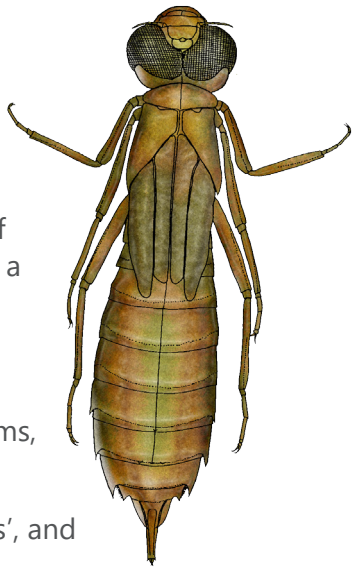
GREEN ADELAIDE

Aquatic Macroinvertebrates

Teacher Information Pack

Introduction to Aquatic Macroinvertebrates



Aquatic macroinvertebrates (water bugs) are easy to catch and come in a variety of weird and wonderful shapes. Students of all ages love looking at them, so they are a great way to stimulate student interest in environmental issues.

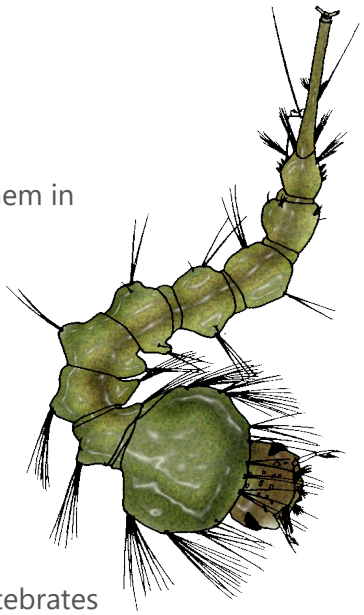
What are they?

Aquatic macroinvertebrates are a diverse range of creatures including insects, worms, crustaceans, spiders, sponges, snails, mussels and many more.

Aquatic means 'of or relating to water', macro means 'you can see it with your eyes', and an invertebrate is an animal without a backbone.

For more information about South Australian aquatic macroinvertebrates, refer to the Critter Catalogue available on the Green Adelaide website.

Where are they found?



As macroinvertebrates are found in most freshwater environments, you will find them in rivers, creeks, wetlands, estuaries, dams or even drains.

Macroinvertebrates choose their homes for camouflage, shelter and food. A good site has a variety of habitats. Some areas like sand banks and muddy beds without stones, wood or plants won't support many macroinvertebrates.

Macroinvertebrates can be found in still pools and running water (riffles). In fast flowing water, they may be found on or under submerged wood, rock or stones. Some macroinvertebrates swim in still or slow moving water, while others hide among aquatic plants, or crawl and burrow at the bottom.

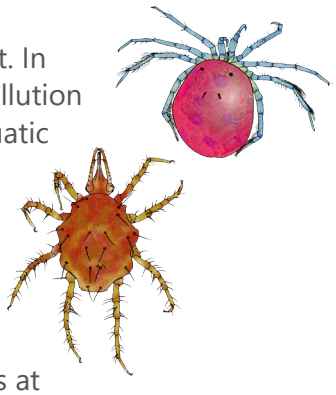
Sampling each of these habitats will give you a representative sample of the invertebrates living there.

Refer to the Habitat Zone Series posters, available on the Green Adelaide website, for more information on aquatic habitats.

Why collect aquatic macroinvertebrates?

Aquatic macroinvertebrates are pollution indicators. You can use aquatic macroinvertebrates to get an estimate of the amount of pollution in a waterway. A very polluted stream will have only a few types of macroinvertebrate living there. A less polluted stream will usually have more invertebrate species.

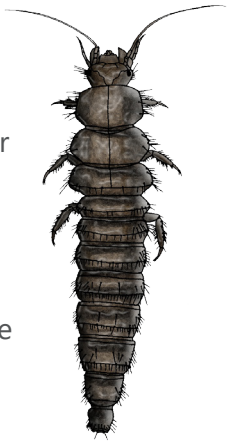
Sensitive or tolerant to pollution?



Some macroinvertebrates are sensitive to pollution while others are pollution tolerant. In fact, scientists have grouped the macroinvertebrates found in our region into four pollution groups. These are very sensitive, sensitive, tolerant and very tolerant. Refer to the aquatic macroinvertebrate ID charts on the Green Adelaide website.

