Activity 1: Creating a macroinvertebrate identification key

Macroinvertebrates are animals without a backbone that are large enough to be seen with the naked eye. Freshwater macroinvertebrates spend part or all of their life cycle in flowing or standing waters. They include insects (fly nymphs and larvae, beetles and bugs), snails, mussels, leeches, worms, flatworms, slaters and shrimps. Fly nymphs and larvae leave water when they metamorphose and reach maturity, spending their adult life on land. In many cases, their adult life stage is short and lasts only from several hours to a few days. In contrast, to their immature stage spent in water can last for one or two years.

Macroinvertebrates play an important role in the aquatic food web - they feed on algae and plant material, such as leaves, helping to break down organic matter. They also provide a source of food for other animals, such as fish, birds and mammals. Macroinvertebrates are also good indicators of water quality because different species have different levels of tolerance to pollution. They also show integrated responses to pollution over time, rather than just at the time of sampling (like spot water samples analysed for the pollutant chemicals), and as such, they are useful for assessing the health of freshwater ecosystems.

Eutrophication (over-enrichment with plant nutrients such as phosphorus and nitrogen) is a significant problem that affects the quality of fresh waters, leading to decreased levels of dissolved oxygen in the water and lower levels of biodiversity. The main sources of nutrients are discharges from wastewater treatment systems and run-off from agricultural land. Some freshwater macroinvertebrate species are more sensitive to this form of pollution than others and, therefore, investigating which macroinvertebrate groups are present or absent and comparing abundance of these groups allows us to assess water quality.

The activity

The purpose of this activity is to produce a dichotomous or ‘paired-statements’ key to identify macroinvertebrates living in streams. You will be presented with pictures of the main groups of macroinvertebrates: insects (mayfly and stonefly nymphs, and caddisfly and chironomid larvae), freshwater snails, mussels, leeches, worms, slaters and shrimps. Based on the differences between them, you will develop a list of steps that will allow you to identify a macroinvertebrate group. Each step will need to be a choice between two mutually exclusive statements about a characteristic and will refer to a reference image (e.g. ‘go to slide 2’).

An example of a paired-statement key for freshwater macroinvertebrate identification can be seen on the Field Studies Council website:

https://www.field-studies-council.org/shop/publications/freshwater-name-trail/

The key starts with the choice between “jointed legs” and “no jointed legs.”

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Major characteristics of aquatic macroinvertebrates:

- Jointed legs or no jointed legs
- Number of pairs of legs
- Animal in a case or free-living
- Animal with wing pads or wings/hard wing covers or animals without wing pads or wings/hard wing covers
- Worm-like body, with no shell or animal in a shell
- Single shell or double shell

Setting up the activity

You will work in pre-agreed groups of three or four. This will allow one member of the group to move to another group who will test their key, once it has been completed, by identifying one of the macroinvertebrates in the collection of printed slides.

Equipment required for each group

- Pen/pencil
- Plain paper (A3 or larger)
- Sticky notes
- Printed slides with macroinvertebrate images

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