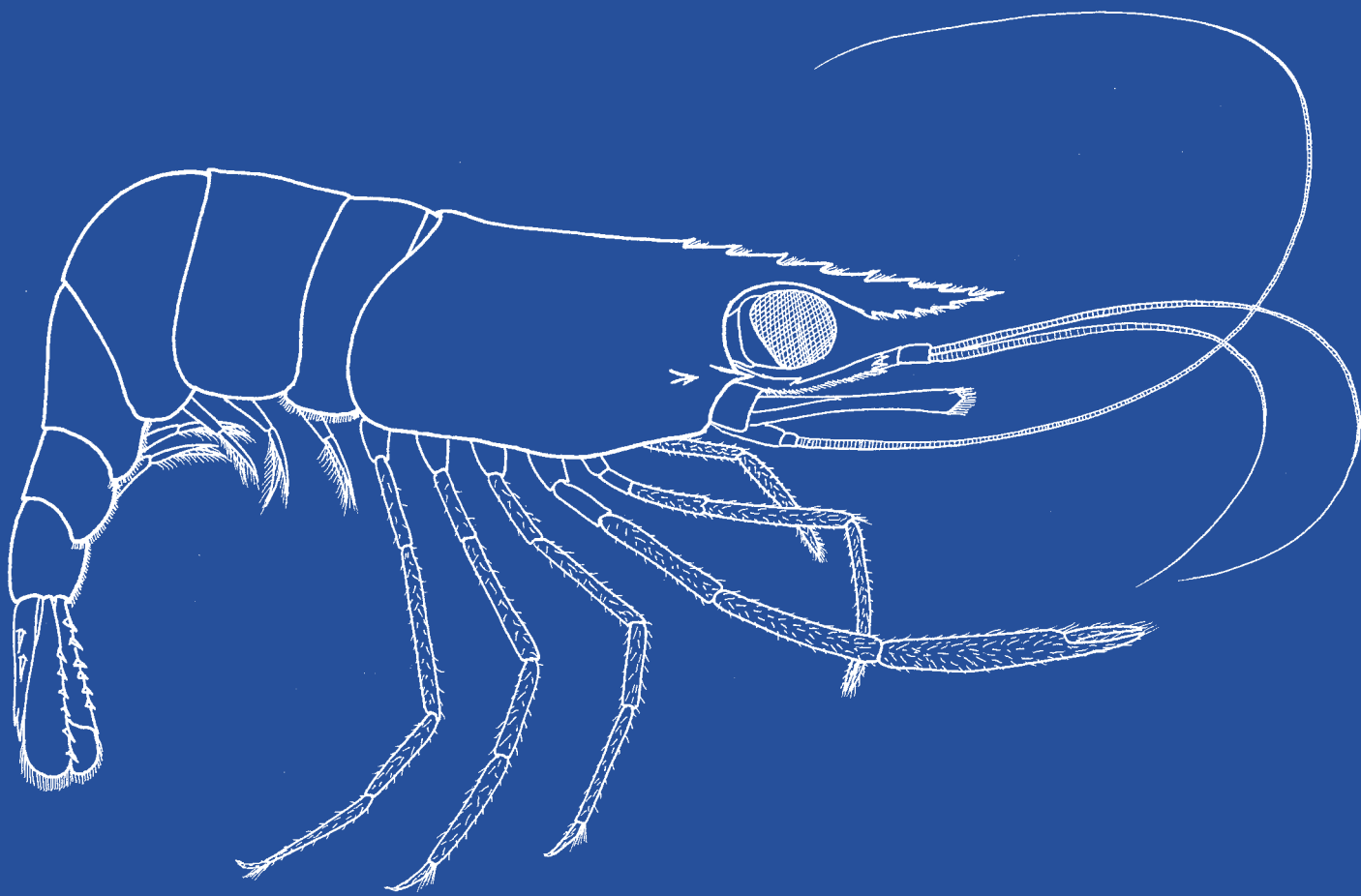


Crustaceans



10 Class Crustacea—crustaceans

Background

Worldwide, more than 42,000 species of Crustacea are known. They are divided between eight subclasses and include terrestrial, marine and freshwater forms. Around 500 species of freshwater crustaceans are listed for Australia. Due to the difficulty of identifying some crustaceans, it is unknown how many species occur in South Australia. Fossil records date back to the Devonian period, approximately 400 million years ago.

Freshwater biologists group crustaceans by size. Microcrustaceans, including Ostracoda (seed shrimps), Copepoda (copepods), Cladocera (water fleas) and Conchostraca (clam shrimps, an uncommon group not covered in this guide) are often small and many species from these groups tend to be planktonic, although this is not always the case.

Crustaceans from the groups Anostraca (fairy shrimps), Notostraca (shield or tadpole shrimps), Amphipoda (scuds or side-swimmers), Isopoda (water slaters or sow bugs) and Decapoda (freshwater crabs, crayfish, prawns and shrimps) are called 'macroinvertebrates'. These animals tend to be larger and benthic, rather than planktonic.

Size

Crustaceans range in size from less than 1 mm to more than 300 mm long for large freshwater crayfish.

Features

Crustaceans are highly variable in body form but some general rules apply. All crustaceans have two pairs of antennae, one pair of mandibles, and two pairs of 'maxillae', on their heads. Characteristically, they also have a pair of appendages on each body segment, although sometimes these are reduced or absent from various parts of the body, depending on the species. The appendages can be modified in shape to perform tasks such as swimming, walking, feeding, respiration or copulation. Crustacean bodies are composed of between 16 and 60 segments. The first six segments form the head and the remainder make up the thorax and abdomen.

Diet and feeding

Smaller crustaceans are generally filter feeders, using specialised appendages to create a current of water that passes over the 'filter'. The collected particles, including bacteria, algae and small plankton, are removed by special combing or brushing hairs and transported to the mouth. Larger forms feed by grabbing prey with their large front claws; they locate their prey by smell and take insects, molluscs and fish. Some larger crustaceans, including yabbies, eat plants. A number of crustaceans are parasites, often during their larval stages.

Locomotion

Smaller crustaceans are able to swim through the water using their body appendages. Larger forms tend to crawl along the bottom of the water body.

Gas exchange (breathing)

Larger crustaceans respire by use of gills; smaller crustaceans, such as members of the suborder Cladocera and subclasses Ostracoda and Copepoda, respire by diffusion through the body surface. Oxygen is then transported to the rest of the body, either dissolved in the blood or bound to haemoglobin.

Life cycle and reproduction

Most crustaceans have separate sexes. Some reproduce parthenogenetically. Eggs may be attached to certain appendages or contained within a brood pouch or in an egg sac. The most common form of larva is the 'nauplius', which is free-swimming and has only three pairs of appendages: first and second antennae, and mandibles. All crustaceans moult and additional appendages are formed as the animal grows. Many of the smaller crustaceans have resting eggs that are resistant to desiccation, but these are not found in amphipods, isopods and decapods. The life span of a crustacean can be anywhere between two weeks and 15 years, depending on the species.

Habitat

Crustaceans can be found in just about all kinds of waters—fast-flowing, still, fresh and saline. They can be found living in the water column, on the bottom of a water body, or among aquatic plants. Some are tolerant of pollution, while other species are intolerant and prefer clean water. Smaller crustaceans can be found in just about every water body in South Australia. Some of the larger ones are less common or are found only in particular areas of the state. Adult crayfish have been known to roam the banks of creeks for a period of time and to move from one water body to another if conditions become unfavourable.

Critter facts

Unlike insects, most crustaceans are aquatic, although some, including slaters, live on land.

Identification

Most crustaceans have a carapace and all have two pairs of antennae, but their appearance varies greatly. The larger freshwater forms are very similar to their marine cousins and are easily recognised. The tiny microcrustaceans are harder to recognise and it may be difficult to see their features without a microscope.

The key starting on page 21 of *The Waterbug Book* should help you tell crustaceans from other animals and separate the major groups from each other.

Classification and sensitivity

Phylum Arthropoda

Class Crustacea

Suborder Cladocera (NR)

Suborder Copepoda (NR)

Suborder Ostracoda (NR)

Order Anostraca (1)

Order Notostraca (1)

Order Amphipoda (3)

Order Isopoda (2)

Order Decapoda (4)

References

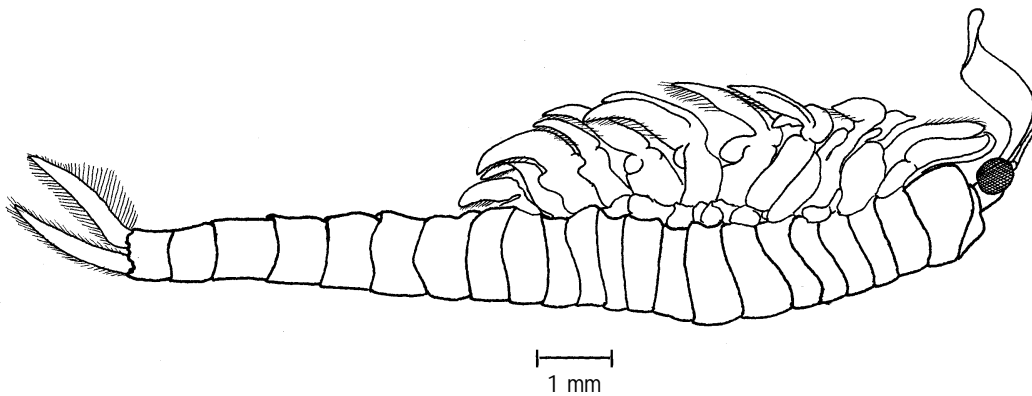
Hawking & Smith 1997, pp 47-73; Williams 1980, p 122; Gooderham & Tsyrlin 2002, pp 63-83.

10.1 Order Anostraca-fairy shrimps or brine shrimps

Background

Anostracans are among the most primitive of all living crustaceans. They occur worldwide, and at least three families, each containing one genus, occur in inland waters Australia. Two genera of brine shrimp live in highly saline waters, the native *Parartemia* (with eight described species) and the introduced *Artemia salina*. The fairy shrimp genus *Branchiella* (nineteen described species) lives in wetlands and temporary ponds of lower salinity. All three of these genera are found in South Australia.

Fossil records of this Order date back to the Miocene epoch of the Caerozoic era, nearly 25 million years ago.



The Anostraca *Parartemia* sp. (family Branchipodidae)

Size

Anostracans can grow up to 50 mm in length, but usually are much smaller.

Features

Anostracans have a clearly defined head and a thorax that lacks a carapace. The eyes are stalked. They have two pairs of antennae; the first pair is small, the second pair is more prominent. The abdomen is made up of eight segments. Anostraca may be either white or a reddish-orange colour.

