

**GREAT LAKES PANEL ON AQUATIC
NUISANCE SPECIES**

ANNUAL REPORT

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Presented To: The National Task Force on Aquatic Nuisance Species

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EXECUTIVE SUMMARY

The enactment of the federal Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990, Public Law 101-646, was due largely to the unintentional introduction of the zebra mussel and the subsequent economic and ecological impacts. In drafting the Act, Congress recognized that mitigation of the adverse impacts of all such species is dependent upon a well-coordinated research, monitoring and prevention program at the regional and national level. As enacted, the legislation has five purposes: to prevent unintentional introductions; to coordinate research, control and information dissemination; to develop and carry out environmentally sound control methods; to minimize economic and ecological impacts; and to establish a research and technology program to benefit state governments. Section 1203 of the ANS Act is of principal interest to the Great Lakes.

There are two operational subtitles in the Act, one directed at the prevention of unintentional introductions via ballast water exchange, and the other directed at prevention and control via research, control and coordination activities. The second operational subtitle has several key provisions of particular relevance to the Great Lakes Basin. First and foremost, it establishes, at the national level, an Aquatic Nuisance Species (ANS) Task Force co-chaired by the Director of the U.S. Fish and Wildlife Service (F&WS) and the Under Secretary of Commerce for Oceans and Atmosphere. It provides for representation from the U. S Environmental Protection Agency (EPA), Coast Guard, Department of Army and others, as appropriate. It also stipulates that the co-chairs shall invite representatives of the Great Lakes Commission and state agencies and other government entities to participate as ex-officio members.

As directed by the Act, in section 1203, the Task Force requested the Great Lakes Commission to convene the Great Lakes Panel on Aquatic Nuisance Species. Officially convened in late 1991, the Panel's primary responsibilities for the Great Lakes region are six-fold: to identify priorities for the Great Lakes with respect to aquatic nuisance species; to make recommendations to the Task Force regarding programs to carry out the zebra mussel demonstration program; to assist the Task Force in coordinating federal aquatic nuisance species program activities in the Great Lakes; to coordinate nonfederal programs within the regions; to provide advice to the public and private individuals and entities concerning methods of controlling aquatic nuisance species; and to submit annually a report to the Task Force describing activities within the Great Lakes related to aquatic nuisance species prevention, research, and control.

Over the last year (Sept. 1, 1993 through Aug. 31, 1994), the Panel has made significant advancements in coordinating public information and education efforts to control or prevent the transport of the zebra mussel and other aquatic nuisance species to uninfested waters. In October 1993, an Information/Education strategy was developed and approved by the Panel. The purpose of the strategy is to facilitate regional cooperation of outreach programs among participating agencies, institutions and organizations.

The strategy focuses on seven areas: prevention of ANS introduction and dispersal involving Great Lakes water users; outreach activities targeted at resource harvesters and users; activities targeted at recreational boaters; regional coordination of information dissemination; active involvement of Great Lakes policymakers and user groups; congressional/parliamentary dialogue and related initiatives; and availability of adequate resources to implement the I/E strategy. Three committees (Information/Education, Policy and Legislation, and Research and Coordination) will be proposed at the

fall Panel meeting to coordinate the implementation of the activities in these areas. Each committee will be responsible for developing a work plan that includes products and timelines.

In an effort to provide the national Task Force and Congress with balanced, multi-jurisdictional positions on ANS issues, five policy positions have been prepared and approved by the Panel in FY1994 (these positions reinforce previously established Panel priorities): increased budget needs in specified areas; timely implementation of the Ruffe Control Program; timely reauthorization of the P.L. 101-646; enhanced funding for specific Great Lakes Fishery Commission activities; and endorsement of the proposed Ballast Water Management Act.

Approximately \$30 million is authorized annually for implementation of the ANS Act. Of this, the Great Lakes Panel is authorized at a level of \$200,000 per year for five years. To date, no funds have been appropriated under the Act. Modest support for Panel activities has been secured through the U.S. F&WS and National Oceanic Atmospheric Administration (NOAA). Efforts will continue in FY1995 to secure additional resources to fully implement P.L. 101-646.

INTRODUCTION

This annual report of the Great Lakes Panel on Aquatic Nuisance Species, covering the period of Sept. 1, 1993, through Aug. 31, 1994, is submitted to the national ANS Task Force under the provisions of the Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990, P.L. 101-646, Section 1203 (a,6). The report is primarily targeted at the ANS Task Force, represented by co-chairs from the NOAA and the U.S. F&WS, to provide an update on activities that have occurred within the Great Lakes region related to aquatic nuisance species prevention, research and control.

The report also provides state/federal legislators and policymakers with key information on the aquatic nuisance species issue in the Great Lakes region. The annual report includes a synopsis of the aquatic nuisance species problem in the Great Lakes; an overview of the implementation strategy and policy positions of the Great Lakes Panel on Aquatic Nuisance Species; the accomplishments and current initiatives for FY1994; and Panel initiatives for FY1995. The supporting documentation cited in this report is available from the Great Lakes Commission.

BACKGROUND ON NONINDIGENOUS AQUATIC NUISANCE SPECIES IN THE GREAT LAKES

The Laurentian Great Lakes have been subject to the invasion of nonindigenous aquatic nuisance species since the settlement of the region by Europeans. Since the 1800s, at least 139 nonindigenous aquatic organisms have become established in the Great Lakes. The bulk of these organisms have been represented by plants (59), fish (25), algae (24), mollusks (14) and oligochaetes (7). About 55 percent of these species are native to Eurasia; 13 percent are native to the Atlantic Coast.

As human activity has increased in the Great Lakes watershed, the rate of introduction of aquatic nuisance species also has increased. More than one-third of the organisms have been introduced in the past 30 years, a surge coinciding with the opening of the St. Lawrence Seaway. The major entry mechanisms, unintentional releases and ships, were responsible for all but one introduction in the period from 1960-1990.

Approximately 10 percent of the Great Lakes' nonindigenous species have had significant impacts, both economic and ecological. The impacts of some of these species have been enormous. The presence of the sea lamprey has resulted in substantial economic losses to recreational and commercial fisheries, and requires annual expenditures of millions of dollars to finance control programs. Alewife once littered beaches each spring and altered food webs, thereby increasing water turbidity before salmonids such as chinook salmon (themselves nonindigenous) were stocked as predators and became the foundation of a new recreational fishery. Efforts to contain the ruffe (a small percid fish, which became the most abundant fish species in Lake Superior's St. Louis River within five years of first detection) to Lake Superior appear to be failing, given the discovery of ruffe in Michigan waters of Lake Superior in August 1994. The goby, first observed in the St. Clair River in 1990, preys upon bottom-feeding fishes, and may extend its impact throughout the Great Lakes.

The spiny water flea (*Bythotrephes cederstroemi*), one likely ballast water introduction, is a tiny crustacean with a sharply barbed tail spine. The northern Europe native was first found in Lake Huron in 1984. Although researchers do not know what effect the invader will have on the ecosystem, resource managers suspect that the water flea competes directly for food with small fish such as perch. The spiny water flea is now found throughout the Great Lakes and in some inland lakes.

The zebra mussel, another ballast water introduction, has also caused serious economic and ecosystem impacts with costs estimated (absent of controls) at \$5 billion over the next 10 years. The potential

impact on the fishery is profound due to changes in food availability and spawning areas, to name a few. Economic impacts are as pervasive as the ecosystem impacts. Municipal treatment and power plants, commercial and recreational vessels, and beach areas are all vulnerable to the negative impacts of the zebra mussel.

Exotic plants also have been introduced to the Great Lakes Basin. Purple loosestrife is a wetland plant from Europe and Asia that was introduced to the east coast of North America in the 1800s. Purple loosestrife invades marshes and lakeshores, replacing cattails and other wetland plants. The plants are unsuitable as cover, food or nesting sites for a wide range of native wetland animals including ducks, geese, rails, bitterns, muskrats, frogs, toads and turtles.

Eurasian watermilfoil, accidentally introduced to North America from Europe, has spread westward into inland lakes primarily by boats and waterbirds. In shallow areas, the plant can interfere with water recreation such as boating, fishing and swimming. The plant's floating canopy can also crowd out important native water plants.

The above examples illustrate the need for coordinated national and regional efforts to minimize the impacts of unintentional introductions of aquatic nuisance species and to examine ways to prevent future introductions.

GREAT LAKES PANEL ON AQUATIC NUISANCE SPECIES

Section 1203 of the Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990, P.L. 101-646 calls upon the Great Lakes Commission to convene the Great Lakes Panel on Aquatic Nuisance Species. Membership is drawn from a wide range of federal, state, provincial and regional agencies, private sector user groups, and Sea Grants Programs and environmental organizations, to ensure positions of the Panel provide a balanced and regional perspective on Great Lakes issues.

Great Lakes Panel Implementation Strategy

In designing and coordinating Great Lakes Panel activities, the Great Lakes Commission is guided by five objectives:

Participation by all interests in the binational Great Lakes-St. Lawrence Basin will be maximized to ensure that Section 1203 goals are fully addressed.

The Panel will build upon and showcase ongoing efforts, rather than duplicate or replace them.

The Panel will adopt a consensus-based approach in setting priorities and all related decisionmaking activities.

The Panel will serve as a coordinator, catalyst and convener, relying upon its membership and other cooperators for the conduct of most program activities (e.g., research, public information, outreach). The Panel will provide binational clearinghouse/referral services.

The Panel will serve as the principal regional conduit to the national ANS Task Force, federal agencies and Congress with regard to legislative, policy and program matters.

Panel Structure and Procedures

The Great Lakes Panel is responsible for addressing the provisions of Section 1203 and for carrying out all identified elements of a work program.

The Great Lakes Panel meets in full session on a regular basis, generally two-to-three times per year. The chair is selected from among state members; the vice-chair from the membership-at-large. Jay Rendall, Panel chair (Minnesota Department of Natural Resources) and David Yount, vice-chair (U.S.EPA) were elected in December 1993 by Panel members for one-year terms. These two officers assist the Great Lakes Commission staff in facilitating meetings and serve, on occasion, as spokesman for the Panel.

The Panel establishes working groups and task forces, as needed, to accomplish its mandate. This includes, for example, the ability to form a working group that would coordinate with the other regions of the country that do not have a Great Lakes Panel equivalent.

The Panel operates by consensus in all aspects of its work. In the event that recommendations from the Panel reflect a majority view but lack consensus, the Great Lakes Commission (as an ex-officio member of the ANS Task Force) will use its discretion in accompanying any such recommendation with a minority opinion.

The breadth of Panel activities will be a function of funding levels and the extent to which members and observers can contribute in-kind services, including staff resources. Limited support for travel and associated meeting expenses of non-federal Panel members may be available at the discretion of the Great Lakes Commission. The Great Lakes Commission will administer all funds received for Great Lakes Panel operation, and expenditures recommended by the Panel will require Commission approval.

Staff Support

The Great Lakes Commission provides staff support to the Great Lakes Panel. The level of support is a function of the availability of funds. In FY1994 Panel support was provided by Tom Crane (program manager), Lori Reynolds (project manager) Kathe Glassner-Shwayder (project manager), Paula McIntyre (communication specialist) and Rita Straith (support staff). Under ideal funding circumstances, a full-time aquatic nuisance species coordinator will be hired and dedicated exclusively to Great Lakes Panel support. The executive director of the Great Lakes Commission provided oversight of all personnel assigned to support Great Lakes Panel activities.

In undertaking the work program, the Great Lakes Panel recognizes the special expertise of the Great Lakes Fishery Commission and its mandate under P.L. 101-646 to provide information on "technical and policy matters related to the international fishery resources of the Great Lakes." Every effort is made to draw upon Fishery Commission expertise.

Funding

Section 1301 (b)(6) of P.L. 101-646 authorizes \$200,000 in each of five years "to fund aquatic nuisance species prevention and control activities of the Great Lakes Commission." However, funds were not appropriated in fiscal years 1991, 1992, 1993 or 1994.

Recognizing the immediacy of the aquatic nuisance species infestation problem, the Great Lakes Commission committed itself to the expeditious start-up and operation of the Great Lakes Panel (at some level) irrespective of funding uncertainties at the time.

While working to secure a full or partial appropriation of authorized federal funds, the Great Lakes Commission continues to seek and access alternate sources to ensure continued Panel activity at a level necessary to accomplish Section 1203 objectives.

Partial funding for the first-year start-up (FY1992) was secured from the NOAA-Great Lakes Environmental Research Laboratory (GLERL) and through the interstate grants program of the federal Interjurisdictional Fisheries Act (IFA). Support for the second year of Panel operation (FY1993) was supplemented by funding from the U.S. F&WS, in addition to NOAA funds provided through GLERL, IFA and Sea Grant. Support for the third year (FY1994) was provided by funding through the U.S. F&WS and funds under NOAA's IFA. Support from Panel members will also be sought until federal funds are appropriated under the terms of P.L. 101-646. FY1994 appropriations for aquatic nuisance species programs is provided in Appendix H.

RESPONSIBILITIES, WORK PROGRAM AND 1994 ACCOMPLISHMENTS

The Panel's work program consists of six elements that collectively support Panel responsibilities specified in Section 1203 (a) (1-6) of P.L. 101-646. Each element is presented below, accompanied by a statement describing the implementation approach and Panel accomplishments for FY1994. In a case where an individual activity crosses program elements, each program element will be referenced. Panel support activities have been grouped under work program element #6 (annual report).

