

Hear Water freshwater invertebrate sampling (a.k.a pond dipping!)

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Summary

The purpose of this short exercise is to introduce the children to some basic identification of underwater life based on some well-established volunteer friendly methods; namely OPAL Pond Survey (for ponds)¹ and the Riverfly Monitoring Initiative (ARMI)² method (for streams and rivers)³. Both methods use indicator species, which is a fantastic way to quickly understand to assess the health of the pond, stream or river!

Alongside this method we also recommend some other basic tests for pH (the acidity of the water), turbidity (how cloudy the water is), and nitrate and phosphate (key nutrients for plant growth). There are also some useful, easy to take observations about the site that are based on FreshWater Watch⁴. All of these additional tests might offer some reason why a pond, river, or stream is more or less healthy.

Specifically for Hear Water, being able to see and identify these aquatic organisms can also give the children an opportunity to appreciate how the underwater soundscape might affect their lifecycle, as well as to see some of the animals responsible for the biophonic noises being heard through the hydrophones such as the true bugs (Hemiptera) or beetles (Coleoptera).

Things needed

To do this exercise you will need:

- **A pond net.** The best kind of pond net is called a D-Frame pond net and has a mesh-size of 1mm and a net width of 25cm. To minimise risk and harm to the environment, we recommend the sampling is undertaken by the instructor.
- **One white tray per 3 children.** These standard white trays are typically the size of an A4 piece of paper, and about 7cm deep. They allow the sample to be spread out and seen clearly.
- **Plastic droppers.** These are for 'sucking' up the animals into the dropper to be seen up close or dropped out into a magnifying pot. It's helpful to cut the end off the dropper to allow for slightly larger organisms to be captured (around 3 or 4mm diameter).
- **Magnifying pots.** These are fantastic for holding an organism safely and being able to see their finer details under 3x magnification. Remember to put about 10mm of water into these pots first!
- **Soft (storkbill) forceps (instructors only):** Unless handled with care, these can damage the animals. However, they can be useful for catching the larger animals.

¹ <https://www.imperial.ac.uk/opal/surveys/watersurvey/>

² <https://www.riverflies.org/riverfly-monitoring-initiative-rmi>

³ Please note that while the exercise below is based on these methods, it is adapted for Hear Water and is not suitably robust for formal submission to either citizen science programme without further training. To find out more, why not check out these projects?

⁴ <https://www.freshwaterwatch.org/>

- **Sorting tray or petri dishes.** There are optional and can be useful for sorting out different looking animals into separate compartments. There may not be time to do this, but it can be helpful to clearly show children the range of life in the water.
- **Guides.** Although this guide contains some pictures, you might also want to purchase some basic identification charts. The Field Studies Council offers lots of such field charts (e.g., the Freshwater Name Trail), though these are typically targeted at slightly older children.

The Hear Water process

We recommend carrying out the exercise in the following order: 1) observations, 2) water quality, 3) kicknet sampling. This will reduce disturbance to the water that would otherwise impact on the measurements, and also saves the most exciting till last! Approach the water body carefully and quietly. It is best if the children stay back from the edge of the bank.

1. Carry out the observations using the form below as a group, or depending on the size, multiple groups. This should take about 10 or 15 minutes including measurements of water quality using the test strips (for pH, nitrate and phosphate), and the OPALometer (for turbidity). It's useful to have a bottle on a long stick to collect water, and when doing so, try very hard not to stir up the sediment.
2. Once the observations and water quality are complete. Lay out enough white trays on the ground in flat locations, each with about 10mm of water in them. If it is safe to do so, for example, if the water is no deeper than knee deep and the substrate is solid, the instructor can enter the water with the net.
3. A professional kick sample lasts for 3 minutes, but here we recommend just 15 seconds (that will be plenty!). This is collected with the net immediately downstream as the person sampling shuffles their feet, dislodging aquatic life into the water column and into the net while they move a small distance in an upstream location.
4. If you are sampling a still water, you should plunge the net into the substrate, and then use a figure of eight motion over the top of the substrate to collect aquatic organisms.

