving the Tribal, commercial and State sport fishing opportunities in these waters.

BROOK TROUT

Lake Superior

- Worked with several partners to revise the 1998-1999, *Brook Trout Rehabilitation Plan for Picture Rocks National Lakeshore* to continue to guide stocking of over 50,000 brook trout fingerlings.
- Conserved and assessed populations coaster brook trout in Lake Superior through membership on the Lake Superior Technical Committee and by coordinating the inter-agency Brook Trout Subcommittee of the Lake Superior Committee to produce and implement the "*Brook Trout Rehabilitation Plan for Lake Superior.*"
- Developed two coaster brook trout broodstocks for use in restoration stocking programs in Lake Superior and conducted restoration stocking under guidance of the "*Brook Trout Rehabilitation Plan for Lake Superior.*"
- Established two isolation facilities with the Keweenaw Bay Indian Community for the purpose of certifying gametes from wild coaster brook trout donor stocks as disease free, and to enable use of eggs for brood stock development.

Multi-Lake and Basin-Wide

- Sampled and analyzed the genetic variability of coaster brook trout stocks throughout the Great Lakes to guide the Service in selecting donor stocks for stock delineation, brood stock development, propagation and stocking for restoration purposes.

LAKE STURGEON

Lake Superior

- Coordinated the conservation and assessment of lake sturgeon throughout Lake Superior.
- Served as a member of the Lake Superior Lake Sturgeon Subcommittee and contributed to the development of status reports and plans for this species.

Lake Huron

- Coordinated research project to identify and describe habitat use by juvenile lake sturgeon in the upper St. Clair River.

Lake Michigan

- Organized a multi-agency sampling project to assess the abundance and genetic characteristic of existing lake sturgeon stocks in Lake Michigan.
- Initiated a project to describe the historical range and abundance of lake sturgeon in Lake Michigan.
- Initiated a project to identify critical habitat used by juvenile lake sturgeon in the Peshtigo River, tributary to Green Bay.

Lake Erie

- Collaborated with the U.S. Geological Survey to evaluate the current habitat quality and sturgeon use of historical spawning reefs in the Detroit River.

Lake Ontario

- Stocked lake sturgeon and evaluated restoration success in the Oswegatchie River, a tributary to the St. Lawrence River in collaboration with the New York State Department of Environmental Conservation.
- Collaborated with the U.S. Geological Survey to evaluate the habitat suitability of the Genesee River for lake sturgeon restoration.

Multi-Lake and Basin-Wide

- Conducted lake sturgeon population assessments in Saginaw Bay, Lake Huron and the St. Clair/Detroit River corridor to better understand stock status and trends, and the interaction between various stocks.
- Conducted lake sturgeon population assessments and restoration activities in Lake Superior and Lake Michigan tributaries in cooperation with State agencies and Tribes.
- Hosted the "*Great Lakes Lake Sturgeon Genetics Workshop*" in December, 1999 to address discrepancies associated with standardized collection and analysis of lake sturgeon genetic materials, resulting in the report, "*Great Lakes Lake Sturgeon Genetics Status Assessment: An Analysis of Samples, Methods, and Standardization.*"
- Sampled and analyzed the genetic variability of lake sturgeon stocks throughout the Great Lakes to guide the Service in selecting donor stocks for stock delineation, brood stock development, propagation and stocking for restoration purposes.
- Initiated development of a "*Great Lakes Basin Lake Sturgeon Rehabilitation Plan,*" and a comprehensive database of historic and current lake sturgeon rivers, using an interactive Geographic Information System and web-based accessibility tools to support rehabilitation efforts.
- Organized a steering committee to hold a workshop, sponsored by the Great Lakes Fishery Trust, to identify the research and information needs to restore lake sturgeon in the Great Lakes. Authored the report "*Research and Assessment Needs to Restore Lake Sturgeon in the Great Lakes.*"
- Participated in the ongoing multi-agency Menomonee Reservation Lake Sturgeon Committee to develop and implement the "*Menominee Reservoir Lake Sturgeon Management Plan*" to restore lake sturgeon to Tribal waters.

ATLANTIC SALMON

Lake Ontario

- Co-authored the Lake Ontario Technical Committee's "*Lake Ontario Atlantic Salmon Feasibility Study Plan.*"
- Stocked 88,450 Atlantic salmon fry in 1999 in the Lake Ontario and St. Lawrence River watersheds and stocked 6,478 adults in Lake Ontario and collected samples of various strains for genetic analysis.
- Evaluated the quality and quantity of available habitats in Lake Ontario that would support a healthy self-sustaining Atlantic salmon population as part of an ongoing program of research and restoration activities focusing on Atlantic salmon habitat in the Lake Ontario watershed.

St. Lawrence River

- Cultured and stocked Atlantic salmon fry in selected St. Lawrence River Tributaries to evaluate the feasibility for restoration, in partnership with the U.S. Geological Survey – Biological Resources Division and the St. Regis Mohawk Tribe.

AQUATIC INVASIVE SPECIES SURVEILLANCE AND CONTROL

SEA LAMPREY

- Researched the effectiveness of using lamprey homing instincts as part of a non pesticide control option.
- Participated in partnership with the Great Lakes Fishery Commission, Canadian Department of Fisheries and Oceans and the U.S. Army Corps of Engineers in an expanded sea lamprey barrier program with several new barrier projects in the planning phase.
- Implemented a sea lamprey control program in the St. Mary's River, as an agent of the Great Lakes Fishery Commission, and in partnership with the Canadian Department of Fisheries and Oceans, Michigan Department of Natural Resources and other Federal, State and Tribal agencies, with the objective of reducing lake trout mortality toward promoting their recovery in northern Lake Huron within 15 years.

EURASIAN RUFFE

- Led the implementation of "The Ruffe Control Plan", a multi-partner approach to prevent or delay the further spread of ruffe through the Great Lakes and prevent their spread to inland waters and watersheds.
- Conducted small-mesh gillnetting for physical removal of Eurasian ruffe from the Thunder Bay River in Lake Huron in an effort to restrict population growth and range expansion.

ROUND GOBY

- Evaluated the impacts of round goby in Lake Erie and authored the reports, "*Diet of the Round Goby in Lake Erie.*" 1999. National Aquatic Nuisance Species Clearinghouse. 10(1):7-12 and, "*The round goby, Neogobius melanostomus, in Lake Erie.*" Great Lakes Research Review. 2000. Vol. 5, Number 1.
- Monitored the spread of invasive round goby throughout the lower Great Lakes and associated inland waters.
- Monitored the movement of round goby from Lake Michigan into the Mississippi River Basin through the Chicago Sanitary and Ship Canal.

ZEBRA MUSSELS

- Investigated the colonization dynamics of zebra and quagga mussels on both native and non-native aquatic macrophyte beds in Lake Erie's nearshore community and co-authored the report, "*Niche partitioning between Dreissenid mussel species, with an epiphytic refugium for Dreissena polymorpha.*" (In Press).

OTHER AQUATIC INVASIVE SPECIES EFFORTS

- Provided leadership for public education and awareness of aquatic invasive species, their presence, potential ecological impacts, and methods to prevent further introductions in Lake Huron.
- Authored the "Status of Recent Invasive Species" section of *The State of Lake Huron in 1999* and presented a summary of the information at the first State of Lake Huron Conference.
- Initiated an economic analysis of the cost of invasive species in the New York State Canal System to examine the feasibility of utilizing various barrier alternatives to control and prevent the spread of invasive species at strategic entry points along the Canal.
- Monitored the Thunder Bay, Lake Huron, northern Lake Michigan and western Lake Superior fish community to evaluate potential impacts of the non-indigenous species round goby and Eurasian ruffe.
- Conducted annual surveillance at over 20 ports in Lake Huron, two in northern Lake Michigan and 19 in Lake Superior to monitor the range expansion of non-indigenous fish species.
- Conducted the biological community surveys, hydrologic modeling of species dispersal, training and educational workshops for science educators, assessment of boater awareness relative to invasive species, water lettuce monitoring, Asian clam and *Cercopagis* monitoring, dispersal barrier analysis and economic analyses as part of the New York State Canal System Aquatic Nuisance Species Program.

IMPROVING FISHERIES MANAGEMENT AND INFORMATION

Lake Superior

- Contributed to development of a Fishery Management Plan for Isle Royale National Park.
- Co-chaired the Lake Superior Binational Program's Aquatic Community Committee and contributes to the Superior Work Group and the Terrestrial Wildlife Community Committee – which developed and is currently implementing a Lakewide Management Plan for Lake Superior.

Lake Huron

- Assisted in drafting the fisheries portions of a series of reports on the ecological status of Lake Huron for the "*The Lake Huron Initiative*," led by Michigan Department of Environmental Quality.

