

Title: Nature or Nurture		
Overview:	At the conclusion of this lesson students will be able to <ul style="list-style-type: none"> • Describe the environmental conditions needed by hatchling and juvenile trout. • Explain how conditions in an aquarium mimic the environmental conditions found in nature. 	
Grade:	Upper Elementary	
Standards	NGSS	<ul style="list-style-type: none"> • 3-LS4-3 – Construct an argument with evidence that in a particular habitat some organisms survive well, some survive less well, and some cannot survive at all
	Core Idea	Biological Evolution: Unity and Diversity
	Practices	<ul style="list-style-type: none"> • Asking questions and defining problems • Engaging in argument from evidence
	Cross-Cutting Theme	Systems and system models
	Reading, Writing and Social Studies	<ul style="list-style-type: none"> • CCSS.ELA/Lit.RI.3-5.1 - Read closely to determine what the text says explicitly and to make logical inferences from it; cite specific textual evidence when writing or speaking to support conclusions drawn from the text. • CCSS.ELA/Lit.<u>SL.4-5.1</u> - 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.
	Environmental Literacy	<ul style="list-style-type: none"> • 1.A.1 – Identify an environmental issue • 1.A.5 – Use data and references to...form conclusions • 1.B.1 – Use recommendations to develop and implement an environmental action plan

	Description	Resources
Engage	<p>It is probably best to do this activity once the aquarium has been set up so the students can use it as a reference.</p> <ul style="list-style-type: none"> • Ask the students, “What are the basic needs of all animals?” <i>Air, water, food, and suitable habitat</i> <ul style="list-style-type: none"> ○ Have them brainstorm how humans usually have these needs met. Have them think especially about what is involved in meeting the need for suitable habitat, i.e., temperature, space, shelter, etc. ○ Now have them imagine that they are going to move to the moon. How will their basic needs be met there? <i>Accept any reasonable answer. The point is to make them understand that living in an artificial environment often requires</i> 	

	<p><i>artificial means.</i></p> <ul style="list-style-type: none"> Point out to the students that the exercise they just did is the same as what is happening to the rainbow trout in their classroom. They are being raised in an artificial environment. What are their basic needs, how are these needs met in the wild, and how will the students create an artificial environment in the classroom that meets their needs? 	
Explore	<ul style="list-style-type: none"> Hand out the Student Worksheet and Background Information. Have the students read the Background Information. Then have them work in small groups to decide the basic needs of rainbow trout and fill out that part of the worksheet. Next have them decide how these needs are met in the wild, and enter the answers on the worksheet. Then have them study the aquarium set-up, decide how the needs will be met in the classroom, and enter these answers on the worksheet. 	<ul style="list-style-type: none"> “Trout in the Classroom” aquarium set-up Student worksheet Student background information
Explain	<ul style="list-style-type: none"> Have the groups come together and compare answers. Was there agreement or were there major differences? What were they? Which of the basic needs are more easily met in the aquarium? <i>The need for clear water should not be a problem since most drinking water (either from a municipal system or a well) is clear. The need to hide from predators is not a problem either, since there are none in the aquarium. pH usually is not a problem either, although it can be.</i> What might make raising trout in the classroom more difficult? <i>Too much ammonia, equipment failure (especially the chiller or air pump), leak in the tank, power outage, accidentally overfeeding, soap on hands, dealing with vacations, etc</i> 	
Extend	<p>Many previously healthy trout streams are no longer suitable for trout because of man-made changes to the environment – acid rain, acid mine drainage, increased erosion caused by clear cutting, removal of riparian buffers, or livestock in the stream, increased water temperature caused by development or dam releases, introduction of non-native species, etc. Have the students research what is happening to trout streams, choose and research one problem and discuss human causes and possible solutions.</p>	
Evaluate	<p>Valuation based on accuracy of answers and participation in discussion</p>	

Teacher Background:

