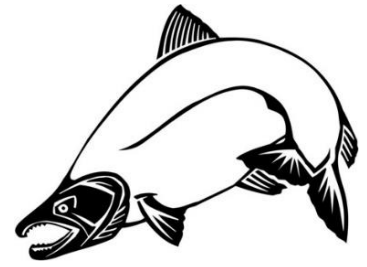

Biotic Index (Classroom)



Purpose: This activity provides an indoor resource for fostering students' knowledge of stream macroinvertebrates' tolerance levels to pollution and calculating biotic indices. The activity is designed to provide experience calculating biotic index before, or instead of, visiting a field site.

Objectives:

Students will

- Key out and draw at least three kinds of macroinvertebrates.
- Describe at least three organisms' sensitivity levels to pollution
- Brainstorm at least two factors that affect the health of a stream.
- Calculate biotic index values and designate a water quality rating based on these values.
- Make at least 2 recommendations for ways to improve or maintain stream health.
- Create a drawing of a stream based on a biotic index, and write a paragraph summarizing the health of the stream that is clearly supported by the macroinvertebrates in the stream.

Materials:

- Blank sample stream study form (one per group)
- One blue and one pink dice (per group)
- Blank laminated macroinvertebrate grid sheet (one set per group)
- Macroinvertebrate identification key (one per group)
- Thin dry erase pen (one per group-not provided)
- Drawing supplies and paper (not provided)

Time Required: 1.5-2 hours

Appropriate grades: 5-8

NGSS and Common Core Standards:

5-ESS2-1 Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact

CCSS.ELA-LITERACY.W.5.2 Write informative/explanatory texts to examine a topic and convey ideas and information clearly.

MS-LS2-1 Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem

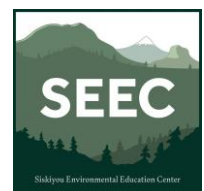
MS-LS2-4 Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations

CCSS.ELA-LITERACY.W.6.1.B Support claim(s) with clear reasons and relevant evidence, using credible sources and demonstrating an understanding of the topic or text.

CCSS.ELA-LITERACY.W.7.1 and CCSS.ELA-LITERACY.W.8.1 Write arguments to support claims with clear reasons and relevant evidence.



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Activity:

Introduction	<ul style="list-style-type: none"> • Brainstorm ways that a stream can become polluted. • Brainstorm characteristics of a healthy stream. • Briefly discuss what macroinvertebrates are, show some pictures of different types, and explain how different macroinvertebrates indicate different water pollution levels.
Body	<ul style="list-style-type: none"> • Divide the class into small groups of about 4 students. • Give each group blank, laminated macroinvertebrate grid sheet, two dice (one of each color), a dry erase pen, and a macroinvertebrate key (there are several kinds to choose from in the kit). • Group members take turns rolling the dice in order to figure out how many of which macroinvertebrate were found in their sample stream. Each group should roll about 15-20 times. To use the macroinvertebrate grid, for each role look at the numbers on each colored dice, and match the corresponding dice color and number to the correct macroinvertebrate on the sheet. • Use the dry erase marker to mark down how many of each kind are found. • Groups key out all macros. Found in their stream, using the keys. • Hand out a blank stream study form to each group. • Students record the number of each organism found in the sample stream onto a sample record assessment form, and calculate the biotic index. • Students draw a sample stream, including identifying any factors that may be contributing to stream health. Drawings should include macroinvertebrates, and may include other organisms that may use the stream. • Students write out a paragraph summarizing their stream health, supported with macroinvertebrate evidence, and make at least 2 recommendations for how to improve or maintain the health of the stream.
Closure	<ul style="list-style-type: none"> • Groups share their stream drawing and assessment with the whole class. • Discussion can follow on the relationship of macroinvertebrate populations to water quality rating. Debrief discussion ideas:



	<ul style="list-style-type: none"> ○ What characteristics of macroinvertebrates are easy to identify? How can you remember common macroinvertebrates? Examples: <ul style="list-style-type: none"> ▪ Mayflies have gills on sides of abdomen, stoneflies do not. ▪ Stoneflies always have 2 filaments, while mayflies can have 2 or 3. ▪ Damselflies have 3 “feathery” filaments ○ What characteristic macroinvertebrates were in each stream quality category (excellent, good, fair, poor)? ○ Who had the most diverse stream? ○ Who had the most densely populated stream? ● If heading into the field, have the students plan collection, identification, and biotic index techniques to use when they are collecting their own stream samples.
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Modifications:

- **Elementary:**
 - Use simpler dichotomous keys
 - Have students write a poem about a macroinvertebrate of their choosing.
 - Have students do a detailed drawing of one macroinvertebrate of their choosing; post all drawings on the board in a “stream”. Have students work together to determine what class they fall into. As a class, use these drawings to determine the health of the “stream” together.

- **High School:**
 - Have students use more challenging and detailed keys to identify macroinvertebrates.
 - Students research and write a paper on a specific macroinvertebrate, or on the health of the fictitious stream, providing additional recommendations for stream health improvement.

