

# Community Stewardship Projects on Exotic Aquatic Species

Developed by students as part of Sea Grant's "Exotic Aquatics on the Move" education project



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Published by the Illinois-Indiana Sea Grant College Program.

## **Publication no. IISG-01-24**

Additional copies may be downloaded from the Illinois-Indiana Sea Grant Web site:

<[www.iisgcp.org/edu/cr/index.html](http://www.iisgcp.org/edu/cr/index.html)> and Exotic Aquatics on the Move Web site:

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Funding is provided by the U.S. Department of Commerce,  
National Oceanic and Atmospheric Administration  
(NOAA Grant #NA86RG0048), University of Illinois  
at Urbana-Champaign and Purdue University,  
West Lafayette, Indiana. The University of Illinois  
and Purdue University are affirmative action, equal  
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Developed by students as part of Sea Grant's "Exotic Aquatics on the Move" education project



**Exotic Aquatics on the Move is a joint project of** Illinois-Indiana Sea Grant College Program, Louisiana Sea Grant College Program, Minnesota Sea Grant College Program, New York Sea Grant Institute, Ohio Sea Grant College Program, and Washington Sea Grant College Program

**Stewardship projects from workshops offered by Sea Grant Programs in** Illinois-Indiana, Louisiana, New York, and Washington



**Exotic Aquatics on the Move was conducted in collaboration with** Geography Educators Network of Indiana, Inc., Louisiana Geography Education Alliance, and Illinois Geographic Alliance

## **ACKNOWLEDGEMENTS**

This project could not have been accomplished without the technical expertise provided by Geographic Alliances in partnership with Sea Grant. We would especially like to thank:

**Dr. Anthony Lewis**, Louisiana Geography Education Alliance, Coordinator

**Lou Camilotto**, Geography Educators Network of Indiana, Vice President

**Dr. Norman Bettis**, Illinois Geographic Alliance, State Coordinator

These educators were invaluable in providing the geographic framework from which to base our plans for this teacher training and student learning project.

We are grateful to the many Sea Grant programs that were involved with this project. We would especially like to thank:

**Dr. Pam Blanchard**, Louisiana Sea Grant,

Principal investigator and workshop facilitator

**Andrea Copping**, Washington Sea Grant, Principal investigator

**Helen Domske**, New York Sea Grant,

Principal investigator and workshop facilitator

**Dr. Rosanne Fortner**, Ohio Sea Grant,

Principal investigator and Web site coordinator

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Principal investigator and coordinator of stewardship project presentations and poster session at the National Council for Geographic Education 2001 Conference

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*We dedicate this publication in memory of*

J. Joe Ferguson

Assistant Director

Geography Education Program

National Geographic Society

He lent his support to this project, and said, "Thank you for informing me about the exotic aquatic invaders project. It sounds like an interesting and much needed program. I was excited to learn that you have already been in contact with our Geographic Alliances in Indiana, New York, Louisiana, and Washington."

J. Joe Ferguson was a victim of the September 11, 2001, national tragedy.

We will miss him.

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## **INTRODUCTION**

Exotic aquatic invaders are impacting waterways throughout North America. These invasive species, which range from zebra mussels to green crab to nutria, have had serious ecological and socio-economic impacts from the Great Lakes to the Gulf of Mexico and from the Atlantic to Pacific oceans—and rivers and lakes in between. Purple loosestrife, water hyacinth, and hydrilla are just a few examples of non-native aquatic plants that are choking waterways, hampering wetlands, and creating great disturbances in the native flora and fauna.

Sea Grant outreach staff members have acquired a good understanding of boaters' and anglers' knowledge, perceptions, and attitudes about exotic aquatic species, especially related to how these species affect the environment and what role people can play to improve the situation. Through interactions with the public at boat shows and fishing events it has become apparent that many people are not well informed about the numerous impacts and what steps they can take as individuals to prevent further spread of these species into new bodies of water.

“Exotic Aquatics on the Move” is a national Sea Grant education project that was developed to teach educators and their students about the ecological impacts of exotics and how these students and members of their community can make environmentally responsible decisions to help prevent the spread and transport of exotic species.

One important objective of this project was to facilitate community awareness of these invasive species and improve understanding of how they affect humans and how humans affect their dispersal and population distribution.

Another prime objective was to infuse the topic of exotic aquatic species into geography classrooms and show this subject's relevance to the National Geography Education Standards.

### **Teacher Training**

Teachers and non-formal educators attended Sea Grant-sponsored workshops held in Indiana, Louisiana, New York and Washington. The sessions included presentations by scientists and outreach specialists focusing on important geographical factors such as origin, distribution, movement, consequences, and solutions. Those themes were chosen to coincide with the geographic applications of the study of exotic species. Attendees became aware of the numerous ways that people can take an active part in helping prevent further spread of these menacing species.

Geographic Alliances in Louisiana, Indiana, and Illinois all played an active role in the planning and actual presentation of the workshops. Teachers who were members of these Alliances came on board as eager participants in these Sea Grant professional development sessions. The Alliance Coordinators also served in an advisory capacity ensuring that the workshop content aligned well with National Geography Education Standards.

### **Students Taking Action as Community Stewards**

Teachers then went back to their classrooms and education centers to teach their students about the effects of exotic species on the environment and economy. Students became very excited about learning more about the invaders in their local area. They were intrigued with how they arrived here and the numerous consequences caused by the invasion of these species.

The final outcome of this community awareness element of the project was 14 new community stewardship projects created by students to engage local citizens in taking action to improve their environment. These projects were impressive in their approaches to reaching out to the community with new information. Methods used to inform the public included bumper stickers, videotaped programs, t-shirts, large school displays and events, artwork, murals, posters, and

flyers. Students met with the public at boat shows, marinas, and educational events such as the Great Lakes Student Summit. Some young people met with community groups such as a city council, the Kiwanis Club, and high school academic boosters who were interested in learning more about exotic aquatics.

After doing extensive research, students developed key messages such as “Don’t Dump Your Aquarium” and “Be Careful with Purple Loosestrife—It’s Pretty but It Kills.” These young stewards used creative methods to distribute their information. They met with reporters to share information. They placed flyers in doctor and dental offices and exhibited student projects at community educational facilities such as the Center for Great Lakes Environmental Education and the Aquarium of Niagara. They reached out to the Hispanic community with a play in Spanish about purple loosestrife and a merengue dance which demonstrated how native plants are “bumped out” of their habitat by purple loosestrife.

### **What’s in Store for the Future**

Members of the Sea Grant team and representatives of the state Geographic Alliances felt this project was a tremendous success. Many more people in the participating states now have a better understanding of why we should not take exotic aquatic species for granted and how we can all play a role in preventing further spread of these plants and animals.

The coordinators of “Exotic Aquatics on the Move” (EATM) plan to continue spreading the key messages that have been so well articulated by students involved in this project. We will present additional teacher training sessions at national, regional and state teacher conferences. The EATM Web site, [iisgcp.org/EXOTICSP/](http://iisgcp.org/EXOTICSP/) will continue to be enhanced with new information for teachers and students to explore. Another helpful Web site is SGNIS, the Sea Grant Nonindigenous Species site, [www.sgnis.org](http://www.sgnis.org). This site includes the Kids’ Page geared for students. We encourage you to visit both sites often, share the information with colleagues, and make suggestions. You will be able to download a collection of teacher-developed lessons that resulted from this education project, along with a printable PDF document of this Community Stewardship Project Guide.

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**With everyone’s help we can slow the spread and sometimes even stop the spread of certain exotic aquatic species. By raising awareness and taking responsibility, we can work together to make a big difference on the local, regional, national, and global scale!**

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# ALIEN SPECIES AWARENESS PROJECT

*Susan Keith, Teacher  
Caddo Magnet High School  
Shreveport, LA*

## Introduction to Stewardship Project

The waterbodies in northwest Louisiana are under assault by invasive exotic species. These species have a tremendous impact on one of the areas largest recreational sports: fishing. Hydrilla and water hyacinths clog up many of Louisiana's beautiful waterways, making boat travel and sport fishing difficult. Students at Caddo Magnet High School decided to take their newfound exotic species information "on the water." They developed flyers to distribute to area sport fishermen and women to encourage them to stop the spread of exotic hitchhikers on their boats, motors, and trailers.



Students greet bass tournament fishermen with flyers they made on how they can help prevent the spread of exotic aquatics .

## Objectives

Students set out to share specific information with younger students (fourth graders at a nearby Shreveport school) on exotic species. They also wanted to distribute, in the form of posters and letters, information on invasive species to area fishermen.



Students talk with a sport fisherman at a boat and sports show about the importance of removing exotic species from fishing and boating equipment.

## Student Activities

Students developed flyers that explained to sport fishermen how they could stop the spread of exotic species by taking the time to check their boats, motors and trailers for hitchhiking exotics. Students then went to a bass tournament at a marina on the Red River and talked with fishermen, passing out their flyers. They also attended a boat and sports show in Shreveport, passing out flyers and speaking with interested visitors. Students were pen-pals to fourth grade students at Sunset Acres Elementary School in Shreveport. They exchanged information on exotic species with these young learners.