Diet and feeding

Fairy shrimps feed mainly on micro-organisms such as bacteria, protozoa, rotifers and algae, and also on bits of detritus that they filter from the water. By beating their thoracic appendages they produce a current over their gills. As the water is moved across the gills, it is filtered, the food particles settling along a groove between the bases of the thoracic appendages. Setae on the ventral, or abdominal, groove transport the food to the mouth.

Locomotion

Fairy shrimps swim through the water column on their backs with their ventral side oriented to the light. They feed and take up oxygen as they swim. If they stop moving their thoracic appendages, fairy shrimps sink to the bottom.

Gas exchange (breathing)

Anostracans lack true gills; instead, they have leaf-like extensions on the ends of their appendages. They move the thoracic appendages through the water to produce a current that flows over these extensions. Some anostracans have haemoglobin, which is used to transport oxygen throughout the body, and gives the shrimp a red colour.

Life cycle and reproduction

The sexes are separate, and males and females differ in the structure of the second antennae. Male antennae are longer and adapted for grasping the females, and the mating shrimps often swim around attached to one another for hours. Once mating has finished the male dies.

Females carry their eggs in a brood sac on the abdomen, and the eggs are deposited in the sediment. When an egg-carrying female dies the eggs often end up in the sediment as well. A female can have between 10 and 150 eggs in each brood and can produce many broods in her lifetime. In one species, under optimum conditions, the female can live for three months and produce around 300 young every four days.

Anostracan eggs are resistant to desiccation and can survive in the sediment if a water body dries up. When the pool fills with water again, some of these eggs will hatch. The time between hatching and adulthood is very short. The young are born as nauplii and go through 15 moulting stages or 'instars'. At each instar, they grow more segments on the body until they reach the adult stage.

Habitat

Anostracans may be seen swimming in the water column in both fresh and saline waters. They prefer the still waters of pools and ponds. They have been recorded in the South East region of South Australia, in the Far North and arid regions, as well as in solar salt ponds.

Critter facts

'Brine' describes water containing a high concentration of salt, and some species of brine shrimps are able to survive in very saline waters by regulating their osmotic pressure. Some can even survive at salinities around 300 grams/litre, about 8 1/2 times as salty as seawater.

'Sea monkeys' are species of *Artemia* sold as 'pets', often in a kit complete with dried algae for food and a small tank in which to keep the shrimps. Also, *Artemia* are often used as fish food. The dehydrated eggs of these brine shrimps can be bought from aquarium shops. When placed in brine solution, the eggs hatch. Resting eggs have been hatched under laboratory conditions after 15 years of dehydration.

One species of fairy shrimp is on the endangered species list in the United States of America.

Identification

These animals are quite unusual in appearance. Because they do not have a carapace, their many thoracic appendages are clearly visible. They have stalked eyes and two pairs of antennae, and the elongate abdomen is divided into eight segments. The key starting on page 21 of *The Waterbug Book* should help you tell anostracans from other animals.

Fairy shrimps are not easy to identify to genus level. However, in saline waters you will get native *Parartemia* species and the introduced *Artemia salina*. In fresher waters you are likely to get *Branchiella*.

Classification and sensitivity

Phylum Arthropoda

Class Crustacea

Order Anostraca (1)

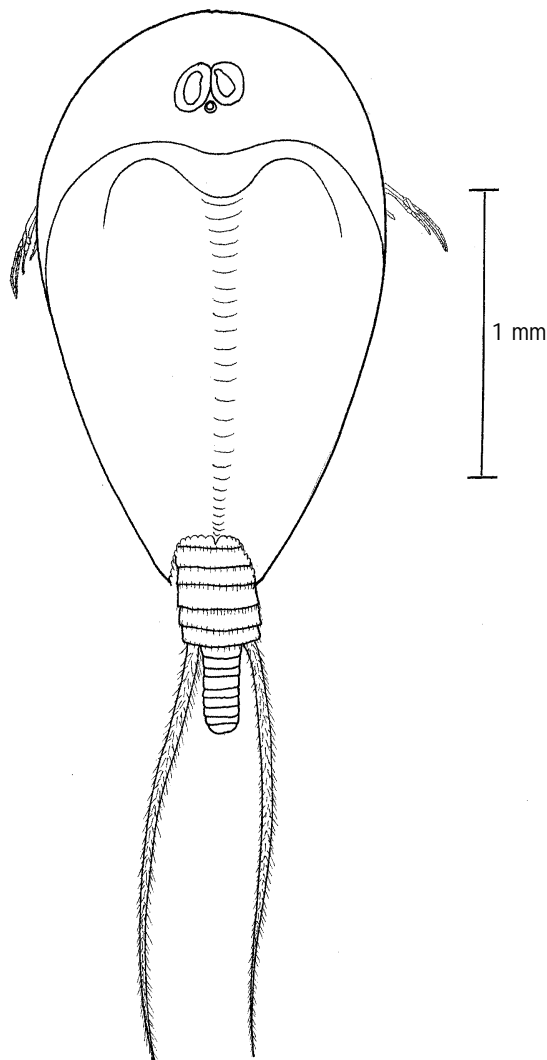
References

Hawking & Smith 1997, p 48; Williams 1980, p 126; Gooderham & Tsyrlin 2002, pp 75.

10.2 Order Notostraca—shield or tadpole shrimps

Background

Notostraca have been recorded from as early as the Carboniferous period and have not changed physically in almost 300 million years. The 220-million-year-old *Triops cancriformis* is thought to be the oldest animal species living on earth. Notostracans evolved before freshwater fish and appear never to have adapted to fish predation. Typically, they are found in temporary pools that do not contain fish. They have been found on every continent except Antarctica, but there are only 15 species worldwide, all in one family. Two genera of shield shrimps (also known as tadpole shrimps) are found in Australia, and members of both can be found in South Australia.



The Notostraca *Lepidurus apus viridis* (family Triopsidae)

Size

First instar larvae of the shield shrimp are approximately 0.5 mm long, but adults can grow to 35 mm in length.

Features

Shield shrimps have a prominent, hardened shield that covers the head and thorax of the animal. The last segment of the abdomen bears two slender 'tails'. From underneath they have a mass of feathery legs, sometimes as many as 60 pairs. They are usually brown or white in colour on the upper side, while their underside can be a fleshy pink colour.

Diet and feeding

Shield shrimps are omnivorous, feeding on algae, bacteria, protozoa, rotifers, aquatic worms, fairy shrimp, frog eggs, tadpoles, rotting leaves and other detritus. Some of this food is filtered from the water using the thoracic appendages that are situated under the shield. The food settles in a groove on the underside of the animal and is then passed along to the mouth. Notostracans sometimes cannibalise others of their kind that have just moulted.

Locomotion

Shield shrimps tend to rest on the bottom of the pool, sometimes partially submerging themselves in the mud or sand. Like most aquatic animals, but unlike anostracans, they swim with their back facing towards the light; lack of oxygen, however, can force them to swim upside down with their gill-like appendages close to the surface of the water.

Gas exchange (breathing)

All of the appendages beneath the shield have leaf-like gills at their bases. The beating appendages create a current of water that flows over the gills.

Life cycle and reproduction

Some species are hermaphroditic and reproduce sexually either through cross-fertilisation or self-fertilisation. They are also able to reproduce by parthenogenesis. Desiccation-resistant resting eggs are often produced and are an important method of survival for the species over periods of drought. The eggs can survive in the dried mud long after the adult shrimps have died; they are quite small and may be carried by wind to other water bodies.

For one species, a period of dry conditions is necessary for the development of all their eggs. Once immersed in water (as the temporary pools are filled), eggs may take as long as two weeks to hatch, but usually take between one and three days. Larvae go through a series of moults and, in less than 24 hours, resemble the adults. Within seven to ten days of hatching, a female shrimp can produce her first brood of eggs. Resting eggs as old as 27 years have hatched successfully.

Habitat

Notostracans have been found in freshwater lakes and ponds, and in slightly saline waters, particularly temporary pools. Members of the two genera prefer different climates: *Triops* species are found in warmer parts and arid areas of South Australia, and *Lepidurus* species are found in cooler regions, such as the South East of South Australia. They are not very common animals and are usually found in temporary water bodies, even puddles.

Class Crustacea—crustaceans

Critter facts

Overseas, shield shrimps have been known to cause extensive damage to rice crops. They chew off the roots and leaves of the seedlings or uproot the seedlings with their digging. They also stir up mud as they dig, and reduce the amount of light penetrating to the rice seedlings.

If a shield shrimp is placed in a petri dish with a light shining underneath it, the animal will flip over to swim on its back.

One species of tadpole shrimp is on the endangered species list in United States of America.

Identification

Shield shrimps are easy to identify, but are not often seen. They have very obvious hardened shields that cover the head and thorax so that only the eyes are visible. The abdomen has two 'tails' attached at the end. The key starting on page 21 of *The Waterbug Book* should help you tell notostracans from other animals.

Classification and sensitivity

Phylum Arthropoda

Class Crustacea

Order Notostraca (1)

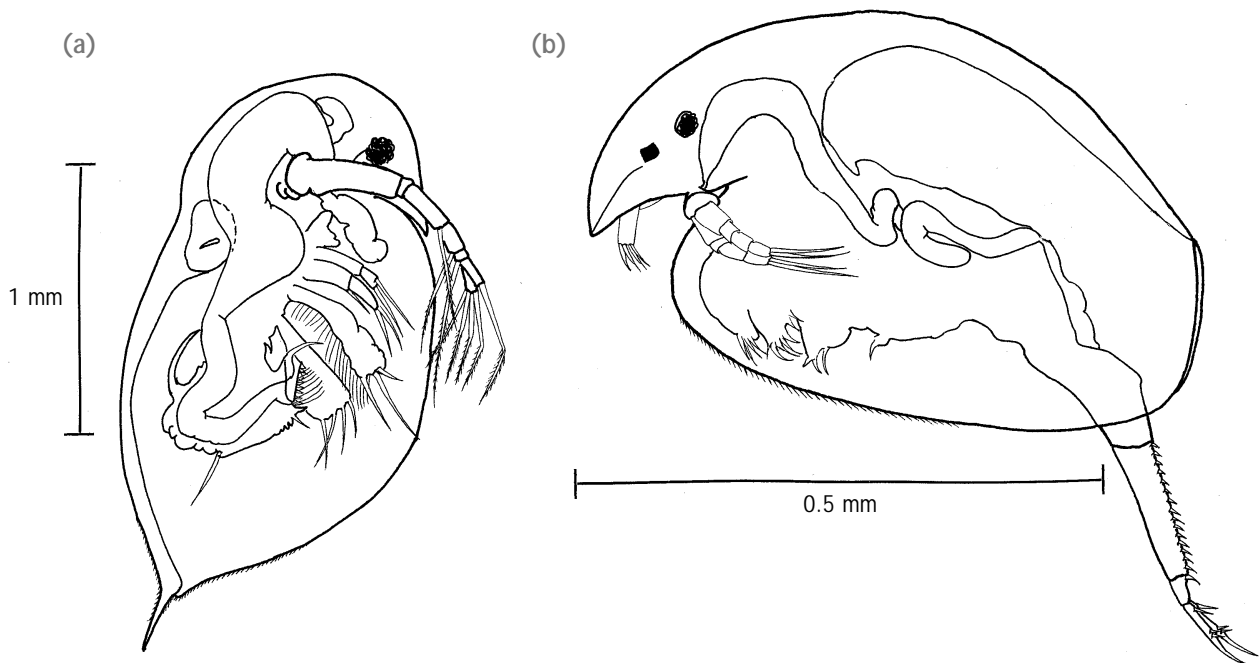
References

Hawking & Smith 1997, p 49; Williams 1980, p 129; Gooderham & Tsyrlin 2002, pp 76.

