Going All Out on the AIS Front

The history of exotic species in the Great Lakes is one of profound ecological change at considerable financial cost. In the 1950s, the sea lamprey drastically changed the food web of the Great Lakes and now costs more than $12 million a year to control. Zebra mussels cause ongoing ecological damage by reducing food availability for native aquatic organisms, disrupting food webs, changing nutrient cycles in lakes, and costing industries and citizens millions to clean up clogged intake pipes, boats, and underwater structures. The annual cost of zebra mussels throughout the U.S. is estimated at $100 million. Today the Great Lakes are threatened by new introductions as well as unrealized impacts from the 160 invasive species already in the basin. These threats also apply to inland waters in both Illinois and Indiana.

The introduction and spread of aquatic invasive species (AIS) typically happens as a result of human activity. These organisms are transported around the world in the ballast water of ships and from lake to lake on the bottom of boats and in bait buckets. They are brought here from foreign waters to enhance fish tanks and water gardens, often ending up released into the wild.

Illinois-Indiana Sea Grant has directed efforts towards reducing the introduction, spread, and ecological and economic harm of aquatic invasive species through research, outreach, and education. This “pull-out-all-the-stops” campaign has provided crucial information to legislators, resource managers, industry people, teachers, students, recreational water users, and other targeted audiences.

Research Informs Policy and Management

From 1997 through 2003, Sea Grant funded 15 research projects related to AIS in the Lake Michigan basin. Project goals include: determining the present and future effect of infestations of exotic species on the food chain and on biodiversity; identifying likely new invading species; developing protocols for prevention of new invasions and spread of existing ones; and searching for likely control mechanisms. These research projects have leveraged over $3.6 million, resulted in 25 scientific journal publications, and have formed the foundation for the impacts described below.

Critical Testimony

Sea Grant has played a significant role in legislative efforts to prevent the introduction and spread of invasive species. At the local level, Pat Charlebois, Sea Grant’s biological resources specialist, testified on AIS for Chicago’s City Council, which led to a citywide ban on snakehead fish and sales of live Asian carp. Sea Grant’s Biological Resources Extension Associate Kristin TePas also testified before the Illinois House of Representatives Conservation and Land Use Committee, raising awareness of AIS at the legislative level. Also, with Sea Grant encouragement, the Illinois Department of Natural Resources established an emergency administrative rule prohibiting possession of all snakehead fish in the state. This regulation was the first step towards the establishment of an easily amended, prohibited species list in Illinois.

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Stopping Asian Carp in Their Tracks

Chicago waterways link the Great Lakes and the Mississippi River, providing a convenient transportation route for industry and agriculture. Unfortunately, in recent years, some invasive species accidentally introduced into either the Great Lakes or the Mississippi River have made their way into the other watershed, escalating regional problems into national ones. Zebra mussels, for example, which were first introduced into the Great Lakes, are now upsetting the ecology of the Mississippi River from Minnesota to Louisiana.

The latest species poised to pass through the Chicago waterways and into the Great Lakes are two Asian carp, the bighead and silver. These fish have a voracious appetite for zooplankton, which all fishes typically feed on in their juvenile stages, so they have the potential to adversely affect every species of fish in the Mississippi River and the Great Lakes. Concern is especially high for the $4.5 billion commercial sport and fishing industry in the Great Lakes.

Sea Grant played a critical role in the creation of a groundbreaking electric barrier in the Chicago waterways that is stopping the Asian carp in its tracks. The barrier is designed to allow water and boats to flow through, but not fish. The idea is that fish experience increasing levels of electricity as they move through the dispersal barrier and are compelled to turn around. Pat Charlebois and Rip Sparks are
Outreach, Education Change Attitudes and Actions

Because people play such an important role in the spread of invasive species, Sea Grant has dedicated a great deal of time and effort to informing relevant audiences about the problems of AIS and what they can do to help prevent their spread. In fact, IISG is the primary purveyor of AIS information in the region.

Boaters and Anglers

Recreational water users have transported a variety of organisms from lake to lake, including Eurasian watermilfoil and zebra mussels. IISG has developed extensive programming directed towards boaters, anglers, and others. The program has reached out to these audiences in many ways and has seen results.

