Title: **Home for a Trout**		
Overview:	At the conclusion of this lesson students will be able to • Perform basic water quality tests and macroinvertebrate studies. • Explain the importance of appropriate parameters when choosing a site for releasing captive-raised trout.	
Grade:	Upper Elementary, Middle School	
Standards	NGSS	• 3-LS4-3 – Construct an argument with evidence that in a particular environment some organisms can survive well, some survive less well, and some cannot survive at all. • 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.
	Core Idea	Elementary – Biological Evolution: Unity and Diversity Middle School - Ecosystems; Interactions, Energy, and Dynamics
	Practices	• Asking questions and defining problems • Planning and carrying out investigations • Analyzing and interpreting data • Constructing explanations
	Cross-Cutting Concepts	• Cause and effect • Systems and system models
	Reading, Writing and Social Studies	• CCSS.ELA/Lit.W.3 - Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence. • CCSS.ELA/Lit.SL.1 - Engage effectively in a range of collaborative texts, discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade appropriate topics and building on others' ideas and expressing their own clearly. • CCSS.ELA/Lit.RST.6-8.3 - Follow precisely a multistep procedure when carrying out experiments, taking measurements or performing technical tasks.
	Environmental Literacy	• 1.A.1 – Identify an environmental issue • 1.A.4 – Design and conduct the research • 1.A.5 – Use data and references to interpret findings to form conclusions

	Description	Resources

Engage	Before beginning this activity, check out the site:
	• If the site is on private property, you (or the students) will have to request permission from the landowner.
	• You will also need to check the site yourself first to make sure it is easily accessible and hazard-free.
	  ○ Check for the presence of broken glass, medical waste, metal debris, etc.
	  ○ Make sure there is an open area next to the stream for macroinvertebrate identification.
	Ask students, "Suppose we could release our trout in any local stream. Based on what you've learned from taking care of the trout in the classroom, what would we have to take into consideration?" Have them brainstorm a list.
	  ○ Water quality parameters
	  ○ Clean water – no evidence of pollution or sedimentation
	  ○ Gravel or rocky bottom
	  ○ Plenty of food items, especially macroinvertebrates
	• Do they think a local stream would be suitable? Why or why not? How could they confirm their hypothesis?	

Explore	In the classroom: • Go over the directions for each of the tasks, especially the directions for each of the water quality tests. • Depending on the number of students and the amount of time available, you might want to divide the students into groups and assign specific tasks. Before beginning the stream study - establish rules: • **Absolutely no bare feet!** Students who want to wade in the stream must wear waders or rubber boots. • No wading in water above the knees. • After the visit, wash hands thoroughly and be sure to check for ticks. At the site: • Hand out the student worksheet and clipboards to each group. Explain that they will only have to record the data for their assigned tasks, not the entire worksheet. • All groups should do the visual inspection and fill out that part of the worksheet. • Water quality testing – follow the directions that came with the kit you are using. **Be sure to pour used samples into a milk jug for appropriate disposal back at school.** • Macroinvertebrate sampling – follow the directions on the worksheet. Macroinvertebrate ID sheet - http://www.dnr.state.md.us/education/envirothon/dnrbugid.pdf	For water quality testing: • Water test kits (see Teacher Background) • Safety goggles • Clean bucket for collecting water samples • Empty gallon milk jug for used test samples For macroinvertebrate study • Nets (kick nets, D-ring nets or aquarium nets); nets should be white so macroinvertebrates can be seen • Brushes for scrubbing off rocks • Collection containers – white

		buckets, white plastic pans, or white ice cube trays • Eye droppers, forceps for transferring macroinvertebrates • Magnifying glasses – helpful for identification Student worksheets, clipboards and pencils
Explain	• Discuss the results of the visual inspection. Did they see (or smell) anything that might be cause for concern? • Go over the results of the water quality tests and the macroinvertebrate sampling. • Have students write a paragraph answering the question "Did the stream study support our hypothesis? Would the stream support trout? Why or why not?"	
Extend	• If the stream could not support trout, have the students brainstorm ideas they could do to improve the health of the stream • Have them design and execute a feasible project. Remind them that even of the stream cannot be made to support trout (i.e., high temperature), a project would still improve the overall health of the stream.	
Evaluate	Evaluation based on participation in on-site activity and accuracy and reasoning in written paragraph	

Teacher Background:

When the time comes to release your classroom raised trout, you will probably take part in a TIC trout release event. The release site will be one that has been approved by DNR fisheries biologists, based on a number of parameters, including water quality, species of trout already present, and others. The release site may or may not be close to your school.

However, you might have a stream close to your school, and although you **cannot** release your trout there, your students might be curious as to whether the stream would support trout. To satisfy their curiosity, you can have the students do a physical and chemical study of the stream.

Water quality parameters for rainbow trout:

- Dissolved oxygen – prefer DO levels of at least 6.0 mg/L

- pH – 6-8
    - Turbidity – less than 50 NTU
    - Salinity – 0 ppt
    - Water temperature – 10°- 16°C (50° - 60° F)

Other parameters:

    - Clean water – no evidence of pollution or sedimentation
    - Gravel or rocky bottom
    - Plenty of food items, especially macroinvertebrates

For water quality testing: The water testing materials will depend on the age and ability of your students. **Check with your school system first to find out what types of chemicals are permitted and the protocols for proper disposal**.