Finally, students from Magnet High posted signs from Louisiana Sea Grant at local boat launches on Cross Lake and Cypress Lake.

## Outcome/Impact of the Project

Students in this stewardship project had personal contact with hundreds of sport fishing enthusiasts in the Shreveport-Bossier area. Area boaters got information on the prevention of the spread of invasive exotic species so that now they will know what they can do to keep these species from moving to new bodies of water.

# AMERICA'S MOST UNWANTED

*Christine Hedge, Teacher*

*Carmel Junior High School  
Carmel, IN*

## **Introduction to Stewardship Project**

Students at Carmel Junior High sought to educate their community about the many different exotic species invading America and the ecological and economic damage these invaders are causing. If people do not know that exotic species are a problem, then they are not going to take any interest in this issue—the key is to “know your enemy.”

## **Objectives**

The first steps are knowing there is a problem and understanding how widespread the problem is. Our goal was to raise awareness about the issue of exotic invaders. We wanted to teach people in our community that exotic species are a major threat to biodiversity all around our country as well as in our own backyard.

## **Student Activities**

Each team of two or three students researched one exotic invader and created a PowerPoint presentation to be shown to our school's students, teachers, and visitors from our community. We are in the process of attaching these presentations to our school Web site to educate our virtual community, and we hope that will be available during the 2001–2002 school year.

We have taught about exotic aquatic invaders from all over the United States. In addition, we selected a few terrestrial exotic invaders from our own county to bring our point home. These local invaders include gypsy moths and garlic mustard. Presentations were created about the following species: zebra mussels, Chinese mitten crabs, European green crabs, European ruffe, sea lamprey, purple loosestrife, nutria, round goby, Asian eel, garlic mustard, and gypsy moths. Students explained the following concepts for each species: Where is this species native? Where is it invading the United States? How, when, and where did it get to the United States? What are the ecological, economic, and human health problems caused by this invader? What kind of solution is being used to deal with this problem?



Students researched an exotic invader to create a PowerPoint presentation.



Showing the damage that sea lamprey inflict on native Great Lakes species was one way that students shared information at their school.

### **Outcome/Impact of the Project**

Due to the success of this project, our community now knows that exotic species are more than just a nuisance. They know that these invading organisms threaten the biodiversity of many waterways and the economies of many communities. In addition, people went away with an understanding of what they can do as gardeners, aquarium owners, and boaters to help prevent the spread of exotics.

# AQUÁTICOS EXÓTICOS

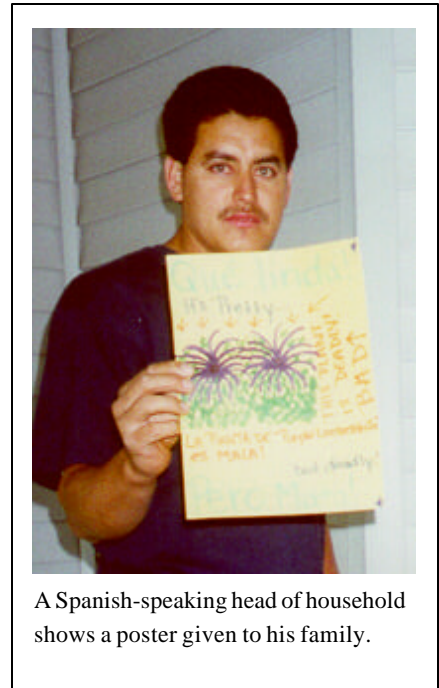
*Susan E. Marquez, Teacher  
North White High School  
Grades 9–12 Foreign Language  
Monon, IN*

## Introduction to Stewardship Project

Students in Susan Marquez’s Spanish class worked on raising awareness of the invasion of the purple loosestrife plant in the Spanish-speaking community. Many of the students were not aware of the plant’s presence, stating that some had seen the plant, while others had not. In Mexico and El Salvador, there are populations of purple loosestrife that can travel up into communities in the United States. Because of this, students decided to take their knowledge of the language to target the portion of the community that primarily spoke Spanish to show that the plant was a threat to the natural habitat.

## Objectives

Students wanted to practice their use of the Spanish language by informing the Hispanic community, who had previously not known of the purple loosestrife, about the dangers this plant poses upon the habitat of their community. Students had the opportunity to use their Spanish with native speakers while creating awareness about the environment in that community.



A Spanish-speaking head of household shows a poster given to his family.



Learning the merengue and creating a dance about purple loosestrife invasion reinforced students’ understanding of purple loosestrife impacts.

## Student Activities

To begin this project, students began to do research about purple loosestrife on the Internet and found nearly 5,000 sites dedicated to this plant. With this information, the students used their Spanish-speaking capabilities to translate the information. They were able to tie Spanish into science and agriculture, making this a very interdisciplinary lesson.

A play was chosen to present to the community via video. The third and fourth days of this activity were set aside for students to learn their

lines. As a break and a cultural experience, students learned how to dance the merengue, a traditional Spanish dance. Music was a great way to help students learn about this topic.

The following week, students designed bilingual posters to help their community become more aware of the plant. Each student used such Spanish phrases as “Be Careful with Purple Loosestrife!” and “It’s Pretty, But It Kills.” The class members told local citizens to look out for the plant in July, in the counties of La Porte, St. Joseph, and Starke, Indiana.

When all of these tasks were completed, the posters and video were presented to the community. Ten of the posters were prominently displayed in the school, while six other posters went out to homes and stores. Students who created the best posters were recognized in class.



Prize-winning posters were displayed throughout the Spanish-speaking community.

### **Outcome/Impact of the Project**

This project was successful in raising awareness not only in Susan Marquez’s Spanish class, but also in the Hispanic community. The play, coupled with the construction of the bilingual posters, made this a great experience for the students as they had fun while practicing translating, writing, and speaking Spanish. The Hispanic community became more aware of the hazards of the plant—something most people had not previously known. The posters helped to spread the information to Hispanics that work in and visit Indiana Beach, thus increasing the reach and impact of the students’ efforts.

# BEWARE! THE ALIENS HAVE LANDED

*Cynthia Keith, Teacher*

*Sunset Acres Elementary School*

*4<sup>th</sup> Grade*

*Shreveport, LA*

## Introduction to Stewardship Project

Students in Cynthia Keith's fourth grade class learned about exotic aquatics and then put that knowledge to use by corresponding with their high school pen-pal buddies about the problems that certain exotic species in their area are causing in their local water bodies. Students learned about the particular problems caused by water hyacinth, hydrilla, and nutria to local recreational fishing.

## Objectives

Students wanted to stop the spread of alien species that had been spotted on the “exotic radar screen” near their area lakes.

## Student Activities

Sunset Acres Elementary School fourth grade students became pen-pals with Caddo Magnet High School students. They corresponded with each other about the problems of the exotic invasion that was occurring in the Shreveport area lakes. The fourth grade students made posters to display to the public at area marinas and boat launches. The posters focused on the problems caused by exotic species such as water hyacinth, hydrilla, and nutria. Students also included information about cleaning your boat of exotic aquatics when leaving the boat launch, as well as areas of Louisiana that are suffering from the effects of these exotic animals.

Posters made by these industrious fourth grade students traveled to several locations during the school year. They were displayed at the Krewe of Centaur’s annual fishing tournament. In addition, they were also displayed at the annual boat show sponsored by a local television station, KTBS Channel 3 in Shreveport, Louisiana.

The culmination of this project was when the fourth grade students met their high school pen-pals at a local boat launch. They ate lunch together, sang songs, and then “dedicated” a permanent sign that will serve to make boaters more aware of ways to help stop the “alien invasion.”



A class picture of Cynthia’s fourth grade students at their dedication of a permanent sign to remind boaters to clean their boats when leaving the boat launch.



A student stands with a poster created by Cynthia Keith’s fourth grade class at the Krewe of Centaur’s Fishing Tournament.

## Outcome/Impact of the Project

Students put their learning into action by creating colorful, eye-catching posters for display at local fishing tournaments, boat launches, and boat shows. They finished the year by joining with their high school pen-pals to dedicate a permanent sign at a local boat launch to inform fishermen about the importance of cleaning their boats and trailers of exotic debris when leaving the boat launch.



**Peggy Meaux, Teacher**

*Acadiana High School*

*Lafayette, LA*

**Introduction to Stewardship Project**

One important pathway for introductions of exotic species into our waterways is through the dumping of home and school aquaria. The purpose of this project is to build awareness of the consequences of dumping exotic species into our waterways.

**Objectives**

Students will learn about how exotic aquatic animals and plants are introduced into our waterways, and then create a t-shirt design that explains why dumping aquaria contents into local waterways is not a good idea.