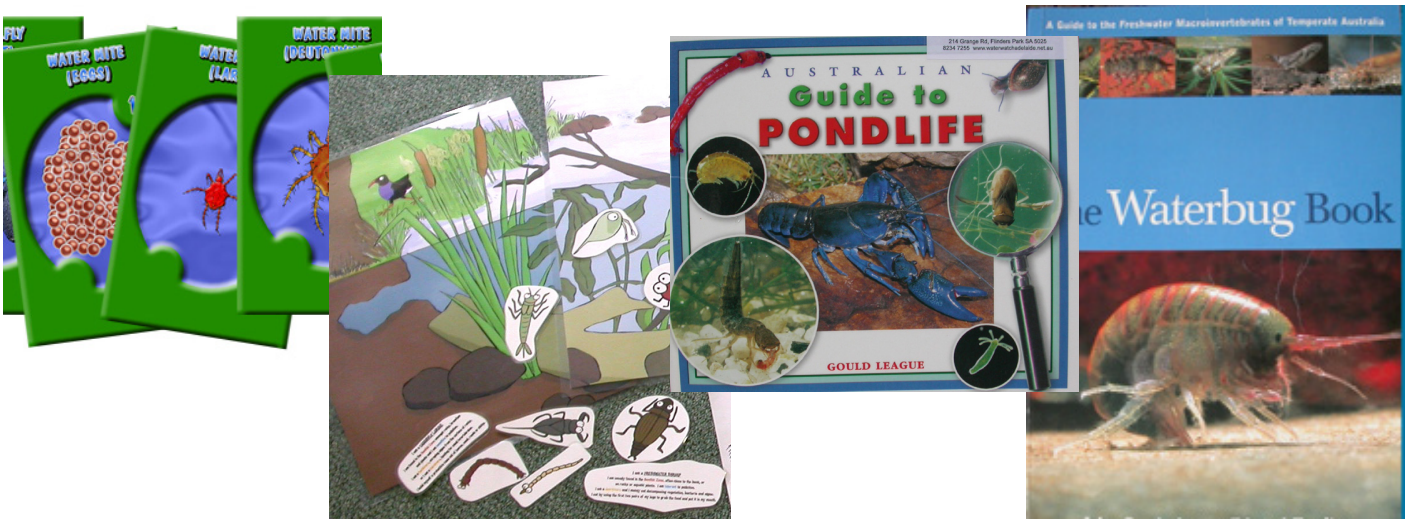
Imagine a healthy stream with many waterbugs living in it. If we were to add a small amount of pollutant, let's say detergent, then the first group of waterbugs to disappear would be those in the very sensitive category. If we added more detergent, the sensitive waterbugs would be wiped out. If we kept adding pollution, eventually even the very tolerant waterbugs would die. So if you find no invertebrates at your site, this may be a sign of a very polluted waterway. Sometimes you will find a mixture of tolerant and sensitive waterbugs in a waterway. This could mean that the pollution level in the waterway is low.

Why else might the aquatic macroinvertebrates disappear?



Heavy rainfall can cause many creek animals to be flushed downstream. So if you sample after heavy rain, you may find fewer waterbugs present in your sample. During cooler months, the breeding activity of some animals is lower, and fewer kinds of waterbugs may be found. However if you sample the same site over a year, you will get to know what types of bugs should be there at different times of the year. So, if you expect to find ten different types of macroinvertebrates, but only find a few types of very tolerant ones, then it is a fair bet that the site has been polluted.

Our loan library has many resources to support an inquiry into aquatic macroinvertebrates.



Macroinvertebrate Sampling Instructions

Before you start

Select your site

Choose somewhere that is near to you and easy to access. Make sure you get permission if you are sampling on privately owned land and always take a friend with you. Safety comes first, so if you are sampling with younger children consider sampling in shallow, slow flowing waterways.

When sampling at the edge of the waterway, it is best to select a sheltered area if possible, with overhanging vegetation, water plants, snags, rocks, riffles, algae, etc. Deep water and very fast-flowing water can be unsafe and should be avoided.

It is best to sample a site only once per season, and at the end of the day make sure you return your bugs to where you found them - alive!

You may like to pick two contrasting sites and sample them both to compare results.

Complete sampling kits including nets can be borrowed from Green Adelaide

What to take to the site

Nets: Stocking nets are simple and fun to make! Refer to Extension Activity 1 for easy to follow instructions.

Aquatic Invertebrate Record Sheet and ID Charts: Use these to identify and record the animals as you catch them.