Lake Michigan

- Served as a primary contributor to the organization and presentation of the first ever "*Lake Michigan State of the Lake Report*" conference that documented progress toward achieving fish community goals and edited the published report.
- Participated in developing models to determine what predation effect stocked trout and salmon will have on the Lake Michigan prey fish community and to guide stocking efforts in Lake Michigan.
- Made significant contributions to lake-wide management and restoration of the fish communities in the Great Lakes through Lake Committee participation by chairing the Lake Michigan Technical Committee from 1992-2001.
- Assisted in planning and organization of a lake-wide stocking conference.
- Contributed to development of a protocol for the collection of diet information from Lake Michigan predators and conducted subsequent analyses.
- Served on the habitat subcommittee and the Lake Michigan Monitoring Coordination Council.

Lake Erie

- Awarded \$5,000 to the Ohio Division of Wildlife to purchase equipment necessary to process Lake Erie fisheries data while at sea to improve the efficiency of fisheries data collection and processing in Lake Erie.

Multi-Lake and Basin-Wide

- Participated in a project supported by the Great Lakes Fishery Commission to assess coastal wetland fish communities of the Great Lakes basin and determine the biological and physical variables that most directly influence fish assemblages in coastal wetlands.
- Co-authored paper, "Ecological Factors Affecting the Sustainability of Chinook and Coho Salmon Populations in the Great Lakes, Especially Lake Michigan." *In* 2002 Sustaining North American Salmon: Perspectives Across Regions and Disciplines. American Fisheries Society.
- Participated in the development of catch-at-age models for the purpose of managing the sport and Tribal commercial fisheries within the 1836 Treaty waters of Lakes Superior, Michigan, and Huron within safe harvest levels.
- Coordinated the development of the Great Lakes Fish Stocking Database where stocking data from all fishery agencies that stock fish in the Great Lakes are annually compiled and made accessible.
- Participated in two lower trophic level monitoring programs, in collaboration with state agencies and universities, to assess seasonal and annual trends in primary production in offshore and near-shore waters and embayments of Lake Erie and Lake Ontario.
- Provided critical diagnostic fish health services to National Fish Hatcheries, U.S. Geological Survey Research Centers, State and Tribal partners and commercial fish facilities in the Great Lakes Basin – more than 1,095 lots of fish were inspected and reported to these entities during 1998-2001, including results from more than 65,000 fish.
- Assessed the health of more than 18,000 fish from 57 species in the Great Lakes, under the *National Wild Fish Health Survey*, to provide important information on the distribution of pathogens in wild fish populations.

EDUCATION, OUTREACH AND INTERPRETIVE PROGRAMS

- Co-authored the report "A Guide to Ohio Streams" in collaboration with over 24 partners as a valuable tool for stream conservation and public education.
- Sponsored the "Ecosystem Approaches to Fish and Wildlife Conservation on the Great Lakes" Symposium at the "61st Midwest Fish and Wildlife Conference" in Chicago, Illinois, to share ideas and promote an ecosystem approach to conservation of Great Lakes natural resources.
- Provided technical assistance for development of an interactive exhibit at the Northern Great Lakes Visitor Center located near Ashland, Wisconsin, to provide information about coastal ecosystems and how people can live, work and play in coastal areas without damaging the environment.
- Hosted six Science Educator Workshops with New York Sea Grant in 1999, 2000, 2001 and 2002 providing science teachers and educators with the training and materials necessary to help students explore the past and present role of the Erie Canal in the introduction and spread of invasive species.
- Assisted NCTC with development of a fish passage training course specifically dealing with road-stream crossings and road culverts.
- Participated on an eight-member Board of Trustees to administer the far-reaching Great Lakes Fisheries Trust Program in Michigan to fund government agencies, universities and non-profit conservation organizations to support Great Lakes habitat protection and rehabilitation, education and fishing access research.
- Continued to provide fishery assessment and technical expertise to Lake Superior tribes including establishment of lake sturgeon index surveys, coaster brook trout assessment and inland lake and stream management.

Goal #2 Minimize the impact of contaminants on fishery and wildlife resources.

CONTAMINANT ASSESSMENT

- Investigated the role of the invasive fish species, round goby, in trophic transfer of toxic contaminants formerly directed to the benthos by dreissenid mussels.
- Presented paper: “*Food web biomagnification of persistent environmental contaminants facilitated by the invading round goby (Neogobius melanostomus).*” 2001. Great Lakes Research Consortium Annual Conference.
- Presented paper: “*Experimental analysis of native sportfish predation on the round goby (Neogobius melanostomus).*” 2001. International Association of Great Lakes Researchers Annual Conference.
- Developed a geographic information system– based decision tool for Cuyahoga River transportation that will make State, Federal, and local planners aware of environmentally sensitive areas in the planning of transportation corridors.
- Conducted, along with other trustees, a Natural Resource Damage Assessment for the Kalamazoo River in Michigan that will restore and protect habitat for fish and wildlife injured by hazardous substances.
- Conducted contaminant analysis in the Rochester Embayment Area of Concern by collecting sediment samples to determine sediment characteristics and contaminant concentrations, for sediment toxicity testing, and to measure contaminant concentrations in macroinvertebrates and lake sturgeon.
- Joined an Interagency Response to a Rouge River and Detroit River Oil Spill of more than 60,000 gallons of used oil in April of 2002; helped assess damage to wildlife, conduct wildlife recovery and rehabilitation, and advise the Coast Guard on cleanup actions.
- Conducted a fish survey of shallow vegetated habitats within the Buffalo River Area of Concern resulting in a report, “*Fish utilization of aquatic vegetation beds in the Buffalo River,*” to be used in determining priorities for sediment cleanup and provide baseline information to measure fish community changes following contaminant cleanup.
- Completed a survey of mussels in the Kalamazoo River to help guide remediation and restoration planning for the PCB-contaminated river.
- Analyzed mercury levels in selected sportfish species in Indian and Narrow Lakes at Fort Drum, New York by collecting samples of various sportfish species in the lakes and determining species and size specific tissue burdens of mercury to create a future fishery management plan for the lakes.
- Identified contaminant impacts to fish and wildlife and remediated contamination to reduce impacts at Great Lakes Watershed Sites such as York Oil, ALCOA, Reynolds Metals and Onondaga Lake.
- Measured contaminant levels in red-breasted mergansers from the Green Bay Island National Wildlife Refuge to determine how much contaminants have declined since the beginning of this long term study in 1975.
- Co-authored a scientific paper stating that most or all of the depression in reproductive rates in Green Bay bald eagles from 1897-1996 was caused by environmental contaminants and that recent observations suggest that reproduction in the Green Bay population has improved – further studies are underway to determine if this is related to continued declines in contaminant levels in this species.
- Published six scientific reports documenting the relative contributions of several persistent contaminants in reproductive impairment of Great Lakes fish-eating birds and integrated the results into the Green Bay/Fox River Natural Resource Damage Assessment.

- Conducted, with the Michigan Department of Environmental Quality, an ecological risk assessment for dioxin-like compounds in the Tittabawassee River, including measuring exposure to wood ducks and hooded mergansers in that floodplain and in a reference area.

RESTORATION & CLEAN-UP

- Worked via a Natural Resource Damage Assessment for a #2 Diesel fuel spill in Fish Creek to restore the pristine Fish Creek watershed to pre-spill conditions and to improve and enhance endangered mussel populations.
- Worked with U.S. EPA to reduce impacts to natural resources during cleanup activities following a train derailment that released diesel fuel and lubricants into wetlands at the headwaters of the Huron River in Michigan.
- Restored natural hydrology for coastal wetlands lake plain prairie on 391 acres of public lands along Saginaw Bay through the Saginaw River and Bay Natural Resource Damage Assessment Settlement and, through partnering with others on a North American Wetland Conservation Act grant, restored native vegetation on an upland portion of one of the restored sites.
- Developed and implemented a comprehensive management plan for environmental enhancement of the Ashtabula River and tributaries to support the Ashtabula River Remedial Action Plan.
- Developed strategies to clean up contaminants in the Ottawa River.
- Worked with other trustees and the defendants in the Saginaw River and Bay Natural Resource Damages Settlement, to convert approximately 30 acres of undeveloped industrial property to public nature park, built two boat launches with river overlooks, significantly enhanced a third boat launch, and added an accessible platform for viewing Saginaw Bay and its coastal wetlands.

MONITORING

- Continued long-term monitoring of bald eagle productivity and contaminant exposure in the Great Lakes basin to provide data for water quality criteria, fish passage decisions, remediation of contaminated sediments, and claims for natural resource damage assessments.
- Worked with the Canadian Wildlife Service and others to monitor contaminant exposure to herring gulls throughout the Great Lakes basin.
- Worked with Dr. Keith Grasman at Wright State University to monitor reproduction, growth, and immune function in Great Lakes fish-eating birds including herring gulls, Caspian terns, and black-crowned night-herons.

