NATIONAL

Waterbug Blitz

EDUCATION RESOURCE FOR AUSTRALIAN SCHOOLS

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Adapted with permission from the following resources:

Department of Environment, Climate Change and Water NSW
- Junior Waterwatch Field Manual and Teachers Guide
- Senior Waterwatch Field Manual and Teachers Guide

Melbourne Water
- Teacher guide: How to run a waterbug session with students
- The life of waterbugs lesson sequence Years 3-4
- Waterway adaptations lesson sequence Years 5-6
- Identifying waterbugs lesson sequence Years 7-8
- Environmental leader guide to running an ALT macroinvertebrate survey

For more information

www.waterbugblitz.org.au

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Contents

1 Introduction

Photo: N.Ord/Manifeasto Photography

National Waterbug Blitz

The National Waterbug Blitz is Australia's first nationwide citizen science water quality monitoring project aiming to get Australian's out to investigate how healthy their local freshwater waterway is. Simply by collect the waterbugs from their habitats, and using our innovative Waterbug App participants can identify them and add their data to our National Waterbug Blitz database. The Waterbug App is free to download and fun to use. You can watch our video tutorials on the Waterbug Blitz website to find out more, or host a training session in your area.

Data is available online for anyone to access too! Waterbug Blitz data will be added to historical data we've collected from Waterwatch groups and various agencies and will contribute in helping to map the health of waterways across Australia.

We're calling all fishers, farmers/landholders, schools, Landcare, Waterwatch, NRM and community groups... and all Aussies to get involved. The National Waterbug Blitz is a great fun, hands-on, outdoor activity for all ages and skills.

Contact us for more information on getting involved, training sessions or data sharing!

www.waterbugblitz.org.au info@waterbugblitz.org.au

About this resource

The Waterbug Blitz Education Resource supports schools and other education institutions in running activities around waterbugs and to support participation in the National Waterbug Blitz citizen science project.

Curriculum aligned

This resource is aligned to the Australian Curriculum (see Appendix 1) and activities can be completed from early years/pre-school to Year 10.

Key Learning Areas have been targetted to the science and geography subjects – with science focussed on working scientifically and understanding living things, and geography focussed on place, space, environments and civic responsibility.

This unit of work also aligns to the cross-curriculum priority of Sustainability – with a major focus on the organising ideas Systems (OI.1, OI.2 and OI.3) and Futures (OI.6, OI.7, OI.8 and OI.9).

Objectives

The primary objective of this resource is to learn about the different types of waterbugs (macroinvertebrates) living in our waterways, how they can indicate the health of our waterways and this is best achieved through hands-on field surveys. Every care has been taken into providing supportive instruction on running a field survey, including an equipment checklist and a pre-prepared Risk Management Plan (see Appendix 2).

We understand that not everyone can get out in the field to conduct a survey, so options are available to either (a) bring a collected sample of waterbugs into the school/classroom for students to investigate and identify, or (b) identify bugs using The Waterbug App without a sample.

Let's get started...

2 Waterbug welcome

Photo: J.Gooderham/The Waterbug Company

All about waterbugs

What are waterbugs?

Waterbugs, or aquatic macroinvertebrates, are small creatures that have no backbone and can be seen with the naked eye. They live all or part of their life in the water, providing a food source for larger animals such as fish, frogs, birds and platypus.

Waterbugs include snails, beetles, dragonflies, yabbies and worms.

MACROINVERTEBRATE

macro
can be seen with our eyes

invertebrate
animal with no backbone

The Agreed Level Taxonomy Method

The National Waterbug Blitz uses the ALT (Agreed Level Taxonomy) Method for identifying waterbugs, developed by The Waterbug Company. The ALT Method uses body structure, movement and other features visible to the naked eye to identify live waterbugs to Order or Family level (see page 41 for details), without the need for microscopes, laboratories and scientific jargon. This method gives citizen scientists the ability to produce good quality/robust data sets that can be used to estimate the health of freshwater ecosystems. To find out more about the ALT Method, go to www.thewaterbug.net/ALT.html

Indicators of waterway health

Waterbugs provide a biological indication of the health of our waterways and are used to assess river health for the following reasons:

- Waterbugs are found in almost every water body, even those that are dry from time to time.
- They are easy to catch with simple hand nets and are relatively easy to identify.
- They have different tolerances to pollution.
- The sedentary nature of some waterbugs means they provide an indication of past conditions as well as present conditions.
- Waterbugs are a major component of biological diversity. About 99% of animal species are invertebrates. Understanding the effects of human activity on waterbugs helps in finding ways to conserve them.
- A healthy waterbug community is important to the normal functioning of a water body. Waterbugs occupy a central position in the food webs of rivers and streams.



Surveying waterbugs is used to complement other water science analysis. When compared to other locations, or at different times of the years, these surveys help us determine the health of, or changes that occur in, the aquatic ecosystem.

Abundance, diversity and composition

Sampling reveals information about the abundance, diversity and composition of waterbugs. This in turn gives an indication of the health of the waterway.

Abundance

Abundance refers to the **number of animals present**. Excessive numbers of waterbugs, particularly gastropod snails, tend to be found in water artificially enriched with nutrients. Small numbers may indicate erosion, toxic pollution or scouring by floodwaters.

Diversity

Diversity refers to the **number of different types of animal present**. Healthy streams usually have a greater diversity than degraded streams, although the diversity in headwaters (the source of a stream or river) may be naturally low due to a lack of food variety. Communities with many different species appear to be more stable and healthy than less diverse ones.

Composition

Composition of the community refers to the **proportion of different types of animals living together**. A sample from a healthy stream tends to contain a good number of mayfly, stonefly and caddisfly nymphs. However, a sample containing lots of worms and midge larvae (chironomids) indicates a degraded stream.

Pollution tolerance

Pollution tolerance refers to the **ability of macroinvertebrates to withstand pollution** from a range of sources, such as stormwater run off, sewage and industrial effluent and other diffuse sources across the catchment. This is reflected in the waterbug's SIGNAL 2 score – a simple scoring system for water bug samples (see page 18 for more information on SIGNAL 2 scores).



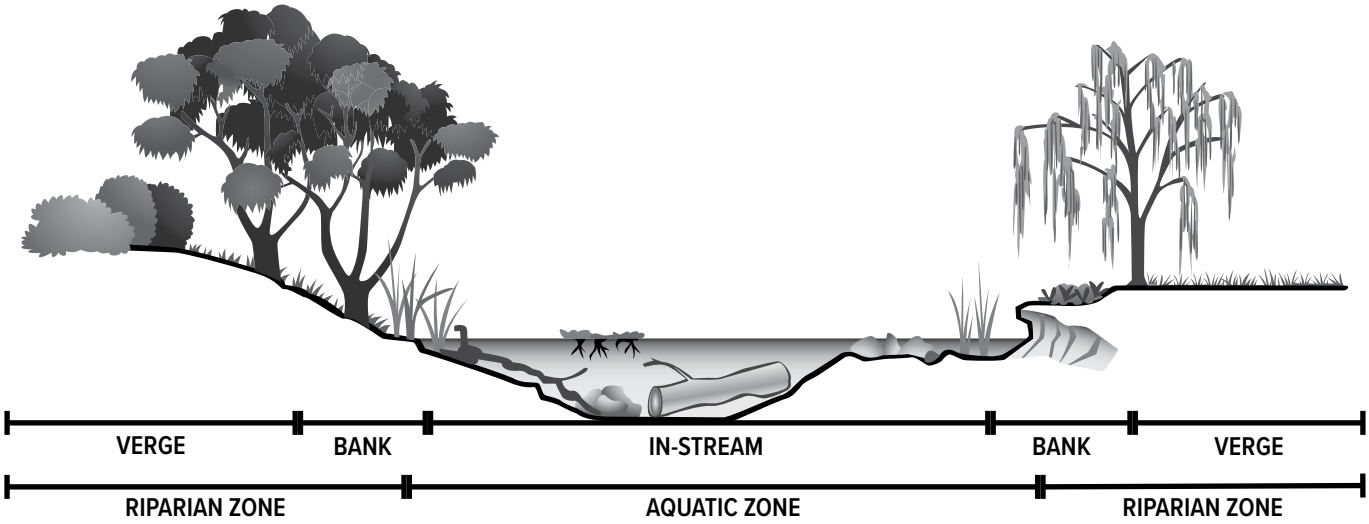
A waterbug's habitat

What is a habitat?

A habitat is a place that provides food and shelter for living things. At waterways there are two main habitats:

- the riparian zone
- the aquatic zone.

The aquatic and riparian zones are interlinked and are important because they protect the health of the waterway. Changes in one zone will impact on the other. Erosion or revegetation of the banks directly impacts on water quality and aquatic habitats. Erosion causes sedimentation which smothers aquatic plants, the channel bed and fish breeding sites. Revegetation of riparian zones using native plants reduces erosion and provides a greater range of food sources for aquatic animals.

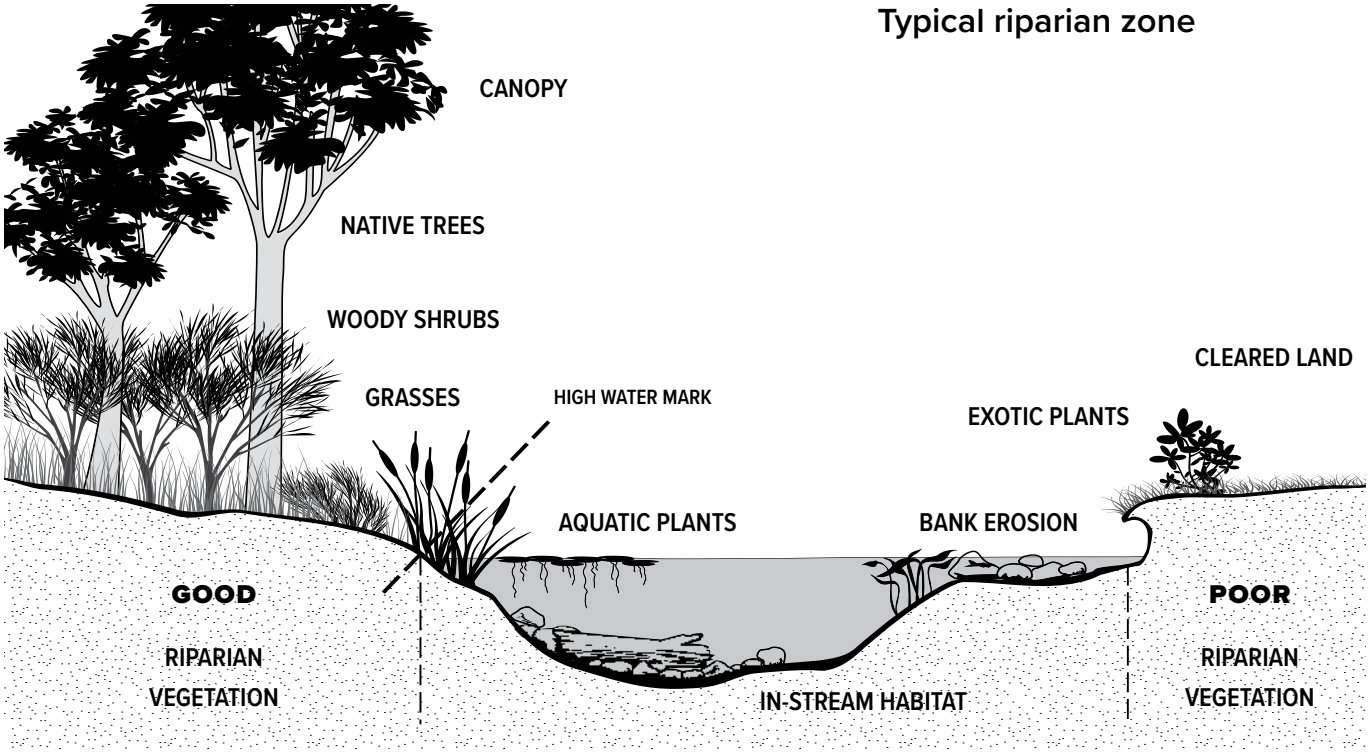


Riparian zone

The riparian zone extends along the banks of a river, creek or wetland. This area is next to, and influenced by, the water body. It includes aquatic and semi-aquatic plants, as well as tree and shrub vegetation.