Suitable containers for viewing macroinvertebrates: Take containers or trays that are large enough to empty the nets into. White 4 litre icecream containers are great because they are a good size and you can see the animals easily in them.

Hand Lenses: Useful for examining surfaces of rocks, sticks etc, for attached invertebrates.

Miscellaneous: Gumboots, bucket, sunscreen, hat, camera (optional).

What to do at the creek

Fill container/tray with 5 – 10cm of fresh water from your sampling site. Place your sorting trays in the shade, as macroinvertebrates do not like to be exposed to strong light.

Now Catch Those Bugs: Scrape, jiggle and sweep the nets through the water. Be respectful as you will be dealing with living creatures and the aim is to return them safely to their habitat afterwards.

Check out the video tutorial on youtube:

https://youtu.be/AXDlhG-3lRg

- **Scrape** the frame of the nets along solid objects such as rocks, branches, gravel and amongst leaf litter on the bottom but don't get too much mud as you will not be able to see any of your 'catch'.
- **Jiggle** the nets amongst the vegetation and scrape along the stems and leaves to dislodge any invertebrates. Take care, though, that you don't break or uproot the plants.
- **Sweep** your net across the surface and drag it through the water in a figure of 8 motion to catch the free-swimming critters.

Look under rocks and stones: Carefully turn over stones, small rocks and other objects and examine their surface. You might be surprised at what is clinging to them. Replace them carefully to avoid crushing invertebrates.

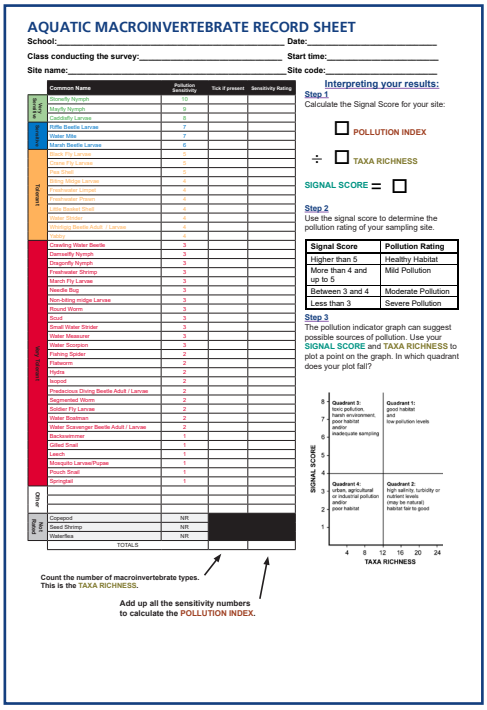
Watch as you go: Record any animals you see during the collection. Mark these off on the Record Sheet.

Empty the nets: Turn the nets inside out in the container/tray. Jiggle the net sideways in the water in the container to wash debris and animals into the water.

Sort the sample: Closely observe the sample for at least 20 minutes and record any animals seen. Some critters are great at camouflage and may take time to find. Gently move debris to expose any hidden animals. If possible leave the sample where it can be observed intermittently over a long period of time. It is amazing what crawls out from a dark corner. Some animals can be gently lifted from the sample for closer examination with hand lenses, bug viewers or microscopes.

Leave plenty of time to marvel at the normally unseen underwater life!

Remember to return your freshwater invertebrate sample to the site where it was taken from.



AQUATIC MACROINVERTEBRATE RECORD SHEET

School:_____ Date:_____

Class conducting the survey:_____ Start time:_____

Site name:_____ Site code:_____

	Common Name	Pollution Sensitivity	Tick if present	Sensitivity Rating
Sensitive	Stonefly Nymph	10		
	Mayfly Nymph	9		
	Caddisfly Larvae	8		
Moderate	Riffle Beetle Larvae	7		
	Water Mite	7		
	Marsh Beetle Larvae	6		
Resistant	Black Fly Larvae	5		
	Cranefly Larvae	5		
	Pea Shell	5		
	Dining Midge Larvae	4		
	Freshwater Limpet	4		
	Freshwater Prawn	4		
	Little Backet Shell	4		
	Water Strider	4		
	Whirligig Beetle Adult / Larvae	4		
	Yabby	4		
Very Tolerant	Crawling Water Beetle	3		
	Damselfly Nymph	3		
	Dragonfly Nymph	3		
	Freshwater Shrimp	3		
	March Fly Larvae	3		
	Needle Bug	3		
	Non-biting midge Larvae	3		
	Round Worm	3		
	Snail	3		
	Small Water Strider	3		
	Water Measurer	3		
	Water Scorpion	3		
	Fishing Spider	2		
	Flatworm	2		
	Hydra	2		
	Isopod	2		
	Predacious Diving Beetle Adult / Larvae	2		
	Segmented Worm	2		
	Soldier Fly Larvae	2		
	Water Boatmen	2		
	Water Scavenger Beetle Adult / Larvae	2		
	Backswimmer	1		
	Gilled Snail	1		
	Leech	1		
	Mosquito Larvae/Pupae	1		
	Pouch Snail	1		
	Springtail	1		
Other				
Water Flea	Copepod	N/R		
	Seed Shrimp	N/R		
	Waterflea	N/R		
	TOTALS			

