

Invaders

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Grade level: 9-12

Time allotment: Two 50-minute class periods

Overview: Organisms compete for resources such as food, water, and living space. When organisms of the same species compete with each other it is called *intraspecific competition*. When organisms of different species compete it is called *interspecific competition*. A special kind of interspecific competition that has become a worldwide problem with severe ecological and economic impact is the competition between native species with non-native species. These non-native species are called *invasive species*. Invasive species generally have effective dissemination mechanisms, high reproductive rates, few natural predators, and quickly displace native species.

Through video clips and activities presented in this lesson students will learn the difference between intraspecific and interspecific competition and be able to identify resources for which these organisms compete. The concept of invasive species will be introduced and the Asiatic Clam presented as an example of how an organism can out compete native species and take over an ecosystem. Students will learn about local invasive species by examining the Invasive Species web site and doing a poster project on an invasive species of their choosing.

Subject Matter: Biology and Life Science

Learning Objectives:

Students will be able to:

- Define intraspecific competition;
- Define interspecific competition;
- Identify resources for which organisms compete;
- Describe characteristics of an invasive species;
- Make a poster describing an invasive species in their local area.

Standards:

From the National Science Education Standards (1995) -- Center for Science, Mathematics, and Engineering Education for grades 9-12 available on line at <http://www.nap.edu/readingroom/books/nse/html/6e.html>

The Interdependence of Organisms -- Life Science Content Standard C; Guide to the Content Standard:

- Organisms both cooperate and compete in ecosystems. The interrelationships and interdependencies of these organisms may generate ecosystems that are stable for hundreds or thousands of years.

- Living organisms have the capacity to produce populations of infinite size, but environments and resources are finite. This fundamental tension has profound effects on the interactions between organisms.
- Human beings live within the world's ecosystems. Increasingly, humans modify ecosystems as a result of population growth, technology, and consumption. Human destruction of habitats through direct harvesting, pollution, atmospheric changes, and other factors is threatening current global stability, and if not addressed, ecosystems will be irreversibly affected.

From the Virginia Learning Standards for Biology, available on line at <http://www.pen.k12.va.us/VDOE/Superintendent/Sols/sciencebiology.doc>

BIO.9 The student will investigate and understand dynamic equilibria within populations, communities, and ecosystems. Key concepts include:

- a) interactions within and among populations including carrying capacities, limiting factors, and growth curves;
- b) the effects of natural events and human activities on ecosystems; and
- c) analysis of the flora, fauna, and microorganisms of Virginia ecosystems including the Chesapeake Bay and its tributaries.

Media Components:

Video:

Each of these can be found at the United Streaming Web Site (www.unitedstreaming.com)

- “Competition Affects How Animals Look” (02:30) which is a subtitle in *Concepts in Nature: Why Do Animals Look the Way They Do?* (14:11)
- “Examples of Intraspecific and Interspecific Competition” (00:37) which is a subtitle in *Biologix: Interactions and Relationships among Organisms* (29:07)
- *Natural Focus with Laurie Sanders, Asiatic (Corbicula) Clam* (05:00) . This title is also available as part of BRPTV’s instructional broadcast: *Natural Focus, #113* .

Web Sites:

Invasive Species

<http://www.invasivespecies.gov/>

This web site describes invasive species, impacts of invasive species and control efforts around the United States. The site includes many excellent links to other informative web sites on invasive species. The site promotes itself as "the gateway to national and state invasive species programs and activities." This web site is a node of the National Biological Information Infrastructure.

What's in My Neighborhood?

<http://www.invasivespecies.gov/geog/state/statemain.shtml>

This part of the invasive species web site allows one to click on their state on a map of the United States and link directly to state specific species lists and web sites.

Materials:

Computer connected to a projection device

Computers for each student or group of students

For each student:

Paper and pencil

Invasive Species (Focus Sheet)-attached

Invasive Species Poster Assignment sheet-attached

Prep for Teachers:

- Prior to teaching this lesson, download video clips from the United Streaming web site in advance.
- Bookmark the invasive species web site on all student computers.
- Make one copy for each student:
 - 1) Invasive Species (focus sheet)
 - 2) Invasive Species Poster Assignment sheet
- When using media, provide students with a **FOCUS FOR MEDIA INTERACTION**, as a specific task to complete and/or information to identify during or after viewing of video segments, web sites, or other multimedia elements.

Introductory Activity:

Step 1. Provide students with a **FOCUS FOR MEDIA INTERACTION** by saying to students: “I want you to make some observations about how the animals in a video clip I am going to show you are interacting.” **TURN OFF** the sound for the video. **Select** video clip - From the United Streaming Web Site: “Competition Affects How Animals Look” (02:30) which is a subtitle in *Concepts in Nature: Why Do Animals Look the Way They Do?* **PLAY** the video and **PAUSE** at the end of the sequence showing antelope fighting.

