

# NOW and THEN

WATERWATCH  
Corangamite



A collection of some aquatic larval and adult invertebrates that depend on Victorian rivers

WATERWATCH  
Victoria

CORANGAMITE CMA

CENTRAL  
HIGHLANDS  
WATER

Barwon Water

State Government  
Victoria

## **Acknowledgments**

Corangamite Waterwatch has facilitated the production of this resource in 2006.

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Continuing inspiration: John Hawking, Lynette Smith and Kathy Le Busque

(Murray Darling Freshwater Research Centre).

### **Special mention:**

The exceptional patience and talent of Christine Walsh, has meant that all invertebrates featured in this resource were captured, photographed in the field, and then released live back into their habitat.

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### **Disclaimer**

This resource may be of assistance to you but Corangamite Waterwatch and Christine Walsh, do not guarantee that the publication is without error and therefore disclaim all liability for any unfortunate consequence that may result from the use this material.

All information was sourced from recent freshwater invertebrate reference guides, textbooks and scientific literature.

## Why monitor invertebrates?

Aquatic invertebrates aren't just interesting to look at; they are an important indicator of a waterway's health. These invertebrates depend on freshwater for all or part of their life cycle and are a critical part of food webs within and around fresh waterways.

Because they cannot easily escape pollution, the presence/absence and numbers of different invertebrate groups within waterways can give us clues about how healthy a waterway is. A healthy waterway will have many different types of invertebrates (including sensitive groups) present and abundant.

### Sensitivity Groupings

Coloured strips feature along the edge of aquatic juvenile and aquatic adult invertebrate cards. Four colours represent the relative sensitivities of different invertebrates to water quality degradation and other human impacts on rivers.

No coloured strip is included on cards of terrestrial adults or micro invertebrates (ie Cladoceran/Water Fleas).

Very sensitive invertebrates (blue strip) are usually only found at healthy stream sites with very favourable conditions (eg. cool, unpolluted, flowing water). Very tolerant invertebrates (red strip) survive and are often abundant in difficult conditions (eg. warm, still water with high nutrients).

This relative colour rating was developed to summarise the SIGNAL 2 (Order/Class/Phylum biotic index Chessman 2003).

# Suggested uses for the “Now and Then” cards.

## Diversity

Use simple card grouping activities. E.g. how many have no legs? How many are insects? How many groups (Classes or Orders) are represented? How many can fly? Which ones are herbivores? Which ones are ‘very sensitive’ to changes in water quality and habitat?

## Living and non-living survival needs

Students could create a habitat mural of their local stream and the invertebrate cards could then be ‘blue tacked’ on to this mural to reflect the organism’s preferred area of habitation.

See also “Ponding -Activities for your local lake, pond or puddle” produced by the Gould Group\*

## Threats

Which invertebrates would ‘disappear’ if you (for example):

Took away the vegetation within and along the waterways?

Added pollutants to the river, leaving only ‘tolerant’ or ‘very tolerant’ invertebrates?

## Research and report

Do communities of invertebrates in a waterbody change according to the seasons?

How do communities of invertebrates respond to flood events or drought conditions?

How are communities of invertebrates influenced by salinity levels?

Compare communities of invertebrates from rural and urban sections of a river/stream.

Results of seasonal invertebrate sampling and monthly physical/chemical testing will help to determine the response of an aquatic community to environmental conditions.

Students could plan and instigate their own scientific investigation.

## Aquatic food chains

The cards may be used in conjunction with cards created by students, of aquatic producers and top-level consumers present in a river/stream, to construct simple food chains, webs or trophic level pyramids that reflect a typical freshwater ecosystem.

# Suggested uses for the “Now and Then” cards.

## **Aquatic food chain games**

Refer to and adapt some “Outdoor Environmental Games” produced by the Gould Group \*

## **Life cycles**

The cards may be used to pair a juvenile with an appropriate adult form. They may also be sorted into ‘incomplete or complete metamorphosis’ lifecycle groups.

## **Create the ‘Ultimate Invertebrate’**

This activity could involve:

‘The Arts’- providing inspiration for a collage, drawing or box construction.

‘English’- initiating a creative writing task that incorporates survival adaptations “I am King of the Creek, totally invincible!”

## **Drama and dance**

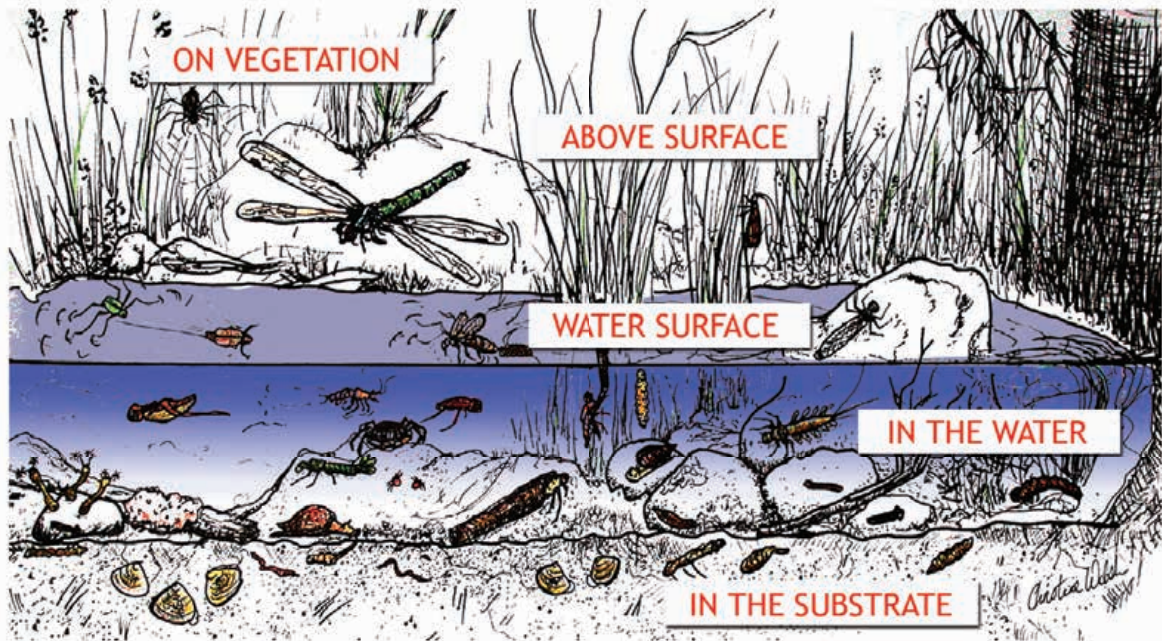
Movement with coloured scarves or other small props, could reflect the way invertebrates move around in a waterbody at different stages of development, or while catching food, avoiding danger, moving in and out of the current, and reacting to a flood event.

## **Observe and count**

Numbers involving trophic groups, most abundant invertebrates, largest invertebrates, and those able to fly etc. can be incorporated in a range of Maths activities.

\* The above-mentioned Gould Group resources are available at [www.gould.edu.au/shop](http://www.gould.edu.au/shop)

# WHERE INVERTEBRATES ARE FOUND



# Where do invertebrates live?

Different invertebrates live and survive in different habitats. All aquatic invertebrates live for part of their lives on or amongst:

- Mud, gravel, sand and rocks,
- Snags and debris (leaves, twigs, etc),
- Plants (algae, reeds and overhanging plants),
- On the water's surface, and/or
- Within the water column itself.

Some aquatic invertebrates prefer to live in faster flowing freshwater, while some prefer the quieter calm of pools and backwaters. Some invertebrates complete their life cycle on land, while some can move between aquatic and land-based habitats.

Connectivity between different habitats is important for all life stages of invertebrates. It allows invertebrates to complete life cycles, escape predators and threats (eg. low flow), and to migrate and colonise new river reaches and bodies of freshwater.

Next time you visit your local waterway, have a good look at the range of habitats present within the stream and around it. A non-polluted waterway with a good variety of connected habitats should host a diversity of invertebrates.



**VARIETY OF MOUTHPART DESIGN**



# **MOUTHPARTS**

The mouthparts of invertebrates have evolved in response to diet. Those illustrated on this card are examples of the diversity and design of mouthparts, and indicate how an organism may feed.

## **STRIKING/CHEWING**

Extendable mouthpart to strike and capture food; jaws for shredding and tearing food

## **CHEWING**

Jaws for shredding plant matter or eating other organisms

## **SCRAPING**

For rasping food into small fragments

## **FILTER-FEEDING**

Feathery 'brush-like' mouthparts for capturing small particles of floating food

## **PIERCING**

'Straw-like' mouthpart acts like a syringe, pumping and/or sucking food

## **PIERCING/CHEWING**

Hollow mouthpart/s inject toxins to kill or disable prey; jaws for shredding and tearing food



**Aquatic caterpillars**

# Aquatic caterpillars

Class Insecta, Order Lepidoptera

**Life cycle:** egg, larva, pupa, winged adult (complete metamorphosis)

## Did you know?

Caterpillars emerge from eggs laid in plant tissue.

They can look similar to some caddisfly larvae.

Portable cases for protection are constructed from surrounding vegetation.

## Habitat

They can be found in slow moving freshwater amongst vegetation.

## Diet

They eat aquatic plants (herbivores).

## Predators include:

Invertebrates, birds and fish.

**Aquatic caterpillars have branching, hair-like gills along the abdomen.**





# Aquatic caterpillar adults/pyralid moths

Class Insecta, Order Lepidoptera

**Life cycle:** egg, larva, pupa, winged adult (complete metamorphosis)

## Did you know?

Their lifecycle is between 26-50 days, depending on water temperature and plant availability.

Adults are small night flying moths with patterned triangular wings.

