Aquamon

Overview

The Aquamon activity is designed to make participants think critically about the biological and behavioral adaptations that increase an aquatic organism's fitness. In particular, participants will learn the adaptations that allow a non-native species to become invasive.

Objectives

Participants will be able to:

- Define the vocabulary words.
- Explain the difference between native species, non-native species, and invasive species.
- Identify the five adaptations of invasive species.
- Think critically about how adaptability, strength, speed, reproduction, and impact effect an organism's ability to persist and succeed in an environment.
- Examine how different organisms interact within their ecosystem, and how their Aquamon would interact with each other.

Vocabulary

- Adaptation: physical or behavioral characteristics that improve the ability of an organism to survive in its environment.
- Aquatic species: any organism that lives in the water for most or all of its life.
- Ecosystem: a community of organisms interacting with each other and their physical environment within a given area.
- Fitness: an organism's ability to survive and reproduce in its environment.
- Invasive species: a non-native species that causes economic and/or environmental harm.
- Interspecific competition: the direct or indirect competition between two organisms of different species for limited resources.
- Native species: an indigenous species historically found in an ecosystem.
- Natural selection: organisms best fit for their environment tend to survive and reproduce; survival of the fittest.
- Niche: the role an organism has in its ecosystem.
- Non-native species: a species that has moved, or been moved, outside of its natural geographic range.

Background

Adaptations, both physical and behavioral, are heritable traits that enhance a species' **fitness**- or its ability to survive, reproduce, and persist as a species within an **ecosystem** (related concept: **natural selection**). However, as ecosystems undergo rapid changes due to human activity and climate change, **native species** that were once well-suited to their environment may be struggling to retain their **niche**. Populations of the western pearlshell mussel, a species native to Montana, have been declining due to polluted waters, damming, and the decline of the westslope cutthroat trout that serves as a host for juvenile mussels. This decline could provide an available niche for non-native and invasive **aquatic**

species that are more tolerant of polluted waters, better adapted to fragmented habitat, and able to reproduce without a host fish.

Most **invasive species**- both aquatic and terrestrial- have these five adaptations in common: they grow fast, they reproduce quickly, they spread easily, they're tolerant of many different environments and conditions, and they engage in **interspecific competition** for food, space, water, sunlight, and other limited resources essential to survival. Organisms like zebra and quagga mussels are easily transported through human activities, tolerate poor environmental conditions that exclude native species, reach reproductive age quickly, reproduce in larger numbers and more frequently than their native counterparts, and have adaptations that deter native predators or disease. These adaptations have helped zebra and quagga mussels establish invasive populations across the US.

	Zebra Mussels	**Western Pearlshell Mussels**
Grow Fast	Reach adult size within 1 year. Average lifespan 4-8 years.	Continues to grow over lifespan. Average lifespan 60-70 years.
Reproduce Quickly	Sexually mature at 2 years. Produce 30,000-40,000 eggs each reproductive cycle, over 1 million/year.	Sexually mature at 12-15 years. Decreased reproductive frequency due to pollution and host population decline.
Spread Easily	Free-floating planktonic stage. Byssal thread attachments. Desiccation-resistant.	Planktonic lifestage requires fish host. Westslope Cutthroat Trout decline. Adult lifestage is sedentary.
Tolerant	Can withstand high pollution levels.	Sensitive to pollution levels as primary consumer.
Outcompete Natives	Attaches to native invertebrate species. Outcompetes native mussels. Eats primary producers.	

Invasive species are all non-native species, but not all non-native species are invasive. **Non-native species** that do not become invasive often have human, environmental, or biological restraints that prevent them establishing populations large enough to cause harm. Some may not be able to reproduce outside hatcheries while others might be vulnerable to native predators or disease. Still others might be kept in check by heavy fishing pressure, such as popular non-native sports species. However, these species may still cause problems, especially in environments with limited resources or where native species are already stressed and declining.

Understanding the way adaptations influence species fitness and persistence is key to understanding how species become invasive.

Procedure

1. Review the presentation and make adjustments according to your audience's age, background, and location. The presentation is currently targeted for teens and adults in Montana with limited

to introductory ecological knowledge. There are notes for each slide that give additional information that you can choose to include.

   a. If you chose to use your own presentation, it's important to cover the adaptations that make an aquatic species invasive.

2. Present to your audience, giving and/or asking for examples of the behavioral and physical adaptations of native, introduced, and invasive species.

3. Pause when you reach slide #18 and distribute one Aquamon sheet to each participant- or have a print-out of both slide #18 and #19 available for reference.

   a. Make writing utensils, erasers, and sharpeners available. Plain and colored pencils recommended.

4. Allow participants to access rolladie.net and have them roll a 5-sided die five times, then record the results on their page as adaptability, strength, speed, reproduction, and impact scores.

   a. Define these five traits for your participants, giving examples or explaining each one when needed.

5. Bring up slide #19 once everyone has recorded their five trait scores to provide inspiration as needed. Be prepared to switch back to slide #18, or to provide hard copies of both slides, for reference.

6. The time this activity takes varies according to audience.

7. Once most participants are finished, there are at least three options for wrap-up:

   a. Encourage participants to share their Aquamon- either one by one or in groups- and see how their Aquamon interact with each other. This gives each participant a chance to explain why they chose certain traits and adaptations, as well as a chance to reflect.

   b. Collect the Aquamon pages to be scanned and distributed online (via file sharing or email) to all participants on a later day.

   c. Both a and b.

Possible variations:

- Participants can take their Aquamon home to work on them and bring them back on a different day.
   - Recommendation: don't wait too long to collect the Aquamon, as the longer you wait the more chance they'll be misplaced or damaged.
- Rather than allowing participants to choose whether their Aquamon is native, introduced, or invasive, assign them a type. This helps ensure that all three will be represented.

Supplies Needed

- Printed Aquamon pages
- Colored pencils, pens, or crayons
- Erasers, pencil sharpeners
- Internet access for online dice (rolladie.net)
- Computer and projector for presentation (optional)

Provide feedback to: Sophiane Nacer at sophiane.nacer@mt.gov