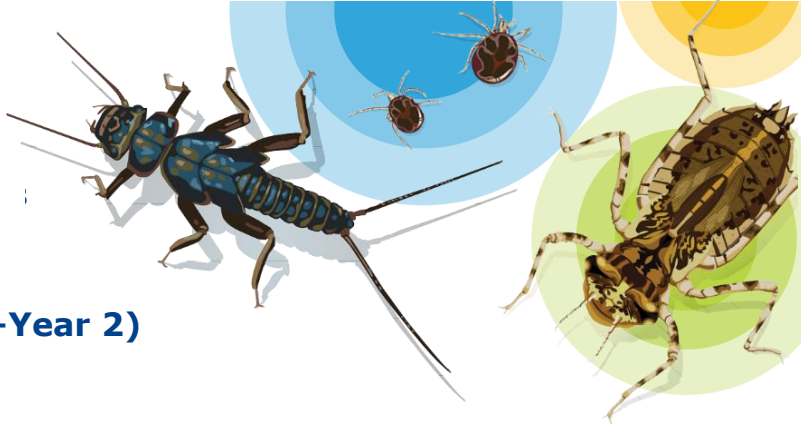


WATERWATCH

| Meet the waterbugs (Foundation–Year 2)

Lesson sequence

Introduction

The presence of waterbugs (aquatic macroinvertebrates) in a waterway tells us a lot about water quality.

This lesson sequence focuses on developing an understanding of waterbugs and how they live. There is a strong focus on working scientifically as students make observations and identify the key features and characteristics of waterbugs. Scientists observe these animals to learn about where they live, their anatomy and what they need to survive. The types of gills they have, the food they eat and the places they live all contribute to waterbugs' survival. Students, as citizen scientists, can begin to understand the role scientists play in monitoring animals in our environment.

Victorian Curriculum F–2[1] links:

Science

Foundation – Level 2

Science Understanding

Science as a Human Endeavour

People use science in their daily lives (VCSSU041)

Biological sciences

Living things have a variety of external features and live in different places where their basic needs, including food, water and shelter, are met (VCSSU042)

Living things grow, change and have offspring similar to themselves (VCSSU043)

Activity 1: What are waterbugs?

Students explore the features of waterbugs and where they live.

Activity 2: Hunting waterbugs

Students investigate the features and behaviour of waterbugs found in a local waterway.

Activity 3: How do waterbugs live?

Students discuss what they found out about the waterbugs and explore how waterbugs live.

Activity 4: Where are the waterbugs?

Students explore a scenario about a river then play a game to discover why the waterbugs are disappearing.

 Victorian Curriculum and Assessment Authority (VCAA) <victoriancurriculum.vcaa.vic.edu.au/> 8 January 2019.

WATERWATCH | Meet the waterbugs (Foundation–Year 2)

Activity 1: What are waterbugs?

Students discover the features of waterbugs and where they can be found.

Equipment

Meet the waterbugs (Resource 1)

Predict Observe Explain chart (Resource 2)

Scope: Waterbugs video <www.youtube.com/watch?v=ufUrn0_mmGo> [3:13] This video explains how waterbugs can be used to monitor the levels of pollution in waterways. It also covers waterbug adaptations including how they breathe and hunt.

Digital projector for class display

An image of a local waterway

A sampling net, bucket and gloves

Images of waterbugs

Preparation

Take a photo or find images online of a local waterway (river, creek, lake, pond or dam) that the students are likely to know.

Activity steps

Ask students to think about a river, creek, lake, pond or dam that they visit. Ask for some examples. What types of activities do they do there?

Read *Meet the waterbugs* (Resource 1).

Ask students to imagine they are scientists. Ask: Where would you look for the waterbugs seen in the book? How would you find them? How would you collect them (to count and observe them)?

> Waterbugs are also known as **aquatic macroinvertebrates**. They include a range of different animals like insects, worms, snails, beetles and crustaceans.

Discuss whether they see animals when they visit these places (rivers, creeks, lakes, ponds and dams). Ask them to describe the types of animals they see. Have they ever seen waterbugs there? Waterbugs, or aquatic macroinvertebrates, are animals that live in our waterways. They are tiny creatures and a lot of other animals eat them. Ask students if they can think of any animals in and around the waterway that macroinvertebrates need to hide from (e.g. platypus, frogs, fish, birds, other waterbugs).

Display an image of a local waterway (photograph or online image). Ask students to describe what they can see. Ask them to offer ideas about which features in the image can provide habitat for different animals. For example:

- Trees provide habitat for birds.
- Water provides habitat for fish.
- The reeds provide habitat for waterbugs.

- The water and banks provide habitat for platypus.
- The water and logs provide habitat for frogs.
- The grass provides habitat and food for kangaroos.

Ask students if they can tell if the waterway in the image is healthy. Is the water clean? Are there trees and other plants? Would there be oxygen? Explain that we can't always see pollution. However, macroinvertebrates can be used as an indicator – some species cannot tolerate pollution so their presence (or absence) can tell us how healthy the waterway is. So one of the ways we can tell if a river or creek is healthy is to find out what is living in the water.

Finding waterbugs

Explain the process of finding waterbugs by watching the *Scope: waterbugs* video.

Explain that waterbugs can tell us how healthy our creek or river is. In a healthy waterway, we are firstly looking for lots of waterbugs and then lots of different types of waterbugs.

Where do waterbugs live?

Display the image of a local waterway again and, referring to the *Scope: waterbugs* video, ask:

a) In what part of the river do you think we might find waterbugs? Ask students to point to the places they might be found on the image.

- Some live on the edges.
- Some live in the mud at the bottom.
- Some live in the plants.
- Some live on rocks in the water.

b) What features of the river would help waterbugs live there?

- where they can find food and/or air
- where there are pools of slow flowing water, where they can cling to rocks (for some waterbugs)
- where there is a fast flow of water (for other waterbugs)
- clean water
- where they can hide to avoid being eaten.

Explain that our waterbugs have different features that can help them survive in different parts in the river. Explain they are very small and we need to look very carefully with our eyes to see their different features.

Show students some images of waterbugs or refer to *Meet the waterbugs* (Resource 1). As you show each waterbug image, discuss:

- What features can you see?
- What colour is the animal?

- How many legs does it have?
- Where does it live in a waterway?
- Ask students if they have seen any of these waterbugs before.

Explain that in the next lesson, students will practise their observation skills by looking at and discussing the waterbugs' features such as shape, colour, number of legs, etc. Observation is a skill that scientists use as part of their work and, in the next lesson, students will put their observations skills to the test!