Hint: in flowing or still water, if you can run the net through different types of habitat e.g., marginal and submerged plants, you will likely sample a wider diversity of life.

5. Once the 15 seconds are finished, empty a small amount of the sample into each white tray (e.g., handful). It will not take long for the children to start to see things moving.
6. It can be better to observe the trays without touching them for the first few minutes, until things settle down and the animals start to move.
7. Under careful supervision, the children could try to catch some of the animals into the magnifying pots.
8. If you are looking at a pond, we recommend using Guide 1 (based on the OPAL Water Survey). Or, if looking at a stream, we recommend using Guide 2 (based on the Riverfly Monitoring Initiative). Both can be used to calculate a score.
9. Always return the animals back to where you sampled them, and don't forget to say thanks.

Date:

Time:

Site name:

Number of participants:

Freshwater body type

- Pond
- Stream
- Lake
- River
- Wetland
- Canal
- Ditch
- Other:

What is the main land use within ~50m?

- Urban residential
- Rural residential
- Industrial/commercial
- Urban green space
- Mixed agricultural
- Arable agricultural
- Livestock
- Forest
- Grassland/shrub
- Other:

What is the main bank vegetation? (select all that apply)

- Trees/shrubs
- Grass/small plants
- Bare soil
- Concrete/impermeable surface
- Other:

Is there any of the following on the water surface? (select all that apply)



- None
- Foam
- Floating algae
- Oily sheen
- Slurry

Can you see any litter (including litter caught in vegetation)?

- In/on the water
- Within 1m of river edge
- 1-5m from river edge
- No

Are there any pipes with water flowing into the water? If so, where do you think they are coming from?

- Roads or buildings
- Farmland
- Other land

Can you see any of the following water uses right now? (select all that apply)

- Fishing
- Swimming
- Boating
- Irrigation
- Public water supply
- Public use of bank
- Livestock entering the water
- Other:

What aquatic life is there evidence of? (select all that apply)

- Plants below the surface
- Plants emerging from the water
- Floating plants
- Fish
- Frogs/toads
- Aquatic birds
- Aquatic mammals
- Dragonflies/damselflies
- Reptiles
- None
- Other:

Nitrate (mg/L): 0 5 10 25 50

Phosphate (mg/L): < 0.02 0.02-0.05 0.05-0.1 0.1-0.2 0.2-0.5 0.5-1 >1 No water

How many Opals can you see (turbidity)?

Estimate the water colour: Colourless Yellow Brown Green Grey White/milky

Other:

Notes

What your results meanScore 31 or more
This lake or pond is very healthyScore 6-30
This lake or pond is quite healthyScore 0-5
This lake or pond could be improved

Animal	Score (circle if found)
Worm-like animals	1
Snails	1
Cased caddis	10
Caseless caddis	10
Dragonfly	10
Damselfly	10
Alderfly larvae	10
Mayfly and stonefly larvae	5
Water beetles	5
Water bugs	5
Pond skaters	5
Water shrimps	5
Water slaters	1
Total score:	

Guide 2: Streams and rivers			
Animal	Score (circle how many)		
	None 😬	Some (less than 10)	Lots (more than 10)
Cased caddis	0	2	4
Caseless caddis	0	2	4
Mayfly	0	2	4
Blue-winged olive	0	2	4
Heptageniidae	0	2	4
Olives	0	2	4
Stoneflies	0	2	4
Gammarus (shrimp)	0	2	4
Total score:			

As a very general guide, Riverfly Initiative scores (Guide 2) across the Bristol Avon in 2023-24 were 12.1 but using the standard 3 minutes kick samples with a 1 minute rock search. For more information about Riverfly data, visit: <https://www.riverflies.org/cartographer>

Note to teachers: These two methods are not directly comparable and have been designed for two different systems. Similarly, this Hear Water exercise is a taster, and not intended to be a professional application of either of these methods. For more information about OPAL Water Survey or The Riverfly Initiative, please visit the links provided.