1) Priority Setting

P.L. 101-646 calls for the Panel to "identify priorities for the Great Lakes with respect to aquatic nuisance species." The Panel interprets this broad statement as applying to the areas of research, monitoring, control, information/education and policy. In each of the first four areas, the Panel is responsible for developing, maintaining, distributing and periodically updating a listing of priorities for use by policymakers at all levels, as well as the scientific and management communities. The statements of priority provide guidance for program development, budgeting and operational purposes, and will be of use at the regional and national levels, particularly with the ANS Task Force.

The Panel has used both surveys and workshops to establish such priorities. In the area of research, the Panel has made full use of the research needs identified in a document titled, "*Coordinated Program of Research on Nonindigenous Species in the Great Lakes*, prepared in August 1990 by the United States Great Lakes Nonindigenous Species Coordinating Committee, which operated on an ad hoc basis prior to the establishment of the Panel. The document provides a balanced approach to researching the nonindigenous species problem in the following priority areas: biology/life history, ecosystem effects, socio-economic analysis regarding the cost and benefits of nonindigenous species, control and mitigation, prevention of introduction and control of spread. The International Joint Commission (IJC) - Council of Great Lakes Research Manager's report titled *1991/1992 Evaluation of Research Activities in the Great Lakes Basin* has also been used to identify areas where research is lacking. Research categories are the same as in the above mentioned document.

With respect to policy priorities, the Panel determines policy, program, legislative, regulatory and budgetary needs to ensure that the Great Lakes-related provisions of P.L. 101-646 are pursued to the maximum extent possible. Such priorities are regularly conveyed to the ANS Task Force, as well as agency and elected officials at all levels of government.

A Selected Listing of Panel Initiatives and Accomplishments in Priority Setting:

Provided a forum for regional policy discussion and decision-making on ANS

issues: The Great Lakes Panel has contributed to efforts to develop a balanced, multi-jurisdictional ANS program that integrates components of prevention, research, monitoring and control efforts. The diverse representation on the Panel, including federal, state, local and tribal jurisdictions; private and commercial sectors; environmental groups; and the university research community, facilitates well-balanced discussions essential to the development and implementation of viable policy decisions.

Establishment of Panel Priorities for 1995: At its seventh meeting (April, 1994) in Middleton, Wisconsin, the Panel identified its priorities for FY1995. The priorities are as follows:

- i) Development and implementation of state management plans
- ii) Expanded Sea Grant funding
- iii) Implementation of the Information/Education (I/E) strategy (Appendix E)
- iv) Initiation of a Ballast Water Demonstration project
- v) Increased visibility of the Panel
- vi) Maintaining the visibility of aquatic nuisance species as a critical regional/national issue

Informational briefings: Over the course of the year, Panel staff have sought and pursued opportunities to publicize the importance of the zebra mussel and other aquatic nuisance species issues, impacts on the Great Lakes system and means by which prevention and control strategies must be implemented. Such informational briefings have been held at many levels. These included, among others, presentations to congressional staff; federal agency officials; state agency officials; state and provincial legislators; business and citizens leaders; and other interested parties. Typically, existing meetings (e.g., Great Lakes Commission meetings, association conferences, annual aquatic nuisance species conferences, periodic congressional briefings) have been used as the vehicle for such briefings. Collectively these activities address several of the Great Lakes Panel responsibilities as mandated in P.L. 101-646.

Development of policy statements: Several policy positions were developed as a result of discussion at the March 11, 1994 Panel meeting concerning: budget needs; ruffe control; the Ballast Water Management Act; reauthorization of P.L. 101-646; and specific Great Lakes Fishery Commission activities (e.g., maintenance of a full sea lamprey control program; re-registration of lampricides; and research and development of alternative (non-pesticide) control technologies). These statements are discussed in detail in the Policy Position section of this report (page 15).

On May 26, 1994, Panel positions statements were transmitted for informational purposes to members of the Great Lakes congressional delegation and have also been incorporated into a larger policy statement transmittal to Congress, approved at the Great Lakes Commission Semi-Annual Meeting in May.

2) **Recommendations to the National ANS Task Force on Section 1202 activities**

The legislation calls upon the Panel to "make recommendations to the Task Force regarding programs to carry out section 1202(i)." The section, titled *Zebra Mussel Demonstration Program*, has two elements. The first provides for a "program of prevention, monitoring, control, education and research for the zebra mussel to be implemented in the Great Lakes and any other waters of the United States infested or likely to become infested by the zebra mussel..." Elements include research and development on control options; tracking establishment of

populations and developing an early warning system; developing control plans; and providing technical assistance to state, regional and local entities.

The second element of the demonstration program is titled *Public Facility Research and Development*, and calls upon the Assistant Secretary of the Army to devise a research and technology development program that provides for environmentally sound control of zebra mussels in and around public facilities.

The Great Lakes Panel cooperates with the states, the ANS Task Force and other applicable entities throughout the development and implementation of the Zebra Mussel Demonstration Program. The Great Lakes Commission is an ex-officio member of the Task Force and will be present at all meetings of the national Task Force, in particular, those meetings where the demonstration program is discussed.

3) **Federal Great Lakes Activities**

The ANS Task Force has oversight and primary coordination responsibilities for federal programs called for in P.L. 101-646. The Act states that the Panel is to "assist the Task Force in coordinating Federal ANS program activities in the Great Lakes". The assistance of the Great Lakes Panel is vital since the Panel has a coordination responsibility for all other (i.e., non-federal) programs.

The Great Lakes Panel believes that a single system for tracking activities and related programs at all levels of government is vital to successful aquatic nuisance species research, coordination and control efforts. The Panel therefore works with the ANS Task Force to establish a protocol for tracking and coordinating all relevant programs. Furthermore, the Panel offers the ANS Task Force advice and recommendations relative to the coordination of priorities and the relationship of those programs to non-federal efforts, both public and non-governmental.

A Selected Listing of Panel Initiatives and Accomplishments in Coordinating Federal Great Lakes Activities:

Coordinated regional comments on the ANS Task Force report titled *Findings, Conclusions, and Recommendation on the Intentional Introduction Policy*: This report was developed to identify and evaluate options for reducing the risk of adverse consequences associated with intentional introductions of aquatic organisms, as required in Section 1207 of P.L. 101-646. The report recommends strategies to control the introduction of nonindigenous species from sources such as the aquarium business, bait dealers and sport fishing stocking programs.

The Panel's review of the document focused on issues regarding education/extension, research, existing authority for policy implementation, permit systems, protocols and environmental assessments.

Coordinated regional comments on the ANS Task Force report titled *The Ruffe Control Program*: This report is a strategy to prevent or delay the spread of ruffe through the Great Lakes and inland waters by containing it to its current range in western Lake Superior. Panel member comments focused on issues regarding the geographic and strategic scope of the program, the benefits and costs of using chemical controls, and the role of information/education activities to mitigate further spread of the ruffe.

Coordinated regional comments on the ANS Task Force report titled *Benefits and*

Costs of the Ruffe Control Program: The report was developed to evaluate the cost-effectiveness of alternative control strategies, as well as the cost/benefit of taking action versus no action. The Panel's review of the document focused on issues regarding environmental impact of chemical treatment and the methods used to calculate benefits and costs.

Coordinated regional comments on a resolution pertaining to the Task Force's Research Protocol (drafted by David Yount, Panel Vice-Chair): The resolution proposed a solution to problems realized after applying the Research Protocol through two funding cycles. Comments from Panel members were received and transmitted to the Research Protocol Committee on July 22, 1994 for consideration. Comments received supported the proposed resolution and offered an alternative method for reviewing/approving research proposals.

Provided ex-officio representative to the national ANS Task Force: Pursuant to P.L.101-646, the executive director of the Great Lakes Commission was requested to serve as an ex-officio member of the ANS Task Force, with the Chair of the Great Lakes Panel serving as alternate. The executive director participated at the Nov. 9, 1993, ANS Task Force Meeting held in Washington, D.C., providing the Task Force with an update on Panel activities and reporting on actions taken at the Panel meeting the previous month. He also presented Task Force members with Panel comments on the draft intentional introductions and ruffe control reports and announced that the Great Lakes Commission had endorsed (at its Annual Meeting in October 1993) the Ruffe Control Program.

The Chair of the Panel, Jay Rendall, attended the April 28, 1994, meeting held in Washington, D.C. He described the Panel's priorities for the year, provided copies of the Panel's position statements and indicated the ongoing need for continued funding for the National Park Service's efforts to keep zebra mussels from the St. Croix River National Scenic Riverway. He also reported on other ongoing ANS related activities in the region.

Coordinated regional comments (first round) on the reauthorization of P.L. 101-646: As requested by the ANS Task Force Coordinator, Great Lakes Panel members provided preliminary comments regarding desired amendments to P.L. 101-646. Comments focused on: Sec. 1202, amending the control provision; Sec. 1208, injurious species; Sec. 1204, the provision of federal funds for the development as well as implementation of state management plans; and Sec 1203, the need to maintain the emphasis on the Great Lakes Basin. The Panel will be discussing the reauthorization of P.L. 101-646 in more detail as the reauthorization process progresses.

Development and implementation of state management plans: Great Lakes Panel meetings have provided a forum to discuss and promote development and implementation of state aquatic nuisance species management plans outlined in Section 1204 of P.L. 101-646. The purpose of the state plans is to identify management practices and measures that will be undertaken to reduce infestations of aquatic nuisance species.

New York is the first state to have a plan approved by the ANS Task Force. The plan was prepared by the New York Department of Environmental Conservation.

Minnesota's state management plan is scheduled for completion in the Spring of 1995.

Under Section 308 of the federal Coastal Zone Management Act, the Michigan Department of Natural Resources has been awarded a grant of \$29,800 to conduct, in partnership with the Great Lakes Commission, a symposium in 1995 for state coastal management and aquatic nuisance species officials. The event will provide information needed to promote the preparation and implementation of comprehensive state management plans for aquatic nuisance species; better inform coastal managers of ANS issues so they can be incorporated into other state planning activities; and provide a comprehensive review of relevant statutes for the control of ANS in coastal areas.

4) **Non-Federal Programs in the Great Lakes**

The Great Lakes Panel is charged with coordinating, where possible, non-federal program activities associated with aquatic nuisance species prevention and control. As indicated in work program priority #3, the Panel recognizes that a multi-jurisdictional "partnership approach" is required to address the aquatic nuisance species issue, and a single system for tracking and coordinating activities is advisable.

On the basis of its broad membership and regular meetings, the Panel provides a vehicle for the assembly of research, control and monitoring activities. Current efforts to compile this data (e.g., Sea Grant clearinghouse services) are relied upon to the extent possible. Through its own membership, workshops and other networking techniques (e.g., newsletter inserts, annual reports), the Panel conveys its research, control, monitoring and policy priorities to all applicable agencies and interests, and promotes coordination of efforts among them.

A Selected Listing of Panel Initiatives and Accomplishments in Coordinating Non-Federal Activities:

Increased computer access to ANS information: To convey Panel research, control, monitoring and policy priorities, an ANS subdirectory has been created on the Great Lakes Information Network (GLIN). The subdirectory currently houses the following information: panel membership list, minutes of meetings, policy positions, field guides to exotic animals and plants, information/education strategy, FY1993 annual report and the *ANS UPDATE*.

Usage of GLIN as a vehicle for ANS information exchange was monitored over several months in mid-1994. Field guides to exotic animals and plants (such as purple loosestrife, spiny water flea, and zebra mussels) were the most sought after items. The Panel will continue to place ANS information on-line and monitor its usage (This activity also responds to objectives #1 and #5).

Preparation of Panel newsletter insert: Rather than adding to the already large population of aquatic nuisance species newsletters in circulation throughout the Basin, the Panel elected to prepare a two-page update for insertion into, or selective use by, existing newsletters. The purpose of the insert is to educate and inform readers of Great Lakes Panel activities, events, publications and important issues relating to the zebra mussel and other aquatic nuisance species (Appendix F).

At the March 11, 1994 Panel meeting, members provided information on potential newsletters that they believe may feature ANS information. From this information, a summary table was prepared listing the newsletters along with contact person, main

focus, distribution and audience, production schedule and the way each newsletter would use the information (i.e., as an insert or for excerpts). Assuming that each of the 20 newsletters listed carries information from the *ANS UPDATE*, it is estimated that more than 50,000 readers will be reached.

On Aug. 5, 1994 the first edition of the Panel's quarterly newsletter was completed and distributed. Usage of the information in the newsletters will be monitored each quarter. For the first edition, the majority of the newsletters used excerpts from the insert with three of the 20 newsletters using it as an insert. (This activity also responds to objective #5).

IJC research inventory: Staff have been working with the IJC in the development of an updated version of the ANS research inventory. The ANS research inventory will be a section within the larger Great Lakes/ St. Lawrence Research Inventory, published by the IJC's Council of Great Lakes Research Managers. Responsibilities for data compilation for the current Research Inventory have been assumed jointly by the NOAA-GLERL and the Ontario Ministry of Environment and Energy. The classification system has been changed to one based on key words, to allow for more efficient and effective database searches. A goal of the IJC is to put the Research Inventory on-line via the Great Lakes Information Network.