Year 2 students can fill in the Predict column of their *Predict Observe Explain* (POE) chart (Resource 2). Students can predict (by drawing or writing) what they think they will see when the real waterbugs arrive.

Useful resources

Waterwatch Program
<www.melbournewater.com.au/community-and-education/waterwatch-program>
Melbourne Water's Waterwatch Program supports people to get involved in exploring and protecting their local waterways through the Frog Census, Platypus Census, Waterbug Census or becoming a water quality testing volunteer. In addition, schools can apply to participate in the River Detectives program.

The program also provides keen citizen scientists with training and tools to become involved in monitoring the health of our waterways. Data collected contributes to scientific research, management planning and on ground actions that improve the health of our waterways.

You can become involved by joining a Waterwatch group, attending one of their events, using the citizen science apps or downloading resources to learn more about your local waterway.

Waterbug Census
<www.melbournewater.com.au/community-and-education/waterwatch-program/waterbug-census>
Waterbugs (macroinvertebrates) are very useful biological indicators and students can join other citizen scientists in monitoring waterbugs in Melbourne Water's Waterbug Census. This data is important for ongoing research and water management.

River Detectives
<www.riverdetectives.net.au/>
The River Detectives sustainability program supports educators in schools and youth community programs to explore their local waterways with students. Some activities include monitoring waterways for waterbugs, collecting samples, recording findings and compiling data.

As part of the program, your group will receive a water monitoring kit (on loan), invitations to training sessions and access to more activities, resources and an interactive data recording portal. Application open towards the end of Term 4.

Healthy Waterways, Waterways Program Handbook
<www.melbournewater.com.au/media/425/download>

WATERWATCH | Meet the waterbugs (Foundation–Year 2)

Complete Waterways Training document, including safety information, macroinvertebrate identification and data forms.

Waterbug Census: discovering the world of waterbugs brochure
<www.melbournewater.com.au/media/442/download>
This brochure provides readily accessible graphics to introduce waterbugs to students. It includes a map of the Waterbug Census sites across Melbourne, a diagram of the main types of waterbugs including their feeding strategies and a 'waterbug profile' diagram.

A beginners guide to waterbug identification
<www.melbournewater.com.au/media/117/download>
This guide assists students to identify the more common waterbugs found in the Melbourne area. It also provides information about the taxonomy of the waterbugs, their anatomy, distribution, diet and sensitivity to pollution.

The waterbug app
<thewaterbugapp.com/>
The waterbug app is a very useful tool for identifying and uploading waterbug data. Students can identify waterbugs using a dichotomous key with engaging cartoon diagrams to explain structural features.

River health and monitoring
<www.melbournewater.com.au/water/health-and-monitoring/river-health-and-monitoring>
Melbourne Water monitors rivers and creeks so they know if their condition changes or if the improvement programs need adjusting. Learn how Melbourne Water assesses river health and views current data.

Other information includes: indicators of river health, the health of Melbourne's waterways, and key waterway values.

Know your river booklets
Know your river - Werribee River
Know your river - Yarra River
Know your river - Maribyrnong River
Know your river - Dandenong Creek
Know your river - Bass River
The booklets provide valuable teacher background information about the history, geography and wildlife of the Werribee River, Yarra River, Maribyrnong River, Dandenong Creek and Bass River.

Melbourne's Living Museum of the West Inc.
<https://www.livingmuseum.org.au/>
Melbourne's Living Museum of the West is a community Museum which actively involves the people of Melbourne's West and others in documenting, preserving and interpreting the richness and depth of the region's social, industrial and environmental history.

Melbourne Water – Melbourne's Water Story
<http://www.waterstory.melbournewater.com.au/>Melbourne's Water Story is an interactive timeline that explores significant milestones that have helped shape the city of Melbourne.

WATERWATCH | Meet the waterbugs (Foundation–Year 2)

Activity 2: Hunting waterbugs

In this activity, students investigate real waterbugs and observe their different features in the classroom.

Equipment

For the teacher:

Teacher guide: Running a waterbug session with students <https://www.melbournewater.com.au/media/8431/download>

Bug sampling equipment: Net, bucket and gloves

Digital microscope and plastic petri dishes (if possible)

Digital projector for class display

Waterbug sample

Predict Observe Explain chart (Resource 2)

For each group:

As per the equipment list in the *Teacher guide: Running a waterbug session with students* (page 7). Provide magnifying lamps with LED lights or a digital microscope (10X magnification) and laptop, if available.

Preparation

Refer to the *Teacher guide: Running a waterbug session with students* (pages 2–6) for detailed instructions on how to sample for waterbugs. The *Waterbug identification in the classroom* section (page 5) provides additional advice.

Ensure that you comply with your school's risk assessment procedures when collecting the sample. Take someone with you when you collect the sample.

Activity steps

Collecting the sample

1. Review what students learned about waterbugs in Activity 1. Explain that in this activity, they are going to hunt for some real waterbugs. Explain how you collected the waterbugs using gestures to show how you did it e.g. you put some water into a bucket (mime scooping water into the bucket) and used a net to scoop through the water. By sweeping the net through the water and in amongst plants and through the mud at the bottom, you caught some of the animals that live there in your net. Then, you emptied all the things from your net into a bucket. Ask: Do you think I caught an eel and a platypus in my net? (No!)

Observing waterbugs

2. Follow the *Waterbug identification and data collection activity* instructions in the *Teacher guide: Running a waterbug session with students* (pages 8–9) Divide students into groups and look for waterbugs for around ten minutes. Assist students to find, identify and observe the different features of waterbugs in the samples, such as:

- number of legs (e. g. waterbugs with six legs are insects)
- colour
- movement
- shape
- size.

Students in Year 2 could spend longer on this activity and they may also like to draw their waterbugs or make notes. They fill in the Observe column of the *Predict Observe Explain* chart (Resource 2). They can draw what they see, discuss what they see or write notes about what they see.

Findings

3. Students spend a minute thinking about their waterbug observations, then pair and share with someone from a different group and discuss what they found. Discuss any surprising waterbugs and their features.

Useful resources

See Activity 1.

WATERWATCH | Meet the waterbugs (Foundation–Year 2)

Activity 3: How do waterbugs live?

In this activity, students share what they found out about the waterbugs and explore how waterbugs live.