The riparian zone habitat is an important link between the aquatic environment and the adjoining land. It provides food and shelter for aquatic, semi-aquatic and land animals such as lizards, snakes, bats, frogs and birds. When riparian vegetation is lost, many animals can no longer survive due to loss of habitat.

Riparian vegetation is also important to protect the waterway from erosion and prevent pollutants entering the stream. A lack of plants along the banks may cause poor water quality by increasing turbidity, which will affect aquatic life.



Aliens at the site

Weeds are alien plants that have been introduced to the area from another place. They can include:

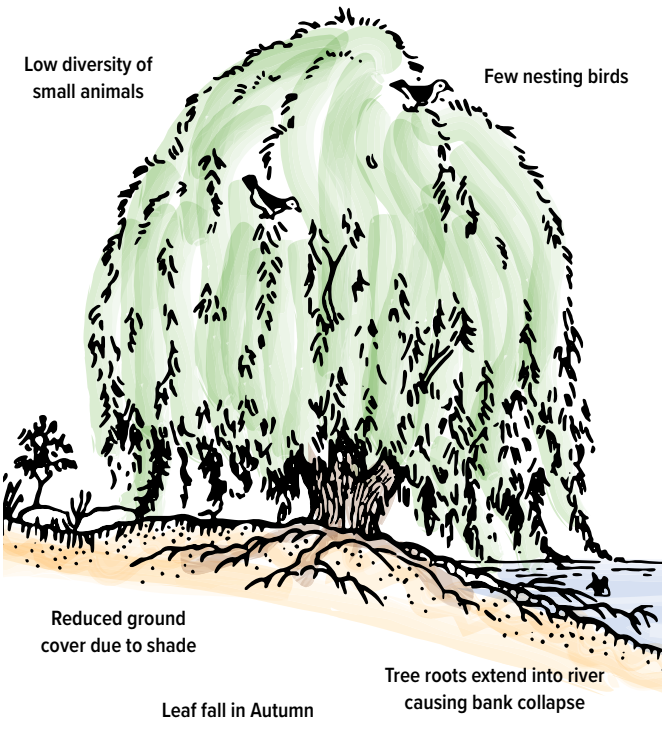
- trees such as willows
- vines and bushes such as blackberries and lantana
- pasture weeds such as Paterson's curse
- aquatic plants such as alligator weed and salvinia.

Many weeds have been introduced to Australia. Few insects or birds live under or in exotic (weed) species. These weed species can also pollute the waterways.

Examples of this include the leaves of weeping willows, which clog waterways, and camphor laurel leaves, which can be toxic to native fish.

Because introduced species sometimes don't have any natural predators or diseases in Australia, they can easily spread out of control.

Effects of willow trees on waterways



The aquatic zone

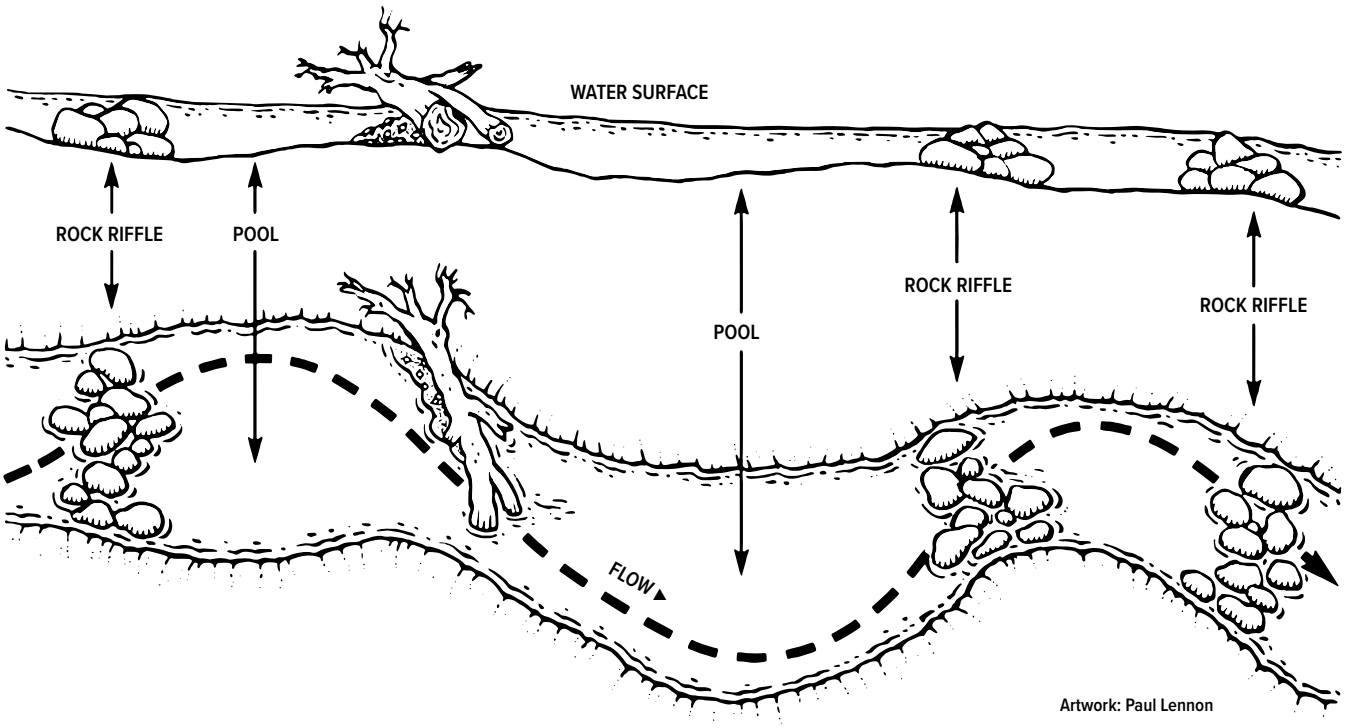
In-stream habitats are provided by the shape of the stream channel and by logs, branches, aquatic vegetation, stones and rocks within the channel.

The features of habitats in the aquatic zone can be described as follows:

- **riffles** – shallow areas where the water rushes over rocks
- **pools** – deeper areas of still water which provide important habitats for larger fish and aquatic species
- **runs** – links between pools and riffles, with deep flowing water and little or no turbulence
- **snags** – fallen branches and washed-in shrubs
- **logs and rocks**.

Fish and other aquatic organisms need snags, rocks and logs to shelter from predators and the current and to reproduce. Protruding snags provide safe perching and roosting sites for birds. Aquatic plants provide food and dissolved oxygen for aquatic species.

Diagram of a pool and riffle sequence



The health of habitats in the aquatic zone is closely linked to the nature of the surrounding riparian zone. Plants along the stream support a range of aquatic plant and animal species. Logs and branches provide a habitat for fish and waterbugs. Organic matter assists plant growth while insects falling from branches may provide food for some aquatic species.

Where waterbugs can be found

Waterbugs live in different habitats within waterways (see diagram pages 16-17).

Freshwater habitat	Waterbugs that may live there
Still water (edge and water surface), including overhanging vegetation from banks	Fast moving bugs and beetles and freshwater shrimp
Bottom mud, sand, silt, gravel and rocks	Worms and fly larvae, mussels and clams
Aquatic plants (under the surface as well as those growing through the water and floating)	Gripping insects, caddisflies, damselflies, shrimp, snails and caterpillars
Flowing water, riffle zone where water tumbles over rocks and logs and flows faster around bends	Gripping insects, caddisflies, beetle larvae that have burrowed into logs and under rocks, mayfly and stonefly nymphs

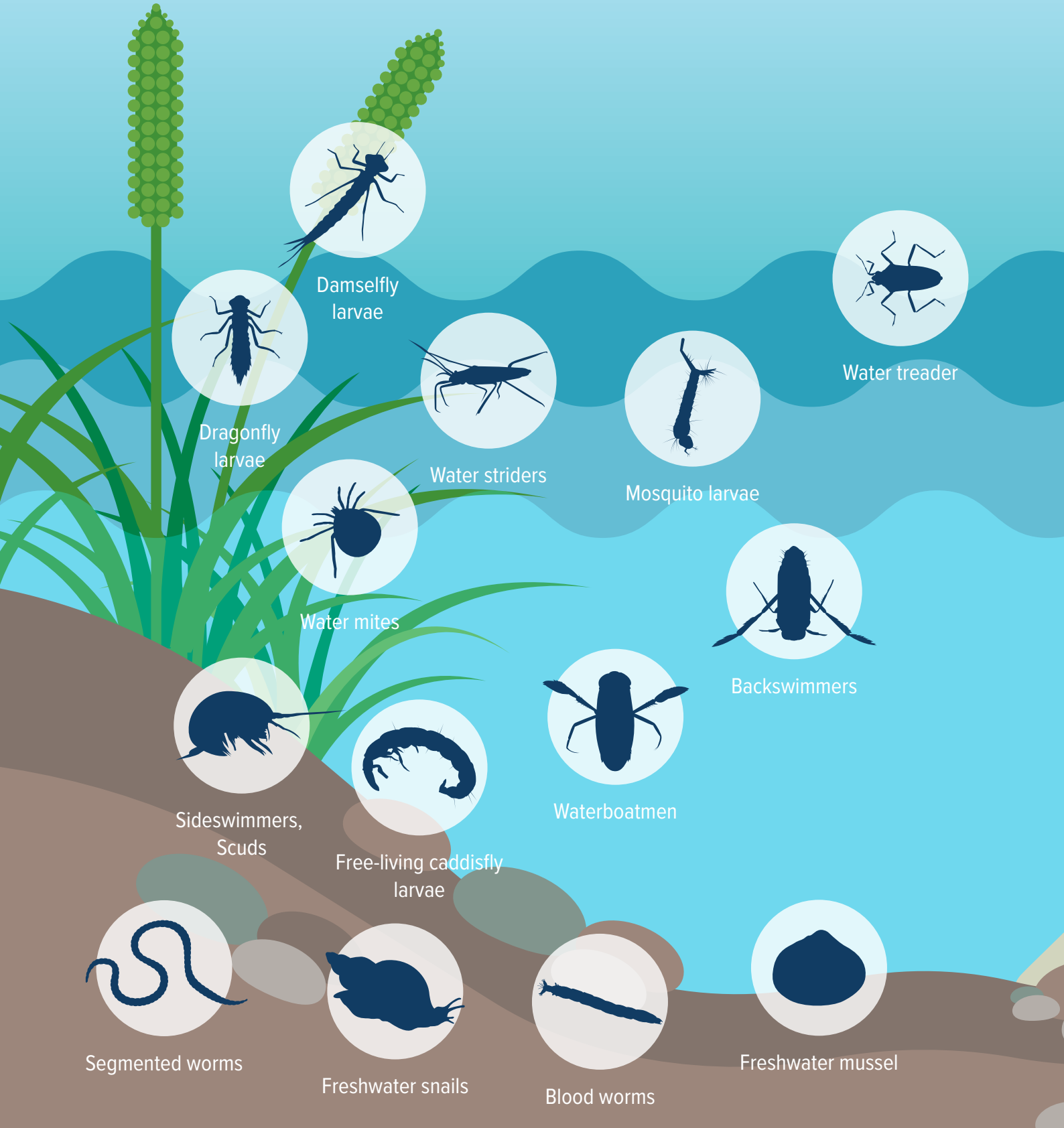
When a habitat is missing from a location, the diversity of bugs will be reduced. Make sure sampling takes place in all habitats so you really know what lives there! Changes within water bug communities