NATURAL RESOURCE DAMAGE SETTLEMENTS

- In cooperation with other trustees, completed a final Natural Resource Damages Assessment Settlement with Georgia-Pacific (formerly Fort James Corporation) to provide habitat for fish and wildlife species, to conduct aquatic habitat quality improvement projects to restore and enhance aquatic habitat, and to improve outdoor recreational facilities associated with riverine or coastal habitat recreation, appreciation or education.
- Reached a \$28.2 million Natural Resource Damage Assessment settlement with General Motors and other parties which has resulted in cleanup of 342,000 cubic yards of sediment contaminated with PCBs from Michigan's Saginaw River and restoration of coastal wetlands and lake plain prairies around Saginaw Bay. Additionally, the settlement funded the purchase of 1,677 acres of wildlife habitat, restoration of fish spawning grounds at Tobico Marsh, facilities for and restoration of habitat at the Green Point Environmental Learning Center in Saginaw, Michigan, construction and operation of two boat launches on the River and improvements to one on the Bay, as well as future monitoring and restoration.

- Reached a Natural Resource Damage Assessment settlement for the American Chemical Services Site to restore 82 acres of palustrine wetlands by developing a restoration plan including National Environmental Policy Act compliance, public comment, design of suitable restoration options, contracting, implementation and follow-up monitoring.
- Reached a Natural Resource Damage Assessment settlement for the Ft. Wayne Reduction Dump to convey 75 acres of agricultural land adjacent to the Maumee River to the Indiana Department of Natural Resources and implement reforestation efforts on this property.
- Achieved Clean Water Act and Natural Resource Damage Consent Decrees, in 1998, for the remediation and restoration of 5 miles of the Grand Calumet River and enhancement or restoration of 321 acres of habitat.
- Achieved a Natural Resource Damage Consent Decree, in 2002, worth nearly \$63 million, to be used for the remediation and restoration of 10 miles of the Grand Calumet River and Indiana Harbor Canal and enhancement or restoration of 375 acres of habitat.
- Achieved a Court approved interim settlement with other trustees, the U.S. Environmental Protection Agency, Appleton Papers Incorporated and NCR Corporation for \$40 million in remedial and restoration work, and reimbursement of \$1.5 million in assessment costs, in exchange for an agreement to pursue a negotiated settlement in lieu of litigation for at least the next four years.
- Reached a settlement with the responsible parties for the North Bronson Industrial Site for damages to migratory birds and other natural resources injured by hazardous substances released to ponds and a stream. Planning is underway to use the \$100,000 settlement to improve migratory bird habitat and stream quality in the watershed.

OUTREACH

- Documented that mercury levels in some northern pike and yellow perch fillets exceed State and/or Federal criteria for the protection of humans and recommended interim consumption advice for certain fish species on Seney National Wildlife Refuge. Submitted the data to the Michigan Department of Community Health for possible formal consumption advice, and initiated public outreach to inform and educate refuge visitors and sport fishermen.
- Presented a report, "*Aerial Imaging to Identify Groundwater Upwellings*" to members of the Lake Superior Technical Committee summarizing the results of a model project done by the Service to test the feasibility of using aircraft-mounted, hyperspectral video and high resolution visible and infrared photographic techniques to identify and locate groundwater upwellings.
- Worked with the Northeastern Illinois Planning Commission to develop a new Water Strategy for the region and identified about 15 major issues that affect water quality in the six county area along with strategies to address the issues and produce local governmental policies that will be more protective of the region's waterways, lakes and wetlands.

Goal #3 Protect, maintain, and where degraded and destroyed, restore fish and wildlife habitat, including the enhancement and creation of wetlands that result in a net gain in the amount of those habitats.

WETLAND PROTECTION AND RESTORATION

- Developed biological indicators to assess the condition and status of 135 river-mouth coastal wetlands in the Great Lakes and connecting channels.
- Restored or enhanced 5,684 wetland acres on private lands, increasing both the quality and quantity of fish and wildlife habitat beneficial to waterfowl, shorebirds and wading birds.
- Partnered to protect a 3 acre scrub-shrub wetland from degradation by funding purchase of 420 feet of 18-inch diameter non-perforated tubing that allowed adequate drainage for the upstream watershed, and provided a water tight conduit in the wetland portion of the project.
- Worked with the State of Illinois and several non-governmental resource organizations to restore 68 acres of rare fen wetlands in northeast Illinois via brush removal and control of exotic species on seven fen wetlands dedicated as Illinois Nature Preserves.
- Restored a 1 acre emergent wetland in Allen County, Ohio.
- In collaboration with The Conservation Fund, awarded \$281,000 in fiscal year 2001 to fund 8 wetland restoration projects in the Chicago area.
- Restored thirty-six wetland sites in southern Michigan totaling 193 acres in Hillsdale and Lenawee counties.
- Completed an agreement with the Natural Resources Conservation Service and the Wisconsin Department of Natural Resources to establish a streamlined wetland restoration permitting process that is economically efficient and will result in more wetlands being restored by allowing more efficient use of both Federal and State funding and staff.
- Worked to ensure that the U.S. Army Corps of Engineers' Clean Water Act, Section 404, and Rivers and Harbors Act, Section 10, permits minimized project impacts on wetlands and other waters of the Great Lakes.
- Designated the Northern Montezuma Wetlands, one of the most important staging and migration areas for waterfowl in the northeastern U.S., as an Atlantic Coast Joint Venture focus area and approved four North American Wetlands Conservation Act (NAWCA) grants to protect, restore and enhance over 11,000 acres within this important wetland complex.
- Collaborated to construct a lakefront dike, containing a fish access and control structure, to restore the wetland habitat and ecological benefits of the historically important Metzger Marsh and to ensure benefits of this 960 acre restoration project to the Lake Erie fish community.
- Provided review of large scale mitigation projects and created criteria to select mitigation sites as part of the Mitigation Bank Review Team toward creating meaningful mitigation and quality wetlands.

STREAM PROTECTION AND RESTORATION

- Fenced 2,278 feet of Johnson Creek riparian zone, a tributary of Lake Ontario, to protect it from livestock damage and restored 4,200 feet of streambank.
- Completed the first phase of the Marsh Creek watershed restoration at Seney National Wildlife Refuge and restored water flow to three miles of the creek
- Restored approximately 2,000 feet of stream bank on the Driggs River at Seney National Wildlife Refuge to improve fish habitat.
- Helped to facilitate implementation of streambank restoration on the Black River in Michigan.
- Helped to facilitate a biological and hydrological assessment of the Buffalo River watershed in western New York.

FISH PASSAGE

- Established and coordinated the Great Lakes Coastal Program which has restored or protected more than 1000 acres of coastal habitat, protected and restored over 14 miles of riparian habitat and reopened over 10 miles of stream to the passage of anadromous trout and salmon.
- Helped to facilitate fish passage and wetland restoration on Johnson Creek at Lyndonville, New York.
- Completed 3 road-stream crossing improvement projects in Michigan by replacing culverts with bridges, resulting in reduced sediment deposition into the stream and restoring fish passage, including twelve miles of brook trout habitat in Michigan's northern lower peninsula.
- Established Whittlesey Creek National Wildlife Refuge in 1999 with objectives to protect and restore several streams and creeks for migration, spawning and rearing of Lake Superior trout and salmon; 97 acres have been acquired from willing sellers with an eventual goal of acquiring 540 acres.
- Participated in the development of the National Inventory of Barriers to Fish Passage database to assist decision makers with prioritizing, visualizing, analyzing and implementing projects for improving fisheries habitat; this database is now being included in the Environmental Conservation Online System.
- Participated in hydropower licensing renewal process at facilities along the St. Lawrence, Raquette, Oswego, Black and Oswegatchie Rivers resulting in improved fish passage and wetland protection and restoration.
- Completed 13 region-wide fish passage projects through the National Fish Passage Program, including culvert or road crossing renovations, dam removals, and fish passage structures; these projects have provided access to 159 miles of river habitat and 960 acres of wetland habitat for fish spawning, rearing, and feeding.
- Restored the 342 acre Eagle/North Marsh Complex at Shiawassee National Wildlife Refuge enhancing passage of spawning adult and juvenile fish as well as enhancing habitat for migratory birds.
- Worked with the Ohio Division of Wildlife, the National Fish and Wildlife Foundation, and local watershed groups to open 10 miles of river habitat for fish passage along the Ottawa River in Toledo, Ohio by removing a low head dam on the Boy Scout Camp, Miakonda.

HABITAT ASSESSMENT TO IMPROVE SPECIES CONSERVATION

- Studied mitigated wetlands with the Max McGraw Wildlife Foundation to provide better information on wildlife use of mitigated wetlands in the Chicago region.
- Calibrated remote sensing imagery of coastal wetlands of Lake Ontario and the St. Lawrence River to evaluate the effects of water level management practices, resulting from construction of the St. Lawrence Seaway, on the long-term health of lower Great Lakes coastal wetland ecosystems.
- Conducted fishery surveys at selected marsh complexes at Shiawassee National Wildlife Refuge to determine accessibility to spawning habitat and provide management recommendations to NWR for improved marsh management that will aid in recovery of depleted northern pike stocks in Saginaw Bay.
- Developed the Lake Michigan Islands Decision Support System to assist with the management and analysis of habitat within Lake Michigan for aquatic species and migratory birds.
- Created a base map of habitat restoration sites along the Ottawa River in Ohio to function as an evolving database for the local watershed groups and agencies to utilize in support of watershed restoration efforts.
- Worked with the Ohio Division of Geological Survey to conduct habitat mapping of the Sandusky River as part of a larger Great Lakes Protection Fund project designed to develop a model for large dam removals and habitat restoration techniques in river systems.
- Analyzed Atlantic Coast waterways, including the St. Lawrence River System and Lake Ontario tributaries, for the availability of unimpeded American eel habitat; producing spatial data coverage of unobstructed and historical habitat.

