| **Water Dawgs Lesson Plan**  **Topic: Stream Bioassessments, Part B**  **Learning Module #17** | | | |
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| **Lesson Objectives(s):** | | * SWBAT explain why standardization of macroinvertebrate collection protocols is important for bioassessment data quality. * SWBAT conduct macroinvertebrate collection and bioassessment in a campus stream using Adopt-a-Stream protocols. | |
| **Associated NGSS Standard(s):** | | * N/A | |
| **Associated A.P. Environmental Science Standard(s):** | | * N/A | |
| **Materials:** | | * PowerPoint * Printed materials:   + Lesson Worksheet (WS) – 1 copy per student   + Macroinvertebrate Bioassessment Forms (BOTH pages; Handout 1 [H1]) – 1 copy per student   + Handouts for Macroinvertebrate ID binder (H2 and p. 17 & pp. 30-54 of H3; see below) – 1 copy per every ~2 students * Sharpies * 1 piece of large poster paper/notepad (for EXPLAIN Activity) * Materials for macroinvertebrate collection and bioassessment:   + Forceps (1 per student)   + Collecting trays (1 per student)   + Buckets (1 per ~2 students)   + D-nets (1 per ~2 students)   + Kick seine (1)   + Pencils (1 per student)   + Boots (1 set per student)   + Rite in Rains (1 per student)   + Clear plastic cups or similar   + Sieves (1mm mesh; 1 per ~2 students)   + Macroinvertebrate ID Binders (see below; 1 per ~2 students). Each will consist of:     - 1 three ring binder     - Handouts       * West Virginia Save Our Streams BMI - ID Field Guide (H2)       * Georgia Adopt-A-Stream Macroinvertebrate Training – p. 17 and pp. 30-54 of Handout 3 (H3)   + A Guide to Common Freshwater Invertebrates of North America (~2 copies) | |
| **Instructor to do before lesson:** | | * Print:   + Lesson Worksheet (WS) – 1 copy per student   + Macroinvertebrate Bioassessment Forms (BOTH pages; Handout 1 [H1]) – 1 copy per student   + Handouts for Macroinvertebrate ID binder (H2 and p. 17 & pp. 30-54 of H3)– 1 copy per every ~2 students * Look over PPT/Lesson plan * Check to make sure audio/visual works on video * Create Macroinvertebrate ID Binders (1 for every ~2 students)   + Place printed Macroinvertebrate ID materials into binder (see above)   *🡪* ***NOTE****: The lesson has allotted two hours for transit to and from the campus stream, as well as the macro collection and ID…. It is possible that this part of the lesson could take longer or shorter, depending on how many macroinvertebrates are in the stream. You may want to complete the engage, explore, and explain parts of the lessons as quickly as possible to allow more time in the stream. If needed, you could push the evaluate part of the lesson (macroinvertebrate bioassessment) to the next module.* | |
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| **Part of Lesson** | **Time** | **Duration** | **Lesson** |
| **ENGAGE** | 9:00 | 15 min | Opening Activity  \*\*Tell students:   * For the opening activity, we are going to watch a short video about a youth science trip on the Colorado River. * In the video, you’ll see the students collecting both macroinvertebrate and fishes. Note the tools and methods they are using to collect these organisms…. this is what we’ll be doing today in our campus stream!   \*\*Watch Freshwater Illustrated Video: What You Take Away  <https://www.freshwatersillustrated.org/what-you-take-away>  ^^Allow ~8 min for video  \*\*After the video plays, discuss the following questions with the students:   1. What kind of tools and methods did you use the youth scientists use to collect macroinvertebrates? What about fishes? 2. Did it surprise you that macroinvertebrates can also be found in large rivers, like the Colorado River, as well as small streams? 3. Was there anything that surprised you in this video? 4. What other observations or questions do you have after watching this video?   ^^Allow ~7 min for discussion |
| **EXPLORE** | 9:15 | 20 min | Macroinvertebrate Collection Methods  \*\*Tell students:   * Today, we are going to be collecting and identifying macroinvertebrates from our campus stream! * Before we head out to the stream, we need to learn methods for how to collect macroinvertebrates from the stream.   **Slide 1**  STREAM TYPES  1. Rocky Bottom Streams   * + Generally found in North GA and Piedmont Region   + Characterized by fast moving water flowing over large rocks and boulders   + Stream stretch consist of pool/riffle system   2. Muddy Bottom Streams   * + Found mostly in South GA and urban environments due to erosion and sedimentation   + Slow moving water with little or no turbulence   + Substrate is generally composed of fine silt, sand or coarse gravel   *If your stream shows traits of both categories, do your best to CHOOSE ONE and proceed with that method!*  **Slide 2**  \*\*Ask students: What kind of stream is our campus stream – rocky bottom or muddy bottom?  ^^Allow students to answer.  \*\*Tell students: It’s important to note the type of stream bottom, because that will determine what collection methods to use.  **Slide 3**  HABITAT TYPES  1. Vegetative margins - area along the edge of water body consisting of overhanging bank vegetation  2. Substrate   * + Sand/rock/gravel streambed - area of stream with coarse substrate   + Riffles - shallow area of a stream in which water flows rapidly over a rocky or gravelly stream bed   3. Organic Matter   * + Leaf packs – decomposing vegetation that is submerged in the water   + Woody debris – decomposing trees, roots, or branches that are submerged in the water   *🡪****NOTE****: Slides 4 and 5 will cover methodology for rocky bottom streams and muddy bottom streams. You will only be using one (depending on your stream type) – but review methods for both.*  **Slide 4**  Rocky Bottom Streams  Sample TWO different habitats using a kick seine  *Substrate* – 3 samples   * + Sample 2x2 foot area with kick seine net in riffle areas   *Organic matter* – 4 samples   * + Using both hands, take 4 handfuls (1 square foot) of decayed, submerged leaf packs   \*\*Demonstrate how to use Kick Seine for students.  **Slide 5**  Muddy Bottom Streams  Sample THREE different habitats using a D-frame net.  *Vegetative Margins*-- 7 Samples   * + 7 scoops (1 square foot)   *Organic Matter*-- 4 samples   * + 4 scoops (1 square foot) in woody debris   *Substrate* -- 3 samples   * + 3 scoops (1 square foot) of sand/rock/gravel or coarsest area of streambed   *Tip: Try to avoid collecting a lot of sand to save time*  \*\*Demonstrate how to use D-net for students. |
| **EXPLAIN** | 9:35 | 15 min | Why is collection standardization important?  \*\*Pass out Lesson Worksheet (WS)  \*\*Next, we will complete a short activity to discuss why standardization of collection techniques is important for macroinvertebrate bioassessments.   * Working with a partner, take 5 minutes to brainstorm reasons why standardization of macroinvertebrate collection methods is important. (In other words, why it is important that all muddy bottom streams get the same number of samples of each habitat type?) * Write down your ideas on your lesson worksheet.   ^^Allow 5 min for students to brainstorm.  \*\*Have students share out their answers/discuss. As students are sharing their responses, have one student write down reasons on a piece of larger poster paper. When the activity is complete, you can hang this in the classroom.  ^^Allow 10 min for sharing/discussion. |
| *BREAK* | 9:50 | 10 min | *BREAK* |
| **ELABORATE** | 10:00 | 2 hours | Campus Stream Macroinvertebrate Collection and ID  \*\*Pass out p.1 of Handout 1 (H1)  \*\*Tell students:  Next, we are going to be collecting and identifying macroinvertebrates (using the Adopt-A-Stream protocols) at our campus Stream.  You will need:   * Forceps * Collecting tray * Pencil(s) * Water boots * Rite in Rains * Clear plastic cups or similar (to aid with sorting) * Adopt-A-Stream Macroinvertebrate Bioassessment Form (page 1 ONLY)   You and your partner will need (between the two of you):   * Bucket * D-Net or Kick Seine (depending on stream type) * Macro ID Binder * Sieve   🡪 NOTE: We will be filling out Page 1 (Site Info/ Weather/ Observations) at the site, but we will be waiting until we get back to the classroom to fill out Page 2 (Macroinvertebrate Bioassessment).  So, **you and your partner should be collecting ID data (i.e., what macroinvertebrates you have and how many) in your Rite-in-Rains!**  When we get back to the classroom, we will compile all our data together so that we can complete Page 2.  \*\*Review example of how to create data collection sheet in Rite-in-Rain.  ^^Allow 5 min for creating data sheet and the distribution and packing of materials.  \*\*Walk to campus stream with the class  ^^Allow 15-20 min for transit  \*\*At the stream, divide up macroinvertebrate tasks among the students. You might divide students into 3 groups and assign each to one habitat type.  --Once macroinvertebrates have been collected, work as a team to “pick” macroinvertebrates from debris using nets, buckets, seines, forceps and collecting trays.  --Once macroinvertebrates have been picked, let students work in pairs to ID macroinvertebrates using forceps, collecting trays, clear plastic cups (for sorting), Macro ID binders and Rite-in-Rains.  ^^Allow ~1 hour 25 min for macroinvertebrate collection, picking, and IDing.  \*\*Walk back to classroom  ^^Allow 15-20 min for transit |
| **EVALUATE** | 12:00 | 30 min | Campus Stream Macroinvertebrate Bioassessment  \*Once students are back in class, each group should bring their data sheet to the instructor so that the instructor can compile ALL the macroinvertebrate collection data.  ^^Allow 10 min for data compilation.  \*\*Pass out p. 2 of Handout 1 (H1)  \*Once data has been compiled, each student should use the macroinvertebrate collection data to fill out the Macroinvertebrate Bioassessment Form (Page 2).  ^^Allow 15 min for students to fill the bioassessment form.  \*\*Review forms/answer with students.  ^^Allow 5 min. |