Waterbug communities can change throughout the year

Seasonal change – Some waterbugs will be more abundant at certain times of the year, depending on the stage of their life cycle and opportunities for breeding.

Weather patterns – Storms may disturb sites by flushing waterbugs downstream (this can also occur when water is released from dams). Periods of low flow and drying up of waterways will concentrate animals into smaller areas. Some animals will cope better with these types of stresses, so changes may occur in the diversity and numbers of waterbugs.

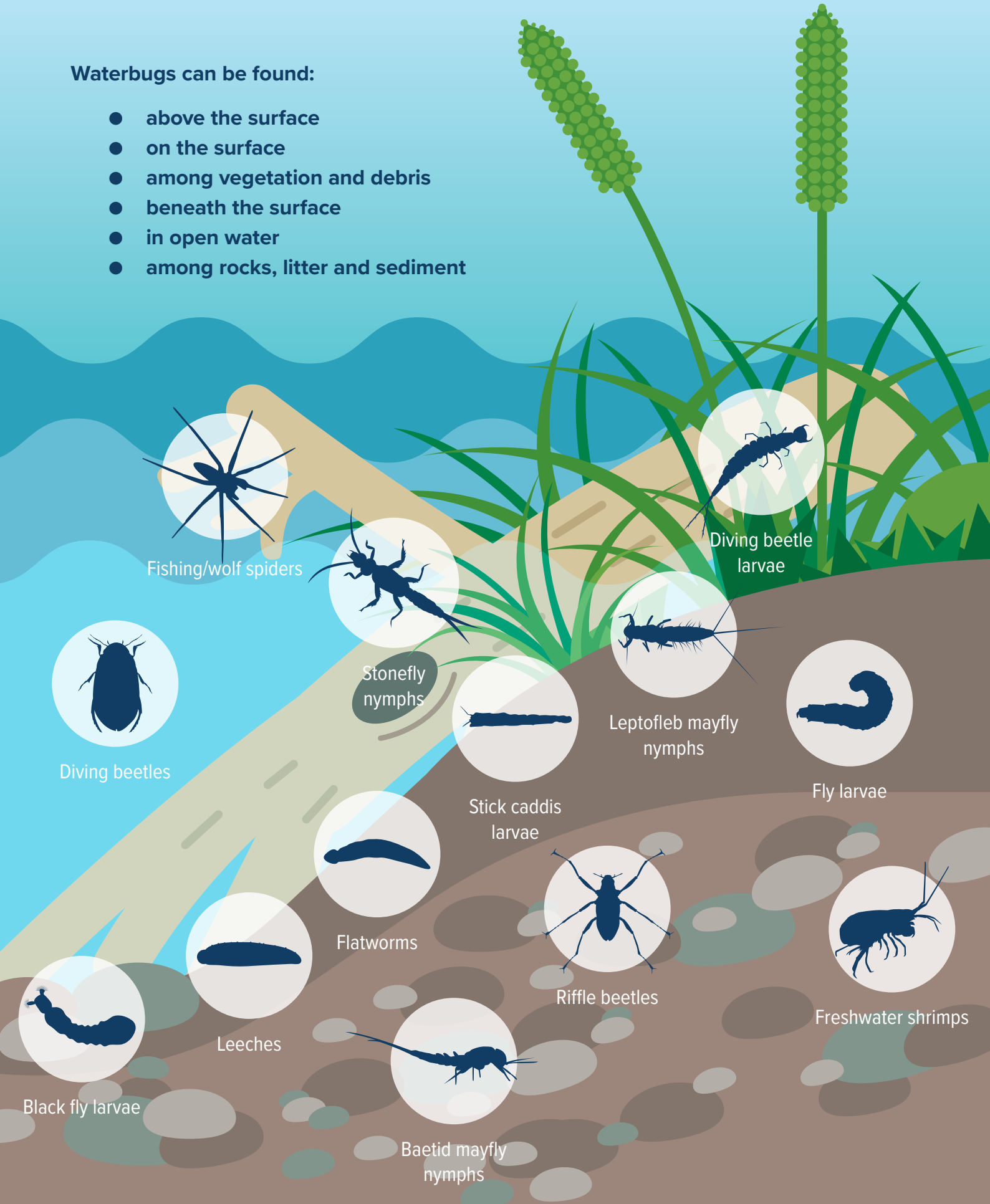
Where waterbugs can be found



Adapted from Melbourne Water "Dive into the underwater world of waterbugs in Melbourne's waterways"

Waterbugs can be found:

- **above the surface**
- **on the surface**
- **among vegetation and debris**
- **beneath the surface**
- **in open water**
- **among rocks, litter and sediment**



Waterway health

What makes a waterway unhealthy?

Unhealthy waterways have higher levels of sediment, nutrients or other pollutants. They also have fewer trees, shrubs and grasses (vegetation) on the banks of the waterway to provide shade, cooling the water. The riparian vegetation also protects the banks from erosion and reduces the sediment in the water. Unhealthy waterways have few logs and branches in the water. Logs and branches provide a range of habitats for waterbugs and other animals. So, unhealthy waterways have fewer types of organisms, including waterbugs.

Many factors can affect waterbug communities including:

- increased sediment which can smother bottom-dwelling communities
- increases in nutrients and effluents
- suspended solids in the water that can reduce light and therefore photosynthesis in plants
- loss of shade from riparian vegetation which can increase water temperature
- the loss of habitat including snags (woody debris), stones and plants that then reduces the diversity of waterbugs.

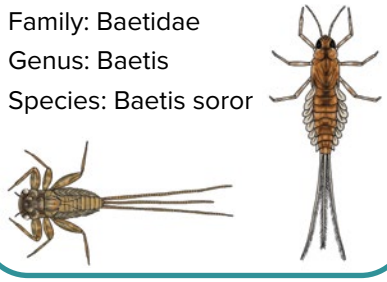
Sensitivity and SIGNAL scores

Different types of waterbugs vary in their tolerance to changes in their environment (e.g. temperature, pH and pollutant levels). The SIGNAL (Stream Invertebrate Grade Number - Average Level) score of a waterbug species indicates its level of tolerance. Species with high SIGNAL scores (6-10) are very sensitive to changes in their environment; while species with low SIGNAL scores (1-5) are very tolerant of environmental change. Consequently, the presence of high numbers of different types of waterbugs, including those with high SIGNAL scores, indicates that the waterway ecosystem is healthy.

SIGNAL scores have been developed for waterbugs identified to Family level. Please refer to The Waterbug App and other additional resources on the National Waterbug Blitz website for details on each species' classification taxonomy.

Mayfly

Kingdom: Animalia
Phylum: Arthropoda
Class: Insecta
Order: Ephemeroptera
Family: Baetidae
Genus: Baetis
Species: Baetis soror



Very Sensitive Bugs – 10,9
Stonefly nymph – 10
Mayfly nymph – 9

Sensitive Bugs – 8,7,6
Alderfly larva – 8
Caddisfly larve – 8
Riffle beetle and larva – 7
Water mite – 6

Tolerant Bugs – 5,4,3
Beetle larva – 5
Dragonfly nymph – 4
Water strider – 4
Whirligig beetle and larva – 4
Freshwater yabby – 4
Damselfly nymph – 3
Fly larva and pupa – 3
Midge larva and pupa – 3
Freshwater mussel – 3
Nematode – 3
Freshwater sandhopper – 3
Freshwater shrimp – 3
Water scorpion/Needle bug – 3

Very Tolerant Bugs – 2,1
Diving beetle – 2
Flatworm – 2
Hydra – 2
Water treader – 2
Freshwater worm – 2
Freshwater slater – 2
Waterboatman – 2
Backswimmer – 2
Bloodworm – 1
Leech – 1
Mosquito larva and pupa – 1
Freshwater snail – 1


1-2
1-2
1-2
1-2
1-2
1-2
1-2
3-5
1-2
1-2
Sample

3 The Waterbug App

Photo: I.Garland/EnviroComm Connections

Using the App

Get the App

Head to the Apple or Android App store on your device and download **The Waterbug App**.

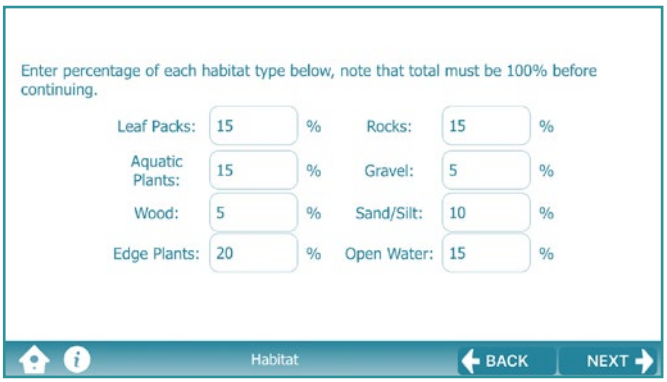
Once installed, open the App and click **Waterbug Survey**

Site details

- Tap to select if you are doing the **Quick or Detailed Survey**. The Quick Survey is for basic level identification to Order level. The Detailed Survey is more in-depth identification to Family level.
- Select the **Waterbody Type** – River, Wetland or Lake/Dam.
- Enter the **Waterbody Name** with some descriptive information and the suburb/locality you're in.
- Enter the name of any **Near by Features** – a park, road, structure, dam etc.
- Click on the **Red Pin** to locate your site – this gets GPS coordinates for your site to upload your data to. If you can't do this when at your site, then you can do it manually later. Use the map to zoom in on your site, and tap and hold to drop the pin.
- Tap on the camera in the **Site Photo** box, to connect to your camera. Please take a photo at your site that includes the water and banks/edges of your site.
- Click on **NEXT** to move on to the next section of the App.