- Conducted field surveys of fish communities in selected Lake Erie and Lake Ontario wetlands and coastal marshes, and in the Niagara and St. Lawrence Rivers, to identify the most important environmental factors relevant to successful fish reproduction and recruitment in Great Lakes coastal wetlands; these efforts will result in greater protection or restoration of this critical, and increasingly rare habitat type.
- Conducted habitat and fish community assessments at degraded Seneca Bluffs riverine wetland areas identified for restoration in the Buffalo River floodplain, and provided technical input and recommendations for improvement of in-stream and riparian zone habitat to improve native fish, amphibian and aquatic invertebrate population health.
- Assisted development of the “Lower St. Louis River Habitat Plan” identifying specific strategies and actions to conserve fish and wildlife resources and restore habitat along the St. Louis River in Duluth, Minnesota and Superior, Wisconsin.

MULTIPLE HABITAT TYPE PROTECTION AND RESTORATION

- Protected, acquired and restored coastal habitats and conducted outreach, research, planning and monitoring of Great Lakes coastal habitats via funding and collaborative opportunities provided by the Great Lakes Fish and Wildlife Restoration Act, the Binational Program, the Service’s Great Lakes Coastal Program, the Partners for Fish and Wildlife Program, the North American Waterfowl Management Plan, and the Superior Coastal Wetland Initiative.
- Restored Ridge Park, a Chicago natural area that provides habitat and education for city dwellers.
- Planted 235 acres of native prairie on private lands in Sandusky County and restored waterfowl nesting habitat and winter habitat for game and non-game birds.
- Formed the Great Lakes Ecosystem Team Islands Committee to enhance the conservation of the world’s largest inland island system through development of collaborative partnerships. These islands provide important habitat for waterfowl, are important stopover sites for many migratory and neo-tropical migrant birds, provide spawning and nursery areas for many fish species and provide habitat for plants that are found nowhere else.
- Restored 80 acres of dune and swale habitat through removal of invasive trees and brush and benefited four federally-listed species and expanded grassland bird habitat.
- Assisted in restoring or enhancing 450 acres of wetlands and 930 acres of uplands as part of the following projects: Wetland and Eastern Prairie Fringed Orchid Habitat Enhancement, Nelson Lake Marsh - Reed Canary Grass Management, Mud Lake Marsh Restoration, Tri-County Sedge Meadow Enhancement, Woods Creek Riparian Corridor Restoration and Mill Creek Floodplain Restoration and Stewardship.
- Completed approximately 138 Service Challenge Cost-Share Program projects valued at more than \$3 million during Fiscal Year 2002. Approximately 150 wetland acres and 1,100 upland acres were restored, 25 projects to enhance recreational fishing opportunities on national wildlife refuges were carried out, and hunting, fishing, wildlife observation, hiking, photographic and other recreational opportunities were enhanced on Service lands.
- Restored 1,740 acres of grassland and increased habitat for grassland-dependent migratory birds – including 61 grassland restoration projects in fiscal year 1999.

LAND ACQUISITION

- Acquired most of Big Charity Island and all of Little Charity Island in Lake Huron's Saginaw Bay, Michigan via General Motors purchase of the islands from private landowners and transfer to the Service as part of the Saginaw River and Bay Natural Resource Damage Assessment Settlement. The islands are managed by Shiawassee National Wildlife Refuge as part of the Michigan Islands National Wildlife Refuge.

- Accepted the donation of 18 acre Mud Island by National Steel Corporation as a potential Detroit River National Wildlife Refuge addition to be managed to benefit wildlife and provide opportunities for other wildlife-dependent uses, including hunting, fishing, wildlife observation and photography.

OUTREACH

- Assisted the Ohio Department of Transportation in developing consultation guidelines for federally endangered freshwater mussels in Ohio to be included in the Ohio Department of Transportation Ecological Guidelines manual.
- Co-hosted a conference entitled "*Midwestern Ephemeral Wetlands: A Vanishing Habitat*," in Chicago, Illinois, which covered topics ranging from organismal use of ephemeral wetlands, to related conservation, funding, research and regulatory issues.
- Produced Fish and Wildlife Coordination Act Reports for projects conducted in Rochester Harbor, Irondequoit Creek, and Athol Springs highlighting actions that minimized impacts of U.S. Army Corps of Engineers activities conducted in these areas on fish and wildlife resources and providing recommendations for mitigation of unavoidable impacts.

Goal #4 Stop illegal activities adversely impacting fishery and wildlife resources.

GREAT LAKES FISH AND WILDLIFE PROTECTION

- Conducted numerous patrols and combined investigations of illegal Great Lakes commercial fishing activities.
- Participated in several joint Federal/State/Canadian border details including boat patrols along the Great Lakes looking for commercial fishing vessel incursions and border inspections of sportsmen returning to the U.S. from Canada.

PROSECUTION

- Convicted L. R. Jackson Fisheries LTD, a Canadian company, of illegal harvest of fish in the U. S. waters of Lake Erie and secured a settlement of \$15,000 for Great Lakes fish protection which was deposited in the National Fish and Wildlife Foundation's Great Lakes Fisheries Conservation Fund.
- Prosecuted the Weyco Group Inc., a Wisconsin company, of grossly exceeding a permit to destroy herring gull and ring-billed gull nests and eggs and secured \$15,000 in criminal fines, as well as a donation to the National Fish and Wildlife Foundation, Great Lakes Fisheries Conservation Fund, to be used for the conservation of colonial water birds in the Great Lakes region.
- Prosecuted a Chicago area attorney for smuggling two olive ridley sea turtle shells, six hinge-back tortoise shells, two elephant ivory carvings, eight pair of elephant ivory ear rings, nine monitor lizard skin wallets and nine elephant ivory handle and tip walking canes in violation of the 'Endangered Species Act' and the 'African Elephant Conservation Act.' A total of \$4,615 in fines were collected and several of the seized items were donated to the DuSable Museum of African-American History in Chicago for African wildlife education.
- Collaborated with Dr. Brian Beard of the University of Wisconsin who conducted an analysis of strontium isotope antler content to convict a Wisconsin hunter of illegally taking a trophy buck from Michigan. The poacher was sentenced to 30 days in jail, fined \$2,000, placed on five years probation and ordered to perform 1,000 hours of community service for violations of the Lacey Act.
- Confiscated 23,590 grams of undeclared Russian sturgeon caviar valued at \$5,000, that was imported in violation of CITES, and discovered in passenger's luggage.
- Prosecuted 3 individuals for illegal dam construction on the Shiawassee National Wildlife Refuge;
- Prosecuted 10 individuals for violation of migratory bird hunting regulations as part of a Great Lakes joint waterfowl task force operation in 1999.
- Prosecuted an individual for smuggling Asian Arowanas, an endangered fish, into the U.S. at the Rainbow Bridge, Niagara Falls in 2002.
- Prosecuted 10 individuals in 1999 for their involvement with the mass killing of cormorants on Little Galloo Island in eastern Lake Ontario. This action resulted in terms of incarceration ranging from probation to six months home confinement, and individual fines up to \$2,500; additionally, a cumulative contribution of \$27,500 was made to the National Fish and Wildlife Foundation to support wetland restoration and enhancement projects in the Lake Ontario region.
- Prosecuted a Canadian individual for smuggling CITES protected birds into the United States from Canada. Further investigations revealed efforts to smuggle thousands of exotic tropical finches into the U.S.; these actions resulted in the first prison sentence handed down under the U.S. Wild Bird Conservation Act.

OUTREACH

- As part of Chicago's Shedd Aquarium Phillipines Exhibit, the Service's Wildlife Inspection Program is featured via seized wildlife and numerous 'tacky' examples of commercialization in wildlife products, including strange items made from shells and coral are exhibited to demonstrate how purchases of these items contributes to the destruction of coral reefs and the marine environment.
- The Wildlife Inspection Program at O'Hare Airport was featured on the A&E Television Program "*Behind Closed Doors with Joan Lunden*," providing national exposure for and helping inform the public about wildlife import and export laws.

Goal #5 Restore threatened and endangered species to viable, self-sustaining levels.

