U.S. Fish & Wildlife Service

GO FURTHER!

Come On In! The Water's Fine?

Freshwater Mussels

Freshwater mussels are mollusks that get their microscopic food by filtering water through thin membranes. They live partly submerged in the clay or mud at the bottom of the lake or stream. To feed, they open their shells and allow water to pass through a delicate membrane.

Elliptio fisheriana

Lampsilis radiata

A natural ecosystem is filled with many species—plants, animals and microorganisms. Each has its role or "niche" and affects all the other species.

Some species can tell us more about the health of the system than others. They are so sensitive to changes that their survival helps us check the balance of the many other species in their habitat.

The mussel is one such species. Because it must filter fresh water to collect its food, it can only thrive when the water is clean. Mud and pollution can clog their membranes and slow or stop their growth. That clear water is better for algae, plants and all the other organisms in the stream.

When organisms compete for the same food supply, we must often consider the population density. That's how closely mussels live to one another.

Another factor in their feeding is the clarity of the water. The delicate membranes that collect tiny organisms can be harmed by pollution or silt. As human communities have grown along rivers and streams, they have used and abused the waters. Some river and lake bottoms have finer particles of clay and can become quite "muddy." Dams slow streams, allowing more sediment to cloud the waters. Knowing what's on the bottom of a river or stream is important too..

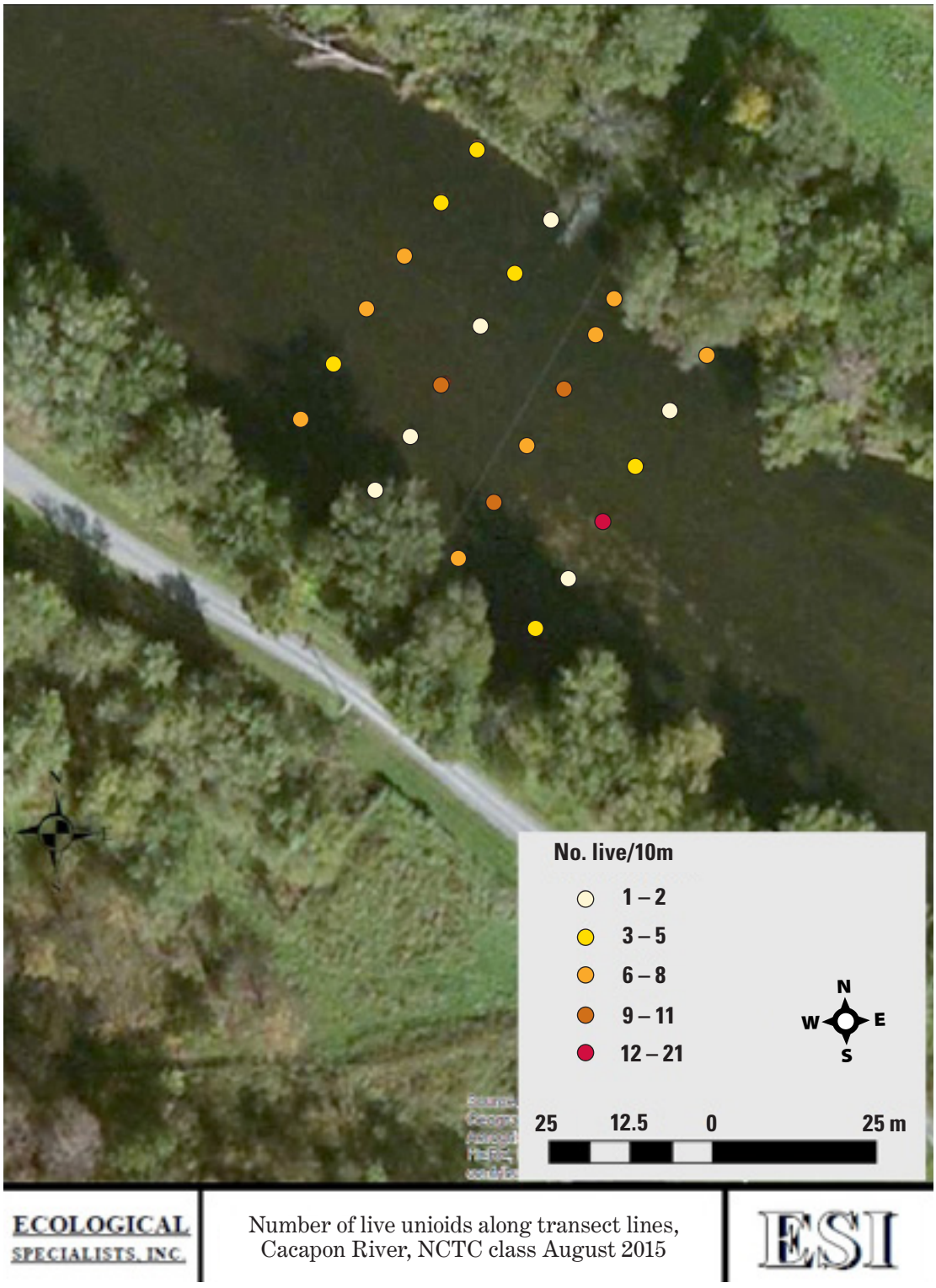
Monitoring where mussels live helps us measure changes in the entire ecosystem and predict changes in the entire food web of a river or stream.

