**Summer Academy 2018**

**Bio-Assessment of Local Water System**

**INTRODUCTION:**

Aquatic macroinvertebrates include insects, crustaceans, mollusks, and worms that are found in streams, sloughs and lakes. Researchers have found that certain types of macroinvertebrates are sensitive to pollution, others are tolerant, and others are somewhere in between. Researchers can easily get a fairly accurate measure of the general quality of the water in a freshwater habitat (stream, slough or lake) by sampling the macroinvertebrates in a body of water and tallying up the different types of macroinvertebrates found. This quick, relatively painless exercise will give you a feel for this type of very impactful type of research.

**OBJECTIVES:**

* Students will explore background information on bio-assessments and macroinvertebrates
* Students will identify and classify macroinvertebrates
* Students will assess water quality based off results of bio-assessment

**STANDARDS COVERED:**

11-12.2.2. Select and use appropriate instruments, measuring tools, and units of measure to improve scientific investigations

9-10.2.7. Maintain clear and accurate records of scientific investigations

11-12.2.6. Analyze data using appropriate strategies (e.g., interpolation, and extrapolation of data, significant figures, dimensional analysis)

11-12.6.1 Select and use appropriate technologies, tools, and techniques to solve a problem (e.g., computer-assisted tools, Internet, research skills, CBL, graphing calculators)

**Materials Needed:**

* **Buckets**
* **Petri Dishes**
* **Plastic Pipettes**
* **Aquatic Nets**
* **Dissecting Microscopes**
* **Dissecting Trays**

**SESSION ORGANIZATION:**

9:00 – 9:30 Cultural connection & general organization

9:30 – 10:00 Background Information

10:00 – 11:00 Internet Activity

11:00 – 12:00 Collect Sample Site 1

12:00 – 12:30 Lunch

12:30 – 1:30 Identification/Classification of Macroinvertebrates from water sample

1:30 – 1:45 Clean-Up

1:45 – 2:30 Analyze Results

2:30 – 3:00 Closing discussion: Perception Vs. Reality

**Activity One: Background information on Bio-Assessment**

Using the internet, find the definitions for the following words and answer the following question:

**Macroinvertebrates -** organism without backbone that are visible by the naked eye

**Bio-Indicator –** an organism whose status in an ecosystem is analyzed as an indication of the ecosystems health

**Ecosystem –** a biological community of interacting organisms and their physical environment

**What is a lotic water system and give 2 examples?**

Flowing water system. Rivers and creeks.

**What is a lentic water system and give 2 examples?**

Still water systems. Lakes and ponds.

**Why use bio-assessments?**

The quality of streams can be determined by analyzing macroinvertebrates present. These organisms provide an excellent tool for stream quality assessment work because they are restricted to their immediate habitat and cannot escape changes in water quality.

**Activity Two: Collect samples from sites**

**If you are sampling in flowing water:**

1. Wade into the stream and place your net so the mouth of the net is perpendicular to and facing the flow of water.

2. Stand upstream of the net and disturb the stream bottom with your feet and hands.

 3. Carefully pick up and rub stones directly in front of the net to remove attached animals. The stream bottom material and organisms will be carried by the current into the net. If the rocks are lodged in the stream bottom, rub them vigorously, concentrating your effort on any cracks or indentations.

4. After removing all large stones, disturb the sand and gravel to a depth of about 3 inches by raking and stirring with your hands.

5. Continue this process until you can see no additional animals or organic matter being washed into the net.

**If you are sampling in pools or highly-vegetated areas:**

1. Scoop material from the stream bottom with the net. Try not to scoop up too much sediment as it will make it difficult to sort the macroinvertebrates.

2. Push and pull the net through aquatic vegetation.

3. Hand pick organisms from sticks and other structures.

4. Continue until you have at least 100 organisms.

**Activity Three: Sort and Classify Macroinvertebrates from Sample**

 **Empty your sample**

1. Hold your sampling net over a plastic pan and use a bucket of stream water to wash the material into the pan.

2. If your sample contains a lot of rocks or debris, stir the sample in the pan to suspend the animals, then pour the suspended material back into your net. Rinse the debris from the pan, then wash the animals in the net back into the pan.