Supporting development and implementation of economic assessment of Great Lakes zebra mussel infestation: In response to several information requests on the economic impacts of the zebra mussel, Great Lakes Commission staff initiated work on a proposal and survey to evaluate the economic costs of the zebra mussel infestation. The proposal and survey were developed after reviewing background information on zebra mussel prevention and control technology. Survey content was discussed with a select number of municipal plant managers affected by the mussels, and professionals experienced in survey research on aquatic nuisance issues.

After reviewing the draft survey, the Panel recognized that, although the cost information will be challenging to obtain, this type of information would be useful to the national Task Force, resource managers and policymakers for planning purposes and also to highlight the importance of preventing future introductions of nonindigenous species.

With the Panel's support, Great Lakes Commission staff joined forces with research staff from Ohio Sea Grant on the project. The project team worked together in refining the original survey with the objective of estimating the costs that zebra mussel infestation has imposed on facilities that draw water from the Great Lakes: electric generating plants, municipal water systems and industrial water users.

The survey was piloted among several facility managers in the summer of 1994 and is scheduled to be mailed to approximately 1,500 Great Lakes facilities in mid-November. The surveys are expected to be returned by the end of December, allowing for preliminary assessment of cost data by the end of January.

In addition to the water user survey, Ohio Sea Grant is conducting another survey targeted at research investigators. The purpose of the survey is to document research efforts geared to mitigate control costs, with a longer term goal of estimating the investment returns of research conducted on mitigation strategies and technologies.

The survey will be distributed to about 300 researchers in early 1995.

The information gleaned from both surveys will be used to raise awareness among policymakers, resource managers, researchers, and other Great Lakes water users regarding control costs and research efforts needed to address zebra mussel infestation in the Great Lakes region.

5) **Control Methods**

The Panel is directed to "provide advice to public and private individuals and entities concerning methods of controlling aquatic nuisance species." This activity is accomplished primarily by Panel members, particularly via Sea Grant education extension specialists in the Great Lakes states, which have special expertise in this area and presently maintain active information and outreach programs.

The Great Lakes Panel serves primarily as a vehicle for coordinating and communicating the efforts of the Sea Grant programs, government agencies and other entities presently or potentially engaged in public advisory programs regarding methods of aquatic nuisance control. Furthermore, the Great Lakes Panel identifies and prioritizes information/education needs and works with applicable public entities to address them. This type of coordination role eliminates duplication of efforts. In those instances where the Panel itself is determined to be the preferred vehicle for delivering a public information/education service, the design and implementation of such is pursued.

Given its role within the overall aquatic nuisance species control effort, the Panel operates in conjunction with existing agencies and organizations (e.g., Great Lakes Sea Grant Network) to assume a facilitating function with government agencies, industry, and the public. The Panel makes referrals, provides its own documents (e.g., priority lists, annual reports, technical reports), and distributes public information materials that its members make available. A descriptive list of all entities providing public information/referral services is one valuable initiative the Panel plans to undertake.

A Selected Listing of Panel Initiatives and Accomplishments in Providing Advice on Control Methods:

Establishment of a committee to develop a consistent message to the public on ways to prevent the spread of the zebra mussel: Concern was raised by Panel members at the March 11 Panel meeting that an inconsistent message is being sent to the public in the eight Great Lake States on what is required to prevent the spread of the zebra mussel (e.g., drying times for boats). The Panel therefore established a working committee to address this issue and report back to the Panel on its findings.

The Information/Education Strategy activities for aquatic nuisance prevention and control-shift from strategy development to implementation: To move the I/E strategy from the development stage into implementation, three working committees will be proposed at the Sept. 19 and 20 Panel meeting: an I/E Committee, a Research Coordination Committee, and a Policy and Legislation Committee. Each committee will be charged with preparing a workplan to implement the activities that fall within their program scope. As of August 1994, a summary table has been prepared listing the status of all strategy activities. Additional resources will be required in order to implement several of the activities. (This activity also responds to objectives #1, #2, #3, and # 4) (Appendix E).

Disseminate state-of-the-art control information and contacts in the ANS UPDATE: Notice of recent publications, contacts and information are included in the quarterly editions of the newsletter insert. This has proven to be an effective vehicle for information exchange.

6) Annual Report on Great Lakes Activities

The Panel is directed to "submit annually a report to the Task Force describing activities within the Great Lakes related to aquatic nuisance species prevention, and research and control."

A Selected Listing of Reporting and Related Administrative Initiatives and Accomplishments is as follows:

Chair and vice-chair elections: The Panel's *Organizational Strategy* specifies that the chair be held by a representative from one of the Great Lakes states. The vice-chair is open to all members of the Panel (the successful candidate is determined by majority vote of Panel members). Jay Rendall (Minnesota Department of Natural Resources) was the successful candidate for the chair and David Yount, U.S. Environmental Protection Agency, was elected vice-chair.

Conducted two Panel meetings

- 6th meeting of the Great Lakes Panel, Oct. 8, 1993, held in Duluth Minnesota, in conjunction with the Great Lakes Commission Annual Meeting
- 7th meeting of the Great Lakes Panel, March 11, 1994, held in Middleton, Wisconsin, in conjunction with the 4th Annual Zebra Mussel Conference

Developed a work program to guide future efforts: The Great Lakes Panel oversees the development of a work program for each fiscal year addressing the tasks specified in Section 1203 of P.L. 101-646. The Program is designed to support the following baseline functions:

- Conducting Great Lakes Panel meetings;
- Providing representation at national ANS Task Force meetings;
- Providing Panel representation at all significant research, control and prevention oriented meetings;
- Providing program support to the Panel;
- Providing basic information and referral services;
- Continuing to develop and implement policy statements;
- Providing advice to the ANS Task Force pursuant to P.L. 101-646; and
- Developing and pursuing new Panel initiatives consistent with mandated functions.

These activities and other activities will be pursued at a level consistent with available funds and will be expanded when possible.

Maintenance of Panel Membership: The Great Lakes Commission initiated the formation of the Great Lakes Panel in close consultation with the national ANS Task Force. In convening the Panel, efforts were made to maintain a balance to ensure that the Panel was both broad in representation and manageable in size. Membership includes Great Lakes representation from federal, state, local and regional/binational agencies, tribal authorities, private environmental/user groups, commercial interests,

and the university/research community. The Great Lakes Commission is responsible for extending Panel membership invitations, pending approval of the ANS Task Force co-chairs. In addition to Panel members, Panel observers were identified who have the opportunity to contribute fully in Panel discussion and decisionmaking (e.g., Canadian federal and provincial officials).

In June 1994, Panel members requested that membership be extended to include representation from the National Park Service. The Service has had strong interest in ANS issues in and around the Great Lakes. On July 7, 1994, the ANS Task Force approved the Panel's request. Dan Kimball, Chief, Water Resources Division, National Park Service, appointed Richard Klukas, Chief, Research Branch Midwest Regional office, to the Panel.

On Aug. 1, 1994, Glen Salmon, Fisheries Staff Specialist (Indiana DNR) was appointed by Patrick Ralston, chair of Indiana's delegation to the Great Lakes Commission, to fill Indiana's seat on the Panel (formerly held by Thomas Lauer).

Provided general staff support for Great Lakes Panel activities: Substantial time has been invested on routine coordination activities between and among Panel members as well as larger community interests. Outreach/education activities included community information referrals, inquiries from the press, speaking engagements, preparation of briefing papers and general interest articles. A primary focus was placed on research coordination activities and strengthening lines of communication between the research and policy communities. Articles in the Great Lakes Commission's bimonthly newsletter, the *ADVISOR*, and special presentations at Commission meetings ensured that key policymakers and opinion leaders in the binational Great Lakes region were well informed of development regarding aquatic nuisance species.

Development of Great Lakes Panel letterhead: In keeping with the Panel chair's priority to heighten the visibility of the Panel and avoid confusion with other Great Lakes organizations, ANS Panel letterhead has been designed and approved by the national ANS Task Force (this activity also responds to #1 objectives).

Secured funding from numerous sources to ensure operation of the Great Lakes Panel: Although P.L. 101-646 authorized \$200,000 per year over a five-year period for the establishment and operation of the Great Lakes Panel, no appropriations have been made under P.L. 101-646 to date. To ensure basic operation of the Panel from September 1993 to August 1994, the Great Lakes Commission secured funding from two federal sources. These funds were designated by the states of Illinois and Indiana from their share of funds allocated via NOAA's Interjurisdictional Fisheries Act (IFA) (\$31,462), and the U.S. F&WS (\$40,000). Total funding from these sources has been much less than the annual amount authorized under P.L. 101-646 but has provided baseline support for the Panel and allowed substantial progress toward the goals of that legislation. Efforts continue to secure additional Panel support, including appropriation of federal funds authorized in P.L. 101-646.

For FY1995, proposals were prepared for and approved by the U.S. F&WS (\$40,000) and Illinois' share of funds allocated via NOAA's IFA project grant (\$15,400). A cost extension was also prepared for NOAA under the IFA grant requesting that the balance of the funds (\$23,306) remaining under year one of the IFA project grant be utilized during this budget period. Formal approval of the cost extension is pending.

POLICY POSITIONS OF THE GREAT LAKES PANEL

Several policy position statements have been prepared by the Panel since its inception and are outlined briefly below. These policy positions have been widely disseminated for Information/Education purposes to members of Congress, state/federal agency officials, and other policymakers and opinion leaders.

Research and Management Needs and Legislative/Budget Needs

The first two policy position statements were developed by the Panel in 1992 to coordinate efforts of the research community and link them with the challenges facing policymakers and resource managers. The research and management policy position helps guide strategic decisionmaking in the scientific community by providing guidelines for interactions between researchers and managers, and compiling a list of key research needs that exist in the areas of the biology and life history of nonindigenous species; ecosystem effects of the species; socio-economic costs and benefits, control and mitigation; prevention of future introductions of nonindigenous species; and finally, reducing the spread of established nonindigenous species.

The budget and legislative policy positions for ANS programs at the binational, national and regional levels target the policy community thereby providing an important foundation for future development and funding. Three areas are of particular interest:

a) Budget/Appropriations

Panel Position: Funding for ANS programs under P.L. 101-646 has been inadequate to address the burgeoning need for prevention, monitoring, research, management and control measures in the Great Lakes Basin and elsewhere. A strong federal lead through the national Aquatic Nuisance Species Task Force, coupled with a federal/state/local partnership, will reduce unnecessary duplication of efforts. Budget and program emphasis is especially needed in the areas of:

- Research, development and implementation of effective measures to prevent the introduction of aquatic nuisance species into the Great Lakes, especially alternatives or refinements to ballast exchange in order to reduce ballast introductions;
- Research, development and registration of environmentally sound zebra mussel control measures for raw water users in the Great Lakes Basin (currently, chlorine is the principle control option, yet other options may be equally or more environmentally sound);
- Research, development and implementation of effective intrabasin and interbasin containment measures for the zebra mussel and the river huffe; and
- Information and outreach to industry, recreational boaters and anglers regarding containment and control of aquatic nuisance infestations.

b) Program Implementation

Panel Position: The agencies currently receiving funding through P.L. 101-646 are utilizing those funds in well-targeted and productive ways. The Task Force is urged to address the infestation problem on a basinwide scale, focusing on inland waters as well as the Great Lakes and their tributaries, as authorized in P.L. 101-646. The Panel emphasizes the importance of international cooperation and coordination in implementation of its responsibilities.

c) Legislative Needs to Expand or Enhance P.L.101-646

Panel Position: There is a need for new legislative language to expand the geographic scope of the U.S. Coast Guard's authority in implementing its aquatic nuisance species prevention efforts to include Great Lakes contiguous waters and other U.S. coastlines.

Information/Education Strategy for Aquatic Nuisance Prevention and Control

This policy document was completed and approved at the Panel's October 1993 meeting in Duluth, Minnesota. The purpose of the strategy is to facilitate regional cooperation of outreach programs among participating agencies, institutions and organizations. The strategy, based on the goals of P.L. 101-646, promotes the following primary issues:

Prevention of the unintentional introduction and dispersal of aquatic nuisance species into, within and from Great Lakes waters through implementation of I/E activities;

Regional coordination of information dissemination regarding aquatic nuisance species programs involving prevention, control, monitoring, research, education, policy and other related activities;

Active involvement of Great Lakes regional policymakers and user groups in the promotion of aquatic nuisance prevention and control programming; and

Availability of adequate resources to implement the Great Lakes Panel's *Information/Education Strategy for Aquatic Nuisance Prevention and Control*.

FY1995 Appropriations for P.L. 101-646 Implementation

At the March 1994 Panel meeting, Panel member revisited existing policy positions. Panel members believe that for FY1995 the program emphasis should remain the same as stated in the 1992 Legislative/ Budget Needs policy position statement (above), however, in order to meet these and related program priorities, the Panel approved the following position statement on suggested appropriation levels for FY1995:

1. U.S. F&WS/National Biological Survey - for support of ANS Task Force and implementation of the National Aquatic Nuisance Species program (\$7 million).
2. NOAA - for support of ANS Task Force and implementation of the National Aquatic Nuisance Species program (\$5 million).
3. NOAA - Great Lakes Environmental Research Laboratory - for conducting aquatic nuisance species research (\$1.125 million).
4. NOAA - National Sea Grant Program - for conducting aquatic nuisance species research, education and outreach programs (\$3.375 million, of which \$2.5 million is targeted exclusively at the Great Lakes Basin).
5. Great Lakes Commission - for operation of the Great Lakes Panel on Aquatic Nuisance Species (\$0.2 million).
6. U.S. Army Corps of Engineers and U.S. F&WS - for implementation of state management plans (\$2.5 million, through U.S. F&WS and \$5 million, through U.S. Army Corps of Engineers).