MAMMALS

GRAY WOLF

- Reclassified the gray wolf from endangered to threatened in Michigan and Wisconsin and established a special rule to allow State and Tribal personnel to use lethal methods to control depredation. Reclassification included preparation of the proposal; conducting six informational meetings and public hearings on the proposal to explain the proposal, to answer questions, to hear concerns, and to receive new information; and finalizing the proposal.
- Worked with the State of Wisconsin to address depredation problems on deer farms.
- Funded wolf monitoring activities in Wisconsin and Michigan.
- Participated as an observer to the citizen's advisory committee, which is considering the proposal by Defenders of Wildlife to reintroduce the Eastern timber wolf into the Adirondack Mountains in New York.
- Maintained web pages that provide information about wolf biology, status, threats, Service activities etc. The website included an email address for questions and we responded to thousands of information requests from the public.

INDIANA BAT

- Conducted Section 7 consultation with the USDA Forest Service regarding the "*Land and Resource Management Plan for the Finger Lakes National Forest*" by assisting the Forest Service in conducting mist netting surveys to help determine the presence or absence of Indiana bats during the summer months.
- Completed a comprehensive "*Cuyahoga Valley National Park Bat Inventory*" with emphasis on understanding the status of the federally listed Indiana bat.

BIRDS

KIRTLAND'S WARBLER

- Continued a multi-decade long brown-headed cowbird trapping program to save the Kirtland's warbler from extinction. Cowbirds are nest parasites that lay their eggs in warbler nests; as a result, the cowbird young are raised instead of warblers.
- Planted 525,000 jackpine seedlings at Seney National Wildlife Refuge, to benefit Kirtland's warblers.
- Conducted guided tours to Kirtland's warbler nesting areas to provide opportunities for birdwatchers to see this endangered species.
- Conducted annual Kirtland's warbler singing male surveys to document the species population and response to habitat management.

PIPING PLOVER

- Designated 201 miles of mainland and island shoreline in eight Great Lakes states as critical habitat for endangered breeding populations of the piping plover.
- Conducted six public meetings and hearings to explain the Piping Plover critical habitat proposal, to answer questions on the proposal, and to receive information and comments from the public.
- Worked with the Michigan DNR to train volunteers to monitor and protect piping plover nests, and to distribute information to the public.

- Worked with the U.S. Army Corps of Engineers Buffalo District on a proposed habitat restoration plan at Sheldon Marsh State Nature Preserve in Ohio, which is designated Critical Habitat for the piping plover.
- Prepared the draft revised recovery plan for the Great Lakes population of the piping plover in August of 2002.
- Negotiated the "*Magic Carpet Woods Association Habitat Conservation Plan*," which provides 25 years of monitoring and protection for piping plover and Pitcher's thistle on one-half mile of Lake Michigan beach in Leelanau County, Michigan.
- Coordinated efforts to protect piping plover critical habitat at Sheldon Marsh Barrier Beach in Ohio.

WHOOPING CRANE

- Completed the first two years of leading captive-reared whooping cranes by ultralight aircraft from summering grounds at Wisconsin's Necedah National Wildlife Refuge to wintering in the Gulf coastal marshes of Chassahowitzka National Wildlife Refuge in Florida. Five whoopers returned on their own to central Wisconsin in spring 2002 while an additional 16 young birds successfully made an ultralight-led flight to Florida in autumn 2002. These flights mark an important milestone in re-establishing this species in portions of its former eastern U.S. range and a close cooperative effort between the Service, 20 State natural resource agencies, private landowners, and several nongovernmental organizations.

BALD EAGLE

- Documented the continuing recovery of the Great Lakes bald eagle population and collected genetic samples to determine if recovery has resulted from improved health of this population or merely reflects immigration from surplus eagles produced in less contaminated inland habitats.

REPTILES & AMPHIBIA

LAKE ERIE WATER SNAKE

- Discussed development of consistency in the issuance of Federal, State, and local permits for island construction projects, sea wall and dock designs that may affect the federally listed threatened and State-listed endangered Lake Erie water snake.
- Conducted a Lake Erie water snake telemetry study to increase understanding of life history traits of the Lake Erie water snake to aid in the recovery of the species.
- Implemented a Lake Erie Water Snake Outreach Program complete with the newsletter, "*LEWS News*," brochures, posters, and signs to increase awareness of the Lake Erie water snake.
- Completed the Lake Erie water snake Draft Recovery Plan.
- Worked with the Long Point Homeowner's Association, LLC, to develop a Habitat Conservation Plan for the Lake Erie water snake to permit development while protecting the snake and its habitat; the HCP was finalized and an incidental take permit was issued in 2003.
- Printed and distributed Lake Erie water snake conservation signs that over 400 island landowners put on their docks, buildings, and other property.

EASTERN MASSASAUGA RATTLESNAKE

- Conducted a habitat management and improvement project for the eastern massasauga rattlesnake a candidate species, at a site in Onondaga County in New York.
- Participated in a workgroup to develop management guidelines for the eastern massasauga rattlesnake to assist land managers and landowners in identifying sound conservation actions for this species.

Appendix II

- Conservation activities between State and Federal agencies and private landowners are being coordinated to remove or preclude the need to list this species. Massasauga conservation actions include development and distribution of a survey protocol and land management guidance; one-on-one contacts with private landowners; and public information.
- The Service is working with each state in the range of the species to develop Candidate Conservation Agreements to implement the land management guidance on public lands.

BOG TURTLE

- Conducted a habitat management and improvement project for the bog turtle at a site in Oswego County, New York by restoring wetland hydrologic conditions and providing tussock sedge habitat.
- Provided funds to conduct surveys for the bog turtle and to identify and characterize bog turtle habitats by gathering data on the physical and biological features at historic and newly found sites to assist in bog turtle protection and recovery and focus management efforts.

FISH

LAKE STURGEON

- Evaluated the survival and habitat use of 3000 stocked lake sturgeon and assessed habitat quality in several tributaries as part of a project to enhance lake sturgeon populations in the Oswegatchie River, a tributary of the St. Lawrence River.
- Surveyed adult and juvenile lake sturgeon populations in the Niagara River to determine distribution, movements and habitat use.
- Coordinated lake sturgeon genetic evaluation activities in the Great Lakes and completed the report, "*Great Lakes Lake Sturgeon Genetics Status Assessment: An Analysis of Samples, Methods, and Standardization.*"
- Assessed the suitability of the Genesee River for lake sturgeon restoration.
- Negotiated favorable stream flows downstream of hydroelectric projects that dramatically improved spawning success.
- Gathered data to describe the current status of remnant lake sturgeon populations throughout the Great Lakes. Data included size of spawning populations, reproductive success, genetic identity, use and suitability of existing habitat.

INSECTS

KARNER BLUE BUTTERFLY

- Completed a draft of the Karner Blue Butterfly Recovery Plan that prioritizes conservation actions necessary to recover this endangered species and identifies goals for reclassification.
- Developed the first statewide Habitat Conservation Plan (HCP) in the nation. This HCP has 27 partners responsible for 256,000 acres of habitat in Wisconsin.
- Hosted the annual Karner Blue Recovery Implementation Workshops that allow coordination of recovery activities among all partners, with an emphasis on habitat restoration on private lands.
- Worked with the Ohio Karner Blue Butterfly Recovery Team and the Oak Opening Working Group to reintroduce Karner blue butterflies to northwest Ohio.
- Developed a Safe Harbor Agreement for the Karner blue butterfly in the Lake Michigan lake plain of Indiana to encourage and facilitate restoration and enhancement of habitat.
- Provided \$1.47 million under the Cooperative Endangered Species Conservation Fund in 2000 to Wisconsin to acquire lands for the conservation and recovery of the Karner blue butterfly under the Wisconsin Statewide HCP.
- Completed 61 grassland restoration projects on private land in 1999 encompassing 1,129 acres of grassland acres; 352 acres will directly benefit this species.
- Developed a protocol for a successful Karner blue butterfly captive breeding program.

HINE'S EMERALD DRAGONFLY

- Completed the Hine's Emerald Dragonfly Recovery Plan.
- Conducted two workshops to train field biologists to identify the species habitat.
- Prepared and distributed a brochure for the general public that included information on identification, threats, conservation actions and benefits of conservation.

PLANTS

EASTERN PRAIRIE FRINGED ORCHID

- Authored the *Eastern Prairie Fringed Orchid Recovery Plan* to protect and restore habitats that support the prairie orchid.
- Restored approximately 20 acres of habitat at the Uihlein Waterfowl Production Area resulting in a significant increase in the Eastern prairie fringed orchid population from 3 orchids in 1996 to more than 400 orchids in 2002.
- Trained volunteers to help survey for and hand pollinate plants (hand pollination is sometimes necessary because of the absence of the hawkmoth, which is the plant's primary pollinator). Continued surveys and monitoring of populations.
- Prepared voluntary guidelines for development and management of lands for conservation of this species.

NORTHERN WILD MONKSHOOD

- Achieved a milestone in conservation of northern monkshood plants in Ohio by negotiating with the City of Cuyahoga Falls and the Ohio Department of Transportation to secure construction of highway modifications to divert destructive road salt outwash from away from Ohio's largest population of this federally threatened species.

LAKESIDE DAISY

- Increased understanding of the life history and demographics of this federally listed Lakeside daisy at reintroduction sites on Kelleys Island.