Equipment

Predict Observe Explain chart (Resource 2)

Waterbug cards (Resource 3)

Melbourne Water colouring sheets and activity sheets <www.melbournewater.com.au/community-and-education/waterwatch-program/waterwatch-resources-teachers-and-community/waterwatch>

A beginners guide to waterbug identification <www.melbournewater.com.au/media/117/download> for class display

Playdough

Craft material

Natural materials such as rocks, feathers, sticks etc.

Activity steps

Waterbug features

1. As a class, ask students to review the features of waterbugs they found in the sample:
    - size (tiny, small)
    - movement (slow, fast, backwards, above the water)
    - shape (spiky, round, long, curly, flat)
    - if they had legs, wings or a shell
2. Identify a few common waterbugs using observed features. The *Waterbug cards* (Resource 3) can be used for this. For example:
    - Freshwater snails – slow moving, have a shell, small
    - Cased caddisfly larvae – live inside a case, have long legs protruding from its case
    - Damselfly nymph – six legs, three tails (gills), move quickly
    - Freshwater shrimp – move quickly, have a lot of legs, are transparent, large in size
    - Backswimmers – strong swimming legs
    - Dragonflies – large eyes

Waterbug sensitivity

3. Using A beginners guide to waterbug identification, work with students to identify the habitat requirements of the common waterbugs listed above. Page 3 of *A*

beginners guide to waterbug identification explains the habitat icons used throughout the guide.

4. The guide also explains that there is likely to be some kind of waterbug in almost any aquatic environment (page 3). Healthy waterways tend to have more different types of waterbugs than polluted waterways. The lower the SIGNAL score, the more likely the waterbug is to tolerate pollution. Again, using A beginners guide to waterbug identification, work with students to find the SIGNAL scores of the common waterbugs listed above. Which waterbugs would you find in a polluted waterway? Which would you find in a healthy waterway?
5. Year 2 students can complete their *Predict Observe Explain* chart (Resource 2).

Waterbug creations

6. Using the Melbourne Water colouring sheet and activity sheets, students draw the waterbug in its own environment – including water, plants, rocks, trees and other features.
7. Students use play dough, craft materials and/or natural materials such as rocks, feathers and sticks to make their own waterbug, emphasising its 'super power' e.g. hard shell, wings, hairy legs to help it swim, walk on water etc.
8. Students discuss and compare their ideas and creations with each other.

Call to action

9. Ask students to think about how they and the community can also help our waterbugs to survive in rivers and creeks such as keeping litter out of waterways, picking up after your dog, recycling and replanting trees.
10. Conclude by emphasising the key messages about waterbugs in our waterways:
    - Our waterways are home for a range of animals including waterbugs.
    - Waterbugs are an important food source for platypus, fish and frogs. They are very sensitive to changes in the environment and are a good indicator of waterway health. Healthy waterways have a variety of habitats – logs, stones, plants, etc.
    - Everyone can help improve our local rivers and creeks by reducing stormwater pollution and litter – simple things like picking up after your dog, binning rubbish and fixing oil leaks in your car can reduce the impacts.

Useful resources

See Activity 1.

Activity 4: Where are the waterbugs?

In this activity, students explore a scenario and discover why waterbugs are disappearing.

Equipment

The Melbourne River scenario (based on life in a fictional Melbourne river) (Resource 4)

Macroinvertebrate mayhem game (Resource 5)

The waterbug app <https://thewaterbugapp.com/>

Activity steps

The situation

1. As a class, read the scenario *The Melbourne River scenario* (Resource 4). Ask students to listen or read carefully and emphasise or take note when a platypus and the different species of waterbugs are mentioned.

   Discuss:

   - What happened to make the mayfly nymphs and stonefly nymphs leave?
   - What happened to make the dragonfly larvae and damselfly larvae leave?
   - Where did the pond snails come from? (Introduced species)
   - What sorts of waterbugs were in the river when the factories were polluting the river?
   - What happened to make the platypus disappear?
   - What happened to bring the sensitive species back?
   - How might we bring the platypus back?

2. Outline the rules for the *Macroinvertebrate mayhem game* (Resource 5). This game gives students an understanding of how hard it is for platypus and certain species of waterbugs to survive in a polluted waterway.
3. Discuss why some of the species were more easily caught than others.

Further activity

Using *The waterbug app*, discover the waterbugs in your local waterway as a school group or family outing.

Key messages

- Our waterways are home for a range of animals including waterbugs.
- Waterbugs are an important food source for platypus, fish and frogs. They are very sensitive to changes in the environment and are a good indicator of waterway health.
- Everyone can help improve our local rivers and creeks by reducing stormwater pollution and litter – simple things like picking up after your dog, binning rubbish and fixing oil leaks in your car can reduce the impacts.

Resource 1 Meet the waterbugs[2]

Dragonfly larva

I am a dragonfly larva

I live in the reeds

You can find me in rivers

Where the platypus feeds

Amphipod

Still and slow-moving water is where I like to be

I have seven pairs of walking legs that you can see

My colours are green, grey, red or blue

Decaying vegetation is my favourite food

[2] All images © Copyright Amy Piesse 2007

Backswimmer

I like to hunt and eat tiny crustaceans

As a nymph, I have large red eyes for sight

I swim upside down but fly upside up

Be careful of me – I can bite!

Beetle

I am tolerant to pollution

So you'll find beetles everywhere

I keep an air bubble under my wing covers

Trapped with special hairs

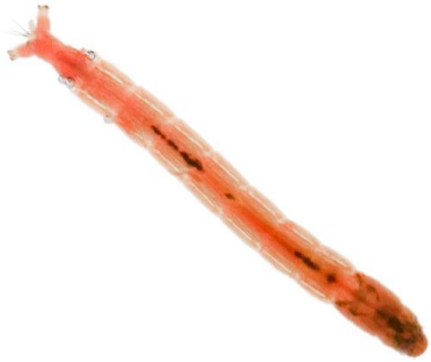
Bloodworm

I move like a coil

And live almost anywhere wet

I grow up to look like a mozzie

But I've not bitten anyone yet.



Caddisfly larva

The water of my home needs to be a really clean place

I spend most of my life as larva in a case

Most of my life is spent in the water

As an adult my lifetime is shorter

Damselfly larva

I start as an egg and end up with wings

I like to eat flies, midges and other small things

As platypus forage for food, it's me they eat

It's part of the food web and I probably taste sweet!

Flatworm

Under a rock is where you'll find me

I move slowly by gliding as you will see

If I'm cut in half, I can become two flatworms

I lay my eggs in a leathery cocoon that's firm

Freshwater snail

I came to Australia from the USA

I am a fish tank stowaway!