These recommendations address specific priorities of the Great Lakes Panel; other appropriations opportunities, while not specifically mentioned above, were also supported where consistent with the

goals of the act.

Ruffe Control Plan for Lake Superior

In April 1994, the Panel approved the following position statement: In order to contain the spread of ruffe in western Lake Superior and protect the valuable international fisheries of the Great Lakes, the Great Lakes Panel supports approval and implementation of the Ruffe Control Program under authority of the Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990. The program is an integrated plan that addresses each of the ways that 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.

If range reduction for the ruffe is to be successful, the Great Lakes Panel emphasizes the need for immediate implementation of the Ruffe Control Program. To this end, it is essential that state/federal resources be allocated to this pressing issue. In addition, the Panel recommends that Wisconsin and Michigan expedite the process by which emergency use permits are issued for the use of TFM or a TFM/Bayluscide combination (non-bioaccumulative fish toxicant) in western Lake Superior. The Panel recognizes the need to monitor and evaluate the performance of TFM or TFM/Bayluscide treatments.

Ballast Water Management Measures

In April 1994, the Panel approved the following position statement: The Great Lakes Panel endorses the proposed Ballast Water Management Act presently under consideration by Congress. The bill seeks to curb the spread of aquatic nonindigenous species through the discharge of vessel ballast water by directing the Marine Board of the National Research Council to evaluate and identify promising ballast water management technologies and practices. Upon completion of the evaluation, the Administrator of the Maritime Administration (MARAD) is directed to conduct a national demonstration program to test and evaluate the most cost and biologically effective ballast water management technologies and practices identified by the Marine Board. Because discharge of vessel ballast water is a documented source of aquatic nuisance species introduction, this legislation is a critical component of prevention and control efforts. It should be funded at authorized levels (\$0.15 million in FY1995; \$1.85 million in FY1996).

Timely reauthorization of the P.L. 101-646

In April 1994, the Panel approved the following position statement: The Nonindigenous Aquatic Nuisance Prevention and Control Act, P.L. 101-646, is the first act to address impacts of nonindigenous invaders on aquatic ecosystems. As such, the legislation addresses a previously uncharted area of environmental protection. It also seeks to mitigate the economic impacts of a newly recognized type of environmental disaster: aquatic nuisance species infestation. The act expires in 1995, and the Great Lakes Panel urges Congress to enact reauthorizing language in a timely manner. During this process the Great Lakes Panel will examine the existing language and make recommendations on any necessary refinements or expansions to ensure that regional needs are adequately addressed.

Sea Lamprey Control and Related Great Lakes Fishery Commission Activities

In April 1994, the Panel prepared the following position statement: The Great Lakes Panel recommends enhanced funding for the Great Lakes Fishery Commission in FY1995 to protect the Basin's multi-billion dollar sport and commercial fisheries and to coordinate/conduct fisheries research

and management activities. Important program requirements include: maintenance of a full sea lamprey control program; re-registration of lampricides as required by the U.S. EPA; and research and development of alternative (non-pesticide) control technologies. To meet these requirements, \$14,080,500 is needed in FY1995.

GREAT LAKES PANEL INITIATIVES FOR FY1995

The Great Lakes Panel will continue to address the legislative mandate of P.L. 101-646, with particular emphasis on issues raised in the Panel's policy statements; reauthorization of P.L. 101-646; supporting the development of state management plans; and implementing the information and education (I/E) strategy. An overview of FY1995 priority activities is as follows:

Development and Implementation of Panel Policy Statements: During the upcoming fiscal year, efforts will continue in the implementation of the policy statements. The policy statements present several initiatives that will require substantial investment of staff time.

Implementation of the Information/Education Strategy: The Panel, through the operation of the three working committees, will implement an I/E strategy for aquatic nuisance prevention and control to facilitate regional coordination of I/E activities among participating agencies, institutions and organizations. Each committee will prepare a workplan that identifies deliverables and timelines for completion. Several activities that will be undertaken include (among others):

- Completion of a regional survey to assess the economic costs of zebra mussel infestation among municipalities, industries and other Great Lakes water users;
- Support for clearinghouse services through the Great Lakes Information Network and other Great Lakes Commission program initiatives;
- Conduct of special advisory services to specific interest groups, such as policymakers, municipalities, industry and other Great Lakes water users;
- Sponsorship of various briefings and dialogues among and between elected officials and policymakers to promote timely and appropriate decisions, necessary legislative and programmatic foundations, adequate funding support at all levels, and multi-jurisdictional partnerships for program implementation;
- Prepare quarterly *ANS UPDATE* inserts to be disseminated to more than 20 newsletters.

- Continue to audit the usage of the insert in order to assess its effectiveness.
- Continue to provide updates on Panel activities in the Great Lakes Commission bimonthly newsletter, the *ADVISOR*.
- Continue to provide ANS information on the Great Lakes Information Network
- Continuation of annual reporting as required under Section 1203 of P.L. 101-646.
- Encourage states/federal agencies, organizations and others to implement activities identified in the I/E strategy.

Reauthorization of the Aquatic Nonindigenous Nuisance Prevention and Control Act: The Panel will develop a policy position on the reauthorization of P.L. 101-646. The position statement will be presented to the national Task Force and the Great Lakes congressional delegation.

Convene a workshop to assist in the preparation of comprehensive state management plans

The Panel, in cooperation with the Michigan Department of Natural Resources, will convene a workshop in Michigan for state coastal management and aquatic nuisance species officials. The conference will provide information needed to promote the preparation and implementation of comprehensive state management plans for aquatic nuisance species; work to better inform coastal managers of ANS issues so they can be incorporated into other state planning activities; and provide a comprehensive review of relevant statutes for the control of ANS in coastal zone areas.

Enhanced data base to advance coordination of research monitoring and control efforts: The Great Lakes Commission will forge partnerships with other entities to generate the data needed to meet the goals of P.L. 101-646 especially Section 1203. This will include, for example, assistance to the IJC's Council of Great Lakes Research Managers for its research database development on aquatic nuisance species.

Support for Great Lakes Panel on Aquatic Nuisance Species: A portion of available funds will be directed at providing staff support to Panel activities. This will include allocation of time for the executive director; special projects manager; communications specialist; administrative assistant and a research associate. Services will include coordination among, and responsiveness to, Panel members; advisory services to the national ANS Task Force; and the conduct of related activities consistent with provisions in the federal Nonindigenous Aquatic Nuisance Prevention and Control Act (P.L. 101-646).

PROGRAM UPDATES OF GREAT LAKES PANEL MEMBERSHIP

The following information, provided by Great Lakes Panel members, details some of the aquatic nuisance species research, control and information dissemination efforts being undertaken around the Basin during September 1993 through August 1994. In addition to the work of Great Lakes Panel members, many other agencies, such as research institutes in the Sea Grant network, conduct a wide variety of research and public information efforts.

Key U.S. and Canadian Federal Agencies

U.S. Fish & Wildlife Service Great Lakes - Big Rivers RegionThe Service's Ashland Fishery Resources Office served as chair of the Ruffe Control Committee. The Ruffe Control Committee developed a ruffe control program to prevent or delay the spread of ruffe through the Great Lakes and inland waters by containing the species to its current range in western Lake Superior. This is the first control program developed under the Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990 and will be made available for public review and comment in 1995.

Ruffe control efforts continued in 1994. Surveillance crews from the Ashland Fishery Resources Office surveyed 26 Lake Superior tributaries and coastal locations, one shipping port in Lake Michigan and seven sites in Lake Huron. The Huron sites included tributaries, shipping ports and coastal locations. Ruffe were documented in four new locations in Lake Superior: Chequamegon Bay and Saxon Harbor in Wisconsin; and Black River Harbor and the Ontonagon River in Michigan. These are the first findings of ruffe in Michigan waters. Ruffe were also rediscovered in Thunder Bay, Ontario.

The Service assisted the maritime industry in updating the Voluntary Ballast Water Management Plan for Control of Ruffe in the Great Lakes to prevent inter- and intra- lake shipping introductions. Assuming affected states, tribes and federal agencies agree that piscicide treatments should be conducted in 1995 as part of ruffe control, the Service participated in drafting a tactical plan to control ruffe using experimental piscicide treatments. Finally, the Service has engaged in numerous public education activities, including writing articles, making presentations, providing information to newspapers and disseminating a Service-produced video on the ruffe.

U.S. Fish and Wildlife Service - Northeast RegionThe Exotic Species Program (Program), implemented by the Service's Lower Great Lakes Fishery Resources Office (LGLFRO) in Amherst, N.Y., consists of four components: monitoring, research, education and coordination.

Monitoring: Effective monitoring programs are essential to the timely prevention and control of

nonindigenous aquatic species introductions and range expansions. Early detection of nonindigenous species is necessary to implement effective control alternatives and prevention strategies and minimize the risk of further spread. Early detection monitoring programs also provide a means of evaluating the effectiveness of control strategies already implemented.

Monitoring networks previously established by the Program have been coordinated with the Nonindigenous Aquatic Species GIS Program conducted by the Southeastern Biological Science Center, National Biological Survey in Gainesville, FL. The Lower Great Lakes Ruffe Monitoring Program (LGLRMP) 1993 Progress Report was completed and in 1994, the LGLRMP was expanded to include seven sites in Lake Erie and one in Lake Ontario.

As nonindigenous aquatic species introductions expand their range beyond the Great Lakes Basin, the Northeast region has provided technical assistance to other areas within the region that are implementing monitoring programs. As a member of the Chesapeake Bay Program Exotic Species Work Group Monitoring Task Group, the Service assisted in drafting the Implementation Plan for the Chesapeake Bay Policy for the Introduction of Nonindigenous Aquatic Species.

Research: Research is a critical factor contributing to the development of effective prevention strategies and control technology. The LGLFRO developed several funding proposals focusing on the restoration of indigenous freshwater mussel populations potentially threatened by the invasion of zebra mussels. A cooperative work order agreement between the Service and Cornell University examining fish predation on zebra mussel veligers was completed. An investigation analyzing the impacts of changing ecosystem productivity on young-of-the-year fish growth was initiated. Contributions continue to the Zebra Mussel Reference Collection, previously established in cooperation with the Academy of Natural Sciences.

Education: Educational programs strive to educate on the values, functions and dynamics of aquatic ecosystems and make individuals understand their role as monitors and controllers of nonindigenous species introductions and range expansions. The ruffe identification poster titled, *WANTED: Dead or Alive*, developed through the Lower Great Lakes Ruffe Monitoring Program, was distributed throughout the lower lakes to state, federal, provincial and tribal resource agencies, private and public agencies, public access points, marinas, and bait and tackle shops. In cooperation with state Sea Grant agencies, the LGLFRO assists in the development and promotion of educational strategies throughout the region.

Coordination: As the scope on nonindigenous species issues continues to broaden and become a national concern, the need for effective coordination is essential. The Service has maintained a leadership role in the coordination of nonindigenous species issues within the Northeast region. Efficient information exchange and transfer between resource agencies, researchers, private, and public organizations is necessary to maintain an effective and cohesive approach to prevention and control.

NOAA - Great Lakes Environmental Research Laboratory (GLERL) While the GLERL has a number of research projects dealing with the zebra mussel, the largest project involves assessing the impacts of the mussel on the Saginaw Bay ecosystem. In 1994, efforts focused on analyzing and interpreting data collected in the bay in 1990-93. Zebra mussels were found in the bay in 1990, but the first large recruitment did not occur until 1991. Thus, the 1990-93 data documents changes in the bay during the initial years of the invasion. The data will be presented in a series of papers written by GLERL and Sea Grant researchers and published in a peer-reviewed journal in 1995. The papers summarize trends in water quality parameters, primary production and zebra mussel abundances. Also included are measured filtering rates of both zooplankton and mussels. Other papers in the series focus on impacts of zebra mussels on nutrient dynamics, macrophyte growth and bacteria. Sampling in the bay continued in 1994, and preliminary analysis of the data indicate that 1994 was a unique year. A significant bloom of noxious blue-green algae occurred in July and lasted until September. The role of zebra mussels in causing the bloom, if indeed mussels played a role, will be examined in future laboratory and field

experiments.

A survey of native mussels was conducted in Lake St. Clair in 1994. This was the fourth survey since 1986. Results of this latest survey indicate that the native mussels have been virtually eliminated from the lake as a result of the zebra mussel infestation. For example, the survey in 1986 yielded a total of 281 native mussels, while the 1994 survey yielded a total of six. In addition to documenting the decline of native mussels, the surveys will provide information on distributions and abundance trends in the zebra mussel population of the lake.

Success was achieved in rearing zebra mussel larvae from the egg to the settling stage using pure cultures of freshwater algae. The larvae require small algae, rich in polyunsaturated fatty acids. Such algae are not always present in the environment, especially in summer, and may explain the larvae's variable recruitment to the settling state. Laboratory culture is the first stage necessary for understanding the larvae so that suitable control strategies can be developed.