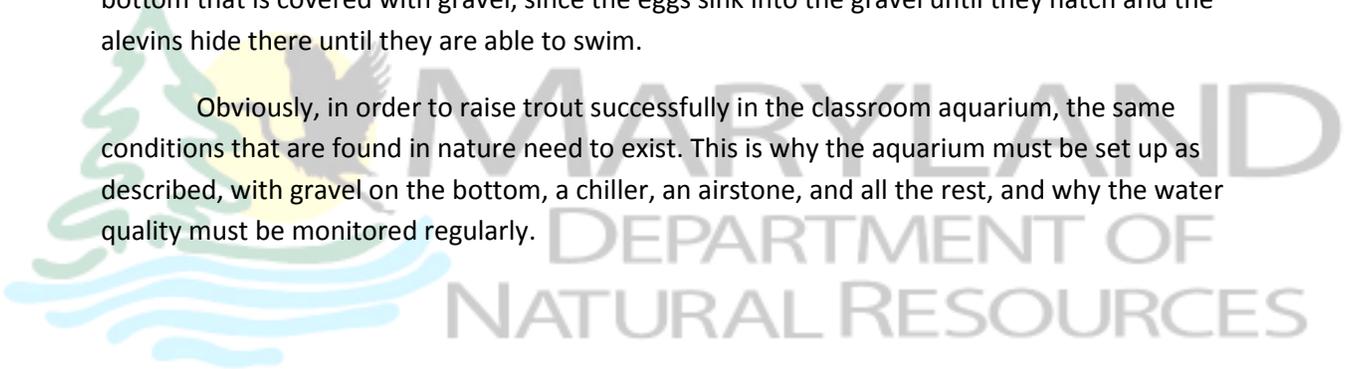
Rainbow trout are not native to Maryland; they are native to the Pacific Coast, but they have been introduced into every state in the country. The Maryland Department of Natural Resources currently stocks over 500,000 hatchery-raised trout in 100 streams, lakes and reservoirs throughout the state, because there are only three streams in Maryland that support a naturally spawning population.

Whether the fish are naturally spawned or stocked, certain environmental requirements should be met:

- Cool water – 10 to 16° C (50 to 60° F)
- High level of dissolved oxygen – at least 5 ppm, preferably higher
- pH – 6-8
- Clear water
- Light – alevins hide in gravel away from light
- Food – anything that fits in their mouths
- Predators – need hiding places like overhanging banks, deep pools, vegetation

In the wild, trout tend to live in streams whose headwaters are in the mountains or are fed from underground springs, which supply the cold water that trout need. They can also live in lakes which have deep areas which tend to stay colder than the surface water. The streams or lakes need to have plenty of surrounding vegetation to prevent erosion, since trout are visual hunters and need clear water in order to see their prey. There also needs to be adequate natural cover – aquatic vegetation, overhanging stream banks, large rocks or deep pools – to provide places to hide from predators. In order to spawn successfully, the trout prefer a stream bottom that is covered with gravel, since the eggs sink into the gravel until they hatch and the alevins hide there until they are able to swim.

Obviously, in order to raise trout successfully in the classroom aquarium, the same conditions that are found in nature need to exist. This is why the aquarium must be set up as described, with gravel on the bottom, a chiller, an airstone, and all the rest, and why the water quality must be monitored regularly.



Rainbow Trout – Student Background Information



Scientific Name: *Oncorhynchus mykiss*

Oncorhynchus means “hooked nose” (This refers to the hook or “kype” which develops on the lower jaw of breeding males.); *mykiss* is probably a Russian native name.

Rainbow trout are members of the Salmon family and are related to Pacific salmon. Like Pacific salmon, some Pacific populations of rainbow trout are anadromous. They spend their adult years in the ocean and return to fresh water to spawn. Unlike salmon, however, anadromous rainbow trout do not spawn once and die, but return to spawn several times. Rainbow trout in Maryland are not anadromous.

Range:

The native range of rainbow trout in North America is the Pacific Coast from northern Mexico to Alaska and inland to the Rocky Mountains. They have since been introduced into every state in the United States and every continent except Antarctica.

In Maryland, over 500,000 rainbow trout are stocked in more than 100 streams and lakes all over the state.

Appearance:

Rainbow trout are colored like typical trout with dark spots on a light background. Most rainbow trout in Maryland are olive-green on the back, shading to silver on the sides and then to white on the belly. There is a faint red or pink band along the lateral line, and the body, dorsal fin and tail fin are covered with dark spots. The anal and pelvic fins are often tipped with white.

The average size of rainbow trout is 20 to 30 inches and the average weight is 2 to 16 pounds. The world record is a fish caught in Canada in 2009 which weighed 48 pounds; the Maryland record is a fish which weighed 14 pounds 3 ounces and was caught in the Savage River Reservoir in 1987.