Living in Aussie rivers can't be beat

I use my rows of tiny teeth to scrape slime to eat.

Leech

Some leeches suck on the blood of frogs, birds or fishes

Some just engulf snails, worms or midges

A water tiger might eat us, but in a drought

We can burrow in mud until there's water about.

Mayfly nymph

My habitat needs to be very clean

I live under logs where I can't be seen

I have a claw on the end of each leg

I only live a short time with wings and start as an egg.

Stonefly nymph

My home is a stream where it's clean and cool

A stonefly's eggs stick to the bottom of the water pool

I look similar to what I become as an adult

But will grow wings after I moult.

Water boatman

I am common at the edge of a wide river or lake

Swimming in water is a piece of cake

Strong hairs on my legs in the water ripple

Moving like a rowboat I love a pool, but dodge a riffle.

Water mite

I like shallow slow flowing water that's fresh

I have a round body and eight small legs

If something eats me they'll get a fright

A bad taste will come from a water mite.

Water treader

I can feel my prey by vibrations on the water surface

Hairs on the tips of my legs serve a purpose

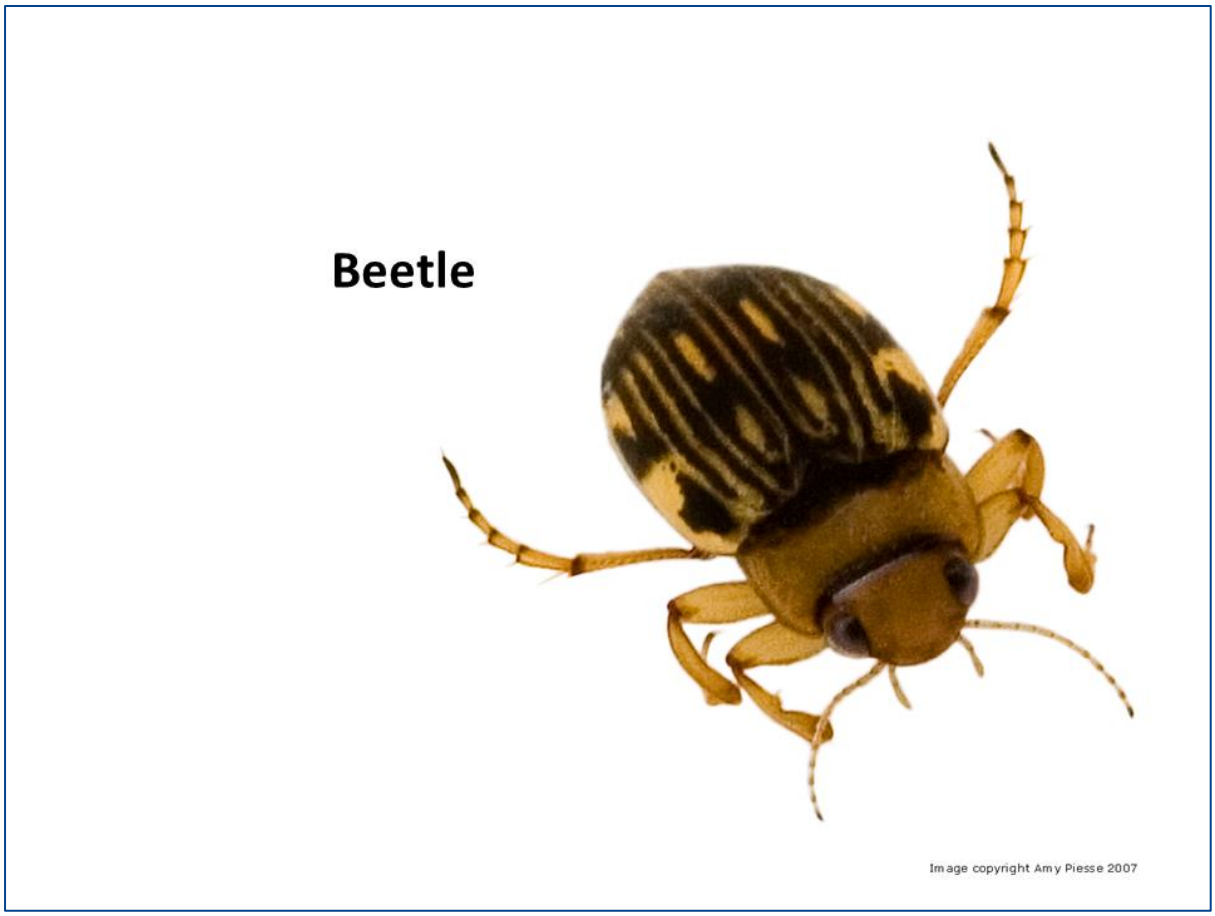
They help me and my friends walk on water all day

