Bug Kicking and Macroinvertebrate Study

Location: On a river or creek in Eagle County!

Theme: Macroinvertebrates are the canary in a coalmine for our rivers

Goals: Students will gain familiarity with macroinvertebrates in our watershed, understanding how to safely collect these insects and determine the health of the river from the composition. They will also identify threats surrounding the river and how we can help protect these ecosystems.

Objectives: Students will be able to name and identify the three common macroinvertebrates that delineate a healthy stream. They will be able to name 2-3 major threats to a stream in our community.

Materials*: Macroinvertebrate Dichotomous Key, ice cube tray, magnifying glass, waterproof shoes, pencil, notepad

*Make sure that your gear is clean! Don’t use dirty equipment in the river, as this can spread harmful contaminants like rock snot (pictured below) and environmental pollutants. For tips on how to clean your gear, click here. If you decide to do two assessments of different streams, be sure to clean your gear in between as well.

Introduction: Macroinvertebrates are like the canary in the coalmine – they communicate the health of the stream without any formal testing or chemicals. Certain species are more sensitive to environmental pollutants than others, allowing for the composition of macroinvertebrates to tell the story of river health. These insects are regularly studied in the professional world, creating the MMI index of a stream. This index shows the current health of the stream and helps to track improvements or degradation of a stream over time. See below for MMI Indexes from 2018 of Gore Creek and the Eagle River!

What is a Macroinvertebrate?

- Macroinvertebrates are insects, larvae, snails, worms, that are large enough (MACRO) to see without a magnifying glass (though still small) and do not have a backbone (INVERTEBRATES).

- Why are these so important?
  o They are primary consumers meaning that they process organic material such as algae, other aquatic vegetation for energy
  o As detritivores, they also break down dead organic matter in the water (leaves, wood, etc). These materials, left to break down on their own, require oxygen which they pull from the water and reduce what is available for aquatic life
  o They are the main source of food for our fish and other aquatic species!
Macroinvertebrate Survey & Inventory
- There are a lot of fancy materials you can use to make this study more official, from D-Nets to waders, but all you really need are a few simple household items.
- There are three main techniques, but the main theme is to be gentle!
  1) Use a soft bristled brush (an old, clean toothbrush works great!) to jostle the bugs off of their rocks
  2) Dig your hands into the stream bed and turn up all of the rocks
  3) Feet shuffling along the bottom to stir them up
   - Techniques 2 and 3 work better with D-Nets

Survey
1. Find an accessible point on the river where you can comfortably walk into the stream and stand up safely (no deeper that mid-calf)
2. Fill your ice cube tray with water from the stream.
3. Choose a river rock that is within the flowing water and pick it up.
4. Using your clean toothbrush, gently remove the bugs on the rock into the ice cube tray.
5. Repeat with a few rocks until you have filled the tray with insects.

Inventory
1. Create a form in a notebook or on a sheet of paper that lists out the possible macroinvertebrates*.  
   a. Tolerant: Leeches, Aquatic Worms, Flat Worms, Left-handed Snails, Midge Flies, Black Flies  
   b. Somewhat sensitive: Scuds, Crayfish, Sow bugs, Crane flies, Net-Spinning Caddisflies, Damselflies, Dragonflies  
   c. Sensitive: Right-handed Snails, Caddisflies (other), Dobsonflies, Alderflies, Water Pennies, Stoneflies, Mayflies Riffle Beetles
2. Use the Macroinvertebrate Dichotomous Key (either printed or on a mobile device) to identify which bugs you have collected with tally marks
3. Once you have counted each type, see which category (Tolerant, Somewhat Sensitive, Sensitive) has the most examples in your study.

What makes a healthy stream?
- Aquatic and riparian areas rely on each other to be healthy. Riparian Zones are among the most threatened spaces of land. Here in Eagle County, 270 species of wildlife rely on these areas at some point in their life, but it only makes up 2% of the land.
- There are two identified associated vital-sign metrics, or signs that determine the health of riparian and aquatic zones:
  1. Aquatic macroinvertebrates:
     • Species composition (make-up of the three categories)
     • Abundance (number of each)
What does your inventory tell you about this vital sign? Was there diversity among the insects? How many of each type were there? Were there more tolerant or more sensitive species?
  2. Habitat condition (Look for a lesson on these soon!)
     • Water depth
     • Water velocity
     • Substrate size
     • Canopy closure
What impacts these insects?

- **Development**
  - We all need places to live, but with development comes a lot of stress on our rivers. As we build close to rivers, more impervious surfaces are present, such as roads and roofs, that water cannot pass through. These developed surfaces allow contaminated water to rush into the river during rainstorms or spring snowmelt.

- **Chemicals & Pollutants**
  - Rivers are robust, yet also so sensitive. Chemicals that are in our daily lives from fertilizer to weed kill are not good for our water and those who call it home. Storm drains do not get treated before entering the stream. Whatever goes down there ends up in our river!

- **Invasive Species**
  - These are insects, animals and plants that are not native to an area. They arrive in many forms, from people planting in their gardens to ‘hitch hikers’ on gear. Often, there are no native predators for these species, and they are able to thrive and out-compete, or steal habitat from, natives in rivers and riparian zones.

- **Other threats**
  - Climate change and forest health are also big drivers in the quality of our river. For every degree that our climate in Colorado warms, we lose 3-4% of runoff.

So – How did the river score? What threats do you think your stretch is facing? How can it be improved? Let the Watershed Council know at outreach@erwc.org!

Do you see a trend in the image to the right? Color corresponds to the MMI score which is a measure of stream health. Green is a well scoring section, while orange and red indicate aquatic degradation. The size of the dot correlates to sample size. What areas have the most orange and red? Why do you think that is? HINT: Pink polygons outline urban areas.
Advanced analysis: 2018 MMI Data
Each vertical line represents a year of data collected on the Eagle River, while the grouping of vertical lines indicates a sampling location along the river.

Do you notice any overall trends with this data?

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List of Definitions

MMI: Multi-Metric Index is a rating system used to assess ecological conditions in freshwater ecosystems.

Dichotomous Key: a key used to identify a plant or animal in which each stage presents descriptions of two distinguishing characters, with a direction to another stage in the key, until the species is identified.

Environmental Pollutants: introduction of contaminants into the natural environment that cause adverse change, anything from heat to chemicals.

Riparian Zone: the piece of land alongside a river.