

Be AIS Aware Unit

Lesson 6 Amazing AIS Adaptations

Do you ever wonder which adaptations make an aquatic invasive species more successful than others?

Overview

Subject Areas: Life Science, Environmental Science, Ecology, and Human Impacts

Key Topics: Aquatic invasive species, natural selection, adaptations

Students will design an imaginary aquatic invasive species (AIS), and explain how AIS have physical, chemical, and/or behavioral adaptations that help them outcompete other species.

Objectives

Students will be able to:

- design an imaginary aquatic invasive species.
- explain how their organism's adaptations make it invasive.
- write an adventure story about an encounter with their imaginary aquatic invasive species, from the perspective of another species.

Grade Level

Middle School

Duration

Preparation Time: 20 minutes

Activity Time: 20 minutes

Skills

Applying information; designing; composing

Materials

Warm Up/Activity

- Computer and projector
- Student worksheet #1-8
- Adaptation cards (22 animal and 14 plant/algae cards)
- Colored pencils

Advanced Preparation

- Copy the following worksheets:
 - Student worksheets #1-4 (double-sided; 1 per student)
 - Student worksheets #5-6 (double-sided; colored paper; 1 copy for each student creating and AIS animal)



- Student worksheets #7-8 (double-sided; colored paper; 1 copy for each student creating and AIS plant/algae)
- Adaptation cards are organized by habitat (color dots), by animals (black text), and by plants/algae (green text). Pre-select the habitats and organisms you plan to give to the students
- Prior to class, pre-load the Amazing AIS Adaptations presentation found on the associated thumb drive or request the presentation from FLBS education programs

Background

Montana has a variety of aquatic habitats that are home to diverse populations of animals and plants. Wetlands, rivers, streams, oxbow lakes, spring-fed ponds, and lakes represent a few of the common aquatic habitats that support our native wildlife.

Lakes contain a variety of habitats on different scales, and in different zones within the lake. For example, lakes can be classified into two basic habitats: open water and bottom areas. These two general regions of a lake can be further subdivided based upon the distance from the shoreline and the light intensity/depth. Light greatly impacts where the algae, plants, and phytoplankton can grow in lakes. Phytoplankton, the microscopic algae that drifts in the lake, must stay in the illuminated **photic zone** in order to receive enough light to photosynthesize. If these cells enter the dark **aphotic zone** by sinking lower than the 0.1% light intensity, they will not be able to survive. Similarly, algae and plants along the shoreline typically cannot grow past the illuminated shallows, or **littoral zone**, due to light limitation. In contrast, organisms that live on the bottom in the **benthic zone** do not always need light to survive. For example, the snails, crayfish, and worms that dwell on the bottom of our lakes are consumers that help to recycle the detritus (decaying organic matter) that falls to the bottom of the lake. Invasive quagga mussels have been documented to grow along the benthic zone in water deeper than 300 feet. There are also many organisms that move throughout the open water, or **limnetic zone**, to hunt for prey (ex. trout and zooplankton).

Each aquatic habitat also has a variety of physical or **abiotic factors** that impact where the organisms can live. Water currents, surface waves, dissolved oxygen, temperature, chemical composition, water pressure, water clarity, and nutrient concentrations are a few of the many abiotic factors that can impact the populations of organisms in a lake.

All aquatic organisms have physical, chemical, and behavioral **adaptations** that help them survive in these diverse habitats. Aquatic invasive species' adaptations often make them invasive and difficult to control. For example, the American bullfrog's camouflage, large eyes, countershading, dorsoventrally flattened body shape, strong legs, slimy exterior, voracious appetite, and high reproductive rate help them to outcompete our native frogs for food, and are causing a large impact to the non-native habitats they invade in Montana.

At the end of this document there is a list of common plant and animal adaptations.

Vocabulary

Abiotic factor: A non-living factor that affects where organisms are found within an ecosystem (ex. temperature, light, climate, etc.).



Behavioral adaptation: A behavior that can help an organism survive (ex. migration, hibernation, etc.).

Chemical adaptation: A chemical made by an organism that helps it survive (ex. a poison or hormone).

Natural selection: A process whereby organisms best fit for their environment tend to survive and reproduce.

Physical adaptation: A physical trait of an organism that helps it survive (ex. the changing fur of an arctic fox or hare).