A scale-covered proboscis (piercing mouthpart) is used for feeding.

## Habitat

They can be found around bodies of freshwater.

## Diet

Nectar from flowers provides energy for flight and is important for egg production (nectivores).

## Predators include:

Insects, birds and bats.

**Pyralid moths have hearing organs (ears) to help them detect the presence of bats.**

\*We would like to acknowledge Karlie J. Hawking and thank her for the use of her photograph of this pyralid moth.





**Backswimmer nymphs**

# Backswimmer nymphs

Class Insecta, Order Hemiptera

**Life cycle:** egg, nymph, winged adult (incomplete metamorphosis)

## Did you know?

Nymphs are water bugs with very large red eyes.

They swim upside down at the surface of the water.

Beak-like mouthparts are used for piercing prey and sucking out juices.

Long hind legs, fringed with swimming hairs, help push them through the water.

## Habitat

They can be found in ponds, lakes, billabongs and slow running streams.

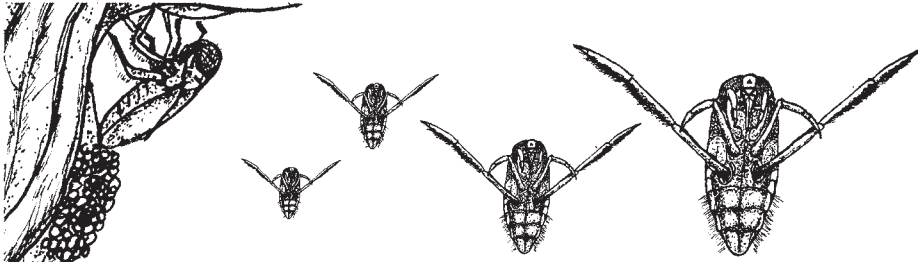
## Diet

They suck body fluids from small aquatic animals including tadpoles, small fish, bloodworms, snails, and crustaceans (carnivores).

## Predators include:

Fish, turtles, waterbirds, platypuses and aquatic invertebrates including adult backswimmers.

**Backswimmers are fierce hunters and can deliver a painful stab to humans.**







# Backswimmer adults

Class Insecta, Order Hemiptera

**Life cycle:** egg, nymph, winged adult (incomplete metamorphosis)

## Did you know?

They can fly to a new habitat.

They collect an air bubble at the water surface through the tip of their abdomen and use this for breathing.

Their long front legs have 2 claws.

## Habitat

They can be found in ponds, lakes and slow running streams.

## Diet

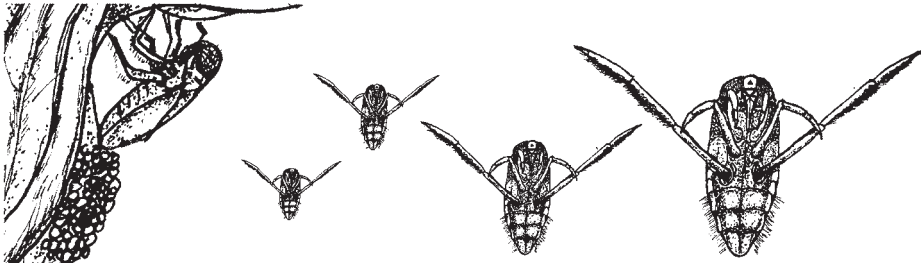
They snatch small organisms from above and below the surface of the water (carnivores).

## Predators include:

Fish, turtles, water birds, platypuses and other aquatic invertebrates.

**Some females lay eggs into holes that they have drilled into the stems of water plants.**

**Others glue eggs to the stems of water plants.**





**Flatworm juveniles**

# Flatworm juveniles

## Class Turbellaria, Order Tricladia

**Life cycle:** A tough leathery cocoon protects eggs from drying out and predation. Immature flatworms emerge from these eggs. Alternatively, flatworms can grow (regenerate) into 2 individuals if they are cut in half.

### Did you know?

Small flatworms are able to swim and glide using their cilia (microscopic hairs).

They breathe through their thin skin.

They don't have obvious mouthparts like other invertebrates, but use their pharynx (throat) to suck in food.

### Habitat

They live under rocks and amongst plants in most bodies of freshwater.

### Diet

They feed on soft or decomposing plant and animal matter and small worms (omnivores).

### Predators:

Most predators avoid eating them as they exude a foul tasting, toxic substance.

**Primitive light-sensitive eyespots may help them avert danger. They move into dark areas where they cannot be seen.**





# Flatworm adults

## Class Turbellaria, Order Tricladia

**Life cycle:** Many flatworms are hermaphrodites (have both male and female body parts). They can reproduce sexually or asexually. During poor conditions, the reproductive organs may be reabsorbed and used for energy.

### Did you know?

Adult flatworms move by contracting their cilia (microscopic hairs) while gliding on a secreted mucus trail. They vary in shape, depending on their habitat. They eat and remove waste through their mouth.

### Habitat

They live under rocks and amongst plants in most bodies of freshwater.

### Diet

They feed on soft or decomposing plant and animal matter and small worms (omnivores).

### Predators:

Most predators avoid eating them as they exude a foul tasting, toxic substance.

**Flatworms are able to glide upside down on the under side of the water surface.**





**Freshwater snail juveniles**

# Freshwater snail juveniles

Class Gastropoda, Order Pulmonata

**Life cycle:** Fertilised eggs are laid in jelly-like clumps and are stuck to plants and stones. Miniature snails emerge from these eggs.

## Did you know?

They possess a 'ribbon like' toothed scraping tongue (radula) for feeding.

Their single shell increases in size by secretions of new calcareous material from the mantle.

They are able to withdraw into their shell for protection.

Shells can either coil to the right or the left.

## Habitat

They can be found attached to aquatic plants and rocks in slow flowing and still freshwater.

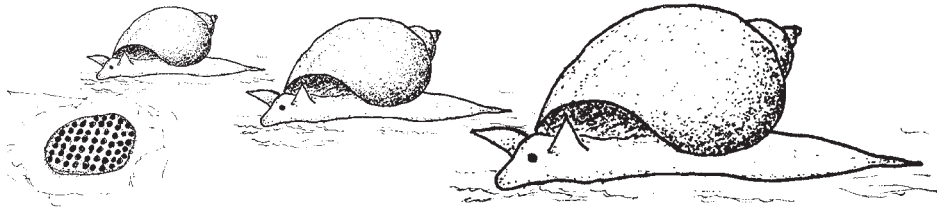
## Diet

They feed on algae and leaves (herbivores).

## Predators include:

Fish, birds, turtles, frogs, platypuses and yabbies.

**Some snails have an operculum (door) that can be closed over the shell's opening for further protection.**



INTRODUCED





# Freshwater snail adults

## Class Gastropoda, Order Pulmonata

**Life cycle:** Some aquatic snails are hermaphrodites (have both male and female body parts). Fertilised eggs are laid in jelly-like clumps, and are stuck to plants and stones. Miniature snails emerge from these eggs.

### Did you know?

Some breathe by floating to the surface and filling their 'lung' with air.

Some act as hosts in the lifecycle of the liver fluke (a parasite that can cause health problems for livestock and humans).

Introduced species have a patterned mantle that is visible through their transparent shell.

### Habitat

They can be found in slow flowing or still freshwater amongst vegetation and on rocks.

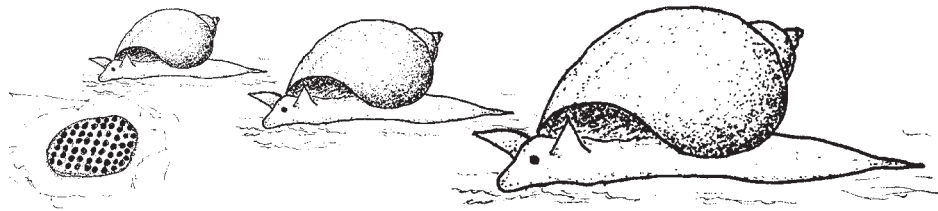
### Diet

They graze on algae and leaves (herbivores).

### Predators include:

Fish, turtles, birds and yabbies.

**Snails secrete mucus to assist locomotion when moving across surfaces, using their muscular foot.**





**Leech juveniles**

# Leech juveniles

## Class Hirudinea

**Life cycle:** Eggs may be brooded or deposited in cocoons in the water. Juvenile leeches look like miniature adults.

### Did you know?

Leeches are limbless and have 34 segments.

Suckers can be found at each end of the body.

They can swim but mostly suck onto something and move in a looping pattern.

### Habitat

They can be found in freshwater ponds, lakes and slow flowing streams amongst plants, stones and decomposing material.

### Diet

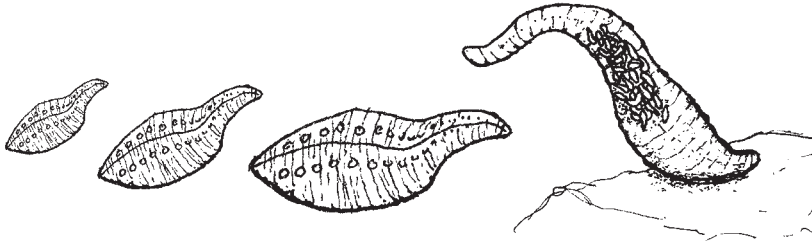
Some feed on the blood of vertebrates such as fish, frogs, birds and mammals (sanguinivores).

Some suck out the juices of worms, snails and midge larvae (carnivores).

### Predators include:

Fish, aquatic insects and yabbies.

**Many forms of leeches have three small jaws with sharp teeth for attachment to their prey.**





# Leech adults

## Class Hirudinea

**Life cycle:** All leeches are hermaphrodites (have both male and female body parts). Eggs may be brooded or deposited in cocoons in the water. Juvenile leeches look like miniature adults.