Habitat:

In the wild, rainbow trout do best in mountain streams or streams whose water comes from underground springs, which supply the cold water that trout need. Their

ideal temperature range is between 10° and 16° C (50° and 60° F) although rainbow trout can survive warmer temperatures than some other species of trout. They can also live in lakes which have deep areas that tend to stay colder than the surface water. Trout also need a high level of dissolved oxygen - at least 5 ppm. Moving streams tend to have high levels of dissolved oxygen because the tumbling water mixes in oxygen from the air. The streams or lakes need to have plenty of surrounding vegetation to prevent erosion, since trout need clear water in order to see their prey. There also needs to be plenty of natural cover – aquatic vegetation, overhanging stream banks, large rocks or deep pools – to provide places to hide from predators. Rainbow trout are more sensitive to acid water than other trout and do best in water with a pH of 6 to 8, so they do not do well in areas where there is acid rain or acid mine drainage.

In order to spawn successfully, rainbow trout prefer a stream bottom that is covered with gravel, since the eggs sink into the gravel until they hatch and the alevins hide there until they are able to swim.

Diet:

Rainbow trout, like other trout, eat a variety of food as long as it fits in their mouth. Rainbow trout, especially juveniles, tend to have a larger proportion of insects, both larvae and adults, in their diet than other trout. Large rainbows will also eat smaller fish, including other trout.

Predation:

Rainbow trout, especially juveniles, are often eaten by larger fish. Adults are also eaten by birds such as kingfishers and herons, water snakes, and mammals such as raccoons, otters and minks.

Reproduction:

Rainbow trout reach maturity between the ages of 1 and 2. In Maryland, there are only three streams that have a naturally spawning population of rainbow trout. These trout spawn any time between late summer and early spring. Spawning and growth occurs best when the temperature is 10 -16° C (50 - 60° F). The male arrives first at the spawning grounds. When the female arrives, she constructs the nest or “redd” and deposits her eggs. Once the eggs are fertilized, they sink to the bottom of the redd and the female covers them with gravel.

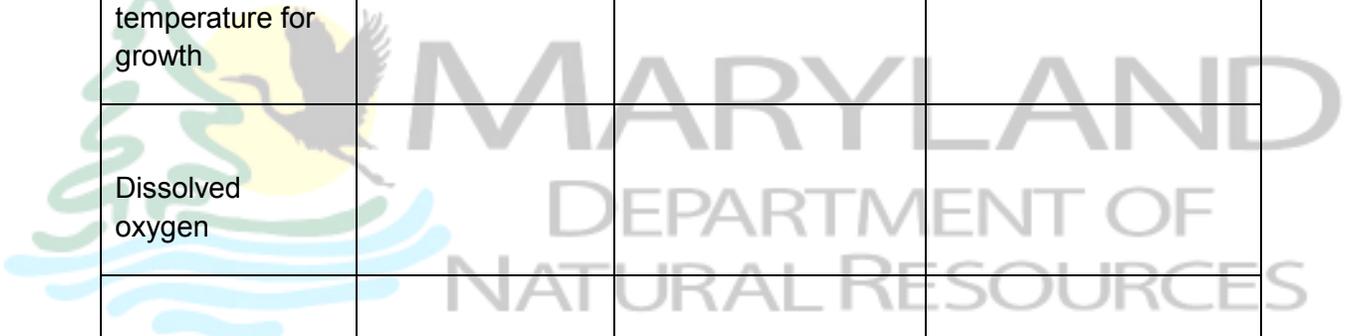


The eggs hatch in the gravel and the “alevins”, which are only 3/4" to 1" long, remain buried in the gravel, hidden away from light. They do not feed, but absorb nutrients from the attached yolk sac. Once the yolk sac is absorbed, the little fish, now called “fry”, wiggle up through the gravel into the stream and begin feeding on tiny insects and crustaceans. Because they rely on vision to find prey, they need clear water. As the fry grow, the size of their prey gets bigger, too.

Most rainbow trout only live for 3 or 4 years; the maximum recorded age is 11.

Nature or Nurture – Worksheet

Need	What do rainbow trout prefer?	How is this need met in the wild?	How will you meet this need in the aquarium?
Water temperature for growth			
Dissolved oxygen			
pH			
Clean or cloudy water?			
Amount of light			
Food			
Predators			





MARYLAND

DEPARTMENT OF
NATURAL RESOURCES