**Student Activities**

Students learned about the problems former exotic aquarium pets and plants pose to Louisiana’s waterways. Students decided they wanted others to be aware of the fact that dumping exotic fish into the water was not good for Louisiana’s ecosystems. The method they chose was to design t-shirts and have a t-shirt design contest to pick the five most creative and informative t-shirt designs. These five shirts were then displayed in the school library and later worn to school.



**Outcome/Impact of the Project**

When students wore their t-shirts to school, other students saw the shirts on campus and wanted to know more about what the shirts meant and what they, as stewards of their community could do to prevent aquarium pets from ruining Louisiana’s ecosystems. Students want to take the t-shirts to pet stores next year and ask store managers to display them in the store. They are also interested in designing and distributing bookmarks to pet stores, fellow students in the school, and other community members.

## EXOTIC AQUATIC SLEUTHS GO PUBLIC

*George Book, Teacher*

*S.P. Arnett Middle School*

*Lake Charles, LA*

### **Introduction to Stewardship Project.**

Eighth grade students at S.P. Arnett Middle School wanted to create an awareness of the problems that certain exotic species were creating in their hometown of Westlake, Louisiana.

### **Objectives**

Students gathered information through digital pictures, Internet, geography programs, encyclopedias, and hands-on activities concerning the following exotic species: fire ants, Formosan termites, pine beetles, and nutria rats. All of this information was organized into a presentation and posters that were presented to the city council and mayor of Westlake, Louisiana. They also contacted local newspaper about the topic and displayed their informational posters at city hall and the Kiwanis recreation building to show the exotic invaders in our community.

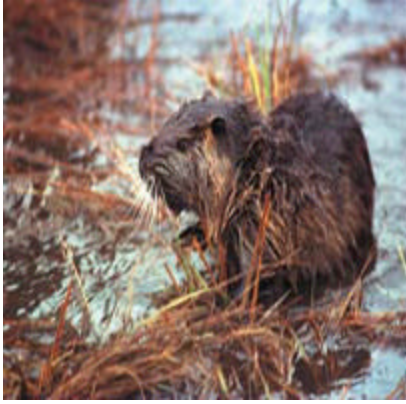
### **Student Activities**

Several students collaborated in creating a presentation concerning these exotic species. These students went on field trips to find the habitats of the Formosan termite, pine beetle, nutria rat, and fire ant, so the students could take digital pictures. They also wrote down and organized information about the habitats and the effect the species have had on the area.



Exotic aquatic sleuths at S.P. Arnett Middle School. These students went public with information on local exotic species causing trouble in their community.

The group returned to the computer lab to find more information through the Internet and Geography programs like Encarta. We involved the whole community, including the mayor, and placed exotic species posters at City Hall. The students, with my guidance, organized a PowerPoint presentation on these species to make our community aware of these invaders. From this educational effort, we were able to work together to try to find a solution to the situation.



Nutria is a non-native aquatic mammal that has devastated wetland areas with its voracious appetite.

Source: Popular Mechanics Web site

### **Outcome/Impact of the Project**

The community of Westlake became more aware of the problems these invaders cause in our region. The mayor and the city council were very supportive of the project and put up our exotic species posters. The students learned that they had a very serious problem in their community. They also became champions for the cause of advertising these invaders and finding a solution to the problem.

The area news affiliates were also very receptive to the advertisement concerning our four foreign invaders. Shortly after our project, the other newspapers in the area started to print information about our invaders and others in the region. Our community and other communities in southwest Louisiana are trying to come up with solutions to the devastating problems of the fire

ant, Formosan termite, nutria rat, and the pine beetle. As a result of our stewardship project, the region is learning about the problems caused by these exotics, as well as what they can do to help eliminate the problem.

# EXOTICS INVADE THE AQUARIUM OF NIAGARA

*Jeanette Brunner, Coordinator of Education*

*Aquarium of Niagara  
Niagara Falls, NY*

## **Introduction to Stewardship Project**

The Aquarium of Niagara is a non-profit educational facility that serves the educational needs of thousands of students from across western New York. After attending the “Exotic Aquatics on the Move” workshop, education specialist Jeanette Brunner worked on getting the word out on exotic species to students, teachers, and guests who visit the Aquarium annually.

## **Objective**

The Aquarium of Niagara wanted to create a display and disseminate information on exotic species to its visitors. Utilizing materials from the “Exotic Aquatics on the Move” workshop an educational display was created in the classroom at the Aquarium of Niagara. Copies of educational materials on exotics were produced for dissemination to teachers and other visitors at the Aquarium.



Many native fishes are endangered, including lake trout, because of the parasitic nature of the sea lamprey.

Photo credit: Great Lakes Sea Grant  
Network Aquatic Species Library

## **Student Activities**

By offering a class on exotic species of the Great Lakes, the Aquarium was able to create a map and display on the spread of exotics from other parts of the world to the Great Lakes. Students were asked to draw pictures of the exotics, and then yarn was used to show their “home” and the point of introduction into the Great Lakes. This student-created map was added to a larger display on exotic species that was developed by the Aquarium’s education department.

## **Outcome/Impacts of the Project**

In one school year alone, more than 20,000 teachers and students were exposed to the display and materials on exotic species and their ecosystem impacts. Many visiting teachers took materials on exotics from the Aquarium back to their classrooms. The Aquarium education staff offered several classes on exotic species, or incorporated information on the ecosystem impacts of these invaders in classes related to the Great Lakes and the environment.

# GEOGRAPHY OF THE GREAT LAKES AND NONINDIGENOUS SPECIES

*Lou Camilotto, Teacher*  
*McCutcheon High School*  
*Grades 9–12 Geography*  
*Lafayette, IN*

## Introduction to the Stewardship Project

McCutcheon High School coordinated several projects related to exotic species as part of National Geography Week to inform the school and community of the problems facing the Great Lakes watershed and the rivers feeding into the Great Lakes. In a science, geography, and learning center “hub,” a world map showed the origin, movement, and range of exotic species’ spread. At a school entryway, MHS Water World was the school’s prominent feature (see Mickey Penrod’s Water World project description).

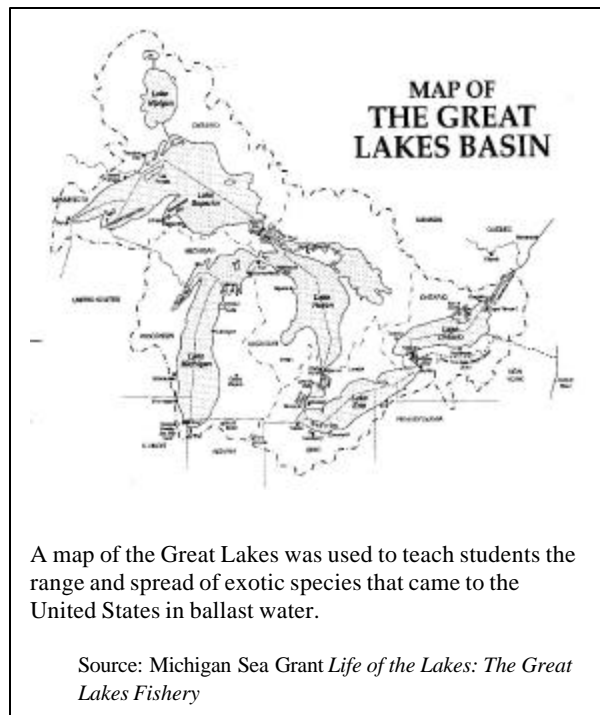
## Objectives

National Geography Week provided an excellent opportunity for students to learn about exotic species, demonstrate an interdisciplinary approach to looking at real-world problems, and increase the school’s awareness of the scope and nature of the field of geography. What are the problems that arise when nonindigenous species come into the Great Lakes? What is being done to solve the problems? What can we do to help? These questions arise from studying the scientific and geographic aspects of exotic species issues.

## Student Activities

Students in Lou Camilotto’s geography class planned an “Exotic Aquatics Species Day” for the McCutcheon High School geography and biological science classes. During class time, students were taught about the indigenous and invasive plants and animals. Students learned about nuisance species, including the Eurasian watermilfoil, ruffe, and sea lamprey in the Great Lakes. Students created a wall display with small posters of exotic species around a large world map. This was placed along a wall of the high school’s large learning center, around which the science and geography classes were located. String between the posters and the map showed the species origin and range of spread. Extra credit was given to students who desired to do more research on how to help spread the awareness about exotic species.

Students also experienced the nuisance of the MHS Water World. This was a serendipitous event because of a fire drill that happened to be scheduled that week, where many students had the nuisance of making their way through the Water World of invasive species. Much of the student body learned firsthand about the annoyance of having foreign objects in their way.