Count the number of macroinvertebrate types. This is the TAXA RICHNESS.

Add up all the sensitivity numbers to calculate the POLLUTION INDEX.

Interpreting your results:

Step 1
Calculate the Signal Score for your site:

☐ POLLUTION INDEX

÷ ☐ TAXA RICHNESS

SIGNAL SCORE = ☐

Step 2
Use the signal score to determine the pollution rating of your sampling site.

Signal Score	Pollution Rating
Higher than 5	Healthy Habitat
More than 4 and up to 5	Mild Pollution
Between 3 and 4	Moderate Pollution
Less than 3	Severe Pollution

Step 3
The pollution indicator graph can suggest possible sources of pollution. Use your SIGNAL SCORE and TAXA RICHNESS to plot a point on the graph. In which quadrant does your plot fall?

Fill in the Aquatic Macroinvertebrate Record Sheet

Finally, make sure you fill in your record sheet. When you regularly sample a site the data sheet becomes a running record of invertebrate life at your site.

The record sheet also includes a simple calculation to give your site an overall health rating.

AQUATIC MACROINVERTEBRATE RECORD SHEET

School:_____ **Date:**_____

Class conducting the survey:_____ **Start time:**_____

Site name:_____ **Site code:**_____

	Common Name	Pollution Sensitivity	Tick if present	Sensitivity Rating
Very Sensitive	Stonefly Nymph	10		
	Mayfly Nymph	9		
	Caddisfly Larvae	8		
Sensitive	Riffle Beetle Larvae	7		
	Water Mite	7		
	Marsh Beetle Larvae	6		
Tolerant	Black Fly Larvae	5		
	Crane Fly Larvae	5		
	Pea Shell	5		
	Biting Midge Larvae	4		
	Freshwater Limpet	4		
	Freshwater Prawn	4		
	Little Basket Shell	4		
	Water Strider	4		
	Whirligig Beetle Adult / Larvae	4		
	Yabby	4		
Very Tolerant	Crawling Water Beetle	3		
	Damselfly Nymph	3		
	Dragonfly Nymph	3		
	Freshwater Shrimp	3		
	March Fly Larvae	3		
	Needle Bug	3		
	Non-biting midge Larvae	3		
	Round Worm	3		
	Scud	3		
	Small Water Strider	3		
	Water Measurer	3		
	Water Scorpion	3		
	Fishing Spider	2		
	Flatworm	2		
	Hydra	2		
	Isopod	2		
	Predacious Diving Beetle Adult / Larvae	2		
	Segmented Worm	2		
	Soldier Fly Larvae	2		
	Water Boatman	2		
	Water Scavenger Beetle Adult / Larvae	2		
	Backswimmer	1		
	Gilled Snail	1		
	Leech	1		
	Mosquito Larvae/Pupae	1		
	Pouch Snail	1		
	Springtail	1		
Other				
Not Rated	Copepod	NR		
	Seed Shrimp	NR		
	Waterflea	NR		
	TOTALS			

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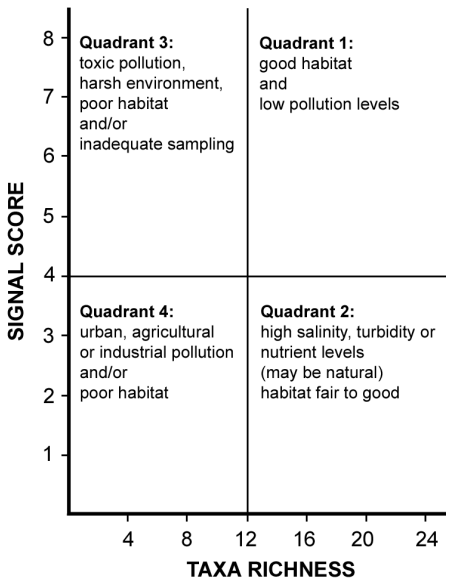
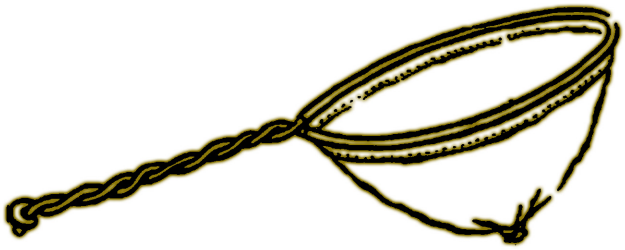