One successful approach has been to provide information, training, and educational products to entities that deal directly with recreational water users. This includes lake associations, Illinois conservation officers, state educators, the U.S. Coast Guard Auxiliary, and the U.S. Power Squadron.

Illinois-Indiana Sea Grant has also developed 10 products, many designed to be strategically located, to remind boaters and anglers of what they can do to help prevent the spread of AIS. Boat-landing signs located at nearly 400 Lake Michigan and inland lake access sites alert boaters to take action to clean their equipment. Nearly 95,000 bait bucket stickers, which remind anglers to not dump their bait in local waters, have been distributed through creel clerks, fisheries biologists, at outdoor shows, and through lake associations. Nine identification cards, which are small enough to fit handily in a tackle

members of the Dispersal Barrier Advisory Panel, which determined the appropriate strategy and implemented the process. Now, an additional barrier is under development; approximately $7 million of new funding has been approved.

Charlebois has worked closely with the City of Chicago Department of Environment, coordinating the Aquatic Invasive Species Summit, which brought together 70 top scientists to generate ideas and develop plans to permanently stop the exchange of invasive species in Chicago waterways. The group developed a list of short-term and long-term proactive strategies that will be submitted to Congress to solicit future funding.

With Sea Grant support, Mark Pegg and John Chick of the Illinois Natural History Survey have been assessing the potential ecological impact of the Asian carp on the Mississippi River and Great Lakes. Using a simulated environment, they have also been testing the effectiveness of the electric barrier, as well as other barrier technologies, in stopping bighead carp. As discussions coalesce around additional barrier plans, Pegg and Chick's data will be crucial. These researchers have also played a critical role in relaying accurate and timely information about Asian carp to the media. They have participated in over 100 radio, newspaper, and television interviews, including coverage by CNN, NBC, ABC, FOX, and CBS news.

Leaving nothing to chance, a task force of federal, state, and local agency representatives (including IISG's Charlebois) has developed a rapid response plan for Asian carp in the Chicago waterways. This plan, which awaits approval, relies on timely sightings of Asian carp in the Chicago waterways. Consequently, Sea Grant's bighead and silver carp identification cards, fact sheets, and the Web-based sighting reporting system will be instrumental to its success. IISG is also developing tools that will allow Illinois officials to rapidly respond to other new invasion, such as an Aquatic Non-Native Species Reporting Form and a New Sightings Protocol. ■
box, provide drawings, photos, and key information on invasive species. Nearly 8,300 bighead and silver carp ID cards, printed in 2003, have already been distributed to anglers and other interested parties in the region.

Another way that Sea Grant reaches these critical audiences is through colorful and creative exhibits for display at conferences and shows geared towards participants in outdoor activities. In the past three years, over 16,000 people have been reached by Sea Grant staff through displays at the Chicagoland Outdoors Show, the Northwest Indiana Steelheaders’ Spring Fever Outdoor Show, Illinois and Indiana State Fairs, and Farm Progress Shows. These shows provide a unique opportunity to talk one-on-one with people of varied backgrounds and ages, learn more about their information needs, and engage them in a fun and direct learning experience.

The result of all these efforts is that between 2000 and 2003 the number of anglers surveyed who reported taking action to prevent the spread of invasive species increased to 84 percent—a 15 percent jump. This increase suggests that Sea Grant’s outreach campaign has helped reduce the rate of spread of aquatic invaders.

**Bait Suppliers**

Our research shows that retail bait in Illinois and Indiana has a high incidence of non-baitfish contamination, indicating that AIS could be introduced into natural waterways through retail outlets. IISG has worked with the Great Lakes Sea Grant Network to adapt a standardized food-preparation approach to prevent contamination. Hazard Analysis and Critical Control Point guidelines, or HACCP, can help bait and aquaculture industries reduce the number of harmful exotic species in bait. HACCP allows bait and aquaculture industry personnel to identify and monitor critical points within their own facility through

• Every wholesale bait facility in Illinois and Indiana received a copy of our HACCP training handbook and video, which describe step-wise protocols to reduce risk of AIS contamination.
• Every known bait shop in Illinois and Indiana received a sign encouraging employees to inspect all bait being packaged for consumers.
• As a final safeguard, bait shops in Illinois and Indiana received a roll of 250 bait bucket stickers that remind anglers to dispose of bait rather than release it into natural waterways.