## Did you know?

Leeches can hibernate during drought by burrowing in the mud.

They are commonly called bloodsuckers and can survive for up to 12 months after a meal.

They have saliva that stops blood clotting.

Since 1000 BC, leeches have been used in medicine.

## Habitat

They can be found in freshwater ponds, lakes and slow flowing streams amongst plants, stones and decomposing material.

## Diet

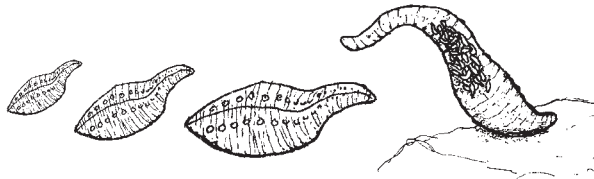
Some feed on the blood of vertebrates such as fish, frogs, birds and mammals (sanguinivores).

Some suck out the juices of worms, snails and midge larvae (carnivores).

## Predators include:

Fish, aquatic insects and yabbies.

**Some species of leech take care of their young, providing food (the adult's mucus), transport and protection. This is unusual behaviour for invertebrates.**





**Water boatman nymphs**

# Water boatmen nymphs

Class Insecta, Order Hemiptera

**Life cycle:** egg, nymph, winged adult (incomplete metamorphosis)

## Did you know?

Water boatmen move like little rowing boats.

Nymphs look like small adults but have no wings.

Nymphs moult 5 times before becoming adults.

They are sometimes eaten by adult water boatmen.

## Habitat

They can be found amongst vegetation in still and slow flowing freshwater.

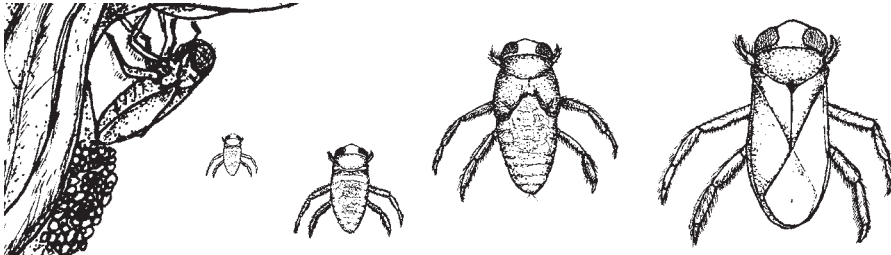
## Diet

Most catch insect larvae (carnivores), others collect decaying organic matter from the substrate (detritivores).

## Predators include:

Fish and adult water bugs.

**The middle and hind legs have a fringe of hairs to assist swimming.**







# Water boatmen adults

Class Insecta, Order Hemiptera

**Life cycle:** egg, nymph, winged adult (incomplete metamorphosis)

## Did you know?

Unlike other bugs, they have short blunt triangular mouthparts.

They are good fliers and can easily move from one body of freshwater to another.

An air bubble for breathing is captured from the water surface and carried underneath the body.

Their front legs are much shorter than their other 2 pairs of legs.

## Habitat

They can be found amongst vegetation in still and slow flowing freshwater.

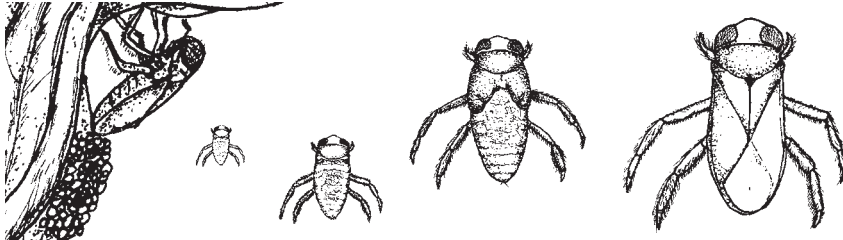
## Diet

Most catch smaller invertebrates including water boatmen (carnivores), some collect decaying organic matter from the substrate (detritivores).

## Predators include:

Fish and water birds.

**Some male water boatmen, rub their front legs across a ridge on top of their head. This produces a sound that attracts females.**





Chironomid larvae

# Chironomid/bloodworm/non biting midge larvae

Class Insecta, Order Diptera

**Life cycle:** egg, larva, pupa, winged adult (complete metamorphosis)

## Did you know?

Chironomid larvae have several eyes.

They move in water by rapidly coiling and uncoiling their bodies.

Some construct portable sand covered cases for protection.

They come in a variety of colours. Red coloured larvae contain haemoglobin and can live in water low in oxygen.

Their eggs are laid in a group, called an egg string or egg mass.

## Habitat

They can be found in, on or under rocks, plants and sediments on the bottom of all bodies of freshwater.

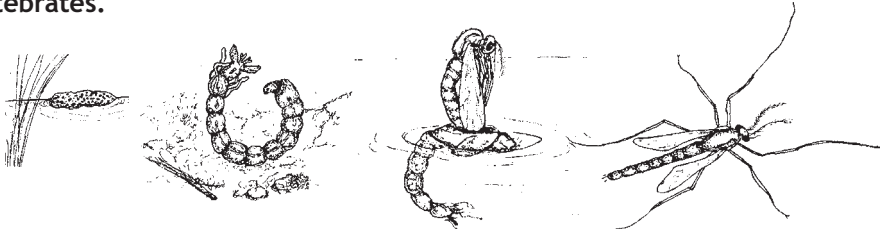
## Diet

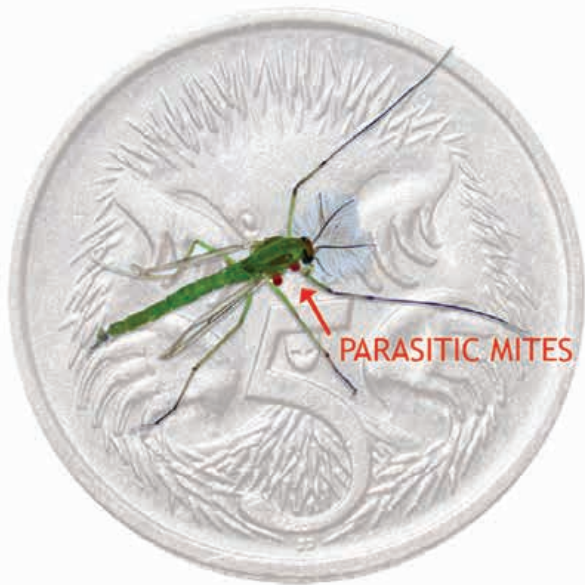
Some feed on algae (herbivores), some on bacteria (detritivores), some on juices of other organisms (parasites).

## Predators include:

Water beetles, water bugs, fish, spiders and frogs.

**Bloodworms are very tolerant and can survive in poorer quality water than many other invertebrates.**





PARASITIC MITES

# Chironomid/bloodworm/non biting midge adults

Class Insecta, Order Diptera

**Life cycle:** egg, larva, pupa, winged adult (complete metamorphosis)

## Did you know?

Adults emerge from the water in early evening, often in great swarms when the conditions are favourable. Males have very fluffy looking antennae and rest with their front legs up.

## Habitat

They can be found near bodies of freshwater.

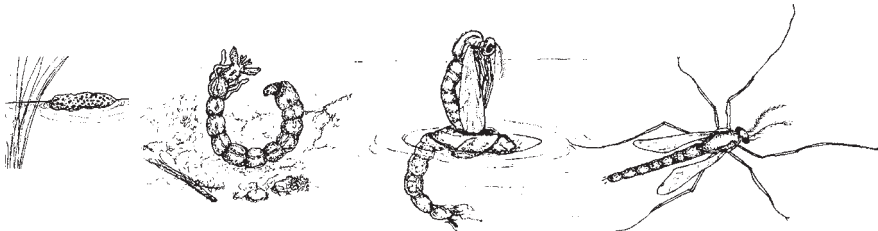
## Diet

They generally do not feed. After emerging from the water, adults mate, lay eggs and then die, all in a short time.

## Predators include:

Dragonflies, damselflies, birds and bats.

**Non biting midges look like mosquitoes.**





Amphipod juveniles

# Amphipod/scud/sideswimmer juveniles

## Class Crustacea, Order Amphipoda

**Life cycle:** After mating, eggs are deposited into a female's brood chamber. Here they hatch within weeks. Young amphipods are released from the brood chamber next time the female moults.

### Did you know?

Their tough outer skin must be shed to allow growth.

They have 7 pairs of leg-like appendages. The first pair is adapted for grasping.

They have 2 pairs of antennae.

### Habitat

They can be found in ponds and slow moving streams amongst aquatic vegetation.

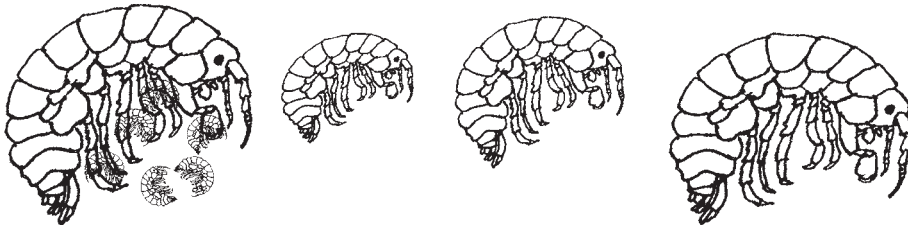
### Diet

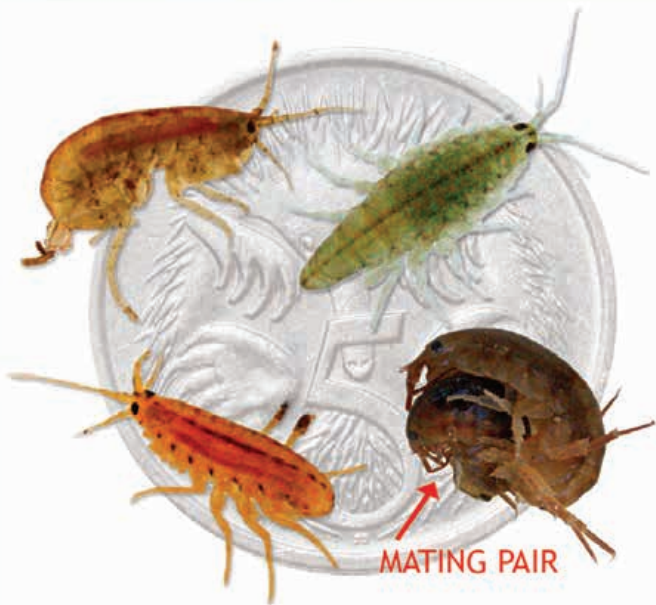
They feed on algae and dead animals (omnivores).