Extension Activities

1. Make your own Stocking Net!

What you need

- 1 pair of stockings
- 1 wire coat hanger (or strong wire)
- 1 pair of pliers (or strong hands)



Instructions

- Unbend the wire coat hanger and form a circular shape
- Cut off one of the legs of the stockings at the widest part
- Stitch lip of stocking around wire coat hanger
- Rewind ends of coat hanger to form handle
- Wind masking tape around the handle to provide a more comfortable grip.

2. Create a Critter

Using your imagination and a bit of artistic flair, have fun and learn at the same time by making your very own macroinvertebrate.

How does your critter move, breathe, feed, and hide?

What habitat are they usually found in?

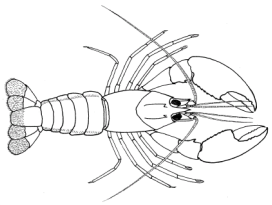
What can you find in nature or around the house to replicate these features?

Here's a creative copepod - what do you think the body is made of?

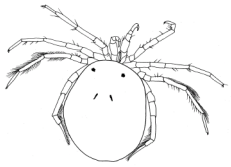
3. Water bug match-up

Draw arrows to match the picture to the correct name. Then colour in the water bug pictures.

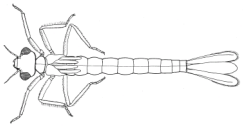
Flatworm



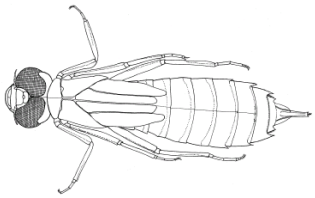
Dragonfly larva



Water mite

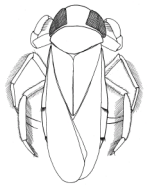


Caddis fly larva

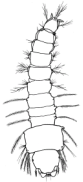


Damselfly larva

Mosquito larva



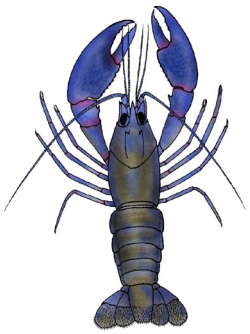
Water boatman



Yabby

Learning Ideas

Early Years



- Find out how some aquatic macro-invertebrates (bugs) help people (e.g. pollination, compost and medicine).
- Create a diagram to illustrate an aquatic macro-invertebrate.s place in the food chain.
- Imagine a world without aquatic macro-invertebrates. What would be some of the problems and benefits?
- Compare the lives and roles of social insects with that of aquatic macroinvertebrates.

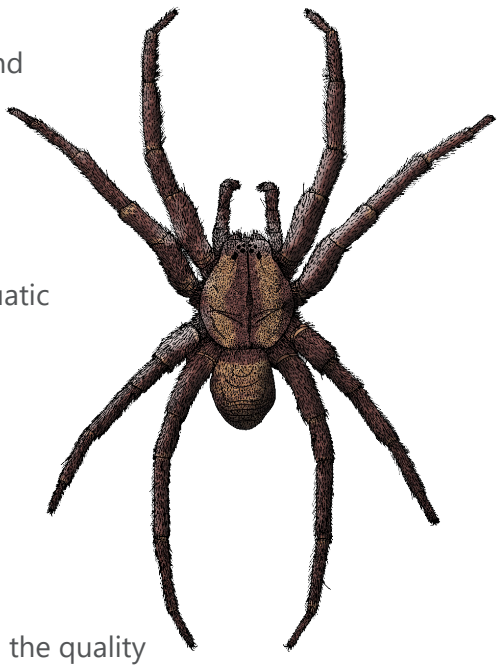
- Plan, draw or construct a healthy water environment for the future.
- You have discovered an unidentified aquatic macro-invertebrate (new to Science). Name it, draw it and describe its features and habitat.
- How might water habitats change over time? Predict how aquatic macroinvertebrates might adapt to survive in the future.

