The University of Chicago Center for International Studies presents *Global Lessons* as part of its commitment to providing educational resources for K-12 educators. These materials offer thematic international & area studies content on topics including culture, economics, politics, history, and environmental issues. With *Global Lessons*, CIS aims to provide classroom materials that will not only help to expose students to global issues, but also to empower them to think critically about their role as global citizens.

**Water: An Interdisciplinary Examination of the World’s Most Essential Resource**

**Impacts of Invasive Species on Lake Michigan**

The University of Chicago Center for International Studies
The Center for International Studies’ Summer Teacher Institute, “Water: An Interdisciplinary Examination of the World’s Most Essential Resource,” was held on the University of Chicago campus from June 28-30, 2010. In addition, a curriculum development workshop was hosted on July 1st and an optional field trip to the Stickney Water Reclamation Plant and the Chicago Center for Green Technology took place on July 2nd.

The Institute provided an in-depth and multifaceted review of global water issues, as well as those that specifically affect the Great Lakes region. Daily topics addressed included: water issues in politics, effective water management, impacts of dams, water scarcity, sanitation, agriculture, and economics.

Thirteen professors, researchers, environmental engineers, and civic leaders from the University of Chicago and other educational institutions from around the world, spoke each day. Sixty elementary, high school, and college teachers from thirty-eight Illinois schools, as well as 20 other education-stakeholders attended the Institute.

The Institute was cosponsored by the University of Chicago Center for International Studies, the Center for East Asian Studies, the Center for Middle Eastern Studies, the Center for East European and Russian Eurasian Studies, the South Asia Language and Area Resource Center, and the Center for Latin American Studies.

The following lesson was created by Jill Krysinski, Honors Biology and Environmental Science Teacher at Bloom High School, and edited by Jamie Bender, Outreach Coordinator for the Center for International Studies at the University of Chicago. The lesson is based on speakers’ presentations at the Institute.

For more information on the Center for International Studies, additional resources and classroom lessons developed based on this Institute, and to download resources from other events, please visit the Center’s website: http://cis.uchicago.edu/
Impacts of Invasive Species on Lake Michigan

Lesson Overview: Students will research various invasive fish and plant species now in Lake Michigan. They will research the origin, means of arrival, current location, and impact on the freshwater ecosystem of these species. Students will then assess the costs and benefits of different species. This lesson is based on information presented at the 2010 University of Chicago Teacher Institute, “Water: An Interdisciplinary Examination of the World’s Most Essential Resource.”

Written By: Jill Krysinski, Honors Biology and Environmental Science Teacher, Bloom High School

Subject(s): Biology, Environmental Science, Social Studies, Geography

Suggested Grade Level(s): Middle School and High School

Time Duration: 3-4 class periods

IL Learning Standards Addressed:

Science
11.A.3g Report and display the process and results of a scientific investigation.
12.B.5a Analyze and explain biodiversity issues and the causes and effects of extinction.
13.B.3d Analyze the interaction of resource acquisition, technological development and ecosystem impact (e.g., diamond, coal or gold mining; deforestation).

Social Studies
17.A.3b Explain how to make and use geographic representations to provide and enhance spatial information including maps, graphs, charts, models, aerial photographs, satellite images.
17.B.3b Explain how changes in components of an ecosystem affect the system overall.
17.C.4a Explain the ability of modern technology to alter geographic features and the impacts of these modifications on human activities.
Objectives:

- Describe the three steps in which a species becomes invasive.
- Research an invasive species of Lake Michigan.
- Examine the negative impacts this species has on the Lake Michigan freshwater ecosystem.
- Investigate ways this invasive species can be stopped or ways to reduce its impact.

Materials:

- Computers with internet access
- Invasion Sequence handout
- Invasive Species of Lake Michigan cutout strips
- Invasive Species Research Worksheet
- Invasive Species Poster/Presentation Rubric
- Butcher paper
- Glue sticks
- Markers or colored pencils

Activities and Procedures:

