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| **Water Dawgs Lesson Plan**  **Topic: Stream Food Webs**  **Learning Module #13** | | | |
| **Lesson Objectives(s):** | | * SWBAT define: algae, detritus, macroinvertebrates, macroconsumers. * SWBAT construct a stream food web. * SWBAT describe how energy flows through stream food web. * SWBAT explain how forest ecosystems are intricately connected with stream food webs. * SWBAT analyze how stream food webs would be affected by a change in one of its constituents. | |
| **Associated NGSS Standard(s):** | | * N/A | |
| **Associated A.P. Environmental Science Standard(s):** | | * ENG-1-B-Explain how energy flows and matter cycles through trophic levels * ENG-1-D-Describe food chains and food webs, and their constituent members by trophic level. | |
| **Materials:** | | * PowerPoint * Printed materials:   + Lesson worksheets (WS) – 1 copy per student * Scissors (1 per 1-2 students) * Scotch tape * Colored pencils * Blank paper (colored or white) * RiverWebs documentary   <https://www.freshwatersillustrated.org/riverwebs>   * OPTIONAL – preserved stream macroinvertebrate specimens for use during Guided Notes | |
| **Instructor to do before lesson:** | | * Print:   + Lesson worksheets (WS) – 1 copy per student * Look over PPT/Lesson plan * To play the movie RiverWebs, you must have a membership to Freshwaters Illustrated. To purchase membership and gain access to the film, visit this website:   <https://www.freshwatersillustrated.org/>  *Note that there is a 40% discount on memberships for K-12 educators!*   * Check to make sure videos work on projector | |
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| **Part of Lesson** | **Time** | **Duration** | **Lesson** |
| **ENGAGE** | 9:00 | 30 min | Opening Activity  \*\*Pass out lesson worksheets (WS).  \*\*Show students an image of a terrestrial food chain (Image 1) and of a terrestrial food web (Image 2). Have students answer Question 1:  Question 1: What do you know about Image 1 and 2? What does each represent? How are they similar or different? What do the arrows represent? Explain what you know!  ^^Allow 5-10 min for students to write their responses for Question 1  \*\*Discuss responses to Question 1 with the class. Make sure to cover that Image 1 represents a food chain while Image 2 represents a food web. The arrows represent the flow of energy from one organism to another – note that the arrow flows from the organism that is EATEN to the organism that is EATING.  ^^Allow 5-10 min for discussion of Question 1.  \*\*Change PPT to the next slide. **Discuss definitions of producer, carnivore, herbivore, and omnivore with students (if you haven’t already).** Then, have students answer Question 2.  Question 2: Sort the organisms into this food web into four categories: producer, herbivore, omnivore, and carnivore.  ^^Allow 5-10 min to write their responses for Question 2.  \*\*Go over response for Question 2.  ^^Allow 5-10 min for discussion of Question 2. |
| **EXPLORE** | 9:30 | 50 min | Stream Food Web Activity  \*\*Pass our materials for Stream Food Web Activity (colored pencils, scissors, tape, blank paper)  \*\*Tell students: We’ve talked about food chains and food webs in forest ecosystems, so now we’re going to talk about stream food webs. In this activity, you’ll be creating your own stream food chains and webs, and then answering some questions regarding the food web.  \*\*Allow students to work through activity on their lesson worksheets (WS) independently. They can chat with a partner if they have questions.  **Make sure to note:**  --Students should raise their hands and have the instructor check their activity at two points   1. Once they’ve created the two food chains 2. Once they’ve created their food web   --Each students food web will likely look different – that’s ok!!  --Once students have made it through the directions, they can start answering the associated questions.  ^^Allow students ~40 min to work through activity and answer the questions.  \*\*Discuss food webs and responses to the questions with the class.  *🡪* ***NOTE****: there is an example food web from the activity in the PPT.*  ^^Allow 10 min for class discussion of responses. |
| *BREAK* | *10:20* | *10 min* | *BREAK* |
| **EXPLAIN** | 10:30 | 30 min | Stream Food Webs  \*\*Use PowerPoint to go through different parts of the food web. Students should write down anything that is bold, brown, and underline in their notes.  \*\*During this presentation, encourage students to interact and ask questions!  **Slide 1**  We are familiar with terrestrial food webs…  **Slide 2**  Streams also have their own food webs. Let’s take a closer look at stream food webs, and learn about their different parts.  **Slide 3**  First, let’s take a look at basal resources. What are basal resources?  \*\*Wait for student responses  **Slide 4**  Basal resources = producers/bottom of food web. Harness sunlight to synthesize foods  In streams, there are two major kinds of basal resources….  **Slide 5**  **Algae** – **mostly aquatic organisms that perform photosynthesis**   * There are many type of algae. * Some kinds of algae you can see with your eyes, while some are microscopic.   **Slide 6**  **Leaves** – **leaves that fall into the stream from plants in the riparian zone**  Sometimes known as “detritus”  **Slide 7/8**  **Macroinvertebrates** – **organisms without skeletons that we can see with our eyes**   * Have no skeleton * Some kinds only live part of their lives in the water (e.g., dragonfly, mayfly) * Some kinds live their whole lives in the water (e.g., snails, crayfish) * Important part of stream food web (food for fish!)   \*\*Discuss macroinvertebrate life cycle – may flying insects you are familiar with (including mosquitoes) start their life cycle in the water as larvae. As they grow, they “emerge” into flying insects.  🡪 OPTIONAL– pass around preserved stream macroinvertebrates for viewing  **Slide 9/10**  **Macroconsumers** – **large bodied, relatively long lived organisms that play dominant roles in stream ecosystems, like fish and crayfish**  \*\*Make sure to discuss that crayfish can be considered macroinvertebrates and macroconsumers  **Slide 11**  Terrestrial consumers are also important parts of stream food webs.  \*\*Discuss how emerging insects from the stream are important food resource for many terrestrial animals, including spiders, bats and birds. Terrestrial insects can also be important food for fishes. |
| **ELABORATE** | 11:00 | 1 hour, 15 min | RiverWebs Documentary Viewing and Discussion  \*\*Tell students that we will be watching a documentary called Riverwebs. This documentary is woven around the personal story of stream ecologist Shigeru Nakano, but through it we will get to see and learn about stream food webs, and how they are connected to the surrounding forest ecosystem.  \*During the film students will write on their lesson worksheets:   * One (or more) things/topics you find cool or interesting * One (or more) questions you have   ^^Allow ~55 min to watch documentary  \*\*After the documentary is completed, start out the discussion by having each student say one cool/or interesting thing they found in the documentary. Then, start discussing questions the students have.  Here are some additional discussion questions/topics:   * Why are insects (or macroinvertebrates) important to stream food webs? * Why did Shigeru Nakano want to build a greenhouse over a stream? * Differences between observational science vs. experimental science * Why is it important to maintain riparian habitat.   ^^Allow ~20 min for discussion |
| **EVALUATE** | 12:15 | 15 min | Closing Activity  \*\*Have students answer questions independently on their lesson worksheets (WS).  **Scenario**: Imagine someone dumped insecticide (in other words, an insect killer) into a stream. This insecticide killed off all of the macroinvertebrates in the stream, but did not directly affect other parts of the stream food web.    Question 1: How do you think **algae** in the stream might be indirectly affected by the insecticide? Explain your reasoning.  Question 2: How do you think **fish** in the stream might be indirectly affected by the insecticide? Explain your reasoning.  ^^Allow 10 min. Collect responses and review after the lesson. |