### Predators include:

Water bugs, water beetles, fish and frogs.

**Some amphipods have adapted to live on land (eg. under rotting logs), some live under rotting seaweed on the shore and others in the sea.**





MATING PAIR



# Amphipod/scud/sideswimmer, adults

Class Crustacea, Order Amphipoda

**Life cycle:** Young amphipods released from the female's brood chamber resemble small adults. They become adults after the ~6th moult.

## Did you know?

They are related to crabs and can be green, red, grey or brown coloured. Their bodies are flattened sideways.

## Habitat

They can be found in ponds and slow moving streams amongst aquatic vegetation.

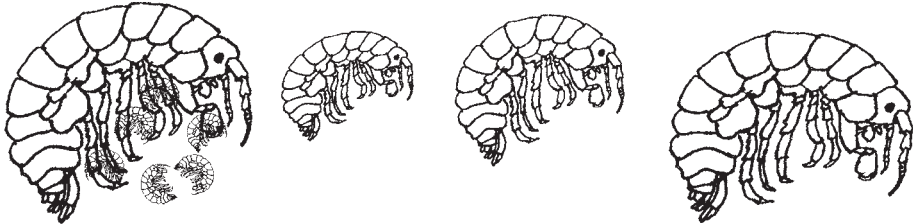
## Diet

They feed on algae and dead animals (omnivores).

## Predators include:

Water bugs, water beetles, fish and frogs.

**A male will guard a female until she disperses her young.**





Water beetle larvae

# Water beetle larvae

Class Insecta, Order Coleoptera

**Life cycle:** egg, larva, pupa, winged adult (complete metamorphosis)

## Did you know?

There are many families of beetles. They form the largest group of animals on earth.

They are represented by a variety of shapes, but most have an elongate body, 3 pairs of walking legs, a hard head and antennae.

They may have sucking or chewing mouthparts.

## Habitat

They can be found in ponds, lakes and slow moving freshwater. They may also be found in sandy or muddy bottoms of flowing freshwater.

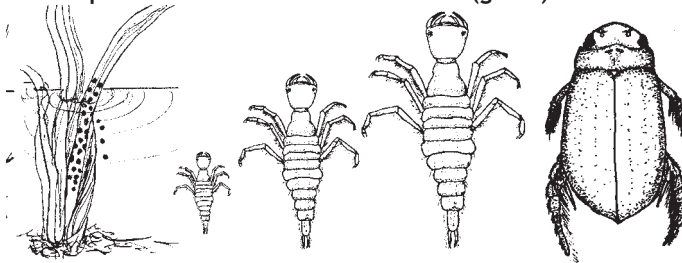
## Diet

Some eat small organisms that live or fall into the water (carnivores), others feed on algae (herbivores), or decaying organic matter (detritivores).

## Predators include:

Fish, frogs, water spiders, water rats (rakali), platypuses, reptiles and birds.

**Water beetles spend most of their lives as larvae (grubs).**





# Water beetle adults

Class Insecta, Order Coleoptera

**Life cycle:** egg, larva, pupa, winged adult (complete metamorphosis)

## Did you know?

Most aquatic beetle larvae leave the water to pupate and become adults. They have hardened wing covers that protect the hind wings and abdomen. Beetles use a variety of methods for obtaining oxygen when in the water. Some trap an air bubble under the abdomen using special hairs. Mandibles (biting mouthparts) tear their food into pieces.

## Habitat

They can be found in ponds, lakes and slow moving freshwater.

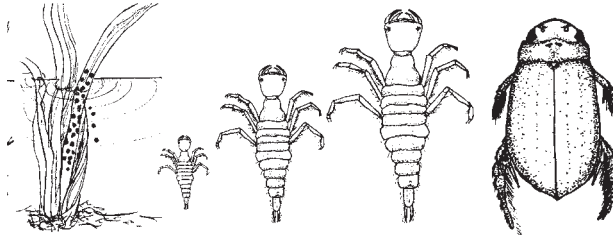
## Diet

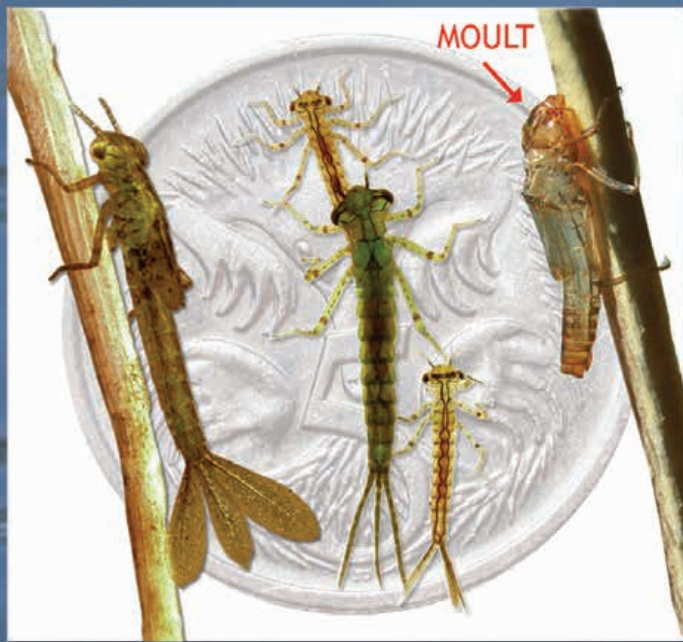
Some feed on aquatic organisms that live in or fall into the water (carnivores). Some feed on algae (herbivores), others on decaying organic matter (detritivores).

## Predators include:

Fish, frogs, reptiles, water rats (rakali), platypuses and birds.

**Many adult water beetles can fly between bodies of freshwater.**





Damselfly nymphs

# Damselfly nymphs

Class Insecta, Order Odonata

**Life cycle:** egg, nymph, winged adult (incomplete metamorphosis)

## Did you know?

They are related to dragonflies.

Most nymphs emerge from eggs that were inserted into plants growing in the water.

At the end of their slender abdomen are three gills that look like leaves.

Their legs have claws for anchorage.

They have striking and grasping mouthparts.

They climb out of the water to enable the final moult to adult form.

## Habitat

They can be found in slow moving freshwater, often amongst plants.

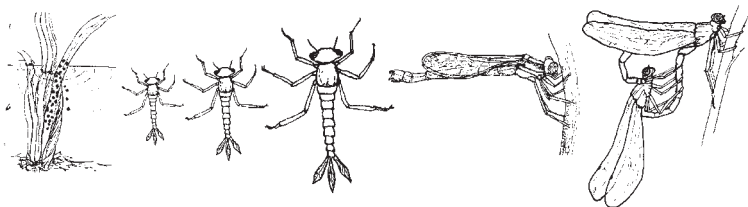
## Diet

They catch water fleas, small fish, worms and tadpoles, mosquito wrigglers, fly larvae, water bugs and beetles (carnivores).

## Predators include:

Platypuses, fish, frogs, reptiles and birds.

**Damselfly nymphs have 10-15 development stages lasting from 5 months to several years.**







# Damselfly adults

Class Insecta, Order Odonata

**Life cycle:** egg, nymph, winged adult (incomplete metamorphosis)

## Did you know?

Emergence from the water varies depending on species, temperature, season and food supply.

At rest, they hold their wings vertically parallel with their body.

Their eyes are separated on either side of the head.

They mate when joined together in a 'heart' shape.

Some females will totally immerse themselves in water to lay eggs on water plants.

## Habitat

They can be found near freshwater and they are often territorial.

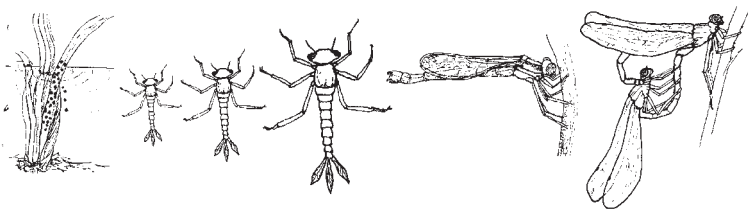
## Diet

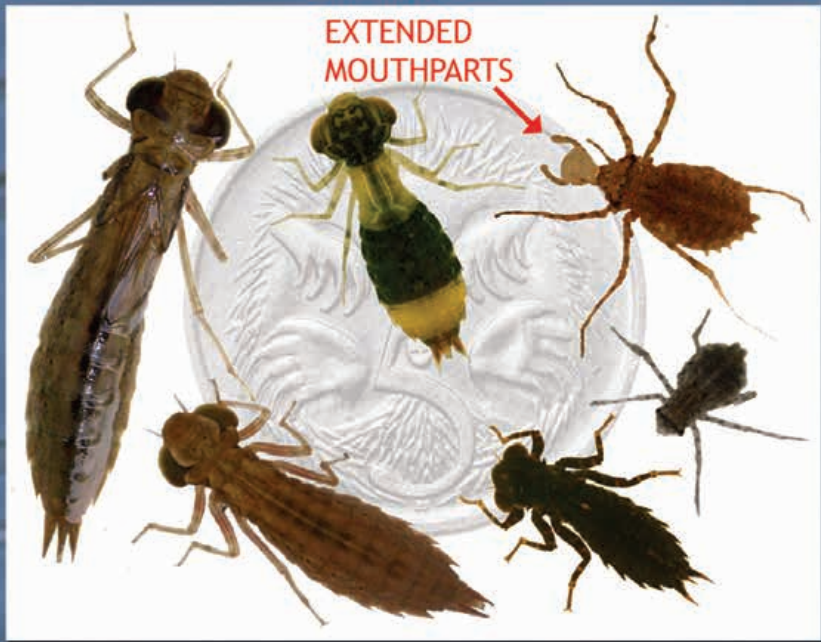
They catch small insects (carnivores).