Ryan Hagerty/USFWS

Using Mussels as Monitors

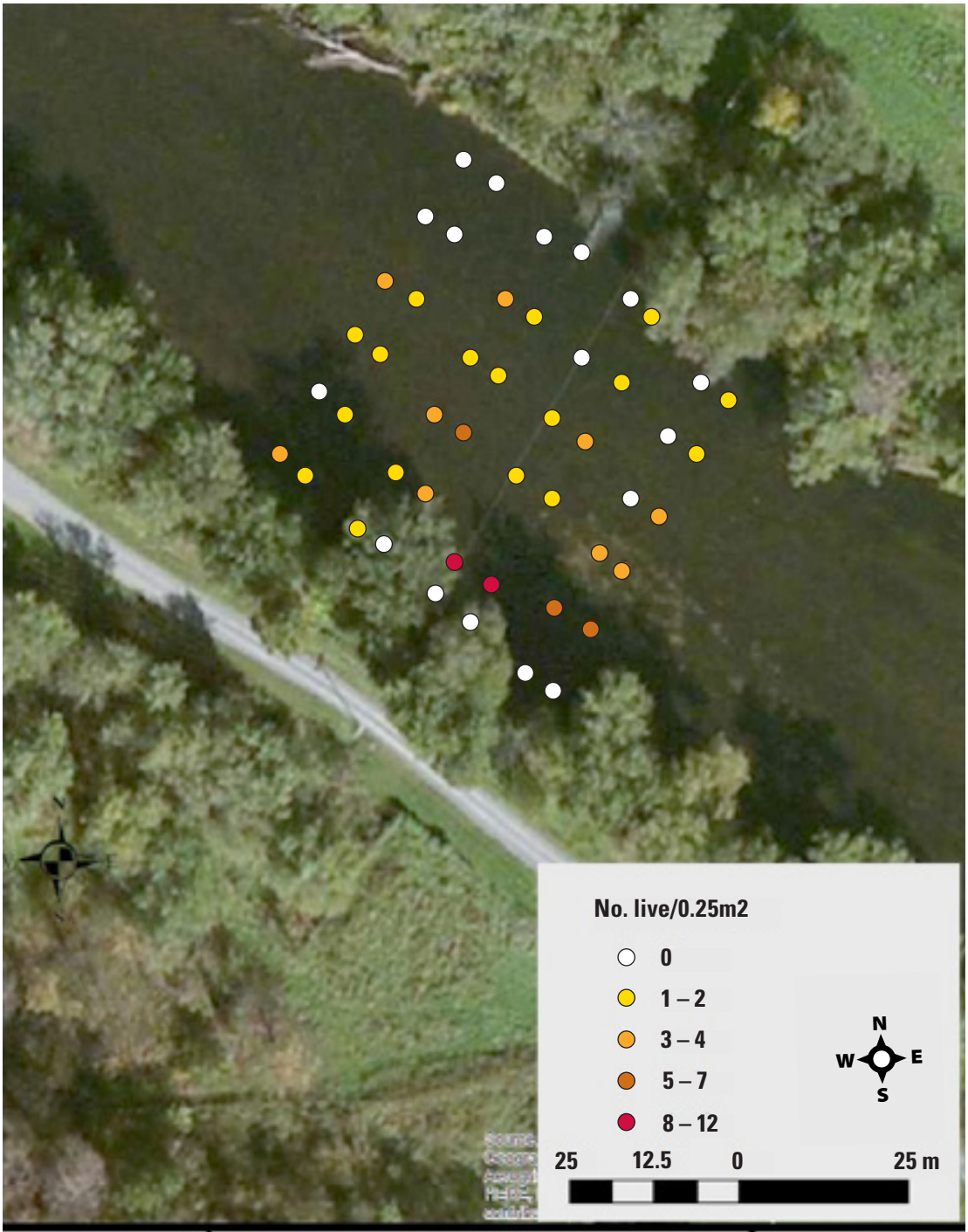
In West Virginia, researchers compared the state of mussel populations in the Capacon River from 2014 and 2015. In the study below volunteers drew 4 transects (imaginary lines) and quadrats (imaginary square meters) to determine the population density. They found that the greatest density of mussels was upstream of the transmission line.