10.3 Suborder Cladocera-water fleas

Background

Cladocerans occur throughout the world, even in Antarctica. Most are freshwater animals, but some species are estuarine and marine. Eight families (Daphniidae, Moinidae, Macrothricidae, Chydoridae, Sididae, Bosminidae, Sayciidae and Ilyocryptidae) and over 170 species of Cladocera are known from Australian inland waters. *Daphnia* is the most commonly known genus in this group. The exoskeletons of some cladocerans fossilise well in the mud of water bodies and can be used to look at changes in water bodies over hundreds of years. Fossil Cladocera have been identified from the Mesozoic era; the group is thought to have existed since the Devonian period, about 400 million years ago.



The water fleas: (a) *Daphnia* sp. (family Daphniidae) and (b) a member of the Chydoridae family

Size

Most cladocerans are less than 1 mm long, but some grow to 7 mm. Males of some species are smaller than the females.

Features

Cladocerans have a bivalved carapace that is usually transparent. The carapace encloses the body and legs, but not the head or antennae. Cladocerans have one compound eye and sometimes another smaller eye called an 'ocellus'. Females sometimes carry dark-coloured eggs under the carapace.

Diet and feeding

Most cladocerans are filter feeders. They do not feed selectively, but will take any small organism or organic particle within an appropriate size range, including small items of detritus, and algae, bacteria and rotifers. Food is filtered from the water by fine hairs on the thoracic appendages.

Locomotion

Cladocerans swim using their second pair of antennae for propulsion. Some swim on their backs through the water and move through the water column with a jerky motion. Others crawl around on plant surfaces or in the mud.

Gas exchange (breathing)

Cladocerans gain oxygen from the water by diffusion. They have blood that is pumped through the body by a heart. The blood of some cladocerans contains haemoglobin, which helps transport oxygen through the body.

Life cycle and reproduction

Male cladocerans are rarely found as most cladocerans reproduce parthenogenetically. When reproducing parthenogenetically, the females carry their young around in a brood pouch for a few days before they are released.

Cladocera reproduce sexually when environmental conditions deteriorate, due to pollution, food shortages, overcrowding, or water bodies drying up. Two thick-shelled resting eggs are formed that are enclosed in a dark capsule, carried around on the back of the female.

Eventually, the capsule containing the resting eggs is shed and falls into the sediment. The eggs are resistant to desiccation and hatch when conditions improve.

Under laboratory conditions, it has been noted that when an adult female is about to die, she moults one last time and sheds the juveniles growing in her brood chamber, even if they are premature. This process is a survival technique to keep the population going.

Like other crustaceans, cladocerans moult; each time a new carapace grows under the old one before it is shed. When the old carapace is shed, the cladoceran absorbs large amounts of water to expand the new carapace. This water is slowly released as animal tissue takes its place.

When an adult female moults, she releases the juveniles from her brood pouch. It can take one to two weeks for a juvenile to become an adult. The whole life cycle may last for several weeks and an adult female will produce at least six broods.

Habitat

Cladocerans live in standing and flowing waters. Members of some families are 'benthic', which means that they are found living on or close to the bottom of the water body. Others are 'planktonic', that is, found in the water column, usually in surface waters. Cladocerans can tolerate a range of salinities and are often found in saline lakes. Some are very tolerant of sewage effluent and thrive in nutrient-enriched waters, but most are quite sensitive to pollutants such as heavy metals and pesticides. Cladocerans can be found in most water bodies throughout South Australia.

Critter facts

Cladocerans are able to alter the shape of their carapace if they are being preyed upon. Some species are able to enlarge their head capsule and, sometimes, to lengthen their tail spine, which makes them less palatable to their predators.

Some cladocerans are grown as fish food for the aquarium trade and aquaculture industry.

Identification

These crustaceans are usually quite small. They have transparent carapaces, and sometimes the eggs can be seen inside the females. Cladocerans have very long antennae, which often protrude from the side of the animal, looking like arms. With the aid of some magnification you should be able to distinguish a cladoceran from other crustaceans using the key starting on page 21 of *The Waterbug Book*. Be careful though—the young larval stages of other crustaceans may be confused with cladocerans.

With specialist keys, cladocerans can be identified to family level with the aid of a dissecting microscope or a very strong hand lens. Identification to species level is quite difficult and may require dissection of the tiny creatures.

Classification and sensitivity

Phylum Arthropoda

Class Crustacea

Suborder Cladocera (NR)

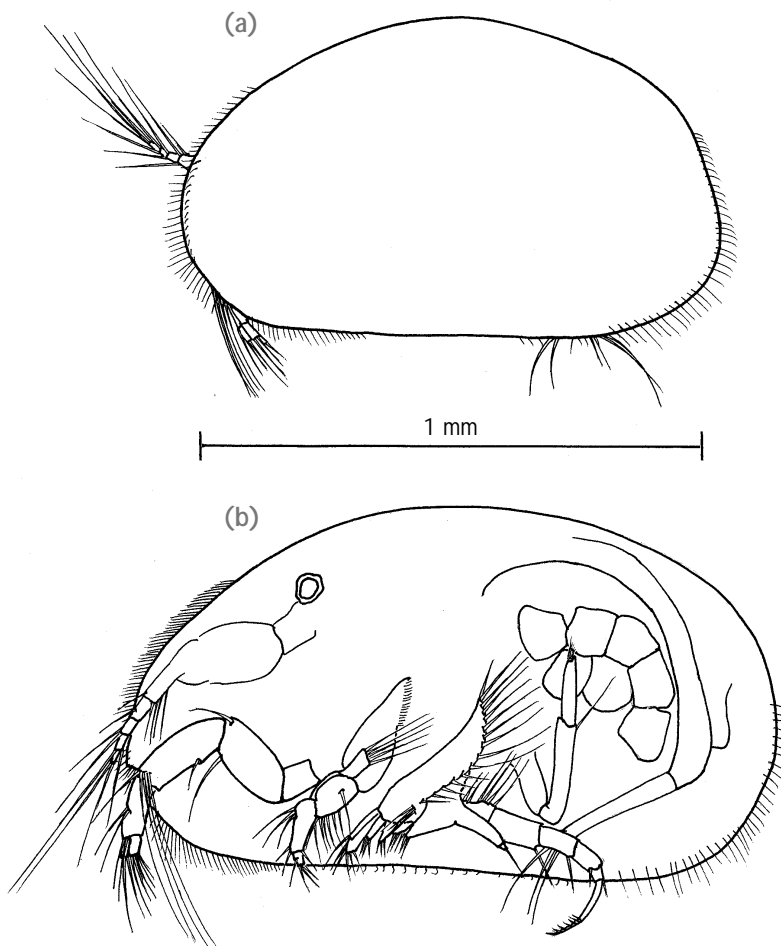
References

Hawking & Smith 1997, pp 50-52; Williams 1980, p 131; Gooderham & Tsyrlin 2002, pp 63-64.

10.4 Subclass Ostracoda-seed shrimps

Background

Worldwide, there are about 5700 species of living Ostracoda and over 10,000 fossil species. The group has a continuous fossil record stretching from the Cambrian period to the present, a period of about 515 million years. Most species are marine, but there are a substantial number of freshwater species and even a few terrestrial species (in New Zealand and South Africa) that live in leaf litter on forest floors. Eleven families and 37 genera of Ostracoda have been recorded from inland waters in Australia.



(a) external view and (b) internal features of an ostracod

Size

In Australian inland waters, adult ostracods range from 0.25 to 6 mm long. The largest marine ostracods are 30 mm long.

Features

Ostracods have a bivalved carapace that generally encloses the entire animal and looks a bit like the shell of a mussel. The carapace is strengthened with calcium carbonate and can be smooth, pitted or ornately sculptured; some have large wing-like projections; sensory hairs can also be present. Ostracods can be green, white, brown, grey or pink, and some are striped or spotted.

Compared with other crustaceans, an ostracod's head is very large, but its body trunk is reduced and has a maximum of two pairs of appendages. When the carapace is open, two pairs of antennae extend out, but if the animal is threatened it retracts all appendages and closes its carapace. The antennae have long setae and are modified for locomotion and feeding. Some ostracods are blind, others have one or two eyes.

Diet and feeding

Ostracods display a range of feeding preferences. They are filter feeders, scavengers, detritivores, herbivores and carnivores. Some marine species parasitise crustaceans, polychaete worms and even sharks. Many freshwater species use their antennae to draw water through the carapace and filter out small food particles. They feed on algae, bacteria and detritus.

Locomotion

Ostracods use their antennae for propulsion and swim actively through the water column, although they only swim short distances. Most also burrow into or skip along the surface of the substrate, using their hinged legs.

Gas exchange (breathing)

Ostracods obtain oxygen from the water by diffusion. Oxygen uptake is enhanced by the currents that the antennae and other appendages create, drawing water through the carapace.

Life cycle and reproduction

Some species lack males and the females reproduce by parthenogenesis. In other species, males range from rare to abundant. Males use their antennae to grasp the female during mating. Some species retain their eggs within the carapace where they are brooded until hatching, but most deposit the eggs onto the substrate.

Ostracod eggs are resistant to desiccation and can lie dormant for a number of years until conditions are favourable. Dry eggs have remained viable for 20 years in laboratory storage. The eggs hatch into small nauplius larvae that have bivalved carapaces like those of adults. The larvae moult eight times before reaching adulthood.

Habitat

Ostracods are found in all types of aquatic habitats—still and flowing, permanent and temporary, fresh and saline waters. Most species are benthic, but some are planktonic; many prefer to shelter in aquatic vegetation. Ostracods are tolerant of pollution and many species can live in waters with low oxygen levels. They are found in most water bodies throughout South Australia.