## Predators include:

Frogs, reptiles and birds.

**Damselflies only live for a couple of weeks as free flying adults.**





Dragonfly nymphs

# Dragonfly nymphs

Class Insecta, Order Odonata

**Life cycle:** egg, nymph, winged adult (incomplete metamorphosis)

## Did you know?

Nymphs are commonly called 'mudeyes'.

They breathe by sucking water in and out through their rear end to reach internal gills.

These well-camouflaged predators possess amazing mouthparts that strike, capture, retract and then chew their prey.

Nymphs can live for 40 days to 7 years, depending on conditions and temperature.

## Habitat

They can be found in vegetation around the edges of both fast and slower moving freshwater. They may also be found in the sediment on the bottom of a body of freshwater.

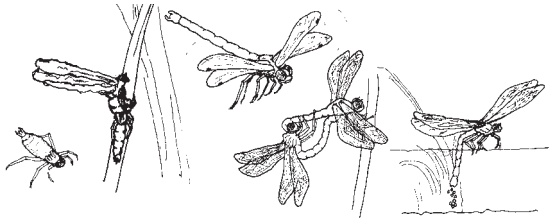
## Diet

They catch many things including; worms, water fleas, small fish, tadpoles, water beetles and other aquatic larvae (carnivores).

## Predators include:

Fish, frogs, platypuses, reptiles and birds.

**Dragonfly nymphs squeeze water in and out rapidly through their rear end to jet propel away from predators.**





# Dragonfly adults

Class Insecta, Order Odonata

**Life cycle:** egg, nymph, winged adult (incomplete metamorphosis)

## Did you know?

The life cycle generally includes 9 to 13 moults, but this varies widely depending on temperature, season and food supply.

They commonly live for about a month.

Adults have large eyes that meet in the middle.

They are very efficient predators and can fly up to 50 km/h.

Their wings spread horizontally when resting.

## Habitat

They can be found near freshwater, where they guard hunting and mating territory.

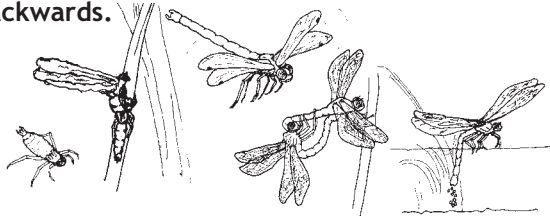
## Diet

They catch small insects, butterflies, damselflies, smaller dragonflies and mosquitoes (carnivores).

## Predators include:

Birds (including Willy Wagtails), spiders, frogs and larger dragonflies.

**Dragonfly adults can fly backwards.**





Freshwater crab juveniles

# Freshwater/false spider crab juveniles

Class Crustacea, Order Decapoda

**Life cycle:** Females carry and brood eggs under a folded tail. Females migrate to high-oxygenated riffle (shallow, turbulent flow) habitats where young are released in spring and summer. Juveniles are thought to settle out onto the substrate downstream in low flow areas.

## Did you know?

The main body of the animal is flat and round and is protected by hard outer skin.

Freshwater crabs are poor swimmers.

Their front legs are modified to form pincers.

## Habitat

They can be found under rocks and in vegetation in a variety of habitats from slightly saline streams to freshwater lakes.

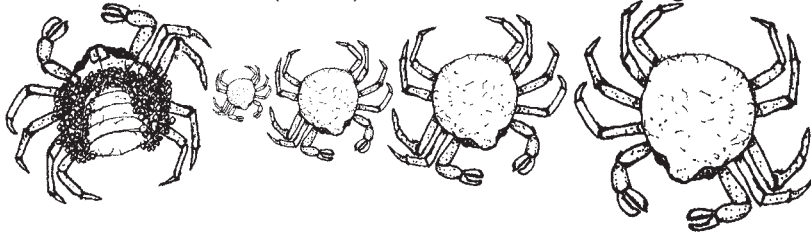
## Diet

They feed on dying and decomposing organic matter (omnivores).

## Predators include:

Fish, birds, water rats (rakali) and platypuses.

**False spider crabs must shed (moult) their hard outer skin to grow.**







# Freshwater/false spider crab adults

Class Crustacea, Order Decapoda

**Life cycle:** Mating can only happen after the female has moulted. The male then guards the female until her skin hardens again. Eggs are carried and brooded under the female's folded tail. Male gametes can be stored by a female to fertilise a number of egg masses over the breeding season.

## Did you know?

Freshwater crabs are thought to live for 1-2 years.

The carapace often has a fine covering of algae.

They are usually brown to grey in colour.

Missing legs and claws can be regrown.

## Habitat

They can be found in freshwater streams and lakes (even those with high salinity), under rocks and amongst vegetation.

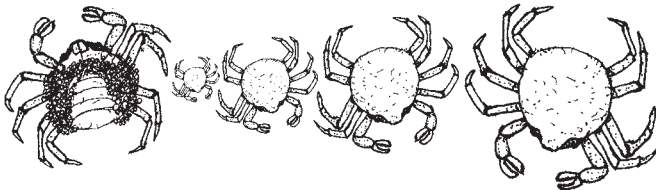
## Diet

They feed on dying and decomposing organic matter (omnivores).

## Predators include:

Fish, birds, water rats (rakali) and platypuses.

To help keep them balanced and upright, most decapod (10 legged) crustaceans have a pair of sensory organs that work a bit like our human inner ears.





Some 'True Fly' larvae

# Some 'True Fly' larvae

Class Insecta, Order Diptera

**Life cycle:** egg, larva, pupa, winged adult (complete metamorphosis)

## Did you know?

Larvae are usually known as maggots.

Pupation occurs on land or on plants at the water's edge.

Many aquatic larvae have short lives, which allows them to grow in temporary water bodies (puddles).

The shortest fly lifecycle is completed in a little over 2 weeks.

## Habitat

They can be found where any type of freshwater collects or flows.

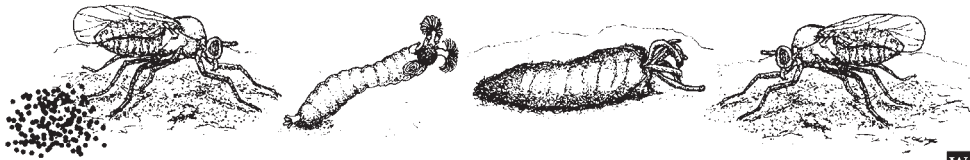
## Diet

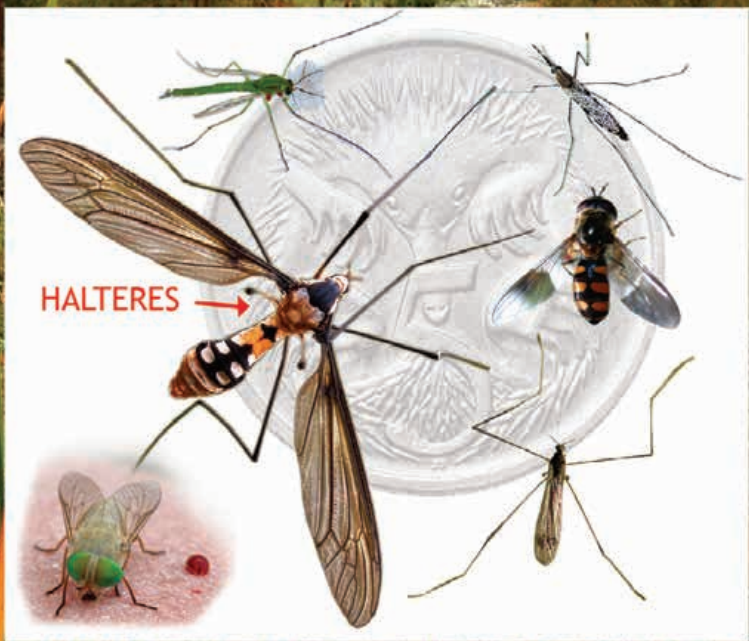
Some feed on decaying organic matter (detritivores), some feed on insect larvae (carnivores).

## Predators include:

Fish, wading birds, frogs and platypuses.

## Maggots often feed day and night





HALTERES

# Some 'True Fly' adults

Class Insecta, Order Diptera

**Life cycle:** egg, larva, pupa, winged adult (complete metamorphosis)

## Did you know?

There are 100's of species of flies.

True flies have only 2 wings; the second pair of wings has been reduced to short balancing appendages (halteres).

They are agile flyers, capable of travelling long distances.

They taste, smell and feel with hairs that cover their body.

## Habitat

They can be found anywhere, but many live near freshwater.