Worm-like animals



Midge larvae

- Red, green, brown or transparent
- Wriggling movement



Flatworms

- Often black or grey
- Move by gliding



Rat-tailed maggot (hoverfly larvae)

- Long thin breathing tube
- Lives in mud



Worms

- Like a small earthworm



Leeches

- Suckers at either end
- Moves by stretching out body

Snails



(a)



(b)

- Hard shell covering body
- Shell may be (a) pointed or (b) a flat coil
- Can vary greatly in size

Other animals

Note: you may find these other animals in your survey. While they are very interesting creatures, they do not give information about pond health, so they have no score.



Water flea (*Daphnia*)

- Tiny animal
- Often in very large numbers



Water mite

- Tiny spider-like animal



Water spider

- Silvery bubble over the body
- Lives under the water

Freshwater Invertebrate Identification Guide

This guide can be used for the OPAL Water Survey



Cased caddisfly larvae



- Body within a case; insect hides when disturbed
- Case can be made of small stones, sand grains or plant material
- Look for sticks that crawl!

Dragonfly larvae



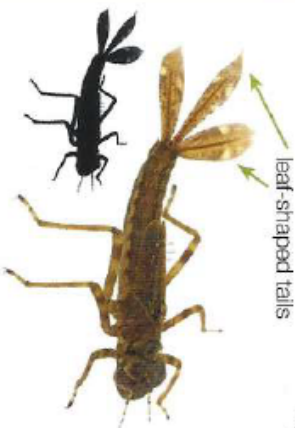
- Fat body
- Angular head
- No tails but 5 short spines at the end of the body

Caseless caddisfly larvae



- A bit like a thin caterpillar
- 3 pairs of legs at the front
- Hooks at the end of body
- Crawls rather than swims

Damselfly larvae



- Angular head
- 3 leaf-shaped tails (one or more may be lost)

Silhouettes show maximum life size. Animals may be smaller than this. If no silhouette is shown, the photograph is at life size. Larvae are the young of aquatic insects.

Hear Water fun fact! Water beetles, water bugs and pond skaters (usually the males) all have specially adapted body parts called 'stridulatory organs', that are used to create calls just like grasshoppers. When they make this sound they are 'stridulating'.

Higher scoring invertebrates need cleaner water to live in

Alderfly larvae



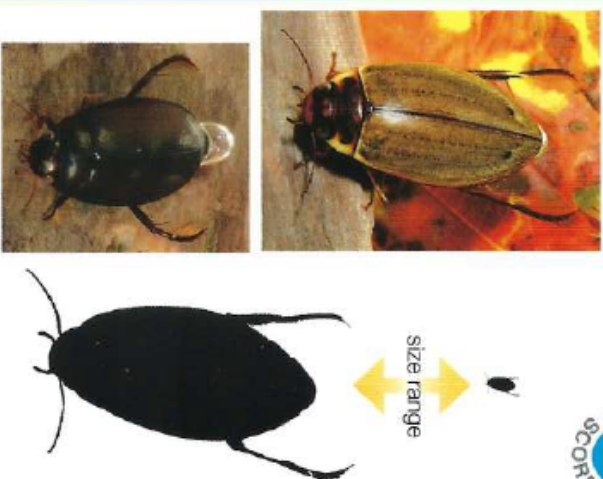
- One tail
- Tapering body
- Pincer-like jaws
- Fine gills along the body

Mayfly and stonefly larvae



- Mayfly larvae**
- 3 thin tails
 - Swim in short darting movements
- Stonely larvae**
- 2 thin tails
 - Generally moves by crawling

Water beetles



- Hard shiny wing cases covering the body
 - Oval-shaped, 6 legs
 - May have bubble attached to the back
 - Scavenging water beetles have a less streamlined shape
- Beetle larvae**
- Larvae are very varied; some have distinct heads, pincer-like jaws, tapering bodies and obvious legs
 - Many have two tails (check these are not mayflies that have lost a tail)
 - Others are more caterpillar-like with very short legs and fat bodies

Water bugs



Backswimmers

- Swim on their backs, just under the water surface
- Use long hair-fringed legs as oars