NOAA - National Sea Grant College Program

The National Sea Grant College's Zebra Mussel Program combines outreach and public education activities with research to examine the effects of zebra mussels on both infrastructure and the environment, and development and evaluation of potential control methods. Carried out primarily by academic researchers supported through the Great Lakes Sea Grant College Programs, the Zebra Mussel Program represents the largest single expenditure of funds by the federal government on the problem. The result has been the development of a closely integrated network of academic and federal researchers and marine advisory personnel focused on developing methods for dealing with the invasion, communicating those results to the user community and increasing public involvement in the issue.

In addition, the National Sea Grant College Program supports research on a variety of other nonindigenous species that impact Great Lakes ecosystems, including the spiny water flea *Bythotrephes*, ruffe, and sea lamprey, and on general aspects of the aquatic nuisance species issue such as the role of ballast water introductions. Refer to the Great Lakes Sea Grant Network for the Great Lakes specific program (page 31)

U.S. Environmental Protection Agency Environmental Research Laboratory, Duluth

The U.S. EPA research program on aquatic nuisance species is conducted and funded through U.S. EPA's Environmental Research Laboratory in Duluth, Mn. (ERLD). The objectives are not only to develop an integrated, coordinated research program in the Great Lakes, but to look beyond this geographic area to introduced aquatic species throughout the continent, focusing initially on the Mississippi River basin.

The approach has been to consider not only the characteristics of the invading species and its effects on the invaded ecosystem, but also to consider characteristics of ecosystems which might make them more or less susceptible to invasion. Under this framework, ERLD is funding research on several species which have demonstrated the ability to successfully invade lake and river ecosystems, including the zebra mussel, the ruffe and the rusty crayfish. Research on the role of disturbances in rivers and streams caused by flow extremes is being funded, as well as research on characteristics of the surrounding watershed. Projects are also underway on the accumulation and trophic transfer of organic chemicals by zebra mussels and their effect on nutrient and energy dynamics, and the potential influence of zebra mussels on native benthic communities in the upper Mississippi River and its major tributaries.

Projects currently underway will be completed within the next two years (in 1995 or 1996), and results will be published in scientific literature. Beginning in 1996, University-based research is expected to be funded through grants awarded by a new Center for Extramural Programs in the Office of Research and Development, Washington, D.C. In-house research will continue on the zebra mussel and the ruffe in the Great Lakes Basin.

National Park Service Great Lakes ParksThe Park Service continued its consultation with the U.S. F&WS regarding development of a test strategy for ruffe control. Lamprey control activities continue in waters of Isle Royale National Park and Pictured Rocks National Lakeshore. Purple loosestrife has been the focus of attention at Indiana Dunes, Sleeping Bear and Apostle Islands National Lakeshore parks. Hand removal and application of herbicide have been the primary management tools to date. However, at Indiana Dunes a trial study is underway that involves the use of loosestrife-eating beetles to determine if biological control is feasible. The University of Wisconsin (Madison) is conducting a purple loosestrife ecology study using areas at Pictured Rocks and Indiana Dunes National Lakeshores as study sites. In addition UW-Madison is including National Park Service Great Lakes Parks in the development of remote sensing techniques for detecting and inventorying purple loosestrife. Reports on these studies should be available in 1995.

At St. Croix National Scenic Riverway the National Park Service, U.S. F&WS, the natural resources agencies of Minnesota and Wisconsin, and private companies and public interest organizations are addressing the problem of preventing the spread of the zebra mussel into the St. Croix river. Their efforts are strongly centered on education of the public and development of voluntary public cooperation. The National Park Service is sponsoring research on zebra mussel riverine habitat

requirements, which will allow for determination on how much of the drainage would be susceptible to zebra mussel colonization. Study results should also have application in the Great Lakes Basin.

Regional/Binational

Great Lakes Fishery CommissionThe Great Lakes Fishery Commission, created by Canada and the United States in the 1955 Convention on Great Lakes Fisheries, is charged to investigate and advise governments on measures to address issues affecting fish stocks of common concern. The Commission's one management responsibility is to control the nonindigenous sea lamprey. The Commission is committed to preventing the ill-considered introduction of nonindigenous species.

In 1994, efforts continued to research and develop alternatives to chemical lampricides, and to formulate a strategy for an economically and environmentally sound treatment of sea lamprey in the St. Marys River (Lamprey spawning in the St. Marys River is responsible for Lake Huron populations of predaceous phase sea lamprey which out-number those of the other Great Lakes combined. Northern Lake Michigan fish populations are also beginning to show increased wounding rates).

The Great Lakes Fishery Commission supported management of exotics through the joint efforts of Great Lakes fishery management agencies under the Strategic Great Lakes Fishery Management Plan. For example, upon request of the U.S. F&WS, states, tribes and Ontario, the Commission agreed to assist in efforts to contain the ruffe by providing training, technical advice, logistical support and a small supply of TFM on a reimbursable basis -- conditional upon the guarantees of no impact on the sea lamprey control program. Under the Strategic Plan, agencies represented on the Commission's management committees reviewed such matters as Ontario's draft position on aquaculture and New York's emergency response to whirling disease.

International Joint Commission

The International Joint Commission (IJC) created the Council of Great Lakes Research Managers

(Council) in 1984 to provide guidance and advice on research. As part of its mandate, the Council is responsible for the collection and dissemination of information on research programs relevant to the Great Lakes Water Quality Agreement, identifying research needs and assisting in the coordination of research in the Great Lakes Basin. The Council membership includes federal, state and provincial governments in the U.S. and Canada, and representatives from a limited number of private institutions with research programs. Member institutions represent a significant proportion of the total binational Great Lakes research effort.

Since 1985, the Council has continuously gathered descriptions of research programs from members, as well as from external agencies and institutions. In 1988, the Council produced a compilation of research projects for the years 1985 through 1988 and reported this effort in the *1989 Report of the Science Advisory Board of the International Joint Commission*. The *1990-91 Great Lakes-St. Lawrence Research Inventory* classification scheme was modified to address the ecosystem approach. Of the 697 research projects described in the 1990-91 inventory, 71 projects are listed for nonindigenous species equalling approximately \$6.1 million (U.S.). This information base is available from the Great Lakes Regional Office of the IJC. The Council has also prepared a 1991-92 inventory; a total of 203 research projects addressing nonindigenous species are compiled in the 1991-92 inventory, amounting to \$11.3 million (U.S.). The 1992-93 inventory is presently being entered into the database.

An ecosystem framework has been developed by the Council to provide a better understanding of management options and the impact of their decisions on the ecosystem. The approach is also being used to assist in establishing and ranking research needs in the Great Lakes Basin. The first exercise employing this concept will take place at a workshop in January 1995.

Great Lakes States and Provinces

ILLINOIS

Illinois Natural History Survey (Acting for and funded by the Illinois Department of Conservation)

The Illinois Natural History Survey has been conducting research and monitoring related to the spread of zebra mussels in Illinois since early 1991. The Survey's Lake Michigan Biological Station monitors larval and adult mussel populations at multiple sites along the Illinois and Indiana shorelines of Lake Michigan, and the Long Term Resource Monitoring Program in Havana monitors the Illinois and Mississippi rivers. Data from these studies reveal an exponential increase in the number of mussels in the lake and large rivers, with consequent economic impacts on local industries and utilities. Research by Survey staff includes a study on zebra mussel substrate preferences, which may lead to alternate methods for control; a genetic study that recently revealed the presence of a second nonindigenous species of mussel in Lake Ontario; and examination of the effects of zebra mussels on native benthic organisms. Survey staff have met with local, state, national and international groups to advise them on monitoring techniques and discuss research priorities and results. Several public interest and scientific documents have been published by the Survey to increase awareness of problems due to aquatic nuisance species. However, despite funding from the U. S. F&WS, the Illinois Department of Conservation, U.S. EPA and public utilities, the paucity of ongoing financial support for this program threatens its continuation.

INDIANA

Indiana Department of Natural Resources

Nonindigenous species management in Indiana is the responsibility of the Indiana Department of Natural Resources (IDNR). Toward this end, the IDNR created a strategic plan to steer the activity in this area, focusing on public education and specific management strategies for purple loosestrife and zebra mussels. In addition, the IDNR is attempting to understand the many complex and diverse issues of

nonindigenous species in an effort to formulate a comprehensive policy.

The IDNR has limited staff resources and funding but is responding to the problem at hand. In the short term, the current level of involvement will not significantly change, although the demands appear to be increasing.

MICHIGAN Michigan Department of Natural Resources

Michigan, surrounded by a vast resource of fresh water open to international shipping through the St. Lawrence Seaway, has been the recipient of many intentional and unintentional aquatic organism introductions. The Michigan Department of Natural Resources (MDNR) is the lead agency within the state responsible for administering statutes associated with the management and control of nonindigenous species. These activities are made possible by the active involvement of many federal, state, and local agencies, and various interest groups.

At the state level, attention focuses on a recent Natural Resources Commission policy on nonindigenous aquatic nuisance species (Commission Policy #2001). The policy position is comprehensive and provides direction for the Department at the state and federal levels to control nonindigenous aquatic nuisance species.

MDNR has initiated development of a comprehensive management plan for funding of state activities under P.L. 101-646 (State Management Plan). The plan is currently being developed and should be completed in April 1995. However, the effectiveness of such a plan will rely heavily on federal appropriations through P.L. 101-646.

Michigan has four DNR Great Lakes Research Stations that are involved in sea lamprey and/or zebra mussel research. The major goal of the studies is to measure the impacts of these species on fish communities. The stations are measuring progress of sea lamprey control by monitoring lake trout wounding rates and recovery of lake trout stocks. Fish stocks in Saginaw Bay are also being monitored to assess the effects of zebra mussels, white perch and the reintroduction of walleye. The DNR has been a leader in lake trout restoration research and in monitoring the effects of sea lamprey in the upper Great Lakes. However, recent budget constraints are limiting the DNR's ability to maintain this research at current levels.

In 1993, the first systematic widespread sampling of inland waters in North America for the presence of zebra mussels was initiated in the lower peninsula of Michigan to assess the incidence and overland dispersal into freshwater systems. Thirty three lakes, considered to be a high risk for zebra mussel invasion, were targeted in the survey. Zebra mussels were detected in 10 of the lakes, thus providing a limited initial assessment of its inland range expansion. The 1994 sampling program set out to increase the scale of zebra mussel monitoring in inland lakes. Existing inland populations were monitored to investigate the early population dynamics of zebra mussel invasions and derive predictive models of the timing and magnitude of future population growth and associated impacts.

A pilot volunteer monitoring program also was developed to provide a model for the creation of a large-scale program for long-term detection and monitoring of the invasion of inland waters by nonindigenous nuisance species. The program sought out citizen involvement in active zebra mussel monitoring using a simple, low cost methodology as a means of demonstrating the efficacy of volunteer efforts in gathering scientifically useful data. A total of 66 lakes in Michigan were involved in active zebra mussel surveys this season. Multiple monitoring methods were used at many of the lakes (i.e., plankton sampling and volunteer pontoon boat monitoring). Overall, 25 Michigan inland lakes have displayed some evidence of zebra mussel infestation, 14 with confirmed populations of adult zebra mussels.

The MDNR Office of the Great Lakes has responded to the introduction of zebra mussels by establishing

an aggressive public information program. The goal of the program is to provide information to stop the spread of zebra mussels to inland lakes and streams and to encourage environmentally sound management practices. In 1994, with assistance from the Secretary of State, the DNR inserted more than 250,000 "exotics" leaflets in watercraft registrations sent by mail. The leaflet describes methods to prevent or minimize the transport of zebra mussels and exotic pests to uncolonized waters of the state by boaters and anglers. The leaflet also is distributed by the Fisheries Division and Recreation Division to marinas and bait shops throughout the state, and the Office of the Great Lakes distributed the brochure upon request. The DNR Recreation Division has produced more than 1000 zebra mussel signs that are posted at all Great Lakes boat launches throughout the state. In addition, signs are posted at inland lake launch sites where zebra mussels have been detected. The signs warn boaters of how zebra mussels are transported to waters of the state and what specific actions can be taken by boaters to prevent the spread.

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MINNESOTA

Minnesota Department of Natural Resources

The Minnesota Department of Natural Resources (MnDNR) is the lead agency for coordinating efforts to curb the spread of ecologically harmful exotic species (all nonindigenous aquatic species and wild animals) in Minnesota. This is a broad responsibility which includes species such as purple loosestrife, eurasian watermilfoil, zebra mussels, ruffe and flowering rush. The state exotic species program is funded at \$1 million per year for fiscal years 1994, 1995 and 1996. Revenues are generated by a watercraft surcharge of \$5 per boat (licenses are for 3 years). Additional state funding of \$200,000 per year for research on biological controls of purple loosestrife and eurasian watermilfoil was also available in FY1994 and FY1995.