## Diet

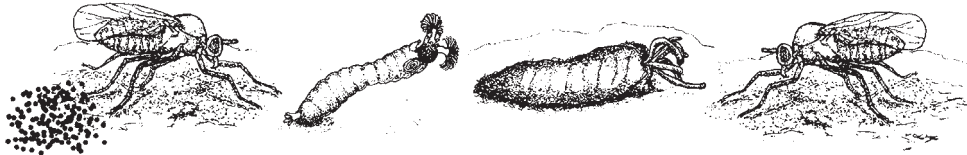
Some feed on blood (sanguinivores), some feed on nectar (nectarivores) and some feed on rotting organic matter (detritivores).

## Predators include:

Birds, bats, spiders and frogs.

**True flies can lay 100's of eggs and rarely live longer than a month.**

\* Adult flies featured on this card represent flies that have aquatic or semi- aquatic larvae. They are not necessarily the adult forms of, or from the same family of, larvae represented on the 'some True Fly larvae' card.





Mosquito larvae

# Mosquito larvae

Class Insecta, Order Diptera

**Life cycle:** egg, larva, pupa, winged adult (complete metamorphosis)

## Did you know?

They hatch from eggs within 48 hours and have no legs.

Brush-like mouthparts sweep food into the mouth.

They are often called wrigglers as they twist and squirm just below the surface of the water.

Larvae hang upside down from the water surface and suck oxygen from the air through a siphon (snorkel) on their tail.

## Habitat

They can be found in still freshwater, often amongst vegetation.

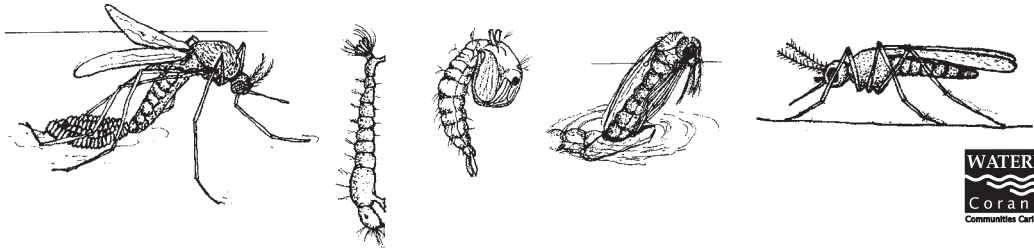
## Diet

They filter-feed, plankton including smaller wrigglers, bacteria, fungi and algae (omnivores).

## Predators include:

Fish, frogs, tadpoles and invertebrates such as water boatmen.

**Larvae become pupae after the 4th moult . Pupae are called tumblers and do not eat.**







# Mosquito adults

Class Insecta, Order Diptera

**Life cycle:** egg, larva, pupa, winged adult (complete metamorphosis)

## Did you know?

Adults emerge from a pupal shell after 7 days then fly off and mate.

They are small flies with piercing mouthparts.

Breeding females can live for 3 weeks.

## Habitat

Still freshwater is necessary for breeding. They can be found near any potential breeding grounds including creeks, ditches and ponds.

## Diet

Females drink blood, so that their eggs mature prior to being laid (sanguinivores).

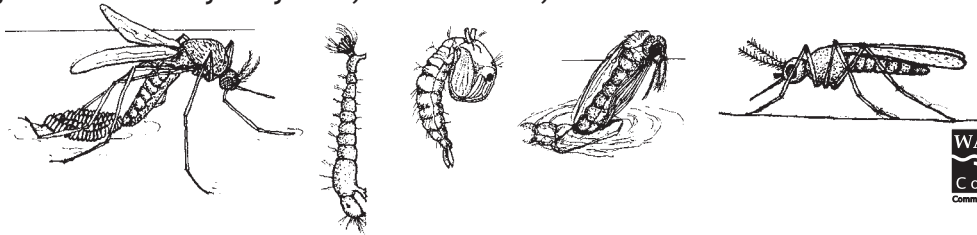
Males drink nectar or sap (nectarivores).

## Predators include:

Dragonflies, birds, bats, fish and frogs.

**1,200,000 adult mosquito bites would drain the blood from an adult human.**

**They are attracted by body heat, human scents, dark colours and exhaled carbon dioxide.**





Freshwater pea shell juveniles

# Freshwater pea shell juveniles

## Class Bivalvia, Order Veneroida

**Life cycle:** Pea shells are hermaphrodites (have both male and female reproductive organs). Eggs hatch within the protective shell of the parent and are then released into the surrounding water. Reproduction can occur at any time of the year but most young are produced during the warmer months.

### Did you know?

Pea shells are bivalves. Their 2 hinged, very thin shells protect their soft body.

At first, they look like large sand particles.

Gills are used for both breathing and filtering food from the water.

### Habitat

They can be found partially buried in soft mud or sand in permanent or semi-permanent bodies of freshwater.

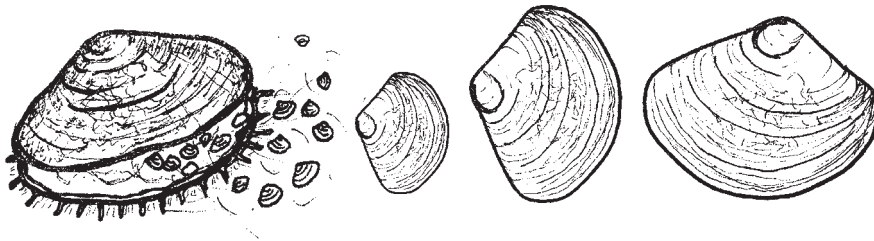
### Diet

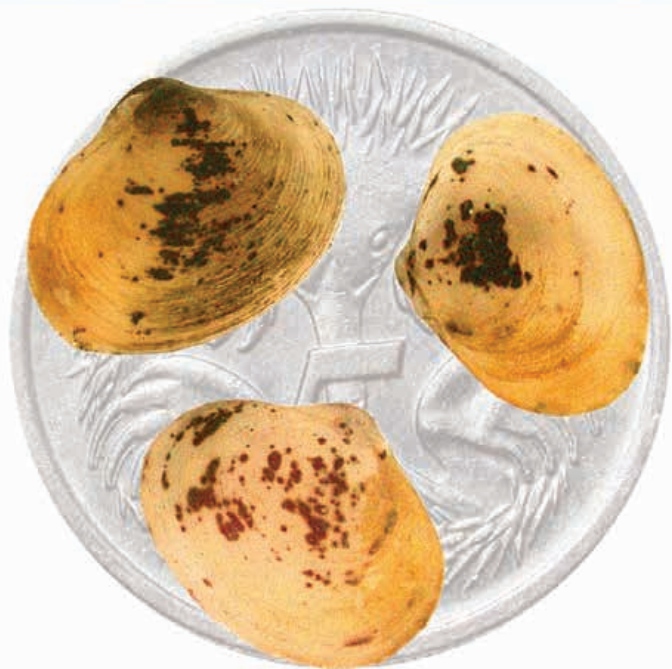
They filter-feed small particles of organic matter and bacteria from the water (omnivores).

### Predators include:

Water rats (rakali), platypuses, bottom feeding fish and wading birds.

Pea shells can be spread to other habitats on the muddy feet or feathers of birds.





# Freshwater pea shell adults

## Class Bivalvia, Order Veneroida

**Life cycle:** Pea shells are hermaphrodites (have both male and female reproductive organs). Eggs hatch within the body protective shell of the parent and are then released into the surrounding water. Reproduction can occur at any time of the year but most young are produced during the warmer months.

### Did you know?

They draw water inside their shell and body using a siphon.  
They burrow into soft bottom sediment using a strong muscular foot.  
Some are capable of surviving extended periods of drying out.  
On average they live for between 12-18 months.

### Habitat

They can be found partially buried in soft bottom sediment in permanent or semi-permanent bodies of freshwater.

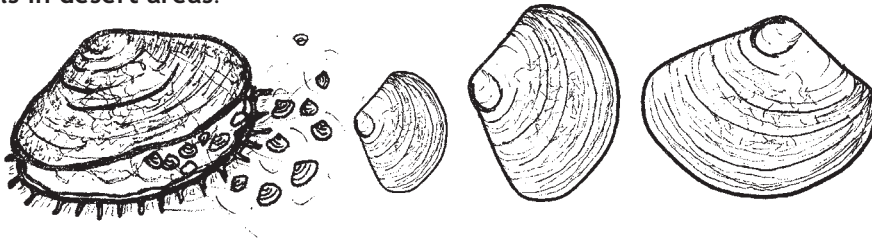
### Diet

They filter-feed small particles of organic matter and bacteria from the water (omnivores).

### Predators include:

Water rats (rakali), platypuses, bottom feeding fish and wading birds.

**They can be found in extremely diverse habitats, from mountain bogs above snow lines to pools in desert areas.**





Freshwater shrimp juveniles

# Freshwater shrimp juveniles

## Class Crustacea, Order Decapoda

**Life cycle:** Females produce 50-250 eggs that are carried by the pleopods (last 5 pairs of legs) under the abdomen. Upon hatching the larvae bear no resemblance to adults. The larvae are termed 'plankton' and go through many stages of development before reaching adulthood. Large numbers of tiny larvae are abundant in spring and summer.

### Did you know?

Their eyes are on short stalks.

Brushes on the front 2 pairs of legs help draw food into the mouth.

### Habitat

They can be found under overhanging banks and amongst vegetation in streams, lower reaches and in salt wedges near the mouth of rivers.

### Diet

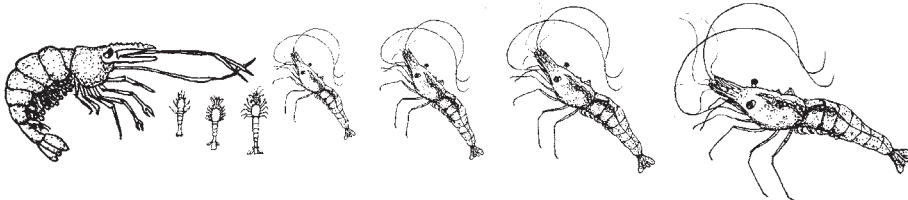
They feed on decomposing organic matter (detritivores).