### **Outcome/Impact of the Project**

The project was successful at informing students about the problems being imposed on the Great Lakes and connecting rivers. The classes learned about the nonindigenous invasive plants and animals and were shown that there needs to be an awareness and understanding of how people can help conserve rare, threatened, and endangered species and their habitats. Nine students took it upon themselves to become community environmental stewards by doing extra research on how to help spread the awareness of exotic species. The results of their research will be used to enhance future Geography Awareness Week activities. These students' interest in this topic also has the potential for many far-reaching effects. In addition to increasing awareness in the school, a few community meetings were held at McCutcheon High School in the evening hours; at one particular meeting, the Academic Booster Club members had the opportunity to see the various displays, as well as the Water World, and they were very impressed.



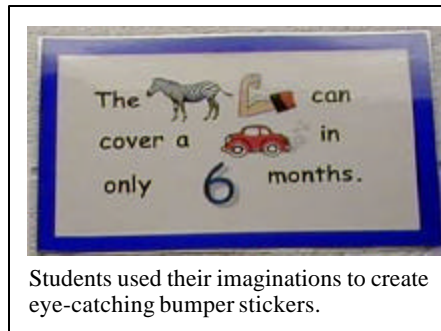
Zebra mussels have spread rapidly through the Great Lakes and connecting rivers and lakes, costing millions of dollars in cleanup and damage control.

## GREAT LAKES AND EXOTIC SPECIES INTERDISCIPLINARY UNIT

*Jennifer MacDonald, Science*  
*Marie Porter, Mathematics*  
*Rose Sebouhian, English*  
*Ilisa Wyman, Social Studies*  
*Marilyn Nowicki, Life Skills*  
*Fredonia Middle School*  
*Fredonia, NY*

### Introduction to Stewardship Project

Five teachers who attended the “Exotic Aquatics on the Move” workshops decided to build a number of stewardship projects into an interdisciplinary unit on the Great Lakes and Exotic Species. After their students had a background on the Great Lakes, they turned their attention to exotic species and their impacts. Their classes worked on several different stewardship activities and then shared their projects with other students in the school. Some students donated their projects to the Center for Great Lakes Environmental Education. (See “Center-ing’ on Great Lakes Exotics” for more information about this project.) A letter writing campaign to area bait and pet shops was another stewardship activity to raise the community’s awareness of ways to keep exotic species from spreading.



Students used their imaginations to create eye-catching bumper stickers.

### Objectives

The object was to create environmental awareness with the students in the classes as well as the other students at Fredonia Middle School. The students felt that their location, near Lake Erie, made it essential for students to learn about exotic species and their impacts on the ecosystem.

### Student Activities

First, the teachers established a learning foundation by working on activities such as: Scientist Career Biographies, Project Wet Water Cycle, Toast to Water, and Great Lakes Food Chain and Food Web. Their aquatic exotics stewardship activities included exotic species “WANTED” posters, environmental bumper stickers, and an exotic species debate. These projects were then shared with other students in the school and were sent to the Center for Great Lakes Environmental Education, where they were displayed throughout the remainder of the school year.

### Exotic Species “WANTED” Posters

Students created “WANTED” posters on invaders of the Great Lakes. They had to research their invader, draw a picture of it, and create a slogan that related to why the organism was “wanted.”

### Environmental Bumper Stickers

Students created environmental bumper stickers related to the Great Lakes and exotic species.

### Great Lakes Debate

Students read an article pertaining to exotic species in the Great Lakes. They were randomly put into groups and picked a card stating what role they would play in the debate. The different roles included a scientist, community member, shipper, angler, government official, and a school member. Each group brainstormed ideas for the debate and represented a different position. For example, the scientist could speak about the ecosystem impacts, the shipper would be concerned with the increased costs and ballast water transfers, the angler could talk about fishing for yellow perch in Lake Erie and catching nothing but round gobies. The students carried out an excellent debate about exotic species in the Great Lakes, and other classes were invited to watch the debate.

### Letter Writing Campaign

After learning about the impacts of exotic species in the Great Lakes, the students wrote letters and sent information packets to area bait shops and pet stores. They asked store personnel to put up information that would help customers learn about exotic species and the dangers of bait bucket transfer and aquarium release of plants and animals.

### **Outcome/Impact of the Project**

The students themselves were interested in the impact that exotic species have on the environment, which is clearly demonstrated by a student composition titled "Rappin' Lamprey." Many Fredonia Middle School students who were not studying the Great Lakes and exotic species learned about these invaders and how they compete with native species for food and habitat. Classes involved their community in the process through an awareness campaign by writing letters to area bait shops and pet stores, encouraging them to help reduce the spread of exotics.

#### **RAPPIN' LAMPREY**

He's the brook trout  
His intestines just got sucked out  
By me the sea lamprey  
Why me? I'm a delicacy  
For King Henry  
I suck on the fish  
And that's my main dish  
I have the body of an eel  
And I can really feel  
When I suck the guts out  
Of that brook trout

Students' interest in the effects of exotic aquatic species is evident in this student composition about the sea lamprey.

county residents about problems  
caused by purple loosestrife .



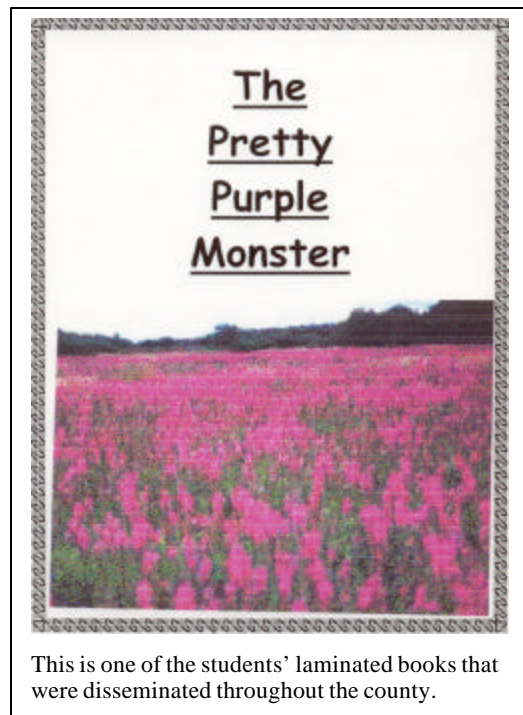
This plant may be pretty but students wanted to warn county residents that purple loosestrife was starting to take over.

Student disseminated books at the following locations: Medford Eye Clinic, Medford Dental Clinic, Medford Medical Clinic, Memorial Hospital, Wildberg Chiropractic Offices, Strama Chiropractic, Tessendorf Chiropractic, Gelhaus Dentistry, Govey Dental Clinic, and Dr. Kaye Orthodontist Office.

### **Outcome/Impact of the Project**

Jeanine Staab and her students believe that this project was a huge success. The service organizations were very pleased and proud to display student work. Many people in the community commented on the books and praised our students for their environmental stewardship.

The students will probably never know how many people will actually implement our suggestions concerning this plant, but they felt confident that awareness is the first step in prevention. Students were extremely proud of their books and the message that they contained.



This is one of the students' laminated books that were disseminated throughout the county.

## **PETS WANT TO STAY HOME**

*Maureen Barnhart, teacher*

*Rebecca Nevers, teacher*

*Leah Naylor, teacher*

*Orengo Elementary School*

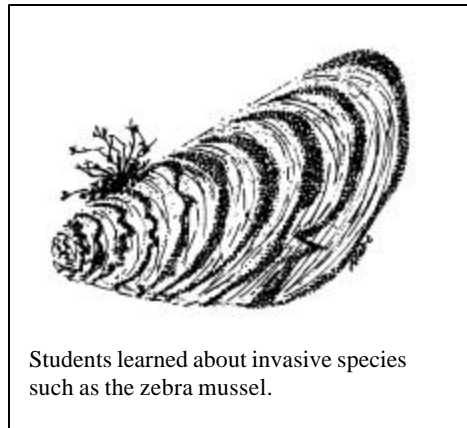
*Grades 3 & 4*

*Hillsboro Schools, Oregon*

### **Introduction to Stewardship Project**

Students shared what they already knew about invasive species: Himalayan blackberries and English ivy removal are constant in the Pacific Northwest. Rats, English sparrows, starlings, nutria, and opossums are some of the many introduced animal species students recognize. Recent stories have appeared in the media regarding discovery in Oregon and Washington of kudzu and hogwart infestations. Finally, they were aware that domestic rabbits have been released at a southeast Portland golf course, which has had an undesirable environmental impact.

The class participated in one of the simulations from the Washington Sea Grant materials in which they played a game resulting in overpopulation of zebra mussels, and a loss of native aquatic species as a result. Although the zebra mussels are not a concern at present in the Northwest, the students were made aware that preventing the introduction of exotic species is an ongoing concern.



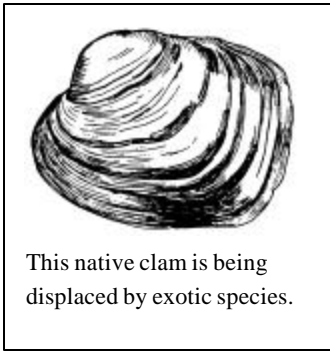
### **Objectives**

The Orengo School grounds include federally-designated wetlands, which students plan to protect and observe. The lessons introducing invasive species gave them the additional goal of educating the community about the dangers of introduced species.