An extensive *Clean Boats, Clean Waters* public awareness effort was continued during the summers of 1993 and 1994. It includes the development and distribution of exotic species packets to resorts; development of a multi-species brochure with a "clean boat" checklist for boaters; posting billboards on critical highway routes leading from infested waters; distributing notices on boat trailers at infested waters; and 20,000 hours spent inspecting boats leaving infested waters. In addition, public service announcements were distributed to 260 radio stations, and advisory signs were placed at public water accesses on infested waters. The MnDNR has cooperated with Minnesota Sea Grant, the Bell Museum of Natural History, U.S. F&WS, Manitoba Environment, Northern States Power, and the Genex Corporation in the production and distribution of public awareness materials.

State laws continue to be redefined to deter the spread of aquatic nuisance species. Under the proposed rules, boaters will be required to drain all water from boating equipment when leaving zebra mussel infested waters. The harvest of bait from infested waters will be prohibited and commercial fishing practices will be altered to minimize the risk of inadvertent spread. To improve public compliance, civil fines of \$50 to \$1000 may be issued for transporting several harmful nonindigenous species or placing a boat with zebra mussels or eurasian watermilfoil attached into waters of the state. The MnDNR also is proposing the prohibition on transporting most aquatic plant species on public roads.

The MnDNR is developing management plans for ecologically harmful species. Eurasian watermilfoil and flowering rush plans have been adopted. A statewide coordinating plan and individual species plans for zebra mussel, purple loosestrife and ruffe are being prepared for public review. The MnDNR also participated with the U.S. F&WS, National Parks Service, Michigan Department of Natural

Resources and Wisconsin Department of Natural Resources to implement and refine a St. Croix River zebra mussel response plan.

MnDNR conducted control work for purple loosestrife, flowering rush and eurasian watermilfoil. In 1994, 27 lakes with small to moderate populations of eurasian watermilfoil and 162 sites with small populations of purple loosestrife were treated.

NEW YORK New York Department of Environmental Conservation

New York's Nonindigenous Aquatic Nuisance Species Comprehensive Management Plan was approved by the National ANS Task Force in March of 1994. Although original planned activities were much more comprehensive, \$68,000 in federal funds recently were received to begin implementation of the management plan.

Initial efforts will be directed in three areas: education, signs will be produced and placed at public waterway access sites, and brochures will be completed for public distribution; monitoring, a pilot project is being developed in the Finger Lakes area to document zebra mussel distribution, abundance, and impacts to important fish populations; research, a proposal is being developed to monitor contaminant concentrations of zebra mussel in various lakes throughout the state. Samples will be analyzed from waters with and without a known history of contaminants.

OHIO

Ohio Department of Natural Resources

Ohio created a Ruffe Advisory Team in 1994 to address concerns for the potential infestation of ruffe in Lake Erie or other Ohio waters. The team, consisting of representatives from numerous state agencies and the Ohio State University, represents a network which will be useful for evaluating future strategies for dealing with the ruffe issue and communicating with the various publics. Extensive monitoring of Lake Erie for the presence of ruffe was conducted by the Division of Wildlife, Ohio EPA, the U.S. National Biological Service and the U.S. F&WS. No ruffe were found. The Division of Wildlife is conducting surveys of the distribution and abundance of the goby in the vicinity of Fairport Harbor, Lake Erie. This new species is present at many nearshore sampling stations and some offshore stations.

At Hargus Lake, a small inland lake near Columbus, investigations continue to determine the effects of zebra mussel invasion. So far, zebra mussel abundance has been low, perhaps due to lack of hard substrate, and effects have been minimal. Ohio also is developing protocols for the handling of fish at three of the state fish hatcheries that use water from reservoirs that could eventually become infested with zebra mussels.

Information campaigns continue to ensure that anglers and aquaculturists in Ohio are aware of the threat of various aquatic nuisance species. Cooperative efforts of Ohio Sea Grant and the Ohio Division of Wildlife have resulted in the distribution of thousands of copies of educational cards and pamphlets.

ONTARIO

Ontario Ministry of Natural Resources The Ontario Ministry of Natural Resources (MNR) is the lead agency with respect to many nonindigenous species issues within the province. The MNR is currently developing a comprehensive strategy to deal with both terrestrial and aquatic introductions into and within the province. The focus of this strategy will be the prevention of new introductions through policies, legislation, research and communications. The strategy will also deal with mitigating the impacts and slowing the spread of species that have already been introduced.

The MNR remains the lead agency of the Ontario Zebra Mussel Program. Although overall funding has been reduced for the program, management and research efforts have been continued. Communications are a high priority for the program and several fact sheets, maps and brochures have been produced and distributed. Research into non-chemical zebra mussel control techniques continues.

Research projects recently completed include an assessment of UV light for zebra mussel control and an evaluation of products designed to protect small water intake pipes from zebra mussels. Assessment of the ecological impacts of zebra mussels on the Great Lakes also continues.

The MNR has entered into partnerships with the Ontario Federation of Anglers and Hunters (OFAH) to help combat nonindigenous species. The Invading Species Hotline recently completed its third year of operation. The public uses this toll-free service to report sightings and get information about zebra mussels and other nonindigenous species. The hotline distributes thousands of brochures and other pieces of information to the public each year and keeps a central record of nonindigenous species sightings. Another cooperative program is the operation of a mobile boatwash station which visits

numerous locations around the province each summer to demonstrate to the public proper ways of removing zebra mussels and other exotics species from their boats.

The MNR also has been involved in several other initiatives related to nonindigenous species. Harmful species lists are being developed under the new Federal Wildlife Trade Act. Import and export of harmful species will be regulated under the Act. New provincial aquaculture regulations, policies and guidelines have been developed jointly with the provincial aquaculture industry. Risk assessments will be used to review aquaculture applications, based on facility type, species and genetic strains. The MNR also participated in the development of the Ruffe Control Program and has been actively involved in surveillance and education efforts. It is now illegal to possess ruffe in Ontario.

PENNSYLVANIA Pennsylvania Department of Environmental Resources

The Department of Environmental Resources continues to coordinate a statewide zebra mussel monitoring program using private industry, water utilities, power generators, academic institutions and government agencies in a cooperative network. Several sightings in the Ohio River basin portion of Pennsylvania during 1994 demonstrate the ability of the zebra mussel to expand its range by a variety of means. Upon sighting mussels in a new area, the department notifies network participants and water users by letter and then issues a press release to alert the general public. These notifications describe the exact location and extent of zebra mussel infestation and urge appropriate action to stop their further spread.

During 1994, the Pennsylvania Fish and Boat Commission implemented a permit program to control the introduction of the nonindigenous grass carp which is used in some ponds and small lakes to control aquatic vegetation. The program allows the introduction of certified sterile triploid grass carp in certain waters when done in accordance with permit conditions. Purchases must be made through permitted dealers.

Pennsylvania continues its active participation in the Chesapeake Bay Program exotic species efforts and is developing an implementation plan pursuant to the bay program's policy on exotic species introductions.

WISCONSIN

Wisconsin Department of Natural Resources

The Bureau of Water Resources Management coordinates activities on aquatic nuisance species within the Department of Natural Resources. The agency's recent focus on nuisance aquatics have been primarily on three species: eurasian watermilfoil, ruffe and zebra mussels. The department continues to be concerned with management issues related to carp, purple loosestrife, rusty crayfish and the sea lamprey. Through brochures, pamphlets, signs, workshops, public service announcements, as well as other information and education efforts, the department has sought to educate Wisconsin's recreational

boaters and anglers on the precautions they should take to avoid transporting nonindigenous species from infested to uninfested waters.

In addition, the department has been instrumental in working with state legislators to fashion legislation that will deal comprehensively with aquatic nuisance species. Although legislation to fund aquatic nuisance species activities was vetoed by the governor in the 1992 session, there were some positive signs. The effect of the veto was to retain an aquatic nuisance control council, which together with the department has drafted reports to the legislature on eurasian watermilfoil and zebra mussels. These reports identify current and potential economic and environmental impacts and recommend potential cost-effective control methods. The report's recommendations may be considered for inclusion as part of the 1995-97 budget. The department also has developed a ruffe control plan that is in the final stages of review. The plan will be submitted to the Natural Resources Board for approval in 1995.

The department has established a monitoring program for zebra mussels (both veligers and adults) on Wisconsin's inland waterways that is a coordinated effort among self-help lake volunteers, water utilities, industrial facilities, hydro users, as well as other agencies. The purpose of the program is to document the arrival of zebra mussels, track their spread inland and provide valuable lead time to take corrective action before the negative impacts of zebra mussel fouling occur.

The department has just begun the process of developing a State Implementation Plan for nonindigenous species. The governor-appointed Aquatic Nuisance Control Council (which is advisory to the department) will assist the agency in developing the plan. The goal is to have a completed plan to submit to the national ANS Task Force in late 1995. The eurasian watermilfoil and zebra mussel reports, as well as the ruffe response plans, will be attached as addendums to the State Implementation Plan and will serve as species-specific action plans.

One of the biggest disappointments continues to be the lack of federal support. The introduction of aquatic nuisance species is a problem of national scope. It is imperative, as part of the reauthorization of P.L.101-646, that some base level of funding be provided to implement the state implementation plans. To effectively control nonindigenous species will require support at the federal level.

Private Environment/User Groups

Great Lakes Sport Fishing Council

The Great Lakes Sport Fishing Council, a not-for-profit binational advocacy umbrella organization, represents the views of the sport fishing community to regional commissions, the Ruffe Control Committee, the Great Lakes Panel on Aquatic Nuisance Species, and at workshops, conferences and public hearings. It disseminates information on ballast water control efforts, the unintentional introduction of new exotics, expansion patterns and control efforts.

In collaboration with various governing bodies, the Council holds timely conferences and meetings to inform and educate its members, other user groups and stakeholders, and the general public on the status of undesirable exotics. Networking through various means of communications such as the outdoors media, bulletins and newsletters, the Council uses information/education strategies to report on efforts that can be implemented by the angling and boating recreational communities to prevent/slow the expansion of exotics.

The Council distributes *ANS Update*, the quarterly publication of the Great Lakes Panel on Aquatic Nuisance Species to the many leaders and representatives affiliated with the Council.

The Great Lakes Sport Fishing Council encourages reproduction of its literature to aid in enhancing the recreational community's knowledge of exotic species.

Tribal Authorities

Chippewa/Ottawa Treaty Fishery Management Authority

Chippewa/Ottawa Treaty Fishery Management Authority (COTFMA) was created by three tribes to regulate the treaty fishery. These tribes are the Sault Ste. Marie Tribe of Chippewa Indians, the Bay Mills Indian Community, and the Grand Traverse Band of Ottawa and Chippewa Indians. The tribes' commercial fishery sections of northern Lake Michigan, southeastern Lake Superior, and northern Lake Huron are defined by an 1836 treaty. Inter-Tribal Fisheries and Assessment Program (ITFAP) was formed by the Management Authority to assemble catch statistics, recommend harvest quotas and conduct fish quality research. Summarized below are areas of research that involve sea lamprey in the upper Great Lakes.

ITFAP conducted a mark-recapture study on the Carp River in Mackinac County, Michigan to determine the number of spawning-phase sea lamprey ascending the river system to spawn in 1993-94. This effort was a cooperative project with the U.S. F&WS-Sea Lamprey Control Station in Marquette, Michigan. An estimated 16,000 spawning-phase sea lamprey ascended the Carp River between May and June of 1993, and 1,700 in 1994.

ITFAP representatives served on the Lake Huron Technical Committee of the Lake Huron Committee which functions under the auspices of the Great Lakes Fishery Commission. In 1993, ITFAP continued to update the 1987 St. Mary's River Task Force Report as requested by the Lake Huron Committee. Activities involved determining the economic impact of sea lamprey predation on fish stocks in northern Lake Huron.

ITFAP has been greatly involved in the Great Lakes Fishery Commission's Integrated Management of Sea Lamprey (IMSEL) project. Models were developed by ITFAP staff that estimated the total number of lake trout deaths due to sea lamprey predation for lakes Superior, Huron and Michigan. COTFMA is actively involved with the Ruffe Control Task Force.

Great Lakes Indian Fish and Wildlife Commission

The Great Lakes Indian Fish and Wildlife Commission (GLIFWC) continues to be involved in management and research of purple loosestrife, sea lamprey, ruffe and zebra mussels. The GLIFWC has been investigating purple loosestrife control efforts since 1988. Their studies have led to a specific loosestrife control strategy in Fish Creek Sloughs and a general loosestrife control strategy for implementation in northern Wisconsin. Both strategies involve containment, control and cleanup. The cleanup phase involves a continued effort to hand pull seedlings that will undoubtedly germinate after the control phase. The Wisconsin Department of Transportation and the Wisconsin Conservation Corps (WCC) have provided funds for these GLIFWC efforts.

In 1994, GLIFWC conducted a purple loosestrife survey of the Kakagon/Bad River Slough Watershed as a component of the larger watershed protection project undertaken by the Bad River Tribe and The Nature Conservancy. The survey provided information on the extent of the loosestrife invasion in the watershed so that protective action could be taken in the Kakagon Sloughs against further infestations. Baseline data, including location of purple loosestrife stands, stand acreage and plant density were recorded. These data were integrated into the Bad River Band's Geographic Information System (GIS), which will provide the basis for systematic monitoring of loosestrife infestation patterns and evaluation of control measures.