### Predators include:

Fish, birds, platypuses and water rats (rakali).

**Planktonic shrimp become juveniles 14 days after being released by the female.**

**They then settle on the bottom of the habitat.**







# Freshwater shrimp adults

## Class Crustacea, Order Decapoda

**Life cycle:** Females produce 50-250 eggs that are carried by the pleopods (last 5 pairs of legs) under the abdomen. Upon hatching, the larvae bear no resemblance to adults. The larvae are termed 'plankton' and go through many stages of development before reaching adulthood.

Large numbers of tiny planktonic larvae are abundant in spring and summer.

## Did you know?

They are able to move backwards rapidly.

Freshwater shrimps are transparent and can be mottled with blues, greens and darker markings.

They have 5 pairs of jointed walking legs; 2 pairs have brush-like endings.

## Habitat

They can be found under overhanging banks and amongst vegetation in streams and lower reaches of rivers.

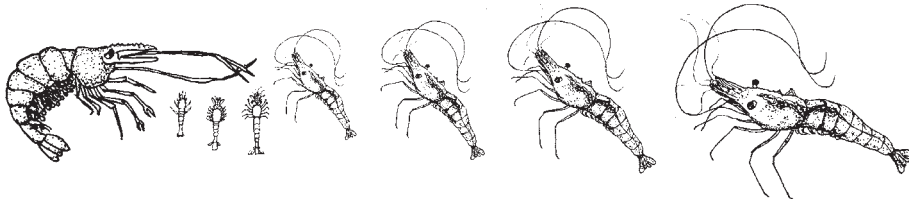
## Diet

They feed on decomposing organic matter (detritivores).

## Predators include:

Fish, birds, platypuses and water rats (rakali).

**Freshwater shrimps breathe through gills located at the base of their legs.**





Water mite juveniles

# Water mite juveniles

Class Arachnida, Order Acariformes

**Life cycle:** They have a complex lifecycle with 4 major stages. After hatching from eggs, the juveniles attach to an aquatic or insect host where they feed on the juices of the host. Eventually the young mites leave the host and become free swimming.

## Did you know?

Many mites have 2 pairs of eyes.

Although related to spiders, juveniles often have only 6 legs.

The mouthparts of juvenile water mites are beak-like and are used to pierce prey.

Bright red mites have a toxic and distasteful substance in their skin, so creatures do not choose to eat them.

## Habitat

They are common in vegetated areas of shallow slow flowing freshwater.

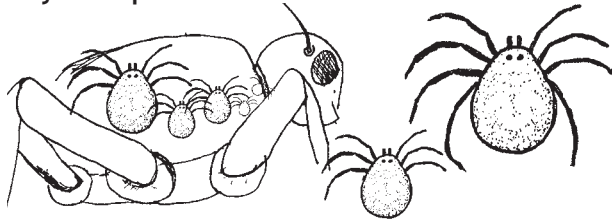
## Diet

They suck out the juices from small aquatic organisms (parasites).

## Predators include:

Filter-feeding organisms such as bivalves and fresh water sponges.

**Young mites attached to flying insect hosts are able to live out of water. Hitch-hiking mites use this opportunity to disperse to and colonise new water bodies.**





# Water mite adults

## Class Arachnida, Order Acariformes

**Life cycle:** They have a complex lifecycle with 4 major stages. Females attach fertilised eggs to aquatic plants. Juvenile mites become adults after the ~3rd moult. Adult mites are often free swimming.

### Did you know?

Adult mites have 4 pairs of legs.

They can be green, brown, red or blue in colour.

Their round bodies can be soft or hard.

They are sensitive to pollutants in the water especially heavy metals.

### Habitat

They are common amongst plants in shallow, slow flowing freshwater.

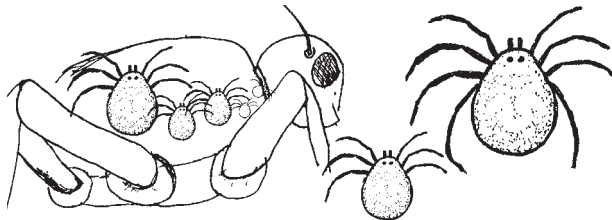
### Diet

Some suck out the juices from other small aquatic organisms (parasites), some are predators (carnivores), and some feed on decaying organic matter (detritivores).

### Predators include:

Filter-feeding organisms such as bivalves and fresh water sponges.

**Some are capable of releasing a foul tasting substance for protection.**





**Caddisfly larvae**

# Caddisfly larvae

Class Insecta, Order Trichoptera

**Life cycle:** egg, larva, pupa, winged adult (complete metamorphosis)

## Did you know?

There are 26 caddisfly families, some are common.

Some are free living.

Most protect their soft bodies using silk and vegetation cases in a variety of ways. The type of case constructed depends on the speed of the water, materials available and preference. (Eg. inside a hollow stick, wrapped in cut-up leaf or rolled-up grass, in cases made from sand.)

## Habitat

They can be found attached to aquatic vegetation, rocks and snags in quiet or fast flowing freshwater.

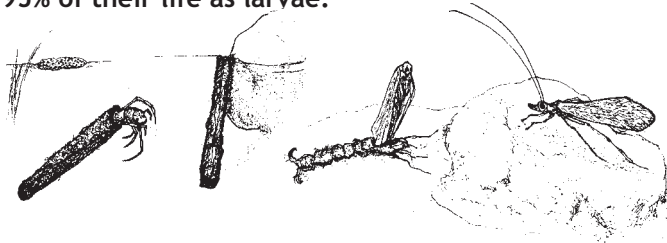
## Diet

They collect or catch plant material (herbivores), fine organic matter (detritivores), or other aquatic invertebrates (carnivores).

## Predators include:

Dragonfly nymphs, frogs, fish and platypuses.

**Caddisflies spend 95% of their life as larvae.**







# Caddisfly adults

Class Insecta, Order Trichoptera

**Life cycle:** egg, larva, pupa, winged adult (complete metamorphosis)

## Did you know?

Adults mostly leave the water between December-January.

They are common and are attracted to lights.

They look like moths but have 'hairy' (not scaly) wings.

## Habitat

They can be found amongst vegetation surrounding bodies of freshwater.

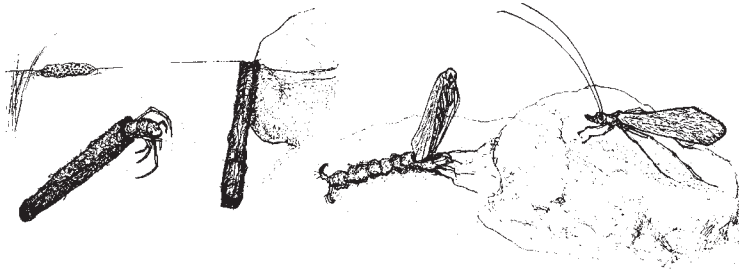
## Diet

Generally they do not feed. After emerging from the water, adults mate, lay eggs and then die, all in a short time.

## Predators include:

Birds, bats, amphibians and reptiles.

**Caddisflies have antennae that may be nearly twice as long as the length of the body.**





**Mayfly nymphs**

# Mayfly nymphs

Class Insecta, Order Ephemeroptera

**Life cycle:** egg, nymph, winged adult (incomplete metamorphosis)

## Did you know?

Their 3 tails, some edged with swimming hairs, help them move in the water.

They can be confused with damselflies because they both have 3 tails.

They have gills along each side of the abdomen that flutter.

Mouthparts have scraping blades or brushes that aid feeding.

They have 1 claw on the end of each leg for anchorage.

## Habitat

They can be found in still to fast flowing freshwater, under rocks and logs and in vegetated areas.

## Diet

Some eat algae and phytoplankton (herbivores), some eat decaying organic matter (detritivores), and some eat other invertebrates (carnivores).

## Predators include:

Fish and invertebrates.

**Most of the life of a mayfly is spent as a nymph.**





# Mayfly adults

Class Insecta, Order Ephemeroptera

**Life cycle:** egg, nymph, winged adult (incomplete metamorphosis)

## Did you know?

They are amongst the most primitive flying insects.

Adults emerge during the spring and swarm in 1,000s above water in the early evening.

They are strongly attracted to light.

Some live for as little as 90 minutes.

## Habitat

They can be found flying or resting near bodies of freshwater.

## Diet

Generally they do not feed. After emerging from the water, adults mate, lay eggs and then die, all in a short time.

## Predators include:

Fish, birds, frogs and invertebrates.

**The male mayfly has split eyes and uses very long forelegs to assist mating while in flight. The female lays eggs in flight, bombing the surface of the water.**





**Stonefly nymph**

# Stonefly nymph

Class Insecta, Order Plecoptera

**Life cycle:** egg, nymph, winged adult (incomplete metamorphosis)

## Did you know?

Eggs are laid in water and have a sticky coating to keep them fixed to the bottom.

The nymphs have 2 long tails.

Some nymphs have gill tufts, some have strings of beaded gills, at the end of their abdomen, and some have gills along their abdomen.

They have 2 claws at the end of hairy legs.

## Habitat

Some live on or under rocks, some cling to aquatic plants, some burrow, some live among woody debris.

They are common in alpine streams where the water is cool and of good quality.