Habitat

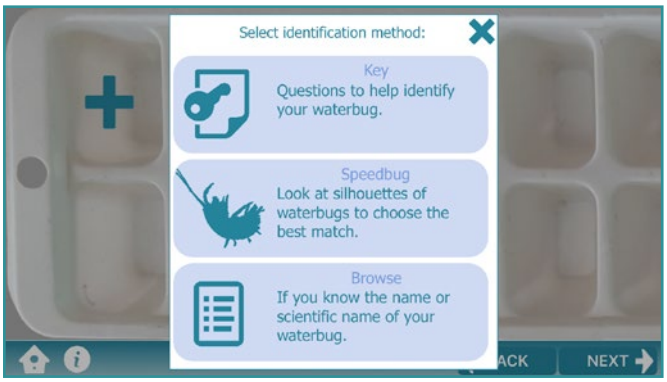
Complete the percentage (%) for each habitat type at your site. To do this, look at the area you are sampling waterbugs from – this includes the waterbody and its edges where you'll be netting to collect the bugs. Decide what approximate percentage of each category makes up your site and enter the fields on the screen. These should add up to 100%. You may have one or two categories, or you might have a number in all of them.



Tap **NEXT** to move to the next section of the App.

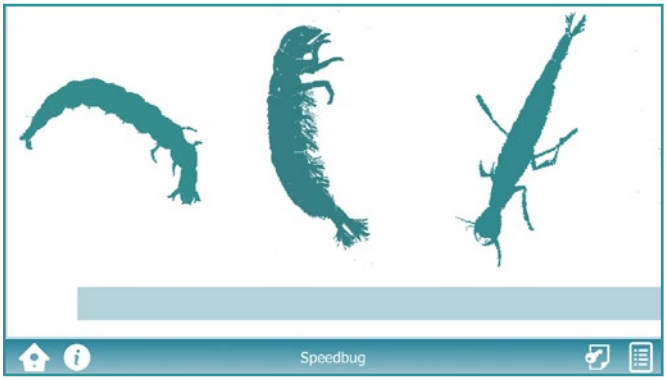
Sample

Tap on the **plus (+)** to select the first cell in the virtual icecube tray.

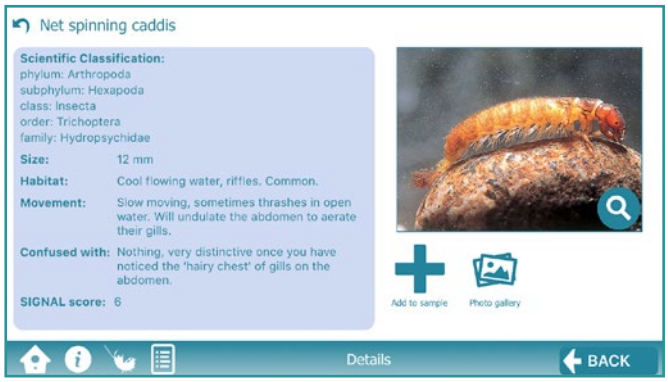


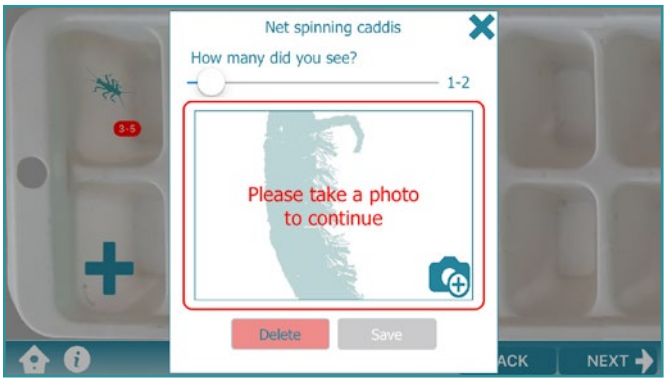
Select how you'd like to start identifying the waterbug – Key, Speedbug or Browse (list):

- **Key** takes you to the Dichotomous Key to work through questions about the bugs to lead you to an identification. Much of these questions are based on body shape, features and movement.
- **Speedbug** allows you to scroll through waterbug silhouettes to give you a faster lead to the waterbug you have (see image on the right). It then asks you to identify further using the key questions if needed.
- **Browse** takes you to a comprehensive list of the waterbugs on this App, which saves you having to work through the key if you already know what it is.



Once you've identified your bug, click on the plus sign on the bottom right of the screen '**Add to Sample**'.





You'll be asked to use the **Slide Counter** to record how many of this type of waterbug you have. **Take a photo** of the bug – tap on the camera and get a good close up of the bug in your tray – use your camera's zoom to help. Then click **Save**. Your bug silhouette will then appear in the icecube tray. That bug is now recorded.

Work through the rest of the icecube tray cells until you've added all of the waterbugs that you have sorted into the icecube tray.

Click **NEXT** to move on to the next screen.

Summary

The Summary screen will give you a:

- **SIGNAL Score** – this rates your waterway based solely on the bugs found. The score can be from zero (lifeless & extremely poor) to excellent 6 (excellent, biodiverse, pristine).
- **Weighted SIGNAL Score** – this rates your waterway based on the waterbugs found and the type of waterbody and land use you're sampling.
- Count of the **number of different waterbug taxa** (or bug types) you found and recorded.
- **Quick Interpretation** comment on the quality of your waterway.

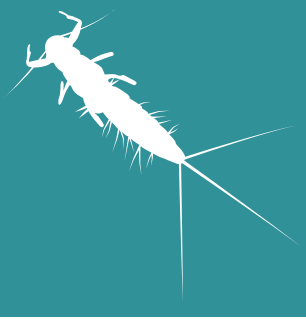
Then hit **SUBMIT** in the bottom right corner to upload your data to the National Waterbug Blitz database. Use the BACK button prior if there's anything you need to edit.

Want to identify a random waterbug?

Open The Waterbug App and tap on the Identify button.

Select your identification method - Key, Speedbug or Browse.

Follow the same steps outlined under 'Sample'.



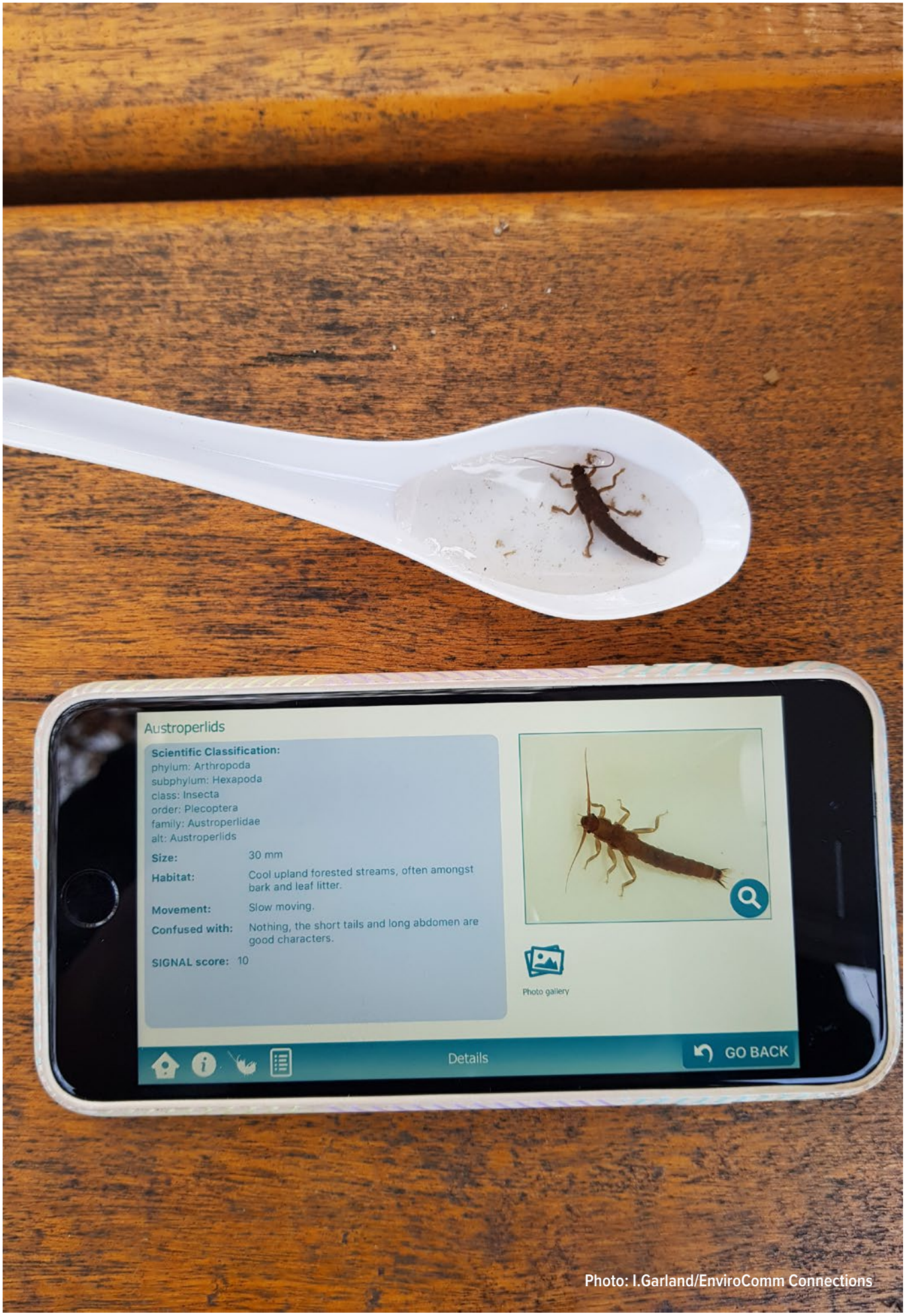


Photo: I.Garland/EnviroComm Connections

4 Conducting a survey

Photo: K.Coleman/PeeKdesigns

Planning a waterbug survey

Overview

This section covers how to coordinate an effective waterbug monitoring excursion. During the excursion, students act as scientists to identify and pose questions, gather and analyse data and draw conclusions to make evidence-based arguments about the health of a waterway.

Discovering waterbugs in your local waterway allows students to explore a fascinating 'invisible' world. It also showcases the work that aquatic ecologists and interested community volunteers do to protect our local waterways – and how students and their families can help.

Before the survey

Excursion safety

Ensure that you comply with your school or organisation's risk assessment procedures. Refer to the **Risk management plan** (Appendix 2) that can be used as a template.

