

## Investigate how indicator species and changes in pH and oxygen levels may be used as signs of pollution

### Introduction

This is a fieldwork exercise that involves sampling water from streams (ideally) or ponds, in two different situations. Sample data are provided which could be used to discuss the process if you cannot carry out the practical work.

### Apparatus

- large container
- indicator species sheet
- animal keys
- plastic trough or enamel dish (deep enough for water at a depth of 3-5 cm without spilling)
- net
- disposable gloves

### Diagram of Apparatus



## Method

1. Identify two locations to be tested e.g. these may be two different areas in the same river.
2. Collect some water in a large container – about 2-3 cm deep.
3. Collect samples of invertebrates using the net and transfer them to the tray. Try to use the same technique each time you collect the sample – holding the net the same way for the same amount of time. Scoop up some of the material from the bottom of the stream, or stir up the bottom and place the net downstream.
4. Study the organisms in the tray and try and identify the invertebrates against the chart – ‘Invertebrate indicators of pollution’. If you cannot identify an invertebrate, take a picture or make a drawing to help identify it later on.
5. Record the number of each invertebrate that has been caught.
6. After identifying and counting the invertebrates, pour them and the water gently back into the stream.
7. Repeat steps 1-6 at the second location.

## Analysis

1. Compare the invertebrates from each location and make a judgement as to the level of pollution in each.

## Risk Assessment

Hazard	Risk	Control measure
Wet ground is slippery	May slip / trip and cause injury	Appropriate footwear to be worn
Disease causing microbes in water can cause illness	May get into body through abrasions and cause harm or may be transferred from hand to mouth	Cover all abrasions with plasters and wear gloves. Do not touch eyes / nose / mouth

## Teacher / Technician notes

There are a number of precautions that should be taken whilst conducting fieldwork (see risk assessment). Before working outside, prepare a risk assessment of the area and put any necessary risk control measures in place.

See CLEAPSS Supplementary Risk Assessment SRA 09 09/06 School ponds for more details. See also the guidance leaflet 'Group safety at water margins' which is downloadable from: <http://www.rosipa.com/leisuresafety/Info/WaterSafety/groupsafety-watermargins.pdf>

Refer to CLEAPSS handbook section 17 for more information on planning safe outdoor activities, and to CLEAPSS supplementary risk assessment *Practical activities in the school grounds* (SRA 08, October 2006). Some elements of these ideas are listed in the safety notes for Biodiversity in your backyard.

You should also refer to your Local Authority or employer's guidelines for working outside the classroom in planning these activities.

This investigation will depend on the access you have to a safe enough area for collecting water samples. If you do not have a suitable area for students to assess, or do not have time for students to collect their own samples, you could collect samples yourself and keep the invertebrates in a tray of water for a day or so. A video or digital camera would be useful to make a record of the animals found, especially to keep information for later identification of unfamiliar invertebrates.

An example set of data from two streams is provided for analysis and discussion. You could work through this before or after students collect invertebrates from their own water samples.

Discourage students from trying to catch fish. Encourage them to treat all living things with the respect they deserve.

These indicator animals are usually quite easy to find if the students have a bit of patience. They are all delicate and so students must handle them with care.

The pictures given are typical of the invertebrates you are likely to find. Be aware that there are other species in each group, so the organisms you find may look different. The Field Studies Council key to freshwater invertebrates (link below) provides a more comprehensive list with colour illustrations: <https://www.field-studies-council.org/>

### Identification clues:

Mayfly nymphs have three tails, whereas stonefly nymphs have two.

Caddis fly larvae collect bits of twig and stone around themselves to make a protective case. If any pieces of twig or stone seem unusually mobile, they are probably caddis fly larvae.

As well as an exercise in pollution monitoring, students can study ways in which living things are adapted to survive in their natural habitat. This follows on from considering why some organisms live only in unpolluted streams, while others survive despite pollution.