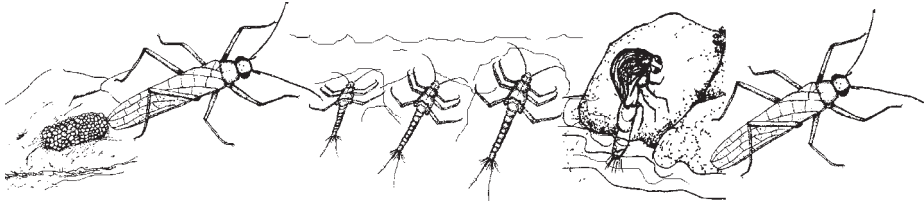
## Diet

Some feed on organic matter (detritivores), some on algae (herbivores), and some on invertebrates (carnivores).

## Predators include:

Fish, invertebrates and birds.

**Stonefly nymph development can be delayed in drought conditions to wait for rain.**







# Stonefly adult

Class Insecta, Order Plecoptera

**Life cycle:** egg, nymph, winged adult (incomplete metamorphosis)

## Did you know?

They are not very good fliers.

They are usually grey or brown with membranous wings.

Most leave the water around spring or autumn and live for about a month.

## Habitat

They are mostly found close to upper/mountainous reaches of waterways.

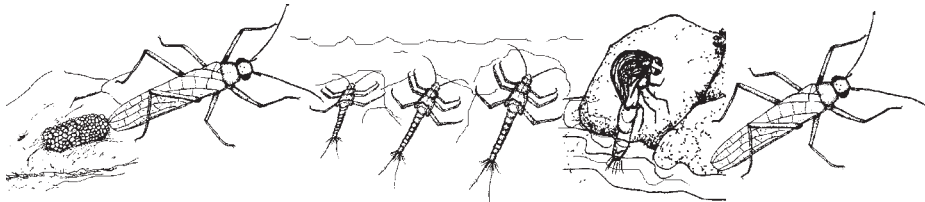
## Diet

They feed on decomposing organic matter (detritivores).

## Predators include:

Fish and birds.

**Some adult stoneflies run and jump instead of flying. Many skim over the water using their wings to propel them like a hovercraft.**





**Cladoceran juveniles**

# Cladoceran/water flea juveniles

Class Crustacea, SubOrder Cladocera

**Life cycle:** Cladocerans alternate between asexual and sexual reproduction. Eggs are carried in a brood chamber where they hatch. Fully developed young are released when the parent moves her limb-like digestive canal forward, creating an opening between the halves of her carapace. In the first couple of minutes after being released, the young take in water to rapidly swell their size.

## Did you know?

They are very common freshwater micro-crustaceans.

A 2 shelled body shield (carapace) encases the body and legs, but not the head.

They have a single eye.

Cladocerans are able to reproduce when they are 14-15 days old.

## Habitat

They can be found in sediments or moving freely in still or slow moving bodies of freshwater such as lakes, streams, rivers and wetlands.

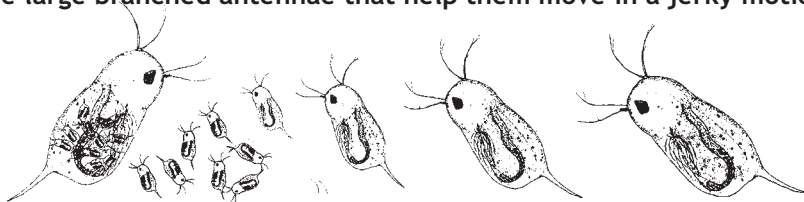
## Diet

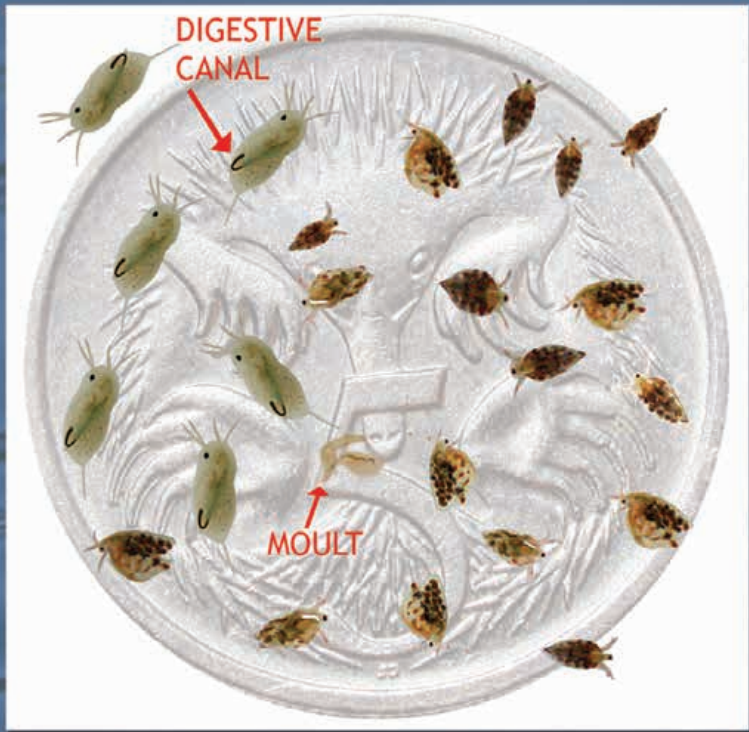
They feed on plankton, bacteria or decaying organic matter (omnivores).

## Predators include:

Fish and filter-feeding organisms such as bivalves and mosquito wigglers.

Some have large branched antennae that help them move in a jerky motion through the water





# Cladoceran/water flea adults

Class Crustacea, SubOrder Cladocera

**Life cycle:** During good conditions cladocerans mainly reproduce asexually. When conditions become poor (eg. low food, low oxygen or dense population), females produce male offspring. These males fertilise eggs that have thick resistant shells and yield females when favourable conditions return.

## Did you know?

Some have been successfully hatched after 250 years!

If a body of water dries up, the eggs can be blown by wind, carried on feathers/fur or in the gut of an animal, to a new habitat.

Cladoceran populations peak during algal blooms.

## Habitat

They can be found in sediments or moving freely in still or slow moving bodies of freshwater such as lakes, streams, rivers and wetlands.

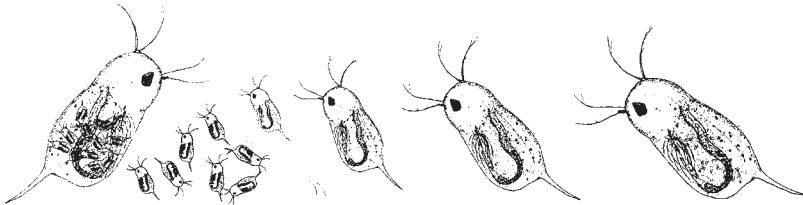
## Diet

They catch phytoplankton (plant plankton), bacteria or decaying organic matter (omnivores).

## Predators include:

Fish and filter-feeding organisms such as bivalves and mosquito wigglers.

**The presence of dark red cladocerans indicates low oxygen levels in the water.**



# Glossary

<b>abdomen</b>	the rear division of an insect's body
<b>algae</b>	simple, aquatic plants
<b>antenna(e)</b>	paired sensory organs located on the head
<b>aquatic</b>	in water
<b>asexual</b>	reproduction creation of a new individual not requiring the union of a male and female gamete
<b>brood chamber</b>	cavity within the body
<b>calcareous material</b>	composed of calcium carbonate
<b>carnivore</b>	an animal that kills and eats other animals for food
<b>carapace</b>	a hard covering over part or all of the body of a crustacean
<b>complete metamorphosis</b>	lifecycle of certain insects with a pupal stage between the immature larva and adult stages
<b>crustacean</b>	an arthropod with a segmented body, a hard exoskeleton and paired jointed legs
<b>detritivore</b>	an animal that feeds on small pieces of decomposing plants and animals
<b>detritus</b>	decomposing plant and animal matter
<b>dorsal</b>	back surface
<b>emerge</b>	to appear or come into view
<b>fertilise</b>	to create a new individual by the union of male and female gametes
<b>filter-feeder</b>	an animal that strains small organisms from the water for food (omnivore)
<b>gamete</b>	a reproductive cell
<b>gills</b>	the respiratory organ of most aquatic animals
<b>herbivore</b>	an animal that only eats plants
<b>host</b>	the animal or plant, on or in which ,another organism lives
<b>incomplete metamorphosis</b>	lifecycle of certain insects without a pupal stage between the immature nymph and adult stages

# Glossary

<b>invertebrate</b>	without a backbone
<b>larva(e)</b>	immature developmental stage of an organism
<b>lung</b>	a respiratory organ that fills with air for breathing
<b>mantle</b>	in molluscs, is a part of the body that lines the shell and secretes the calcareous material that forms the shell
<b>moult</b>	to lose the outer layer of skin (verb) the outer layer of skin that has been lost (noun)
<b>mucus</b>	a slippery substance
<b>nectarivore</b>	an animal that feeds on the sugary nectar produced by flowering plants
<b>nurture</b>	to take care of and help grow
<b>nymph</b>	the larval form of some insects, similar to the adult in appearance but lacking fully developed wings
<b>omnivore</b>	an animal that eats animals and plants
<b>organism</b>	a living thing
<b>organic matter</b>	material derived from living organisms (plants and animals)
<b>plankton</b>	tiny plant and animal life that live in the light zone of fresh or marine waters
<b>pollutant</b>	excessive or potentially toxic material present in the environment that reduces water quality
<b>predator</b>	a hunter and consumer of animal tissue
<b>pupa(e)</b>	a resting stage between larva and adult forms usually non moving and in a protective case
<b>sanguinivore</b>	an animal that feeds on blood
<b>sexual reproduction</b>	the creation of a new individual requiring the union of male and female gametes
<b>substrate</b>	the bottom or solid structure within the water body
<b>vegetation</b>	plant life
<b>vertebrate</b>	having a backbone