Since 1986, the GLIFWC has conducted a cooperative project with the U.S. F&WS, Sea Lamprey Control Station in Marquette, Michigan. This project gathers information on adult spawning-phase sea lamprey ascending various tributaries of Lake Superior. Objectives of this project are to: 1) monitor

upstream spawning movements of the sea lamprey, 2) collect data on biological characteristics of the spawning lamprey, 3) estimate the number of lamprey spawning in each tributary using mark-recapture methods, and 4) reduce the spawning potential of lampreys by removing a portion of the run. The information is used to estimate absolute abundance of adult lamprey in the United States waters of Lake Superior and to estimate the effectiveness of regional control efforts. The GLIFWC has contributed field crews to the U.S. F&WS's research on the river ruffe in western Lake Superior. From 1991 to 1994, the GLIFWC conducted sampling of fish predator stomachs to evaluate the effectiveness of using predators in controlling ruffe. Over the four year period, predator fish were found to feed on ruffe. However, predation has not occurred at a level which will control ruffe populations. The GLIFWC has attended the Ruffe Control Committee meetings to keep apprised on control efforts and has been involved in the development of a treatment plan for ruffe in Lake Superior.

The GLIFWC participated in an effort to monitor and prevent the spread of zebra mussels in the upper Mississippi River watershed. Since 1992, GLIFWC has been a member of the St. Croix River Zebra Mussel Task Force, a multi-agency team working towards protecting the St. Croix National Scenic Riverway and its watershed from the threat of zebra mussel infestation. Field surveys, including passive monitoring of veliger dispersal, collecting, and underwater assessment of range expansion and habitat preference at various localities, have been conducted. In addition, GLIFWC has been documenting distributions of mussel species native to tributaries of the upper Mississippi and Lake Superior regions that may be threatened by zebra mussel range expansions.

University Research

Great Lakes Sea Grant Network

The Great Lakes Sea Grant Network is one of 29 programs in the National Sea Grant College Program of NOAA. There are six programs that form the Great Lakes Sea Grant Network: Illinois-Indiana, Michigan, Minnesota, New York, Ohio, and Wisconsin Sea Grant College Programs.

Sea Grant has played a major role in coordinating the Great Lakes region's response to issues related to nonindigenous species. Many times this involves being a "team player" and working with other federal agencies such as NOAA-GLERL, National Biological Survey, and U.S. EPA, to avoid duplication of effort and maximize the value of every dollar which is spent on this issue. This has truly been a strength of the Sea Grant programs within the region. Experts from these federal agencies are regularly used as reviewers of Sea Grant projects or as co-principal investigators. U.S. EPA has even used Sea Grant's research proposal solicitation and review process to select projects to support.

Within the Network itself, efforts to collaborate and communicate have grown substantially each year. This has been most evident this year with our development of a program to address: 1) control of zebra mussels, 2) ecosystem impacts of nonindigenous species, and 3) the ruffe invasion. The Network's outreach efforts, however, may be the best example of our collaboration. This year Ohio will submit the Network proposal which includes nine separate efforts on which all six programs are heavily involved.

Control of Zebra Mussel

The Great Lakes Sea Grant Network were among the first to react to the zebra mussel invasion. Within a month of the first confirmed sighting in Lake Erie, Sea Grant-funded scientists were researching ways to control the mussel. Besides research, the Sea Grant Network also provided the region's major zebra mussel outreach and education programs. Since 1991, the National Sea Grant College Program has provided a total of \$10.3 million for research and outreach to address this growing national problem. Most of this work has been done by scientists and outreach specialists associated with the Great Lakes Sea Grant programs, whose research and outreach efforts over the last four years include:

* 100 Scientific Studies -- Over a half of these studies were devoted to control strategies and assessing the mussel's environmental and economic impacts. Other research focused on the

mussel's basic biology and ways to predict its spread.

* National Zebra Mussel Information Clearinghouse -- Launched in 1990 by New York Sea Grant with grants from private power and industrial interests, this clearinghouse is now the nation's primary archive of zebra mussel research information. It is recognized and used by the U.S. Fish & Wildlife Service, U.S. Army Corps of Engineers and other agencies. The clearinghouse has processed nearly 2,000 requests for information since 1993. The clearinghouse's bimonthly research periodical, *Dreissena!*, has more than 50 subscribers in 40 states and four Canadian provinces.

* International Zebra Mussel Conferences -- The Great Lakes Sea Grant Network organized and has helped sponsor an annual international zebra mussel conference every year since 1990. The 1994 conference, hosted by Wisconsin Sea Grant, attracted more than 600 researchers from throughout the U.S., Canada and Europe. Cosponsors included the U.S. Fish & Wildlife Service, American Water Works Association, Electric Power Research Institute, Environment Canada and Ontario Hydro. The network is also a cosponsor of the conference every other year with Canadian agencies beginning in 1993. In 1996, the Nonindigenous Species Research Conference will be hosted by Michigan Sea Grant. During this conference, the Network plans to host sessions for Sea Grant research scientists and outreach personnel. These sessions will provide a forum for in-depth discussion among Great Lakes researchers funded by the Sea Grant zebra mussel initiative, Sea Grant extension and communications staff, and selected representatives of the management and business communities. The outcome of these activities would be more effective collaboration between on-going and planned research, more effective transmission of information between the research and outreach community, more effective plans for distributing this information to local, network and national audiences, and a better understanding of user-group needs by both researchers and Sea Grant personnel as well as a better understanding of the state of knowledge on the topic by user groups.

* 2.5 Million Publications -- Sea Grant outreach and communications staff have created 77 information items about the zebra mussel and other exotic species, and the network has distributed more than 2.5 million copies of them in cooperation with more than 100 agencies nationwide. These include field identification cards, fact sheets, posters, booklets, engineering reports, newsletters and conference proceedings. Brunswick Marine, in cooperation with Ohio Sea Grant, has donated printing services valued at more than \$50,000 toward publishing a few of these publications.

* Exotics Species Graphics Library -- Michigan Sea Grant operates a graphics library of slides, photographs and illustrations of zebra mussels and other nonindigenous species. These materials are available to all interested media, schools, agencies and organizations nationwide. The library distributed more than 6,500 graphics in response to requests during 1993-94.

* Interregional Training -- Great Lakes outreach staff are now helping Sea Grant programs, government agencies and industries in other regions prepare for the zebra mussel. They have already conducted educational programs in Connecticut, New Hampshire, New Jersey, Delaware, North Carolina, Virginia, Tennessee, Pennsylvania, Vermont, Louisiana, Mississippi and Arkansas, and are embarking on a nationwide zebra mussel training initiative in cooperation with the U.S. Department of Agriculture Extension Service.

* Volunteer Monitoring Programs -- Wisconsin, Michigan and Rhode Island Sea Grant have organized and trained volunteers to conduct statewide monitoring of inland lakes in cooperation with lake associations, affected water users and state natural resources managers.

Ecosystem Impacts on Nonindigenous Species

Great Lakes Programs have taken the initial approach of examining the ecosystem impacts on nonindigenous species. This provides answers to the potential impact and control problems, as well as providing possible clues to life history bottlenecks that can be exploited for control purposes. However, we have also chosen to pursue possible control strategies for preventing the spread of nonindigenous species of concern and developing cost-effective control strategies.

Comprehensive Regional Cooperation on the Ruffe

With the discovery of the Eurasian ruffe in the Duluth-Superior Harbor of Lake Superior in 1986, Minnesota Sea Grant has been active in sponsoring research and outreach activities related to the ruffe. However, both ecosystem level effects and potential control measures in the harbor have met with mixed and somewhat confounded results. Because of their rapid increase and their continuing eastward spread along the south shore of Lake Superior, the ruffe has a very real potential to affect the other Great Lake ecosystems and economies.

The greatest impacts of the ruffe may be in the lower Great Lakes. However, researchers in these states do not have ready access to ecosystems that have been impacted by the ruffe. Therefore, Minnesota Sea Grant took the lead in developing a truly regional Sea Grant approach to the problem. Minnesota researchers have involved Sea Grant investigators from several other states. They are collaborating on an experimental assessment of the ruffe's affects on the Duluth Harbor ecosystem, as well as looking at the pre- and post-invasion conditions in other parts of the Great Lakes. Concomitantly, we also have inter-Sea Grant Program researchers looking at new control strategies for the ruffe, and an extensive Great Lakes Sea Grant outreach program developed to further educate the public, policy makers, and management agencies. Using this information, the potential ecological and economic impacts on the other Great Lakes, such as Lake Erie, can be better understood and a coherent Great Lakes-wide strategy can be developed. Only through the combined talents of the Great Lakes Sea Grant Programs, can we create a regionally coordinated initiative of this scope and magnitude to deal with the ecological, economic, and management concerns surrounding the continuing spread of the ruffe.

Activities of the Great Lakes Sea Grant College Programs (Illinois-Indiana, Michigan, Minnesota, New York, Ohio, and Wisconsin Sea Grant College Programs) are available by contacting their offices directly (Appendix G).

NOTE: Due to time constraints, the following agencies represented on the Panel were unable to provide program updates for FY1994. Program updates from last years annual report covering activities from 1991-1993 have been included for your information.

Canada

Department of Fisheries and Oceans -

Great Lakes Laboratory for Fisheries & Aquatic Sciences (FY1991-1993)

The Department of Fisheries and Oceans research program on aquatic nuisance species is conducted by the Great Lakes Laboratory for Fisheries and Aquatic Sciences in Burlington, and Sault Ste. Marie, Ontario. Research addresses the distribution, abundance, population dynamics, ecological impacts, and potential management options. Species of interest include the sea lamprey, zebra and quagga mussels and zooplankter, *Bythotrephes cederstroemi*. Projects are integrated into long-term biological monitoring programs on the Great Lakes that provide background data needed to evaluate the ecological impacts of invading species.

Cooperative projects with the Department of Fisheries and Oceans' Sea Lamprey Control Centre determine habitat factors that enhance lamprey recruitment, the effects of lamprey barriers on riverine systems and modeling the effectiveness of alternate control strategies.

Long-term biological monitoring programs in the Bay of Quinte and Lake Ontario provide opportunities to understand the population dynamics and ecological effects of *Bythotrephes cederstroemi*. Studies

examine the dual role of *Bythotrephes* as a new food source for fish and as a predator of native plankton communities. Similar ecological studies are conducted to determine the distribution and abundance of zebra and quagga mussels in the lower Great Lakes, to examine their population dynamics; their impacts on native benthos, larval fish production, and possible adverse effects on spawning success of walleye and lake trout. Dynamics and effects data were combined in a model to predict the impacts of zebra mussels on the Bay of Quinte ecosystem. Finally, a research study evaluated the efficacy of proposed ballast water guidelines in preventing future species introductions.

Cooperative Institute for Limnology and Ecosystems Research (FY1991-1993)The Cooperative Institute for Limnology and Ecosystems Research (CILER) supports a variety of research projects where scientists from NOAA work in conjunction with scientists from academia. A major thrust of CILER research over the past two years has been studies of the effects of the invasion of the zebra mussel in the Great Lakes. The primary objective of these studies is to determine ecosystems effects from infestation of zebra mussels. The Saginaw Bay ecosystem was selected as a major study site and the system has been under study for the past three years. The timing of this study is such that Saginaw Bay has been observed both before and after zebra mussel infestation. Components of the ecosystem under study by CILER funded research projects include: assessment of the lower food web; impacts on the benthic algae; impacts on emergent macrophytes; and the near-bottom particle abundance and distribution.

In addition to the Saginaw Bay studies, CILER funded studies include an investigation of the physiological energetics of zebra mussels and the processes surrounding the formation of pseudofeces by zebra mussels.

Several of these research projects will continue for another two years in order to fully observe the changes to the Saginaw Bay ecosystem as the zebra mussel becomes fully integrated into the food web. Preliminary results to date indicate that the zebra mussels have caused a significant readjustment of the food web, but the system is still undergoing a major transition and as yet has not reached a new stable condition.

NONINDIGENOUS AQUATIC NUISANCE PREVENTION AND CONTROL ACT OF 1990

The zebra mussel is but one of the many nonindigenous aquatic nuisance species (ANS) in the Great Lakes system, but has played the central role in prompting passage of key federal legislation. In drafting the federal Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990 (ANS Act), P.L. 101-646, Congress recognized that mitigation of the adverse impacts of all such species is dependent upon a well-coordinated research, monitoring and prevention program at the regional and national level. As enacted, the legislation has five purposes: to prevent unintentional introductions; to coordinate research, control and information dissemination; to develop and carry out environmentally sound control methods; to minimize economic and ecological impacts; and to establish a research and technology program to benefit state governments. Section 1203 of P.L. 101-646 is of principle interest to the Great Lakes.

There are two operational subtitles, one directed at the prevention of unintentional introductions via ballast water exchange, and the other directed at prevention and control via research, control and coordination activities. Section 1203 calls for voluntary ballast water exchange guidelines within six months, educational and technical assistance programs within 12 months, and regulations within 24 months. Civil and criminal penalties are specified and another clause calls for consultations with the Government of Canada to develop an effective international program. Finally, Section 1102 calls for ballast exchange, biological, and shipping studies at the national level to be completed in 18 months. Language in P.L. 101-646 encourages a negotiation process through the International Maritime Organization to encourage prevention and control measures in other countries.