**Aquarium Hobbyists and Professionals**

Each year, over 2,000 species, representing nearly 150 million exotic freshwater and marine fishes, are imported into the U.S. for use in the aquarium trade. Home aquarium owners have released Oriental weatherfish, goldfish, and piranha (to name a few) into Illinois and Indiana waters. It is critical that this audience understand the impact of releasing unwanted fish or plants into natural waters.

Sea Grant is engaged in a new national project that joins the pet industry with state and federal agencies to raise awareness about AIS. A message is being developed and will be delivered to consumers on products distributed through retail outlets, such as bags in which consumers take fish home. Outreach continued on page 6
Tracking Down AIS Pathways

Live bait, pet, water garden, and biological supply trades are increasingly important pathways for the transportation of exotic species into new waters. David Lodge, Cynthia Kolar, and Reuben Keller at the University of Notre Dame are identifying the live aquatic species that are in trade in the southern basin of Lake Michigan, identifying what environmental and economic risks these species pose, and designing guidelines to lower these risks.

They have found that many species already known to be invasive are readily available for purchase, that many species are misidentified by vendors, and that most plants come with other plant and animal contaminants (for example, snails), which may themselves pose invasion risks. The researchers have also identified some plants in trade that are not yet nuisance species, but pose a considerable risk. Because organisms released in the Great Lakes region can be expected to spread to Canadian waters, this study will have implications for our neighbor as well.

Lodge’s team will create lists of species likely to become nuisances if released and species that are considered safe. Voluntary codes of industry conduct will be developed to reduce the future risk of spreading AIS through these pathways. This partnership with these industries will reduce the introduction and spread of AIS in the short term, and lay the groundwork for more effective and efficient future regulations, should they be necessary.

With IISG funding and follow-up efforts funded by National Sea Grant (AIS), Lodge and Kolar also developed a “decision-tree” model to predict possible AIS of tomorrow that may arrive through ballast water or other pathways. This research, published in Science in 2002, is leading the way towards what will be a major emphasis across the continent—using risk assessment to target prevention efforts towards what are likely to be the most invasive non-native species.
tools are also being created to inform retail employees about AIS, so they can educate their customers. Several national pet retailers from the Pet Industry Joint Advisory Council are enthusiastic and have committed time and an estimated $1 million to this project.

**Plant Hobbyists and Professionals**

The water garden business in the U.S. has grown 10 percent every year since 1992. It is the largest growing facet of the horticulture business. Unfortunately, as this business grows, so does the number of water garden escapees that can become problems for natural waterways. To address this risk, Sea Grant is involved in a national project targeted at all aspects of the aquatic plant industry, wholesalers, retailers, and consumers, which include water gardeners, natural resource managers, and landscape designers. Illinois-Indiana Sea Grant produced a full-color brochure to inform backyard water gardeners how to engage in their hobby responsibly. The brochure covers what to consider when choosing a water garden site and shopping for plants. It also provides a list of species to avoid and explains how to properly dispose of water garden plants.

Sixty-eight teacher-developed lessons were reviewed and pilot tested in 29 states and now are used across the nation, reaching a total of 14,000 students. The “Exotic Aquatics on the Move” program inspired geography teachers to lead 4,200 students in 15 community stewardship projects in Indiana, Wisconsin, New York, Louisiana, and Washington. Here are several of the activities that linked these young people to members of their communities:

- Students in Medford, Wisconsin created a booklet about purple loosestrife and distributed it in waiting rooms of medical clinics;
- Informational posters on the effects of nutria were exhibited at city hall in Lake Charles, Louisiana;
- Students posted signs about invasive species at local Shreveport, Louisiana boat launches and distributed information to area anglers at a bass tournament and at a local boat and sports show.