FRESHWATER INVERTEBRATES

FRESHWATER MUSSELS

- Establishing a freshwater mussel research and propagation facility to increase biological understanding, facilitate reintroduction, provide a refugia and expand outreach and public education concerning threatened and endangered mussels and stream conservation.
- Implemented a stabilization project through the Fish Creek Natural Resource Damage Assessment to benefit the federally listed endangered white cat's paw pearly mussel, which is known only from Fish Creek in northeast Indiana and northwest Ohio.
- Restored approximately 105 acres of floodplain forest habitat to improve stream cover and reduce sedimentation and contaminant runoff threats to the clubshell mussel through a cooperative agreement with The Nature Conservancy.

CHITTENANGO OVATE AMBER SNAIL

- Conducted an intensive mark-release-recapture study for the highly imperiled Chittenango ovate ambersnail, a federally listed threatened species.
- Coordinated a 2002 revision of the *Chittenango Ovate Amber Snail Recovery Plan*, which was originally completed in 1983 and revised by the Service 1997.

MULTIPLE SPECIES RESTORATION EFFORTS

- Conducted more than 2,300 informal Section 7 consultations and provided responses for those proposed projects and activities in the Great Lakes watershed since January 1998. These informal consultations avoided take of listed species and minimized impacts on habitat of listed species.
- Conducted Section 7 consultations with the U.S. Army Corps of Engineers for two general permits for boat ramps and temporary water control structures in New York State to ensure protection of the federally listed bald eagle, piping plover, Indiana bat, bog turtle, Leedy's roseroot, and Houghton's goldenrod.
- Restored approximately 140 acres of wetland and grassland habitat to benefit the Mitchell's satyr and Karner blue butterflies, pitcher's thistle, and other species through a cooperative agreement with the Nature Conservancy.
- Maintain a website to provide the public with easy access to information on all the listed, proposed, and candidate species in the Great Lakes basin including Service activities pertaining to those species and/or the ESA, in general.

Goal #6 Protect, Manage and Conserve Migratory Birds.

POPULATION MONITORING

- Supported surveys for migrating songbirds and shorebirds at Ottawa National Wildlife Refuge, Ohio, verifying the significance of the Lake Erie shoreline to migrants; initiated bird surveys at the newly-established Whittlesey Creek National Wildlife Refuge, Wisconsin, and nearby Lake Superior coastal wetlands; and supported bird surveys on lands managed by the Red Lake Band of Chippewas in Wisconsin.
- With partners, surveyed colonial waterbirds to monitor population abundance, distribution, and trends, and to identify important colonies in need of protection. Identified the West Sister Island National Wildlife Refuge colony in Lake Erie as the most important colonial waterbird colony in the U. S. Great Lakes.
- Worked with partners to monitor migrating songbirds and determine their habitat preferences at several sites within the Great Lakes.
- Completed annual winter waterfowl aerial surveys to determine winter waterfowl use and make population estimates.
- Conducted a major cormorant banding project on the Gravel Island National Wildlife Refuge to determine the survival rate of this species for use in population models to help predict the effects of various management options for this abundant fish-eating bird.

RESEARCH

- Supported several research studies on nongame bird species of concern, including: common loon banding at Seney National Wildlife Refuge, Michigan to assess survival rates and site fidelity; surveys of yellow rails at Seney National Wildlife Refuge to monitor population trends and responses to habitat management; monitoring of common tern productivity in response to habitat enhancement and contaminants in Michigan; analyzing common tern band returns to better understand tern distribution and longevity; development of a research and monitoring plan for northern goshawks in the Great Lakes states; assessing migrant bird mortality at a new communications tower near Whitefish Point National Wildlife Refuge, Michigan; and determining the impacts of deer browsing on songbird habitats in northern Michigan forests.
- Initiated a major study comparing American woodcock mortality in hunted and unhunted areas in Minnesota, Wisconsin, and Michigan to better understand the impacts of hunting regulations and other mortality factors on woodcock survival.
- Supported the development of a cormorant status assessment and several studies on cormorant population dynamics, foraging behavior, and impacts on other colonial waterbirds in the Great Lakes.
- Found that cormorants were taking a relatively small percentage of catchable-size yellow perch around the Les Cheneaux Islands.
- Supported, via the Upper Mississippi River/Great Lakes Joint Venture of the North American Waterfowl Management Plan, mallard studies in Wisconsin, Michigan and Ohio, to develop a Decision Support System that will use Geographic Information System modeling to identify Great Lakes landscapes where partners can most effectively target waterfowl conservation efforts.
- Utilized satellite telemetry to determine whether molt-migrant resident Population Canada geese go north into arctic areas to molt.
- Captured and radio tagged 24 Bonaparte's Gulls in 2001, determined the average length of stay during migration, and estimated the total population that passes through the Niagara River Important Bird Area.

- Conducted field surveys for threatened and endangered species at the Niagara Falls Air Reserve Station and found two New York State threatened and endangered species, the short-eared owl and the northern harrier, for which management plans are being developed.

HABITAT CONSERVATION

- Identified focus areas within the North American Waterfowl Management Plan's Upper Mississippi River and Great Lakes Joint Venture, including the Green Bay and Lake Superior coastal watersheds in Wisconsin, the Saginaw Bay and Lake St. Clair watersheds in Michigan, and the Lake Erie coastal watersheds in Ohio.
- Participated in the Atlantic Coast Joint Venture/Eastern Habitat Joint Venture effort to plan and implement integrated bird habitat conservation in Lakes Erie and Ontario, the Upper St. Lawrence River, the Hudson and Mohawk Rivers, and the adjacent low-lying areas.
- Restored or enhanced more than 5,684 wetland acres and 1,740 grassland acres on private lands, all of which provide important habitat for migratory birds.
- Restored the 342 acre Eagle/North Marsh Complex to enhance passage of spawning adult and juvenile fish and enhance habitat for migratory birds.
- Enhanced 115 acres of wetlands on Shiawassee National Wildlife Refuge to improve migratory bird habitat.
- Accepted designation of the Cedar Point, Horicon, Ottawa, Seney, Shiawassee, West Sister Island, and Whitefish Point National Wildlife Refuges as Important Birds Areas by the American Bird Conservancy.
- Designated Ottawa National Wildlife Refuge and nearby Lake Erie marshes as a Western Hemisphere Shorebird Reserve Network Site.
- Surveyed State and Federal biologists throughout the Upper Mississippi River-Great Lakes shorebird planning region in the north-central United States, to identify important shorebird stopover locales, of which 178 sites were identified, including 18 areas that were considered of regional importance.

PLANNING AND COORDINATION

- Updated the Fish and Wildlife Service's Region 3 Resource Conservation Priorities document and identified 69 bird species that are of concern in the Great Lakes because they are rare/declining, recreationally important (hunted), or superabundant and causing "nuisance" problems.
- Worked with other agencies and organizations to develop Partners in Flight bird conservation plans that identified priority species, habitat conservation goals, and monitoring and research needs for landbirds in Bird Conservation Regions of the Great Lakes.
- Worked with partners to develop the U. S. Shorebird Conservation Plan and its regional component, which identified priority species, habitat conservation goals, and monitoring and research needs for the Great Lakes Region.
- Worked with partners to integrate conservation efforts for waterfowl, landbirds, shorebirds, and waterbirds within several Bird Conservation Regions that overlap the Great Lakes.
- Completed an Environmental Impact Statement on double-crested cormorant management to address the resolution of biological and social conflicts associated with expanding cormorant populations in areas of concern such as the Great Lakes-held public scoping meetings at several locations throughout the Great Lakes.
- Issued permits to control gulls at several sites in the Great Lakes for the benefit of common terns and to address human health and safety concerns.

- Developed the terms of an *Urban Conservation Treaty for Migratory Birds* with the City of Chicago and committed the Service to a long-term partnership with the City and its partners to benefit migratory birds by persuading downtown building owners to turn out lights during bird migration, identifying important bird areas that require special conservation measures, developing bird habitat in city parks, promoting native landscaping for homes and businesses, and ongoing bird education programs and festivals in parks and forest preserves.
- Consulted on the Multi-Agency Radio Communications System (MARCS) telecommunication tower system and reduced negative impacts to migratory birds due to the installation of a 200-tower system.

EDUCATION AND OUTREACH

- Held International Migratory Bird Day events in conjunction with partners at Horicon, Necedah, Ottawa, Seney, and Shiawassee National Wildlife Refuges, and the Columbus, Ohio, and Potter Park, Michigan, Zoos, in which thousands of people were educated about birds, and co-sponsored the 2001 Midwest Birding Symposium, held in Green Bay, Wisconsin.
- Produced fact sheets and a video on cormorants in the Great Lakes and sponsored a symposium on the status and management of cormorants in the Midwest.
- Assisted in the national outreach effort to announce the final delisting of the American peregrine falcon.