Critter facts

Ostracods fossilise very well and their fossils are used by geologists to help determine the age of sediments. Some marine species are 'bioluminescent', producing flashes of light. Ostracods have very long sperm. The genus *Pontocyprus* has sperm that are 6 mm long, which is remarkable for an animal that is only 0.3 mm in length. The Australian species, *Heterocypris sydneyi*, is even more remarkable. At 10 mm long, this species has the largest sperm known for any animal.

Identification

The key starting on page 21 of *The Waterbug Book* should help you tell ostracods from other animals. In live samples, ostracods scurry about and, without closer observation, can easily be mistaken for mites. Ostracods are often mistaken for tiny bivalves, but the presence of jointed appendages, which are absent in molluscs, helps in identification. Conchostracans, or clam shrimps, also have bivalved carapaces, but they are usually much larger, have growth lines on the carapace and have between 10 and 30 appendages on the trunk. This is unlike ostracods, which have a maximum of two.

It is very difficult to identify ostracods to family or genus level as the internal structures of the animal need to be examined. This job is best left to the experts.

Classification and sensitivity

Phylum Arthropoda

Class Crustacea

Subclass Ostracoda (NR)

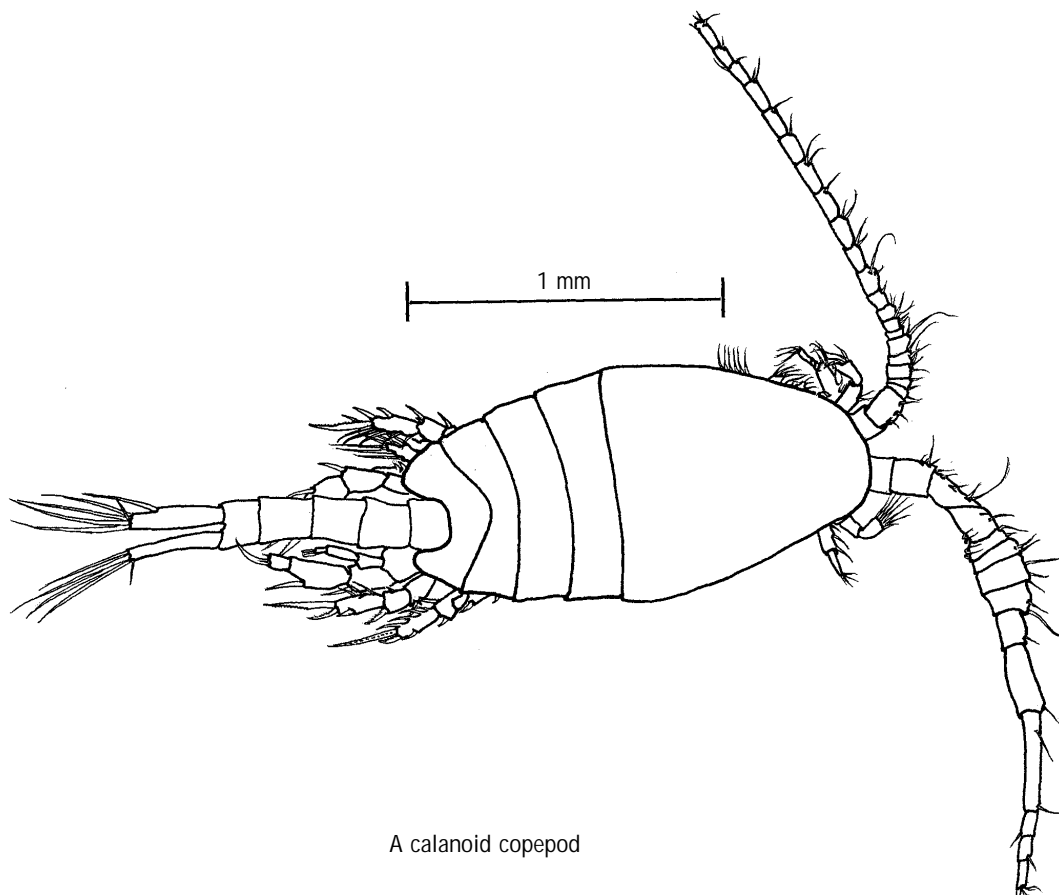
References

Hawking & Smith 1997, p 54; Williams 1980, p 135; Gooderham & Tsyrlin 2002, p 67.

10.5 Subclass Copepoda-copepods

Background

Copepods are found in marine, estuarine and freshwater environments. They are among the most abundant animals on earth. Worldwide, the group comprises ten orders, approximately 210 described families, 2280 genera, and over 14,000 species. Copepods are found in waters from alpine areas to subterranean caves, from fresh water bodies to hypersaline lakes, from shallow coastal waters to deep ocean trenches and as parasites of fish. Members of three orders of Copepoda-Cyclopoida, Harpacticoida and Calanoida-occur in the inland waters of South Australia. Fossil records of Copepoda date back to the Lower Cretaceous period, more than 100 million years ago.



A calanoid copepod

Size

Freshwater copepods grow up to 4 mm long, but usually are much smaller. Harpacticoids are the smallest, at about 1 mm long. The early life stages are very tiny and can be as small as 0.05 mm. Males are smaller than females.

Features

Copepods are small pear- or torpedo-shaped animals with obvious antennae that can be as long as their body. Attached to the thorax they have five pairs of legs that help them swim and grasp food. They usually have a single eye on the head. Copepods are often a pale green colour or translucent in appearance. Females frequently carry around their egg sacs, attached to the end of the abdomen, and this feature can be a useful guide to their identification.

Diet and feeding

Most freshwater species are filter feeders and eat detritus, bacteria and algae. A few are predatory, feeding on small copepods, rotifers and small cladocerans. Some copepods have sensors on their appendages that help them detect their prey. Strong mandibles are used to tear pieces from animals.

Locomotion

Copepods are strong swimmers, propelling themselves by beating their antennae in a rowing manner. They do not swim smoothly through the water, but instead swim in a jerky motion.

Gas exchange (breathing)

Copepods obtain oxygen from the water by diffusion through the body surface. A few species have a heart that pumps oxygenated fluids around the body, but many circulate these fluids by pulsing their digestive systems.

Life cycle and reproduction

Reproduction is thought to be mainly sexual. The male attaches a packet of sperm to the female and these fertilise the eggs as they are released. In some species, mating takes place after the female has undergone her final moult. A few dozen eggs can be produced in one brood and females often carry the eggs, attached to the end of the abdomen. The eggs are released anywhere from a few hours to a few days after mating has occurred and some species can produce eggs that are resistant to desiccation.

After a few days, the larvae, called nauplii, hatch from the eggs. The younger copepods are quite difficult to recognise as they look nothing like the adults. They are triangular and have only three appendages, which they use for feeding and swimming. Larvae go through several moults before reaching adulthood. After the fifth moult, the copepod is sexually mature and can reproduce. Copepods can undergo 11-12 moults in a lifetime.

Habitat

Like ostracods, copepods occur in still and flowing, permanent and temporary, fresh and saline waters. Some are benthic and others planktonic, and many prefer the shelter of aquatic vegetation. Some copepods are parasitic and can be found attached to fish and gastropods. Copepods are common and often abundant, and are found in most water bodies throughout South Australia.

Critter facts

The largest free-living copepods are marine and grow to 17 mm in length, but these are tiny compared to the largest parasitic types, which reach 32 cm long.

Identification

These crustaceans are quite small; close observation is necessary to see them without a microscope. The easiest way to recognise planktonic copepods without a microscope is by looking for small jerking 'Y'-shapes: these are the adult females with clusters of eggs attached to their tails. The key starting on page 21 of *The Waterbug Book* should help you tell copepods from other animals.

Identification of freshwater copepods to genus or species levels requires removal of the legs and scrutiny under a compound microscope. This requires a great deal of patience.

Classification and sensitivity

Phylum Arthropoda

Class Crustacea

Subclass Copepoda (NR)

References

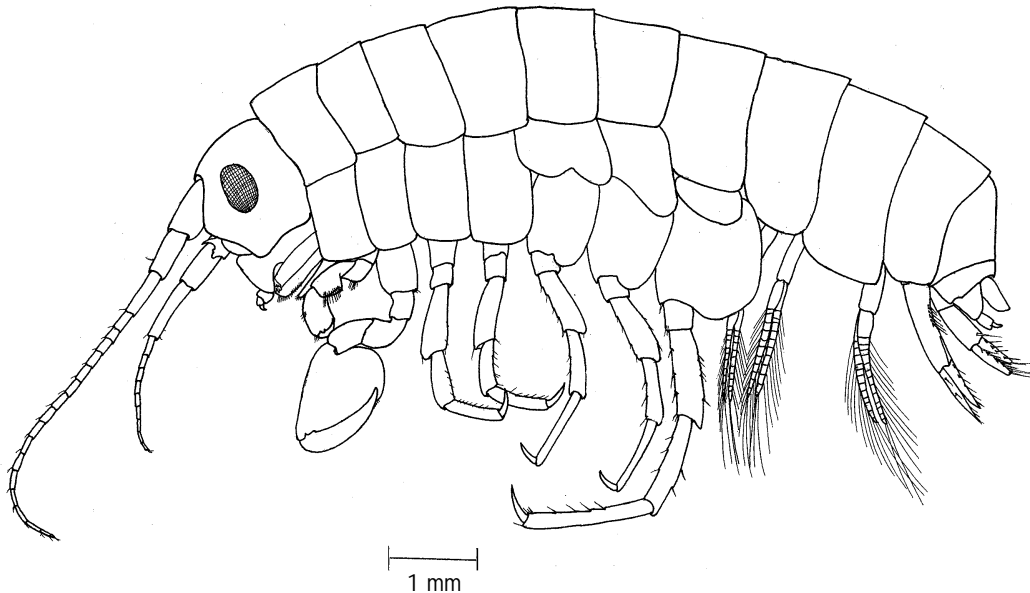
Hawking & Smith 1997, pp 55-59; Williams 1980, p 142; Gooderham & Tsyrlin 2002, p 65.

10.6 Order Amphipoda—scuds or side-swimmers

Background

Over 6000 species of Amphipoda have been found worldwide in marine, freshwater and terrestrial habitats. Nine families of aquatic Amphipoda occur in the inland waters of Australia and seven families are known to occur in South Australia. Beware that amphipods from the terrestrial family Talitridae sometimes slips into aquatic samples.

Amphipods are almost totally absent from the fossil records.



The side-swimmer *Austrochiltonia australis* (family Ceinidae)

Size

Amphipods range in length from 1 mm to 25 mm.