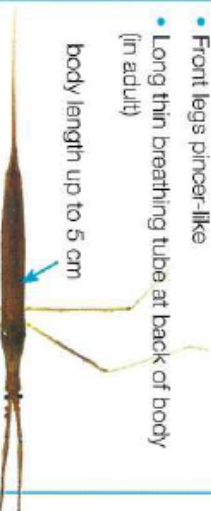
Lesser water boatmen

- Swim the right way up
- Wing cases look black/brown but close up are speckled or striped



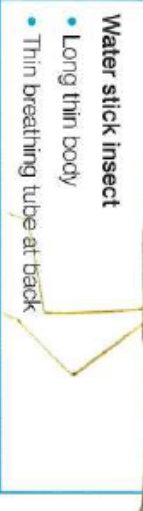
Water scorpion

- Dark-coloured crawling insect
- Front legs pincer-like
- Long thin breathing tube at back of body (in adult)



Water stick insect

- Long thin body
- Thin breathing tube at back



Pond skaters



- Skate on the water surface
- 4 long skating legs and 2 short legs at the front
- Pair of antennae

Water shrimps



- Curved, flattened bodies
- Long antennae
- May appear slightly transparent
- Swim quickly on their sides

Water slaters



- Looks like a woodlouse
- Flattened body
- Moves by crawling



Photographers: Cyril Barnett, Steve Cham, Niall Smith (Bapxi), Simon Pawley (FBA), Jeremy Biggs, Roberto Scherini (www.lina.it), Robert Zoralski (www.linszsls.pl), Alexander Grau and David Kohler (teleopterologie.de), Malcolm Storey (www.biolimages.org.uk), Simon Turner, Morten DD Hansen, Neil Rosen, Roger Key, Brian Jones, Tim Agos, Michael R Clapp (invidua.net), Frank Köhler (www.koelopterologie.de), Designed by FSG Publications, © OPAL 2015. All rights reserved.



LOTTERY FUNDED

Caddisfly (sedg) larvae

Up-wing fly larvae (3 tails)

Stonefly larvae (2 tails)

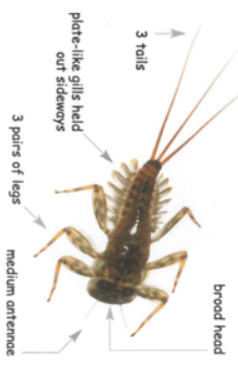
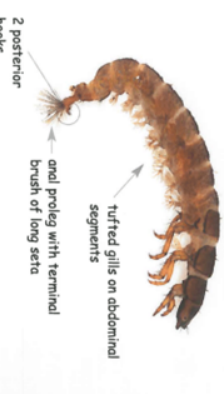
Cased caddis

Caseless caddis

Mayfly
Ephemeridae

Blue-winged olive
Ephemereillidae

Stoneflies



one or more of the 3 pairs of legs may be visible when moving

no visible antennae

2 posterior hooks

2 posterior hooks

tufted gills on abdominal segments

anal proleg with terminal brush of long seta

no visible antennae

2 posterior hooks

3 pairs of legs

3 pairs of legs visible

May be inside web

Avoid confusing with:

• Chironomid midge larvae*, often found inside a case, have no legs but walk using a soft peg near their head
• Beetle larvae* which have no hooks

• Burrows in silt or sand or crawls
• Often swims vigorously when in sampling tray

Flat-bodied
Heptageniidae

• Swims slowly with a rocking motion, body flexing up and down

Olive
Baetidae

• Crawls or reluctantly swims flexing body from side to side
• Some species appear much lighter in colour, e.g. *Isopteria grammatica*

Freshwater shrimp
Gammarus

• Body flattened

• Clings to stones

• Swims slowly, flexing body up and down, more commonly seen scuttling on a surface

• Fast swimmer

• Agile darters

• Body tapered

body always curved

more than 3 pairs of legs plus other appendages on underside of body

• Body within case
• Case made of small stones, sand grains, plant material or shells
• Case may be round, square or flat in cross section