1. Opening Activity
   - Begin by showing students pictures from the BP 2010 Gulf of Mexico oil spill:
     http://www.guardian.co.uk/environment/gallery/2010/may/19/deepwater-horizon-oil-spill-oil#/?picture=362818091&index=10
   - Ask students if they know what happened? Ask students if they know how it happened?
     - The Deepwater Horizon was an offshore oil rig, operated by BP, drilling in 5,000 feet of water about 40 miles off the coast of Louisiana.
     - On April 20, 2010, it exploded, killing at least eleven crew members and leaving 5,000 barrels of oil a day spewing from the blown-out well underneath it.
   - Discuss the concept of ‘consequences’ (something that follows as a result of an action or choice).
   - Ask students to comment on the possible consequences of the 2010 Gulf of Mexico oil spill.
• Have the class brainstorm actions or choices, they have seen or experienced, that have lead to a negative consequence. Write students' responses on the board. Possible answers include:
  o Clean up workers hospitalized (dehydration and too many pollutants)
  o Endangered species killed
  o Damage to habitats of hundreds of species of birds, fish, and other animals
  o Toxins used to breakdown the oil are polluting the ocean
  o Oil has moved into coastal wetlands
  o Seafood shortage
  o Job losses for fishermen, shrimpers, oyster harvesters, crabbers
  o Damage to tourism industries along the coast
  o Higher gas prices

2. Visualize the Concept: Consequences
• Give each student a blank piece of paper
• Tell them they must represent the idea of consequence
• They can choose one method below:
  o Draw a picture, no words are allowed
  o Create a metaphor
  o Find a picture in a magazine and explain how it represents the idea
  o Choose a song that represents consequences
• Have students discuss their concept visualizations out loud with the class

3. Invasive Species Internet Research
• Advanced Preparation: Print out the Invasive Species of Lake Michigan sheets and cut out enough strips for students to work in pairs.
• Provide each pair of students with one (strip) species to research.
• Give each student an Invasive Species Research Worksheet.
• Ask students to fill in the worksheet questions using the internet as a research tool.
• Have students make a poster, based on their research, to demonstrate their knowledge of characteristics associated with their assigned invasive species.
• Have student pairs present their poster to the class.
• Use the Invasive Species Poster/Presentation Rubric to assess student work.

Assessments:
• Visualization of the concept: Consequences
• Invasive Species Research Worksheet
• Invasive Species Poster and Presentation
Adaptations:

- Have students work independently instead of in pairs.
- Teacher can gather information for the Invasive Species Research Worksheet ahead of time instead of asking students to research using a computer.
- Students can make pamphlets, PowerPoint presentations, or any other visual demonstration of knowledge, instead of a poster.

Extra Credit/Additional Resources:

- Field Museum - Asian Carp Game
  [http://www.etc.cmu.edu/projects/bridges/invasion/index.html](http://www.etc.cmu.edu/projects/bridges/invasion/index.html)
- NOAA Great Lakes Aquatic Nonindigenous Species Information System:
  [http://www.glerl.noaa.gov/res/Programs/glansis/glansis.html](http://www.glerl.noaa.gov/res/Programs/glansis/glansis.html)
- Nab the Aquatic Invader: [http://www.sgnis.org/kids/](http://www.sgnis.org/kids/)
- Habitatitude: [http://www.habitattitude.net](http://www.habitattitude.net)
- Protect Your Waters and Stop Aquatic Hitchhikers:
  [http://www.protectyourwaters.com](http://www.protectyourwaters.com)
- Invasive Species – Aquatic Species:
The Invasion Sequence

```
Species Elsewhere
   ↓
Introduced (=Alien)
      ↓
Established
         ↓
Invasive
```

“Invasive species means an alien species whose introduction does or is likely to cause economic or environmental harm or harm to human health.”
- Clinton’s Executive Order 13112
## Invasive Species of Lake Michigan