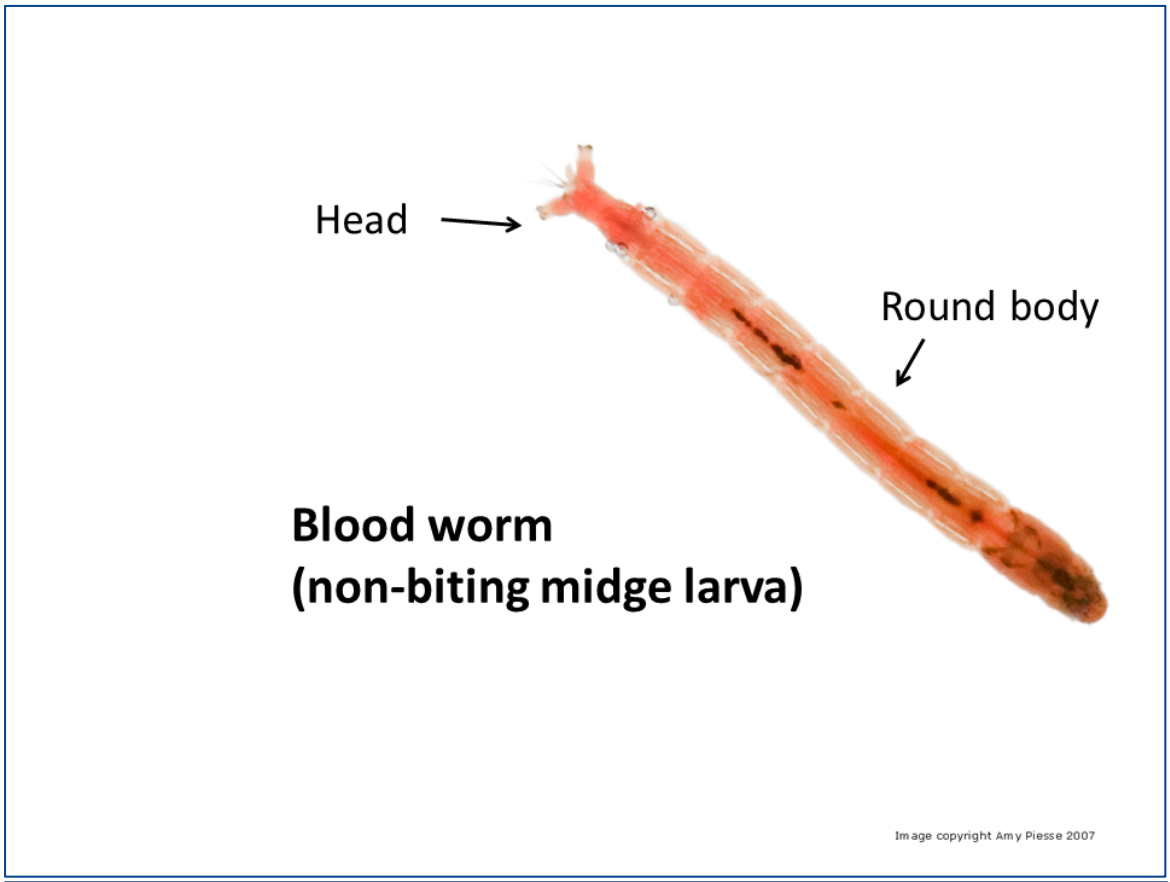
Eating bugs that fall our way

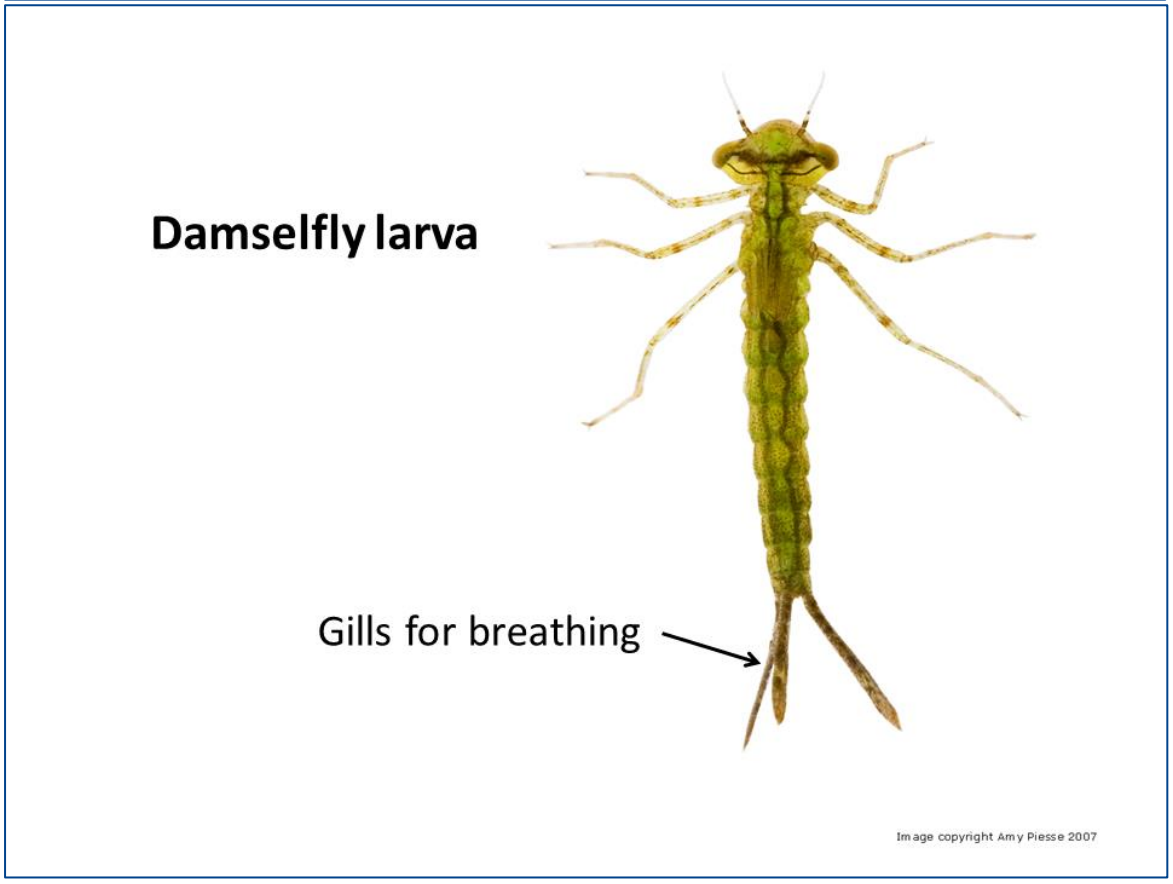
Resource 2 Predict Observe Explain chart