Method	2014	2015	Units	
Transect	Semi-quantitative	8.3	5.3	Number per 10 m transect
Quadrat	Quantitative	5.1	7.3	Number per m2



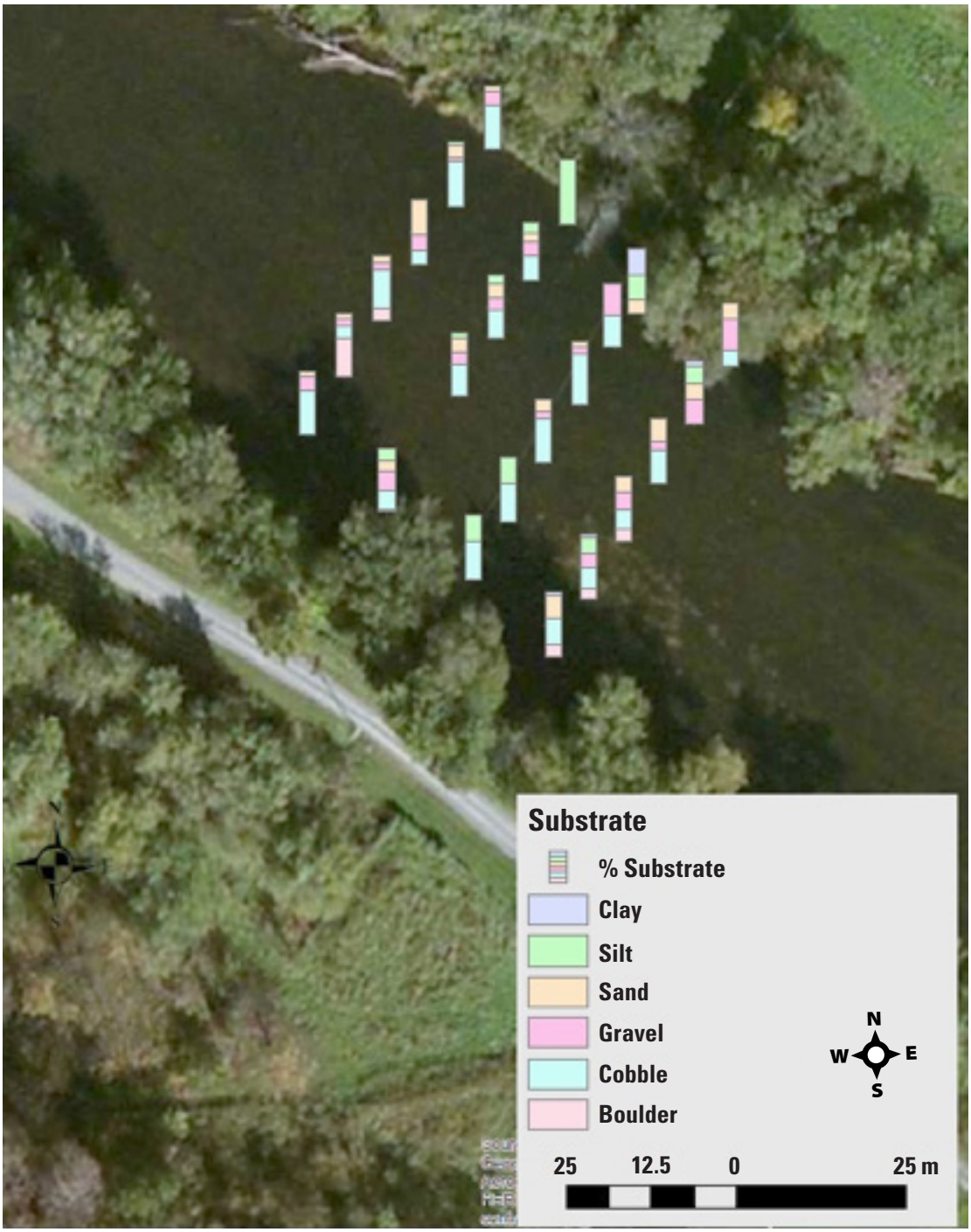
Number of live unioids along transect lines, Cacapon River, NCTC class August 2015