- Probably the easiest kit to use is the LaMotte GREEN Water Monitoring Kit, which will allow you to test for dissolved oxygen, nitrate, pH, phosphate, temperature, and turbidity.
    - Advantages: This kit uses non-toxic TesTabs®, so there are no hazardous chemicals to deal with or dispose of (**Students should wear safety goggles just to get in the habit**); directions are easy to follow
    - Disadvantages: Not as accurate as other more involved testing methods
    - If the body of water is near a road or parking lot, salinity should be tested since run-off from road salt could be an issue.
    - Even though testing for nitrates and phosphates is not required, you might want to have your students do it.
        - High levels of nitrate may indicate fertilizer run-off
        - High levels of phosphates may indicate raw sewage or animal waste.
- For older students (Grade 7 and up): LaMotte GREEN Advanced Water Monitoring Kit or other age-appropriate test kit

Home for a Trout – Student Worksheet

Students' Names: _____

_____

Name of stream (if known):_____

Location:_____

Weather: Clear_____ Cloudy_____ Rain or showers_____ Windy_____

Temperature: Hot_____ Warm_____ Cool_____ Cold_____

Air temperature (if measured) _____

Visual Inspection:

Color of water: Clear_____ Brown_____ Green_____ Other_____

Stream flow: Fast_____ Medium_____ Slow_____

Bottom: Rocky_____ Gravel_____ Sandy_____ Muddy_____ Plant debris_____

Are there plants around the stream? Evergreens_____ Deciduous trees_____

Shrubs_____ Grasses_____

Is the stream shaded? Mostly_____ Somewhat_____ A little_____ No_____

Are there plants in the water? Underwater plants_____ Algae_____

Are there overhanging banks? Yes_____ No_____

Land use around stream: Urban_____ Suburban_____ Agricultural_____

Commercial_____

Signs of possible pollution: Soap scum/suds_____ Oil slick_____ Odor_____

Trash (describe)_____

Other _____

Is there evidence of erosion? Yes_____ No_____

Water Quality Tests

Follow the directions that came with your test kits. **Be sure to pour used samples into milk jug for appropriate disposal back at school.**

Water quality test results:

Dissolved oxygen: _____

pH: _____

Turbidity: _____

Salinity: _____

Water temperature: _____

Nitrate:_____

(Nitrate levels in a stream greater than 30 ppm usually indicates pollution from fertilizer or sewage)

Phosphate_____

Macroinvertebrate Sampling

How to sample for macroinvertebrates: Note: any student wading in the water must be wearing waders or boots. No wading in water above the knees!

- Use nets to sample gravel from stream bottom. Place the gravel in a shallow pan and stir it up to dislodge macroinvertebrates. Use a small net to remove macroinvertebrates and place them in separate sections of the ice cube trays.
- Pick up larger rocks, hold them over a pan and use a brush to scrub off any macroinvertebrates that are clinging to the rocks. Put the macroinvertebrates in the ice cube trays. Be sure to put the rocks back where you found them
- Use your feet to stir up the bottom and then sweep a net through the water.

Once you have finished sampling:

- Separate the macroinvertebrates into groups in the ice cube trays.
- Use the identification sheet to identify what you have found. As you find each kind, put an X next to it on the chart. You do not have to count the number of each kind.

Macroinvertebrate Chart (See the next page for an example)

Sensitive	**Moderately Sensitive**	**Tolerant**
___caddisfly larvae	___riffle beetle larvae	___aquatic worms
___hellgrammite	___clams	___blackfly larvae
___mayfly larvae	___crane fly larvae	___leeches
___stonefly larvae	___crayfish	___midge larvae
___water penny larvae	___damselfly larvae	___pouch snails
___gilled snail	___dragonfly larvae	___ramshorn snails
	___scuds	
	___alderfly larvae	
	___net spinning caddisfly larvae	
# of kinds checked x 3 = _____ index value	# of kinds checked x 2 = _____ index value	# of kinds checked x 1 = _____ index value
Water Quality Rating Total Index Value_____	Excellent – Greater than 22 Good – 17-22	Fair – 11-16 Poor – less than 11

Example - Macroinvertebrate Char

Sensitive	**Moderately Sensitive**	**Tolerant**
_X_caddisfly larvae	___riffle beetle larvae	___aquatic worms
___hellgrammite	_X_clams	___blackfly larvae
_X_mayfly larvae	___crane fly larvae	___leeches
_X_stonefly larvae	_X_crayfish	___midge larvae
___water penny larvae	_X_damselfly larvae	_X_pouch snails
___gilled snail	_ ___scuds	___ramshorn snails
	___alderfly larvae	
	___net spinning caddisfly larvae	
# of kinds checked x 3 =	# of kinds checked x 2 =	# of kinds checked x 1 =
__9__ index value	__8__ index value	___1__ index value
Water Quality Rating	Excellent – Greater than 22	Fair – 11-16
Total Index Value_18__	Good – 17-22	Poor – less than 11

The total index value is 18, so the water quality rating is in the "good" range.