Features

Amphipods are flattened sideways and have a distinctive head and 13 body segments. They have two pairs of antennae and seven pairs of legs, the first two modified to grasp food. Gills are present on the thoracic segments, which are not covered by a carapace. They have three tail appendages, or 'uropods', at the end of the abdomen.

Amphipods have a heart with an open circulatory system. Glands on the antennae regulate the intake and excretion of salts.

Diet and feeding

Most amphipods are detritivores or scavengers. Some have been known to eat their own exoskeleton after a moult. They feed by grasping their prey with the modified front pair of legs. Their diet includes algae, detritus, small crustaceans and small insects.

Locomotion

Most freshwater amphipods can swim very strongly. They can also walk on and burrow into the sediments. Some of them swim sideways—hence the common name, 'side-swimmers'.

Gas exchange (breathing)

Amphipods have ventral gills on the thorax for gas exchange. Their blood contains the respiratory pigment haemocyanin, which aids in distributing oxygen throughout the body.

Life cycle and reproduction

Reproduction is sexual. Females are often seen carrying the smaller males around and have been observed to do so for a number of days. The female releases the eggs into thoracic brood chamber where they are fertilised. Females have broods of about 15-30 eggs at a time. There is no larval stage: the adult form develops directly from the eggs. After hatching, the juveniles are carried around by the adult female for only a few days. The young start to moult very soon after hatching and, in some species, may moult as soon as two days after hatching. Sexual maturity is usually reached around the sixth moult. As the female ages, the number of eggs that she lays after each moult increases. Not all eggs hatch; the mortality rate of eggs is 25-50%. Some amphipods have been known to live through 13 moults.

Habitat

Amphipods are found in still and flowing water and generally live on the sediment or in aquatic vegetation and organic debris. They have been found in waters ranging from fresh to twice the salinity of the sea. One species of amphipod, *Austrochiltonia australis* (Family Ceinidae), is tolerant of high salinity levels and is found in most streams and lakes of South Australia.

One species of Corophiidae was discovered recently in water bodies of South Australia, primarily in streams that are slightly saline to saline, as well as in estuaries. The family Perthiidae has also been found recently in the Onkaparinga catchment and in the Murray River at Woods Point. Previously, this family was known only from Western Australia.

Critter facts

One blind amphipod species, *Brachina invasa* (Family Melitidae), lives in interstitial spaces a metre below the gravel stream beds of the Flinders Ranges.

The largest amphipod was thought to be a marine species that reaches 14 cm in length; however, in 1968, a 28-cm-long benthic amphipod was discovered in the Pacific Ocean. It was detected in an aerial photograph taken from 5300 metres!

Identification

Amphipods may occasionally be confused with isopods, but in South Australia amphipods are flattened sideways (laterally), while isopods are dorso-ventrally flattened. In addition, amphipods have gills on the thoracic segments whereas isopods have gills on the abdominal segments. Another way to distinguish an amphipod from an isopod is to determine if it has three pairs of tail appendages (uropods) since isopods only have one. The most common amphipod in South Australia has a very small third uropod.

The key starting on page 21 of *The Waterbug Book* should help you tell amphipods from other animals; however, identification to family is tricky. If you have some spare time and a microscope you can try the key on page 71 of *The Waterbug Book*.

Classification and sensitivity

Phylum Arthropoda

Class Crustacea

Order Amphipoda (3)

Family Ceinidae (2)

Family Melitidae (NR)

Family Eusiridae (7)

Family Corophiidae (4)

Family Perthiidae (NR)

Family Paramelitidae (4)

Family Neoniphargidae (4)

References

Hawking & Smith 1997, pp 60-61; Williams 1980, p 158; Gooderham & Tsyrlin 2002, pp 69-71.

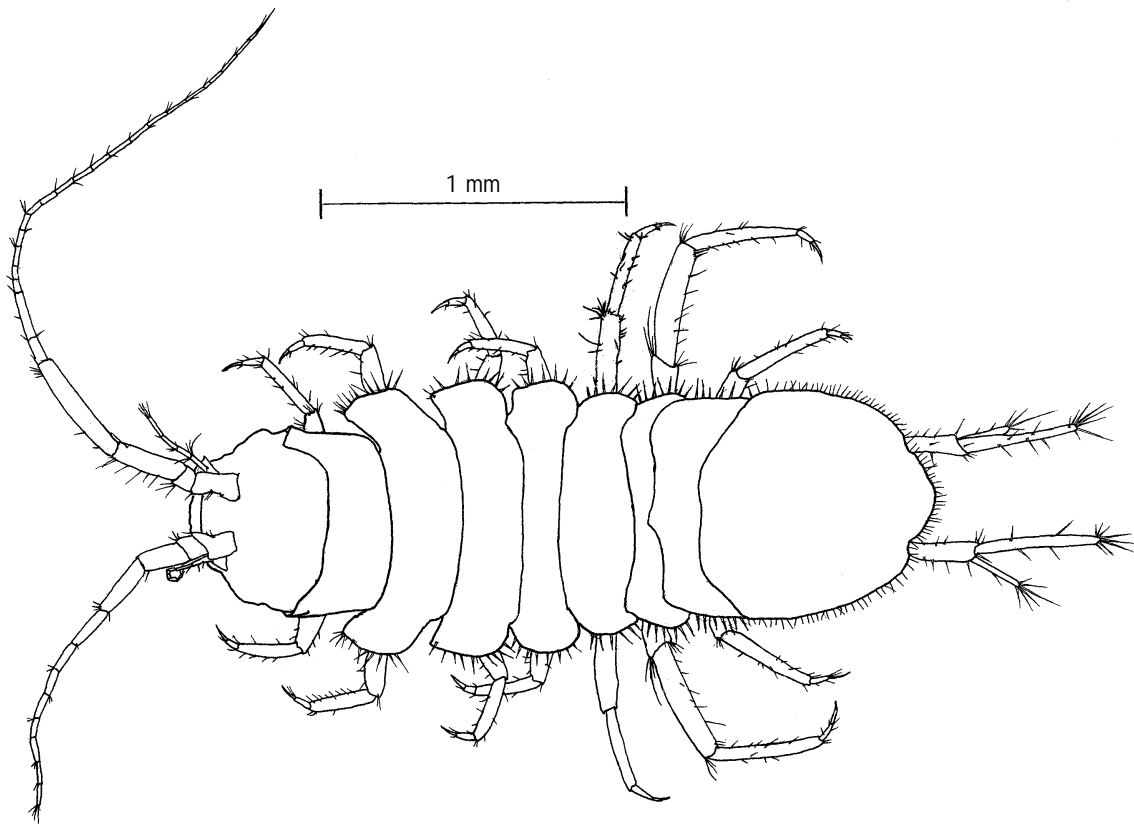
10.7 Order Isopoda-water slaters and sow bugs

Background

There are over 10,000 species of Isopoda worldwide. Most are marine and terrestrial but approximately 500 species have been found in freshwater systems. Isopods have been particularly successful in adapting to deep sea conditions. Their greatest diversity is seen in the ocean depths.

Twelve families are known to occur in inland waters of Australia, with four in South Australia. Three genera commonly found in South Australia are *Heterias* (Family Janiridae), *Haloniscus* (Family Oniscidae) and *Austroargathona* (Family Cirolanidae). A fourth genus, *Phreatomerus*, is found only in the mound springs of the Far North region of the state.

Fossil records of isopods date back to the Carboniferous period, 325 million years ago. Isopods have been living in fresh waters since the Triassic period and species present today are very little different from Triassic forms.



The isopod *Heteria pusilla* (family Janiridae)

Size

Isopods range from 2 mm to 12 mm in length.

Features

Isopods are usually strongly dorso-ventrally flattened, although some can be laterally flattened. They have a distinct head, which may or may not have eyes. They do not have a carapace. They have seven pairs of walking legs. The first two pairs of legs on the abdomen are different in males and females: in males, they are modified to transfer sperm to the female. Gills are present on the abdominal segments. Isopods have two pairs of antennae, the first of which are usually chemical sensors. Isopods have a circulatory system with a large heart.

Diet and feeding

Isopods are mainly herbivorous, feeding on small pieces of dead and decomposing plants, although some also feed on animals. In some species the first pair of legs on the thorax is modified for grasping prey.

Locomotion

Some of the legs of isopods are adapted for crawling while others are adapted for swimming. They often burrow into submerged root mats and gravel. The more primitive short-tailed forms are clumsy movers, but long-tailed isopod species are highly mobile and frequently leave their benthic shelter to swim short distances through the water. Their elongate tails and broad uropods assist in swimming.

Gas exchange (breathing)

Isopods obtain oxygen across the surface of gills that are associated with the abdominal appendages. Like amphipods, isopod blood (haemolymph) contains the respiratory pigment haemocyanin. Most excretion occurs by diffusion through the body wall.

Life cycle and reproduction

Reproduction is sexual and fertilisation occurs inside the female. The eggs are incubated in a brood pouch inside the female. Like amphipods, isopods have no larval stage, adults developing directly from the egg through several moults. Isopods are unable to produce resting eggs, but some species are able to burrow into the sediments to wait out unfavourable conditions.

Habitat

Isopods generally crawl around on the bottom of water bodies. They inhabit streams, pools and lakes, ranging from fresh to very saline waters. Some prefer spring-fed streams.

The genus *Haloniscus* resembles the terrestrial slater and is often found in saline waters; other members of this family are terrestrial. The other two genera commonly found in South Australia prefer freshwater systems. *Austroargathona* is restricted to the Murray River; in their juvenile stages, species of *Austroargathona* are parasitic on the decapods, *Paratya* and *Macrobrachium*, which are very common in the River Murray. *Heterias* can be found in many water bodies throughout South Australia, even those that are slightly polluted.

Criticr facts

The largest isopod is a marine species that reaches a length of 42 cm and width of 15 cm. Some marine isopods bore into wood and can cause damage to boats, jetties and other structures.

The fossil record indicates that the earliest isopods (and the most primitive living species) are members of the suborder Phreatoicidea. Today, phreatoicids are freshwater crustaceans that are restricted to the southern hemisphere: most species occur in the rivers and lakes of Australia. The species that occur in the mound springs of the Far North region of South Australia are part of this group.

Identification

In South Australia aquatic isopods are flattened dorso-ventrally and can be recognised quite easily—some species look like terrestrial slaters. In comparison, amphipods are flattened sideways. Isopods can also be separated from amphipods by the presence of gills on the abdominal segments, rather than thoracic segments. See the key starting on page 21 of *The Waterbug Book* for further guidance.