In the near future, purple loosestrife, an attractive but invasive wetland plant, may have nowhere to run. A biological control program to introduce the natural enemy of purple loosestrife, the *Galerucella* beetle, into local wetlands has been accepted as part of the National 4-H Curriculum Collection. The program provides youth the opportunity to hatch thousands of these plant-eating beetles, to release them into nearby wetland areas where purple loosestrife is a problem, and to monitor the success of their efforts. Thus far, purple loosestrife populations have been reduced in 14 Illinois and Indiana wetlands, totaling nearly 100 acres, due to 4-H youth releasing approximately 35,000 beetles. This experiential learning curriculum was developed by Purdue University 4-H in partnership with Illinois-Indiana Sea Grant, Michigan Sea Grant, Minnesota Sea Grant, and the Illinois Natural History Survey.

**Educators and Students/Youth**

Illinois-Indiana Sea Grant has developed programming for teachers and volunteer leaders involved in formal and informal youth education to help tomorrow’s citizens and leaders learn the impact of AIS and how each of us can be a part of the solution. Annually, 175 teachers and 5,200 students learn about aquatic invasive organisms, including actions they can take to help prevent the spread of these species into uninfested waters.

Collaborating with Sea Grant programs around the nation, IISG held workshops for science and geography teachers to develop lessons based on Sea Grant AIS research.

IISG uses innovative exhibits to inform youth and adults about the threat of AIS. Arrest That Invader! is a game in which players ID the “bad guys” from a police plant lineup.
SGNIS Provides Cutting-Edge Science Data

As a result of $17 million of federal funding through the Nonindigenous Species Control Act of 1990, a wealth of research and outreach information related to AIS is available for scientists, resource managers, and educators. But where? The answer is the Sea Grant Nonindigenous Species (SGNIS) Web site, one of the few genuinely peer-reviewed resources on the Internet.

Between the years 2000 and 2003, nearly 728,000 visitors from over 140 countries accessed www.sgnis.org.

The SGNIS Web site has been the Internet presence on nonindigenous issues for the National Sea Grant College Program since 1996. The SGNIS database contains over 1700 items related to AIS, including research findings, conference proceedings, newsletters, graphic slides, outreach, education, and multimedia products. Contributions to SGNIS come from over 100 organizations (20 of which are Sea Grant programs) and 148 professional scientific journals. Information on over 25 species, including the zebra mussel and round goby, can be searched in a variety of ways.

SGNIS also provides the latest on issues such as ballast water, biological control, impacts, and population dynamics.

“Nab the Aquatic Invader! Be a Sea Grant Super Sleuth” is a new Web site that will make educational materials accessible to large numbers of educators and students in a highly-interactive format. The site, which is part of SGNIS, uses a detective theme to engage youth in grades 4-10 in games and brain teasers as they explore biology, spread, impacts, and control of the “bad guys”—plant and animal invaders in U.S. waterways and wetlands.

Nab the Aquatic Invader! Be a Sea Grant Super Sleuth
Impact Highlights

• Concluding that regulation of the shipping industry would be more appropriate at a regional level, an Illinois legislative study committee turned to Illinois-Indiana Sea Grant (and Chicago’s Port Authority) to educate the industry in the state about AIS issues.

• The Illinois Comprehensive Aquatic Nuisance Species Management Plan was produced and implemented, leading to the development of an online AIS reporting system.

• The City of Chicago passed ordinances banning the sale of snakehead fish and live Asian carp.

• Purple loosestrife populations in 14 wetlands, totaling nearly 100 acres in Illinois and Indiana, have been reduced due to 4-H youth releasing the *Galerucella* beetle, the plant’s natural enemy.

• 84 percent of recreational water users (an increase of 15 percent over the last three years) now take proactive steps to reduce the spread of AIS.

• A dispersal barrier for the Chicago waterways has been designed, installed, and evaluated to prevent the migration of AIS between the Great Lakes and Mississippi River watersheds. Plans are underway for a second barrier.

• A rapid response plan has been developed for Asian carp in the Chicago waterways to prevent their spread into the Lake Michigan ecosystem.

• Annually, 175 teachers and 5,200 students learn about aquatic invasive species, including actions they can take to prevent the spread of AIS into uninfested waters.

• Geography teachers in six states led 4,200 students in 15 community stewardship projects to increase public awareness and reduce the spread of AIS. 200 copies of the stewardship guide assembled from these projects have been distributed to teachers across the U.S.

• Between the years 2000 and 2003, a national Sea Grant site (www.sgnis.org) that responds to researcher and manager informational needs, served nearly 728,000 visitors from over 140 countries.