Biotic sampling

Focus question	How can the health of an aquatic ecosystem be determined by the macroinvertebrates present in the ecosystem?
Vocabulary	Riffle zone, range of tolerance, dichotomous key

Background

Macroinvertebrates are animals without a backbone that can be seen with the naked eye. These bottom-dwelling animals include crustaceans and worms but most are aquatic insects. Macroinvertebrates form permanent, relatively immobile stream communities that can be easily collected in large numbers for observation. They occupy all stream habitats and display a wide range of functional feeding preferences. They are important to the ecosystem and inhabit the middle of the aquatic food web as a major source of food for fish and other aquatic and terrestrial animals. Macroinvertebrates are a good indicator of changing water conditions because they demonstrate both acute and chronic reactions to environmental changes in the aquatic habitat.

The kick seine technique is a useful way to measure the macroinvertebrate diversity of an aquatic ecosystem. Macroinvertebrate taxa can tolerate varying levels of water quality conditions. Some macroinvertebrate groups can only tolerate excellent water quality, whereas other groups have a different **range of tolerance** for environmental conditions. Field sampling should be done when the water is warm and macroinvertebrates are active, usually from the end of May through the end of September. The best areas to locate macroinvertebrates are in areas of high oxygen concentration such as **riffle zones** or rapids in the benthic zone. Students will find that macroinvertebrates may cling to the bottom on rocks and humus and will need to be wiped and kicked into the net for collection.

Procedure

1. Watch the kick seining video with the class to learn the kick seining technique that will be used in this investigation.
2. Select roles for the members in your group—2 people will hold the net and the remaining 2+ participants will be kickers to move macroinvertebrates into the net.
3. Locate a shallow riffle zone to kick seine.
4. Set the poles at a 45 degree angle downstream from the riffle zone.
5. Kickers move upstream of the net and kick the bottom zone vigorously to stir up organisms and allow them to flow downstream into the net.
6. Kickers pick up rocks and other benthic materials and carefully wipe them in the water, then place them back on the bottom moving downstream into the net.
7. Net holders carefully lean the net back and scoop up the bottom of the net to capture the macroinvertebrates and take them to the shore for identification.
8. Using tweezers or your fingers, carefully pick up each organism and place them into a tub or ice cube tray filled with stream water for identification.

9. Use the dichotomous key, water quality Aqua Bugs app, or similar identification tool to identify the organisms collected.
10. Check off the taxa collected on the chart below to create a water quality rating for the stream.
11. Follow the directions on the chart to determine the water quality rating for macroinvertebrate testing.

Biotic sampling

Sensitive	Somewhat sensitive	Tolerant
☐ Caddisfly Larvae	☐ Beetle Larvae	☐ Aquatic Worms
☐ Hellgramite	☐ Clams	☐ Blackfly Larvae
☐ Mayfly Larvae	☐ Crane Fly Larvae	☐ Leeches
☐ Gilled Snails	☐ Crayfish	☐ Midge Larvae
☐ Rifle Beetle Adult	☐ Damselfly Larvae	☐ Lunged Snails
☐ Stonefly Larvae	☐ Dragonfly Larvae	
☐ Water Penny Larvae	☐ Scuds	
	☐ Sowbugs	
	☐ Fishfly Larvae	
	☐ Alderfly Larvae	
	☐ Watersnipe Larvae	
boxes checked × 3 = _____ index value	boxes checked × 2 = _____ index value	boxes checked × 1 = _____ index value
Water Quality Rating **Total Index Value = _____**	Excellent (> 22)	Fair (11–16)
	Good (17–22)	Poor (< 11)

Reflection

Create an explanation for the current water health of the water sample above. Look at the recorded information above. Reflect on the following questions while creating your explanation.

1. How did the stream appear to your group? Healthy or not healthy? Did the stream have an odor or a layer of oil on its surface? Did you notice anything that stood out as unusual? Write details about the stream below.

2. How did your water sample results compare? Did you have organisms from more than one index group? What was your index rating?

3. If your stream rating was less than 'excellent' water quality, what are some factors that could be affecting the rating? Could human impact have changed stream conditions and lessened the water quality rating? If so, how?

Rubric for self-assessment

Skill	Yes	No	Unsure
I can identify macroinvertebrates.			
I can use the collected taxa data to determine a water quality rating of poor, fair, good, or excellent.			
I can use the collected data and assessment to describe possible ways that the health of a disrupted aquatic ecosystem can be improved.			