The three commonly found genera in South Australia, *Heterias* (Family Janiridae), *Haloniscus* (Family Oniscidae) and **Austroargathona** (Family Cirolanidae), are quite easy to tell apart. Comparison with the photographs on pages 62-64 of the *Colour Guide to Invertebrates of Australian Inland Waters* should result in a correct identification.

Classification and sensitivity

Phylum Arthropoda

Class Crustacea

Order Isopoda (2)

Family Janiridae (3)

Family Oniscidae (2)

Family Cirolanidae (2)

Family Sphaeromatidae (NR)

References

Hawking & Smith 1997, pp 62-65; Williams 1980, p 155; Gooderham & Tsyrlin 2002, pp 72-73.

10.8 Order Decapoda-crabs, crayfish, yabbies, freshwater prawns and freshwater shrimps

Background

Decapods are well known to most people as a tasty food. Crabs, crayfish, prawns and shrimps all command high prices at fish markets. Worldwide, there are over 10,000 species of Decapoda, which figure represents about a quarter of the total number of described crustacean species. The majority of these species are marine, but many others occur in inland waters. There are six families of freshwater decapods that occur in the inland waters of Australia, four of which occur in South Australia. Fossil records date back to the Jurassic period, about 150 million years ago.

Size

Decapods range in size from small juveniles about 2 mm long to large crayfish that can grow to lengths of more than 300 mm.

Features

Decapods have a prominent carapace that covers all the thoracic segments. The first three appendages on the thorax are modified to assist with feeding. They have five pairs of thoracic legs, from which feature the name is derived-Decapoda means 'ten legs'. The first or second pair of legs (depending on the species) is enlarged and modified for feeding and grasping prey. The eyes are on stalks. Some decapods have a prominent 'rostrum', a projection that is often serrated, extending from the front of the head. The abdomen of decapods often has a tail fan. The freshwater crab is the exception, with only a small rostrum and no tail fan.

Diet and feeding

Decapods use either their first or second pair of legs for feeding. The legs have pincers at the end to help grasp prey. The decapod diet includes insect larvae and adults, other crustaceans, snails and fish. Some species feed on plant material and are able to scrape algae off rocks and submerged vegetation.

Locomotion

Decapods are not very able swimmers; they prefer to climb among submerged water plants and walk along the bottom of the water body. Many are able to get out of dangerous situations quickly by flicking their tail fans and darting backwards.

Gas exchange (breathing)

Decapods obtain oxygen by diffusion, using gills at the base of their thoracic segments. Thoracic appendages beat to produce a current of water across the gills. As water flows over the surface of the gills, oxygen is extracted. The blood of decapods contains haemocyanin, which aids in the transport of oxygen throughout the body of the animal.

Life cycle and reproduction

The sexes of decapods are separate, and mating usually occurs after a moult. Pheromones are released to attract the opposite sex to initiate mating. All decapods lay eggs. The eggs are carried around by the female, attached to the underside of her body. When the juveniles hatch,

they often remain attached to the female for a few days. Juveniles look similar to the adults, but are smaller. The juvenile goes through numerous moulting stages when young, but the animal moults less frequently as it ages. As the juvenile grows, the number of appendages increases and gradually it becomes more like the adult. These moulting stages are vital for the growth of appendages, even in the adult stage. It is not uncommon for a decapod to lose an appendage such as a leg or claw, and this can be regrown over a few moults.

Habitat

The Parastacidae can be found in burrows along the bottom and sides of a water body, and in waters with clay or sandy sediments. Members of other decapod families can be found among water plants, usually clinging to the leaves or stems that are underwater. Sometimes they can be found in the undercutting of banks. They are usually found in fresh water, but are tolerant of slightly saline waters. Decapods are common throughout South Australia, living mainly in vegetated, still or slow-flowing waters.

Critter facts

Marron, a member of the family Parastacidae and native to Western Australia, has been introduced into South Australia. It resembles the South Australian yabbie. It is farmed on Kangaroo Island and can be eaten at some of the cafes on the island. Unfortunately, it is not restricted just to the farming dams but can be found in many of the streams on Kangaroo Island as well as on the Fleurieu Peninsula.

Identification

Freshwater decapods are quite similar to marine decapods in appearance. Freshwater shrimps and prawns are usually translucent when alive; they have a thin carapace and long rostrum, usually with spikes or teeth along the upper and lower surfaces. Freshwater crayfish and yabbies have a hardened carapace and are usually brownish in colour; they have very large claws on the first pair of legs.

Freshwater crabs are usually quite small and white or yellow in colour; they have a carapace that covers the whole body except the legs, and a small rostrum that appears as a bump between the eyes. See page 78 of *The Waterbug Book* for a key to the families of Decapoda.

Classification and sensitivity

Phylum Arthropoda

Class Crustacea

Order Decapoda (4)

Family Atyidae (3)

Family Palaemonidae (4)

Family Hymenosomatidae (3)

Family Parastacidae (4)

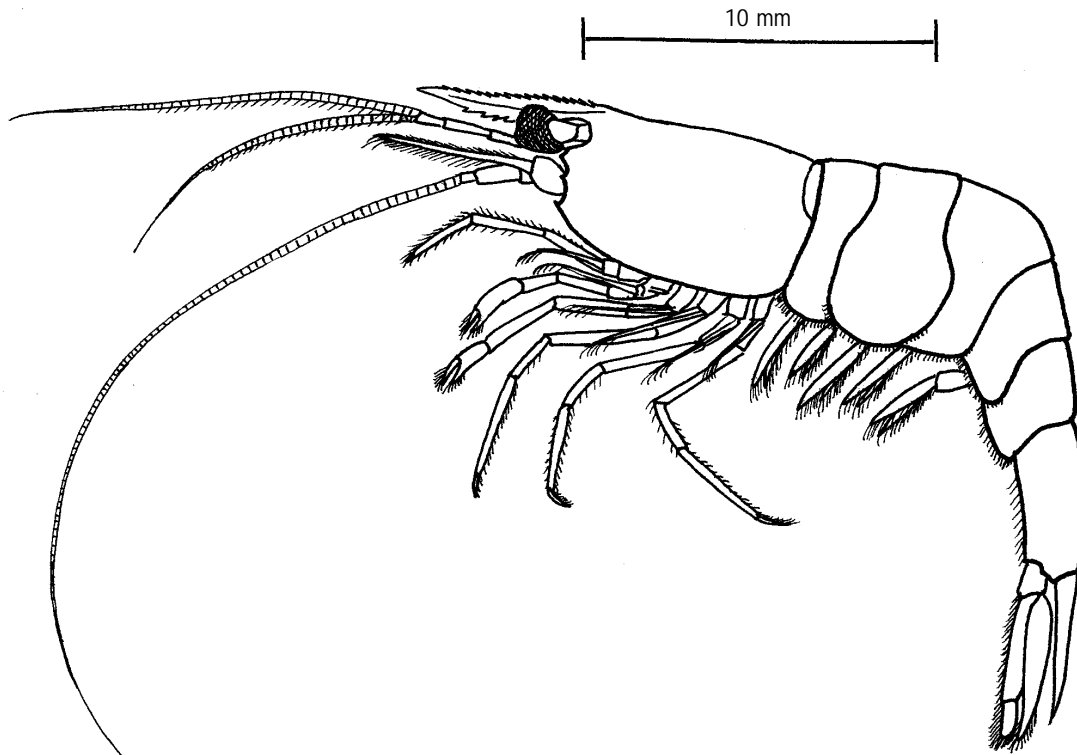
References

Hawking & Smith 1997, pp 66-73; Williams 1980, p 161; Gooderham & Tsyrlin 2002, pp 77-83.

Family Atyidae-freshwater shrimps

Background

This family is found throughout the world. Members of eight genera can be found in inland waters of Australia and at least two genera are found in South Australia. The most common species is *Paratya australiensis*, but species of the genus *Caridina* are also found in South Australia.



The freshwater shrimp *Paratya australiensis* (family Atyidae)

Size

Atyids can grow to about 35 mm long. The males are slightly smaller than the females.

Features

Freshwater shrimps have a prominent rostrum that has teeth or spikes along the upper and lower rostrum ridges. The first two pairs of legs are similar, with pincers on the ends. These pincers are tipped with tufts of long hairs. The atyid body is flattened sideways and the end of the tail resembles a fan. These shrimps are usually transparent and can camouflage well.

Diet and feeding

Freshwater shrimps feed on animal and plant material. They scrape algae and detritus from rocks and water plants, which they pick up with their pincers. They are also able to filter food particles from the water.

Locomotion

Freshwater shrimps walk well, grasping the substrate with their pincers. They also cling and climb up the stems of submerged water plants. Shrimps are able to escape danger by beating the tail fan and shooting quickly backwards. They can also swim by beating the abdominal appendages.

Gas exchange (breathing)

Atyids obtain oxygen by diffusion from the water, using gills at the bases of thoracic appendages. The appendages beat to produce a flow of water over the gills.

Life cycle and reproduction

The sexes are separate, although some species develop as males first and then transform into females. When shrimps mate, they are usually oriented at right angles to each other. In summer, females produce 50-200 eggs, which they attach to their abdominal appendages. The larvae are planktonic and, with high flow, may be swept downstream to develop in an estuary until they are big enough to swim upstream. The larval stage can last up to 45 days. Females sometimes produce two broods of young in a season. Freshwater shrimps live for up to two years.

Habitat

Freshwater shrimps are widespread and can usually be found in the ponded sections of lowland rivers and streams. They mostly shelter among aquatic plants, but have also been found in open waters. Members of the genus *Paratya* are found throughout South Australia in many still waters and are very common in the River Murray. The genus *Caridina* is not as widespread, but has been found in the River Murray as well as in streams in the Flinders Ranges. One species of *Caridina* lives in thermal pools in central Australia. Some atyids are moderately tolerant of water pollution, particularly of increased nutrients.

Critter facts

Freshwater shrimps can be kept in home aquaria. They feed on fish food and apparently have a liking for soft-boiled zucchini.

Identification

Atyids can easily be confused with members of the family Palaemonidae (freshwater prawns). Palaemonids have larger spines on the rostrum and much longer chelae (claws or 'nippers'). Atyids have a very obvious tuft of hair on both the first and second pair of legs that is absent in palaemonids. Juvenile atyids are indistinguishable from juvenile palaemonids. See page 78 of *The Waterbug Book* for a key to the families of Decapoda.

