Title: **Trout vs. Aliens**		
Overview:	At the conclusion of this lesson students will be able to • Explain the potential impact of non-native species on trout populations • Explain that there may be several ways that non-native aquatic species can spread.	
Grade:	Middle School	
Standards	NGSS	• MS-LS2- 1 – Analyze and interpret data to provide evidence for the effect of resources availability on organisms and populations of organisms in an ecosystem • MS-LS2-4 – Construct an argument based on empirical evidence that changes to physical or biological components of an ecosystem affect populations
	Core Idea	Ecosystems: Interactions, Energy, and Dynamics
	Practices	• Engaging in argument from evidence • Obtaining, evaluating, and communicating information
	Cross-Cutting Theme	• Stability and change
	Reading, Writing and Social Studies	• CCSS.ELA/Lit. RI.6-8.1 - 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.SL.6-8.1 - Prepare for and participate effectively in a range of conversations and collaborations with diverse partners, building on others' ideas and expressing their own clearly and persuasively. • CCSS.ELA/Lit.W.6-8.1 - Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence.
	Environmental Literacy	• 1.A.1 - Identify and describe a local, regional or global environmental issue. • 1.B.1 - Identify and describe that ecosystems can be impacted by human activities. • 4.C.1 – Explain how the interrelationships and interdependencies of organisms and populations contribute to the dynamics of communities and ecosystems.

	Description	Resources
Engage	• Have students research honeybees and stink bugs • Key questions • Where did they originally come from? • How did they get here? • Have them read the Definition and Characteristics of Invasive Species • Would honey bees or stink bugs be considered invasive species? Why or why not?	See Resource List
Explore	• Now that the students understand the difference between a species that is non-native and one that is also considered invasive, they are going to do some research on the possible impact of non-native species on trout populations. • Have students work in groups to research the impact of one of the following organisms: round goby, Northern snakehead, rusty crayfish, zebra mussel, New Zealand mud snail, didymo ("rock snot"), whirling disease, VHS (viral hemorrhagic septicemia) • They should write the answers to the following questions: ○ Name of the organism? ○ Description (What is it?) ○ Where did it originally come from? (What is its native range?) ○ How did it probably get to this country? What is its current invasive range? ○ Has it reached Maryland? If so, how did it probably get here? ○ What is the possible impact on trout populations? ○ Would you consider the organism "invasive" or just "non-native"? Why? ○ If it is invasive, is anything being done to prevent its spread?	Computers with Internet access
Explain	• Once their research is done, the students should be prepared to share their research with the rest of the class. This can be done in the form of an oral report, a PowerPoint presentation or a poster. • Based on the reports, which organism or organisms do the students feel might have the most impact on trout populations? Why?	
Extend	• The only trout species native to Maryland is the brook trout; rainbow trout and brown trout are non-native. Have students research the impact of these two non-native trout species on brook trout. They can use the same format as the above exercise. • Public information campaigns are often the best way to stop the spread of invasive species. Have students work in groups to create a 30 second public service announcement, a sign, or brochure that includes pictures and/or description of the organism, the impact on native species or habitat, and what the	

	public can do to stop the spread of the organism	
Evaluate	Evaluation based on thoroughness and accuracy of research, use of evidence in presentation, reasoning	

Resources

- Honey bee - http://en.wikipedia.org/wiki/Honey_bee
- Stink bug - http://en.wikipedia.org/wiki/Brown_marmorated_stink_bug
- Definition and Characteristics of Invasive Species - http://www.fs.usda.gov/detailfull/r8/landmanagement/resourcemanagement/?cid=stelprdb5316137&width=full)

Teacher Background

A "non-native species" is usually defined as a plant or animal species found outside its natural range and which is capable of surviving and reproducing without human help. An "invasive species" is defined as a non-native species that is so successful that it can out-compete native species. In other words, not all non-native plants or animals are considered invasive. For example, honeybees are not native but are not considered invasive. In contrast, Asiatic stink bugs (which are becoming far too familiar to many people) are both a non-native and an invasive species. They have no natural predators and are very destructive because they damage fruit trees, soybeans and nursery plants.

Some non-native species were deliberately introduced. Honeybees are native to Southeast Asia, but were brought to this country by European colonists who wanted honey as a sweetener. Many, however, have arrived accidentally; Asiatic stink bugs probably arrived in this country by stowing away in cargo.

Unfortunately, many non-native species become invasive when introduced into a new ecosystem. Many of them are very quick to adapt to new food sources and can out-compete native species for food. In some cases, they can alter the habitat to the point that native species can no longer use it. They may also be able to reproduce more rapidly than native species. Also, in their new range, there are often no natural predators to keep the populations in check. As a result, they often have a negative effect on native plant and animal species.