### **Student Activities**

Students brainstormed potential causes for exotic species introduction into their community, and agreed that the most obvious concern is the release of pets into the wetlands area or at the adjacent golf course. They determined that the best course of action to educate the community was a campaign of placing posters in local businesses and at the golf course, and writing letters/informative pieces to the local newspaper. In spring of 2001 the students completed a rubric by which posters would be judged for effectiveness, and then they completed the posters. Some of the posters were to be hung in the hallways of the school to educate new students about the wetlands and to describe the protection project. The posters encouraged pet owners to find pet stores that are willing to find new homes for pets, and they reminded people that release of pets into a hostile (for those animals) environment is cruel.

In the fall of 2001 the students plan to design a rubric for a persuasive written piece and/or oral presentation regarding the options for finding a new situation for unwanted pets. Written pieces will be sent to the local media and the school board.



This native clam is being displaced by exotic species.

### **Outcomes/Impact of the Project**

Students felt empowered to have a positive influence on the wetlands area through education of the community: it's something they can point to as a concrete measure of protection. They are also more aware of the many ways in which species can be introduced into a habitat, many of which cannot be as easily controlled. Portland is a port, and the students were surprised to learn that bilge water is a vehicle for species introduction.

A representative from the Metro Environmental Services (a Portland metropolitan area agency) spoke to the students regarding a vacant area in their neighborhood that will be set aside as a “ conversation with them about their plans for their own wetlands, the Metro representative has invited the students to participate in establishing this greenspace during the 2001–2002 school year.

## SHARING AT THE GREAT LAKES STUDENT SUMMIT

*Mary Jean Syreck, Teacher  
Charles Drew Science Magnet School  
Grade 5  
Buffalo, NY*

### Introduction to Stewardship Project

The class formed an Environmental Club that studied exotic species and wetlands as their theme. Throughout the school year, students learned about the native plants of wetlands and the exotic plants and animals that can harm these important aquatic ecosystems. The students prepared to share their findings and research on wetlands and exotic species at the Fourth Biennial Great Lakes Student Summit held in Buffalo, New York.

### Objectives

Students wanted to learn about native and exotic species found in wetlands and the role these important ecosystems play in the Great Lakes basin. Then they wanted to share their findings with other students from around the basin who gathered for the Great Lakes Student Summit on May 9–11, 2001.

### Student Activities

Students listened to guest speakers who spoke about wetlands and the impacts of exotics species. They visited a wetland near the Buffalo River and conducted observational studies of native and invasive species at the site. Students saw exotic species such as purple loosestrife and Phragmites, and they learned that these exotic plants crowd out native plants such as cattails.

They also learned that many amphibian species do not adapt very well to the change from native cattails to the exotic purple loosestrife, often causing a reduction in the number of amphibian species in a wetland. They learned that wetlands mitigate flooding, help to filter pollutants, provide habitat for plants and animals, and serve as a nursery grounds for some species of fish. The wetland team went to the Smith Street wetland site and conducted a clean up for Earth Day.



Students shared their research about wetlands and exotic aquatic species at the 2001 Great Lakes Student Summit.



Students created a wetland display and shared information about exotic aquatic species with 250 teachers from around the Great Lakes basin.

After visiting wetlands and learning about the native and exotic species, the students created a wetland educational display designed for the “student sharing” session at the Great Lakes Student Summit. The wetland team gave a presentation on native and exotic wetland species for other students who visited their display.

**Outcome/Impact of the Project**

The students were able to share information on exotic species and their impacts on wetlands with nearly 250 students and teachers from around the Great Lakes basin during the Great Lakes Student Summit.



“Zelda the Zebra Mussel” from Illinois-Indiana Sea Grant helped the students share their knowledge of exotics.

# WATER WORLD

*Mickey J. Penrod, Teacher  
McCutcheon High School  
Grades 9–12 Special Education  
Lafayette, IN*

## Introduction to the Stewardship Project

The McCutcheon High School (MHS) Water World stewardship project was a simulation that allowed students, staff, and patrons to experience a fanciful, aquaticlike space that had been invaded by aquatic nuisance species. It was a part of a variety of activities done at the high school during National Geography Week.

## Objectives

To develop student awareness of aquatic nuisance species (ANS), the MHS Water World was conceived. The students wanted to help their peers become aware of the aquatic nuisance species (ANS), be able to identify them, and learn the origin and current location of the ANS.



A simulation of an aquatic environment in this entryway helped demonstrate how exotic invaders could become a nuisance.

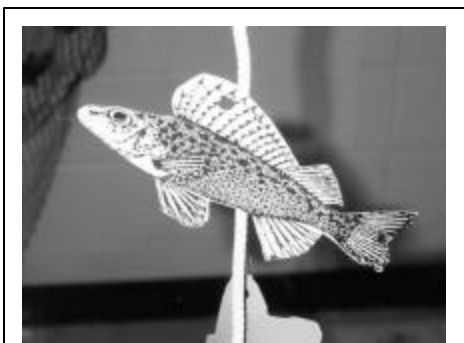
## Student Activities

The MHS Water World was developed between the double-door entry to McCutcheon High School. Dangling from the ceiling were strands of watermilfoil made from white rope and green pipe cleaners. Cutouts of ruffe and sea lamprey were suspended with fishing line to entangle anyone that dared pass through the MHS Water World. Pasta shells and zebra tissue papers were stuck to everything to represent zebra mussels. Green crabs papered the floor. A water feature added the aquarium sound to finish the simulation. The activity was a multi-sensory experience. Posters nearby gave additional information of ANS movement.



One of the displays in the Water World showed the movement and range of zebra mussel invasion from 1988 to 1996.

Thinking questions that were posted at eye level on the windows of the aquarium piqued the interest of the readers. A tri-fold poster represented the “key” to MHS Water World by identifying the actual ANS—matching the real to the simulated. ANS videos were playing throughout the day presenting students with additional information. Cheese fish crackers lured students to the display to complete the jigsaw puzzle of purple loosestrife and to read the answers to the thinking questions. Some students developed brochures and flyers to be positioned on a world map in our main hallway.



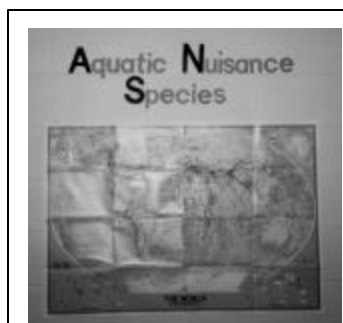
This suspended ruffe entangled those people who passed through the Water World entranceway.

During the two weeks that the MHS Water World was functioning the high school students became aware of just how much a nuisance the ANS could be. Students, including some in wheelchairs, had to go through the maze of the MHS Water World and had a first-hand experience of the entanglement. Classes were invited to visit. Some of the science teachers allowed their students time to watch the videos, work the puzzles, and answer the thinking questions.

### **Outcome/Impact of the Project**

The simulation was a success. The simulation was put together on a Friday night in preparedness for National Geography Week. By coincidence 400 young ladies (3<sup>rd</sup>-8<sup>th</sup> graders) and their families passed through that very entryway that very weekend. It was fun observing the reactions to the simulation. The young people jumped around like they were in the water, parents became frustrated when they became entangled in the ANS look-alikes, while others became curious and began reading the posters.

The simulation survived and more of the community was exposed to aquatic nuisance species than I could have hoped for. During my prep period I would often do minor repairs, and many students passing would comment and after a discussion of the display would always guess I was a science teacher. I often surprised them when I said that I was not a science teacher, but a concerned environmentalist, which they should be, also.



World map helps orient students to the origins of many aquatic exotic species.

## WHERE'S THE BEAUTY IN THE BEASTIES?

*Catherine Kiffe, Teacher*

*N.P. Moss Annex, Lafayette Parish School District  
Middle and High School Homebound Program  
Lafayette, LA*

### Introduction to Stewardship Project

Middle and high school homebound students (students confined to their homes because of health problems), worked on the projects presented. They worked individually researching and collecting exotic aquatic information using the Internet. The results of their information were compiled and then rewritten in a simplified form with a goal to present the information to younger students. This information was used for two projects presented in the community, (1) a “center activity” for a second grade class at Woodvale Elementary School in Lafayette, LA, and (2) a presentation at the Lafayette Public Library for students from the area ages 8-11.



Student works on her exotic aquatic activity sheets displaying the effects of exotics on Louisiana's ecosystems.

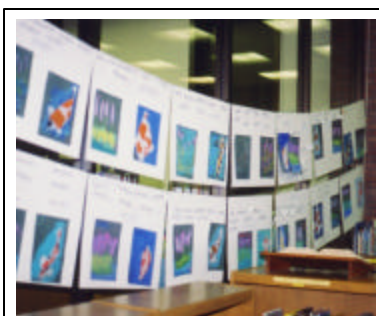
### Objectives

Students will synthesize information gathered on exotic species from Internet sources and then rewrite this information in a simplified form to share with younger students. Younger students then work with the information provided to produce visuals to share with the community.