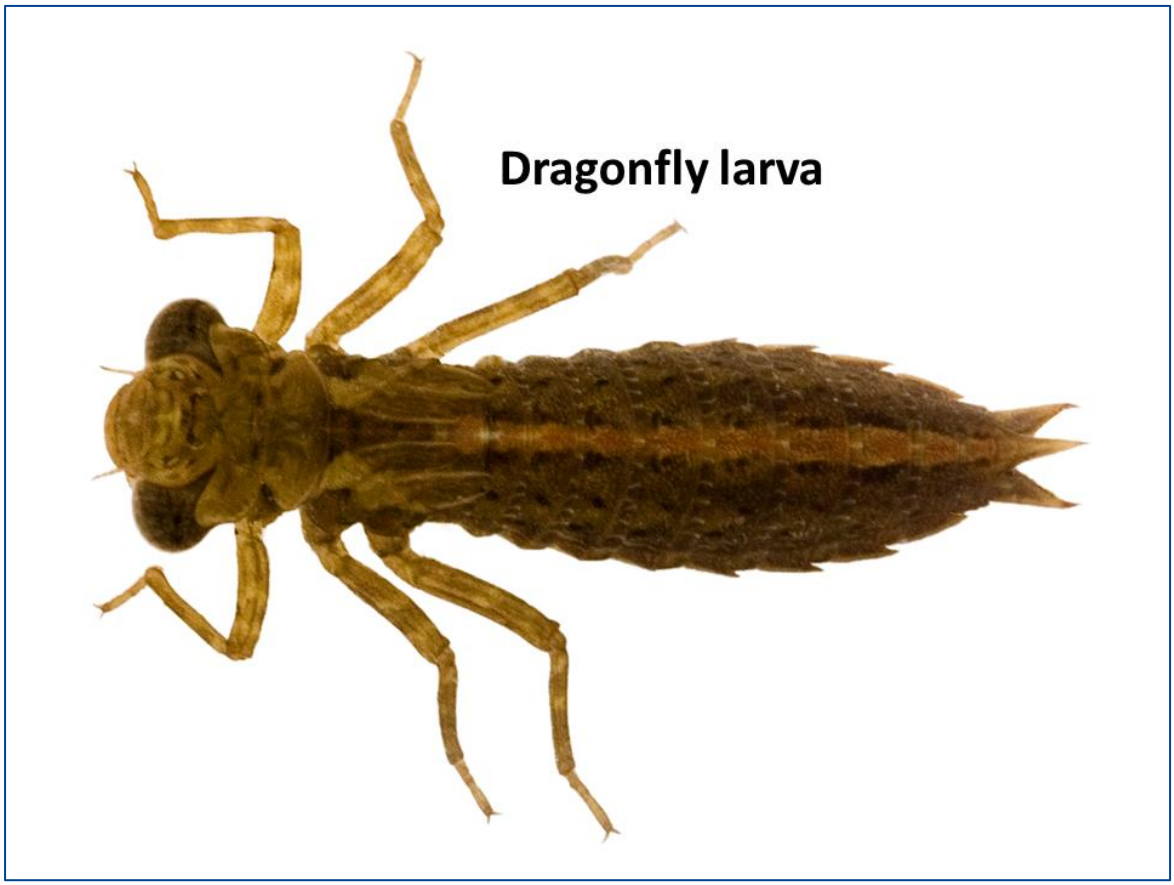
Predict	**Observe**	**Explain**
What do you think the real waterbugs will look like? How big will they be? Draw or write your prediction.	Draw the waterbugs you saw or write some notes about the waterbugs you saw. How did they move? What colour were they? What did they look like?	Explain with words or drawings where the waterbugs live in the waterway.