Classification and sensitivity

Phylum Arthropoda

Class Crustacea

Order Decapoda

Family Atyidae (3)

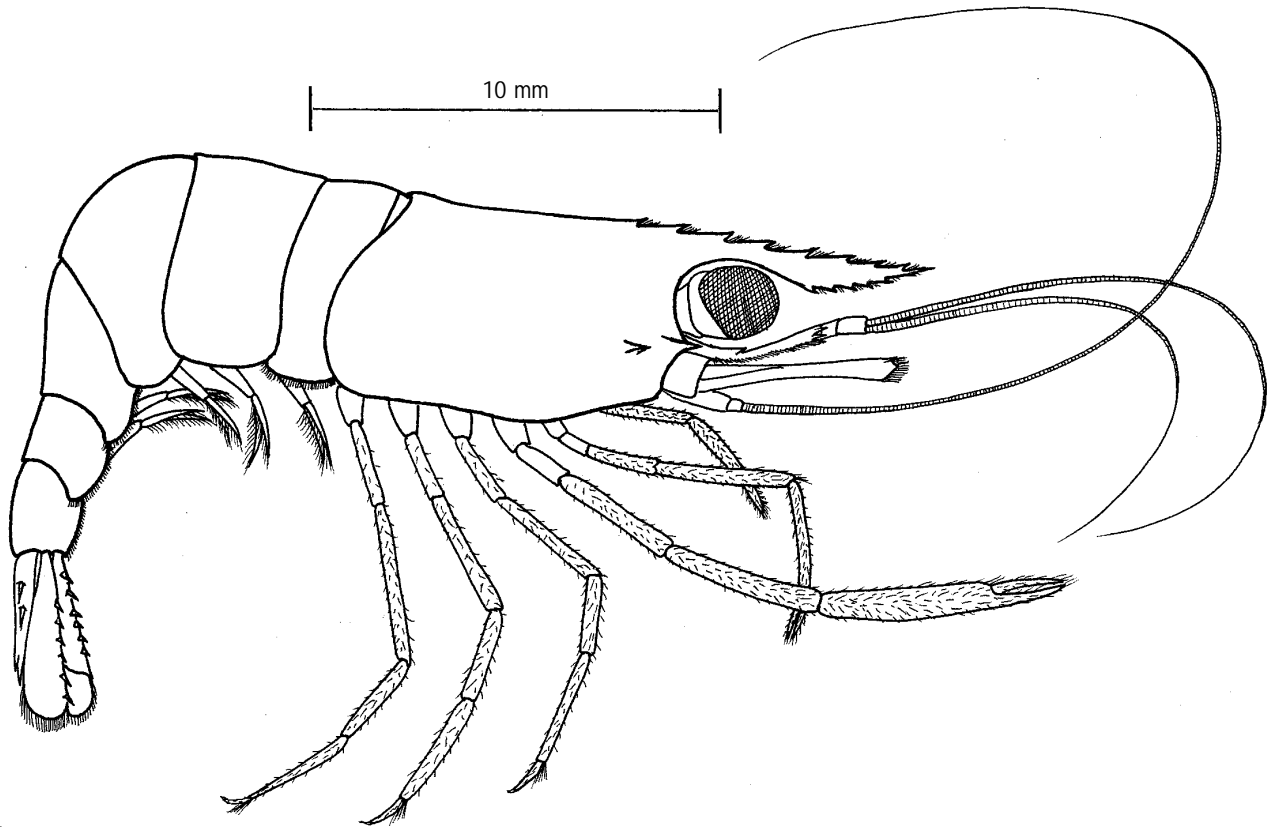
References

Hawking & Smith 1997, pp 66-68; Williams 1980, p 164; Gooderham & Tsyrlin 2002, p 80.

Family Palaemonidae-freshwater prawns

Background

Palaemonids occur worldwide; in some countries they are economically important and are cultured as a food source and as aquarium pets. All members of this family occur in fresh waters. There are four genera of freshwater prawns in Australia, but only one genus, *Macrobrachium*, occurs in South Australia.



The freshwater prawn *Macrobrachium australiense* (family Palaemonidae)

Size

Adults can grow up to 65 mm long. Juvenile palaemonids can be around 2 mm long. Adult males are larger than adult females.

Features

Freshwater prawns have a prominent rostrum that protrudes from between their eyes. The carapace covers their head and thorax, and the eyes are on stalks. Palaemonids are translucent when young and turn to a bluish-brown as they grow older. They have long thin legs; the first pair is longer than the second and has larger pincers.

Diet and feeding

Freshwater prawns are omnivores. They feed on algae and detritus, which they scrape from rocks and stems of water plants; using their long pincers, they are also able to catch prey. These crustaceans feed on larval and adult insects, algae, worms, molluscs, fish and faeces of fish. They tend to eat animals smaller than themselves. At high densities, or when there is a shortage of other food, freshwater prawns become cannibalistic.

Locomotion

Freshwater prawns are able to crawl along the bottom of a water body or cling to water plants, using the pincers on their legs. They are also able to swim by flicking through the water.

Gas exchange (breathing)

Palaemonids have gills at the base of their thoracic appendages. The appendages beat the water and produce a current over the gills.

Life cycle and reproduction

The sexes are separate and mating occurs between a hard-shelled male and a soft-shelled female, the female mating shortly after she has moulted. Females reach reproductive maturity at about six months of age. The male deposits a jelly coated sperm sac in between the female's fourth pair of walking legs. Eggs are laid a few hours after mating and are fertilised after they are laid. A female can lay 30,000 eggs in a lifetime.

Once fertilised, the eggs are transferred to the brood chamber of the female, which is situated under the abdomen or tail of the animal. There, they are kept aerated and clean by the swimming appendages on the tail. The eggs remain attached to the female until they hatch, approximately 20 days after being laid. The young are similar in appearance to the adults and feed almost continuously on zooplankton, worms and small insect larvae. They go through 11 moulting stages, which can take up to 40 days. The juveniles spend all their time suspended in the water column but, with maturity, become bottom-dwelling organisms.

Habitat

Palaemonids are quite common in the larger rivers of South Australia, such as the River Murray, and Cooper Creek in the Far North region of the state. They can be found among submerged water plants in larger slow-flowing rivers and still waters, and they tolerate elevated salinity. All their life stages are vulnerable to desiccation and so they tend to be more common in permanent waters.

Class Crustacea-crustaceans

Critter facts

Freshwater prawns have been known to respond to the presence of people in the River Murray. People who have waded into the water with bare legs have felt the prawns crawling on their skin and, on occasions, have felt a prawn nip them.

Identification

Palaemonids can be confused easily with atyids (freshwater shrimps). Palaemonids have larger spines on the rostrum and much longer pincers; atyids have a very obvious tuft of hair on both the first and second pair of legs that is not present in palaemonids. However, juvenile palaemonids are very difficult to distinguish from juvenile atyids. See page 78 of *The Waterbug Book* for a key to the families of Decapoda.

Classification and sensitivity

Phylum Arthropoda

Class Crustacea

Order Decapoda

Family Palaemonidae (4)

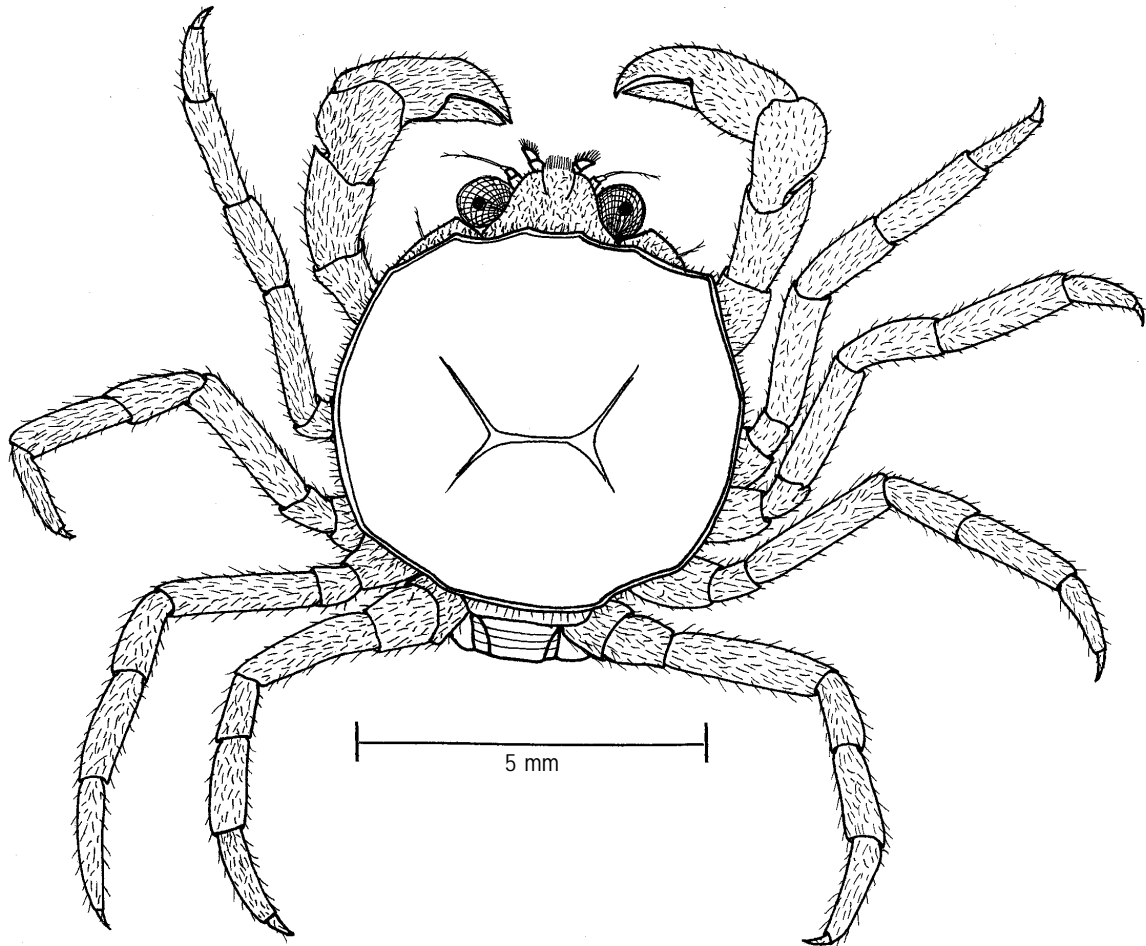
References

Hawking & Smith 1997, pp 66-68; Williams 1980, p 166; Gooderham & Tsyrlin 2002, p 81.

Family Hymenosomatidae-small spider crabs

Background

Throughout the world, there are only 50 species in the family Hymenosomatidae, and 46 of these are either marine or estuarine. One genus, *Amarinus*, occurs in South Australia. Fossil records of these crabs date back to the Palaeocene epoch of the Caenozoic era, up to 65 million years ago.



The freshwater crab *Amarinus lacustris* (family Hymenosomatidae)

Size

Members of *Amarinus* grow to 8 mm wide.