Proposal Review Committee Recommendation Letters 1999-2002



State of Wisconsin \ DEPARTMENT OF NATURAL RESOURCES

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April 30, 1999

Rob MacGregor, Chairman
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Robert Lange, Vice Chairman
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Dear Rob and Robert:

On Thursday, April 22, the Great Lakes Fish and Wildlife Restoration Proposal Review Committee met to consider letters of intent and pre-proposals for funding during FY99 under the Great Lakes Fish and Wildlife Restoration Act. Committee members present were Jack Wingate, Mike Donofrio, Bill Culligan, Sandra Orsatti, Ken Paxton, Steve Scott, Tom Trudeau, and myself. Charlie Wooley, Bob Adair, and Marg Dochoda were present as observers. I was asked to formalize the Committee's recommendations in this letter.

The Committee recommends the following:

1. Fund "Development of a lake-wide lake trout population model for Lake Superior – database standardization" (authored by Hansen and Sitar, sponsored by COTFMA, MDNR, and the Lake Superior Committee) at \$31,000 for FY99 and \$13,000 for FY00. This represents full funding over two years, except that the request for \$7,000 for two computers is not endorsed.
2. Fund "Assessment of Genetic Population Structure in Yellow Perch" (authored by Kapuscinski and Miller, sponsored by the Lake Michigan Committee and the IDNR) at \$30,000 for FY99.
3. Fund "Questionnaire regarding Fish Community Objectives for the St. Lawrence River" (authored by Alastair Mathers, sponsored by the Lake Ontario Committee) at \$2,300 for FY99. This funding is to be used for the development of a questionnaire by Dr. Tommy

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Rob MacGregor and Bob Lange - 04/30/99

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Brown, as described in the letter of intent. The Committee did not endorse funding for other portions of this proposal.

The Committee recommends further that the balance of funds available for FY99 (approximately \$25,000) be carried over to FY00, to be available to fund a genetic survey of the population structure of lake sturgeon in the entire Great Lakes basin. We ask that the Council of Lake Committees request Chris Lowie to form an *ad hoc* task group for the purpose of drafting a request for proposals for such a study. Chris is with the Lower Great Lakes FRO at 405 N. French Rd., Suite 120A, Amherst, NY 14228 (phone 716-691-5456).

Finally, the Committee, noting that the Act calls upon the Review Committee to operate under the guidance of the Council of Lake Committees, asks the CLC to provide additional guidance regarding the process for soliciting and reviewing projects. To that end, we will draft some recommended language for review by the CLC at the fall meeting.

Sincerely,



William H. Horns
for the Review Committee

cc: Charlie Wooley - USFWS
Review Committee (via e-mail)



Great Lakes Fishery Commission

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

2100 Commonwealth Blvd., Ste. 209, Ann Arbor, MI 48105-1563

U.S. GREAT LAKES FISH AND WILDLIFE RESTORATION REVIEW COMMITTEE

30 May 2000

Rob MacGregor, Chair
 Council of Lakes Committee
 Great Lakes Fishery Commission
 2100 Commonwealth Blvd., Suite 209
 Ann Arbor, MI 48105-1563

Dear Mr. MacGregor:

This letter is to serve as the transmittal from the Great Lakes Fishery Commission's Council of Lakes Committee regarding which projects are to be funded by Great Lakes Fish and Wildlife Restoration Act.

The following projects are recommended for funding:

Development of a Management Plan for Lake Sturgeon Within the Great Lakes Basin
 Based on Population Genetic Structure. Phase 1, Task 1, Subtask 1b
 (microsatellites) - Bernard May and Kim Scribner
 \$83,000 Final Report Due 31 December 2001

Development of a Management Plan for Lake Sturgeon within the Great Lakes Basin
 Based on Population Genetic Structure. Phase 1, Task 1, Subtask 1b
 (Mitochondrial DNA development and analysis) - Kim Scribner and Bernard May
 \$30,000 Final Report Due 31 December 2001

Development of an Age-Structured Yellow Perch Population Model for Lake Michigan
 James Bence \$58,499 Final Report Due 31 December 2002

Evaluation and Population-Based Modeling of Steelhead Smolt Production in the Lower
 Cattaraugus Creek, New York Watershed - David Orvos and Robert Roth
 \$15,443.50 Final Report Due 31 December 2002

Restoration of deep water cisco (*Coregonus hoyi*) in Lake Ontario - Steve LaPan, Tom
 Stewart, Randy Eshenroder, Glenn Hooper, Henry Buell, and Richard Colesante
 \$37,590 Final Report Due 31 December 2001

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Rob MacGregor, Chair
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Environmental Issues and the Restoration of River and Nearshore Habitats and
 Dependent Fish Stocks in Eastern Lake Erie - Todd Howell, Brian Schuter, Chris
 Wilson, Don Einhouse, Phil Ryan, Larry Halyk, and Warren Yerex,
 \$97,500 Final Report Due 31 December 2002

Lake Huron Aquatic Habitat Geographic Information System - Troy Zorn, Edward
 Rutherford, James Johnson, Robert Haas, Les Stanfield, and Michelle DePhilip
 \$114,500 Final Report Due 31 December 2002

Development of a Lake-Wide Acoustic Monitoring Program for Lake Superior Pelagic
 Fishes, Phase I: In situ Relations of Target Strength to Fish Size and Target
 Classification - Michael Hoff and Doran Mason
 \$45,867.50 (Project Cost is \$61,900) Final Report Due 31 March 2003

In the event that any of these projects are withdrawn by the principle investigator, the
 following projects are candidate studies to replace them. They are listed in rank order.

Determining the Threshold of Thiaminase-Containing Forage in the Diet of Atlantic
 Salmon That Will Produce Viable Offspring - Neil Ringler and George Ketola
 \$32,900 Final Report Due 31 December 2002

In situ Determination of the Depth and Thermal Habitat Used by Chinook Salmon
 (*Oncorhynchus tshawytscha*) - Ray Argyle and James Johnson
 \$54,000 Final Report Due 31 December 2001

Cesium 137 Based Estimates of Gross Energy Conversion of Siscowet, Humper, and
 Lean Lake Trout in Lake Superior - Bryan Henderson, Stephen Schram, and Don
 Schreiner
 \$15,000 Final Report Due 31 December 2001

Ecology and Restoration of Lake Superior Coaster Brook Trout Along the Keweenaw
 Peninsula of Michigan - Casey Huckins and Patrick Schmalz
 \$41,200 Final Report Due 31 December 2002

Two additional projects were very highly ranked by the Review Committee, however, they
 were not funded due to the large cost associated with the project and the lack of funds. If
 additional monies were to become available in the future, these two projects would receive
 high consideration for funding.

Rob MacGregor, Chair
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30 May 2000

Effect of a Thiamine Deficiency on Spawning Migration of Salmonids in the Great Lakes Basin and Development of Effective Thiamine Treatment Protocols for Adults and Eggs - John Fitzsimons, George Ketola, Dale Honeyfield, and Tom Chiotti
\$278,000 over 3 years

Toward the Development of Ballast Effluent Standards: Population Viability Analysis in Risk Assessment of Ballast-Associated Organisms - David Lodge, Greg Dwyer, Cindy Kolar, Kevin Drury, and John Drake
\$368,700 over 3 years

The Great Lakes Fisheries agencies are grateful for the opportunity afforded by the Restoration Act to support research in the Great Lakes by State and Tribal agencies working together with academia under the Joint Strategic Plan for management of Great Lakes fisheries. These funds will enable us to complete projects that will further our progress in managing the fisheries of the Great Lakes.

Sincerely,



Paul J. Wingate, Chair
Great Lakes Fish and Wildlife Restoration Proposal
Review Committee

PJW/vs

cc: Bob Adair, USFWS



Minnesota Department of Natural Resources

500 Lafayette Road
St. Paul, Minnesota 55155-40__

1 May 2001

Robert Lange, Chair
Council of Lakes Committee
Great Lakes Fishery Commission
2100 Commonwealth Blvd., Ste. 209
Ann Arbor, MI 48103

Dear Mr. Lange:

This letter is to serve as the transmittal from the Great Lakes Fishery Commission's Council of Lakes Committee regarding which projects are to be funded by the Great Lakes Fish and Wildlife Restoration Act with Fiscal Year 2001 funds.

The following projects, which are continuations of partially funded projects, are recommended for funding in FY2001:

Development of a lake-wide acoustic monitoring program for Lake Superior pelagic fishes, Phase I: In situ relations of target strength to fish size and target classification - Michael Hoff and Doran M. Mason
\$16,032.50 Final Report Due 31 March 2003

Lake Superior lake trout model - Michael Hansen
\$13,000 Final Report Due 31 December 2001

The following projects are recommended for full funding in FY2001:

In situ determination of the depth and thermal habitat used by chinook salmon (*Oncorhynchus tshawytscha*) - Ray L. Argyle
\$30,000 Final Report Due 31 December 2004

Little Silver Creek habitat proposal - Michael Donofrio
\$20,000 Final Report Due 31 December 2003.

