Dichotomous Key Quest

Background:

Last time, we introduced invertebrates and talked about how to become a stream bug at home. But what if you want to find stream bugs in the wild? How would you know what stream bug you were looking at? Fortunately, scientists have created an easy way to identify stream bugs (and lots of other organisms too) with a dichotomous key!

A dichotomous key (pronounced die-cot-oh-muss) is a guide for people to identify organisms based on common, visible traits. A person using a dichotomous key doesn't need to be a professional scientist or even have any background knowledge on the species they're trying to identify—all they need is to follow questions based on what they see. In this way, anybody is able to correctly identify organisms!

In order to make a dichotomous key, a scientist first needs to know about all of the species they're trying to identify, and then use a naming system to separate them. Taxonomy is the study of naming, defining, and classifying organisms. Organisms are grouped together based on evolutionary similarities and then split into smaller, more specific groups. There are seven main taxonomic ranks, which are categories of organisms where the first rank is most general while the seventh rank is most specific. The seven ranks are:

Kingdom, Phylum, Class, Order, Family, Genus, Species

For example, a lion is in the kingdom Anamalia, which includes every animal on Earth. Lions are then placed into smaller and more specific groups, separating it from invertebrates, non-mammals, non-carnivores, etc. Eventually, at the bottom of the taxonomic ranks, it is the only animal with the genus and species Panthera leo. By grouping and categorizing every organism this way, we can understand how organisms evolved as well as keep track of similarities and differences between species.

Once we have classified organisms, we can figure out how to differentiate similar organisms from one another. For stream bugs, this can include different body shapes, different numbers of legs, and the presence or absence of a shell. To organize these differences, a dichotomous key is set up kind of like a “choose your own adventure” book, where determining certain traits in an organism can help you narrow down the possibilities and lead you to a correct identification.
Background (continued):

Look at the following dichotomous key (also linked [here](#)) of common stream bugs:

At first, this may look pretty complicated, until you realize that to identify a stream bug, all you need to do is start at the top and work your way down. Let’s do an example together, with the stream bug shown below.

Let’s try to identify the stream bug using our dichotomous key. Our first question – does it have a shell or not?

Nope, it doesn’t have a shell! You’ll see that by choosing this path, it removes a lot of potential stream bugs. We’re narrowing down what it could be!

Let’s keep going. Does it have legs or no legs? How many legs does it have? (its legs are just the long, skinny ones) Does it have wings or no wings?

At this point, there should only be one question left, and it should be pretty easy from this example – how many tails does the stream bug have? If you answer “three”, you’ll notice that you’ve run out of questions, and instead need to visually choose your stream bug. Here are your options.

Have you figured out what your stream bug is yet? Based on the picture, it seems like we’re looking at a Mayfly Larva (more specifically, it looks like it may be the third type of Mayfly Larva, with gills on its abdomen)! If we tried to compare our bug to every bug on this dichotomous key, it would take a long time, but by going through the basic questions we were able to narrow down the possibilities and easily determine our species! For the activity, you’ll try to identify a few more bugs using a dichotomous key, and maybe find some real stream bugs on your own!
Procedure:

- Using the same dichotomous key as before, try to identify the following local stream bugs. If you have trouble or get stuck, start from the beginning again and work your way through, making sure that you’re not making assumptions for questions. Answers will be provided in the “Keep Learning” section, so don’t peek until you’re done!

Stream bug #1. What could this cute worm thing be?

Stream “bug” #2. Yes, this is an Invertebrate!
Picture courtesy: Technology Networks.

Stream bug #3. What is on this stream bug’s back?
Picture courtesy: BugGuide.net
Keep Learning!

- Now that you’re a dichotomous key expert, try to find stream bugs on your own! The best way is to go to a nearby river or lake (that you are allowed to access) and pull up some leaves and rocks that are sitting at the bottom or in shallow areas. You may find some stream bugs! Use a magnifying glass to try to get a better look, and then use your dichotomous key to identify any stream bugs that you see. Once you’re done, make sure to put your bugs back in the river or lake where they came from, and carefully put back any overturned rocks so as to not hurt the bugs!
- Looking for answers to the pictures above? 1) Flatworm. 2) Freshwater mussel. 3) Caddisfly larva.
- Now that you know how to identify stream bugs, you can evaluate the biological health of a local waterway using this stream bug biotic index.
- Try out some other online dichotomous keys, like this one for Common Trees of the Pacific Northwest!
- Make your own dichotomous key by selecting a group of similar organisms and identifying some distinguishing traits with each. When you find similarities and differences between them, organize them with yes or no questions like shown in our key.
- Visit the Stroud Center’s Virtual Learning Resources or their Youtube Channel to see videos of stream bugs in action. While you’re there, check out their online dichotomous key!
- Share your stream bug findings with us on Instagram! Use the hashtag #GREENfromhome or find us at @southsoundgreen.

South Sound GREEN (Global Rivers Environmental Education Network) is a watershed education program in Thurston County that educates, empowers and connects thousands of local students in watershed studies annually. Through South Sound GREEN, participants engage in science and engineering practices related to water quality in South Sound. For more information, visit southsoundgreen.org.