- Imagine what could happen if all pesticides were banned.
- Design a 'Bug Catcher' to capture aquatic macro-invertebrates in different aquatic environments.
- Design a 'Minibeast Dinner Party' invitation and menu. Who will be there and what will they eat?

- Construct a life cycle model of an insect that spends part of its life in water.
- Design a board game that will teach other children about aquatic macroinvertebrates.
- Write a letter to the children of the world to convince them to protect macroinvertebrates.
- Interview an aquatic macro-invertebrate - Write 5 questions that you would like answered.

- If you were an Entomologist, which insect would you study and why?
- Choose an aquatic macro-invertebrate that best symbolises your own character. Give explanations for your choice.
- Imagine you are an aquatic macroinvertebrate. Describe your waterway and a day in your life.

Primary years



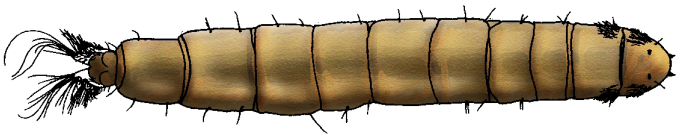
- Construct a visual concept map/mind map of bugs, birds, plants and animals that live in or near water.
- What can humans do to reduce water pollution and improve the environment?
- Select an aquatic macro-invertebrate and describe its place in the food chain. Describe what could happen to a food chain if one aquatic macroinvertebrate became extinct.

- Interview older citizens or access council records and historic photographs to compare local waterways, past and present.
- Predict how water quality might change in your local river or creek over the next 50 years and explain why.
- If you were the Mayor, what laws would you make to help improve the quality of stormwater in your local area?

- Water pollution causes a chain reaction that impacts on the inhabitants of our waterways, draw a diagram to illustrate.
- Investigate the features of an aquatic macro-invertebrate and construct a 3D model.
- Consider how changes in seasons influence water flow and impact upon the life of aquatic macro-invertebrates. Describe what would happen if winter came too late.

- Create a way to illustrate the life cycle of an aquatic macro-invertebrate found in your local area (e.g. dragonfly nymphs, mosquito larvae).
- Share your knowledge of 'A Bug's Life' with other students (e.g. PowerPoint presentations, video, audiotape, performance, flow charts, models).
- Write to the media, industries and businesses to inform them of the effects of water pollution on aquatic macro-invertebrates.

- Imagine you are an aquatic macro-invertebrate. Create a real estate advertisement to describe your ideal habitat.
- Describe how learning about aquatic macro-invertebrates has changed your thinking about water pollution and water care.
- Research an occupation you are interested in that involves working with macro-invertebrates, water and/or the environment.



Middle Years

- Investigate how aquatic macro-invertebrates and other creatures co-exist. (Key words: Ecosystem, Biodiversity and Food Web)
- Explore how an aquatic habitat is affected by any of the following: the water cycle, tidal flows, stormwater collection, urbanisation, industry, agriculture etc.
- Explain possible reasons and implications of decreases in aquatic macroinvertebrate populations.

- Access council records or historic photos and explore changes to a local water body. Discuss how human impacts would have affected local wildlife.
- Develop a food web which expands on the aquatic macro-invertebrates identified, highlight threats to its integrity and ways they could be minimised.
- Research and develop an environmental repair program for a water body in your area which incorporates a monitoring plan.

- Use a microscope or hand lens to investigate and compare the anatomical features of different aquatic macro-invertebrates and construct representative models.
- Compare the structure and function of fresh and saltwater macroinvertebrates.
- Observe, record and report on the life cycle of an aquatic macro-invertebrate, sourced from your local area (e.g. dragonfly nymphs, mosquito larvae).
- Investigate and compare historical macro-invertebrate data at your monitoring site.

- Develop an electronic resource to illustrate macro-invertebrate adaptations for camouflage, breathing or eating.
- Conduct an interview with an Entomologist, Freshwater Ecologist, Marine or Environmental Biologist to learn more about their field of study.
- Develop an argument for and against the construction of urban wetlands. Discuss positives, negatives and personal opinions.

- Compare your survival needs with those of an aquatic macro-invertebrate. How much do you have in common?
- Develop a sensitivity rating, for students in your class, to environmental factors (e.g. noise, odour, space and temperature).
- Examine water use in your daily life and identify ways to minimise use and reduce the amount of pollution you create.