Features

Freshwater crabs are rounded and dorso-ventrally flattened. They have a very reduced rostrum, compared with those of shrimps and crayfish, that appears as just a slight bump between the eyes. Freshwater crabs have eight legs and two large claws. Their abdominal segments are reduced, tucked up under the body, and lack appendages. The front of the carapace is somewhat pointed, not rounded as in other freshwater crabs.

Diet and feeding

Freshwater crabs are omnivores, feeding on algae, roots and submerged plants as well as amphipods and microcrustaceans.

Locomotion

Crabs walk well and can burrow. Some can swim sideways quite quickly.

Gas exchange (breathing)

Members of the genus *Amarinus* obtain oxygen across the surface of their gills. Haemocyanin, a respiratory pigment, present in the blood, aids in transporting oxygen throughout the body.

Life cycle and reproduction

Freshwater crabs usually mate face to face: the female is pinned on her back by the male. Unlike marine crabs, young of *Amarinus* hatch directly from eggs carried under the folded tail of the mother. Hatching takes place after about 55 days. Females can produce up to three broods per season. The young go through a series of moulting stages, growing in spurts rather than continuously. Crabs are very vulnerable when they have just moulted because the new carapace is soft and usually take a few days to harden. Through the moulting stages, they are able to regrow a claw if one is lost.

Habitat

Freshwater crabs can be found in both flowing and standing waters. The genus *Amarinus* is often found in slightly saline to saline waters, in association with rocks or submerged water plants. These spider crabs have also been found where the water plant, *Cotula coronopifolia* (known as 'water buttons'), is growing. In South Australia, this plant is not very common, but it occurs in coastal drains of the South East region and also in the River Murray.

Critter facts

Some freshwater crabs are important vectors of the deadly disease Paragonimiasis, which affects about 20 million people worldwide. This disease is caused by a lung fluke that lives in the crab.

The Japanese spider crab has a four-metre leg span, the largest of any crustacean.

Identification

Freshwater crabs resemble marine crabs, all having ten legs and a hardened shell covering the entire body. The first pair of legs are modified for feeding: they have claws to grasp prey. Crabs are easy to separate from other decapods. If you are having trouble, see page 78 of *The Waterbug Book* for a key to the families of Decapoda.

Only the genus *Amarinus*, family Hymenosomatidae, occurs in South Australia, but in the northern parts Australia, these crabs may be confused with members of another family of freshwater crabs, the Sundathelphusidae. Sundathelphusids have a square body and lack the small rostrum between the eyes.

Classification and sensitivity

Phylum Arthropoda

Class Crustacea

Order Decapoda

Family Hymenosomatidae (3)

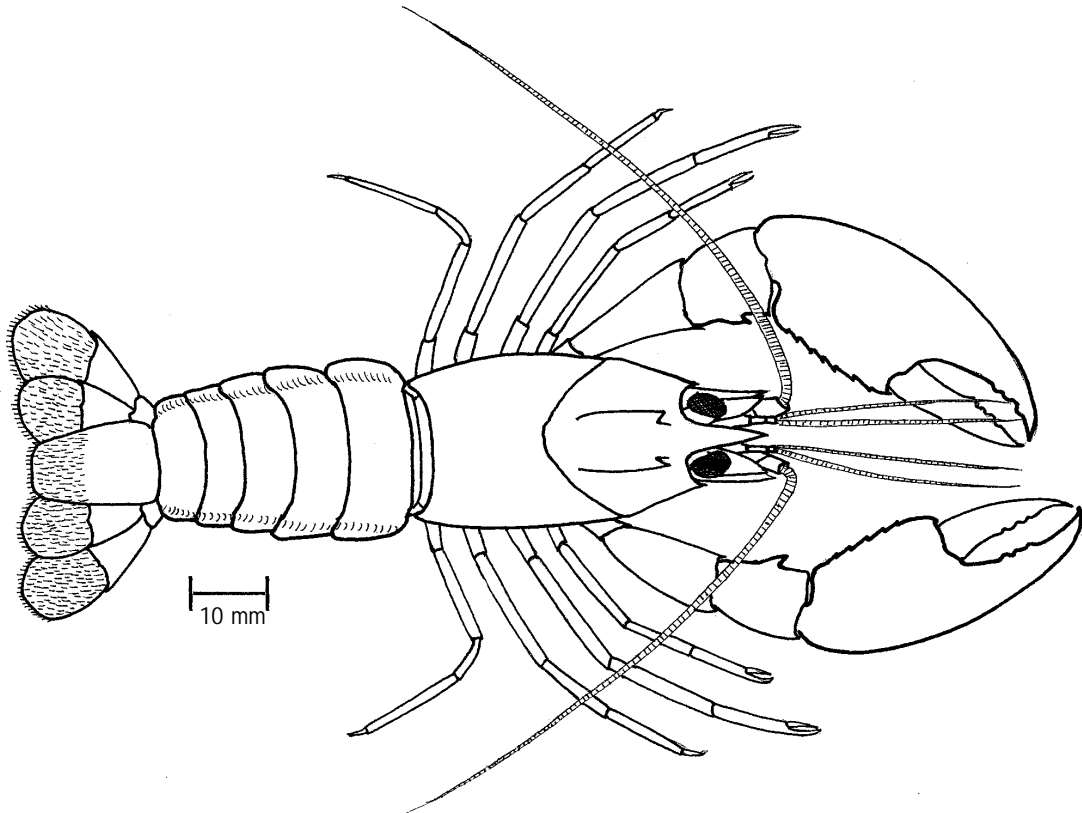
References

Hawking & Smith 1997, pp 69-70; Williams 1980, p 172; Gooderham & Tsyrlin 2002, pp 81-82.

Family Parastacidae-freshwater crayfish and yabbies

Background

There are 500 species of Parastacidae throughout the world; all members of this family occur in fresh water. Nine genera are found in Australia. In South Australia, the yabby, *Cherax destructor*, is the most common species. In addition, an introduced species of the genus *Cherax* can be found in some parts. The large Murray crayfish, *Euastacus armatus*, which used to be quite common, is now quite rare.



The yabby *Cherax destructor* (family Parastacidae)

Size

Adults of the Murray crayfish grow to more than 300 mm long; it is the second-largest freshwater crustacean in the world. Yabbies grow to 200 mm in length.

Features

Freshwater crayfish have a prominent dorso-ventrally flattened rostrum projecting from the front of the head. The abdomen has a tail fan, and the legs are well developed, the first pair having large claws. The crayfish and yabby are usually brown in colour, but may also be bluish, and their shells are thickened and hardened by the deposition of lime salts.

Diet and feeding

Freshwater crayfish feed on both plant and animal matter, including molluscs and fish, and adult and larval aquatic insects. They are predatory, but also scavenge on dead animals if they are available.

Locomotion

Parastacids do not swim, but prefer to walk along the stream or river bottom. They are strong walkers and burrowers. Yabbies can burrow in sediments, usually clay, to a depth of 50 cm—often yabbie burrows can be seen in the beds of streams and ponds. Yabbies and crayfish are able to escape rapidly from danger by flicking the tail and darting backwards. Adult crayfish have been known to roam the banks of creeks for a period of time and to move from one water body to another if conditions become unfavourable.

Gas exchange (breathing)

The gills are covered by the carapace, which forms a branchial chamber along the side of the body. Each gill has a stem that gives rise to numerous filaments, across the surfaces of which oxygen diffuses from the water. Parastacids have colourless blood that is drawn into the heart, which then pumps it out along arteries to parts of the body. It then passes into an open system of sinuses before returning to the heart. The blood contains haemocyanin, which aids in the transportation of oxygen.

Life cycle and reproduction

Freshwater crayfish reach sexual maturity when they are between five and eight years old; freshwater yabbies, however, start to reproduce at a much younger age. Mating in crayfish and yabbies usually occurs face to face: the male turns the female on her back and pins her down with his claws. Females can carry a large number of eggs, sometimes as many as 1200. Crayfish females carry the young under the tail for up to five months, between May and October. Yabbie females carry their young from October to March. The young hatch from eggs as miniature adults while still attached to the female and can remain attached for several days. Juveniles moult several times and grow in spurts. After moulting, for the few days during which the new carapace is still soft, the animal absorbs a lot of water and increases in size. Many juveniles fail to reach adulthood as they are consumed by birds and fish.

Habitat

Freshwater crayfish and yabbies live in most types of aquatic systems. They prefer water bodies with softer sediments into which they can burrow. They can survive over dry periods in these burrows. Crayfish prefer faster flowing waters that are well oxygenated. Yabbies can survive in either temporary or permanent still waters and in waters with low oxygen levels. Yabbies are found quite commonly throughout South Australia. The marron, which is similar to the yabbie, but a native of Western Australia, has been introduced to the waters of Kangaroo Island and some streams on the Fleurieu Peninsula. Murray crayfish numbers are declining in South Australia; they are now only rarely found downstream of Mildura.

Critter facts

Some crayfish live on land for long periods of time. They have been known to burrow into people's lawns. It has been said that the world's smallest and largest crayfish occur in Australia: a species in Queensland reaches a maximum length of 25 mm, while a Tasmanian species reaches 400 mm.

The largest freshwater crayfish in the world is the giant Tasmanian freshwater crayfish, *Astacopsis gouldi*, which grows to at least 400 mm in length and 3.6 kg in weight, and has even been recorded at over 6 kg. It used to be fished but, due to its declining numbers, sensitivity to habitat disturbance, and very long life cycle, it is now a protected species. Females mature after 14 years and the smaller males after about 7-9 years. They are thought to live for up to 60 years.

Some species of crayfish are burrowers and are often referred to as terrestrial or land crayfish. These crayfish occupy an amazing variety of habitats, usually in areas with relatively high rainfalls. The burrows sometimes have a 'chimney' of pelleted soil at the opening.

If a crayfish or yabbie loses a claw it can grow back. It will slowly increase in size over a few moults, eventually returning to its appropriate size.

Fishers who catch freshwater crayfish in Australia should remember that some species are protected and there may be bag and size limits. Small specimens should be put back, and females that have eggs under their tails are likely to be protected and must be returned to the water. Make sure you are familiar with the laws in your state before you go fishing.

Identification

Parastacids are similar to atyids and palaemonids in structure, but are much larger and more robust looking. The first pair of legs in parastacids have large claws. The exoskeletons of parastacids are much harder and darker in colour than the exoskeletons of atyids and palaemonids. See page 78 of *The Waterbug Book* for a key to the families of Decapoda.

Classification and sensitivity

Phylum Arthropoda

Class Crustacea

Order Decapoda

Family Parastacidae (4)

References

Hawking & Smith 1997, pp 71-73; Williams 1980, p 167; Gooderham & Tsyrlin 2002, pp 82-83.