Step 2. **Ask** students: “Tell me what these animals were doing. How were they interacting?” (*Students may describe the antelope interaction as fighting, clashing horns, pushing, or shoving.*) **Ask** students: “What reasons can you think of that would explain why they were doing this?” (*Answers will vary -- fighting for territory, fighting for position in the hierarchy, fighting for a female, and for the herd are possible answers.*) **Ask** students: “Are these two organisms the same species or different species? Why?” (*The organisms are of the same species based on similar structural morphology.*)

Step 3. Explain to students that this is called intraspecific competition because competition is occurring between organisms of the same species. Ask your students to write this term and its definition on their papers. Check for comprehension.

Step 4. Explain to students that competition also occurs between different species. Provide students with a **FOCUS FOR MEDIA INTERACTION** by asking students to observe the organism in the next video clip. **PLAY** the video and **PAUSE** at the end of the giraffe sequence.

Ask students: “What organisms might the giraffe be competing with?” (*Answers will vary -- Antelope, deer, zebra, buffalo, and elephants are organisms the giraffe may compete with.*) **Ask** students: “What are all of these animals competing for?” (*Food, grass, shrubs, leaves, water, space are all possible answers.*) **Ask** students: “What adaptation do giraffes have that make them effective in competing with other species and how does this adaptation help the giraffe?” (*Giraffes have a long neck that allows them to reach food other organisms cannot reach.*)

Step 5. Ask students to write the definition for interspecific competition on their paper. Check for comprehension. (*Interspecific competition occurs when organisms of two or more different species are competing for the same resources.*)

Step 6. **TURN ON** sound for video. Select the video clip from the United Streaming Web Site: “Examples of Intraspecific and Interspecific Competition” which is a subtitle in *Biologix: Interactions and Relationships among Organisms*. Explain to students that interspecific competition can occur between other species besides animals. Provide students with a **FOCUS FOR MEDIA INTERACTION** by asking students to watch the next video sequence for what organisms are competing in a meadow. **PLAY** the video and **PAUSE** when the female student on the right points and says, “...that looks like an example of interspecific competition.” **Ask** students: “What do you think they found that shows competition?” (*Students may guess that two different plant species growing in the meadow will be described.*)

Step 7. Provide students with a **FOCUS FOR MEDIA INTERACTION** by asking students to watch and see if their guess was right. **PLAY** the video from the previous pause point and **PAUSE** when the male student in the center holds two plant species side by side. **Ask** students: “How does the student pictured know he has two different plant species?” (*Answers will vary -- different flowers, different stem, different leaves are possible answers.*) **Ask** students: “What would these two species be competing for?” (*Answers will vary-- water, soil, sun, space, pollinators, minerals, phosphates, nitrates are resources the plants may compete for.*)

Step 8. Provide students with a **FOCUS FOR MEDIA INTERACTION** by asking them to listen for any other resources mentioned that they could add to their list of resources for which plants may compete. **PLAY** the video from the previous pause point and **STOP** when it reaches the end of the video clip.

Step 9. Ask students to list on their paper things for which animal species would compete and a separate list for what plants species might compete. (*Answers will vary but might include: Animals - food, water, prey, space, nesting sites, females, etc. Plants- water, sunlight, space, nitrates phosphates, etc.*) Check for comprehension.

Learning Activities:

Step 1. **Ask** your students, “When you hear the word *invasive* what words or images come to mind?”(Answers will vary.)

Step 2. Explain to students that they will be exploring a special kind of interspecific competition that involves species that have been introduced from other ecosystems. Provide students with a **FOCUS FOR MEDIA INTERACTION** by asking students to think about how

many new species have been introduced to North America over the last three hundred years, how they arrived, and how they have affected us. **PLAY** the Asiatic Clam video clip and **PAUSE** when swans are shown flying across the water.

Check for comprehension. **Review with students:** “How many organisms have been introduced to North America?” (*Hundreds were introduced.*) “How did they get here?” (*Many were brought here purposefully while others were brought accidentally.*) “What are some organisms that were brought here for their economic value?” (*Cows, horses, and other livestock as well as many grains, fruits, and vegetables were brought for their economic value.*) “Why were other organisms brought here?” (*Other organisms were brought for their aesthetic value.*)

Step 3. Ask students if they think that introduced organisms are always beneficial. **Ask:** “Do you think they can cause problems? Can you think of any specific species that are a problem locally?” (*Answers will vary. Some students may be able to name local species they know have been problematic.*)

Step 4. Provide students with a **FOCUS FOR MEDIA INTERACTION** by telling students that the next part of the video clip will identify one organism that is seemingly innocuous but has caused a huge ecological and economic impact. Tell them to listen for the name of the organism and the cost of its control. **Resume** the video. **PAUSE** when Laurie Sanders points to the river behind her and says, "...where it now occurs in the lower Connecticut River."

Check for comprehension. **Ask** students: “What is an example of an invasive species that has been a problem?” (*The Asiatic clam is an invasive species that has become a big problem.*) “What is the cost of controlling this organism?” (*The cost of control in North America has exceeded one billion dollars.*) “What is the common name of this organism?” (*The common name of this organism is the Asiatic Clam.*)

Step 5. Explain to students that these organisms are called Invasive Species.