### Student Activities

In the first project, an elementary class used information presented in printed form at an activity center in their classroom. The information and instructions were presented with the intent that the students could read the instructions and follow through with the activity on an individual basis. Activities included using a world map to locate the country of origin of the exotic species and several art activities in which students used stamps to display overcrowding that typically accompanies exotic invasions as well as the impact of exotics on native fish populations.

In the second project, Internet information gathered on exotic species by middle and high school students was presented to students, ages 8–11, at the Lafayette Public Library. Participating students created posters emphasizing two exotics, koi and water hyacinths. These colorful posters were used for a display at the Lafayette Public Library.



Student exotic species artwork is displayed at the Lafayette Public Library.

### Outcome/Impact of the Project

The middle and high school students increased their research skills in the process of gathering information on exotic species from the Internet. They synthesized this information in a concise, yet simplified way, so that younger students would also understand the information. The younger students gained new knowledge about exotic aquatics and produced visuals to share that knowledge with the community. The community gained new knowledge of exotic aquatics and their impacts on Louisiana's waterways.

*Penrod, responding to a student who thought  
she was a science teacher when working on Water World*

“We learned that some plants look nice but can be harmful.”

*—Roseanna, a 2<sup>nd</sup> grade student at Woodvale Elementary School*

“I learned a lot today, too!”

*—Parent of student giving a presentation  
at Lafayette Public Library*

“We have had many positive comments on the students’ work and the information they shared.”

*—Librarian at Lafayette Public Library*

## **GUIDELINES TO HELP STUDENTS BECOME ENVIRONMENTAL STEWARDS**

Stewardship projects can increase awareness of problems caused by exotic nuisance species, which can lead to slowing and/or preventing the spread of exotic species. This publication showed some projects that teachers did in classrooms. A few other ideas for projects that your students can become involved in are listed below.

### **At Your School**

- Write an illustrated story about an exotic aquatic species and read your story to another grade or classroom of students.
- Plan an “Exotic Aquatic Species Day” in your school to inform other students and teachers of the problem.
- Design T-shirts about exotic aquatic species. Produce the shirt and wear it to school.
- Design a David Letterman-type Top 10 list.

### **In Your Community**

- Design posters, pamphlets, or brochures about exotic aquatic species and distribute or display them in your community.
- Set up a display or make a mini exhibit for a public or school library.
- Set up an exotic aquatic species information booth in a local bait or boat store.
- Write letters to the editor or a series of articles for the local newspaper.
- Present a documentary for broadcast on a community cable access channel, the local television station, or community radio station.
- Write a play on exotic aquatic species that can be presented or filmed for local cable access channels.

### **And Beyond**

- Make signs for local docks describing measures that boaters can take to prevent further spread of exotic aquatic species. Be sure to cooperate with local officials in the appropriate natural resource agency.
- Make a presentation on exotic aquatic species to a local sporting organization, fishing or hunting club, Ducks Unlimited, Bass Pro, Trout Unlimited, or similar organizations.
- Write to the President, a congressperson, or senator urging them to propose laws aimed at preventing invasions of exotic species.
- Identify a “target” community: One that has waterways currently free from infestation by an exotic aquatic species, but one that is especially vulnerable to being invaded. Contact community officials, write letters to the editor, and take other actions that help promote awareness of the problem in that community.
- Write a letter to encourage pet shops to establish a policy for returning unwanted fish.
- Create a “don’t dump your aquarium” poster and asking that it posted in local pet shops.
- Write letters to plant nurseries to persuade them to discontinue selling nuisance exotic species, such as purple loosestrife and giant salvia.

**Let your imagination be your guide!**

## **“EXOTIC AQUATICS ON THE MOVE” WORKSHOP GEOGRAPHY CONNECTIONS**

### **Origin**

*Students can create and use maps showing where exotic aquatics came from.*

- Sea lamprey is native to the coastal regions of both sides of the Atlantic Ocean.
- Zebra mussels are native to the Caspian Sea region of Asia.
- Eurasian watermilfoil are from Europe.
- Purple loosestrife is a wetland plant from Europe and Asia.

(from *A Field Guide to Aquatic Exotic Plants and Animals*, Minnesota Department of Natural Resources, 1992)

*Geography Standard #1  
The World in Spatial Terms*

*How to use maps and other geographic representations, tools, and technologies  
to acquire, process, and report information from a spatial perspective.*

*Students can investigate which regions have the potential of being a suitable habitat for exotic aquatics.*

The new availability of Alaskan oil on the world market will open the doors for more ANS introduction via ballast water from ports of northeast Asia and elsewhere in the world. Of considerable concern is the transmission of fish pathogens and parasites from foreign ports, which could have a devastating impact on Alaskan fisheries. (*Biological Invasions*, Great Lakes Panel on Aquatic Nuisance Species, 1998)

*Geography Standard #16  
Environment and Society*

*The changes that occur in the meaning, use,  
distribution, and importance of resources.*

### **Distribution**

*Students can create and use maps showing where exotic aquatics are located now.*

- Sea lamprey entered the Great Lakes through the Welland Canal about 1921.
- Zebra mussels were first discovered in Lake St. Clair near Detroit in 1988, and have spread to the Great Lakes, the Mississippi River, and many inland rivers.
- Eurasian watermilfoil spread westward into inland lakes and reached Midwestern states between the 1950s and 1980s.
- Purple loosestrife is now in 40 states and all Canadian border provinces.

(from *A Field Guide to Aquatic Exotic Plants and Animals*, Minnesota Department of Natural Resources, 1992)

*Geography Standard #1  
The World in Spatial Terms*

*How to use maps and other geographic representations, tools, and technologies  
to acquire, process, and report information from a spatial perspective.*

***Students can examine factors that affect why some locations are more suitable for species establishment than other locations.***

Eurasian watermilfoil has difficulty becoming established in lakes with healthy populations of native plants. (from *A Field Guide to Aquatic Exotic Plants and Animals*, Minnesota Department of Natural Resources, 1992)

Geography Standard #8  
Physical Systems

*The characteristics and spatial distribution of ecosystems on Earth's surface.*

## **Movement**

***Students can compile information about how each exotic aquatic species was introduced to new areas.***

- Sea lamprey entered the Great Lakes through the Welland Canal about 1921.
- Zebra mussel microscopic larvae may be carried in livewells or bilgewater. Adults can attach to boats or boating equipment that sit in the water.
- Eurasian watermilfoil can become entangled in boat propellers and may wrap around other external parts of the boat. Stems can become lodged among any watercraft apparatus or sports equipment that moves through water including boat trailers.
- Purple loosestrife was introduced into the East Coast of North America in the 1800s. It first spread along roads, canals, and drainage ditches, then later was distributed as an ornamental. Seeds escape from gardens and nurseries into wetlands, lakes and rivers. Once in aquatic systems, seeds are easily spread by moving water and wetland animals.  
(from *A Field Guide to Aquatic Exotic Plants and Animals*, Minnesota Department of Natural Resources, 1992)

European colonization—the single largest source of unintentional introduction is transport via ocean vessels originating at foreign ports. Over the past century, shipping time has become shorter with faster vessels. More species have been able to survive the journey and thrive in new waters. (*Biological Invasions*, Great Lakes Panel on Aquatic Nuisance Species, 1998)

ANS introductions result from activities that provide economic benefits such as aquaculture industry, aquarium trade, sport fish stocking, bait business and ornamental and landscape practices. (*Biological Invasions*, Great Lakes Panel on Aquatic Nuisance Species, 1998)

An aquatic vine, hydrilla, imported into Florida from Sri Lanka for use in aquariums, was dumped into a canal in Tampa in 1951. Also known as water thyme, it has overgrown more than 40% of Florida's rivers and lakes and continues to spread rapidly. The state spends millions of dollars annually to fight the vine, which grows into dense mats, clogging boat propellers and preventing sunlight from reaching the water bottom. By monopolizing the dissolved oxygen that fish and aquatic plants require to thrive, hydrilla reduces native diversity. (Introduction to Geography, Getis et al.)

Geography Standard #14  
Environment and Society

*How human actions modify the physical environment.*

## Consequences

*Students can compile information about the consequences of exotic species introduction to new environments.*

- Sea Lamprey contributed greatly to the decline of whitefish and lake trout in the Great Lakes.
- Zebra Mussels clog water-intake systems of power plants and water treatment facilities, and the cooling systems of boat engines. They have severely reduced or eliminated native mussel species. They filter plankton from the water, reducing what is available for upper-water species.
- Eurasian watermilfoil interferes with water recreation such as boating, fishing and swimming. The plant's floating canopy can also crowd out important native water plants.
- Purple loosestrife invades marches and lakeshores, replacing cattails and other wetland plants. The plant can form dense, impenetrable stands which are unsuitable as cover, food, or nesting sites for a wide range of native wetland animals.

