Title: **Insides and Outsides – The Anatomy of a Fish**		
Overview:	At the conclusion of this lesson students will be able to • Compare and contrast human and fish anatomy. • Explain that the internal and external adaptations of a fish help it survive in its environment.	
Grade:	Upper Elementary, Middle School, High School	
Standards	NGSS	• 4-LS1-1 – Construct and argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction. • MS-LS1-5 – Use argument supported by evidence for how the body is a system of interaction subsystems composed of groups of cells. • HS-LS1-2 – Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.
	Core Idea	From Molecules to Organisms: Structure and Processes
	Practices	• Planning and carrying out investigations • Obtaining, evaluating, and communicating information
	Cross-Cutting Theme	• Structure and function
	Reading, Writing and Social Studies	• 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.
	Environmental Literacy	

	Description	Resources
Engage	• Before beginning this activity, it helps if students know the functions of the various parts of the human digestive system, liver, pancreas, spleen, kidneys, lungs, heart and so on. (http://www.innerbody.com/ or http://www.nlm.nih.gov/medlineplus/anatomy.html). This enables them to compare and contrast fish and human anatomy. • You might also want to have them do some research on fish anatomy (http://www.biographixmedia.com/biology/trout-fish-anatomy.jpg)	

Explore	If students are doing their own dissection: • Have students work in teams of four. • Remind them that a dissection is a scientific procedure; they must work carefully and neatly. • Unless told otherwise, the fish is to remain in the dissecting tray. Explain to the students before beginning that most of the concepts being discussed apply to trout as well as to the actual fish they are using. See Teacher Worksheet for details	Materials – See Teacher Background
Explain	Have students compare and contrast human and fish anatomy – both external and internal. Are they surprised at the similarities? Where there are differences, why do they think these differences exist? Why is internal anatomy similar between fish and human anatomy? • *Similarities – most of the internal organs of fish have the same basic functions as those of humans* • *Differences – the majority of differences are related to an aquatic existence versus a terrestrial one (fins are more efficient for swimming than arms and legs; scales provide better waterproofing than skin, gills instead of lungs, and so on)* • *Shared evolutionary ancestry.* Have students write a paragraph describing the adaptations humans have to make if they are going to spend time under water. How do these adaptations compare to a fish's anatomy? *(Example: fish have slime to help them glide through the water; humans wear a wet suit.)*	
Extend	Have students research the anatomy of another group of vertebrates. How does their external and internal anatomy compare with that of a fish?	
Evaluate	Evaluation based on participation in dissection and class discussion	

Teacher Background

This activity can be done either as a demonstration or as a student activity. Necessary background information will be included in the activity. **If you are uncomfortable doing a dissection, you can stop the activity after the External Anatomy section.**

Materials:

- Whole, uncleaned fish
    - If the activity is to be done as a demonstration, you are going to want a fairly large fish. If the students are going to do their own dissection, smaller fish will work – one fish for every four students.
        - If someone you know is an angler, he or she might be happy to supply you with fish (preferably at least 6 inches long)

        - Otherwise you will have to see if the local grocery store or seafood market can supply whole uncleaned fish.
    - Keep the fish frozen until ready to use. Defrost the day of the activity. Do not thaw and refreeze fish – they will get mushy! They can be kept in the refrigerator for several days.
- Dissecting trays
- Paper towels
- Scissors with pointed tips
- Probe – toothpick, coffee stirrer, etc.
- Microscope
- Student worksheet – one per team of four
- Hand sanitizer