Additional safety considerations:

- Follow the approved procedures when visiting the site with and without students.
- Wear appropriate clothing and footwear.
- If sampling without students, take someone with you.
- Select a sampling site that has safe and simple access (not through plants, private property).
- Be aware of animals, holes and vegetation when going to and from, and while testing at, the site.
- Sample from a safe distance.
- Wash your hands after being in the field and before eating.

Preparation

- Select a suitable site, such as a wetland or a section of waterway with plenty of plants around the edges.
- Spring and autumn are the best times to sample.
- Find a safe place to collect the sample from, with good access to the water e.g. a boardwalk.
- Always take someone with you. Never sample alone.
- Ensure that you have the correct equipment. Refer to the **Equipment checklist**.

Equipment checklist

Waterbug field equipment

- [ ] Bucket
- [ ] Large trays
- [ ] Ice cube trays
- [ ] Spoons, pipettes
- [ ] Magnifying glass (optional)
- [ ] Macro nets
- [ ] Waterbug Key
- [ ] Recording sheets
- [ ] The Waterbug App (pre-installed on school tablets or teacher's phone)
    - Take a number of Tablets to use The Waterbug App for identification and data entry (including taking photos) of the bugs found in the icecube tray to upload; OR
    - Waterbug counts can be collected on result sheets by students and later collated along with photos of the waterbugs, to upload all the group's findings in one data set/ upload. This would be preferable.
- [ ] Camera to record site photos, waterbugs (if you don't use tablets) and other interesting finds

Other requirements

- [ ] First aid kit
- [ ] Sunscreen
- [ ] Student medications
- [ ] Mobile phone
- [ ] Completed risk assessment documentation – remember to visit the site again before you go with your group
- [ ] Hats, closed-toe shoes, water for drinking, sunscreen
- [ ] Check the weather and ensure past weather hasn't affected the site

Classroom activities

1. Waterway citizen scientists

In the classroom, ask students to imagine they are a citizen scientist. Their job is to discover life in the water. How will you do that? What do you think you will find?

Display images of different waterways on a computer. Ask students:

- What can you see that is not living (e.g. rocks, fallen logs, soil, water)?
- What can you see that is living (e.g. animals, trees, grass)?
- Can you tell if the water is clean by looking at it? (No)

Ask students to think about a waterway near their house or school.

- Is it a healthy place for the animals and plants that live there or an unhealthy place? How can we decide?
- What might you find in a healthy waterway?
- What might be missing if the waterway is not healthy? We are looking for an abundance of life.

Explain that one of the ways that we can tell if a river or creek is healthy is to find out what is living in the water. Introduce the term waterbug or aquatic macroinvertebrate. This term refers to the fact that these animals live in water and have no backbone.

Review students' understanding that animals with backbones are called vertebrates and animals without backbones are called invertebrates.

Explain that waterbugs are a collection of bizarre and fascinating creatures that spend some or all of their lives in waterways. You find them in ponds, streams, estuaries and irrigation drains.

Some common waterbugs are freshwater snails, freshwater shrimp, backswimmers, dragonflies and damselfly nymphs. They can be used to assess the health of a waterway.

As a citizen scientist, you are required to collect samples of waterbugs from different waterways. Inform students that you will be going on a field trip to survey waterbugs from a local waterway. Show students the equipment that they will be using, review the sampling videos from the Waterbug Blitz website and look at images of waterbugs they could find.

www.waterbugblitz.org.au

2. Risks

Ask students to suggest potential risks while on excursion. Collate and display their ideas. This is an important part of understanding what's involved in being a citizen scientist.

3. Impacts

Discuss behaviours that minimise the environmental impacts of the excursion such as using existing paths and tracks and don't harm animals and plants.

4. Sampling awareness

Before the excursion, go through the sampling instructions using the videos found on the Waterbug Blitz website (see link below), discuss all the terminology used for waterbug sampling and look at the identification sheets to familiarise students with the waterbug they might come across.

www.waterbugblitz.org.au

Out in the field

Habitat assessment

Before conducting your waterbug survey it is good practice to conduct a quick habitat assessment, in other words, checking to make sure the surrounding environment is healthy or not. From your sampling site, look 50 metres upstream and 50 metres downstream – take a photo for future reference.

Bank

1. Tick which of the following three options best describes your site?

- ☐ Extensive erosion, No plants
- ☐ Erosion occurring, Limited plants
- ☐ No erosion, Lots of plants

2. Tick from the list what you can see (bank stabilisation and erosion control)

- ☐ Stock crossing or access
- ☐ Roads/jetty/bridges
- ☐ Vehicle tracks
- ☐ Concrete-lined channel
- ☐ Unfenced riverbanks
- ☐ Fenced riverbanks

In-stream habitats

3. Tick the following in-stream habitats, if present.

- ☐ Human-made structures
- ☐ Stones/pebbles
- ☐ Silt/sand
- ☐ Water plants
- ☐ Tree roots
- ☐ Logs and branches

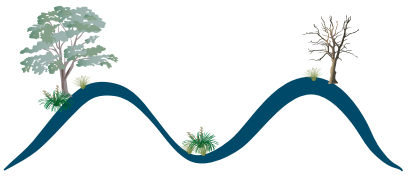
Stream flow

4. Tick the flow types that you can see from your sampling site.

- ☐ Riffle
- ☐ Pool
- ☐ Run

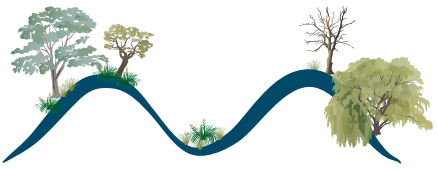
Verge vegetation

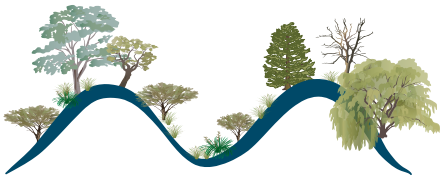
5. Label the image that matches the left bank (label L) and the right bank (R) as you face downstream. The verge is the strip of land near the river bank.



Little or no riparian vegetation ☐

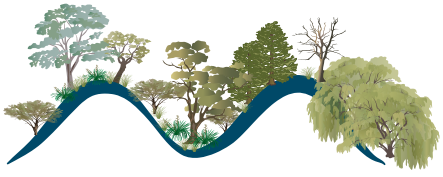
Clumps of native and/or introduced plants ☐

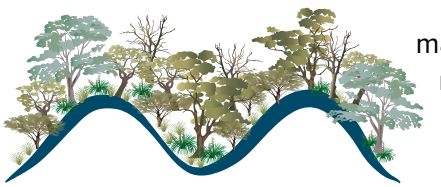




Well vegetated with native and/or introduced plants ☐

Narrow corridor of native and/or introduced plants ☐





Wide corridor of mainly undisturbed native vegetation ☐

Habitat assessment rating

Circle the score (from very poor to excellent) that describes the sampling site. At the end, add up your score to determine your overall site rating. From your sampling site, look 50 metres upstream and 50 metres downstream.

HABITAT AREA	VERY POOR	POOR	FAIR	GOOD	EXCELLENT
BANK EROSION	Lots of erosion with very unstable banks. Little vegetation.	Some erosion occurring with large areas of bare banks. Some vegetation.	Erosion occurring in some places. Good vegetation cover.	Erosion only in small spots. Good vegetation cover.	No erosion. Lower banks covered with grass, reeds or shrubs.
SCORE	**1**	**2**	**3**	**4**	**5**
BANK VEGETATION	Bare ground or concrete lined channel. Occasional tree.	Introduced weeds. Little native vegetation.	Medium cover of native and introduced vegetation. Or it could be cleared on one side and with a wide corridor of native vegetation on the other side.	Mainly native vegetation but has been disturbed.	Mainly undisturbed native vegetation.
SCORE	**2**	**4**	**6**	**8**	**10**
IN-STREAM COVER	No snags, boulders or vegetation in or over water. Could be lined with rock or concrete.	Occasional snag. No vegetation in or over water.	Some snags and boulders present and some vegetation in and over water.	Lots of snags, logs, boulders and vegetation lots in and over water.	Many snags, logs, boulders. Extensive vegetation in and over water.
SCORE	**2**	**4**	**6**	**8**	**10**
RIFFLES/ POOLS/ BENDS	Straight stream with no variation, like an irrigated channel.	Slight variation in depth of water.	Occasional riffle or bend and variation in depth.	Variation in depth in pools and riffles with a variety of habitats	Riffles and pools of varying depths. Bends present.
SCORE	**1**	**2**	**3**	**4**	**5**
VERGE VEGETATION	Bare or pasture and grass cover next to water.	Narrow area of native or introduced vegetation.	Wide corridor of native or introduced plants. One side cleared while other side wide area of natives.	Mainly native but some introduced vegetation. Wide area.	Mainly native vegetation on both sides. >30m verge width.
SCORE	**2**	**4**	**6**	**8**	**10**

Total score:	**(8-11)**	**(12-19)**	**(20-28)**	**(29-35)**	**(36-40)**
Overall site rating:	**Degraded**	**Poor**	**Fair**	**Good**	**Excellent**

Collecting a sample

Time: 15-20 minutes

1. Pour clear stream water into a large white sorting tray to about 2 centimetres deep and put the tray close to the edge of the water.

   Note: Where it is difficult to lie the tray flat at the water's edge, use a bucket and transfer the water into trays after sampling.

2. Use a short upward-sweeping motion to sweep the net through the water. Make sure all habitats are sampled, including fringing vegetation, along 10 metres of stream. Sample the top, edge and bottom of the water.

3. Stop regularly to transfer the waterbugs gently into the tray. Turn the net inside out and wash its top in the tray to transfer the bugs.

4. Rinse any mud or fine silt from your net. The sample should be free of sediment prior to sorting.

5. Spread the sample out in the tray so small waterbugs can be seen.

Sorting the sample

Time: 30–40 minutes

1. Observe the waterbugs in the large white sorting tray.
2. Each group should fill an ice block tray with a small amount of water.
3. Transfer bugs to the ice block trays using plastic spoons and pipettes.
4. Sort the waterbugs into the cubes in the tray, using a different cube for each type.

Identifying and recording

Time: 15–20 minutes

The aim is to count the total number and types of waterbugs. This will give an indication of the health of your waterway. A person trained in waterbug identification should be invited to assist. This may be a Waterwatch coordinator, professional person such as a natural resource management or council staff member, or a trained teacher.

Follow the identification and recording guidelines set out in **Section 3 The Waterbug App**. Alternatively, you can use hard copies of the Waterbug Orders poster to help identify the waterbugs you find to Order level – Download from www.waterbugblitz.org.au/Resources.

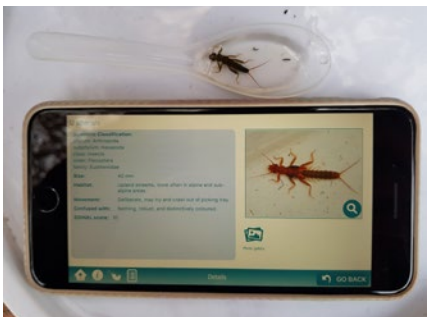
Quick Survey – follow the Quick Survey Activity guidelines set out on pages 38 to 40 of this resource and identify waterbugs to Order level.