The second operational subtitle has several key provisions of particular relevance to the Great Lakes Basin. First and foremost, it establishes, at the national level, an ANS Task Force co-chaired by the Director of the Fish and Wildlife Service and the Under Secretary of Commerce for Oceans and Atmosphere. It provides for representation from the U.S. EPA, Coast Guard, Department of Army and others, as appropriate. It also stipulates that the co-chairs shall invite representatives of the Great Lakes Commission and state agencies and other government entities to participate as ex-officio members.

AQUATIC NUISANCE SPECIES TASK FORCE

The Aquatic Nuisance Species (ANS) Task Force, established by the legislation, has developed a national program that: 1) identifies goals and priorities for prevention, monitoring, control, research and education; 2) describes responsibilities of Task Force members; 3) coordinates their activities; 4) develops funding recommendations and; 5) develops and implements a demonstration program for zebra mussel control to be implemented in the Great Lakes and any other infested (or likely to be infested) waters. The latter task will involve research and development, monitoring, development of control plans, and technical assistance to state and sub-state entities.

The ANS Program is designed to:

prevent the introduction and dispersal of ANS;
monitor, control and study ANS; and
disseminate related information.

The ANS Program has undergone public review whereby 2,100 copies of the proposed program were distributed to a broad array of interested individuals and organizations, including: federal agencies, U.S. Congress, state agencies, Indian tribes/Native American organizations, interstate/regional/international organizations, conservation/environmental/recreation organizations, professional societies/academicians, industry/commercial, media, foreign governments/organizations, and associated members of the Great Lakes Panel and ANS Task Force. In addition, six public meetings were held in late December 1992 to provide an opportunity for the ANS Task Force to explain the proposed ANS Program, respond to questions and listen to comments. The ANS Program is approved and is in the final stages of being published.

Implementation of this comprehensive program will build on existing nonindigenous nuisance species activities and be a cooperative effort among federal agencies, states, tribes, local governments, non-governmental entities, and other countries.

Implementation activities of the ANS Task Force included: developing a research protocol to ensure that research activities carried out under P.L. 101-646 do not result in the introduction of aquatic nuisance species; conducting an "intentional introduction policy review;" developing control programs (eg., zebra mussel and the ruffe); and Great Lakes regional coordination.

The research protocol establishes a process and provides decision criteria for evaluating the risk that research projects are likely to pose for unintentional introduction or dispersal of aquatic nuisance species. The protocol, a product of the Research Protocol Committee of the ANS Task Force, was announced for availability for public review in the Federal Register in September 1992. A summary of public comments was presented to the ANS Task Force during their meeting held in May 1993. The document has been approved by the Task Force and distributed to agencies, universities, and other entities conducting research under P.L. 101-646.

The intentional introductions policy review was conducted by the ANS Task Force to identify and evaluate approaches for reducing the risk of adverse consequences associated with intentional introductions of nonindigenous aquatic species. The nonindigenous species under review are primarily those used extensively in the aquarium industry, aquaculture, and fisheries management which have been and continue to be both a source socio-economic benefits to many sectors of American society and a factor in the loss of biological diversity. The Task Force has prepared a report to summarize the

findings, conclusions, and recommendations of its policy review. The two primary issues addressed in the report are: 1) the need to make ecologically credible decisions, and 2) the need to strike a balance between greater risk reduction and maintaining current activities and economies that depend on the use of nonindigenous species. The final report will be sent forward to Congress in September 1994, and will be available to the public.

At its April 1992 meeting, the ANS Task Force prepared a resolution finding the ruffe to be an aquatic nuisance species, for which control is warranted, and that the ruffe control program, proposed by the Great Lakes Fishery Commission's Ruffe Task Force, addresses the requirements of the Act for control. In response to this resolution, the ANS Task Force Ruffe Control Committee submitted, on April 30, 1993, a proposed ruffe control program to the ANS Task Force. The control program has been conditionally approved by the Task Force with sections to be added on evaluation, reporting and implementation costs. A final draft will be made available for public review during the fall of 1994. The goal of the program is to prevent or delay the spread of ruffe through the Great Lakes and inland waters by containing the species to its current (1992) range in western Lake Superior. The program addresses each of the potential vectors by which ruffe may spread.

The Zebra Mussel Coordinating Committee is primarily working on the development of a research inventory database that includes zebra mussel research throughout the U.S. and Canada. The Committee has also identified the following areas where additional zebra mussel research is needed: protection of small waterbodies, removal methods, riverine areas, and contaminant transfer.

The ANS Task Force provides a forum for discussion on the Coast Guard regulations regarding ballast water management for vessels entering the Great Lakes issues. The regulations, mandated under P.L. 101-646, require ballast water management practices for each vessel entering the Great Lakes to prevent additional introduction of nonindigenous aquatic nuisance species through the ballast water of vessels. The final regulations were published April 8, 1993 in the *Federal Register* and went into effect May 10, 1993.

PANEL MEMBERSHIP

Section 1203 provides limited guidance in establishing membership, calling only for the convening of "a panel of Great Lakes representatives from Federal, State and local agencies and from private environmental and commercial interests..."

It was agreed that a careful balance is necessary to ensure that the Panel is both broad in representation and yet manageable in size. To achieve this, a two-tiered approach has been employed. First, Panel members were drawn from key agencies/organizations pursuant to the categories of interest identified in Section 1203. Second, Panel observers were also identified who have the opportunity to contribute fully to Panel discussion and decision-making. An agency or organization will be designated as an observer (as opposed to a member) if: 1) Section 1203 does not provide for direct membership; 2) if their category of interests (e.g., environmental, commercial) is already adequately represented on the Panel; or 3) if their role in aquatic nuisance species research, control and monitoring is comparatively limited.

In the interest of maintaining a functional Panel size, membership policy dictates that, where available, associations or other umbrella groups will be requested to designate a single individual to represent all within the association.

The membership representation of the Panel is as follows:

Federal - One member each from the U.S. F&WS; the National Oceanic and Atmospheric Administration; the U.S. Coast Guard; the U.S. Army Corps of Engineers; the U.S. Environmental Protection Agency; the State Department; and the Animal and Plant Health Inspection Service.

State - One member each from the states of Illinois, Indiana, Michigan, Minnesota, New York, Ohio, Pennsylvania and Wisconsin.

Regional/Binational - One member each from the Great Lakes Fishery Commission, the International Joint Commission and the Great Lakes Commission (ex-officio).

Canadian - One member each from the Department of Fisheries and Oceans (federal); the Ontario Ministry of Natural Resources; and Ontario Hydro.

Tribal Authorities - One member each from the Great Lakes Indian Fish and Wildlife Commission and the Chippewa-Ottawa Treaty Fishery Management Authority.

Local - Two members representing coastal communities, preferably one U.S. and one Canadian.

Private Environmental/User Groups - One member each from Great Lakes United and the Great Lake Sport Fishing Council.

Private/Commercial - One member representing the Council of Great Lakes Industries. One member each from the following industries: electric utility; Great Lakes St. Lawrence maritime transportation; and water supply.

University/Research - Two members from the Great Lakes Sea Grant Network; one providing expertise on research initiatives, the other on advisory services/extension. One member representing the Cooperative Institute for Limnology and Ecosystem Research. One member from a U.S. F&WS

Cooperative Research Unit.

In finalizing Panel membership, the following points were emphasized:

- a) Panel membership may require the approval of the two co-chairs of the National Task Force (i.e., U.S. F&WS, NOAA) and must meet all criteria for a federally chartered advisory body. The Great Lakes Commission believes that Canadian and tribal authority representatives have membership status. If any such federal criteria preclude non-U.S. membership, those interests will be officially designated as observers and, through that vehicle, participate in Panel activities.
- b) The Great Lakes Commission is responsible for extending Panel membership invitations.
- c) Panel members can suggest to the Great Lakes Commission any agencies/organizations that might be given an observer status. Similarly, any such agency/organization can request that designation via communication with the Commission.
- d) The above list provides for a membership of numerous individuals. In some instances, it is recognized that one representative may be in a position to speak for a larger group. For example, the eight Great Lakes states may wish to appoint one or two individuals as key Panel contacts and regular meeting participants.

ZEBRA MUSSEL

Ecological History

The zebra mussel was first discovered in Lake St. Clair in June 1988, although the age of some harvested specimens suggests that the mussel was introduced in 1985 or 1986. Native to the Black and Caspian Seas, the mussel spread throughout Eastern Europe during the late eighteenth century, aided by the construction of canals for commercial navigation purposes. The zebra mussel had established itself throughout much of the European continent by the 1930's, with colonies being found in Britain as well.

The zebra mussel is believed to have been transported to the Great Lakes Basin via ballast water from a transoceanic vessel. Ballast water taken on in a freshwater European port and subsequently discharged into Lake St. Clair introduced zebra mussel larvae to a new plankton-rich environment well-suited to their proliferation. A small bivalve mollusk with an elongated shell, the zebra mussel grows up to 0.78 centimeters in length, with an expected life span in the Great Lakes of two to three years. The adult mussel feeds on plankton by filtering water at a rate of one liter per day. The adult female, dependent on its size, can produce over 1,000,000 eggs per season, which can range as long as May through October in parts of the Great Lakes Basin.

In their free-swimming larval (or "veliger") stage, zebra mussels are scattered by currents over a wide area. As adults, they become stationary, anchoring with a tuft of fibers known as byssal threads to any hard, non-toxic substrate. In this stage, they can colonize in great density.

Although they prefer warm temperatures, shallow water, slow currents, and a plankton-rich environment, the zebra mussel has demonstrated a tolerance for waters throughout the Great Lakes Basin. Lake Erie remains the locus of the bulk of the infestations, but reports of zebra mussel colonies have come from many parts of the Basin in recent years, including Lake Superior. The entire Great Lakes system and its tributaries are believed to be vulnerable to large scale infestations, as is a substantial portion of the United States.

The quagga mussel, sharing similar characteristics with the zebra mussel, poses related threats to the Great Lakes ecosystem. Discovered in Lake Ontario in 1991, the quagga was transported to the Great Lakes, like the zebra mussel, in the ballast water of a freighter. Preliminary evidence suggests that the quagga inhabit colder, deeper water than the zebra mussel, causing scientists concern that its range could extend beyond that of the zebra mussel, thus compounding the nonindigenous mussel problems in the Great Lakes.

Environmental and Economic Impacts

The ecosystem and economic impacts of the zebra mussel are pervasive. Experts attending a March 1990 workshop sponsored by the Great Lakes Fishery Commission and the International Joint Commission agreed that "nonindigenous aquatic organisms have the potential to transform water quality, existing plant and animal communities, and human use of the aquatic ecosystem that they invade." The potential impact on the fishery is profound. For example, the zebra mussel colonizes the rock substrate used for spawning by various fish species. The filtering capacity of the zebra mussel efficiently eliminates plankton from the water column, binding it into "pseudofeces" that are ejected from the mussel's siphons and accumulate among the shells in the colony. The depletion of plankton may lead to the loss of food for fish larval stages.

Economic impacts of the zebra mussel infestation are as pervasive as the ecosystem impacts. The

zebra mussel is not selective about substrates; it attaches itself to boat hulls, reefs, navigational buoys, anchors, and water intakes, to name a few. The municipal water intake in Monroe, Michigan, for example, experienced a temporary interruption of flow in December 1989 due to large concentrations of zebra mussels obstructing the intake. Emergency sources of water supply were activated until the flow could be resumed. Variations on this scenario have been seen with increasing regularity, since that time, at municipal water intakes, power plants and private manufacturing operations.

Commercial and recreational vessels are also vulnerable to damage or compromised fuel efficiency. Once attached to the hull of a vessel, zebra mussel colonies will create drag, lessen fuel efficiency and on small boats, place an unnecessary strain on motors. Zebra mussels drawn into an engine's cooling water intake can occlude the system, leading to overheating and engine damage. Navigational buoys have sunk under the weight of zebra mussel colonies. Colonies on dock pilings and ladders can interfere with dockage and expedite corrosion. With respect to recreation, beach areas littered by zebra mussel shells and the odors of decaying zebra mussels have been observed, with an attendant impact upon beach usage levels. Beach closing in Lake St. Clair in July 1994 have been attributed to the combined affects of increased algae and rooted aquatic plant growth due to the filtering effects of zebra mussels (increasing water clarity) and urban and rural runoff.

One respected Great Lakes scientist has been quoted as saying that the environmental and economic impacts over the long term could exceed those associated with the Exxon Valdez disaster. If the infestation is left unchecked (as noted earlier) damages in excess of five billion dollars over the next ten years have been estimated; this is approximately the annual economic value of the entire Great Lakes sport fishing industry. Costs associated with the cleaning of municipal and industrial water intakes, the locks at the Welland Canal and other structures have already run into tens of millions of dollars. A variety of control mechanisms have been identified, but a viable means to effectively manage or eradicate the zebra mussel population on a Great Lakes-wide basis has yet to be found. Protection of water intakes is possible (to varying degrees of effectiveness) through physical, mechanical and chemical controls. These include, for example, a traveling screen mesh, micro-straining fabrics, physical scraping, electrical currents, electrostatic filters, chlorine discharge and outright replacement of occluded intakes.

The environmental and economic implications of the zebra mussel infestation problem speak to the magnitude and immediacy of the issue. While this is indeed a matter of national significance, it is clear that effective control strategies within the Great Lakes Basin will have a preventive value for other regions.

Appendix G: Sea Grant Offices

Appendix H: FY1994 Appropriations