(from *A Field Guide to Aquatic Exotic Plants and Animals*, Minnesota Department of Natural Resources, 1992)

The Great Lakes sport and commercial fishing industry, valued at almost \$4.5 billion annually, is at risk due to the growing numbers of nonindigenous mussels and fish, such as the zebra and quagga mussels, sea lamprey, ruffe and goby. (*Biological Invasions*, Great Lakes Panel on Aquatic Nuisance Species, 1998)

Large water users in the Great Lakes, including municipalities and industries, pay an average of \$360,000 year to control zebra mussels, with documented cumulative costs of \$120 million from 1989-1994. (*Biological Invasions*, Great Lakes Panel on Aquatic Nuisance Species, 1998)

Florida spends more than \$14 million per year to control a single nonindigenous aquatic plant, hydrilla. (*Biological Invasions*, Great Lakes Panel on Aquatic Nuisance Species, 1998)

*Geography Standard #15  
Environment and Society*

*How physical systems affect human systems.*

*Geography Standard #17  
Uses of Geography*

*How to apply geography to interpret the past.*

## Solutions

*Students can study federal, regional, state, provincial, local, and private initiatives for controlling the spread and dealing with post introduction costs of exotic species:*

- Federal Initiatives: The U.S. Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990 (reauthorized in through the National Invasive Species Act of 1996) is a first line of defense against ANS invasions. The Act provides an institutional framework that promotes and coordinates research, develops and applies prevention and control technologies,

establishes national priorities, educates and informs citizens, and coordinates public programs. (*Biological Invasions*, Great Lakes Panel on Aquatic Nuisance Species, 1998)

- U.S. ballast water regulations mandated under the Act help limit introductions through transoceanic shipping. These regulations require that vessels bound for the Great Lakes exchange their freshwater ballast, replacing it with open ocean salt water that contains organisms not likely to survive in freshwater. (*Biological Invasions*, Great Lakes Panel on Aquatic Nuisance Species, 1998)
- Water users throughout the Great Lakes Basin, and beyond, rely upon state/provincial agencies, Sea Grant programs, and other groups for advice and assistance ANS prevention and control measures. For example, the regulatory and information/education programs of the Minnesota Department of Natural Resources have limited the spread of Eurasian watermilfoil as indicated by an overall decrease in the number of newly infested lakes over the past decade. (*Biological Invasions*, Great Lakes Panel on Aquatic Nuisance Species, 1998)
- Illinois-Indiana Sea Grant provides information to boaters:

**Before leaving a boat launch:**

- Inspect your boat, trailer, and equipment and remove any plants and animals.
- Drain, on land, all water from the motor, livewell, bilge, and transom well. Some exotics may not be visible to the naked eye.
- Empty your bait bucket on land. Never release live bait into a waterway, or transfer aquatic animals between waterways.

**After leaving the boat launch:**

- Wash your boat, tackle, trailer, and other equipment to kill any exotic species not visible at the boat launch. This can be done with 104° F tap water, or a high-pressure sprayer. Or
- Dry your equipment for at least five days—some exotics can survive for long periods of time out of water.
- Learn what these organisms look like, and know which waterways are infested.
- Report any new infestations to Illinois-Indiana Sea Grant or your Department of Natural Resources.
- Talk with these agencies for recommendations and permits before applying any control methods.

*Geography Standard #16  
Environment and Society*

*The changes that occur in the meaning, use,  
distribution, and importance of resources.*

*Geography Standard #18  
Uses of Geography*

*How to apply geography to interpret the present and plan for the future.*

## EXOTIC SPECIES WEB SITES AND CLASSROOM RESOURCES

**“Exotic Aquatics on the Move” Project Web Site**  
[iisgcp.org/EXOTICSP/](http://iisgcp.org/EXOTICSP/)

### Other Exotic Species Web Sites

Biological Control: A Guide to Natural Enemies in North America, a Cornell University Web site  
<http://www.nysaes.cornell.edu/ent/biocontrol/weedfeeders/galerucella.html>  
<http://www.nysaes.cornell.edu/ent/biocontrol/weedfeeders/hylobius.html>.

EnviroLink: Environmental Education Network Web site: <http://envirolink.netforchange.com>

Environmental Protection Agency (EPA) Web site: <http://www.epa.gov>

Great Lakes Environmental Research Laboratory Web site: <http://www.glerl.noaa.gov/glerl.html>

#### Great Lakes Fishery Commission

Main Web site: <http://www.glfsc.org>

Fact Sheets: [http://www.glfsc.org/pubs\\_out/facts.htm](http://www.glfsc.org/pubs_out/facts.htm)

Fact sheet #3: Sea Lamprey: A Great Lakes Invader

Fact sheet #5: Sea Lamprey Barriers: New Technologies Help Solve an Old Problem

Fact sheet #9: International Sea Lamprey Management on the St. Marys River

Pictures: <http://www.glfsc.org/slft.htm>

#### Great Lakes Information Network (GLIN)

Main Web site: <http://www.great-lakes.net>

Exotic Species Web site: <http://www.great-lakes.net/envt/flora-fauna/invasive/invasive.html>

Lamprey Web site: <http://www.great-lakes.net/envt/flora-fauna/invasive/lamprey.html>

Purple Loosestrife Web site: <http://www.great-lakes.net/envt/flora-fauna/invasive/loosestf.html>

Great Lakes Panel on Aquatic Nuisance Species Web site: <http://www.glc.org/ans/anspanel.html>

Great Lakes Sea Grant Network Web site: <http://www.seagrant.wisc.edu/greatlakes/glnetwork>

Great Lakes Sport Fishing Council Web site: <http://www.great-lakes.org>

#### Illinois Natural History Survey

Crayfish Web site: <http://www.inhs.uiuc.edu/chf/pub/surveyreports/jan-feb96/crayfish.html>

Purple Loosestrife Web site: <http://www.inhs.uiuc.edu/cbd/loosestrife/bcpl.html>

#### Michigan State University Purple Loosestrife Project

Main Web site: [http://www.msue.msu.edu/seagrant/pp/html/the\\_project.html](http://www.msue.msu.edu/seagrant/pp/html/the_project.html)

Purple Pages Web site: <http://www.msue.msu.edu/seagrant/pp/index.html>

#### Minnesota Sea Grant

Main Web site: <http://www.seagrant.umn.edu>

Crayfish fact sheet: <http://seagrant.umn.edu/exotics/rusty.html>

Field Guide: <http://www.seagrant.umn.edu>

Purple Loosestrife brochure: <http://www.seagrant.umn.edu/exotics/purple.html>

National Aquatic Nuisance Species Clearinghouse Web site: <http://www.entryway.com/seagrant>

The Nature Conservancy Web site: <http://www.tnc.org>

NOAA, Great Lakes Environmental Research Laboratory (GLERL) Web site: <http://www.glerl.noaa.gov>

Wildlife Database Web site: [http://www.btinternet.com/~bury\\_rd/purpdb.htm](http://www.btinternet.com/~bury_rd/purpdb.htm)

Sea Grant Nonindigenous Species (SGNIS) Web site: <http://www.sgnis.org>

St. Lawrence University Freshwater Biology Web site: <http://it.stlawu.edu/~fwbio>

U.S. Fish and Wildlife Service Sea Lamprey Web Site: <http://www.fws.gov/~r3pao/marquette>

U.S. Geological Survey, Biological Resources Division  
Nonindigenous Aquatic Species Web site: <http://nas.er.usgs.gov>

## Fact Sheets

Fact sheets on aquatic exotics can be obtained from state Sea Grant programs. For your closest program, visit the National Sea Grant College Program Web site and click on state program: <http://www.nsgo.seagrant.org>

### Illinois-Indiana Sea Grant

*Help Prevent the Spread of Aquatic Exotic Plants and Animals*. 1998. IL-IN-SG-98-1. View at the Illinois-Indiana Sea Grant Web site: [iisgcp.org](http://iisgcp.org)  
*Invasive Aquatic Plants*. 2001. IISG-01-22  
*Zebra Mussels: Questions and Answers for Inland Lake Managers*. 2001, IISG-01-20

### Michigan Sea Grant

*Purple Loosestrife: Biology, Ecology and Life History*. 1997.  
*The Purple Loosestrife Project at Michigan State University*. 1997. MICHU-SG-97-501.

### Minnesota Sea Grant.

*Rusty Crayfish: A Nasty Invader. Biology, Identification, and Impacts*. 1995. X34.  
View at Web site: <http://seagrant.umn.edu/exotics/rusty.html>

### New York Sea Grant

*Exotics of Lake Ontario*. 1995. NYSGI-G-95-004.

### Ohio Sea Grant

*Boaters: Take Action Against Zebra Mussels*. 1992. OHSU-FS-054.  
*Round Gobies Invade North America*. 1995. IL-IN-SG-95-10 and OHSU-FS-065.  
*Ruffe: A New Threat to Our Fishes*. 1995. OHSU-FS-064.  
*The Spiny Water Flea, Bythotrephes Cederstroemi: Another Unwelcome Newcomer to the Great Lakes*. 1991. FS-049.  
*Zebra Mussels in North America: The Invasion and Its Implications*. 1990. OHSU-FS-045.