Step 6. Provide students with a **FOCUS FOR MEDIA INTERACTION** by asking students to consider how such a small, innocuous organism could cause so much trouble. **Say** to students: “Let us take a close look at the biology of this organism, where it came from, and how and why it can be so troublesome.” Handout "Invasive Species (Focus Sheet)" to the students. **PLAY** the video and **STOP** at the end.

Students should fill out the “Invasive Species (Focus Sheet)”.

Check for comprehension and fill in any gaps in their information.

(The name of the organism is the Asiatic Clam. The scientific name is Corbicula fluminea. It is native to Southeast Asia where it is known as the Good Luck or Prosperity Clam. It has spread throughout the world. Asian immigrants brought it to North America in 1924. It lives in freshwater only, burrowing into the sediment of river bottoms. It extends a siphon and strains out microscopic algae from the water. The Asiatic clam is a hermaphrodite meaning it has both male and female sex organs in the same individual. The clams can self-fertilize. They can release two thousand juveniles per day, which is ten times the capacity of native species. In a life span they can produce more than one hundred thousand offspring. Asiatic clams can out

compete and displace endangered native mussel species. Asiatic clams clog pipes by entering them when they are small, attaching inside, then growing. Chlorination has been used to keep pipes clear. Clams die when temperature falls below thirty-five degrees Fahrenheit, limiting population growth in northern states. --from Laurie Sanders Asiatic Clam video clip.)

Culminating Activity:

1. Ask your students to log on to the following web site:
<http://www.invasivespecies.gov/geog/state/statemain.shtml>
2. Ask students to click on map of their state. **Ask** students: “What invasive species occur locally? Which cause the biggest problem? What problems do they cause?”(Answers will vary)
3. Discuss their results. Check for comprehension.
4. Handout "Invasive Species Project Assignment" sheet. Go over assignment details and assessment rubric (See "Invasive Species Poster Project Assignment" sheet). Establish due date.

Cross-Curricular Extensions

LANGUAGE ARTS

Write a story about the life of an invasive species from the perspective of the organism. Use scientific details of its life but write as a children's story.

MATHEMATICS

Choose an invasive species and find out how many offspring it can produce in one generation. Calculate how many offspring it could have if all survived to reproduce after 5 generations; 10 generations; 50 generations; and 100 generations.

TECHNOLOGY

Make a power point presentation on the natural history of an invasive species in your area.

SOCIAL STUDIES

Research the social and economic impact of a particular invasive species on industry, recreation, or agriculture in your state.

VISUAL ART

Draw or paint a picture of an invasive species competing with local flora or fauna.

Community Connections

- Research invasive species in your community. Make an illustrated booklet explaining the impact of these species, their natural history, and what members of the community can do to lessen negative effects of these organisms.
- Choose an invasive species in your community and do a population study on its frequency and distribution in your area.
- Ask a local fish and game agent to come talk to your class about invasive species.

Name: _____

Period _____

Date: _____

Invasive Species (Focus sheet)

1. What is the common and scientific name of the invasive species?
2. The invasive species is native to what country? How and when did it reach North America?
3. What is the natural history (biology of organism, habits, life cycle, food, reproduction, etc.) of this invasive species.
4. What problems does this invasive species cause? (economic/ecological)
5. What are possible controls or solutions to problems caused by this invasive species?

Name: _____ Period _____ Date: _____

Invasive Species Poster Project Assignment

Research a local invasive species. Address the following questions:

- What is the common and scientific name of the invasive species?
- The invasive species is native to what country? How and when did it reach North America?
- What is the natural history (biology of organism, habits, life cycle, food, reproduction, etc.) of this invasive species?
- What problems does this invasive species cause? (economic/ecological)
- What are possible controls or solutions to problems caused by this invasive species?

Present the results of your research as a poster display. Your poster should include:

- Computer generated graphics and text
- Title and subheadings
- Large, easy to read fonts
- Color graphic images printed from public domain web sites
- Concise explanations

The following rubric will be used to grade your project:

Poster Project Scoring Rubric (1-poor 10-Excellent): 100 total points

Fonts are large and easy to read	1	2	3	4	5	6	7	8	9	10
Use of computer generated text/graphics/images	1	2	3	4	5	6	7	8	9	10
Overall layout/aesthetic impression	1	2	3	4	5	6	7	8	9	10
Creativity	1	2	3	4	5	6	7	8	9	10
Text is concise, brief, and to the point	1	2	3	4	5	6	7	8	9	10
Grammar/sentence structure/spelling	1	2	3	4	5	6	7	8	9	10
Addresses each of the assigned content areas	1	2	3	4	5	6	7	8	9	10
Overall Science Content	1	2	3	4	5	6	7	8	9	10
Neatness/Effort	1	2	3	4	5	6	7	8	9	10
References	1	2	3	4	5	6	7	8	9	10