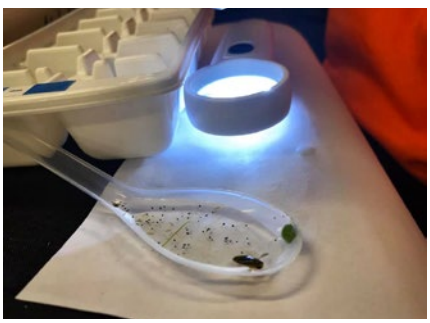
Detailed Survey – follow the Detailed Survey Activity guidelines set out on pages 41 and 42 of this resource. You will need to have a greater understanding of Taxonomy to identify waterbugs using the Agreed Level Taxonomy (ALT) method.

Return the waterbugs to the water gently once you have finished, as close to the collection site as possible.


Photo: N.Ord/Manifeasto Photography


Photo: P.Coleman/PeeKdesigns





What do your results mean?

It is important to take into account the location of your site and whether it has flowing or standing water. Inland streams usually have a lower diversity of species than coastal freshwater streams. Wetlands will have a lower diversity than flowing water.

The Stream Pollution Index (SPI), together with the number of waterbug types, provides information about water quality at your site.

Site hygiene

Make sure that you return the waterbugs to the site you collected them from. Do not return animals to a different site as this may spread disease or pest species. Ensure that the sampling equipment is thoroughly cleaned.

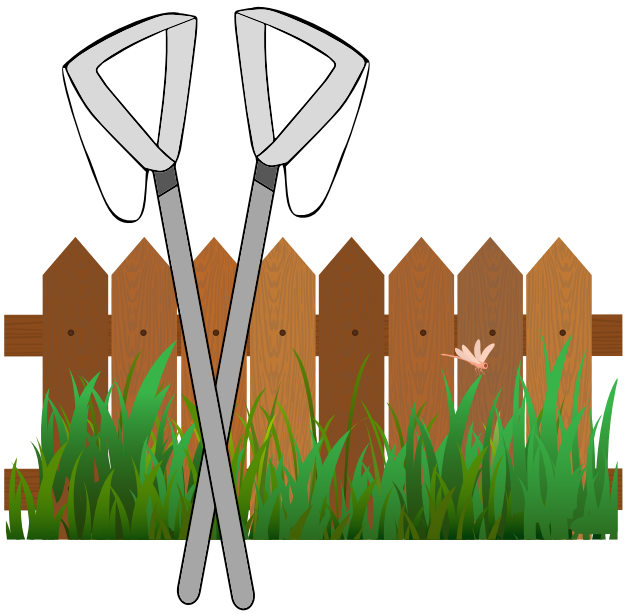
There are a number of ways of sterilising equipment between sites:

Air drying: The simplest method is drying the equipment in the sun. The sun's UV rays kill bacteria.

Methanol/ethanol: Spraying equipment with ethanol (or methylated spirits) can be cheap, effective and quick, so you can do it between sites. Equipment needs to be fairly dry to ensure that the ethanol or methanol doesn't become too diluted to work. Ethanol or methanol is a flammable liquid and should be kept away from open flame. It is also a mild solvent, so you need to be careful with it around some plastics... and it will make marker pen rub off.

Nappy cleaner/salt/antiseptic/bleach: If you have access to a sink or bath between trips, another simple method is to clean your gear with a strong solution (5%) of nappy cleaner, salt or antiseptic, or 2% bleach solution. This method works best if you have the time to soak the equipment. Once it is clean, rinse off the detergent so you don't end up killing any bugs in your next wetland.

Hot water: Soaking items in hot water (above 45°C) for 40 minutes will also kill most problem organisms, and can be useful if you have equipment you don't want to bleach or spray with methylated spirits.



Early learning activity

This resource is primarily targetted at Year Levels 3 to 10. But that shouldn't stop younger students learning about waterbugs and their role in the environment.

What you can do with young learners

Use the information in this resource to collect a waterbug sample from a local waterway (Pages 33-35). Bring the sample into the classroom and setup some white tray in a wet area and allow the kids to look through the trays and see if they can find any waterbugs.

Depending on the age of the group, discuss the following as a group:

- What do these waterbugs need to survive in the water? Food, light, oxygen
- Do they look different?
- What can we see on them that looks different? Lots of legs, tails, gills, antennae, bodies have different/many segments (parts). Go through the images in Appendix 3 and look at the differences between the waterbugs.
- Where do you think the bug live in the water? On the surface, under the water, under rocks, in the plants

Explain that most of these waterbugs spend part of their life in the water, part of their life out of the water. For example, a dragonfly lays its eggs on a reed. The eggs hatch and the baby, or nymph, spends its life in the water. When it's ready, it crawls out of the water up on some plants where it changes into the adult dragonfly we might see near a waterway. Nearly all the waterbugs we see are young flying insects.

Ask your class how can we look after these tiny waterbugs. What can we do to keep our waterway healthy? For example, pick up litter, don't litter, plant trees, ask mum and dad to reduce waste at home.


Photo: N.Ord/Manifeasto Photography

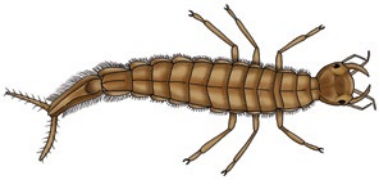
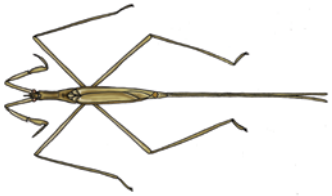
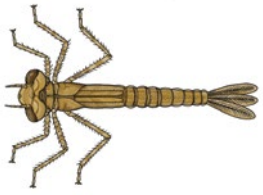
Waterbug App activity

Imagine you're at your favourite local waterway. You have been using a net and a bucket to collect some waterbugs by swishing it through the water. Now you have sorted and organised all the waterbugs you found into an icecube tray. It's time to start identifying them using The Waterbug App.

Open the app and select IDENTIFY. Then use the KEY to start identifying your waterbugs. Stop when you get to Order and record this next to the waterbug you've identified. You can also use SPEEDBUG to help identify as well.

Videos via www.waterbugblitz.org.au/Resources show how to complete a full survey and use the app if you need help.

Remember – Please do not submit this data via the app.

for example: **Hemiptera** (Backswimmer)			
			
			
			
			
			

Quick survey activity

Overview

The Quick Survey is a simple method that identifies obvious waterbugs, such as dragonflies and water striders. The presence (and absence) of certain waterbugs can indicate the health of a waterway through their known sensitivities and tolerances to pollution and disturbance.

Students will collect samples from a chosen site, investigate and identify the waterbugs collected and record their findings. Their findings should be recorded on The Waterbug App, which is then used by scientists to determine if the waterway is healthy.

This activity is most suitable for Years 3-7, but can also be used to support activities in other year levels.

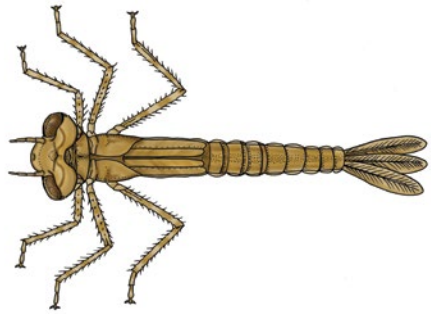
Instructions

As citizen scientist, we are surveying our waterway's waterbugs to record what species live there and record that data using The Waterbug App. When we send our results off, we are helping scientists know the health of our waterway.

- **Where should I sample in the waterway?**
  Sample a range of habitats, including under stones, logs, fringing vegetation and pools and riffles. Sample in roughly the same place each time you visit so that comparisons can be made between data collected at different times.
- **What equipment should I use?**
  Use nets with a triangular frame and fine net dip bag. See tips for student waterbug sampling at the end of this section.
- **When should I sample?**
  Sampling should occur twice a year, preferably in spring (October) and autumn (March).

Follow the steps outlined on pages 33-35 to conduct your waterbug survey.

As well as using The Waterbug App, the following worksheets can be used out in the field to record site details (Worksheet 1) and waterbug identification counts (Worksheet 2). Please note that the manual calculations on Worksheet 2 will differ from the SPI produced via The Waterbug App, as the App takes into account other factors such as the waterway type (River, Lake/Dam, Estuary).



Worksheet 1: Field record sheet

Complete your quick Waterbug Blitz in identifying animals to order level with The Waterbug App. Then get your teacher or organiser to collate all of the sheets to upload via the Waterbug App for your class/group.

Location information

Provide information about your Waterbug Blitz location and conditions on the day.

Date: . . . . . Waterway: . . . . . .

Site Name/Location: . . . . . .

GPS Coordinates: . . . . . .

Nearby feature/s: . . . . . .

Conditions on the day (weather, animals, flow height etc): . . . . . .

. . . . . .

Names of students in your group: . . . . . .

. . . . . .

Habitat Types

Roughly estimate the approximate percentage of each habitat type below that makes up your stream, wetland or other waterway. Remember to make sure the numbers add up to 100 in total.

Leaf Packs	%	Rocks	%
Aquatic Plants	%	Gravel	%
Wood	%	Sand/Silt	%
Edge Plants	%	Open Water	%
		OVERALL TOTAL =	**%**

Worksheet 2: Waterbug identification counts

COMMON NAME	SIGNAL RATING	NUMBER PRESENT
Very Sensitive Waterbugs		
Stonefly Nymphs	10	
Toebiters	10	
Mayfly nymphs	9	
Cased caddis larvae	8	
Free-living caddis larvae	8	
Sensitive Waterbugs		
Gordian worms	6	
Marsh beetle larvae	6	
Water pennies	6	
Black fly larvae	5	
Fishing spider	5	
Water mites	5	
Tolerant Waterbugs		
Chironomids – blood worms	4	
Freshwater prawns	4	
Leafy water scorpions	4	
Pogs	4	
Water strider	4	
Whirligig beetles	4	
Whirligig beetle larvae	4	
Damselfly larvae	3	
Dragonfly larvae	3	
Five cent crabs, false spider crabs	3	
Freshwater mussel and clams	3	
Glass shrimps	3	
Fly larvae	3	
Sideswimmers or scuds	3	

COMMON NAME	SIGNAL RATING	NUMBER PRESENT
Very Tolerant Waterbugs		
Flatworms	2	
Scavenger Beetle larvae	2	
Slender water scorpions, needlebugs, stick bugs	2	
Water boatmen	2	
Water beetles	2	
Water tigers	2	
Worms	2	
Backswimmers	1	
Freshwater crayfish or yabbies	1	
Freshwater snails	1	
Leeches	1	
Mosquito larvae, wrigglers	1	
Water treaders	1	
TOTAL		

How to get an indication of your overall waterway health?

Add up the SIGNAL ratings of the different waterbugs you found

÷

Number of different waterbugs

What does the final score mean?