### Wisconsin Sea Grant

"The Sea Lamprey: Invader of the Great Lakes". *The Great Lakes Alien Series #1*. 1982. WISSG82-138

Ontario Federation of Anglers and Hunters. *Sea Lamprey: The Battle Continues*. 1998. Available from the Great Lakes Fishery Commission at 734-662-3209.

## Books, Pamphlets, Guides and Newsletters

"The Balanced Tangle—Understanding Ecosystems." *National Science and Technology Week*. 1991.

Bernhard, A. *Wetland Plants and Animals Coloring Book*. Dover Publications. 1994.

Global Rivers Environmental Education Network (GREEN). *Field Manual for Water Quality Monitoring: An Environmental Education Program for Schools*. #ISBN-1-6801. To obtain, visit the Global Rivers Environmental Education Network Web site: <http://www.earthforce.org/green>

Global Rivers Environmental Education Network (GREEN). *Field Manual for Global Low Cost Water Quality Monitoring*. #ISBN-1-3601. To obtain, visit the Global Rivers Environmental Education Network Web site: <http://www.earthforce.org/green>

Great Lakes Commission. *ANS (Aquatic Nuisance Species) Update* quarterly newsletter. View at the Great Lakes Commission Web site: <http://www.glc.org/ans/ansupdate/ansupdate.html> or e-mail: [shwayder@glc.org](mailto:shwayder@glc.org)

*The Great Lakes: An Environmental Atlas and Resource Book*

Copies may be obtained from:  
Great Lakes National Program Office  
U.S. Environmental Protection Agency  
77 West Jackson Blvd.  
Chicago, Illinois 60604

Lionni, Leo. 1963. *Swimmy*. Pantheon.

McCormick, A. L. *Vanishing Wetlands*. Lucent Books. 1995.

Meyers, Dr. Norman. *GAIA: An Atlas of Planet Management*. ISBN 0-385-42626-7.

Michigan Sea Grant. *The Purple Loosestrife Project Cooperator's Handbook*. 1999. MSG-99-401.

Michigan Sea Grant. "Spiny Tailed *Bythotrephes*. Its Life History and Effect on the Great Lakes." In *Upwellings* newsletter. Summer 1990 and Winter 1992.

Michigan United Conservation Clubs. "An Alien: but not from Outer Space." In *Tracks*. October 1996.

Mills, E. L., et al. 1993. Exotic Species and the Great Lakes: A History of Biotic Crises and Anthropogenic Introductions. *Journal of Great Lakes Research*, 19(1): 1-54. International Association of Great Lakes Research.

Minnesota Department of Natural Resources. *A Field Guide to Aquatic Exotic Plants and Animals*. 1995. View at the Minnesota Department of Natural Resources Web site: <http://www.dnr.state.mn.us> or the Minnesota Sea Grant Web site: <http://www.seagrant.umn.edu>

Minnesota Sea Grant. "Eurasian milfoil: Can it be controlled?" *The Seiche*. Spring 1992.

National Wildlife Federation. "What Makes a Wetland a Wetland?" *Ranger Rick's Nature Scope Wading into the Wetlands*. 1992.

NSTA Great Lakes Jason Curriculum: The Great Lakes Food Web Invading Species Hotline: 1-800-563-7711 (free brochures)

Ohio Sea Grant. *Great Lakes Instructional Materials for the Changing Earth System*. 1995. OHSU-EP-080. (See ESCAPE activities 17 and 30 for a card-matching game from this publication.)

Ohio Sea Grant. *Supplemental Activities Curriculum for Holling Clancy Holling's Paddle-to-the-Sea*. 1988. EP 076. To obtain, visit the Ohio Sea Grant Web site: <http://www.sg.ohio-state.edu/osgrant/education/f-education.html>

Ohio Sea Grant. "What do scientists know about invader species of the Great Lakes?" In *Earth Systems-Education Activities for Great Lakes Schools: Life in the Great Lakes*, 41-52. 1997.

Ontario Federation of Anglers and Hunters. *Purple Loosestrife: What You Should Know, What You Can Do*. 1997. View at the Minnesota Sea Grant Web site: <http://www.seagrant.umn.edu/exotics/purple.html>

Rezendes, P. and P. Roy. *Wetlands: The Web of Life*. Sierra Club. 1996

Wildlife Conservation Society. *Wetlands*. 1995. To obtain, visit the Wildlife Conservation Society  
Web site: <http://www.wcs.org>

## **Educational Materials**

*Exotic Aquatics Traveling Trunk*, an interactive education kit containing preserved and facsimiles of aquatic exotic species available from Minnesota Sea Grant College Program. Contact Doug Jensen,  
218-726-8712; e-mail: [djensen1@d.umn.edu](mailto:djensen1@d.umn.edu) or visit the Web site: <http://www.seagrants.umn.edu/education/tea.html>

*Exotic Species Compendium of Activities to Protect the Ecosystem (ESCAPE)*, a Great Lakes Sea Grant Network publication produced by Illinois-Indiana Sea Grant College Program and available from Great Lakes Sea Grant Programs. Contact Robin Goettel, Illinois-Indiana Sea Grant, 217-333-9448; e-mail: [goettel@uiuc.edu](mailto:goettel@uiuc.edu) or visit the Web site: [iisgcp.org](http://iisgcp.org)

*Rival for Survival and Beat the Barriers Game Set*, colored and laminated game boards with color coordinated game cards for the board games from the *ESCAPE Compendium*. Includes lesson plans, activity descriptions, and game instructions. Contact Robin Goettel, Illinois-Indiana Sea Grant, 217-333-9448; e-mail: [goettel@uiuc.edu](mailto:goettel@uiuc.edu) or visit the Web site: [iisgcp.org](http://iisgcp.org)

*Zebra Mussel Citizen Monitoring Kit*, developed by Michigan State University for Sea Grant, is available for lending or purchase through the Illinois-Indiana Sea Grant Web site: [iisgcp.org](http://iisgcp.org) and the Minnesota Sea Grant Web site: <http://www.seagrants.umn.edu>

*Zebra Mussel Mania Traveling Trunk*, a hands-on, inquiry-based kit and curriculum that contains simulations, experiments, videos, games, stories, and a CD-ROM; plus includes ideas for student-led community action projects. Available at 32 lending centers across the United States and Canada. Contact Robin Goettel, Illinois-Indiana Sea Grant, 217-333-9448; e-mail: [goettel@uiuc.edu](mailto:goettel@uiuc.edu) or visit the Web site: [iisgcp.org](http://iisgcp.org)

“Zelda, the Zebra Mussel” costume available for rent from Illinois-Indiana Sea Grant. Contact Robin Goettel, 217-333-9448; e-mail: [goettel@uiuc.edu](mailto:goettel@uiuc.edu)

## **Multimedia**

*Encarta Encyclopedia 2001* CD-ROM. Available through the Encarta Web site:  
<http://www.encyarta.msn.com/products/info/Encyclopedia.asp>

*Great Lakes Solution Seeker* CD-ROM and activity guide. The Ohio State University. 1996.

*Mussel Menace* activity and video developed by Minnesota Sea Grant, also available as part of the *Zebra Mussel Mania Traveling Trunk*. Purchase of activity and video can be made through the Minnesota Sea Grant Web site: <http://www.seagrants.umn.edu>

*Sea Grant Nonindigenous Species (SGNIS)* CD-ROM. To obtain, visit the Minnesota Sea Grant Web site:  
<http://www.seagrants.umn.edu>

*Zebra Mussel Information System* CD-ROM, available from the U.S. Army Corps of Engineers:  
Waterways Experiment Station, 3909 Halls Ferry Rd., Vicksburg, MS 39180, Phone: 601-634-2972

*Zebra Mussels: Lessons Learned in the Great Lakes Region* videos; set of four videos—*Biology, Spread and Impact, Control, and Outreach Tools*. Purchase videos through the Illinois-Indiana Sea Grant’s Web site: [iisgcp.org](http://iisgcp.org) or contact Susan White, 217-333-9441; e-mail: [white2@uiuc.edu](mailto:white2@uiuc.edu)

“This is amazing! If we aren’t careful we will homogenize the world’s waterways.”

— 7<sup>th</sup> grade social studies teacher at Carmel Junior High School

“I thought that pollution and poaching were causing most species to become endangered. I had never heard of alien species causing problems.”

— 7<sup>th</sup> grade student at Carmel Junior High School

“Many people in the community commented on the books and praised our students for their environmental stewardship.”

— Jeanine Staab, geography teacher at Medford Area Middle School



*Exotic Aquatics on the Move*  
**[iisgcp.org/EXOTICSP/](http://iisgcp.org/EXOTICSP/)**