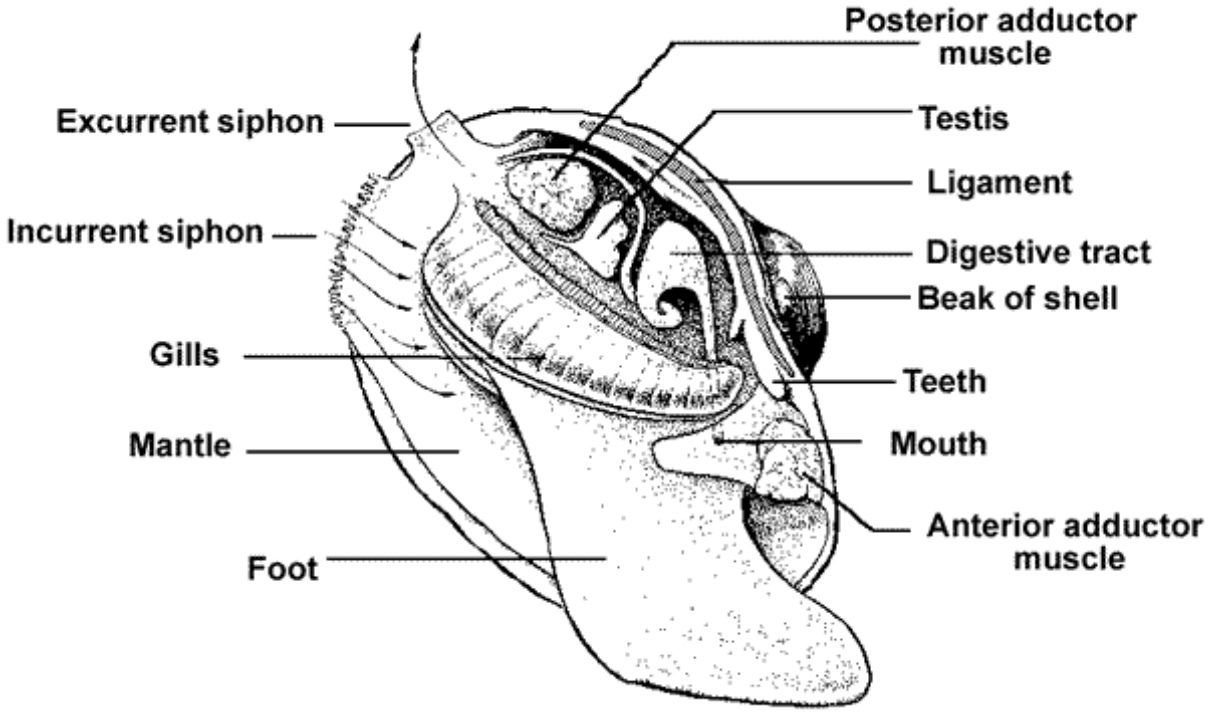
1. Look at the range of mussels measured by two different methods. What differences can you see?