Procedure

- **Warm Up (10 minutes)**
 - Display the Amazing AIS Adaptations slide show on the projector and pass out student worksheets (#1-4).
 - Slide #1: Start off by asking the following two questions:
 - Why are some species more successful than others?
 - What traits does this osprey have to help it to survive? (ex. hollow bones; sharp beak and talons; wing design to dive, lift back up, and soar; countershading; long legs to reach for fish; great eyesight; etc.)
 - Lead the discussion to introduce to the students the concept that organisms with traits that help them survive will be naturally selected to survive and reproduce. AIS are great examples of organisms that are naturally selected to survive based upon their adaptations.
 - Slide #2: Students record the definition of an adaptation, and the adaptations for the zebra mussel and North American bullfrog on their worksheet (#1). Review these adaptations and remind the students that these traits help these invasive organisms survive and outcompete the native species.
 - Slide #3: Here in Montana, we have a diverse community of native mammals, birds, fish, amphibians, and invertebrates that need freshwater habitats? (or fresh water?) to survive. Each of these animals has unique adaptations or traits that help them survive harsh winters, sunny summers, and the seasons in between. Students pick one animal and then list one physical, chemical, and behavioral adaptation that helps it survive.
- **The Activity (80 minutes)**
 - Slide #4: Montana has a variety of complex aquatic habitats where animals and plants live. Explain that each student will be creating a new aquatic invasive species (AIS) that does not already exist, and that must be able to survive in one specific aquatic habitat. Explain that an organism living on the bottom of a lake would need different traits than one that swims freely throughout all habitats. So, the characteristics that the students give their AIS should make them invasive in their particular habitat.
 - Slide #5: Review the different lake zones and habitats as the students record them on their worksheet.
 - Ask the students to read the Project Summary (#2), Story Outline (#3), and Portrait (#4) worksheets with you as you read it aloud. Review the two required tasks and answer any questions. Be sure to explain that their story is written *from the perspective of another animal that encounters their new invasive species*.

- Pass out one adaptation card to each student, ask them to record the six items listed on the card in the space provided on the worksheet, and then collect the adaptation cards.
 - As the students record their traits, pass out one Story Planning worksheet (animal (#5-6) or plant/algae (#7-8)) to each student according to the card that they have been given.
 - Review the Story Planning worksheet and explain that it is a guide to help them create their organism. This must be completed before they begin to write their story.
 - Optional Tip: Students with similar habitats can work together to include each other's organisms in their stories.
- Slide #6: Give the students time to work
- **Wrap Up (10 minutes)**
 - Ask volunteers to read their stories aloud to the class.

Teacher Resources

Assessment Options

Have students:

- complete the Amazing AIS Adaptations story and portrait as described.
- read their adventure story to the class.

Modifications

- There are 22 animal cards (easy to moderate difficulty) and 14 plant/algae cards (high difficulty). We recommend giving the more challenging plant/algae cards to the higher-level students in your classroom.
- Eight different aquatic habitats are represented in the adaptation cards. The color dots on cards reflects the habitat. Particular habitats may be selected to provide some focus for the class or all of the habitats may be included.
- The portrait worksheet may be copied separately from the outline, especially if the teacher would like to display them in the classroom without the outline on the back.
- To easily distinguish them from each other while passing them out in class, it is helpful to copy the Story Planning worksheets (#5-6) in one color and the other Story Planning worksheets (#7-8) in another color.
- Students may work individually or in groups for this project.
- Worksheets can be enlarged for students in need of larger text.

Extensions

Students can:

- build a 3-D model of their aquatic invasive species using recyclable materials.
- create a children's story about their aquatic invasive species.
- animate their story about their aquatic invasive species.

Standards

Common Core:

- *WHST.6-8.9:* Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.



NGSS & Montana Science Standard

- MS-LS-2: construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems
- LS4.B.: Natural Selection
- LS4.C: Adaptation
- CROSSCUTTING CONCEPT(S): Patterns

Information regarding common adaptations in aquatic animals and plants

Common aquatic animal adaptations:

- Physical adaptations:
 - Gills
 - Fusiform (stream-lined) body shape for open water species
 - Dorsoventrally flattened body shape for bottom dwelling species
 - Countershading
 - Webbed appendages
 - Scales
 - Swim bladders
 - Fin, flippers
- Chemical adaptations:
 - Chemical digestion
 - Mucous or slime
 - Poisons/toxins
 - Camouflage via proteins on skin
- Behavioral adaptations
 - Hunting behaviors
 - Mating behaviors
 - Evasive behaviors to avoid becoming prey

Common aquatic plant/algae adaptations:

- Physical adaptations
 - Submergent or emergent
 - Showy petals
 - Emergent flowers
 - Easily fragments
 - Floating leaves
 - Spiny
- Chemical adaptations
 - Poisons/toxin
 - Hormones
- Behavioral adaptations:
 - Phototropic (grows toward light)
 - Gravitropic (grows downward)
 - Movement with flagella
 - Forming colonies

Acknowledgements

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