**Sort/Classify and record data**

1. Sort and identify the macroinvertebrates using the petri dishes and pipettes.

2. Keep track of the number of types of organisms

|  |  |
| --- | --- |
| **Macroinvertebrates** | **Tally of Individuals** |
| Ephemeroptera (Mayflies) |  |
| Odonata (Dragonflies/Damselflies) |  |
| Plecoptera (Stoneflies) |  |
| Trichoptera (caddisflies) |  |
| Diptera (flies) |  |
| Megaloptera (fishflies and dobsonflies) |  |
| Coleoptera (beetles) |  |
| Amphipoda (shrimp and scuds) |  |
| Isopoda (sow bugs) |  |
| Decapoda (crayfish) |  |
| Gastropoda (snails) |  |
| Bivalvia (mussels and clams) |  |
| Oligochaeta (all segmented worms except leeches) |  |
| Hirudinea (leeches) |  |
| Other |  |

**Activity Four: Analyze Data**

**SITE 1:**

|  |  |  |
| --- | --- | --- |
| **SENSITIVE TO** **POLLUTION** | **LESS SENSITIVE TO** **POLLUTION** | **TOLERANT TO** **POLLUTION** |
| **Caddisfly larvae** | **Crane fly larvae** | **Midge larvae** |
| **Mayfly larvae** | **Damselfly larvae** | **Leeches** |
| **Riffle beetles** | **Dragonfly larva** | **Aquatic worms** |
| **Gilled** **(right-handed)** **snails** | **Crayfish/crawdads/****crawfish** | **Lunged (left-handed)** **snails** |
|  | **Freshwater shrimp** | **Mosquito larvae** |
|  | **clams** | **Water boatman** |
|  | **Net-spinning caddisfly** **larvae** | **Pygmy backswimmers** |
|  | **Giant water bugs** | **Riffle bug** |
|  | **Diving beetles** |  |
|  | **Soldier fly larvae** |  |
|  | **springtails** |  |

**CALCULATE A WATER QUALITY INDEX:**

\_\_\_\_# of types of sensitive macrinvertebrates multiplied by 3 = \_\_\_\_

\_\_\_\_# of types of less sensitive macrinvertebrates multiplied by 2 = \_\_\_\_

\_\_\_\_# of types of tolerant macrinvertebrates multiplied by 1 = \_\_\_\_

Now add the three totals from each column to get a Total water quality index

 value = \_\_\_\_.

**SITE 2:**

|  |  |  |
| --- | --- | --- |
| **SENSITIVE TO** **POLLUTION** | **LESS SENSITIVE TO** **POLLUTION** | **TOLERANT TO** **POLLUTION** |
| **Caddisfly larvae** | **Crane fly larvae** | **Midge larvae** |
| **Mayfly larvae** | **Damselfly larvae** | **Leeches** |
| **Riffle beetles** | **Dragonfly larva** | **Aquatic worms** |
| **Gilled** **(right-handed)** **snails** | **Crayfish/crawdads/****crawfish** | **Lunged (left-handed)** **snails** |
|  | **Freshwater shrimp** | **Mosquito larvae** |
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**CALCULATE A WATER QUALITY INDEX:**

\_\_\_\_# of types of sensitive macrinvertebrates multiplied by 3 = \_\_\_\_

\_\_\_\_# of types of less sensitive macrinvertebrates multiplied by 2 = \_\_\_\_

\_\_\_\_# of types of tolerant macrinvertebrates multiplied by 1 = \_\_\_\_

Now add the three totals from each column to get a Total water quality index

 value = \_\_\_\_.

**Compare the water quality index value you calculated to the following ranges**

**of numbers to determine the water quality of the sample site:**

**Excellent > 22; Good = 17-22; Fair = 11-16; Poor < 11**

**What are the results of your sample?**

**How did the results compare to your perceptions?**

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