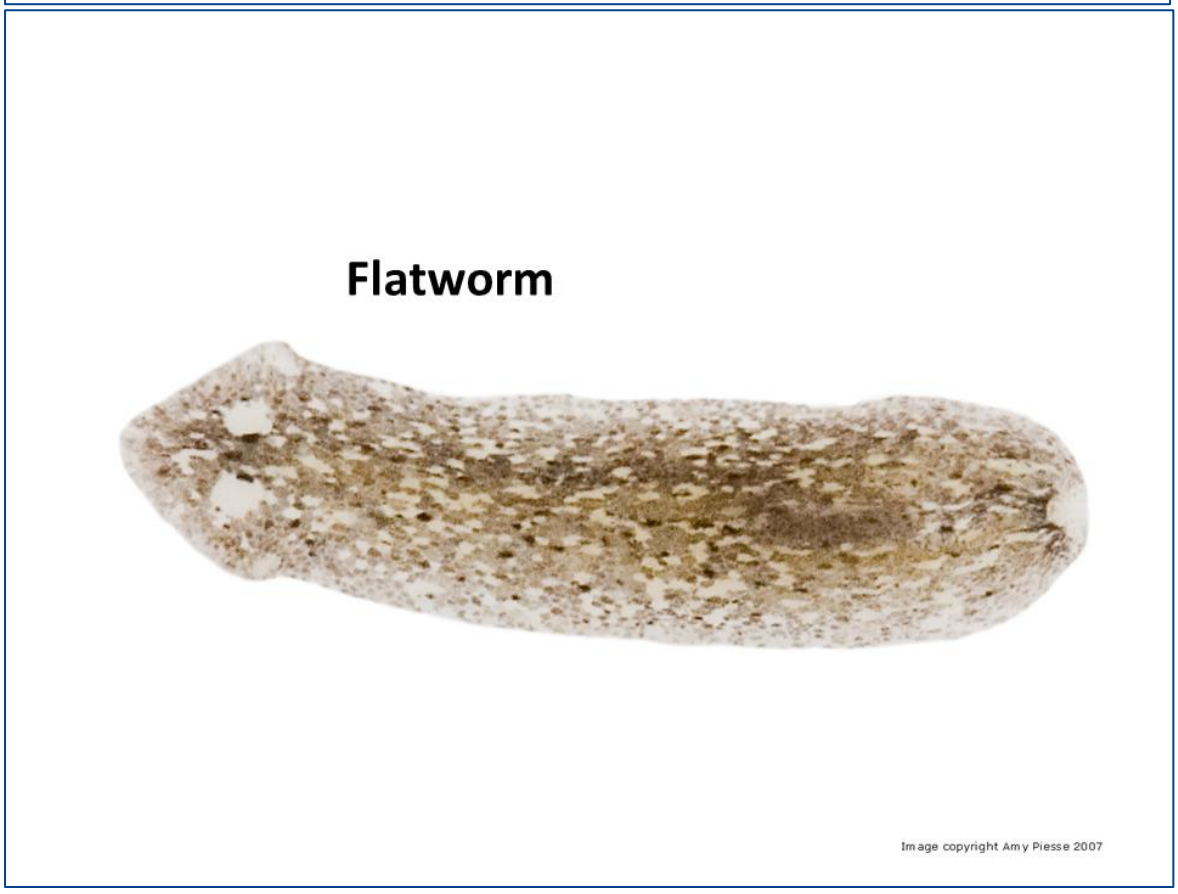
Resource 3 Waterbug cards

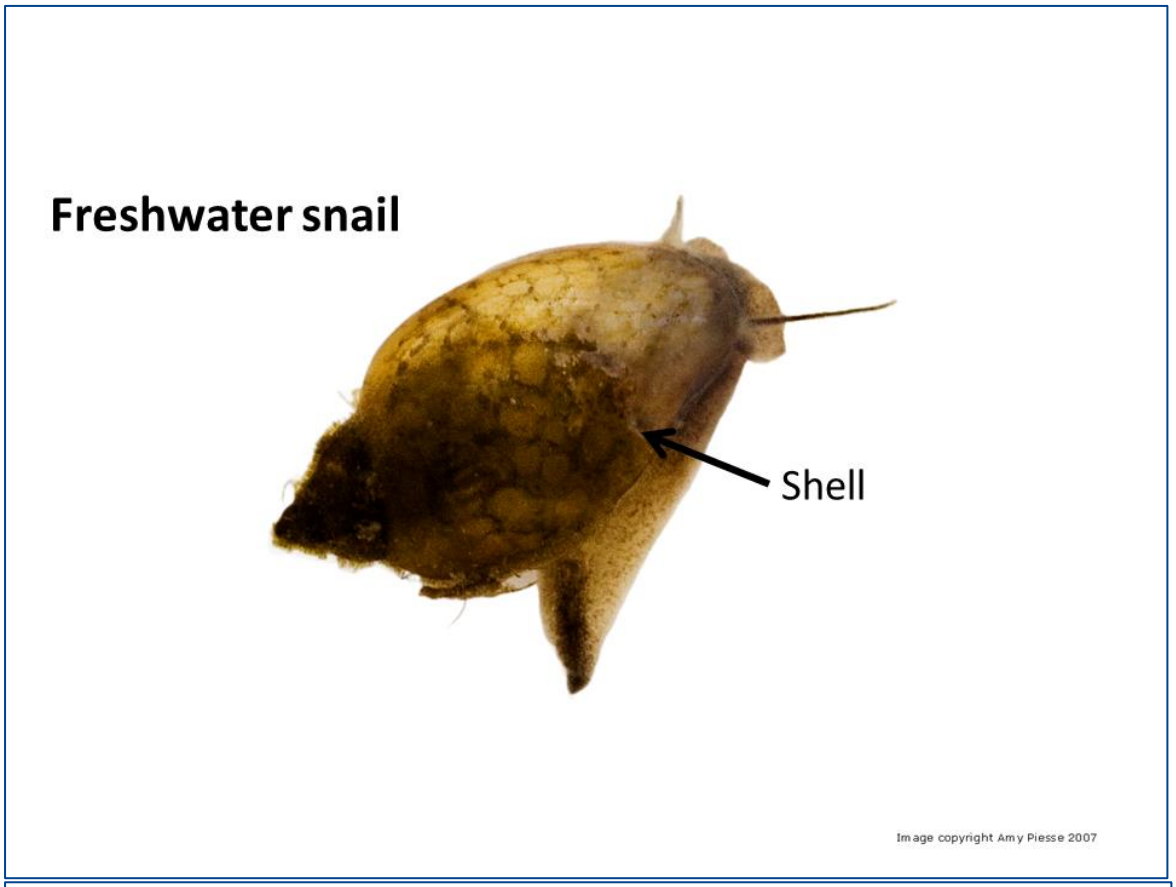


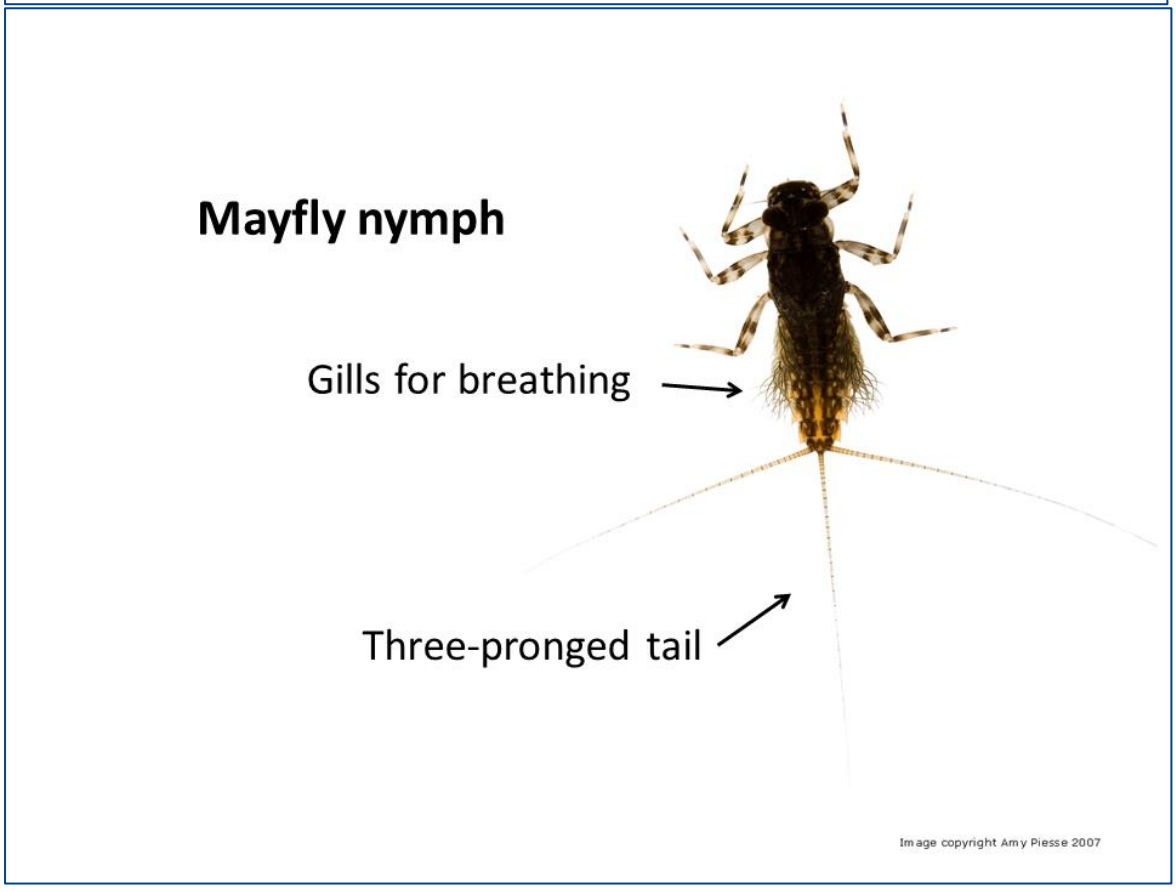

Head
Round body
Blood worm
(non-biting midge larva)
Image copyright Amy Piesse 2007


Damselfly larva
Gills for breathing
Image copyright Amy Piesse 2007


Dragonfly larva


Flatworm
Image copyright Amy Piesse 2007


Freshwater snail
Shell
Image copyright Amy Piesse 2007


Mayfly nymph
Gills for breathing
Three-pronged tail
Image copyright Amy Piesse 2007

Resource 4 The Melbourne River scenario

This story describes the history of a fictional river that starts on the western outskirts of Melbourne and explains the changes that occurred over time in a number of rivers and urban streams in this area.