> 6	clean water
5 to 6	mild pollution
4 to 5	moderate pollution
< 4	severe pollution

Data sheet adapted from: River Detectives Program, Waterbug Data Form, North Central Catchment Management Authority & John Gooderham (The Waterbug Company) for the National Waterbug Blitz Curriculum Link Resources.

Detailed survey activity

Overview

In this detailed survey, students will use the Agreed Level Taxonomy (ALT) method for identifying waterbugs, which has been specially designed for both citizen scientists and professional scientists to use to collect quality data. It uses clear, every-day language and explanations for identifying waterbugs without the need for microscopes. The ALT method identifies waterbugs down to the FAMILY level.

This activity is most suited for Years 7-10.

An introduction to taxonomy

The term 'taxonomy' refers specifically to sorting and classifying living organisms. We also refer to it as 'scientific classification'. Taxonomists study minute features to identify individual species. Every living species is classified in the following structure:

Taxonomic Structure	Example 1 – Dog	Example 2 – Bluetail Damselfly
1. Kingdom	Animalia – animal	Animalia – animal
2. Phylum	Chordata – vertebrate	Arthopoda – arthropod
3. Class	Mammalia – mammal	Insecta – insect
4. Order	Carnivora – carnivore	Odonata – damselflies, dragonflies
5. Family	Canidae – canine	Coenagrionidae – damselflies
6. Genus	*Canis*	*Ischnura*
7. Species	*lupus*	*eterosticta*

Instructions

1. Follow the Waterbug Survey steps outlined on pages 33-35.
2. Record your site's habitat on the ALT Habitat Sheet, which can be downloaded from www.thewaterbug.net/ALT.html
3. Use the ALT method to identify your waterbugs to the FAMILY level. The quick survey only identifies waterbugs to the Order's common name, such as damselfly or stonefly. By using the ALT method you are identifying more features on the waterbug to narrow down their taxonomy at the Family level – such as short-tailed damselfly or fluffy bum stonefly.
4. Record your waterbugs using the ALT Bug Sheet using the ALT Keys to guide you. The Bug Sheet and Keys can be downloaded from www.thewaterbug.net/ALT.html

ALT method

The Agreed Level Taxonomy (ALT) method was developed by The Waterbug Company. ALT uses features that are visible to the naked eye to identify waterbugs. The animals are identified alive rather than being preserved. ALT identifications result in data sets of mixed taxonomic levels, some at genus or species, and others at higher levels.

For more information go to: www.thewaterbug.net/ALT.html

Appendix

Photo: K.Coleman/PeeKdesigns

APPENDIX 1

Australian curriculum outcomes

Science		
Year	**Code**	**Description**
F	ACSSU002	Living things have basic needs, including food and water. • recognising the needs of living things in a range of situations such as animals in bushland
1	ACSHE022	People use science in their daily lives, including when caring for their environment and living things. • identifying ways that science knowledge is used in the care of the local environment such as animal habitats, and suggesting changes to parks and gardens to better meet the needs of native animals
	ACSSU017	Living things have a variety of external features. • recognising common features of animals such as head, legs and wings • describing the use of animal body parts for particular purposes such as moving and feeding
	ACSSU211	Living things live in different places where their needs are met. • exploring different habitats in the local environment • recognising that different living things live in different places such as land and water • exploring what happens when habitats change and some living things can no longer have their needs met
2	ACSHE035	People use science in their daily lives, including when caring for their environment and living things. • identifying the ways humans manage and protect resources, such as caring for water supplies • recognising that many living things rely on resources that may be threatened, and that science understanding can contribute to the preservation of such resources
	ACSSU030	Living things grow, change and have offspring similar to themselves. • recognising that living things have predictable characteristics at different stages of development • exploring different characteristics of life stages in animals such as egg, nymph, adult macroinvertebrate

Science		
Year	**Code**	**Description**
3	ACSHE051	Science knowledge helps people to understand the effect of their actions. • considering how materials including affect the environment in different ways • deciding what characteristics make a material a pollutant
	ACSSU044	Living things can be grouped on the basis of observable features and can be distinguished from non-living things. • recognising characteristics of living things such as growing, moving, sensitivity and reproducing • recognising the range of different living things
4	ACSHE062	Science knowledge helps people to understand the effect of their actions. • exploring how science has contributed to a discussion about an issue such as loss of habitat for living things or how human activity has changed the local environment
	ACSSU072	Living things have life cycles. • making and recording observations of living things as they develop through their life cycles • describing the stages of life cycles of different living things such as insects, birds, frogs and flowering plants • comparing life cycles of animals and plants • recognising that environmental factors can affect life cycles such as fire and seed germination
	ACSSU073	Living things depend on each other and the environment to survive. • investigating how plants provide shelter for animals • investigating the roles of living things in a habitat, for instance producers, consumers or decomposers • observing and describing predator-prey relationships • predicting the effects when living things in feeding relationships are removed or die out in an area • recognising that interactions between living things may be competitive or mutually beneficial

Science		
Year	**Code**	**Description**
5	ACSSU043	Living things have structural features and adaptations that help them to survive in their environment. • explaining how particular adaptations help survival such as nocturnal behaviour, silvery coloured leaves of dune plants • describing and listing adaptations of living things suited for particular Australian environments • exploring general adaptations for particular environments such as how some macroinvertebrates have claws or hooks to hang onto rocks in fast flowing water
6	ACSSU094	The growth and survival of living things are affected by physical conditions of their environment. • investigating how changing the physical conditions for macroinvertebrates impacts their growth and survival, such as pollution, temperature, light, salinity and nutrients
7	ACSHE223	Science knowledge can develop through collaboration across the disciplines of science and the contributions of people from a range of cultures. • considering how water use and management relies on knowledge from different areas of science, and involves the application of technology • identifying the contributions of Australian scientists to the study of human impact on environments and to local environmental management projects
	ACSSU111	Classification helps organise the diverse group of organisms. • considering the reasons for classifying such as identification and communication • grouping a variety of organisms on the basis of similarities and differences in particular features • considering how biological classifications have changed over time • classifying using hierarchical systems such as kingdom, phylum, class, order, family, genus, species • using scientific conventions for naming species • using provided keys to identify organisms surveyed in a local habitat

Science		
Year	**Code**	**Description**
8	ACSHE135	Solutions to contemporary issues that are found using science and technology, may impact on other areas of society and may involve ethical considerations. • investigating strategies implemented to maintain part of the local environment, such as a local waterway
	ACSHE136	People use science understanding and skills in their occupations and these have influenced the development of practices in areas of human activity. • recognising the role of knowledge of the environment and ecosystems in a number of occupations
	ACSSU150	Multi-cellular organisms contain systems of organs carrying out specialised functions that enable them to survive and reproduce. • identifying the organs and overall function of a system of a multicellular organism in supporting the life processes • describing the structure of each organ in a system and relating its function to the overall function of the system
9	ACSHE157 ACSSU176	Scientific understanding, including models and theories, is contestable and is refined over time through a process of review by the scientific community. • investigating how models can be used to predict the changes in populations due to environmental changes, such as the impact of flooding Ecosystems consist of communities of interdependent organisms and abiotic components of the environment; matter and energy flow through these systems. • exploring interactions between organisms such as predator/prey, parasites, competitors, pollinators and disease • examining factors that affect population sizes such as seasonal changes, destruction of habitats, introduced species • considering how energy flows into and out of an ecosystem via the pathways of food webs, and how it must be replaced to maintain the sustainability of the system • investigating how ecosystems change as a result of events such as bushfires, drought and flooding

Science

Year	Code	Description
10	ACSSU185	The theory of evolution by natural selection explains the diversity of living things and is supported by a range of scientific evidence. • outlining processes involved in natural selection including variation, isolation and selection • describing biodiversity as a function of evolution

Geography

Year	Code	Description
3	ACHASSK069	The similarities and differences between places in terms of their type of settlement, demographic characteristics and the lives of the people who live there, and people's perceptions of these places. • discussing why it is important to protect places that have special significance for people
4	ACHASSK088	The importance of environments, including natural vegetation, to animals and people • exploring how vegetation has an important role in sustaining the environment • exploring strategies to protect particular environments that provide the habitats for animals
5	ACHASSK113	The environmental and human influences on the location and characteristics of a place and the management of spaces within them • exploring the extent of change in the local environment over time and the impact of change on ecosystems

Geography		
Year	**Code**	**Description**
7	ACHASSK183 / ACHGK038 ACHASSK190 / ACHGK045	The way that flows of water connect places as they move through the environment and the way these affect places. • explaining how the movement of water through the environment connects places • investigating the importance of environmental flows The influence of environmental quality on the liveability of places. • explaining the importance of water quality to the liveability of places now and into the future • investigating the concepts of environmental quality and pollutions by surveying the environmental quality of their local area and its effect on liveability
10	ACHGK073 (Inland Water Study)	The application of systems thinking to understanding the causes and likely consequences of the environmental change being investigated. A comparative study of inland water environments from Australia and at least one other country. This study could incorporate macroinvertebrate surveys to help understand and compare water quality and ecosystem health. • describing the nature of the environmental change and its effect on the sustainability of environmental functions • examining the interconnections between biophysical processes and human actions that generate environmental change, together with the consequences of these changes

APPENDIX 2

Risk management plan

Please note: This risk management plan is intended as a guide only and no liability is accepted for its use. Please refer to your school's safety and risk management policies prior to undertaking field trips.

Risk levels

1 and 2	Extreme risk; deal with the hazard immediately
3 and 4	Moderate risk; deal with the hazard as soon possible
5 and 6	Low risk; deal with the hazard when able.