Number of live unioids in quadrat samples, Cacapon River, NCTC class August 2015

2. Look at the map of the substrate below. Can you see any patterns? What type of substrate seems best for mussels? (Remember, they don't live deep under the sand, mud or clay but near the top.)





3. Look at the anatomy of a mussel here. Use colors to show how water enters and leaves the gills to help the animal catch food.

4. Use a good reference to help build a food web to show some of the organisms in the mussel's habitat.

Claim, Evidence, Reasoning
Think of one of the possible changes below. Use evidence to predict what would happen to the lake habitat.

- Construction stirs up clay and silt upstream of the area where the mussels live.
- An exotic mussel moves in. (That's one that came from another area of the world.) It reproduces faster than the mussels that were there in the past.
- A dam slows the flow of water down the stream.

Teacher Page

About the activities

Summary:
During this video and activity, students meet Matthew Patterson a Mussel Biologist with the U.S. Fish and Wildlife Service and learn about the exciting life that exists at the bottom of rivers and streams.

Learning Objective(s):
Students will 1. Answer questions based on data provided 2. Use a diagram to show how water enters and leaves a mussel's gills 3. Build a food web.

Method:
The core activities center on students watching the video episode and completing the activities 1. Answer questions about freshwater mussels based on real data provided by a biologist 2. Use a diagram to show how water enters and leaves a mussel's gills 3. Build a food web to show some of the organisms in the mussel's habitat. Completing these activities can help students achieve expectations and standards in mathematics, science and language arts.

Considerations:
Conditions, factors, requirements, key points, and/or concerns an educator needs to take into account when conducting the activities

Possible Answers

1. Look at the range of mussels measured by two different methods. What differences can you see? The transects show mussels shore to shore, but the quadrats suggest that some areas have a lower density.
2. Look at the map of the substrate below. Can you see any patterns? What type of substrate seems best for mussels? A general pattern shows fewest mussels in silt and gravel.
3. Anatomy diagram should show water flowing through the gills.
4. While food chains can vary, students should show green bacteria and algae, plants, microorganisms like protists, microinvertebrates like insect larvae, small and large fish.

Claim, Evidence, Reasoning

Student answers will vary. Here are some possible paths to argument:

1. Construction stirs up clay and silt upstream of the area where the mussels live. Silt clogs gills. From the photographs it is likely to slow growth of mussels.
2. An exotic mussel moves in. (That's one that came from another area of the world.) It reproduces faster than the mussels that were there in the past. They may compete for food. Another effect seems counterintuitive but they often make the water so clear that algae and plants bloom out of control, and then when conditions are not so good there are massive die-offs.
3. A dam slows the flow of water down the stream. Slower water has less oxygen and may be warmer.

Integrate!

Integrating literature with math and science lessons enhances academic achievement in all areas. The National Science Teachers Association (NSTA) Recommends review team identifies great books to use, and provides a searchable database for K-12 educators. The system includes Outstanding Science Trade Books. Educators may choose these or other related materials to supplement the episodes to deepen the learning experience for students. Learn more about wildlife species and habitats using keyword searches in the NSTA Recommends database, which has more than 10,000 reviews, at http://www.nsta.org/recommends/. Use the key word "freshwater" in the "word in title" to find content that relates to this educational resource.

Common Core Mathematics

CCSS.Math.Content.7.SP.A.1

Understand that statistics can be used to gain information about a population by examining a sample of the population; generalizations about a population from a sample are valid only if the sample is representative of that population. Understand that random sampling tends to produce representative samples and support valid inferences.

Next Generation Science Standard

Students who demonstrate understanding can:

MS-LS2-1. Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem.

MS-LS2-1. Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.

Common Core Language Arts

CCSS.ELA-Literacy.RST.6-8.7

Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table).

CCSS.Math.Content.7.G.A.1

Solve problems involving scale drawings of geometric figures, including computing actual lengths and areas from a scale drawing and reproducing a scale drawing at a different scale.

CCSS.Math.Content.HSG.MG.A.2

Apply concepts of density based on area and volume in modeling situations (e.g., persons per square mile, BTUs per cubic foot