Using historical knowledge, you could tailor the scenario for your local river to demonstrate the impacts that urbanisation has on the health of your river.

The Melbourne River starts in the hills, flows through farmland and the suburbs, through the city and out to Port Phillip Bay where it meets the ocean.

Every day for thousands of years, families of the Wurundjeri People came to the river to collect water to drink. The river was cool and fresh. The river provided food and was an important place for ceremonies. The Wurundjeri People saw platypus, fish and eels and listened to the frogs. They collected water from the top layer of the river so it was clean to drink. When they looked closely at the river surface and in the water, they found caddisfly larvae, dragonfly larvae, damselfly larvae, stonefly nymphs, mayfly nymphs, water boatmen, backswimmers, amphipods and leeches.

In the mid-1830s, Europeans arrived in the Melbourne area and thought it was a good place to settle. More and more people followed and that was the beginning of the city we now call Melbourne.

By 1840, farmers settled much of the land next to the Melbourne River. They found the river to be a reliable source of water for their sheep.

During the 1850s, people came from many places to find gold. They travelled through Melbourne to the goldfields in Ballarat and Bendigo and camped along the river on their way. The children liked to scoop up the tiny creatures in the water to see what they could find. They saw lots of backswimmers, amphipods, leeches, mosquito larvae and dragonflies but it was a surprise to find a caddisfly larvae. They played platypus 'I spy' and were thrilled when they saw the head of a platypus.

During the 1860s and 1870s, factories were built along the river. These included places produced meat, made soap and candles out of animal fat and had a place that washed wool from sheep. All of the dirty wastewater from these factories ran into the river. Sometimes the river flooded and homes and businesses went under water.

People also poured household sewage (wastewater from the bath, toilet and buckets) into the river. This was before we had a network of sewerage pipes. Consequently, the river became highly polluted and only the very tolerant waterbugs like flatworms and backswimmers were found. Platypus could not live there anymore. The river earned the nickname 'Stinkopolis' because it smelt terrible!

During the 1890s and early 1900s, people enjoyed fishing and picnicking along cleaner parts of the river. They explored the waterways but they didn't see platypus very often. Following a public health crisis, the Melbourne and Metropolitan Board of Works was formed. Their job was to manage the drinking water supply system and to build a sewerage system to take away wastewater.

Twenty years later, engineers reshaped the waterways to control the flooding. They built bluestone banks and diverted the floodwater. A wetland next to the river was drained to make way for houses. Even the flatworms and backswimmers disappeared and the platypus had to find somewhere else to live.

Life on the river continued like this for some time until the 1970s when people started to realise how important the river and their natural environment was. A law stated that waste from industry now had to be treated before being released into the environment, ensuring that our waterways are protected for future generations.

In the 1980s and 90s, the factories and warehouses that used to send their waste water into the river were converted into apartments, houses, cafes and restaurants. People liked to walk and jog along the river paths. They took family bike rides. Most talked about seeing a platypus but it had been many years since platypus lived in the river here. Every so often, someone saw a dragonfly or damselfly.

Now, we have community groups, councils and government agencies who look after the river. Friends groups and Melbourne Water create healthy waterways with help from the community. Traditional Owners work with these people to help bring life back to the river.

The people who live along the river feel very lucky to call it home. They participate in rubbish clean-up days and tree planting days. They help Melbourne Water to identify frogs around the river. They pick up their dog's poo when they're out walking. They understand that hair ties and rubber bands can be fatal to platypuses so they collect these when they find them.

A local school group participates in the River Detectives program and tests the water quality, including identifying the waterbugs that live in the river. They find caddisfly larvae, dragonfly larvae, damselfly larvae, stonefly nymphs, mayfly nymphs, water boatmen, backswimmers, amphipods and leeches. They also use an app called PlatypusSPOT to see if they can find platypus in the river. They haven't found one yet but they will keep looking.

Resource 5 Macroinvertebrate mayhem game[3]

Students form groups and play a game that simulates changes in a stream when an environmental stressor, such as a pollutant, is introduced. This can be played on a large oval, basketball court or other open area.

Groups:

- Platypus
- Caddisfly larvae
- Dragonfly larvae and damselfly larvae
- Stonefly nymph
- Mayfly nymph
- Flatworms and backswimmers
- Amphipods and leeches

One or two students:

- Act as an environmental stressor (e.g. pollution, sedimentation, sewage or factory waste)

1. Divide the class (apart from the one or two students acting as the environmental stressors) into seven groups. Each group represents one of the above macroinvertebrate species, or a platypus.
2. Create name stickers for each group.
3. Inform students that some macroinvertebrates have hindrances to crossing the field (see table below). These obstacles symbolise very sensitive organisms' intolerance to pollutants. Ask the students with these labels to practice their motions.
4. Assemble the macroinvertebrate groups at one end of the oval and the environmental stressors in the middle of the oval. When a round starts, macroinvertebrates will move toward the opposite end of the oval and the stressor will try to tag them. To "survive", the macroinvertebrates must reach the opposite end of the oval without being tagged by the environmental stressor. The environmental stressor can try to tag any of the macroinvertebrates, but will find it easier to catch those with hindered movements.
5. Begin the first round of the game. Once tagged, macroinvertebrates must go to the sidelines. They can remain there or join the other more tolerant species groups (and put on a new sticker name tag, e.g. flatworms and backswimmers).
6. The round ends when all of the macroinvertebrates have either been tagged or have reached the opposite end of the playing field.

[3] Used with permission, *Cascadia Conservation District* *www.kidsinthecreek.com/wp-content/uploads/2012/06/macroinvertebrate_mayhem.pdf* *Accessed 4 May 2019*

7. Complete two more rounds, with all tagged players re-joining the macroinvertebrates who successfully survived the previous round.
8. Record, or simply draw students' attention to, the number of tolerant species who "survived" compared to the number of sensitive species who "survived".

Organism	Hindrance	Rationale for hindrance
Caddisfly	Must place both feet together and hop across the field, stopping to gasp for breath every five hops.	Caddisflies are intolerant of low oxygen levels. They build cases and attach themselves to rocks for protection and stabilisation.
Stonefly	Must do a push up every ten steps.	When oxygen levels drop, stoneflies undulate their abdomens to increase the flow of water over their bodies.
Mayfly	Must flap arms and spin in circles when crossing the oval.	Mayflies often increase oxygen absorption by moving their gills.
Platypus	Must bend down and touch the ground with one hand every five steps.	Platypus constantly forage for food and require an abundant supply of macroinvertebrates.