Effect of thiamine deficiency on spawning migration of salmonids in the Great Lakes Basin and development of thiamine treatment protocols for adults and eggs - John Fitzsimons
\$43,500 Final Report Due 31 March 2002

Cesium 137 based estimates of gross energy conversion by siscowet, humper, and lean lake trout in Lake Superior - Bryan A. Henderson, Stephen Schram, and Donald Schreiner
\$11,000 Final Report Due 31 December 2002

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Robert Lange
1 May 2001
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Thermal and depth distribution of lake trout in MI-4 - Bill Mattes and Roger Bergstedt
\$55,800 Final Report Due 31 December 2003

Estimating survival rates of Lake Superior lake trout - Kenneth H. Pollock and Mary
C. Fabrizio
\$35,900 Final Report Due 30 September 2002

Genetic assessment of wild and hatchery contributions to steelhead recruitment and to
harvests in open water Lake Michigan fisheries: effects of historical and
contemporary management practices - Kim T. Scribner
\$88,070 Final Report Due 31 August 2003

Analysis and modeling of the spatial and temporal dynamics of the Lake Erie walleye
fishery - Patrick J. Sullivan
\$64,000 Final Report Due 30 September 2003

Lake Huron aquatic habitat geographic information system (GIS) - Troy Zorn
\$92,800 Final Report Due 31 December 2002

Restoration of deepwater ciscoe (*Coregonus hoyi*) in Lake Ontario - Tom Stewart,
Randy Eshenroder, and Glenn Hooper
\$8,000 Final Report Due 31 December 2002
This project is a repeat of last year's work when they were unable to collect
deepwater ciscoe due to adverse weather conditions.

In the event that any of these projects are withdrawn by the principle investigator, the
following projects are candidate studies to replace them. They are listed in rank order:

Increased funding level for the Argyle study which would buy more tags \$10,000

Increased funding level for the Donofrio study which would allow more habitat
improvement work \$10,000

The application of pheromones to disrupt the reproductive behavior of the round goby
in Lake Erie habitats where the survival of native fish is threatened - Weiming
Li, Lynda Corkum, Tim Johnson, Robert Letcher, and Barbara Zielinski
\$66,190 Final Report Due 30 June 2002

Development of standardized fishery surveys for habitats dominated by invading
Dreissena mussels - Jeffrey Schaeffer
\$42,550 Final Report Due 30 December 2002

Robert Lange
1 May 2001
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Four additional projects were very highly ranked by the Review Committee, however, they were not funded due to the large cost associated with the project and/or the lack of funds. If additional monies were to become available in the future, these projects would receive high consideration for funding.

Development of a Great Lakes fish distribution data base and web-based atlas of Great Lakes fishes - G.R. Smith and N.E. Mandrak
\$192,937 over 2 years

Rehabilitation of aquatic and terrestrial communities in Lake Superior tributary streams located within the Red Cliff Reservation, Wisconsin - Gregory J. Fischer
\$50,000 over 2 years

Effects of low level aquatic contaminants on lake trout olfaction and reproduction:
Implication in rehabilitation - Weiming Li and Toshiaki Hara
\$252,000 over 3 years

Restoration of Atlantic salmon (*Salmo salar*) to the Lake Ontario drainage: A model to reduce the potential impacts of non-native salmon - David L.G. Nookes, F. William H. Beamish, and Robert J. Scott
\$216,880 over 3 years

The Great Lakes Fisheries agencies are grateful for the opportunity afforded by the Restoration Act to support research in the Great Lakes by State and Tribal agencies working together with academia under the Joint Strategic Plan for management of Great Lakes fisheries. These funds will enable us to complete projects that will further our progress in managing the fisheries of the Great Lakes.

Sincerely,



Paul J. Wingate
Fisheries Research Manager and Chair,
Great Lakes Fish & Wildlife Restoration
Proposal Review Committee

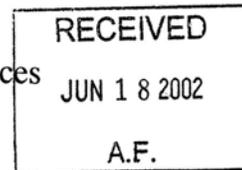
PJW/vs

cc: Bob Adair, USFWS



Minnesota Department of Natural Resources

500 Lafayette Road
St. Paul, Minnesota 55155-40__



7 June 2002

Robert Lange, Chair
Council of Lakes Committee
NYSDEC
625 Broadway
Albany, NY 12233-4573

Dear Mr. Lange:

This letter is to serve as the transmittal from the Great Lakes Fishery Commission's Council of Lakes Committee regarding which projects are recommended for funding under the Great Lakes Fish and Wildlife Restoration Act with Fiscal Year 2002 funds.

The funding levels recommended for the following projects have been substantially reduced from what the principal investigator proposed. The reductions allowed us to fund almost a million dollars of proposals for \$575,000. Another million dollars of funds would have allowed us to fund an additional seven very worthwhile proposals. The following projects are recommended for funding in FY2002 (proposals attached) (original costs in parenthesis are after the project cost):

In situ determination of the depth and thermal habitat used by chinook salmon (*Oncorhynchus tshawytscha*) - Ray L. Argyle
\$34,500 (\$48,500) Final Report Due 31 December 2005
This is for additional tags on an approved project from 2001.

Evaluating current reproductive success of lake trout at the Port of Indiana breakwater - John M. Dettmers
\$115,800 (140,847) Final Report Due 31 December 2004

A modeling approach to understanding potential effects of double crested cormorants on simulated Great Lakes fish populations - James C. Gillingham
\$16,144 (\$16,144) Final Report Due 31 December 2003

Lake Erie aquatic habitat geographic information system - Robert Haas
\$114,000 (\$144,473) Final Report Due 31 December 2004

Mapping of habitat in tributary and nearshore waters of Lake Superior to facilitate development of quantifiable fish community objectives and lake sturgeon rehabilitation - Rick Huber
\$20,000 (\$62,351) Final Report Due 31 August 2005

Use of unmanned submersibles to study lake trout spawning on the Lake Michigan mid-lake reef - John Janssen
\$27,986 (\$48,019) Final Report Due 30 June 2003

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7 June 2002

Comparison of techniques for stock discrimination of Lake Erie walleye - Tim Johnson
\$62,770 (\$85,470) (partial funding) (\$3,191 needed) Final Report Due 30 June 2004

Comparative bioenergetic modeling of lake whitefish populations in Lake Erie and Lake Ontario -
Tim Johnson
\$66,000 (\$70,000) Final Report Due 31 December 2004

Comparative growth and lipid dynamics of Great Lakes chinook salmon -
Michael Jones
\$34,000 (\$42,525) Final Report Due 31 March 2004

Botulism Type E in Lake Erie: ecology and lower food web transfer-
Alicia Perez-Fuentetaja
\$37,000 (\$77,325) Final Report Due 10 June 2003

Effects of barriers and river fragmentation on riverine fish population ecology and genetics - Scott
Reid
\$24,000 (\$35,000) Final Report Due 31 December 2003

Status of a refuge for native freshwater mussels (*Unionidae*) from impacts of the exotic zebra mussel
(*Dreissena polymorpha*) in the delta area of Lake St. Clair -
Janice L. Smith
\$22,800 (\$26,965) Final Report Due 31 May 2004

In the event that any of these projects are withdrawn by the principle investigator, the following
projects are candidate studies to replace them. They are listed in rank order (proposals attached):

Development of a lakewide lake trout population model for Lake Superior to evaluate management
strategies - Michael Hansen
\$70,211 Final Report Due 31 December 2005

Dynamics of *Myxobolus cerebralis* in the Big Manistee River, Michigan: implication for resident
salmoids - Mohamed Faisal
\$83,848 Final Report Due 31 December 2004

Effects of fin clips and coded wire tags on fish health and ability to catch and avoid prey.
H. George Ketola
\$30,184 Final Report Due 30 September 2003

Robert Lange
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31 May 2002

Four additional projects were very highly ranked by the Review Committee, however, they were not funded due to the large cost associated with the project and/or the lack of funds. If additional monies were to become available in the future, these projects would receive high consideration for funding.

Development of a lake-wide acoustic monitoring program for Lake Superior pelagic fishes - Michael H. Hoff, et al.
\$307,000 over 4 years

Changes in Lake Huron fish community 1970-2000 - Sara Adlerstein
\$117,000 over 1 year

Discrimination of walleye stock structure in Eastern Lake Ontario: understanding spatial patterns in a complex ecosystem - Lars G. Rudstam
\$180,000 over 2 years

Establishing management targets and thresholds for yellow perch in Lake Michigan - Thomas Miller
\$127,000 over 3 years

The Great Lakes Fisheries agencies are grateful for the opportunity afforded by the Restoration Act to support projects that are yielding critical information for use in implementing management decisions in the Great Lakes by State and Tribal agencies working together with academia under the Joint Strategic Plan for Management of Great Lakes fisheries. In the first few years under the Act, more focus has been on information needs for management activities. A secure future funding will allow us to focus more on restoration of the fish and wildlife resources once many unmet information needs have been met.

Sincerely,



Paul J. Wingate
Fisheries Research Manager and Chair,
Great Lakes Fish & Wildlife Restoration
Proposal Review Committee

PJW/vs

cc: Bob Adair, USFWS