### Sample results from two streams

Species	Total in sample	
	Stream A	Stream B
Mayfly nymph	4	0
Caddis fly larva	30	0
Freshwater shrimp	70	1
Water louse	34	4
Bloodworm	10	45
Sludge worm	2	100

### Working scientifically skills covered

#### **1. Development of scientific thinking**

Explain every day and technological applications of science; evaluate associated personal, social, economic and environmental implications and make decisions based on the evaluation of evidence and arguments.

Evaluate risks both in practical science and the wider societal context, including perception of risk in relation to data and consequences.

#### **2. Experimental skills and strategies**

Recognise when to apply a knowledge of sampling techniques to ensure that any samples collected are representative.

Evaluate methods and suggest possible improvements and further investigations.

#### **3. Analysis and Evaluation**

Translate data from one form to another.

## Invertebrate indicators of pollution

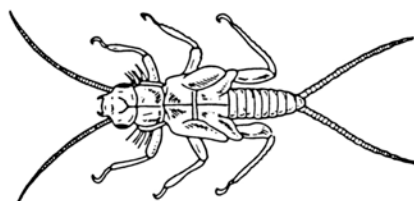
Different invertebrates will live in the water according to how polluted it is.

Unpolluted water is clear and also contains plenty of oxygen.

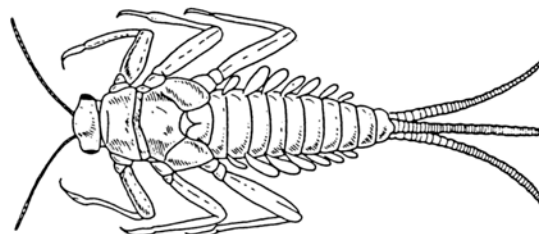
Polluted water may be cloudy, but more importantly, it often contains less oxygen.

### Pollution level

#### A Clean water

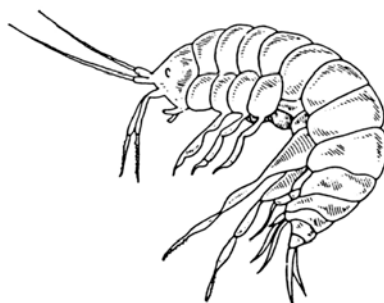


Stonefly nymph (about 10 mm)

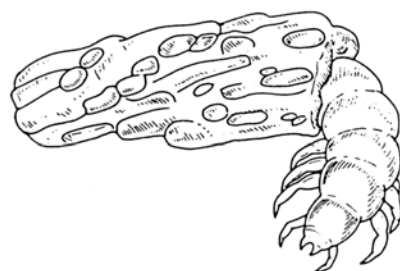


Mayfly nymph (about 20 mm)

#### B Some pollution

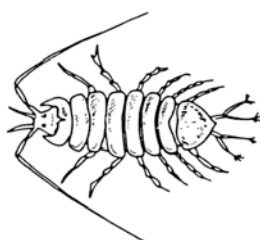


Freshwater shrimp (about 20 mm)



Caddis fly larva (about 10 mm)

#### C Moderate pollution

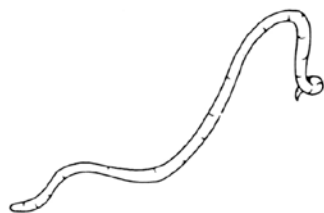


Water louse (about 10 mm)

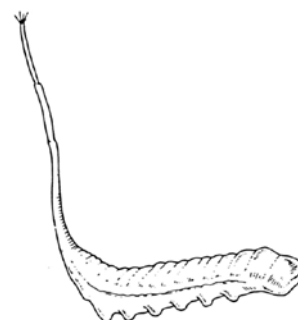


Bloodworm (about 20 mm)

**D** High pollution



Sludgeworm (about 120 mm)



Rat-tailed maggot (up to 55 mm)

**E** Very high pollution – no life