<table>
<thead>
<tr>
<th>Species</th>
<th>Image</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zebra Mussel</td>
<td><img src="image1" alt="Zebra Mussel" /></td>
</tr>
<tr>
<td>Quagga Mussel</td>
<td><img src="image2" alt="Quagga Mussel" /></td>
</tr>
<tr>
<td>Alewife fish</td>
<td><img src="image3" alt="Alewife" /></td>
</tr>
<tr>
<td>Asian Carp Bighead</td>
<td><img src="image4" alt="Bighead Asian Carp" /></td>
</tr>
<tr>
<td>Asian Carp Silver</td>
<td><img src="image5" alt="Silver Asian Carp" /></td>
</tr>
<tr>
<td><strong>Round Goby</strong></td>
<td>![Round Goby Image]</td>
</tr>
<tr>
<td>----------------</td>
<td>---------------------</td>
</tr>
<tr>
<td><strong>Viral Hemorrhagic Septicemia (VHS)</strong></td>
<td>![Viral Hemorrhagic Septicemia Image]</td>
</tr>
<tr>
<td><strong>Sea Lamprey</strong></td>
<td>![Sea Lamprey Image]</td>
</tr>
<tr>
<td><strong>Eurasian Water Milfoil Plant</strong></td>
<td>![Eurasian Water Milfoil Image]</td>
</tr>
<tr>
<td><strong>Water Chestnut Plant</strong></td>
<td>![Water Chestnut Image]</td>
</tr>
<tr>
<td>Common Reed</td>
<td>![Common Reed Image]</td>
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<tr>
<td>-------------</td>
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</tr>
<tr>
<td>Curly Pondweed</td>
<td>![Curly Pondweed Image]</td>
</tr>
<tr>
<td>Eurasian Ruffe</td>
<td>![Eurasian Ruffe Image]</td>
</tr>
<tr>
<td>Spiny Water Flea</td>
<td>![Spiny Water Flea Image]</td>
</tr>
</tbody>
</table>
Invasive Species Research Worksheet

Using the internet, gather research on your invasive species, to answer the questions below. Then, make a poster demonstrating your knowledge of your species’ characteristics. Be prepared to present your poster to your classmates. (One suggested website: www.invasivespeciesinfo.gov)

1. Name of species

2. Where is this species’ native land (origin)?

***Print a small map of the species origin for your poster.***

3. How was this species introduced to Lake Michigan?

4. Was this introduction intentional or unintentional?

5. Describe this species’ native habitat:

6. Describe this species’ native diet:

7. Describe this species’ reproductive behavior:

8. What is this species’ scientific name?

Examine the ecological impacts this species is having on the local ecosystem and describe the consequences, by answering the following questions.

9. Does the species compete for resources? If so, what resources?

10. Does the species hunt and eat non-plant native species or take nutrients and space from local plants?

11. Is the species a known carrier of any parasites or diseases that harm people, animals, or plants? If yes, which ones?
12. Does the species decrease the availability of freshwater?

________________________________________________________________________________________
________________________________________________________________________________________

13. What types of economic activities (e.g., aquaculture, industry, tourism, commercial fishing, recreational fishing, flood control) does the species affect? If possible, give figures for how much money this costs.

________________________________________________________________________________________
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14. Does this species have any benefits to people or other organisms? Explain.

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15. How can this species’ impact be reduced or can its invasion be stopped? Are there any solutions?

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16. Describe any other interesting information that you would like to share in your presentation.

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(Use Google images to print some pictures of your species for your poster!)
### Invasive Species Poster/ Presentation Guidelines and Rubric

Use your research to create a display poster that you will use to present information on your invasive species to your classmates.

1. Construct your poster project on a large piece of butcher paper or poster board.
2. Write the common name and scientific name across the top of your poster.
3. You and your partner can decide how to design your poster. You must include the following information:
   - **Origin**: Describe the species’ origin and habitat. Paste or draw a map of this location.
   - **Introduction**: Intentional or unintentional; Describe this species’ means of arrival.
   - **Diet**: What does this species eat (animals)?
   - **Ecological Impacts**: Describe the consequences of bringing this species into Lake Michigan’s ecosystem.
   - **Economic Cost**: Describe how much money this species is costing.
   - **Solutions**: Describe any ways this species can be stopped or ways to reduce the negative impact.
   - **Other Interesting Information**: Picture or illustration of your researched invasive species.
4. Present your poster and information to the class.

### Items to Include on Poster and in Presentation

<table>
<thead>
<tr>
<th>Items to Include on Poster and in Presentation</th>
<th>Points Possible</th>
<th>Points Earned</th>
</tr>
</thead>
<tbody>
<tr>
<td>Names: Common name and scientific name</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Origin: Description and map</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Habitat: Description of this species’ natural and new habitat</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Introduction: Description of how this species was introduced</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ecological Impacts: Description of the consequences for Lake Michigan’s ecosystem</td>
<td></td>
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<tr>
<td>Economic Cost: Description of the possible financial burden of this species.</td>
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</tr>
<tr>
<td>Solutions: Description of possible ways to stop the negative impacts of this species</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Picture or illustration of your researched invasive species</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Presentation Non-verbal Skills</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Make eye contact with the group at all times</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Posture is straight, both feet on the ground; no slumping</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Presentation Vocal Skills</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Speak slowly, loudly, and clearly</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>