Task/Activity	Hazard & Associated Risk	Risk Level	Elimination or Control Measures	Who	When
Walking to and from transport and on public roads	Struck by vehicle on road Uneven footpath	4	Teachers and parent/carer volunteers attending to supervise excursion.	Coordinating teacher	Before
		6	Brief participants on rules and behaviour.		
		6	Remain on pedestrian pathways and use pedestrian crossings at all times.	All	During
		6	Teachers and parent/carer volunteers "ferry" students along the road.		
Coach transport to excursion venue	Boarding transport Vehicle accidents	6	Ensure vehicle operators hold appropriate licence(s) and insurance.	Coordinating teacher	Before
		5	Check availability of seat belts.		
		6	Vehicle to be appropriate for the needs of the group (e.g. wheelchair access).		
		5	Enforce rules and monitor behaviour.	Teachers	During
		5	Ensure seat belts are worn.		
Diet and food during excursions	Student food allergies	3	Be aware of the possibility that a student who has previously been undiagnosed with anaphylaxis might have an allergic reaction. Use the general use adrenaline auto injector, such as EpiPen®, and contact an Ambulance immediately if a student shows symptoms of anaphylaxis. These symptoms are listed on the ASCIA action plan (general use) for autoinjector which should also be located in the first aid kit.	Teachers	Before & During
		3	Confirm appropriate food with parents/carers for student with allergies		

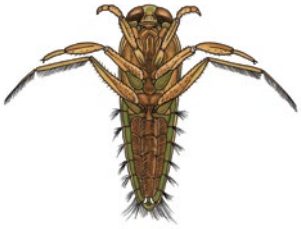
Task/Activity	Hazard & Associated Risk	Risk Level	Elimination or Control Measures	Who	When
Diet and food during excursions	Student food allergies	3	Food brought by student should be provided by student's parent/carer.	Teachers	Before & During
		3	Discuss with students the importance of only eating your own food.		
		3	Ensure a responsible adult is with each group of students.		
		3	Ensure all staff attending have anaphylaxis training (use of adrenaline autoinjector) and E-emergency care training.		
		3	Arrange for staff attending to practice the emergency response for anaphylaxis with the school's practice EpiPen® and to be familiar with the ASCIA Action Plan for Anaphylaxis.		
		3	Communicate special requirements to all staff and volunteers especially emergency response procedures and equipment.		
		3	For students with allergies to bee/insect bites and stings, be aware of bees/insects attracted by soft drinks cans and food in garbage bins.		
Observing animals and plants	Bites and stings from insects, spiders, ticks and snakes (including allergies) Exposure to sun	4	Ensure participation of students with known allergies has been considered, implement appropriate risk controls, e.g. a trained staff member is available to provide appropriate first aid and emergency response (e.g. adrenalin auto injector, such as EpiPen®, for student with anaphylaxis).	Teachers	Before
		5	Ensure staff and students are aware of emergency response procedures.		
		5	Ensure students are wearing enclosed footwear, long pants and avoid walking through long grass. Students can bring gum boots for entering the water.	All	Before & During
		4	Ensure student wear hats, shirts with sleeves and 30+ sunscreen.		
		4	Ensure students are provided with insect repellent on the day.		During
		6	Don't touch animals or hazardous plants.		
		6	Carry a first aid kit which includes general use adrenaline auto injector such as EpiPen®.	Teachers	

Task/Activity	Hazard & Associated Risk	Risk Level	Elimination or Control Measures	Who	When
Walking in a natural area or near open waterway	Uneven ground surfaces, bites and stings, exposure to sun, wind, rain and dehydration Allergies to insects, reptiles and plants Becoming lost or isolated from the group Change in weather conditions	3	Ensure participation of students with known allergies has been considered, implement appropriate risk controls (e.g. trained staff member can apply first aid such as EpiPen® for anaphylaxis).	Teachers	Before
		4	Ensure staff and students are aware of emergency procedures, including knowing the symptoms of heat exhaustion/stroke.		
		6	Check weather forecast on day of excursion. Do not undertake physical activity in hot weather		
		5	Emergency plans communicated for dealing with potential incidents.		
		5	Carry first aid kit.		
		5	Teachers or relevant staff to the lead walk. Adult supervision at front and back to keep the group together.		During
		5	Inform excursion participants of Aboriginal Area safety instructions.		
		3	Ensure all participants carry water bottles. Take extra water to refill water bottles.		
		4	Staff carry insect repellent, additional sunscreen and ensure rest breaks are taken in the shade.		
		5	Wear enclosed footwear suitable for walking, clothing to protect arms and legs and suitable for changing weather conditions.	All	
		5	Wear hats, shirts with sleeves and sunscreen while outdoors. Seek out shade wherever possible to avoid heat exhaustion.		

APPENDIX 3

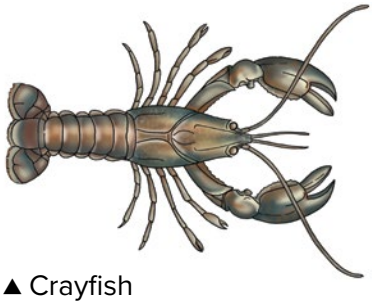
Common freshwater waterbugs

▲ Alderfly

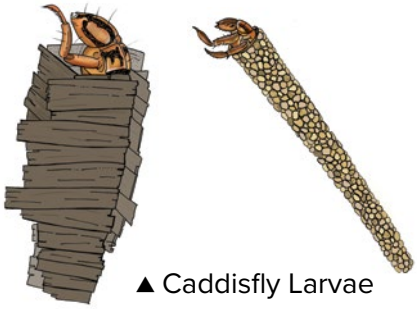


▲ Backswimmer

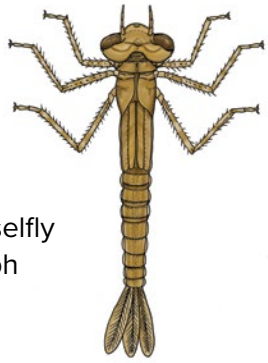
▲ Bloodworm



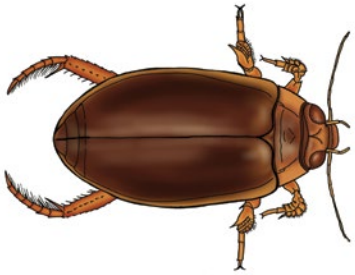
▲ Crayfish



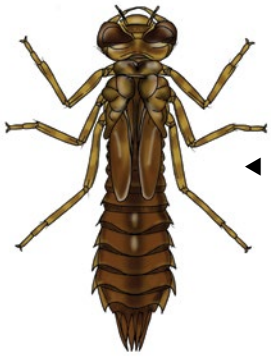
▲ Caddisfly Larvae



▶ Damselfly Nymph

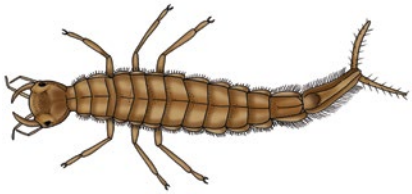


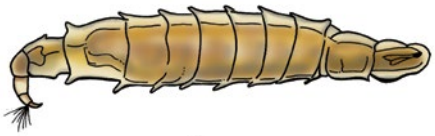
▲ Diving Beetle & Larvae ▼



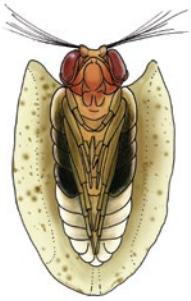
◀ Dragonfly Nymph ▼

▶ Flatworm



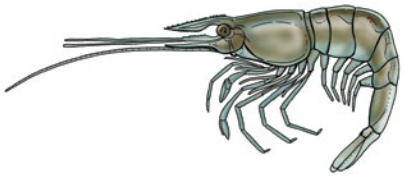


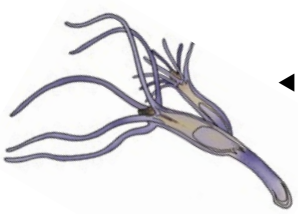
▲ Fly Larvae & Pupa ▶



▼ Freshwater Worm

▼ Freshwater Shrimp



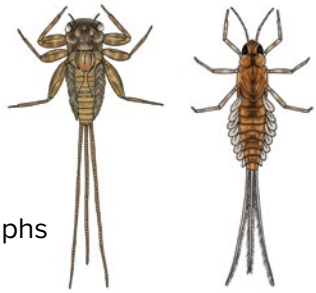


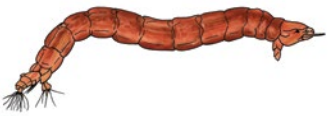
◀ Hydra

▼ Leech

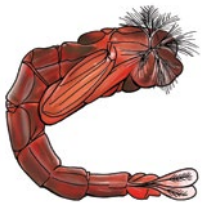
▲ Mosquito Larvae & Pupa ▼

▶ Mayfly Nymphs

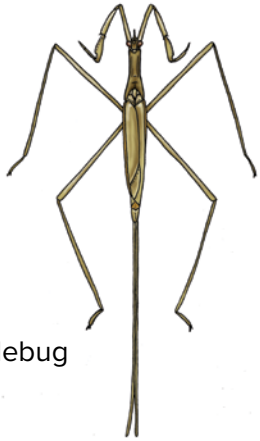




▲ Midge Larvae & Pupa ▼

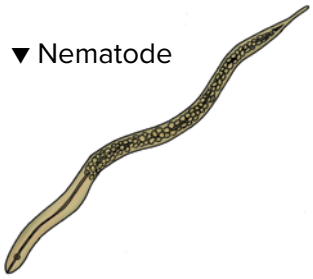


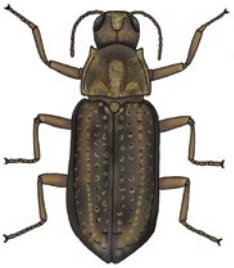
▶ Mussel



▶ Needlebug

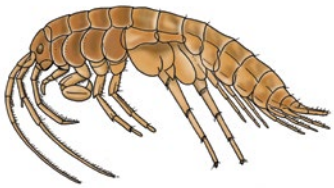
▼ Nematode





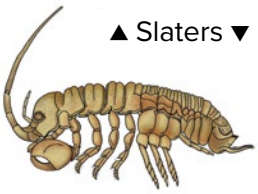
▲ Riffle Beetle & Larvae ▲

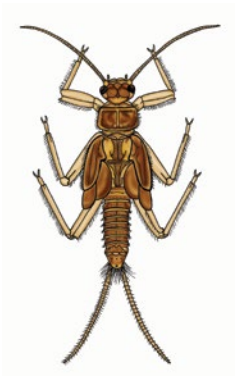
▼ Sandhopper



▲ Snail

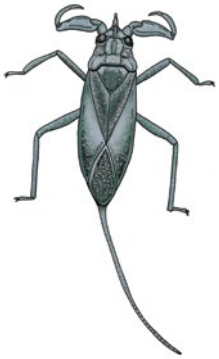
▲ Slaters ▼



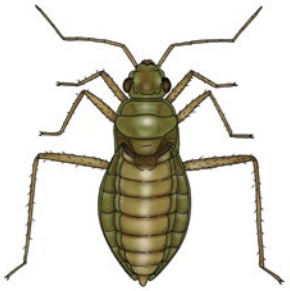


▲ Stonefly Nymph

▼ Water Scorpion



▼ Water Treader

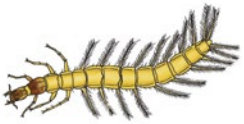


▼ Water Boatmen

▼ Water Strider

▼ Water Mite

▲ Whirligig Beetle & Larvae ▼



APPENDIX 4

Additional resources

The following information references some suitable resources that could be used in a classroom or as part of an excursion activity. There are also resources for learning more about waterbugs and purchasing equipment to run your waterbug surveys.

Melbourne Water
www.melbournewater.com.au/community-and-education/education

River Detectives
www.riverdetectives.net.au

Waterwatch Victoria
www.vic.waterwatch.org.au

NSW Waterwatch
www.nswwaterwatch.org.au

ACT Waterwatch
www.act.waterwatch.org.au

NRM Education: Macroinvertebrates
www.naturalresources.sa.gov.au/adelaidemtloftyranges/education/for-educators/plants-and-animals/freshwater-environments

The Waterbug Company
www.thewaterbug.net

The Waterbug Shop
www.thewaterbugshop.com.au

NATIONAL

Waterbug Blitz

Photo: K.Coleman/PeeKdesigns

For more information

www.waterbugblitz.org.au

info@waterbugblitz.org.au